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March 30-31, 1982

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Fairbanks, Alaska

School of Mineral Industry

and

Alaska Miners Association

An abridged format of papers, presentations
and addresses given during the conference
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WELCOME

Earl H. Belstline
Dean, School of Mineral Industry

Placer mining is the foundation of Alaska's heritage, economy and society. Placer mining was never easy, but rather involved hard work, creative thinking, innovative methods, and a challenge every step of the way to the cleanup. The outdoor life appeals to the miner, and he obtains great satisfaction upon completing a successful season, perhaps defined as: 'When the income exceeds the expense'.

FAIRBANKS, THE MINING AND MINERAL CENTER OF ALASKA

Ron Davis
President, Fairbanks Chamber of Commerce

I'd like to welcome you today by asking a question: Where is the mining and mineral center of the State?

In October of last year, the Greater Chamber of Commerce recognized the need to take a strong stand in support of the mining industry in Alaska, and to make Fairbanks the mining and mineral center of Alaska. At present the Chamber is putting together the structure and people needed to form the necessary policies, goals and objectives for this new committee.

I need not remind most of you of the important role mining has played in the development of Fairbanks, since its founding in 1902, when (on July 22 of that year) Felix Pedro made Fairbanks famous by his discovery of gold 16 miles from the here. In 1906, the production of gold in the Fairbanks District was valued at more than \$9 million. The population at that time was 3,541. Today, it's 25,500 in the city and approximately 55,000 in our Borough.

Between 1919 and 1920, the exhaustion of the initial gold discoveries and the difficulty of mining the deep veins led to a decline both in mining and in the population of Fairbanks. In 1923, the government constructed the Alaska railroad, connecting Fairbanks with Seward on the Coast. At the same time, the United States Smelting, Refining and Mining Company began a large scale placer gold mining operation.

This economic stimulus resulted in a steady population growth that reached 5,571 in 1950. Increased spending by the Federal Government for national defense, Alaska Statehood, and the discovery of oil on the North Slope have been more recent economic stimuli to Interior Alaska and the State.

During all this time, mining has continued to play a significant role in our economic growth and development. With our geographic location at the center of the State, and the great many other known mineral deposits that are waiting to be developed, we see Fairbanks as the best possible area for the location of mining exploration companies, support facilities and services to the mining industry in this coming year.

The Chamber pledges its full support to the economic growth and development of Interior Alaska, the exploration of its minerals and mining potential, and the construction of utility corridors to facilitate this development. We hope to encourage the mining industry to locate here in Fairbanks.

As President of the Greater Fairbanks Chamber of Commerce, it gives me great pleasure to welcome each one of you to Fairbanks and this Fourth Alaska Placer Mining Conference.

Thank you very much.

THE ECONOMIC IMPACT OF PLACER MINING IN ALASKA

Dr. John Sims
Director

Alaska Office of Mineral Development
Department of Commerce and Economic Development

I don't think anyone in the State truly knows what impact placer mining has on the economy of the State of Alaska. This is attributable to the fact that there isn't any comprehensive or reliable information available on the subject.

I could, at this juncture, address the substance of my topic with a one-word response - "considerable". The economic impact of placer mining in Alaska is considerable. With that, I could sit down and call it a day.

We've all been put to sleep listening to people quote statistics to prove they do know something. I'm going to quote some statistics to prove how well we don't know something, that something being the economic impact of placer mining in the State.

Here's a good one. In 1981, State-wide gold placer production was estimated at 18,000 ounces. That's a published figure. Now, just looking around this room, if there isn't that amount of production just coming from the people sitting on the far side of this auditorium, we might as well all go home now.

Here's another statistic. This one sounds reasonable at first. I'm sure you'll nod your heads. There are some 5,562 people gainfully employed gainfully in mining in Alaska. When this figure is broken down by geographic regions, however, it turns out there are 2,500 miners on the North Slope. That's one stampede that I, for one, haven't heard about. Then there are another 800 or so miners splashing around Cook Inlet. Now, I knew that there was, and there is, a very interesting placer in the tidal lands of Point Woronzof on the approachway into Anchorage International Airport, but I had not realized just how many of you were involved. If we pursue these statistics a little further, we'll find that in the same census there are only 54 people involved in mining in the Fairbanks district.

Now, my point, and it's important, is not to make fun of people who put these statistics together. They make assumptions, design their methods, collect data and publish what they get back. And the two statistical summaries of surveys which I'm quoting from, in addition to getting back some inaccurate data, such as I've quoted, also get back a lot of accurate information. The same reports can tell you the value of timber harvested in the State, the value of sand and gravel produced, the value of this year's fishery harvest and the value of the State's agricultural production. Why is this important? Let me give you an example, an unfortunate one, but very true and very relevant to our time. A recent international news item came over the wires concerning the unfortunate fate of a Belgian who died from eating a contaminated can of Alaskan salmon. At this very moment the State Legislature rightfully is beside itself trying to figure out what it can do to keep this year's salmon harvest from becoming a financial disaster. The sort of figures being mentioned in the Legislature the last I heard were on the order of \$300 million. The governor even volunteered to go on the road assuring international communities and consumers overseas that one contaminated can of salmon doesn't spoil the whole lot.

I think the efforts of the governor and the Legislature are appropriate. Some of the most dynamic economies in the world, some of the countries with which we look forward to doing business around the Pacific Rim, have developed their economic prosperity with strong governmental support.

Now let's examine the response to another possible news item. That news item, probably very relevant to the concerns of the people here--Gold price falls below \$300. Did you hear much clamor from Juneau? Chances are you may see some commentary in the press from Mr. Peter Bushre saying how comfortable he was with the \$45 million investment made in gold on behalf of the State Employees Retirement Portfolio at prices in excess of \$600 per ounce, and how mysteriously in a falling market he has made a large sum of money for the fund (the figure mentioned

is \$16 million). Probably the only noises you heard were growls from the lien holders on the equipment.

Now I'm not suggesting that the State of Alaska should subsidize gold producers in the event of this sort of scenario—I certainly know that's alien to your thoughts and principles. Nor do I suggest that the governor should tour the Mid-East urging oil sheiks to hold onto their gold ingots. But the point I'm trying to make is that if legislators and administrators and community leaders and John Q. Public don't have any idea what placer miners contribute to the economy, they, for the most part, won't care what happens to placer miners. There may be some very good reasons for maintaining a low profile, but there may be some better reasons for making your economic impact known. It is mainly a question of constituency and clout. The mining industry in its total spectrum from the small operators like most of you here today to the big guys; U.S. Borax, Anaconda, Noranda, Cominco and Bear Creek, etc. must cultivate that constituency, that essential clout, whereby it will be heard.

The clue, I feel, is to communicate to the public at large the tangible basis for stating - "Yes, mining is extremely important here in Alaska" and attach some meaningful numbers to backup that assertion. We in mining have one great advantage over the oil business, which came in from outside and, some would say, 'suffered the fate of not having a concerned constituency when it came to dealing with government and the general public'. Mining, in contrast, is a major part of the heritage of Alaska. Alaska is a mining state, and there are a lot of people who do not appreciate the fundamental issue and who deny the benefits of mineral development. Our best weapons are forthrightness and the dissemination of information which really do translate those benefits into hard, factual data.

I was holding back on you earlier. There is some good, although incomplete, information available on placer mining if you dig it up. The Tri-Agency permits you began filing out in 1981 will provide some interesting figures. In the Interior area, according to those permit applications, there were some 245 placer permits not counting suction dredgers. These operations intended to employ about 1100 people. That means the average placer mine employs 4.5 people.

That sounds about right, and when you count them on your fingers, the first is the guy who feeds the box, the second stacks the tailings; the third does the stripping; the fourth hooks rocks. Then we come to the remaining one-half employee—he's the fellow who spends half his time in town, and when he does come back to the mine, brings the wrong parts and forgets the tobacco. However, that guy cannot really be classified as an employee—he is the owner of the property.

Why is it important to know that the average placer mine employs 4.5 people? Because, when a government agency draws up land-use regulations, restricting mining activities, you'll be able to tell your legislators just how many people could be put out of work.

While you're at it, you can tell them how much diesel fuel you won't be pumping into your equipment, and how many groceries you won't be consuming, and how many new pickups you won't be buying. I think you get the picture. It all adds up, and it's important to a lot more people than yourselves. That is where the count comes in - we will be listened to just as the fishermen are being listened to when it comes to botulism and the economic effects of that unfortunate incident.

Here's a question that the City of Fairbanks and the North Star Borough would like to know the answer to, but at this moment do not. What is the total value of goods and services purchased by placer miners in the Fairbanks area? In response to that question, we can certainly do some qualified guessing. After some canvassing for information on the subject, a fair estimate of the value of fuel and lubricants that were sold to miners in Fairbanks last year was about \$4 million. Assuming fuel and oil represent something in the range of 10% to 15% of your total operating costs, that would mean that the total value of goods and services purchased in Fairbanks would be between \$30 and \$40 million. That may be a trifle low or high, but it's about the best we can do at the moment. My point is that there are quite a few people who would like to know with a greater degree of certainty, and if we knew with a greater degree of certainty, we would have a lot more clout and credibility.

I have heard from knowledgeable sources that probably 50% of all heavy equipment sales last year in the Fairbanks area were to placer miners. That's a pretty significant figure to a city that is largely dependent on governmental activity for its present economic well being.

I've heard about some initiatives, which I personally laud and support, by the School of Management at this University under Dean Phillips, to undertake some research on this very issue. I certainly hope that efforts such as he is trying to mount are successful in quantifying that term "considerable" which I used to prelude my presentation and describe the economic impact of placer mining in Alaska.

I'm going to discuss one more statistic. Earlier, I quoted a 1981 total gold production figure of 18,000 ounces. The State Geological Survey has spent some time canvassing operators around the State in order to get a more realistic figure. They tried to get estimates from three miners in every mining area of the State. As a result of that survey, they came up with an estimated 1981 gold production of over 128,000 ounces, though they do believe that that figure is conservative, and I would certainly share that belief.

This figure was up from an estimate for the previous year of 75,000 ounces in 1980. Even though these figures may be conservative, they indicate a milestone in gold production in Alaska. While historical production has been greater in terms of ounces produced, the value of the production, using current 1981, has never been higher in the history of the State. In fact, the value of 1981's production was more than twice the previous annual high set in 1941. This statistic deserves some attention, and it's important to a lot more people than those of you working the creeks.

As I said earlier, there have been good reasons for placer miners to maintain a low profile. I suppose, if the gold price continues its descent, many of you won't have much choice in the matter, but if the industry continues to prosper and grow, along with the prosperity that will be engendered there will be pressures. You may be anonymous as individual operators, but that does not mean you are invulnerable.

One way to insure that you are not politically isolated is to demonstrate to your communities your economic impact. To do this there is no reason why confidential information need be exposed. Operators from a local area could pool their information and forward it to the local headquarters of the Miners Association. From there, it could be assembled into meaningful statewide community specific figures.

Now, I'm very interested in the information I hear about attempts to organize and get meaningful representation for all the mining districts in Alaska. I would certainly like to see those groups generate some meaningful hard data.

This information would be invaluable in gathering support for the miners' position on matters such as land use planning, water quality regulations, road improvements, infrastructure development, etc. I intend discussing these ideas with the officers of the Miners Association and will offer the assistance of my office in any way needed in an effort to generate some solid placer mining information. Such efforts involving the gathering of factual information under the auspices of the Miners Association, followed by the synthesis and distribution of that information to focus on the issue before us is a most appropriate function for the office of Mineral Development which I direct. For you, it should be a pleasant chore to be involved, for a change, in a project which stresses cooperative effort between the private and public sectors.

And this, I might add, is the way I operate within my office, to build bridges between the public and the private sectors, not to create barriers.

If we're successful in this, I'll be prepared next year to give you a real talk on The Economic Impact of Placer Mining in the State of Alaska. In the meantime, while the rest of you are enjoying this conference, I'm contemplating one of two actions, either heading north to the Slope to stake some claims up there before it's too late, or perhaps heading south to Anchorage to try and stake the airport before they put a mineral closing order on it.

Thank you very much indeed.

PLACERS OTHER THAN GOLD

James Madonna
Mining Extension, UAF

It's been said many, many times that placer miners are the most optimistic people in the world. And, today those of you who are sitting in this audience are living proof that this statement is true.

Let's take a look at what's happened. Over two years ago, gold reached its peak at approximately \$850 an ounce. Since that time, gold has plummeted and is now hovering around \$300 an ounce. Yet there are more of you attending this conference than any previous Alaskan Placer Mining Conference. All the old, seasoned veterans are here, and disseminated among you are many new people just now entering the placer mining industry.

Your one common goal is a desire to extract gold values out of those sands and gravels. Before we launch into the topic of this presentation, placer deposits of valuable minerals other than gold, let's look at a question that all of you have heard before:

What pops into your mind when some newcomer asks, "Did those old-timers leave anything behind?" The first few times I heard this question, the image I got was that of an old, wrinkled, arthritic prospector with a pack on his back, and one foot in the grave, bent over taking a pan of gravel from some remote Alaskan stream; however, after a moment of thought, we become aware that this particular question has a two part answer.

First of all, what was the real condition of those earlier, pioneer prospectors? And, secondly, what, if anything, did they leave behind?

To answer the first part of that question: Certainly, some of the early, pioneer prospectors were in their 30's and 40's, and even in their 50's. By the rules that govern natural selection, these early pioneers of the north either were strong enough to persevere or they turned back before they ever reached the gold fields. Furthermore, of those early pioneer prospectors that came to Alaska and later to the Klondike and to Nome, only the most hardy and persevering had the stamina to invade this vast, untouched wilderness in search of new deposits. It can now be said that there is hardly a stream that is untouched by the prospector's hands, or a forest that has not heard the blow of his axe or the sound of his whipsaw as he prepared the lumber for a rocker or sluice box.

Evidence of his passing exists all the way from the semitropical jungles of Southeastern Alaska to the very shores of the Arctic Ocean in the north.

And now to answer the second part of that question: What did he leave behind? An incident that occurred a couple of decades ago on the Seward Peninsula might shed some light on this particular question. A couple of miners, mining by the hand sluicing method on Gold Run Creek, (a creek by the way that had no previous record of placer mining activity), were experiencing rather meager returns from their efforts. They were seriously debating the value of the project. Their decisions to abandon the operation came late one afternoon, after a hard day of sluicing, when they discovered an old, rusty loaded revolver caught up in the ruffles of their sluice box.

Now, perhaps this story has a somewhat hidden meaning and doesn't tell the true story of exactly what the old-timers left behind. Certainly, they left many valuable minerals behind. But, we have to keep in mind that these early pioneer prospectors were after just one mineral. They weren't after copper; they weren't after tin; they weren't after scheelite or any other mineral which might have modern-day value. They knew and they understood how to mine and sought just one mineral, and you know that mineral was gold.

Generally, where they sought it, they left little behind that could be mined by similar, available methods.

However, with time, conditions and needs change. By the second decade of the 20th century, the U.S. Geological Survey had published much information regarding the geography of

Alaska, and had begun inventorying its mineral wealth. By 1974, they published a map on the metal provinces of Alaska. A metal province is defined as any area the size of an entire region or as small as a single mining district that has, within its limits, an anomalously high concentration of metals or metal.

For example: The gold province of Alaska occupies the entire State, with the exception of the North Slope. Within this gold province exist geographically smaller metal provinces. Within these geographically smaller metal provinces, exists valuable minerals other than gold, which might be of benefit to the placer miner. But, this benefit is of a three-fold value. First of all, these minerals might be valuable to placer miners as a by-product of the placer gold operation, sometimes referred to as 'sweetener'. Secondly, these minerals may be the primary purpose of the placer mining operation, and gold may well be the 'sweetener'. Finally, these minerals may serve in leading the placer miner or the prospector to the location of valuable lode deposits.

Figure 1 shows the location of the metal provinces in Alaska which might be important to the placer miner. These include the copper province located in eastern Alaska; the mercury province which occupies the Kuskokwim River region; the tin provinces, one of which lies on the Seward Peninsula, the second of which is in central Alaska near Tofty. There are two tungsten provinces, one on the Seward Peninsula and the second in the Fairbanks region, and finally the platinum province in southwestern Alaska at Goodnews Bay.

The Copper Province, located in Eastern Alaska, has a very interesting history. Over 690,000 tons of copper have been mined in Alaska, most of which came from the Kennicott lode deposits in the copper province near McCarthy. The sequence of events that led to the discovery of these copper deposits began as early as 1885, when Lieutenant Allen of the U.S. Army was dispatched to explore the Copper River, and met Chief Nikolai of the Copper River Indians. With Chief Nikolai as his guide, Lieutenant Allen led the first effective exploration of the Copper and Chitna Rivers.

During this exploration, Chief Nikolai recognized the many signs of mineral wealth in the area. In addition to this, Chief Nikolai showed Lieutenant Allen copper utensils, bullets made from copper and silver alloy, huge copper nuggets and Chief Nikolai's very own lode deposit of copper.

Thirteen years later in 1898-1899, the winter was very fierce. Chief Nikolai and his people had run out of food; Chief Nikolai himself had fallen ill. About this time, a group of prospectors came into the country in hopes of persuading Chief Nikolai to show them the location of his lode vein of copper. The men sat around for hours negotiating. The rather dramatic results of this pow-wow was that Chief Nikolai, during a period of famine, sold a multi-million dollar copper mine for a single cache of food.

The efforts of the prospectors led to the discovery of several lode deposits, and as you might expect, ultimately to the discovery of valuable placer deposits. The first valuable placers in the Copper Province were discovered in 1901 at Dan Creek, the next a year later on Chititu Creek. These discoveries sparked a stampede into the area, which led to much claim staking and ultimately to the formation of a short-lived town on Chititu Creek. All the creeks in the area carried gold, but none were as profitable as either Dan or Chititu Creeks. As a point of interest, Dan Creek has the longest and essentially continuous history of mining activity of any creek in Alaska.

Both native copper and native silver accompanied the gold in Dan and Chititu Creeks. The native copper occurs as copper colored nuggets, or more commonly as copper nuggets coated with a green coating of malachite which accumulates in the bottom of the gold pan. The size of the copper ranges from very fine shot-like particles to nuggets weighing several hundred pounds. Of special interest is the 5200 pound copper nugget that was taken from Dan Creek in 1939. Around the base of this particular copper nugget there had accumulated smaller copper nuggets, many gold nuggets, and considerable gold fines. This particular copper nugget is now on display at the University of Alaska Museum here in Fairbanks.

During the mining operation on Dan Creek, the miners collected several tubs of fine native copper with each cleanup of the sluice box. This fine copper made extracting the gold difficult. This was because the finest of the copper had to be separated from the gold by hand.

Interestingly, the copper nuggets from these creeks commonly contained native silver, but even more interesting was the fact that native silver nuggets weighing up to seven pounds were collected from both Dan and Chititu Creeks. However, where native copper and silver occurred in the same nugget, native copper predominated, and the silver simply acted as a very palatable sweetener.

Others creeks that have yielded native copper include the creeks in the Willow Creek District, the Hot Springs District (Sullivan Creek carried native copper), the Rampart District (Little Minook) and the adjacent creeks carried copper, and in the Koyukuk District, where native copper nuggets weighing up to seven pounds were collected from Mule Creek.

Now, the big question: If you've mined native copper, what's it worth and where would you market it? If you could get a ton of copper in a 55 gallon drum and the copper was worth 80 cents a pound, the drum would be worth \$1,600. But, if in addition, that native copper contained just one percent silver, the silver value alone would be \$1,900, thereby giving the drum a value of \$3,500. Now, if you've collected 10 drums worth \$3,500, where would you market it? You'd market it at Asarco, Inc., P.O. Box 1677, Tacoma, Washington 98401.

Unlike copper which lends itself simply as a sweetener to a placer mining operation, cinnabar, the bright red ore of mercury, has been mined as a primary mineral in placer mining operations. Cinnabar is recognized as a bright-red sand tail which accumulates in the bottom of the goldpan, or possibly as larger pebbles or even angular fragments, which have eroded from the outcrop.

The first cinnabar was discovered in Alaska by the Russians in 1838. During the transfer of Alaska to the United States in 1867, Russian officials were a bit vague about the source of the fine cinnabar samples collected by their explorers. They suggested that the cinnabar had come from the Alexander Archipelago in southeastern Alaska. However, subsequent investigation has revealed no mercury mineralization in this area, and it is now generally believed that the cinnabar came from the Kuskokwim River Region.

Over 35,000 76-pound flasks of mercury have been mined from Alaska. Over 20,000 of these flasks came from the Red Devil lode mine located in the central portion of the Kuskokwim River Region. This lode was discovered by Hans Halverson in 1933 by panning the sands of a small creek, which overlaid the deposit. Because the lode was overlaid by 10 to 20 ft. of cinnabar bearing sands, Halverson employed six men to sluice the sands from on top the lode. The result of this sluicing operation was the accumulation of over 75 tons of high-grade mercury ore, while simultaneously uncovering one of the most valuable mercury lode deposits in the State.

Other creeks where cinnabar has been placer mined include the creeks at Marsh Mountain in the Bristol Bay region, Aniak district; Cinnabar and Bear Creeks in the Bethel district; and Rainy Creek in the Iditarod district. Many creeks of the Flat area contain cinnabar, as does Candle Creek in the McGrath District. The beach placers at Bluff, on the Seward Peninsula, also contain mercury.

Now to answer the big questions: If you could get a ton of Cinnabar in a 55 gallon drum, and the Cinnabar consisted of 76 percent mercury at \$400 per flask, that drum would be worth \$8,000. If you had 10 barrels worth \$80,000., what would you do with them? In the past, placer miners have retorted the mercury themselves and sold it to other placer miners within the state for amalgamation.

Tin, like mercury, has not only been mined as a sweetener in placer mining operations, but also as a primary mineral. Cassiterite, the primary mineral of tin, is recognized as light to dark gray pebbles which accumulate in the bottom of the gold pan. Cassiterite was first discovered by the U.S. Geological Survey in 1900 on the Seward Peninsula. From 1900 to 1911, cassiterite was mined in small-scale placer mining operations on the Seward Peninsula. However, in 1911, a gold dredge was brought in and installed on Buck Creek. This dredge operated for several years, profitably extracting the cassiterite. In 1914, two more dredges were brought in and installed on the Nivovik River, where not only cassiterite was extracted at a profit, but also placer gold as a sweetener.

Over 2,400 tons of cassiterite have been mined in Alaska, most of which came from the Seward Peninsula. However, we don't want to overlook the valuable deposits that have occurred

In the Toffy tin belt. It was recognized that cassiterite was a common constituent of the concentrate from early gold placer operations, but it was seldom saved because of its low market value. But some cassiterite was sold to local merchants at Toffy at a price as low as five cents a pound, delivered at boat landings.

Finally, in 1929, a load of Toffy cassiterite was sold in Singapore with a net proceeds to the shipper at Toffy, at \$400 a ton. Over 125 tons of tin have been mined from the Toffy area, most of it mined after 1929. There was no special equipment used to separate the cassiterite; it was simply collected in the concentrate of the standard sluice box used in the placer gold operation.

Other creeks which carry significant amounts of cassiterite include the creeks of the Rampart area: Quail, Hunter, and Troublesome Creeks; Long and Greenstone Creeks in the Ruby District; the creeks of the Melozitna district; Humble Creek in the Fairhaven District; and in the Port Clarence District: Cassiterite Creek and Lost River.

Now, the big question: If you could get a ton of cassiterite in a 55 gallon drum, and the cassiterite consisted of 60 percent tin at \$8.00 a pound, that drum would be worth \$9600. Now, if you've mined ten barrels of cassiterite worth \$96,000., where would you market them? You would send them to: Gulf Chemical and Metallurgical Company, P.O. Box 2130, Texas City, Texas 77590.

Although both scheelite and wolframite are important ores of tungsten, scheelite is the most widely distributed in the streams of Alaska.

It was said, as early as 1905, that scheelite was difficult to separate from gold. Over 9,000 units (20 lb. units) of WO_3 have been mined in the State of Alaska. 4,000 of these units have come from the lode deposits near Hyder in southeastern Alaska. Another 3,200 units were mined from the Fairbanks District. Most of the remainder came from placer deposits on the Seward Peninsula. Other creeks where scheelite or other tungsten minerals have been mined include: in the Circle District, Deadwood Creek; in the Koyukuk District, Bonanza Creek; in the Nome District, Twin Mountain, Glacier and Rock Creeks, and Sophie Gulch.

The big question: If you mine it, what is it worth and where do you sell it? If you could get a ton of scheelite in a 55 gallon drum and that scheelite consisted of 30 percent WO_3 at \$125. per 20 lb. unit, that drum would be worth \$10,000. If you've mined 10 barrels worth \$100,000., where would you send it? You would contact Sylvanian, Inc., Tuanda, Pennsylvania 18848.

Platinum, like mercury or cinnabar and cassiterite, has not only been mined as a sweetener, but also as a primary mineral in a placer mining operation. Platinum is recognized by its silver to gray, long branching crystals, or more commonly, steely, rounded, shot-like particles that accumulate in the bottom of the gold pan.

Over one half million ounces of platinum have been mined from Alaska, most of which came from the platinum province in Southwestern Alaska near Goodnews Bay.

The sequence of events that led to the discovery of platinum in the Goodnews Bay area began in 1926, when an Eskimo by the name of Walter Smith told another Eskimo, Henry Wolja, that he had discovered white gold at the mouth of Fox Gulch on the southside of Red Mountain. Wolja, in turn, told a local white resident named Charles Thurson of the discovery.

At first, Thurson didn't recognize the gray material as platinum, probably because it was in the form of long, branching crystals, rather than the roundish shot-like particles that he'd seen from other mining districts.

However, by biting a small nugget, he did recognize that it was indeed malleable and a metal, and he consequently sent his pannings off to the Bureau of Mines where they were analyzed and pronounced high-grade platinum.

The first platinum mining then in the Goodnews Bay area was by Charles Thurson in 1927, when he extracted 10 ounces of platinum from the mouth of Fox Gulch, and in the same year, an additional 7 1/2 ounces from Platinum Creek.

From 1927 until 1935, platinum was mined in the Goodnews Bay area by small scale placer mining methods. However, in 1935, the Goodnews Bay Mining Company was formed, and platinum mining began on a large scale using a dragline and a bucket-line dredge. Since that time, the Goodnews Bay area has become the largest producer of platinum in the United States, supplying over 90 percent of all U.S. production. Other areas where platinum has been mined as a sweetener include: the west coastal beaches of Kodiak Island; Metal Creek in the Anchorage area; the creeks of the Willow Creek district; Cache Creek in the Yentna district; the creeks of the Ruby district; the Innoko district; the Iditarod district; the Aniak District; the Arolik River basin of the Bethel district; and of course, creeks on the Seward Peninsula.

For those of you who have always wondered about the amount of alloyed platinum in your placer gold -- the highest recorded amount was from the 70 Mile River and Fourth of July in the Eagle quadrangle, and from Woodchopper Creek in the Circle quadrangle. The average was 3/10ths of one percent. Clearly, it would require large-scale mining to make an extraction of the platinum worthwhile. One thousand ounces of gold would yield three ounces of platinum.

Large-scale mining was being conducted by a gold dredge operating on Woodchopper Creek in 1938. When the operators were informed of the high platinum content of their gold, they attempted to recover payment from the U.S. Government. The Government denied payment, and the operators took measures to remove the platinum before selling gold to the government in the future.

Platinum currently is worth about \$400 an ounce. If you want to market your platinum, send it to Mathey / Bishop, Inc., Melbourne Refinery, Melbourne, Pennsylvania 19355.

Other minerals which have been mined from placers in Alaska include native silver on Crooked Creek in the Eagle district; on Ruby Creek in the Rampart District and many of the creeks in the Wiseman District.

In addition to the native silver, stibnite--the ore of antimony--has been placer mined from Smith Creek in the Wiseman District. And, of course, jade has been mined from the creeks in Northwestern Alaska in the Klana district and in the creeks draining the Cosmos Hills. Garnets were mined from the Imuruk Basin on the Seward Peninsula and considerable garnets occur on Kanagunut in southeastern Alaska. Finally, quartz crystals were mined from California Creek in the Northern Alaska region.

What other mineral can lie hidden in that concentrate? There are many, many minerals of value that can go undetected in the concentrate. Important among these are the gold and silver tellurides valued for both their gold and their silver. Monazite, the source of thorium, a rare earth, valued up to \$6,000 a ton; ilmenite, one of the ores of titanium, valued at \$475 a ton; pyrochlore and columbite, valued at \$1800 a ton, and finally zircon, the ore of zirconium, valued at \$175 a ton.

Now, granted, many of these minerals may serve simply as a sweetener in a placer mining operation. But, of equal value is the potential of leading the placer miner and the prospector to the location of a lode deposit. To help the placer miner in his effort, the chemical laboratory of the State Geological Survey will analyze Alaska placer concentrates free of charge. This will supply the placer miner and the prospector with information regarding the potential of a valuable lode deposit in his creek or drainage system.

