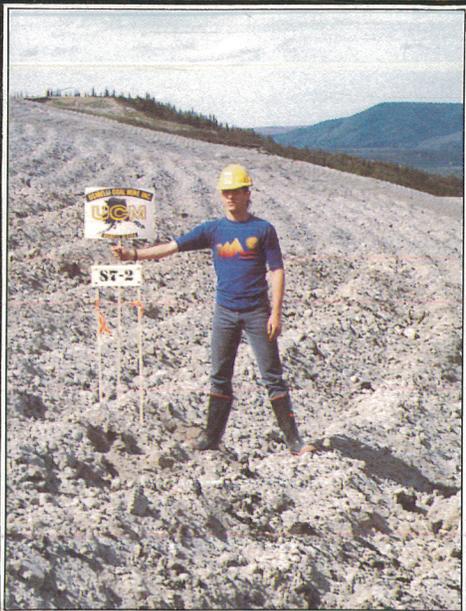


Alaska's Mineral Industry 1990

Division of Economic Development
Division of Geological & Geophysical Surveys
Division of Mining



SPECIAL REPORT 45





"During 1990, Alaska saw two major mines come into full production. Our world-class developments at Red Dog and Green's Creek mines not only advertise our mineral potential to the world, their success is a magnet to further exploration. The industry is key to economic development across the state."—Dr. Glenn A. Olds, Commissioner of the Department of Commerce and Economic Development. (Photo by Margaret Bauman)



"The numbers from 1990 reveal a positive change in the health of the mineral industry in the state. Alaska has the potential to become a major mineral producer while demonstrating the technical ability to do it right environmentally. We're confident that responsible mining operators will be a credit to their communities."—Harold C. Heinze, Commissioner of the Department of Natural Resources. (Photo by Cindy Roberts)

Cover photo: Usibelli Coal Mine, Inc. (UCM) began a reclamation program in 1971, six years before it was required by federal law. Disturbed lands at UCM are recontoured and furrowed (inset). Lands are then fertilized and seeded with a mixture of hardy grasses and yellow mustard. Plants bloom a few months after treatment. (Photo by Usibelli Coal Mine)

Alaska's Mineral Industry 1990

By R.C. Swainbank, T.K. Bundtzen, and John Wood

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

SPECIAL REPORT 45



"Our message to the mining industry is, 'Yes, you are welcome here.' Our opportunity in Alaska, perhaps more than any other part of the world, is to be leaders, not followers. Our mining industry can provide a pattern environmentally and in every sense for the world at large."—Governor Walter J. Hickel.

(Photo by Mark Farmer)



STATE OF ALASKA
Walter J. Hickel, *Governor*

DEPARTMENT OF
NATURAL RESOURCES
Harold C. Heinze, *Commissioner*

DIVISION OF GEOLOGICAL &
GEOPHYSICAL SURVEYS
Thomas E. Smith, *Acting Director
and State Geologist*

DIVISION OF MINING
Sam Dunaway, *Acting Director*

DEPARTMENT OF COMMERCE
AND ECONOMIC
DEVELOPMENT
Glenn A. Olds, *Commissioner*

DIVISION OF ECONOMIC
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Paul Fuhs, *Director*

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EXECUTIVE SUMMARY

Special Report 45, "Alaska's Mineral Industry 1990," is the tenth annual report produced by the Department of Natural Resources, Division of Geological and Geophysical Surveys, the Division of Mining, and the Division of Economic Development of the Department of Commerce and Economic Development.

The report is designed to provide current, accurate, and technically reliable information about Alaska's mineral industry. The report depends on the cooperation of individuals, private industry, and government agencies to provide information on their mining projects and activities.

In 1990 the sum of expenditures for exploration and development, and the estimated value of production totaled \$610.6 million. Exploration expenditures rose to \$63.3 million, with most of the effort concentrated on hardrock gold projects, some of them in advanced stages. Development expenditures were \$14.3 million, considerably less than the \$134.3 million in 1989, mainly due to completion of development at the **Red Dog**¹ and **Greens Creek** mines.

Value of mineral production in 1990 was \$533 million, doubling the 1989 production value of \$277 million.

In 1990, with 55 percent of the nation's supply, Alaska led the United States in zinc production. Consequently, U.S. net import reliance for this crucial commodity decreased from 61 to 48 percent.

Alaskan silver production accounted for about 18 percent of the domestic mine production. Only Idaho and Nevada produced more.

Alaska continues to have the nation's largest placer gold mining industry, which provides jobs to many rural Alaskans.

Significant progress in land reclamation and water quality at placer mines indicate that Alaska's mining industry is capable of providing economic diversity and environmentally sound operations in the 1990s.

¹Names of significant mines and deposits appear in **boldface** type throughout this report.

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Alaska's Mineral Industry 1990

By R.C. Swainbank,¹ T.K. Bundtzen,² and John Wood³



Authors of the "Alaska Mineral Industry Report, 1990" discuss the results of their data gathering. Left to right: Dick Swainbank, Division of Economic Development, Department of Commerce and Economic Development, John Wood, Division of Mining, and Tom Bundtzen, Division of Geological and Geophysical Surveys, Department of Natural Resources. (Photo by Cindy Roberts)

INTRODUCTION

MINERAL INDUSTRY ACTIVITY

Alaska's mineral industry in 1990 showed positive gains in metallic production and exploration expenditures while industrial mineral activities stabilized.

Continuing the upward trend which began in 1987, exploration expenditures reported in 1990 were \$63.3 million (fig. 1). These expenditures represent an increase of 32 percent over the \$47.8 reported in 1989 and were predominantly invested in advanced hardrock gold projects. Some of these projects might proceed to development in 1991 or 1992.

Development expenditures declined dramatically to \$14.3 million in 1990 from \$134.3 million in 1989, which was in turn a decline from \$275 million in 1988 (fig. 2). This decline reflects the shift from development to production modes at the **Greens Creek** and **Red Dog** mines.

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The value of mineral production in Alaska doubled in value from \$277 million in 1989 to about \$533 million in 1990 (fig. 3). All of the increase was due to production of zinc, lead, and silver concentrates. The 1990 total value of Alaska's mineral industry as measured by the additive value of exploration, development, and production was \$610.6 million, 33 percent higher than the 1989 estimate of \$459 million (table 1, fig. 4).

Employment

Table 2 shows the employment statistics for the mineral industry for the last three years.

Generally, fewer workers are needed to operate a producing mine than to construct a new mine; the decline in employment during the last three years reflects the shift from construction (mineral development) to production at the **Red Dog** and the **Greens Creek** mines. Concurrent with that change, employment has increased in base metal and hardrock precious metal mining from 99 in 1987, to 690 in 1990.

Table 1. Total value of mineral industry in Alaska, 1988-90

	1988	1989	1990
Exploration	\$ 45,468,800	\$ 47,762,596	\$ 63,255,594
Development	274,945,400	134,272,350	14,326,500
Production	232,172,000	276,983,741	533,024,500
TOTAL	\$552,586,200	\$459,018,687	\$610,606,594

Exploration

Exploration expenditures increased to \$63.3 million in 1990, up 32 percent from the \$47.8 million in 1989, which was in turn an increase from \$45.5 million in 1988. This increase is in contrast with a marked decline in the neighboring Yukon Territory during the same period. Returns from 109 mining firms and small partnerships working in Alaska show that precious metals exploration accounted for 90 percent of the total mineral exploration expenditures. Base metal and coal exploration accounted for 8.4 percent and 0.5 percent respectively. There were 374 individuals employed full-time in mineral exploration.

Four major hardrock gold exploration projects in advanced stages accounted for expenditures of \$35.7 million, or 57 percent of the exploration total. In the Juneau area, Echo Bay Mines continued to drill the **Kensington** and **Alaska-Juneau (A-J)** mines, and began exploration of the deep **Treadwell** structure. Placer Dome U.S. continued drilling at the **Jualin** property, also near Juneau, and Fairbanks Gold, Inc., continued drilling and bulk sampling at their **Fort Knox** property near Fairbanks.

Other significant exploration projects were conducted by American Copper and Nickel Company at the **Grant Mine** on Ester Dome near Fairbanks; by Central Alaska, Inc., at their **Nixon Fork** property near Medfra; by Tenneco, Inc., at **Rock Creek** near Nome; by Battle Mountain Gold in the Aleutian Islands; and by Cominco Alaska Exploration in various places around the state, including **Pebble Beach** near Iliamna.

Companies with active exploration programs in 1990 were: in the northern Alaska region, Cominco Alaska and Moneta-Porcupine Mines; in the western region, Central Alaska Gold Company, Tenneco, Cyprus-Anvil and Vinta Exploration Ltd.; in the eastern interior, AMAX, Phelps-Dodge, American Copper and Nickel Company, Inc. (ACNC), American Smelting & Refining Co. (ASARCO), Freegold, Fairbanks Exploration, Inc., Central Alaska, and Citigold; in the southcentral region, Cambior Alaska, Inc., CanAlaska Resources Ltd., Caprock Corp., Gold Tech Resources, Inc., and Hunt, Ware & Proffett; and in the southeastern

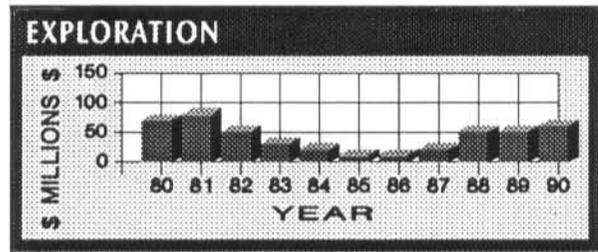


Figure 1. Exploration expenditures reported, 1980-90.

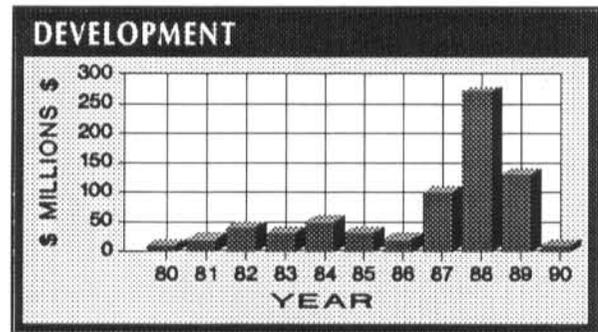


Figure 2. Development expenditures reported, 1980-90.

Table 2. Alaskan mine employment, 1988-90

	1988	1989	1990
Gold/silver mining			
Placer	1,206	1,316	1,151
Lode	99	161	265
Base Metals	--	407	425
Recreational	350	325	315
Sand and gravel	752	625	645
Building stone	210	148	160
Coal	120	120	115
Peat	--	--	--
Tin, jade, soapstone			
ceramics, platinum	40	40	40
Mineral development*	1,294	785	95
Mineral exploration*	323	350	374
TOTAL	4,394	4,277	3,585

-- = Information not available.

*Calculated for 260-day workyear.

region, ACNC, Placer Dome U.S., Inc., Echo Bay Mines, Lac Minerals, Pulsar Resources (U.S.), Inc., Hecla, BHP-Utah, and Kennecott Exploration, Inc.

Development

Mineral development expenditures in 1990 totaled \$14.3 million, a 90 percent reduction from the \$134 million in 1989. This reduction reflects the end of the development phase of the **Red Dog** mine and the change to production.

Alaska Gold continued thawfield drilling at their **Nome** placer operations, and Cambior continued development drilling at their **Valdez Creek** placer mine near Cantwell, central Alaska. Cambior also started a major diversion of the creek to allow the upstream advance of their open-pit operations.

Feasibility studies for coal development by Indemitsu-Alaska at their **Wishbone Hill Mine** near Palmer, and by Diamond Alaska at their **Chuitna Coal Project** west of Anchorage accounted for the remainder of the development expenditures.

Production

For the first time since 1925 the value of base metals produced in Alaska far exceeded the value of precious metals in 1990 (appendix F). The estimated value of zinc and lead, \$284.6 million, accounted for over half the total value of mineral production in the state, and was double the value of gold and silver production. Much of the base metal produced was from the **Red Dog Mine** of Cominco Alaska, Inc. Although the mine shipped only 320,000 tons (290,240 tonnes) of concentrate in 1990, Cominco has estimated that it will ship over 700,000 tons (634,900 tonnes) of concentrate per year when the mine is at full production. So, unless there is a drastic fall in the price of lead and zinc, it is likely that base metals will continue to capture a major share of metallic mineral production in future years.

Kennecott mined about 382,000 tons (346,470 tonnes) of sulfide ore at **Greens Creek Mine** and produced about 37,000 tons (33,600 tonnes) of zinc, 16,730 tons (15,175 tonnes) of lead, 38,103 oz (1,182 kg) of gold and 7.6 million oz (235,812 kg) of silver in concentrates. For the second consecutive year the mine was the nation's largest producer of silver.

Total production of gold in 1990, estimated at 231,700 oz (7,206 kg), was down substantially from 1989 because of poor production by Westgold's **BIMA** dredge, and because the **Valdez Creek** placer mine operated by Cambior was closed for most of the year for diversion of the creek. Only about 40,300 oz (1,251 kg), of hardrock gold was produced in 1990, with 38,100 oz (1,183 kg) from **Greens Creek Mine** and most of the remainder from Citigold Alaska's, **Ryan Lode Mine** near Fairbanks.

Usibelli Coal Mine near Healy, in central Alaska, produced 1.576 million tons (1,429 million tonnes) of coal worth about \$45 million, a new production record. Of this about half of the total was exported to Korea, and the rest used locally.

With no major development projects in the state in 1990, rock, and sand and gravel production was slightly higher than in 1989, with a combined total of 18.2 million tons, (16.6 million tonnes), with a value of about \$62.9 million.

