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on
ALASKA PLACER MINING

University of Alaska Fairbanks

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Bruce W. Campbell
Editor, M.I.R.L.

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INTRODUCTION

Earl H. Beistline
Dean
School of Mineral Industry
University of Alaska, Fairbanks

To begin the Third Placer Mining Conference, an observation today is that the price of gold one year ago was $504 per troy ounce, today it is quoted at $514.25 per troy ounce, up about $10.00 from last year whereas the price of silver has declined somewhat to $11.60 per troy ounce. Overall, we are moving ahead.

By way of background, the University of Alaska has a statewide organization that has three major campuses: The University of Alaska, Juneau; the University of Alaska, Anchorage and the University of Alaska, Fairbanks. In addition, eleven community colleges located in various communities in the state are a part of the educational system as are a number of educational centers.

Major units comprising the Fairbanks campus are: two colleges, Arts and Sciences and Environmental Sciences; five professional Schools: School of Agriculture & Land Resources Management, School of Education, School of Engineering, School of Management and School of Mineral Industry, and 15 research units.

The chief administrator of the Fairbanks campus is the Chancellor who is here to welcome you. It is my sincere pleasure to present to you Dr. Howard A. Cutler, Chancellor, University of Alaska, Fairbanks.

WELCOME
BY
Howard A. Cutler
Chancellor
University of Alaska, Fairbanks

Thank you, Earl. It is my pleasure to welcome you to this third Conference sponsored by the Alaska Miners Association and the School of Mineral Industry here on the Fairbanks Campus.

I have been contemplating some of the major changes that you have experienced, individually, in this industry.

Approximately 79 years ago, there was a gold strike in this area. It started out very similar to our situation now; small, independent miners worked for about twenty years. Then, the Fairbanks Exploration Company, a subsidiary of the U. S. Smelting, Refining and Mining Co., came, and large scale placer mining took place. The last dredge stopped digging operations in the early 60s.

With the return of a higher price for gold, we find ourselves, again, with many eager small-size placer mining enterprises. Now think about these changes and then think of the function of this Conference.

They used to find out the news in the assay office, the hotel lobby, the bar and in the bank. Now we have organized our gossip, we've organized our roots, we call it a conference. We bring it together to give you the best information and the best rumors, putting it forward in a more efficient manner, giving you a chance to ask questions.

The University is proud of its development over these years. It started out in the very beginning with the School of Mines. Its function has been that of educating you--students and the general public--about the mining industry. Your presence is the evidence of our success. The growth of the Conference over the last three years indicates the success of this institutionalizing of the news process.

I am proud of the accomplishments of our School of Mineral Industry, which is only made possible by the support that the citizens of the State have given us. Now, the industry has had some setbacks, but also some advances in the last year. We have hopes that we will be less regulated now. At the same time, we find that the hopes for the decrease in regulations didn't have too much effect on the price of gold. The insecurity of the World seems to remain enough to keep the price up.

Welcome to the Third Conference of Placer Mining. I hope the information that you receive is helpful, and that you will have a chance to share your knowledge. Thank you.

INTRODUCTION (Cont'd)
Dean Earl H. Beistline
School lof Mineral Industry
University of Alaska, Fairbanks

Thank you, Howard. We appreciate the excellent support you have given the School of Mineral Industry in the past and are looking forward to continued and greater achievements with the support of your office.

The gold mining industry has been a substantial part of the Alaska economy for many years. The interest in placer gold mining has been stimulated here in recent years by the relatively high price of the metal, and by the numerous gold deposits that do exist in many parts of the State.

Many of the deposits have unique and challenging conditions, being deeply buried and frozen. In a number of cases, ground with lower unit values are being mined today, compared to the high-grade deposits that have been located and mined previously. This situation has led to greater volumes being processed in a unit time by various combinations of equipment, such as tractor dozers, shovels, loaders, pumps, and recovery units. There is also more experimenting with sluicing systems to achieve greater recovery of fine sized gold, and the development or more efficient techniques of prospecting, to achieve an accurate evaluation prior to mining.

In addition, the aspects of regulations pertaining to the environment, sedimentation, turbidity of streams and land reclamation are being proposed and injected into mining operations.

This Conference has been designed to present pertinent information on the foregoing facets of Placer Mining for the benefit of the industry; to allow discussion with fellow miners, and to permit sharing experience so that each may benefit in conducting his own operation.

THE LIVENGOOD CREEK PLACER OPERATION

by
Gil Monroe
Chief Engineer, Livengood Operation

The Spirit of the Goldrush in '98 is the same as it is today. People are out there scrabbling in muck. But, the difference is in the technology. We have machines today that, if the oldtimers had used them, there would not be an ounce of gold left in the country.

Technology is still changing, and the company I work for, Livengood Joint Ventures, is playing a big part in this.

First, I'd better tell you about the Placer Deposit. Without question, it's the largest proven placer gold reserve in North America. The paystreak has been proven out by over 1,000 drill holes. The paystreak is up on a bench and is about 5½ miles long. It ranges in width from 200 to 2,000 feet, with an average width of 700 feet. The depth of the pay gravel itself ranges from 10 to 30 feet, with an average thickness of 23 feet.

The frozen muck overburden has an average thickness of 37 feet and, in many cases, will run as thick as 60 feet.

It was discovered in 1915 by J. Livengood and Teddy Hudson. From 1915 until World War I, the oldtimers (by hand) mined out approximately $4 million at $20 an ounce.

Most of the gold on the ground is quite 'high-grade gold'. It's 910 fine. There a few places where side creeks have come in and lowered the grade of it to the high 800s.

Anyway, if you have the largest placer reserve in North America, you had better mine it on a scale which is comparable.

This year, we're building a dike for environmental concerns. A dike is different from a dam. A dam is to impound water and not let any of if leak through. In this case, there is plenty of water to mine with. This water is for a settling pond,it was designed to have leakage. There is a gravel channel inside of the dike that carries the water along to a ditch.

It is the largest dike built on permafrost in North America; it's about two-thirds finished.

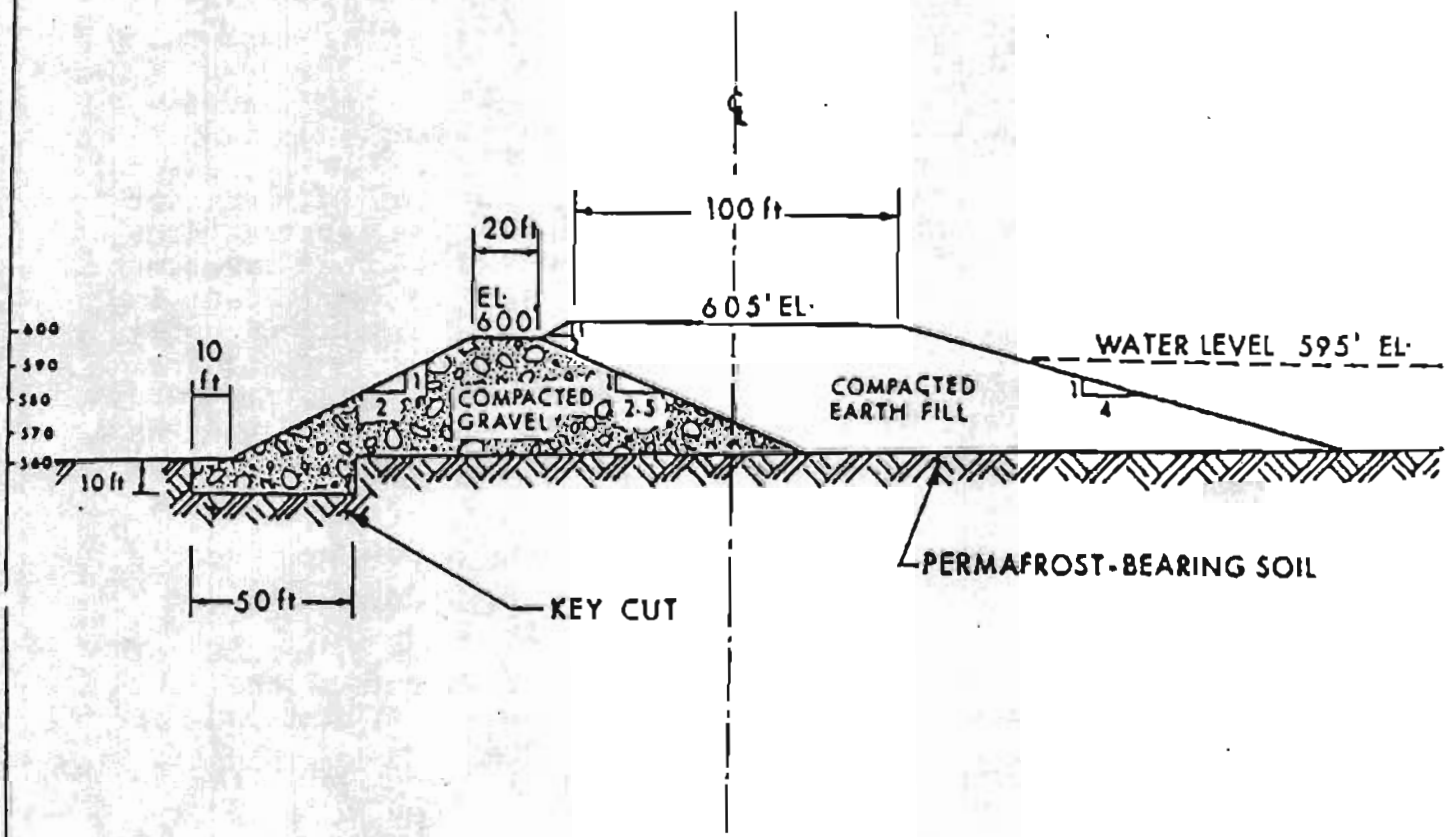
It will require 300,000 yards of gravel for the interal drainage. The water flows through the gravel to the lowest point and then goes out through a very long ditch tied into the gravel core of the dam.

FIGURE 1

TYPICAL SECTION

SETTLING POND DYKE.

SCALE: 1"=60 ft



The frozen muck that we're building this dam out of is coming from the mining cut, at the rate of 15,000 yards a day, which is somewhat slower than what we'd like, but there have been cold weather problems with the equipment.

There is another little dike that we're building up, above the water level. Wash material from the washing plant comes in a ditch and comes out into the creek after some 10 days, to give it a chance to settle. Hopefully. it will be clear enough to meet water-quality standards.

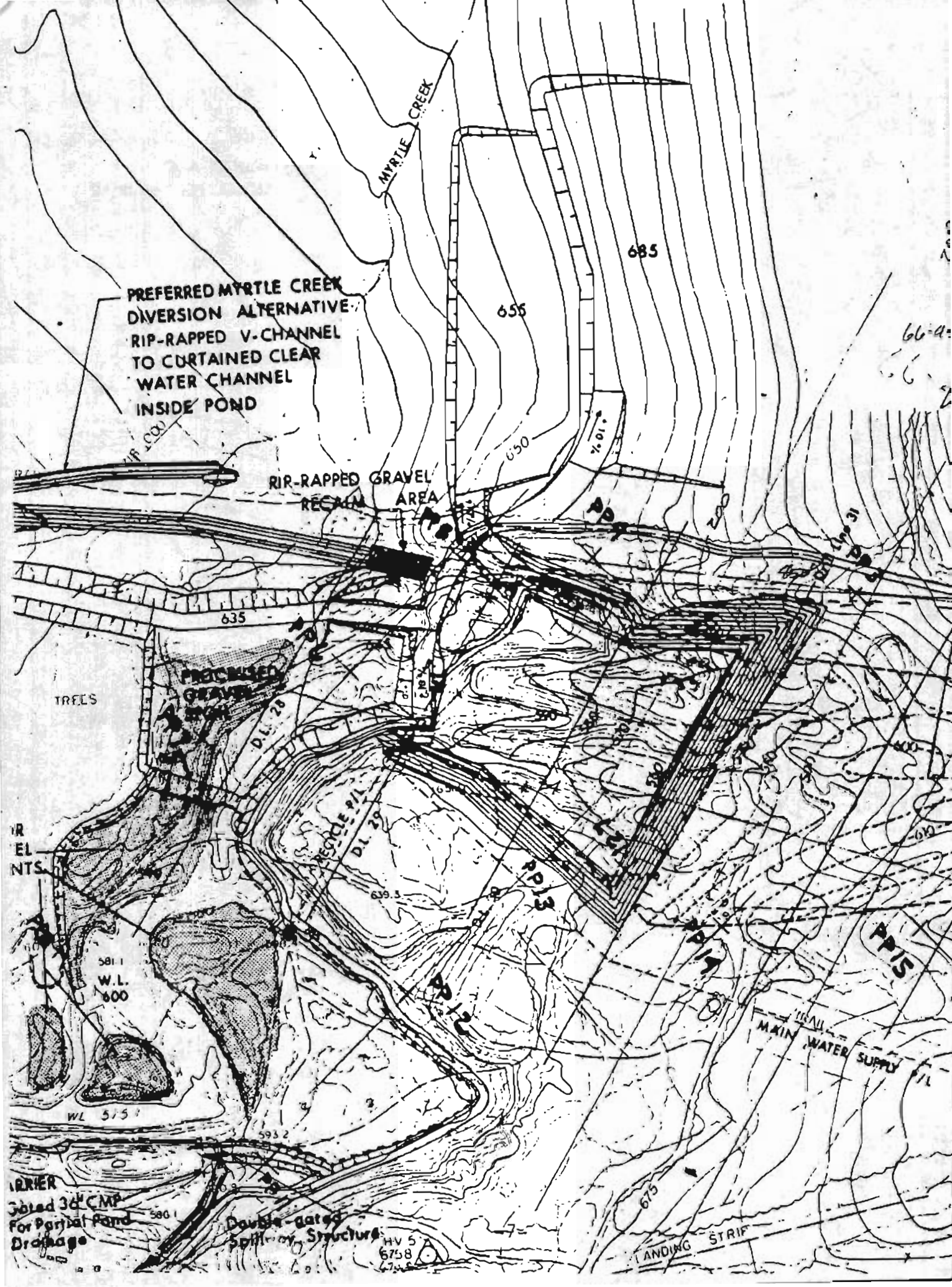
The pond water level will be 600 feet. A great deal of the enclosed area inside the pond is on bedrock due to the dredging in previous years. We expect the water coming in will go out through the bedrock and then into the creek. We may not be able to fill this pond this first year until the mud seals up those cracks. The design life of this dike and this pond is for the entire life of the mine which we expect to be approximately eight years. With the placer machine we're using, there will be no sand coming into this thing; it will only be silt; muddy water, clay and that type of thing.

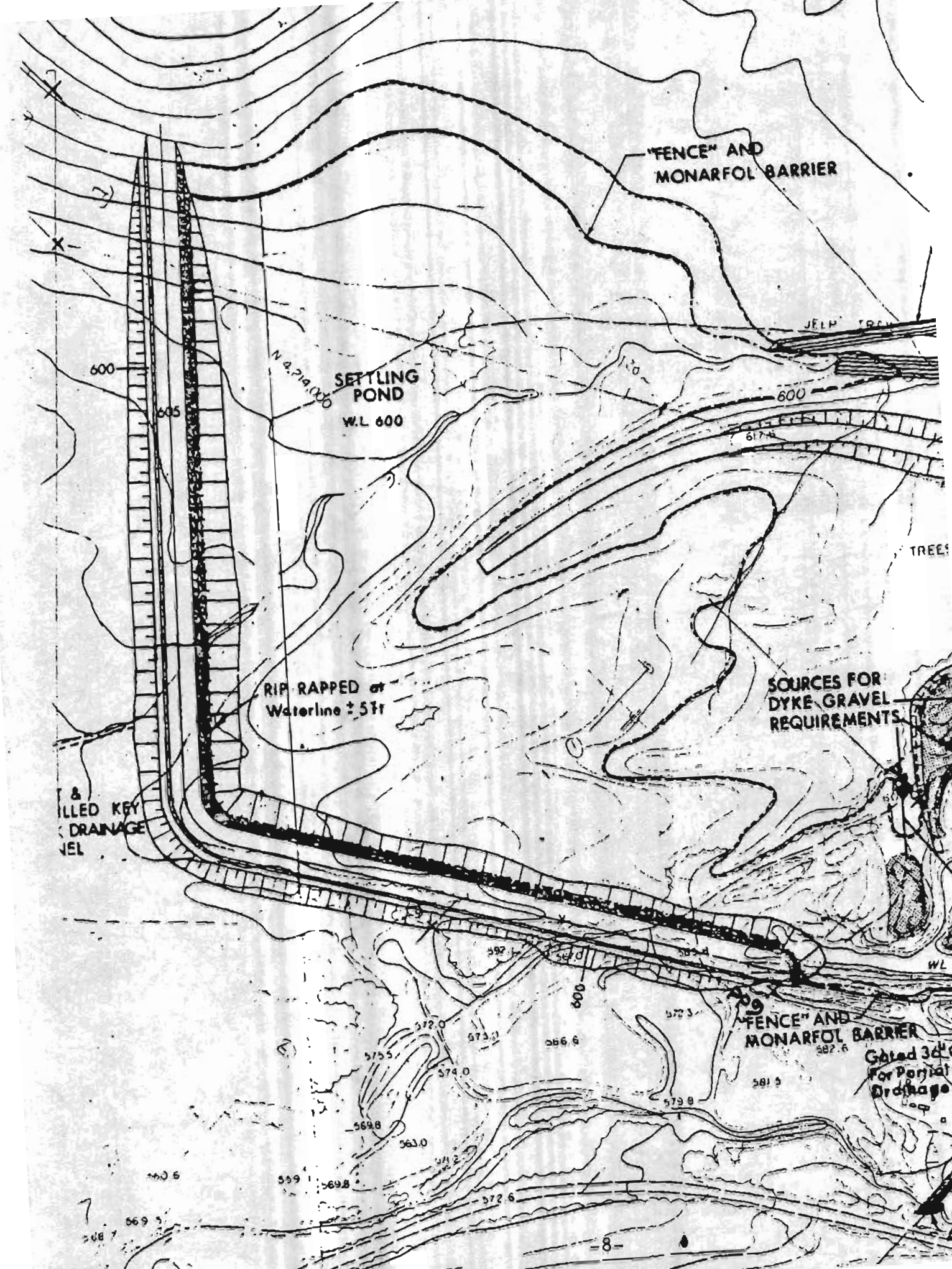
Our mining cut is a very peculiar thing. Bedrock is sloping downhill, going upstream. But, there is a reason for this. This area in here lies right on top of a rather major fault called Myrtle Creek Fault. The gravel dips parallel with the bedrock, and shows that the movement along the fault happened after the gravel was deposited. In any event, we may have a slight problem of keeping water out of the cut. The cut is approximately 800 feet square. All of the frozen muck (about 48 feet deep) is going onto the dam. The last week, we've been moving something like 28,000 yards a day. In some areas, we're down to gravel already.

In future years, we will mine other cuts. Next year's cut will be upstream.

One unusual thing that we did was our method of measuring the amount of material that comes out of the cut. We have contracted out the movement of this material to Doyon. We have all the equipment; scrapers and such like. When you hire someone to move material for you, you like to pay them on the basis of how much material they move.

Normal procedure on dredge cuts and mining cuts of various kinds in placer mining has been to survey cross-sections at parallel intervals. But these were all dredge tailings with piles so uneven that you would have had to run cross-sections every ten feet apart. In the winter, on top of the snow, we put 4' x 4' slats of black celotex with white x's at selected control points, with the elevation of each one surveyed. In January, photogrammetric coverage was flown and 1½ foot interval contour maps were constructed from the airphotos. You can then very easily measure all of the yardage moved out of a cut. Payment can now be on the basis of yardage measure.


MYRTLE CREEK
685
655
650
PREFERRED MYRTLE CREEK DIVERSION ALTERNATIVE RIP-RAPPED V-CHANNEL TO CURTAINED CLEAR WATER CHANNEL INSIDE POND
RIP-RAPPED GRAVEL RECLAIM AREA
635
TREES
FRACTURED GRAVEL
D.L. 28
D.L. 29
RECYCLE P/L
639.5
PP13
PP14
PP15
PP12
581.1
W.L. 600
WL 575
593.2
580.1
MAIN WATER SUPPLY
LANDING STRIP
675
Double-gated Spillway Structure
HV 5
6758
Sealed 36" CMP For Partial Pond Drainage


"FENCE" AND
MONARFOL BARRIER
SETTLING
POND
W.L 600
600
605
RIP RAPPED at
Waterline ± 5ft
SOURCES FOR
DYKE GRAVEL
REQUIREMENTS
"FENCE" AND
MONARFOL BARRIER

Now, this particular photogrametric procedure is commonly used in big open-cuts in the west. But, as far as I know, it's the first time photogrammetry has ever been used to measure the amount of dirt moved in a placer mining operation. It was faster and cheaper. There was less wear and tear on the suveyors. It is windy up at Livengood in the winter and surveyors are not expendable.

In this mining cut, there is a half million cubic yards of pay gravel that we will be mining this summer.

The amount of frozen muck in here is more than required to finish the job. So, we're stripping a lot of it up on the ground to the north. The amount of muck to be removed this winter is 1.2 million yards. They're using D9s with ripper teeth. In the frozen gravel, the ripper teeth have an average life of about three hours. Whereas, in the frozen muck, they last a full shift of ten hours. Ripper teeth are about $55 each. On a hourly basis, it is relatively cheap.

We had a great deal of breakdowns due to cold weather. Below zero, metals don't hold up well. Everything imaginable goes wrong with the equipment. At one time, we had two-thirds of the entire fleet of scrapers broken down; either wheel bearings or flat tires and everything else. On the worst shift we were only able to move 3,000 pounds of dirt. Our best shift was 28,000 yards. We have averaged 50,000 yards a day by running two shifts.

Being the largest placer mine around, we need the biggest washing plant around. An outfit in Seattle has designed and built, especially for this operation, one of the largest gold washing plants in North America. We're going to buy three more. This particular plant costs at this time, $900,000.

The main body of the plant is 20 feet wide and 150 feet long. The conveyor belt on the end is another 150 feet. The gravels first pass through a log washer, two big steel, rotating, shafts with little knobby protuberances. This breaks up the clay.

If you place a little ball of clay in a gold pan and roll it around, in a moment or so, that piece of clay will have all the gold in the pan stuck to it. There is almost a chemical affinity between gold and clay.

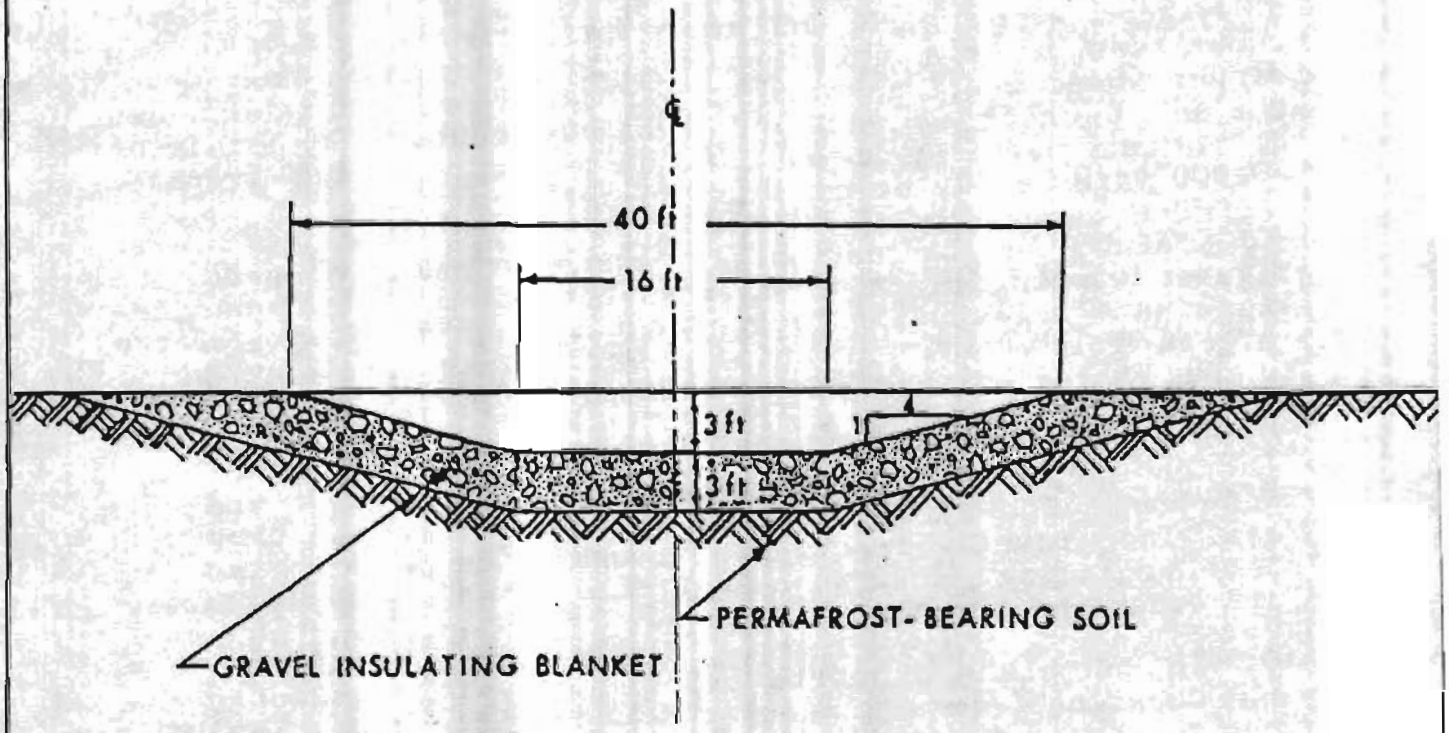
When you have clay in your gravel, you're going to lose a lot of your gold. It will wash out with the clay. The objective of the log washer is to grind up the clay into small pieces and wash it away.

FIGURE 3

TYPICAL SECTION

SLUICE BOX DISCHARGE AND SETTLING POND DISCHARGE CHANNEL

SCALE : 1=10ft



Next is a set of shaking screens. Then it goes through a muller, where a rubbing action helps rub the clay off. Then it goes through different sluice boxes. Eventually, the finest grade material of all goes into a classifier. It is what they call a detached classifier, with spirals 36 inches in diameter. As it revolves, the sand is carried up and out of the top. On the incline tank, the overflow portion has the muddy water which is then pumped with a 14 inch pump, through a pipeline, up into the riprap rock area. It will slow through a ditch into the dam and, after settling out in clear water; will enter Livengood Creek.

This plant will handle 600 yards per hour. We'll be running it for two shifts, to process about 12,000 yards a day.

We have bigger and better technology.

Q What do you do with the sand when you bring it out?
A The sand is the part that is going to come over the top of the twin classifier and be put onto the stacker belt and get stacked up with the gravel.
Q What size sluice box do you have?
A I couldn't tell you that. The machine's not here yet and our drawings of it were not as complete as I would have liked.
Q Do you have a vibrating Grizzley on the top?
A No vibrating Grizzley. But the vibration would be on the shaking screen, of course. Fortunately, in the Livengood gravel, we have hardly any boulders. The gravel is relatively small, as gravel goes.
Q Can you tell us what the pay is of your gravel?
A That is proprietary information. I'd like to work there a while. The pay does warrant doing all this.
Q How are you carrying materials to the sluice or in the sluice?
A We're going to use scrapers. We have a D-10 on the way up.

RECOVERY OF FINE GOLD IN A PLACER OPERATION

Cleland N. Conwell, Mining Engineer

(The following is an excerpt of the presentation given at the third annual Placer Mining Conference.)

Fine gold may be found in any placer area (Cook and Rao, 1973). As referred to here, fine gold is particulate gold that will pass a 65 mesh screen, or is less than 210 microns in diameter. In a gravity concentrator, flakes of gold in the auriferous (gold-bearing) gravels react like fine gold and are often lost.

Origin of Placer Deposits

Fine gold is more likely to be found in areas with a low-energy gradient at the time of deposition. It is important to consider the origin of the deposit when planning recovery of fine gold.

Wolff (1969) classifies placer deposits as residual, stream, beach or marine, colluvial, and eolian. Most Alaskan gold placer deposits are from streams and beaches. In high-energy gradient segments near stream headwaters, auriferous gravels are poorly sorted, and fine gold may not be deposited. In marine or beach placers the gravels or sand may be well sorted, with fine gold concentrated by wave action and winnowing. The serious investigator may refer to Brady and Jobson (1973) for a report on the segregation of heavy minerals.

Mineral Recovery Techniques

There are proven gravity methods used to recover fine gold. Classification or screening, which will discard a percentage of coarse material that has little or no value, may upgrade material enough so that a more elaborate method such as froth flotation, chemical reaction, or a hydroclone (Wolff and Rao, 1981) may be used.

Nearly all mineral recovery systems start with separation of material by size, because the gravity recovery systems used have optimum limiting size ranges. Will (1979) gives a rough classification of the more commonly used feed-particle sizes for gravity separators:

25 mm* to 75 um** jigs	- 1" to 200 mesh
3 mm to 30 um pinched sluices and cones	- #6 to 400 mesh
3 mm to 75 um spirals	- #6 to 200 mesh
3 mm to 15 um shaking tables	- #6 to 600 mesh
100 um to 5 um tilting frames	- 150 mesh to 5 um.

* millimeter = 0.001 meter
** micron = 0.000001 meter

Recovery of lower size material drops very rapidly without close control of particle size by classification.

Most gold placer operations use a riffle sluice box which has very low recovery of gold below 65 mesh (210 microns). However, fine-gold recovery can be improved by using corduroy, "astrotruf", or carpeting under the riffles. The slope of the sluice box should be set at grade to balance recovery with the amount of water available and still move large particles. Cook (1979) describes the velocity of water necessary to move particles up to 18 in. in diameter. Griffth (1960) describes the sluice-box arrangement for maximum efficiency.

Gold Particle Size

The size of gold particles in any one placer may be expected to fall in a fairly narrow range. Cook and Rao (1973) show 57.68 percent of the gold in a Goldstream sample was -6 to +20 mesh with a very small percent of fine gold.

Field and Laboratory Procedures

First determine if fine gold is present and then identify the particle size. The sampling procedure must start with an adequate sample:

+10 in. - 3 tons
+ 4 in. - 1 ton
+ 2 in. - 400 lb
+ 1 in. - 100 lb
-1/2 in. - 50 lb

If there are boulders over 10 inches in diameter, then 3 tons should be screened in the field and a 50 pound sample brought to the laboratory. If there are no pebbles over one inch, a 100 pound sample should suffice.

The first step in the laboratory is to complete the screen analyses, including information from the field screening, if any. Assuming there is sufficient quantities of -65 mesh material, the laboratory screen sizes should include 10, 14, 28, 35, 48, 65, 100, 200 and 270 mesh.

The second step is to assay the sized fractions to determine if there is enough fine gold to continue. If there is, the operator should consider the options for recovery: classification or sizing, gravity, hydroclones, flotation and chemical.

Laboratory Case Histories on Fine Gold

Before discussing recovery of fine gold, an example from Cook and Rao (1973) will show there may not be enough fine-gold to justify recovery. In this sample, from upper Goldstream Creek near Fairbanks, very little fine gold—about 9 percent—was present (Table 1).

Table 1
Screen Analyses of Gold Recovered from
Upper Goldstream Creek

Tyler mesh			Cummulative Wt-%	
Passed	Retained	Wt. %	Retained	Passed
3	8	0.00	0.00	100.00
8	20	6.59	6.59	93.41
20	28	26.03	32.62	67.38
28	35	41.12	73.74	26.26
35	65	17.11	90.85	9.15
65	100	7.63	98.48	1.52
100	--	1.52	100.00	-0-

Table 2 is the screen analysis of the gravel. In this example 69.31 percent of the raw material could have been removed by screening without losing any gold (Fig. 1).

Table 2
Screen Analysis, Goldstream Sample
(From Cook and Rao, 1973)

Mesh size	Wt-%	Retained	Passing
+3	54.21	54.21	45.79
-3/+6	15.10	69.31	30.69
-6/+20	11.96	81.27	18.73
-20/+28	4.71	85.98	14.02
-28/+35	3.14	89.12	10.88
-35/+48	2.62	91.74	8.26
-48/+65	1.13	92.87	7.13
-65/+100	0.84	93.71	6.29
-100 +	6.29	100.00	-0-

An auriferous beach sand was also examined, (Tables 3 and 4, fig. 2). Note that 78.14 percent of the gold is from only 2.12 percent of the original volume and that this fraction would assay 8.58 ounces of gold per ton (Table 5).

Table 3
Screen Analysis, Beach

Mesh size	Wt (g)	Percent	Retained	Passing
+28	22	4.91	4.91	95.09
-28/+35	73	16.30	21.21	78.79
-35/+48	144	32.16	53.37	46.63
-48/+65	193	43.10	96.47	3.53
-65/+100	6.3	1.41	97.88	2.12
-100+150	8.0	1.79	99.67	0.33
-150	1.50	0.33	100.00	-0-
	447.80	100.00		

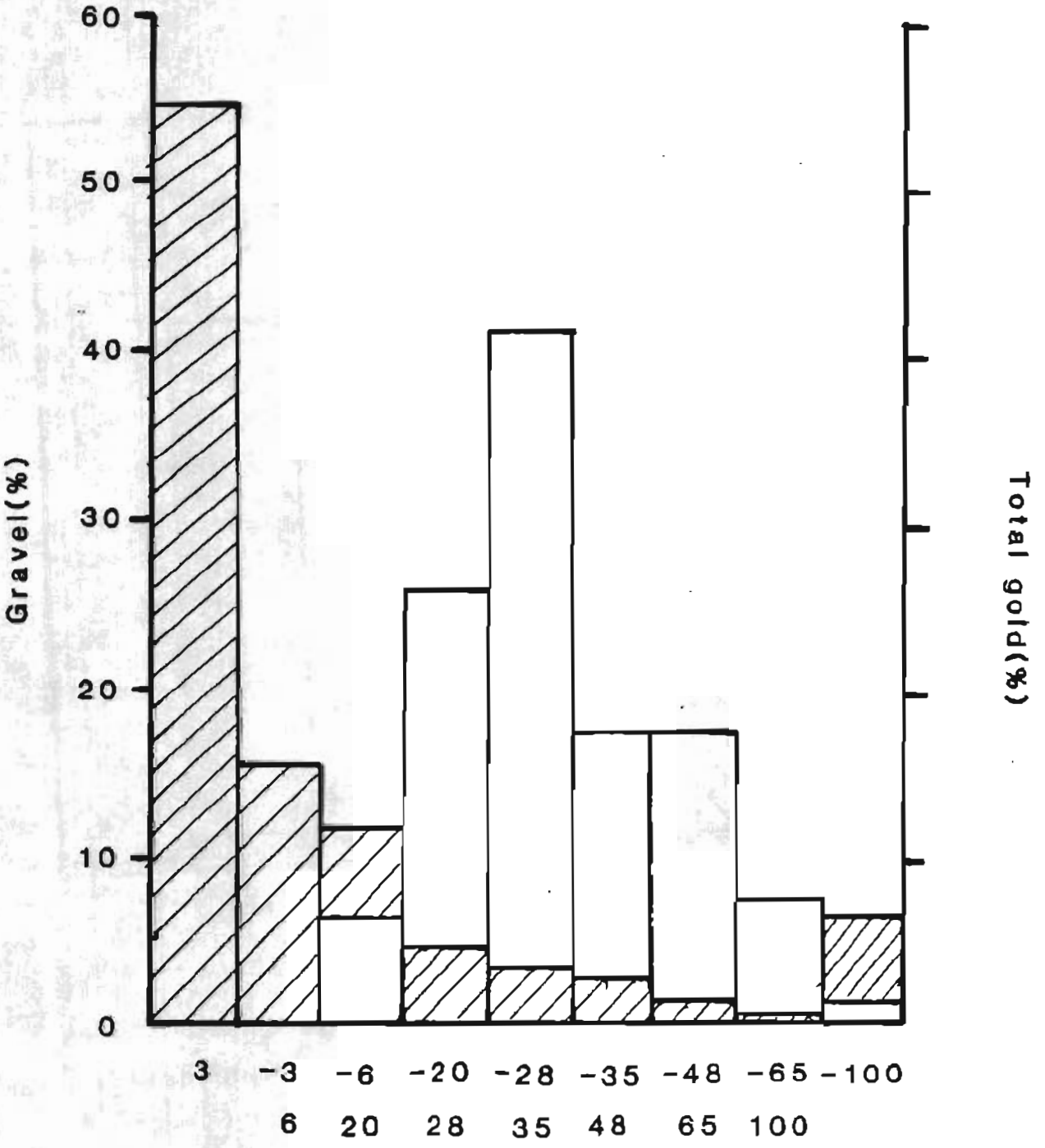


Figure 1. Particle size of gravels and gold from Goldstream (Cook and RAO, 1973)

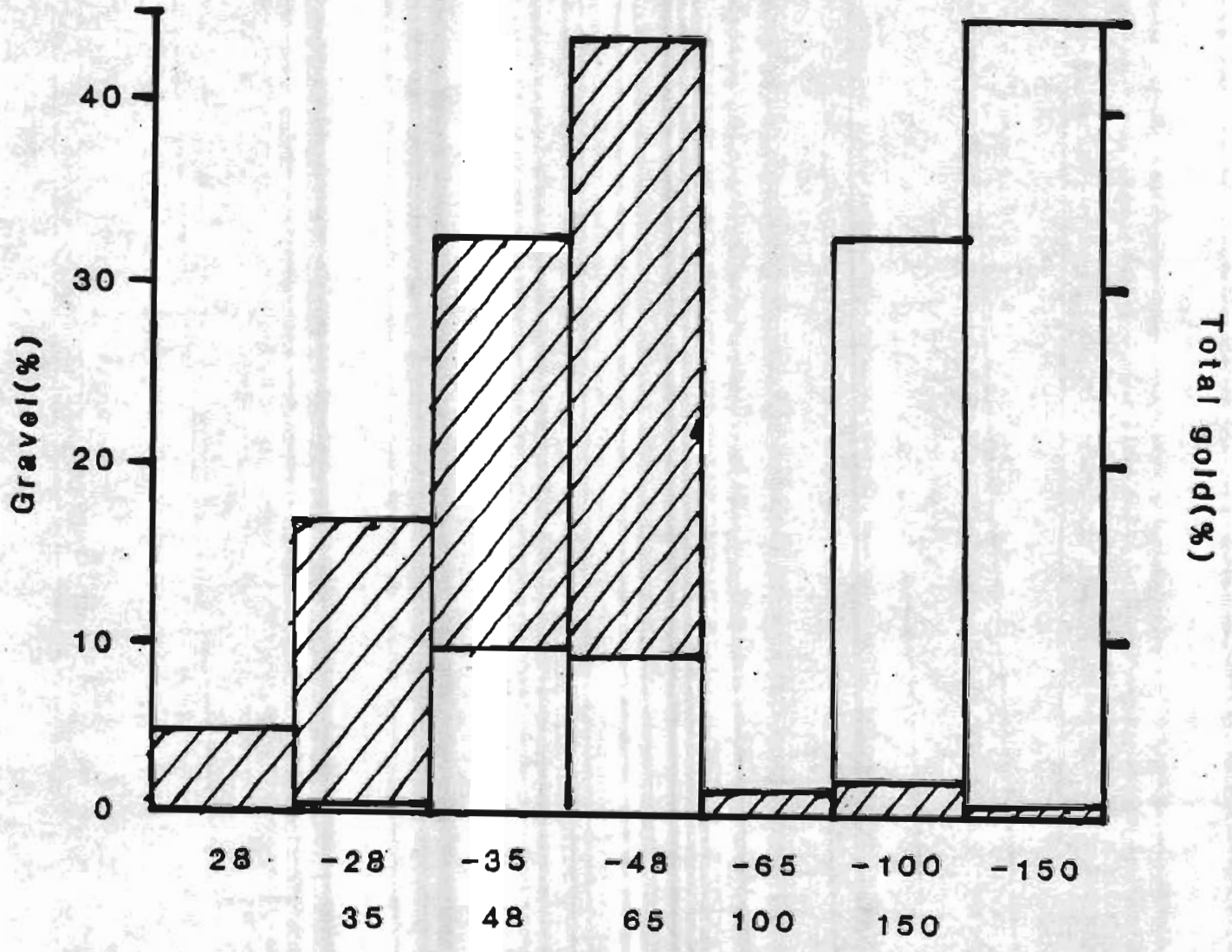


Figure 2. Particle size of sand and gold from a beach placer

Table 4
Gold Distribution, Beach Sand

Tyler Mesh size	Wt (%)	Assay Gold oz/ton	Total Gold (%)
+28	4.91	- 0 -	- 0 -
-28/+35	16.30	0.0127	0.89
-35/+48	32.16	0.0718	9.91
-48/+65	43.10	0.0530	9.81
-65/+100	1.41	0.2062	1.25
-100+150	1.79	4.2477	32.64
-150	0.33	32.1200	45.50
	100.00		100.00

Table 5
Assay Value of -100 Mesh Fraction, Beach Sand

Tyler Mesh size	Percent Total Weight	Assay Gold oz/ton	Product
-100/+150	1.79	4.2477	7.60
-150	0.33	32.120	10.60
	2.12	8.25	18.20

Classification alone would have produced 78.14 percent recovery and a marketable product assaying 8.25 ounces of gold per ton.

The next step was to float the various size fractions (except, for lack of material, the -150 mesh.) Table 6 shows the concentrate ratio and value by froth flotation. The recovery was low (42 percent) in the -48 to +65 mesh size fraction.

Table 6
Concentrate Ratio and Value by Froth Flotation

Tyler Mesh size	Wt (%)	Concentrate Ratio	Assay (oz/ton gold) Conc.	Tails
+28	not floated	- -	- -	- -
-28/+35	16.30	80.11	0.664	0.0035
-35/+48	32.16	130.11	5.298	0.0287
-48/+65	43.10	134.1	6.005	0.0309
-65/+100	1.41	188.1	32.666	0.0303
-100+150	1.49	356.1	1266.75	0.0696
-150	not floated	- -	- -	- -

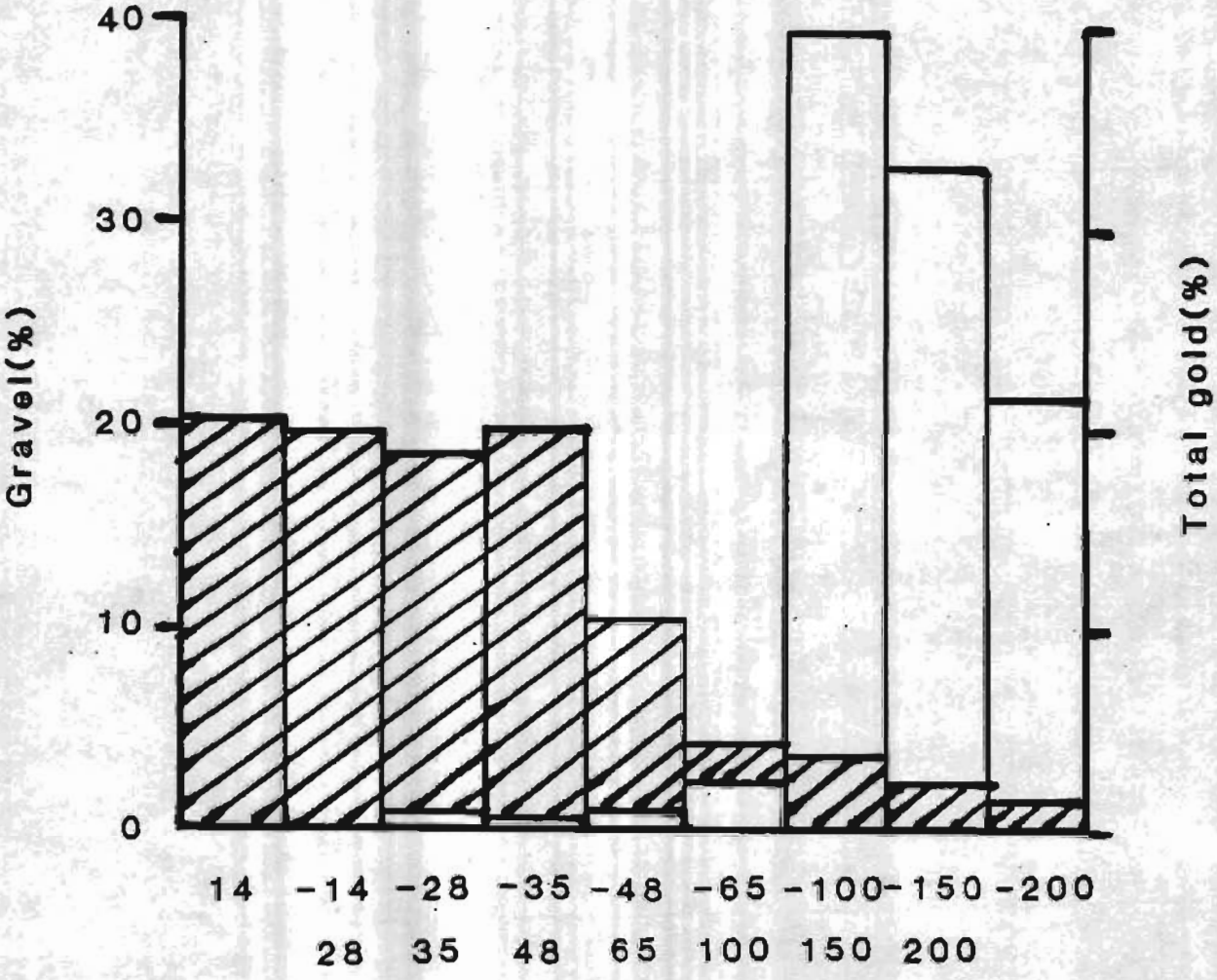


Figure 3. Particle size of gravels and gold from an alluvial placer.

In the -48 to +65 mesh size fraction the gold particles that floated were flaky with a large dimension several times the smallest dimension, whereas those in the flotation tails were nearly spherical. This could be expected on flotation size (Glembotskii and others, 1963). Nevertheless, 85 percent of the gold (19.88470 x 100/23.2941 = 85%) was recovered by flotation and classification (Table 7).

Table 7
Gold Recovery by Froth Flotation

Mesh size	Percent		Assay		Product		Recovery by flotation		Factor
+28	4.91		- 0 -		- 0 -		- 0 -		- 0 -
-28/+35	16.3	x	0.0127	=	0.2070	x	0.73	=	0.15111
-35/+48	32.16	x	0.0718	=	2.3091	x	0.60	=	1.38546
-48/+65	43.10	x	0.0530	=	2.2843	x	0.42	=	0.95941
-65/+100	1.41	x	0.0062	=	0.2907	x	0.86	=	0.25291
-100/+150	1.79	x	4.2477	=	7.6034	x	0.86	=	6.53892
-150	0.33	x	32.1200	=	10.5996	x	1.00	=	10.5996
					23.2941				19.88740

Recovery of gold from this particular area by gravity methods alone was made more difficult by an abundance of garnet. For this example, classification alone, or with froth flotation, appears to be an excellent method of recovery.

A third example is an alluvial gold placer that may have been worked previously removing some fine material (Table 8, fig 3).

Table 8
Screen Analysis, Alluvial Gold Placer

Mesh size	Wt (g)	Percent	Retained	Passing
+14	100	20.01	20.01	79.99
-14/+28	96.6	19.33	39.34	60.66
-28/+35	93.2	18.65	57.99	42.01
-35/+48	99.7	19.95	77.94	22.06
-48+65	51.8	10.37	88.31	11,69
-65+100	20.60	4.12	92.43	7.57
-100/+150	18.90	3.78	96.21	3.79
-150/+200	10.60	2.12	98.33	1.66
-200	8.30	1.66		-0-
	499.70	99.99	100.00	

Table 9 indicates the distribution of gold by mesh size; 95.07 percent of the gold (all -100 mesh) is in 7.56 percent of the total volume and the material would assay 0.322 ounces per ton. This product would have sufficient gold to be recovered by flotation or cyanidation. Unfortunately, experimental work stopped at this point.

Table 9
Distribution of Gold by Mesh Size, Alluvial Placer

Mesh size	Sample Wt. %	Gold Assay	Product	Distribution
+14	20.00	0.000	0.000	0.00
-14/+28	19.32	0.000	0.000	0.00
-28/+35	18.69	0.001	0.019	0.66
-35/+48	19.94	0.001	0.020	0.69
-48/+65	10.37	0.002	0.021	0.73
-65/+100	4.12	0.020	0.082	2.85
-100/+150	3.78	0.300	1.134	39.40
-150/+200	2.12	0.460	0.975	33.88
-200	1.66	0.378	0.627	21.79
	100.00	0.029	2.878	100.00

Summary

Fine gold, defined here as particulate gold smaller than 65 mesh, is the smallest size that can be effectively recovered in a riffle sluice box.

If there is fine gold present in the placer deposit, a controlling factor in recovery may be the origin of the deposit. There are several methods of recovering the fine gold, starting with classification. Classifying material prior to recovery will remove worthless material, increase recovery, and upgrade the fine fraction for recovery of gold by flotation or other methods.

If there is a high enough percentage of fine gold in a placer deposit, you can find a way to recover it.

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RECREATIONAL MINING
by
Jim Madonna

I don't doubt that everyone of you sitting in the audience today is fully aware that we are in the midst of a modern day goldrush. It might be better to say that we are on the declining edge of peak.

This is not to imply that the rush is over. Anytime that gold reaches such a dramatic high as $800 an ounce or more as it did in the 1980s, there is apt to be an urge, on the part of otherwise mentally stable individuals, to rush out with goldpan and shovel in search of that golden prize that lays buried in an Alaskan stream.

This isn't the first time this has happened. Men have been mining gold for over 6,000 years. In that period of time, seemingly everytime there was a discovery, there was a big stampede into the area. Some of these stampedes were on a grand, dynamic, colorful scale; others were quite small in magnitude. One of the most colorful, of course, was the Klondike stampede in Canada in the 1890s.

It began when a fellow by the name of George Washington Carmack discovered gold in Bonanza Creek. He carried the gold from Bonanza Creek in his spent rifle cartridge to prove his discovery at the 40 Mile Roadhouse. He staked the first claim in the Klondike.

The men in the 40 Mile area at that time stampeded into the Klondike. They began prospecting and mining gold in the creeks. Now, as you probably know, because of the high specific gravity, it had drifted down through the stream gravels and lodged itself in the very fractures and cracks of the bedrock that existed below. These gravels in the Interior of Alaska and in the Klondike region are perpetually frozen.

They mined the frozen gravels with the drift-mining method. This meant that they dropped shafts, going sometimes as deep as 40 feet through those frozen gravels before they hit the rich pay. They then drifted out laterally, following the rich paystreaks, and hoisted the auriferous gravels to the surface, piling them to await the spring thaw which would bring water for sluicing.

The second big goldrush was in the Nome area of Alaska. It started when an aging prospector by the name of John Hummel, while recouperating from scurvy at the present site of Nome, discovered that the beach sands were laced with gold. The stampeders that entered the area soon found that, to extract the very fine gold disseminated among the beach sands, they would have to use only the simplest of equipment. They used goldpans, surfwashers and the rocker box.

The third discovery began on July 22, 1902, when an Italian immigrant by the name of Felix Pedro discovered gold in the Fairbanks area. Unlike the rather colorful goldrushes to the Klondike and to the Nome area, the discovery in the Fairbanks area was slowly developed. The fact of the matter is, it didn't reach its peak until 1909, some seven years after Felix Pedro staked his claims.

The reason for this was probably due to the fact that the gold was buried beneath up to 100 feet and more of frozen gravel and muck. This didn't disenchant the miners. They dropped shafts to bedrock; they hoisted those auriferous gravels and piled them up to await the spring thaw.

The mining in the Fairbanks area continued from 1902 until 1914. In that period of time, these drift miners extracted almost $70 million worth of gold.

In 1914, the war effort brought the drift mining to a close; and unfortunately, it was not revived following the war. However, somehow Fairbanks stayed alive, and in 1928 the future became certain when the United States Smelting, Refining & Mining Company brought in the first of the California-type bucket-line gold dredges.

Between 1928 and the early 1960s, the United States Smelting, Refining & Mining Company operated eight such dredges in the Fairbanks area. The largest of these dredges was capable of digging to a depth of 70 feet and processing up to 10,000 cubic yards of gravel per day.

Up until this point, we've been talking about rushes into areas where there were abnormally high concentrations of gold. But there are other reasons for people to enter into the mining game. One of them is the advance of technology. The other, of course, is the increase in the price of gold.

For example, in the early part of this century, most open-cut placer mining of relatively shallow gravels was conducted by the use of very cumbersome, immobile steam-driven scrapers, draglines and immobile reciprocating pulsometer pumps. However, the development of the diesel engine in the 1930s created a revolution in the mining industry. The lightweight, mobile diesel-powered bulldozers, draglines and, of course, the centrifugal pump made it possible to mine ground that was not profitable with the more cumbersome steam-powered equipment.

Now, with gold at $500 an ounce and more, there has been another revolution in the mining industry. Naturally, ground is now possible to mine that was not possible to mine at $35 an ounce.

In addition to that, the increase in price has also stimulated thousands of people to enter into the mining game.

Most of these people had no desire to enter into the drift-mining operation such as was conducted in the Klondike and the Fairbanks area of Alaska. They knew it included a great deal of hard work. They didn't want to drop shafts all the way to bedrock and pursue the gold in those frozen rat holes. And entering into a bucket-line dredging operation was unthinkable. And of course, to most of these people, the hundreds of thousands of dollars required to enter into a profitable open-cut mining operation was not available.

So many of these people used small scale equipment for their prospecting and mining operation. They used the rockerbox which was so successful in the Nome beach sands. They turned to the goldpan which was very useful and, in addition, was very inexpensive to use. They used the portable sluice box which, again, was inexpensive and simple to use in both small and large streams. And then, some turned to the newest piece of mining equipment on the market—the floating surface suction dredge.

These units were not only inexpensive, but they were relatively easy to learn to use. They had a degree of popularity in the lower states before the 1970s; however, they weren't widely used in the State of Alaska until probably the mid-1970s. This was probably due to the other restrictions on gold ownership. It would be safe to say that, in 1980, there were probably 1,000 of this type of unit in use within the State of Alaska.

Just what is a surface suction dredge? Well, it is simply a machine that floats on the surface of the water while vacuuming auriferous gravel in the stream bed below. There is generally a flotation system, and sometimes a dual inner-tube flotation system. An engine drives the centrifugal pump which pumps fresh water from the intake out a high pressure hose. The inductor system might be a suction nozzle or a power jet.

The high pressure water coming into the inductor system shoots back up a hose. This creates a suction by the venturi principle. When the tip is submerged beneath the water level and into the gravel, it begins vacuuming the gravels. The gravels are rotated around in the hopper of the sluice box and forced across the riffle system. The gold and other heavy materials are tossed into the riffle system and the light weight aggregate falls off the end of the sluice box.

There are two types of inductor systems The suction nozzle as you just saw and the power jet. Each has an

advantage. The suction nozzle fits on the end of the suction hose; its position gives it the advantage of having high application for use in the shallow streams where the water is limited. On the other hand, it has approximately 20% less power that does the power jet.

The power jet may have a single inductor system or a double inductor system. Its position exists right at the contact of the sluice box. The disadvantage of the power jet is because of its position up close to the sluice box here, away from the tip, it is difficult to use where water is limited.

Suction dredges are named on the basis of the size rock that they will process; a 2½ inch suction dredge, for example, will process a 2½ inch rock, through the suction hose and through the sluice box. A 4 inch suction dredge will process a 4 inch rock, and so on. There are 2½, 3, 4, 5, 6 and 8 inch suction dredges. The power jet is used exclusively on dredges of 5 inches or larger simply because of the excess power needed to move the large boulders.

The 2½ inch suction dredge is floated on a single inner-tube flotation system; it employs a three horsepower four cycle engine to drive a 125 gallon-per-minute pump which pumps pressure into a suction nozzle type inductor system. The unit is capable of dredging approximately four cubic yards of gravel per hour. It runs approximately three hours on a single gallon of regular gasoline and has a total weight of approximately 77 pounds.

An intermediate size suction dredge employs a suction nozzle inductor system; is floated on a double inner-tube flotation system; and uses an eight horsepower four cycle engine to drive a 225 gallon per minute pump. The unit is capable of processing ten cubic yards of loose gravel an hour. It runs two hours on a gallon of regular gasoline and has a total weight of approximately 180 pounds.

The eight inch suction dredge runs a dual inductor type power jet system, powered by two 16 horsepower Briggs and Stratton engines driving two 150 gallon per minute pumps. It is capable of dredging up to 30 cubic yards of loosely packed gravel an hour at a depth of 30 feet. It runs one hour on two gallons of regular gasoline and has a total weight of 750 pounds.

Now, let's take a quick look at some of the characteristics of deposits that are conducive to the use of suction dredges.

On occasion, there are traps within a stream system that cause the deposit of large quantities of gold. These are the kind of traps that we need to study to determine

the beneficial use of a suction dredge. For example, gold accumulates in fractures—cracks in joints of bedrock. Bedrock exposed on the riverbank with the fracture running out in the stream would be an excellent place to vacuum up materials with the suction dredge. Other areas include behind dikes, and resistant beds tilted in the direction of the stream flow so that gold accumlates on the downstream side of these dikes. Around the base of large boulders, especially where they exist on bedrock. Around the base of a 5,200 pound copper nugget in Dome Creek in the McCarthy area there was a considerable amount of fine gold and also a number of larger gold nuggets.

Another type of gold deposit is called flood gold. Gold that is small enough and fine enough to be carried along by swift stream currents during flood stage, becomes deposited on the river bars when the river drops. One of the major points of deposition of this flood gold is at the confluence of two streams. An example of that is O'Brian Creek, where it enters the 40 Mile River. The inside of the curves are deposition points and the outside of the curves are erosional points for this flood gold.

It wouldn't be fair to give you a lecture on suction dredges unless I explained clearly that suction dredges plug up. They may plug up only six or seven tims a day. On the other hand, they may plug up six or seven times an hour. In the early morning stages of an operation, a person is rested and he can cope with a few little plug ups. Eventually, clearing the suction lines becomes quite tiring. But remember, there is that golden treasure awaiting in that sluice box.

THE SLATE CREEK PLACER OPERATION

by

Douglas B. Colp

I am talking today on the Slate Creek Operation in the Chistochina area, south of the Alaska Range. It's on the Mt. Wrangell side of the Alaska Range. The Chistochina River crosses the Tok Highway about 30 miles from the Gakona Junction toward Tok--the wagon and horse trail into the district. It is also about 309 miles directly east of Paxson's Lodge.

It's an old area. In 1898 and 1899, the first claims were staked. It's never been a big area, but as far as mining is concerned, it's been tough and persistent. The first people in there were George Hazelet and a fellow by the name of Jack Meals. Jack Meals lived a long time in Valdez. Some of you oldtimers will remember the name of Hazelet. Cap Osborne of the old F.E. Company married John Hazelet's daughter. He was in the area around 1907. The Osborne family goes back into the Fairbanks area many years. They've both passed on now. Two of the Osborne boys are still alive, and still own claims in there. All their claims are patented. They are on what they call the Chesna River, which is another tributary of Chistochina River.

The first post office came into being in 1901. It was under the name of Chesna until 1908; then it was changed to Dempsey through 1925 when it was closed. The trials and tribulations of the early route in were terrific. It was one of the first places that they used cattle in place of horses. They'd take in 15, 20, or 30 head of cattle out of Valdez and spend two weeks training them to walk on snowshoes and pull. With the cattle and horses, they managed to get all their freight in there taking up to three or four months for the 250 mile traverse.

The first two expeditions took a year, as they were caught during breakup and lost most of their outfit. They had to go back for a resupply. It wasn't easy. You've got to take your hat off to those old boys who braved the elements, trials and tribulations to make that trip.

Miller Gulch was a tributary to Slate Creek. It will probably be the big producer in the area. Most everybody that knows about Slate Creek knows about Miller Gulch. Miller Gulch is easy to mine for the oldtimers. It was shallow and the shoveling techniques were ideal for that particular creek. Bedrock was shallow; maybe six or eight feet or less. The bedrock was steep which gave them the natural grade for their boxes. They took about $3 million from Miller Gulch alone. That's the majority of the money taken from the Slate Creek area by the oldtimers. They tried Slate Creek itself, but in most cases it was too deep and they were quite unsuccessful.

It's been tried many times since then by machinery but none of the attempts have been very successful partly because of the fineness of the gold. The gold is very fine. A lot of it will float on water. A sluice box, per se, is not a good concentrating method. You have to have some washing mechanism ahead of your sluice box. I do have a sluice box. It was made here in Fairbanks. It's a five section box; 32 feet long with a five foot to six foot distributor.

The present ground owners, Ranchers Exploration & Development Company from New Mexico. They are a small mining company, mainly involved with uranium, copper and silver. This is their only placer gold venture to date.

They came in here in 1973. I became involved in a small way with their land acquisition, staking and so forth. In 1974, we put together a $300,000 to $400,000 exploration program. We prospected and drilled a lot of the ground. In 1975, we carried out an even larger exploration program, roughly $500,000 or $600,000. Obviously this is not a small undertaking.

At the end of 1975 we determined that it was economical, but the price of gold wasn't right. I advised them to put it on ice for a while. In 1978, the price of gold started to come up. I suggested that we compare our recovery to our estimate before we designed a washing plant.

We went in with a sluice box and a grizzly. We tested about 50,000 yards, and we got about 50% to 55% recovery of our estimate. We decided that we had better do more engineering and more testing to see if we could design an efficient plant. We knew immediately that that sluice box would not work.

We found out that all of our gold would pass a 4 mesh screen, roughly a one quarter of an inch. None of our gold was larger than one quarter of an inch. We determined, immediately, that that was all we were going to wash. We took cuts in the bank, made a pebble count and screen analysis and determined that we would have to handle 35% to 40% of our material through a sluice box. The other 60% to 65% would go to waste. So, with that in mind, we designed a five section sluice box to take care of the minus one-fourth inch material.

The feed box is five feet by seventeen feet and vibrates. The grizzly at the lower end is set at eight inches. Everything larger than eight inches goes into what we call the "watermelon patch". Everything smaller than eight inches goes up belts into a washing plant and across

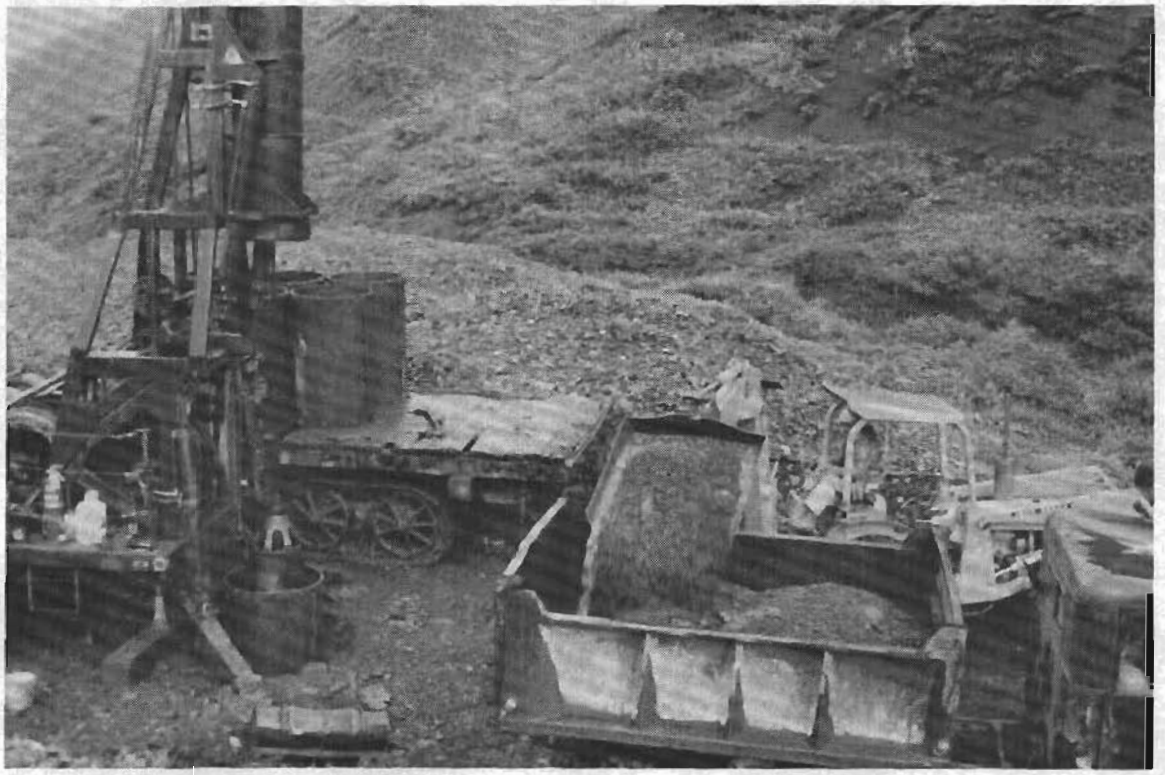

Fig. 1: Klam Drill; one of the methods used to evaluate the Slate Creek property. Capable of drilling holes 36" in diameter at an approximate rate of 10 feet per 10 hour shift, it is best utilized in thawed ground. Here it is being used in ground that is approximately 30 feet to bedrock.

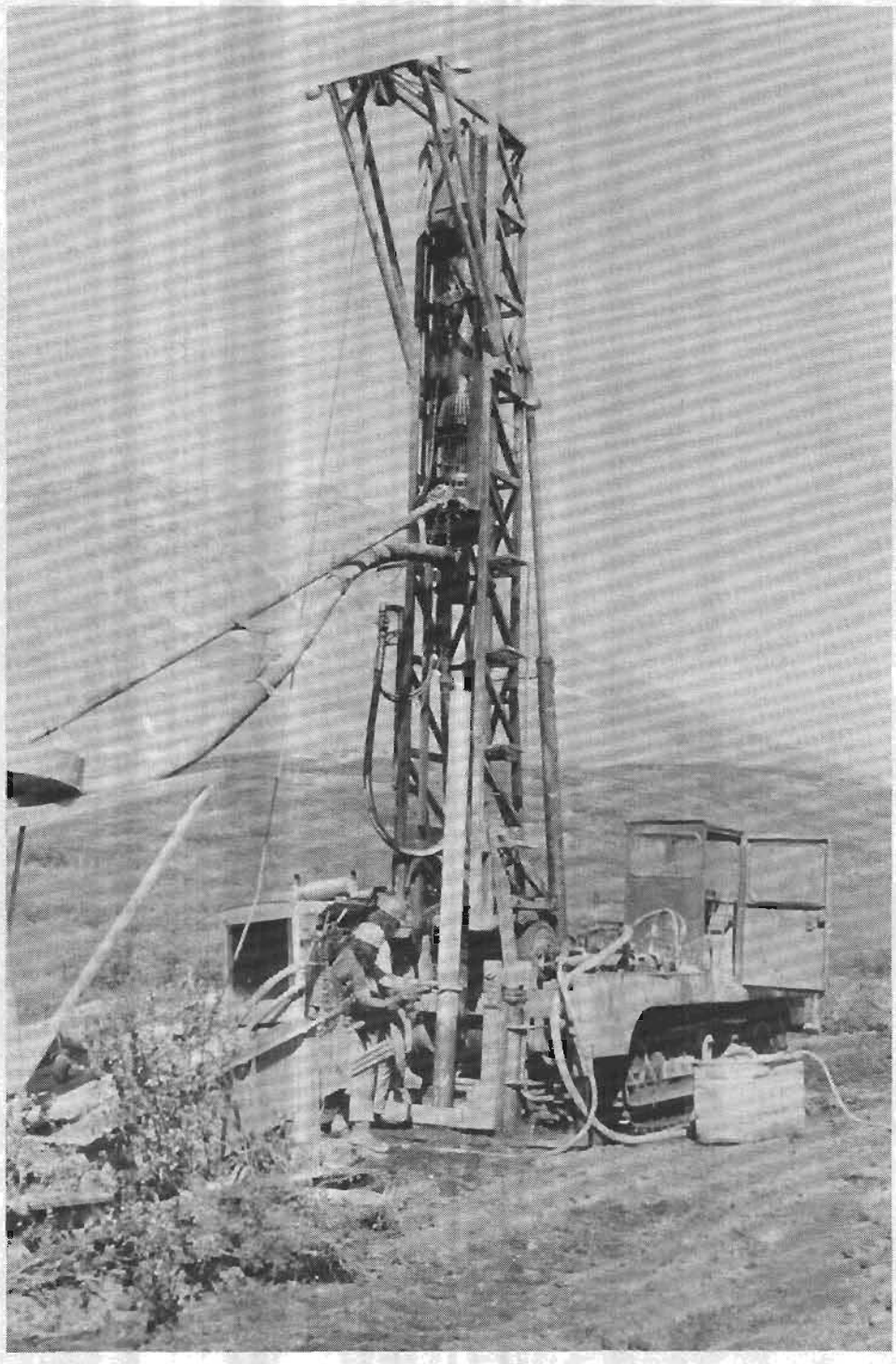

Fig. 2: A Becker 180 Hammer Drill can average 100 feet per shift. It utilizes double wall casing with air blown down between the outside 6 5/8 casing and the inside 4" casing, forcing the cuttings to be returned up the center of the drill. The cuttings are collected by a cyclone.

Fig. 3: The cyclone, with containers to catch the cuttings for volume measurements. Drilling is stopped at various intervals and the volume of the cuttings are measured for eventual comparison to the values of gold.

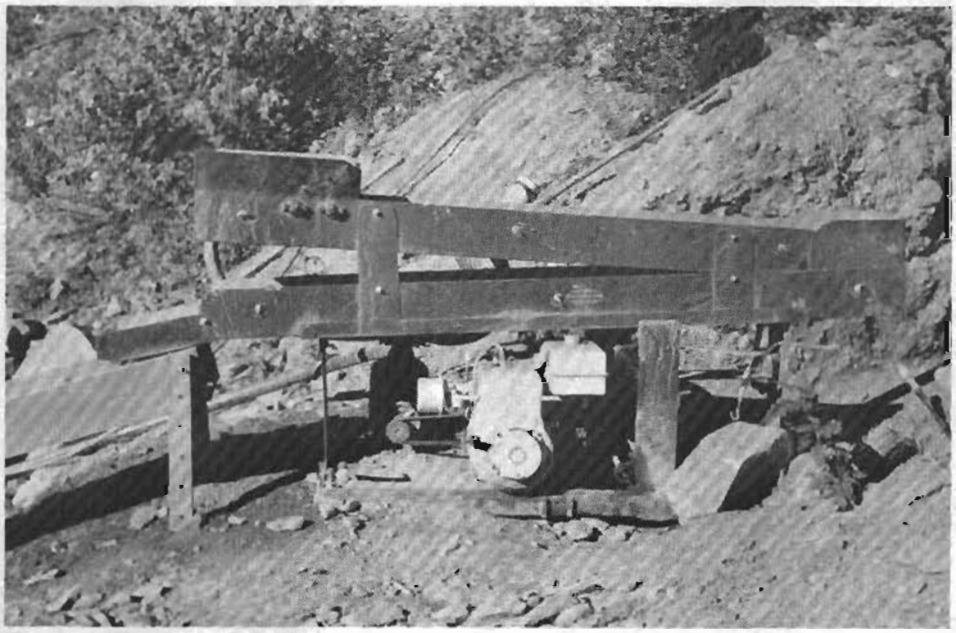

Fig. 4: The cuttings are then washed through a Pan-O-Matic, or . . . .