Perhaps the best way to describe how this works is with a case history. This example uses gold as the primary actor, but applies equally to other valuable ore minerals.

A couple of decades ago, a friend and old-time placer miner by the name of Tiny Shields wrote a book covering the exciting events of his life. In this book, Tiny related his mining experiences on No Grub Creek, a tributary to the Salcha River.

Tiny began working several claims on No Grub Creek. These claims had previously been mined by drift mining. The drift miners informed Tiny that he would experience tremendous results until he hit the white bar, but after passing the white bar which cut across the stream, he would run out of gold. Tiny didn't pay too much attention to these drift miners and he went ahead mining with his cat and his sluice, and indeed he did experience tremendous results. The gravel yielded coarse biscuit size nuggets with considerable fines. However, a

short distance into the third season, Tiny began cutting that white ridge. After mining past the white quartz vein, the gold content of the gravel fell below minable concentrations. This quartz not only ran across Tiny's creek, but also ran over the ridge and down into the adjacent creek. A gold dredge, operating on this adjacent creek also ran out of gold after passing this white ridge. Now, a couple of years later, it dawned on Tiny that that white quartz vein was probably the source of those coarse, biscuit size nuggets that he had been mining.

So, he hurried back to Alaska from his new home in Oregon to stake that white ridge. But, ironically someone else had read his book and had already staked the claims.

A conclusion, ladies and gentlemen: I hope that 50 years from today, when some cheechako newcomer comes to Alaska and asks if those oldtimers of the 1980's left anything behind, that some young mining extension instructor can look them straight in the eye and say, with complete confidence, "Not a chance."

On a personal note, I would like to wish you the best of luck in the upcoming season, and I want to thank you very much for your consideration.

GOLD/TIN MINING AT TOFTY WITH A WASHING PLANT

Jack Neubauer, Miner
Manley District

Washington Iron Works built our washing plant in 1941. It was initially built for my partner, L. McGee, who has now retired. The plant is designed to process 150 yards an hour, but we slow down to 100 or 130 yards per hour when we are in ground with gold values. A 20 horsepower electric motor turns the trommel screen, and an 18 horsepower motor moves the belt on the stacker. On the other side of the plant is the pump for the four or five 1 1/2 inch nozzles used inside the screen. The nozzles are directed up into the screen. They hold the material up in the center of the screen, then when it builds up too far, which I don't like, the material comes out in a rush. At least it's well washed. The trommel screen is perforated with 3/8" holes in the upper end, gradually increasing to 1 1/2 inches at the bottom end. The plant is set up as high as possible to provide room for tailings to accumulate. We can run for about five or six hours without getting the cats in running water. Two 46 A's are brought in at noon to clean out the tailings and we are then able to run the rest of the afternoon before pushing more tailings. While the cats are running they're only making money for the N.C. Machinery Company.

The plant has 120 feet of sluice boxes, the longest of which is 60 to 80 feet in length. In addition to gold, we also mine tin. When the tin begins to fill the riffles within five feet of the end of a sluice, we clean that sluice up. It takes about three hours to clean up the sluices and continue the operation. Some days we are only able to sluice for about four hours before we have to clean up, sluice another four hours and clean up again. This is tough work. We generally obtain one-half to three-quarters of a barrel of tin concentrate per cleanup.

We now use a front-end loader to feed the plant. We used to feed it with a dragline but dragline operators were too hard to get along with. I can break in a front-end loader operator in about a week.

No two creeks are alike. Sometimes there are only 2 feet of gravel worth sluicing under 40-50 feet of overburden. Our biggest problem is stripping.

Any questions?

Q How do you handle your stripping?

A We rip the muck, push it off, and wash what we can when we have the water. The thickest muck is on Cache Creek. We have about 25 ft. of gravel, of which we strip off about 15 ft., and then shove the rest through the washing plant. Over on Sullivan Creek, it takes us all summer to take a cut of about 100,000 square feet.

Q Do you have any frozen ground in the area?

A The ground is frozen from right under the moss on down to bedrock. That is why we open up an area of 300 by 400 ft. It takes a cat all day to scrape off approximately a foot, which is the depth the ground will thaw in a day. By the time the whole area has been stripped, one can start over again on the other side, repeating the process until getting down to the bottom.

Q How do you market your tin?

A Our tin is quite a problem to clean. We dry it and then screen it over a 1/4 inch screen. Most of the tin is about the size of your finger nail. Any tin bigger than 2 inches is lost out the stacker. The tin is hard to dry. We made shelves in an old pizza oven heated with a propane weed burner. This dries the tin, so that we are not shipping moisture. We ship it to Texas City, Gulf Chemical. They receive the product around Thanksgiving. We get our check around February. So, it's the same as gold mining, you wait for your money.

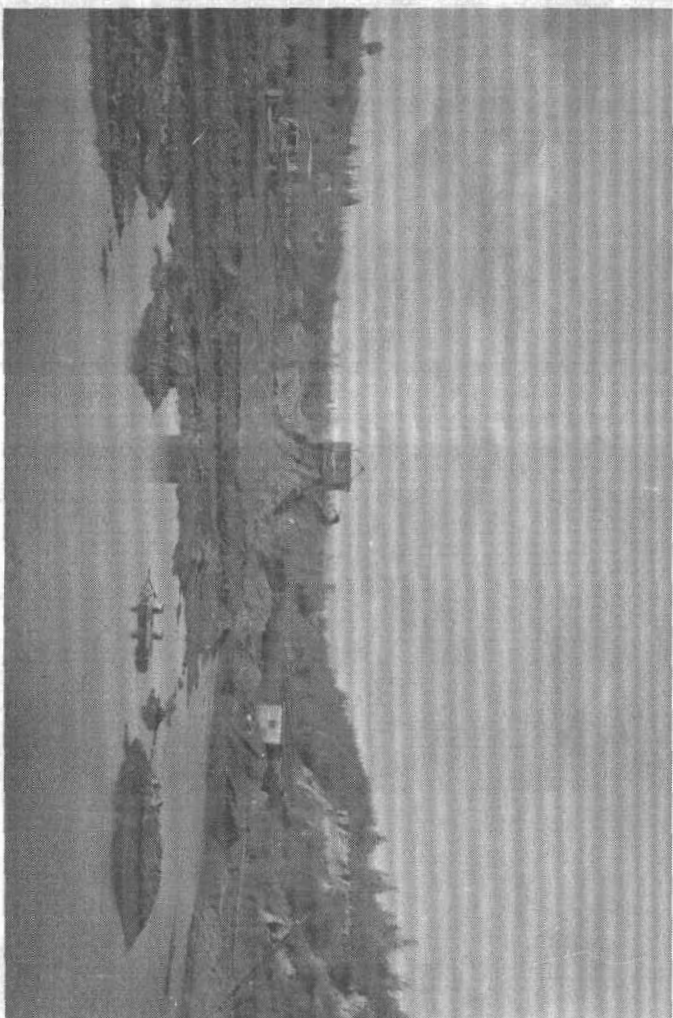


Figure 2. Washing plant with front end loader ramp.



Figure 4. Loading the washing plant with a hydraulic excavator.

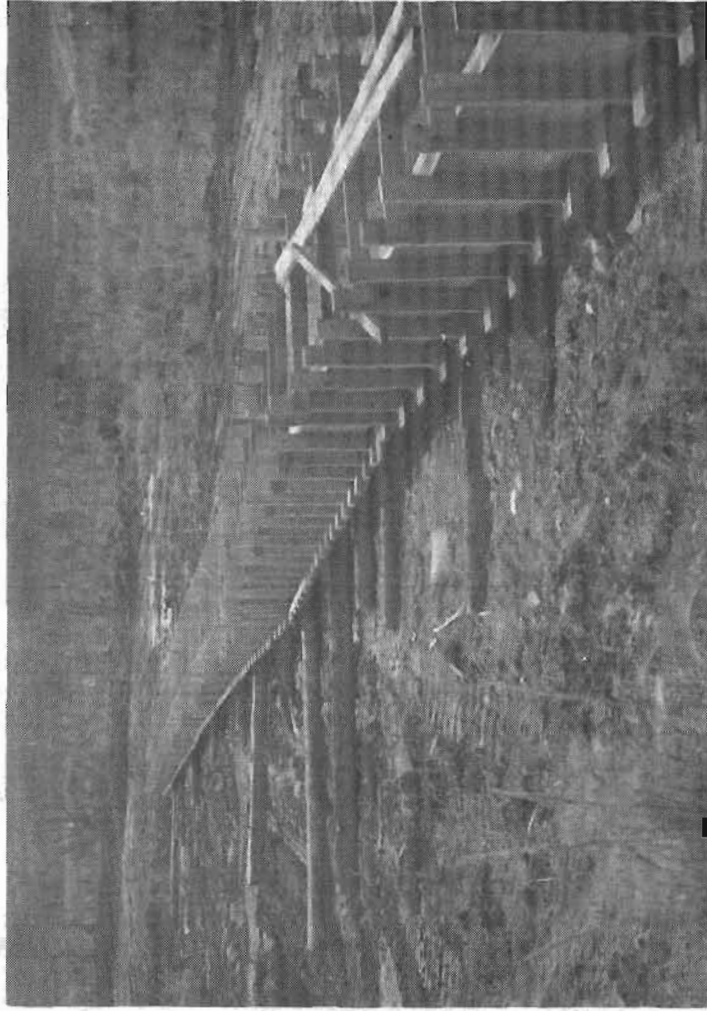


Figure 5. Flume, bringing water for stripping.



Figure 6. Cleanup area with long ton, Pan-O-Matic, and cement mixer.

OXFORD: PAST, PRESENT AND FUTURE

Richard Calamari, District Manager/President
Oxford Assaying and Refining

Oxford Metal Recovery was Incorporated over ten years ago, after buying a gold plating business on Long Island in New York. Assay and smelting facilities were put together and in two years a full-scale refinery was in operation. The company has since bought a refinery in Florida for commercial gold and one in Indiana to handle silver, and has been instrumental in the setting up of Oxford Assaying and Refining Corp. here in Alaska. They are presently negotiating terms for the purchase of another refinery in Jackson, Ohio. All of our gold and silver has been and still is being traded with Republic National Bank and also Basch, Palsey, Stewart, and Shields, Inc. The Alaskan Corporation set up an assayer and smelter in Anchorage in September of 1980. In April of 1981 we opened a receiving office in Fairbanks. We plan to build a full-scale refinery in Fairbanks in the near future. The offices in Fairbanks and Anchorage are presently set up to trade precious metal commodities.

We are now producing the new Oxford-Alaskan one troy ounce silver ingot. The design of the ingot will lay on a horizontal plane with the State map and identification on the left side and verification of the bar on the right. On the back will be an imprint of the big dipper and the north star. The bar will be announced and available the 15th of May. We are presently marketing our national bar, of which we have sold over 11,000 since its introduction last Thanksgiving Day.

It is interesting to note that the best days for selling in this first quarter have been Tuesdays and Wednesdays. The best days for buying have been Mondays and Fridays, with Thursdays being fairly neutral. This all leads me to emphasize a point that is of utmost importance. If both you and we, the miner and the refiner, are going to have a productive season. This point is control!

There are many aspects of selling and trading that are out of our control, yet we are able to control what to do with our gold. Placer fines certainly have an intrinsic value, but lack the all important negotiable value. Except for a few ounces here and there, placer gold must be converted to fine or pure gold in order to be bought, sold or traded. This process is the work of the refiner. Many times last year a miner would come in with 40 or 50 ounces, saying that he needed immediate cash to take care of some unforeseen problem. Because of the immediacy of the problem he was forced to enter the gold on a less productive schedule. It makes more sense to bring in gold to the refiner as it is produced, so that the gold can be made negotiable and sold on a favorable schedule. The gold may be returned to you in an immediately negotiable form, either coins or bullion. In addition, gold on deposit earns interest.

It takes a great deal of trust in the refiner to leave gold with him. It is my belief that this trust must be earned! We all have to share this trust. One way is to be willing and flexible enough to change with the times, and be able to support the needs of each other. Let's work together! Let's share knowledge and experience! Let's get control of this business before we get lost in the world of big business and politics.

PLATINUM MINING AT GOODNEWS BAY, ALASKA

Raymond A. Hanson
President, Hanson Properties

The Goodnews Bay Mine is located at Platinum, Alaska. It is 450 miles west and 150 miles south of Anchorage. It is also 150 miles directly south of Bethel. Summers are quite pleasant and winters are not too cold. The area receives only a few feet of snow, which is extensively drifted by the wind.

The discovery of platinum in the Goodnews Bay area was made in 1926 when Walter Smith, an Eskimo from a small village on Chaguan Bay led Henry Wuya and Charlie Thorsen to a place on Platinum Creek. Smith had earlier panned some of the heavy metal, which he termed "Black Gold". Thorsen, who was a prospector, persuaded Joe Jean, a French Canadian Trader at Mumtrak, Alaska, to send a sample of the metal to the College of Mines at Fairbanks for assay. In the winter of 1927 a confirmation was received that the heavy gray metal was platinum.

Hand-mining operations began in the summer of 1927 in Clara Creek, Squirrel Creek, Fox Gulch and Platinum Creek. All of these streams are right-limit tributaries of the Salmon River and all cut the eastern flank of Red Mountain. Red Mountain, a rust colored ridge of rock, rises 2,000 feet from the Bering Sea.

From 1927 until 1933, hand-mining produced a scant 3,000 ounces of crude platinum (less than 500 ounces a year) with 8 to 10 individual miners involved in this project. It became clear that little profit or progress could be made in developing this deposit.

In 1933, an Anchorage prospector, Walter Culver, obtained leases and options on most of the mining claims in the area. In the fall of that year, Culver turned these claims and leases over to a group of successful pioneer goldminers headed by Andrew Olson. Olson, together with his partners, operated the Northland Development Company and Olson & Company in the Flat-Iditarod section of Interior Alaska.

By 1934, the Northland Development Company had shipped a dragline excavator, trestle sluice box, caterpillar tractor and other equipment and supplies into Goodnews Bay, thus setting up a complete and self-sufficient modern mining camp. The boat carrying this equipment arrived at Goodnews Bay on July 10th and the shipment was hauled twenty-five miles around the western flank of Red Mountain and up the Salmon River to Squirrel Creek, the mining campsite. Equipment was then assembled, buildings constructed and on August 11, 1934, mining operations began. Mining continued without interruption, except for seasonal shutdowns until the fall of 1975.

Early in 1935, the Goodnews Bay Mining Company, was incorporated in the territory of Alaska to consolidate the holdings of the predecessor company in the Goodnews area. The first two years of mining were limited to the dragline operations. Extensive exploration and drilling indicated a substantial yardage of deeper ground on the Salmon River, which provided the basis of a \$600,000 loan for the purchase of a bucketline dredge. In 1937, a Yuba diesel electric dredge with 8 cubic foot buckets were purchased and transported to the Salmon River. The Yuba Dredge 129 started digging on November 10, 1937, perilously close to the freeze-up weather. A benign providence provided mild weather making it not only possible to complete the 30-day trial run, but as an added and most welcome bonus, allowed dredging to continue until December 22nd.

The total cubic yards dredged from 1938 to 1975 were 42,115,518. The total number of ounces dredged from 38 to 75 was 519,844,142. In the first year of operation, the mine produced approximately 2,575 troy ounces of crude platinum; increasing in 1935 to almost 8,000 ounces. The following two years showed a production decline, which was partially attributable to the preparation and erection of the dredge. In 1938, the first full season of operation for both the dredge and the dragline, increased production to 37,000. In subsequent years, the operating methods did not change materially, although a number of mining problems were encountered and solved. Through the years, ingenious modifications and additions to the equipment have been introduced. The successful solution of mining and mechanical problems is largely contributed to the inventive minds of the two Olson brothers, Andrew and Edward.

One of the first tasks each season is the removal of ice from the dredge pond. The ice, which averages about 3 feet in thickness, is first cut into blocks with a power chain saw. These blocks are approximately 5 feet wide and 10 feet long and are hoisted from the pond by the dragline and piled on the shore. With an average dredge pond surface area of 2 to 2-1/2 acres, the weight of ice to be removed is formidable -- running from 8,000 to 10,000 tons.

The dragline operations utilized two Bucyrus-Erie machines with 1-1/4 yard bucket capacity, bulldozers and hydraulic water. Sometimes an elevated trestle was used for the sluice boxes and other times, the boxes were placed on bedrock. The dragline season was shorter than the dredge season, running from May 15 to October 15, involving the handling of about 200,000 cubic yards of gravel and bedrock. Dragline operations were discontinued in 1957 when the shallow gravels suitable for this method of mining were exhausted.

The Yuba Dredge was capable of digging 50 feet below pond water level and in 1961 an additional 10 feet was added to the digging ladder. The depth of the placer ground varies from 15 to 60 feet. The actual thickness of the pay gravel lying on a bedrock of altered dunite, serpentine and some extremely hard sedimentary rock, ranges from 2 to 6 feet.

The Yuba Dredge originally weighed about 1,400 tons and now totals nearly 2,000 tons as a result of added equipment. The added weight required the addition of 4 more pontoons to the original 33 that constitute the steel hull.

The digging ladder of the original dredge carried a line of 94 buckets, each of 8 cubic foot capacity, running at a speed of 31 buckets a minute. Working 24 hours a day, the dredge has averaged a little over one million cubic yards each mining season.

A Bucyrus Erie walking dragline (200W) with a 6 cubic yard bucket was used in the later years to strip up to 40 feet of overburden so that the dredge could reach bedrock.

The mining season extends from about May 1st to November 15th each year. The first crew, however, starts work around the 1st of April overhauling equipment and preparing for the season. The ground has little permafrost, although occasional lenses of frozen ground do occur. Transportation to the area is good. Air freight arrives almost daily, and Wlen has three scheduled flights per week. Barge service is also available since the mine is located on the ocean.

Our company acquired this property in January of 1980 from the Goodnews Bay Mining Company. After refurbishing the dredge, the first operation season was completed in 1980. Once underway, the plan was to move the dredge from the bench where the former owners had it parked, down to the Salmon River Paystreak. The dredge operated until August of 1980 when it was shut down for the season. During the period between June and August, 1980, we dredged a total of 127,573 cubic yards. Digging mainly for flotation, the area dredged was not an area of indicated values for any platinum or gold. Some of the problems involved with the first season were almost a complete replacement of the water pipes on the dredge, electrical problems, a lower tumbler bearing change and the use of many untrained bucketline dredge personnel. We had the good fortune of having many of the former owners and workers act as consultants which somewhat eased our problems.

The 1981 season started in May with the dredge still proceeding off the bench toward the Salmon River. The season ran from May through October 8th, 1981, during which we dredged 322,396.166 cubic yards.

Our primary thrust is to remine the tailings. There are many examples of gold dredges running through old tailings and recovering as much the second and third time as the first. We hope to produce at least half as much as the previous owners.

Fine platinum, we believe, is easier to recover than fine gold. Platinum is not malleable like gold. Fine grains of platinum retain their shape, unlike flat, flaky gold. I have placed fine platinum (-200 mesh) and fine gold together in a vial of water. When the vial is turned over the platinum drops instantly to the bottom. The gold comes down like a leaf falling off a tree, by comparison. Although the platinum is 5% heavier than gold, its particle shape makes it easier to recover. Of course, this means that the first dredging may have recovered most of the platinum, but our testing is still favorable at this time.

The records kept by the previous owners are one of the property's most valuable assets. We can review these records and determine how much they recovered at any place on the property. They recorded all of their cable tool drilling and compared the drill results with their dredge recoveries. Every drill hole is related to the subsequent dredging and both are located on a map. They calculated and recorded the yardage dredged, area of bedrock mined, and screened and classified each recovery. The cleanup data is important because they recovered two-thirds of their metal from one-third of the ground. I do not want to spend the next 40 years going over the property again. We will cover the third of the ground where they had their best recoveries in about 15 years.

The overall values are not fantastic, totaling about \$250 million at \$500 an ounce. This value, divided by the 50 million yards of dredged tailings yields an average value of \$5 per cubic yard. The best areas produced \$20 to \$30 per cubic yard. Our recoveries to date are approximating those of the original owners, in \$2 per cubic yard ground.

The dredge has a capacity of 6,000 yards per day, averaging just over one million cubic yards per year. Material dumped by the dredge buckets into the main hopper feeds through a 7-1/2 foot diameter revolving trommel screen 36 feet long with perforations ranging from 3/8 to 5/8 inch in diameter. The trommel is powered by a 75 horsepower motor. Undersize material passing through the screen flows onto a bank of tables fitted with rubber covered wooden riffles, from which the major part of the platinum concentrates are recovered. Overflow from the tables goes through a series of Yuba jigs, the concentrates from which are collected on expanded metal and coconut matting in cleanup sluices. Oversize material from the trommel screen discharges on to a 140 foot long stacker belt at the stern end of the dredge.

The on board recovery system includes a closed loop that recycles the tails from the finishing jig back across the first rough jig. The system is however, quite labor intensive to clean up because half or more of the metal remains in the sluices ahead of the jigs. About a ton of material, mostly rock, is removed from the sluices with each cleanup, and must be worked down in the shore lab.

Dredge concentrates, consisting of crude platinum and some gold with considerable quantities of black sands of magnetite, chromite, ilmenite, chromiferous spinel, etc. are processed further in a cleanup house on shore where they are passed over a 4 x 8 foot wifley table. Further concentration is affected after drying by screening and magnetic separation. Finally, air is blown through the concentrates as they drop from a vibrating hopper, the heavier platinum metals falling through the air into a sectionalized box, while the lighter impurities are blown away into different sections. This method successfully yields a 90% concentrate. Concentrates from our last season were processed by elutriation tubes of our own design. The elutriation yields a much cleaner concentrate in far less time than blowing and hand plucking the platinum.

When we upgraded the dredge, high pressure pumps were added inside the trommel substantially increasing the amount of water. A retaining ring keeps the clay balls in the trommel longer. Lifters are also present in the trommel. However, there is still a significant amount of clay leaving the trommel and going out the stacker. It may take major design changes to break up the clay.

Breaking up clay balls is perhaps the biggest problem on the property. Many of the recoverable values are trapped in the clays. In the upper bench the values are almost entirely in the top clay. We will probably not dredge this area at all, but will develop some other type of machinery that can selectively mine only the top 10 or 15 feet of material rather than the entire 60 foot section. There is also a lot of clay in the upper channel. We are presently mining in the lower channel where there is less clay.

We have tested many of the tailings, and determined that the values are in the top 10-15 feet. This indicates that the platinum did in fact go out via the clay. The tailings look clean on the surface, but one finds quite a bit of clay and fine material when you dig into them. We hope there are significant values remaining in this material.

Some of our recent ideas have included putting in rubber screen plates instead of the steel punch plate. We have purchased some spirals to install in the concentration circuit, hopefully to reduce the labor of cleanup. We believe we can automate and upgrade the machinery

to cut down on labor by a third. At present it takes half a day to clean up -- this is half a day that the dredge is down.

Energy is a major expense. Since there is a lot of wind, we are going to consider the possibilities of using wind power to generate electricity. There is a natural wind tunnel in the saddle between Red Mountain and the mountain next to it.

Instead of pumping muddy water out of the pond for the washing plant, we would like to pipe in fresh water. Water could be piped in under pressure with about one mile of steel pipe. This would also save us the cost of the three or four 100 h.p. pumps now in use. We would not recover the cost of the pipe in fuel savings, but we believe we could significantly improve our recovery by washing with clean water.

General Geology

Both bedded and intrusive rocks are present in the area. Outcrops are rare. The bedrock in creek bottoms is the best source of geological information.

The Sedimentary Rocks have been highly indurated. These rocks are gray to light tan and yellow to greenish in color. They are dense, very fine grained, hard rocks with some epidote. They are thought to be mainly siliceous argillites and some quartzites. The strike and dip of these bedded rocks vary considerably. Highly altered and weathered tuffs are located at the north end of the east upper bench. These thin bedded strata are tan to brownish black in color, broken and quite soft. The dredge could dig 6 feet of this strata before it became too hard to dig.

Intrusive Rock. An ultrabasic mass of dunite forms the Red Mountain Ridge west of the Salmon River. The dunite weathers to a yellowish brown in color with small black crystals of magnetite and chromite exposed on the surface. The weathered zone varies, but is generally about 1/4 to 1/2 inch thick. The unweathered dunite is very fine grained and is black in color. The dunite appears to have been cracked and shattered at some time in the past, for these fine lines are now rehealed. Pyroxenite filled fractures cut the dunite.

Perknite is found to the east of Red Mountain dunite. Hornblendite with coarse black crystals of hornblende is found on upper Squirrel Creek.

Peridotite. Dark colored, medium grained, equigranular, with some mica is found in Fox Gulch and on Dowry Creek.

A one foot dike of dark, equigranular, fine grained diorite can be found cutting the meta sediments and the bleached serpentine zone at the head of Fox Gulch. There is only one place where the perknite border rocks can be seen in contact with the main dunite mass of Red Mountain. This contact is at the end of the upper placer workings in Fox Gulch. Here a major fault striking north 70° east separates black dunite from the bleached light green serpentine zone, 110 feet in width, that contains blackish clots of magnetic rock that is considered to be a breccia. Coarse and medium grained peridotite is found southeast of the light green serpentine zone. On Dry Gulch a black pyroxenite is found in contact with metasediment breccia.

On Squirrel Creek, the perknite rocks appear to be an island surrounded on all sides by meta sediments. On Dowry Creek, medium grained equigranular, unaltered peridotite is found surrounded by highly faulted, serpentinized black dunite.

On the crest of the hill above McCann Creek, 1/2 to 3 inch wide pyroxenite filled fractures cut the dunite.

Two complete chemical analyses of the dunite of Red Mountain were made by E.T. Erickson of the U.S. Geological Survey: one (A) of a composite sample of fresh unaltered dunite with a representative content of marginal perknitic rocks and one (B) of the oxidized shell that forms a veneer on these ultrabasic rocks.

Ultrabasic Rocks. Chemical Analysis in weight percent

	(A)	(B)
Si O ₂	39.20	28.54
Al ₂ O ₃	1.50	.78
Fe ₂ O ₃	3.10	5.29
Mg O	37.79	42.29
Ca O	5.66	.34
Na ₂ O	N.D.	N.D.
K ₂ O	N.D.	N.D.
H ₂ O +	5.81	5.53
TiO ₂	.05	.14
Cr ₂ O ₃	.27	.13
MnO	.01	.01
NiO	.077	.053
CuO	.007	.004

The presence of chromite (Cr₂O₃) shown by the chemical analysis is significant, as the placers contain platinum nuggets that are intergrown with or have adhering chromite. Chromite constitutes a small but significant part of the accessory minerals recovered with the platinum metals. In an analysis of pebbles of chromite recovered from these placer concentrates made by E.T. Erickson, the tenor in platinum metals was found to be 0.05 troy ounces per ton of chromite. An interesting characteristic of the Goodnews Platinum deposit is the wide variation in the percentage of iridium. Clara Creek, which is the northernmost of the creeks cutting Red Mountain, yielded a crude that contained 4% iridium. The iridium percentage increases progressively in each creek to the south, reaching a high of 33% in Fox Gulch, the southernmost of the creeks cutting the mineralized section of Red Mountain. The Salmon River deposit, which is a mixture of mineral from its north right limit tributaries, has averaged an iridium content of 10% over the years.

Platinum is 50 times as rare as gold. All the platinum mined in the world would fit into a 13 foot cube. There are 50 million cubic yards of tailings at Goodnews Bay, from which 1 1/4 cubic yards of platinum have been extracted in 40 years of mining. At the time we purchased the property, platinum was selling for \$800 an ounce. Since then it has gone up to \$1,100 and down to \$300 an ounce. We converted all of our cost data to a price of \$500 an ounce, even though platinum is now worth \$350.

We received a little bad news recently. Our watchman called and said that the dredge was sinking. What he meant was that it was already on the bottom of the pond. Fortunately the pond is not too deep. We hope to be able to pump enough water out of the pond to get to the pontoons. We will then pump out the pontoons and refloat the dredge. If we are unable to lower the pond level it will be a big job for underwater divers. There are now five or six feet of ice on the pond and three or four feet of ice inside the dredge. We may be delayed a month this year.

Engelhard and Johnson-Mathey purchased last season's platinum. Engelhard's new office in Anchorage will be a big help to us as they buy gold and all precious metals.

Q How much did you recover?

A The last two years we have been digging to obtain flotation. We have mined only one corner of a known pay area. We recovered about \$2 per cubic yard, which is roughly what the Goodnews Bay Company produced. We also recovered approximately the same graduation of platinum from fine to coarse in size. This is encouraging, but we do not pretend that we will also have the same recovery in an area where the previous owners produced \$20 to \$30 of platinum per cubic yard.