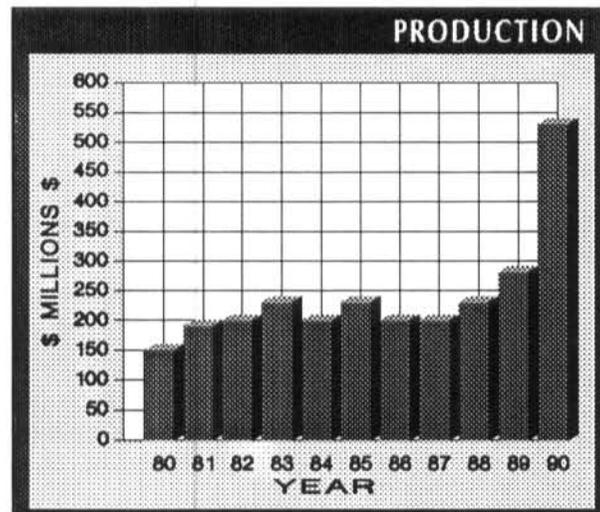


Figure 3. Production expenditures reported, 1980-90.

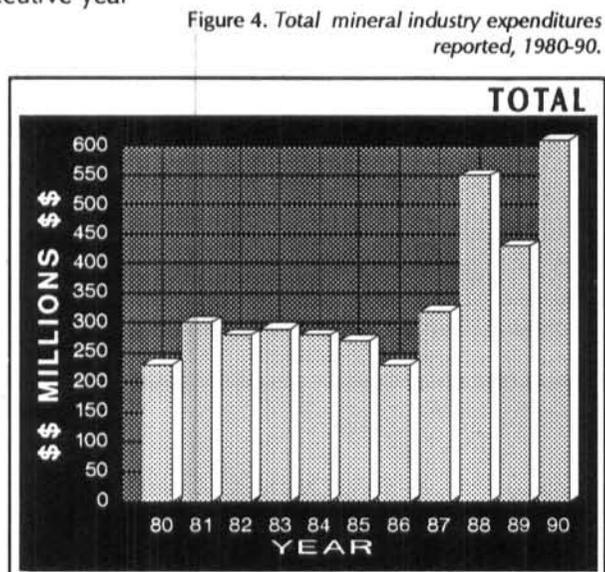


Figure 4. Total mineral industry expenditures reported, 1980-90.

Government Actions



Figure 5. In the first few weeks of the current state government administration, Commissioner Heinze initiated a department-wide effort to complete the selection of the final 20-million acres of land of the state's entitlement under the statehood act. Land selection will focus on mineral potential, access, and ownership patterns. (Photo by Cindy Roberts)

Figure 6. Dr. Earl Beistline, chairman of the Alaska Minerals Commission, discusses pending legislation with Dr. Richard Swainbank, Commission development specialist. The Commission acts in an advisory capacity to the legislature and to the executive branch of state government. (Photo by Cindy Roberts)



In 1990, all claims on state land became subject to rental and net royalty fees as a result of legislation signed by Governor Cowper. Reclamation requirements were established for state, federal, and private lands.

Rent was backdated to 1989, with payment due in June 1990, and rents for 1990 were due by November 30, 1990. Revenue for 1989 was \$641,000, and for 1990 increased to \$653,080.

Regulations supporting reclamation legislation are expected to include a performance bonding provision. Regulations are discussed in more detail beginning on p. 42, "Rents, Royalties, and Reclamation."

In 1990, the mineral industry was greatly impacted by the *Weiss v. State of Alaska* lawsuit which demanded the resolution of many issues surrounding the Alaska Mental Health Land Trust. This 1985 suit demanded the reconstitution of the 1-million-acre trust established prior to statehood in order to support in-state mental health programs. The 1978 legislature changed the status of unsold and unencumbered trust lands to general grant state land. As a result, lands were conveyed to municipalities and private owners. The provision for automatic revenue flow to the trust was ignored and the lawsuit by trust beneficiaries followed.

Legislation passed in 1990 to provide a guaranteed revenue stream for the trust. However, a Superior Court ruling placed an injunction on the conveyance or permit issuance on any of the original acreage. These lands were selected for their income potential from mineral, coal, and timber development, and many properties became third parties in the lawsuit.

The legislation affected exploration plans for Usibelli properties, but it shut down the Wishbone Hill coal project owned by Idemitsu-Alaska. NOTE: The Hickel administration and the 1991 Legislature crafted a settlement agreement to resolve the lawsuit. As of press time, it has not gone before the judge. If accepted, it will clear title on the original trust land and open 1 million acres for development to benefit the mental health groups.

The November 1990 election returned Walter J. Hickel, Alaska's second governor, to Juneau with former senator from Nenana Jack Coghill as his lieutenant governor. The election reflected a shift to a pro-development philosophy.

In December, Department of Natural Resources Commissioner Harold C. Heinze established as a priority during the next two years to select the lands that will complete the state's entitlement of 104.5 million acres.

Education and Research

The Alaska Miners Association (AMA) hosted 11 geologists and mining engineers from the Soviet Far East at their November 1990, 15th Annual Miners Association Convention in Anchorage. The Soviets traveled from Provideniya (USSR) to Nome on charter flights flown by Bering Air and arranged by AMA. The arrival in Nome of the large geoscience contingent marked a symbolic return to Russian America (fig. 7).

The technical sessions comparing the geology and mineral deposits of Alaska, Canada and the Soviet Far East were co-chaired by the Alaska Division of Geological and Geophysical Surveys, and the U.S. Geological Survey. Over

420 people registered for the three day convention, the best attendance since 1981. Soviet and American speakers presented papers on placer geology, engineering geology, regional geology and geophysics, ore deposit summaries, and regional metallogenesis. Table 3 lists the speakers at the symposium. Workshops were held over the weekend to encourage informal dialogue between the Soviet geologists and their counterparts in Alaska (fig. 8).

Two geologists, Farid Kutjev and Leonid Parfenov from Yakutsk traveled to Fairbanks to lecture at the University of Alaska Geology Department and met with collaborators on several joint projects. The AMA is currently editing papers submitted by those who participated in the symposium; a full journal is expected to be released in 1991.



Figure 7. During 1990, Alaskans had many opportunities to visit with their professional counterparts in the Soviet Far East. Geologists from the USSR Ministry of Geology and Academy of Science inspect Alaska Gold Company's dredge #5 in the Nome goldfields. The geologists participated in an exchange with USGS and Alaska DGGs personnel. Many similarities were found between the mineral districts of Alaska and those in the Magadan region of the Soviet Far East. (Photo by T.K. Bundtzen)

Table 3. Soviet participants in geology and metallogeny of Soviet Far East, Alaska, and Canada Symposium

Dr. Eugene Bogdanov Director, Mining Institute U.S.S.R. Academy of Sciences, Khabarovsk	Dr. Vyacheslav Popeko Institute of Tectonics and Geophysics U.S.S.R. Academy of Sciences, Khabarovsk
Dr. Chermen Borukayev , Director Institute of Tectonics and Geophysics U.S.S.R. Academy of Sciences, Khabarovsk	Dr. Vladimir Ratkin , Chief, Laboratory on Mineral Deposits and Metallogenesis Far East Geological Institute U.S.S.R. Academy of Sciences, Vladivostok
Ms. Lidiya Kovbas , Assoc. Director for International Relations Far East Geological Institute U.S.S.R. Academy of Sciences, Vladivostok	Dr. Vatali Tchepko , Chief Geologist Ministry of Geology Berelexkaya Geological Expedition Susuman/Nexico District, Madadan Region
Dr. Farid Kutjev , Chief Laboratory on Petrology and Metallogenesis Institute of Volcanology U.S.S.R. Academy of Sciences, Petropavlovsk-Kamchatsky	Dr. Eugeny Sidorov Laboratory on Petrology and Metallogenesis Institute of Volcanology U.S.S.R. Academy of Sciences, Petropavlovsk-Kamchatsky
Dr. Ivan Nekrasov , Director Far East Geological Institute U.S.S.R. Academy of Sciences, Vladivostok	Ms. Tatiana Koryakina Assoc. Director for International Relations Institute of Tectonics and Geophysics U.S.S.R. Academy of Sciences, Khabarovsk
Dr. Leonid Parfenov , Chief Laboratory on Regional Geology Yakut Institute of Geology Siberian Department U.S.S.R. Academy of Sciences, Yakutsk	

Figure 8. At a farewell dinner in Anchorage, colleagues from the Soviet Union, Alaska, and Canada celebrate their common scientific enthusiasm and new friendships. (Photo by Warren Nokleberg)





Figure 9. The Alaska Mineral and Energy Resource Education Fund (AMEREF) celebrated its eighth year of operation in 1990. This joint venture between Alaska's mineral industry and the Alaska Department of Education has provided nearly 500 schools across the state with teaching materials ranging from a sample rock kit to detailed geologic lesson plans. The kits can be adapted for use in classrooms from first grade through high school. Here, both teacher and student examine rock samples with a DGGs geologist. (Photo by Cindy Roberts)

Two Alaska programs continue to provide mining vocational training. The Mining and Petroleum Training Service (MAPTS) is based in Soldotna and predominantly serves southcentral Alaska. The Institute of Mining Technology (IMT) of the University of Alaska Southeast is based in Juneau. IMT is a partnership between the University and the mining industry. This program provides training for a variety of mine and mining-related vocations and has over 80 percent placement rate of its graduates. With Alaska's expanding minerals production sector, these programs play an important role in providing a well-trained workforce for the industry.

The Alaska Science and Technology Foundation (ASTF) awarded a grant to Goldstream Exploration Inc. of Fairbanks to design a placer mining plant that can meet reclamation and water quality standards required in state and federal law. A 40 yd³/hr demonstration plant operated for part of the 1990 season. A full scale plant is expected to be in operation during the 1991 placer mining season. The ASTF was designed to provide matching funds for selected proposals tailored to enhance the Alaskan economy.

The Fairbanks Historic Preservation Foundation announced plans to raise funds to purchase buildings and land of the original headquarters of the United States Smelting, Refining, & Mining Co. (USSR&M). This company was a major employer in Fairbanks prior to statehood. Plans include restoration and educational presentations at the site.

The Alaska Mineral and Energy Resource Education Foundation (AMEREF) continued the resource education curriculum (fig. 9). Since 1985 AMEREF has placed resource education kits in 490 Alaskan elementary and secondary schools (Tunley, 1990).

ACKNOWLEDGMENTS

This report is designed, produced, and distributed by the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys (DGGs), Division of Mining (DOM), and the Department of Commerce and Economic Development, Division of Economic Development (DED).

We thank many people for supplying data for this report: Alaskan mining exploration firms, placer miners, mine production companies, metal recycling firms, sand-and-gravel and other producers, Native Regional Corporations, and federal, state, and municipal agencies.

T.K. Bundtzen (DGGs) and Ellen Harris (DGGs) mailed out about 1,050 questionnaires on mining activity, 214 of which were returned by private firms, agencies, and individuals.

R.C. Swainbank (DED) and Bundtzen wrote the Introduction; Swainbank wrote the Exploration, Drilling and Development Sections; Bundtzen wrote the Production and Metal Recycling Sections, and J.E. Wood (DOM) produced the section on Rents, Royalties and Reclamation. All authors updated appendixes C-G; Erik Hansen (DOM) compiled appendixes A and B.

We want to acknowledge the following people for their contributions to the production of this report: Cindy Roberts (DNR), ideas and inspiration for the new format of this edition; A-L Schell (DGGs), design, graphics layout, and production coordination; G.M. Laird, computer graphics; R.A. Mann (DGGs), desktop publishing; F.C. Tannian (DGGs), editing; Cindy Roberts, T.K. Bundtzen, and R.C. Swainbank, photograph selection. For reviewing the document, we wish to thank M.W. Henning (DGGs), B.W. Campbell (DOM), and A.H. Clough (DED).



Echo Bay

EXPLORATION

Mineral industry exploration expenditures grew by 32 percent to \$63.3 million in 1990. Precious metals exploration accounted for 90 percent of the total investment.

INTRODUCTION

Exploration expenditures in Alaska in 1990 were \$63.3 million, up 32 percent from \$47.8 million in 1989, continuing the trend which began in 1987. About 60 percent of these funds were invested in bulk minable gold properties; three are advanced exploration projects near Juneau, and one project is near Fairbanks. However, significant expenditures were made in all areas of the state.

The increase in expenditures was encouraging, particularly because exploration has been declining in neighboring Canada during the last two years. It is anticipated that one or more of the advanced exploration projects will proceed to mine development in the next few years, and, ultimately, to production.

Tables 4 and 5 show the distribution of the exploration expenditures by type of commodity and by region. Numbers of persons employed in exploration is also shown by region in table 5.

Figure 10 illustrates locations of selected exploration projects described in the following chapter. Figure 11 illustrates trends in exploration during the last 35 years. In 1990, as in past years, exploration expenditures for precious metals far outweighed those for other metals or material, and most exploration effort was again in southeast Alaska both in terms of capital and people employed (table 5).

Figures 12 and 13 show the number of new claims filed in Alaska annually since 1970, and assessment work filed for the same

period. In 1990 new state claims numbered 2,573 and 1,888 new federal claims were staked, compared with 3,928 and 1,664 respectively in 1989. Royalties on state claims increased from \$641,000 for 1989 to \$653,000 in 1990. Active claims in 1990 totaled 62,528, a decrease of 8 percent from 67,948 in 1989.