Fig. 5: . . . a Denver Panner, to separate and measure the gold content.

Fig. 6: Pushing auriferous gravels into the feed hopper with a D-8 tractor. The grizzly bars scalp off the plus 8" boulders, dry.

Fig. 7: Overview of the feed hopper, conveyor belts, the El Jay screen, and the sluice. The belts have scrapers or belt cleaners at the end to prevent spillage. Processing at a rate of 200 yards per hour or 4,000 yards per day.

Fig 8: The El Jay screen is washed by 1,500 gallons of water per minute. The plus ¼" material is stacked (to the left) by another belt. The minus ¼" is then sluiced.

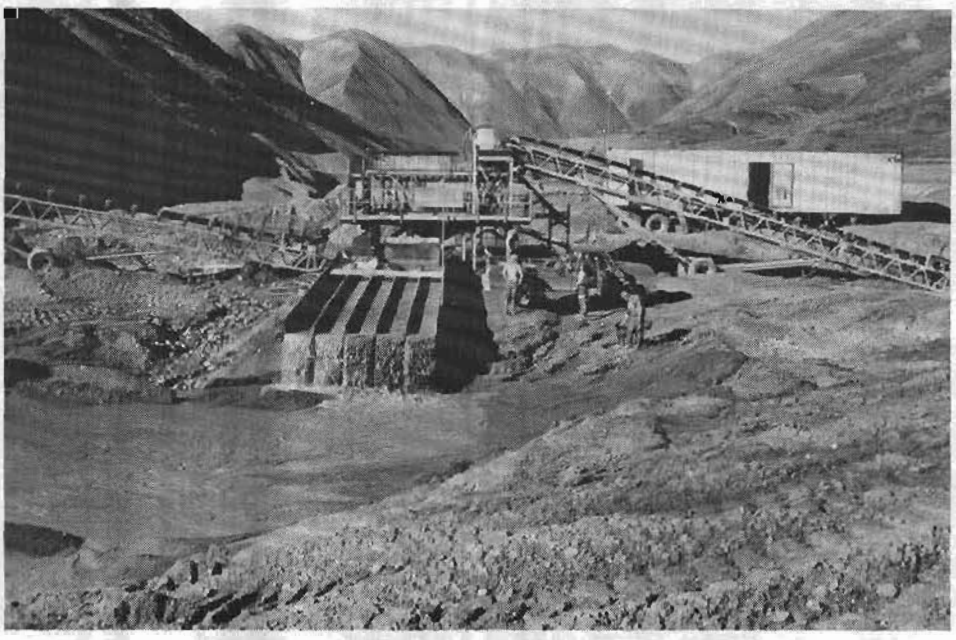

Fig. 9: The 250 KW power house, in the background, supplies electricity to the feed belts, screen and stacker belt.

horizontal three-deck screens. The top deck is two inch screen, the middle deck is one inch, and the lower deck is one-fourth inch. The plus material from all decks goes directly to tailings; the minus quarter goes into the distributor, and is spread evenly through the five sections of the sluice box.

As far as freighting, we have to go roughly 55 miles from the highway to the operation. This year we went in when there was about three feet of snow. Two trips over the area with three cats widened it out to a 16 to 18 foot wide hard-packed layer of snow. We sent our grader in high-blading so that all it leveled out was the humps and hollows. At the end of two trips, we were able to get some house trailers and equipment in there, tankers and other things in.

We made 48 vehicle trips to bring in our equipment for this summer, including 130,000 gallons of diesel oil. We did not have a tank break or any other serious mishap. It took three weeks without rushing things. Everybody had Sunday off.

In our camp there is an old mess hall that was built about 1935 and moved about three times. We used that up until last year. This year we have a new mess hall, and the old one will be used as kind of a reaction hall. You're either going uphill or downhill in that old mess hall. You run down one side of it and climb the other side. I don't know how the cook put up with it. It was easy to clean. You just dumped the water on one end and it flushed right on out the other.

We also brought in new bunk houses. There are two rooms about 10 feet by 12 feet; two men in each room, or four men per bunk house.

We brought in conveyor belts, 42 inches wide and 60 feet long, two of them side by side on the flat. We took them right on in and right on up to camp without offloading. As a precautionary measure, we had a semi pulling a lowboy with a D-6. Four or five of the units traveled together, the D-6 and the lowboy semi traveling along with them in case they got into trouble. It's easier to deadhead a D-6 around with the unit than it is to wish you had it there and have to call it in several hours later. You're money ahead by taking it right along with you whether you use it or not. We did make four or five trips without using it, but the rest of the time it was used up to a dozen times keeping the trucks on the road and pulling them out of bad positions.

We brought in eight or nine tanks, eight feet in diameter, 36 feet long. Michigan bobsleds with steel runners and steel decks were used to haul bunk houses. When

there wasn't any gravel showing we used the sleds. If there was gravel exposed, we had to use rubber-tired wagons. Otherwise, the shoes wear out on those sled runners pretty fast. We also freighted in a complete sewer system and leaching tank for the mess hall.

One of the bug-a-boos of our operation is the air strip. It's a poor, poor, airstrip. It is a one-shot operation. You circle until you feel that you can land, and then you come in and do it. You don't change your mind on the way in. There's a flat area that we expect we will use for a new airstrip this summer. We'll take out the hazard in landing; at least they'll have a little dog leg on each end with a way out and a way in from either end which will make it a lot safer.

Our gravel deposit is sometimes 80 to 90 feet deep. It pays from the grass roots down. So, we have a tremendous gravel moving operation. Everything plus eight inches goes to waste. There are not too many large rocks, although occasionally there will be one up to three feet in diameter.

We load the hopper with a D-8, using 'U' blades, or we use a 988 loader. We use both pieces of equipment at various times for various reasons.

The lower feeder belt goes into a secondary belt, and on that secondary belt there's a weightometer that weights the material coming up that belt. We know at the end of the day how many tons of material was fed into the screening plant. The upper belt dumps into a wetting box on an El Joy screen, a horizontal sixteen foot long, triple-deck screen.

The design of that screen called for 2,000 gallons per minute. Well, 2,000 gallons a minute didn't do the job. So, I added another set of spray bars on top, to give it another 1,500 gallons per minute. We're now using 3,500 gallons a minute. That gives an excellent washing action. There has been no sign of values going over the screen and up the stacker belt. Our losses are strictly through the slice box and not to oversize waste.

In the sluice box I have cleanup slots cut across the bottom of the box. Any one of ten sections can be cleaned up without shutting the plant down. If the plant has to be down for repair, then I'd prefer to clean up several sections of the box as there is plenty of room to stack riffles, astroturf and so-forth. We clean up, not longitudinally, but horizontally, always working away from the stream. We put a firehose in the left hand side of the cleanup slot and flush everything into a tub on the right hand side. The effort is minimal. One to three of the ten sections is cleaned every day.

The tailings are moved by one cat. There are two sets of tails. The fine tailings have come across the box, and the coarse tailings which have been rejected by the El-Jay screen and accumulated at the end of the stacker belt.

We use astroturf 3/4 of an inch thick. It is an excellent type of material for collecting fine gold. Sometimes we get out about 400 ounces during cleanup, though usually much less.

The cleanup house is a separate building with a feeder that transports the concentrate to the top of a high tower into a Sweco screen 36 inches in diameter with three decks. Each deck has water on it and gives you a different size product. The smallest one is 24 mesh, everything 24 inch minus goes directly to the Deister shaker table inside of the building. Other size material comes down into various other concentrating units, including Denver Panners and Pan-O-Matics.

Material flows from a 500 pound bin regulated by a syntrone feeder on the bottom. A soap injection unit feeds a continuous supply of soap into the unit at the same time the material is fed up onto the Sweco screen.

Three pipes come down from the top of the Sweco. Each one used to go into a different garbage can for further classification. We've now cut out the garbage can routine and just funnel all the various size concentrates into respective concentrating units, thereby eliminating a lot of hand work.

The concentrates are sized at plus one-fourth; minus one-fourth; plus 11 mesh; minus 11 mesh; plus 24 mesh, then the fine size, -24 mesh.

A man stands at the Deister Table with a squirt gun and soapy water. Unless you keep squirting that soapy water the gold floats away.

We have about 6% shrinkage coming off the back end.That's good enough. My biggest nugget of the year was about the size of my fingernail. It weighed a little bit less than a quarter ounce. Of course, we have to check all our tailings; that's done by hand.

Fig. 10: Discharge of the -½" material from the sluice box.

Fig. 11: Pushing fine tailings, the coarse (+½") material accumulating at the end of the stacker belt will be moved next.

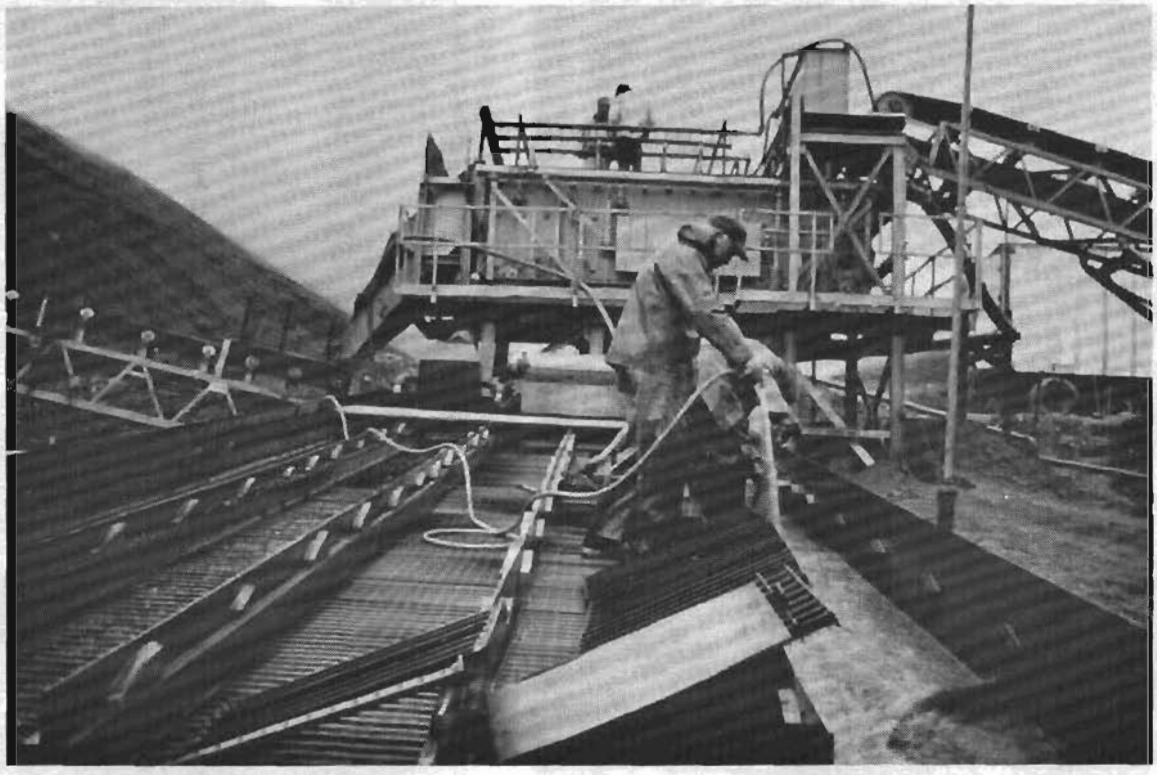

Fig. 12: Starting the clean-up of two upper sections and two lower sections of the box, while the upper deck (2" rubberized punch plate) of the El Jay Screen is being replaced.

Fig. 13: Final stages of clean-up. The first separation is achieved in the box by paddling an even stream of water over the concentrate.

Fig. 14: Approximately 400 ounces, in one section of the box. An unusually good cleanup of -½" + 200 mesh gold.

Fig. 15: Same cleanup, another view.

Fig. 16: Final pick-up in the sluice box.

Fig. 17: The clean-up house where gold is recovered from the black sands. The truck brings the black sands to the screw feeder where it is elevated to a 36" three-deck Sweco screen. The minus 24 mesh goes directly to the Deister Table. The plus 24 mesh, minus 14 mesh goes to the pan-o-matic, and the plus 14 minus 1/4" mesh goes to the Denver Panner. The plus 1/4" is panned and inspected by hand.

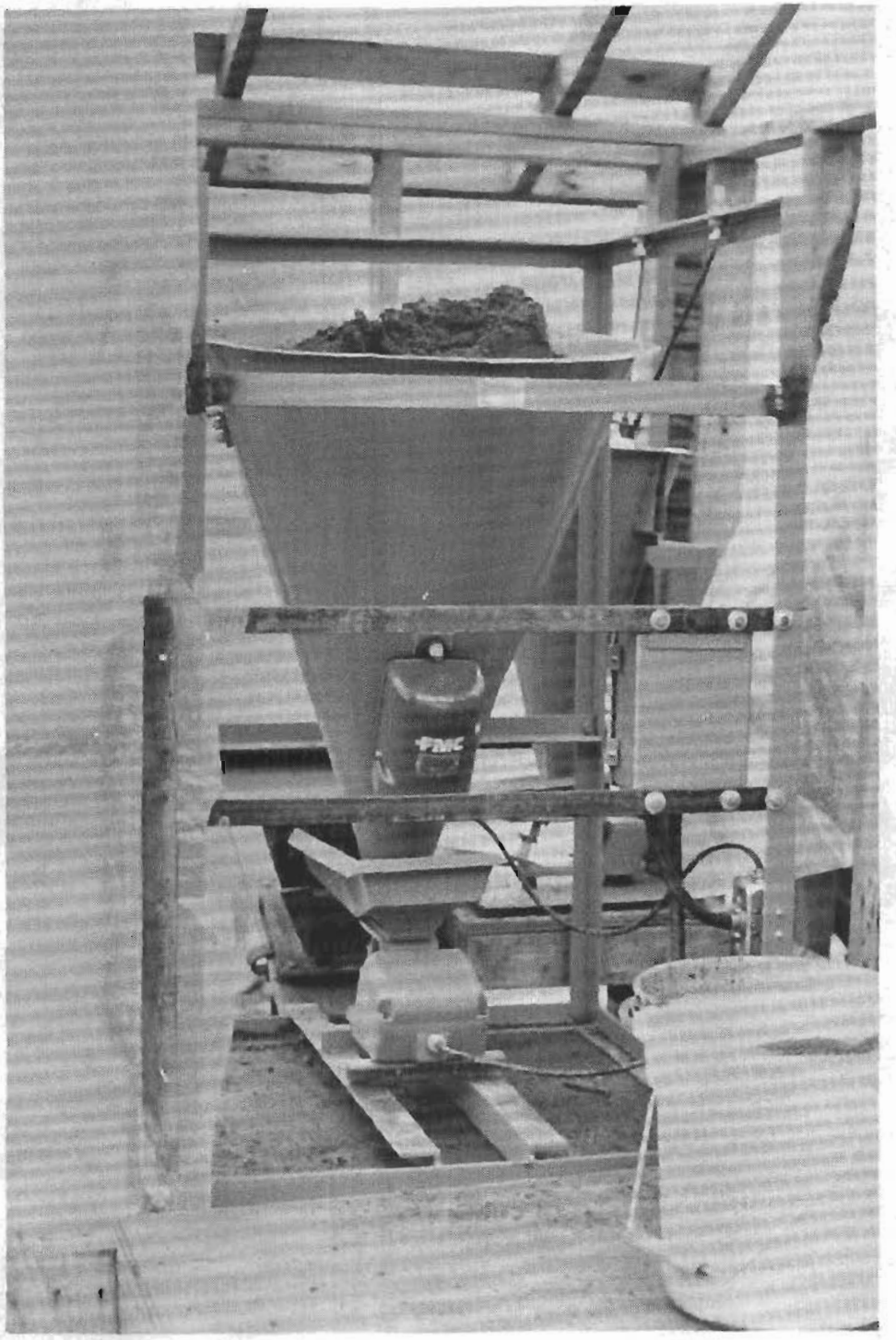

Fig. 18: The hopper and Syntron feeder which feeds the elevating screw.

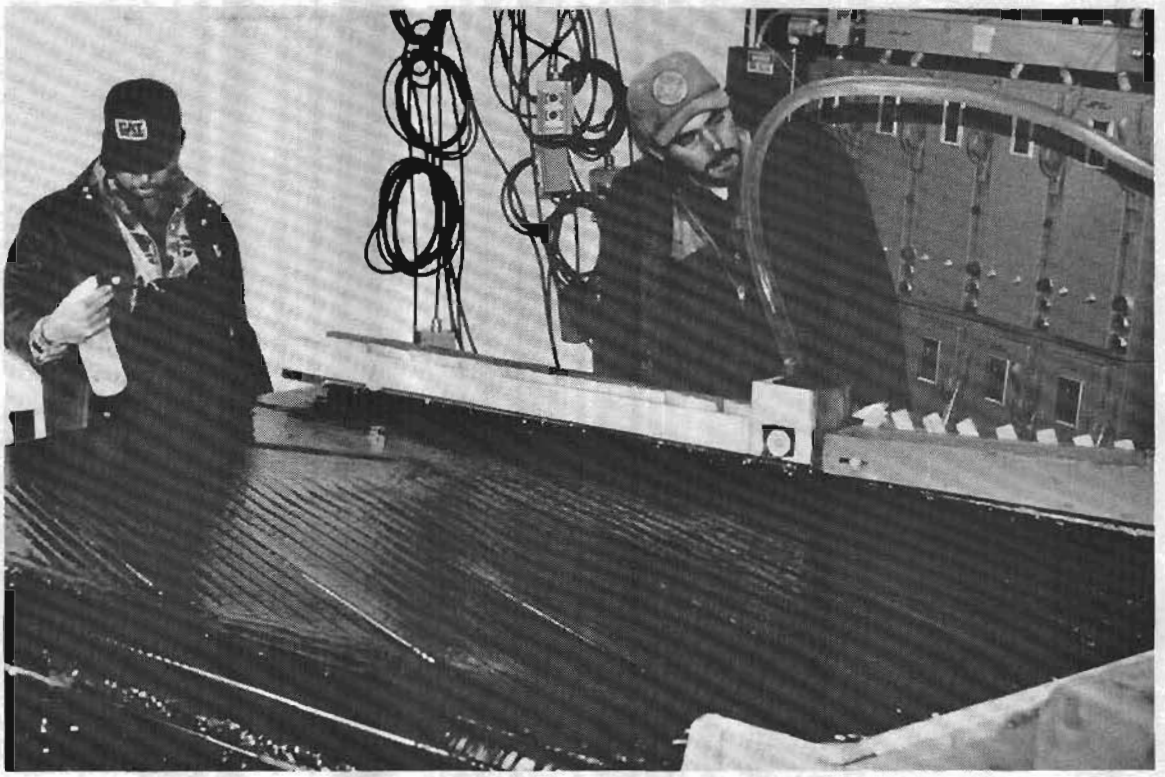

Fig. 19: The 4' x 8' Deister Table.

Fig. 20: The final clean-up is made in an 18" Goldhound Wheel.

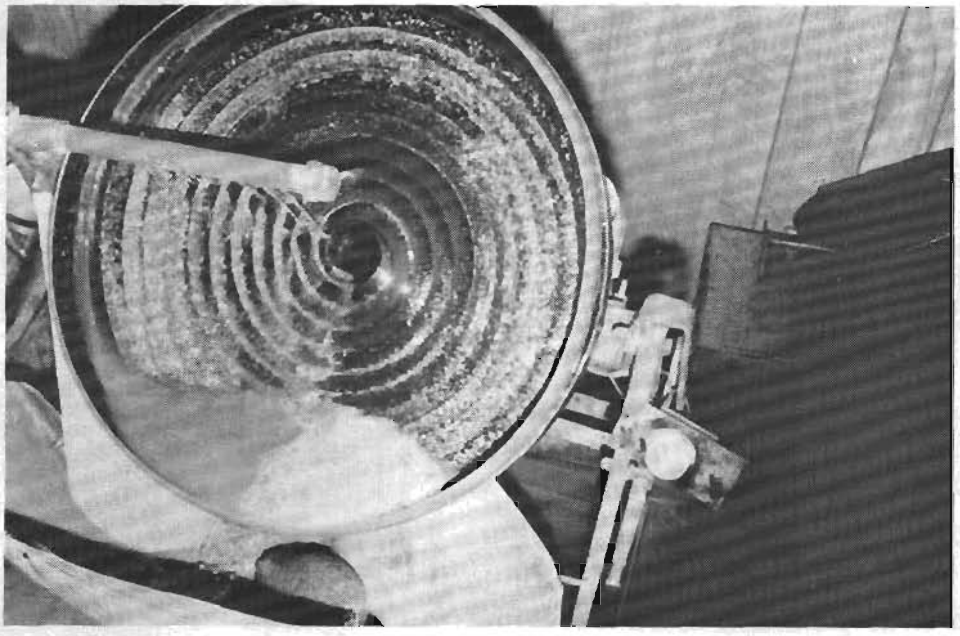

Fig. 21: The Goldhound Wheel in operation.

Fig. 22: All tailings are checked by hand. They are then stock piled for possible amalgamation and cyanidization in the future.

Fig. 23: Final weigh-up.

Some Effects of Glaciation Upon Placer Geology

by
Jeff Kline

It has long been understood that glaciation presents problems for the preservation and location of mature placer deposits. Glacial processes can remove, transport, bury, mask and in some cases even cause the development of placers.

With the exception of the beach placers at Nome and some other notable exceptions, most of the big producing placer districts in Alaska occur beyond the limits of known glaciation. There are, however, many small placer districts which occur in regions known to have undergone glaciation.

This is a brief review of glacial mechanisms which may have an effect on placer preservation and development.

Glacier systems have both erosional and depositional components. The erosional components can very effectively scour and remove material from the glacier's bed. At the same time, adjacent areas may be receiving sediments, deposited by the same ice that up or down glacier acts as an erosive agent. Several factors determine whether a glacier acts as an agent of erosion or of deposition. Generally, these are related to physical conditions surrounding and within the glacier at any given point. Some of these factors include basal temperature, ice thickness, flow velocity, constriction or lack of it by valley walls, debris loaded at the base of the ice, hardness of the particles comprising the debris load, presence or absence of subglacial water, permeability of the glacier's bed, and steepness of the bed. Singly or in a wide variety of combinations these factors can have a significant bearing on whether or not a glacier will strip off or deposit material.

Glaciated areas are commonly recognized by the set of glacial land forms generated by erosion and deposition. Collectively these forms give rise to a glacial landscape. Features such as cirques, U-shaped valleys, scoured and streamlined bedrock forms and moraines are common to these landscapes and help to identify glaciated terrain.

Processes causing glacial erosion can be divided into four categories: Scour, plucking, action of subglacial water flow, and bulldozing.

Scour results from abrasive action at the base of a glacier as it slides over its bed. Glacier movement has both flow and slide components. Which of these components dominates, depends on several factors such as a steepness of the bed and basal temperature. Ice on the soul of a glacier is commonly loaded with sand, silt and clay size debris. The debris-laden ice acts in a manner analagous to sandpaper wearing down the underlying rock as it inches forward year after year. Just as sandpaper becomes clogged after a time with fine sawdust, the abrasive at the base of a glacier may become clogged or dulled by fine

clay size particles derived from the relentless grinding. Subglacial water commonly helps to unclog or "sharpen" the base of a glacier by washing out the clay size material and re-exposing the tiny cutting edges of sand grains. Another "sharpening" process is the melting by frictional heating and pressure of the ice cement which entraps abrasive particles in the glacier base.

The effectiveness of the entrapped particles in the glacier's base as an abrasive is dependent upon their hardness relative to the bed material which they override. For example, a glacier originating in a shale or lime stone terrane and carrying shale particles in its base, would not very effectively abrade a hard granite or quartzite in its path.

Glacial plucking is a process by which large chunks of bed material are lifted or plucked from place by incorporation into moving glacier ice. This may occur by entrainment - a process by which the block or irregularity is surrounded or engulfed by moving plastically deforming ice, and dragged away, or the process may result from a particle being frozen to the base of the glacier by a pressure melting and refreezing process known as regelation.

As a glacier erodes deeper into the bed material that was underlying it - the fresh, unweathered bedrock will become unloaded and will start to joint or sheet parallel to the surface. Fresh bedrock thus released can be incorporated in the base of the glacier. The glacier may also exploit previously existing sub-vertical and vertical joints and pluck blocks of joint bounded material from bedrock surfaces.

The action of melt water is a very important erosion agent in the glacier environment. Flowing sub-glacial melt-water may act to remove the scour debris. Particles that are removed during glacial scouring are then transported from underneath the glacier, cleaning the bedrock surface and allow more scour to occur. If this process did not occur, in many cases, scour would become ineffective. In some cases, it does not occur. That is one reason why pre-glacial placers are preserved and not removed from under the glacier. Water escaping from under a glacier is under a tremendous amount of pressure, especially when the ice is active, providing a very effective agent of erosion.

The quantity and mobility of subglacial water can be important to erosion. Erosion is dependent on whether or not the bedrock underneath the glacier is permeable. If water is trapped in an impermeable situatin under hydrostatic pressure, it may tend to raise the glacier slightly off it's bed thus reducing friction and erosion.

Bulldozing occurs when an advancing glacier shoves and pushes material ahead of its terminus. This may disrupt pre-existing placers in the glacier's path and cause any paystreaks to be fragmented, disoriented and diluted.

Glacial deposition

There are two basic types of glacial deposition. One involves the direct deposition of till by active ice---a completely unsorted, unwashed sediment, and the other involves the action of melt water within and adjacent to active or stagnant glaciers. Deposits associated with the latter type are variously known as outwash, ice contact and/or stratified drift. These deposits have undergone some degree of sorting and washing. Rarely, under proper conditions these types of deposits may have placers developed within them.

In some areas where erosion was never a dominant characteristic of the glacier system, glacial deposits may have buried or wasted preexisting placers making prospecting difficult. A famous gold field where this occured is the Bakersville-Caribou District. Placers residing in incised canyons were preserved there when glacial ice covered the surrounding plateau. In this area deposition was dominant over scour, especially in canyon bottoms, predominantly due to the topographic setting which allowed ice to pool on a mountain rimmed plateau with very restricted outlets.

In rare situatins glaciofluvial deposition may result in the production of placers. A famous and notable example of this occurred on a large scale in the Westland District, New Zealand. In this region there is a remarkable correlation between the positions of former glacier terminal and rich gold placers in outwash and ice contact deposits such as eskers and kames. It is believed that former glaciers held terminal positions for long periods of time in the region. Detritus transported to the front by glacial ice was washed and sorted by melt water at and beneath the glacier allowing concentration of placer gold. The occurrence of placers here is correlated only to glaciofluvial (involving water transport) deposits and not to the unsorted till up valley. The richness of the placers in this area is in part attibutable to the long period of time which the stationary glacier terminus lingered in the area and to the quantities of disseminated gold in the bedrock toward the glacier's source.

An analogous but smaller scale occurrance of this type in Alaska is the Tammany Channel on Valdez Creek near the headwaters of the Susitna River. The pay gravels here, like those at Kumara, Westland, New Zealand, are of glaciofluvial origin. Glacial meltwater flowing at the margins and from beneath a glacial tongue occupying Valdez Creek formed outwash channels during late glacial times. Washed, coarse material in these channels contains the coarse gold typical of high energy outwash deposits. The Dry Creek cut on the south side of Valdez Creek, is in one of these abandoned glacial outwash channels and produced on the order of 36,000 ounces (T.K. Bundtzen, oral communication).

It seems to hold true that if a relatively large area of auriferous bedrock is present in a glaciated drainage basin and the outwash

streams hold their courses in the same place for long periods that placer concentration is most likely.

Numerous examples can be cited in Alaska where preglacial placers are preserved in spite of heavy glaciation. Some of these include the beach placers at Nome where at least 11 known auriferous beach deposits occurring beneath and intimately associated with glacial drift sheets have been worked or prospected to produce over two million ounces of gold since 1899. Smaller deposits are known from glaciated terrain from the Iliamna to the Wiseman District, Nabesna District to the Kobuk. Many of these occurrences have their own set of peculiarities owing to the glaciated nature of the country. Pay streaks may end or begin abruptly seemingly without apparent cause in glaciated country. In unraveling the glacial story may indeed be the key to their fate.

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LUNCHEON SPEAKER
David Heatwole
President, Executive Director
Alaska Miners Association

I can't impart any knowledge to you about placer mining. In fact, I'm learning a lot myself today. What I'd like to do is tell you a little bit about what's going on in the hardrock mining industry in the State, share with you some of my ideas as to why the hardrock industry is going to flourish again. I'd also like to comment on how the development of a major hardrock industry is going to benefit the small miner. I'll close with a few words of what I think the Alaska Miners Association should be doing.

As most of you know, mining, historically, has always been very important to the economy of Alaska. It was the discovery of gold in the late 1800's that led to the settlement of the State. Placer mining has been a solid and important part of Alaska's economy from the goldrush days. Production has consistently added to Alaska's economy. I don't need to tell this group that, currently, the placer mining contribution to Alaska's economy is on the rise. We're in another goldrush situation in the State.

The hardrock mining industry in Alaska began on the heels of the goldrush with the discovery and development of the Kennicott Mine in the Wrangell Mountains and the Alaska Juneau Mine. This was around the turn of the century. The hardrock mining industry flourished and contributed to the State's economy, right up to the start of the Second World War in the 1940s, when the war effort forced the closure of Alaska's major and small hardrock mines.

After the war, because of the high capital cost of getting started again, and the availability of cheaper foreign minerals, Alaska's hardrock mining industry never really got started again. I think it's very important to look at the Kennicott operation in detail.

When the Guggenheim interests attempted to develop the Kennicott property back in the late 1900s, they faced a situation very similar to the one that we face right now with Alaska's hardrock industry. If they wanted to develop that mine, they had to put in a transportation system, they had to supply power, they had to build a townsite for people to live in, and they had to find a market for their product. They were able to do that because they had a good ore body. They developed it. They had enough money to pay for the transportation system and all the infrastructure; they also made enough profit out of the mine to start the great Kennicott Copper Corporation. This was the seed that started Kennicott Copper.

We still have these kinds of deposits in Alaska to help us get the industry started.

When I first came to Alaska back in 1974, I made my tour around to a lot of the government agencies. I was told that, because of the remoteness, climate, high cost of labor and all those other unique Alaskan things, major hardrock mining was never going to be economical. In other words, just "why don't you pack your bags and go home."

If remoteness and climate and all of our neat Alaskan problems are the reason that hardrock mining isn't being developed, then why, in the Yukon Territory, does mining provide 85% of the economic base? Likewise, on the Siberian Peninsula, the Russians are currently developing deposits of gold, tin, nickel and even diamonds in an area that is geographically and geologically similar to Alaska's Seward Peninsula. Alaska is a big, blank area of political boundary with no development. If the mines can be developed in other countries under these conditions, we should be able to do it in Alaska also.

Another thing that leads me to believe that Alaskan deposits will be developed is the fact that they're high-grade. My company is currently mining copper ore at Butte, Montana with values on the order of $20 a ton. Our deposits that we're drilling up in the Ambler District in the southwestern Brooks Range are averaging over $220 a ton—over ten times as rich. That goes a long way toward offsetting the increase of doing business in Alaska.

We have to realize that the bonanza deposits that developed the western United States are still here in Alaska. Some of them are going to be found. They will provide the highgrade ores needed to get some of the infrastructure in place to proceed with development.

The United States is dependent on foreign suppliers for mineral supplies. It starts with 100% dependence for minerals like columbium—niobium—and mica. Down to 5% import of pumice and volcanic cinder. I think, since Mt. St. Helens, we're now self-sufficient in the cinder category.

If you look at such metals as cobalt, we import 97% from such politically unstable countries as Sambia and Rhodesia. Platinum-group metals and chromium are also imported from our friends abroad at a high percentage. The best known chrome deposits in the United States are in Alaska. Most of the U.S. platinum production has come from Alaska. We're importing 81% of our tin from Asian countries and Bolivia. Everytime we have a World War, the government runs up to the Seward Peninsula, opens up the tin mines and mines a little tin. Then as soon as the shipping lanes are open, we forget about it again. The point being that Alaska has these strategic metals, and there's a growing awareness of national dependence on other nations for them.

There are many known strategic metal occurences in Alaska. These aren't developed reserves, but they're areas that can be prospected. Undoubtedly, some of those will result in economic deposits. All the strategic metals are known to exist in Alaska.

During the D-2 debates, a lot of you heard Mr. Andrus and his crowd get up and say, "We have specifically tailored our part to exclude known mineral deposits." I've plotted those known strategic metals, which our country needs, with respect to the duly created parks and wildlife refuges. I think, if Mr. Andrus was a tailor, I wouldn't buy a suit from him, because a lot of the strategic metals are right inside the boundaries of parks where a six or seven mile shift could have left them out. These were known deposits at the time the parks were created.

In the early 1970s a few major companies, in spite of the uncertainty of Alaskan Lands and the other problems here, began to explore with modern techniques. Those of you who are in the business know that it takes almost 10 years from the iniation of an exploration idea to the development of reserves, or put some "rock in the box", as we say in the hardrock industry. This exploration, as started in the late 60s and early 70s has produced some very spectacular results.

I will list six of the known Alaskan mineral deposits. These are deposits that have been drilled, or that are proven reserves. I have used unit values instead of grades.

We have the Lik Sue deposits up in northwest Alaska, a highgrade lead-zinc silver deposit with over $100 a ton value, estimating a gross metal value of over six billion dollars.

We have the Ambler District in the southwestern Brooks Range, again a highgrade copper-lead-zinc silver; gross tonnage values of over $200 a ton; proven reserves up to $15 billion. We have the Quartz Hill deposit near Ketchikan, southeast Alaska. Molybdenum, a pretty low-grade ore, but a lot of it. The value of that has gone up considerably. Borax has released some additional tonnages, additional reserves.

We have the Brady Glacial Deposit, the United States' largest nickel deposit, locked up in Glacier Bay. A copper nickel deposit of over $10 billion gross value. Down in Admiralty Island, Noranda is attempting to develop a highgrade gold-silver-lead-zinc deposit. It was an impressive $500 per ton unit value, highgrade silver and gold.

I think the total is $54 billion of known reserves, of latent development in Alaska.

What effect would the development of some of these reserves have in Alaska's economy? We have the results of a 1979 government study on the development of the Ambler District. Bear in mind that these are 1979 dollars, and the cost today would be inflated. In 1979, a $200 million capital investment would have put the mines in production and created over 600 new jobs at the mine site and in the State. It would have provided the State of Alaska with an annual $25 million income from taxes that are already in place.

If, by the 1990s, we had 10 major hardrock mines in development the hardrock mining industry could be employing 6,000 to 10,000 people. It could be providing the State of Alaska with an additional $250 million of income to the treasury. (Not oil income, and you know how badly the treasury needs more money in Alaska right now.)

I have to get a little lick in about rape, ruin and run—the common statement of Mr. Andrus. I will illustrate, with a deposit that Anaconda has drilled in the Brooks Range. There are over 26 drill sites on the hill. We've developed over $2 billion worth of reserves. The impact on the environment is practically nil. The drill pads are put in with pick and shovel. We move the equipment with a helicopter. When we're done, we take the equipment out. There is no impact on the environment. Now, if this deposit's developed, there will be impact, of course. But, the point is to get in an exploratory operation and find out what's there—modern exploration techniques do not leave any tracks. We can get in to do the exploration and find out where the minerals are, and not disturb the land for other uses.

What could the hardrock development mean to the small miner in Alaska? One thing is, it will have to improve the State's transportation systems. We will build some roads in the Interior to where these deposits are; roads or railroads, and also some new ports. Once this is in place and done, of course that's going to lower shipping costs in the Bush, which will make small operations a lot more profitable, or able to mine lower grades.

Likewise, there's going to be remote power sites developed: the coal-fired hydroelectric, or something exotic like a small nuclear plant. There will be power in the Bush that's quite a bit cheaper than burning diesel.

More importantly, construction of roads—it's going to give the small miner access to Alaska's hardrock minerals. Because of the remoteness and the way Alaska's transportation system is, only the companies with major financing have been able to get in and explore for Alaska's hardrock minerals. When you get the roads in place, the small miner is going to be able to drive his pickup and start doing his style of prospecting also, in Alaska's vast interior.

I cannot over emphasize the role that the small miner plays in the development of the large mine. In the Lower '48, over 90% of the mines that are now producing were discovered by the small miner. He makes his strike, it's too big for him to handle; he turns it over to the big companies. He provides the big companies with discoveries. Now, I'm a professional geologist, and I should be telling you if we're in there professionally, we'll find everything. But the small miner's attitude, his feel for the land, his love of prospecting, his decision to give it one more round--all the time he really goes for broke. Those are the the things that produce quite a few discoveries.

So, the construction of these roads and getting the small miner in there is going to be a 'shot in the arm' for the major companies because you're going to get this small miner's impact on the state's economy. We see that as a very beneficial spin-off.

Also, when the transportation's in place, I think you'll see some small hardrock mines. You're already seeing a few around the Fairbanks area. Once the roads are there, the small miner will be able to develop the smaller deposits also. So, there will be small hardrock mines that grow on the coat tails of the majors.

I have just a little more here. I've painted a pretty rosy picture for hardrock mining. I know that a lot of you here have questions: When is all this going to take place? When can we expect to see these roads in? The answer to that, as I see it, is very simple. It's going to happen when the people of Alaska want it to happen.

I can tell you for sure that Alaskan desposits are going to be developed sometime in the future. Worldwide shortages and domestic shortages are going to force the development over everybody's objections. If the people of Alaska want a major hardrock industry, and they support it by road construction, and by keeping a stable investment climate, you're going to see these mines being developed in the "short term". But the people of Alaska will have to get behind it and push a little bit.

The message I would like to leave is that we miners, be we small miners, large miners, placer miners or hardrockers, producers or prospectors, we really face a common problem. That is how to get the government moving in our direction. A lot of the government regulations are really designed to inhibit development and inhibit production.

I think we're seeing a change in the country right now; we're seeing a little window opening up. You can go down and pick up a copy of Readers Digest and Time and read articles that say, "Hey, we're running out of strategic minerals; we have a problem." This means that the "man on

the street" is starting to think this way also. He is aware that we have a problem. So he's wondering, "What can we do about this problem?" Well, the mining industry has to show them what we can do. The way we do this is by putting our position in front of them and in front of the government. We do it through organizations such as the Alaska Miners Association, the Organized Mining Districts.

What we don't want to do is try to do it independently. Now, if we each take our own idea to the public, and to the government for promotion we won't have much impact. If, however, we can get together and take a concensus position, and then go the public, I feel like we have an opportunity to really impact with the government and with what's happening right now.

So, I would encourage those of you that aren't members of the Mining Associations to become members, and those of you who are inactive members to start coming out to the meetings to find out what is going on.

Thank you.

COMPARISON OF DRILLING TECHNIQUES

by
Ron Sheardon
Great Land Exploration

Thank you, Chris. When I received this invitation last winter sometime, Jim Barker called me and asked if I'd speak on our placer mining operation in Nome. Then, I happened to pick up the program the other day, and found out I was talking about comparison drilling. Anyway, I'll give you a few of my ideas on the drilling program that we carried out.

Being a small company and being without a great amount of money, we looked into several different methods. For example, Churn Drilling: We've looked at the Becker Drill and have been involved with it on a couple of programs (when we were spending other people's money). The Atlas Copco. Odex System or overburden drill. Reverse circulation, and I've looked at some of the more recent vibratron drills that Fred Wink is working on back east, and the Hawker-Sydney ultrasonic drill.

Looking at costs: To bring a piece of equipment into the Nome area, we've been looking at somewhere between $15 and $20 a foot, minimum. We took a look at what was available in Nome. Thrasher and Associated had a number of Mayhu 1,000s—straight rotary drills, not reverse circulation. (Table Drive.) We felt that we could drill in the range of $2 to $3 a foot, and it would be rough and dirty and cheap. However, it would give us some information, so we elected to try this system.

I think our results have been reasonably reliable. We do have some contamination, although in frozen ground I think it's much more reliable, or in stable ground. We've done more drilling this winter, and with the ground being drier and less saturated we had excellent recovery even in the thawed ground. We feel there were pretty good results. Naturally, being an explorationist and running hardrock operations for many many years, you're normally looking for something much more scientific. In this particular case, I feel confident in our results. Our total cost was somewhere around $2.25 a foot. We did a minor amount of mining on the property last fall, and it certainly beats the next best thing, which we couldn't afford.

Some of the problems that you run into with a high speed drill: There is no point in even trying to keep up with sampling with the drill. The first day we found out that there was absolutely no way that you could keep up to 8 or 10 drill holes, or say 500 feet of recovered material. The volumes were large and there's just no way to keep up

with it. We elected to pass by that and just use a spaced program, and do it in stages. We went in in June and drilled 35 holes in about a three day period. We just bagged it and, immediately after the drilling was finished, went to sampling the cuttings. When that program was done, that gave us a rough pattern of where the pay was. We came back in and drilled another 25 holes to close that gap. Initially, we went with 50 foot centers and 200 foot lines. We came back in and placed a number of our holes on 25 foot centers, staying with the 200 foot lines.

This spring in the section to be mined later this summer, we will use 100 foot lines and 25 foot centers. In some areas, we may even close that up. This is radically different from the old Churn Drill operation where you knew at the end of each day where the pay was going. With a high speed drill, there's no way you can keep up.

We used a Ross Box last summer on the mining operation itself, after the drilling program. It was a 100-yard-an-hour operation.

In all of our tailings, pit samples and drill cuts, we screened off the front, and then used Denver riffles for our final recovery.

We used a Terrex 8240 for both stripping and pushing into the box. As you can see, at the latter part of the season, we had lights on it for working into the evening.

That's really all I've got from my end. If there are any questions, I'd be happy to answer them.

Q What kind of a drill did you say you were using? I didn't hear.
A We used our Mayhu 1000, with a 20 foot kellet, and a 5½ inch hole. On our second round of drilling, we cased 20 feet on our holes.
Q How did you collect your samples?
A We collected below the table and just blew it out on plywood and bagged it.
Q Have you had a chance to cross check?
A The only other data I have is from the drilling on the property back in the 40's or 50's by Nel Swanberg from Nome. It looks to me that the values that we're coming up with are probably in the range of 25% below what they recorded on their churn drilling; which is fine with us. We know that we're economic and we're satisfied with what we're getting; if anything, it may mine out a little better.
Q (Indiscernible)
A We lost a number of holes in the bog ground. If it was saturated—if it wasn't saturated, then it really wasn't a problem. But, if there was a high water content in the ground, then there definitely was a problem.

Q What air pressure did you use?
A I don't know, off hand. I think a 600 CFM compressor was used on the machine.
Q You haven't been able to check on your own drilling?
A We've gone in (as I said, this winter) and done more drilling close, to where we mined. From this winter's drilling we're satisfied our results were reliable.
Q How much time was lost by casing?
A It would be about 30% more time in drilling a hole with the casing. We were averaging 7 to 10; in that range.
Q How deep were your holes?
A We went as deep as 130 feet. We averaged 50 feet.
Q Did you have a problem with the return of the water table?
A When we were in the water table we did lose a lot of holes, until we cased. But, all we could do is bag it; if we recovered too large a volume, too much return due to contamination, we just wrote off that section of the hole. The whole scenario of this type of drilling is that it was cheap and dirty; there are certain conditions that you have no control over.
Q You did not have a problem with gold washing away?
A I'm sure we did in super-saturated holes. We will go back into those sections now that we know where those problems are, and either drill them in the winter time or use a different type of drill.
Q What would be your next choice of drill?
A I would say probably a straight churn drill. There's a lot of new equipment around, but I'm not sure of their reliability factors. The churn drill has been around longer than most of them. Getting down to the newer stuff like the vibratron, I'm not sure. I visited the Vermilian Placer in Ontario this winter and observed the drilling utilizing the electrosonic or vibratron drill. Everytime you come in with a new drill, you come in with a new set of problems. I still think the churn drill is the most reliable one.
Q How would you feel about prospecting in 15 foot or 20 foot ground?
A If you've got a 20 foot Kelly, anything within that 20 feet, even if it's got a lot of water in it should give you an accurate sample. It's when you stop to change and put that first rod on, that you get into problems. If you shoot it straight and bag off your 5 foot sections within 20 feet of the surface, your reliability would be up.

A HYPOTHETICAL UNDERGROUND PLACER OPERATION AT LIVENGOOD

A Master's Thesis for the University of Alaska

by
Thomas Albanese,
Graduate Student
School of Mineral Industry

The objective of my study is to compare the costs of underground placer mining to surface mining. The study consists of two parts; first an evaluation procedure was developed for 483 drill holes at Livengood. Secondly, a computer program was designed to model the drill hole values, the gold values, the overburden thickness and the gravel thickness. This program yielded the total volumes of gravel; total volumes of overburden and total value of gold.

The data produced by the computer programs was compared with more traditional methods, notably the triangle valuation and double end area block valuation. Comparisons were made between each method. Error analysis, distribution analysis and cut operating analysis was calculated to yield a reliable determination.

The values from one paystreak were applied to a feasibility study, employing underground mining. This ground is being worked at this time from the surface. It's more economic (I'll be honest) to mine by surface methods.

I believe, however, that underground mining is going to be an important part of the mining industry in the future, and justifies this hypothetical case study.

The placer deposit extends for a large area in Livengood Creek. The area I was interested in is, between Line 28 and Line 48. I called a particularly rich paystreak, the UG Ore Body. This was the focus of my thesis and the feasibility study.

The gravels are in the high bench of Livengood Creek overlain by a thick section of overburden. The gravels are primarily chert and limestone boulders. The overburden consists of wind blown loess and boggy organics.

I looked at an underground mining plan because of the very thick section of overburden, 80 feet to 90 feet deep. This requires a lot of earth moving and alarms a lot of environmentalists.

Underground mining has been the traditional procedure for mining the gravels at Livengood Creek. A shaft was driven down to bedrock; drives driven parallel to the paystreak of the ore body. The material was mined, by

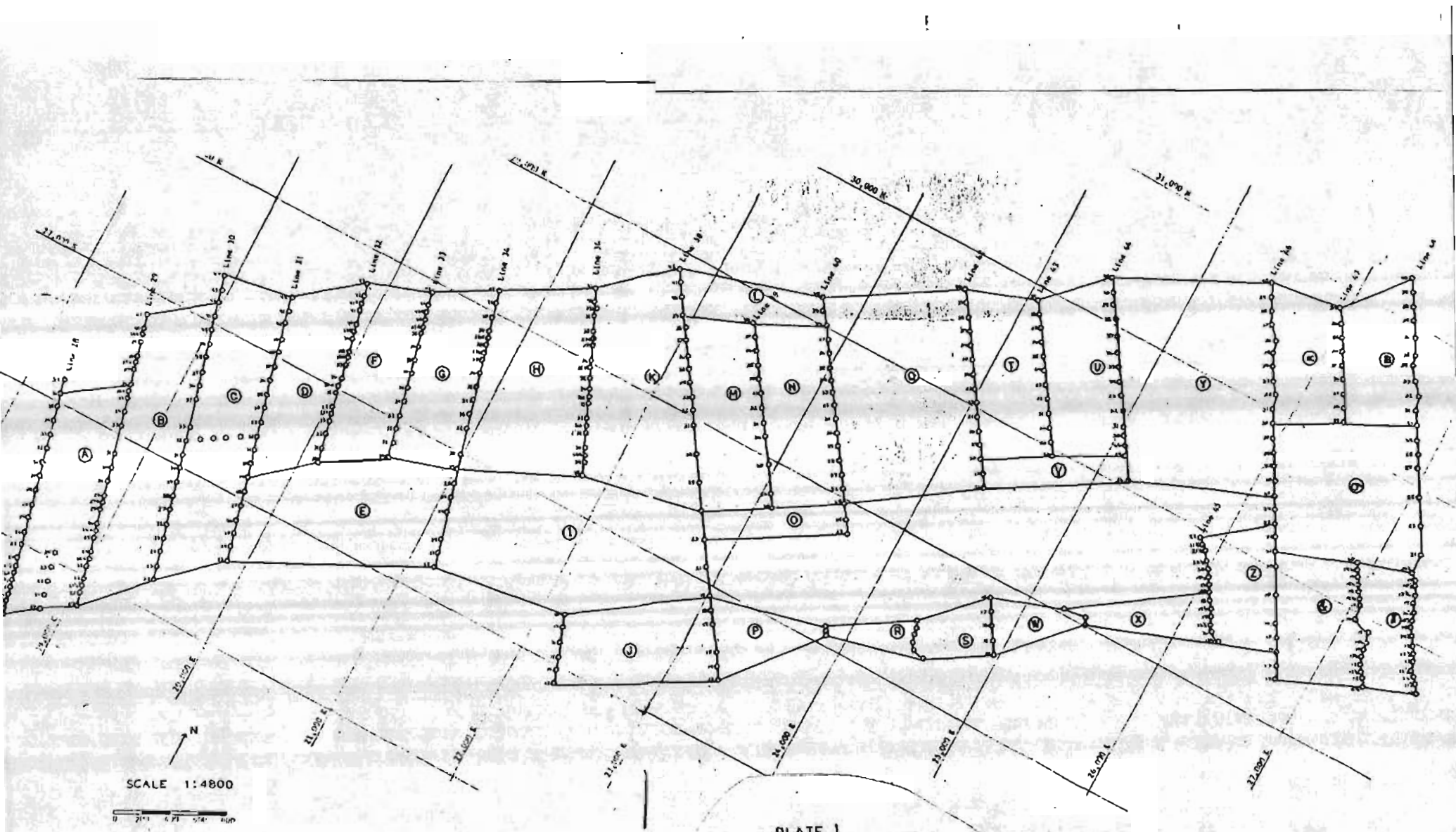


PLATE 1

Positioning and size of blocks used in double-end area valuation, drill lines 28-48, Livengood Creek.

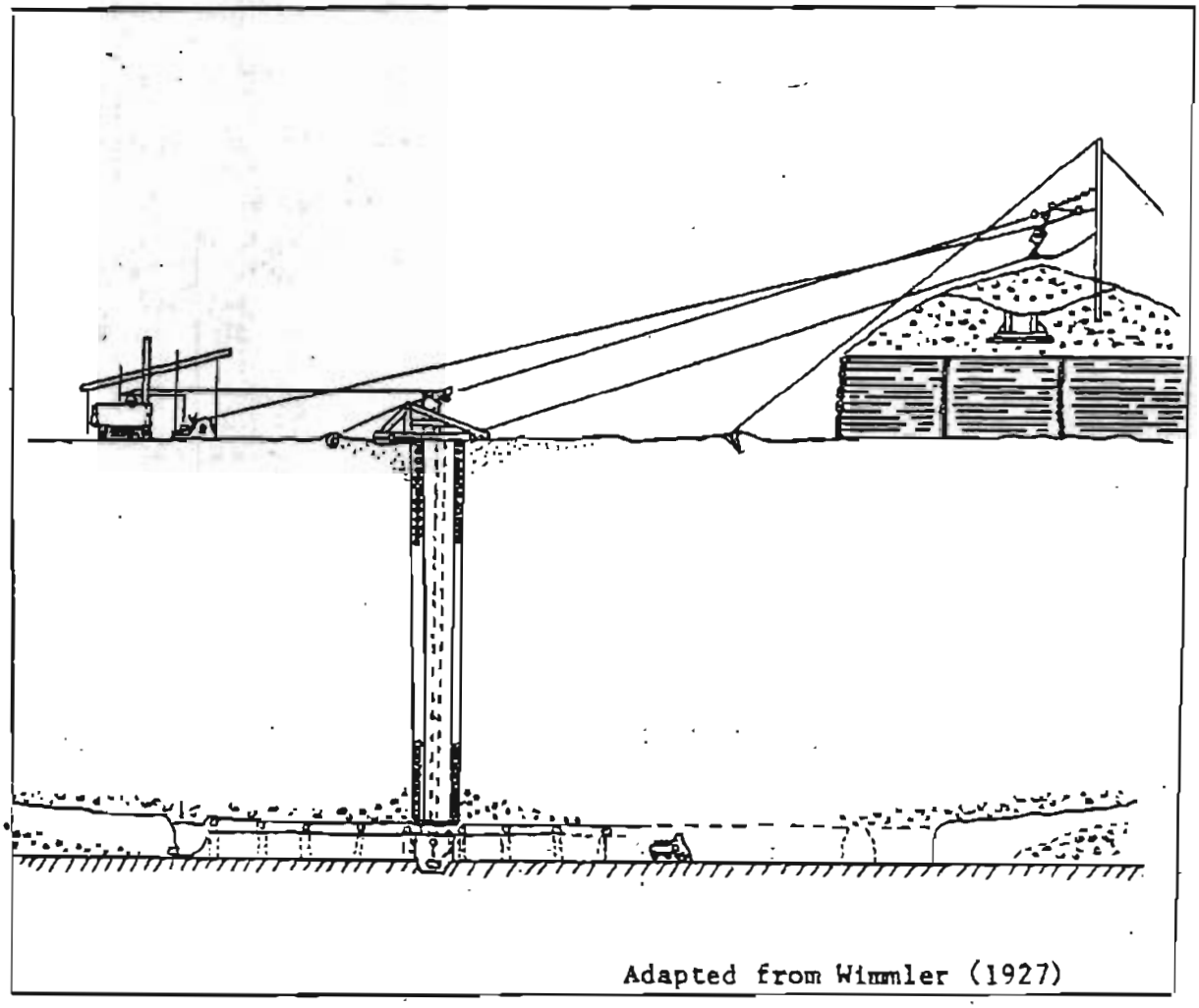


Figure 3. Cross-section of a former drift mining operation.

retreat stoping techniques, using thaw points and shovelling the material into wheel barrels. The material was hand trammed to the bottom of the shaft, at which point it was hoisted to the surface and transferred to the top of a conical pile by means of a gin pole and self sumping bucket. The material was washed in the summer months and the gold extracted.

Livengood Creek was considered to be a very good creek for underground mining, for several reasons: 1) It is solidly frozen from the surface to the bedrock. 2) There is very little underground water at bedrock. This provides for safer mining conditions. 3) A lack of silt interbeds within the gravel itself increases the safety of underground operation. Silt beds cause large scale slabbing and deformation of the mined stopes. 4) Most of the gold is at bedrock, and a very thin working face will extract most of the gold in the entire gravel section.

A computer model was used because 483 drill holes strewn across a map give one very little intuitive feel for the dimensions of the paystreak. The computer plot allows one to put on paper a model that represents the relative values of each drill hole. The data was plotted on a 3-dimensional prospective block diagram.

The modeling can also be used for geology. It shows that there are two different trends of paystreaks. The lower one is in the recent gravels; those existing at the base of Livengood Creek. The upper ones are the high bench gravels that are well distinquished from the lower placers, with a barren streak in between. The block diagram of the overburden thickness in these drill lines illustrates the thick section of overburden on the paystreak that is about 100 feet deep. The ore body is 30 to 35 feet deep.

I used, for a cutoff, 80 cent per square foot contour lines to delineate the ore body. The values are very high in the areas where limited bedrock contour information suggests that there was a narrow gorge. This deep bedrock channel contains very rich gravel. The overburden thickness contours can easily show us the total volume of overburden. The thickest section of overburden and gravel is right in the area of the UG ore body. This was another reason why I looked at an underground mining plan in order to exploit this deposit. The computer plot suggests a long tabular deposit. Other techniques such as triangle or block valuation depict a spotty, erratic deposit without an apparent trend.

Within the ore body, assuming an 8½ foot mining height, there is 240,000 yards of gravel containing over 40,000 ounces of gold. I am considering a very high

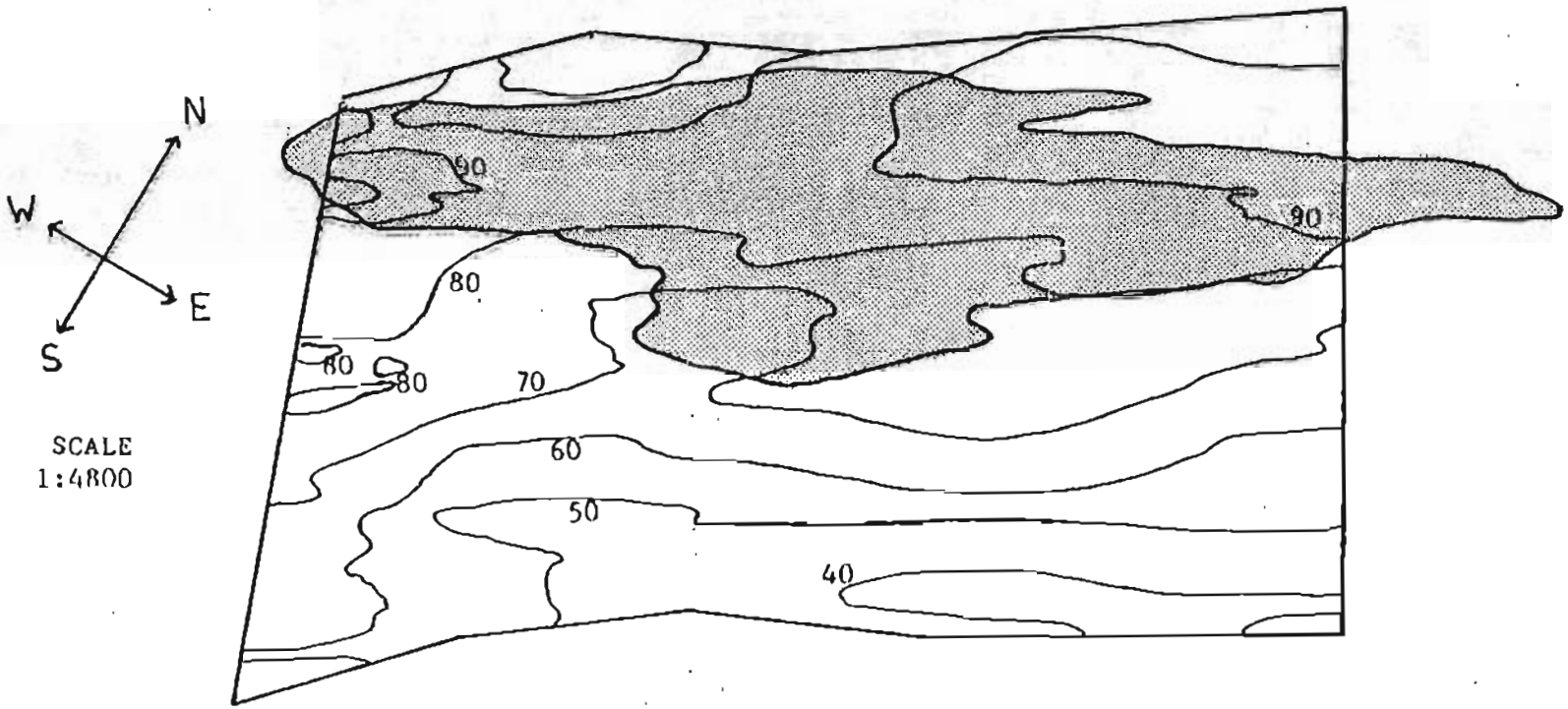


Figure 12. Overburden thickness contours (ft) within blocks D,G,H, and F and the U-G orebody (shaded).

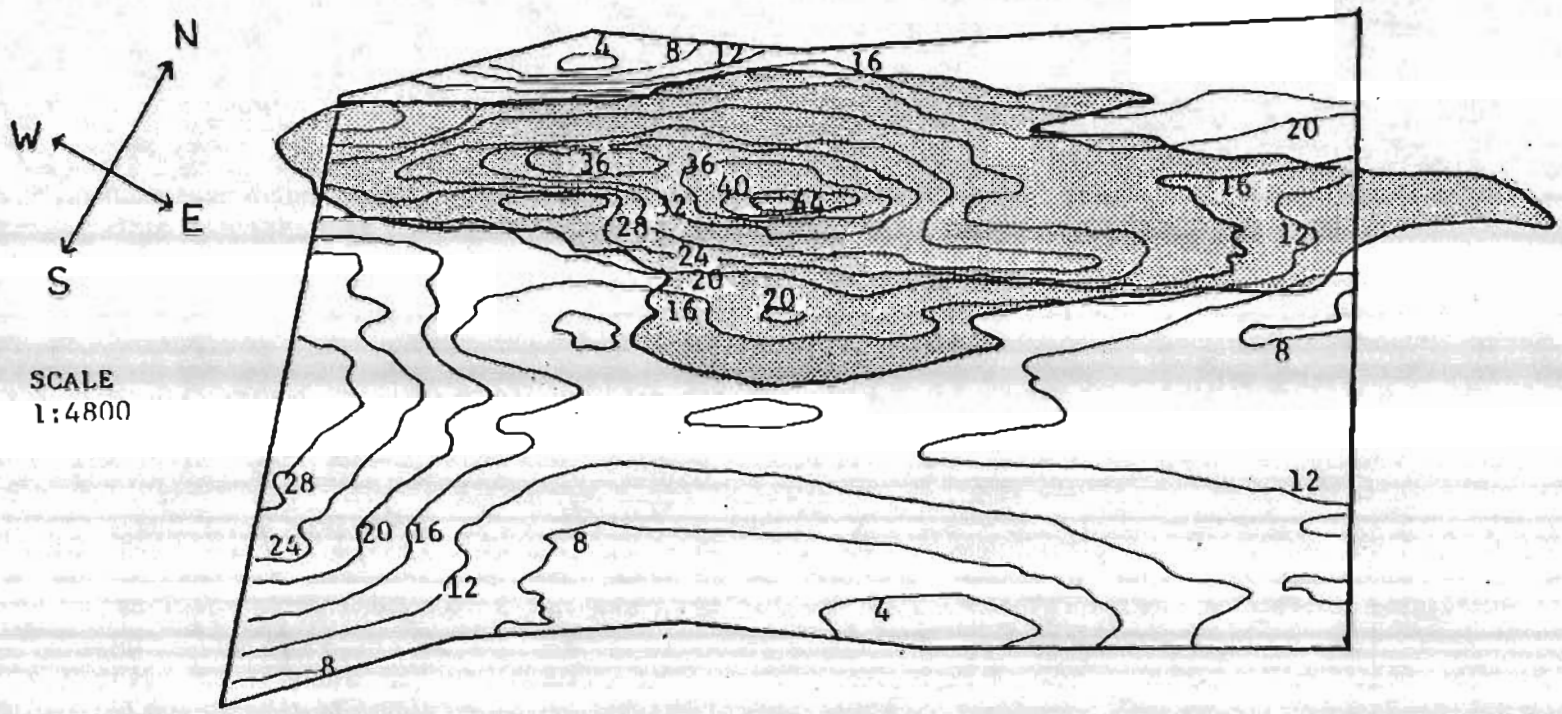


Figure 13. Gravel thickness contours (ft) within blocks D,G,H, and F and the U-G orebody (shaded).

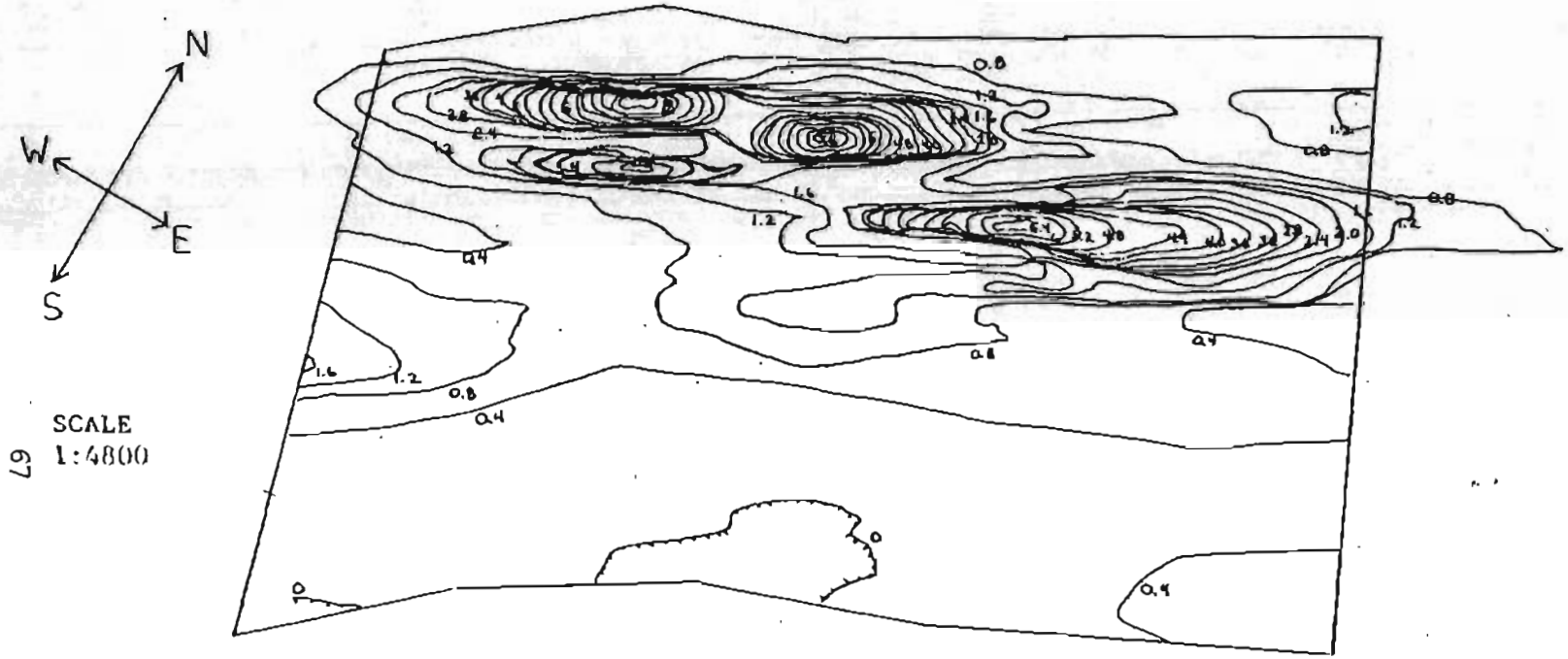


Figure 14. Gold value contours (in $/S.F. assuming $35/oz. gold) within blocks D,G,H, and F and the U-G orebody.

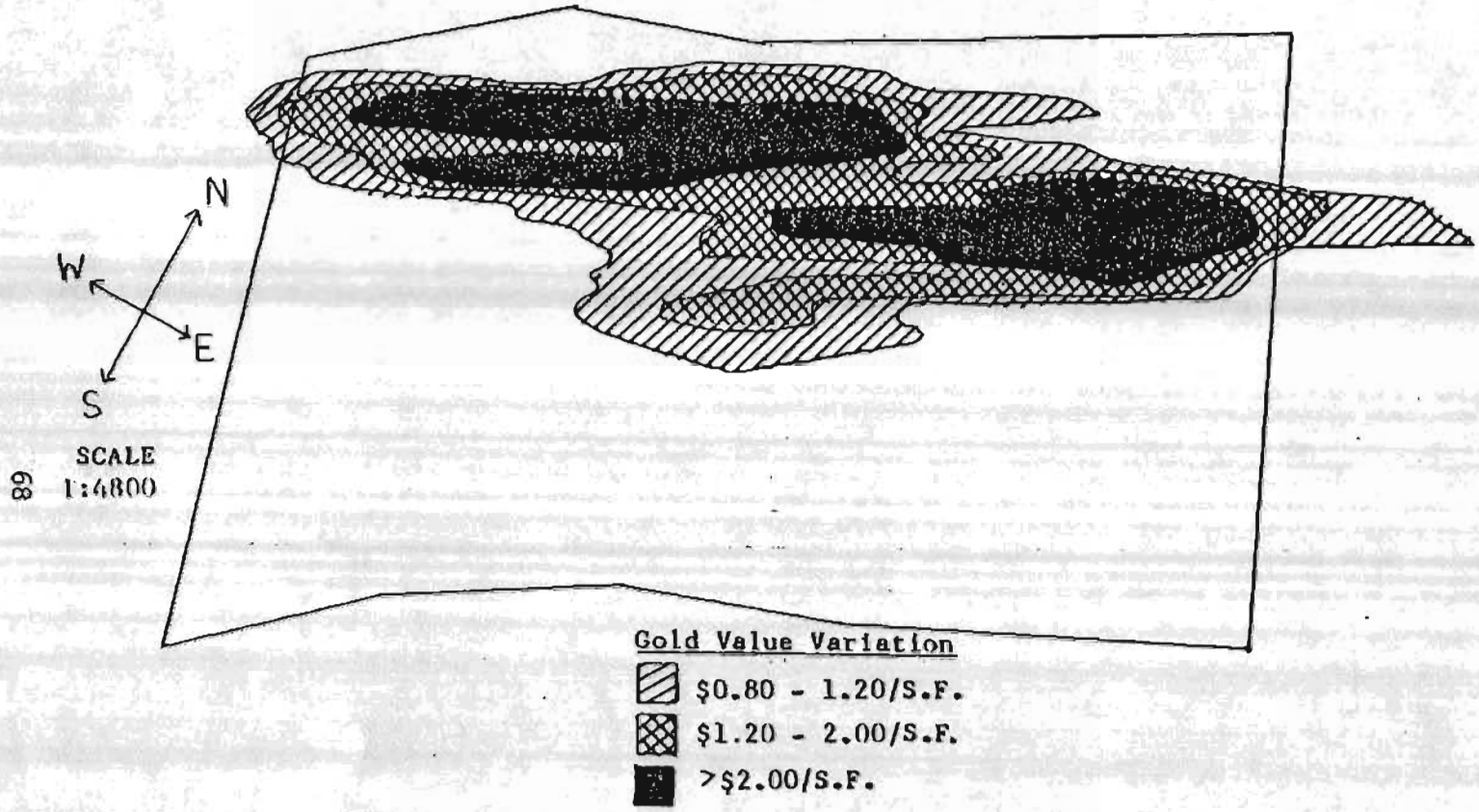


Figure 16. U-G orebody computer isopach valuation.
($/S.F. assuming $35/ounce gold)

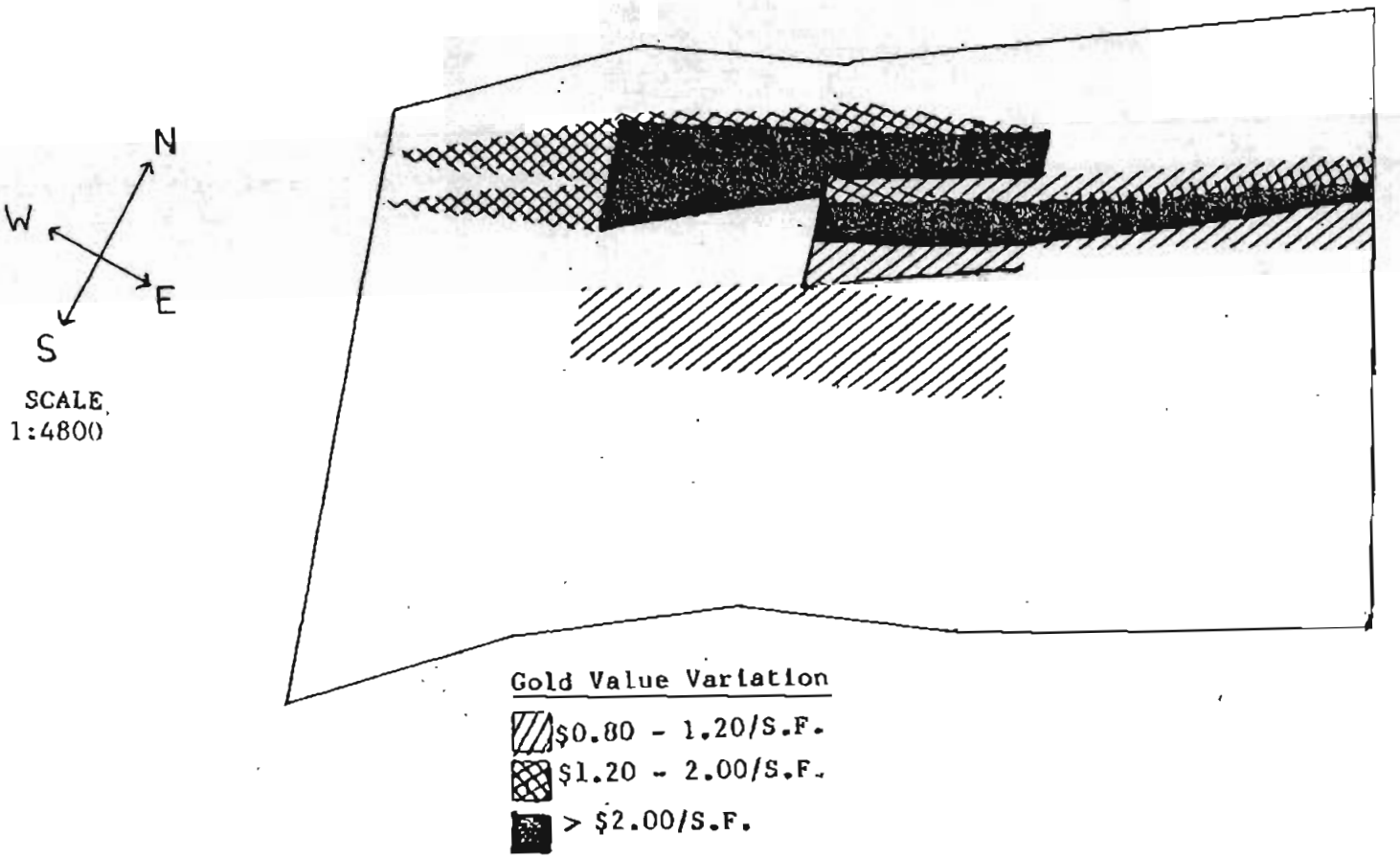


Figure 17. U-G orebody triangle valuation.
($/S.F. assuming $35/ounce gold)

production underground placer operation--about 380 yards of unbroken material per day, or about 570 tons per day.