We sold about \$200,000 of platinum, which is not much considering that we spent about a million and a half getting it. We are not very skilled yet. We are also desperately in need of experienced winchmen. We have built and trained an excellent crew that is good at everything except winching.

Q How do you break up the clay?

A Inside the trommel are high pressure pumps and water jets. There are also retainers and lifters, but it's really hard to break up one of those clay balls once it's formed. It reminds me of plowing on the farm, when a crust formed on the soil we'd harrow to break it up. If we just went out there with a tillage tool the crust ripped into clods. We could then harrow it ten times over and never get rid of the clods. I think the same things apply here. The best way to solve the clay ball problem is to not make one. I haven't figured out how to do that yet, but it's the end I'm going to work on.

Q How will you utilize the spirals?

A They are part of the effort to reduce the labor involved in cleanup. If we can we're going to put them in a circuit in such a way as to clean the concentrate a lot better before we take it ashore. Exactly how we're going to do that, I don't know. I'm going to ask Tom Feree while I'm here and he's going to give me all the answers, I'm sure.

Q Do you use your trommel to physically break up the clay?

A Well, I think it's physical, but I also think that there's got to be some help chemically. The magnitude of the problem is determining how much water is needed to dissolve the amount of fine clay present. There is a physical limitation. Even if solved mechanically, the ability to dissolve more clay, or to settle out the clay in the pond, might be enhanced chemically, producing cleaner water to work with.

Q Is the greenstone bedrock hard on your machinery?

A No, most of the tailings are less than a foot in diameter. Scraping bedrock is, of course, hard on it. Where the bedrock is deteriorated, we dig into it as far as we can, between two to five feet. This is where the values are. That's the only time it's very hard on the equipment. In the upper channel, which was there 10,000 years ago, before the glaciation of the area, the bedrock is more deeply decomposed. It is yellowish material that looks like clay. The values may be from the weathered bedrock and all mixed up with the clay. Some clay balls assay up to \$1,000 a cubic yard. On the other hand the next 100 clay balls may have nothing in them.

Q Have you tried methods that cut down the amount of water needed to break up the clay, such as a scrubber or trommel arrangement with fewer holes? This might save some washing water.

A We haven't tried that, but it might be a good approach. Major changes like that are not easy to accomplish in an existing machine.

Q Have you tried retaining the clay longer?

A There is a retaining ring in the trommel and we could add more. This approach would work best, if the washing section were larger and revolved at an r.p.m. suitable for scrubbing and if the screen was a separate trommel that revolved at the right speed for screening. I think that's a good idea that would work much better than what we presently have, and it

would be much more energy efficient. Using high pressure pumps is not an energy efficient way to break up the clay. If we could also retain, rather permanently, a few of the rocks in the scrubbing section it would help. I think that's a good idea and I thank you.

Q What about physically breaking the clay?

A We've thought about it, but haven't really figured out how we could make that clay into a slurry. The former owners tried a special sort of impact device, appropriately called a 'mudhog'. It worked like a traditional hammer mill but the anvil parts were continuously moving large bars mounted on a chain revolving very slowly to prevent it from plugging up, no matter how much mud went through it. The hammers beat up the clay balls. Of course, the rocks went through also, and it turned out to have a high maintenance cost. But, I guess it worked quite well. I thought more about mashing those clay balls with something like the old wringer washing machine. If we had some huge rollers that we could run everything through, the rocks would pass through without harming the machine, but the clay balls would be squeezed into flat pancakes which would break up in the trommel. The worst thing about the clay is that it often comes out of the bucket line in a ball the size of the bucket. If you start out with a ball, it's pretty hard to not have a ball come out the back end.

Q Joe Vogler: Have you considered using a revolving cutter wheel like that developed by the Germans?

A Yes, that goes back to my story about the farmer. The best way to not have a clod is to not make one. If we could dig clay so that it was cut in to little shavings it would be a help. I don't think little balls will grow into big balls. I make that kind of machinery, by the way, so I certainly have thought of it. That kind of machinery would also work well above water level where clay occurs. I'm not sure I believe the story that a clay ball rolling through the trommel and the sluice boxes is picking up the values. I think that, if we find a clay ball with values in it, the values were always inside of it. Perhaps we could not recover the clay shavings from deep underwater. But there are suction dredges being made now that have a little wheel on them, very much like a German wheel, that pick up the material and dump it in to the suction of the dredge. That might also be an answer.

LUNCHEON SPEECH

John Spencer
Regional Administrator for Region 10
Environmental Protection Agency

The EPA is changing. There's a lot of talk about the fact that the Reagan Administration is dismantling the Environmental Protection Agency. That's not the case. We are not going to dismantle or do away with it, because 82 percent of the people in the United States say: "We want clear air and clean water." So, environmental protection is something that most everybody wants. The issue is how you do it, how clean is clean, is a dollar spent for environmental protection going to yield a dollar's worth of benefit?

Now, the problem is that too many things have gone on in the world in the name of environmental protection or environmentalism that have absolutely no impact on the environment at all. The bottom line is, "How clean is clean? What can we afford to do?" Let's take some reasonable approaches to what we are going to do.

Let's use common sense. The Federal Government has been designed for abject failure. Everything that's done is designed for failure. We're trying to turn that around and make some sense out of it.

I hope that I survive for a while; you people out here present one big problem to me, because I'm trying to do what I think is reasonable about two decisions that recently came up, that give me some real stiff guidance.

Here is an example: we just got into trouble with an agency because the hazardous waste reporting requirements were changed. The people that generate hazardous waste can be a real problem. The Love Canal made a lot of headlines.

The administration decided to reduce the reporting and recording departments for people who generate hazardous waste. What they're going to do is sample 10 percent. That made the front pages of the newspapers. Time Magazine, the Wall Street Journal, and all the environmentalists in the world said, 'You're giving away the farm'. However, the regulations still require you to maintain the records. If you're going to lie about the records you maintain, you're certainly going to lie about the forms you're going to send in to the agency. Who has time to read those forms? Are we going to hire a bunch of bureaucrats to read the forms or are we going to go out and monitor to see if the records are, in fact, correct? We chose the latter.

I tell my people: "Don't worry about the forms; go out and see if it's really a hazardous waste. See what people are doing. Are they keeping records on site?" We did away with the forms because we were getting to the point where regulations drove our total effort for regulatory purposes alone, not for any environmental benefits.

We have reduced our forces. I don't know exactly how many my boss has reduced in headquarters or what other regions have, but from 1977 to 1980, EPA grew 67 percent. We have been able to cut back six percent, and we propose to reduce this by another \$100 million next year. Congress has already said that that's too much of a reduction, they want the EPA to take more money than requested.

We did away with one-third of our management people within two months after my arrival. We had division chiefs, deputy division directors, grants managers, section chiefs, team leaders and more. By the time a single document got to me to sign it had been reviewed five or six times. I think we're going to do better with less. We're trying to bring common sense into an operation that has done things without an environmental payoff. A friend of mine who owns a pulp mill in California is supposed to install the most modern technology to treat the plant's waste. EPA and the State of California all agreed in the Ninth Circuit Court that putting on this additional waste treatment (\$30,000,000 worth) would not improve the quality of the discharge into the Pacific Ocean. But, as the court said, "Under our regulations, the technology is what counts." That's the way the law reads. It seems to me that if you're going to spend \$30,000,000 you ought to have some environmental payoff.

A couple of things have happened recently which will make your lives a little harder. Both involve litigation. Judge Van der Heydt in Anchorage said to me, "The word 'shall' means shall. You have no discretion; it is mandatory. If you find a violation of the clean water act or a permit, you 'shall' do one of two things." One of those is to send out a compliance order under Section 309 of the Clean-Water Act. That compliance order has to be complied with or you, the miner, go to court. The second choice is for EPA to file a civil case in court. I have no latitude; if I don't do that I go to jail. If somebody's going to go to jail, I would rather it be you than me.

I've asked Headquarter's people to appeal that decision, because they don't necessarily agree with that law. I've also been around Judge Van der Heydt all my legal career. I've practiced before him, and I know that if I were to disobey his law, he would probably send me to jail. He would say he was sorry, but he would anyhow. If you are in violation, we will either submit to you a petition, refer it to the Justice Department and take it to Federal court in a civil case, or issue a compliance order.

Judge Yost's decision came out Friday on the Zemanski case. Zemanski sued the placer miners and EPA. I suggest that all of you get a copy of the decision and read it, because it explains how your lives are going to be ruled for a while in the placer mining business. Zemanski argued primarily for a closed system, with zero discharge. He introduced a lot of dialogue relative to settling ponds, the cost of settling ponds, the cost of pumps and more. Ron Rosander argued vehemently for miners. The judge said that EPA permits must delete any references to technology. You must do whatever is necessary to meet the requirements. Several requirements must be included in the permit.

The judge feels that you ought to monitor for arsenic and mercury for at least one mining season. Deena Henkins (Director, Alaska Environmental Quality Operations) and I have talked about this to some degree, and we're probably going to say that either ADEC or EPA ought to do the monitoring. It is awfully expensive and this would standardize the results.

The decision also requires monitoring for soluble solids and turbidity. The present permits specify 25 JTU's of turbidity and .2 milliliter per liter of suspended solids. The thinking right now is that we should change the suspended solids from .2 to 1 milliliter per liter. Headquarters people think that 25 JTU is too low, perhaps it ought to be 50 JTU. You're going to have to do the monitoring.

There's not a lot I can do about the regulations, except try to interpret them. There are four parties to this: you, the courts, the regulators (Deena and I) and the people who file the lawsuit against you. Those are the rules.

How are you going to get into operation this year? I'm not going to give you a permit right now. I'm trying to give you a general permit so that you don't have to apply and fill out the forms like you have in the past. However, I can't issue your general permit in time for you to get to work. The earliest it can come out is probably sometime in July. Of the people I've talked to, very few want to wait until July to start working.

We have figured out some ways to enable you to start mining. One is to give you a compliance order under Section 309. A Section 309 compliance order is generally given to you when you violate the terms of your permit. It says you've got to comply with the law on specific points or you'll be in trouble. There are three different classifications. 1) People who have violated the law. 2) People who haven't violated the law because they just applied for a permit and they haven't worked yet. 3) People who want to mine, but haven't made application yet and have never been in the field. So, you can mine on a lease temporarily until permits come out under the Section 309 compliance order. A letter will come to you. I'll go over this with your boards so they can get it to you in more detail.

Such a letter will say, "On October 28, 1976, EPA issued you a permit authorizing discharge from your placer mining facilities. This permit expired October 20, 1981. We are contemplating a general permit, etc., but unfortunately this process will not be completed by the commencement of the 1982 mining season. Therefore, we've reviewed your file and determined that you have not provided this agency with the following information under your old permit. To provide you with a clear understanding of the duties and obligations required of placer miners to comply with existing federal and environmental law, and to emphasize our desires to

obtain the information needed from you, under the terms of your old permit, authorization was hereby given for you to discharge pollutants during the 1982 mining season in accordance with the following limits and conditions." You get the limits and conditions from the general permit. That will make you legal. It will also put you on notice not to violate those rules. That's about the only way I can do it, because I can't get you a permit. The State, as I understand from Deena, is probably going to issue permits to those people that have applied for them, and these permits will expire automatically when I issue the general permit. This will cover you from a legal point of view. It's unfortunate that it has to be done this way, but it will not make a lot of difference whether it is done this way or by permit.

It is extremely important to keep everything legal, because it is not just between me and you. There are also the environmentalists who want to make sure you do everything according to the letter of the law. I am going to be observing what you do.

I will have to file the EPA placer mining policy in Judge Van der Heydt's court. We envision that the monitoring will be done by EPA from the limited sources we now have. Of course, if the Alaska Department of Fish & Game reports any violations, we will have to send an investigator.

We do not anticipate many problems. Indeed, there should be very few violations if the standards are set on a reasonable basis. It's not fun to file a compliance letter or file a case in court against friends of mine who have been here for a long time. Hopefully, people will take this to heart. Get your settling ponds.

There are certain things the EPA and ADEC still need to negotiate and discuss. Will the enforcement limits be 25 JTU or 50 JTU, at 500 ft. or 1,000 ft. downstream? Will the suspended solids limit be .2 milliliter per liter or one milliliter per liter? If something should be done differently, for goodness sake, let me know. I get input from Gil Zemanski on a daily basis. I should get your input too.

DREDGING AT NYAC

Joseph Fisher, Manager
Northland Dredging Company

Nyac is located about 65 miles east of Bethel in the Tuliksak River Valley. Access into the region is limited to aircraft. Presently there are two airstrips, one 2,000 feet long at the upper camp and one 5,000 feet long near the lower camp. Gold was discovered in this area on upper Bear Creek about 1908. The early prospecting and hand mining was centered near the mouth of Bonanza Creek where the gravels were fairly shallow and moderately rich.

Around 1915 - 1916, a group with financial backing from New York began consolidating and leasing the claims. In 1925, a decision was made to purchase a dredge. The dredge was manufactured in San Francisco, shipped to Bethel, loaded on a barge at Bethel, barged up the Kuskokwim to the mouth of the Tuliksak, where in the winter of 1925-1926 it was hauled overland 45 miles up the Tuliksak River, and up Bear Creek to an area near the mouth of Bonanza Creek.

In the Spring of 1926, the dredge was erected, and mining started in June of 1926. The dredge had a wooden hull and four cubic foot buckets. This dredge, now referred to as Dredge No. 1, was operated by the New York - Alaska Dredging Company from 1926 to 1929. This first dredging effort was not too successful. In late 1929, the dredging company was reorganized, and renamed the New York - Alaska Gold Dredging Company under the management of James Crowdy. The Nyac No. 1 dredge then continued to operate on Upper Bear Creek until 1937.

During the 1920's exploration drilling in the main Tuliksak River Valley was concentrated between the mouth of Slate Creek and the mouth of Bear Creek. Fair gold reserves were indicated. In 1935, the New York - Alaska Gold Mining Company purchased a 1 1/2 cubic foot bucket-line dredge from Washington Ironworks, and put it into operation near the mouth of Slate Creek. The results of this dredging were quite encouraging.

Exploration continued on the Tuliksak River, and in 1937, the decision was made to move the dredging operation from Upper Bear Creek to the Tuliksak River Valley. A steel hull and a new screen were purchased for the construction of a new dredge. Most of the digging equipment off Nyac No. 1 was brought down and put on the new dredge, and this dredge was then called Nyac No. 3.

In the winter of 1939-1940, it was decided to remodel Dredge No. 3 from a four cubic foot bucket-line dredge to a six cubic foot dredge. Most of the modifications for this conversion were purchased from Washington Iron Works.

The remodeled dredge operated part-time throughout the war. The only year they had to shut down was 1944. Throughout the war period, as I understand it, they were able to operate during the day, but at night they had to shut down because they couldn't use any lights.

In 1953, the dredge was moved from the Tuliksak River Valley to Upper California Creek. It operated on California Creek until 1957. When the reserves on California Creek were exhausted it was then moved back down the Tuliksak River to below Slate Creek, where it continued to operate until 1964.

In 1954, the New York - Alaska Gold Mining Company purchased a 4 1/2 cubic foot Washington Iron Works dredge in California; rebuilt it in the Seattle Washington Iron Works Factory then moved it to the upper end of Rock Creek. This dredge, named Nyac No. 4, operated downstream until 1958. At this time the reserves were exhausted and the dredge was moved to the central area of Bear Creek, just above the east fork.

Nyac No. 4 continued to operate on Bear Creek until 1960. The fixed price of gold and the ever increasing cost of operation forced the New York - Alaska Gold Dredging Company to suspend operations in the fall of 1964.

James Crowdy was manager of the operation throughout this time span. In 1969, the assets of the New York - Alaska Gold Dredging Company at Nyac were sold to the Tuliksak Dredging

Company. In 1973, Tuliksak Dredging ran a power line to Dredge No. 4 on Bear Creek, and have operated Dredge No. 4 continuously through 1981.

In early 1980, the lower plains of the Tuliksak River and Dredge No. 3 were leased from Tuliksak Dredging by Northland Gold Dredging Joint Venture. The Joint Venture was formed to rebuild the dredge and to develop the reserves. The Nyac No. 3 Dredge was rebuilt in the Fall of 1980 and the Spring of 1981. The remodeled dredge began digging in June and continued throughout the '81 season. (Figures 1 and 2.)

The dredging season here at Nyac starts in Upper Bear Creek between the 15th of May and the 1st of June, continuing through the end of October. The area is ideally suited for settling ponds. By the time that water comes out the edge of our tailings on the lower end, there's just a slight turbidity.

The recovery system on Dredge No. 4 consists of tables with Hungarian Riffles. They generally operate for 14 days before they stop and clean the sluices. This is a very labor intensive operation.

We maintain complete repair facilities allowing us to repair any of our equipment.

In 1979 dredge No. 3 was sitting on the bottom of its pond. During the summer the water would come up about six inches above the bow deck. When the beavers were busy, the waterline would get three feet higher. (Figure 3.)

To refloat the dredge, a drain was dug out to dry the bow deck, and the pontoons were pumped out. It was really much simpler than we had thought, because the pontoons pumped out right away. A new camp was built nearby and all the supplies were flown in with a Herc aircraft, for the rebuilding of Dredge No. 3.

We leveled off a pile of tailings, and a sandbar in front of it, raised the water as high as we could raise it, then pulled the dredge over and set it down on the sandbar to dry the hull completely. (Figure 4.)

Once we got the dredge up on the bench we began rebuilding it. The old house was completely torn off, and a new house was constructed. The walls were prefabricated, flat on the ground, and then the 12' x 16' sections were picked up and set in place. We left every other piece of plywood off for weight.

Construction proceeded quite rapidly. We had a crew of about 10 men, with one lead foreman. I think everyone was pretty happy with the way it turned out. We completed the house in the fall of 1980. In the spring of 1981, we went in and then repaired all the machinery on board. The concentration equipment originally on this dredge consisted of shaking tables. We cut the tables and installed 42" x 42" duplex jigs. There are four flow lines on each side. (Figure 5.)

Dredging has become a dying art over the last few years, making it difficult to assemble a dredge crew. We decided to train the new crews ourselves. It was kind of exciting the first few days, with the green crew. In about three months, we were able to run at full production, averaging around 550 yards a day through the dredge.

For those of you who are not familiar with a bucket-line dredge, the crew consists of a winchman and one or two oilers. We need two oilers on this boat. The dredge will dig approximately 20 feet below water level, at a rate of 32 buckets per minute. Each bucket moves six cubic feet of gravel. The buckets are dumped into a trommel screen 6 1/2 feet in diameter and 29 feet long. The largest holes in the screen are 5/8 inch. The oversize material from the screen goes up the stacker. The stacker is 80 feet long and 36 inches wide. The undersize material from the screen comes out across tables, with Hungarian Riffles in them, and then across the jigs. (Figure 6.)

We recover about 50 percent of the gold in the riffles. The riffles are made of wood with a 3/16 inch rubber strip on top. The jigs are started with about two inches of steel shot. As the material runs across the jigs, it builds up a natural bed of magnetite and ilmenite giving us a full 3 - 3 1/2 inch deep bed.

The concentrates from the jigs are pumped back up and collected on astroturf. We're doing a lot of testing work so we're picking up these mats nearly every day. The concentrates are brought up to our cleanup room where we run them across a small shaker table to clean the concentrates. The concentrates are cleaned fairly well on the table, then we dry them, screen them, hand pick, and pour them into bags. (Figure 7.)

The boats at Nyac are all electric powered, with about 15 miles of power line to be maintained. For short distances the voltage is transmitted at 4,160 volts, but for the dredge on Bear Creek, the voltage is stepped up to 12,000 volts, and then stepped back to 480 volts on the dredge. One of the real assets of Nyac is the 500 kw hydroelectric plant. It was installed in 1954, and is still in excellent shape. An accident last fall burned up the windings in the starter. Westinghouse came out, rewound the generator, and put it back on line in about 24 days. The penstock is five feet in diameter, 550 feet long and has a 70 foot head. (Figure 8.)

When it starts getting cold, ice forming in the ditch to the hydroplant tends to block up the screen. We then have a worker rake the ice through the screens. We can operate through short periods of fairly cold weather, but once the ice really starts to flow, we suspend operations. We now have a large enough diesel backup capacity to operate without the hydroplant. (Figure 9.)



Figure 1. Dredge No. 3

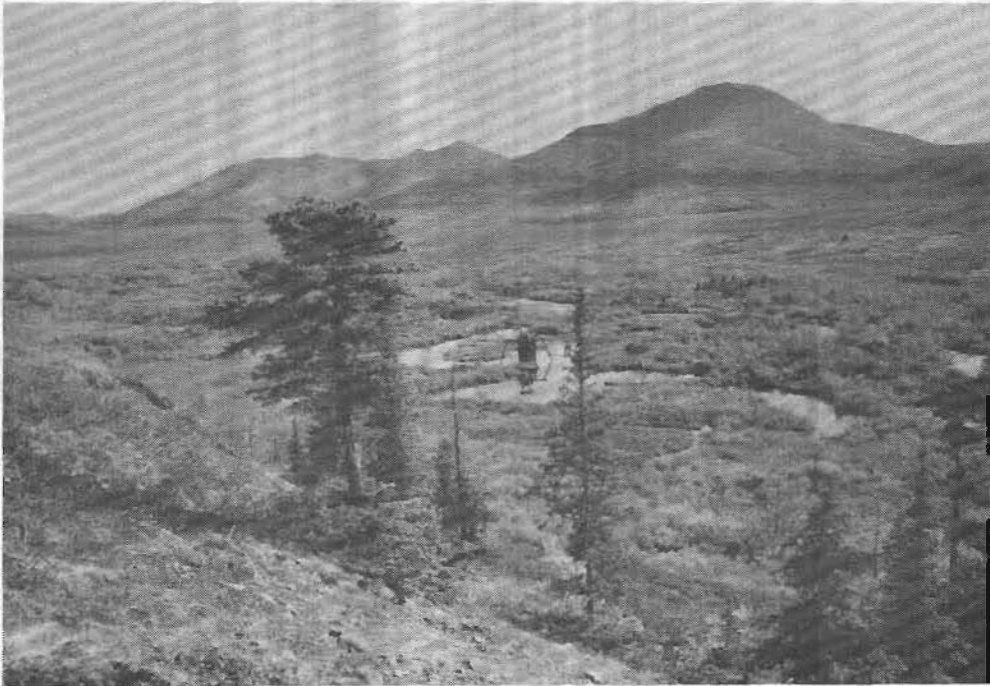


Figure 2. View of the river valley



Figure 3. Bucket line on the dredge

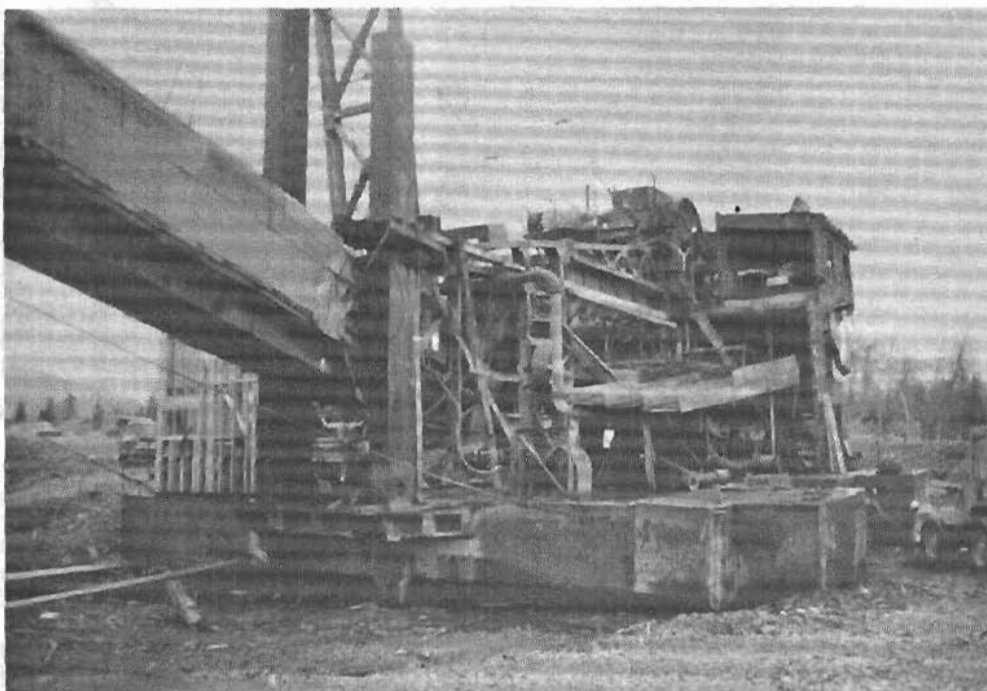


Figure 4. Stripped dredge undergoing repair

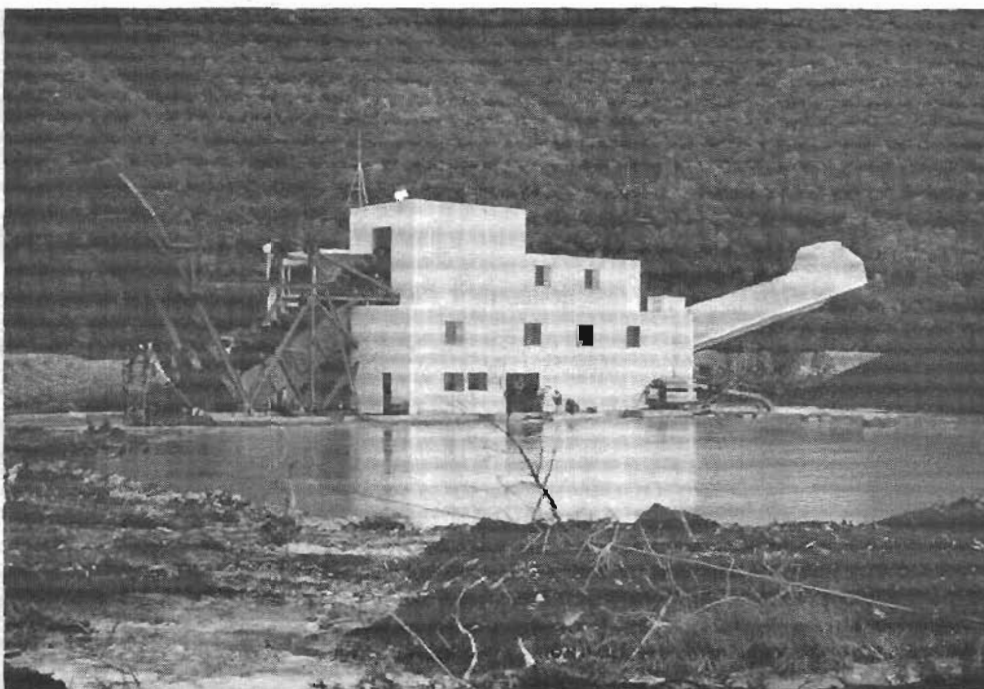


Figure 5. The new dredge house



Figure 6. Tables receiving undersize material from trommel



Figure 7. Drive mechanism on the jigs. We adjusted the stroke to 1 1/2 inches (arm on the left) with 125 strokes per minute.



Figure 8. The 500 KW hydroelectric plant at Nyak has a penstock 5 feet in diameter, 550 feet long with a 70 foot head.

PLACER DISTRICTS OF ALASKA

Mary Albanese
Alaska Division of Geological and Geophysical Surveys

The total reported gold production of Alaska is about 30 million troy ounces. About 2/3 or 20,000,000 troy ounces has come from placer operations. Figure 1 shows the mining districts of Alaska (based on the 1954 U.S. Bureau of Mines mining district classification) and their reported placer gold production is listed in Table 1. These figures show that three districts (Fairbanks, Nome and Iditarod) have each produced over one million ounces of placer gold while 17 districts have each produced over 100,000 ounces of placer gold.