NORTHERN REGION

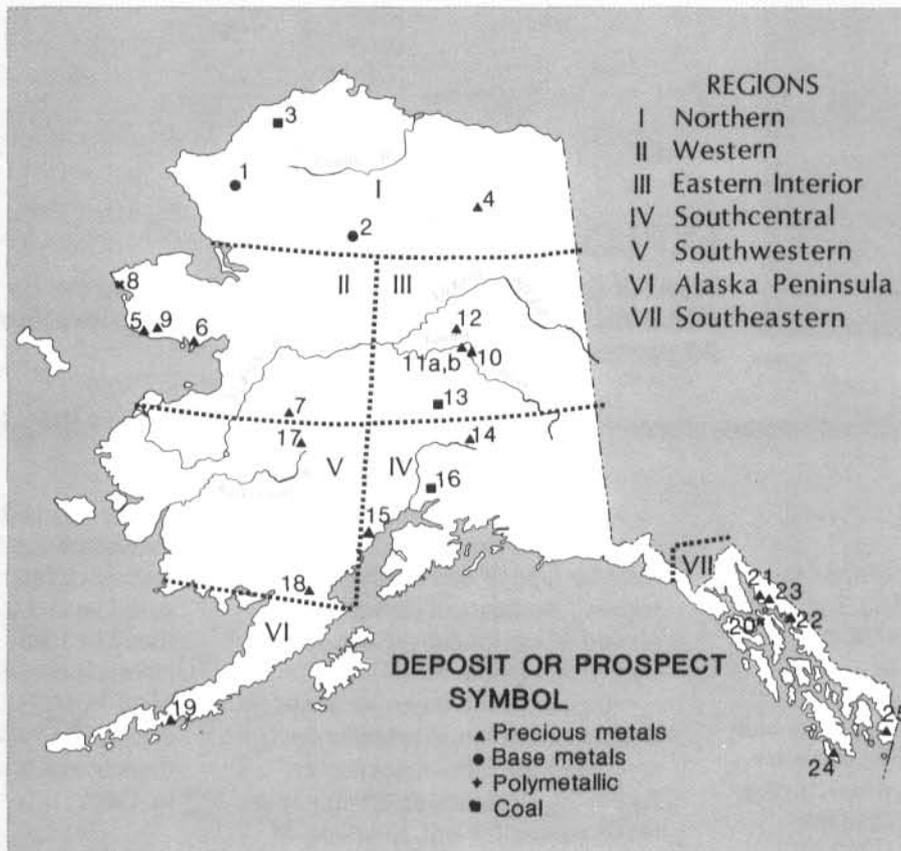
The northern region covers about 30 percent of Alaska's landmass and includes some of the state's least populated and most remote geographic areas, such as the Brooks Range and North Slope. Reported 1990 expenditures totaled \$1,152,000 up a little from the \$983,000 reported 1989. Nine

Table 4. Reported exploration expenditures in Alaska by commodity, 1983-90

	1983	1984	1985	1986	1987	1988	1989	1990
Base metals	\$ 9,758,760	\$ 4,720,596	\$2,397,600	\$1,847,660	\$ 2,523,350	\$ 1,208,000	\$ 3,503,000	\$ 5,282,200
Precious metals	20,897,555	14,948,554	6,482,400	6,107,084	11,743,711	41,370,600	43,205,300	57,185,394
Industrial minerals	2,068,300	270,000	--	170,000	286,000	160,200	125,000	370,000
Coal and peat	1,338,454	2,065,000	270,000	790,000	1,150,000	2,730,000	924,296	321,000
Other*	70,000	279,500	--	--	31,000	--	5,000	97,000
TOTAL	\$34,133,069	\$22,283,650	\$9,150,000	\$8,914,744	\$15,734,061	\$45,468,800	\$47,762,596	\$63,255,594

-- No expenditures reported.

*Jade, platinum, diamonds, and colored gemstones.



NORTHERN REGION (I)

- 1. Moneta-Porcupine Mines (Lik Deposit)
- 2. Cominco Alaska Exploration (Ambler Copper Belt)
- 3. Arctic Slope Consulting Group (Deadfall syncline)
- 4. Gold Dust Mines, Inc. (Chandalar Camp)

WESTERN REGION (II)

- 5. Tenneco Minerals (Rock Creek)
- 6. BHP-Utah International (Bluff)
- 7. Vinta Explorations, Ltd. (Illinois Creek)
- 8. Kennecott (Potato Mountain)
- 9. Cyprus Gold (Nome placers)

EASTERN REGION (III)

- 10. Fairbanks Gold, Inc. (Fort Knox)

11a. American Copper & Nickel

Company, Inc. (Ester Dome)

11b. Citigold Alaska, Inc. (Ester Dome)

12. Fairbanks Exploration, Inc. (Livengood, Fairbanks, Circle)

13. Usibelli Mines, Inc. (Healy)

SOUTHCENTRAL REGION (IV)

14. CanAlaska Resources, Ltd. (Rainbow Hill project)

15. Hunt, Ware & Proffett (Johnson River)

16. Hobbs Industries, Inc. (Castle Mountain Mine)

SOUTHWESTERN REGION (V)

17. Battle Mountain Exploration Company (Independence Mine)

18. Cominco Alaska Exploration (Pebble Beach)

ALASKA PENINSULA (VI)

19. Battle Mountain Exploration Company (Centennial)

SOUTHEASTERN REGION (VII)

20. Kennecott Greens Creek Mining Company (Greens Creek Mine)

21. Echo Bay Exploration, Inc. (Kensington)

22. Echo Bay Exploration, Inc. (A-J/Treadwell)

23. Placer Dome (U.S.), Inc. (Jualin Mine)

24. Sealaska Corporation (Dall Island)

25. Pulsar Resources (U.S.), Inc. (Hyder District)

Figure 10. Regions of mining activity and selected mineral exploration projects.

companies reported 4,650 work-days of employment on precious, base metal, and coal projects.

Metals

Cominco Alaska Exploration was active in northwest Alaska drilling near the **Red Dog** deposit, and also at the **Smucker** and **Sun** base metal deposits at the west and east ends of the Ambler Copper Belt (fig. 14). Moneta-Porcupine Mines, as part of an agreement to purchase a 50 percent interest in the **Lik** prospect from General Crude Oil (GCO) Minerals, drilled three holes to provide samples for metallurgical tests. The other 50 percent is presently owned by Echo Bay Mine and, by spending \$25 million over the next 30 years, Moneta can reduce Echo Bay Mine's share of the property from 50 percent to 20 percent. The **Lik** property is 12 mi northwest of the **Red Dog Mine**,

and has preliminary reserves of 18.2 million tons grading 10.2 percent zinc, 3.3 percent lead and 1.5 oz/ton silver at a cut-off grade of 7 percent combined lead-zinc. An additional 10,000 to 15,000 ft of drilling is reported to be necessary in the vicinity of a planned open-pit area, which contains an estimated two-thirds of the reserves to a depth of 500 ft.

About 500 tons of equipment and supplies valued at \$3 million were freighted cross-country from Coldfoot to Little Squaw Gold's Chandalar Camp by the lessee, Gold Dust Mines, Inc. Placer gold claims under evaluation at the camp cover more than 10 mi of creek, and consist of 455 patented acres and 4,200 acres of state claims. Exploration and some production were reported on Tobin Creek, with future activity expected on Little Squaw and Big Squaw Creeks.

Some exploration activity including geochemical and geologi-

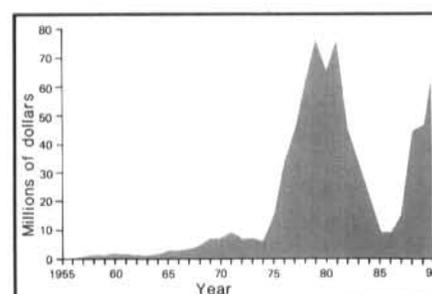


Figure 11. Mineral exploration expenditures in Alaska, 1956-90.

Table 5. Reported exploration expenditures and employment in Alaska by commodity and region, 1990

	Northern	Western	Eastern interior	South-western	South-central	Alaska Peninsula	South-eastern	TOTAL
Exploration Expenditures								
Base metals	\$ 620,000	\$ 256,000	\$ 1,106,200	\$ 750,000	\$ 765,000	\$ 125,000	\$ 1,660,000	\$ 5,282,200
Precious metals								
Placer	257,000	2,190,760	312,000	110,000	418,150	--	41,484	3,329,394
Lode	250,000	5,385,000	14,110,000	1,277,000	1,542,000	1,575,000	29,717,000	53,856,000
Coal and peat	--	--	256,000	--	65,000	--	--	321,000
Industrial minerals	--	--	20,000	2,000	63,000	70,000	215,000	370,000
Other ^a	25,000	--	30,000	2,000	40,000	--	--	97,000
TOTAL	\$1,152,000	\$7,831,760	\$15,834,200	\$2,141,000	\$2,893,150	\$1,770,000	\$31,633,484	\$63,255,594
Exploration Employment								
Employment								
Workdays	4,650	12,415	24,503	4,097	7,006	2,590	42,160	97,421
Workyears ^b	18	48	94	16	27	10	162	374
Number of companies reporting ^c	9	15	34	10	23	4	14	109

-- = No expenditures reported.

^aJade, platinum, diamonds, and colored gemstones.

^bBased on a 260-day workyear.

^cSome companies were active in several areas.

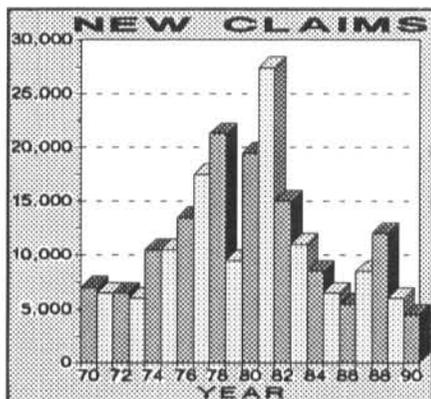


Figure 12. Number of new claims, 1970-90.

Figure 13. Claim assessment work filed, 1970-90.

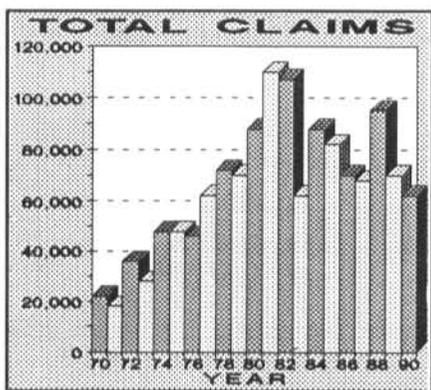


Figure 14. The science of advanced exploration of any mineral prospect involves highly trained technical specialists. Field data from core drilling and geophysical analyses are translated into maps which delineate the ore body. The timing of investment decisions often depends on the data generated during the summer field season. (Photo by Echo Bay)

cal sampling, geophysical surveys and minor trenching was reported in Lake Creek and at the headwaters of Lake Creek and Spring Creek in the Wild River drainage. Paradise Valley Mining Company, Inc., also reported testing on Agnes and Oregon Creeks north of Bettles and west of Wiseman.

Coal

Arctic Slope Consulting Group continued to assess the feasibility of developing high quality bituminous coals on lands owned by Arctic Slope Regional Corporation. Between 1986-1990, 700 tons of coal were sampled or used domestically in 53 houses at Point Lay, Point Hope, and Wainwright. The company studied the feasibility of export of coal to Europe via a northern Russian transportation route.

WESTERN REGION

Metals

Exploration in the western region was predominantly for gold, both placer and hardrock. Nearly \$8 million was invested in 1990, compared with less than \$4 million in each of the last two reporting years.

As reported last year, Tenneco Minerals entered into a complex joint venture with Aspen Exploration and native interests to continue exploration at **Rock Creek** and on Anvil Creek north of Nome. Further drilling was done at the **Rock Creek** deposit where the inferred reserves are 6.6 million tons grading 0.07 oz/ton. However, late in the year Tenneco announced their intention to withdraw from the joint-venture. A large soil geochemical program near **Rock Creek** defined a number of gold and arsenic anomalies in an 8-mi by 2-mi zone, and one trench at Anvil Creek contained 110 ft of 0.13oz/ton gold.

BHP-Utah International was actively exploring in the Bluff and Mt. Distin areas of the Seward Peninsula, including diamond-drilling and geochemical sampling.

Vinta Explorations, Ltd., acquired the **Illinois Creek** project from Goldmor Resources by purchase of all shares of the Silvertown Corporation, an Alaska company with the rights to explore and lease the property. The share purchase was worth \$1,364,467. During 1990 a 6,030 ft drill program in 38 vertical reverse-circulation drill holes confirmed proven and probable reserves of 1.59 million tons grading 0.072 oz/ton gold and 1.79 oz/ton silver, with an additional possible reserve of 0.76 million tons with 0.059 oz/ton gold and 1.15 oz/ton silver. The reserves were calculated by SAI, Inc., an affiliate of Salisbury Associates, Inc., of Spokane. These reserves occur within 1,900 ft of a possible 3,200 ft strike length of the known system, to a depth of only 250 ft. There are several other prospects within the 124,520 acre property, including Waterpump Creek 2 mi north of **Illinois Creek**. Preliminary geologic reserves at Waterpump Creek are 183,000 tons grading 16.1 percent lead, 5.5 percent zinc and 9.5 oz/ton silver, based on 16,700 ft of drilling in 38 holes completed by Anaconda.