It is necessary to mine an underground operation like this on a short term basis, with rubber tired equipment. Drilling should be with rubber tired jumbos, and the holes blasted with explosives. The rubble would then be mucked by whole load dump units conveyed down a haulage way to low profile trucks which will convey the ore up an incline to the surface. Ore will be dumped during the winter months and prepared for winter storage. My plan uses explosives for gravel breakdown. There are other techniques available and people are looking at them. Most notably, they include a continuous miner, ripper system, a micro-wave thaw or localized steam thawing.

The U.S. Bureau of Mines has done some excellent work at the Fox Permafrost Tunnel with regard to blasting conditions in gravel. I was able to take that information and directly apply it to my thesis and determine that my production assumptions will meet those goals as shown in the experimentation by the Bureau of Mines. The present mining of deep placers in the Soviet Union is by underground methods and this is done with explosives. That material is hauled by scrapers into a rail driven haulage to the surface.

Prior to a consideration of the expenses for the mining operation and initial capital expenditures required, it is necessary to look at the underground mine plan in relation to the ventilation and in relation to the support problems one would expect to encounter. The working face retreats toward the main haulage way and an open portal. The ventilation will be a negative pressure system with two large fans exhausting the material. Air intakes at open portal plus sixteen inch air intakes and a 36 inch air shaft will be continually exposed as mining retreats. Air will be continuously moving to clear not only the explosive gases during blasting but also dust built up along the walls from sublimation and fumes from the diesel powered rubber tired equipment.

Support problems can be classified into two general types. The first of these is small scale rock deformation, rock fall, and dust caused from the sublimation of ice out of the frozen ground. The second is large scale slabbing and deformation in the open work stope. The first type can be solved using the work they have done both in Greenland and in Spitzbergen north of Norway, in the frozen coal mines. A combination of rock flour slurry and water is sprayed onto the walls. This freezes to form a shell. If not only prevents the sublimation of the material behind the shell but it also hardens the surface. Experimentation has shown that this is both stronger and cheaper than Portland cement in winter conditions.

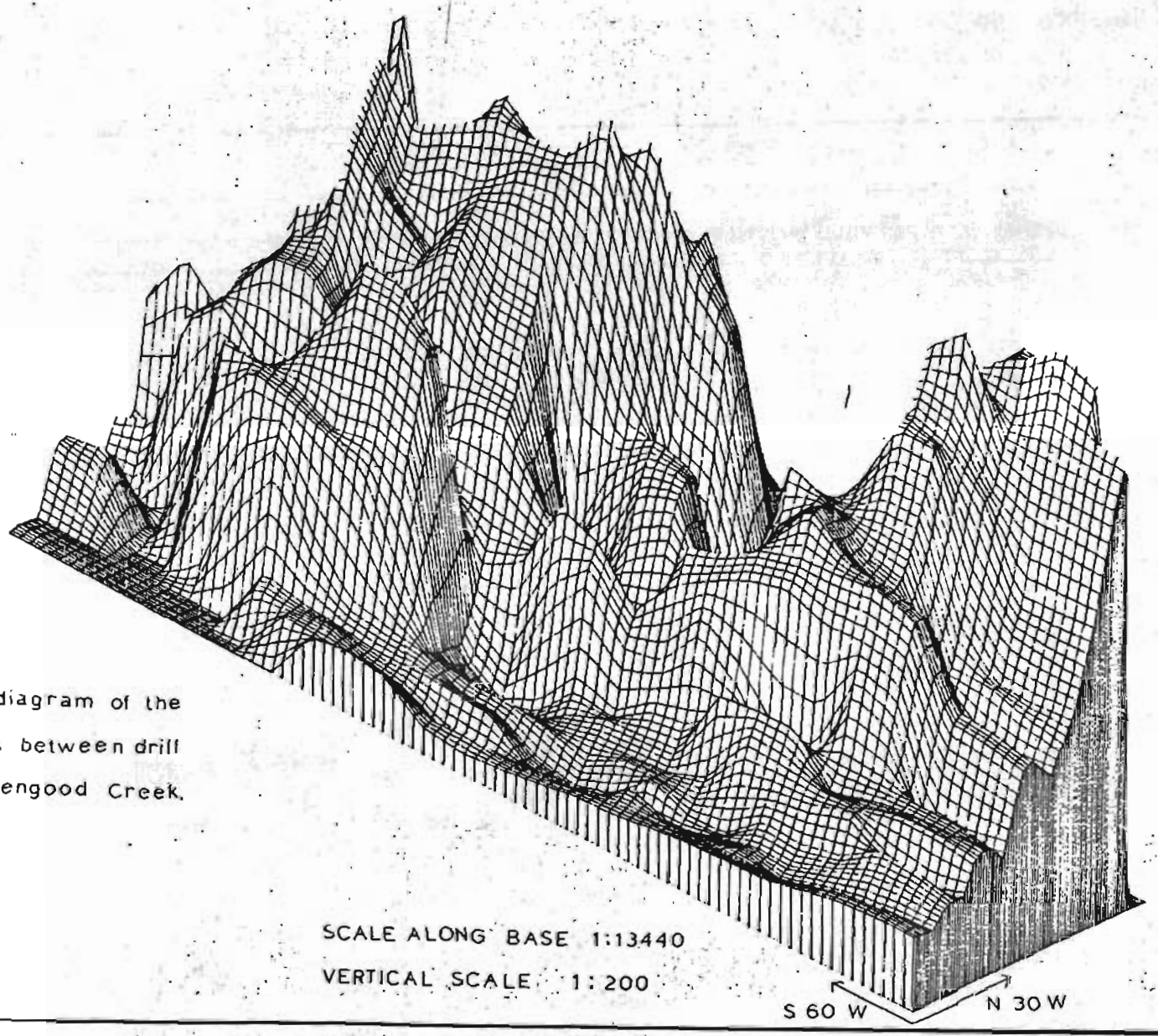


PLATE 2

Perspective block diagram of the overburden thickness between drill lines 28 and 48, Livengood Creek.

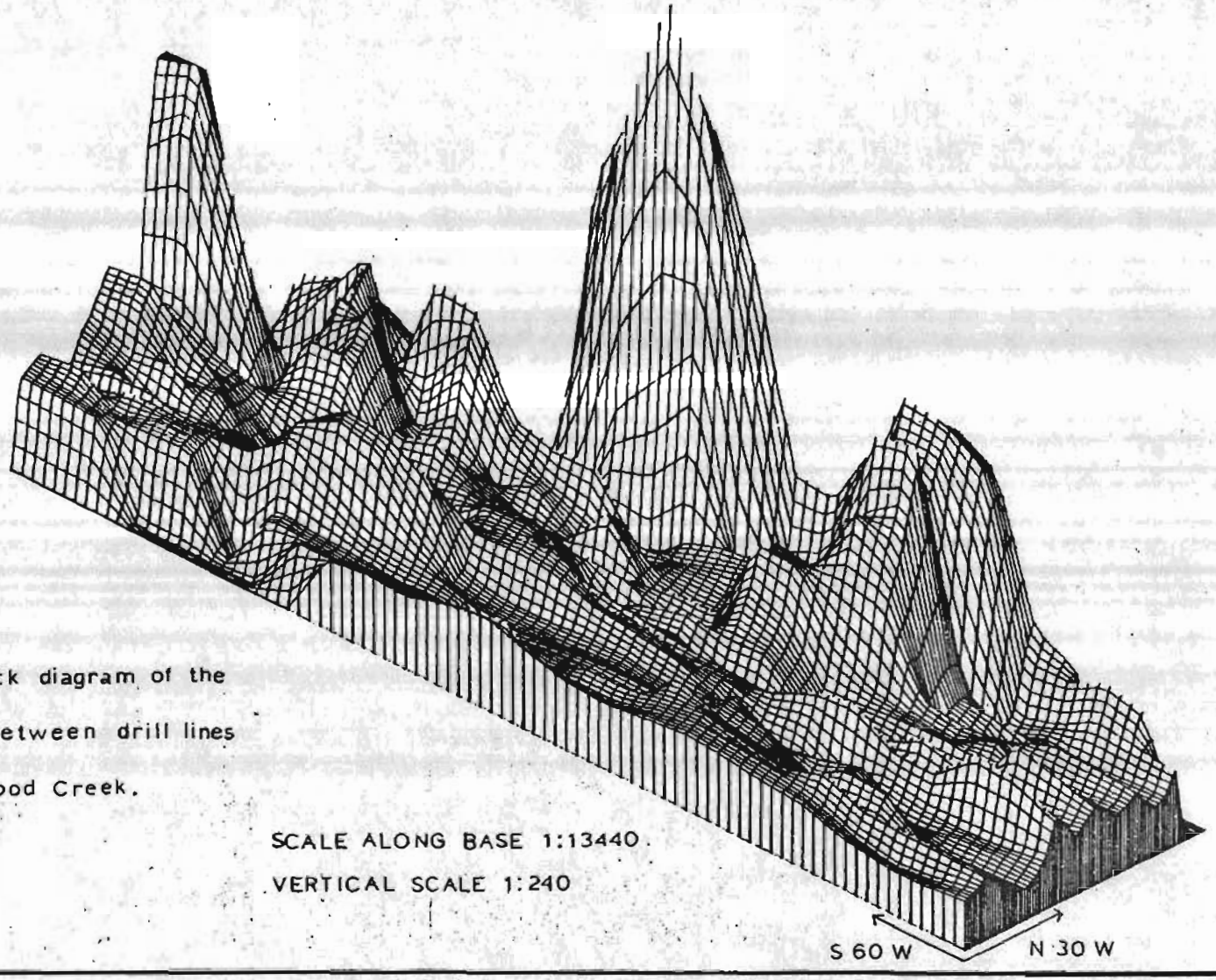


PLATE 3

Perspective block diagram of the gravel thickness between drill lines 28 and 48, Livengood Creek.

SCALE ALONG BASE 1:13440.

VERTICAL SCALE 1:240

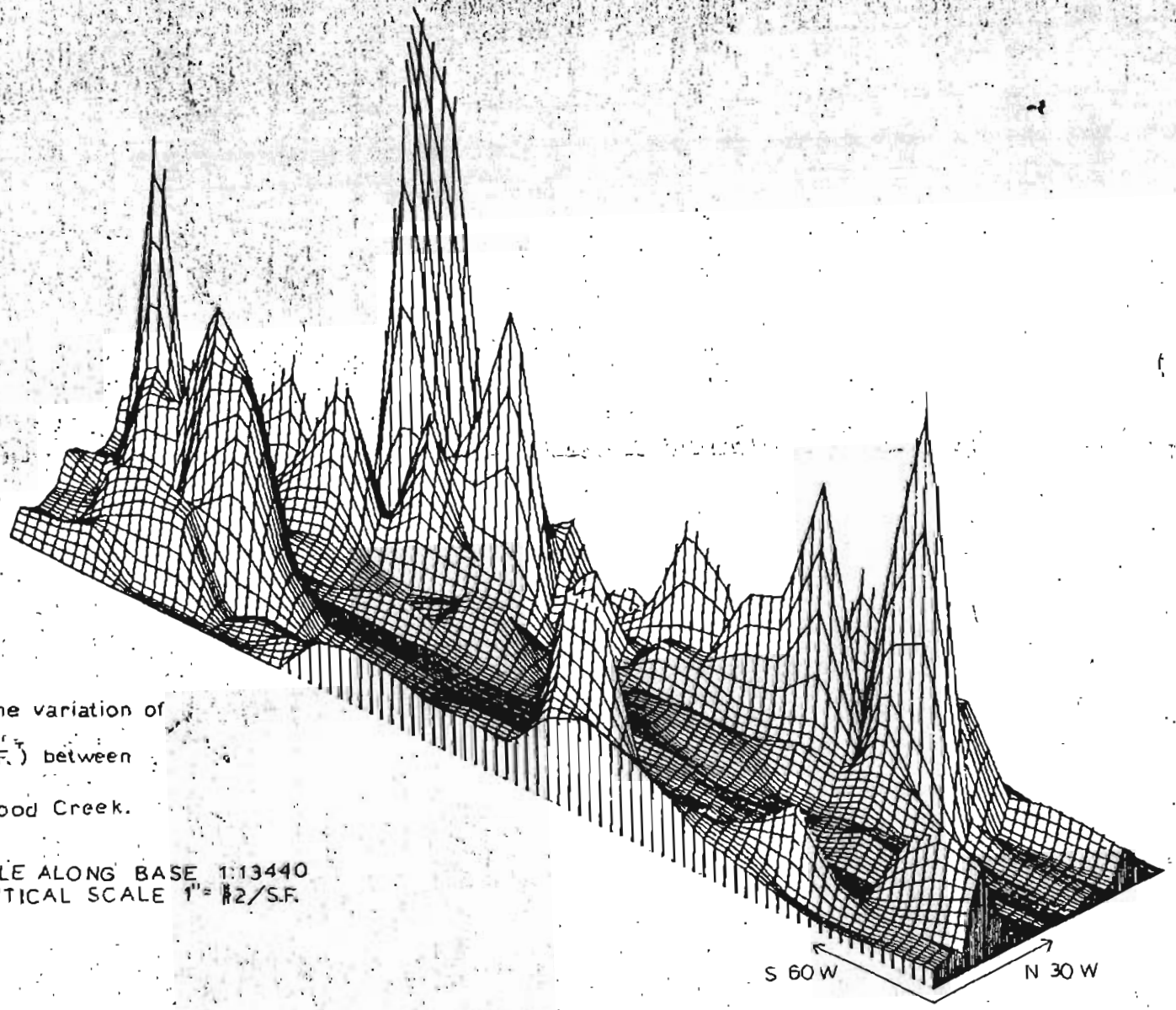


PLATE 4

Perspective block diagram of the variation of gold values along bedrock ($/S.F.) between drill lines 28 and 48, Livengood Creek.

SCALE ALONG BASE 1:13440
VERTICAL SCALE 1" = $2/S.F.

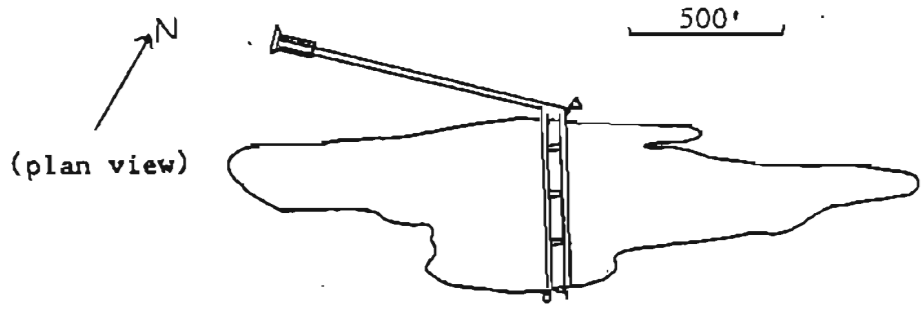
The haulage way going through the overburden will be a critical problem. It will be steel lined and backfilled with permacrete except for the portion at the open portal and the haulage going through the active permafrost layer. At this point we will backfill with cement.

The second support problem of large scale slabbing and deformation cannot be controled, but can be prevented from the onset. Studies in Russia and Alaskan drift mining operations have shown that the mine face will retreat on a rapid enough scale to allow a large margin of safety for the miners and the mine equipment at the working face. As the stope is being excavated the material will be subsiding but at a very slow rate. In Russian deposits where the surface area exceeds 64,000 square feet, they will allow the installation of pillars. In my feasibility study I have made provision for pillar support. Other techniques which can be used to prevent and hold back the susidence will be the use of hydraulic jacks behind the working face, the use of tailings backfill, ice backfill or snow spraying in the working face to minimize the volume and area in which deformation can occur.

This operation is not a very cheap method of mining. The initial capital investment is 6.1 million dollars. The majority is for the underground plant, and equipment and the surface plant and buildings. Most of the needed equipment is also used in coal mines or hardrock lead-zinc mines.

Mining will take place during six months in the winter, to keep the mine workings below freezing. This will prevent excess deformation or rock fall caused by thawing. During the winter, the majority of the mining costs are accrued as earth moving and excavation takes place. In the summer months one is only washing gravels. The total operating cost for the first six months of winter is 2.4 million dollars, which is very high. The majority of these costs are the operating maintenance labor and operating maintenance supply which includes diesel fuel. The total direct mining cost is 2.1 million as opposed to the total operating cost of 2.4 with the minor amount being for the indirect and fixed cost.

Summer costs aren't very high. They're negligible in comparison with the winter operating cost. All that is being done at this point is washing the gravels and overhauling the equipment and with day to day maintenance on the mine plant. Adding these two numbers together and dividing it by our annual average production stoping, we can come up with a total expected operating cost per yard of gravel mined. This is a real shocker for most people—about $51 per yard of placer gravel. We are used to seeing $2 to $15 dollars per yard. Underground placer mining is not much different from hardrock underground mining. Very high operating costs require a very high tenor of gravel to be profitable. A majority of the direct mine costs are about $30 per yard with a direct support cost of $14. The indirect and fixed costs are negligible.



Year 1 - Production Development

9700 yd^3 gravel @ 0.174 oz/yd^3

Au = 1687 oz x 0.915 fineness
= 1543 oz gold

Ag = 1687 oz x (1 - 0.915 fineness)
= 143 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver in all cases

Price per ounce gold	Credit to development ($)
$450	683,265
$550	834,479
$600	911,020
$625	948,979
$650	985,693
$750	1,136,907
$1000	1,514,942

Figure 25. Production and credit parameters for year one.

Next we must look at our revenues. To do this we need a year by year scenario of the mining plan. In year one, the decline is driven and a limited amount of ore along bedrock is removed. This will produce some gold bearing gravels and these values can be credited directly to development.

In year two the stope is developed. A large amount of gravel is now being moved and the revenues derived from that gold bearing gravel will exceed your costs. The production will start during year two, royalties and taxes will also start at this time.

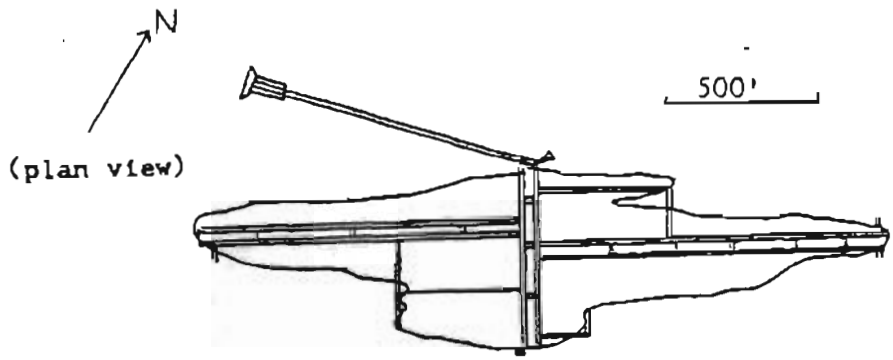
In year three, the stoping starts on the left hand side and retreats toward the main access way. The gross revenues pick up quite a bit now that full production is achieved. A pillar of 150 foot width is left between the main haulage way and the worked out stope. Next, one moves over to the right hand side and retreats back toward the main haulage way.

In year five, stoping continues until all that is left is the main haulage pillar. It is mined out in the sixth and last year of production. At this time the extractable gravel has been mined out.

The expected gross revenues can now be summarized per year and at several gold prices. Assuming a starting gold price at the time mining starts we can evaluate a relevant range between $450 gold and $1,000 gold. There is a good chance that gold will go below $450 and can go above $1000, but this is suitable for our needs.

I am also assuming that the starting gold price and any expected price increases to be seen during the mining operation will offset any increases in cost incurred during mining from inflation. This wash out principle is the only procedure for negating inflation and the price fluctuation of gold, it is not perfect.

After subtracting the operating costs from the revenues and considering depreciation, royalties, depletion and the taxes to be incurred as a corporation doing the mining, we can come up with an annual cash flow for each year and for each gold price. The price of gold is very important to the cash flow. At $1,000 gold, the net annual cash flow is 27 times higher than that at $450 gold. The price of gold is the most critical parameter determining the feasibility of the project. The annual cash flow is then compared with the initial expenditure to determine the present worth of the investment. I calculated this for several interest rates, reflecting several different investment scenarios. The scenario at 10% reflects the use of a low interest state mining loan.



Year 2 - Stope Development

43,040 yd^3 @ 0.174 oz/yd^3

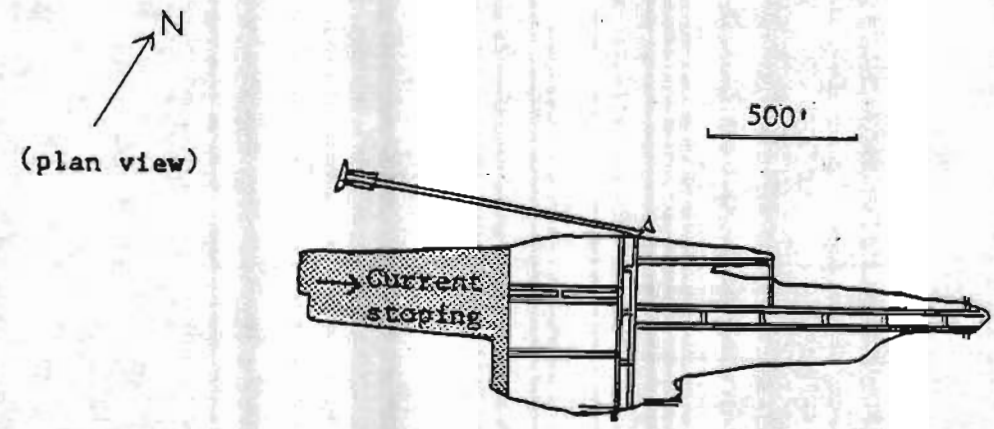
Au = 7488 oz x 0.915 fineness
= 6851 oz gold

Ag = 7488 oz x (1 - 0.915 fineness)
= 635 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver in all cases

Price per ounce gold	Gross revenue ($)
$450	3,064,093
$550	3,742,942
$600	4,086,257
$625	4,256,518
$650	4,421,191
$750	5,099,440
$1000	6,873,573

Figure 26. Production and revenue parameters for year two.



Year 3 - Production Stoping

64,800 yd^3 gravel @ 0.176 oz/yd^3

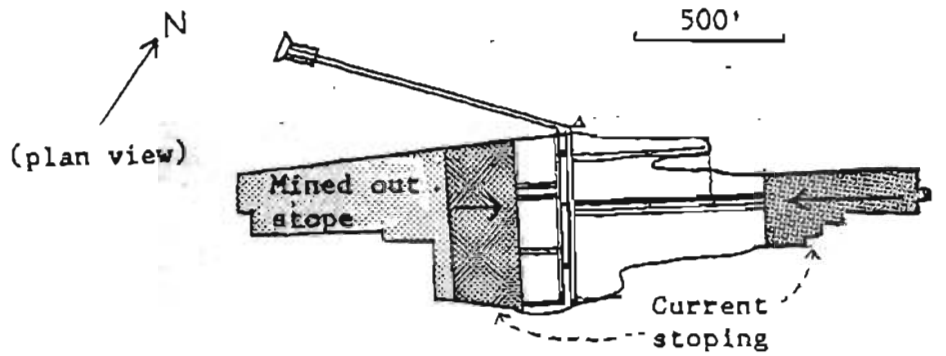
Au = 10,172 oz x 0.915 fineness x 0.95 pillar loss = 8842 oz gold

Ag = 10,172 oz x (1 - 0.915 fineness) x 0.95 pillar loss = 821 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver in all cases

Price per ounce gold	Gross revenue ($)
$450	3,955,366
$550	4,879,355
$600	5,270,821
$625	5,493,563
$650	5,706,082
$750	6,581,440
$1000	8,769,835

Figure 27. Production and revenue parameters for year three.



Year 4 - Production Stoping

57,120 yd^3 @ 0.163 oz/yd^3

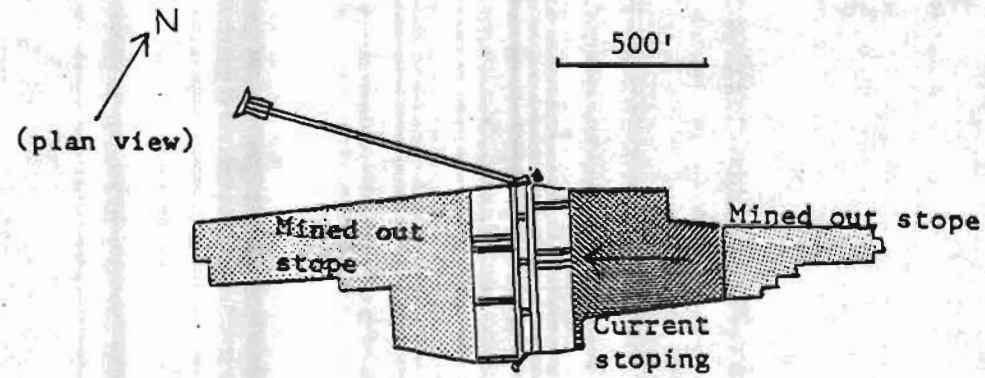
Au = 9311 oz x 0.915 fineness x 0.95
pillar loss = 8093 oz gold

Ag = 9311 oz x (1 - 0.915 fineness) x 0.95
pillar loss = 751 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver in all cases

Price per ounce of gold	Gross revenue ($)
$450	3,656,719
$550	4,466,019
$600	4,875,625
$625	5,078,776
$650	5,275,319
$750	6,084,619
$1000	8,107,869

Figure 28. Production and revenue parameters for year four.



Year 5 - Production Stoping

58,300 yd^3 @ 0.182 oz/yd^3

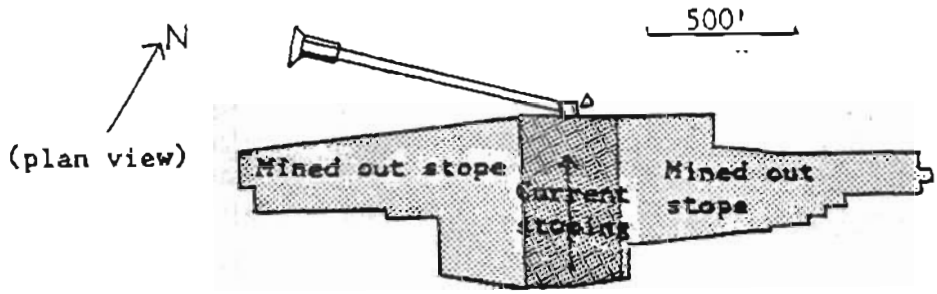
Au = 10,610 oz x 0.915
pillar loss = 9222 oz gold

Ag = 10,610 oz x (1 - 0.915 fineness)
x 0.95 pillar loss = 856 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver for all cases

Price per ounce gold	Gross revenue ($)
$450	4,166,848
$550	5,089,048
$600	5,555,797
$625	5,787,288
$650	6,011,248
$750	6,933,448
$1000	9,238,948

Figure 29. Production and revenue parameters for year five.



Year 6 - Production Stoping - Retreat

52,800 yd^3 @ 0.175 oz/yd^3

Au = 9240 oz x 0.915 fineness x 0.95
pillar loss = 8032 oz gold

Ag = 9240 oz x (1 - 0.915 fineness) x 0.95
pillar loss = 746 oz silver

1. Deductions
   2% Smelter fee
2. Assume $20/oz silver in all cases

Price per ounce gold	Gross revenue ($)
$450	3,629,170
$550	4,432,370
$600	4,838,893
$625	5,040,513
$650	5,235,570
$750	6,038,770
$1000	8,046,770

Figure 30. Production and revenue parameters for year six.

A second interest rate at 14% assumes the use of a roll back from other revenues in another mining operation within the same company and for equity financing. An 18% real interest rate reflects the use of some sort of debt equity financing ratio for total equity financing at a respectable rate. A starting gold price below $500 an ounce yields a negative present worth of the investment.

This data plotted in a graphical format can yield exact cutoff, the exact price needed to make a marginal operation the present worth exactly zero. At 10% interest, a gold price of about $560 an ounce is required. 14% equity financing requires about $595 an ounce, and 18% equity financing requires about $625 an ounce in order to make the operation viable.

In this particular instance a surface placer operation is more economic than an underground placer operation. In the future as the price of gold gets higher and the placers near the surface become depleted, it is going to be mandatory for mining companies to look at deep placers and mining by underground mining techniques. Thank you.

Any questions?

Joe?

Q What was the deepest area drift mined in Livengood?
A I might be corrected on this, but I think it was the area around Dome Creek where they went down about 140--150 feet. I think that's the deepest that they have really mined underground.
Q Did you consider conveyors for transporting material out of the mine??
A Yes,. conveyors are being used in Spitzbergen coal mines. There is a problem with them in cold weather when you are dealing with, say 10° to -20° below zero. You have a lot of belt problems—expansion and contraction of the belts, buckling and breakage. For the high production operation I wanted, I looked at rubber tired haulage to eliminate down time due to belt problems. The costs I came up with using the conveyor were similar. There was not a real large difference between the two except for potential down time.
Q How do your costs increase with increased mining depth?
A That's a critical thing for this underground mining. What makes it important, and will be more important in the future, is that your operating costs for underground mining are not that dependent on your total depth from the surface to the bedrock profile. Surface mining is completely dependent on it—if you get twice as deep, operating costs will be more than twice as high. Your operating costs in underground mining will not be twice as high but only a small fraction higher. So you can mine a 200-foot body at about the same cost you can mine a 100-foot deep body.

Q Would this be a continuous operation?
A Yes, a two shift operation. They'll be employing 45 men in the wintertime.
Q The price of placer gold is so high, how can you effectively mine gold at depths like that and still make a profit?
A You're working at a larger production rate and it's a longer period of time, You don't have to pay off your investment in such a short period of time as with surface mining. You mine it out quick, and it's done with. You have to have everything paid off by then. Now, in the case of underground mining, a series of pay streaks you may find that you have some economics to scale. You may mine for ten or even fifteen years. Thereby, you can spread the cost of your equipment out and make it look a lot better.
Q Surface mines are quite dependent on fuel oil. Given, for instance, the doubling in price of fuel oil in the next few years, how would that change your overall scenario for underground mines?
A Well, you saw the total operating maintenance supply cost which included the fuel oil. They were lower than your labor costs in this case. It is dependent since you're using diesel equipment. If the price of diesel fuel goes up considerably, there's always the option of transferring to electric equipment.
Q (Indiscernible)
A The problem is they were able to do that in the past, and they did have some rock fall and things. But they also didn't have the mine safety inspectors and didn't have all these agencies that look at the health and safety aspects. You're going to have to have a very safe operation with no uncertainty regarding the safety of those miners. For that reason I looked at the costs and I saw that they were higher even without any of those uncertainties involved. The Bureau of Mines has shown that keeping the portal open at the Fox Permafrost Tunnel in the summer months causes exponential increase in the amount of rock fall and slabbing underground. So, forcing ventilated air, you would be seeing such a rapid rate of melting in your working face and also in your haulage ways that you're going to see nothing but problems.
Q Have you ever considered water problems?
A Well, in this case, I mentioned that was one of the factors involved that made Livengood Creek particularly nice was the fact that there was very little water at the bedrock. The underground miners did not encounter large amounts of water as they did in the Fairbanks district and other areas where they were drift mining. That water did add to the rate of thawing in the Fairbanks district and cause a lot of timbering problems then you have to consider a large

number of sumps at regular intervals to collect the water and pump it out before it has a chance to sit around and melt things. But you're going to want to keep the underground workings cold all the time in this hypothetical plan.

Q Have you ever thought of freezing unstable ground?

A You would have to do that in the Fairbanks district where you were mining cold weather materials. The Alyeska oil pipe line did the best research on refreezing with long heat pumps. Ammonia heat pumps can actually pre-freeze your ground ahead of you, and cut down freezing cost considerably. That's what you would have do in unstable ground, refreeze it. That might possibly cut down the amount of water you have along bedrock if you pre-froze it, say a year or two in advance, using those long ammonia heat piles.

Q What type of supports would you recommend?

A As long as you keep it frozen, your underground haulage ways in the gravel will not need any support based on the work done in Greenland, Spitzbergen and Russia. As I mentioned in your overburden you have a problem there, especially at your interface between the overburden and your gravel. That will have to be steel-lined. And as I mentioned in the working face, you might be able to use hydraulic jacks similar to those used in coal mines.

Q A few weeks ago we put down a drill hole and at 104 feet we hit an artesian well and a lot of gas. We lost that hole. It does show that there is some live water beneath the old workings.

A Now that's from filling in the old workings. That is one of the reasons I looked at using a drill blast cycle here that it is a lot more versatile. You may encounter old workings, you may encounter old timber, you may encounter wedges of ice and you can work around them a lot better with some sort of versatile mining technique than you can with some stable stationary method. The bedrock is also very undulating at that point, and that makes drilling and blasting look better.

Q (Indiscernible)

A Okay, there's no experimental work on that. You're going to be taking air from the outside and passing it quickly though your underground workings so you might think those underground workings would be the same temperature as the surface. What you'd probably be seeing, and that's also based on the work done in Spitzbergen, is that as your mining face is continually exposed you're going to be heating up those underground workings. The gravel will be say 28° or 29°F and will cool off, thereby liberating that heat to that colder ground. I estimate your working temperatures under there would be anywhere from 10° to 20° above your outside ambient temperature.

GOLD MINERALIZATION OF THE UPPER YUKON RIVER REGION

by
Jim Barker
U.S. Bureau of Mines

The region to the south of the upper Yukon River has hosted a number of placer gold deposits which have been mined since 1898. Mining was first recorded that year on both Woodchopper and Fourth of July Creeks.

The area that I will be discussing in this paper is a poorly defined auriferous district of east central Alaska which is mid-way between Circle and Eagle and lies east of the Birch Creek placers and west-northwest of the Seventy-mile district.

Since 1898, the upper Yukon River region has produced an estimated 230,000 troy ounces of gold and an associated 21,000 troy ounces of silver. These figures do not take into account unreported placer gold production which may be significant for some creeks.

The principal producing creeks have been Woodchopper and Coal Creeks, both of which have reported over 100,000 ounces of gold primarily from dredging operations. Other production of gold in decreasing order of magnitude has come from Fourth of July Creek, Nugget Creek, Mineral Creek, Boulder Creek, Ben Creek, Colorado Creek, Ruby Creek, Iron Creek, Alice Gulch and Rosebud Creek. Evidence of past prospecting and mining can be found on other drainages as indicated by the symbols of the map. (Figure 1)

Although gold mining was conducted intermittently in the years following the turn of the century, it wasn't until the depression years that it was profitable to install bucketline floating, dredges on Woodchopper Creek (1936), and Coal Creek (1937). The dredge on Woodchopper Creek worked a paystreak 600 to 700 feet wide with depth to bedrock ranging from 11 to 30 feet.

As elsewhere in Alaska, mining was essentially halted following the outbreak of the Second World War. Although it was resumed thereafter, the post-war inflation eventually rendered the mining ventures unprofitable at the fixed price of gold. In recent years, mining has revived as a result of the rise in the world price of gold in the mid-1970's.

Mining is now underway again on Coal Creek. A 15 to 20 man crew there is engaged in an open-cut sluicing operation and a churn drilling program. In addition, some mining has occurred in the past few years on Ben Creek and Fourth of July Creek. Exploration and limited test mining has also recently been conducted on Woodchopper Creek and its tributaries.

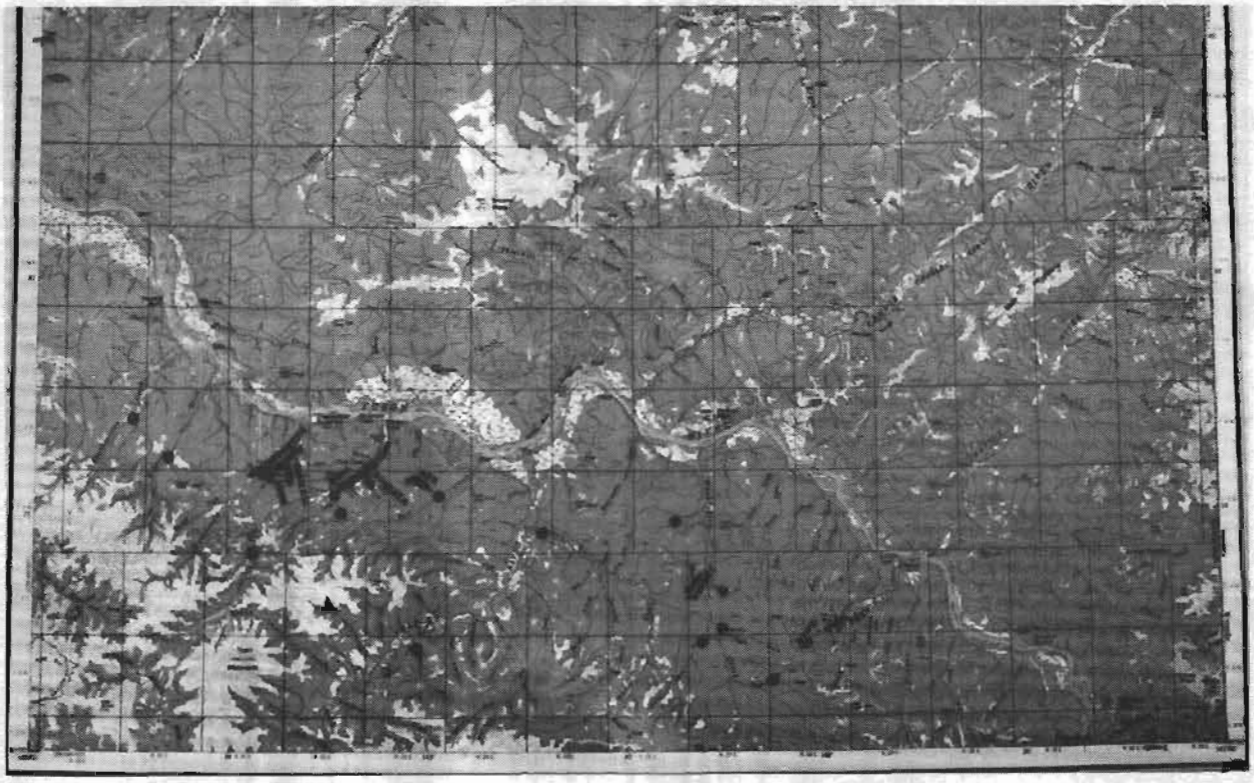


Fig. 1

Considerable reserves remain on all of these creeks in the form of main channel paystreaks, as well as side pay and benches. Some reworking of the old tailings may be possible due to fine gold loss in the earlier operations.

A number of previous investigators have documented some of the prospecting and mining activities of this region. The most comprehensive work has been by J.B. Mertie, Jr., particularly in 1938 and 1942. There has been very little published on the area since then.

The Bureau of Mines most recently became involved with the area in 1976, as a result of a Congressional request that we inventory mineral resources on lands proposed for classification under section 17 (D) 2 of the Alaska Native Claims Settlement Act. Proposed classification of the Charley River region included the district to which I am speaking. The investigation has been conducted intermittently between 1976 and 1980.

As a point of departure for the Bureau of Mines work, I will make the following assessment of the known information regarding the upper Yukon district. The region contains a number of auriferous creeks, several of which have produced significant quantities of placer gold. There has been no lode gold production nor have any lode gold occurences been found. The total of remaining measured and indicated reserves of the district, based in part on available drill data, are on the same order of magnitude as past bench placers which have long been known in the upper Yukon and the Seventymile districts. There are unverified reports of significant values in these upper benches; however, the inability to transport water to them has curtailed further development.

Generally speaking, the upper Yukon River region has not received the attention that other Alaskan placer districts have. The area is extensively vegetated and covered with loess and colluvium. Permafrost has been found to be nearly continuous. Many of the drainage systems consist of muskeg seeps and flow over frozen loess and vegetative matter rather than active alluvial channels that can be readily tested for placer gold by use of a gold pan. In the past the poor availability of water for stripping and mining operations has also been a deterrent to development. There is no evidence that there has been systematic sampling or drilling of any of the creeks other than these. I have previously described, and as a result my assessment is that the region is poorly prospected at best. Consequently, valuable, undiscovered placer deposits may still exist to be found as well as the possibility for lode deposits from which they were formed. Our investigation attempted to shed some light on these possibilities.

The bedrock geology of the upper Yukon region consists of a sequence of Teritary continental sediments (sandstone, mudstone, coal and conglomerate) which lie in the Eagle Trough along the Tintina Fault system.

Geology presented here is adapted from Brabb and Churkin in 1969.

To the south is the Tanana Upland crystalline terrance of metasedimentary and igneous rocks primarily of felsic composition. North of the Eagle Trough are Precambrian to Cretaceous rocks mostly of marine origin.

Placer gold prospects are represented by the black dots, the hatching shows where production has occurred. The occurrence of placer gold appears associated with the Tertiary sedimentary rocks shown as light brown on this map. Previous work by J.B. Mertie has expounded on the Tertiary association in which he draws comparisons to auriferous conglomerates elsewhere in the world, some of which have produced modern placers through erosional recyling. Mertie felt that the original source of the gold was the Tanana upland to the south with alluvial transport to the present site of the presumably auriferious fossil conglomerates. He cited, for example, the fourth of July Creek area where a few colors can be panned from disintegrated conglomerates.

During the Quaternary Period the Tertiary conglomerates have been down cut due to regional uplift. This erosional process presumably produced the present placer deposits as shown here.

Since Mertie's investigation in the late 1930s, a major right-lateral movement along the Tintina Fault system has been recognized. Right-lateral movement would shift that bedrock south of the fault zone. (the double dashed line shown here), toward the northwest. Although episodes of movement on the Tintina Fault system in eastern Alaska are poorly understood, there is evidence of some relatively recent displacement. For instance, note on Figure 2 the characteristic step-displacement on the valleys of Woodchopper, Coal and Sam Creeks. Consequently any such recent fault movement may have displaced the sources of placer gold somewhere to the west-northwest and parallel to the fault. This can be seen in a color aerial photograph mosaic of the Woodchopper area with the Tintina Fault as delineated by Brabb and Churkin.

Other data was found which complicates the suggestion that the gold in the present placers is being reworked directly from Tertiary fossil placers, and furthermore, that gold was transported miles from its original upland source during the Teritary era.

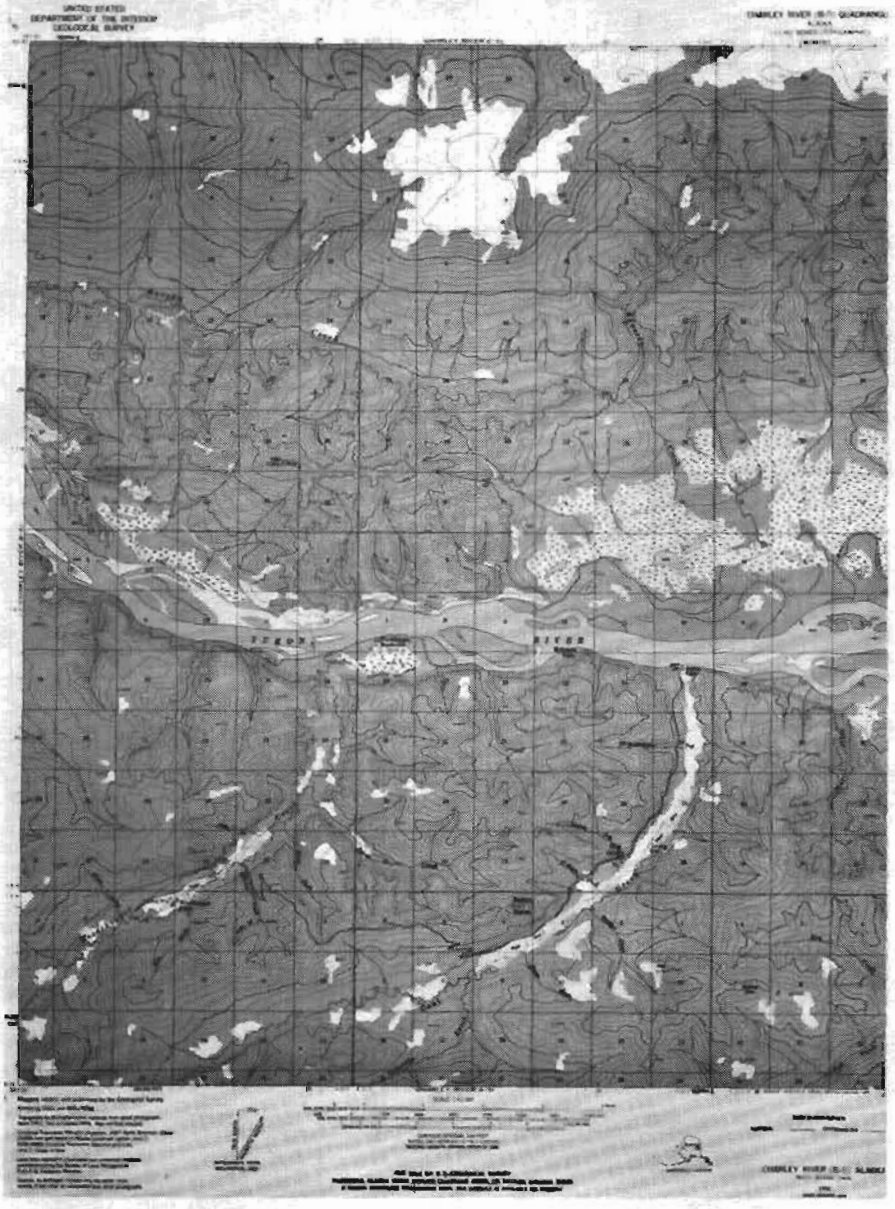


Fig. 2

Gold and other heavy minerals transported through a series of concentration and distribution processes should be well-rounded and abraided, and contain a considerable volume percentage in the fine-size fractions. While some placer gold of this region displays these characteristics, a second type of gold is instead composed of bright flakes, sub-angular or sub-rounded, and angular nuggets with quartz attached.

Concentrates contain heavy friable minerals such as bismuth, galena, wolframite and angular garnet. Placers formed from several stages of transport from distant sources should not contain these minerals.

The placers of the region are also found to have an unusually high fineness for interior Alaska, with values which average in excess of 900.

Several previous investigators, Brooks in 1907, and the unpublished work by Sainsbury in the mid-1960s, have speculated on the possibility of hydrothermal sources for the gold in several creeks. While there has been no documentation, I would now agree in part with their hypothesis.

The concern over identifying the source or sources of gold is that given the varying theories, there will be considerable difference in interpreting which areas are potentially favorable for gold resources and where future exploration should be concentrated.

In an attempt to provide a more specific geologic correlation for placer gold (other than the generalized association with the Teritiary Eagle Trough) a review of satellite imagery and aerial photography for linear features was made. The interpretation is based in part on work by R.C. Swainbank in 1977 who made a generalized review of photo linears of the eastern Tanana Upland.

The Tintina Fault system dominates prominent southeast-northwest fracture sets. Lineaments, in some cases documentable as thrust faults, strike southwest at near 90 angles to the Tintina system. This thrusting feature is apparently associated with the right lateral movement and has been noted elsewhere along the Tintina such as the Circle Hot Springs area by Davis (1972). Several unexplained large circular features typical of overthrusted sheets, are found to the southeast.

I would like to draw your attention to a particular splay of the Tintina system which we have termed the "Bonanza Creek" lineament zone due to its alignment to the creek valley of that name. (Figure 3)

It was immediately apparent that much of the placer production of the upper Yukon River region has come from

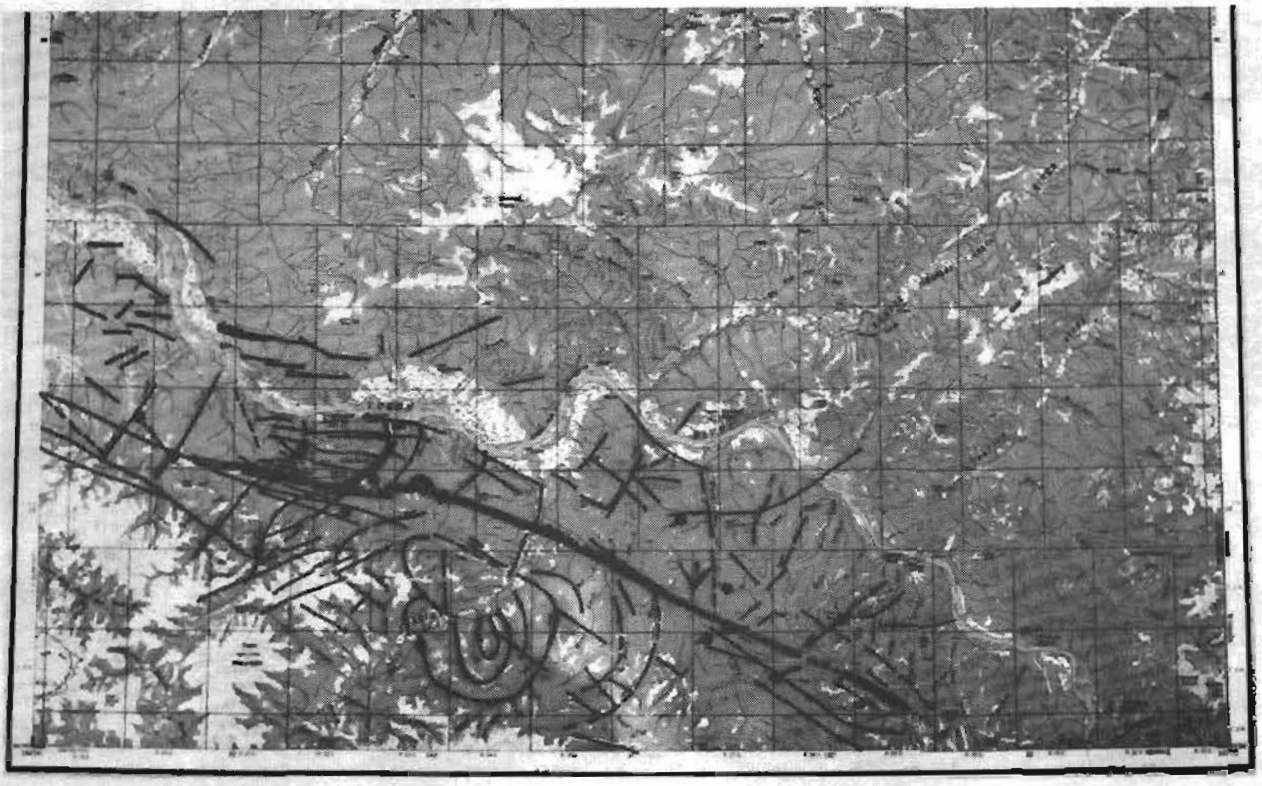


Fig. 3

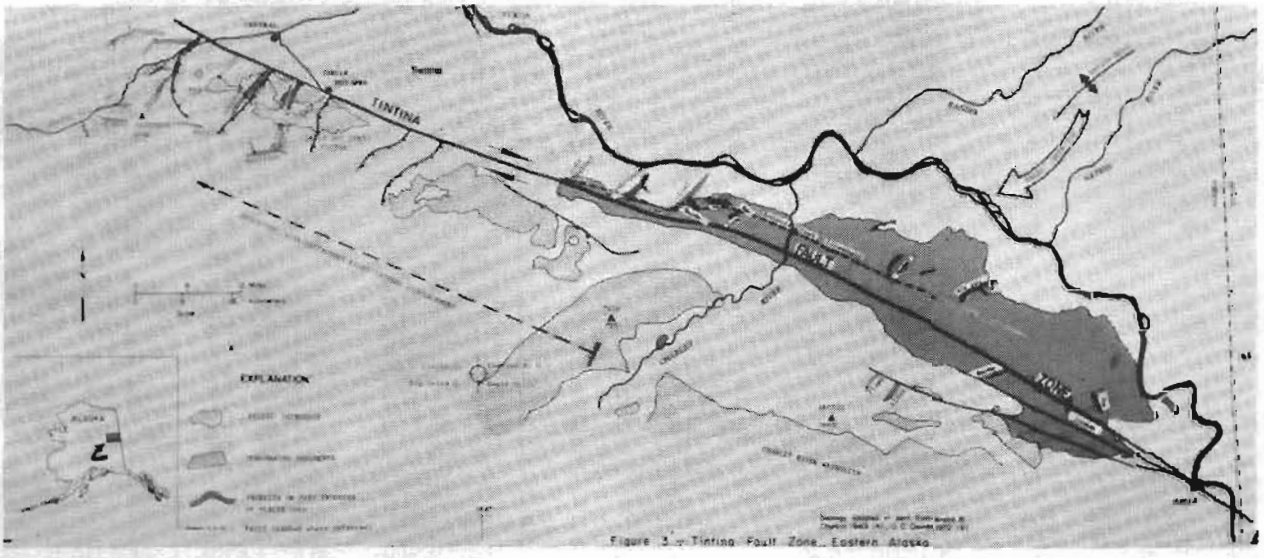


Figure 3.—Tintina Fault Zone, Eastern Alaska.

Fig. 4

creek valleys downstream of this lineament. While other placer occurrences of gold are known, and undoubtedly other sources of gold exist, it was elected to examine this lineament in greater detail in order to determine its control of mineral potential (or as an exploration target in itself).

The lineament is characterized by multicolored clay zones due to variable amounts of hematite and chlorite, and decomposition of sedimentary detritus. On Coal and Woodchopper Creeks the lineament separates the older bedrock to the north from the Tertiary sediments to the south. In the older bedrock, quartz stockworks, slickenside, and boxwork leaching were observed. On Ben Creek, extensive silicification and chloritic alteration occurs. The clay zones contain angular quartz replacement and breccia, and reportedly, the placers in the immediate vicinity have been particularly rich. The Teriary mudstones and conglomerates along the lineament are highly folded and faulted. Contorted, but very vitreous coal seams are found with occasional crosscutting quartz and pyrite seams.

The mudstones contain disseminated vugs of mineral, dawsonite, which is a saline aluminum sodium carbonate, as well as trace values of gold. Evidence of the alteration, which is tenuously intepreted to represent a low temperature hydrothermal event, can be observed at several localities between Woodchopper Creek and the Charley River. Observations of placer gold recovered from both mining and drill tests on Coal Creek indicate an increasing proportion of angular gold and quartz closer to the downstream side of the "Bonanza Creek" lineament.

Other lineaments also may be associated with primary gold as local enrichments have been noted on several creeks. For example, an interpreted lineament parallels the valley of Placer Creek, a tributary to Washington Creek. Conglomerate in this valley was discovered to locally contain spalerite, galena, arsenopyrite and a trace of gold in the matrix. Other examples of replacement minerals in the conglomerates can be cited.

Now for a bit of speculation. While we can still not document the actual sources for the placer gold in the upper Yukon region, I will suggest that some of these lineaments or faults, such as the "Bonanza Creek" lineament, are strongly of suspect as lode sources of the heavy mineral placers in the creeks.

Another lineament between Cutlas and Dome Creeks aligned with locatilities where gold can be panned. Taking this one step further, I would suggest that any future exploration, if and when permitted in the area, make a detailed evaluation of the lineaments for both placer and lode sources of gold. Particular attention should be given lower Sam Creek and especially the wide alluvial valley of Bonanza Creek which parallels that lineament.

The explanation is still unclear for the relation and source of the rounded-type of gold which composes a portion of the pay in the district, and even predominates in concentrates from some creeks such as Rosebud. The occurrence of this type of gold, because of its character, does not appear related to the lineaments but rather solely to fossil placers in the conglomerates. The evidence does indicate that the original sources have been displaced westward.

Extending our discussion to placer locations further west including the gold placers of Circle Hot Springs area; (Figure 4) creeks in the Circle area have produced gold only south of the Tintina Fault system while the opposite is generally true in the Woodchopper to Sam Creek area. Given a 50 mile reconstruction of the fault, various evidence now lines up, such as the occurrence of placer wolfromaite and cassiterite on both Woodchopper and Deadwood Creeks. Fineness values of approximately 800 for gold of the rounded, shotty-type such as from Rosebud Creek, align with values reported for the Circle District. Again, I stress this is only a preliminary speculation. However, based on this reconstruction, I would suggest that the mineral potential of valleys west of Woodchopper Creek be considered since a source of placer gold may have once been in their ancestral headwaters. This includes the valley of Alder, Thanksgiving and Weber Creeks.

This preparation has summarized and abbreviated various technical data which are included in a forthcoming report by the Bureau.

Perhaps some similarities to the upper Yukon district exist elsewhere in Alaska or northwestern Canada.

Q How old are the placers in the upper Yukon region on Woodchopper and Coal Creeks?

A About the best evidence is the documentation of about 700 feet of down-cutting by the Yukon River and its tributaries which occurred sometime in the early Quaternary, I presume. Nobody has tied it in any closer than that. That would have been the time to have expected the reworking of the modern placers.

PLACER SAMPLING AND RELATED BUREAU OF MINES ACTIVITIES ON THE KENAI PENINSULA, ALASKA

by

Robert B. Hoekzema 1/

Open File Report 138-81

Abstract

The Bureau of Mines and U.S. Geological Survey have completed two years of a four-year multidisciplinary mineral appraisal of 2.8 million acres of the Chugach National Forest, Alaska. In 1979 and 1980 Bureau of Mines crews spent a total of three months evaluating the mineral potential of approximately 1,120,000 acres in the northeastern portion of the Kenai Peninsula and northwestern Prince William Sound.

Systematic placer sampling in 1980 identified that several previously nonproducing drainages in the east-central portion of the Kenai Peninsula and on the east side of Port Wells contain highly anomalous values of gold. This placer gold mineralization led to the identification of two potentially mineralized, northeasterly striking belts of limonite-stained pyrrhotite-bearing metasediments that are characterized by the presence of numerous felsic sills and dikes and sulfide bearing quartz veins. These rivers and the basins they drain should be explored further for placer and lode gold deposits.

Placer and lode mines in the study area have produced approximately 165,000 ounces of gold since 1895. Estimated 1980 placer production from 22 operations is about 2,000 ounces; lode mines are not currently producing in the area.

1/ Physical Scientist, Alaska Field Operations Center, Anchorage, Alaska

Introduction

The Bureau of Mines subdivided the Forest into three study areas based upon geography and mineralization for purposes of efficient field investigation. A crew has been assigned to each of the study areas. This is a status report covering literature research and field work completed in 1979 and 1980 on the mineral potential of the westernmost study area which contains approximately 1,120,000 acres and includes the northeastern portion of the Kenai Peninsula, the Girdwood area, and northwestern Prince William Sound of the Chugach National Forest (Figure 1).

Physiography

The northeastern portion of the Kenai Peninsula and the Girdwood area are characterized by glaciated, mountainous terrain typically with a relief of 3,000 feet or more. Alpine glaciers and rock glaciers are common above 3,000 feet, but some extend to sea level. Portions of the area are accessible by highway or trail, but the majority of the area is most efficiently reached by helicopter. Vegetation is relatively sparse above 1,400 feet allowing much of the higher area to be worked with relative ease. Stream drainages are poorly to moderately developed and are characterized by relatively steep gradients, cascades, and numerous bedrock canyons. Several of the streams, notably the Kenai River system, serve as significant spawning grounds for several species of anadromous fish.

Northwestern Prince William Sound is characterized by high relief, numerous large alpine glaciers, several of which reach tidewater, and steep rocky cliffs. The shoreline is accessible by boat or float plane but the interior portions can be easily reached only by helicopter. Field evaluation is hampered by dense vegetation below 1,400 feet and the extremely steep terrain. Stream drainages are generally poorly developed, steep and with numerous falls and canyons. Most of the clear-water streams serve as spawning areas for anadromous fish near tidewater.

Mining History, Production, and Potential

The earliest recorded attempts to identify mineral resources in the area that is now the Chugach National Forest were made by Russian explorers in the mid-1800's. In 1848 Peter Doroshin, a mining engineer sent by the Russian American Company, reported finding widespread auriferous gravels along the Kenai River system but was apparently unsuccessful in locating commercial quantities of gold. In the 1890's gold placers were discovered on Resurrection, Mills, Canyon, and other creeks on the Kenai Peninsula and many prospectors originally destined for the Klondike gold fields were attracted to the area. Many of these early prospectors also explored Prince William Sound and discovered significant gold and copper deposits. Several of these were brought into production during the early 1900's.

Mine production figures for the area are incomplete but it is estimated that about 125,000 ounces of gold has been recovered from the Kenai Peninsula and Girdwood districts since 1895. The majority of this production came from placer mines located on Crow, Canyon, and Resurrection Creeks, but at least 20,000-30,000 ounces were produced from lode mines in the Moose Pass, Summit Lake, Hope, and Girdwood districts.

Northwestern Prince William Sound has produced an additional 40,000 ounces of gold, mostly from the Granite Mine located on the west side of Port Wells, prior to 1920.

Currently there are approximately 650 placer, 270 lode, and 5 patented mining claims located within the "Peninsula Study Area." Twenty-two gold placer operations were active during the 1980 mining season (Figure 1). These ranged from 4 to 8-inch suction dredges and pick and shovel operations capable of processing 10-15 yds^3/day to backhoe-dozer-washing plant operations which process up to 2,000 yds^3/day. Numerous "recreational" miners also worked along the gold-bearing streams of the Kenai Peninsula but their estimated aggregate production did not likely exceed 100 ounces of gold. Estimated total 1980 production for the area based upon interviews with many of the mine operators is:

Drainage Basin	Estimated 1980 Production (troy ounces)	Operations (See Fig 1)
Resurrection Creek, Bear Creek	1,000 - 1,300	3, 4, 5, 6
Canyon - Mills Creek	300 - 400	10, 13, 14, 15
Quartz - Crescent Creek	150 - 200	16, 17, 18, 19
Crow Creek	50 - 100	1, 2
Others (East Fork-Sixmile Creek, Gulch	150 - 250	7, 8, 9
Lynx, Silvertip		11, 12
Stetson-Cooper Creek		20, 21
Falls Creek)		22
TOTAL	1,650 - 2,250	

While hardrock mining operations were not active in 1980, interest is being expressed in reopening several lode gold properties such as the Crown Point (4L), East Point (4L), Falls Creek (5L), and Grant Lake Mines (3L) in the Moose Pass district and the Granite (1L) and Mineral King Mines (2L) on Port Wells (Figure 1). In 1980, development work at these consisted of road improvements, sampling, and application for permits. Proposed work for 1981 includes establishing a small cyanide

leaching plant to process stamp mill tailings at the Granite Mine and extensive underground sampling of the East Point and Falls Creek mines.

Recent discussions with local miners reveal that increased lode and placer mining activity is likely on the Kenai Peninsula and northwestern Prince William Sound in 1981. While gold production can be expected to increase, the total annual production is not anticipated to exceed 5,000 ounces/year during the next five years. Production will increase slightly from existing placer operations and additional production may come from subeconomic placer deposits which will become minable should gold prices continue to rise. The greatest potential for increased future production is from the reopening of lode mines and development of new placer discoveries.

Previous Work

The earliest reports concerning the mineral potential of the study area were published by the U.S. Geological Survey (Becker, [1][2/] Mendenhall, [24]). Moffit [27] gave the first detailed description of the placer gold deposits in the Hope-Sunrise district and Johnson [11] first discussed the lode deposits of the northern Kenai Peninsula. Later U.S. Geological Survey reports concerned with geology and mining on the Kenai Peninsula and nearby areas include Martin [21], Tuck [34], and Park [29]. The Port Wells lode-gold district was first described by Grant and Higgins [9], in greater detail by Johnson [12-13], and mentioned briefly in later U.S. Geological Survey Mineral Resources of Alaska Reports. MacKevett [22-23] published tables describing the metalliferous deposits of southern Alaska which include those occurring in the

2/ Underlined numbers in brackets refer to items listed in the reference section.

those occurring in the study area. Mitchell [25-26], and Silberman [33] while working for the U.S. Geological Survey have collected oxygen isotope data and studies the geology of the Hope-Sunrise mining district.

To date only reconnaissance level geologic mapping, generally at a scale of 1:250,000, has been completed in the study area. The McHugh Complex in the western end of the area has been discussed by Clark [6-7] and Tysdal and Case [36]. Characteristics of the Valdez and Orca Group metasediments have been summarized by Moffit [28], and reviewed in greater detail by Tysdal and Case [35, 37-38-39]. Intrusive rocks are discussed by Grant and Higgins [9], Lanphere [18], Lanphere and Plafker [19], and Tysdal and Case [37-38]. Results of regional aeromagnetic and gravity surveys in the Seward and Blying Sound Quadrangles were published by the U.S.G.S. (Case et al, [4, 5]). Le Compte [20] compiled maps displaying linear and arcuate features interpreted from Landsat imagery for the same quadrangles. Quaternary geology of the western portion of the study area has been described by Karlstrom [16] and Kachadoorian and others [15]. Interpretations of the regional tectonic framework of the Kenai Peninsula and Prince William Sound have been published by Plafker [30-31], Budnik [3], and Tysdal and Case [37], Jones and Silberling [14], Hillhouse and Gromme [10], Cowan and Boss [8], and Kirschner and Lyon [17].

Reports by the Territorial Department of Mines discuss several mines and occurrences located on the Kenai Peninsula and Prince William Sound. More recent studies by geologists of the State of Alaska DGGS include a geochemical traverse of the Nellie Juan River (Herreid, 1965, Geol. Report No. 9) and an examination of the lode gold deposits near Nuka Bay (Richter, [32]).

Land Status

The study area consists of lands which were opened to mineral entry in December 1980 with the signing into law of the Alaska Lands Bill (P. L. 96-487). The majority of the study area had previously been withdrawn from mineral entry on December 5, 1978, by the Secretary of the Department of the Interior at the request of the Director of the Department of Agriculture. However, over the years several small areas have been withdrawn for recreational or other purposes and land status should be checked with the U.S. Forest Service prior to staking areas of interest.

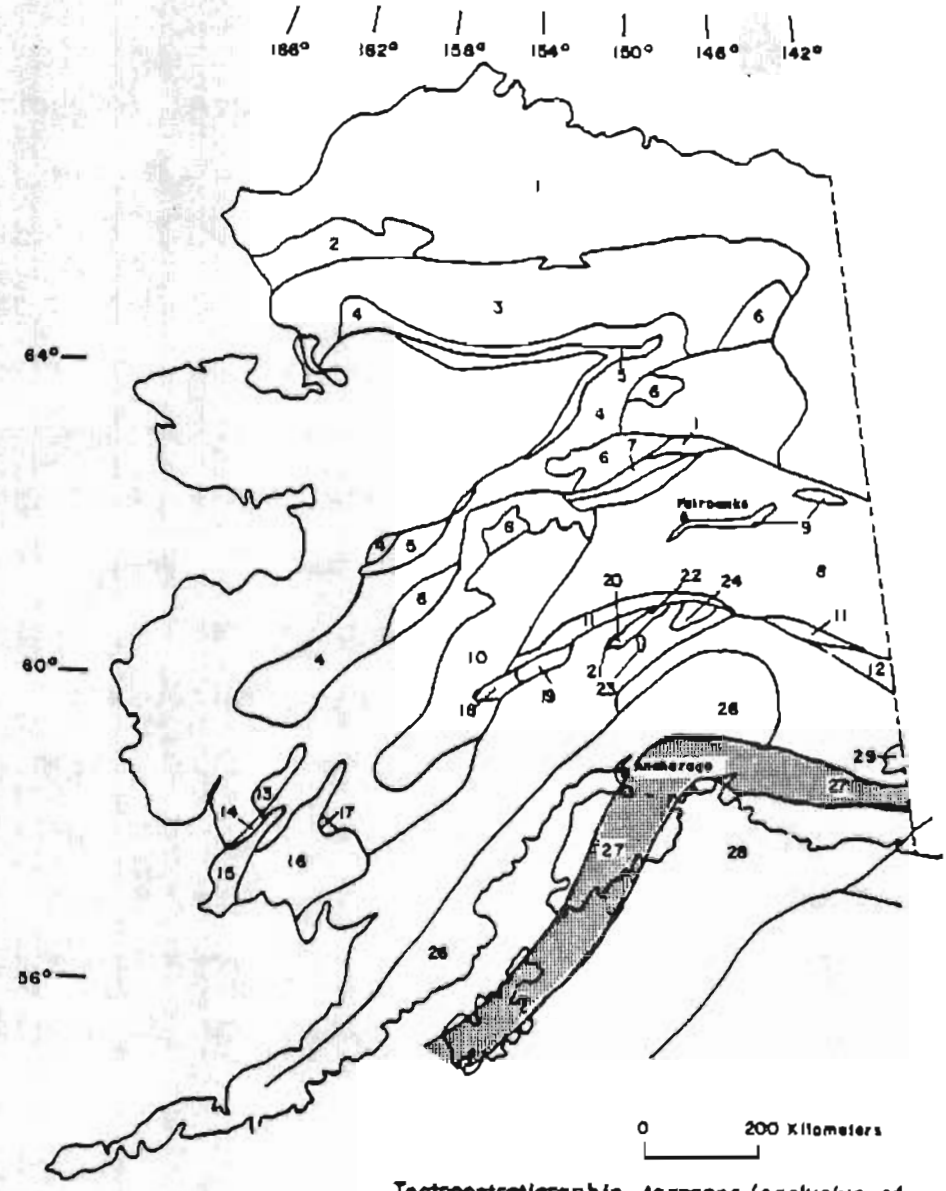
Geology and Mineralization

The Cretaceous Chugach Terrane, which consists predominantly of a northerly striking, steeply dipping marine metaclastic sequence (Valdez Group slates and graywacke) (Figure 2), underlies most of the Peninsula Study Area. Tysdal and Case [37] and others speculate that these rocks accreted to the southern Alaska mainland during the latest Cretaceous and early Tertiary time. It is part of a subduction complex which extends north from Kodiak Island through the study area and continues east nearly to the Canadian border.