TABLE 1

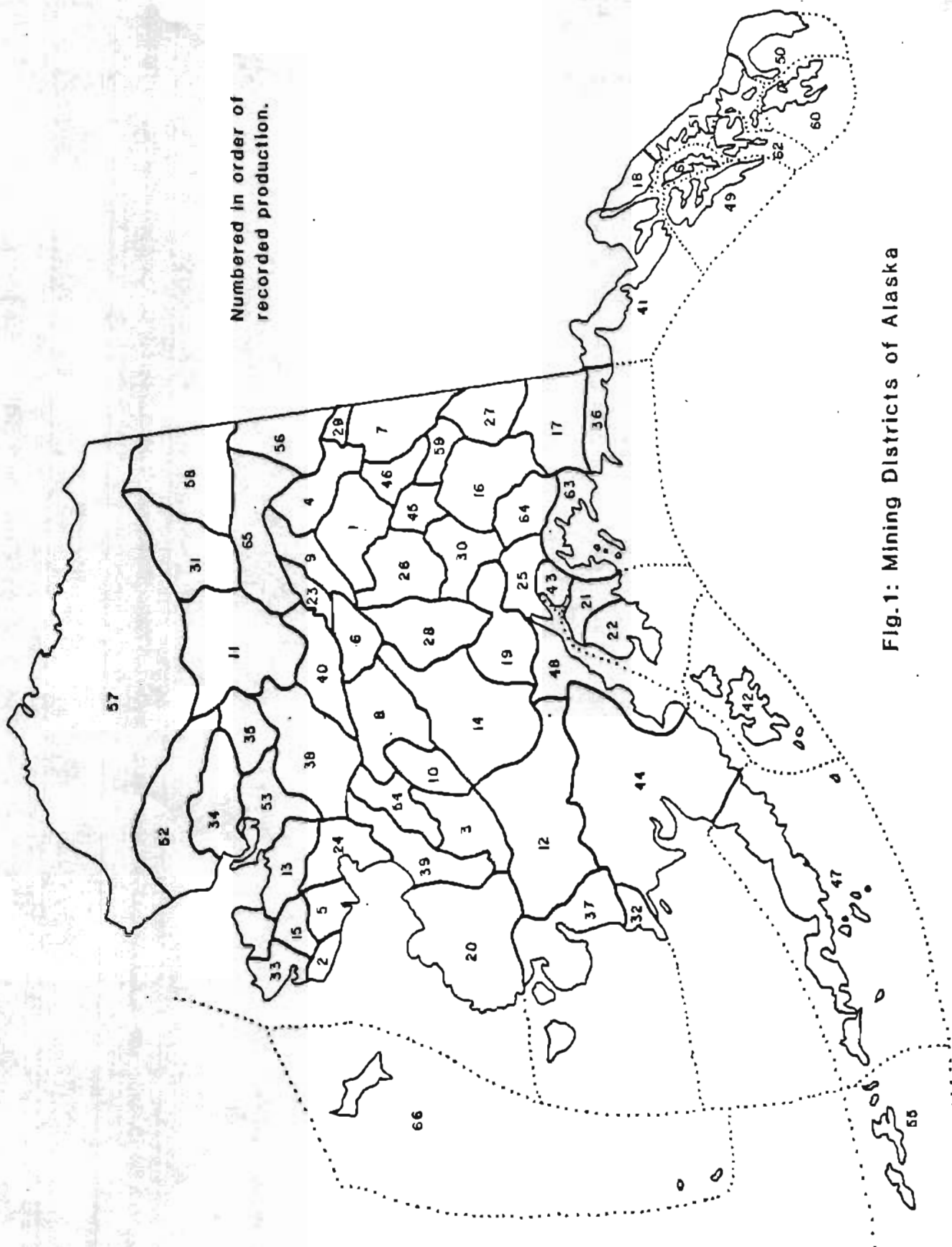
Reported placer gold production through 1981 in troy ounces

1. Fairbanks	7,464,200	35. Shungnak	17,000?
2. Nome	4,000,000	36. Yakataga	15,700
3. Iditarod	1,329,404	37. Bethel	14,500
4. Circle	735,000	38. Hughes	8,500
5. Council	588,000	39. Anvik	6,000
6. Manley Hot Springs	447,900	40. Melozitna	5,000
7. 40-Mile	417,000	41. Yakatak	3,700
8. Ruby	389,000	42. Kodiak	a few thousand
9. Tolovana (Livengood)	375,000	43. Anchorage	a few thousand
10. Innoko	350,000	44. Bristol Bay	500-100
11. Koyukuk	270-295,000	45. Delta River	<1000
12. Aniak	230,000	46. Good Pasture	a few thousand
13. Fairhaven	179,000	47. Alaska Peninsula	580
14. McGrath	173,000	48. Redoubt	275
15. Kougarkuk	150,000	VERY LITTLE PRODUCTION TO NO PRODUCTION	
16. Chistochim	140-160,000	49. Chitachof	
17. Nizina	143,000	50. Hyder	
18. Juneau	120,000	51. Petersburg	
19. Yentna	115,000	52. Noatak	
20. Marshal	110,000	53. Selawik	
21. & 22. Hope and Homer	101-105,000 (Total)	54. Kalyuk	
23. Rampart	90,000	55. Aleutian Islands	
24. Koyuk	87,000	56. Black	
25. Willow Creek	85,000	57. Northern Alaska	
26. Bonifield	45,000	58. Sheenjek	
27. Chisana	45,000	59. Tok	
28. Kantishna	45,000	60. Ketchikan	
29. Eagle	45,000	61. Admiralty	
30. Valdez	37,000-40,000	62. Kupreanof	
31. Chandalar	25-30,000	63. Prince William Sound	
32. Good News Bay	29,700	64. Nechima	
33. Pt. Clearance	28,000	65. Yukon Flats	
34. Klana	17,000?	66. Bearing Seas Region	

from Robinson & Bundtzen, 1979

In order to form placer deposits several geologic conditions are needed:

1. Rich lode source: Figure 2 shows the areas of lode gold or silver production. Areas of lode gold and silver (fig. 2) roughly correlate with areas of placer production (fig. 1) in the Interior and Seward Peninsula, although in southeast and south-central Alaska there are considerably more lode deposits than placer deposits.
2. Long period of erosion: Topography and tectonic setting can influence the rate of erosion. Steep mountainous terrain (such as the Alaska Range or Brooks Range) or areas of tectonic uplift generally have short periods of erosion which are not conducive to placer formation.



Numbered in order of
recorded production.

Fig.1: Mining Districts of Alaska

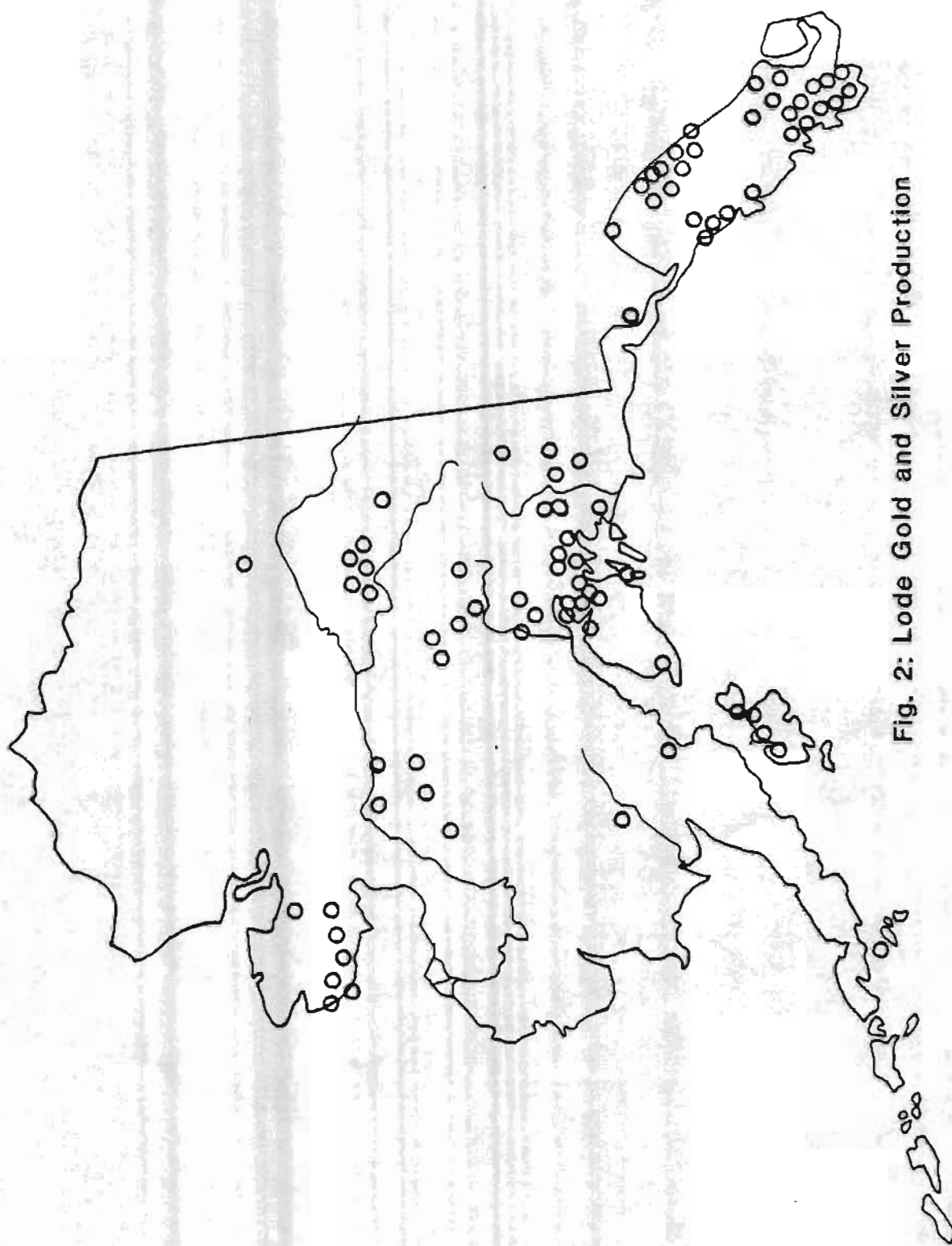


Fig. 2: Lode Gold and Silver Production

3. Various mechanisms for sorting include:

- A) Stream sorting that forms alluvial placers.
- B) Residual placers caused by weathering of lode source and residual accumulation of material at or near the lode source.
- C) Beach placers caused by longshore drift along coastlines.
- D) Eolian deposits formed in wind blown sand.

4. Preservation: Glaciation can affect preservation. In general, glacial ice can scour out, disseminate or bury placer deposits. In Alaska, 50-60% of the state has experienced late Quaternary glaciation. Only 27% of Alaska's placer gold came from glaciated areas (see Fig. 3), Bundtzen, 1980.

The history of gold production is as rich and intriguing as the precious metals themselves.

Aleuts, Indians, and Eskimos used gold for jewelry, weapons, utensils, and other purposes. The first westerners to learn of gold in Alaska were a party of Russian Americans under Malakoff. They reported gold on the Russian River drainage of the Kenai Peninsula in 1834.

18 years later, P.P. Doroshin, a Russian mining engineer was sent from St. Petersburg to examine precious metal potential. In 1848 he found auriferous gravels on the Kenai River. After two seasons of hard labor and difficulties, including surviving a major forest fire, they had obtained only a few ounces of gold. He returned to Russia reporting that although he had not found much gold, it was present and he hoped another engineer would find it.

The first major gold mining activities began near Juneau in the early 1880's. Initial discoveries were gold placers in the Silver Bow Basin area. Shortly after, low grade lode deposits were found on Douglas Island across Gastineau Channel. Major strikes that followed include:

- 1886 Fortymile
- 1893 Circle
- 1895 Seventymile
- 1896 Klondike
- 1898 Nome/Council
- 1902 Fairbanks
- 1906 Innoko
- 1909 Iditarod
- 1914 Livengood (Tolovana)

Alaska gold production from 1880 to 1981 is shown in Figure 4. From 1880 to the early 1900's Alaskan gold production increased due to the various gold strikes and numerous prospectors. The bonanzas were soon depleted and gold production gradually declined. Small increases in gold production during this generally declining trend can be attributed to the introduction of floating dredges in the Seward Peninsula which could mine large deposits of low grade material. After World War I gold production dropped dramatically due in part to the high inflation following World War I and the severe state-wide drought of 1917.

Starting in 1928 floating dredges were brought to Fairbanks and the annual gold production increased slightly. Then, during 1933 the price of gold was increased from \$20.67/ounce to \$35/ounce providing increased incentive for gold mining. Gold production increased to 800,000 ounces shortly before World War II. However, during World War II gold production in Alaska dropped to virtually zero because of the U.S. Government's gold mining limitation order.

After World War II when man power and machinery were again available for commercial use (about 1945), gold production increased to 300,000 ounces--considerably less than pre World War I and World War II peaks. Soon dredging and labor costs increased and gold mining became less profitable. Annual gold production decreased until the late 1970's.

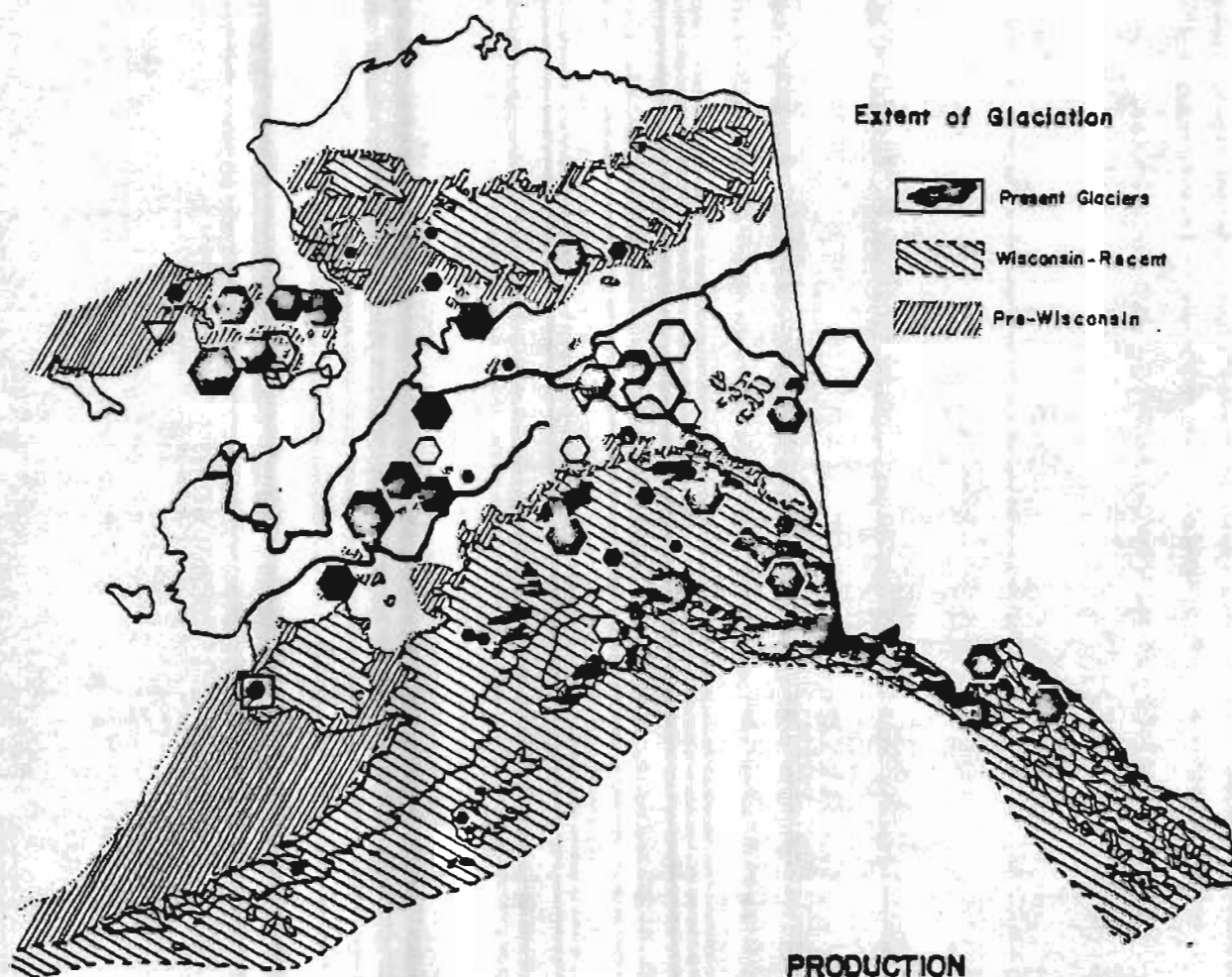


Figure 3 Placer gold production

and Quaternary glaciation.

Maximum glacial extent
modified from Pewe (1975).

PRODUCTION

- 10,000 oz gold
- 10-50,000 oz gold
- ◻ 50-100,000 oz gold
- ◻ 100-500,000 oz gold
- ◻ 500-1,000,000 oz gold
- ◻ 1-5,000,000 oz gold
- ◻ 5,000,000 oz gold
- ◻ 532,000 oz platinum
- ◻ 4,000,000 lbs tin

GOLD PRODUCTION vs. GLACIATION

Glaciated Areas = 1,222,500 oz. (6%)

Non-Glaciated Areas = 14,613,200 oz. (73%)

Nome Beach Placers = 4,051,000 oz. (21%)

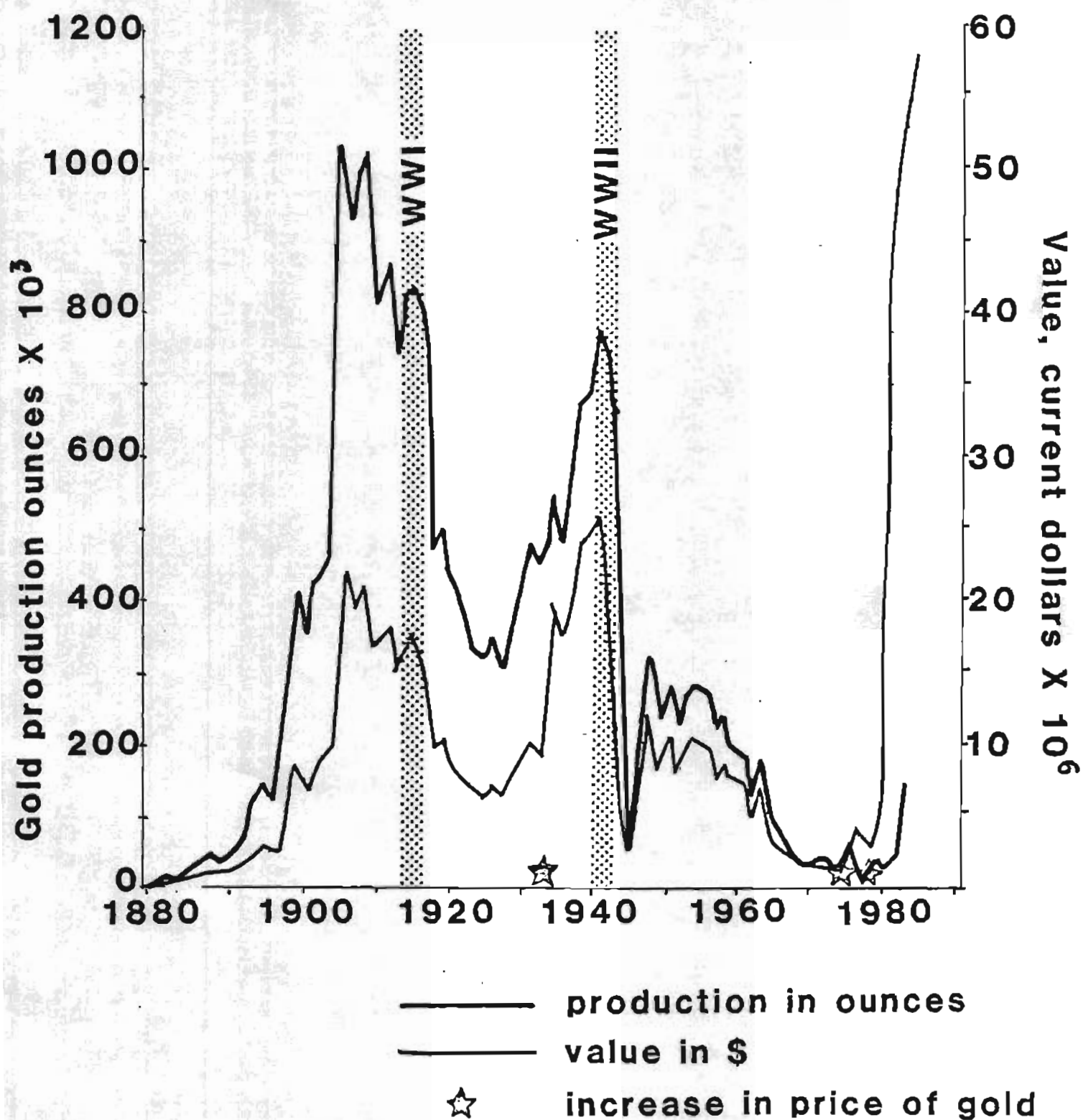


Figure 4

ALASKAN GOLD PRODUCTION

In 1974 the price of gold was no longer controlled by the U.S. Government. Americans were allowed to buy gold for investment purposes and the price of gold was allowed to float with the world market. During the spring of 1980 gold reached an all-time high price of about \$850 an ounce. The 1981 production consequently increased. An estimated 134,000 ounces of gold was produced in Alaska in 1981 (see Table 2). These 1981 production figures were derived by a canvas survey of Alaskan miners conducted by the Alaska Division of Geological and Geophysical Surveys. These production figures include the total production of 207 significant mining operations out of more than 400 mining operations. Therefore, these production figures generally represent minimum values.

TABLE 2
ALASKAN GOLD PRODUCTION BY REGION, 1981

<u>Region</u>	<u>No. of major Operations*</u>	<u>Production (troy ounces)</u>
NORTHERN	18	10,500
Chandalar		
Koyukuk		
Nolan		
Ambler Districts		
WESTERN	40	21,000
Nome		
Kougarok		
Teller		
Fairhaven		
Candle		
Ruby		
Solomon Districts		
EASTERN INTERIOR	104	63,900
Circle		
Manley		
Rampart		
40-Mile		
Fairbanks		
Richardson		
Bonnifield Districts		
SOUTH-CENTRAL	26	22,500
Cache Creek		
Nizina		
Chistochina		
Valdez Creek		
Kenai Peninsula		
Nelchina Districts		
SOUTHWESTERN	16	16,500
Innoko		
Tolstoi		
Iditarod		
NYAC		
Moore Creek		
Crooked Creek Districts		
SOUTHEASTERN AND ALASKA PENINSULA	3	Unknown
TOTAL	207	134,400

* Total placer mines statewide exceeds 400.
From Alaska Mineral Resources, 1981-1982.

One interesting fact that the 1981 gold production figures illustrate is that in 1981, 96% of all Alaskan gold production was derived from placer operations while only 5,200 ounces, or 4% of Alaskan gold, were derived from lode sources.

Although the price of gold has declined from the 1980 peak price of about \$850/ounce, it is considerably higher than the 1967 price of \$35/ounce. Hopefully, the future of the placer industry will be as exciting as the past.

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TRI-CON'S WISEMAN PLACER OPERATION

Edward Armstrong
Tri-Con Mining, Inc.

During the fall of 1907, three Swedes were given a piece of ground along Nolan Creek, approximately 300 feet wide. The owners of the two adjacent pieces of ground had given them this ground with the hopes that they would get some free prospecting, exploration, and development done. The three Swedes sank a shaft to bedrock that winter and brought out 5,000 ounces of gold. During the next two winters, they brought out another 7,000 ounces of gold from the deep channel of the Nolan Valley. This located the shallow gulch gravels of the tributaries to Nolan Valley, including Fay, Archibald and Smith Creeks.

Wiseman is 275 miles north of Fairbanks via the Dalton Highway. Tri-Con mining is the contracting manager of the Nolan gold placer which is owned by Silverado Mines, Ltd., a public company listed on both the Vancouver Stock Exchange and the North American securities dealers in the United States.

Silverado holds 32 unpatented federal placer mining claims in the Nolan district, covering Archibald Creek, Fay Creek, Nolan Creek and Thompson's Pup. The Nolan area has been worked extensively since approximately 1901 by both small-scale open cut and drift mining methods. To present, the area has reportedly produced approximately 1/2 million ounces of gold, mostly in nuggets. We are finding appreciable quantities of gold remaining both in the lower grade gravel, which was sub-economic for drift mining, and also in virgin ground, which was either saturated or thawed, and therefore was not amenable to drift mining methods.

Most of the early-day open cut work was on the elevated benches. Water was brought to the site in ditches and hydraulic giants were utilized to clean off the bedrock. An excellent, historical sketch of the Wiseman area in the Koyukuk is the book by Robert Marshall entitled "Arctic Village." Although the book is out of print now, copies can be ordered from any of the local bookstores. It is a very entertaining and factual book, not only from a mining standpoint, but from a personal and a psychological standpoint of the whites and the natives and their interaction. We first became active in the Wiseman area during 1978. During 1979, we conducted sampling, stripping, and exploration work in the Nolan area. During 1980, we continued our testing and exploration, but became tied up in litigation. Later that year, we settled our litigation, and during 1981, we installed a small-scale operation, while continuing our exploration and testing work.

Mining operations in the Nolan area are affected by several factors. We have a very heavy runoff during the months of May and early June. However, during July, August, and September, we have a very scant water supply. We have to work in very narrow canyons and therefore we don't have a lot of room to work. We're also affected by permafrost, which can be wide spread or in patches.

The gold is generally located in narrow discontinuous paystreaks resting on or near bedrock. There is commonly a thick, clay layer intermixed with gravel. Large greenstone and quartz boulders weighing up to 7 tons are quite common. The gold is chunky, averaging better than 930 in fineness, and occurs both in smooth nuggets and nuggets of a lacey variety. The Nolan gold is very desirable for jewelry grade gold.

A breakdown of our 1981 production by size range illustrates the overall coarseness of the gold in this area. Number four-mesh gold nuggets (larger than 1/4 inch) accounted for 58 percent of our total production. Ten percent of the gold was larger than six-mesh, 9 percent was larger than 8-mesh, 8 percent was larger than 10-mesh; 5 percent was larger than 12-mesh; and 10 percent of our total production would fit through a number 12-mesh.

Eighty-five percent of all of the gold we recovered accumulated in the upper 10 feet of the sluice box.

Because of the operating variables of the Nolan area, the variable gold distribution, and the chunky character of the gold, we have found that the best mining program entails an extensive and expensive amount of testing. This must be followed with a very selective mining

In many cases, we followed up the drilling with carefully selected bulk samples in 10 or 25 cubic yard lots. Bulk sampling of thawed gravel during the summer is by far the most reliable development sampling method. Let's say, in a one cubic yard block of ground, that we have a single one penny weight nugget. To us this represents \$20 a yard ground. If one drills that cubic yard block with the 4-1/8 inch drill bit that we were using, one's chances of drilling that nugget - never mind getting it up the stem - are about one in 100. If one bulk processes that same yard he is virtually guaranteed of processing that single nugget and, with care, has a good chance of recovering that nugget.

We found that drill samples producing a few specks of gold from a series of drill lines, yield values anywhere from one to three dollars a cubic yard. The same ground, when followed by bulk sampling, could contain \$20 - \$50 per cubic yard.

The value of drilling was limited to exploring and locating the areas which would be amenable to follow-up with bulk development sampling. Our mining has been highly selective. During the last season, we stripped 50,000 to 60,000 cubic yards of overburden, yet we only processed about 25,000 cubic yards of material. We used a settling pond not only to comply with the EPA requirements, but also for the recirculation of our water supply. Without a pond we would probably not have been able to operate.

A miner may agree to perform exploration or development work on property belonging to another person in return for an economic interest in future production from the property; or, the miner may agree to produce or mine the property in return for a share of both the current production and an ownership interest in the property. The tax results of receiving an ownership interest in return for exploration or development work are quite different from the tax results of receiving an interest for producing the property.

Under the pooling of capital theory, a mining property is not regarded as a producing property until after exploration and development are both completed. Hence, a person performing geological, legal, exploration or development work is contributing necessary capital elements just as is the person owning the claims or lease. Therefore, these various persons are "pooling" their respective capital contributions to bring a mine to production. Accordingly, neither transferor nor transferee receives income when an economic interest in mining property is transferred in consideration for exploration or development work performed upon that property. (An economic interest means that holder of the interest can only look to production for recovery of costs and for profit).

The person performing the geological, exploration or development work may deduct all his expenses if he receives a working interest in the property, obligating him to bear his share of all expenses in return for the same share of production. If the person performs all the development work and receives a 40% working interest then 40% of the costs of development are deductible and 60% must be capitalized. This is because the 60% is attributed to the property owner's working interest. However, the property owner does not receive income from this 40% - 60% transaction.

Alternatively, the property owner's interest may be "carried" until full payout. This means the property owner assigns his entire working interest until after the total costs of exploration or development have been recovered from production, after which the property owner begins to receive a share of production. This structure allows the person developing the property to deduct all his costs.

The person performing the geological, exploration or development work might receive a royalty instead of a working interest. In this case, the entire cost of the work performed must be capitalized and becomes cost basis in the royalty. Only the receipt of a working interest allows deduction of development work.