Central Alaska Gold Company, as operator for the Nixon Fork Mining Company (Caithness Gold Mining, Ltd., Central Alaska Gold Company, and Battle Mountain Exploration Company), continued exploration of the gold-copper skarn mineralization at **Nixon Fork**, completing exploration drilling and trenching. A feasibility study will be completed in 1991 and a production decision will follow. The **Nixon Fork** copper-bismuth-gold deposit occurs in recrystallized Ordovician limestone adjacent to a Late Cretaceous monzonite pluton. The extensive drilling program in 1990 contributed largely to the increased exploration expenditures

in the western region over those of the previous year.

Kennecott mapped 8 mi², took soil and rock geochemical samples and drilled two holes at Potato Mountain in a tin exploration program.

The Bering Straits Native Corporation conducted extensive reconnaissance exploration near Nome, Golovin, Solomon, Teller, White Mountain and Brevig Mission for gold and rare-earth elements. Most of these projects were joint ventures with local corporations or with federal agencies.

Berg and Wetlesen were actively exploring in the vicinity of the Independence Mine in the northeastern part of the Seward Peninsula, including geochemical and geophysical surveys and drilling. American Copper and Nickel Company (ACNC) was active in the Candle Hills area in a joint venture with Doyon Native Corporation.

Placer gold exploration in the western region attracted several companies. Alaska Placer Development, Inc., drilled and sampled Ophir Creek, and also drilled in a joint-venture with Bering Strait Native Corporation in the Solomon drainage.

Cyprus Gold, as lessee from Alaska Gold Company, excavated several test pits to check drill-indicated grades on the Second Beachline and Monroeville Beachlines at Nome. Al Vezey drilled his property at Hastings Creek, near Nome, and Berg-Wetlesen investigated Mud Creek, leased from Bud Meyers. Kougarok Mining Company stripped and prospected in the Kougarok River area.

Sphinx Mining, Inc., had an active exploration program south of Ruby on Greenstone, Midnight, Monument, and Trail Creeks, following up geologic mapping, geophysical and geochemical surveying with a substantial auger-drilling program. Flat Creek Mining Co.,

Inc., was also active in the same region, with a reverse-circulation drilling project on Flat and Timber Creeks.

EASTERN INTERIOR REGION

As in 1989, the eastern interior was the second most active area of Alaska for exploration in 1990, mainly due to advanced projects in the Fairbanks mining district, (see section on Advanced Exploration Projects). Placer mining camps in this region include Manley-Tofty-Eureka-Rampart, Tolovana-Livengood, Fairbanks, Circle-Central, Richardson and 40-Mile-Eagle. There were active hardrock exploration programs in 1990 in most of these areas seeking the source or sources of the placer gold. Reported mineral exploration expenditures in 1990 were almost \$16 million, up 78 percent from the \$9.17 million reported in 1989. A total of 24,503 man days of work were reported in 1990, equivalent to 94 year-round jobs.

Metals

The **Fort Knox** property of Fairbanks Gold, Inc., was the largest exploration project outside of southeast Alaska in 1990. Approximately 60 people were employed in an ambitious \$9.32 million program entailing 46,300 ft of diamond drilling and 62,600 ft of reverse-circulation drilling. A 170,000 ton bulk sample was reduced on site to 45 tons, of which 7 tons were split for metallurgical testing. Geotechnical work, environmental baseline studies and a prefeasibility study were also initiated in 1990. Further details of this project are available in the "Advanced Exploration Projects" section of this report (p. 15).

Central Alaska Gold Company, as operator for the joint venture with Caithness Gold Mining, Ltd., explored lands optioned from Doyon, Ltd. at the Flume Creek

prospect, 25 mi northwest of Eagle, and completed diamond drilling, geochemical sampling, and geologic mapping. The company, also as operator for their joint venture with Caithness Gold Mining, Ltd., completed a second year of reconnaissance exploration on lands optioned from Doyon, Ltd. Work consisted of regional geochemical sampling and geologic mapping accompanied by exploration diamond drilling at one property.

ACNC, in a joint venture with Silverado Mines (U.S.), Inc., spent \$1.6 million drilling 17,434 ft of core in the O'Dea vein system at the **Grant Mine**, and on the subparallel Ethel vein system 2,000 ft to the north. The results of this drilling show a resource of 212,000 drill-indicated tons grading 0.36 oz/ton gold on a portion of the O'Dea system, which is still open at depth and along strike. In a separate joint-venture with Can-Ex Resources, ACNC mapped, sampled, and surveyed at Eagle Creek north of Fairbanks. ACNC contracted with Dighem Surveys & Processing to fly an airborne geophysical survey, (magnetic and electromagnetic), over both properties.

Citigold Alaska, Inc., conducted an aggressive drilling and trenching program at the **Ryan Lode** property on Ester Dome, near Fairbanks. In the process, Citigold discovered a new vein system, the Curlew/Iving, subparallel to the **Ryan Lode**, consisting of quartz veins within an altered monzodiorite intrusive host. This new system, which has not been explored laterally or to depth, could contain 350,000 tons of 0.077 oz/ton gold to a depth of 100 ft. One particularly good hole in the **Ryan** structure assayed 4.25 oz/ton for more than 60 ft. Several 1,000 ft-deep holes on the shear confirm that the vein persists to depth and maintains width and grade.

Fairbanks Exploration, Inc., was also active in 1990, with projects

ranging from precious metal exploration in Fairbanks, Livengood, and Central mining districts, to limestone north of Fairbanks and coal at Jarvis Creek near Delta. The exploration was conducted with joint-venture partners ASARCO near Livengood, and with Freegold Recovery, Inc., near Central. A bulk sample of the Christina Vein near Fairbanks was tested by Polar Mining, Inc.

Amax Gold Exploration, Inc., drilled Ed Montgomery's Ruth & Lillian Creeks properties near Livengood, and had an active reconnaissance program throughout interior Alaska.

Many smaller exploration programs, almost all for precious metals, contributed significantly to the overall exploration expenditures. BHP-Utah had a regional reconnaissance program in the interior; Charles W. Cleveland, Lyle and Steve Collenge, Flat Pick Mining, Paul Manuel, Wilde Enterprises, Hecla Mining Company and Helen Warner all conducted exploration on their properties in the Circle district; in the 40-Mile district Tap the Pot Mining and Howard Fix were exploring for precious metals and stones. The **Taurus** porphyry copper-molybdenum deposit was restaked with 138 state claims which were acquired by Lodestar Explorations, Inc. when gold was found in old drill core. Tok Gold and Exploration reported activity near Tok. Grateful Dog Mining continued exploration for intrusive-hosted gold near Murphy Dome north of Fairbanks; Dennis Shepard and Mark Thoennes were active on Pedro Dome, Gypsy Luck, Inc., worked on the Bonnielield district, and Herning Exploration and Mining worked in the Upper Chena area.

Coal

Usibelli Coal Mine, Inc., had a large geophysics, drilling and bulk

sampling program at Two Bull Ridge, North Fork Ridge, and Gold Run Pass near Healy. Fairbanks Exploration, Inc., in a joint-venture with Hobbs Industries, was actively exploring the Jarvis Creek coalfield near Delta. It was hoped that the 3 million ton proven reserve of sub-bituminous B coal in this field could provide the energy for a proposed backscatter radar at Tok and Glennallen.

SOUTHCENTRAL REGION

The southcentral region includes the Valdez Creek mining district, the Kennecott copper belt, and the copper and lode gold mineral belts from Valdez to Seward. A variety of metals and minerals have been developed and promising coal, gold, and base metal properties have been explored in recent years. Expenditures in 1990 increased 17 percent from 1989 levels of \$2.44 million to \$2.9 million.

Metals

CanAlaska Resources, Ltd., continued exploration in the Valdez Creek area on the Black Creek Adit, Gold Hill Zone, and TMC Zone of its **Rainbow Hill** Project. At the Black Creek Adit a 65-ft-thick granodioritic intrusive is emplaced in sheared agillite and graywacke. The intrusive and stockwork quartz veins within the intrusive both contain gold. A larger intrusive to the north is not intersected by the underground workings, but surface trenching showed gold in quartz stockwork veinlets within the intrusive. Work on the TMC Zone to the north of the intrusive in 1990, including some diamond drilling and 12,519 ft of reverse-circulation drilling, identified five vertically-stacked gold-bearing zones dipping to the south within a 700-ft interval. The gold occurs in veinlets in both the igneous and sedimentary rocks. This zone was defined by geophysi-

cal surveying over 5,000 ft, but only drill-intercepted over 2,600 ft. The zone is open to the west, and downdip where drill intercepts suggest greater width and better grades. Inferred reserves from the 1990 program are 262,000 tons with a grade of 0.151 oz/ton gold. Based on recent work and metal sieve analysis, these reserves have been increased to 383,000 tonnes grading 0.209 oz/ton.

Caprock Corporation, leasing from Rowallen Mine Partnership was also active on White Creek in the Valdez Creek area, and a large reverse-circulation drill program on their placer claims was completed in 1990. Engineering and pit design in 1990 could result in production in 1991.

Gold Tech Resources, Inc., had an active year mapping, sampling, conducting geophysical surveys, opening old shafts and sinking new shafts in the Pass Creek and Valdez Creek area.

Hunt, Ware & Proffett ran a significant diamond drill program on the **Johnson River** volcanogenic gold-zinc prospect in the southern Alaska Range. The property is leased by Howard Keck and partners from Cook Inlet Region, Inc., a Native corporation.

Ed Ellis continued mapping and sampling for gold in Tertiary sandstone on Lake Creek, a tributary to the Yentna River, and in the Willow Creek District Gold Cord Development Corporation continued exploration of its Hatcher Pass properties.

On the west side of the Susitna River, TC Mining mapped deposits in the Cache Creek and Thunder Creek drainages, and H & H Exploration and Mining dug test-holes with a Nodwell-mounted backhoe on Forsy Gulch on Miller Creek.

IIS Company Machine, Inc., dug test-holes at Moose Pass on the Kenai Peninsula. Quartz Creek Exploration conducted geochemical and geophysical surveys in the same area. F.W. Haas Company

sampled Canyon Creek at mile 50 on the Seward Highway using test pits and a suction dredge.

Hoffman Mining used a backhoe to dig test pits on the Middle Fork Mine in the Chistochina drainage. Mike Connor sampled Metal Creek in the Matanuska Valley using auger holes. Bob Ticheval used a backhoe to sample Busch Creek.

Coal

Hobbs Industries, Inc., had a significant exploration program at both the **Evan Jones** and the **Castle Mountain** coal mines near Palmer in the Matanuska Valley. At the **Castle Mountain Mine** the project included mapping, trenching, bulk sampling and drilling, while at the **Evan Jones Mine** in the Wishbone Hill coalfield a similar program included environmental base-line studies preparatory to development. Both projects are impacted by the Mental Health Lands dispute.

Industrial Minerals

Only a few of the many sand and gravel operations in the southcentral area did any exploration in 1990. AAA Valley Gravel, Inc., spent much of the summer evaluating the reserves along Wasilla Creek on Trunk Road at Palmer.

SOUTHWESTERN REGION

The southwestern region includes numerous lode and placer deposits originating in the Kuskokwim mineral belt, a 400-mile long (640 km), northeast-trending zone of Late Cretaceous-early Tertiary metal-bearing volcanic and plutonic rocks. Mining districts include Goodnews Bay, Aniak, Iditarod, Innoko, Candle Creek, and Iliamna. The region has produced about 10 percent of Alaska's gold (2.8 million oz; 87,092 kg), nearly all of Alaska's platinum metals

(575,000 oz; 17,885 kg refined), and all of Alaska's 41,000 flasks (1,413,417 kg) of mercury production. Mineral exploration expenditures reached \$2.14 million in 1990, a 54 percent decrease from the \$4.5 million spent in 1989. Long dormant, southwestern Alaska has become one of the top areas of grassroots exploration efforts by recently arrived mining firms, most working on State of Alaska and Native corporation lands.

Metals

The most published prospect explored in the southwest region in 1990 was Cominco Alaska Exploration's **Pebble Beach** copper-gold porphyry prospect about 20 mi west of Newhalen on Lake Iliamna. Based on drill-holes 300 to 400 ft deep and 1,000 ft apart, Cominco estimates a resource of 200 million tons of 0.4 percent copper and 0.012 oz/ton gold, and within that area a 50 million ton portion averages 0.5 percent copper and 0.015 oz/ton gold. The deposit is still open at depth and to the northeast, so some increase is expected from the planned 1991 drill program (fig. 15).

Golden Horn Mining Company continued crosscutting near the Golden Horn shaft on Otter Creek near Flat, and a bulk sample was evaluated by Mountain States Engineering of Tucson, Arizona for separation. Minerals present include gold, scheelite, cinnabar, stibnite, silver, arsenopyrite and zircon.

Julian Creek Mining also worked near Flat on the George River, trenching and panning in an area where auriferous gravel is underlain by quartz porphyry.

Battle Mountain Exploration Company had a core-drilling program at the Independence Mine between Ganes and Yankee Creeks in the Ophir mining district, and also on Granite Creek, a tributary to



Figure 15. The Pebble Beach Project ore reserves are estimated at 200 million tons, based on the findings of the 1990 drilling season. A project geologist at the Cominco Alaska Exploration site shows a core sample containing disseminated copper sulfide minerals to Sam Dunaway (right), Director of the Alaska Division of Mining. (Photo by Cindy Roberts)

the George River in the central Iditarod Quadrangle. The mineralization in the area appears to be structurally controlled quartz-stibnite-gold veins associated with quartz-porphyry intrusives. Battle Mountain leased the Independence Mine ground from Lloyd Magnuson and the Granite Creek prospect from L.E. Wyrick.

Richard Wilmarth continued placer sampling of Chicken Creek in the Iditarod area with a backhoe. James Wylie spent some time mapping in the Sleetmute Quadrangle. Howard N. Bowman followed up a magnetometer survey on Portage Creek at Lake Clark with test pitting. John B. Murphy prospected in the Middle Kuskokwim region.