Small high-grade gold-bearing quartz veins and gold-bearing placer deposits, presumably derived from the veins as a result of glacial erosion and fluvial processes, are the major locatable mineral deposits in the study area. Potentially valuable common variety materials such as sand and gravel, building stone, haydite, and limestone also occur in the area.

Placer Deposits

Placer gold deposits are present in variable amounts in most drainages within the study area. Many of these have been operated commercially.



Tectonostratigraphic terranes (exclusive of the Seward Peninsula and S.E. Alaska)

1 North America
2 Kagvik
3 Endicott
4 Ruby
5 Angayucham
6 Innoko
7 Livengood
8 Yukon-Tanana
9 70-mile
10 Nixon fork
11 Pingston-McKinley, undivided
12 Mentasta
13 Nyack
14 Kilbuck
15 Goodnews
16 Togiak
17 Tikchik
18 Dillinger
19 Mystic
20 Chulitna
21 West fork
22 Broad Pass
23 Susitna
24 McLaren
25 Wrangellia
26 Peninsular
27 Chugach
28 Prince William
29 Alexander

FIGURE 2. Tectonostratigraphic Terranes of Alaska, Exclusive of the Seward Peninsula and S. E. Alaska, from Jones and Silberling (1979)

Origin

The gold in the placer deposits is believed to be derived by glacial erosion and fluvial concentration of gold obtained from the numerous small high-grade lode gold deposits which occur in the area. The lode deposits consist of epigenetic quartz veins emplaced along shear zones and fractures in Valdez Group slates and metagraywackes. Bedrock in the region has been extensively eroded at least five times by glaciation during the Pleistocene (Karlstrom, [16]), and gold placers were likely developed during preglacial and interglacial stages. The preservation of placers would have been largely dependent upon their location relative to later glacial scour. Several deposits of this type, recognized by their relatively high degree of compaction and cementation, have been identified in the study area. The time elapsed since the last glacial stage and postglacial advances has been insufficient to allow the development of large placer deposits such as those found in interior Alaska and the existing deposits occur as small, relatively rich, placers in existing stream valleys.

Placer Types in the Study Area

Placer deposits within the study area can be classified into four broad categories: 1) alluvial placers, 2) bench placers, 3) eluvial placers, and 4) glacial placers. These are discussed in detail below. Alluvial placers produced the greatest quantities of gold with lesser production from bench deposits; eluvial and glacial placers have potential for future mineral development and may have a genetic relationship to some alluvial and bench placers.

Alluvial Placers

Alluvial placers result from the depositional and sorting processes of existing streams and include gravel bars such as point and mid-channel bars, thin veneers of gravel resting directly on fractured bedrock within active stream channels and consolidated gravels. Significant production from alluvial deposits has occurred along Resurrection, Bear, Canyon, and Crescent Creeks. Gravel bars usually consist of relatively loose, sandy, moderately well sorted material and are generally limited in size. They are suitable for mining by small scale mechanized or hand-placer techniques. Values as high as 0.14 oz/yd^3 3/ have been obtained from gravel bars within the project area during this evaluation. The pay streaks are discontinuous and often confined to near-surface accumulations of flood gold (flood gold consists of small [<0.2 mm], very thin flakes which are easily transported during periods of high water). Samples obtained from such deposits can easily mislead the prospector because values often do not continue to depth and values obtained during one evaluation may not be duplicated by a later evaluation. Bars containing high gold values are often entirely removed by flooding. Nevertheless, gravel bars located along several drainages on the Kenai Peninsula have been successfully mined during periods of low water. Potentially valuable bars have been identified along Sixmile-East Fork, Canyon-Mills, Quartz, Crescent, and Cooper Creeks.

Active channel deposits consist of a layer of actively migrating unconsolidated sandy gravel resting upon moderately consolidated, clay-bearing gravel interspersed with angular bedrock fragments and boulders lying directly on bedrock. Coarse gold flakes and small nuggets commonly

3/ All gold values are given in troy ounces.

occur within the clay-bearing layer and in open fractures in bedrock. Suction dredges have been successfully used to mine such deposits along many of the streams on the Kenai Peninsula with recovery ranging from 1/4 to several ounces per day depending upon dredge size, water conditions, and ore concentration.

Consolidated alluvial deposits have supplied much of the gold produced from the study area. These deposits occur beneath existing flood plains and consist of poorly-sorted moderately-consolidated stratified gravels containing a significant clay-silt matrix resting directly on bedrock or, as at Resurrection Creek, upon a clay hard-pan. Gold is usually concentrated within a foot or two of bedrock and within bedrock fractures which extend as deep as 18 inches. A sticky light-brown clay which occurs in bedrock fractures examined along most gold-bearing drainages in the study area can be used to indicate the lower limit of excavating needed to recover the majority of the gold. Gold has not been found in significant quantities within or beneath this clay layer. Values of gold from consolidated alluvial deposits range from 0.005-0.025 oz/yd^3. These deposits have been and are being mined on Mills, Bear, and Resurrection Creeks by medium-sized dozer-backhoe-washing plant sluice operations capable of processing 300-2,000 yds^3/day.

Bench Placers

Bench placers are the result of alluvial processes but they were deposited by glacial runoff at higher elevations within present valleys, prior to the formation of the more deeply eroded active stream channels of today. Some of these deposits were likely formed during interglacial periods prior to the last advance. Bench gravels have supplied significant quantities of gold from Mills, Canyon, Crow, Quartz, and Stetson-

Cooper Creeks. Benches provide the greatest potential for future gold production because of the large volume of gravel they contain along Canyon-Mills, Sixmile, Crow, Resurrection, Quartz, Crescent, and Stetson-Cooper Creeks. These deposits tend to be poorly sorted, moderately consolidated, poorly to moderately stratified, contain a significant amount of clay-silt matrix and generally rest directly on bedrock. Gold values are concentrated near bedrock and within bedrock fractures on top of a light-brown sticky clay similar to that discussed above. Gold values in bench deposits worked along Quartz Creek range from 0.02-0.04 oz/yd^3; those sampled along Canyon Creek and East Fork Creek range from 0.004-0.016 oz/yd^3. Additional evaluation of benches located along the major drainages of the Kenai Peninsula seems warranted based upon data obtained to date. These deposits have been successfully mined using hydraulic mining techniques and more recently by small loader operations.

Eluvial Placers

The principle mechanism for the concentration of heavy minerals in eluvial placers is the winnowing action of gravity and downhill creep, the latter being essentially dependent on the angle of slope or gradient where the placers are formed on the sides of hills or mountains Boyle, [2]. Eluvial placers usually occur in the form of irregular sheets of angular rock fragments and soil mantling hillside slopes below gold-quartz veins or other sources of a valuable mineral.

Little data has been obtained concerning this type of deposit within the study area. Grant Lake Development Co. recently sampled for eluvial placer potential below the Case Mine, located on the north side of Grant Lake, using hand dug pits but was unsuccessful at finding economic concen-

trations of gold. Promising areas for accumulation of eluvial deposits include slopes below high-grade gold-quartz veins located along Falls Creek near Moose Pass, Slate and Summit Creeks near Summit Lake, Crow Creek near Girdwood, and Palmer Creek near Hope. Eluvial placers may grade into alluvial deposits and provide a source of alluvial gold.

Glacial Placers

Glacial deposits composed largely of till are common in the study area. They tend to contain sparsely disseminated gold and offer minimal resource potential at the present time. Till deposits consist of unsorted, unstratified angular rock fragments in a clay-silt matrix and commonly form steep river banks up to 200 feet high, where cut by subsequent stream action. Although economic glacial placer deposits have not been found, they are a significant source of gold for concentration by alluvial processes. Notable placers have been mined at the mouths of Palmer and Mills Creeks where the streams have eroded through recessional moraines of significant lateral extent and thickness and apparently concentrated the contained gold.

Present Investigations

This investigation on gold mineralization started in 1979 and includes library research and related studies, a field program, an evaluation of the geologic controls and environments of the deposits, and the identification of zones that have potential for gold occurrences.

Literature Research

A literature search and compilation of bibliographies has been made using the following sources: U.S. Geological Survey (including a review of historical files in Menlo Park), Bureau of Mines (including MAS files), U.S. Forest Service, State of Alaska, and mining companies which have

been active in the study area. Claim records have been obtained and updated by using the Bureau of Land Management and State of Alaska Kardex recording systems. Additional information has been obtained from interviews with and correspondence received from several miners and other individuals knowledgeable about the geology, mining history and mineral development of the area. Much of the above information, together with new data obtained by the Bureau of Mines and U.S. Geological Survey, has been placed in files which have been established for all known mines, claims, and prospects in the study area. Existing claims and mineral occurrences have been plotted on both 1:250,000 and 1:63,360 scale topographic maps.

Field Programs

Field investigations of the Peninsula Study area which commenced in 1979 and continued during the 1980 field season, have included obtaining stream sediment, placer, rock, and mineral samples; mapping and sampling of underground and surface mine workings; and traversing potentially mineralized terrains in search of previously unreported deposits. Placer sampling has been completed in approximately two-thirds of the Kenai Peninsula portion of the study area and in the Golden district in Prince William Sound. Stream sediment samples have been collected from most of the remaining portions of the study area. Regional geologic mapping has been restricted to locating boundaries of potential mineral belts and positions and attitudes of significant structures not indicated on existing geologic maps.

In 1979, stream sediment samples were taken from drainages within the Summit Lake-Hope mining districts at quarter-mile intervals to determine if this technique would be useful for prospecting for gold on the

Fig. 1: Typical placer channel sample collected on the Kenai Peninsula, Alaska in 1980.

Kenai Peninsula. Each sample consisted of 50-100 grams of sediment collected from within the active stream channel. These samples were sent to a commercial testing laboratory in Anchorage for sizing and quantitative analyses for Au, Ag, Cu, Pb, Zn, Ni, and occasionally Hg and Mo. Splits of the samples were sent to a commercial testing laboratory in Colorado for 31 element emission spectrographic analysis. Sediment samples taken from streams flowing close to known lode-gold deposits were often found to contain anomalously high Au and Pb values. However, the sediment samples taken from placer producing drainages commonly did not contain detectable gold. These results suggest that stream sediment samples cannot be used reliably to directly detect Au in placers. Analyzing the samples for known geochemical indicators associated with gold such as As, Sb, Pb, and Mo may be helpful in identifying lode gold occurrences. Stream sediment sampling in 1980 was used primarily to identify the geochemical expression of known mineral deposits such as the Antimony prospect on Kenai Lake.

Placer sampling techniques such as hydraulic concentration, sluicing, panning and dredging were used in 1980 to obtain additional information to that obtained from stream sediment sampling, and to evaluate several types of placer deposits within each drainage. Sampling procedure consisted of processing 0.1 yd^3 increments of gravel through a portable sluice box or hydraulic concentrator and panning the recovered concentrate to retain only the gold and heavy minerals. Whenever possible channel samples were taken of gravels from surface to and including bedrock. Using these techniques, gold recovery varies depending upon size and shape of the gold, clay content of the gravels, and processing parameters, but generally exceeds 80 percent, based upon testing of the tailings.

Fig. 2: Suction dredge being used to collect channel gravel sample on Stetson Creek, Kenai Peninsula, Alaska.

A 3-inch Keene suction dredge was used occasionally to sample gravels within active stream channels. This method is most successful during periods of low water and was of limited use in 1980 due to flood conditions which persisted during most of the field season. Placer concentrates were retained in Anchorage in order to separate and weigh the visible gold and examine the heavy mineral concentrate with a microscope and under a UV light. Table 1 lists gold content in samples in ounces/ yd^3. Only gold coarser than approximately 0.25 mm was physically separated and weighed. Finer gold sizes will be separated by amalgamation. The listed gold values may be expected to increase when the weight of the finer gold is added. Upon completion of these studies, the samples were sent to the Bureau of Mines analytical lab located in Juneau for multielement X-ray spectrographic and/or fire assay to identify gold-silver ratios and analyze for trace elements which may be present in the gold (e.g. Ag, Cu, Fe, Bi, Pb, Te, Sb, As, S, Hg, Ti, Mo, Ba, Zn, and Cd). Fire assay results for several samples are listed on Table 2.

Results

Historic mining areas, as well as new placer gold-bearing areas, were identified. Placer sampling methods were highly effective in identifying known producing streams such as Crow, Quartz, Crescent, and Cooper Creeks and revealed gold values ranging from 0.002 oz/yd^3, or less, to over 1 oz/yd^3. Samples collected from several drainages located on the east central portion of the Kenai Peninsula and some rivers located on the east side of Port Wells in Prince William Sound were also found to contain placer gold ranging in value from 0.002-0.01 oz/yd^3 (Figure

Fig. 3: Wingdam, located on Canyon Creek, Kenai Peninusla, Alaska. Construction began in 1921 , but the dam was never completed.

1). These drainages have not previously been thought to have significant placer potential.

Geologic reconnaissance of the areas drained by the latter streams led to the identification of two potentially mineralized, north-northeast striking belts of limonite stained metasediments that are cut by numerous felsic dikes and sills, and sulfide-bearing quartz veins. One belt extends northeast from the toe of Wolverine Glacier along the west side of the Kings River to Blackstone Glacier. The second was traced twelve miles northeast from Davis Lake to the cirque located above Lafayette Glacier. Portions of these areas have recently been exposed due to retreating glaciers and it is unlikely that they were prospected during the heavy exploration period of the early 1900's.

Recommendations

Based upon the results obtained from the 1979 and 1980 field seasons, recommendations pertinent to additional resource evaluation of the study area can be made.

1. Systematic evaluation of the placer potential of the Kings, Snow, and Avery Rivers appears to be warranted. Drilling or small bulk processing equipment should be utilized to obtain samples at depth.
2. Exploration, using helicopter support, of the associated, potentially mineralized bedrock for lode deposits is also needed.
3. Processing of bulk samples using the techniques described appears to be a viable method of testing for placer mineralization. Advantages include:
   a. Results are quickly available in the field and follow-up can begin immediately.

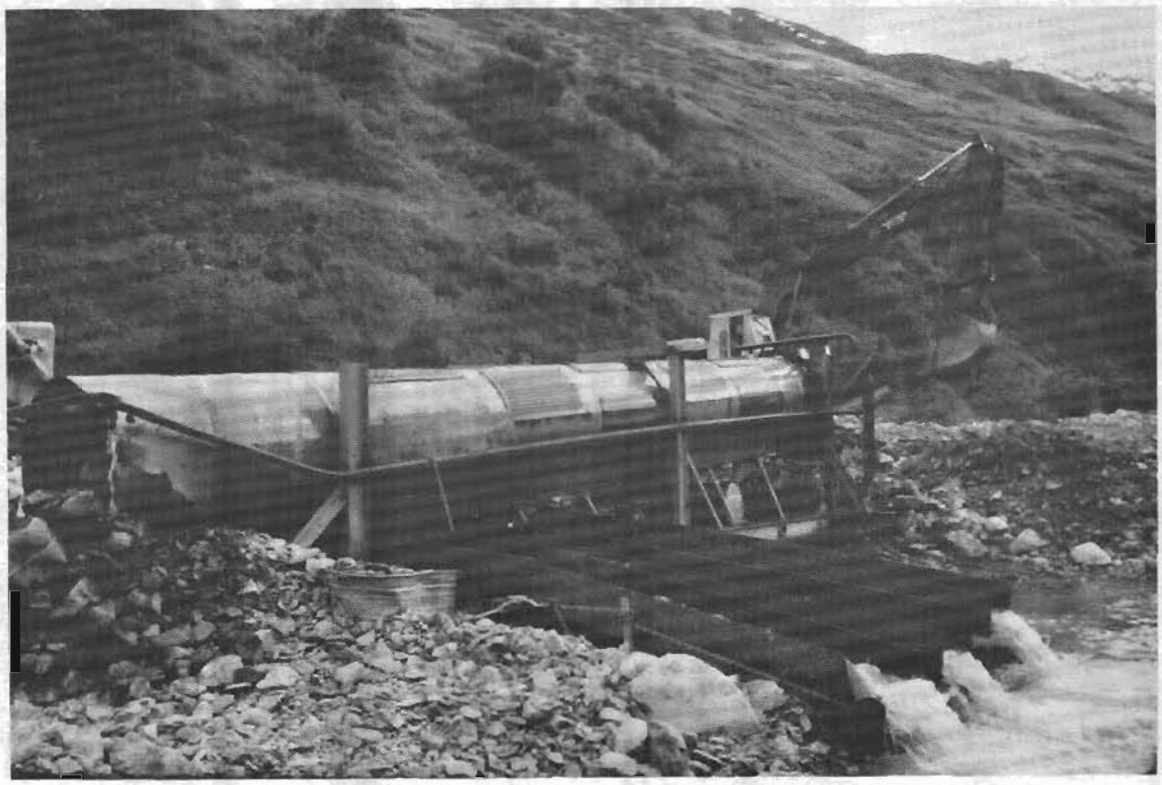


Fig. 4: Trommel washing plant processing placer gravels on Mills Creek, Kenai Peninsula, Alaska, in August of 1980.

b. Samples are obtained at greater depths, are of larger volume, and probably more representative than is usual for stream sediment and pan-concentrate samples.

c. Cuts made for bulk samples allow samplers to examine the geology of the deposits in some detail.

d. Large numbers of processed samples can be transported by helicopter in remote areas; only one or two 300-400 pound bulk samples can be carried at one time by most helicopters utilized for exploration in Alaska.

e. Larger quantities of gold are recovered from bulk samples than from pan-concentrates improving the opportunity for laboratory study of the gold.

TABLE 1. 1980 Placer Sample Results

Quad		Drainage	Sample No.	Sample Size	**Value/oz/ cu. yard	Comments
Seward	D3	Avery River	5451	0.1 yd^3	0.00016 oz	
Seward	D3	Avery River	5453	0.1 yd^3	0.008 oz	***Coarse gold recovered.
Seward	D3	Avery River	5453	0.1 yd^3	0.0016 oz	
Seward	D3	Avery River	5456	0.1 yd^3	0.00006 oz	
Seward	D4	Bettles Bay	4981	0.1 yd^3	0.00003 oz	Gold too fine to separate.
Seward	B4	Bettles Bay	5417	0.1 yd^3	0.0009 oz	
Seward	B4	Bettles Bay	5419	****1 pan	0.018 oz	Sample on bedrock.
Seward	B8	Boulder Creek	5257	0.1 yd^3	0.0003 oz	
Seward	C7	Canyon Creek	4752	0.1 yd^3	0.0054 oz	Coarse gold recovered.
Seward	C7	Canyon Creek	4753	0.05 yd^3	0.014 oz	Coarse gold recovered. Bedrock sample.
Seward	D8	Chickaloon River	4822	0.1 yd^3	0.00063 oz	
Anchorage	A3	Coghill River (North Fork)	5439	0.1 yd^3	0.0063 oz	Coarse gold recovered. Sampled to bedrock.
Seward	C7	Colorado Creek	4856	0.1 yd^3	0.00022 oz	
Seward	B8	Cooper Creek	4805	0.1 yd^3	0.01 oz	Coarse gold recovered.
Seward	B8	Cooper Creek	4735	0.1 yd^3	0.00183 oz	
Seward	B8	Cooper Creek	4841	0.2 yd^3	0.019 oz	Coarse gold recovered.
Seward	B8	Cooper Creek	5255	45 minutes dredging		
Seward	B8	Cooper Creek	5256	0.1 yd^3	0.0046 oz	Coarse gold recovered.

TABLE 1. 1980 Placer Sample Results - Continued

Quad		Drainage	Sample No.	Sample Size	**Value/oz/ cu. yard	Comments
Seward	C8	Crescent Creek	5260	0.1 yd^3	0.01 oz	
Seward	C8	Crescent Creek	5261	0.05 yd^3	0.031 oz	1 sq.yd. bedrock worked. Coarse gold recovered.
Seward	C8	Crescent Creek	5262	0.1 yd^3	0.015 oz	Coarse gold recovered.
Seward	C7	Crescent Creek	5356	0.04 yd^3	0.0135 oz	1 hours work sniping on bedrock. Coarse gold recovered.
Seward	D6	Crow Creek	4736	0.1 yd^3	0.0127 oz	Coarse gold recovered.
Seward	D6	Crow Creek	4737	1/2 hour of bedrock sniping		Coarse gold recovered.
Seward	D6	Crow Creek	4739	0.1 yd^3	0.144 oz	Coarse gold recovered.
Seward	D6	Crow Creek	4740	0.1 yd^3	1.17 oz	Coarse gold recovered.
			4743	0.05 yd^3	0.074 oz	Coarse gold recovered
Anchorage	A6	Crow Creek	4744	0.1 yd^3	0.039 oz	Coarse gold recovered.
Anchorage	A6	Crow Creek	4751	0.1 yd^3	0.0042 oz	Coarse gold recovered.
Seward	C4	Culross Mine Drainage	5397	0.1 yd^3	0.0009 oz	
Seward	B8	Dry Creek	4877	0.1 yd^3	0.0005 oz	
Seward	C8	Falls Creek	4847	0.1 yd^3		Too fine to separate.
Seward	C8	Falls Creek	4848	0.03 yd^3	0.0042 oz	Coarse gold recovered. Bedrock sample.

TABLE 1. 1980 Placer Sample Results - Continued

Quad		Drainage	Sample No.	Sample Size	**Value/oz/ cu. yard	Comments
Seward	B7	Falls Creek	4858	0.1 yd^3	0.0077 oz	Site of active mining operation.
Seward	B7	Falls Creek	5305	0.1 yd^3	0.0022 oz	
Seward	C7	Fresno Creek	4857	0.1 yd^3	0.00057 oz	
Seward	B8	Kenai River	4733	0.1 yd^3	0.0135 oz	
Seward	C5	Kings River	4959	0.1 yd^3	0.0003 oz	Considerable fine gold not separated from sample.
Seward	B5	Tributary to Kings River	5316	0.1 yd^3	0.0035 oz	Coarse gold recovered.
Seward	C5	Kings River	5373	0.1 yd^3	0.0083 oz	Coarse gold recovered.
Seward	C5	Kings River	5379	1 1/2 hour dredge		Sampling done at high level in channel coarse gold recovered.
Seward	C5	Kings River	5381	0.1 yd^3	0.0014 oz	
Anchorage	A3	Lafayette Gl.	5432	0.1 yd^3	0.001 oz	
Seward	C7	Mills Creek	4898	0.1 yd^3	0.0011 oz	
Seward	A7	Paradise Creek	5274	0.1 yd^3	0.00013 oz	Considerable galena recovered.
Seward	D4	Pirate Cove	4979	0.1 yd^3	0.001 oz	
Seward	B7	Porcupine Creek	4890	0.02 yd^3	0.0022 oz	Sample taken on bedrock.

TABLE 1. 1980 Placer Sample Results - Continued

Quad		Drainage	Sample No.	Sample Size	**Value/oz/ cu. yard	Comments
Seward	B7	Porcupine Creek	4891	0.1 yd^3	0.0008 oz	
Seward	B7	Primrose Creek	4892	0.1 yd^3		Gold too fine to separate.
Seward	B7	Ptarmigan Creek	4962	0.2 yd^3	0.0003 oz	
Seward	C7	Quartz Creek	4820	0.1 yd^3	0.0024 oz	Coarse gold recovered.
Seward	C7	(Upper Quartz Creek)	4938	****1 pan	0.0384 oz	Sample taken on bedrock.
Seward	C7	(Upper Quartz Creek)	4939	0.1 yd^3	0.0024 oz	
Seward	A8	Redman Creek	5270	0.1 yd^3	0.00025 oz	
Seward	B7	Ship Creek	4960	0.1 yd^3		Gold too fine to separate.
Seward	B8	Stetson Creek	5340	0.1 yd^3	0.0043 oz	Coarse gold recovered, sampled to bedrock.
Seward	B6	Snow River	4864			Gold too fine to separate.
Seward	B6	Snow River	4882			Gold too fine to separate.
Seward	B6	Snow River	4883	****1 pan	0.0464 oz	Sample taken on bedrock. Could not separate all the gold.
Seward	B6	Snow River	4886	0.1 yd^3	0.0011 oz	Could not separate all the gold.
Seward	B6	Snow River	5306	40 minute dredge		Could not separate most of the gold.

TABLE 1. 1980 Placer Sample Results - Continued

Quad		Drainage	Sample No.	Sample Size	**Value/oz/ cu. yard	Comments
Seward	C7	Summit Creek	4851	0.1 yd^3	0.0001 oz	
Kenai	B1	Surprise Creek	4903	0.05 yd^3		Unable to weight.
Kenai	B1	Surprise Creek	4904	0.05 yd^3	0.00132 oz	
Kenai	B1	Surprise Creek	5251	0.2 yd^3	0.0045 oz	Coarse gold recovered.
Kenai	B1	Surprise Creek	5252	0.2 yd^3	0.0105 oz	Coarse gold recovered.
Kenai	B1	Surprise Creek	5253	0.1 yd^3	0.022 oz	Coarse gold recovered.
Kenai	B1	Surprise Creek	5254	0.1 yd^3	0.025 oz	Coarse gold recovered.
Seward	B7	Victor Creek	4860	0.1 yd^3	0.0043 oz	Coarse gold recovered.
Seward	B7	Victor Creek	4935	0.1 yd^3	0.00015 oz	
Seward	B7	Victor Creek	4936	0.1 yd^3	0.00069 oz	
Seward	D6	Winner Creek	4746	0.1 yd^3	0.0283 oz	Coarse gold recovered.
Seward	D6	Winner Creek	4748	4 hours		Coarse gold recovered sniping bedrock.
Seward	B6	Wolverine Gl.	5371	0.1 yd^3	0.0002 oz	

*Only gold coarser than 0.1 inch was separated from the concentrate and weighed. The above weights do not include what in some cases amounts to considerable very fine gold nor that which may be included in other minerals.

**Dollar values calculated from these values should assume gold is 0.8 fine.

***Coarse gold refers to particles >0.05 inches in diameter.

****Value calculated assumes 160-16 inches pans equals 1 cubic yard.

TABLE 2. 1980 Placer Sample Gold/Silver Ratios

Stream Drainage	Sample #	Fineness			Au/Ag
		Au	Ag	Base	
Avery River	5453	822	73	105	11.3
Canyon Creek	4752	840	96	64	8.8
	4753	855	93	52	9.2
Coghill River	5439	799	83	118	9.6
Cooper Creek	4805	572	156	272	3.7
	4841	820	136	44	6
	5256	770	42	188	18.3
Stetson Creek	5340	835	53	112	15.8
Crescent Creek	5260	770	82	147	9.4
	5261	770	124	106	6.2
	5262	818	64	118	12.8
	5356	773	111	116	7
Crow Creek	4736	711	154	135	4.6
	4737	744	206	50	3.6
	4739	719	209	72	3.4
	4740	706	248	46	2.8
	4743	729	246	25	3
	4744	715	206	79	3.5
Winner Creek	4746	716	213	72	3.4
	4748	709	229	63	3.1
Falls Creek	4848	808	23	169	35.1
	4858	776	127	97	6.1
	5305	803			
Kenai River	4733	814	106	80	7.7
Kings River	5316	742	94	168	7.9
	5373	812	100	88	8.1
	5379	827	104	69	8
Quartz Creek	4820	747	144	109	5.2
Resurrection Creek	4911	837	117	46	7.2
Surprise Creek	5251	811	135	54	6.0
	5253	820	119	61	6.9
	5254	811	122	67	6.6
Victor Creek	4860	745	111	144	6.7

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BANQUET INTRODUCTION
by
Earl Beistline

Lyle Talbot was reared in the mountains of Western Colorado, the son of a ranger. He received a Bachelor of Science in Agriculture from Colorado State University, and a Bachelor of Science in Geology from the University of Colorado. After working in industry for some years, he received a Master of Science in Geological Engineering from Colorado State University, and Master of Business Administration as a Sloane Fellow at M.I.T. Mr. Talbot has had extensive experience in both the exploration and mining of coal, uranium, base metals and precious metals. He currently is resident manager of the Delemar Silver Mine, a producer of gold and silver, and resides with his wife in nearby Garden Valley, Oregon. I might point out that the mine was owned and operated by Earth Resources and I think the majority of you here are familiar with the company that operates the North Pole Refinery.As you are also aware, MAPCO has taken over the company. Some of you in exploration may recall that MAPCO, a year ago last summer, did exploration at Mt. Prindle on a uranium prospect.

BANQUET SPEECH
GOOD AS GOLD
by
Lyle Talbot

I am a professional miner. Now, my wife believes that I am a recreational miner. She says that I do it because I like it. Perhaps that makes me a recreational miner.

I presently manage the Delemar Silver Mine. The Delemar Silver Mine is in southwest Idaho, the nation's largest open-pit silver mine and one of the larger silver producers in the United States.

The Delemar is a joint venture between Earth Resources Company and the Superior Oil Company, with Earth Resources the majority holder and the operator. Earth Resources Company is truly an Alaskan Company.

At the Delemar, we derive about half of our revenue from gold, produced as a 98 to 99 fine dore bouillon. By a cyanide leeching process and a Merle Crowe precipitation system.

We are a silver mine, because our silver reserves are greater than our gold reserves. But, we really had the choice. We are a gold and silver mine. One of my tasks is to market our production. It is from this effort that I have gained the respect for the marketing system, as well as the metal. I'll have to tell you, right now, I'm really not an expert on this subject; I'm a novice.

To become a trader in the precious metals business, you need a lot of nerve and a few aids. Anyone can do it. The real trick is to know when to use dice and when to use darts. You won't have any trouble knowing when to use whisky; when to use rolaids; or when to use aspirin. Let's reflect back on the events of the last several months. Then, let's speculate on what lies ahead.

The price of gold closed the year at about $990; approximately 10% above its start. In-between the ends of the year, it literally ric-o-chetted back and forth in two dramatic price cycles. The high of $875 on the 21st of Janaury was complimented by a 'low' on March 27th of $453.

Some called it a bull market; others a market blow off. But, it was a new and different experience for the once stable gold market. At the Delemar, we just gave all our employees a little prayer rug, and they all faced Dallas, once each day.

What forces caused these gyrations on the price of gold? First, there was a sharp contraction of a gold supply in 1980. Secondly, the speculators and investors bid the price to historic highs, then liquidated and retreated. Thirdly, the federal reserves struck out on a new monetary policy. Fourth, inflation gathered momentum and the dollar sank. Fifth, there was great political unrest, both in the U.S. and the World.

Now, let's examine these more closely. SUPPLY — As the price began to rise, two natural reactions took place. There was a very sharp; nearly 50% decrease in industrial demand. This was the result of jewelers retreating from the market and industrial consumers working off their inventory. At the same time, with high prices hoarding took place, especially in the Middle East. I'm sure that all of you remember when people set up little booths and bought all the scrap silver and old jewelry they could find. This especially occurred in the U.S.

Coupled with this was the decrease of mine production of new metals. This decrease had a greater psychological effect than a real effect, because it was really quite a small volume decrease, compared to the total. It was a good thing for we miners. Less ounces were produced because low-grade ore became economic as the price rose.

The greatest effect came as the U.S. Treasury and the IMS sales were halted, and the USSR withdrew from the market as a seller. These sources had an important influence on the total supply. From a statistical point of view, the withdrawal of the IMS sales was important because of its timing. You all remember that this occurred (as you look at this graph) as the price collapsed. Heaven help us, had they not withdrawn. Who knows where that price would have gone.

SPECULATORS: All of you remember the events of the last year. There were two distinct cycles, both slowly increasing momentum and demand. The so-called market blow-offs remind me of an explosion in a coal mine. The concussion from a small explosion stirs up a lot of coal dust, then it ignites it. That explosion, in turn, creates a lot of concussion and stirs up more dust; the explosion gathers momentum and becomes a rip-roaring event. The only thing that stops it is that you finally run out of coal dust and there's nothing else to explode. Boy, when it gets going, it tears things up.

In a simplistic way, that's what happens in a market blow-off. A simple demand of some sort causes a sharp market rise and sharp market increase. This is triggered by some economic event. The shorts have to cover; that demand fuels the market, drives it up more. More shorts have to cover.

The market heats up, finally burns itself out. I haven't really figured out why it burns it out, unless everybody runs out of money.

The market finally collapses. The experts call this a blow- off. A blow-off only occurs if the environment is conducive to it. They are not manipulated in themselves, they are chain reaction to a lot of circumstances. One of these circumstances, which was a factor in the price of gold, was a new U.S. monetary policy. A great gladiator came in the economic arena. His name was Charles Bokker.

Considering the prime rate, I doubt that there are very many of you here tonight who would have much of a disagreement with Mr. Volker's premise that we should be controlling the money supply.

Let's look at the gold - interest rate relationship. This red line is the price of gold. You can quickly see the response to the increasing interest rates. This is a normal reaction, as a risk - reward ratio becomes more inviting to the money market as interest rates rise. Forest and I were discussing that on the plane this morning. As the interest lowers, the opposite reaction results; there's an increased demand for gold as an investment.

Another influence on the price of gold was inflation. We have come to equate the inflation rate with the strength of the dollar, and so has everybody else around this world.

Each of you are well aware of the price increases of oil which spurred inflation world wide, especially in the U.S. I need not discuss the effects of inflation with you. Each of you are a 'first-hand' aquaintance with it and very expert.

Let's superimpose our gold price on an inflation chart. Had we not had the market blow-off in the subsequent collapse, coupled with the accelerated interest rate, our gold line could have very well mirrored the inflation as people stopped to hedge. More Americans want the hedge against rising energy costs. The energy czars want to hedge against the demise of the dollar. This creates a cycle which creates a dilemma.

The next influence is POLITICAL FEARS: 1980 was a year of political anxiety. I doubt any of us would argue that point. There was Afghanistan; the Hostage Crisis; toward the end of the year, Poland. In America, these events were magnified by an administration that just coundn't get its act together. There was liberalism; deficit spending; loss in the GMP. Need I go on? These things were the order of the day. The market reacted quickly to each political beat as its pulse weakened.

Then a new hope came with the fall election. The hope that a decisive, conservative Reagan could help that patient survive and maybe even regain his health. This too is mirrored in the market for all of you know what has happened to the price of gold since the election. It has treaded downward; because, not only Americans, but people the world over believe that they are going to see a miracle.

Now with this background and review, let's speculate a little. This hoarding is, no doubt, over and indeed industrial consumers have a much decreased inventory of gold. Mine production is projected to increase slightly. But, this won't be enough to really have much effect on the total supply. It is not expected that the IMS will resume any of their sales, and the Treasury Department of the United States, in all likelihood will not get back in the gold business this year.

Who really knows what the Russians will do. At the present, there is no reason to believe the Russians will come into the market as a net seller. They generally do their selling in order to create a balance of payments. And, at this point in time, we've given them all the wheat. Hell, they don't owe us anything. We gave it to them.

This is what my friends at J. Arend & Company call a good, technical position. It's a positive sign. Where we see the great swings in the market over the coming year, the environment and climate is there to a lesser degree, and it may even decrease as we proceed through the year. But, the chances are very real that we will see again, during 1981, wild swings in the gold marekt. I expect them to be less severe than we saw in 1980. The conditions are not as extreme, and the speculators and investors have had some burnings and are a little more wary. What about interest rates?

Our gladiator is even stronger than he was. He now has the support of a new adminstration. I believe he has the support of most Americans. Reagan's tax cuts are projected to increase savings and, thus, cause a decrease in the interest rates, stabilize interest; but these are down the road. I doubt we will see much effect of that in 1981. I believe interest rates will decrease only slightly; that they will have less erratic swings; that we will see interest is on a much straighter line than we did in 1980. Well, they tell me that's a negative.

Certainly, it will take most of 1981 to see any significant change in the U.S. But, there is a general belief around the world that the dollar is stronger; the dollar is worth more. The foreign pyschology of inflation is strong, for each of us believes that the energy cost will rise during the next year. That's a positive sign for gold.

That's a negative sign for each of us. Certainly world anxiety is strong. El Salvador, Poland—we still have Afganistan. Who of us can predict what the U.S. - Russian relationship will become in a year? Now, just this week, we've seen an assassination attempt on our President.

In the U.S., there is an apparent new hope. This is mirrored around the world. A new hope in the new administration and a new hope in ourselves even. But, it won't be easy; it will take some real doings to turn that into reality.

Reflect on these factors and make your own judgment. Each of you is equally qualified to predict what is going to happen to gold during the next year. I believe that gold has a very bright future, long-term, due to increasing consuming industrial uses; and increase in monetary and monetary like acceptance; an increase in its value to individuals as a secure form of wealth during economic and political turmoil. I believe that we will see Americans begin to own gold in ever increasing amounts.

But, the short-term worries me. What can one expect in 1981? Well, if you're a chartist, it's really quite easy. The green line is a trimmed line of the data. You can see the price will be above the 1981 average. It will be around $500. That's certainly pretty close to what we've seen.

Then, if you are a little more sophisticated with your numbers, your line may look like this. You'll predict a price of $575. It all hinges on your point of view and your math ability. Just make your guess.

I'm going to stick with gold, myself; because I believe there's nothing as Good as Gold. Thank you very much.

THE DeLAMAR SILVER MINE

The DeLamar Silver Mine is a joint mining venture of Earth Resources Company, Canadian Superior Mining (U.S.) Ltd., and The Superior Oil Company. Earth Resources Company is the operating partner. Production began in April of this year after nearly nine years of exploration, research and development. Total investment in the property to bring it into production was approximately $22,400,000.

Exploration drilling has delineated three large deposits on DeLamar Mountain and several smaller deposits nearby. Ore reserves are sufficient to keep the Mine and Mill operating for at least the next 20 years at the current production rate. Production of the silver and gold bullion involves several stages of mining, milling and refining. About 110 people are presently employed to accomplish this task.

Mining is currently underway in the Sommercamp Pit. It begins with drilling, sampling, assaying and blasting of the rock. Since the silver and gold occur in narrow quartz veins within the "rhyolite" volcanic rock careful control is required to avoid mixing the ore and waste rock. After the rock is blasted it is loaded onto 35 ton trucks by either a front end loader or hydraulic shovel. The rock is trucked to a waste area, stockpile, or the ore pad depending on its assay value. Low grade material is being stockpiled for milling at a later date. Approximately 5000 tons of ore and waste material is moved on each shift.

At the ore pad the rock is crushed in a jaw crusher and then transferred by conveyor to the balloon, or air structure, for storage. The purpose of the balloon is to keep the crushed rock from getting wet and then freezing in the winter time. Conveyor belts below the floor of the balloon move the ore from the balloon to the mill building where two mills grind the rock with water, lime and cyanide. The ground solution is then pumped into four tall leach tanks where the cyanide leaches the gold and silver out of the finely ground rock. From the leach tanks the solution is pumped to the thickener tanks for settling and separation of the now barren rock from the "pregnant solution" containing the gold and silver. The pregnant solution is pumped back to the mill where the gold and silver is precipitated on filter presses with zinc dust. The "filter cake", as it is called, is melted in the refinery to produce a combined silver and gold dore' bullion that is poured into 1000 ounce ingots. The ingots are shipped to Belgium for final refining of the precious metals.

At full production the mill will process 1700 tons of ore per day and produce approximately 2,500,000 ounces of silver and 17,000 ounces of gold annually, making the mine the third largest silver mine in the U.S

Tailings from the milling process are piped to the tailings dam where the solids settle out and the water is reclaimed and pumped back to the mill. The dam has an impervious core of clay which prevents the tailings solution from leaking into the local ground water supply. When completed the dam will be 225 feet high and have enough storage capacity for 20 years of production.

DeLAMAR GEOLOGY

Silver-gold mineralization at the DeLamar Silver Mine occurs in a complex pile of mid-Tertiary silicic volcanic rocks overlying older basalt flows. Both stratigraphic and structural controls are important in the localization of the deposits. Economic mineralization is best developed in porphyritic rhyolite tuff units and rhyolite breccia beneath the relatively flat lying DeLamar and Sommercamp faults. Within the "rhyolitic quartz porphyry" host rocks the mineralization occurs with quartz in irregular steeply dipping fissure fillings and zones of silicification and brecciation. Naumannite, the silver selenide, and minor argentite are the principal silver minerals. Within the quartz veins the silver minerals are finely disseminated. Individual grains rarely exceed 1mm in diameter. The gold occurs as free gold and cannot be seen with the unaided eye. Alteration consists of widespread silicification, with lesser development of clays, alunite and sericite.

Published reserves are 4.6 million tons of ore averaging approximately 4.1 ounces of silver and 0.046 ounces of gold per ton. Recent drilling has substantially increased the tonnage while lowering the overall average grade.

Mineralogical Distribution of Silver in Sommercamp Zone Ore

Mineral	Percentage of Total Silver
Naumannite, Ag_2Se	75 to 80
Argentite, Ag_2S	15 to 20
Cerargyrite, Ag(Cl,Br)	1 to 2
Argentojarosite, $AgFe_3(SO_4)_2(OH)_6$	2 to 4
Native silver & electrum, Ag & (Ag,Au)	1

EXPLANATION

QUATERNARY

Qbg - Bench Gravels

unconformity

TERTIARY — MIOCENE

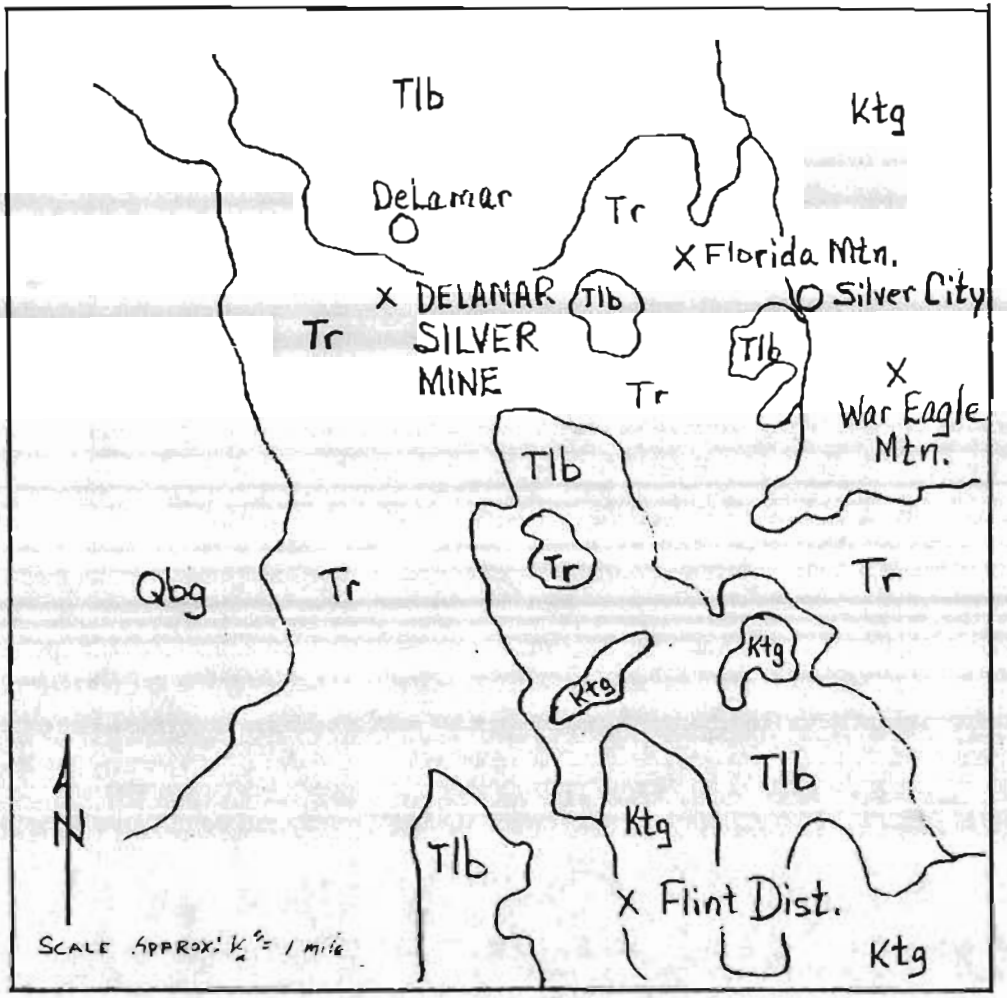
Tr - Rhyolite, Tuff and Quartz Latite
15.6-15.7 m.y.

Tlb - Basalt
16.6 ± 4.3 m.y.

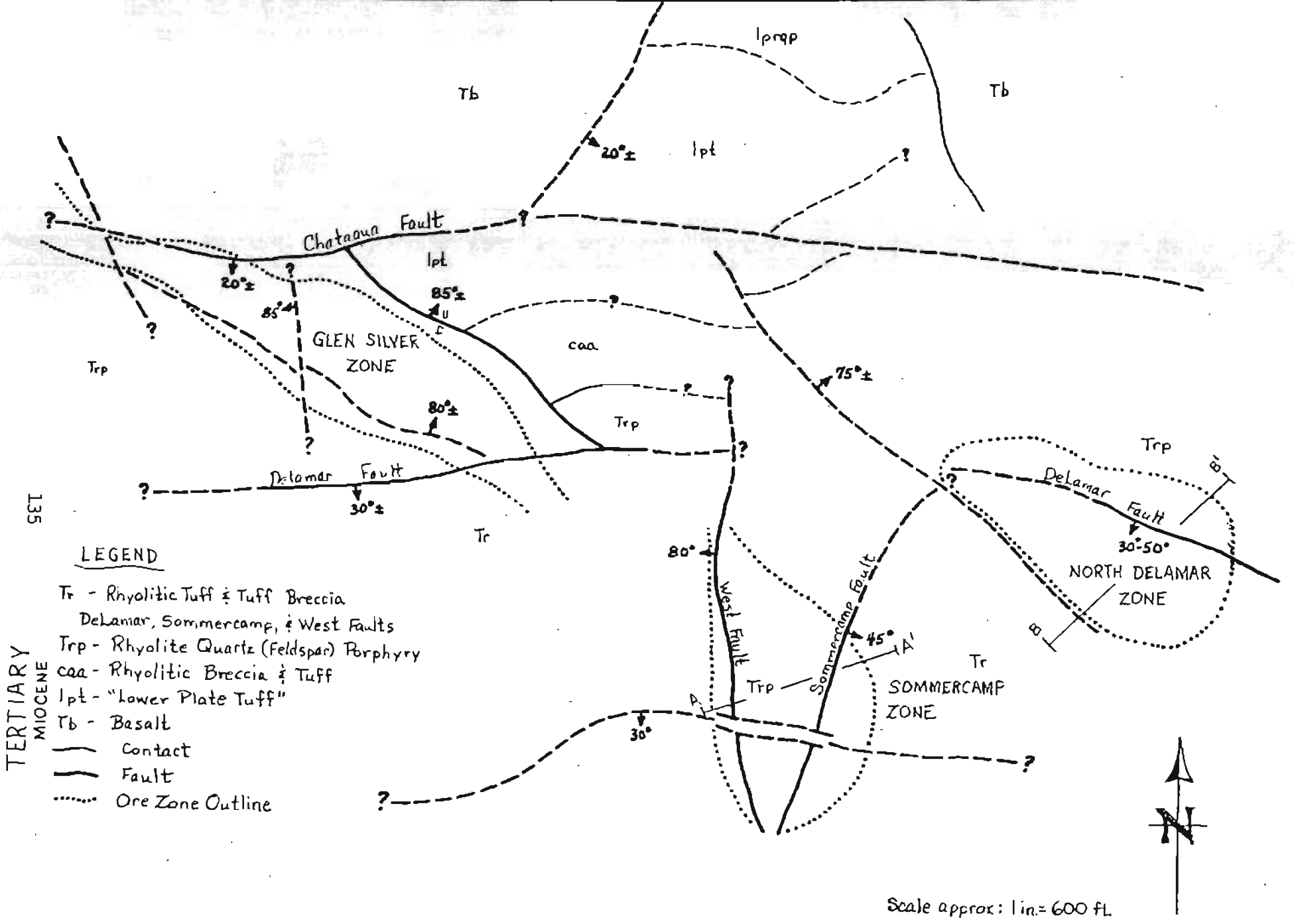
unconformity

CRETACEOUS

Ktg - Granodiorite
65.6 ± 2.0 m.y.



Geology simplified from PANZE, 1975
Age dates from PANZE, 1972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Tb
20°±
lpt
Chataqua Fault
lpt
20°±
85°±
85°±
GLEN SILVER ZONE
caa
Trp
75°±
80°±
Trp
Trp
Delamar Fault
30°±
Tr
135
B'
Delamar Fault
30°-50°
NORTH DELAMAR ZONE
B
80°
West Fault
Sommercamp Fault
45°
A'
Tr
SOMMERCAMP ZONE
Trp
A
30°
TERTIARY
MIOCENE
LEGEND
Tr - Rhyolitic Tuff & Tuff Breccia
DeLamar, Sommercamp, & West Faults
Trp - Rhyolite Quartz (Feldspar) Porphyry
caa - Rhyolitic Breccia & Tuff
lpt - "Lower Plate Tuff"
Tb - Basalt
Contact
Fault
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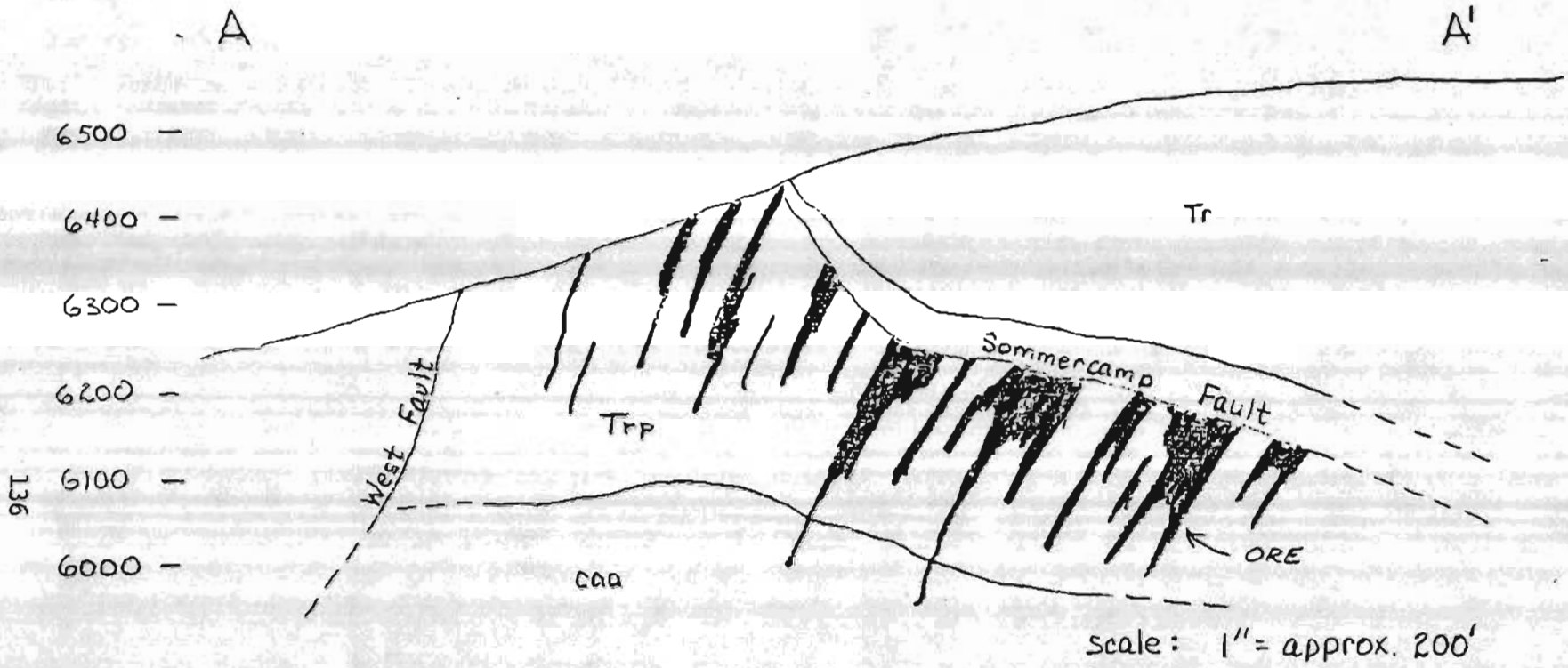
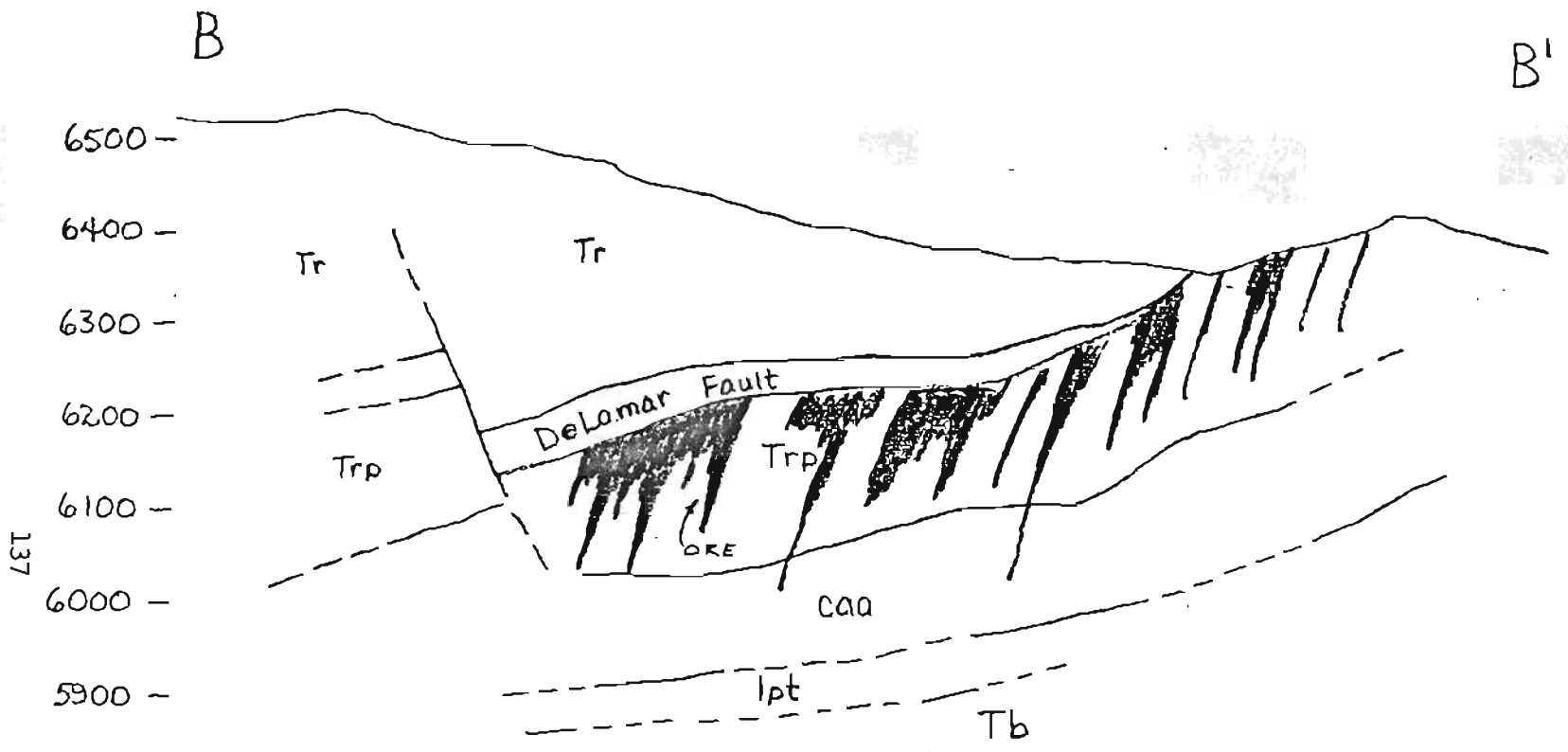
Scale approx: 1 in.= 600 ft.



Sommercamp Zone

looking North-Northwest



North Delamar Zone
looking Northwest

Scale: 1" = approx. 200'

ORGANIZATIONAL PROBLEMS & TAXATION

by

Richard J. Stock

We'll discuss some of the problems that have been developing in the last couple of years since gold mining has become a major factor in the Fairbanks economy again.

Fairbanks has not really realized what's happening to it, nor has the State of Alaska. Everybody seems to be looking back at the Oil Pipeline and looking forward to a Natural Gas Pipeline. They're not really realizing what an impact you people are having on our economy today. Up until a couple of years ago our firm had perhaps four or five clients mining—very low key. Today we probably have 30 people involved in mining, and eveybody is getting a lot of business as a result of the mining activity, but our community does not recognize that.

Also, perhaps fortunately, IRS does not recognize that. So, you probably have a few years of relative freedom from them. Speaking of the IRS, we have some letters to them; I thought I'd share one of them with you this morning: "Gentlemen: I am not interested in this income tax service of yours. Could you please cancel out my name in your books, because the system has upset my mind. I do not know who registered me as one of your customers in this matter."

When you look at the situation, as far as income taxes today, the system has been totally corrupted. There has been a longrange debate whether or not income taxes are constitutional. Actually, in 1885 they were ruled unconstitutional by a Supreme Court. How then did we get them? Well, our legislators, in their wisdom, decided that if it was unconstitutional, then they would change the Constitution. In 1913, when Wyoming ratified the 16th Amendment, we were blessed with a permanent income tax.

It is interesting to note that, at that point in time, the income tax was used totally as a tax on wealth. Only 1% of the population in 1913 was required to even file tax returns.

We went from that to what we have today, which is a mass tax. This occurred primarily as a result of World War II. In 1939, only four million people were required to file income tax. By 1945, 40 million people were filing. Now, everyone is filing.

Also during the Second World War, withholding started in order to finance the war effort. That is probably the most disastrous thing that happened to our country. We are now in a situation where employees no longer look at the

gross amount they earn; they look at the net amount. They don't look at their tax return to see how much taxes they are actually paying, they look to see whether they're going to get a $200 refund. It's disastrous.

The people in the mining industry are really in a very enviable situation. You have the ability to increase your net worth without paying taxes. You are probably the only people who can do that.

Mining didn't seem to take off until this last season. People have a lot of difficulty determining how to structure their organizations. You get two or more people together and they decide to go out mining. That's great, but in order to make this tax game work, you've got to follow the rules. You can't go around them or you ultimately lose.

There are many loose associations. As far as the Internal Revenue is concerned, if two or more people get together to undertake a project, then you probably have a partnership. There is a very select group of people who can elect not to file a partnership return. That's you. The decision not to file is available to partnerships established for joint production of extraction, and not for the purpose of selling the product. It's a very keen issue there. If your partnership sells the product—the gold—then you cannot elect to not be taxed as a partnership and not file a partnership return.

In order to elect not to file a partnership return, you have to be co-owners in the property rights. You don't have to own the property, but the property rights. You have to reserve the right to take the product out; you cannot jointly sell that product.

The election is made in one of two ways: either affirmatively by filing the partnership return and telling IRS what you are doing; or passively, by not filing that return—by simply filling out your own form with your information on it. (You have to be able to account for the various types of information.)

Now, why not file a partnership return? Basically, it boils down to your ability to do things to the IRS that you may not want to do to your partner. As an example: You have a $20,000 motor home which you are using at the mine site. Your partner is very comfortable sleeping in his tent. Well, you legitimately can depreciate your motor home. You don't want to give half of that depreciation to him. By not filing as a partnership, you can do that.

There might be other types of expenses that you feel that you can legitimately deduct, but you don't want to hit your partner with them. Not filing as a partnership allows you to do that. It's critical though that, as I said

before, you don't jointly sell the product—everything that you do is clearly an indication that you do not wish to file a partnership return. If you jointly sell the product and do not file a partnership return, then they can come in and force you to file it.

The next form of organization which has been used is a corporation. In the last year, we've seen three examples of rather poor planning on the part of individuals. They've incorporated for various and sundry reasons. In one particular instance, a group of fairly high-income people decided to go gold mining. They incorporated; spent thousands of dollars in the process; wound up with a large operating loss in the corporation. They could not use it personally. So, that loss sits there. They may be able to use it in the future, but it was poor planning on their part. They thought they could use it.

The other thing that we have seen happening is: People are putting mining claims into corporations. There may be good reasons for doing that; however, if those mining claims are sold, the corporation will pay taxes on the income or profit that results from the sale. The individual will also pay taxes on some of that profit. You wind up, in effect, with double taxation.

Now, there can be very good reasons for forming the corporation in the first place, but if you're selling claims you sure don't want to be selling through the corporation. This happened in two separate almost identical instances. What they should have done was to liquidate the corporation first, and then sell off the claims. So, if you're out staking a bunch of claims with the idea of selling them, a corporation is not necessarily the best way to go. So much for partnerships and corporations.

Another letter that was sent to the IRS said: "Sir: my typist, being a lady, cannot write down what I think of you. I, being a gentlemen cannot say it, but you being neither will know what I mean."

Briefly then, a discussion of the various stages of mining, and how the expenses related to those stages will impact your taxable income.

IRS considers that mining has three stages: 1) exploration, 2) development and 3) production.

Exploration is basically the "search". All costs involved in the "search" for the mineral may be deducted in the year you incur the cost, or they may be capitalized to take in future years when you are actually producing. However—and this is a point that many people don't recognize—if you do expense these development costs, and you do

sell the property, that gain on the property which would otherwise be capital gain income will become ordinary income to the amount of the expense which you have taken in previous years.

In the development stage, which for mining is basically the stripping process, all of those costs are also deductible in the year that they are incurred. However, in development there is no recapture. So, never explore; always develop. I guess that's what that boils down to.

The final stage, production, isn't as clearly defined in the statutes as the first two, as for the deductibility of various expenses. So, again, it boils down to that you probably want to be in the development stage as long as possible.

Another thing that is creating problems for some people is: When do they have income? If you sell the gold, you obviously have income. No question. If you give it away, in exchange for property, equipment or rights, you also are going to have income in the amount of the fair market value of the gold that you have given away. Incidently, you have probably heard of the five year hobby loss. You are doing something for five years and you are continually losing money, IRS can designate your business as only a "hobby". Mining is exempt from that.

One last point that will be of interest. You probably are aware that the Congress has been talking about significantly shortening depreciation lives of various assets, and also allowing the immediate deductibility of some—the last number thrown out was $25,000 in property and equipment acquired for use in a trade or business. There has been a real hesitancy on the part of people across the country, this year, to purchase any equipment, not knowing what depreciation methods were available. The congressional committees involved got together and, along with the White House, agreed that any changes to the depreciaiton method—any increases in allowable deductions—will be effective no later than March 11, 1981. So, if you've been holding off buying any equipment to see what Congress is going to do, you are reasonably well assured that anything you buy after March 11th will qualify for this year's accelerated methods. It may also go further back—they're talking retroactive to January.

One final letter to the IRS: "Dear Sir: Please send me full details of tax avoidance and how it is done. I am very interested in this aspect of your business."

Questions.

Q Could the disadvantages of corporations be circumvented by filing subchapter S status which is a corporation tax as a partnership?

A Yes.

Q Why incorporate at all? Why not just elect out of the partnership, filing and go that way.

A There may be other valid reasons for incorporating.

Q What about taking gold to the refinery?

A Are you saying gold for gold? Processed gold or unprocessed gold?

Q We're getting something different.

A Then IRS has recently ruled that that is not the same commodity.

Q Our own gold...

A Your own gold, sure. If you're trading though; somebody else's gold. If you take your gold in and have it processed and get it back, that's fine. There's no problem there.

Q It's not important?

A Nothing has happened.

Q What about 337 liquidation?

A 337 Liquidation is a tax free liquidation. You liquidate the corporation, personally take the assets—whatever they may be—in exchange for your stock, and then you sell off your assets.

Q Any problem on deducting losses related to Canadian activity?

A The limitation on developmental and exploration in foreign countries is $100,000 per year, with a maximum of $400,000. So, as long as you don't exceed those limitations, you're all right.

Q Can you take the expenses in the year in which they are incurred, if you don't sell the gold?

A That is really kind of up in the air. One thing that has happened in relation to gold mining is that there has been so little in this country for so long. Congress has done very little. All of the other regulations that IRS puts out have been tightened and tightened constantly grabbing more. Since there has been very little gold mining, nobody's looked at gold mining. That kind of relates to my opening comment: You've got a few years, probably, before they come down on you. In our office we have seen no miners audited as a result of their mining activities. But, it will come as there become more of you and there's more money involved.

Q Is the cost of the mineral survey an expense in the year that it occurs or does it have to be capitalized?

A The survey on the claim would probably be capitalized because you're acquiring the property, right? It's part of the process of the acquisition.

Q Would you have income as a result of borrowing?
A The act of borrowing doesn't generally create income. If you sold the gold to pay off the loan, you'd obviously have income at that point. I don't think though that you would have income at the point at which you borrow. It's no different than borrowing against anything else. But I'm not certain.

Thank you.

THE USE OF AERIAL PHOTOGRAPHS TO DELINEATE PLACER GRAVELS

by
Jan Cannon

There's a three-fold objective that I have this morning. One objective is to present data that can be commonly acquired at the present for much of Alaska, and the possible applications of this data. The second objective will be to introduce some new data that's being made available to Alaska, with the possible applications to things that might interest you.

My feeling usually, is that a professor is charged with technology transfer. In other words, techniques come along and he should try to communicate techniques to the general public in one aspect or another. So, I'll attempt to do this today.

Most of us are familiar with aerial photography to some extent. Probably, in the past the bad thing about aerial photography has been its availability. Where is it available; how much is it; who has it. Then if you do get it, what can you use it for, what are the limitations; what are the applications? As an example, there is black and white photography of the kind that's been available since the 30s in much of the United States showing part of Fairbanks. You can get high enough resolution to see individual houses. You can see the particular channel way; you can see what we call scroll marks or old abandoned channels as the river migrates and changes its course as a result of natural processes. Of course, particular gravels deposited as the river changes its course are potential placer deposits. Now, I'm not so naive to think that I can tell a prospector how to find gold, but perhaps I can give you some techniques that you can use at sometime.

In the last few years, it has been discovered that use of color in photography is cost effective. I have discovered that term doesn't ring many bells in the federal government in discussing things with them, but they do have a term called incremental value which means the same thing —if you ever need that buzz word.

But cost effectiveness is very important to you and to me. Color may be more expensive than black and white by three or four times more but it can provide you with at least ten times more information. Color photography, however, particularly aerial photography which uses natural colors, has not been too popular or too successful for exploration type work. There is a lack of tones that are naturally available. But using an improved type of what we use to call color infrared film, we have some highly informative data available to us.

Take a normal color scene of a young lady and her friend. With the new type of exporation photography which is called color infrared photography, there are very definitely some color shifts. Things don't look the same color at all. This is why it is often called false color infrared photography. But, this provides us with some additional information. A scene at the University Experimental Farm that shows the flowers and in the background some vehicles and houses in normal color, in color infrared photography we'll see some very drastic color shifts. Odd colors showing up; vegetation, perhaps, reflects the greatest number of changes when you go to infrared.

Now, let me emphasize one point very emphatically. In photography, when we talk about infrared, we're actually only talking about red radiation just beyond what your eye can see. It has nothing to do with heat—nothing to do with heat. To do the type of infrared work that is directly related to the heat that is being emitted, you cannot use a camera lense system, you have to use what we call a scanning system which I'll talk more about in just a little bit. So, if it's a photography system with a camera lens, you're merely looking at this long red wavelength just beyond visible red. Unforunately called the near IR, the solar IR or false color IR. So, what we do is we expand our information that we are getting. We not only see the visible, but also see what is invisible to the eye, putting it into color tones we can see. That part of the invisible radiation recorded on the film is represented by the tones red, magenta and pink. You see different levels of reflectivity of that radiation. Then, the red part of the visible spectrum is represented with greens and yellows. The green part of the spectrum is usually represented with blues, and we cut out the blues because usually there is very little information connected with the blue part of the spectrum.

In aerial photography applications, the real key for placer mining is land-form enhancement. We want to look at gravel deposits; where they might be; particular land-forms that might be associated with them. So, using false color infrared photography, because we have lots of information about minor vegetation, and utilizing stereo viewing, we can get a tremendous amount of information about our land-form. Colors will be characteristic of various rock types, and various types of vegetation will not only have characteristic colors telling the species, the colors will also tell you how many days old a crop is. So, it also has extensive present day applications in agriculture. In some high altitude false color infrared photography of the University area, and you can see there's shades of pink and red that represents the various amounts of vegetation.

In a false color photograph of part of the Brooks Range we see a stream and associated with this stream, of course, are the land-forms that we are most interested in. The particular flat area adjacent to the stream is our flood plain which contains immense amounts of gravels—a thick wedge of gravels. Along the banks you can see a bulge; this bulge is materials that are in transit but there is quite an accumulation of them. Sort of terrace-like materials in most part colluvial type of material that has mass wasted down the particular slope. Another potential area is shown by these particular bulges, for materials adjacent to the stream valleys and stream floors.

Another scene in the Brooks Range shows a distance of about one mile. Here you can see a nice confined flood plain; the light-colored material indicates gravels in transit. The various tones of reds indicate the vegetation, and again a terraced deposit associated with it. In stereo, this would stand out three-dimensionally for you giving you more information.

A photo of a stream in the Brooks Range shows very little in the way of terraced materials, pretty clean walls, just materials in transit, very thin; but quite a wedge of sediments in the valley bottom itself.

Color prints of these photographs are available for $12 in the U.S. Geological Survey. Most of the Brooks Range is available; in fact, by the end of the summer, they plan to have all of Alaska covered. In the Elvey Building, there's an archive that has most of them on file. There's an EROS Data Center field office in Anchorage which will have all of them on file for you to look at, and then you can order or purchase the areas you need. The photographs have a scale of about one inch to a mile. They cover a lot of area; and give you a lot of information.

On the north flank of the Brooks Range, a photo of another stream shows a minor wedge of sediments. But more importantly perhaps, it shows the tremendous amounts of material that are moving down the slopes that are often unnoticed. This particular stream on the north flank of the Brooks Range shows some bedrock and a stream which has very little, if any, sediment material. Actually there would be very little in the way of any gravels available in this area.

A more dramatic example of what I call a clean valley would be one in the Brooks Range which shows a nice straight valley, which by the way is fault controlled. The walls are straight right down to the major stream, there is essentially no sediment. There will be a lot of float in transit but there is no volume of materials here to pick up and work with. So this can quickly tell you the volume of potential materials you would have to deal with.