In some cases, in return for performing development work, a person may receive an interest in an unrelated property. For tax purposes, a "property" is generally defined as contiguous tracts which the holder obtained in one transaction, on one date, for a common price, upon which the holder has the same mineral rights and upon which is located the same single mineral deposit or mineral vein. For some holders of a portion of the mineral interest several different properties may exist while for other holders of a portion of the mineral interest a single

property may exist. When an interest in an unrelated mineral property is transferred in return for performing development work, the person receiving the ownership interest in the unrelated property has ordinary income to the extent of the value of the property interest received. The transferor is treated as having sold the property interest outright or as having created a production payment. A production payment is any payment which terminates after (a) a specified number of units is reached, (b) a time period has expired, or (c) a specific dollar amount has been paid. The creator of a production payment (transferor) generally records ordinary income when the specified production takes place and potentially has a deduction depending upon the circumstances in which the production payment was created.

In contrast to performing development work, a person contributing money, material or services towards producing or mining the property has different tax results. The person who receives an ownership interest in the property has ordinary income to the extent of the fair market value of the interest received. This is because once the property reaches the production stage, the pooling of capital theory no longer applies. For an analogy from another industry, if a person contracted to operate a hotel, and in return not only received a fee or a share of the revenue, but also an ownership in the real estate, then the fair market value of the real estate interest received would be ordinary income.

If both development and production work are performed, it would seem that a sale or exchange does not take place, although this conclusion may be in doubt if the production work predominates. Apparently, as long as the development work is substantial, the transaction will not be viewed as a sale or exchange.

II.

A comparison of the tax implications of a lease versus a sale was made in an article on Taxation in the January 1981 issue of the Alaska Miner's Journal. However, an expanded discussion of the various payments under a lease might be helpful.

Unlike the tax treatment in the oil industry, a lease bonus for signing a mining lease is ordinary, depletable income for the lessor. The lessee must capitalize the payment for deduction through cost depletion. (Remember that percentage depletion is available in any event and is probably greater than cost depletion; accordingly, cost depletion is usually of little value). Additionally, when computing percentage depletion the lessee must annually reduce his depletable gross revenue from mining by a pro-rate portion of the bonus.

Over the economic life of the property the lessee will not be able to compute percentage depletion on an amount of gross revenue equal to the bonus paid. A lease bonus may be payable in installments, but will be income to the recipient immediately if the promise to pay is freely transferable. The result is the same even though the recipient uses the cash method of accounting.

A production payment paid over a period of time in a transaction where a royalty continues for the economic life of the property is a lease bonus. This is true even though the transaction is termed a sale and title to the property passes. For example, title may pass after a number of years or a specified amount of money has been paid, while a smaller royalty runs forever. This is not a desirable result for the lessee. The only way to avoid "lease bonus" treatment is if a knowledgeable miner would conclude at the time the transaction is made that 85% of the known future economic production of the property in fact will not pay out the production payment. In this case the current IRS position is that the production payment is actually a royalty because payment of the full amount is in doubt. This will change the installment payments from a lease bonus to an ordinary royalty which is deductible by the lessee.

In contrast to a lease bonus, a delay rental is deductible by a lessee, and is non-depletable ordinary income to the lessor. A delay rental is defined as an amount paid for the privilege of deferring development of the property, the payment of which can be avoided by abandoning the lease or by either beginning development or production.

A minimum royalty is generally any payment which is not a lease bonus or a delay rental. Since the standard minimum royalty is recoupable from or creditable against future production

royalties, the lessor-payee may take depletion. If the minimum royalty is not totally recouped by future production, then a proportionate amount of depletion will be recaptured when the lease is terminated.

After October 29, 1976 the lessee of a minimum royalty is subject to two tax provisions. First, the minimum royalty generally is deductible when the mineral against which the royalty is recoupable is sold. Second, if the annual royalties are substantially equal over the life of the lease, or for at least 20 years in a longer lease, then the lessee may deduct the royalties. The amount of the current deduction will also reduce future gross revenue from the property as a base for percentage depletion. In the tax return of the first year of payment of a minimum royalty the lessee must make a permanent election to deduct currently or to defer deduction for all properties which meet the requirements of the 20 year provision. While the specifics of minimum royalties vary, and in some cases the tax treatment as well, generally it is advisable to currently deduct a minimum royalty.

A payment for exploration rights on a lease differs from a Shooting Option. An exploration right is for the use of land - the operator purchases the right to explore for a period of time. The landowner receives non-depletable rent while the operator has geological costs. A Shooting Option allows the operator to acquire a mineral lease at a specified cost if exploration is successful. If the lease is not taken up, non-depletable ordinary income results for the landowner and geological costs for the operator. If a lease is taken up, then the landowner has depletable lease bonus while the operator has a capital investment in the lease.

Exploration may take place on a mineral claim. It would appear the payment for an exploration right would be depletable ordinary income. If the payment is for a Shooting Option, the character of the income would appear to depend on the nature of the underlying agreement, i.e., lease versus sale. The treatment for the operator would be the same as above.

A production royalty should be distinguished from a net profits royalty. A production royalty is payable by the lessee regardless of his expenses and is expressed as a percentage or fraction of total mineral produced. In contrast, a net profits royalty is payable only if the lessee makes a profit.

The accounting methods used for a net profits royalty are crucial, for instance, how much administrative overhead may be charged to the property? Development costs? Purchase price of equipment? These should be defined in the original agreement, and can change the value of the net profits royalty dramatically. The same questions apply to any joint operation.

III.

In a purchase, lease or joint operation a miner acquires a direct interest in mining property. However, through a corporation or partnership an indirect interest may be acquired.

Generally, a miner should be reluctant to put any mineral property in a corporation. This is because of the double taxation inherent in corporations, and the fact that royalties are personal holding company income. This means that corporate tax must be paid upon royalties received, and the after-tax cash from the royalty must be promptly paid by the corporation as a dividend to avoid an additional 50% corporate penalty tax. Of course, dividends are not deductible by the corporation and are ordinary income to the shareholder. Therefore, in addition to the corporate income tax (above) a further individual tax of up to 50% is due. The combination of these two maximum tax rates is approximately 75% when Alaska corporate taxes are considered.

A partnership avoids a double tax as all income is taxable to the partners, and any losses are deductible by the partners. Additionally, a partnership offers great flexibility for joint operations. In many instances, a situation which in joint operations results in taxable income or loss of deductions will in a partnership be non-taxable or preserve the deductions. A salary may be paid to one or all partners which is deductible by the partnership. A working partner should never enter into a partnership without discussing this provision with investing partners. However, the flexibility of a partnership also leads to complexity; therefore, a written partnership agreement and sophisticated tax advisors are requirements.

In summary, with an increase in mining activity in Alaska and increasing IRS scrutiny, the above income tax provisions are important to miners who are transferring mineral interests or who are combining forces with investors or other miners. While the complexity of the above provisions creates traps for the unwary, a flexibility which is unusual in income taxation is also provided.



POTENTIAL FOR IMPROVED PRODUCTIVITY

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My mining experience is entirely in the field of production and industrial engineering. Nothing succeeds like production. People might ask, "What did you produce today?", but very seldom ask, "What did it cost you today?"

Production solves a lot of problems. I have spent hours calculating budgets and operating costs, primarily because I was asked to. I have found that when one is able to spell out specifically how the mining plan is to produce that ore, then and only then is one able to specify what the operating cost, that is supplies, parts, and capital, will be. It is futile to try to do it otherwise, yet many of the larger companies calculate costs before the mining plan is specified for the simple reason that accountants step in and do this work automatically. Their ignorance does not deter them in the least. It is necessary to work out an operating plan in detail before coming up with a good estimated cost, and before one has a handle on the productivity or a way to control costs.

It is not so important to know what labor costs per hour, or what supplies cost per unit, but rather what the unit cost of your product is in terms of the labor and supplies. The cost per unit is a function of productivity.

Two very important factors in mining which we will discuss are: 1) dilution and 2) recovery. In the case of lode mines, dilution has run a lot of mines out of business. There may be an excellent mining plan on paper, it may actually get lip service; but, if it is not policed adequately, if there is not some sort of reward or penalty connected with the control, then the quality of the product when it hits the mill will not be what it should be. There was an embarrassing situation of that type recently here in Fairbanks. The evidence is still to be seen.

Dilution in placer mining is not too important, except when mining beyond the cutoff limits. One doesn't want to put plain gravel through the box — that gravel should have gold in it, and it should have gold in profitable amounts.

The next factor is recovery. This topic has been an important part of most of these conferences. Recovery represents the dollars in placer mining, but it must be put in perspective. We must also contrast recovery with throughput or production. Is it profitable to recover the smaller fractions of gold on a particular creek?

As Director of Industrial Engineering at the Nevada Mines Division of Kennecott, I have had to battle with recovery problems. While open-pit mining in an area that had previously been block-caved, the sulfides had an oxide coating that played hell with the mill. Recovery dropped. The only way to recover the sulfide was to recover pyrite also, which wasn't good for the concentrate grade.

Try as we would by the book, we weren't getting enough blister copper out of the smelter to pay expenses. The laboratory could not find ways to improve the recovery. So, being the dumb miners that we were, we just shoved material through the mill. A very low grade of concentrate came out, but we did get copper. Our penalty of course, cost wise, was that we had to put on line an extra reverberatory furnace. That resulted in blister copper, the tonnage in a cost per ton equation, and the tonnage put the division in the profit column. Certainly the grade of concentrate suffered, but we did what we had to do, and it was throughput that saved the day.

Many placer deposits may be in the same position with regards to recovery versus throughput. The -100 mesh gold is often present in quantities of 25 percent or less, depending on the location. If one improves this recovery of -100 mesh gold significantly, it may yield a 5-12 percent overall improvement. How much will this improved recovery add to your profit? If it requires complicated additions to the sluice box operation or a separate material handling step, the increased costs and resultant downtime may erase these profits.

Let's look at throughput and compare its possible benefits with the possible benefits of improved recovery in a hypothetical example. Assume the ground runs 15 cents per square foot of bedrock, with gold at the old price of \$35 an ounce. At today's price of \$350 per ounce, that's \$675 per yard of gravel if the pay gravel is six feet deep. If one puts 150 tons an hour through the sluice box; for 10 hours a day for 90 days and multiplies that by \$675, that is \$911,250, or 2600 ounces. 2600 ounces divided by the 900 hours and the \$350 comes to \$1,000 an hour. \$1,000 an hour is quite an expensive operation. Every hour the mine isn't running, and running at its optimum flow, we are losing part or all of that \$1,000.

If we compare this with saving 8 percent through better recovery we find that the 8 percent is equivalent to 72 hours of operating time (8% of 900 hours). So, by preventing the loss of 72 hours in the season, one has achieved as much as possible with improved recovery.

Eight percent of our 150 tons an hour; is +12 or -12 tons per hour. Every property is different, of course, and every individual is different, but, I would suppose that most placer miners, being miners rather than mill men, can improve their mining, or production easier than they can recovery. Someone with more time and experience can solve the recovery problem. This increase in production is something I do think most miners are capable of achieving.

Let's examine a few production factors. There is always a better way. Most of the points I will make are obvious, yet I think if some of us look back we will see that we have made these same mistakes. Be punctual as to your starting and quitting times, and work continuously. Starting at 6:00 or 7:00 doesn't mean just getting out there. It means that water is actually flowing and that gravel is moving and the wheels are going around. This must happen if you want to achieve your 1,000 hours in a season. Plans must be made to anticipate what may go wrong so that when you are ready to start the water flowing, nothing is out of fuel.

Lunch is another situation. If shutting down for lunch fits well into something else, like letting the water build up, plan it that way. But don't let lunch lose part of that target, 1,000 hours a season. I was reading in an article recently that the Japanese did not operate through lunch like most American factories, but took their lunch period and relaxed. The equipment was idle on the theory that, having an unqualified person operating a piece of equipment deteriorates the equipment and it would not be operating at capacity. However, I think that operating while the regular crew takes short lunch breaks is the best way.

Another is the business of going to town. As a boy I can remember people going to town from the farm for this and that. This can eat up an operation too. To reach that target of 1000 or more hours everything must be on the property before starting to operate. An operating plan is necessary, to know exactly what supplies must be available.

First and foremost in consideration is mine planning. I believe that planning in a placer operation should be at least two years ahead. One should plan for the season coming up and the next two seasons. Things are not static, but happen every season. Opportunities present themselves, adverse conditions will occur and you may change the second year plan when the first season is over. Plans are based on facts: depth of cover, stripping needs, location of the stream, and dozens of other factors. After the completion of a season one can refine the mine plan for the up coming one. A continuous mining plan is necessary to estimate the life of the creek being worked.

Use your imagination when mine planning. Can it be mined hydraulically? When will equipment and supplies be needed? What priority should be placed on the materials being freighted to the mine. What is the life of the mine? How long will your initial equipment suffice? Is your sluice box or pump time consuming and awkward to move? Where is the box going to be at the start of this season, at what point is it going to be moved? If it is to be moved, figure in advance what is going to be gained by moving it versus what will be lost with extra machine time, especially the costs of bulldozing longer distances. There is a tradeoff and it must be considered well ahead of time. Other factors include tailings disposal and the location and size of a dam. Water is the bloodline of this business, one should plan well ahead to make sure that the stripping operation and the gravel operation do not interfere with the location of the water line.

These plans require facts that you may not have ready access to. What will be your equipment availability? How much down-time can be expected? Do you have records to guide you?

Have you accounted for time needed to fuel lubricate and inspect the equipment? Equipment availability to me means a machine is out there operating. Maintenance people may define it differently: If it's out of the shop, it's available. This does not take into account the factors that may cost us our profit.

You should be aware of how much time it takes this equipment to do a given job, what the supply costs are and what the operating costs in performing a certain job are. Not just moving gravel, but all functions. Get a handle not only on operating costs but capital costs. The capital cost of a machine divided by the years you're going to operate it will give you the capital cost per year. Consider the tax laws. If you can take depreciation early, you gain on the time value of money. The new tax laws allow faster depreciation. Again you must determine your capital cost per ton of gravel handled or ounce of gold mined. That's just as much a part of your operating cost as fuel or anything else, and must be looked at in that way.

You don't want any surprises during the season. It would be to your advantage to outline a plan of action for even the most unlikely problems that could occur. This premeditated problem solving would no doubt prove time saving, and therefore a cost benefit. Once thought out, your plan of action allows you to approach problems quickly. Keep maintenance records, they will lead you to such things as: the capability of your equipment, operator caused damage? How can we correct that damage? Every piece of equipment has a power train and the power train has a weak link. It's going to break down. Your equipment is designed to do so much, and you have to learn what that is. I think that beefing up is limited to such things as hard surfacing and changing teeth and a few things like that. If you overtax the equipment, you're in for trouble. Your records will tell you the capability of the equipment. If you don't like that piece of equipment, it's time to change.

Once you know what volume you plan to put through the sluice box, the object is to get that volume continuously. What feeding mechanism do you need? What type of pushing? How many dozers? What distance can you doze? You should have this information and you should apply it to increasing your production, because that is part of the job of operating and servicing a sluice box.

Cleanup is another operation that you need to examine. You can spend hours sitting back and admiring your work and I know your cleanup must really give you a thrill. But, it also shuts down the operation, and you should have a cleanup designed to take up as few hours as possible.

Let's look at cutoff grade. I know this is a difficult problem and that most of you consider it in laying out your cuts. Suppose that 1500 ounces of gold is required to pay all the expenses of your operation. That 1500 ounces divided by the tonnage sluiced in a season gives you the ounces per ton. Any gravel containing less than that is waste. It may glitter, but it's not gold to you. This is merely gravel that's got gold in it. It's not gold ore, because your sluice box has to have a certain amount of gravel containing a certain amount of gold to make it a profitable operation. You wouldn't run barren gravel through it for the fun of it, so why do it when the operation is going on, just because it contains some gold. It may be difficult to acquire this information, but if you have reason to believe the gravel is significantly below the cutoff, call it waste. Sluicing it will only increase costs and reduce the opportunity of making a profit.

Summary

First, there's a production function. That's very simple: ore is coming up the shaft, or gravel is going through the box. Anything less than that is not production. Without production there is no return on investment. Second, it takes a lot of service to keep a piece of equipment going. This costs money, but you must keep it going.

Next is the delay function. Down time of one particular dozer may not seem too important, but you must understand how it equates to so many minutes of down time to the box. Try to understand the relationship. The object of course is to reduce the delays and make the service as efficient as possible. All this will lead to more meticulous and flexible planning. Keep an open mind continually, have plans that you can adjust, keep records.

One of the most important concepts, that affects all of the above, is motivation. What has motivated you to take these risks? You have people working for you. They may be strangers, or friends, or relatives, but they must be motivated to work. They're there for only one reason, their own self interest. They'll work for you only if you can tickle that self-interest of theirs and make their time worthwhile. They'll work for you willingly, they'll appreciate you and you'll appreciate them.

THE FLAT OPERATION
AND
UNDERGROUND MINING POSSIBILITIES WITH THE MISCO-GIANT

John Miscovich
Miner and Mining Consultant

The Golden Horn mine, at Flat, Alaska, is located 8 miles from Iditarod. The placer operation is adjacent to a monzonite intrusive. Our deposit consists of gold and silver, scheelite with high grade gold and tungsten values, cinnabar with high grade mercury, zirconium with some hafnium, stibnite with high grade gold, and lesser amounts of chrome and nickel. The metallurgists and geologists can figure that one out!

I utilize a 980 C loader, a 3/4 yard backhoe, an 8 KD caterpillar tractor, a pump, and a washing plant of my own design. Misco-Giants are utilized to feed the plant and strip the muck and overburden.

The front-end loader transports material to a hopper. A giant with a four inch nozzle, and about 2500 gallons of water per minute deslimes and washes the material across the grizzly. A punch plate deflector keeps the oversize material on the grizzly. The coarse material goes across the grizzly and into a separate section of the sluice box. Three to five hundred yards of material are handled per hour with this operation.

I built the grizzly about six years ago. My son can easily operate the monitor as it is very easy and safe. I feel it is very important to have a man who can visually control the sluicing operation.

We operated in the Ruby Mining District for a number of years up until 1958. During that time we moved several million cubic yards of overburden, with the Bering Sea as a settling pond.

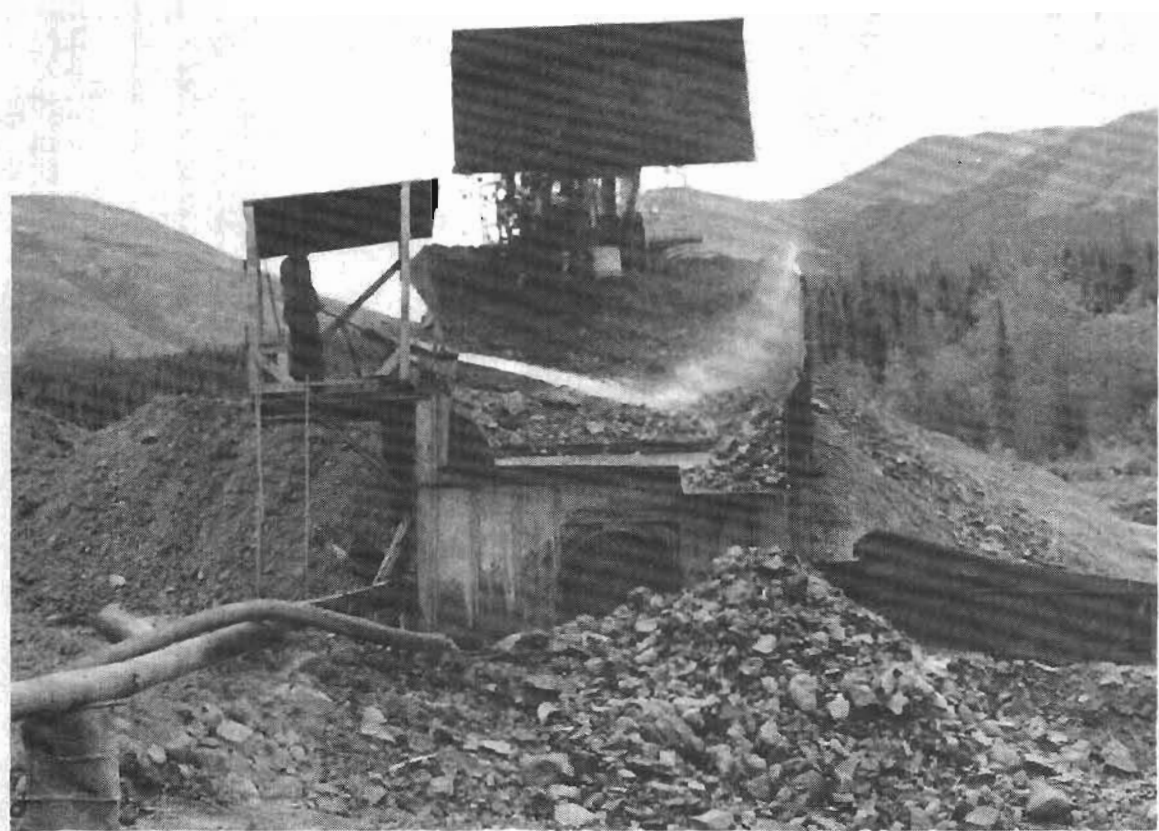
The permafrost was up to 100 feet deep. The giants were operated automatically on a pre-set pattern. The water was directed against the top of the bank of permafrost. It was not necessary for the giants to run vertically, only horizontally. As the warm water ran down the permafrost it melted the ice and washed out unfrozen areas. The giants had 2 1/2 inch nozzles and operated with about 300 pounds of pressure. A Murphy diesel pump brought the water from a ditch line. A tremendous volume of material can be removed in a 24 hour day.

There are many, many places in Alaska that can use giants, in a recycle system, to cut down the cost of overburden removal in comparison to rippers and cats. Permafrost removal is something I have spent a lifetime around and I'm familiar with it. In my opinion, no one is going to succeed in Alaska while using mechanical equipment on permafrost, even with \$300 or \$500 per ounce gold prices.

The hydraulic giant was developed in 1870 and remained unchanged for about 75 years. In 1946 I developed the Intelligine, which is now trade marked Misco-Giant. Various sizes of this giant are used in sluicing operations, as fire-fighting equipment, in a number of large scale hard rock mining operations, as an important part of our missile program, and in the Vietnam War to knock out enemy bunker systems along the river banks.

Underground Mining Possibilities with the Misco-Giant

In 1958 I assisted in an experimental program to hydraulically mine uranium bearing sands in Colorado, at a depth of 160 feet. The ore body was 10 feet thick. A four inch Misco-Giant was used as a submerged cutting tool to break up and slurry the ore body. The giant was inverted and remote controlled in a steel caisson shaft 36 inches in diameter. The experiment was successful, however the water also saturated the non-mineral sands above the ore horizon. This resulted in a dilution of the uranium bearing sands with waste material and made the system impractical.



In later years the Misco-Giant was also used in an attempt to mine oil saturated sands near Bakersfield, California. The system was reasonably successful, but the operation of a high pressure jet in a submerged situation was impractical. I then directed my attention to the use of jets in a dewatered excavation, with visible control.

The future of Alaskan placer mining lies in deeper ground. The more shallow creeks are becoming extinct, and after hearing Mr. Spencer of the E.P.A. talk, I think they will become even less usable. I feel that the time is right to experiment with underground hydraulicking of deep placer gold deposits.

Figure 2 is a schematic of the "Misco-Giant" underground miner. It was initially designed for oil sands excavation and processing. The drawing generally shows the caisson and equipment that would be used in the process for excavating oil-saturated sands.

The general idea is to supply a high-pressure water source to the three Misco-Giants and the two Misco-Jet Pumps. You will note we have a co-axial design whereby we can rotate the nose-cone with three oil hydraulic motors a full 360°. This 360° rotation is made possible by installing the water pressure line and slurry discharge line in the center of the caisson and using swivel joints to separate the inner water pressure from the outer slurry line compartment. These swivel joints are manufactured by Chiksan Co. of Brea, California, Division of F.M.C.

The nose-cone assembly is also attached to the main caisson by a swivel joint and rotated by three hydraulic oil motors which drive a pinion on the ring gear.

The slurry pump is mounted on a receiving tank and the suction is equipped with a priming jet at the intake. The receiving tank is supplied by a Misco-Jet Pump and the water pressure is supplied to the hydraulic lift nozzle through the outer compartment. Proper valving for proportioning the water supply is installed on the main lines and remote controlled.

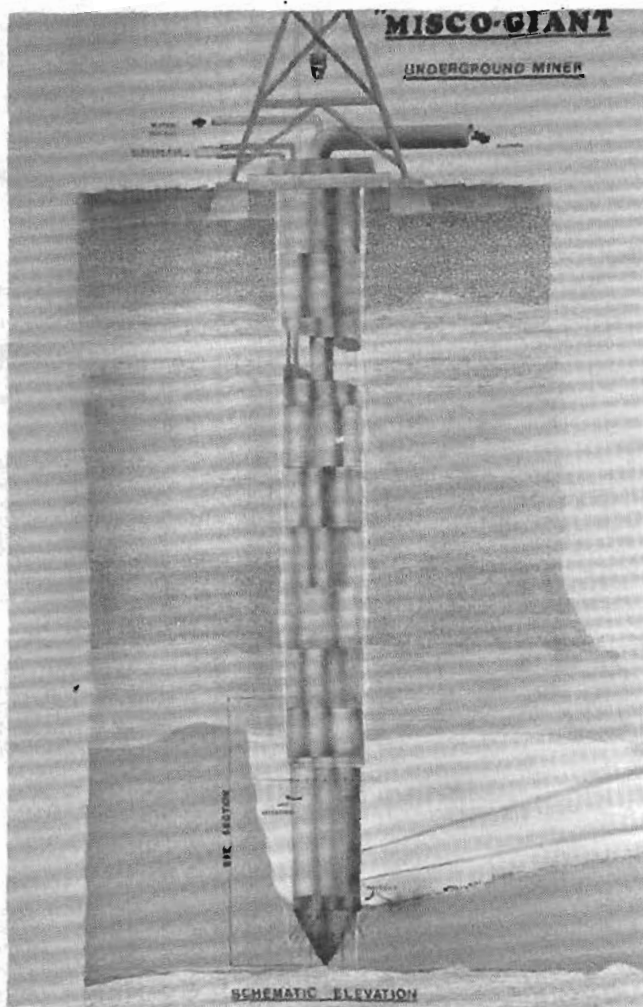
The three Misco-Giants are mounted on a dolly which supports the assembly when extended outside the Caisson by cylinders. A swivel joint allows for any movement in elevation as the Tri-Jet system is operating or when moved takes any twisting motion off of the four cylinders.

When the caisson has been lowered into its excavated shaft and readied for hydraulicking, gate is opened slightly to allow the jet stream to penetrate the oil sands on the outside. As soon as a forward cut is made of several feet, the gate is opened a few more inches exposing a pie-shaped cut into the sands. As soon as the gate is opened far enough for the two side Misco-Giants, they join the vertical mounted Misco-Giant in the hydraulicking procedure. The slurry flow enters the nose-cone through the Grizzly classifiers around the nose-cone. If material that will not break up readily accumulates around Grizzly, sink jets are started and bore vertical holes for the heavy, hard obstacles to sink into.

When the three Misco-Giants have cleared an area 360° in diameter around the nose-cone and the pressure is not effective for slurry recovery, the flange on the water feed cylinder is disconnected and a spool inserted in between the Misco-Giant supply flange and swivel joint. Spool extensions are added between the cylinder connection and the tri-jet manifold on the dolly. The controls for such a system are designed for manual and semi-automation on the Misco-Giants. Television remote control to the Caisson platform allows visual judgement in the pit area and also in the Caisson nose-cone.

The slurry pump motor can be oil or electric. The nose-cone rotating motors are oil-operated, as well as the Misco-Giant swivel joint drives. Remote control valving for all high-pressure water circuits are oil motor-operated.

The volume of water for the three Misco-Giants varies depending on the inflow of liquids from the sands. However, we will assume 500 gallons per minute through a 1" diameter orifice at 300 psi as an effective working volume and pressure to break up the sands. Three Misco-Giants require 1,500 gallons per minute.