Industrial Minerals

The city of Anvik prospected for gravel at the Anvik gravel pit, in preparation for a water-treatment plant.

ALASKA PENINSULA

The Alaska Peninsula region includes the Tertiary plutonic-

volcanic rocks of the Alaska-Aleutian arc and recent Quaternary volcanoes of the Aleutian Chain. Mineral exploration during 1990 in this classic epithermal gold setting amounted to \$1.77 million compared to \$2.01 million in 1989, a decrease of 12 percent.

Metals

Battle Mountain Exploration Company had an aggressive precious metal exploration program in 1990 on lands leased from the Aleut Native corporation on Unga, Popof, and Nagai Islands in the Shumagins. The program included mapping, rock sampling and drilling following a large airborne magnetic/electromagnetic geophysical survey. A smaller geophysical survey was also conducted on Umnak and Unalaska Islands, followed by intensive geologic mapping, geochemical sampling and drilling.

There was no exploration in 1990 by Alaska Apollo Gold Mines, Ltd., on its **Shumagin** and **Apollo** ore deposits where reserves stand at 208,260 tons grading 0.765 oz/ton gold and 2.47 oz per ton silver, but work was done to ready the property for production.

Industrial Minerals

Moorcroft Construction Company spent part of the 1990 season investigating sources of gravel for the Naknek-King Salmon Highway.

SOUTHEASTERN REGION

The Panhandle of Alaska received the largest exploration effort of any area of the state, accounting for \$31.6 million in expenditures, about half of the statewide total. Mineral deposits under investigation include vein, vein disseminated, massive sulfide, and skarn types.

Metals

Kennecott's Greens Creek Mining Company, a wholly owned subsidiary of the RTZ Group, contracted with Nana-Coates drilling for 21,721 ft of diamond drilling from the surface at the **Big Sore Claims** at the **Greens Creek Mine**. Surface mapping and geochemistry complemented the drill program. Kennecott also had a substantial program mapping and sampling the rest of the claim holdings nearby, including the **Mariposite group**.

Echo Bay Exploration, Inc., had the largest exploration program in the state in 1990 in four separate projects, the **A-J**, the **Treadwell**, the **Kensington** and the **Herbert Glacier**. The **A-J/Treadwell** and the **Kensington** are both advanced exploration projects, and are discussed in more detail in that section of this report. About 83,000 ft of diamond drilling at the **A-J Mine** was supplemented by driving of drifts, ramps and crosscuts which were mapped and channel-sampled. This project and the associated **Treadwell**, where 10,000 ft of diamond drilling was completed in 1990, are a joint-venture with Watts, Griffis, McQuat, Ltd., (WGM) carrying 15 percent. Tonto Drilling Services was the contractor for the **Treadwell**, while Boyles Brothers Drilling Company and Nana-Coates Diamond Drilling, Inc., did the drilling at the **A-J Mine**.

The Draft Environmental Impact Statement for the **A-J Mine** was issued early in 1991, and the stated reserves are 63.6 million tons of proven and probable ore grading 0.052 oz/ton gold and 42.1 million tons of possible ore grading 0.051 oz/ton.

Fifty miles north of the **A-J Mine** at Juneau, Echo Bay in a 50 percent joint venture with Coeur Alaska, Inc., contacted with Wink Brothers Diamond Drilling, Inc., and Nana-Coates for 122,000 ft of underground diamond drilling at

the **Kensington Mine**. This was complemented by driving crosscuts, drifts, ramps, and raises. Ore reserves were increased in 1990 to 12.8 million tons grading 0.148 oz/ton gold. Late in the year it was announced that each partner will invest \$30 million for mine development pending approval of the final environmental impact statement.

Another advanced exploration project adjacent to the **Kensington** is the **Jualin Mine**, where Placer Dome (U.S.), Inc., is currently earning a 50 percent interest from International Curator Resources (60 percent) and Granges, Inc., (40 percent). About 26,000 ft of diamond drilling in 1990 resulted in estimates of the resource as 1.07 million tons at an uncut grade of 0.349 oz/ton gold. More details are provided in the "Advanced Exploration" section of this report. Placer Dome also drilled about 3,000 ft on the Dream massive sulphide deposit, and had several reconnaissance projects throughout southeast Alaska.

Hecla Mining Company had a substantial core-drilling program at its Yakima, Red Diamond, and Lawson Creek properties on Douglas Island in the Juneau Gold Belt.

Pulsar Resources (U.S.), Inc., a wholly owned subsidiary of Hyder Gold, Inc., had a large regional geologic and geochemical program in the Hyder district in the extreme southeast of the state, and contracted for 5,500 ft of core drilling.

Lac Minerals (USA), Inc., joint-venturing with Noranda Exploration, Inc., had an active exploration season, focussed on the Niblack, Ruby Tuesday, and Kaigani base and precious metal prospects.

Sealaska Corporation, a regional Alaska Native corporation, initiated exploration on the following locations in 1990: North of Klawock where significant gold mineralization may be associated with a buried porphyry; at Coco

Harbor where skarn copper may have gold potential; in Hetta Inlet and the Trocadero Bay area where volcanogenic massive sulfides contain precious metal credits; at Dora Bay and Sukkwan Island where rare elements have been confirmed. At Breezy Bay on Dall Island, Sealaska identified a large volume of chemical-grade limestone containing more than 98 percent calcium carbonate. The company leased a mineral property on Prince of Wales Island to American Copper and Nickel, Inc. (fig. 16).

Hyak Mining Company, which holds a 5 percent interest in the **Jualin** project, had active exploration projects consisting of mapping, geophysical surveys, and geochemical sampling on Chichagof Island. Hecla Mining Company drilled on the Red Diamond prospect, under lease from Hyak, at the south end of Douglas Island. BHP-Utah spent a month on Prince of Wales Island sampling and mapping in a reconnaissance program for base and precious metals. Delta Minerals had a significant reverse circulation drilling program, and mapped, sampled and conducted geophysical surveys in the Porcupine Townsite near Haines, and Snowlion Mining Company dug a number of prospect holes in the same area.

Guy Comer of Ketchikan explored the Lucky Nell vein gold mine on Prince of Wales Island. His work at the mine consisted of reopening the sloughed portal along with dump and underground sampling for metallurgical testing. The Lucky Nell had minor gold production in the 1930s and early 1940s.

Various individuals also conducted assessment work on vein gold deposits in the Hollis area of Prince of Wales Island.

ADVANCED EXPLORATION PROJECTS

Fort Knox

The **Fort Knox** gold property, located about 15 mi northeast of

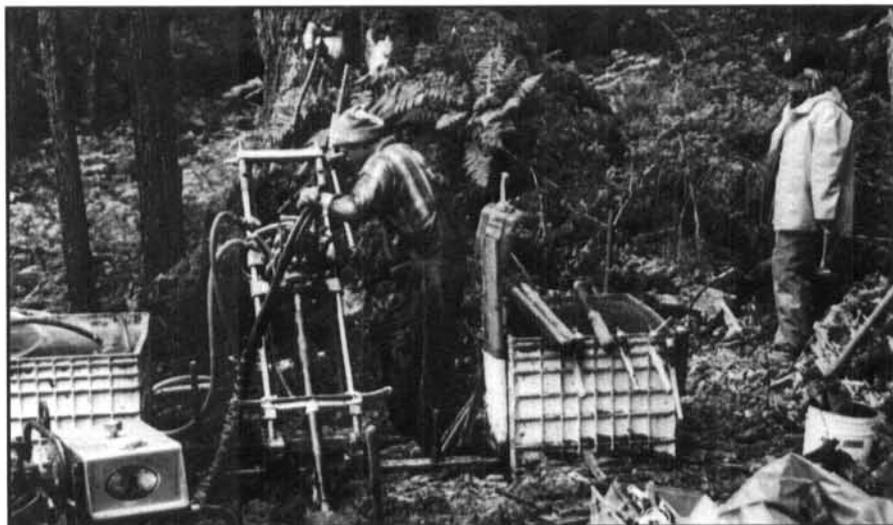


Figure 16. In the rain forest of southeast Alaska, there is considerable exploration activity. American Copper and Nickel Company utilizes a Wink drill rig on a prospect on Prince of Wales Island. The exploration "footprint" in the heavy forest is nearly invisible. (Photo by T.K. Bundtzen)

Fairbanks, is 51 percent owned by Fairbanks Gold, Ltd., with the remainder held by Ventures Trident II Limited Partnership of Lakewood, Colorado, and Bob Nye. Gold occurs in several generations of quartz veins and veinlets within a broad northwesterly-trending zone crosscutting a Cretaceous granodiorite/quartz monzonite stock. Associated trace minerals include molybdenite, bismuthinite, scheelite, and pyrite. Preliminary tests by Lakefield Metallurgical Lab. in Ontario, Canada, indicate that 95 percent to 97 percent recovery is possible using 0.46 to 0.68 pounds cyanide per ton. Strathcona Mineral Services supervised excavation of a 45,000-ton bulk sample from a 170,000-ton pit in 1990. Strathcona is conducting bulk sample assays for cyanide leaching of the material. Davy McKee Corporation has been selected as contractor for the prefeasibility study, and new reserve figures are expected by May 1991.

Earlier company press releases indicated that the deposit contains between 4.74 and 6.04 million oz of gold contained in 99- to 195-million tons of rock, depending on

the cut-off grade. This was based on 160,000 ft of reverse-circulation drilling and 30,000 ft of diamond drilling (fig. 17). In situ gold grades are reported to be between 0.031 oz/ton and 0.048 oz/ton, at cut-off grades of 0.01 to 0.02 oz/ton. Mining costs are estimated to be 15 to 20 percent higher than in Nevada.

The Fairbanks Mining District, covering about 800 mi², produced about 8-million oz of gold, of which only about 300,000 oz were from hardrock mines. This provides a perspective on the importance of the **Fort Knox** deposit, should it be developed.

Kensington

Jointly owned by Coeur Alaska and Echo Bay Alaska, Inc., the **Kensington** project is located on the east shore of Lynn Canal, about 50 mi north of Juneau. Recent press releases place reserves at 12.8 million tons containing 1.9 million oz of gold, mainly as the telluride calaverite (AuTe₂) with minor native gold. Recovery at a mining rate of 4,000 tons/day, or



Figure 17. In interior Alaska, Fairbanks Gold Inc. completed a prefeasibility study for the Fort Knox Project. Based upon favorable results, the project has entered the permitting phase and is drilling for ore reserve definition. The feasibility study will be completed by the end of 1991. The company predicts an annual production of about 300,000 oz of gold if development occurs. (Photo by Aisha Tinker)

200,000 oz of gold per year, is believed to exceed 92 percent based on metallurgical tests. If the mine goes into production, it will employ about 350 people (fig. 18).

Gold is found in a complex vein stockwork, dated at 55 million years (Goldfarb and others, 1991), in older Jualin diorite, dated at 105 million years (Gehrels, 1991). This formation has an average north-south trend and 65° east dip. The system, which is open to the south and at depth, is more than 1,500 ft long and 2,800 ft deep, and has an average width of about 50 ft. Individual veins are from one inch to several feet wide, and are often enclosed in zones of potassic alteration enclosed within broader zones of widespread propylitic alteration. Pyrite and rare chalcopyrite are associated with the gold.

A 5,200-ft adit at the 800 ft level provides access to the Kensington vein stockwork, and a raise joins this level with a 4,800 ft long adit at the 2,050 ft elevation which was driven in 1915 through the Kensington to access another

vein to the east. A ramp from the 850 ft level provides access to the footwall of the Kensington at the 900 ft and 1,175 ft levels.

The rock in the proposed mine area is extremely competent, and has required only 1,000 rock bolts in over 11,000 ft of tunnel. This characteristic should allow modified longhole open stope methods using both transverse and longitudinal stopes depending on the width of the stockwork system.

Jualin

Placer Dome U.S. is currently earning a 50 percent share in this property from International Curator, (60 percent) and Granges, Inc., (40 percent) who optioned it with a 5 percent royalty from Hyak Mining Co., a Juneau-based company. In mid-1990, 100 drill holes totaling 73,000 ft had been drilled in the Main Zone to indicate a resource of 1.04 million tons at 0.28 oz/ton. By November 1990, a total of 1.07 million tons at an uncut grade of 0.349 oz/ton was reported, without consideration of mining or metallurgical constraints.

Like the Kensington deposit only a few miles to the northwest, the Jualin is hosted in the multiphase Jualin diorite, which has compositions ranging from diorite to quartz monzonite. About 20 percent of the pluton is sheared, and the brittle fractures in the homogeneous rock between the shears appears to be a control of mineralization.

Alteration is complex, with ubiquitous propylitic alteration



Figure 18. This Kensington Mine crew and others like it are having a major impact on the state's overall employment figures, especially in the Juneau area. Although mining remains a small component of the area's total employment, there has been a 700 percent increase since 1985. (Photo by Echo Bay)

events overprinting an earlier, pervasive, potassic event. These alteration events precede the main mineralization, which is of three types. Stockwork gold vein zones with quartz, carbonate, pyrite, galena and sphalerite are up to 50 ft wide and contain the bulk of the estimated tonnage. More massive and restricted veins, usually 1 to 5 ft wide, contain abundant gold and sulfides, and often crosscut the earlier carbonate-rich veins, significantly enriching their potential. A third, and only recently recognized, target is quartz-sericite-pyrite-sphalerite-gold related to late-stage felsic dikes which crosscut the Jualin diorite.