A photograph on the north slope of the Brooks Range really emphasizes these down slope movement tracks. The materials are going down to this little stream but not in a straight line as one would imagine. Materials start from the divide, come down in an arc towards the particular channel. In the field people are often mislead in that they go to the stream and go at right angles up the hill to find the source of the flow of materials. They actually can come down in a rather curvilinear fashion being controlled by the topography. This can be important to you in exploration.

A scene on the North Slope emphasizes the minor vegetation, and shows some features that might be missed on black and white. Abandoned stream channels were active stream sources at one time and now are abandoned. They have wedges of sediment in them, something that quite classically could be a potential placer material.

Some spectacular views have been acquired by this particular program including part of the Malaspina Glacier showing the loops and the moraines, ridges of rock embedded with ice.

Well, to go into a little different technology we'll talk about "big brother" or "the eye in the sky" and talk a little bit about Land-sat data. Now this is easily available; it has nice scales to work with. But people acquire it and they say: "Gee, how can I use it?" Well, it has such a terrible resolution that it's limited but there is an application for it.

The data is acquired from a satellite. As the satellite goes over, it images the ground with a scanner-type device kind of like a TV system. In Alaska this data is sent to Gilmore Tracking Station in Fairbanks and then to Goddard Spacecraft Center where it is made into an image. It's what we call a passive system, radiation coming in from the sun on the zap line, is reflected along a zen line back up to the spacecraft and then it's recorded. That is why we call it a passive system. The energy is coming from a natural source. So this energy is then recorded in little discrete blocks called picture elements or picsals. The particular spacecraft scans the area back and forth, compiling a whole line of picsals and then the scan lines are comprised of picsals, and you put a whole bunch of scans together to get an image like you have on TV.

The resolution is limited because the spacecraft is traveling at some 6.47 kilometers per second. It takes only 103 minutes to go all around the planet; you see it acquires a lot of data in a very small time.

This classic picture of a skull is actually a woman sitting at a vanity. If you look at things in a different perspective, your mind will draw different conclusions. You can utilize things of a lower scale as long as you realize this.. Theoretically, it provides black and white imagery from eight bands. The imagery is much like our false color photography, it covers the same area. This represents the visible green part of the spectrum; the visible red which is called band four, band five. Band six is a little bit of this near infrared and then band seven is a whole lot of this near infrared. What happens to bands one, two and three. Well, they didn't work. There is also a band eight which didn't work. We were stuck with bands four, five, six and seven.

An image of the Glacier Bay National Monument area, the infrared scene, band seven scene is probably the best because it shows very strongly the land-water context and the topography. But, go to the band six which is a small part of the infrared, then band five which is the visible red. You see quite a change—a lot of information on the vegetation, a lot of information on sediment. And you go to band four, there's a tremendous amount of sediment load. If you're interested in water quality, band four is the optimum way to go. But we can combine these black and white scenes artificially to make color composites which, to many people, have an aesthetic appeal. However, that which has aesthetic appeal will not necessarily give you the best geological information.

Lituya Bay area shows part of the Glacier Bay National Monument in a color composite. The particular low sun angle in winter-time enhances minor land forms helping us with interpretation.

An area down on the Alaskan Peninsula; the spacecraft is some 575 miles up, but with the enhancement from the low sun angle, a very minor relief can give us of the information. Here, it's showing us the extent of glacial moraines.

On the North Slope, a particular interesting project showed us some abandoned channels, which again have a great potential for placer mining. There is a network of streams between the Colville River and Sagavanirktok River, near Prudhoe Bay. By looking at the land sat image, we see that there are old abandoned stream channels. At one time, the major part of the Colville was flowing in a different place. We see also, by the enhacement technique of low sun angle, that a little farther back in time, the Sag and Colville Rivers were combined. Now this means there are large sections of abandoned channels that are thick with gravels. What's their content? As far as I know, no one knows. But, these images tell us this type of information. It shows us where these potential places for exploration do indeed occur.

This is just some false color land sat imagery from the North Slope showing, on the north flank of the Brooks Range, the various folds north of the mountains.

This a winter time image of the Yukon Flat areas.

A variety of information can be acquired from this data.

Now, an introduction to another technique. We have aerial photography and we have land sat data available for the entire state. The land sat data is available in repetition for the last nine years in the entire state. The gap of information is in the thermal imagery which will be a long time coming. But last year and this year, probably the entire state will be completed with what we call radar imagery. The U.S. Geological Survey has already acquired large portions of the state and this will be available to the public this month.

Well, what's radar imagery, why use it? It's a little different system,it tells us different information; it's what we call an active system. The aircraft or spacecraft produces the energy which is ultimately the image. So, it comes from aircraft, is reflected off the surface, and reflected back to the aircraft and the aircraft then makes an image. In other words, this shows another portrait of broadcast energy in the radio micro-wave range, reflected from surface features and recorded again in this scanline method. Like the land-sat data, but with materials coming in from close and from off to the side. It is often called side-looking airborne radar imagery. It has one extremely useful property. It enhances land forms like no other feature--none can surpass it.

Since it is an active system, it can be flown in the dead of night, through solid cloud cover, throughout the dark arctic winter night—you don't have to wait for good weather to acquire this data.

An airborne radar image of part of the Tanana River just between Fairbanks and Nenana enhances some land forms that I've discovered many people aren't really aware of. There are large cuts that have been made by the stream at a higher level and then abandoned, so large, stream deposits are resting on a platform.

Outcrop geometry is the characteristics of the rocks and the way they weather. The data energy hits smooth surface, is reflected away and you get a dark tone. But if it hits an irregular surface, such as vegetation, it appears bright on the imagery. Rocks will give off a variety of tones in reflectivity. So rock type discrimination and vegetation identification is also possible to some extent with the radar imagery.

Down around Yakutat, most interestingly, the radar enhances the famous black sand bench. You can actually point out exactly the extent of that bench into the network of sixteen different benches. Those benches have a high potential for the black sands. This can show you precisely where every one of those benches are. So, it has a tremendous potential.

This is an aerial photograph of the false color infrared photography we were talking about of the La Perouse Glacier; some moraines doing a rather strange curve. But, look at some radar imagery of the same area and you see quite an enhancement of such things as an old bench terrace; various bench terraces. A land forms map of that particular area shows there are at least four major abandoned bench levels ranging up to 2,000 feet above sea level. The cross-section on the map shows these various bench levels--B-1, B-2, B-3, B-4.

Just south of Delta, radar imagery again shows enhancement of the land form or the glacial moraines. The bright line is the pipe line where it's above ground. The key is you can more rapidly identify land forms on radar imagery than you can with stereo photography. You lose a little bit in resolution but speed and accuracy is often very important. So, you see it has a tremendous potential and it's becoming available this year for the whole state through the U.S. Geological Surveys EROS Data Center.

I would also like to just mention "expanded spectrum analysis". I use everything I can get my hands on; lots of material are becoming available to us. I thought I would just introduce it.

Thank you very much. We have time for questions.

Q Of all these methods which could be magnified the most for details?

A The question you're asking is what can be enlarged the greatest and still retain a high resolution. The photography can be enlarged the greatest, because in photography, the individual cell of resolution is a chemical grain, a molecule. So far we've got nothing that will beat films for resolution. But you may not be interested in identifying a tank or some pinpoint thing—you may want to look at a composite feature and high resolution is not always what you want.

Q Inaudible

A The radar imagery has been acquired for 80% of Alaska. 30% of that will be available to the public this month, the rest is available through private concerns.

Q Inaudible.

A The radar imagery, as well as land-sat, and photography is available through the EROS Data Center field office in Anchorage; the main center is in Sioux Falls, South Dakota. These are presently being operated by the U.S. Geological Survey. They can get you into indexes and things like this and the cost is quite reasonable.

Q Inaudible

A Well, it's much like I indicated in the article. The nickel anomolies could be from the rocks. I've no reason to say that a meteorite has a lot of nickel in it because we discovered that lots of meteorites are just stones, just stoney materials; silicates with very little concentrations of nickel.

Thank you.

SUPERDRILL 150

D. R. Dance, Product Manager, Sound Dynamics Group
Canadian Car (Pacific) Div., Hawker Siddeley Canada, Inc.

Introduction

The Sound Dynamics Group of Hawker Siddeley Canada, Inc., have for the last seven years been working on the development and production of Resonant Vibrational Drilling Systems. This development was undertaken in Toronto, Thunder Bay, and for the last five years in the new Surrey, British Columbia plant.

The drill functions by developing high frequency axial vibrations within the drill string. It has been used to undertake a wide range of overburden drilling applications throughout Canada in standard vehicle-mounted and in helicopter portable configurations.

History of the Equipment

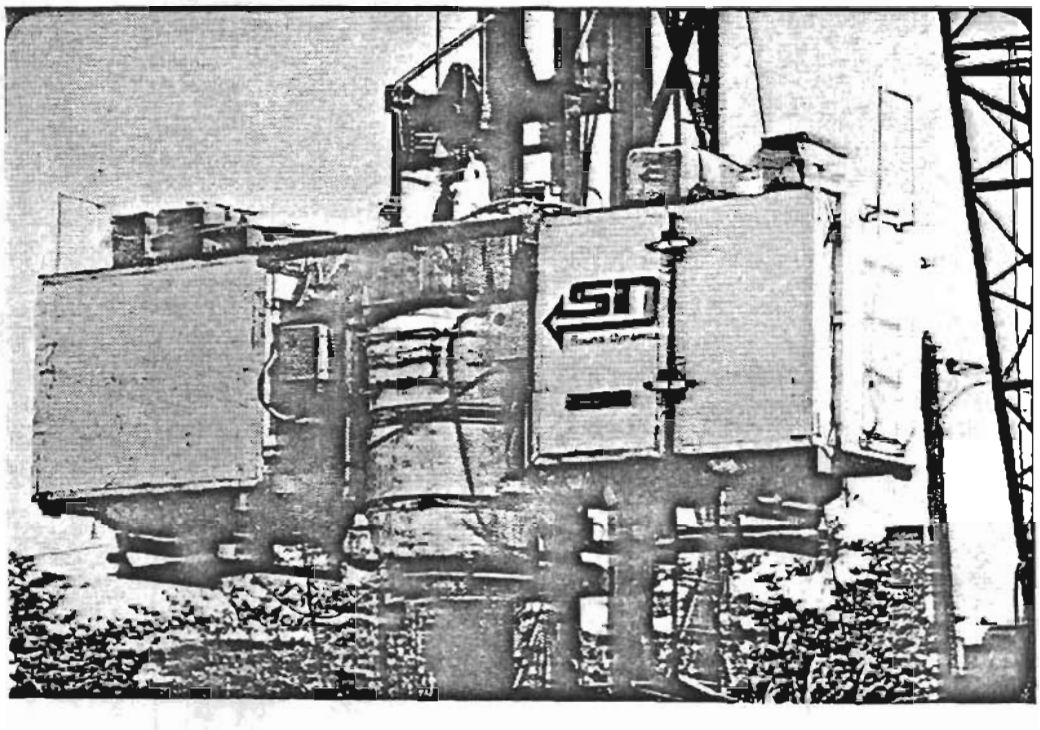
The Resonant Drill equipment, produced by Hawker Siddeley Canada, Inc., is derived from equipment initially conceived by Dr. A.G. Bodine of Los Angeles, California, and embodies patents held by him. He, in his initial work, constructed both pile driving and drill equipment based on the resonant principle.

The larger pile driver (called BRD 1000) was used quite extensively throughout the United States in the mid 1960s but suffered badly due to poor mechanical reliability. Hawker Siddeley work during the early months centered around this machine, with the object of using it to drive the main support pilings for the Alaska Pipeline Program directly rather than using an augering technique. Unfortunately the mechanical problems were not resolved in time for the project. Currently a derivative of this equipment (RDU 400) is operating in Buffalo, New York on a "cut and cover" project, where it has driven more than 2,000 piles in the last 12 months at penetration rates averaging around 25 ft/min. (Figure 1.)

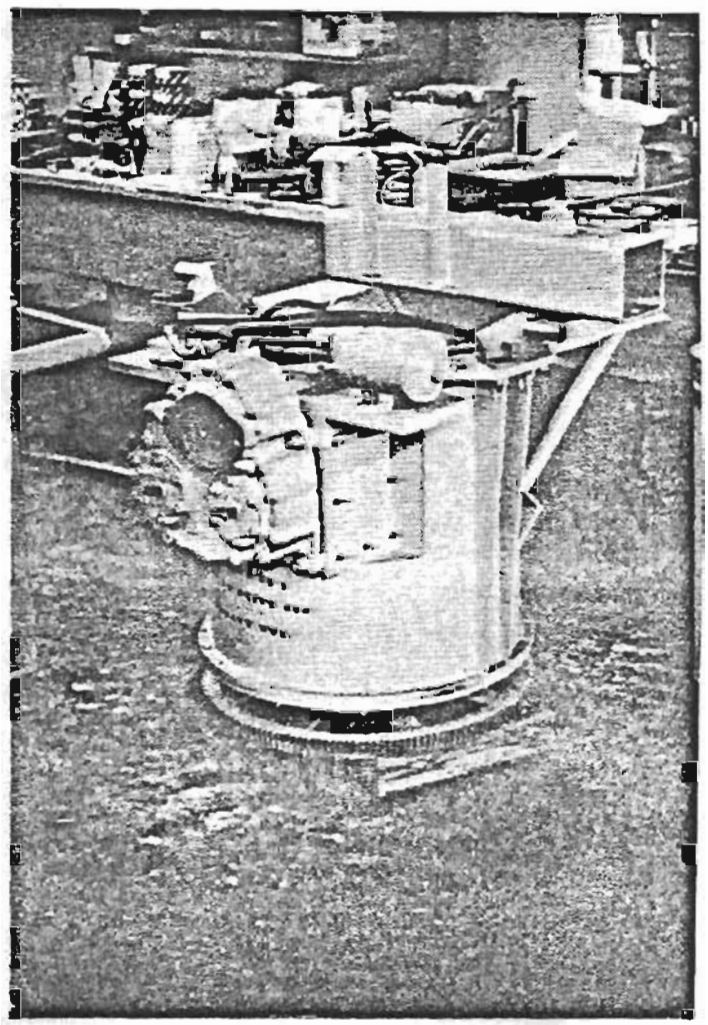
Subsequent to the above, we transferred our interest to the smaller drill which existed in the form of a BRD 100 (Figure 2). The equipment was mechanically upgraded to a horsepower level of 150 (RDU 150), and more recently redesigned to offer a better-engineered and more versatile drill unit, the BRD 150 (Figure 3). Both the RDU 150 and BRD 150 forms of the equipment will be operating in Alaska during the coming summer.

Description of the Drill Mode of Operation

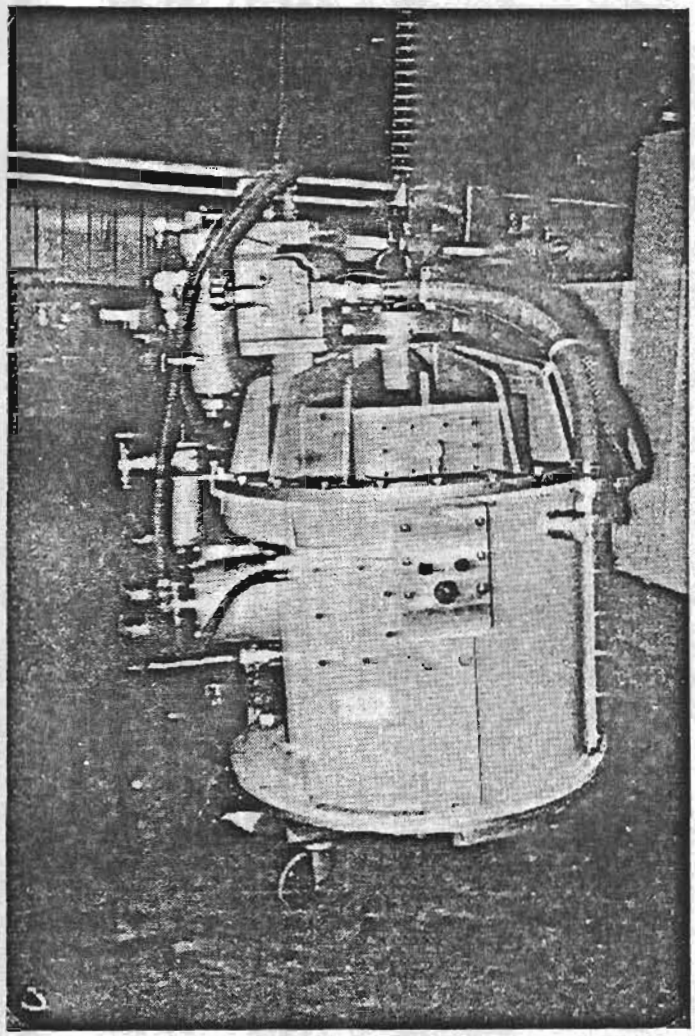
The drill unit functions by producing axial sinusoidal vibrations "in harmony" with the natural frequency of the drill string. On top of this basic motion, the more common



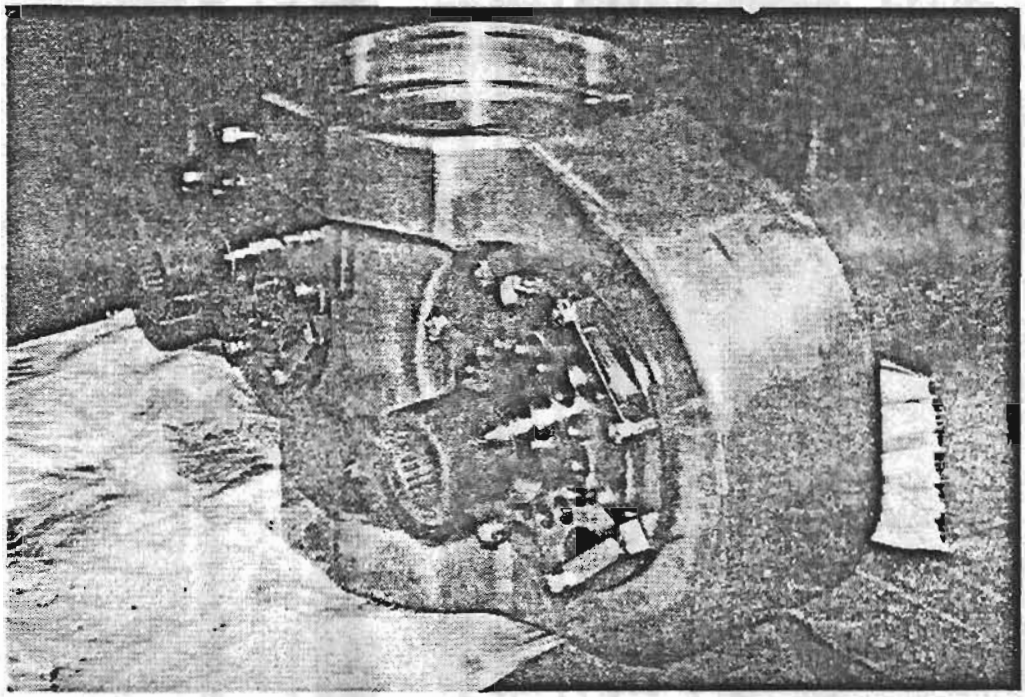
1. RDU 400 PILE DRIVER



2. BRD 100 DRILL HEAD



3. BRD 150 DRILL HEAD



4. OSCILLATOR ASSEMBLY

rotational and axial movements may be superimposed. This high frequency vibration (up to 150 hz) produces a condition of resonance within the drill pipe, offering several significant differences to the more common low frequency (25-30 hz) vibrational systems. These major differences are:

1. In a non-resonant system, as the mass of the drill pipe is increased with depth, the amplitude of the vibration produced is diminished to a level where effective penetration ceases. In a resonant system, the amplitude is not related to the drill pipe mass, therefore, serious depth limitations are not incurred.

2. In a resonant system, the drill pipe acts like a flywheel storing energy and permitting its intermittent release at many times the continuous input level. This is termed the Q of the system. This does not happen on a non-resonant system.

3. In a resonant system, as the drill pipe mass does not block the transfer of energy; therfore much higher levels of power can be delivered to the working area.

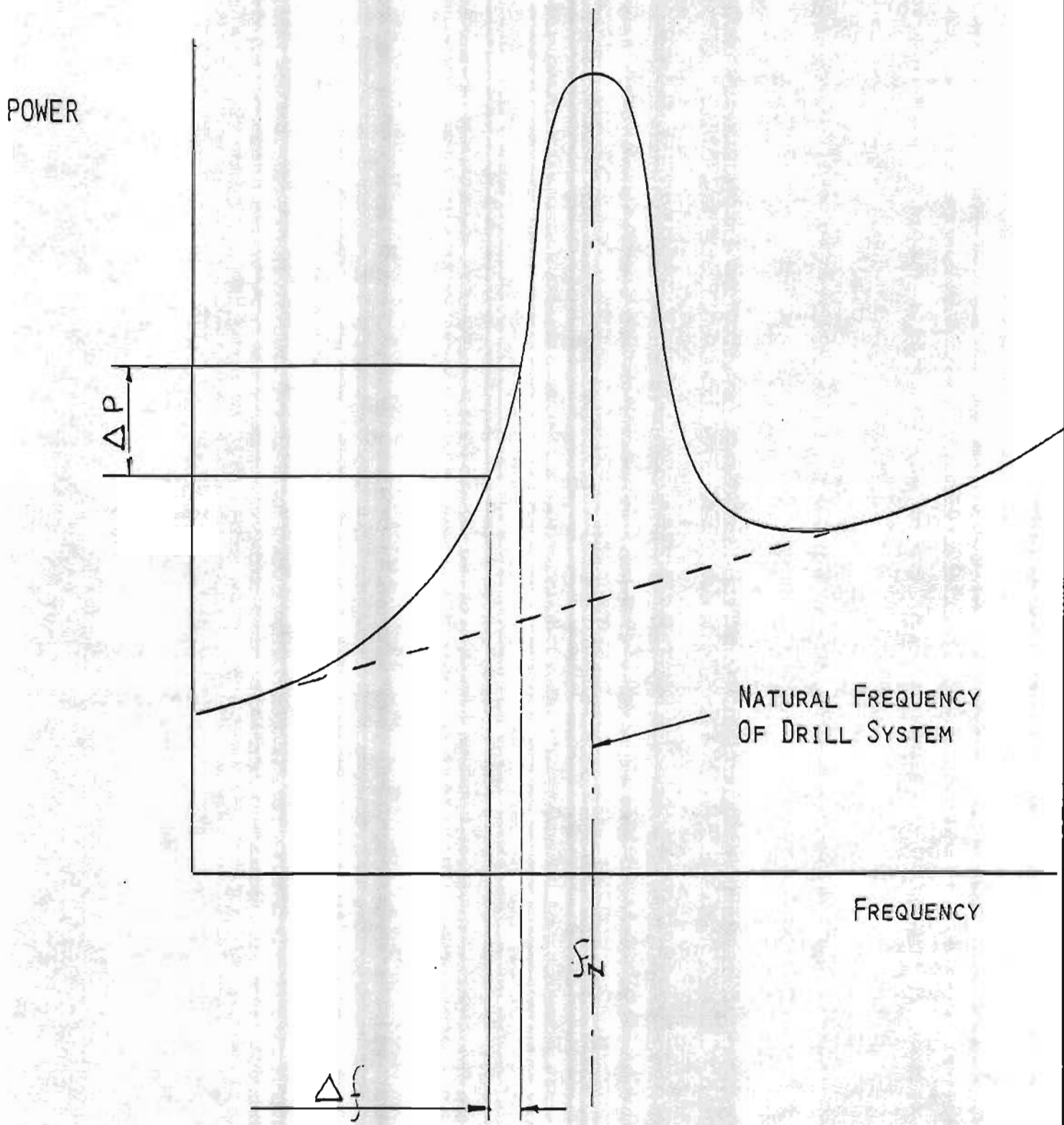
Operation of the system in the resonant condition does not represent a difficult control problem. The reason for this can be seen in Figure 5 which shows a typical power/frequency characteristic of a drill in operation. It can be seen that the curve forms a relatively high "bell" curve. In practice, the machine is operated at a frequency below that of absolute resonance at some point along the steeply inclined portion of the curve. In this area, a "lock" is established over which only a relatively small change in frequency is experienced in spite of substantial changes in input power. Thus the resonant condition can be said to be automatically found without precise control effort on the part of the driller.

Description of Drill System

Resonant Drill Head (Figure 3)

The Drill Head is cylindrical in form, having dimensions of approximately 30" diameter x 36" long, and weighing 1,100 pounds. The Drill Head has three major mechanical systems; the oscillator, rotational drive, and vibrational isolation system (Figure 6).

Oscillator (Figure 4) The Oscillator consists of two counter rotating out-of-balance rollers (weights) timed and synchronised, to permit only the vertical components of the forces generated to emerge and provide drilling action. Drive to this oscillator is provided by hydraulic motor through a gear box assembly located on the side of the unit. This system is capable of rotational speeds up to 9,000 RPM (150 hz) and producing peak dynamic forces up to ± 48,000 pounds.



TYPICAL POWER FREQUENCY
CHARACTERISTIC CURVE FOR THE DRILL

Fig. 5

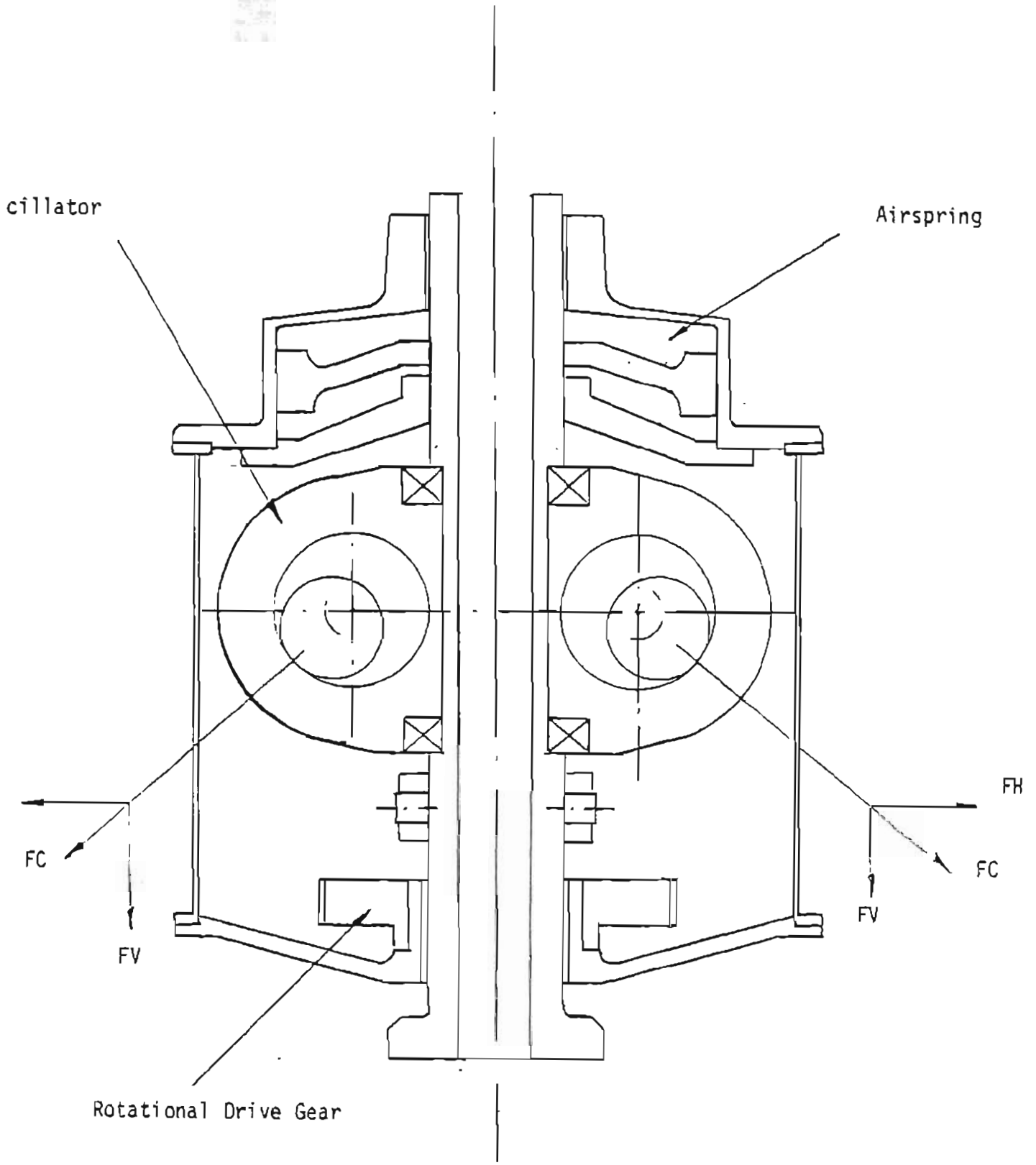


Fig. 6 RESONANT DRILL LAYOUT

Rotational Drive. The Rotational Drive system consists of an internally-mounted low speed hydraulic motor driving through gearing and torque— transmitting linkage to the main oscillating column. The motion produced is utilized to supplement the primary vibrational drilling action, and also to attach and remove lengths of threaded drill pipe. The torque of 3,000 ft. lbs. provided at a speed of 60 RPM is sufficient to undertake some specific drilling operations requiring rotation only.

Vibrational Isolation System. The axial reciprocating motion generated is isolated from the main casing by means of an air spring. This consists of a large diameter piston set on the column of the machine and contained within a closed cylinder assembly. Compressed air is supplied to each side of this piston; this acts in a manner similar to a spring, preventing transmission of the vibration to the surrounding system. An additional feature of the air spring is that by providing it with a system of porting, external direct-hoisting or pull-down forces may be transmitted to the drill string. The port system responds to an external disturbing force from the rig and establishes a pressure differential across the piston to give an equal and opposite force value. The graphs shown in Figure 7 show the effect of superimposing this direct force upon the basic vibration, and the penetration or extraction effect achieved.

Connection of the Drill Head to the drill string is made through an adaptor attached to the bolted flange protruding from the lower face of the machine.

Drill Rig (Figure 8)

The Drill Rig, consisting of Power Rack, Tower and Skid assembly, is suitable for direct-mounting on a vehicle or on a heavy-skid. The Drill Rig provides all the services required by the Drill Head, plus guidance and operational functions necessary to undertake most standard drilling programs. The functions provided include: 1) Pull Down and Hoist, 2) Drill Head Tilt, 3) Tower Erect, and 4) Pipe Joint Breakout. In addition to these "standard" features, extra equipment such as pipe storage and Sand Line winch are available at customer request.

Drilling Action

The action of the drill in achieving penetration varies with the type of soil being drilled. In the case of sands and gravels, the action is one of agitation and re-sorting of the particles to permit the drill pipe to pass through. In rock and other competent materials, the

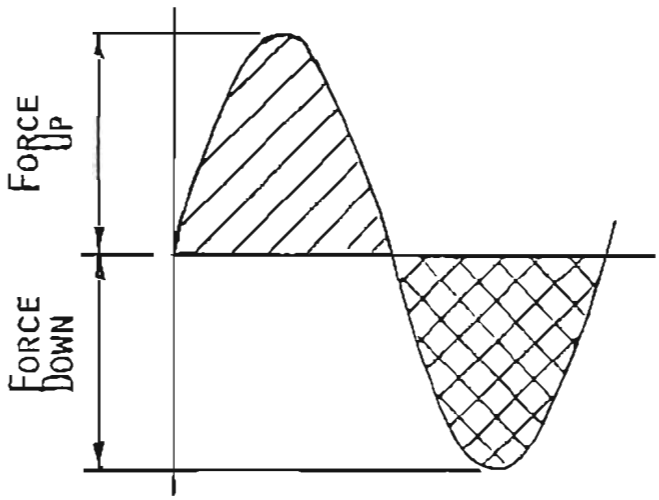


FIG. 3A
OSCILLATOR FORCE ONLY

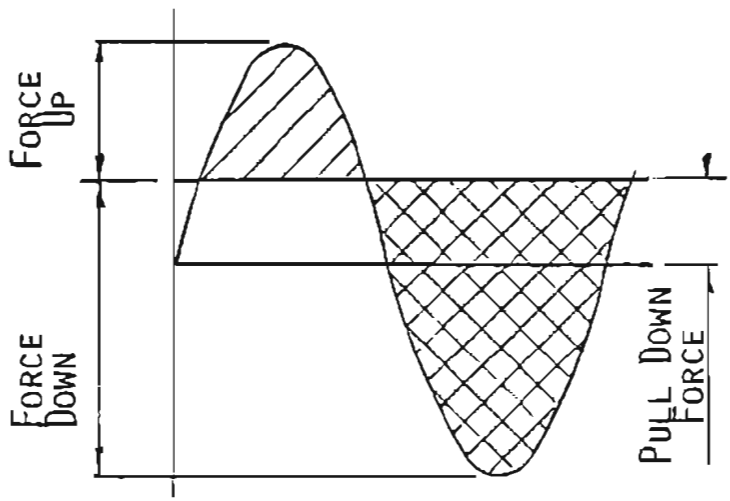


FIG. 3B
OSCILLATOR & PULL DOWN FORCES

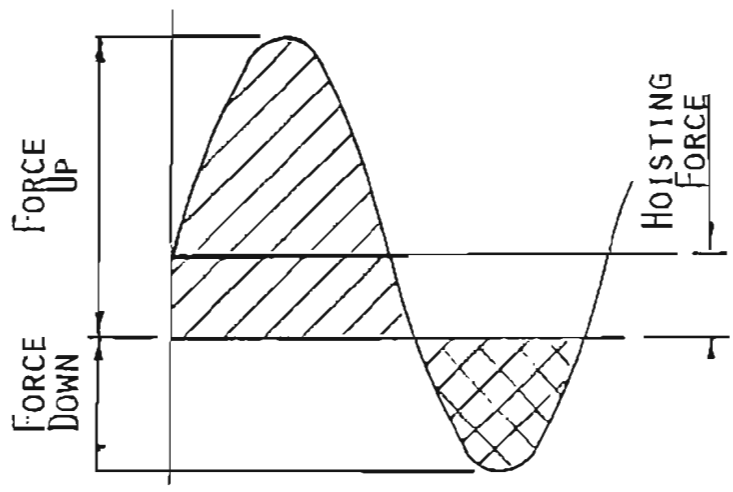


FIG. 3C
OSCILLATOR & HOISTING FORCES

TIME →

Fig. 7 EFFECT OF SUPERIMPOSED DIRECT FORCES UPON THE OSCILLATOR FORCE

process is one of fracturing by impact. In this case, reinforcement of the drill face by hard facing or carbide to resist the abrasive action of the rock is essential. When drilling these harder materials, continuous rotation of the drill bit is superimposed upon the basic vibrational action. This serves to present new material to the tooling for fracture and subsequent removal by air or drilling fluid.

Penetration rates achieved vary considerably with the material being drilled. In the case of sands and gravels, rates of 1 ft/sec. and better are common. For the other materials, penetration rates are ususally related to their degree of hardness, providing adequate flushing away of the cuttings is provided. As a general indication, with a 4½" diameter bit, rates of 30 ft/hour in granite, to 200 ft/hour in limestone have been monitored. In discussing the operation of the unit in comparison with a conventional rotary system, we feel that a major advantage exists in the fact that the cutting forces are dynamic in form. This permits the rig to be made as light as practical without serious reduction in performance. (In the case of rotary drilling system, weight is essential to provide the crushing and cutting action at the tool face.)

Lightweight Drill Rig Systems

In addition to the standard rig, extensive use of the Resonant Drill has been made in a lightweight heliportable configuration.

In general, these systems have consisted of two 3,000 lb. packages; the tower and drill unit, and power pack. Figure 9 shows the Drill Rig which we have constructed for B.C. Hydro, based on this concept. The rig has been used for the installation of hydro transmission tower foundations in the more inaccessible areas of British Columbia. The rig is designed for transportation by helicopter, with the tower in the vertical position and set on a concrete plinthe for drilling purposes. This plinthe later forms the tower footing. The foundation holes are to be drilled in an angular array from this footing, and grouted anchors set to complete the system.

In addition to this specific application, extensive use of heliportable equipment has been made in the sampling of a wide variety of soils particularly in remote permafrost pipeline routes.

Drill Tooling and Equipment Applications

Experience to date with this drill equipment has demonstrated its ability to penetrate a wide range of earth structures and perform a considerable number of drilling tasks.

The tooling utilized in each case has been custom developed to suit the specific job in hand. Many problems have been experienced due to the use of inappropriate drill stem and tooling by drillers unfamiliar with the requirements and peculiarities of the resonant drill. Consulting with us on specific problems can avoid some of the more common and expensive pitfalls.

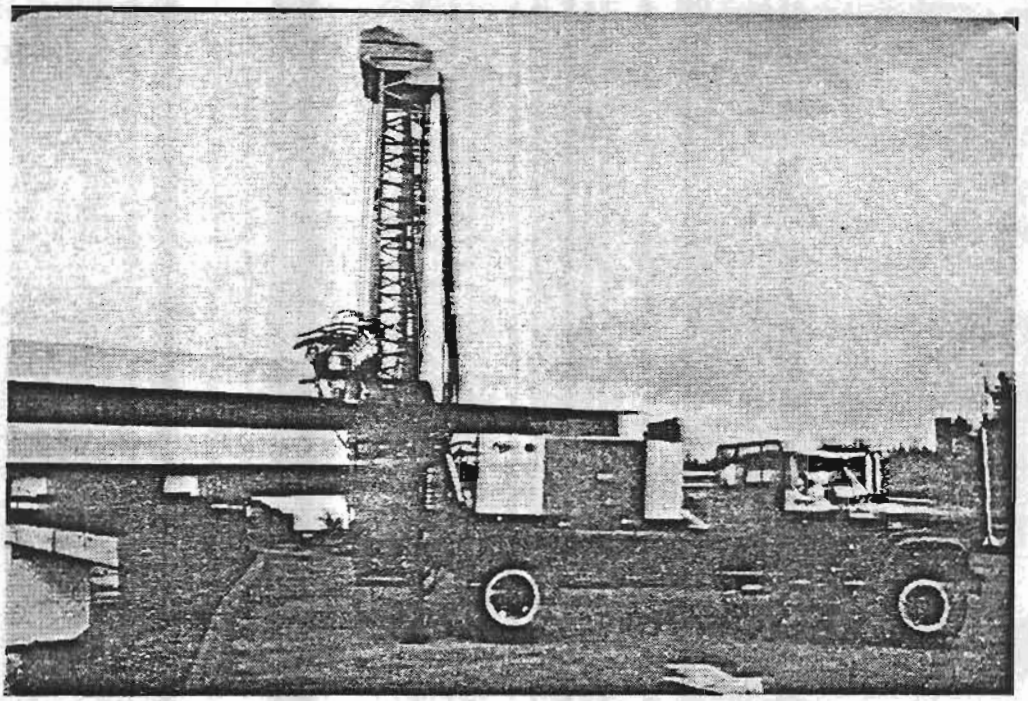
We are progressively finding more areas of application with increased exposure to the drilling community. To date the equipment is in regular use in the following areas:

1. The sampling of sands, gravels and soft clays both in regular and offshore applications.

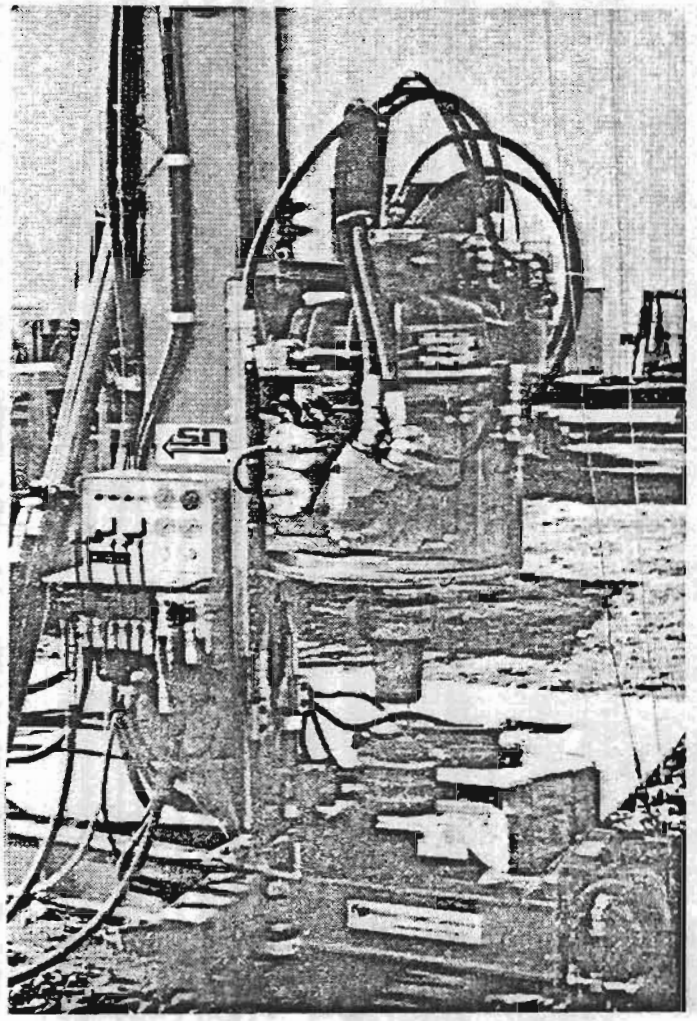
2. The rapid drilling of holes for seismic explosive charges.

3. The driving and extraction of overburden casing associated with diamond drilling or water well applications.

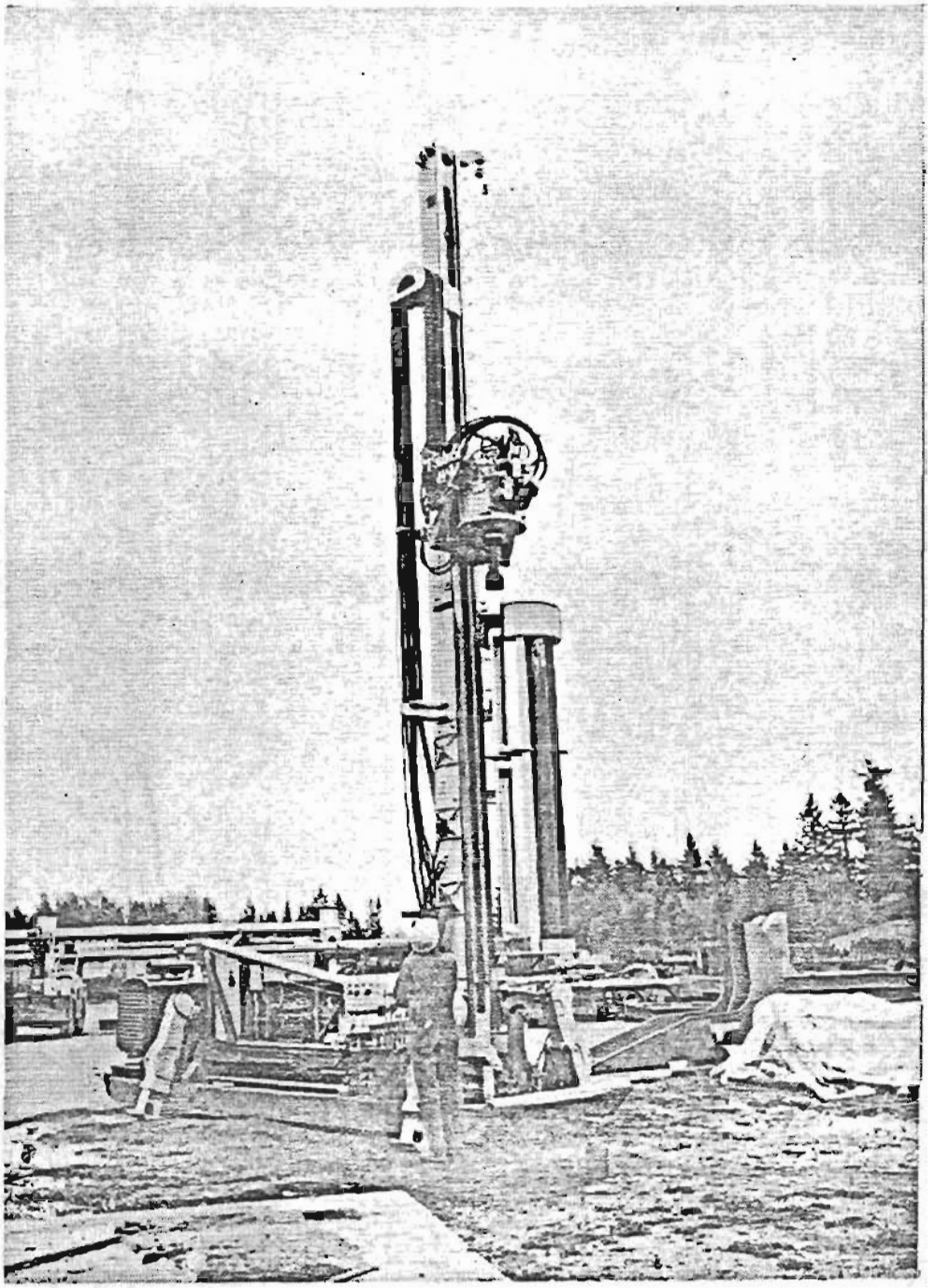
As drill tooling and operating techniques are developed and refined, the scope and usage of this drilling system will increase.



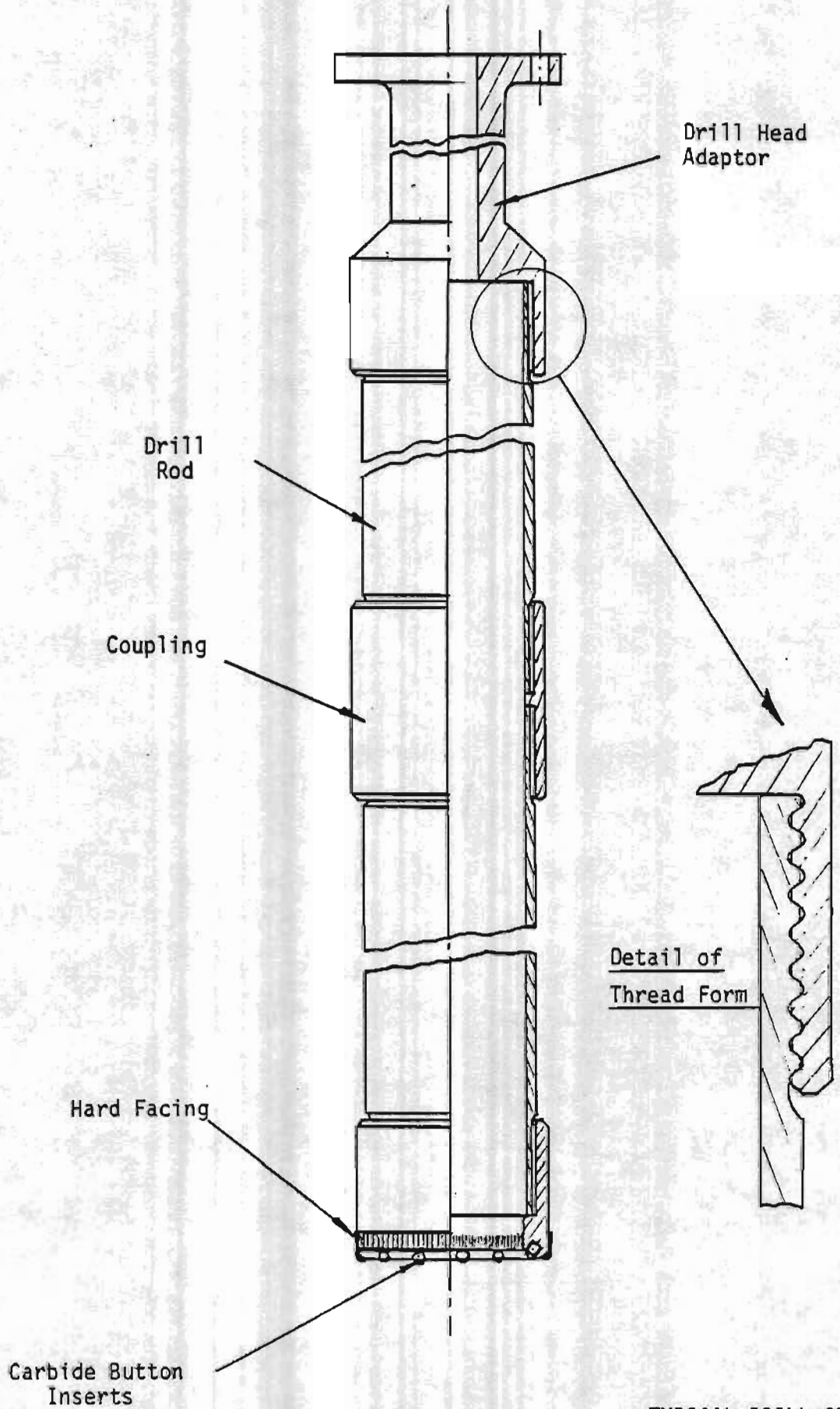
DRILL RIG



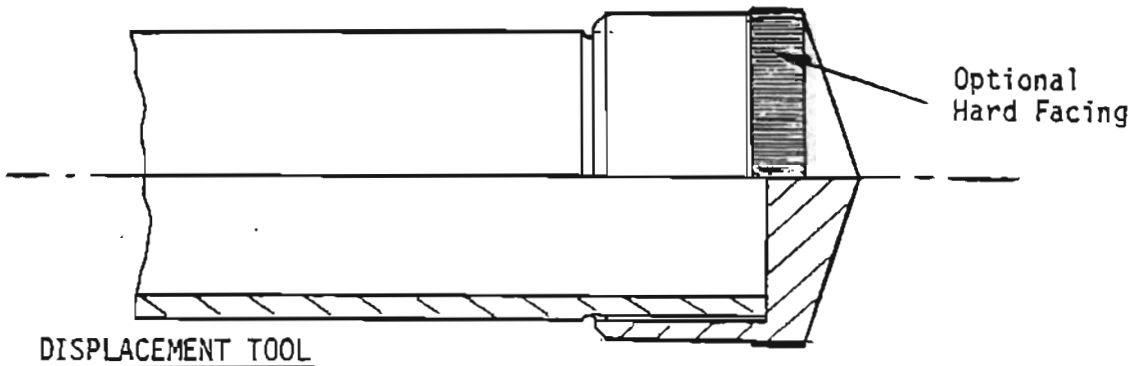
162 HELIPORTABLE DRILL RIG



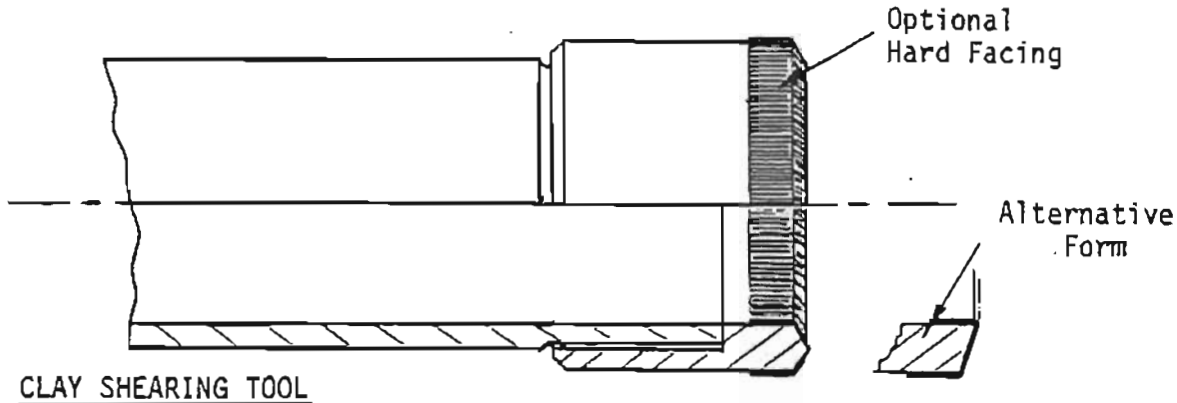
SUPERDRILL 150 DRILL RIG



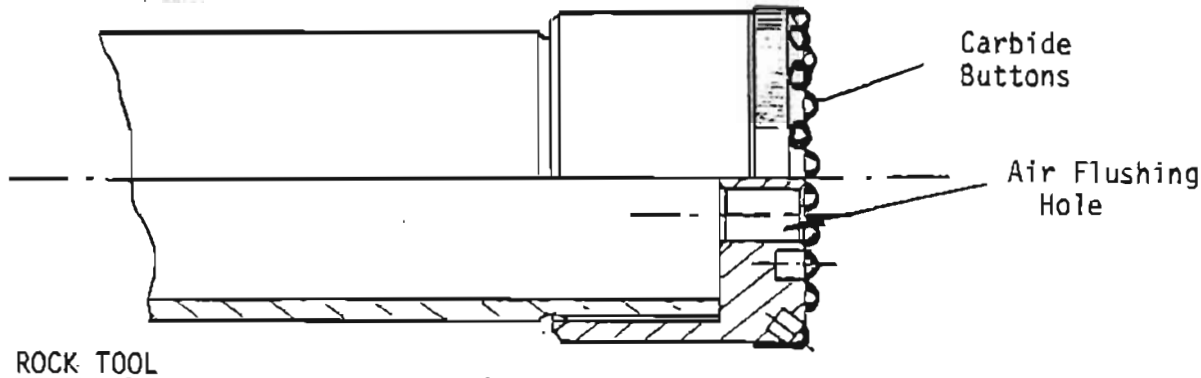
TYPICAL DRILL STRING
FOR SAMPLING OPERATIONS



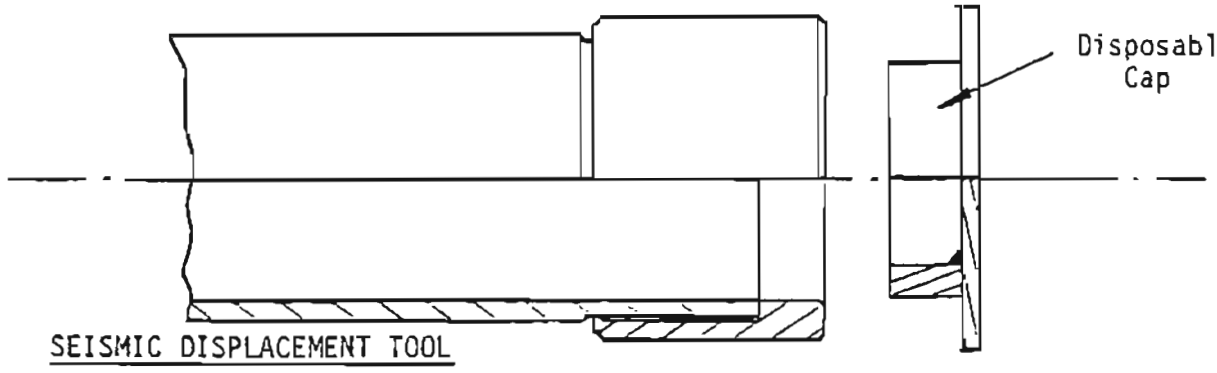
DISPLACEMENT TOOL



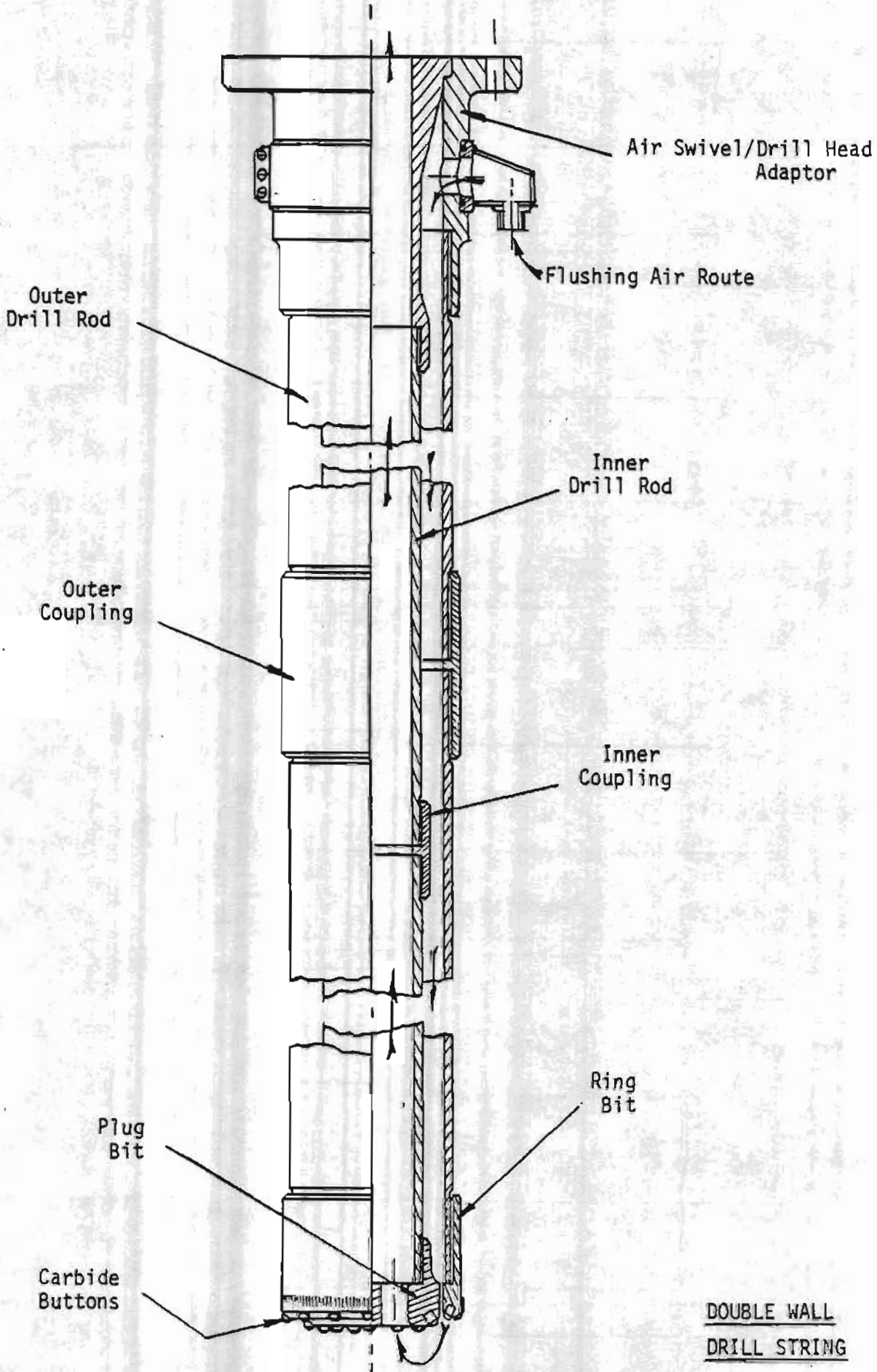
CLAY SHEARING TOOL



ROCK TOOL



SEISMIC DISPLACEMENT TOOL



DOUBLE WALL DRILL STRING

APPENDIX "A" - SUMMARY OF RESONANT DRILL UNIT OPERATIONAL CHARACTERISTICS

SOIL TYPE	METHOD OF PENETRATION	TOOL FORM	TYPICAL PENETRATION RATE *	FLUSHING FLUID	COMMENTS
Loose Sand	Displacement	Plain Unreinforced	1 ft/sec.	None	
Hard Packed Sand	Displacement	Plain-Reinforced with Hard Facing	3-6 ft/min.	None or Air	Penetration rate varies with Packing and particle distribution
Gravels (Loose)	Displacement	Reinforced with Hard Facing	3-6 ft/min.	None	
Gravels (Tight)	Impact	Tungsten Carbide Buttons	1-4 ft/min.	None	
Clay - Wet	Shearing	Reinforced Tubular	5-10 ft/min.	None	Coring Method
Clay - Wet	Shearing	Plain-Reinforced with Hard Facing	5-10 ft/min.	Water, or Water/Air	
Clay - Dry	Shearing	Reinforced with Hard Facing or Carbide Buttons	3-6 ft/min.	Air or Air/ Water Mix	
Silt - Hard Packed	Impact	Carbide Buttons	2-4 ft/min.	Air or Air/ Water Mix	
Rock - Hard (Granite)	Impact	Carbide Buttons	1 ft/min	Air	
Rock - Soft (Soft Limestone)	Impact	Carbide Buttons	3-6 ft/min.	Air	

* For 4" Diameter Drill String

EVALUATING GOLD PLACERS BY DRILLING

by
Jim Wallace
President, Arctic Engineering Service, Ltd.

I'm not really going to talk on the sonic drill although I will hit some of the high points. I am going to talk on a different series of drilling methods that area available for evaluating gold placers.

Anyway, what has happened over the past few years is that we've got a great increase in gold prices. This, in turn, has created a new surge of activity in placer mining camps in both Canada and the U.S. These price increases, along with the availability of modern earth moving machinery, have made many deep placer deposits—formerly uneconomical—viable deposits. This gets into a sampling problem and evaluation of this type of deposit is probably best accomplished by drilling.

Since the early days, modern technology has created a great variety of placer drills. Most of these are specialized overburden drills, adapted to suit a placer need. They have one thing in common, they all produce samples and they're usually pretty quick.

When choosing a drill for a program, the first question anyone must ask is, exactly what is the purpose of the program. If you have a rough prospecting program, almost anything can be used. If you're trying to outline reserves to justify some very large expenditures, then you're going to have to be a lot more accurate. In an initial prospecting venture, any one of the rotary drills or almost anything available will fill the bill. Basically what you're trying to do is to sort out where there is gold and where there isn't gold. Probably at that stage, you are not all that concerned about the dollar value.

The rotary drill is a great drill for this. It's quick; it drills in frozen ground; it'll handle boulders well. But like all of them, there's a few things that you should be keeping your eye on. One is, the casing in all of these holes should follow the bit very closely or else you will get dilution of your sample. If you get dilution, of course it's going to cause all kinds of problems in calculating how much sample you've got and what the gold return is related to. In addition, if the ground is dry, the drill pipe and the complete return system should be flushed with water after each advance to permit loss of gold within this system. It becomes very apparent that this system has lots of weaknesses where the water table is very high, or if the ambient air temperature is below 32°.

Then, we get into the case of losses or additions. You can handle this very well in dry ground. You have bigger problems in wet ground. The importance in preventing these losses or additions can be best understood if you take a look at the theoretical, volumetric gold-to-gravel ratios in any deposit. Currently when gold is around $500 an ounce, if you're taking a look at ground valued at $2 a yard, the volumetric gold-to-gravel ratio in this ground is one part gold to 100,000,000 parts gravel. So obviously, one little piece extra or if you lose a couple has a great effect on that. The error in calculated value caused by the loss or addition of one of these specks of gold in a normal 7½ inch drill hole at $500 gold is for 20 mesh gold about $8 a yard, for 40 mesh gold about $1 a yard, and 60 mesh at 35¢. So obviously, if you're into a program that's any great footage at all, then what you're looking at right away is going to be darned expensive and you can't afford to be sloppy with it. Make sure you're recovering everything and know exactly what you are getting.

A small one or two man placer operation, undoubtedly has completely different drilling requirements than a large company that's planning on operating with several thousand yards a day. The only real thing that any of these people have in common is a need for accurate samples. The small operator is probably best advised to use a churn drill. There are a number of churn drills around. The availability is good. They are very accurate and your mobilization and demobilization costs are not too high.

The larger operation that is getting into a lot of drilling in one particular year is up against another problem. The churn drill, although it has a proven track record, is a slow machine. Our averages over a year of drilling is probably somewhere in the neighborhood of ten to fifteen feet a day for average drill hole penetration. For a large program this is just not going to give you enough samples quick enough.

If ground conditions are ideal, and by ideal ground I mean hard ground, dry or frozen, the rotary or the Becker drill will in most cases do a very passable job for you. You have to be very careful then to measure returned volumes so you can calculate whether you have to upgrade your gold returns or downgrade them. For most ground conditions, the new Hawker Siddeley drill that Derric was talking about is by far the best choice. It's main advantage besides being fast is that gives a core rather than a cutting. This gives you less of a problem in sampling error.

But there are a couple of disadvantages of the machine. Resonant drilling concepts are not really understood, consequently there are very few experienced operators around. On top of that, standard tooling that is

available limits holes in wet ground or bog ground to the depth of the drill tower. If you're looking at a 24-foot Kelly then you can probably drill 22-foot ground with no problem and expect to get 100 percent recovery.

We go from there into what you do with these drill samples once you get them. With the churn drill you end up measuring core rise in a six inch pipe and actually keeping very close track of the sample that you're retrieving in a bucket. This allows you to adjust your values accordingly. People that have used churn drills for any length of time can do this quite accurately.

With the rotary or the Becker drill, you end up with the same problem. You have to make sure you know exactly how much material you are recovering, and then you're adjusting values. The biggest problem you get with this is that these upgraded or downgraded values can be questionable.

With the Hawker Siddeley Super Drill, in thawed ground, the reliable drilling depths are limited to the height of the Kelly as I said. The hole is drilled in one complete run. As a result, you're just filling up the pipe and you're retrieving one pipe full of sample; there's no chance that you can get any extraneous material in there. In frozen ground, you can drill a hole deeper. You usually drill the length of the Kelly and pull, take the sample out, and then go back into the frozen hole and know that you are not going to get a lot of sluff. Your chances of getting slightly over 100 percent recovery are because of that interface where you go back down into the hole in 20-foot increments.

I want to say a little bit at this time on what you're going to do with this sample once you get it out of the machine. There are a lot of new people in the game that really don't know what the problems are in handling this material. I've seen the core split because of the great volumes of gravel you get. Some people elect to split this down and take a ten pound sample. In my estimation, and in the testing we have done, it is almost useless to do this. The results are just completely unreliable—that gets back to the volumetric gold to gravel ratios.

Actually you should handle the whole sample; retrieve what gold is retrievable. If you have an awfully lot of fines you can amalgamate some of it. In most grounds, we do not amalgamate, we keep track of the very fine colors and use this for upgrading the whole accordingly. The black sands in all of these should really be kept, at least on a spot check basis, to see what you are running. You'll find a lot of black sands in the Alaskan gravels contain appreciable amounts of tin, and in some cases, tungsten. In many

cases you'll get straight magnetite and a few of the accesory minerals like ilmenite, rutile, and so on. In a lot of the placers in Alaska, the black sands are a valuable element.

I've also run into a lot of people in the past couple of years that have taken the drill hole concentrate and had it fire assayed. That is probably the worst thing that you could ever do with a placer sample. If you fire assay them, you'll find you are usually very very high in your evaluation results. We've seen them up to ten times as high as they should be. Part of that is related to how you take a small piece or a small portion of the black sands and assay it. It just cannot be representative and usually it's way, way high. The other problem you get into, of course, is that you start looking at gold that is held up in some of the sulfides and one thing or another; you're looking at now recoverable gold. The main thing is to make sure that you have a system worked out that is similar to your sluicing operation.

Regardless of how you get into a drilling program you know that it's going to be expensive. I certainly don't know of any easy way of doing it, or any cheap way. Some are just less expensive than others. With that, I'll leave you at this time.

Q Has there been any indication from the Bureau of Land Management or other government agencies on whether or not a core sample will stand up for validation?

A Jim: I'm not exactly sure what the case is within Alaska. I know on the other side of the border, on the Yukon, most of these are acceptable results as long as they are done by somebody that is accredited for doing this type of thing. I would imagine you'll find much the same thing here.

Q Can you drill a two hundred foot hole in frozen ground and take a sample from the base of those gravels?

A Jim: With current tooling, we can drill some pretty deep holes. We could probably get well into that depth with the machine. With our tooling, we can handle that ground quite well in frozen ground. Our problem in thawed ground that is not extremely tight is that you end up with a sluffing problem. We're in the stages of spending some time on new tooling to handle that, so we do not have to pull the drill pipe every time to retrieve a sample. That is our major problem in thawed ground.

Derric: If, I can comment on depths, the deepest that the drill's been, to our knowledge, is in excess of 700 feet. I'll qualify what Jim was saying with regard to tooling, the current tooling that is being used is perhaps the most basic that can be considered. That certainly has the advantage in that it gives speed of

operation. I think if you're looking to go very deep then you're certainly looking at concentric tube systems where you have a sample collecting tube inside the drill string which is retained through the center of the drill head and is returned progressively with the casing left in place.

Q What type of a recovery system do you use for the core?

A Jim: In this type of machine, we do not use a core catcher as such. In most of the firm ground you've got no problem. We're using basically a seven inch bit and you are crowding the sample into a six inch tube. The biggest problem we've got right now is getting the sample out of the tube.

Q Would you comment on the type of the drill rates you are using? Mostly vibration or mostly rotation?

A Jim: Depending on the type of ground, we find in frozen muck we get penetration rates of seven and eight feet a minute. In good frozen gravels, our penetration rate is about two feet a minute. If the gravel has a lot of rock in it, very coarse material, then we slow down; but we can usually handle at least a foot minute in most of this stuff.

We use rotation in combination with the vibration, but not much. We slow our rotation down pretty well just enough to clear the bit.

Derric: The front end of the bit has certain carbide reinforcing so it is necessary to provide some rotation just to index it round when you're cutting through gravel and small boulders.

Q (Indiscernbile)

A Jim: Certainly crowding is minimal.

Derric: The penetration method in ice-rich soils is by local melting of the ice, causing it to flow around.

Q What is the difference in cost between the rotary and Becker and, say, the resonant drill?

A Jim: We have some numbers worked out on this thing, in most cases. We had a big prospecting program going using a rotary rig, and I haven't got all the cost figures in on that one, but it looks like our total cost is going to be in the neighborhood of about $32 a foot. Maybe you can better it considerably here, but I would doubt it very much. With the sonic machine, under the same conditions, our drilling cost are somewhere in the range of $45 a foot - between $45 and $50 a foot. The only difference really is that with the resonant system, we can promise 100 percent recovery, you do not have to adjust values. If you're willing to pay for that, then this type of drill is the machine to use. We've just purchased a new one; we feel confident that's what we want.

THE PORCUPINE CREEK PLACER DEMONSTRATION PROJECT

by
Jerry Brossia
Alaska Dept. of Environmental Conservation

Thank you, Don. This morning I'm going to give an interim report on the settling pond project we have going on in the Circle mining district. The project was funded by the U.S. Environmental Protection Agency by a 208 Grant under the Clean Water Act. We have contracted the project out to R&M Consultants of Fairbanks and L.A. Peterson & Associates of Fairbanks.

The purpose of this project is to design, construct and monitor a settling pond. Originally we had intended to build a settling pond that would meet the State Water Quality Standards. Since that time, due to physical limitations and cost limitations, we had to settle for something less. The second departure from our original plan is going to involve our monitoring program. Initially we were planning on monitoring this pond for 100 days; we have now decided to monitor it for 40 to 60 days, and to sample other mine sites in the Circle mining district. So you may see myself or Mr. Peterson out in the field trying to get some water samples from your mines. We have designed a pond to meet State Water Quality Standards and I will talk about that a little later on.

We started soil sampling and water sampling in the summer of 1980, but the contract wasn't finalized until December of 1980. So we are currently finishing up the initial design work for the project and we hope to build the settling pond sometime this spring, do the monitoring this summer and we should have a final report on the project by this time next year.