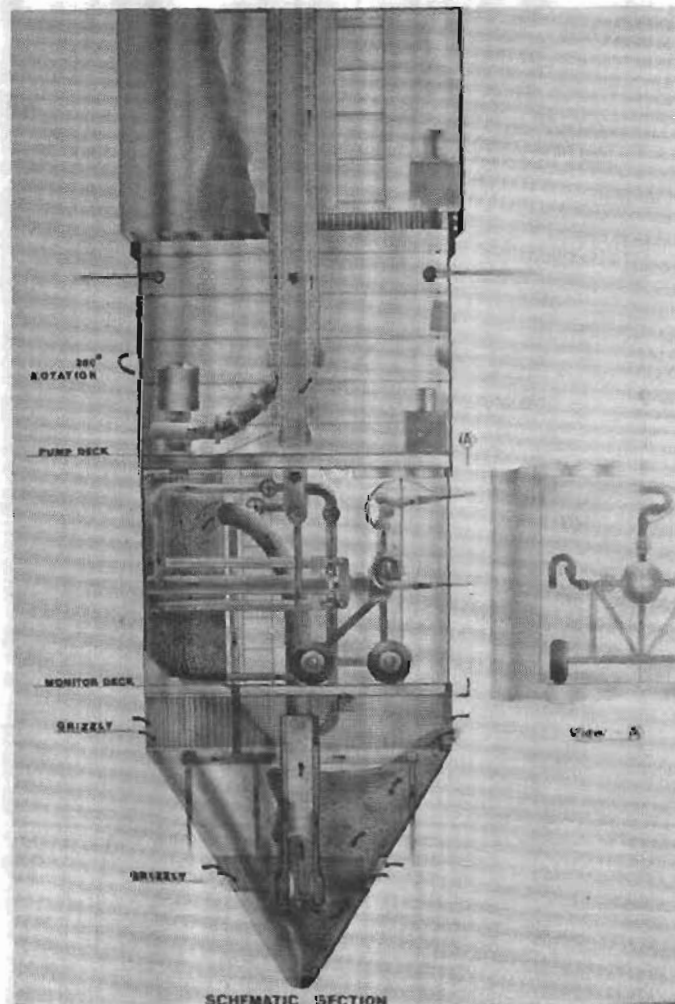


The hydraulic lift nozzle, 2-1/2" in diameter, requires approximately 65 psi to elevate the 1,500 gallons of water from the sump to the slurry tank. The slurry pump priming and agitating nozzle in tank require approximately 300 gallons per minute at a low pressure of 10 to 20 psi.

The system requires a slurry pump that has a capacity of approximately 5,000 gpm. We do not show a series system which would be required to pump the water and oil sands to the surface when depths exceed the range of single-stage slurry pumps.

While we have shown the system quite compact in a nose-cone design, the elevation between the slurry tank and the Misco-Jet Hydraulic Lift could be increased to 30 feet if so desired by increasing the lift nozzle pressure to 100 psi.

These drawings are for the purpose of establishing a concept only. Your engineering studies will undoubtedly bring forth many constructive ideas to add to such a system. For that reason, I prefer not to "freeze" my thinking on a drawing with all the details until I learn more about the problems of hydraulicking sands.



SOME POTENTIAL TECHNIQUES FOR USING AERIAL PHOTOGRAPHY

J.T. Kilne

Alaska Division of Geological and Geophysical Surveys

There are many kinds of air photos and remote sensing formats available for use by the prospector or professional geologist. These include satellite imagery, skylab, and side-looking airborne radar. Even airborne geophysical surveys can be considered a type of remote sensing format. All have advantages and disadvantages. Many require manipulation by computers to obtain complex modeling programs. Some of these techniques, while very interesting and exciting, are expensive and not readily available for direct application by most prospectors. It requires a specialist to make coherent sense out of much modern remote sensing data due to its complexity and sophistication.

Aerial photographs remain the most widely useful, accessible, and easy to understand form of remote sensing. Their interpretation involves relatively straight forward recognition of visible surface features on earth. They do not normally require extensive decoding or computer enhancement. Often their information or their message is intuitively obvious even to the newly initiated user.

Aerial photographs have been used for decades as valuable tools for delineating geologic features of interest. At the state geological survey they are used almost daily as an aid in resource mapping. They give us a very realistic picture of what is on the ground and how features on the ground collectively relate to each other. Since they are stationary and lasting we can study photos to derive a coherent geological picture of an area. This is something that is often difficult to do when on the ground with a limited perspective or from a moving aircraft, where perspectives are constantly changing. Such features as faults, dikes, intrusives, structural trends and changes in bedrock lithology are commonly discernible and their approximate limits can be mapped by an experienced interpreter. Aerial photographs are especially useful for mapping surficial deposits derived from streams, mass wasting, shorelines, glacial processes, and wind. These deposits are generally recognized by form and position. Commonly a good guess can be made as to their thickness and source. Doing this takes a little practice and requires field checking. In fact one of the cardinal rules of good photogeologic mapping is that it must be extensively field checked on the ground by digging test pits or other available subsurface data to verify a preliminary interpretation. Even the best photointerpreters are occasionally fooled by look alike or indistinct landforms. The more spot checking that is done, the more adept the geologist or prospector becomes in interpreting subtleties of the terrain. With aerial photographs we are identifying units of common origin, or blocks of ground containing similar material, and distinguishing these units from surrounding ground. To be 100% sure of a given unit, we must dig test holes.

The proper use of aerial photographs can be an extremely beneficial low cost tool for exploration geologists and prospectors. The amount of information to be derived from photos is large given a basic knowledge of their use and a few simple tools.

Most aerial photographs are taken in sequential lines such that each successive photograph overlaps the prior one by approximately 60%. In addition, adjacent lines overlap about 10% to insure complete coverage. These lines are identified by several sets of numbers. The mission number identifies a series of flight lines taken by an aircraft during a single mission. The frame number which usually advances by one with each successive frame. Other numbers often include the day, month and year taken, and the altitude. Most of the aerial photography available in Alaska has been indexed by quadrangle. The indices are miniature versions of USGS 1:250,000 quadrangles showing the orientation of flight lines and their coverage with mission and frame number indicated. These indices are used to locate and identify photos covering the area of interest.

There are several types and scales of aerial photographs available to the public. Some are flown and produced by various government agencies including the National Oceanic and Atmospheric Administration, the Bureau of Land Management, the U.S. Forest Service, U.S. Navy, U.S. Coast and Geodetic Survey and most recently NASA. There are also private companies, some based in Alaska, which have the capability of flying custom aerial surveys at almost any scale and in a variety of formats.

The formats most commonly available to the public include black and white, false color infrared and natural color. Extensive black and white photography was flown in the late 1940's and early 1950's, for a large percentage of the State, at a scale of 1:40,000 (approximately 1" = 2/3 mile), and was used by the U.S. Geological Survey and the military in the production of topographic maps. Prints of this type can be ordered from the E.R.O.S. Data Center in Sioux Falls, South Dakota or from the U.S.D.A. aerial photography field office in Salt Lake City, Utah.

False color near infrared photography covering most of the state has been flown recently by NASA using U-2 aircraft. It is available in 9" x 9" print or transparency format at a scale of about 1:62,000 (1" = 1 mile). The photos are excellent with very high resolution and contrast and are capable of being enlarged by at least 4 times with minimal loss of resolution in most cases.

Natural color is the least common format in terms of the percent of the State covered. It is available for selected areas from private vendors, very limited coverage has been flown by government agencies.

Other scales of photography with less extensive coverage in Alaska are 1:120,000, 1:20,000, 1:10,000 and various other scales flown at low level for very specific purposes such as forest inventory, or construction alignments.

In Fairbanks, an archive containing much of the recently flown imagery of the State, and an extensive collection of indices showing the many types of remote sensing data available is located at the University of Alaska on the 5th floor of the Geophysical Institute. The northern remote sensing library has the most complete public collection of satellite imagery and aerial photography of Alaska in the State. If you are interested in viewing or obtaining aerial photography, I encourage you to avail yourself to the services of this library and its helpful staff. They will be happy to assist you in locating imagery of an area you are interested in and will be glad to place orders for it from the many sources which I have mentioned.

When using aerial photographs, one must realize that a scale and format should be picked which best suits the need. If one wants to look at relationships between features over a very large area, then small scale high altitude photos in which each frame covers 300 or more square miles may be the best choice. However, if one wishes to concentrate on a stretch of creek or beach which he wishes to investigate for placer potential, he may want the greater detail and resolution of large scale lower altitude photographs in which each frame takes in 80 square miles or less.

The next choice to make is whether to obtain false color infrared, black and white, or natural color. Each type has distinct advantages and disadvantages. It may, in some circumstances, be good to have both. An example of this was illustrated to us recently while mapping in the McGrath B-2 and B-3 quadrangles. Dike swarms, which are highly visible and easy to map on black and white photos, are indistinct or invisible on color infrared. On the other hand, unconsolidated surficial materials, such as glacial till or bench gravels, are often easier to distinguish in false color as vegetation differences resulting from various soil conditions are vividly contrasted. Likewise, major faults in an area are sometimes more distinct in color format and at other times show up better in black and white. As a result we use both formats to gather information.

Finally, and perhaps most importantly, overlapping coverage of the entire area should be obtained in order to take advantage of stereo viewing. By overlapping coverage, I mean that an area of interest should be represented on at least two sequential photos which look at the same objects from different angles.

I commonly have people ask me questions about an area they are interested in who produce only one aerial photograph covering that area and I always ask them if they have the photos on either side. Their response all too often is that they only took the one photo centering on their area or property, because they weren't interested in adjacent areas. They didn't understand that overlapping coverage is necessary for optimum interpretation.

With overlapping coverage and a few simple tools, one can see vertical relief and delineate features such as benches, beach berms, or abandoned channels and get a feel for their relative heights and/or thicknesses and how various features in the scene relate to one another in three dimensions.

The principle tool for three dimensional viewing is a stereoscope. Simple ones can be purchased at relatively low cost. for precision measurements or for the convenience of viewing a larger area more expensive stereoscopes are available. The small pocket types are used most for field work. Some geologists even prefer to use them in the office. The more sophisticated models have focusing oculars and prescription glasses are not needed.

Stereo alignment requires two adjacent photos that overlap in the area of interest. Find the same easily recognizable landmark on each photo and separate them on a table so that the landmarks or conjugate points on adjacent photos are about as far apart as are the centers of your eyes. Be sure that the photos are in the proper sequence and properly oriented. Place the stereoscope over the photos and look straight down so that your left eye is looking at the mark on the left photo and your right eye is looking at the same landmark on the right photo. Adjustments are usually necessary at first, but the combined image you see should be in stereo much like looking through an old stereopticon or view master. It may be necessary to bend up the edge of one photo so that images beneath it can be viewed.

It is often desirable to make marks or draw boundaries around units that can be delineated on photos. There are several good ways to do this. One is to tape a sheet of clear acetate film to the photographs and record features with a fine point waterproof felt tip marker a drafting pen and India ink designed for use on acetate. If the ink beads up on the acetate a drop of liquid detergent added to the ink bottle will sometime help.

Once the units of interest have been delineated such as benches or floodplain gravels, their area can be measured. If approximate thickness of a unit is known the yardage can be roughly calculated. Other uses for airphotos might include the location of old workings. The old buried beach lines at Nome can be traced despite the lack of natural surface expression by the presence of prospect pits and mining cuts. By connecting these pits, it is possible to trace the ancient shore lines now buried beneath a blanket of glacial deposits and vegetation. Similar techniques are sometimes used in the interior to trace old pay streaks which were drift mined. Old disturbances of the ground sometimes give rise to anomalous vegetation patterns which are visible on photos.

Stereo photographs can easily be made with hand held camera and any available film format from black and white prints to color slides or polaroid prints. These can be made on the ground of cuts or trenches or from an airplane or helicopter. The principle is much the same as that employed in vertical aerial photography. One moves between pictures so that your angle of view changes, while remaining about the same distance from the subject to keep the scale constant. A 30° - 50° change in the angle of view is all that is necessary. The more one moves between each picture in a stereopair the more exaggerated the stereo will be. An interesting technique for taking a stereopair, allowing it to be used as a page in ones field notes or as a sketch, is to use a Polaroid SX-70 or other "Instant" camera.

EXPLORATION METHODOLOGY FOR LARGE SCALE PLACER DEVELOPMENT

Thomas Albanese
Resource Associate of Alaska, Inc.

The earliest prospecting in Alaska was accomplished through the use of random hit-and-miss shafts dug to bedrock. This was a very expensive and time consuming procedure and was soon superseded by the introduction of the churn drill. The churn drill has been the standard prospecting tool for over fifty years.

Over the past few years, several types of drilling rigs have been developed and modified for use in placer exploration. For our purposes we have decided to use a Hawker-Siddeley resonant drill, commonly referred to as a sonic drill, mounted on a Nodwell carrier. This is paired with a Bombardier track vehicle, which is used as a tool and welding unit in addition to hauling samples to the panning station and switch crews at shift change. The drill assembly is shown in the following photograph (Photograph 2).

This drilling set up has proven to be satisfactory and offers several advantages. First, high mobility is achieved by concentrating all drill materials on track equipment, greatly decreasing the downtime due to moving and hole setup. Second, the sonic drill has shown an extraordinary ability to "make-hole". This is particularly important in our present work in the Ruby district, where the gravel section and paystreak bears no relationship to the present topography. A large amount of drill footage is required in order to adequately evaluate the placer reserves. Finally, the quality of the sample recovered by the sonic drill is the decisive factor in using this system. A virtually perfect six inch diameter core of the overburden, gravel section, and bedrock is obtained. It is fairly obvious that this is a much more representative sample than available for other drilling systems. In addition to providing an accurate sample, a core can be used to evaluate mining parameters including: ice content, continuity of permafrost, gravel sorting and gold distribution, bearing strength and the ease with which the bedrock can be ripped.

The drill is run by a driller and a driller's helper. It is backed in a premarked location, the tower raised, and the jacks set and leveled. The driller proceeds with drilling while the driller's helper is responsible for pipe handling. A repetitious system of drilling and pipe handling is undertaken until bedrock is reached and rotation of the tooling is slowed. A three to five foot plug of bedrock is taken. The vibration is turned off and the pipe is pulled out of the ground. When each section of pipe is pulled to the surface, the collar is broken, head tilted outward, vibration turned on and the core removed. In the gravel section, this core is bagged in 1-1/2 foot increments, as shown in the following photo. (Photograph 3) These bags are tied, labeled, and dropped off at a central panning facility during shift change.

At the panning station, the samples are weighed, measured and then slimed prior to processing in a Denver Gold Saver. A Long-Tom is located at the end of the Denver Gold Saver's riffles. After each sample has been processed the riffles are panned and evaluated. The Long-Tom is panned after the completion of each hole for a cross-check. The concentrate is dried, magnetite and cassiterite are removed and the gold is then weighed. The gravel tenor can then be estimated for the hole and used toward reserve evaluation.

In many cases, drilling is neither required nor adequate in the evaluation of potential placer ground. In the case of our 1981 Minook Creek operation (run by Bill Lanning, a 1976 School of Mines graduate) the ground is rich but spotty and shallow enough to be best evaluated by open cut. Initial prospecting by open trench in 1980 justified the installation of a pilot plant to process about 30,000 square feet of gravel. An overall creek grade was derived, and both the washing characteristics of the gravel and recovery characteristics of the gold were determined. Based on these results, a decision was made to install a full scale mine plant in 1981. Two D-8K bulldozers and two 980-C loaders were employed to strip 350,000 cubic yards of overburden and process 250,000 cubic yards of gravel. We used a Tyler Screen with 3" square mesh urethane decking and the spray bars utilizing 2000 gpm of recirculated water. Due to the characteristics of the gravel, this was a very satisfactory arrangement.



Figure 1. Shaking screen washing plant at Little Minook Creek, fed by a front end loader.

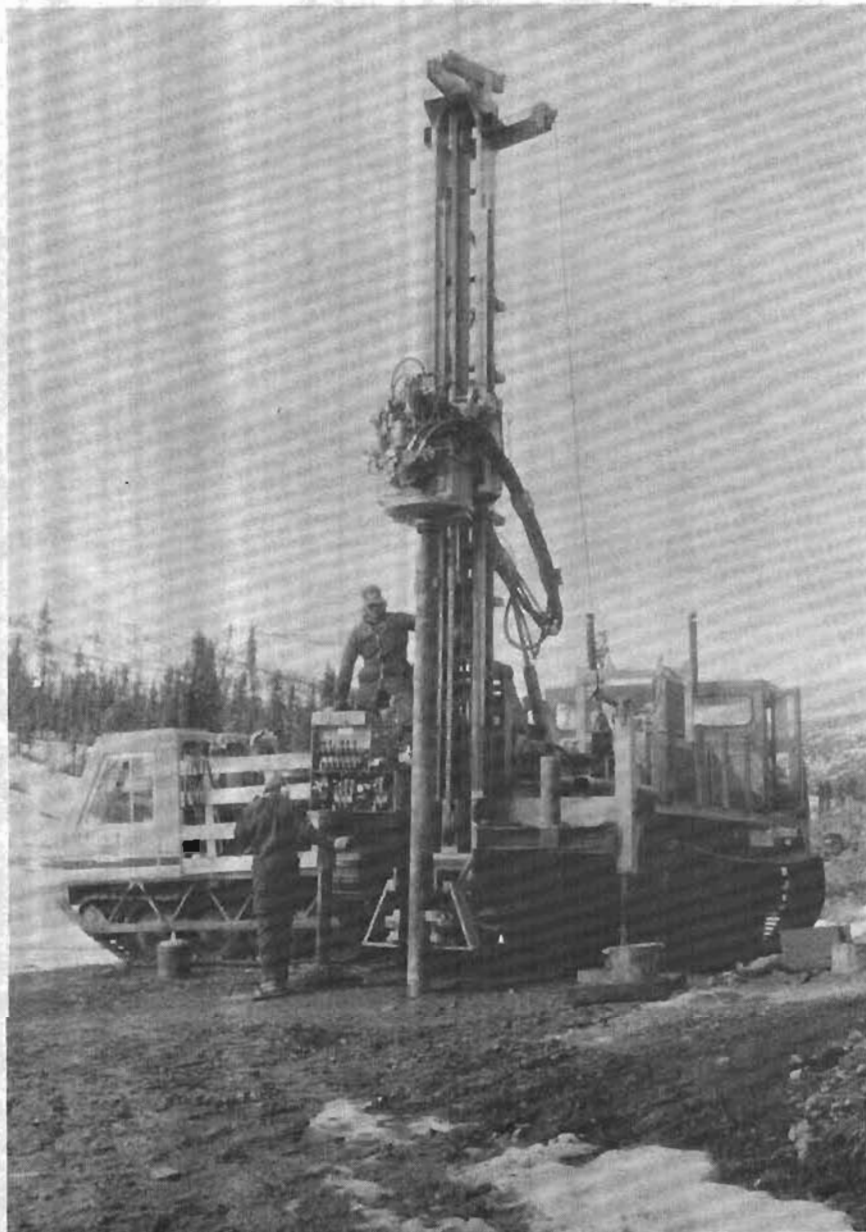


Figure 2. Drilling with the sonic rig.

MINING IN THE YUKON

Ruth Debicki, DIAND, Canada

This paper will address three aspects of the placer mining industry in Yukon. We'll look at the scale of the Yukon placer mining industry, the mining and processing methods that are being used today, and the geomorphologic setting of the placer deposits in Yukon. These will be compared briefly with the situation in Alaska.

Scale

The increasing price of gold during 1979 and 1980 started a pretty significant rush to acquire claims. In 1971, there were about 550 miles of claims and leases in Yukon. At the beginning of 1979 there were about 1250 miles of claims, and by the end of 1980, there were about 3650 miles of claims and leases. The price of gold dropped off dramatically, and the number of miles of claims and leases in Yukon at the end of 1981 was about 3700. The increase in water-use authorizations correlates with the increase in the number of operating placer mines. In 1978, 174 authorizations were issued, and in 1979 there were 179. In 1980, there were 299 and in 1981, 347. There has been a significant increase over the last few years. This is also true with the tri-agency permits in Alaska. There were 415 applications for large mechanized operations in Alaska in 1981, about 20% more than in Yukon.

Along with the increase in the number of operations, there was also an increase in the size of the operations. In 1978, only 8 Yukon operations recovered more than 500 ozs. of gold, 10 in 1979, 25 in 1980 and in 1981 we expect a further increase.

The export royalty on gold leaving the Territory has recently increased from 22-1/2 cents an ounce to 37-1/2 cents an ounce. The royalty is not paid on gold sold within the territory, hence these production estimates are minimum values. In 1971, 5500 ounces of gold were produced. In 1980, there were 73,000 ounces of gold produced, and by the end of December, 1981, 99,583 ounces of gold were recorded (these are crude ounces). We estimate that a minimum of 120,000 to 125,000 ounces, and possibly up to 200,000 ounces of gold were produced. Compared to the production figures quoted yesterday from Alaska, Yukon produces 20 to 30% less than the placer industry in Alaska. Not bad considering the whole population of our territory would fit into Fairbanks.

Mining Methods

The scale of an operation and the topography of a creek are factors which affect the mining methods utilized in an operation. A narrow, confined valley with deep gravel is mined differently from a broad, flat valley or a high-level bench deposit. Many pay gravels are over 100 feet above the current creek levels.

We do have a little hydraulic mining, but only a little, mainly because of problems with water quality. One of the larger hydraulic operations can process about 8 cu. yd. every 4 seconds. There's a couple of operations that use hydraulicing a little bit for stripping.

Mechanical mining is by far the most widely used means of placer mining in Yukon, and a variety of bulldozers, front-end loaders and backhoes are used. The biggest backhoe in use has a bucket of about 5 1/2 cu. yards. Some of the larger operations use scraper loaders to mine. They mine a few inches each day, allowing thawing to occur naturally. Some scraper loaders are capable of 35 cu. yds. at a pass. The largest single operation in Yukon mines about 10,000 cu. yds. a day.

There is only one dredge operating in the territory. It started full-time operation in 1981. This new dredge is the first to operate in Yukon since 1966. The presently operating dredge utilizes 2 1/2 cu. foot buckets and processes about 2,000 yards per day, on Clear Creek halfway between Dawson and Mayo.

There were two underground operations in 1981. In some areas, the pay channel is only about 10 feet thick, and it lies beneath 200 to 300 feet of overburden. People are going in

along bedrock and mining 10 feet of rich gravels with about 150 feet gravel above them. Perhaps Mr. Mircovich's underground hydraulic mining could be applied here.

People in the Yukon are beginning to realize that screening is important in their processing operation. Screening makes the processing more specific to the size fraction of the gravel which contains the gold. It also increases throughput, because less gravel is actually sluiced. Several operators use stationary grizzlies. One operator has a remote control on his stationary grizzly. When he punches a button inside his loader, a hydraulic ram lifts up the grizzly, clearing any rocks lodged in it.

A specialized screening plant was designed and patented by a Yukon placer miner. It consists of a series of steel plates with hinge joints, much like the track of a dozer. The plates are driven by two sets of rubber tired wheels on hydraulic rams. The wheels go up and down, producing a sinuous motion. The gravel is dumped onto the plates. Material smaller than the space in between the steel plates falls through into the sluice box. This is particularly useful in glaciated areas because it can handle large boulders. I've seen 4 foot and 5 foot boulders go through this classifier with no problems at all. Most miners are using steel sluice boxes. There may be one wooden sluice box left in the Territory. Inside the box one generally sees punch plates over Hungarian riffles or expanded metal, with some type of matting or astro turf underneath. One large sluicing operation purchased their stacker from the asbestos mine at Clinton Creek. They convey the coarse tailings from their trommel 1200 feet to the end of the stacker and get them away from their mining operation.

Another interesting unit is the Mill Spex. Manufactured in Carson City, Nevada, the Mill Spex screens the fine material is dumped into rotating drums which are supposed to be particularly efficient for recovering fine, flat gold that would float on the water in a conventional sluice box. As these drums rotate, the gold is caught on spiraled riffles inside the drum while the coarse tailings pass on out the end. To clean up, the rotation of the drum is slowed and the concentrates are washed out the bottom end.

The Canada Tungsten Mining Company is mining for gold, tungsten and tin. Scheelite is the tungsten mineral, and tin is present in small quantities in the form of cassiterite. The gravel is run through a trommel and the undersize goes to a series of jigs. From the jigs the concentrate goes into a series of spirals. The spiral concentrates are passed across two large shaking tables for their final recovery of gold, scheelite, and cassiterite concentrate.

Cleanup in Yukon has not kept up with the current technology in placer mining. Longtoms and gold pans are common, a very labor intensive process. A few miners are beginning to use gold wheels, rotating drums, and Dyster tables. Amalgamation is rare. The Whitehorse Copper Company has a small sluice box at the end of their ball mill. They recover about 25,000 ozs. of gold a year, half of which is recovered in the sluice box at the end of the ball mill. They clean the sluice box concentrate on a small shaker table.

Most of the placer deposits in Yukon are mined for gold. Magnetite is an important accessory mineral. Pyrite and hematite are common and there is some cassiterite. Scheelite is an economic by-product in a few places, and wolframite, the other ore mineral of tungsten, is an important by-product. Also present is garnet, zircon, rutile and epidote, but not in economic concentrations. Exploration is taking place in the North Ladue River area. At Russell Creek exploration is taking place in an area far away from the traditional mining areas, and also in an area that has been glaciated.

In summary it should be emphasized that each step in the mining and processing of the placer deposits in Yukon is site-specific and depends on the type of material being mined, the area being mined, and the size of the operation. It is possible to pick and choose bits and pieces of information, put them altogether, and create an individual operation.

Geomorphology

Mining goes on in a variety of areas in the Territory. Besides Dawson City, Whitehorse and the Klondike, there is mining on or near the 16 Mile River, 40 Mile River, Stewart River and Kier Creek, where the previously mentioned dredge is operating. There is also some mining in the Mayo area and in the Burwash area. In previous years Livingston Creek was active, but little mining is being done today.

Drilling is becoming important in Yukon exploration. In 1978, 3,000 to 4,000 feet of drilling was completed. Churn drills, becker drills, reverse circulation, hammer drills and also the ultrasonic drills are being used. In 1979, about 4,000 feet were drilled. In 1980, 17,000 to 21,000 feet was drilled, and in 1981, that went up to 18,000 to 28,000 feet of drilling.

The geomorphology of placer deposits in unglaciated terrain is of particular interest. The geomorphology of glaciated terrain is generally more complex and could be better addressed at another time. Theoretically, there should be nice, v-shaped valleys with placer deposits situated down in the center of the valley. That is not often the case.

In permafrost areas in Yukon and Alaska, one thing that happens is that south facing slopes tend to thaw and slump and force the river valley up against the north basin slope.

In this situation, you might get existing placer concentration buried by slump, which might include large bedrock slabs, creating false bedrock layers overlying placer concentration. In areas such as these, one should prospect for old, buried placer channels.

Another consideration is the constant upheaval and subsidence of land. The earth is not static in the Yukon Territory. In places the ground is moving up and down at the rate of 5 centimeters per hundred years, which translates into about 80 feet in 50,000 years. The 50,000 year number is about the age of some of the fossils found in the black muck over the gravel. 50,000 years is a very reasonable number to look at with regard to placer deposits. Ground movement of 80 feet is pretty significant with regard to the creek level.

If a stream has been down-dropped, new deposits of gravel are layered upon. In a situation like this, one could expect to find placer deposits buried under very thick sections of younger gravel. The Ladue River Region contains valleys of this type. People have been actively prospecting this area in the last couple of years, and have found placer deposits, especially in areas where the gravel is not so thick.

If a creek has been uplifted it will down-cut dramatically and deposit new gravels in the active valley bottom. To prospect for old deposits in this area, one would have to look for high benches. Some bench deposits lay 100 to 150 feet above the current creek level. The high benches in the Dawson area are spectacular, particularly in the Bonanza Creek area where the present day creek has incised and left considerable deposits of gravel on an older bedrock surface. A third possibility is the migration of a stream from one side of the valley to the other, resulting in the deposition of young gravels on older placers. One might also find placer concentrations in older channels on the opposite side of the valley from the current channel.

Understanding the processes by which the land is shaped allows one to look at a river valley with a critical eye, perhaps seeing something that was not recognized before, that might aid in prospecting or mining development. Standard black and white aerial photographs or false-color infrared photographs can be useful.

In summary, the scale of placer mining in Yukon makes it a significant industry in the Territory. Our mining methods are similar to those commonly used in Alaskan placer mines, each operation slightly different, depending on site-specific factors.

The geomorphology of a particular area can be crucial in understanding known gold deposits and in prospecting for new ones.

RECLAMATION AT PLACER MINING SITES

David R. Maneval
Professor, Department of Mineral Engineering
School of Mineral Industry

Introduction

Historically, the mine operations in Alaska have been production oriented, not always concerned about the site during mineral production or the post mining use of the abandoned site. Some "abandoned" mine sites have recently become valuable as much sought permafrost free sites for homes and industry. It is possible that the state, prompted by Federal Laws and regulations, may slowly but surely tighten up its controls regarding the impacts of abandoned mine sites. It is suggested that some modest effort on site reclamation may be low cost if preplanned (rather than an after thought), may produce a commercially viable site (if near populated areas), may reduce erosion-silt producing run off and may blunt yet another set of state regulations.

Background

The Coal Mining Act of 1977 (PL 95-87) contained in Section 709 the requirement that the National Academy of Science (NAS) perform a study of Surface Mining of noncoal minerals. This committee of NAS has completed its study and it is pertinent to note their finding (NAS, 1979).