A-J and Treadwell Mines

Echo Bay Alaska, Inc., (85 percent) and WGM, Inc., (15 percent) continued intensive exploration of the **Alaska-Juneau (A-J) Mine** beneath Roberts and Gastineau Peaks immediately behind Juneau. The **A-J** and **Perseverance Mines** produced 3.3 million oz of gold from 99 million tons of rock averaging 0.042 oz/ton during the period 1901-1943, and at peak production mined 13,000 tons/day. Present plans call for mining about 22,500 tons/day with a work force of about 450 (fig. 19).

The **A-J** orebody is about 3 mi long, trending northwesterly and dipping about 65° to the northeast. Like the **Kensington** and **Jualin** deposits 50 mi to the north, the **A-J** is localized along the Coast Range Megalineament. But instead of occurring in diorite, the **A-J** deposit occurs as vein swarms near the contact between a footwall greenschist and hanging-wall metagabbro with black phyllite. Veins range from 1 in. to 15 ft, and average about 6 in. with average grades of about 0.5 oz/ton. Mineralization occurs from 2,500 ft above sea level to at least 1,300 ft

below sea level, and is accessed by tunnels and declines from the Sheep Creek Valley about 4 mi east of Juneau. A major east-west fault, the **Silverbow**, with 1,800 ft of oblique left-lateral displacement, bisects the orebody near a hoist and internal shaft which extends 1,000 ft below sea level.

At the north end of the North orebody veins are hosted in metagabbro with a slate hanging wall, and vein density is sufficient to average 0.10 oz/ton over 135 ft. Pyrrhotite is the most common associated sulphide, with lesser amounts of sphalerite and minor galena. In the middle of the South orebody, about a mile southeast of the **Silverbow Fault**, mineralization in the metagabbro footwall zone averages 0.037 oz/ton over 450 ft. In the same crosscut into the hanging wall phyllites and meta-graywacke, another swarm of veins adds at least 250 more feet of mineralization for an aggregate width of 700 ft. Mineralization extends over 350 ft beyond the crosscut. This crosscut demonstrates the presence of ore veins in both the hanging wall and footwall rocks adjacent to the main northwest-southeast fault. Galena is more common in the south orebody, which probably accounts for the higher silver content of the ore.

About 2-1/2 mi southwest of the **A-J** orebody, and about 1 mi across the Gastineau Channel from the Echo Bay exploration office at Thane, the **Treadwell** deposit trends subparallel to the **A-J**, with a similar steep southeasterly dip. The deposit was worked to 2,300 ft below sea level, and exploratory work had been done at the 2,800 ft level when a massive collapse and inflow of water flooded the mine on April 20-21, 1917.

The **Treadwell** operated from 1891 to the time of the cave-in, mining 15.2 million tons of rock



Figure 19. Efforts to reopen the **A-J** mine in the city of Juneau depend on the economic picture as well as a number of other factors. Here, a miner operates a core-drill at an underground exploration station. More than \$25 million was spent on just three advanced exploration projects in southeast Alaska during 1990. (Photo by Echo Bay)

with an average grade of 0.12 oz/ton at a gold price of \$20.67 per ounce. Through 1922, the Alaska United Company and the Alaska Mexican Company mined a further 12.2 million tons with an average grade of about 0.114 oz/ton from adjacent properties.

In 1990 Echo Bay Mines, Inc., drilled a 5,000-ft hole from the east side of the Gastineau Channel to intersect the **Treadwell** structure on the west side of the channel. (This project is discussed further in the Drilling Activity section, p. 40.) The best mineralization was a true width of 187 ft of 0.101 oz/ton gold, including 49 ft with 0.223 oz/ton. This interception at 3,250 ft below sea-level was in the downrake extension of the diorite lobe below the Mexican Mine. It is possible that the deep levels of the **Treadwell** could be accessed by declines under the channel from the internal shaft of the **A-J Mine**.



Echo Bay

DEVELOPMENT

A dramatic 90 percent decrease in mineral development expenditures in the state in 1990 reflects the Red Dog Mine transition from development to production.

INTRODUCTION

The decline in mineral development expenditures noted in 1989 continued in 1990, when only \$14.3 million was reported (table 6). Several projects in the state could progress to a development stage in the next few years; this would boost present low

development expenditures. Of this \$14.3 million, \$3.1 million was expended on coal development, \$4.1 million on base metal development, and \$7.1 million on development of gold deposits.

Only expenditures after a production decision has been made are considered as development expenditures, but in placer mining

some development activities such as stripping or thawfield drilling are reported as production expenses. In general, only the expenditures identified by the respondents as development are included in this section.

As in the past annual reports the selected development projects are considered in relation to the

Table 6. Reported mineral development expenditures and employment in Alaska, 1990

	<u>Northern</u>	<u>Western</u>	<u>Eastern interior</u>	<u>South-western</u>	<u>South-central</u>	<u>Alaska Peninsula</u>	<u>South-eastern</u>	<u>TOTAL</u>
Development Expenditures								
Base metals	\$ --	\$ --	\$ --	\$ 1,000	\$ --	\$ --	\$ 4,100,000	\$ 4,101,000
Precious metals								
Placer	501,000	1,180,000	748,500	220,000	4,035,000	--	20,000	6,704,500
Hardrock	--	--	115,000	--	5,000	312,000	--	432,000
Coal and peat	--	--	94,000	--	2,985,000	--	--	3,079,000
Industrial minerals	--	--	--	30,000	--	--	--	30,000
TOTAL	\$501,000	\$1,180,000	\$957,500	\$251,000	\$7,025,000	\$312,000	\$4,120,000	\$14,346,500
Development Employment								
Employment								
Workdays	500	2,280	1,874	853	14,240	600	4,342	24,689
Workyears ^a	2	9	7	3	55	2	17	95
Number of companies reporting ^b	2	3	10	5	8	2	3	33

-- = No expenditures reported

^aBased on a 260-day workyear.

^bSome companies were active in several areas.

seven geographical divisions of the state shown in figure 20.

PRECIOUS METALS

About 50 percent of the 1990 development money was spent on precious metal projects. Of this \$7.1 million, 94 percent was invested in placer rather than hardrock projects.

The largest project was that of Cambior Alaska, Inc., in southcentral Alaska at the **Valdez Creek** placer project, where total reserves—proven, probable and possible—as of December 31, 1990, stand at 5,005,000 yd³ with an overall grade of about 0.10 oz of refined gold per cubic yard. As its major work Cambior constructed a diversion dike and excavated a new, 5,200-ft long channel for Valdez Creek along the base of the right limit hillside. The diversion was necessary because the original mining excavation had proceeded up-valley as far as possible without intercepting the creek.

During 1990 Cambior acquired a 28.125 percent interest in the **Valdez Creek** placer from American Barrick Resource Corporation for \$3.64 million, and now owns 49 percent of the project. By agreement with Camindex Resources, Inc., which owns the remaining 51 percent, Cambior Alaska, Inc., will act as operator. In addition to diversion of the creek, a new wash plant and tailings pond were designed and constructed in 1990, which should allow 60 percent more throughput than the previous system.

Alaska Gold Company had a large thawfield drilling project at **Nome** in western Alaska in preparation for mining by dredges No. 5 and 6. Although the thawfield program was not as extensive as in the previous two years, the reason is that some of the ground which the company proposes to mine is

already thawed, and does not require as much preparation.

In northern Alaska, Mick Manns reported significant development of Flat, Agnes, and Oregon Creeks, mainly in stripping of frozen overburden. Twenty-one other placer operators in the eastern interior, southwestern, and southcentral Alaska reported similar development activity.

Fewer companies reported development of hardrock precious metal properties, but in interior Alaska, Polar Mining bulk sampled and tested material from the Christina Vein at Cleary near Fairbanks. On Unga Island in the Alaska Peninsula area Alaska Apollo Gold Mines, Ltd., had a substantial program to enlarge and update its camp at the **Shumagin Project** to accommodate 25 workers. The development work also included engineering design

work for two haulage adits and a connecting shaft to intersect the orebody which is estimated to contain 208,260 tons grading 0.765 oz/ton gold and 2.47 oz/ton silver.

BASE METALS

The only significant base metal development project in 1990 was at the **Greens Creek Mine** of Kennecott's Greens Creek Mining Company. With partners Hecla Mining Company, CSX Alaska Mining, Inc., and Exalas Resources, over 60,000 ft of drilling was completed from underground cross-cuts to test the extension of known reserves on the gold- and silver-rich lead-zinc-copper deposit near Juneau in southeast Alaska (fig. 21). Results of other work have added an additional 14 million tons of reserves in all categories to the mine.

Figure 20. Selected mineral development projects.

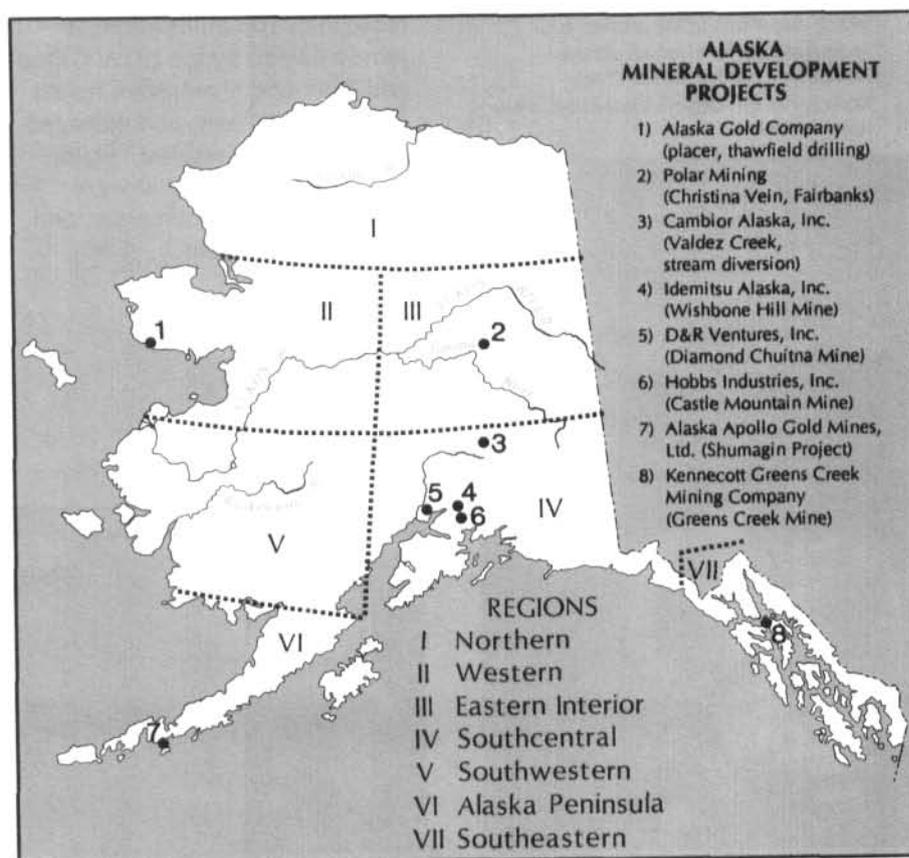




Figure 21. For the second year Greens Creek Mine on Admiralty Island in southeast Alaska was the largest producer of silver in the United States. The mine is located in the Tongass National Forest and is a model of environmentally sound operations. Here, a blaster loads water gel to loosen rock at the production face. (Photo by John Barry)

Figure 22. Hydrologists from DGGs have done extensive research over the last four years, documenting the erosion and sedimentation level which occurs naturally in the Hoseanna Creek drainage at the Usibelli Coal Mine. (Photo by Bruce Campbell)



COAL

In mid 1990 a court injunction halted mineral development on lands in Alaska that are to be managed by the Mental Health Lands Trust. Although production was halted at **Wishbone Hill Mine** near Palmer, activity in 1990 included core and churn drilling, geophysical logging, detailed mine engineering and engineering design of facilities, permit preparation, and environmental baseline studies.

Idemitsu Alaska, Inc., the developer of the project, estimates the mine contains 15-million tons of high-heat content, low-sulfur coal. It is expected to be active for 15 years and provide approximately 200 jobs with an annual payroll of more than \$10 million.

Another southcentral Alaska coal project that had a substantial development program in 1990 was the **Diamond Chuitna Mine** in the Beluga coal fields. This project of more than 300 million tons is jointly owned by the BHW Group and Diamond Shamrock Chuitna Coal Joint Venture, and managed by D & R Ventures, Inc. Major efforts reported in 1990 were engineering, environmental, and permitting activities.

Hobbs Industries, Inc., did surface excavation and development of the portal at its **Castle Mountain Mine** near Sutton. In 1990 the company built surface-plant facilities, such as settling ponds, access roads, working pads, and storage areas. According to Hobbs, reserves at this mine are estimated at about 22.4 million tons. Only 2 million tons of the reserves are on lands unaffected by the Mental Health Land issue, **Castle Mountain Mine** produced about 6 million tons of coal between 1920 and 1968, which Hobbs plans to sell locally as well as overseas.

As in past years, Usibelli Coal Mine, Inc., had a significant development program at the **Usibelli Coal Mine** near Healy in interior Alaska. Specific activity was drilling and hydrology testing in the Hoseanna Creek drainage (figs. 22 and 23).

INDUSTRIAL MINERALS

With few major construction projects statewide in 1990 there was a corresponding decline in development of rock, sand and gravel resources. Only \$30,000 of development was reported, down substantially from the \$7 million reported in 1989.



Figure 23. On August 26, 1989, samples were taken from the naturally turbid waters of Hoseanna Creek (right jar) and the clear discharge from the Usibelli settling pond (left jar). Usibelli Coal Mine made a major investment to bring discharged water to this required standard. (Photo by Usibelli)



Echo Bay

PRODUCTION

For the first time since 1925, the value of base metal production far exceeded the value of precious metals production.