The project is on claims owned by Henry and Helen Warner on a tributary of Birch Creek.

There are several reasons why we're doing this project. One of them is the high number of complaints that we have received from recreationists about muddy water put out by the miners in the area. There are approximately 60 active mines in this area. They discharge up to 4,000,000 waters a day from each site. Each one of these mines is processing somewhere between 500 and 1,000 cubic yards of material through the sluice box each day.

The second reason we're doing this project is because many miners have complained that they cannot meet either the state or federal water quality standards. The U.S. Environmental Protection Agency has established two effluent guidelines. The miner has his choice of either one of them. The first is to build a settling pond which would

Objectives:

1. Determine the effectiveness of settling ponds as a primary treatment step in removing solids.

2. Design a settling pond that will theoretically provide the best possible treatment and compare the results to EPA effluent guidelines and the state water quality standards.

3. Evaluate the actual effectiveness of treatment compared to the theoretical values for solids and turbidity removal rates.

4. Evaluate the economics of construction, operation, maintenance, and closeout of a settling pond.

5. To develop data that would enable ADEC to provide miners with technical assistance on how to design, construct and maintain settling ponds.

6. Provide technical data to be used for policy decision making and regulations reviews.

contain your processed water for 24 hours. The second is a monitoring program where you measure the settleable solids in the discharge water from the pond. Settleable solids are the amount of solids that will settle out in one hour when held in an Imhoff cone. The standard is .2 milliliters per liter, as measured at the bottom of the cone.

The other standard that causes considerably more controversy is the State Water Quality Standard in regards to turbidity. Turbidity is measured against the natural background of the stream at a point 500 feet downstream from where your affluent discharges into the receiving water. It is measured when this water comes out of the mixing zone. A mixing zone is a very important concept because turbidity appears to have an almost linear relationship to dilution. For example, if you're discharging 5 cubic feet of processed water into 5 cubic feet of receiving water and your discharge is 400 NTUs, it would be diluted down to approximately half of that value by the receiving water or 200 NTUs.

The third reason we're doing this project is because very few miners have acutally maximized the use of settling ponds for removable solids.

The concept of minimum water use, is the less you use the less you have to treat. It involves water stockpiling of tailings, fish passage and good settling pond layout.

Inlet structures should be designed for uniform flow; good outlet design and to prevent washouts. The outlet structures should be built of wood and concrete with metal overflow pipes.

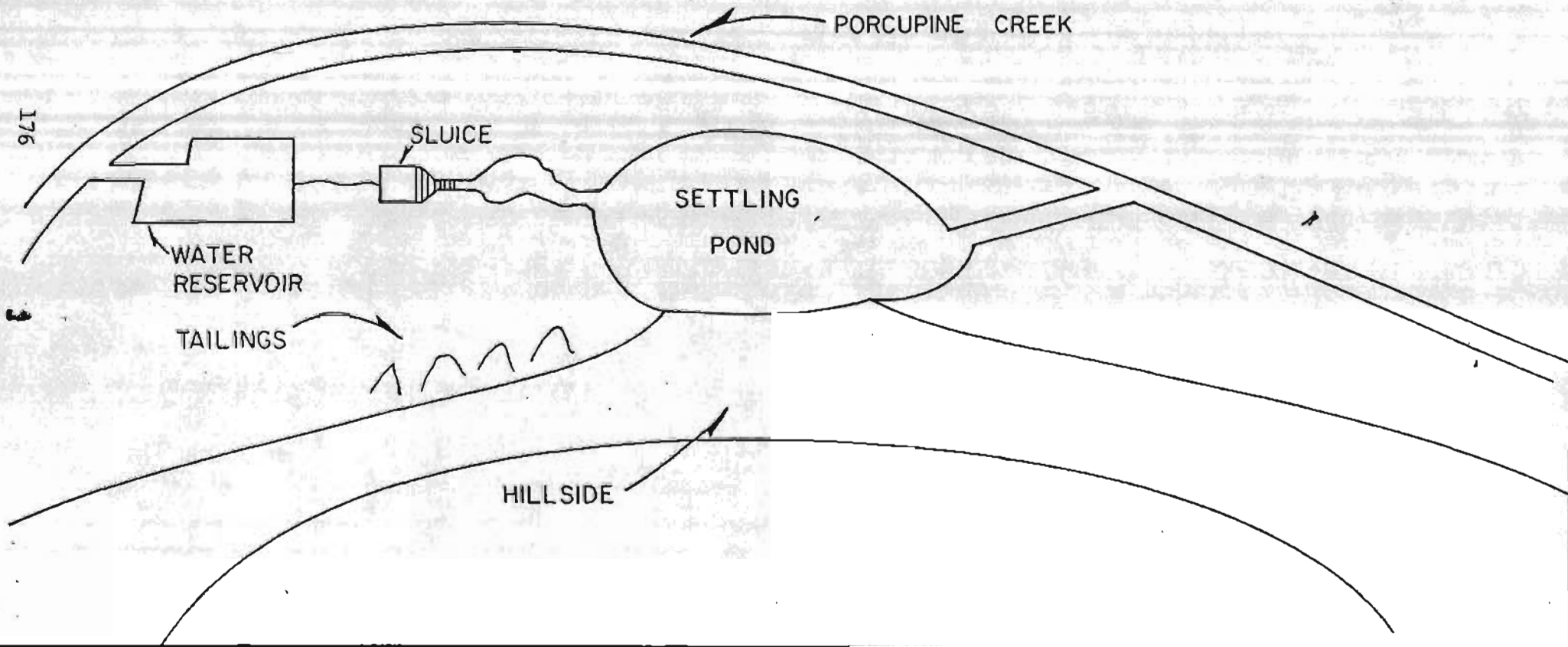
Certain practices actually hurt or are detrimental to solids control: overburden being dumped directly into the creek, high velocity flows through inlet structures or outlet structures; short circuiting; pond walls that just blade up rather than having integrity; channelization; washouts; and dead spaces in the pond where very litte settling occurs.

At the Warner's mine we found that the stream had a flow of about six cubic feet per second. Mr. Warner needs to run approximately eleven cubic feet per second to operate his sluice box so he has a water shortage problem. In order to get around that he's constructed a water reservoir; he fills the reservoir from the creek and then has a pipe to his box. The natural condition of the stream had almost no suspended solids or settleable solids in it, and the turbidity was less than one. However, below his sluice box the suspended solids were raised up to around 6,000 miligrams per liter. The settleable solids, measured by the Imhoff cone, were 16 milliliters per liter and the turbidity was 1400 NTUs.

SCHEMATIC SITE LAYOUT

PORCUPINE CREEK MINING SITE

SETTLING POND DEMONSTRATION PROJECT



Henry operates a conventional sluice box, steel sluice with riffles. It's got a mouth piece on it. He feeds it with a dozer and removes the tailings with a rubber-tired loader, processing somewhere around 100 to 150 yards of material a day. The area below the box will be used as a drain going toward the settling pond.

Probably one of the most important things that we've found so far in the initial sampling and design work is that the Warner's mine has about 6% clay in the discharge water. This clay appears to stay in suspension and will not settle out. It doesn't appear to follow Stoke's Law and reach terminal settling velocities. This is going to present somewhat of a problem as far as meeting state turbidity standards. We took an 80 gallon sample from the end of the sluice box and we placed it in a ten-foot high column one foot in diameter with a number of ports at various steps. We let that water stand for 60 days. What we found was in order to design a pond that would meet the State water quality standards, we would need to have a surface area of approximately 25 acres. The pond would have to be 25 feet in depth, have a 60-day detention time, and an overflow rate of approximately three gallons a day per square foot. This would give us the 99 percent removal of suspended solids and turbidity which is what we needed to meet State water quality standards based on the flow of the stream and mixing zone characteristics of the area. After the 60 day holding time in the column, the suspended solids were down to 40 milligrams per liter and the turbidity was down to 150 NTUs.

What we ended up doing was designing two ponds. One that would meet State water quality standards, and a second that we would actually build on the site. We estimated that after 24 hours 90 percent of the suspended solids will be removed and 70 percent of the turbidity. Our pond is limited by space to a 2 acre surface area, 5 feet deep, with one day detention time and an overflow rate of about 35 gallons per day per square foot. In reality, the actual performance of this pond under field conditions will probably somewhat less than the estimate. This is due to poor design, short circuiting, turbulence from wind, bottom scour, induced turbulence as the pond fills with sediment and perhaps increased velocities around inlet and outlet structures.

The pond will be built out of native materials such as sand and gravel. Silts will be mixed in to act as a binder and to make the dike walls impermeable. The pond will be built in six inch lifts, compacted with a D-9 dozer and will probably have walls sloped around 3 to 1. It is going to take approximately 5,000 yards of material to build the pond. We expect it to hold somewhere around 3.3 million gallons of water.

SUMMARY OF WATER QUALITY AND FLOW DATA COLLECTED AT HENRY WARNER'S PLACER MINE ON AUGUST 14, 1980

Porcupine Creek Mine Above Mining Operation

Flow	5.6 cfs
Dissolved Oxygen	13.0 mg/l
pH	6.4
Temperature	8.0° C
Settleable Solids	0.1 ml/l
Suspended Solids	0.8 mg/l
Turbidity	0.20 NTU

Wastewater Discharge 75 Feet Downstream From Sluice Box

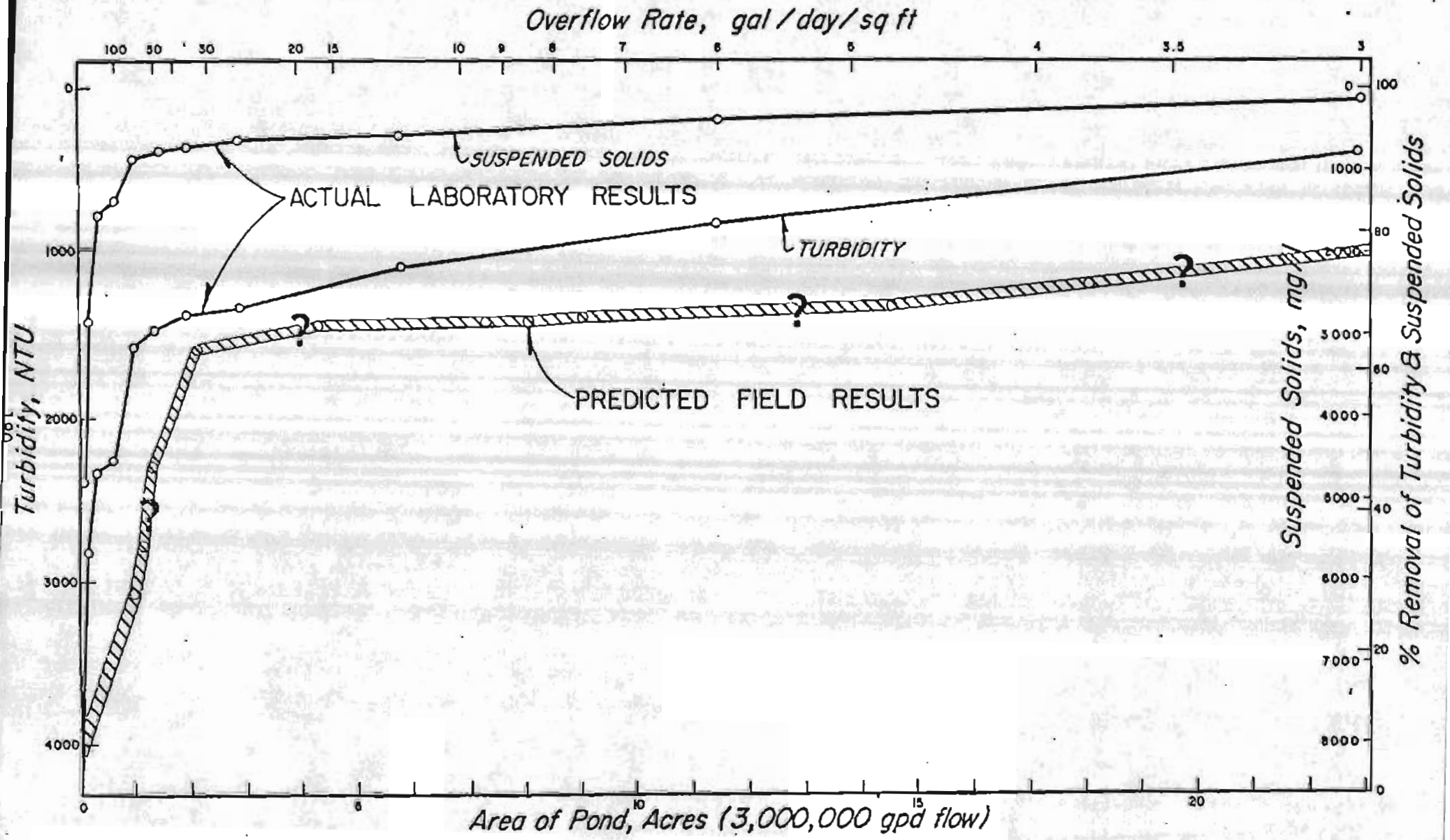
Flow	11.3 cfs
Dissolved Oxygen	12.6 mg/l
pH	6.6
Temperature	9.6° C
Settleable Solids	16 ml/l
Suspended Solids	5910 mg/l
Turbidity	1400 NTU

Wastewater Discharge 800 Feet Downstream From Sluice Box

Settleable Solids	3.2 ml/l
Suspended Solids	2320 mg/l
Turbidity	480 NTU

GRAIN SIZE DISTRIBUTIONS

Seive Size	Material Mined Percent Passing (by weight)	Material Discharged From Sluice Box Percent Smaller (by weight)
1 1/4 inch	100	
1 inch	90	
3/4 inch	80	
3/8 inch	57	
No. 4	39	
No. 10	25	100
No. 20	14	-
No. 40	8	-
No. 50	6	-
No. 100	4	94
No. 200	2.2	75
0.05 mm		61
0.02 mm		42
0.01 mm		27
0.005 mm		13
0.002 mm		6
0.001 mm		3



Porcupine Creek Site-Settling Pond Demonstration Project

As I mentioned earlier, our monitoring program is going to shift then from monitoring this project all summer into a program where we anticipate monitoring a number of other mines in the area. At all mine sites, we plan to take suspended solids, turbidity samples, settleable solids and flows above the mine sites, below the sluice boxes, as the water enters the pond, as it leaves the pond and at a distance 500 feet below the pond as it comes out of the mixing zone. We also plan to take samples and run them in the column to determine theoretical predicted removal rates and then measure the ponds in the field to determine the actual values.

We hope to find people who will allow us to sample sites using a hydraulic giant, wash plants, new design on boxes, and the modified Ross boxes.

In summary then, we hope to be able to design a pond that will meet the State Water Quality Standards. We also hope to build a pond, monitor it's efficiency and effectiveness at removing solids, and compare those results to existing standards. We hope to monitor ponds in the surrounding area, determine their effectiveness at removing solids,and compare those results to theoretical values. We feel this infomation is going to help the department make technical decisions on how to build ponds for sediment control purposes.

Last, and probably most importantly, we hope to use this information to make policy and regulation decisions. Thank you.

Are there any questions?

Q Have you tried to use flocculant at the pond sites?
A We had not, but there's been one individual mining company that has. What they found was that they've had problems with the metering of the flocculant and mixing of the flocculant. It is also very costly.
Q Are you going to use your settling pond test to adjust your standards?
A The question was will we use this information to upgrade our standards. The answer is my purpose in the project is to merely gather hard data that will enable decision makers to see what we've got under field conditions.
Q Are you accepting data generated by individual people?
A We would certainly accept it, but we would like to have one individual sample all the mines involved so that the same method is used at all the sites for scientic purposes.

Predicted Results Based on Preliminary Data and Design

1) Data will be developed that will enable ADEC to provide miners with technical assistance on how to design, construct and maintain settling ponds.

2) The actual effectiveness for solids removal will be determined for settling ponds in Circle Mining District.

3) The actual effectiveness of settling ponds in the Circle Mining District will be compared to the theoretically predicted effectiveness for removing solids.

4) The cost of design, and construction of settling ponds will be evaluated for the Porcupine Creek pond.

5) The results of comparing effluent to EPA and state water quality standards are:

   a. It is predicted that pond effluent will meet E.P.A. guideline of 0.2 ml/l settleable solids.

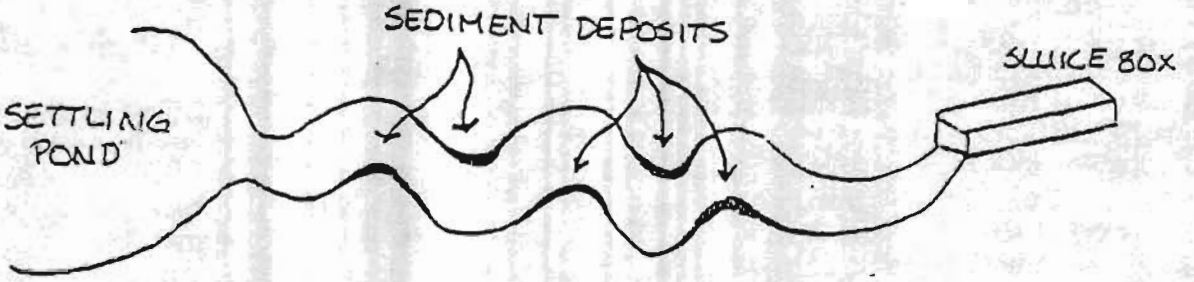
   b. It is predicted that turbidity of the effluent will not meet state turbidity standards.

   c. It is predicted that the turbidity measured 500 feet from the pond after effluent has mixed with Porcupine Creek will be highly variable and approximately linearally dependent on creek flow.

6) The project will provide technical data to be used for policy decision making and regulations reviews.

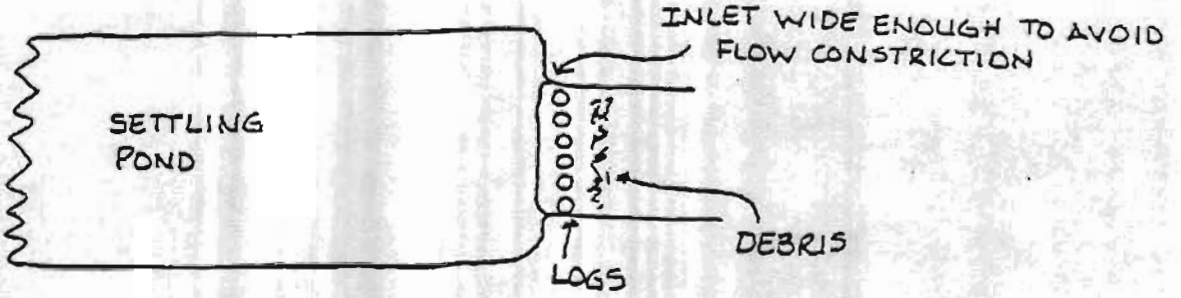
Q Will you use the information that you gather to close down operations that aren't meeting current state standards?
A At this time, we're looking at this as a monitoring project.
Q Would you have problems with miners allowing you to come on site to take your samples because it seems like you may use the data to shut people down.
A We always have had problems with miners not wanting us to sample because of potential enforcement actions against them. For the miners that are operating on public domain land, we usually try to make a cooperative agreement where we enter the site. Those that are operating on private land, we try to do the same but we have had problems and we would certainly appreciate cooperation in taking samples this summer.
Q Is the information that you gather available to other departments in the State, like Fish and Game?
A Yes, any information that we gather is public information that's available to anyone.
Q So they could use that information to shut down miners?
A Well, the regulations that are involved in the study pertain to the Alaska Department of Environmental Conservation and the U.S. Environmental Protection Agency so it's customary that any action taken with those regulations funnel through our department.
Q Inaudible
A After this pond fills up, we will be monitoring it during the sedimentation period and we expect to see significant changes as the pond fills. We will attempt one change in construciton to accomodate additional settling. We haven't decided whether to put baffles in, to build an additional pond or what we are going to do.
Q What if you don't have room for another pond?
A Well, as this pond fills up, we would have some additional room as the miner moves upstream.
Q Well, what about another site where you don't have room, for example, in a steep-walled valley where you don't have room for a settling pond on a bench or a lower elevation?
A I don't have an answer to that.
Q I'd like to know, since you know you've had a number of years now to make all these environmental studies, has anyone come up with any information concerning permanent environmental damage, or percent of damage to the community or to the wildlife since the days that Felix Pedro and the other old-time miners started using all these hydraulics? Esepecially around in the '30s when there was so awful much silt and mud and overburden put in the streams. Wouldn't you think that you would have a definite decision as to how much permanent damage was done?
A The question is, I believe, what is the long-term damage from placer mining based on historical mine

It has been found that settling ponds are more effective if sluiced material is discharged to a meandering raceway that leads to the pond. This allows coarse sand and larger tailings particles to settle out before they reach the settling pond, sometimes up to 50% of the total material processed. The sediment deposits are easy to remove with a bulldozer.

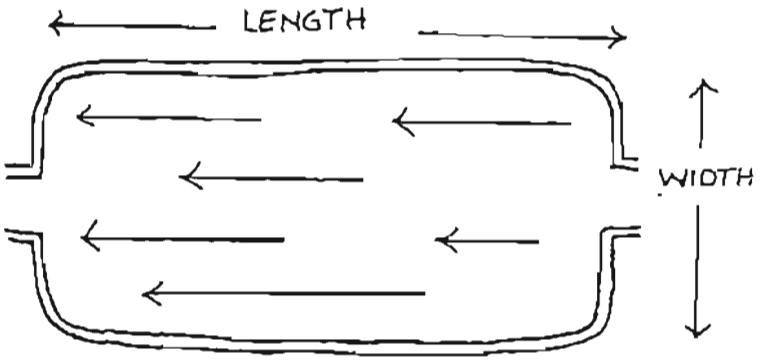


Both inlet and outlet structures should be made of material that will not erode. Concrete, metal, rock, rock-filled gabions and wood all work. The inlet structure should be wide enough to avoid constriction of the flow at the entrance; this will help reduce water velocity.

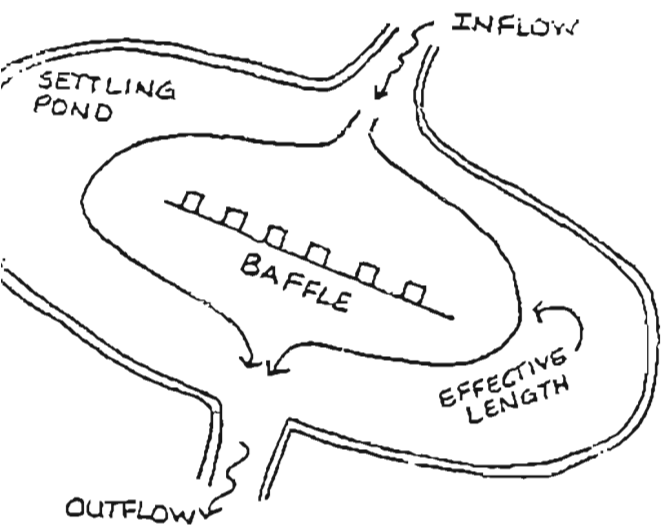
Energy dissipaters placed above the pond entrance also help reduce water velocity. This minimizes the potential for short-circuiting. The diagram here shows a log structure upstream of a sediment pond, acting as an energy dissipater.

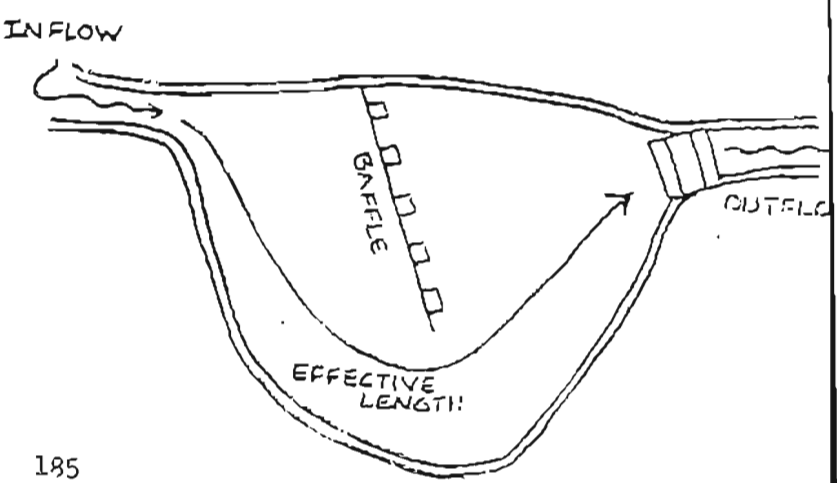


Pond length should be at least two times greater than its width.



Baffles can be used to prevent direct flow from inlet to outlet (short-circuiting). Properly placed baffles increase the effective length of the pond and, therefore, retention time. The effective length is the length of the shortest flow path between the inlet and outlet. Examples are shown below, with baffles placed to deflect the water and increase the effective lengths of the ponds.





evidence? I think you'd have to have some pretty good information prior to mining before you could evaluate it. On the Chatanika River, for example, there was extensive mining done in the early 1900s. Historically, it was reported that there was a significant salmon fishery in that river, a significant run of salmon. After the mining period, the salmon run was essentially brought down to zero. Within the last ten years, there has been very little mining activity on the Chatanika and the salmon run has significantly returned. That's about the only information I have and that comes from Fish and Game.

Q Have we not had, along with the increase in placer mining in the last five years one of the largest salmon runs in history?

A I'm not sure of the relevance of that question, sir.

Q What is the projected cost on the settling pond project?

A At this time, we don't have the cost of construction but the overall project is approximately $105,000 for monitoring, construction, design, and sampling.

Q (Indiscernible)
Is there anything being done to designate mining streams without turbidity restrictions?

A The way State Water Quality Standards are set up you can reclassifiy streams. You can classify them for drinking water; fish propagation; as individual streams. At the present time, no one has presented the department with a classification for placer mining streams or proposed that to us in any formal way.

Q Mr. Vogler: I beg to differ with you on that.Three years ago this summer, it was a group up from your department, I believe, to Central. It was suggested then by the Central Mining District that you open. I was there and there were others there who felt that the use of mining in Alaska was the primary economic, historical, and factual use of water since the white man came here. We reminded you people of that and we got exactly nowhere.
The problem is that these water standards were set up in about '68 or '69 when gold was $35 an ounce; that's why we didn't get any consideration. I think it's high time.

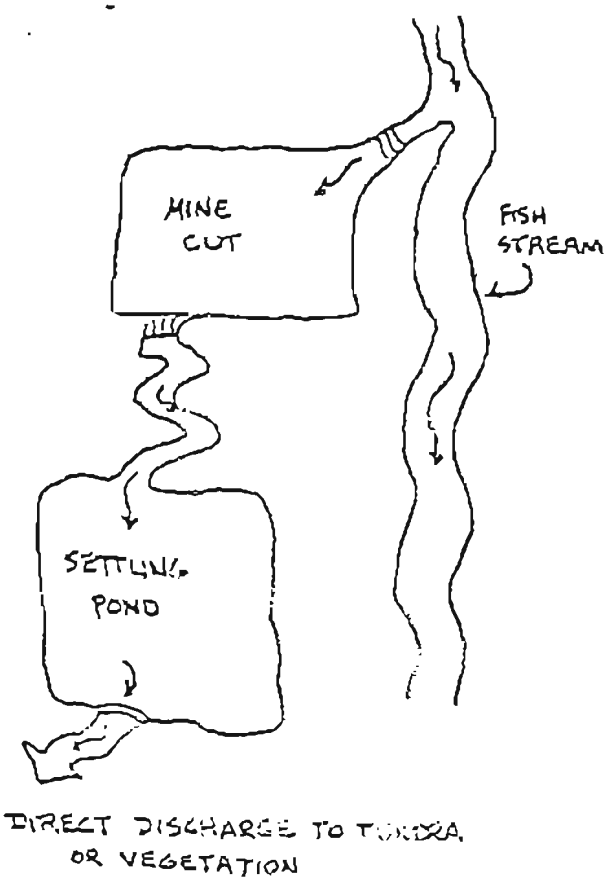
A I think that should be brought out in the study. I think one of the purposes of the study is to bring these things to light. I think, if Mr. Vogler would like to present that in writing to the department, that it certainly should be presented.

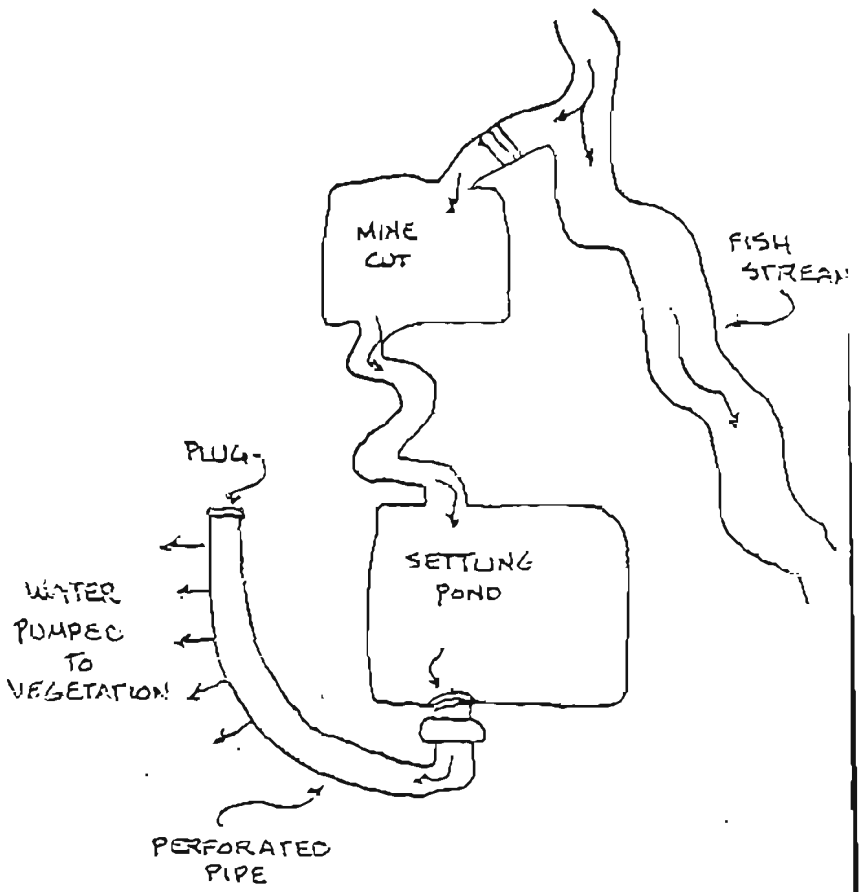
Q Our big trouble with Juneau is the fact that we don't have an advocate down there. What we need is a Department of Mines.

A I believe the question is the mining industry would like an advocate. I believe at this time there are two

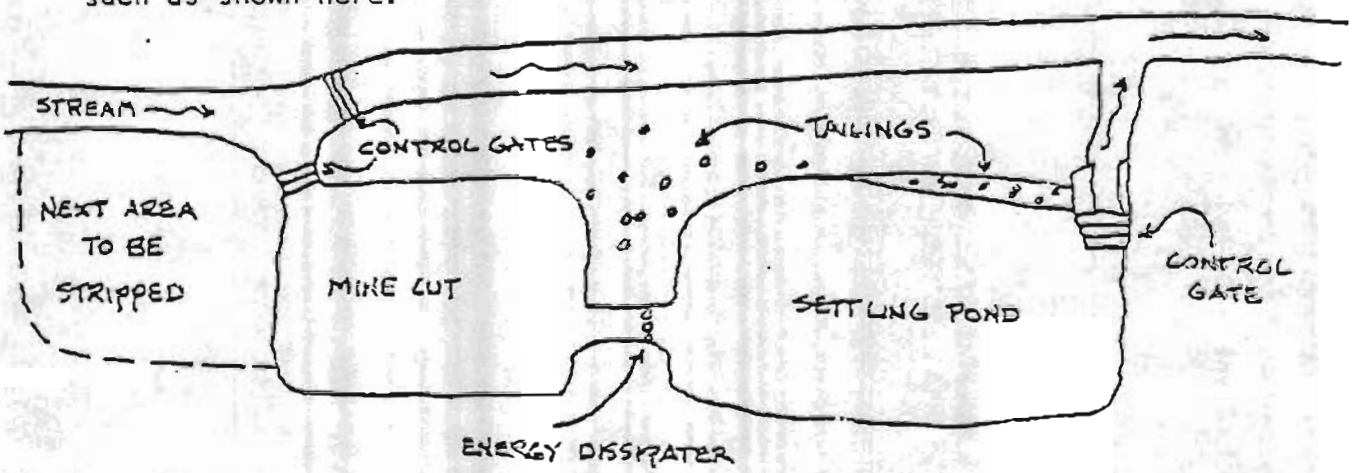
Land Application and Vegetative Filters

It is possible to use natural vegetation as a filter media. This should be considered if the soil texture is a very fine silt or clay and an anadromous fishery may be affected. This control method can result in effective removal of the sediment load from the wastewater from mining operations. The treated water either percolates into the soil or results in relatively sediment-free runoff to the receiving water. The resultant deposit of sediments on land can be beneficial in some cases and contribute to land reclamation.





If circumstances require a setup where flooding can occur, the mine workings and settling pond should be protected from flooding by gates and stream diversion such as shown here.



advocates within the State government - Mr. E.L. Bracken, I believe, and Dr. John Sims has recently been appointed to Commerce and Economical Development as an advocate.

Don Stein: We're going to have to move on here. I just want to make one brief comment, Jerry, about fish in the Chatanika. Tiny Thomas said to me last night that before they started mining in the Chatanika River there weren't many fish in there, and after they started mining there were lots of fish, and now that they've quit mining, the fish are gone again. I've heard that from different members.

Mr. Brossia: Don, I think the answer to that question is I disagree with you. Mr. Fred Anderson over at the Department of Fish and Game has some quantifying numbers on the fish population in the Chatanika.

Mr. Stein: I also found that may be they have not gone into the field to find out what's happening. The gentleman that gave me that information is no longer with us. I knew him real well and I don't have any reason to believe what he told me is not true.

Mr. Brossia: I think that you're bringing up an important point here. And that's each and everyone of us in this room have personal opinions and we all tend to listen to other peoples' opinions. There are very few quantifying and qualifying documents available on the effects of placer mining on the stream biology. And, there are also almost no studies available on how well settling ponds worked.

From audience - That's no reason why you should wipe us out.

Mr. Brossia: I didn't say we're going to wipe you out. Again, the main point is that this study is going to produce some hard data to make some decisions.

Mr. Stein: Thank you, Jerry. I think, basically, what we need in the mining industry is a lot more research before a lot of these regulations are implemented so that we can have practical regulation.

THE REICHERT CONE CONCENTRATOR
An Innovation for a Fine Gold Recovery System

Thomas J. Ferree, Manager
Mineral Processing Services, National Lead Industries, Inc.

ABSTRACT

A Reichert cone concentrator was installed in an aggregate plant circuit to recover the extremely fine "flour gold" known to exist in the deposit. The gold content of the bank-run gravels averages about 0.1 grams per ton (about $US2.00 per ton, based upon $US600/ounce gold). The Reichert cone, in conjunction with a conventional shaking table, recovers in excess of 85% of the gold. A screen analysis of the gold particles shows 44.1% is -200 mesh in size. The plant operates with a two-man crew.

HISTORY OF THE REICHERT CONE

The Reichert cone concentrator was developed by Mineral Deposits Limited, a company long established in the mineral sands mining industry of Australia. The cone was developed through necessity; an innovative system was required to mine and concentrate the low-grade beach sand deposits for efficient recovery of the titanium minerals and zircon. The Reichert cone was the key device for efficient gravity concentration of the heavy minerals from the beach sands. The concepts developed by Mineral Deposits Limited in suction dredge design and gravity concentration technology results in mining, concentration, and land restoration costs of less than 10¢ per ton of sand mined.

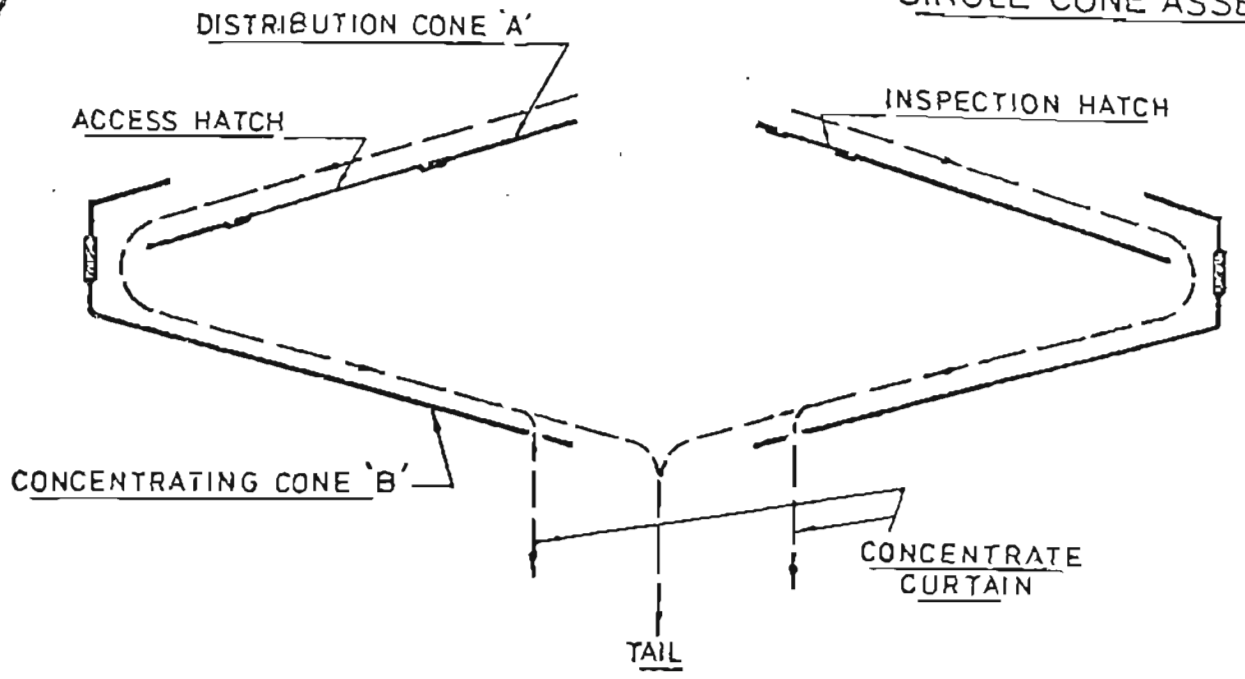
The Reichert cone concentrators, introduced in the 1960s, underwent many improvements in the early years of use in the mining operations of Mineral Deposits Limited. Acceptance of the cone concepts and high metallurgical efficiency resulted in the use of cones by almost all other sand mining companies in Australia and Africa.

In 1972, the use of Reichert cones was extended to applications other than mineral sands concentration. The cones are now being used for beneficiation of iron ore, wolframite, scheelite, gold, cassiterite, copper, and various other minerals. The high-capacity of the cone concentrators makes them well suited for scavenger system supplements to existing beneficiation circuits. The high metallurgical efficiencies of concentration within the size ranges of 10 mesh to about 400 mesh allows recoveries of trace quantities of contained high specific-gravity minerals from what would otherwise be "plant tailings".

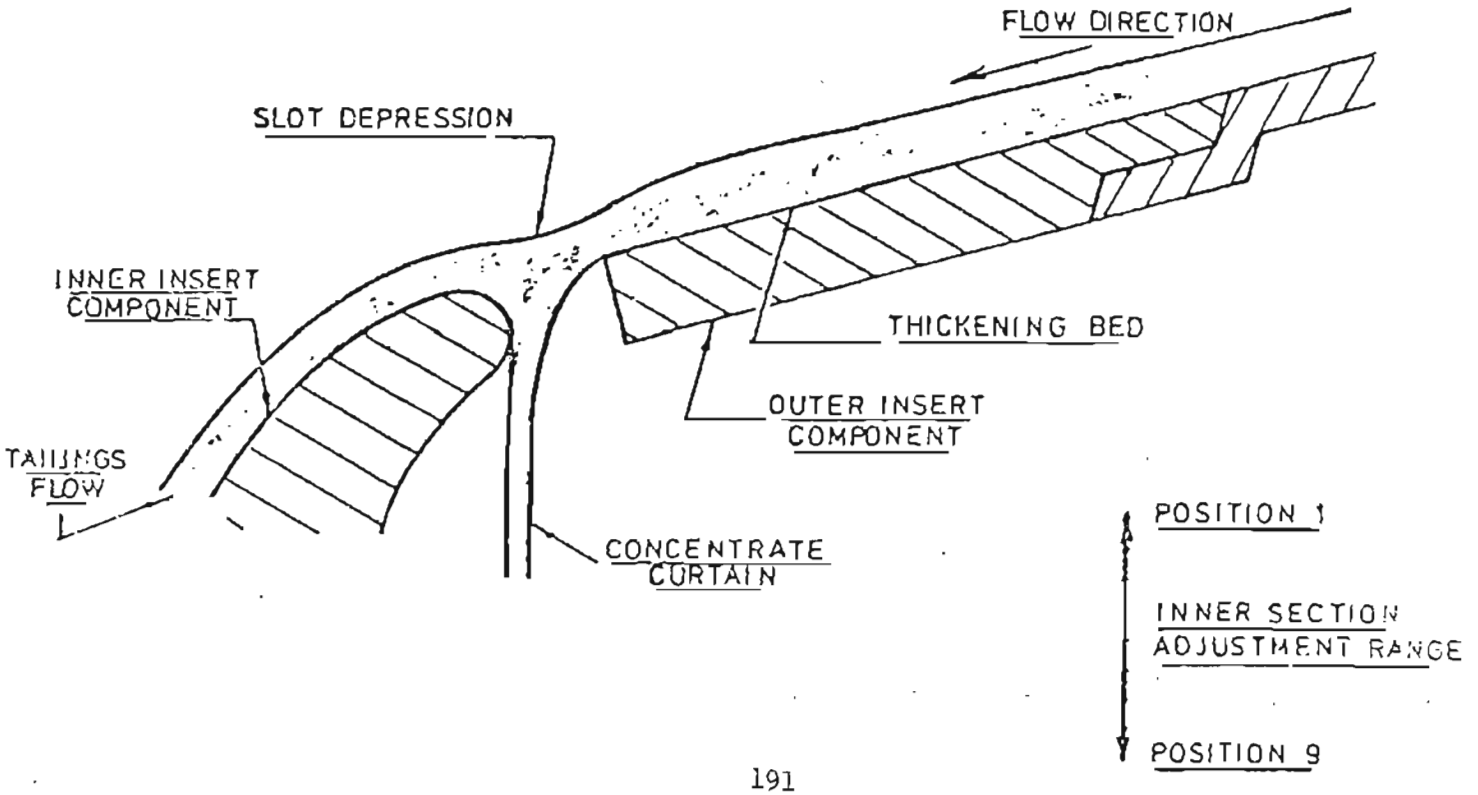
WHY THE REICHERT CONE CONCENTRATES EFFICIENTLY

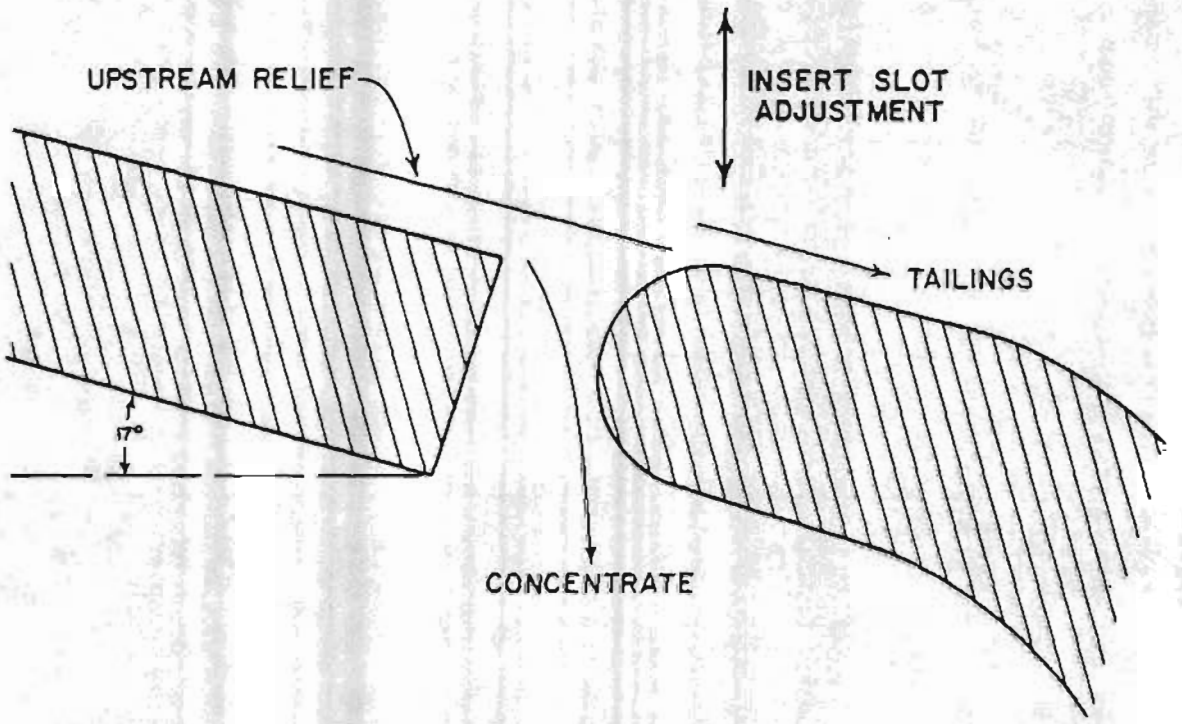
The Reichert cone is a high-capacity gravity concentrator designed for feed throughputs of 50 to 80 tons per hour for feed material finer than 10 mesh (1.5mm) in size. The

DIAGRAM
SINGLE CONE ASSEMBLY



DIAGRAM





PROFILE OF CONCENTRATE INSERT SLOT
REICHERT CONE CONCENTRATOR

cones operate at feed pulp densities of 60% to 65% solids (by weight), and have excellent recovery efficiencies for high specific gravity minerals down to about 400 mesh (32 microns). There are no moving parts in a cone concentrator, except for the adjustable concentrate inserts used for metallurgical control. Material flows through the cone by gravity, and the concentration of the heavy minerals is achieved by stratification in the flowing pulp, as in a pinched sluice. The high feed pulp density reduces the turbulence of the pulp flow, and allows the gold particles and other heavy minerals to stratify very efficiently. Removal of coarse particles (+10 mesh) from the feed reduces the turbulence and disturbance factors in the flowing pulp, enhancing the separation of the high specific gravity minerals. The internal flows of the cone system allows repeated up-grading of the concentrate products as well as retreatment (scavenging) of the "tailing" streams before the final discharge of products from the Reichert cone unit. The concepts incorporated in the cone greatly enhance the chances for recovery of the high specific gravity particles compared to other sluice-type devices.

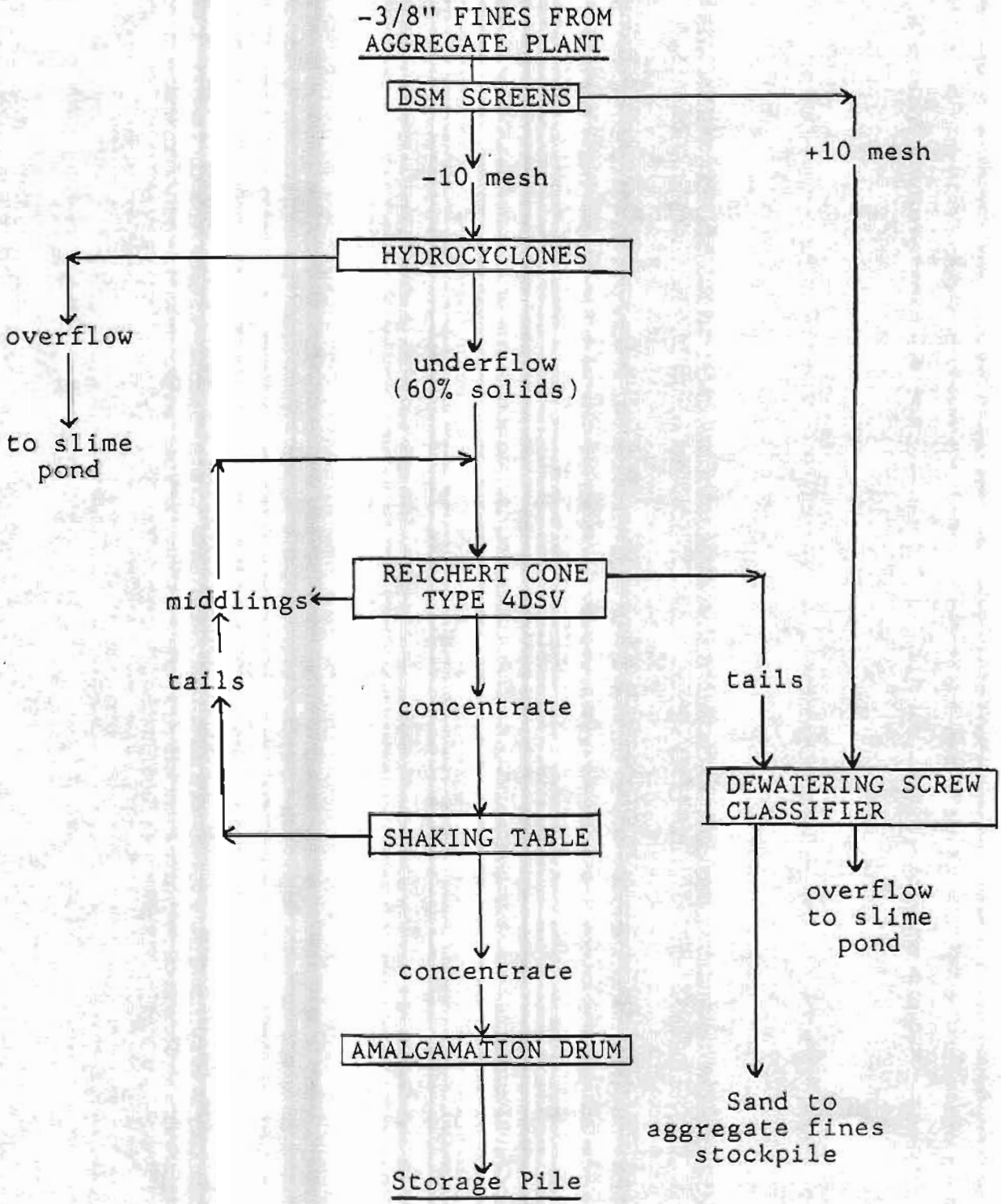
RECOVERING SNAKE RIVER "FLOUR GOLD" WITH A REICHERT CONE

The history of gold occurrences in the Snake River sands of Southern Idaho are well documented. The gold occurrences are somewhat uniform along the river; the gold particles are very thin and plate-like, and the values rarely exceed 0.1 grams per ton of bank-run gravel (about $US2.00 per ton, based upon $600/oz. gold). The average particle size has been characterized as "400,000 colors per ounce". Small deposits of relatively high-grade values have been mined successfully by individual miners, but commercial operations have not been successful. Equipment did not exist which could process substantial volumes of material and achieve significant recovery of the gold values.

The first installation of a Reichert cone concentrator in a placer gold recovery system was made in April, 1980, when a Type 4 DSV cone and other equipment were installed as an "add-on" to an existing aggregate plant. The small aggregate operation, using semi-portable crushing and screening equipment, had a throughput of about 125 yards per hour of bank-run gravel. The gravel, mined with a front-end loader, was crushed and washed through the shaking screens to produce several sized fractions. The smallest size, containing the gold values, was a nominal -3/8". The fine gold recovery system was installed to treat the -3/8" fraction.

The gold recovery circuit consists of two static DSM-type screens to remove the +10 mesh product from the -3/8" circuit feed, two Krebs D10B hydrocyclones to densify the screen undersize (-10 mesh), the Reichert cone concentrator, and a single-deck full-size Deister shaking table. A simple amalgamation system recovers the gold from the table concentrate. The flowsheet of the recovery circuit is shown in Figure 1.

FINE GOLD RECOVERY SYSTEM
IN THE
SNAKE RIVER AGGREGATE PLANT



Flowsheet for Recovery Systems

The Reichert cones are high-capacity gravity concentrators designed for throughputs of 50 to 80 tons per hour solids. An attractive feature of the cone is the high-volume, low operating cost of the units; generally speaking, low tonnage systems have not considered incorporating cone concentrators into the circuit design, as other conventional equipment was available for handling low tonnages. The Snake River plant is an exception.

The -10 mesh product (cone feed) at the Snake River aggregate plant averages about 20 tons per hour, normally too low a tonnage to consider a Reichert cone system. To obtain sufficient pulp volume within the cone, a high recirculating load is maintained. The circulating load, in addition to providing proper loading within the cone system, tends to buffer variations in the plant feed rate. The cone, accepting screen undersize at about 20 tons per hour, produces concentrate at a rate of about 1.0 to 1.25 tons per hour. The cone concentrate is gravity-fed to the Deister shaking table. The table concentrate, containing the black sands and fine gold, is fed to a small amalgamation drum for recovery of the gold. The black sands are stock-piled for further treatment, if required. The table tailings are recirculated back to the cone feed circuit. Tailings from the fine gold recovery circuit consist of the -3/8", +10 mesh screen oversize, the Reichert cone tailings, and the overflow from the densifying cyclones. Only trace quantities of gold have been detected in the circuit tailings.

The gold recovery in the circuit is calculated to be in excess of 85%, based upon the known values in the bank-run gravel and the quantity of bullion recovered. Metallurgical balances of the circuit are difficult as the quantity of gold in the tailings is too low for accurate analysis.

A sample of black sand concentrate and gold was collected from the shaking table and subjected to laboratory flotation tests to produce a clean gold concentrate. A screen analysis was made on the gold concentrate to determine the size distribution of the gold particles. The results were as follows:

SNAKE RIVER GOLD
Size Distribtution
(Tyler Mesh)

PRODUCT	WEIGHT PERCENT
Heads	100.0
+100	6.4
-100,+200	49.5
-200,+325	40.4
-325	3.7

The gold particles are flat and very thin. The figures above reflect the largest dimension of the particles.

The plant described has proven to be economically and metallurgically successful. The aggregate plant and fine gold recovery system are operated with only two men; one operates the front-end loader, and the other operates the plant. Gold recovery has been sufficient to operate the plant solely for recovery of the gold.

The writer wishes to express thanks and appreciation to Mountain Home Redi-Mix, of Mt. Home, Idaho, for permission to describe their plant. Special thanks is given to Mr. Larry Mashburn of Boise, Idaho, who was instrumental in making this installation possible.

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1. "Gravity Separation Technology" - R. A. Graves.

2. "The Reichert Cone Concentrator - An Update" - T.J. Ferree and I.J. Terrill.

3. "High Capacity Gravity Separation Systems for Gold Recovery" - I.J. Terrill.

INTERNAL FLOW DIAGRAM 1 STAGE OF A CONE CONCENTRATOR

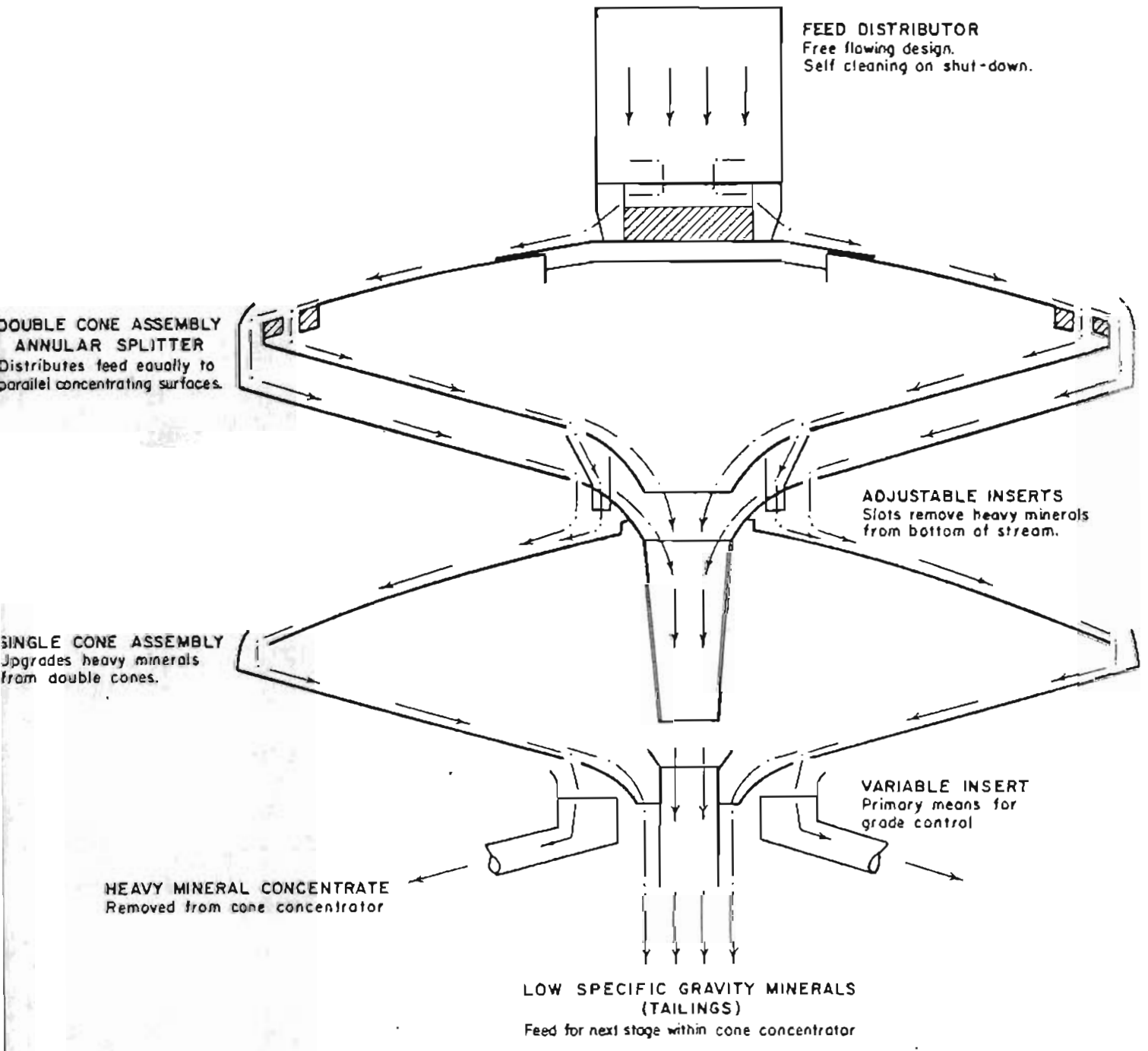
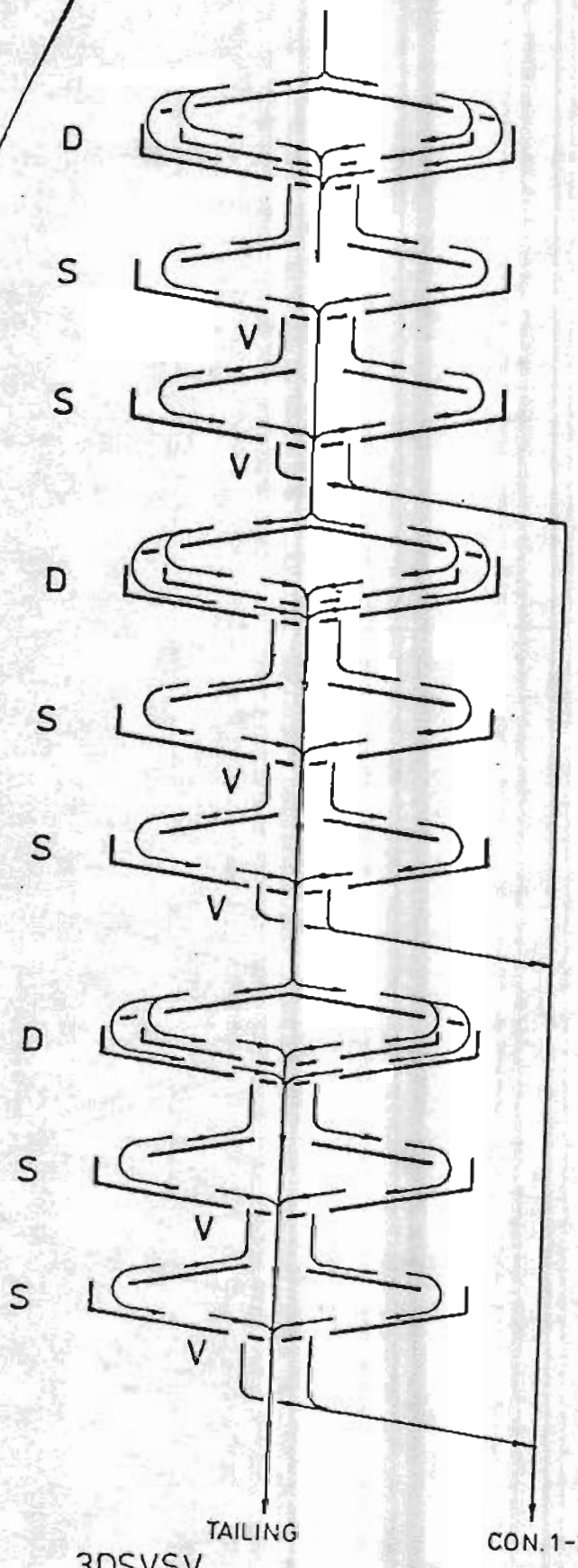
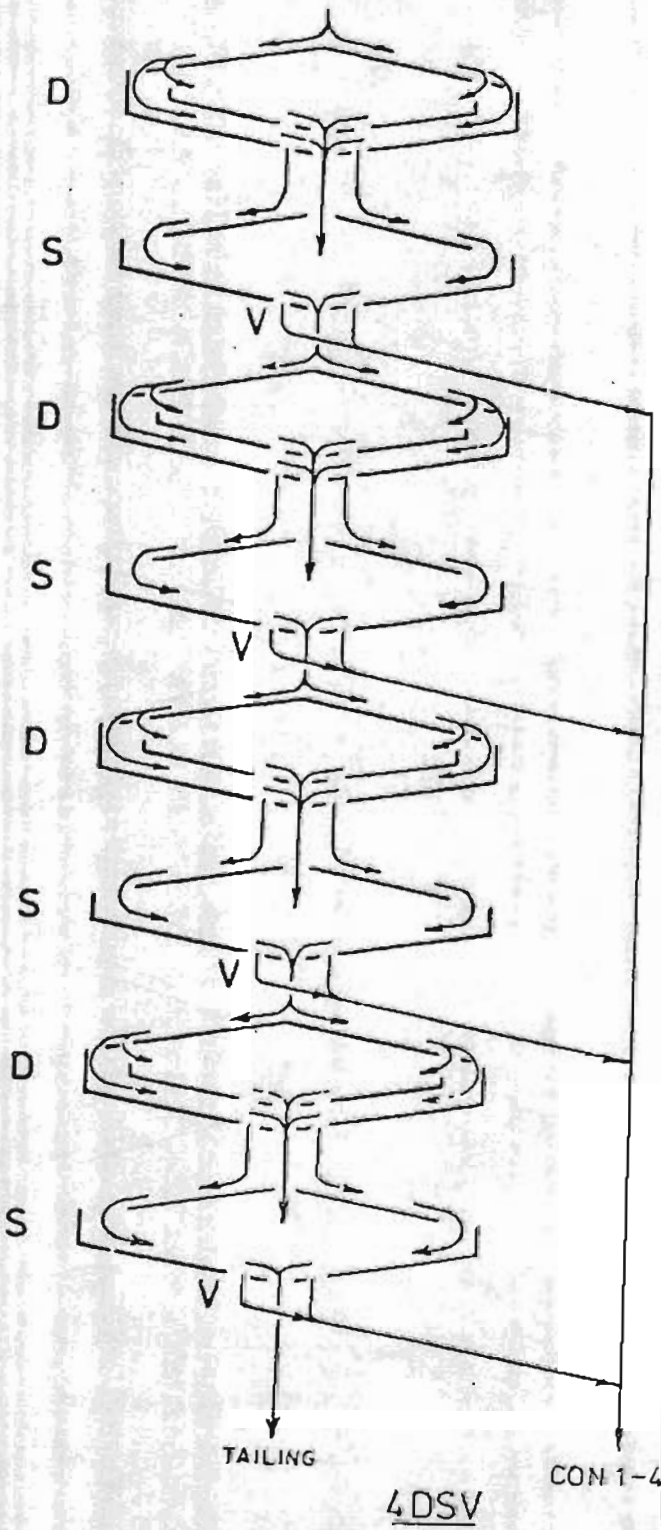


DIAGRAM 3-2

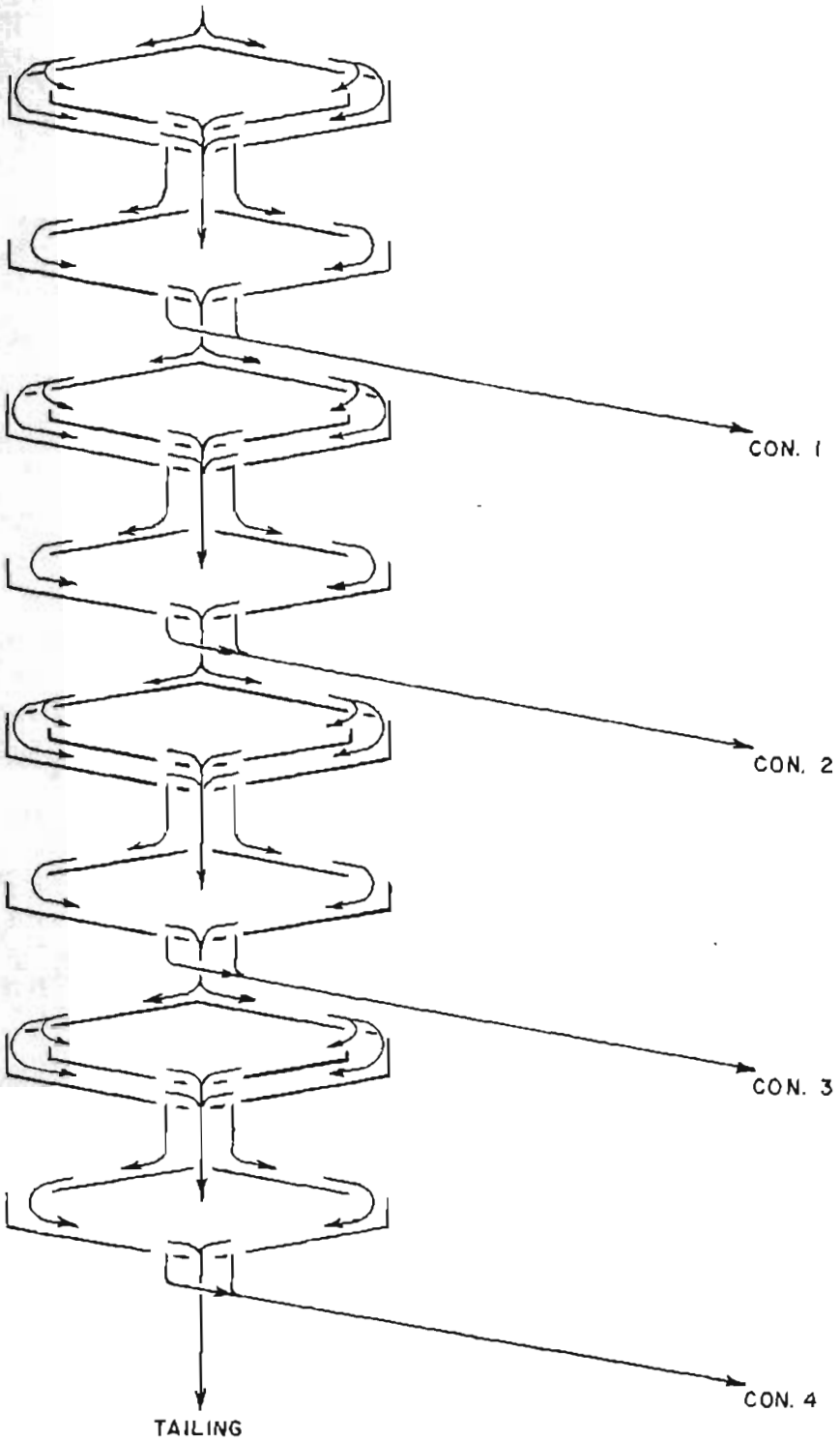


3DSVSV



4DSV

TYPICAL CONE CONFIGURATIONS



N L INDUSTRIES, INC.
Mining and Exploration Department
5950 McIntyre Street, Golden, Col. 80401

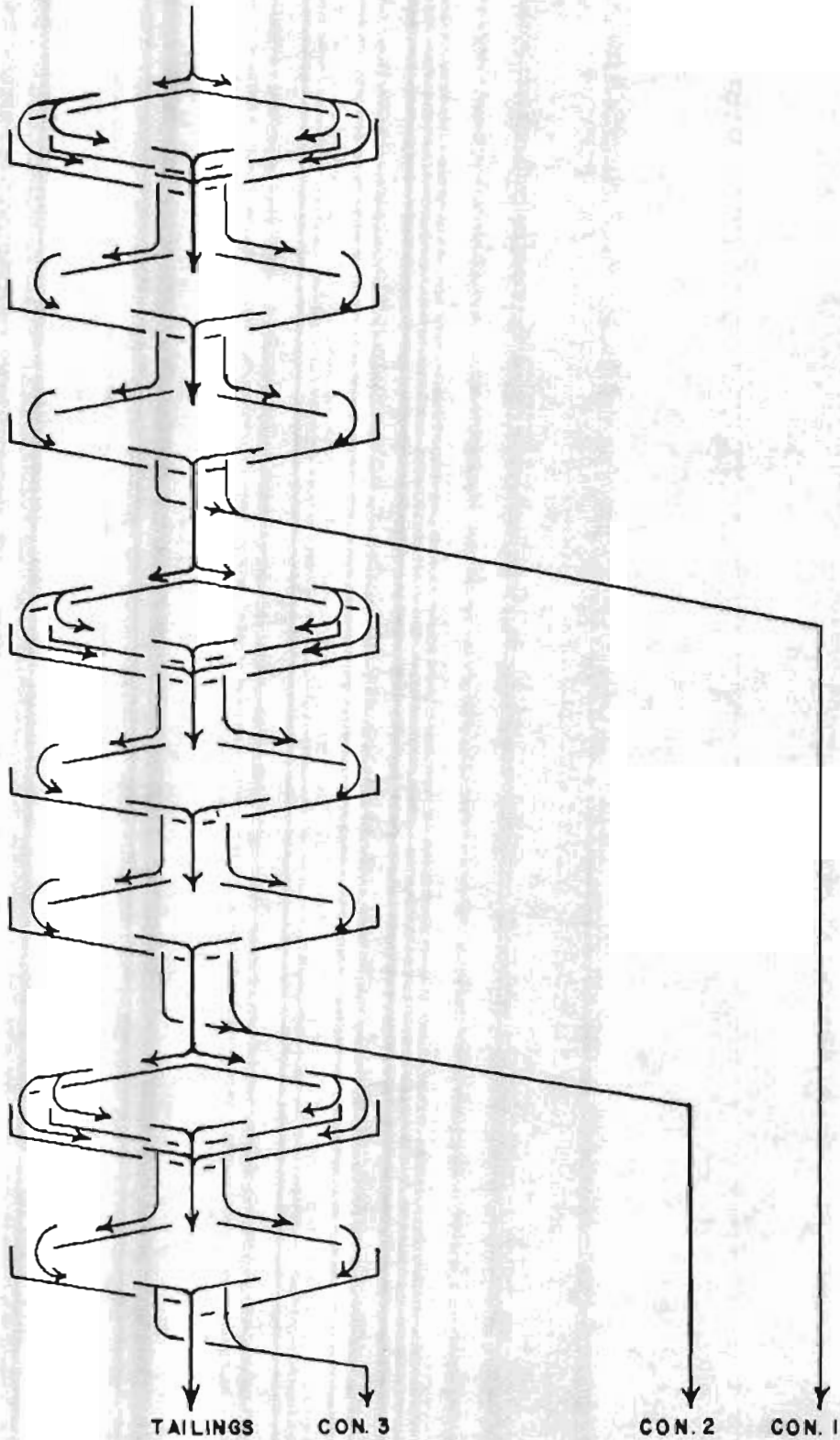
4DS

REICHERT CONE CONCENTRATOR
INTERNAL FLOW CONFIGURATION
TYPE 4DS

DRAWN: RGM

DATE: 6-24-74

SCALE: ————



N L INDUSTRIES, INC.
Mineral Resources Department
5926 McIntyre Street, Golden, Col. 80401