"In response to the specific charges addressed to the Committee in Section 709 of the Surface Mining Control and Reclamation Act of 1977 (PL 95-87), COSMAR finds:

(4) that there are alternative regulatory mechanisms, and institutional approaches not regulatory in character, that could ensure the achievement of the most beneficial postmining land use for areas affected by surface and open-pit mining; these alternatives were identified and their applicability to a range of requirements and situations was discussed."

Based in part on this recommendation, it is deemed unlikely that the Congress will regulate mining of other minerals to the same extent that coal mining is now under Federal/State laws and regulations. The NAS report further notes however that their findings are due in large measure to the existence of laws already enacted. It is inferred that the noncoal mining industry should carefully obey existing laws and also consider land use in its mining planning.

Land Reclamation

With few exceptions, the wastes or tailings from both large and small placer operations have remained where they were dropped during the mining cycle. These piles were only moved if they were in the way of new advances of the mine or were needed for a base for equipment or buildings. Virtually no post mine sculpturing or shaping has been practiced or any attempts made to cover these mixed aggregates with soil.

As reported by Errington, 1975, Patterson, 1977, Nelland, 1978, and at this conference in 1980 by Holmes, there are a wide array of vegetative species which volunteer and can cover old tailings piles. These studies generally deal with waste which has been abandoned without the benefit of shaping, soil covering or other reclamation assistance. Even in interior Alaska or Northern Canada there are occurrences at old mines of densely vegetated mounds supporting vigorous mixed hardwood forests--all propagated without assistance of man.

The experience of the surface mining industry at other locations may well be applicable here. Today in many mining situations it is general practice to preplan the post mine reclamation before initiation of the operation. The final surface configuration is usually thought through and determined. Is the site to be returned to timber production, developed for building sites, or returned as closely as possible to its original state? After these decisions are made, engineers calculate the well factors anticipated upon disturbance of virgin material, optimum haul distance for run-of-mine material and lean-processed tailings. Top soil (A horizon) material is usually scraped off, stock piled and vegetated with inexpensive grass seed to minimize erosion losses. Following the normal mining sequence of top soil removal, overburden

Using average conditions of permit size (i.e. 40 acres), slope, soil conditions and rainfall, a "standard" plan for sedimentation design and construction was prepared. This standard plan, as appropriately tailored to the individual mine site, has been submitted to the state regulatory agency and has been found in most cases to be satisfactory. This technique has been expanded to include several other areas where information is required of the applicant. We foresee that in the future, even more mining companies may opt for the use of consultants to prepare parts of the mine permit application.

It should also be noted that various state agencies can provide advice and limited technical assistance. Examples of these services might include design of settling ponds thru the Soil Conservation Service which has extensive experience in design of thousands of farm ponds and small dams. Stream flow data is available from the State Geological Survey. Rain fall amounts and frequencies information is provided by the Weather Bureau (part of NOAA). The state Bureau of Forestry can provide advice on woody plant species desirable for revegetation in your locale. Your Agricultural Agent will be able to recommend soil amendments and lime treatment if necessary for optimum growth of vegetation on the reclaimed site.

Conclusions

Limited services from these agencies when augmented by preplanning and design forethought can lead to a well engineered mine operation and a site which, after mining, lends itself to an acceptable post mining land use.

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APPLICATION OF RESONANT DRILLS TO PLACER EXPLORATION

Rodney A. Blakestad, President, Sedcore Ltd.

I would like to take this next block of your time to describe a revolutionary placer evaluation system that was first described in this forum last year in papers delivered by Mr. Jim Wallis of Atlin, British Columbia and Mr. Derrick Dance, representing Hawker Siddeley Canada, of Vancouver, British Columbia.

This relatively new placer evaluation system is embodied in a drill known as the Superdrill 150 and its more mobile sister drill, the Hellisonic 150. These have been referred to, and are also variously known as the Resonant Drill System or Sonic Drill.

The Superdrill 150, manufactured by Hawker Siddeley Canada, is based on the patented designs of Dr. A.G. Bodine. The drill is capable of coring unconsolidated and semiconsolidated sediments, whether frozen or thawed, through the generation of a relatively high speed axial vibration which I will describe in more detail in a few minutes. Beyond the scope of placer evaluation, the Resonant Drill System (RDS) has been used in geotechnical soils investigations, permafrost coring, casing extraction, seismic shot-hole drilling, tie-back anchor emplacement and other subsurface grouting applications. It has also been used, in a limited extent, in lode mineral exploration.

The scope of my discussion today will be limited to placer sampling based on our experience with the RDS in exploring for valuable heavy minerals in Recent sedimentary environments.

To look back for a moment at the history of placer exploration and the evolution of placer evaluation technology, one would have to consider shaft sinking as the earliest practical method of subsurface placer evaluation prior to adaptation of the drill. Shaft sinking is conducted by digging the material within a certain area on the surface all the way to bedrock, cribbing the walls of the excavation where necessary, as you go, or by utilization of the nested casing segments. This old and proven method of evaluation was labor intensive, slow, and subject to numerous difficulties by virtue of the nature of the environment in which the work is conducted, and as Ed Armstrong mentioned yesterday, it is quite an expensive undertaking.

The most profound revolution in placer exploration work was begun in 1898 when Keystone Drill arrived in the Boise Basin, Idaho (Gardner, 1921) and instituted the evaluation of a placer gold deposit. For almost one hundred years since, the terms Keystone Drill, churn drill, and placer drill have been essentially synonymous.

Churn drilling is affected through the rather simple process of driving a heavy string of cable tools into the ground within a heavy walled drill pipe fitted with a drill shoe on its leading end. This percussion method literally chops its way down and the cuttings and other drilled materials are removed from the drill pipe with a baller or sand pump. In placer exploration each pumping, generally representing a foot of drilling, is de-slimed, measured loose in a special measuring bucket, and then panned or concentrated in a rocker box. Gold derived from the drilled materials is then weighed and an engineer or geologist, familiar with the characteristics of the ground, calculates the value of the area drilled. Though highly variable, Churn drilling can be expected to proceed at a rate of 4.0 to 8.0 feet per hour of operation, averaging around 30 feet per shift when including move and set-up time.

Other drilling methods evolved throughout the 1940's and 1950's utilizing other mobile percussion drills, augers, and clamshell type "diggers". In recent years we have seen the use of rotary drills and rotary percussion units using air and/or fluid circulation in the direct or reverse circulation mode. These later drills are much larger and heavier than their predecessors and have some mobility restrictions in the placer fields of Alaska. In spite of various sampling problems inherent to drilling methods utilizing a circulation medium for the drilling process, rotary rigs have greatly increased the daily production rate, thus benefiting the cost effectiveness of many exploration programs.

In 1980 a Canadian Company introduced the Resonant Drill System into the placer fields of the Dawson area. News of their success and increased cost effective projects trickled over the

order and gave impetus to the establishment of SEDCORE Exploration, Ltd. as a resonant drilling company located here in Fairbanks, Alaska. Our experience with the Superdrill 150 has proven it to be mobile, fast, and quite capable of obtaining high quality core samples in the placer environment on a routine basis.

A complete Superdrill 150 unit weighs about 15,000 pounds and is readily adaptable to skid, truck, or tracked vehicle mounting. The unit should be fitted with hydraulic leveling jacks for stabilization and to compensate for uneven drill sites. The Superdrill 150 has proven itself to be a reliable, well-engineered piece of equipment requiring only a nominal amount of routine maintenance.

The RDS performs its function in a mode substantially different from that of conventional drilling equipment. The drill head generates a sinusoidal axial vibration which is transmitted to the drill stem, with a variable frequency up to 150 HZ. The Superdrill 150 is designed to be operated at frequencies close to the natural frequency of the drill column, producing a vibration that is transmitted elastically along its longitudinal axis.

The amplitude of the vibrational motion varies in accordance with several factors such as weight of the drill string, dampening characteristics of the ground, and the energy which is stored within the drill system; this latter term is technically referred to as the "Q" of the system. At any rate, the drill pipe amplitudes may vary from a few thousandths of an inch to as much as 0.25 inch under different conditions. In addition to the vibration transmitted to the drill stem, conventional rotary motion is available with variable speed up to 60 RPM.

Penetration of the drill string requires no fluid or air circulation and is achieved as a result of one or more of three basic actions: displacement, shearing, and fracture by impact.

Displacement occurs at the drill bit as a result of the high speed vibration which tends to fluidize particles in contact with the drill column, making them highly mobile and causing them to move out of the way and permit the drill pipe to pass through. This same fluidization at the surface of the drill stem decreases the friction on the steel and allows the core to enter the stem in relatively undisturbed form.

When drilling in materials which are plastic in nature, such as clays and some glacial deposits, penetration is achieved by a shearing action. In this instance the force and vibrational amplitude of the system, coupled with rotational drive, must be of a sufficiently high value to overcome the elastic nature of the material.

The other drilling action produced by the RDS is penetration by impact and fragmentation. When boulders or bedrock are encountered at a drill site this action promotes penetration by virtue of the high contact forces between the drill bit and the rock surface. Rotation is superimposed on vibration in this environment to provide a new rock surface for the drill bit to work on. Dynamic force of impact in this mode of penetration reaches a peak of 48,000 lbs. and this is delivered 150 times per second. Conventional pull-down and hoisting operations are used to allow the drill column to move up or down.

In our placer drilling operations we utilize 6 5/8 inch O.D., single walled drill steel with a 6.0 inch I.D. We generally use 20 foot stems, male threaded on each end with couplings for use in drill holes requiring extra lengths of drill steel. Our drill bits are 7.0 inch O.D., 6.0 inch I.D. with carbide inserts on the leading edge. These bits allow us to drill just about any type of material encountered in the placer environment, including permafrost, boulders, and bedrock. We use specially designed core baskets to aid in core retention when the ground so requires.

The Superdrill 150 is designed to obtain sediment cores with only minimal disturbance of the material and its gold content. The R.D.S. eliminates contamination and inadvertent high-grading of placer samples. We feel that the data obtained from resonant drill core is factual data from which specific value calculations and hard economic decisions can be made.

The Superdrill 150 has been used in the Dawson area to drill holes in excess of 120 feet deep. SEDCORE's normal production rates are on the order of 80 feet per shift, as our production is controlled not by the speed of the drill, but by the time required to provide the best possible sample from the ground drilled.

In keeping with the attitude of the manufacturer, we wish to make no wild claims concerning the performance and potential of the RDS, but we are confident that its use will increase as more people become aware of its specific capabilities in the placer evaluation application.

From the point of view of an experienced geologist the two most important aspects of sonic drill sampling are the quality of the sample, which allows for accurate volume, lithological and geological measurements of a medium that is perfectly representative of the ground tested, and the accuracy in establishing the value of the ground.

FROM PLACER TO BULLION

John Garrigan,
Engelhard Industries West, Inc.

I represent Engelhard Corporation, with specific responsibility for the 13 Western States. Engelhard has been basically an eastern operation, with international operations in the refining of precious metal as well as the manufacture of precious metal-containing products.

I will discuss what happens after gold ore is delivered to a refinery such as Engelhard, the various complex refinery processes used to upgrade gold concentrate to fine gold, and the variety of gold or precious metal-containing products that are subsequently produced.

Engelhard Corp. does not speculate or trade in the precious metal business. Our business is basically two-fold. First: for a fee, we provide a refining service for gold miners and industrial customers who come to us for precious metal products. Our second function is manufacturing for sale a variety of precious metal-containing products. In essence, the metal price that a customer pays is the same metal price that we would sell that material for on the same day. The same situation is true in the case of refining precious metals.

Originally formed as a marketing center for the full line of Engelhard products, the western operations have successfully grown into a full service recycling, marketing, and product distribution entity, employing about 80 people. In addition to expanding our services, we recently moved to larger headquarters in Anaheim, California, and we've opened satellite refining and sales facilities in Union City, California, and Anchorage, Alaska.

An essential part of placer development is determining which treatment one may apply in order to recover as much as possible of the precious metals value from the placer gravels.

The placer gold may be recovered using riffles, sluice boxes or other physical means, such as rotation or amalgamation. However, fine gold particles and organically held gold require milling and/or chemical treatment. To recover gold from cyanide solutions, one may elect to follow Counter Current Decantation (CCD) or a carbon and pulp process. The resulting concentrate would then be melted, producing a slag of nominal metal content, giving bullion which is not yet pure and may contain silver. This process thus far is performed by the customer. The impure bullion could then be sent to a refinery for further processing.

At Engelhard, we not only deal with mining materials, but also process gold scrap received from industrial users. This is an ideal situation for our company, in that production scrap is returned to the customer as an unpriced metal in a product form. Such gold scrap must be processed chemically or by smelting. In either case, an impure gold sponge of about 99% purity is the result. If silver is present, we might only achieve a gold sponge of 70% to 80% purity. The lower grade sponge is then melted and processed via the Miller process, which uses chlorine to remove all the base metals and silver, while the gold remains as a metal. This gold is then processed via electrolysis, cyanidization, and cementation to produce high purity gold.

Building a refinery is no easy task. Refineries are a complex system of glass-lined vessels and condensers. Scrubbing towers and effluent treatment systems satisfy our obligations to the EPA. The Engelhard Refinery in New Jersey was rebuilt and enlarged in 1976, and is one of the largest refineries in the world.

Engelhard has spent many millions of dollars in our commitment to research and development at our facility in New Jersey. We are constantly examining any possible optimization of the refining processes that we utilize, and investigating applications for new innovative products which use precious metals. We are also investigating the possibility of developing an optimum recovery process for black sands or concentrates.

We market approximately 30,000 products. The inventory includes everything from gold plated products and silver bars for investment purposes, to silver and gold brazing alloys which are used for joining metal applications by the air conditioning, refrigeration, aerospace and electronic industries. These products are manufactured in the form of wire, sheet, ribbon, powder and preforms.

We are a pioneer in electronic materials systems, and we've provided special formulations for thick and thin film applications that include inks, metalorganics and gold powder. These products are innovatively applied in the manufacture of hybrid circuits, capacitors or other types of electrical components, as well as automobile rear window defrosters.

We have developed application advances in the decorative area, such as liquid gold. This is important to glass packaging and/or china tableware, and we have developed some unique, no-smear formulas for the application of bright gold to glass containers. These formulas offer to the decorating industry improved handling efficiency and a wider artistic scope for packaging designs.

Recently we introduced a unique customer service system, providing up-to-the-minute information on product inventory, pool account balances, quotes for fabricated platinum, and platinum-rhodium thermocouple. We also offer precious metal market prices and spot thermocouple prices.

Recovering precious metal from mined ore is of economic importance to industry. Daily, these materials are brought into one of our receiving points in Anchorage or Fairbanks. Refined materials are melted on the day of receipt, and we encourage customers to witness and sample melts. Subsequently, the sample is forwarded to our assay facility and the material can be purchased on the basis of assay. Contents of reclaimed material, whatever metal it may be, is credited to a customer's metal account and used to repurchase products.

Alternatively, gold in a pool account is a metal liability to the miner, and is subject to his request for return of metals, or sale, at any time. We also purchase, under a quick settlement plan, any metals that the customer requires.

Engelhard has recently produced a gold coin which we call the American Prospector. We are currently marketing this coin, hoping that it will become a desirable investor's item and a fine jewelry item. The coin recognizes the contributions of Alaskan gold miners. This gold resource becomes a component of many products which in some way benefit Americans every day.

In summary, I have attempted to give you an understanding of what a refiner does and the processing steps necessary to put it into a form readily usable as an investment item or product. Thank you.

Q Does Engelhard recover gold from black sands?

A I understand that there are gold values in black sands, and I think Engelhard is a refiner that has been asked to try to analyze such black sands. We have been working on a process whereby we may be able to recover some of the gold from a black sand. At the moment, we don't have an answer to that, but we're looking into it.

Q Why are the charges for refining gold higher than the charges for refining silver?

A Anybody who is carrying metal on a subsidiary of a large company must pay the cost of carrying the metal. Since a company like Engelhard must accumulate metal, and therefore must pay for carrying costs on that metal, we attempt to turn the metal over very quickly, particularly on manufactured gold products. Our carrying costs must be absorbed by our customers who purchase gold bars or gold products. We're at the whim of their purchase. As long as we carry it in our inventory, it costs us money. There is a significant difference in the carrying costs of gold and silver mainly because of their contrasting values. So, all of these things are put into a formula to come up with a refining service charge.

Q Do you process ore?

A Yes. To refine ore is our business--taking gold ore and turning it into fine gold. Ultimately a great deal of our business is taking that metal and manufacturing it into a product. The products that we sell are a combination of both base and precious metal compositions. The silver alloy, for example, is a silver copper base brazing material. It varies in silver content anywhere from 5% to 45%, depending on the application.

MARINE PLACERS IN ALASKA

J. Robert Moore, Director
Marine Science Institute, University of Texas

I'd like to take a few moments today to discuss some of the placer activities that go far beyond the usual creeks, hills and valleys that we all associate with Alaska's placer deposits. There is more of Alaska lying under water on the continental shelf within the 200 mile limit available for mineral development than there is land above water in Alaska. It would, in my opinion, behoove the people of Alaska and the nation to move prudently, but with purpose, to explore the mineral wealth that is to be found beneath Alaska's waters.

There are a few areas in Alaska that have noteworthy marine placers. Over the last decade, we've studied the platinum placer deposits at Goodnews Bay, south of the Kuskokwim River. Around the Seward Peninsula we have looked at Marine placers at Tent City, York, Grantly Harbor, and off Sledge Island in the Nome area. We have also made a considerable effort near Golovin and around Bluff, Alaska.

There are two types of marine placers found in Alaskan waters. The first type are those which have long since been buried near shore by marine sediments but were originally deposited in the fluvial environment when sea levels were far lower than they are today. The second type are those deposits formed as a result of marine currents reworking and sorting the sediment entering the ocean at the mouths of rivers and streams. This second type can result in both high and low energy placers. At Goodnews Bay the incoming waves generate offshore drift acting as the concentrating mechanism for the platinum.

Our efforts to explore offshore placers have led to the adaptation and engineering of some unique equipment. With the help of three sponsors at the University, we purchased a condemned U.S. surplus mine sweeper. We named it the 'White Plum', mounted a trailer on it and used it for our base of operations. From this vessel we were able to live and carry out our dredge sampling and geophysical testing.

We made a center well on the ship and procured a waterwell drill from some friends. People really wondered what we were doing when they saw our ship, complete with drill rig, anchored in Goodnews Bay. We used a small pipe dredge in a skiff to get in close and sample some of the shallower areas.

We went back to Goodnews the second year to do some more coring and to get bigger samples. That year we used a barge that we put together in Anchorage. One major problem with exploring for beach placers is the lack of an acceptable sampling technique. These placers are grossly misunderstood and only trial and error will yield more reliable sampling approaches. At this level of understanding, the same rule that applies to other geochemical sampling applies here. The larger the sample, the more representative it is. Through our years of placer work we've collected about 70,000 pounds of samples.

After we used computers to process thousands of pieces of geochemical data we began to see some positive correlations between certain trace metals and the coarser platinum. Without going into any detail about the geochemistry, I simply want to point out that in the near shore placers in Kuskokwim Bay we found a positive zinc, copper and vanadium correlation and a negative cobalt correlation.

We used these geochemical tools, based on geochemical information generated from dredge samples, to pick a drill target. We cored it and made a discovery intercept of a platinum horizon. We felt it was quite a breakthrough. Our sponsor, Inlet Oil, eventually secured a lease on this area.

One of the more serious problems we encountered was a sharp contrast in recorded geochemical assays and the actual recoverable platinum. Because of certain surface electrical phenomenon, platinum reacts like a clay, rendering mechanical separation useless. We have brought this concentration problem to the attention of the people at Engelhard in California.

We made similar exploration studies up around the Seward Peninsula. Most of the Seward placers are gold, but again we found a correlation with zinc, nickel and cobalt. We found minor concentrations of ultra-fine gold in Grantly Harbor and at Bluff. At Bluff the gold occurs in discrete linear belts 7-10 miles offshore.

One site that we think holds potential for significant tin placers is immediately north of Cape Prince of Wales. We feel that most of the tin that went offshore made its way north to the cape.

THE ECONOMICS OF GOLD

Peter Short
Delta Smelting and Refining Co., Ltd.

I will take a rather simple approach toward the Economics of Gold, because economics and economic approaches are more simple than a lot of people will believe. First let me say that we're into about the 18th or 20th month of a bear market, a downward market. These markets cannot and do not go on forever. I feel quite confident that we are very close to the bottom, if not at the bottom. I'm looking for better prices in the months ahead.

There are two basic factors that influence the metals market. There are economic influences and political influences, and sometimes the two are mixed together. I believe that the economic influences can be considered 'logical', and the political influences 'emotional'. Over a long period of time, the economic influences are the more significant. In 1981, the economic influences were such that the market simply had to decline. Bearing in mind what was happening to the economy and what was projected to happen, you can see that it was a 'long-term' influence. The political or emotional influences were far more short-term in nature. I draw your attention to the attempted assassination of President Reagan, the actual assassination of President Sadat of Egypt, and the Polish crisis. In the case of President Sadat, it was a very interesting day in the markets. When the announcement was made of his assassination, the market went up to the maximum for the day on Commodities Exchange; about \$25. About an hour or so later, it was announced that the assassination had not been carried out by external influences, but that it was a domestic situation where he had been shot by officers from within the Egyptian army. That had the reverse effect on the market. People realized there wasn't going to be as much international conflict or attention as a result of this assassination and the market promptly went down again. This was a political, emotional and very short-term influence.

What did happen last year was economically motivated. President Reagan's election in the latter part of 1980 signalled a dramatic change in the economic path that the United States would embark upon. I live in Canada, where the economy is very much affected by the U.S., and consequently what we look for in Canada is very similar to what is happening in the United States. President Elect Reagan had made it quite clear that one of his major functions would be to bring inflation under control. President Carter had made no effort at all to handle inflation. Inflation was rampant, and appeared to be totally out of control. What was perhaps more significant, viewing it as a foreigner, was that nobody seemed really to be concerned about it. As a result, it was a logical move to place one's money into gold and precious metals as a store of value, taking advantage of the rampant inflation. It was not surprising that in 1979 and 1980, the price of gold and the price of silver did go extremely high. Many, many people that had never considered buying precious metals as an investment, found themselves very excited and caught up in the momentum of the market and jumped in with both feet.

The election of President Reagan signalled an end to this surge in prices. People became more conservative and realized that if inflation was going to be brought under control, there needed to be some very strict approaches. Mr. Reagan made it quite clear that he had every intention, no matter how much hardship it caused, to curb inflation. It was easy to see that 1981 was not going to be a good year for gold.

There are a number of negative factors resulting from the effort to slow inflation, and the biggest single factor is rising interest rates. The one way that the government of the United States could bring the economy under control was to cool down the inflation cycle. The best way to do that was to make the cost of money much higher. The cost of money was made higher by pushing up interest rates to record highs. Sometimes people find it difficult to equate cost and money. They look at money as being the cost of an item. Very rarely are they able to see that money itself has a cost, and that that cost will affect the interest rate. When the interest rate goes up, money becomes more expensive, and hopefully, fewer people will want to use or borrow it. This will help to calm inflation and keep the economy under control.

Domestic inflation raises the price of a country's exports and makes them less competitive. It also means that imports become cheaper. This creates an over-supply of a country's currency overseas. In the case of the United States, a lot of U.S. dollars were held on

overseas accounts, the inflation rate was going up and it appeared that more money was being printed. Consequently, people became scared of the value of the dollar. Some people requested payment in gold, or in a different currency. All of this put pressure on the dollar, pushing it down and feeding inflation.

Many people opted to hold onto gold instead of dollars. People with money on hand who really didn't want to see their buying powers diminish rapidly by inflation turned to gold, because historically it has been an excellent store of value.

Cooling down the overheated economy required major surgery and the new administration took to the job with scalpels in hand. Inflation was controlled by regulating the rate of expansion of the money supply, which itself was achieved by increasing interest rates. What happened when interest rates went up? First, those companies borrowing money for their every-day activities had to find ways of cutting their costs. Since one of their major costs was interest, they tried to get their borrowing down.

Companies started to look for ways of reducing inventories. The various users of gold in industrial, electronics and jewelry were faced by the same problem of 'high interest' rates, and because of the economic squeeze and the declining value in the price of the metal, they were among the first to reduce inventories. They started selling off inventories, maintaining them at absolute minimum levels. This in itself created pressure on the price of gold by having an abundance of sellers in the market.

Due to the selling of the physical metal, a lot of people who bought gold on margins, either through the commodities accounts and comtrex in Chicago or elsewhere, found that the value of their contracts had declined, and they had to pay margins in order to maintain their accounts in balance. As a result, a lot of the people holding speculative gold accounts sold out, putting additional pressure on the price of gold. The physical sales were pushing the price down, creating pressure in the speculative sector. Speculators were selling more of their positions out, creating further pressure on the physical price of gold, and putting it into a tailspin.

Another casualty of high interest rates was business expansion. Along with a reduction of metal inventories, a lot of the industrial users of gold also cut back quite substantially, creating a further decrease in demand. The reduction of business expansion caused higher unemployment. Less money in the pockets of people who would buy things like jewelry or electronic products created even less demand, which caused even more selling of physical gold, and still further depression in the metal price.

Perhaps the most significant factor that hurt the price of gold was that the interest rates went to very high levels, while the inflation rate was gradually being brought under control. This is the case today, where certificates of deposit will bring in 14% or 15% with an inflation rate somewhere around 8%. This gives about a 6% or 7% real growth in your investment, if you simply put your money into the bank. Last year, when interest rates were very high, and the price looked as if it was going nowhere but down, people were selling their gold and placing their money in bank certificates. Then, in the latter part of 1981, interest rates started coming down and a lot of people expected the price of gold to go back up. This didn't happen, as we all know. Perhaps the principal reason is because falling interest rates are never a guarantee that money will come out of the banking system or the financial system, and go back into precious metals. In 1981 people had already locked in high interest rate returns on their bank certificate money, and likely took the attitude of, 'Why should I risk that investment in gold, when I know that I have a very good return at very high interest rates'. Consequently, the money didn't come back out of the system when interest rates came down and there was no consequent increase in the value of gold.

In 1981, there were some significant international factors that also affected the price of gold. The Soviet Union and other Communist countries were again forced to sell substantial amounts of gold. The Soviet Union sold somewhere in the region of 7 million ounces of gold in the open markets, compared to just under 3 million ounces in 1980. The Russian demand for western agricultural and industrial products remains high even now, and they continue to be fairly heavy sellers of gold. They are always an influence to be considered in the market. In years when their grain crops are poor, as was the case last year, they have to sell more gold in order to feed the nation.

The downturn in the western economies created a decreased demand for petroleum products. This, together with a very active and successful campaign in many western nations to reduce the consumption of these nonrenewable resources, produced a marked downturn in the demand for oil. This marked downturn resulted in a greater supply than demand. The price of oil dropped substantially, and continues to drop. The OPEC nations, depending on very high prices for their oil, had been buying gold with surplus revenue in the latter part of the 1970's. Suddenly they found themselves with less income than they needed to maintain their status-quo. Consequently, several OPEC countries have had to sell gold to balance their books, causing even more downward pressure in the gold market place.

The effect of high interest rates and U.S. economic policy throughout 1981 produced the effect desired by the Reagan administration. By December, the inflation rate was down to 9%, and now I believe it's just under 8%.

Because gold is a good store of value in inflationary times, it was a popular investment. Many people held on to it, but have had their fingers burned very badly with the dramatic decline in the price over the last 18 months. Let's have a look at 1982.

The first three months of 1982 have really been a mirror image of what happened in the 12 months of 1981. The price of gold has continued to tumble, the price of oil has come down, there's been some political tension in the world, and at this point, it's a pretty sorry situation for those people that are looking at the price of gold.

Interest rates are still high and there has been an increase in broker/loan rates charged by the banks in the last few days. There is pressure in the market for even higher prime interest rates. I feel confident that within the next few months we will see the end of this market slump and a return to higher gold prices. I was in New York last week talking to a substantial number of commodities brokers. When I asked them what they felt the price of gold would be at the end of 1982, their projections ranged from \$230 per ounce up to about \$1500 per ounce. If there's any solace to be gained from that wide variance of numbers, it is that there were only one or two at \$230; there was only one at \$1500, but a substantial number of those bankers and brokers are anticipating prices significantly higher than those of today.

Mining companies that deal with us often ask: "What can we do about a low price like this?" In many instances, there's not a lot one can do to protect oneself except to sell at the current price, and hope that at some point in the year the price will go up and improve the average for the year. Many people should consider hedging their metal. This is not a subject that we should get into deeply today, because it is a very complicated matter. I would certainly urge you, if you are interested in hedging, to talk to a reputable broker. I deal quite extensively with brokers, and I'm quite familiar with them. It is a matter that shouldn't be taken lightly; it could be considered by a mining company as a way to protect itself, if the company feels, as I do, that the price is going to go up. I think we're in the mature stages of a fair market. The market activity in the last few weeks has indicated that there is very strong support for the price of gold. There have been attempts to move it down below the \$300 mark, yet, at this point, there's been a substantial amount of buying from central banks. The only thing we can say for certain is that there are buyers out there, and at this point it would appear that a base is being built.