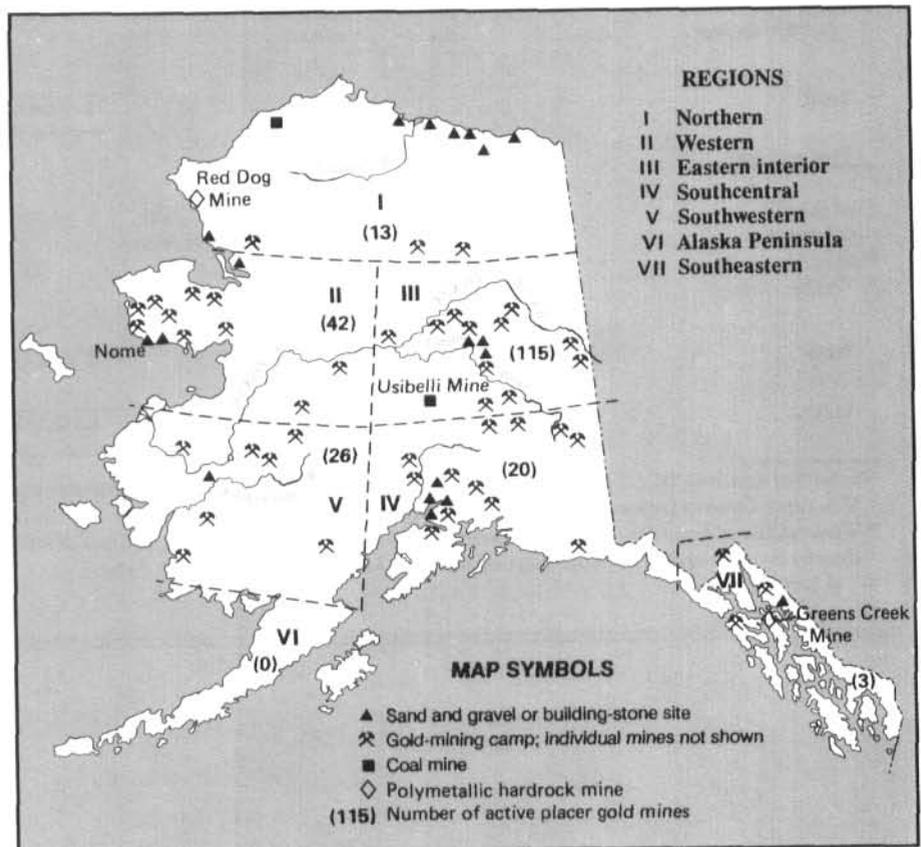
INTRODUCTION

The value of Alaskan mineral production in 1990 was \$533 million, an increase of 93 percent from the \$277 million produced in 1989 (table 7). The respective value percentages are: zinc, 48; gold, 17; silver, 10; coal, 8; sand and gravel, 7; lead, 6; and all others, 4. Mineral production sites include at least 290 coal, hardrock and placer metal mines, and aggregate and stone quarries statewide. Principal metallic, nonmetallic, and quarry locations are shown in figure 24.

Production estimates are based on data compiled from 204 DGGS questionnaires returned by companies and individuals; responses from an additional 15 sand, gravel and stone quarry operators; summaries supplied by the Department of Transportation and Public Facilities and U.S. Forest Service; and bullion sale volume from precious metal refiners. Historical production of gold, sand and gravel, and coal are graphically depicted in figures 25, 26, and 27 respectively. Additional production estimates for 10 metals and other industrial minerals (appendixes F, G) show that a wide variety of mineral commodities have been produced and shipped to markets since the early 20th century.

Mineral production was dominated by metals for the fourth consecutive year, and collectively metals accounted for 80 percent of total product value. However, unlike most previous years, a base metal, zinc, was the most valuable commodity. Gold, although important in terms of overall employment

Figure 24. Location of principal gold mining camps, coal mines, and industrial mineral sites in Alaska, 1990.



PRODUCTION

Table 7. Reported mineral production in Alaska, 1988-90^a

Metals	Quantity			Estimated values ^b		
	1988	1989	1990	1988	1989	1990
Gold (ounces)	265,500	284,617	231,700	\$112,837,000	\$108,723,694	\$ 89,204,000
(kilograms)	8,258	8,852	7,206			
Silver (ounces)	47,790	5,211,591	10,135,000	281,950	27,360,852	50,675,000
(kilograms)	1,486	162,102	315,199			
Platinum (ounces)	25	W	--	13,750	W	--
(grams)	777	W	--			
Lead (tons)	--	9,585	44,220	--	7,672,009	30,954,000
(tonnes)	--	8,698	40,106			
Zinc (tons)	--	19,843	181,200	--	29,383,400	253,680,000
(tonnes)	--	18,007	164,350			
Mercury (pounds)	W	W	--	W	W	--
(kilograms)	W	W	--			
Tin (pounds)	300,000	194,000	57,000	950,000	672,000	200,000
(kilograms)	136,080	87,988	25,855			
Tungsten (short ton units)	240	--	--	14,000	--	--
(kilograms)	2,181	--	--			
Total				\$114,096,700	\$173,811,955	\$424,713,000
Industrial minerals						
Jade and soapstone (tons)	W	57.0	W	\$ W	\$ 1,140,000	\$ W
(tonnes)	W	51.7	W			
Sand and gravel (million tons)	17.2	14.4	15.0	48,750,508	39,875,000	40,821,500
(million tonnes)	15.6	13.1	13.6			
Building stone (million tons)	3.6	2.9	3.2	24,650,000	20,340,000	22,100,000
(million tonnes)	3.3	2.6	2.5			
Total				\$ 73,400,508	\$ 61,355,000	\$ 62,921,500
Coal and peat						
Coal (tons)	1,551,162	1,452,353	1,576,000	\$ 44,300,000	\$ 41,464,800	\$ 44,990,000
(tonnes)	1,407,214	1,317,574	1,429,400			
Peat (cubic yards)	55,000	51,000	65,000	375,000	352,000	400,000
(cubic meters)	42,053	38,995	49,699			
Total				\$ 44,675,000	\$ 41,816,800	\$ 45,390,000
TOTAL				\$232,172,208	\$276,983,755	\$533,024,500

^aProduction data from DGGs questionnaires, phone interviews with mine operators, Alaska Department of Transportation and Public Facilities, the U.S. Army Corps of Engineers, and other confidential sources.

^bValues calculated from 1990 annual price averages of gold, silver, platinum, zinc, and lead as reported in the "Mining Journal"; other values supplied directly by mine operators. Coal-value estimates include some in-state freight costs.

-- = Not reported.

W = Withheld.

and diversity, dropped to second place. Zinc's climb to the top is attributed solely to the first-year production at the **Red Dog Mine** and a second consecutive year of concentrate exports from the **Greens Creek Mine** on Admiralty Island. These two properties supplied fully 55 percent of the United State's domestic mine output of zinc, and reduced the country's net import reliance on zinc from about 61 to 48 percent during the year.

Silver also added luster to Alaska's mines. In 1990 an estimated 10,135,000 oz was recovered, 74 percent of which came from the **Greens Creek Mine**, the nation's largest silver producer for the second consecutive year. The 315 metric-ton total, about 18 percent of U.S. mine production of silver, was enough to rank Alaska the third largest producer of silver behind Idaho and Nevada.

Lead, essentially produced as a byproduct at the **Greens Creek** and **Red Dog Mines**, was also nationally ranked and amounted to about 10 percent of U.S. domestic mine output.

The positive upward movement of lead, zinc, and silver was offset by the 20 percent drop in both volume and value of gold (tables 7, 8). Alaska's gold miners faced a relatively weak price of about \$382/oz in 1990 and several significant mine shutdowns.

Greens Creek Mining Company became the largest gold producer in Alaska for the year with 38,103 oz and earned the unique distinction of being the only mine in Alaskan mining history to be the leading producer of both gold and silver during a calendar year. This achievement was balanced by Westgold's announcement that the **BIMA** offshore gold dredging operation was uneconomic and was permanently suspended at the end of the dredging season late in October. The **Valdez Creek Mine**, previously Alaska's largest gold

mine for five of the last six years, was inoperative for most of 1990 although some production did occur during a six-week sluicing period in September and October by Cambior Mines, the new operator.

Hence, the dynamics of Alaska's gold mining industry continued to fluctuate in response to complex economic factors and the demands of new state and

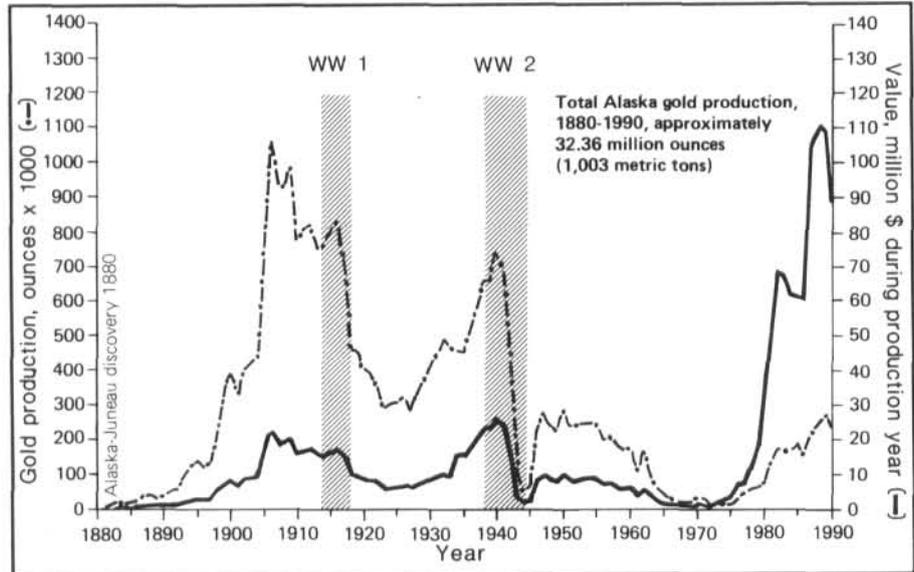
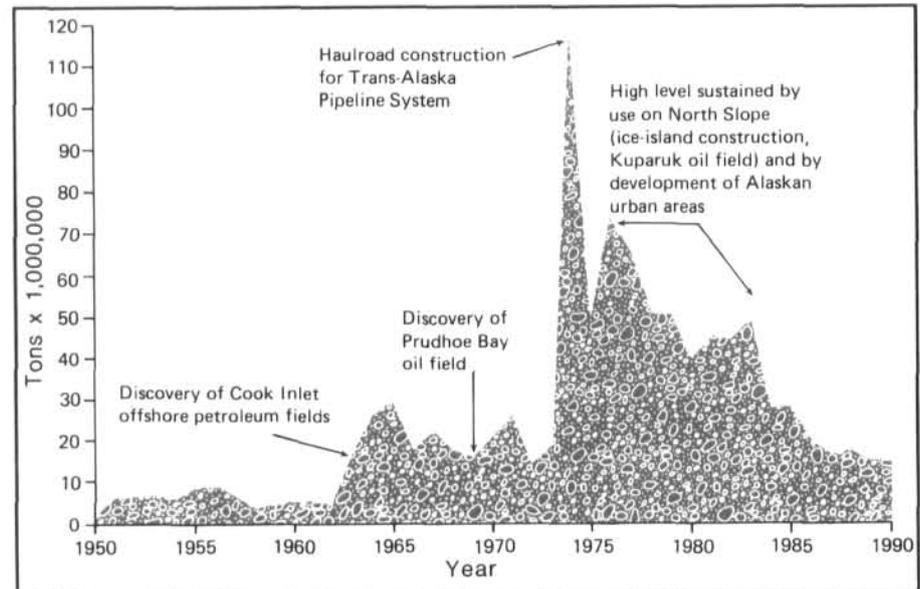


Figure 25. Gold production in Alaska, 1880-1990.

Figure 26. Sand and gravel production in Alaska, 1950-1990.



PRODUCTION

federal regulations. Alaska's 10 largest producers—Greens Creek Mining Company, Alaska Gold Company, Westgold, Cambior Mines, Inc., Polar Mining, Anvil Mining, Sphinx Mining, Alaska Placer Development, Nyac Mining, and Citigold Alaska, Inc. produced 114,083 oz of gold or 49 percent of statewide bullion output. Alaska's 10 largest mines in the previous three calendar years produced 61, 59, and 58 percent of the statewide

total respectively. Evidently a shift to smaller operations took place in 1990, despite the improved performance of the **Greens Creek Mine**. In 1990 about 83 percent of gold bullion came from placer mines; the remaining 17 percent was recovered from two hardrock properties. The mean average output for an Alaskan gold mine amounted to 892 oz, compared to 1,143 oz in 1989 and 1,282 oz in 1988; these statistics also reinforce the contention that smaller operations took a greater share of the gold in 1990 than in the previous three years.

Unit-cost data of selected placer gold mines is summarized in table 9. The figures are based on company estimates of the cost of producing an ounce of gold during the 1989 and 1990 seasons. Although the mine population represented is only about 10 percent of the total mechanized placer mines in operation, the same trends occur during the two reporting years. The smallest and largest placer operations experience higher costs than medium-sized ventures, which are apparently the most economical on a unit-cost basis.

Figure 27. Coal production in Alaska, 1915-1990.