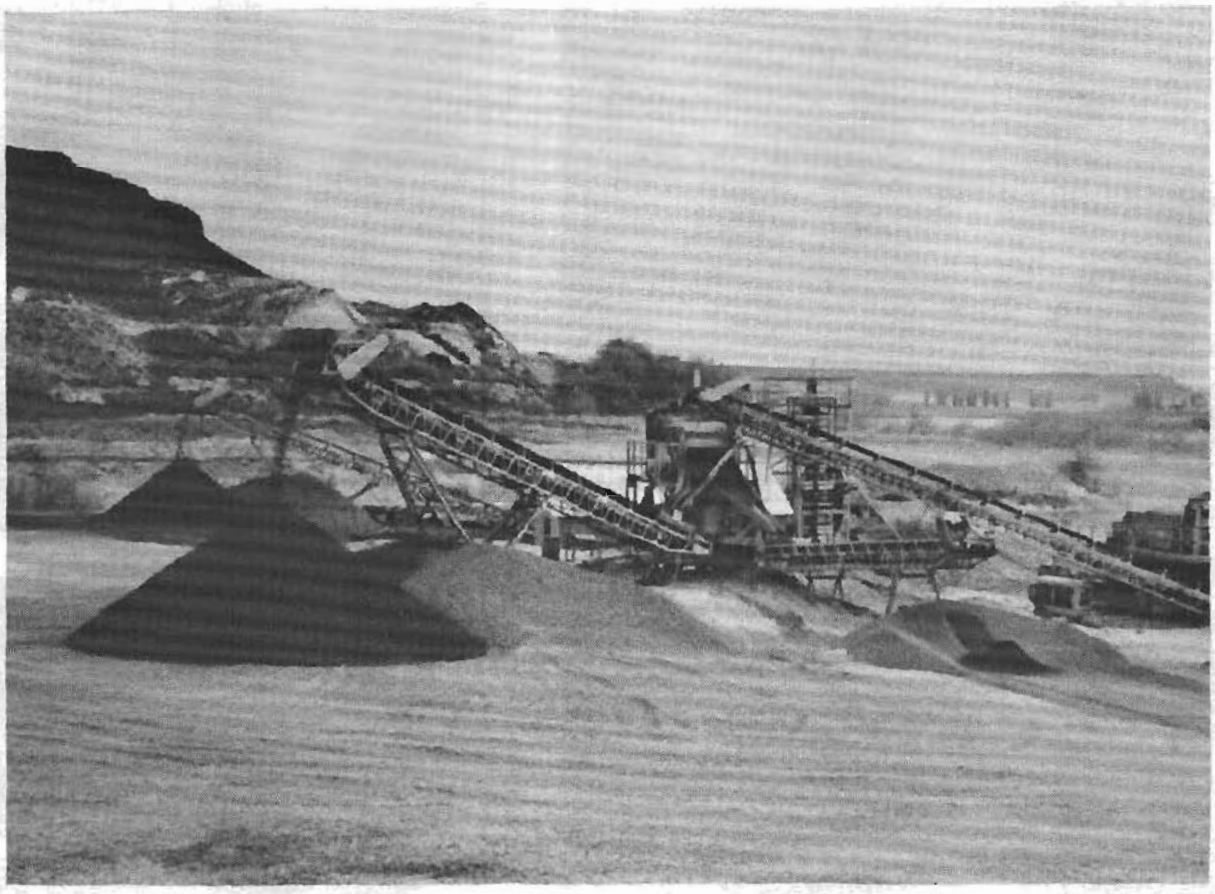
2DSS DS

REICHERT CONE CONCENTRATOR
INTERNAL FLOW CONFIGURATION
TYPE 2DSS DS

DRAWN: I.J.T/H.H.H

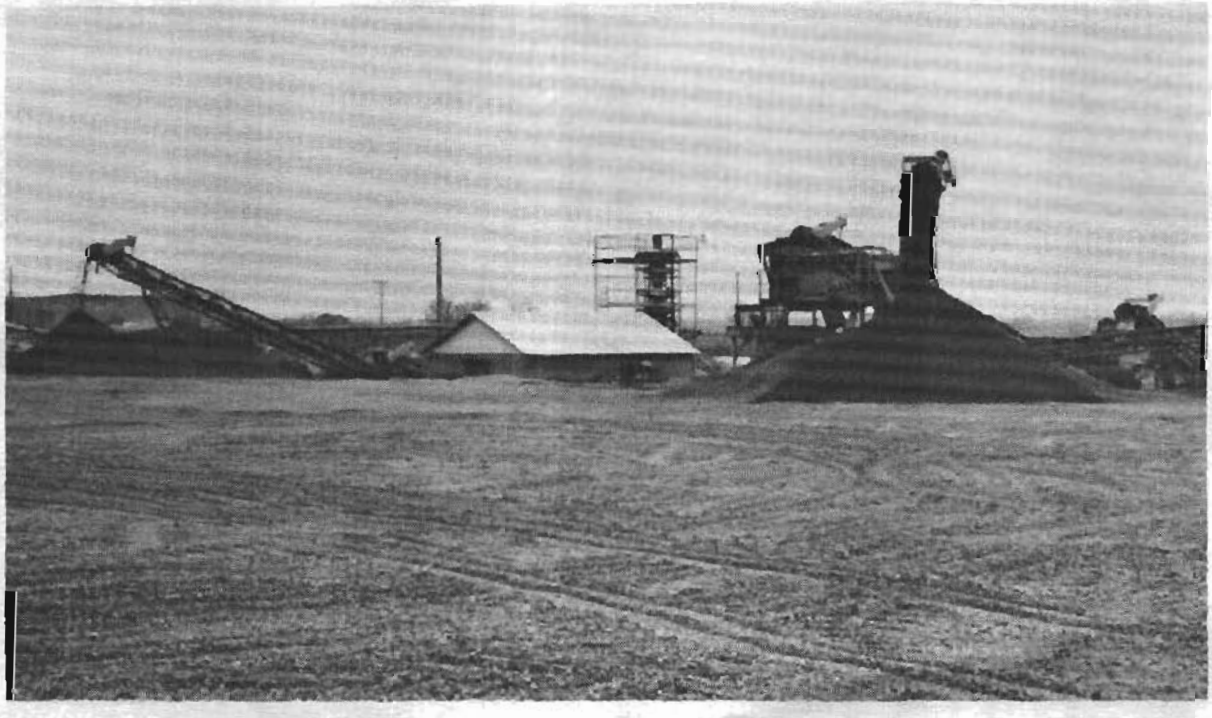
DATE: APRIL 11, 1978

SCALE:



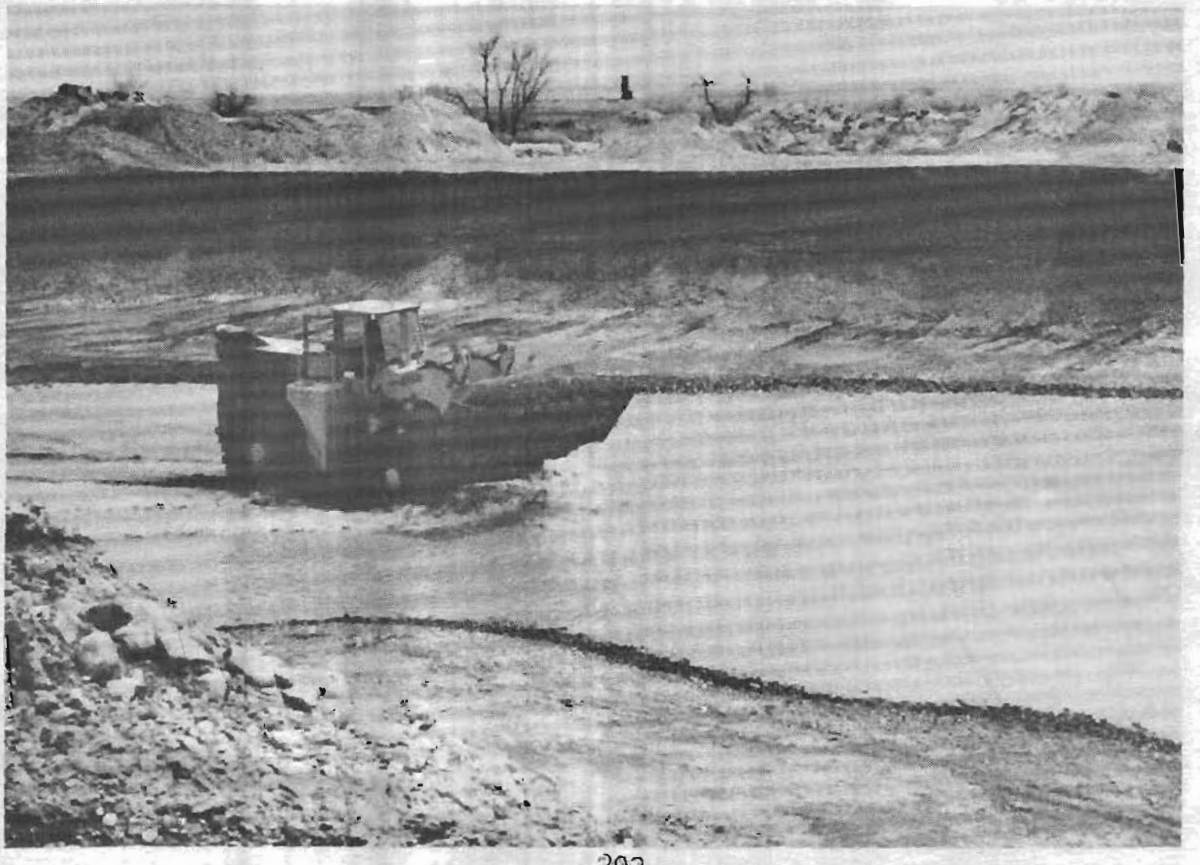
MT. HOME READY-MIX, INC.
150 tph aggregate plant that is treating the -3/8" product in a Reichert cone for fine gold recovery.

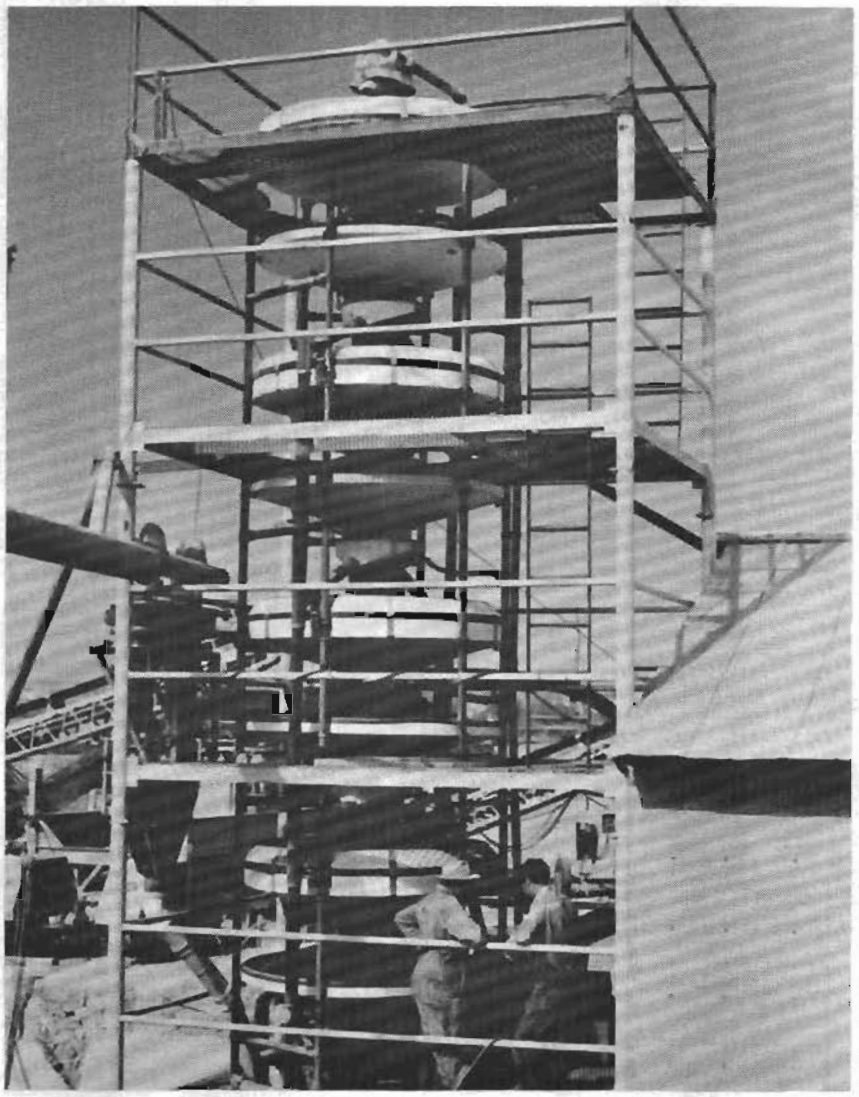
The conventional aggregate plan uses El-Jay semi-portable gear mining bank-run material that is essentially -6" size. The heads average about 0.10 g/T gold



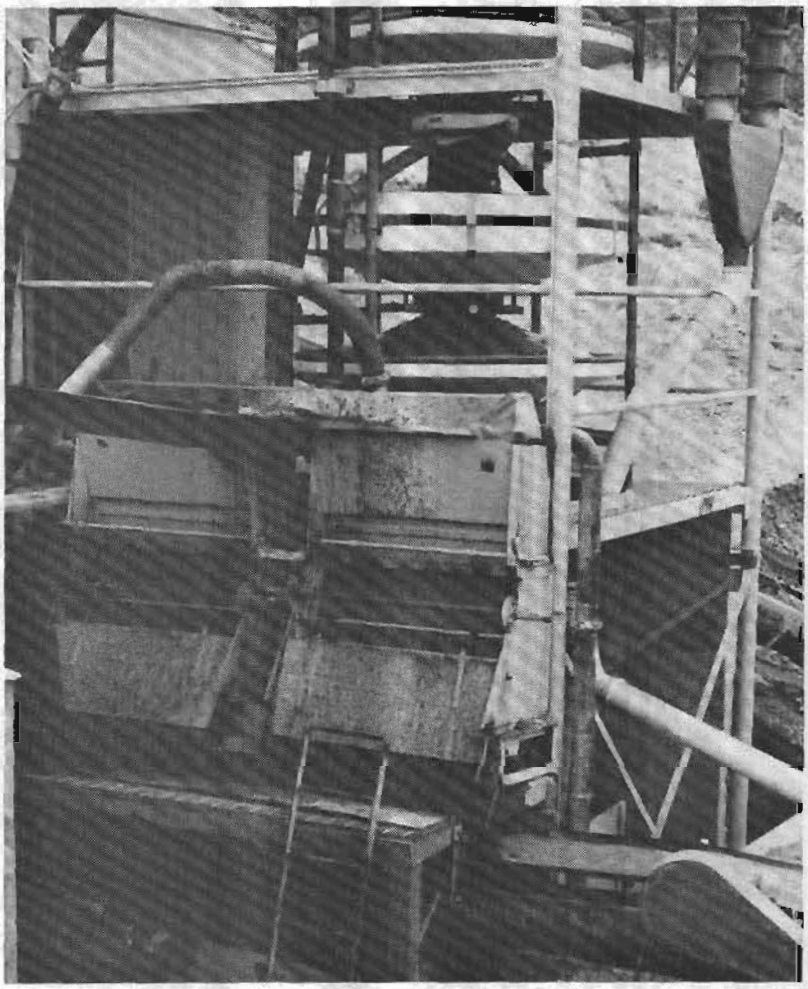
The -3/8" w-shing plant under-size flows down a launder to gravity feed 2 DSM screens, to screen out the +1.5 mm (10 mesh) fraction prior to feeding the cone.

The 15' bank is mined with a front-end loader to the water table. Deposit is about 50 yds from the Snake River, near Grandview, Idaho.

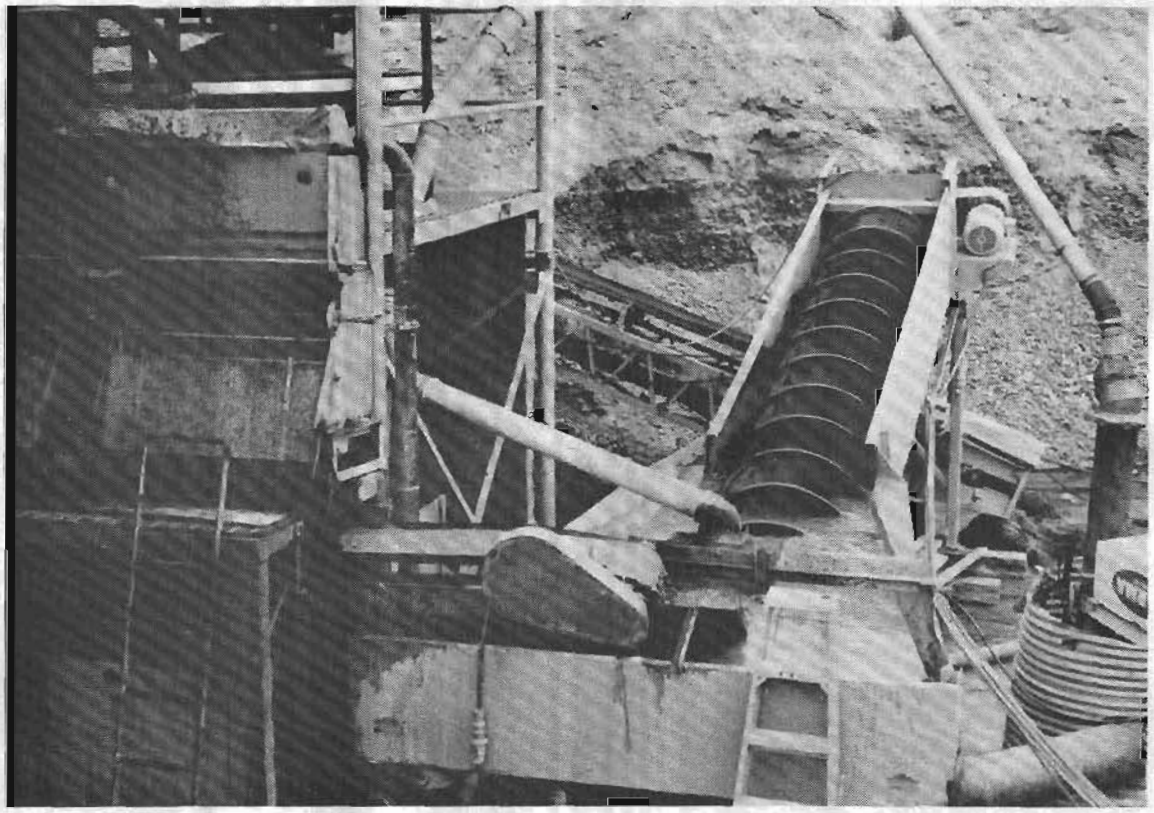




The 4DSV Reichert cone is mounted in a tower constructed in three sections. Each section and the contained segment of the cone concentrator can be lifted off with a crane for transport to another site, if desired.

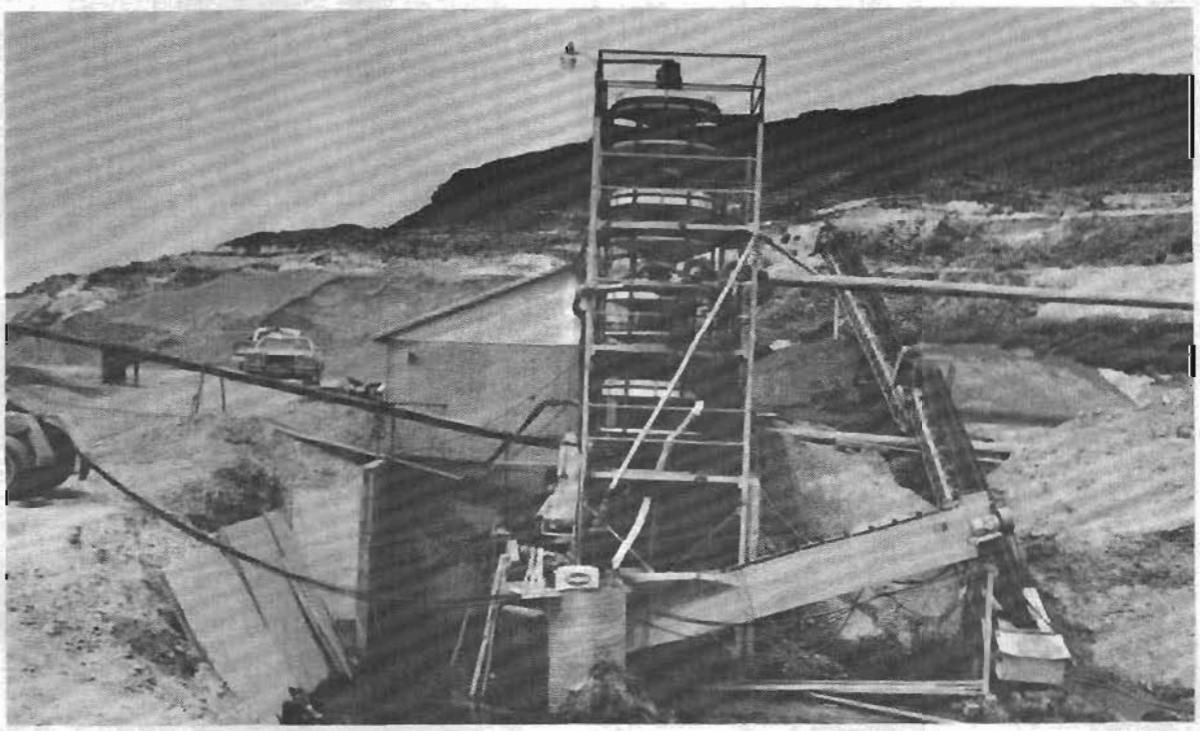


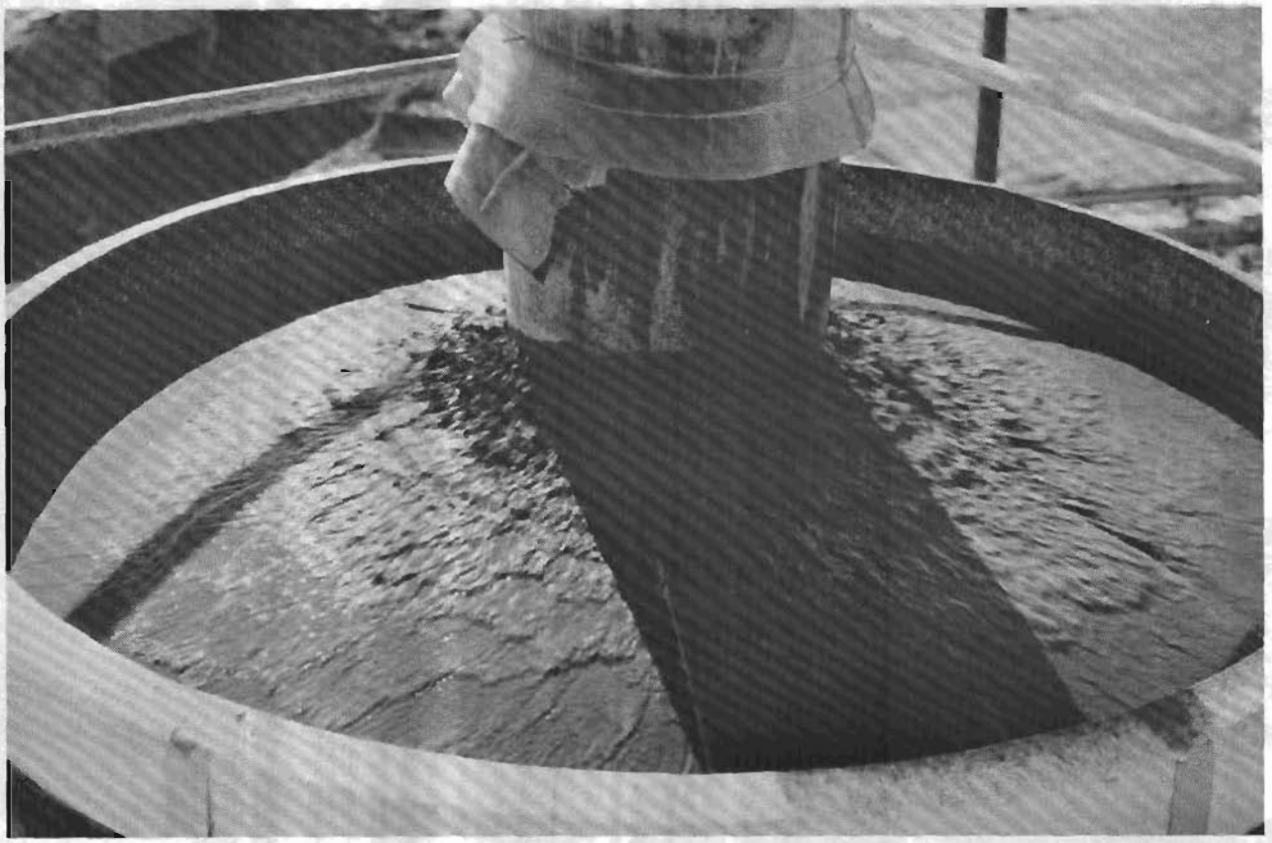
The -3/8" screening plant fir
are fed to 2 DSM screens by
gravity, to remove the +1.5mm
oversize prior to cone separa
The screen oversize is convey
to the Eagle screw classifier
for dewatering, with cone tai



The screen undersize (-1.5mm) is densified with two 10-inch Knebs cyclones to about 60% solids, as required by the Reichert cone. Gold losses in the cyclone overflow are nil.

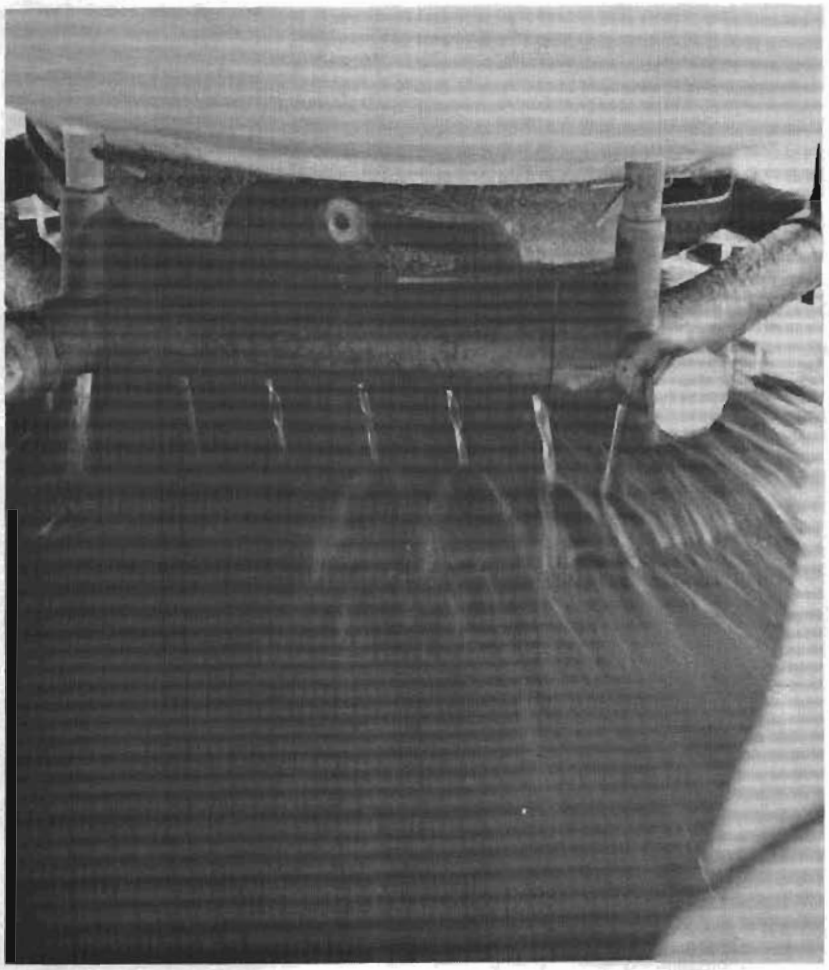
Feed to the cone is about 20 tph; internal cone products are re-cycled to achieve an effective cone load of about 45-50 tph.





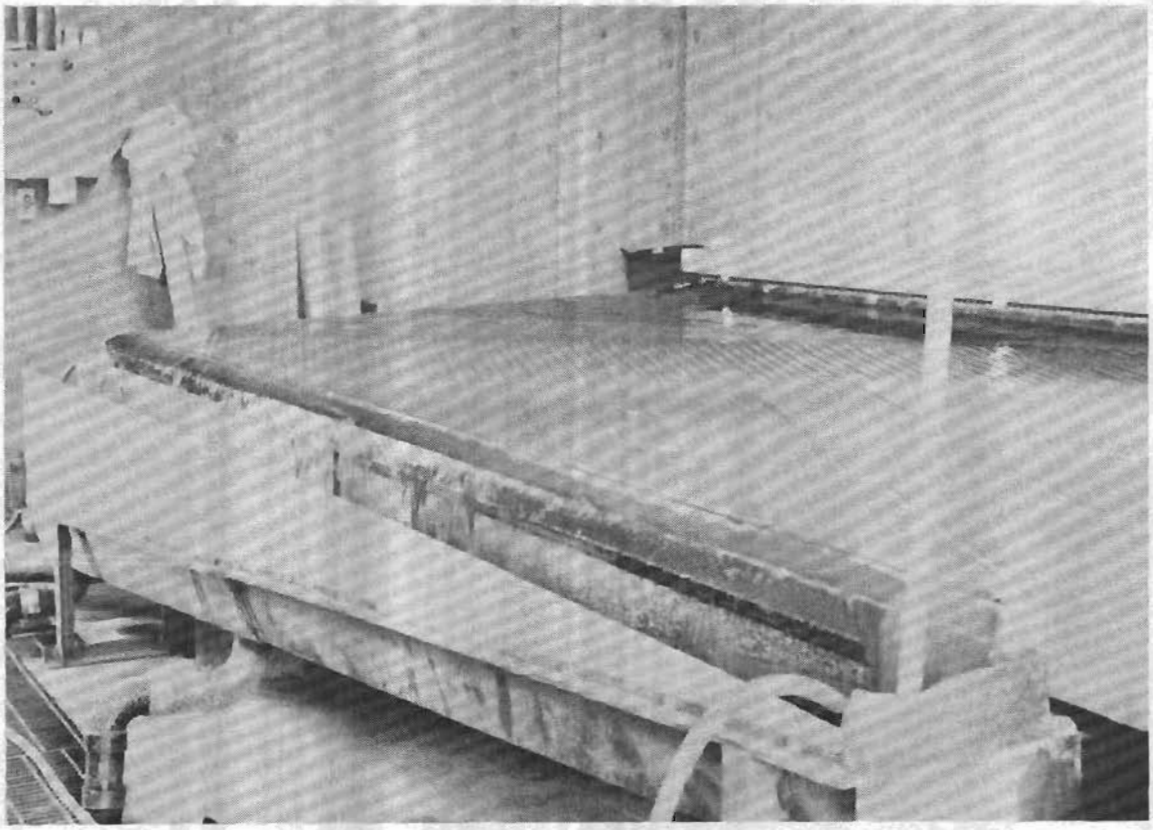
The cone, itself, is simply a sluice box; it uses the principle of pinch sluice separation. Material will flow down along a horizontal plane, heavily stratify along a plane, and drop through a slot. The material that does not drop through the slot is forced over and goes over as tailings. So inside the cone we have a concentrate slot where the heavies are drawn off; this is the basic profile. The adjustment that we have for controlling the grade of concentrate—how much material we pull off—is to move the inside profile up and down vertically. By moving it up, we force more material through the slot as concentrate. If we drop it down, we have less material coming through but a higher grade concentrate; more material goes over as tailings.

There are two basic reasons it works as well as it does. One we're using a very high density pulp. When you use high density, you get rid of most of the water and practically all of the turbulence. If you would look inside the cone when this is running, the pulp flow is essentially smooth, not totally smooth but really quite smooth. This allows the heavy particles to stratify and to stay stratified.

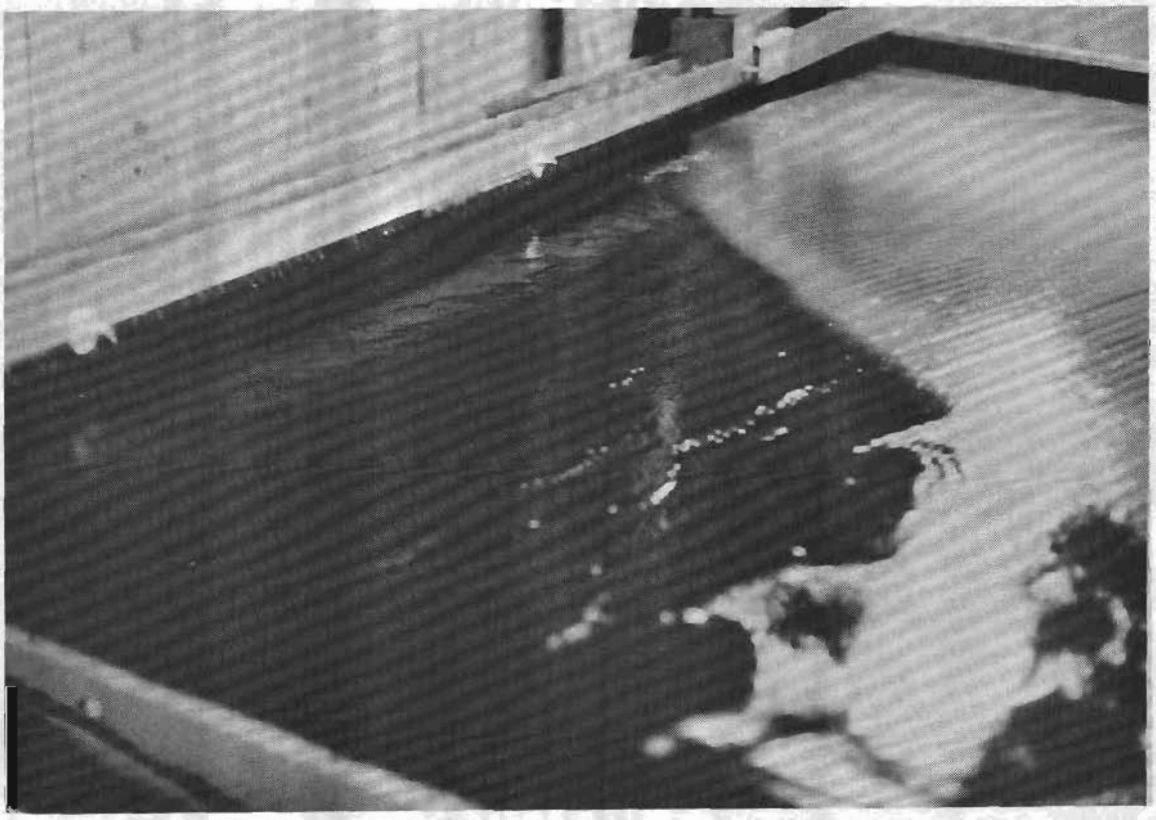


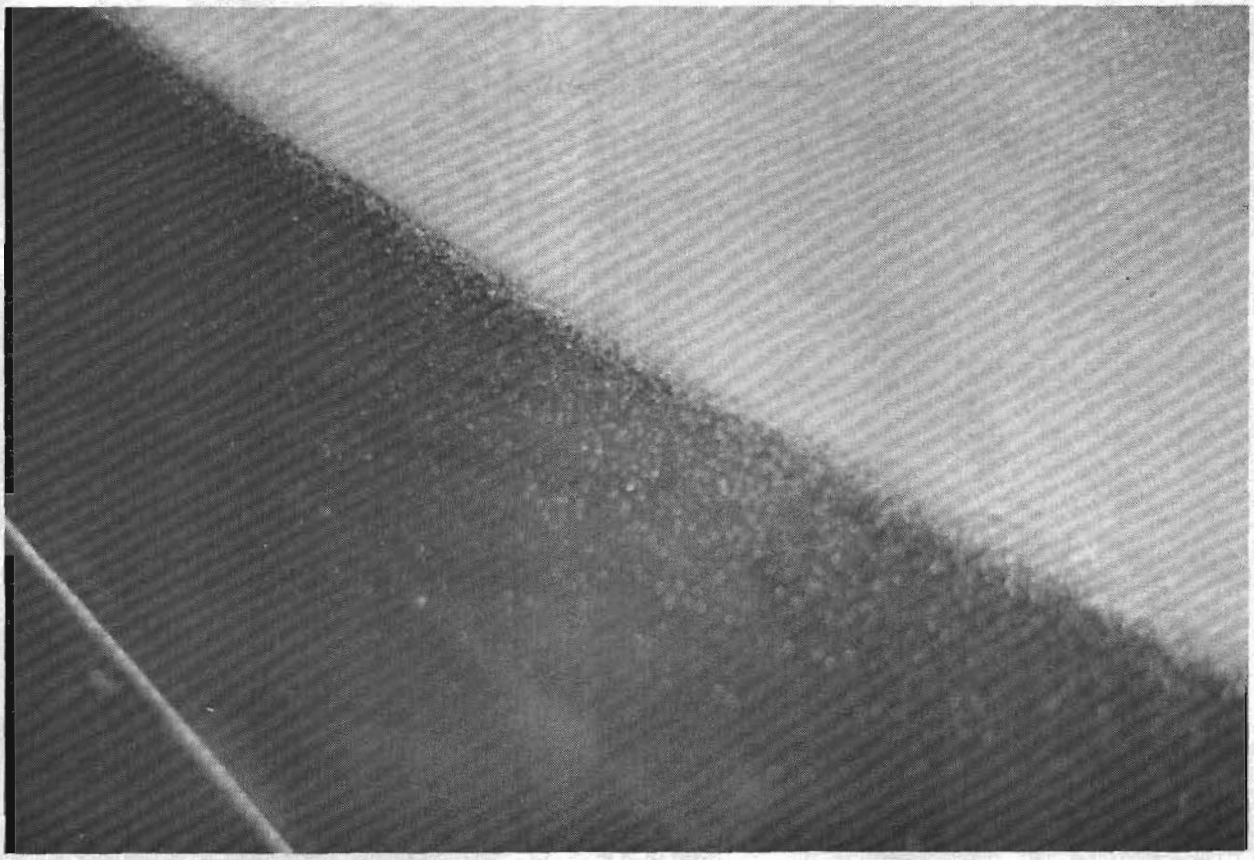
One has to feed only minus 10 mesh material into this unit, if you feed larger particles, the larger particles will tend to start rolling and it will disrupt the stratified layers. A smaller particle will simply flow. You can tolerate oversize a little bit but not more than one or two percent.

If you look in your sluice box with three to five or six thousand gallons a minute going through, it's amazing that any gold particles at all settle down into the riffles. At the south side edge, running at about 60 to 70 tons an hour, the thickness of the pulp is only about 1/8 of an inch. As it comes in toward the slot, it's coming into a smaller diameter so the thickness increases. At the slot it is about 5/8 of an inch thick. When you're bringing a heavy particle in at this point it can be no further from the concentrating surface than 1/8th of an inch. A gold particle will tend to stay in that lower area. As the pulp layer gets thicker, it will be the lower specific gravity particles that are forced up. If you can maintain non-turbulence, the heavy particles will stay down and flow through the slot. The low gravity particles will build up about 1/2 inch to 5/8ths of an inch thick, and go on over the slot.



The cone concentrate, at about 1.5 tph, is fed to a full-sized Deister shaking table (single-deck) which produces a bulk heavy mineral concentrate. There is significant magnetite and garnet in the table concentrate.





The operation of the table is critical but it is not sensitive. As I said this whole operation goes with two men. The one man that runs the plant has very little time to watch the table. The main control is the amount of water that is put onto the table so if they have too much water it tends to wash the gold off. If they don't have enough water, a dry spot will develop and the gold will collect in little agglomerates and then pop up and float off.

The gold does not necessarily form into a band. It comes over the whole upper area of the table. They have a lot of other heavy minerals there, mainly magnitite. This whole band that you see is magnitite and garnet primarily; they make no attempt to make a high gold product. They pull off about a quarter to a half of their total heavies and that is what goes to the amalgamation circuit. The rest of the product is recycled within the system.

The material here is very, very thin and very light weight; and as soon as you wet it it has a very strong tendency for floating. This system does not use any wetting agents. They just simply run their creek water in here. The system operates at a very high density, it's not like a sluice box. When you get rid of most of the water, you reduce to a great extent the problem of floating off fine gold. So by reducing or eliminating about 90 to 95 percent of the water in the system, you greatly reduce the possibility of any of the fine gold floating off.

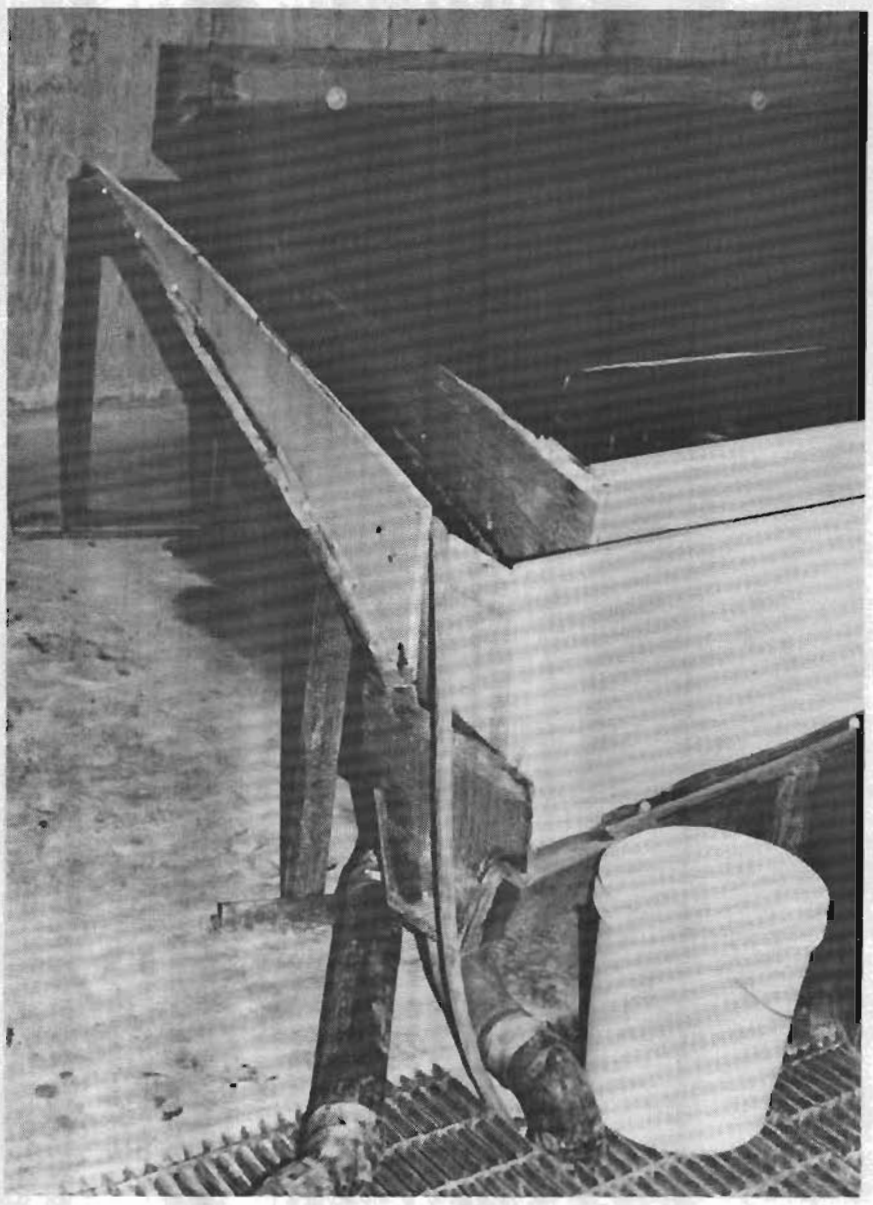
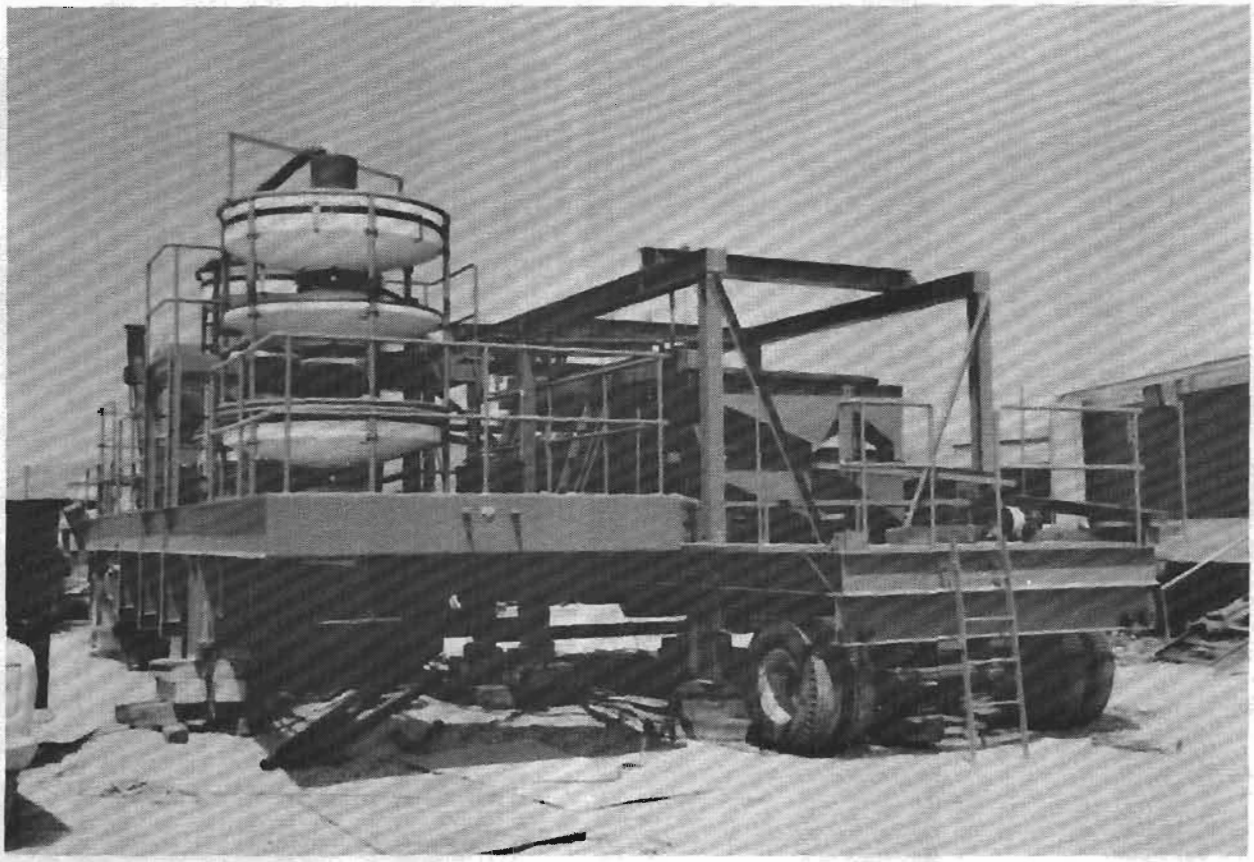
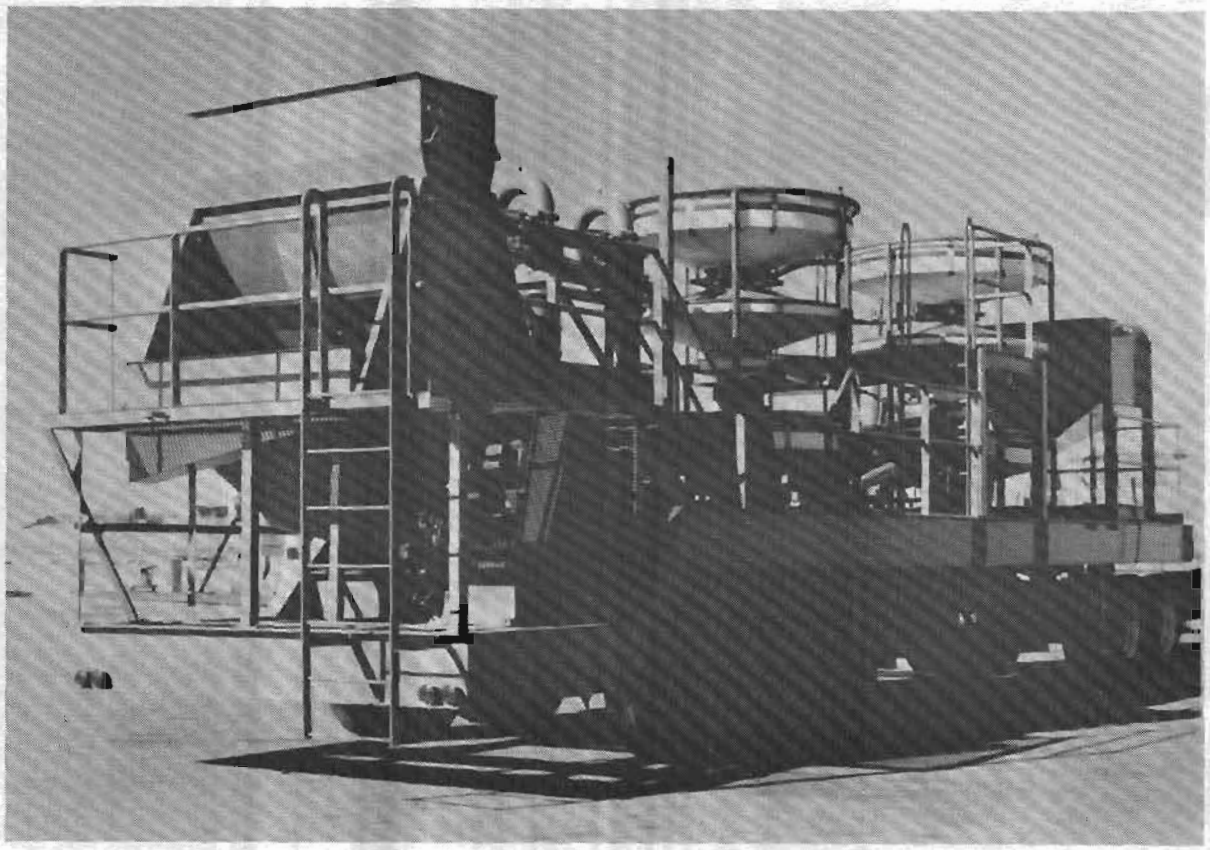
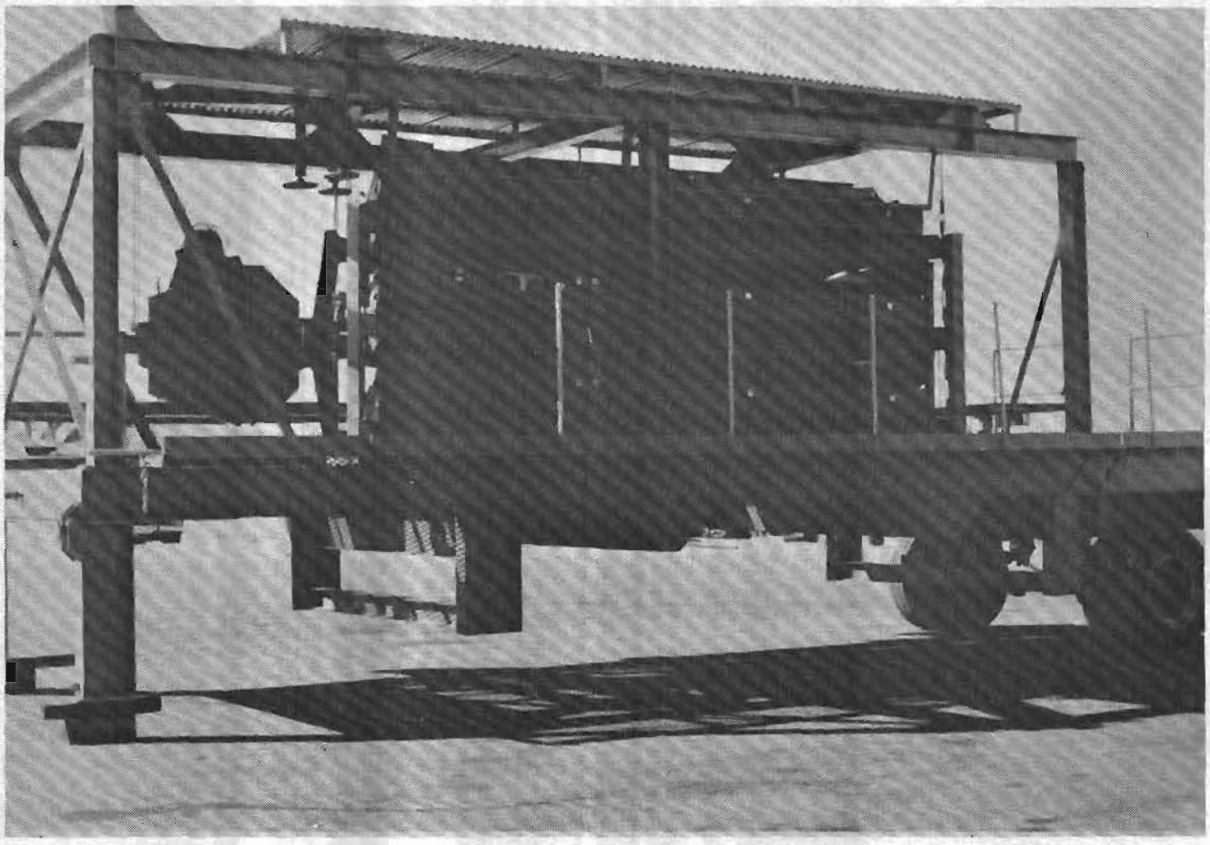


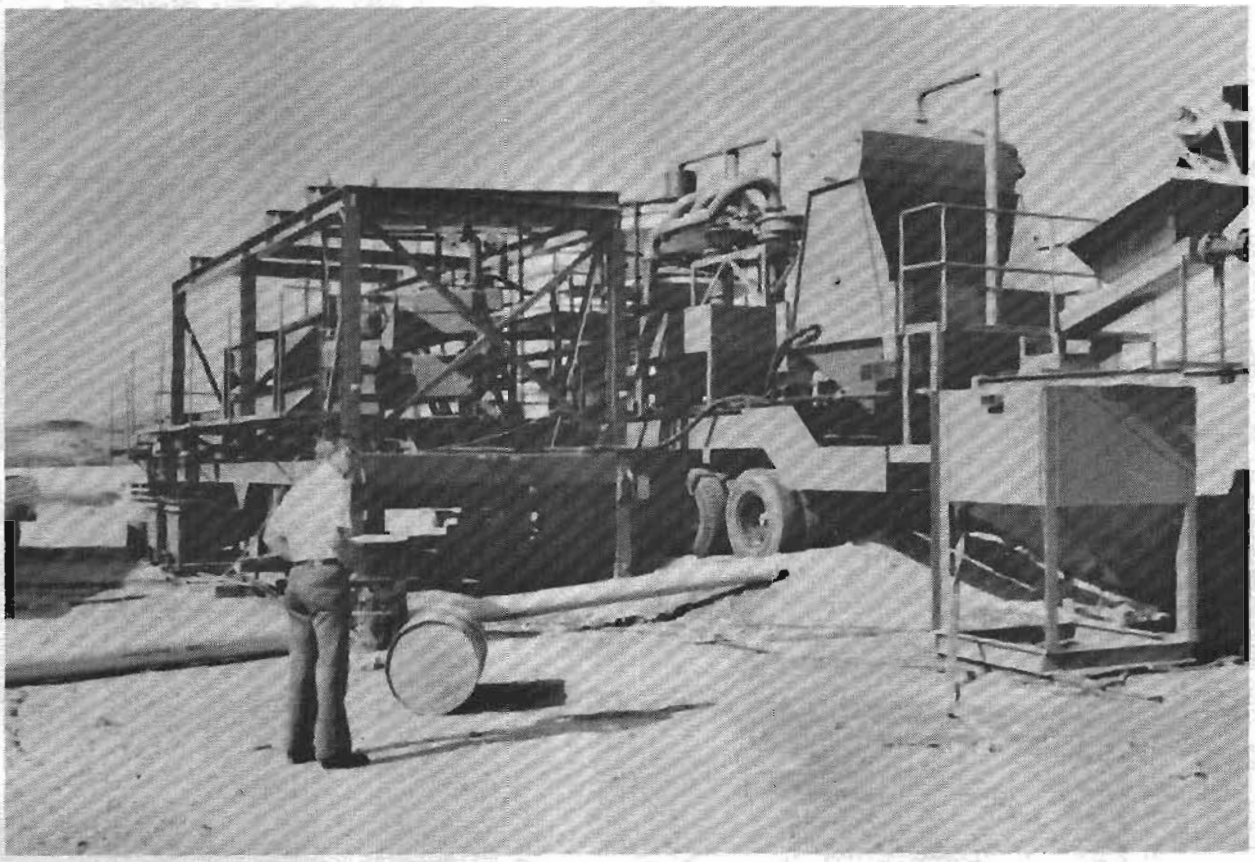
Table tailings are recycled back to the cone feed to retain values. The table concentrate is diverted through a small amalgamation drum.



This past Spring we had a "portable" plant built on two low-boy type trailers; the equipment is almost identical to that used in the Snake River plant. One trailer contains a DSM-type screen for the sizing at about 10 mesh ahead of the cones, three cyclones for dewatering the cone feed to about 60% solids, and a full 4DSV type Reichert cone (although the cone is split into two sections to facilitate head room). The other trailer contains a triple-deck Deister shaking table. Three of these units have been built and put into operation, and a fourth is now under construction. I am enclosing a couple photos of that system, although it was not yet completed when I gave the paper. The portable plant is designed to accept feed of -3/8" or possibly -½" size (after normal washing screens. The capacity of the plant would be about 30-40 tph of -10 mesh material. That would -robably be about 50-60 tph -3/8" product to the DSM-type screen. About 100 GPM water would be required for the cone and table operation, and the power requirement would be about 125 HP. The system contains 8 pumps. The two trailers as shown are priced at about $250,000, FOB Boise, Idaho.







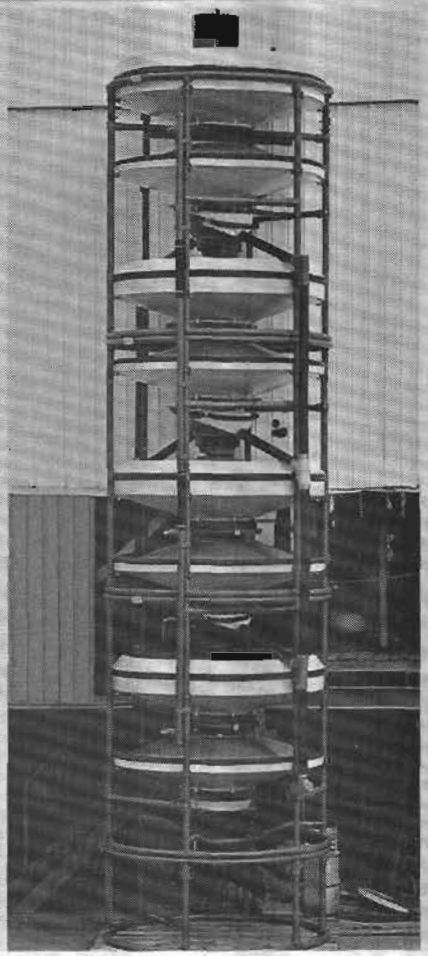
The cones are manufactured in Australia by Mineral Deposits Limited, and the units are sold on an FOB Australia basis. The current price of a type 4DSV cone (the configuration most commonly employed in the fine gold operations) is $A41,355, FOB Brisbane. At the present currency exchange rate of $A1.00 to $US1.14, that is about $US47,150. We have shipped in about ten cones in the past three months, and the landed price in California, duty and freight paid, is about $US51,000. Australia has about the same inflation rate as the US, so one must expect at least 10% price increase per year. Different configurations of the cone have a different cost structure; most are slightly less than the 4DSV, but the differences are minor.

MINERAL DEPOSITS LIMITED

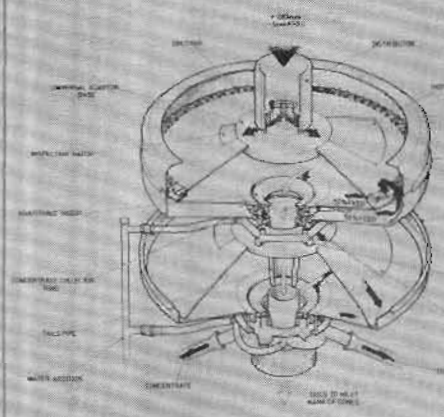
Head Office: 81 Ashmore Road, Southport, Qld. 4215, Australia
Postal Address: P.O. Box 5044, Gold Coast Mail Centre, Australia, 4217.
Telephone: (075) 39 9055
Cables: Mindeposit, Southport, Queensland
Telex: 40438

Agent: [redacted]

Type 4DSV Cone Concentrator



Reichert Cone Concentrators



DSV CONE CONCENTRATOR STAGE

Reichert Cone Concentrator

Proven — high capacity gravity separation systems with low installation, maintenance and operating costs.

MINERAL DEPOSITS LIMITED

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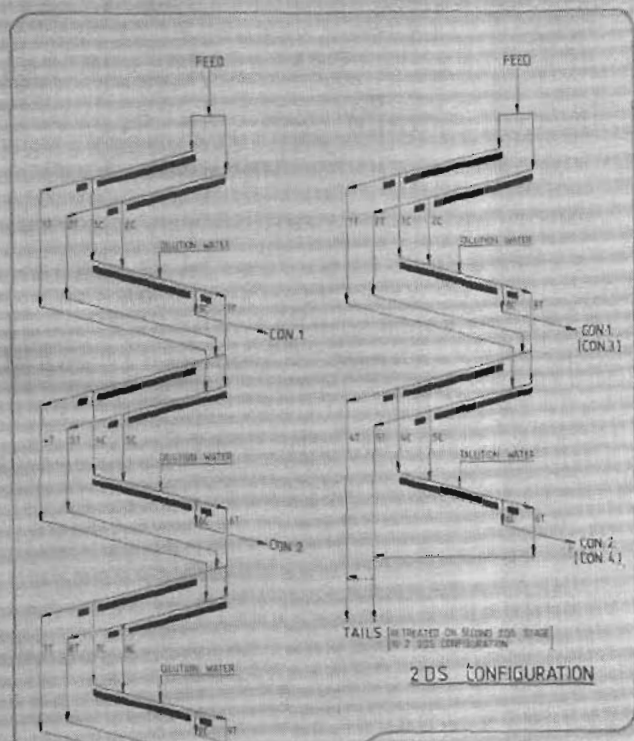

2 DS CONFIGURATION

4 DS CONFIGURATION

Reichert Mark V1 Tray Test Assembly

Low cost simulation of the characteristics of the Reichert Cone Concentrator in closed or open circuits.

WHAT WE CAN DO FOR THE MINING INDUSTRY

by
Joe Swanson
Alaska Department of Commerce

Thank you. I won't keep you very long, just a few comments. Probably the three greatest stories in the world, that I'm sure you've all heard, are: I paid that bill last month; the check's in the mail; and I'm from the government and I'm here to help you. As soon as you hear that, you're checking your hand to make sure you've still got your rings or you lock up the door and don't let them in.

Well, for 34 years of my life I've been in Alaska, and up until four years ago I worked in Private Industry. That 20 years of background employment in private industry in mining, electrical, and with the petroleum industry, with Texaco, pretty much proved to me that no government agent ever comes to help you. I've spent the last four years of my life trying to prove that it's not true all the time.

One of the things that has happened to your industry in the last five, six or seven years, especially with the escalation of gold, and with the amount of money and the amount of publicity you're getting, every government agent in the world wants to get into your pocket in some way or another. As soon as you get into something and start making the press, then the regulators and the politicians start writing laws to tell you what you can and can't do.

I came up specifically to promise you what the Section of Weights and Measures will not do, and to give you a little bit of information on some of the services that we offer. We are a regulatory agency. We have regulatory powers over anything that's sold by weight, measure or count. I sat in some of the meetings yesterday and this morning. Everything that people talked about was cost per pound, how much it costs you to operate--$250,000, $400,000, $500,000--the cost of your equipment and how much you are getting for your product. After you spend all the money to set up your plant and take care of all the government regulations, everything boils down to that scale that you've got that you're about to sell your product over.

One of the things that we can do for you in Weights and Measures, and the main reason I came up, is to tell you about our laboratory in Anchorage. That lab has been funded by the state and the federal government. We have about $250,000 worth of equipment that weighs in mass. We can weigh to nine digits--decimal digits. We can give you that kind of accuracy. We can certify any set of weights that you have in any calibration that you want, and we do it all free of charge to you.

If you've decided that you want to be able to weigh down to a certain quality we can give you the information on where to go and where to get it. If you have a set of weights, bring them down to our lab and we can certify them for you. The one thing that we're not going to dois to regulate the mining industry, especially on the retail side. We've got people coming into the state, they set up in a little room in the back of the Captain Cook or the Sheraton, and they buy gold. They advertise, you get big advertisements in the paper. They are buying everything anybody in the state sells and consequently the legislature would like to pass some type of regulation to stop it. I don't think the state needs to be involved in most of these instances.

In the same instance, where you people are buying and selling, everyone of you are professionals. You are transacting in a commercial environment, and there are some people who think that you need to be regulated. I don't think it's necessary. You know what your product is; most of the time you know what it weighs or the other person knows what it weighs. But it's a transaction between the two of you. We don't want to be in that transaction. We don't belong in it. What we do want to be able to do is guarantee you that the instruments that you're using to buy and sell are accurate; that's the kind of service we're willing to give you. If any of you need us, we've got an office here in Fairbanks, we've got one in Juneau, and our headquarters are in Anchorage. We have the finest metrology lab on the West Coast. We work closely with the National Bureau of Standards. We have the state metrologist that is trained by the National Bureau of Standards. We can give you anything that you need in mass calibration.

That's all I wanted to tell you and I'll promise you you won't see any of my inspectors at any of your sites. Thank you very much.

INTRODUCTION TO LUNCHEON SPEAKER

by

David Heatwole

President of the Alaska Miners Association

The proposed Fish and Game Habitat Regulations look to be very bad for the small miner. Essentially a Fish and Game official can come to your claims and shut you down, or have you alter your operation, right there on the spot. This will not be a person familiar with mining at all. So, if you think that might affect your operation, you may want to get a copy of these regulations, read them, write to the Commission of Fish & Game and tell them what it means to your operation. Just so that your letter receives its due respect, I would suggest that you send a copy of your letter to your legislator so that he knows of your concern about it too. The statewide organization will be attending some hearings, but we need some grass roots support on this. We are hoping we will be able to get a public hearing in Fairbanks, and I would encourage you all to turn out in numbers. Don Stein and his group will have copies of these regulations. For those of you in Anchorage or Fairbanks, Paul Glavinovich or Howard Grey will have the copies.

Also at the Directors' meeting, we got into the nitty-gritty of finances. The statewide Alaska Miners' Association is solvent, as far as operational costs go, but we are incurring some steep legal expenses with the Zamanski case. If we lose the Zamanski case, you could be faced with having zero discharge from your operation. If we cannot get additional funding, we most likely will have to discontinue our statewide support. So the Board of Directors is asking those of you operating in the state, to at least be an operating member of the Alaska Miners' Association. That's a $100 a year contribution, or better than that, could you give an ounce of gold towards keeping the Zamanski case alive. I think you might think a little bit about what zero discharge would mean to your operation. An ounce of gold is probably a pretty cheap investment for you, at this time. Don't just assume that somebody is doing your work for you. We need everybody's help in getting this done with this hearing.

That was the major business. The statewide branch will also remind those of you who are not members of the Miners' Association, we do need your support in the suppliers' section. There is a table there with AMA memberships. Please join, if you're not a member; or if you know miners in your district that are not members, please take some applications and see if we can get everybody together in one unit.

Our speaker today has numerous years of mining experience. John Sims was born in England; he received a B.S. degree in Geology from Durham University in 1956. He spent

an impressive 21 year career with the Anglo-American Company, holding a variety of positions, starting as a mine geologist in one of the Orange Free State mines. He later went into exploration in Sierra Leone for diamonds and gold and became chief geologist of the Presidnet Stein Gold Mine. While he was a chief geologist, he managed to go to enough classes at the University of Witwatersrand to receive his PhD in 1969. He did extensive research on gold-bearing environments and designed Anglo-Americxan's gold exploration programs on a worldwide basis. This resulted in a four-year stint in Brazil exploring for gold. In 1977, he accepted the posiiton of Associate Professor of Geological Engineering at the University of Alaska, Fairbanks. Most recently, John has joined the Alaska Department of Commerce as Director of the Office of Mineral Development.

I would just like to say that John's position, to me, represents a slight change in the attitude of our state government. For the first time since I've been associated with Alaska's mineral industry, we now have an adavocate in state government. I believe this is a change in attitude. I am very glad to see it, and I'm happy that we have such a qualified man as John to represent us.

LUNCHEON SPEAKER

THE FUNCTION OF THE OFFICE OF MINERALS DEVELOPMENT

by
Dr. John F.M. Simms
Director, Office of Mineral Industry
Department of Commerce and Economic Development

This is the third Placer Mining Conference which I have had the pleasure of attending. At the first conference in 1979 I was assigned the task of preparing and editing the proceedings of that milestone event. Last year I managed to present two talks or presentations while this year I have the pleasure of "singing" for my lunch.