For those who are interested in hedging, I will be available to discuss it at the Delta open-house tonight on Hanson Drive. It is a matter of "buying contracts to cover sales, and hoping that, at a later point in the year, you will be able to receive some of the cost by selling out those contracts at a higher price". There are costs and risks involved. I might also suggest that some one could use the future's contract as a means of improving the price he gets for his metal this year or any other year. I don't want to advertise for Delta, but we are, at this point, embarking on a bullion management program. We're in the embryonic stages of putting it together.

This program will permit miners to take advantage of hedging through an essential fund, which will be administered by Delta for those miners who are interested. If anyone would like to obtain more information contact David Seed, Terry Mulligan or me and we can give you the bare details now, and will be happy to send you complete information when it's ready.

Q What is the possibility that there's an agreement between the United States and the Soviets to control the gold market?

A I haven't heard that one. I've heard something very similar that happened last year between the South Africans and the Russians. There was apparently overwhelming evidence that the South Africans and the Russians were working together, and there was even evidence shown on television of meetings where they were seen huddled together around tables, discussing this very point. I was in London at the time, and I was in the Rothschild Bank. They are very responsible and reliable people. They had been in attendance at some of these meetings, and they said that it was purely by chance that these people were sitting as they were, and the photographs had been taken specifically to make it look as if the Russians and the South Africans were together. They felt that there was nothing to that rumor. I can only assume that it's a similar sort of rumor that started concerning the Russians and the Americans. I certainly have heard nothing about it from anybody I speak to.

Q How much gold have the Russians sold?

A In 1981, it's estimated they sold just over 7 million ounces. There has been no word as to how much they've sold this year. There have been a number of rumors. One that circulated a couple of weeks ago was that they had asked their Swiss bankers to advise the world that they have not sold any gold for the last couple of weeks. There are, however, some indications that they are very active in the future's market, and consequently, they may be selling, but maintaining the price by hedging. There is very firm evidence that the Russians have become very astute traders in futures, and the commodities market.

I must say that I place far more importance on fundamental analysis than technical analysis for a number of reasons. Having looked at the sources of demand for gold in the last 3-6 months, I feel that there has been a marked increase in the base of official buyers. This includes the central banks and international organizations that buy gold. I don't have exact numbers but, for example, if there were 50 central banks buying gold a year ago, that number has increased dramatically and may now be closer to 100. With a broader base of central banks purchasing gold for the first time, I think it is creating a greater demand at levels which will be very difficult to penetrate.

Q Regarding international monetary funds, I was just wondering if there is anything in the wind about reintroducing the gold standard.

A There has been little talk about the gold standard, or a partial gold standard, being reintroduced. I think the figure that I read stated "In order for the United States to go on a gold standard, the price would have to go up to \$4,500 an ounce". A partial gold standard, if introduced, might work for a while, but would be very temporary. Of the people I speak to in New York and London, the vast majority feel that a gold standard, as we once knew it, would be impossible to administer.

Q Is there going to be any pressure on the gold market considering that the OPEC countries are selling gold to make up for revenues lost as a result of the glut in oil demand and depressed prices?

A There has been a fair amount of speculation in gold by the Middle East in recent months, but most of their trading has actually been the sale of gold to support their faltering economies caused by the dramatic reduction in demand, and in the price of oil. I don't know of any move, collectively, to create too much trouble for the American dollar. I think the Saudis, who have a great deal of influence, would work very hard to prevent anything like that. I think King Faisal must be considered a very reliable person, and probably a friend of the United States. Consequently, I don't think, as a group, the OPEC countries would be able to successfully create trouble for the dollar. A splinter group may attempt to do it, but I don't think it would work.

PLACER SAMPLING IN THE CHUGACH NATIONAL FOREST, ALASKA

Steven A. Fechner, U.S. Bureau of Mines

The Bureau of Mines mineral appraisal of the Chugach National Forest started in 1979. It is a four year study that is funded under the RARE II Wilderness Program.

The Chugach National Forest encompasses approximately 4.8 million acres in Southcentral Alaska. Because of the large size of the forest, the Bureau of Mines subdivided it into three study areas: Peninsula, Islands, and Sound. This presentation reports on placer sampling within the Sound study area, which takes up approximately the eastern half of the forest from Eagle Bay on the west to Berling Glacier on the east and from Kayak Island on the south to Mt. Siegfried on the north. Towns within the area include Valdez and Cordova. We also examined the entire Valdez mining district. The district is only partially within the National Forest boundaries, but the entire district was studied in order to understand the mineral trends which might extend into the National Forest.

Physiographically, the forest includes coastal environment land with a relief from 1,000 to 3,000 ft., with spruce forest and muskeg areas, and inland environment land with glaciers and mountains ranging from 4,000 to 10,000 ft. in elevation. The study area contains state, private and federal land. State land is restricted to areas around the Columbia Glacier, the Rude River, and around the towns of Cordova and Valdez. The private lands are mostly along the coast. The remainder is federal land managed by the U.S. Forest Service. In 1980, with the passage of the Alaska National Interest Lands Conservation Act or ANILCA, the size of the forest was nearly doubled. Additions are found in the Copper River area and Columbia Glacier area. ANILCA closed these newly included lands to mineral entry pending further study, however, it did open the traditional forest to mineral entry.

The mining history of the area started in 1894 when gold was found in gravels around Valdez. When the Klondike was discovered in 1896, a lot of people came to the area and staked the first copper, gold, oil and coal prospects. The years from 1897 to 1920 were the busiest for mining in the Sound study area. Major mining activity included five mines: the Cliff Mine and the Midas Mine, near Valdez; the Ellamar Mine near Tatitlek; the Schlosser near Port Fidalgo; and the Bering River Coal Company Mine near Katalla. From 1897 to 1920 approximately 25 million pounds of copper were produced, most of it from the Ellamar, Slater and Midas Mines. Over 200,000 ounces of silver, mostly from the Ellamar Mine; over 100,000 ounces of gold, almost half from the Cliff Mine; and 20,000 tons of coal, all from the Bering River Coal Company, were produced in this district after 1920, mining activity ceased until 1934, when the price of gold was raised from \$20 to \$35 an ounce. From 1934 to World War II, 8,000 ounces of gold were mined in the area, 7,000 of those ounces coming from the Cliff Mine. After World War II all mining activity in the Sound study area stopped again. Presently, the only mining activity in the area is exploratory drilling for coal near Katalla. The geology in the Sound area consists of four units: the Valdez Group; the Orca Group; younger tertiary sedimentary rocks; and tertiary intrusive rocks. The Valdez group is the northernmost unit. It is Cretaceous in age and extends from Eastern Alaska, west on down the Kenai Peninsula. It consists of slates, graywackes, and minor greenstones. The major mineral resource within the Valdez group is gold. Gold occurs in two major belts within the sound study area, an east-west trending belt through Valdez, which stretches from the Columbia Glacier to the Valdez Glacier. We believe the belt extends 60 miles to the east and connects with the Bremner River gold deposits. The second belt is a northeast trending belt, 12 miles in extent between Unakwik Inlet and Port Wells. The Valdez group does contain other mineral resources, like the Midas Copper Mine, but these resources are minor compared with gold.

The second group, called the Orca group lies in contact with the Valdez group to the north; it is tertiary in age and extends from Eastern Alaska down through the Kenai Peninsula and onto Kodiak Island, which is farther southwest. It is lithologically similar to the Valdez group; consisting of slates and graywackes but different in that the Orca Group has a major greenstone component. The major mineral resource in the Orca is copper, instead of gold. There are some minor gold prospects around McKinley Lake near Cordova and on Bilgh Island.

The third group of younger tertiary rocks are sedimentary in origin. The major mineral resources in this group include oil, gas and coal. None of these are pertinent to this study.

The fourth unit includes the intrusive rocks which are scattered throughout the older sedimentary units.

In 1979, the Bureau of Mines started a reconnaissance level sampling program of Chugach National forest, including some mine evaluations. In 1980 and 1981 we did more detailed mine evaluations, and in 1981 we started placer sampling.

Placer sampling consists of shoveling 1/10 of a cu. yd. of surficial material through a portable sluice box. The mineral concentrate obtained from the sluicing is panned down to a heavy mineral concentrate. Any concentrate sample containing greater than 30 particles of gold amalgamation is called the recoverable gold value. The rest of the concentrates were sent to a lab for atomic absorption analysis for gold, silver, copper, lead, zinc and numerous other metals.

Because of the large size of the study area, and because it was the first year of the study, we had to restrict our sampling to four types of drainages. The drainages sampled include 1) those that contained historical lode mines or prospects, 2) those that contained historical placer mines or prospects, 3) those that contained Valdez group rocks but without reported gold mineralization, and 4) those with gold in stream sediment samples. We sampled 80% of the drainages that fit into these categories. We collected 107 samples, 20 of which contained recoverable gold values. These anomalous localities are scattered between Unakwik Inlet and the Copper River.

Most of the historical gold deposits are found in the Valdez area. The gold values in the lodes range from .03 to 101.49 ounces per ton. Most drainages below these lodes were sampled, but the only anomalous values came from Columbia Glacier; McAllister Creek, Gold Creek and Mineral Creek. The values range from .005 to .001 ounces per cu. yd. We did find recoverable gold values in Mineral Creek, but we took a 1,000 lb. sample and sent it down to the Bureau of Mines placer lab in Albany, Oregon, for more detailed heavy mineral analysis.

We sampled drainages with historical placer mines and prospects, as well as Solomon Gulch, Lode River, Redhead Beach, and Miner's River, which do not have a history of gold mineralization. We found gold values in all these except for Lode River. The values ranged from .002 to .0049 ounces per cu. yd.

Recoverable gold values were discovered in 13 creeks with no previously recorded gold mineralization. The values range from .001 to .028 ounces per cu. yd. These creeks have potential for economic gold mineralization. The best creeks should yield samples that contain greater than 100 gold particles or large gold particle size. Brown Creek, Cleave Creek, the Copper River, the tributary to Jack Bay, and the Tasnuna have the highest potentials for economic gold mineralization.

Using this placer sample method we found recoverable gold values in only five of the creeks that had anomalous stream sediment samples. The gold in stream sediment samples range from .0012 to .0156 ounces per cu. yd. (recoverable and nonrecoverable) and those in the placer samples were from .003 to .0020 (recoverable) ounces per cu. yd. There is little correlation between stream sediment sample values and placer sampling values from the same creek. Creeks that run up to 1/10 of an ounce per cu. yd. using the placer sampling method did not show any recoverable gold values in stream sediment samples.

Through placer sampling, we can rediscover drainages with historical lode mines, placer mines and prospects, as well as find a number of drainages that contain recoverable amounts of gold, but do not have a historical record of gold mineralization. We also found that you can use gold and stream sediment samples to find gold bearing drainages. However, the placer sampling method would be a better technique to delineate the gold mineralization within the creek.

We believe that this sampling program extends the east-west trending gold belt from Columbia Glacier to Valdez Glacier through the Tasnuna River drainage, to connect up with the Bremner River gold district. We might also take it across the Columbia Glacier and connect it with the Miner's River gold finds. Alternatively, the mineralization in the Miner's River may be connected with the northeast trending gold belt between Unakwik Inlet and Port Wells.

Thank you.

Q Did you sample gravel close to bedrock?

A We sampled surficial gravels, often in the active stream channel. We seldom got down to bedrock. Placer sampling is spotty, you might be 5 or 10 ft. away from auriferous gravels, but you're just sampling barren gravel. This plus the small size of our samples accounts for the inconsistencies present in our results.

Q (Inaudible)

A We have 2.8 million acres to look at in a short period of time. Hopefully next year, we can go in and do some more detailed work.

This information is out in an open file report, available from the Bureau of Mines.

NEW DIRECTIONS TO
THE MINE SAFETY AND HEALTH ADMINISTRATION PROGRAM

Kenneth U. Russell, MSHA

With the new Reagan administration we are going to assist rather than regulate as in the past; though we still have a minor role as a regulator, and we have been given the authority to use what we call 'compliance assistance visits' at your property. If you want to find out what we think of your property, ask for a compliance visit. There are never any penalties involved with the visit. These are available throughout the mining season. These visits are also helpful anytime an operation is changed, be it a new piece of equipment or a new technique. We will go over your equipment with a fine tooth comb from the health and safety standpoint only. We are like EPA in that the burden of proof is on MSHA if we want to fight you for a violation. We must prove that the violation is there. We have equipment to prove certain violations, but we are lacking the equipment necessary to substantiate others.

We are not here to harass; we try to maintain safe and healthy operations. That's the name of the game as far as we're concerned. We have stipulations like any other regulatory agency, and when violations of these particular standards are found during a regular inspection, then they have to be cited.

The MSHA education and training function is now administered directly through my office. When you request them, educational services will be provided to you, at least while our funding holds out.

We have changed our citation policy. In the past, when a citation or an order was issued, it was up to you to resolve the issue, by phone, with a specialist in Denver, Colorado. With the new changes, however, these negotiations will be done on your property by the inspector, before he leaves the property.

If you cannot negotiate directly with the inspector and come to a sound agreement you have the option to request a conference at the level above me, the district manager's office in Alameda, California. He has the option then to either hold that conference with you himself or to pass it down to me, or one step below me to the inspector's immediate supervisor. We hope that, in this way, we will have some meaningful consultations over the problems that we find, rather than have someone back in Washington, D.C. judging and issuing assessments.

At the present time, most of the MSHA regulations are being presented at hearings for proposed changes. These hearings are coming up within the next month at various places across the country, and will last for three days. The hearing which I think you people will be most interested in will be held in Spokane, and will address loading, hauling and dumping. If you have someone that you want to 'ride hard' on this particular part of the hearing program, I'd advise you to have him there, because once these things are 'cast in concrete', they just don't want to change them again.

Many of you have been, in the past, indoctrinated to or associated with the old Bureau of Mines "Act and Prevention Program". In the new phase of training under the local office, I'm going to attempt to bring this type of training back, to replace the story-book type of training that the education and training section has been involved with.

Some of this training is mandatory. If you are not a seasoned miner or a miner of old standing, there are certain things that you have to be trained in. These mainly encompass safety skills you'll be involved with on-the-job. I hope to develop a job analysis program and break that job analysis program down into a job safety analysis program. The training you will receive will be based on an analysis of your particular operation.

Basically, that is where MSHA is headed. We have had a severe reduction in force, with a decrease in budgeting. Our budget may be cut by another 30% as well, and as a result there are far fewer men to make the MSHA compliance visits. This might seem like a blessing to many of you.

**GOVERNMENT REGULATIONS AND
WHAT THE MINING INDUSTRY CAN DO ABOUT THEM**

Roger C. Burggraf, Miner and Mine Consultant
Tri-Con Mining, Inc.

My comments today are in no way intended as a personal attack against the various employees in State and Federal government. Our new Commissioner of Natural Resources, John Katz, is doing an excellent job. He is making a determined effort to get the input of the mining industry in planning for the future development of our mineral resources in Alaska. He wants to see a healthy mining industry. I have found the staff at the Department of Minerals and Energy Management to be very cooperative and helpful. The Tri-Agency one-stop permit application form is an effort by the state government to simplify the permitting process.

There is some hope for the Department of Interior with Secretary of the Interior James Watt in office. The local Bureau of Land Management office personnel have been very helpful and are trying to do the best job they can to fulfill the tasks assigned to them.

Last year the Office of Mineral Development, with the Alaska State Department of Commerce and Economic Development, was set up. John Sims was appointed director and has done an outstanding job of promoting mining in Alaska.

Why do we have the morass of regulations we have today? There are a multitude of reasons, some of which are:

1. Abuses to the environment which include:
 - a) Destruction of forests and top soil
 - b) Pollution of streams
 - c) Failure to restore mined lands
2. Disregard of the needs of others
3. Failure to have an adequate public relations program and educational program to inform the public of the need for mineral resources. A recent survey taken in the United States reported that less than 4% of all people believed that mining and minerals had any direct effect on their lifestyle. Less than 35% believed that mining was necessary for a healthy economy.

The abuses of the past have led to the Environmental Movement which has been manipulated by special interest groups. Today we are paying for these abuses, and it has cost us, and our nation, dearly. The one good thing that the Environmental Movement has done is to make us more aware of the land around us and more considerate toward the needs of other people.

Like other movements, certain radical elements gained control. Many of those involved are idealists who come from well-to-do homes. Life has been easy for most of them. They do not know what it is like to go out into the world and scratch for an existence. Unfortunately, most of these people see the world only through rose-colored glasses and look upon industry as being dirty and evil. Even with all their education they are totally unaware of this nation's dependence on minerals.

H. Peter Metzger, Ph.D., gave a talk to the National Meeting of the American College of Nuclear Medicine on April 28, 1978 titled "The Coercive Utopians: Their Hidden Agenda". I strongly urge you to read this to gain a better insight of the dangers this nation faces today from the Environmental Movement.

In Alaska, the environmentalists have criticized our placer operations for destroying the pristine environment. Little do they realize what mining has contributed to Alaska and the nation.

To develop the placer deposits, people had to be hired and industry had to produce the equipment to mine the gravels and produce the gold and silver which added to this Nation's wealth and financial stability. Both are strategic metals necessary for industry. The lands, which for the most part were muskeg and of little value, now have an economic value to mankind. Much of this land is now good fish and game habitat. In addition, the placer tailings have been very important for providing material for roads, and pads for building. The average value of the gravels when mined was 25¢ per yard. Now the tailings are selling for \$3.00 per yard. So you can see this has not been all bad. Actually, Mother Nature can be a far worse polluter than man.

Why have we all sat back and taken the abuse heaped upon us by the radical environmentalists? We have allowed the environmentalists, through government, to impose regulation upon regulation on our industry. The result has been increased costs of operation resulting in higher costs to the consumer.

Just take a look at the Trans-Alaska Pipeline. The original cost was estimated at 900 million dollars, but after years of delays the final cost was 11 billion dollars.

Delays because of environmental restrictions and red tape, such as those which prevented the Trans-Alaska Oil Pipeline from being completed on time, have held back construction of the Alaska Natural Gas Pipeline to the point where it might not now be economically feasible to construct. If the Pipeline is not constructed, it will cost this nation and its people even more billions of dollars in an energy resource not utilized.

The foot dragging caused by the Environmental Movement has delayed the construction of numerous hydroelectric and power plant projects, at the expense of the public.

The Environmental Movement, instead of conserving our natural resources, has resulted in locking up valuable minerals which we may never be able to utilize. Every regulation or restriction imposed upon the mining industry raises the cost of operation, resulting in the closing of mines or requiring the companies to mine only the higher grade deposits. This has left billions of dollars worth of minerals in the ground that would have been economical to mine had costs not been so high. A good example of this is the Kennecott Mine at McCarthy. In 1907, Kennecott wanted to build a smelter at Cordova using the coal from the Bering Coal Fields. Teddy Roosevelt was pressured by Gifford Pinchot, Chief of the Bureau of Forestry, and other environmentalists, into refusing Kennecott's request. So began the attempt by the environmentalists to lock up Alaska. The result was that only the richest ore was mined and billions of dollars of low grade ore was left in the ground. This mineralized zone is now in a national park and will never be mined. Instead of conserving our resources, the Environmental Movement has resulted in the squandering of billions of dollars of our resources at the expense of the people. Coal leases in the Bering Coal Field were denied in 1908, resulting in the importation of coal from Australia, Japan and the State of Washington. The imported coal cost \$15.00 per ton versus a cost of \$3.00 per ton for locally mined coal. Plans to extend the Copper River Northwestern Railroad into Interior Alaska had to be abandoned. The end result was that the Federal government built the present railroad system at public expense.

The present regulations have made it uneconomical to properly utilize our resources. Economics dictate what we can and cannot mine.

The no-growth attitude of the environmentalists is tearing apart the material and moral fibers of this nation. It has resulted in this nation's inability to compete on the world market and has reduced our GNP. Inflation has hit us heavily, deficit spending is the order of the day, unemployment is high, cost of food and fuel has gone sky-high. Land and building materials have increased to the point where the "Great American Dream" of home ownership is a thing of the past. We have our friends, the radical environmentalists, to thank for this.

If we are to survive as a nation, we must stand up and fight for what we think is right. We are the soldiers of industry. Without the production of the natural resources—oil, coal and metals—this country cannot survive in today's world.

Many of you in this room have fought in one or more of the numerous wars this country has been in during the last half century. We fought in an attempt to preserve this nation's

Republican form of government and our way of life. The enemy we have within our borders is a far greater threat to our lives than those from outside.

Let's face it, we miners are the last of a rare breed. We are independent, strong willed, hard working, self sufficient, and accept the challenge of overcoming odds. Most of us do not want government handouts, preferring to make it on our own steam. We scare the pants off of the planners and bureaucrats, who feel their job is to plan, regulate and control. We do not want to become regulated like the lowly hamburger.

Dixie Lee Ray, former governor of Washington state, gave a very good talk to the coal conference last month. One of the points she mentioned was the effect regulations have had on the price of hamburger. Are you aware that you are paying 8 to 11 cents more per pound for hamburger so that 41,000 regulations and 200 legal statutes can be enforced to protect the consumer?

Our attitude towards our enemies has been that we will do as we please no matter what they say. We have been like the ostrich with its head in the sand--most of us have been oblivious to all that is going on around us. As a result, we are today faced with a multitude of Federal and State government regulations, which, unless we do something about them, will force most of you small miners out of business within the next 10 to 20 years. The permit system that is being forced upon us is a nightmare to enforce. Little did our legislators realize the 13-headed monster they created when they passed the innocent appearing legislation to regulate the industry. Bureaucratic kingdoms are being created. The administrative costs of regulating our resource agencies now runs in the millions of dollars, and I bet within 20 years will cost the State billions of dollars in administrative costs, lost production and lost jobs. Each job lost costs not only in lost production, but in unemployment benefits and welfare handouts which have to be paid from the productive elements of our society.

This nation of ours appears to be running full steam for our final leap into oblivion. We have not learned from the mistakes of other nations. We seem to be bound and determined to destroy that which has made us great. Land ownership, independence and self sufficiency are being discouraged. Food stamps, welfare, medicare and government handouts are being doled out to encourage dependency on the government. What has happened to the old work philosophy of rewarding effort and penalizing mediocrity?

Look what has happened in the Soviet Union, Poland and Vietnam. Nations that were once self-sustaining have regulated themselves to death in a morass of bureaucratic red tape and five year plans that seem to go nowhere. The Socialistic system is no better. Great Britain, and to a lesser degree Canada, are caught up in a no-win situation where the workers expect government to provide them with cradle-to-grave security. They have not yet learned that productivity is the key to a secure nation.

What can the mining industry do to bring a balance back into government to allow for an orderly development of our mineral resources?

1. If our resources are to be economically developed, we need to convince our legislators and the executive branch of the government--both Federal and State--of the need for fewer controls and less red tape.
2. Regulate ourselves by using the prudent man approach to mining, disrupting the land surface no more than necessary.
 - a) Use - 1) Geophysical and geochemical techniques for exploration.
 - 2) Trench and sample the ground, using appropriate equipment, before mining.
 - 3) Drill the ground to prove up reserves.
 - b) Use settling ponds if feasible.
 - c) After mining, level out tailings piles, or stack tailings in such a way that they blend into the landscape and reseed if necessary.

3. Educate the public of our need for minerals and of the benefits from mining to mankind. These include:
 - a) Jobs to construct the equipment and to support the mining industry.
 - b) Jobs within the industry--mining, milling, shipping, etc.
 - c) Jobs to take the resources and turn them into products enabling industry to function. Farm equipment, heavy equipment, etc.
 - d) How metals and minerals benefit people in everyday life--autos, computers, washing machines, housing components, etc.
 - e) The minimal impact of mining when compared to the total land mass. Less than 0.16% of the land surface has been disturbed by mining. This includes quarry and gravel operations. Are you aware that less than .2% of the earth's surface will have been affected by mining by the year 2000? Most of the land can be restored and made more productive than it was before it was mined. Example, the Usibelli Mine. Mineral deposits cannot be moved from place to place. If a person does not like mining, or what it does, I suggest they move to the other 99.8% of the earth's surface. A recent Canadian study done by Dr. John Stahl, Canadian Federal Department of Energy, Mines and Resources, indicated the following:
 1. For every dollar spent in producing raw ore, 2.7 dollars were generated.
 2. When the ore was refined at site, it generated 9.7 dollars for every dollar worth of raw ore mined.
 3. When manufactured into a product, one dollar of raw ore generated 43.00 dollars.
 - f) The fact that many towns and cities would never have come into existence if it had not been for the location of ore deposits nearby. Fairbanks is a good example.
4. Take active interest in what is going on around you. Don't leave it up to the other guy to pull your chestnuts out of the fire. We are a small individualistic group fighting a large well organized group that wants to shut us down and destroy this nation. They have infiltrated the government with their no-growth attitude and have succeeded in getting legislation passed that could result in our extermination as miners. We must work with our legislators and the executive branch of our government to remove counterproductive regulations and overhaul regulations which are cumbersome and ineffective. For example, the Tri-Agency Report. Incidentally, sometimes these permits may end up as a mailing list for enforcement agencies such as MSHA. If necessary, we must fight illegal and unreasonable regulations in the courts.
5. Stop bureaucratic "Empire Building". Remove those nonessential bureaucratic functions. The reduction in oil prices are going to require that the State trim the fat off of the government. Now is our chance to bring reason back to government.
6. The front line troops are getting tired. We need your help--you cannot continue to sit back and expect a few to carry on the battle. We ask you to take an active interest in and support your mining associations.

It would be nice to see the regulatory system eliminated, however, I am afraid that is never going to happen. What we must strive for is a realistic level of regulations which will not unduly hinder our efforts to produce the resources this nation so badly needs.

The State needs to implement a policy which will encourage mining. Thank God for John Sims and the Office of Mineral Development. This is the first time in many years that we in the mining industry have had an advocate in government. What we need is a Department of Mines

run by people familiar with mining. We don't need any more biologists telling us how to mine. Let's get professionalism back in government.

We, as miners, are facing the fight of our lives. We must take interest in the world around us and fight, through our Republican form of government, for the right to produce the products which this nation depends upon for its survival. We cannot go back to the horse and buggy days if we are to retain our freedom and independence. The masses must be educated. They have been brainwashed by the no-growthers and radical environmentalists.

Let's march together as the soldiers of industry and do battle with our enemies.

CONCLUDING REMARKS

David A. Heatwole, President, Alaska Miners Association

I think that the quality of papers and the presentations has been excellent. This has been a first rate conference. It is certainly on par with technical mining conferences that you'll find anywhere in the country. It is probably the conference for placer mining.

I think the central point of the conference, at least the most emotional issue that the conference faced, was made during our lunch yesterday when John Spencer told us about the two court decisions regarding air and water quality compliance, mandating that his office demand compliance or take court action. Many people expressed shock that this was going to happen. I heard a lot of emotion expressed following that talk. Yet that particular decision is nothing new. It has been before the mining industry for at least two years. When I look back over the last 18 months to the Samanski hearings, I know that I can count on two hands the number of miners that showed up in court to give their side of the story. Those who were shocked with what happened didn't show up when the chips were down.

At that time the Miner's Association put out a call for one ounce of gold each from the producing miners, to help with the legal battle during the Samanski hearings. We wound up with 20 ounces of gold. Thirteen of those came from one person. Only a few people, when they couldn't give the time, came forth with some money to help in this fight. That's all past, and I'm not trying to sling mud around. But I do want to reinforce what Roger said, "If you don't get involved, you get the consequences".

There are two paths that the AMA will pursue in the future regarding the Samanski decisions. First, we will review the legal options. We haven't had a chance to thoroughly study the legal options but I believe they are very limited. Legally, all we can hope to do is delay action. This can only be a short-term solution, and somewhere in the future we're going to have to face the regulations.

Our second and most productive pursuit should be to simply change the regulations. During his presentation yesterday, Mr. Spencer invited us to do that. We're going to pursue that. Ron Rozander has volunteered to make the first stab at drafting a rough proposal for modified regulations. These won't be regulations that everyone in the Association will necessarily agree upon. The modifications will have to be something that we feel we can get the government to accept. I plan to circulate Ron's draft to each branch of the AMA for review. I'm also going to send it to the organized districts and let them review and comment on it. I hope to get this all back together and then formulate a unified position. I can tell you right now that if we aren't unified, if everyone isn't pulling the same cart this time, our efforts may be fruitless. Start the effort.

We must move forward as one association, to get these regulations changed. I hope that those of you that are here will go out and tell those that aren't present what our intentions are, and try to get them to join the team. We must pull together and see if we can do something this time.