You are, I am sure, all familiar with the T.V. ad in which Orson Welles orates the credo of Ernesto and Julio Gallo (or is it Paul Masson)..."We shall sell no wine before its time." We in Alaska who work diligently towards the day when this state will figure prominently as a producer of mineral products (as well as oil and gas) will appreciate the appropriateness of my distant corruption of the Wellesian effort..."we can sell no mineral before we effectively get our house in order." That may sound a little extreme, but I am convinced that until vital policy issues are resolved at the state level, there will be little of consequence taking place with regard to new and exciting mine development. My perception is that the private sector is willing and able to operate responsibly within a reasonable regulatory framework—certainly not the over-regulation which has manifested itself as a debilitating cancer of our economy. That same private sector has been frustrated by a lack of sensitivity to and an understanding of the problems which relate to mining. This has been a major criticism by miners of the public sector both at the state and federal level.

A recent Prime Minister of England popularised the phrase "winds of change" in an historic excursion to Africa. He was speaking of and identified with social changes in that continent which equated with politcal evolution, or perhaps more aptly, disintegration of a semblance of orderliness of that continent. I am stealing that phrase and using it in the very different connotation of Alaska. I believe that recent political realities are beginning to be heard loud and clear and that a wind of change will benefit the miner and the entire mining industry in this state. Noises and actual deeds are coming out of Washington, D.C. which you must agree support this view. Why only this morning it was reported in the media that Interior Secretary James Watt intends to open the Salcha Tin and Tungsten Belt for mineral entry!

There is still an inertia from the old scheme of things and many of you are understandably alarmed by the rash of new regulations which have been generated from sundry agencies. I am an advocate of the mining industry and from where I stand I perceive some positive movement slowly manifesting itself in the form of simplifying the regulatory process by combining the intent of several different permit processes into one multi-agency document. Mechanisms are being developed to place time constraints on the issuance of permits. This trend is welcome and is a beginning. Another positive sign, which I identify, is the growing realization by the population at large that other resources besides oil and gas, timber and fish may open up exciting vistas of employment, economic diversification (always a healthy thing) and, not least, the ability to reduce the nation's scandalous dependence upon importation for many vital minerals. Dave Heatwole in his talk at yesterday's luncheon drew attention to this and explained the potential for Alaska to help alleviate the problem.

Alaska is at the bottom rung of the ladder when it comes to mineral development—we have yet to get both feet off the ground and achieve real tangible progress. The key, I believe, is to generate visible and positive momentum towards converting identified assets in the ground into viable mining operations and clearly demonstrate that mining can provide thousands of stable jobs, broaden the economic base and be conducted in such a way to have a minimal degrading effect of the environment. No one can deny that once we get our act together—assuming that we can get our act together—that the future is one of great, almost limitless, promise.

Alaska presents a unique economic model. To my knowledge the situation in which we in Alaska find ourselves today has no precedent. This is what makes our times even more exciting and I stress encumbers us with the responsibility of managing our resource extraction and harvesting operations with care. With foresight, give and take on the part of our diverse population balance, sound objective planning followed by decisive action, I believe that a healthy mining industry will be a reality of our time. If the present is a period of devilish frustration for the miner, there is no denying that there is excitment in the air.

My remarks hopefully convey to you "where I am coming from" in terms of philosophy. I seek to transpose or convert that philosophy into deeds through the actions of the Office of Mineral Development.

I would now like to explain to you the role of that office and what it can do to promote mineral development within Alaska.

When I speak of mineral development in Alaska, I encompass activities of the small individual operation through to the large corporate giants of mining. I would venture that of prime basic importance is the need to devolve an operating and investment climate in which the prime producer—the miner—can work for fair and just reward with assurances that arbitrary actions will not be imposed and threaten his livelihood and investment at some time in the future. Hence, I am concerned and seek to be heard in my advocacy role for mining when it comes to formulating and framing vital policy issues such as taxation, royalty payments for leasable minerals and even the very interpretation of mining law as it will apply to state-selected lands.

Many conflicts are arising because of the land classification and usage policy which in its present form restricts and adversely impacts the miner on many types of state land. Again in my advocacy role I could plead for drastic overhaul and simplification of the system stressing a return to or the adoption of compatible multiple use polices for the vast majority of acreage.

The Office does not have regulatory function but it does and will in the future have vital policy inputs to help frame a pro orderly development policy. It has a major objective, I repeat, a promotional role and an advocacy role within government on behalf of mining by the private sector. Some of my functions besides those already mentioned:

1. Develop and maintain an information bank with subsections covering:

    a. The Resource Base - what, where, how much of, etc.
    b. Service Directory - who is active in the state, what specialist services are available, and where and at what cost.
    c. Regulatory Requirements - what is one looking at in terms of regulatory permit requirement when it comes to prospecting and mining in Alaska.

    The data gathering and preparation of this information will be contracted out to other agencies and contractors who are staffed to provide the services involved.

2. Work cooperatively with private sector and state agencies to achieve orderly development of known

viable deposits, for example:

a. Quartz Hill
b. Greens Creek
c. Beluga Coal Field
d. Healy Coal Field Expansion

3. Work cooperatively with agencies and private sectors on the development scenario for mining in the Interior—especially the need to evolve an integrated infrastructural framework involving transportation, power, water and community services in regions such as the South Flank of the Brooks Range.

4. Use the Office to upgrade and improve the image of mining stressing the positive impacts. There are many ways in which this can be tackled; media coverage being the most effective.

5. Support and seek to improve programs which are designed to help the small miner. I would single out the state mining loan program as an area which is being improved in certain ways which make it more responsive to the miner. I believe that the loan program should be managed in a financially sound framework. None of you would want to be looked upon as "wards of the state".

6. Last, and not least, a concern of both myself and my office is that this University and more especially the School of Mineral Industry gear up for the future needs of, and be responsive to, the mineral industry in the state. It is incumbent upon the School of Mineral Industry to maintain, strengthen and broaden its programs and do all possible to attain a reputation of excellence in the eyes of industry. Remember, there will soon be a great and urgent need for mining and geological engineers—there is nothing more certain than that in my mind.

The goals and objectives that I have set will require dedication and hard work to accomplish. I hope that I and my staff can help deliver the goods.

Finally, I trust that those of you who are miners will have a successful and rewarding mining season ahead of you.

THE DELTA STORY

by
Terry Mulligan
Marketing Director
Delta Smelting and Refining Company, Ltd.

Fellow Guests, and Ladies and Gentlemen, and Placer Miners, on behalf of the Delta Smelting and Refining Company, I wish to thank the University of Alaska with particular reference to Ernie Wolff, the Alaska Miners Association for this kind invitation to address the conference.

Delta appreciates the support shown to us by the industry. We, in turn, will never knowingly let down the confidence that you've placed in us as a smelter and refiner. We're quite conscious of the fact that you hand us the fruit of your labor and only have an estimate as to value. We, on the other hand, hand you a piece of numbered paper that says that you have given us something that is reported to be gold.

We are always quite fascinated by the ingenuity that is shown in the packaging. It quite often staggers the imagination. You get everything from the standard baby food jars to certain cartons that formerly contained goods that you could never advertise on the late hours of T.V.

In 1979, because of support by industry, we made a commitment to have the smelting operation in Fairbanks by the 1980 season. The equipment was cleared by customs, and 30 days later it was installed and we were pouring. I think that indicates the dedication of our people. At that time, we announced the appointment of Dan Barrett, resident manager and Ed MacDaniel as plant superintendent. Last October, we said that there would be a bouillon assay laboratory ready for the 1981 season. Well, the room's ready; the counters are in place; most of equipment has arrived with the exception of the assay furnace, and we are told now that's between here and there. We know where "here" is but we sure don't know where "there" is.

But the most important ingredient has arrived completely intact. We wish to announce the appointment of Fred Burgess as our senior assayer. We hired him away from a major company in Vancouver. He is registered by the Administry of Energy Mines and Petroleum Resources of the Province of British Columbia. That points out the caliber of the gentleman in question. Fred and his wife Pat became official residents of Fairbanks Tuesday night. The local office manager, Barbara Heider is on a training program in Vancouver right now. So, this season when you call up and have questions like: "What is my bar weight melt?", or "Where are my assay results?", or "When will they be ready?" or "What did you do with my check?". they won't be able to

say, "I'll phone Vancouver and find out." You'll be able to get mad at the person right there. It's going to be a totally self-sufficient operation here. I think that will improve a lot of things between the industry relationship with the refiner.

We also added another field representative, John Filler and in addition, Sandy Thomas is now a bonded employee of Delta in Anchorage. So, you can drop metal off in Anchorage. The minute we take possession of any metal, it's automatically covered by the insurance policies.

We added a new feature last year. That's the addition of a full-time trader. You saw him in the slides. His name is Peter Short. The standard refinery schedule states that metal in by Thursday night is price-based on the following Tuesday's London afternoon fix. But, if you would like to fix any other day of pricing, just get on the phone and call Peter. If you have any metal on deposit and you want to make a transaction, phone him between 7:00 a.m. and 11:30 a.m., Vancouver time, he can walk in on the following London afternoon fix. If you phone him before 12:00 noon on any given business day and you want a sale on that day, he'll get hold of New York or wherever in the running market. You could make the transaction right then. If you called well after 12:00, all he can do is give you a little bit of history because the markets are closed; but He can give you the latest market trend. His service is available; please utilize that service.

This evening we are holding an open house, 5:00 until 8:00, I believe there is a question mark after 8:00, at our smelter. We invite all of you to please come out and look at our facilities. The address is 2740 Hanson Road. If you drive down Aurora and across the tracks, right where the Sealand yard is located, we're about ½ mile down Hanson Road. All our staff will be there; Peter will be there in particular, if any of you people have any inquiries about pricing metal.

I'm going to conclude this by saying, as we've said before, we feel very strongly about our place in the Alaskan placer industry. I think we've shown some positive actions to demonstrate to you our sincerity about being part of your industry. Thank you for your support.

ALASKA'S FIRST MINT

by

Frank Tolley, President
Precious Gems and Metals, Ltd.

I'm here today to introduce the first gold and silver mint in the state of Alaska. Last year Doug Nestrum designed the coin. You might have heard his name; he's a noted wildlife artist here in the state. It's a beautiful coin. I had about 150 coins with me last week when I left Anchorage going to California. I came back with three or four left. Everybody is so excited over them in California. I was kind of shocked to know that we have a lot of Californians who would like to be Alaskans. I'm going to cut it short to get on with the program.

But, if anybody is interested in taking their gold and having it refined, I can turn it into some beautiful gold coins. The sizes of the coins will be one-eighth ounce, one-quarter ounce, one-half ounce or one ounce. I also will make little bars. All my products will have the Seal of Alaska on them.

It is an opportunity for a gift for anybody that's ever been to Alaska; or who will ever come to Alaska.

The response has been pretty great. It takes quite a while to set up if you're privately owned and you're doing it individually. I've had my problems up and down, but it looks like it's going to get going now.

There are opportunities for anyone in the audience today who would like to get involved in a private mint. All you have to do is call me and I'll be glad to clue you in on what's expected with the mint. If you've got any questions, you can see me after the meeting this evening. I do have three or four coins with me. If you'd like to see one, I'd be glad to show it to you. Thank you.

You've heard all about how to mine; how to go about it. We're going to have some people from the state, and federal agencies that are going to tell you how simple and easy it is to go out and get your permits and get with it.

First, we have Carl Johnson, District Manager of the Federal Bureau of Land Management.. Many of you have worked with Carl and are familiar with him. He's easy to get along with and easy to talk to.

After Carl, we're going to have a talk from Jeff Haines, Deputy Commissioner from the State Department of Natural Resources in Juneau. Jeff's one of the people that I've had the pleasure of dealing with. I get along with him real good. I go talk to him in his office, and I think I've done real fine; then I'll be walking down the street afterwards and I'll say, "Now what did he tell me he was going to do for me?"

Next is Deming Cole of the state Department of Environmental Conservation. He has an aide here, Deanna Hengins who's director of field operations.

Then we have Scott Grundy. Many of you know Scott. I don't know who wrote this introduction, but it's got Scott down here as fish hugger and moose hugger. Is there something happening in the habitat section that I don't know about? He is the Regional Supervisor, Habitat Protection Section, Alaska Dpartment of Fish and Game.

Also we have Bill Lamoreaux, U.S. Environmental Protection Agency.

We're going to ask each one of these gentlemen to make some opening statements up to ten minutes. Then, we have a panel over there of miners and interested citizens that is going to have the opportunity to raise questions or ask these gentlemen to clarify some of their statements.

On the panel we've got down here on the end, Leo Mark Anthony. Leo's a miner and educator. He's been around Alaska for a long time. I can tell you that he'll forever be a friend of mine, because he pulled me out of an airplane crash down on the Kantishna Airstrip one time.

We have Roger Burgraff. He is a miner, banker, dogmusher, long time Fairbanks resident. He has the distinction of having the only operating underground hardrock mine in the state of Alaska. That alone should tell us that we've got a long ways to go in the mining industry.

Another gentlemen that we have is Richard Wien, who's a famous name in Alaska. He has been involved in a lot of things. He's owned a helicopter outfit, and recently chose to turn down a major promotion. What he's going to do, I don't know, but I'm going to have some suggestions for him after this is over; an opportunity to serve his community.

Of course, our Dr. William Wood, president emeritus of the University of Alaska. I don't think he needs any introduction.

So, we'll get started with our first speaker, Carl.

GOVERNMENT REGULATIONS FORUM
CARL JOHNSON
BLM Fairbanks District Manager

I feel it is appropriate for the BLM to be first on the government regulatory side. I've often said to people around Fairbanks—particularly since the D-2 Lands Legislative Debate for the past 10 years—that one of these days, people are going to remember when BLM managed the lands as the "good ole days".

However, I'd like to go through a quick review of some of the major changes. There have been four major laws passed that affect Alaska, and particularly placer miners. Starting with the Statehood Act in 1959, a lot of changes have been in motion; a lot of change in motion. This act started the momentum that pushed for a fair Native Claims Settlement Act. It took our U.S. Congress an additional 11 years to finally pass, in 1971, this second major piece of legislation for Alaska.

I needn't remind very many of you that what really pushed that through Congress in a record time of only three years was the discovery of oil at Prudhoe Bay. I think it's fair to say it was long overdue; the Native Claims Settlement Act had been laying there, languishing as an issue, ever since Alaska was purchased from Russia.

In 1971, that act passed. One of the major provisions in that Act was the D-2 thing that you've all heard so much about in the Press and from everyone. D-2 simply was one part of the Native Claims Settlement Act, and it was the part that required all the remaining federal lands in Alaska to be studied for inclusion in what was called, in the law, the major four systems of management.

They would have been the National Parks, the federal wildlife lands under Fish & Wildlife Service, the U.S. Forest Service lands, and the wild and scenic rivers under whichever agency might happen to have those lands.

You'll notice I didn't say anything about BLM, because in 1971 BLM wasn't a recognized lands manager. It never has been. It has always been what was referred to as the "Custodial Federal Land Manager" which simply meant we were managing those federal lands that had never been designated for anything else. If you compare just acres of lands, even today, BLM is still managing the most.

Finally, in 1976, Congress did pass a third law that told BLM they didn't want the Federal Lands all to pass from the public domain status. And, that was the Federal Land Policy Management Act. That's a fairly recent act that allows has a lot of detail in it. Some of the regulations I've been asked to talk about today really came out of that Act.

The last, and fourth, major law affecting Alaskan public lands--and certainly all of the miners in Alaska--is the recent one that just passed in December, 1980. That's the Alaska National Interest Lands Act, the culmination of the D-2 requirements of the Alaska Native Claims Settlement Act.

Those four major acts put a lot of things into motion that will change the rest of our lives.

There are also other Federal Land laws that apply to BLM land. In particular, the 1872 Mining Act. I want to reassure everyone that it's still there. I've not even heard any debate about changing it recently; there had been some in the '60s and the '70s, but it seems to have died down. There seems to be a recognition that the basic premises contained in that law are still valid. I needn't remind any of you what they are. I think you know what they are.

Today I want to talk about the Surface Management Regulations. That's the topic I think each agency is supposed to discuss. It's been about four years in the making since the Federal Land Policy Management Act was passed in 1976. These surface management regulations apply only to lands remaining with BLM. They do not apply to claims on other federal lands. You could have claims on Native-selected lands, independent lands, state lands, parks, or fish and wildlife controlled lands. These regulations do not apply to those lands once the title is passed. I want to be sure that you understand that. You then would fall under their regulations.

Under the state and Native-selected lands, after they go through "tentative approval" and the management authority and conveyance has happened, you would still have rights under the Federal Mining Law. But the surface protection regulations usually relate to access also, and it would probably fall under that agency.

The BLM Surface Management regulations were proposed to January 1st of this year, for over four years. A lot of you have attended public meetings here in Fairbanks I have, and a lot of other people have. I think if you stayed with it, you can see the value in attending those meetings, saying how you felt about them, because these final regs are a far cry from what was originally proposed.

The original regulations were very restictive, fourteen pages of fine print in the federal register. Frankly, they were unenforceable and they weren't even trying to help the miner. They were simply interested in safeguarding all the surface resources to keep them untouched, in my opinion. I really think that our new regulations are workable although they still need some refinement. I would like to quickly review what they say.

The basic purpose of the regulations, of course, is to provide some rules by which we can disturb the surface in a mining operation. They are designed to prevent unnecessary damage to the surface resources—mainly the vegetative resource, but also soils, water and other resources that could be affected. We want to do this with the fullest possible cooperation of the miner.

The definition of "undue and unnecessary degradation" is difficult. Obviously, that could mean a lot of different things to just about everybody. But we call it "a disturbance of the environment that is beyond the ordinary activity associated with the mining operation". You all know that everybody's operation varies, so that still leaves a lot of interpretation. I know that worries everyone.

Since the first of the year we had a lot of public meetings here in Fairbanks with our BLM District Advisory Council, which Earl Beistline chaired for us. I would like to say that many miners came out and testified, and I believe it was very helpful for the council to reach some decisions and recommendations on changing these regulations to better fit Alaska.

I'd like to quickly review that the regulations now say there are three catagories; the casual use, a notice and a plan of operation. The casual use is where negligible disturbance is planned such as prospect shaft, drill holes, or geochemical analysis that do not disturb the surface resource very much. Bulldozer work would not fall under casual use. The currrent regulations say explosives also do not come under casual use. That's one of the issues that our Advisory Council took exception with, and we are sending back to Washington to reconsider the use of explosives even in casual use. I'll read that a little later.

The second area where you only have to file a notice, in other words tell the BLM that you're planning to go out and do your mine operation, is where you've less than five acres of surface disturbance per season. If you're less than five acres, you're only required to notify BLM 15 days before you go to mine and there's no need of approval from BLM.

You should include a detailed mining plan, access route, reclamation procedures, etc. even for under five acres. But we simply review the plan to see if there appears to be any undue damage. In most cases, your 15 days have passed and you've completed your operation. Built into these regulations is the fact that if we don't respond in a timely way, you move ahead. Now, I think that's a good thing because, frankly, Congress has passed the laws; we've got the regulations in effect, but we've never had any increase in personnel to do some of the things originated in legislation.

At the present time, for instance, in the northern half of Alaska where we have nearly 50,000 mining claims, we have a $54,000 budget, including salaries and everything for that program. The point I'm making is this is largely a voluntary program, and we want to trust the miners to do the right thing. We're only going to be looking at what is really extreme and unusual degradation of the landscape or the resources.

The third category where you have to follow a full plan of operation, is where it's over five acres disturbance in one season. That includes any new access roads. Of course, established roads that are under R 24.77 State right-of-way or whatever, would not be included. But new access routes into the claim might be included in the acreage.

At any rate, if it's over five acres, the miner must submit his plan of operation and a detailed mining plan with reclamation procedures as to the area to be mined. He must describe how the tailings will be handled; how the overburden is stock piled, and so-forth. Then, we have 30 days to review the plan. This would include our writing a small environmental analysis of what you're planning to do. We're going to try to streamline that. For instance, we'll have one that fits most of the mine operations in the interior of Alaska and others for the other regions.

A lot of the placer mine operations are basically the same as to how you do it. So, we want to get some streamlined procedures; we haven't done that yet, but we intend to.

At any rate, we must send a letter within the 30 day period, approving the plan or suggesting changes. Then, we can monitor the operation if we have the capability. I would say that monitoring some 50,000 claims is out of the question. We'll be very selective and we'll be relying on some of you to help.

If you see someone that you feel is doing something that is giving the mining industry a bad name, you may want to tell us about it, and we'll try to help.

I want to emphasize the word "help", because I foresee that we can help in some cases, particularly on new access. We have air photos, maps and things that could help you design access to a claim. I want to remind everybody that we understand that the right of access to a valid entry is guaranteed in the 1872 act.

I could go into some of the council recommendations, but I'll leave that. If you're interested, we expect to be following up on that at future council meetings. We invite any of you to be there if you care.

GOVERNMENT REGULATIONS FORUM
JEFF HAINES
Deputy Commissioner
Alaska Department of Natural Resources

I would like to use this chance to update some of the things that we promised to do at the Mining Symposium in Anchorage last fall and, in fact are doing to make life easier for you.

To start with, a policy statement: it is the objective of the department to support full development of the mining industry in Alaska. I would say what I said before, that we expect it to become an increasingly large part of the economy in the State, and over a period of time to approach the magnitude now occupied by oil and gas, particularly as a result of strategic and critical mineral development. For this to happen, it is absolutely essential that the Department of Natural Resources administer laws relating to mining in a manner that is fair. I would emphasize that, when we talk about fair administration, we mean fair for everyone and that we do not inadvertently favor large companies over small miners or individual operators. Because, if we do that, we might inadvertently render them extinct, and that's something that we absolutely do not want to do.

The principal functions of the Department of Natural Resources, relating to mining, are really three. Number one, we administer a system of property rights. That's really our principal function in Alaska with respect to all resources; to get resources into private hands. In the case of mining, it involves administration of the mining claim system.

Our second function has to do with maximizing multiple use of state lands, getting as many resources used as we can. That's the primary reason we have permit systems; in many cases we have different interests fighting over the same lands. However, we presume all resources are compatible on a given piece of ground unless proven otherwise. We've attempted to resolve conflicts in a manner which permits the largest number to go ahead.

Our third function is simply identification of resources that may be developed for future use. As far as recent devlopment goes, this really has to do with trying to make our own system work for you in the mining industry.

First of all, with respect to the filing of mining claims, we realize that we were reminded at the last mining symposium that it's a pain right now to have to go to several places in the Department of Natural Resources in order to file a mining claim.

We are about to issue changes in our own regulations which will change that. That's something we promised last year. Shortly, it will be possible to file mining claims

simply with the State Recorders Office, and all other transmission of documents within the department will be taken care of without your having to go there. In fact, I have some copies of those draft regulations here which I'd be glad to leave with Dave Heatwole or anyone else who wants to distribute them.

Secondly, we have a couple of more long-term ideas as far as speeding up the mining claims administration system, and also maintaining the currency of status plats. We have an item in the governor's capital budget this year for an automated drafting and distribution system within our Division of Technical Services to hopefully speed up the turnaround time in which we have to actually record mining claims, and then update the status plats in the field. That was approved by the governor with very high priority in the department.

Secondly, we have already hired a contractor to institute the automation of mining claims themselves. I'm not making any hard predictions on when that gets done, because I don't have high level confidence in the State computer system. But we have hired a contractor to do that, and at some point within the next year or so we should be able to go into our office in either Juneau, Anchorage or Fairbanks and pick out mining claims on the computer arranged by name case, file number and geographic location.

The third thing, that I'm sure you're aware of, is that there's a backlog of mining claims in the department right now. We were caught unaware by the increase in the price of gold which resulted in about a three or four fold increase in the number of claims that were filed. We have hired a number of temporary persons in the department to clean those up, and we've given the Division of Minerals and Energy, which is the one that adjudicates those, the highest priority for next year's budget in terms of increasing positions to try and get that backlog down to zero.

We will, again this year, in conjunction with the Department of Fish and Game and the Department of Environmental Conservation, operate what has been called a "triagency placer mining permit system". This is a way of using one application to get all the permits you need from state government. I don't think any of us that were involved in that last year were satisfied with the state government's performance, but it should improve this year.

With respect to permit regulations, we, as you know, have existing regulations requiring land use permits for a number of activities on state lands. We intend to revise those very shortly. The mining industry has been the one that's been most concerned about those. I can tell you, although it's not final at this point, that there will be a

number of activities that will be generally permitted on state land, meaning that we can issue a general permit to the public. Included in those will be such things as driving pickup trucks around on exploration activities, using dynamite, using light, portable field equipment and things of that nature.

We will also have a provision in those regulations to make exceptions to permit requirements on a geographic basis, including a mining district basis. As I mentioned, all of the foregoing were expressly requested by the Miners Association, by Mr. J. P. Tangent.

Fifth, I'm sure you're aware that we perform an assay function in the department for the general public. I think simply through better administration in the department this year, we've doubled the number of assays that we've performed. Also, as a result of an item that was put in our budget last year, we're going to buy some better equipment which should improve our ability to do them and turn them around quickly.

As I mentioned, one of our other functions is simply to find resources and it's something we want to do on a much larger scale than we have in the past. As a result, this year we proposed to the governor a five year, $50 million resource-inventory program for the department, which includes all resources. But a very major component will be both surficial geology and bedrock mapping. The five year figure for those two items would be $11 million for bedrock mapping and $6.6 million for surficial geology. Of course, that would produce maps and evaluations which should be very useful to you. The Governor has so far approved the first two years of those for inclusion in the budget and I'd say that it looks real good in the legislature. That's in addition to the three resource investigations we have going on right now. We have one at McGrath Line Hills, one in the Fairbanks Mining District and a third in the Brooks Range.

Those are all on schedule. I'll say at least one word about the infamous opinion of the Attorney General relating to Section 6-I of the Statehood Act. As you may know, we asked for an opinion last year, relating to how to handle mining claims on state-selected lands. The Attorney General's office expanded that considerably and came up with at least a draft opinion, raising the spectre of having to convert existing mining claims to leases on state lands.

We don't like it any better than you do, and we would love it if it went away. However, we have to look at this question simply from the standpoint of a combination realtor and title company. That is, if the rights that we've been authorizing are called into question, if there's a

cloud put in that title, we have to do something about it.

But Mr. La Resche testified a couple of weeks ago before the Legislature on what we would do if, in fact, the AG's opinion does become final. Because it is very important to you, I'm going to repeat it here.

> Number one, there will be no competitive leasing. In fact, that's just flat unconstitutional. Number two, there will be no royalties.Number three we will attempt to duplicate the existing system as fully as possible through any kind of conversion to leases. That means no sneaky, new terms; no attempt to institute some new kind of system. It will simply be a duplication of the existing system. It will be as simple a conversion as possible.

Finally, just a mention of strategic minerals, that's something that we certainly would like to emphasize as much as you would. I might add that we're trying to work as steadily as possible with our congressional delegation. Tom Bundtzen of our Department of Geological and Geophysical Surveys did do a preliminary compilation of strategic and critical minerals in Alaska by location last year. That's the only list that does exist in Alaska at the present time.

GOVERNMENT REGULATION FORUM
DEMING COLE
Deputy Commissioner
Department of Environmental Conservation

There are three well known lies. "Your check is in the mail"; "I'll respect you in the morning"; and "I'm here from the government to help you.".

Two years ago, two weeks after I became Deputy in our department, I came to this convention and talked on a panel much as this. At that time I had my East Coast suit and tie on, and I came up to find out what a placer miner was and what the placer mining industry was. I 'd worked in Alaska for a long time, but only with the oil and gas industry; I didn't know the mining industry.

There are two things that you all told me two years ago. That you were really frustrated by the procedures of government and by the police force approach the government took to you. It's been our department's theme to try to correct those mis-impressions.

Earlier this morning, someone asked the question of a panel member: "Why doesn't the mining industry have an advocate in Juneau?" We know they do; we know they have them in the Department of Commerce. You also have a number of other agencies who are, I'll say trying, to understand what the mining industry is and how each and every one of you is impacted by us, and how each one of our regulations affect you as you're trying to do your job over the summer months.

As far as procedures are concerned, we have tried to develop information and present that to you on what we are doing as state agencies and why we do it. If we can make that explanation to you, and if we can talk reasonably about it, I've found that by and large, the mining industry and individual miners have understood what it is we're trying to accomplish in the environmental field, in fish and game protection and in land management.

We've also developed permit applications that Jeff talked about; trying to figure out ways that you don't have to deal with needless amounts and types of paper. We've developed people within the department who are trying to become more familiar with the mining industry and to work with it. We have tried, as a state government, to better coordinate our field presence. How many times do we need to send someone out to a mining operation to inspect, or to fly over, or to see you? How many times do you have to come to how many different state agencies to file the countless pieces of paper that you need to file? We're trying to minimize those kinds of impacts.

As far as the police force approach—we've added a new element. That is to provide technical assistance or help from a standpoint of how you can build a sediment pond; how you can meet our water quality standards; how you can meet the countless regulations we have and the the other agencies have as well.

The whole effect there is to try to develop a dialogue. Our department may not be your advocate, but at least we're getting to understand how it is you operate so we can operate with you better.

Basically, it is the state's policy to conserve, improve and protect the natural resources and environment; and to control water, land and air pollution in order to enhance the health, safety and welfare of the people of this state and their overall economic and social well-being. Those are in our department's enabling statutes. That's Environmental Conservation's charge.

And, right in there you see that there is a balance, and that's one thing we have to maintain.

To carry out this responsibility, we've set up countless numbers of programs for water quality, air quality, solid waste, public water supply, air pollution and the like. Generally, our concern with large mining operations relates to construction camps, permanent camps or new towns, mining and milling operations, tailings and waste water disposal, power generation and fuel storage.

Our primary concern with small mining operations is water quality including tailings and waste water disposal.

This morning you heard a presentation on Methods of Obtaining Water Quality Standards in the state. Generally, waters are classified to serve a number of uses. We do have a procedure for reclassifying waters after public hearings. There are currently several applications for reclassification pending before the department now. We do act on those; we do listen to what people ask for; we do listen to the information that is presented.

Water quality criteria of primary interest to small mining operations are settleable solids, and suspended solids and turbidity when no chemicals are used to aid mineral recovery.

In the absence of public water supply, the most common water uses to be protected include recreation, fish, wildlife habitat and industrial water supply.

To recreationists, turbid, silty water in once clear streams prevents fishing, hides rocks which are hazardous to canoes, rafts and health and is asthetically objectionable.

Settleable solids impede spawning, coat stream bottoms, and destroy insect larvae and other food for higher organisms such as fish. High solids loads may make the water unusable as industrial water for downstream users. Silty water will not efficiently separate gold from overburden in a sluice box or other physical separation equipment. These are all problems in our water quality standards. These are things that the water quality standards are trying to get at.

One of our major tools to insure that water quality is maintained for all beneficial uses are State Waste Disposal Permits. You also will hear that the federal agencies have a Federal Waste Disposal Permit. The State and Federal agencies have gotten together and decided that, obviously, only one permit is necessary. So, the State will be issuing permits in most instances and in other instances will be working with the Federal Environmental Protection Agency to develop general permits. So, in both cases within a year, you will not even need to apply for a permit. Your permit will be issued by regulation and "generally."

The objective of any condition placed in a permit is that the discharge should not degrade water quality, as defined by water quality standards. Except in unusual circumstances, the average placer mining operation requires efficiently designed and maintained settling ponds to remove solids before the waste water is discharged to streams.

To bring you up-to-date on a settling pond demonstration project which the department is conducting and will be conducting over the next year. If there are any fine particles such as clay in the material put through the sluice box, it may not be feasible in the space available to many miners to construct ponds with sufficient detention time to settle the fine particles. In those cases, additional or alternative forms of treatment may be needed. In these instances, technical assistance will be available from our department and hopefully from the University.

The State Departments of Natural Resources, Environmental Conservation, and Fish and Game, and the federal Environmental Protection Agency will continue to coordinate our field activities and our permitting programs to eliminate conflicting requirements and conflicting inspections. We will also be working with other federal agencies such as the Fish and Wildlife Service, the Forest Service, the BLM, and Parks Service to persuade them to use the State application which Jeff Haines talked about earlier for any of the permits or operating plants.

Basically, we're going to continue to work with you in the field to install cost-effective treatment systems; and to coordinate our activities, our regulations, and our permits with other state and federal agencies to attempt to minimize regulatory impact on mining so that you can be in the field doing your operations. Thank you.

GOVERNMENT REGULATIONS FORUM
SCOTT GRUNDY
Interior Manager
Alaska Department of Fish & Game

I have a cartoon hanging on the wall of my office that I think summarizes how miners feel about regulations. It depicts Moses standing in front of a multitude, two tabloids, Roman numerals I through X. A voice in the crowd is saying, "We feel we're being over-regulated".

As you know, Fish & Game is putting together regulations to define our authority and procedures to protect our fish streams. The Board is, of course, considering these regulations today in Anchorage, and will receive testimony tomorrow morning at 9:00 a.m. from any additional miners who wish to testify.

You'll be pleased to hear that because of the controversy involved, the Department is going to urge that the Board take no action on our regulations at this time, but instead, postpone them until the next joint Board meeting which will be in December. In addition, we are tentatively scheduling a meeting here in Fairbanks April 15th in the University's Schiable Auditorium at 7:00 p.m. Your input will be recorded. We are certainly interested in obtaining your input. I, as the front line person, certainly want to make sure that our regulations are workable and meaningful.

I will try to stall the notion that we haven't really tried to circulate these regulations. I think we've done a reasonably credible job. Excuse my defensiveness here. We started last summer coordinating with the Alaska Mining Association's leadership in Juneau. Last October, I made a presentation explaining what we intended to do at that time. Of course, we had draft regulations that we were working on. In November, we decided to postpone our planned December presentation to the joint boards, because the governor's uniform regulation package was not assembled these uniform regs will standardize the procedures in the handling of regulations by various departments, and establishes dispute mechanisms and that type of thing. So, we postponed until the Spring Board meeting which is going on right now.

In late November, we also sent out a copy of our draft regulations to many organizations and gave a real short time fuse for their cursory review. I think we had a two-week review period; they were due before Christmas. We took that input and were astounded at some of the meaningful suggestions that we did get, because we thought we'd worked hard to clean up controversial areas. We then came out with the regulations that you are familiar with at this time. In late February, after a legal notice, we mailed regulations to several hundreds of organizations and individuals.

On March 11th, I attended the Advisory Committee and explained what we were trying to do. The Advisory Committee came up again with some rather startling input.

In March, an ad was run in the newspaper announcing the Fairbanks Chapter Meeting of the Alaska Miners Association. "It is an emergency meeting. Attend or be shut down." I offered to attend that meeting but higher authority prevailed. I said, "Well, maybe you should wait until after that meeting and attend our regular scheduled meeting on March 30th, which I did."

So, there's been quite a bit of exchange between us. The important thing to remember is that the exchange will continue.

Basically what we're attempting to do is put into writing what we've been doing for the last decade. Our authority is, of course, granted by the Legislature; by Alaska Statute Title 16 as it affects placer miners. There are two sections within the act; Section 840 which mandates for the passage of fish, and H-70 which addresses the protection of anadromous fish streams.

The latter basically states that any time wheeled, or tracked excavating equipment is going to be used in an anadromous fish stream, a permit is required from the Department of Fish and Game.

We have a listing of anadromous waters. This is for Regent 3 which is the area north of the Alaska Range.

These regulations are merely an attempt to define, as I said, what we've been doing. Regs are broken down into two basic packages. First anadromous streams and special areas, we're not going to require a permit for your activities for those areas that are in the drainages now mandated to be covered by a permit. We're proposing that they be covered by regulations which means that our standards for fish passage will be presented to you in writing.

What this means to the miner in the Interior is that 90 percent of the time you won't have to come to the Department for an actual permit. I see some very distinct advantages to the placer miners if this process is adopted. However, if you were to propose to dam a headwater creek a permit would be required from the department; standards would be put in as to what situations would require this permit.

Without regulations, any time you take a vehicle across a stream, you need a permit from Fish and Game. This is pretty absurd. We haven't been enforcing it to that extent. The Legislature and, of course, the mining industry would be rather disturbed with us if we were to push it that far.

It is certainly not our intent to shut anybody down. It is our intention to make things work for you. Basically, if you haven't had any trouble with Fish and Game in the last decade, you will have even less of a problem with us in the future.

GOVERNMENT REGULATIONS FORUM
BILL LAMOREAUX
U.S. Environmental Protection Agency

I'd like to start out by saying that the EPA regulations and laws that might affect placer mining haven't changed in the last several years, nor do I expect to see any changes in the foreseeable future. There are, however, several significant events occurring presently involving EPA which can or could affect the placer mining industry.

In Alaska, EPA operates the NPDS permit system to control effluent discharges. Most of this I'm sure you've heard before, so I don't want to go into a lot of detail on that subject.

EPA has advocated treatment for settleable solids as a reasonable effluent standard for Alaska placer mining operations. I trust that the treatment level will remain the same for the foreseeable future, at least for several years.

In my opinion, it is a reasonable standard for the industry in Alaska, 0.2 milliliters per liter, is measured in a simple Imhoff cone. This can be easily done by an operator at a mine site. In Jerry Brossia's talk this morning, you saw a picture of an Imhoff cone. They really are a simple apparatus to operate.

I would like to mention today the current events, which the mining community should be aware of, that are occurring under provisions of the Clean Water Act.

The first of these is an update concerning the hearing process involving many Alaska placer miners, the EPA and the environmental group. The hearing, itself, involves the first 168 permits issued by EPA for placer mining approximately five years ago.

The initial challenge made against EPA's permits that I prepared came from an individual supported by legal groups who felt we had not been stringent enough when we set the effluent criteria. Zero discharge or total recycle is what this group believes is the appropriate technology for miners in Alaska.

After a lengthy hearing and review process from 1976 through 1977, EPA's permits were upheld as a minimum criteria, but a decision on total recycle was remanded back to Region 10 of EPA. We were required then to open up the hearing process again to obtain the additional information on the cost and the benefits of total recycle. Possibly, had sufficient evidence been presented by EPA and the miners during the first hearing, the remanding might have been averted.

Anyway, two weeks ago a full week was devoted to gathering this information in a formal hearing process in Anchorage. We were unable to finish up, so that hearing will be continued starting May 19. What remains to be completed is the presentation of witnesses for the trustees of Alaska, Gil Zamanski and EPA. Unfortunately, because we're not finished with the hearing, it would be improper for me to discuss at this time some of the highlights of the testimony. I can only guess now, but I don't believe we will see any significant changes in standards as a result of the hearing. I'm fairly optimistic about that.

We admit that technology exists to recycle water, and further, that recycling, in part or in total, is practiced by some miners. But we argue that this level of control for all miners may be unreasonable and excessive and does not meet the test required under the Clean Water Act. For these reasons, we have essentially taken a position similar to that of the mining industry in favor of effluent standards which offer the greatest degree of flexibility for the mine operator, while satisfying the objectives of the Clean Water Act.

This is where my concerns come in. People who know mining best are miners and mining engineers; however, the entire defense of our position has been carried by EPA and only a small group of miners working on a limited budget.

Criteria are being argued now which could affect mining for years to come. The only way to guarantee fair and reasonable standards is to get involved in the development process. For all practical purposes, the Clean Water Act is here to stay, and it is all of our jobs to make sure that the system works like it was intended to. The more information this agency has, the more likely it is that we will be able to develop criteria which satisfies the law and is fair to all parties.

The second item I'd like to mention is a situation that EPA is facing now involving enforcement-related activities. The same individual who initially challenged our first 168 permits, Mr. Gil Zamanski has now notified EPA of his intentions under Section 505 of the Clean Water Act to bring civil actions against EPA for a lack of enforcement for effluent-limitation violations, and for reporting and monitoring violations by placer mining permittees.

The act clearly provides for citizen suits when someone feels EPA has failed to carry out the provisions of the Clean Water Act. As provided by Section 505: "Sixty days notice must be given to EPA before other formal actions towards the suit can be taken. This 60 day's period is provided to allow EPA time to react and hopefully prevent the need for the civil action to be carried on."

Some of the allegations made include: Failure to follow up on the required reports to EPA concerning the methods selected to meet effluent limits contained in the issue permits; failure to follow up on the permit condition requiring annual operating plans; failure to take adequate action for apparent effluent and receiving water violations observed during inspections; and finally, failure to conduct a sufficiently large enough number of inspections.

Because this notice was filed on February 5 and our 60 day period is not yet run out, I cannot disclose, at this time, what form EPA's response will take; nor can I speculate, at this time, where the action will lead us. One observation, however, I think is worth noting. While some people within the mining industry have frequently made claims of EPA's tough enforcement potential, when push comes to shove EPA is faced with a possible civil suit because of our apparent lack of enforcement.

On another topic, I'd like to cover our present activities which we hope will simplify procedural requirements such as applications and operating plans. We hope to concentrate instead on obtaining results in the quality of effluent waters discharged from mining sites.

In the past, EPA has required that all miners apply for permits to discharge waste waters back into streams. This has been the requirement of the Clean Water Act. As the result of the amendments of our water act, however, we are now able, under certain circumstances, to issue general permits covering a very large group of operations. This general permit is applicable to placer mining and will eliminate the need to apply for an individual permit, thus reducing significantly the paper shuffle we all dislike.

We expect the general permit conditions will basically be the same as those contained in the individual permits that we've issued. Notification of this general permit, when ready, will be in local newspapers, in mail-outs and possibly the Alaska Miners Newsletter. We're probably close to somewhere between 6 and 12 months away from having a general permit. It's a very time-consuming process; we've been working on it and surely want to get it completed as rapidly as we possibly can.

In the past, operating plans have been requested annually as a means of evaluating compliance. This year, we will accept the State of Alaska's annual placer mining application form. We view this as a significant reduction in paperwork without sacrificing our need to obtain sufficient information. It is our intention to reduce the paper suffle and coordinate our activities with other state and federal agencies as much as possible. We hope to concentrate on what the real problems are and work with the miners in achieving the objective of this Clean Water Act.

One final point, EPA—through our "effluent guidelines" position in Washington, D.C.—has for several years now been attempting to establish national regulations, to set up standards for various types of mining and milling processes including placer mining.

Normally, people might think this would establish more red tape. I think, in this case, it's really the opposite with or without a regulation setting a national effluent standard. We of the local EPA, by law must establish effluent levels for discharges. This we have been doing for many years now with our permitting procedures. One thing the national guideline would do is reduce the livelihood of third party challengers to our permits. These have cost everyone time and money in administrative hearings, plus creating an atmosphere of uncertainty within the mining community.

Right now, my Washington, D.C. counterparts are viewing Alaska placer mining very realistically. I think any regulation established now will parallel very closely the position I've held and maintained for many years. If EPA isn't restricted by problems of budgetary matters or other problems, I do think that the Alaska placer miners will fare quite well if the national guidelines are developed.

GOVERNMENT REGULATIONS FORUM
Comments by Dr. William Wood
University of Alaska, President Emeritus

Is such a session as this really necessary? Under the type of government which we espouse—of the people, by the people and for the people—how come we get into adversary positions with some of us wanting to play God. I am puzzled by this.

Frankly, I was encouraged by the presentations, particularly by Carl Johnson of BLM, who I thought gave one of the clearest and the most straightforward statements that I've heard in a long, long time. Carl, my congratulations on it.

You raised a question though that I have no answer for—the difference between custodial management by the Bureau of Land Management and management, which I assume is management for utilization. You raise a real interesting concept there which sometime I would like to have you explore in greater depth. The difference between custodial management—what in the world is that—and management for utilization.

Obviously, some of the presentations made were on the defensive side. I doubt that should be necessary in this society. There has been some intra-relationship improvements in the last few months. You wonder what triggered that. But, there's still cloudy things here that have to be resolved. I am hopeful that, as citizens of a republic, a democratic form of society, we will be able to resolve these cloudy matters and come up with something that we can all live with for the common good.

About all that I would have to offer from the community standpoint, is that Fairbanks has a very high regard for the mining industry, as it does for agriculture.

Without new wealth, we have periods of stagnation of the human race and deterioration. The attempt simply to redistribute what has already been produced by somebody else, is merely to take the old wealth and shuffle it around. We simply stand still and stagnate, essentially deteriorating. So I believe you must produce new wealth. Certainly in Alaska at this time we need new wealth to affect improvements, not only for those who choose to reside in Alaska, but for the whole nation and perhaps the world.

Finally from the community standpoint, we are convinced that Fairbanks is in the process of becoming the headquarters for both agriculture and the mining industries. This state has taken some very noble steps in this

direction. Recently, they sent the top person in the mineral industry here to open an office in Fairbanks. The community has pledged to help in every way possible; to bring into reality the kind of service that the mineral industry and the agricultural industry need in order to succeed in making wise use of our extraordinary natural resources. Thank you.

Moderator Bob Bettisworth: Thank you, Dr. Wood. Do any of the other members have some specific questions? Roger?

GOVERNMENT REGULATIONS FORUM
Comments by ROGER BURGRAFF
Miner and Banker

I have quite a few things I want to comment on. Not as much questions as comments on the miners' outlook, philosophy and attitudes toward these present regulations.

Number one, I'm pleased to serve with such a distinguished panel. It's good to see a people like this gathered together. Something like this is very important in order for us to understand each other.

I realize that the different agencies are trying to do the best jobs they can and that they are mandated by law. I think it is very important for us as miners to be ever vigilant in watching what type of legislation is being passed. Once the legislation is passed, then we're stuck with regulations. What has happened here is that there has been a whole bunch of laws passed and the state government is finally getting around to passing regulations.

I'd like to state, basically, what the miner's position is. I hope I'm reflecting the miner's opinion on this.

Number one, miners are opposed to regulations, period. Most of the recent regulations that have been promulgated have been counter-productive. They've been very costly in the form of man hours lost and by increasing the cost of the resource that is being developed. They've tended to straddle the industry with burdensome regulations which has discouraged development. One thing that so many of us fail to realize is that we really don't have much of a mining industry in Alaska. We have our placer miners, but the hardrock mining industry is just about zilch. There's a lot of potential. That potential is never going to be realized unless the state and the federal government does something to try and encourage it. I am hopeful that we're beginning to come around to the point where we're going to have an industry.

The miners are opposed to permitting systems which are used as a means for regulating the people. Right now it's being used to regulate the miners and other industries, but it's going to have an effect on all the people in Alaska if we're not careful.

We feel that many of these regulations are being promulgated without proper research. They don't know what they're really regulating or what the effects are going to be on the environment. I feel there should be more research before regulations are passed.

So many regulators have failed to realize that they're having a very strong and adverse economic impact on all of us. It is something that has to be considered. Hopefully we're beginning to come out of the woods as far as the federal government is concerned. Jimmy Carter and his environmentalist group brought this country down to its knees on the verge of bankruptcy. I am hopeful that we're going to see a change and we're going to start developing the resources that we have.

The last three years have been very turbulent years. We had the Alaska Lands Bill to contend with. Most of us have been drawn into this. That bill is a very poor piece of legislation and it's going to be a lawyer's paradise for years to come.

Litigation—we've had MSHA regulations. A lot of you probably know what they are. They're Mine Safety Health Administration laws which technically are supposed to regulate every one of you people that are miners. The MSHA people have stayed away from a lot of you placer miners, and I'm sure you hope they will in the future. But they are given very broad powers and they can force you out of business very easily.

Basically, the way the law is written, the guy that goes out with a goldpan and a shovel and a pick has to get a permit and have to have 20 hours of training. I mean, this is what has happened. These laws and regulations have been passed without the industry having a chance to have input into them.

We have the surface mining regulations which are very inclusive and could be very dangerous. Fortunately, President Reagan and Secretary Watt are trying to water these down and not come down on us too hard. But, they are potentially very disastrous.

The local office has been very cooperative. All the people that I have worked with have been very cooperative and helpful in government. Where a lot of our problems come from is from up above.

Now, we're being faced with some real problems as far as the State. It's been one big battle after another for the last three years. We are a young state and we're trying to prevent a lot of things from happening that created problems down in the Lower '48, but I think we're getting carried away. Each one of us that are miners have a heavy investment in money and time and we're going to fight for anything that threatens our livelihood. Of course, on the other side, there's been the environmentalists trying to shut us down. Most of them don't have very much and could care less if we lose our livelihood.

I am very pleased to see John Sims put in the position that he is in. He is our advocate right now. I am sure he is going to do a lot to try to look out after our interests.

The one thing that I think we should look into and start talking to our Legislators about now, is the fact that what we need is a Department of Mines and possibly a Department of Energy. Mr. La Resche has had his hands full in these last years.

The Department of Natural Resources is a eight-headed or ten-headed monster. No one man can actually control it. The one thing with the mining industry needs to be put on an equal footing with the Department of Fish & Game, the DEC and some of these other departments. I urge you to try to get something like this started in the Legislature.

I don't know whether you're aware of it, but the Miners Association, the local branch, has been meeting every Friday at Auggies. Our meetings are usually at 7:00 in the morning and usually last from three to four hours. We put in a lot of time. We need help, and we need help from you people out there. We cannot handle it all ourselves.

It has been mentioned that we've had the proposed Fish and Game regulations which we are opposed to as a group. We need your help in trying to see that things are done to protect our interests. We've had problems as far as access. One of the big things that has happened in the Alaska Lands issue is that they tried to choke off our access to state lands. This has been done, in some cases, by some of the state departments.

We have this House Bill 281 which is proposed forest regulations. We've had meetings. The miners were all in favor of it until the doggone bill came out. The last sentence in the bill stated that "no mining would be allowed in these forest preserves."

It's things like this that really create a few problems. I think our biggest problem as miners is that a lot of people have a distrust for government. It's unfortunate that we have to live under those conditions. I think one of the problems that we have today is that most bureaucrats, in their specific departments, have what you might call tunnel vision; they can only see what they are regulating or trying to control. They do not fully understand, in most cases, what impact their regulations are going to have on other people.

It's very important that we maintain communications, and that we work together on these so-called regulations.

One of the problems that I've noticed during this period or era of environmental fanaticism that we've just gone through is that anything went. The means achieved the ends and all stops were pulled. I don't believe in this. I believe in laying the cards out on the table and discussing things and working things out.

Miners are hard-headed by nature and mining is a tough business. Every one of you that are miners know it. There's nothing easy about it. We have an awful lot tied up. Our lives and everything we have, in many cases, are tied up in equipment and our mining property. We're trying to be productive and provide a living, provide a resource for the other people. I can understand when some of these things come down on us, why we get so upset.

We need to develop a mutual spirit of cooperation and trust. We must have an interchange of ideas. Any efforts by any department in promulgating regulations must be in the open. If there's anything that gets me madder than having some of these regulations try to be slipped past us, I don't know what it is.

I know that in many cases on these regulations, they have certain statute requirements, as far as publishing notices. In many cases, these things are done. But a lot of times the word does not get down to us, and we just manage to catch these proposed regulations at the last moment. I feel that it is important when these departments are dealing with problems that face the mining industry, or any industry or other individual, there should be input. There should be proper notice and an effort made to contact the parties concerned.

The main comment I have is that government is made to serve the people. It's not the people's function to serve government. These regulations are costly and non-productive. It is the miners job is to police their own industry. In order to remain free, we must stay ever alert. Vigilance is the price of freedom. I'm urging every one of you to be vigilant to keep your freedom. Thank you.

(Questions and Answers)

Roger had the philosophy, so I have the questions.

Q I'll start with Mr. Johnson of the BLM. There is an urgent need, Mr. Johnson, for a statewide Alaska map, giving land status in a generalized way. What's the BLM doing about it?

A Carl Johnson: I'm sure glad you asked that one, Mark, because I brought a map today and finally decided it was too small a scale for everybody to see. But, it's out in the lobby. We just finished making one today that shows national parks, and fish and wildlife refuges. The colors are drawn in. Those remaining under BLM and, there's another adjoining map that shows state-selected lands, where they stand as far as PA goes and so-forth. We don't have a consolidated summary of all of the Native-selected lands. You'll have to assume they're scattered throughout all of it. But, there is a map in the a lobby at the far left door as you go out. We'll have some folks interpreting there if you want to stop and look. I apologize for not having them here at the start of the conference, but frankly I just put it together this morning.

Q Well, fine. We're glad your're working on it. The next question is: We've been working with the State people and they have an overlay map system where they are using tracings now on their land status sheets. Is the BLM working on something similar to this? It started with the Bureau of Mines.

A Johnson: Yes, we're headed that way. That's one of the things I cut out of my speech when my ten minutes were up. I did want to talk a little about some of the tools that we have available for miners in our Fairbanks office as well as in Anchorage.

To start with, we have a series of computer listings that show where mining claim numbers and so-forth are. I think the most useable tool was just completed this winter on the USGS quads. You can go in now and they can give you a listing of all the mining claims, or any other claims that will land within the GSA quad. We're not to the point yet that we can map those, but we're heading that way.

Q Fine. Now, one more question. Will you enlighten us about Secretary Watt's announcement yesterday?

A Johnson: All I can really say is that I understand he announced that he intends to reopen the Steese White

Mountains area, which was closed in the Alaska's National Interest Lands legislation. The way I read that, and I have to go on my own interpretation, the portion that we're talking about provides for immediate closure for five years, while the area is being studied for all multiple uses, all right? It does say "where consistent with land-use plans for the area, mineral development may be permitted". The secretary, as I perceive it, intends to short-circuit that normal planning process.

Q Mr. Haines, you actually attended the AMA meeting last fall. So, in a way, you've got a start on some of the things that we want to stress. Is there any need for compulsory forms? Really, the AMA is opposed to compulsory forms. We don't mind having a form that says, "this is the model that should be followed." But a compulsory form means that a prospector out in the bush in a tent would have to go to town to get a form.

A Haines: I would hope that forms would be available before they went out to the mines. Our interest in this is not to try to make everybody operate off a set of forms just for that reason alone. Remember we are talking about property rights here. Our interest is in getting them accurately described.

Frankly, some of the ones that come in make it difficult to do that. Consequently, with respect to any kind of compulsory form, it's compulsory to make sure that the property interest is accurately described so that it is properly recorded and therefore protected. That's the only reason for doing it in the first place. We're talking about a property management system.

Q My next questions concerns state classification for multiple use. The mining industry is alarmed about the classifications for multiple use that excludes mining.

A Haines: Our cost benefit analysis study includes the cases where mining is excluded. I take it that wasn't the right answer. Okay, I'll try another one. Actually, the short answer is I expect we're going to re-do our classifications very shortly to make them a lot simplier. To try to be very specific about what objectives we're promoting on state lands. I'm talking about commodity interests. Right now, a large portion of the State is open to mineral entry. The only places, in fact, that I know of in the last year or so that we've closed to mineral entry have been areas that we put up for land disposal.

Q Okay. My third question pertains to 6-I. As you know, we miners are opposed to 6-I and we're glad to hear you are. Actually even the present leasing is not a desireable way to go because we have great difficulty in financing and in trying to develop the properties. We actualy can give an example where one prospector applied for a lease 20 years ago and still doesn't have it.

A Haines: I take it that's a comment and not a question.

Q Mr. Cole, We're glad to see that the DEC and EPA are working towards one permit. Is there any attempt towards working towards one agency?

(TREMENDOUS AUDIENCE RESPONSE)

A Cole: I wouldn't want to comment on the recent efforts of Mr. Reagan to do some reduction in government on the federal side. There are a number of programs that the state agency can take over, one of which is the Federal Discharge Permit. Rather than eliminate the EPA, perhaps it would be better for the State to take a look at running that program in cooperation with EPA, so that you would only have to deal with one environmental agency.

Q You were speaking about setting up standards and methods for standards. There's a problem when the government agency does the research work for the standards. If we miners submit material, you say, "Well anyone who belongs to the Sierra Club or the Friends of the Earth is also biased on the other side of the issue." I think you should look into using University research facilities and having this research done where it would be without question, unbiased research...

A Cole: I couldn't agree with you more. The last two years, I have been working with our Congressional Delegation to try to get research money poured into the State for research on specific Alaskan environmental problems. We've been pretty successful. Each year, there has been a million dollars available, some of which is coming to the University for cold climate research. Recently, one of the key members of the Legislature suggested that we try to put together a proposal for research on the effect of placer mining on streams and on the environment. Perhaps working with the University or some private researchers.

Q The next question that I have for you pertains to specific streams. In your statement, you more-or-less theorized that there were certain things on the

streams that had to be protected. We feel that we've gone beyond the theory state on this. Is there any move towards the cost-benefit analysis on each stream?

A Cole: No. Frankly, the department's not funded to do that, (which is the typical bureaucratic answer that you'll get to a hard questions.) We do not have the capability or the funds to do that, at this point. That is one of the difficulties with developing a classification system. When you develop water quality standards under any regulatory program you have two ways to go. We could have gone stream by stream, which would have been a very long and expensive process, or we could have gone statewide and then set up a process for reclassification as people were ready to come in and take a look at the specific streams. We chose the later case, because it was frankly the only way we could do our job in getting the standards in place. But, we do have a system whereby the streams can be reclassified to a lower use or to a better use if that's appropriate. We do entertain those reclassification efforts; however, we have not initiated any.

Q Mr. Grundy, you know, we miners are in favor of protecting salmon. In fact, I think in the past, when we've had votes on the protection of salmon, the mining areas have had the highest percentage of people voting for the protection of salmon. On the other hand though, we pretty well feel that some of the regulations that are being promulgated go far beyond protecting salmon streams. We feel that there should be an attempt to name the streams that are important for fish, other than salmon. They should be specified because we've gone through years of trying to have the salmon streams specified, and all the Fish and Game people do is list every stream that they can think of in Alaska.

A Grundy: All right. The department is coming out with a new catalog listing salmon streams. The Legislature has funded the department to be more definitive. In the Interior, for example, we've listed drainages such as the Yukon. If we were to cover Region 3, we could list some of the coastal drainages. This would certainly not be definitive to the miner or to anybody else. So what we've done in the past is try to be more definitive, but currently our jurisdiction affects the whole drainage if we list it. For example, we have the Chatinika River, a local river. With the new catalog, we'll define those portions of the stream which are important to spawning. By regulation, we're addressing only the fish passage issue in the tributaries. The other part of your question goes beyond our area of jurisdiction. I've got a tough job here. I'm trying to sell this group on the advantage of regulation. Right now, without regulations, we're operating with essentially a blank checkbook. I can essentially get away

with many, many things in this area where maybe someplace else in the State they do something differently. What we're trying to do by regulations is to define the areas of authority; place limits and establish statewide consistency. From that perspective, I think the regulation process is very good, and it is obviously essential that we have to have a very candid and real exchange to make sure that we aren't expanding beyond our jurisdiction.

Q Has the Fish and Game Department ever considered defining areas of major mining potential and excluding those areas from its regulations?

A Grundy: We've considered it. We have no process for doing that. For our new catalog, in addition to defining areas, we're also deleting those areas which should not be included in the anadromous catalog and then adding those which should be. We're, at this time, considering deleting the 40-Mile and Birch Creek drainages, because we have not been able to document the presence of salmon in those areas. So, it's a credibility process.

Q Representative Bettisworth, the Alaska Miners Association supports an advisory board for mining, because there are advisory boards for the fishing industry, for agricultcural and so-forth. Is there any move in the legislature to create such a board for mining?

A Bettisworth: No, not to my knowledge. On the Senate side, there's a Senate Bill 32 that advocates an advisory board to work with the BLM on regulations but to date, no, there hasn't been, to my knowledge any introduced legislation to advocate an advisory board for miners. I would say it ought to be done.

Q I would have another one for you then. The State has had on the books for many years a miner market road program. It actually doesn't cost the taxpayers more than 50 cents on the dollar. The miner puts up the other 50 cents. We have not seen a penny of funding for the Miner Market Road program in years and years. Is there any attempt to put funds in the Miner Market Road program this time?

A Bettisworth: There's going to be. I got interested in that program a couple of weeks ago. I can verify that your statement is correct; there hasn't been activity along those lines. I've got research going on in

Juneau, right now, to find out what was done in the past and see if we can't get it revived. I have some support down there for that.

Richard Wien: Just a real quick observation. I think there are more people here who have more to say than I do. Probably, next to government regulations, one of the biggest obstacles the mining industry has to overcome is transportation. I've been in aviation transportation for 25 years, actively. In fact, one of the first jobs I had was supporting Bear Creek Mining up in the Kennicot area. One thing that I have observed is other than exploration and perhaps transporting out concentrates such as gold and other precious metals, there just isn't going to be any mining industry in Alaska, unless there's a transportation system to handle it. Even roads, in some cases, are not an economical system.

I remember, years ago, for Kennicot mining, we did a study in the airlines to see whether or not it was economical to fly copper concentrate out of that area. One thing that became obvious to us right away was that if you can haul one mile more by surface transportation, you were better off than anything in the air. The costs are just staggering and they're going up all the time now with the cost of energy. (Even Hovercraft is not a practical approach to getting any mining product out.)

As I learned in some of the basic college courses in resources, it's really not a resource unless it's marketable. Most of the products that I see in Alaska are not marketable at this time, primarily because of transportation.

Although it's not a regulation-oriented subject, it certainly is government. We see some publicity about the Alaska Railroad and their studies for extending the railroad into Canada. It would seem to me that there is a very good possibility that the State's going to have to take over that railroad. And everybody—the industry and certainly the governor—is going to have to take a look at key mining areas and get that surface transportation in or we're just not going to have a mining industry other than the type we have right now. That's my observation.

Moderator Bettisworth: Very good, Dick. I'm glad you brought up the transportation aspect of it. This is a great state and it has very little transportation systems compared to our size.

We've got a few minutes left. I'm sure that some of you have been sitting out there wanting to ask some questions. See if we can get into it.

Q You mentioned that there was a statute that prevented classifying streams as mining streams. What is that statute like; mechanism?

A Scott Grundy: The stream classification process is administered by the Alaska Department of Environmental Conservation. The Department of Fish and Game is charged with the protection of fish and wildlife resources; obviously not tied to any specific piece of property. To my knowledge, there is no means where the Commissioner can waive the State interest in those rights. He can recommend, through the governor, that he does not want to achieve his charge by statute. What I'm saying does not mean we would ignore fish and wildlife values. We have a statute mandate and we're to achieve that. That's the advocacy issue that was addressed earlier. It's a tough mandate. The governor is the one who will achieve the balance that we all want.

Q When will the stream classification be available to the public?

A Grundy: The Anadromous Fish Streams catalog has been available since statehood. We upgrade the list on a fairly regular basis; every five years or so. This one was published in 1975. The legislature has given us funding for an update. What this is is a list of streams that are important to anadromous fish, those that travel from salt water to fresh water to lay their eggs. The Department of Environmental Conservation can, by petition, classify a stream as essentially "industrial". Correct me if I'm wrong.

Q Bettisworth: Scott, I'm a little bit surprised at that. Wasn't there an amendment to the water allocation bill that passed last year, that required the Commissioner to reclassify streams as to anadromous streams so that we could definitely determine...

A That's correct.

Q How's that coming?

A The mandate is that we come out with a new catalog listing by summer of '82. We're working on that listing now. In fact, this is rather a difficult document to use. It's a computer listing. The new process will have an official document listing, but instead of listing streams, will list (as required by the Legislature) the portions of streams that are important to

anadromous fish. I think there is a meaningful difference. Right now we list the Yukon drainage. Obviously, every little stream that flows into the Yukon is not important to anadromous fish. So, we are going to define it.

We have some problems trying to identify rearing areas. We will be discussing our problems with the Legislature. I think the important thing for miners is when you come in, we'll be able to hand you a blue line quadrangle map, which will illustrate, not only the drainages, but the portions of drainages and the areas of that drainage that are important to fish spawning, rearing, and/or migration. I've got one here that I'd be happy to show to anybody.

Q When are you going to pass laws to eliminate individual agencies with no costs of their own involved that say, "Don't do this." The miner or any type of person in business out in the bush, has spent considerable money, but the individual or some group down there gets up and says, "Stop your mining and whatever you're doing; no more of that." I know we have a lot of reasonable people down in Juneau. When are you going to come out and wipe out all these rules and regulations and say, "Let's start over"?

A Bettisworth: You seemed to be directing that question to me. I'll agree that there are a lot of reasonable people down there, but there's not quite enough.

Q Andy: My question would be to the Fish and Game Department. I'd like to know what legal procedure or what legal rights we have when you say that I'm hurting the fish. I've been here 24 years and there's good fishing in my stream. I believe I don't hurt the fish, and you say I do. One of us has to be wrong.

What legal procedure would I have to go through to contest this regulation? You say I commit the crime; you don't prove that I commit the crime. Can I sue you or hold you responsible if you shut me down? I don't hurt the fish. They don't complain. You say that I do.

A Grundy: We're all held accountable for our actions. What the statute requires of you as a miner is that you come to us for a permit if you're going to affect the stream. As I recall, we have only said No to one miner in my administration of the permitting system. What we're trying to do with these regulations is to define the limits of our authority, so that you can see it in writing. It won't change the necessity for a permit. In fact, as I mentioned earlier, we're trying to expedite the process.

But, yes, we all are accountable; and we definitely are trying to be reasonable. I think the history of the Department of Fish and Game shows we've had a good relationship with the mining community.

The regulations don't change the law. They don't expand the statute requirement of the department. They're merely definitions. I urge you to take a very close look, as I said earliler, at what we're trying to do. I see some advantages. If there are disadvantages to you, it's vital that those disadvantages be communicated to us.

I, for one, am very serious about wanting to make this situation work. I'm the chap who will receive your complaints at Fish and Game. We are striving for a reasonable balance. It's very difficult, when I confront industry, I'm viewed as a rabid environmentalist. When I sit in front of the ultra conservative conservation group, I'm viewed as being "in the pocket of industry". I'm sure every member of this panel can identify with that. That tells me, hopefully, that we are achieving a reasonable balance.

Bettisworth: Andy, if I may respond briefly. Certainly, you do have recourse through the courts if your operation is damaged in any way. Of course, it's a costly, cumbersome, time-consuming thing. Hopefully, the Legislature, with enough pressure on the regulation writers, can bring us some of reasonable regulation.

While we're on the subject, there was a landmark court decision made down in southeastern Alaska here about a month ago that may not have made its way up here to the Interior. There was an environmental group that shut down a timber operation in Haines. The timber operator took it to court; won the suit and made the environmentalists pay court costs. I think that's a real milestone in equal rights under the court. Previously, anybody could file suit and seemingly not be responsible for their actions. This is setting a precedent in the court system in Alaska; if you do in fact sue somebody, you are responsible if you happen to lose. I think that's going to have a lot to do with the question you asked.

Q How quickly are you going to enforce the Water Quality Standards regulations?

A Grundy: Our regulations, as we're proposing them, will have no increased costs to the taxpayer. The enforcement of the Water Quality Standards still rests with

the Department of Environmental Conservation. What we are doing with our new anadromous catalog will be a notice to everybody of where our concern is for anadromous fish and will also be a document used by the Department of Environmental Conservation.

Q Can you go down a wild and scenic river with what they call a recreational dredge without a permit?

A Lamoreaux: You don't need one from D.N.R.

A Johnson: Apparently you need one from Fish and Game if it's listed anadromous stream. In our regulations, we're trying to cover that with a general permit, so you personally would not need a permit; you'd already be permitted.

Q Okay, how about federal lands?

A Lamoreux: Well, once we get our general permits issued, there will be a general permit coverage, automatically. I guess in the strict definition of the law there's no minimum size that falls outside the requirement for permit. We have received applications from people with small suction dredges, although we haven't really concentrated on that activity.

A Johnson: As the only federal land manager here, I should comment on that. Within Interior Alaska, the BLM has several wild and scenic rivers, some of which are common recreation dredge operation areas. There's been a lot of confusion among the state and federal agencies trying to define recreational mining. We had some real conflicts up at the 40-Mile last summer between miners and quote "Recreation Miners". We're right in the middle, as usual.

We're still trying to come up with a definition of where you draw the line between the recreational miner you described, and a true miner who is out there on his claim. Most of the recreational miners do not have claims. They're mining the bed of the river. There are some legal issues here that have never been resolved, frankly. The bed of the river on a navigable stream belongs to the State of Alaska. That throws open the whole question of navigability too.

So, there's no easy answer for you. At the present time, you're clean. There are some legal issues now pending that ultimately, I hope will be pinned down. It may end up in the courts as a lot of these sticky things go. Who really owns the gold in the bed of that river?

Q What is the time limit in which you have to send for the new state Miner's License?

A Johnson: Let me answer first. What I tried to say earlier was that BLM's limit is 30 days, if you have to file a plan of operation. I didn't make it clear that we are using a multi-agency form. We have been since last year. Bascially, the BLM and the State of Alaska are now working together. It can be filed in one location; leave it up to us to get it filed at the right agency. I'd say that our 30-day notice fits for those federal claims on BLM lands.

Q Bettisworth: Do we currently have a minimum time frame required for application on state lands?

A Grundy: No. There's no minimum requirement, but currently, the administration is trying to set limits on the amount of time it takes an agency to process a permit. Four state agencies and then the federal agencies added to that application will set in motion all the permits that you need. Some of those will be issued in 30 days; some will be issued in 60 days. So, presumably within two months, you should have all the permits you need. One system is up and running, and the other is just about up and running.

Bettisworth: To add to that, there was a permit bill in the Legislature last year that was advocated by all miners and everybody else that's involved with permits—it went all through committee and it died the last day of the Legislature during a fight between the House and the Senate. I have resubmitted that bill. It creates a window; it does establish a 30 day limit where the State has to give you your permit or show cause why not. So, if you want something to push, remember House Bill number 415.

Q There was mentioned earlier a need to develop a transportation system. With the funds from the oil companies pouring into the State, have there been any moves made in the state legislature to have the State take charge of development of a transportation system?

A Bettisworth: There are a number of advocates developing primary access roads; mineral access roads all over the State. Senator Bennett and I have put together a list, two pages long, of those in which we feel the State should be putting its money.

Q I have a question of Scott Grundy. After you come out with the new catalog—if we disagree with your classifications what procedure do we go through to correct that?

A Grundy: Before we come out with a new catalog we will go to a public hearing. That's your forum for disagreement or questioning what we're doing. I attended the public hearings, for example, in 1974, prior to the issuance of our current catalog. We'll be explaining additions, deletions and changes in our method of presentation. This will be in public notices. I assure you that I'll go out of my way to make sure that the mining groups are advised, as we did this the last time.

Q I have a question of Mr. Haines. Could you withdraw your request to the Attorney General regarding an opinion on mining claims on state-selected lands?

A Haines: Even if we withdrew the request, it wouldn't make any difference, because the answer we got back was more than what we asked. Secondly, to the extent that it has been brought up by the Attorney General's office, it is "out of the bag". We're merely standing here as a title company, wondering whether what we're giving out or allowing to be filed is, in fact, legal. If it is, that's fine. I'm sure you'd agree this is typical of bureaucrats—we don't want to do any more work than we have to. The last thing we want to do is convert tens of thousands of mining claims to leases. If the question can be resolved without having to do that, fine. But withdrawing the request for an opinion, is not an option.

Q Why can Canadians come over to Alaska and mine our gold and take it home with them, and Americans can't go into Canada and mine their gold and bring it back over here?

A Johnson: All I can say is that's the first time I've heard the question. It's really a State Department issue, I think. If a foreigner files a mining claim, we have no requirements that they even make a statement that they're U.S. citizens.

END OF CONFERENCE