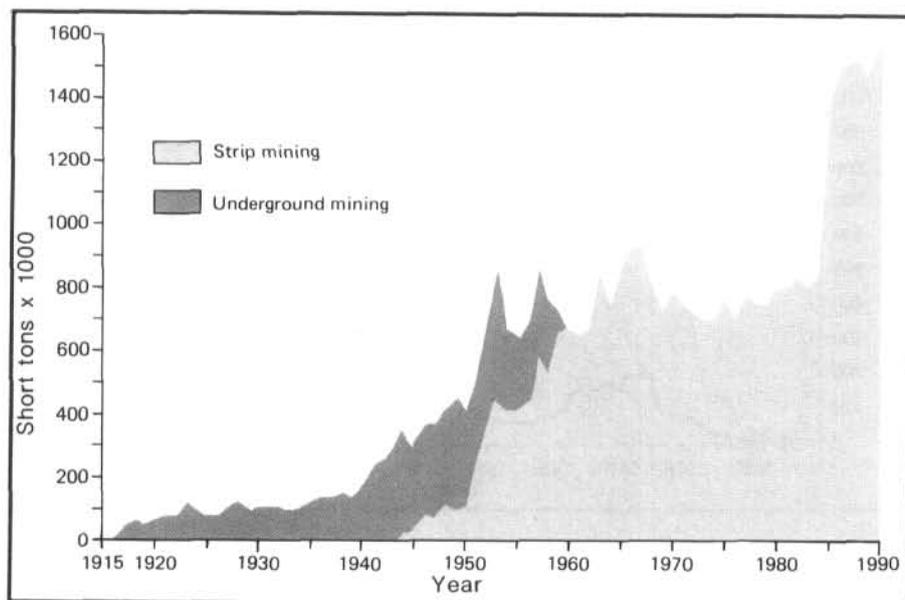


Table 8. Reported refined gold production, number of operators, and industry employment in Alaska, 1989-90

Region	Number of operators		Production in ounces of gold		Number of employees	
	1989	1990	1989	1990	1989	1990
Northern	13	11	6,800 (211 Kg)	4,750 (148 Kg)	38	35
Western	43	42	87,500 (2,721 Kg)	79,100 (2,460 Kg)	437	400
Eastern interior	115	115	79,300 (2,466 Kg)	78,480 (2,441 Kg)	494	495
Southcentral	21	20	73,100 (2,273 Kg)	16,670 (518 Kg)	280	160
Southwestern	26	26	13,950 (434 Kg)	14,400 (448 Kg)	102	100
Southeastern	4	4	24,967 (776 Kg)	38,300 (1,191 Kg)	126	135
TOTAL	222	218	284,617 (8,881 kg)	231,700 (7,206 kg)	1,477	1,325

METALS

Northern Region

Cominco Alaska Inc. mined 1,318,200 tons of zinc-lead-silver ore from the **Red Dog** deposit north of Kotzebue in its first year of commercial operation. **Red Dog** is a shale-hosted stratiform zinc-lead-silver deposit located in the De Long Mountains of the northwestern Brooks Range and is owned by NANA Regional Corporation. The first year of mining could take place only after four years and \$415 million expended in the development of what has been described as one of the largest and richest zinc deposits ever found (Kennedy, 1990). Final mine development involved the integration and cooperation of Cominco (as operator), NANA Corporation (the owner), and the State of Alaska, which financed the De Long Mountains Regional Transportation System.

The shale-hosted **Red Dog** deposit contains inferred reserves of 85 million tons of 17.1 percent zinc, 5 percent lead, 2.4 oz/ton silver and a significant but presently

nonrecoverable barium resource. The nearly flat-lying, shallow ore bodies are mined by open-cut mining methods. During 1990 mining rates increased to about 4,000 tons/day, with about 6,000 tons/day expected in 1991. A small fleet of heavy equipment strips overburden and mines the ore bodies. These include a 13 yd³ loader, four 85-ton-rated haul trucks, two bulldozers, and a grader (Kennedy, 1990).

The **Red Dog** mill facilities are approximately one-half mile from the mine site, and consist of a power plant, concentrator, and storage unit (fig. 28). Column-cell flotation yielded about 321,700 tons of concentrates. These were trucked down the 52-mi haul road to a port site near Kivalina in specially-designed 75-ton trucks under contract by Arrow Transportation International of Seattle, Washington. During the 100-day shipping season, Foss Maritime Inc., also of Seattle, barged the concentrates from the shallow-water port near Kivalina to eight ocean-going ships that ranged in size from 25,000 to 70,000 tons. The concentrates were then shipped to Cominco's



Figure 28. Technology has been developed to permit year-round operations at the Red Dog Mine, above the Arctic Circle. (Photo by Cominco)

Table 9. Production costs for selected Alaskan placer gold mines, 1989-90

Mine size	Number of mines		Production in ounces of gold		Total reported mine cost		Unit cost per ounce	
	1989	1990	1989	1990	1989	1990	1989	1990
Small (50-650 oz gold/yr)	11	8	2,977	1,856	\$ 784,177	\$ 560,600	\$263	\$302
Medium (650-2,500 oz gold/yr)	5	11	6,461	12,132	1,538,000	3,314,000	238	273
Large (> 2,500 oz gold/yr)	5	5	98,816	54,497	31,972,300	18,990,000	324	348
TOTAL	21	24	108,253^a (3,359 kg)	68,485^b (2,124 kg)	\$34,294,477	\$22,864,600	\$317	\$333

^a43 percent total placer gold.

^b36 percent total placer gold.



Figure 29. The Red Dog Mine in northwest Alaska is a joint venture between NANA Regional Native Corporation and Cominco Alaska, Inc. It has become a model of the training and employment of corporation shareholders. By organizing shifts four weeks on and two weeks off, employees can return to their villages and participate in cultural events and traditional hunting activities. (Photo by Cominco)

smelter in Trail, British Columbia, and to several European and Far Eastern destinations. Our estimates of mineral production from **Red Dog** include only concentrates shipped to market in 1990 (321,700 tons), consistent with Cominco's own production accounting system.

The 1990 production of concentrates was about 44 percent of the planned production of 720,000 tons annually of zinc, lead, and bulk concentrates. Because unexpectedly high amounts of oxidized ore were encountered, lead and silver recoveries were initially below that forecasted from development tests. This necessitated a costly redesign of the semi-autogeneous milling circuit and flotation-column cells. By the fall of 1990, recovery of all three metals—zinc, lead, and silver—had nearly reached the planned amounts.

Metal contamination of Red Dog Creek and Wulik River from groundwater sources at the **Red Dog Mine** caused concern during 1990. Although Red Dog Creek naturally contains toxic levels of trace metals due to erosion of the dissected ore body, groundwater seepage and failure to contain flood-level runoff waters from the tailings dam resulted in regulatory enforcement and fines issued by the Alaska Department of Environmental Conservation. Cominco implemented extensive mitigation measures during the year including a rerouting of Red Dog Creek, and elimination of pit water seepage through sump pumps, water treatment and other measures. The mine's water treatment plant is designed to remove heavy metals from the tailings pond effluent and ensure that water used in the flotation circuit is not contaminated with heavy metals. Within the mill complex, two local species of fish, arctic char and grayling, are kept in test tanks containing mine effluents and fresh water; fish tissues are routinely analyzed to determine trace metal concentrations. Acceptable metal concentrations in groundwater test-wells were reached late in the year.

Red Dog Mine employed a workforce of about 300 for most of the year, including technical and engineering consultants brought into the project to solve the milling and water quality problems (fig. 29). The mine is expected to reach full-scale production in 1992.

Placer mining activities in the northern region were confined to the central Brooks Range districts of Wiseman, Chandalar, and Wild Lake. Eleven mines reported a total production of 4,750 oz of gold in 1990, down from 6,800 oz reported from 13 companies in 1989. According to returned questionnaires,

the most difficult challenges for miners to meet were the new water recycle and reclamation requirements.

Dave Ketscher worked the South Fork of the Koyukuk River with small scale mining equipment. Paul Dionne searched for nuggets in underground drifts on the Hammond River using a metal detector. Other Wiseman area miners in production include: Outland Resources Group on Chapman Creek and Koyukuk River; Paradise Valley Mining on Birch Creek near Wild Lake (which also operated a recreational mining venture for tourists); Dan Even on Jim Pup and California Creek; Wild River Ventures on Lake Creek; Robert Aumiller on Prospect Creek; Northern Lights Mining on Jay Creek; and Steve Greene and Jon Brewis on Rocker and Davis Creeks.

Chandalar Mines, Inc. leased placer ground from Chandalar Development Corporation (Eskil Anderson) and reopened the Tobin Creek placer ground after several years of dormancy (fig. 30). This larger-scale mining venture became the northern region's biggest producer of gold in 1990.

Western Region

Estimated 1990 production region-wide is 79,100 oz of gold, down about 10 percent from the 1989 level of 87,500 oz. Production was derived from 42 placer mines, about the same number that was active in 1989. The placer mining industry, the only source of metallic mineral production in the western region, was jolted by the termination of Westgold's **BIMA** offshore dredging venture. Westgold Ltd., the **BIMA's** owner announced in late October that they would sell the dredge (the world's largest) and sell its 22,000 acres of state offshore mining leases near Nome, Alaska (fig. 31). Despite five years of

knowledge gained from research and development while mining the offshore placer deposits, the **BIMA** never lived up to its expected annual take of 50,000 oz of gold. The economics of the operation were further compounded by unexpected costs associated with overwintering of the vessel, a progressively decreasing price of gold, some unresolved gold recovery problems, and costly mechanical failures.

With knowledge from the **BIMA** operation, the company pioneered a smaller undersea mining method that involves a tracked, submersible suction dredge remotely controlled from a surface vessel. Test mining in 1990 recovered nearly 700 oz of gold. Westgold also pioneered environmental monitoring of the subsea environment, and spent several million dollars annually studying marine organisms, sampled for trace elements in sea water, and reduced turbidity of mine wash effluent from the dredge. Westgold is also to be commended for its commitment to local hire, which involved intensive on-the-job training of Nome area residents. In 1990 Westgold employed 125 workers during the mining season and recovered 15,200 oz of refined gold, about half the normal seasonal take, before permanently shutting down the operation. Total production by Westgold offshore Nome, Alaska from 1986-1990 was 121,861 oz of refined gold with the best annual recovery in 1987 when **BIMA** produced 36,500 oz.

Alaska Gold Company continued to operate two Yuba-class, bucket-line stacker dredges onshore in the Nome gold fields. Dredge 6 worked the western extension of the first strandline deposit submarine beach west of the Nome airport. Dredge 5 worked about 3 mi northeast of town on the third, or Monroeville



Figure 30. Working in remote sites in Alaska requires a sizable equipment and transportation infrastructure, even on smaller operations. This staging area is part of the Chandalar Mine, Inc., operation on Tobin Creek on the south side of the Brooks Range. (Photo by Bruce Campbell)

beachline at its intersection with the floodplain of Dry Creek. Both dredges, which operate at daily capacities of about 9,000 yd³, were shut down in early November after a 160 day operating season that began in May. Alaska Gold Company employs about 135 seasonally, and is the largest private sector employer in the Nome area. Gold production from all Alaska Gold Company sources in the western region was 24,000 oz in 1990.

The remaining 40 placer mines that mined in the western region worked ground on the Seward Peninsula, at Hogatza, and in the Ruby-Poorman and Tolstoi districts. Large operations on the Seward Peninsula include: Anvil Mining on Anvil Creek, Nome district; GHD Resources at Kiwalik Flats, Candle district, and Bud Meyers and Associates on Mud Creek, Candle district. GHD's Kiwalik Flats opera-

Figure 31. Westgold's **BIMA** offshore dredge completed its five-year assignment near Nome this year and moved out of state. Its operation was a revolutionary effort to mine marine placers in Norton Sound, off the coast of western Alaska. During its service in Alaska, the **BIMA** produced 122,000 oz of gold and maintained a positive record of local hire and high environmental standards. (Photo by Westgold, Inc.)



tion was refurbished late in the season (winter) with a new jig-based plant built by R.J. Hanson of Spokane, which will be employed in 1991.

Small gold mining firms active on the Seward Peninsula include: N.B. Tweet and Sons on Henry Creek, Kougatok district (a small dredging operation); Edwin Hatch and Tom Johnson (separate operators) on Sweepstakes Creek, Koyuk district; Howard Smith on Little Rocker Creek, Nome district; Bert Pedigrew on Speciman Gulch, Nome district; Paul Steinhacher on Iron Creek, Casedepaga district; Darrell Walker on Clara Creek, Nome district; Allen Vezey on Hastings Creek, Nome district; Mark Gumaer on Macklin and Dick Creeks, Serpentine district; Alaska Placer Development on Solomon River, Solomon district; Jerry Pushcar on Nelson Creek, Council district; Mathisen and Christopherson on Eagle and Iron Creeks, also in the Council district; Hugo Lindfors and C.M. Reader on Dome and Telegraph Creeks, Council district; Roger Nordlum on Candle Creek; and Inmachuk Gold on Inmachuk River. Global Resources continued a tourist-recreational mining program with the old American Creek Flume dredge and pick-and-shovel opportunities for enterprising argonauts on the Penny River west of Nome.

Taiga Mining leased the Alaska Gold Company's Hog River Dredge at Hogatza in the Hughes district, and dredged the left limit of the previously mined ground during the 1990 season. The Alaska Gold Company and its predecessor, USSR&M Company, operated the 6 ft³ dredge from 1957 to 1983 and recovered over 220,000 oz of gold from the remote mining district on the lower Koyukuk River drainage.

Sphinx Mining, Inc. operated the largest placer mine in the Ruby-Poorman district on Midnight Creek about 30 mi south of the Yukon

River. The company employed 10 men to recover \$1.6 million in bullion including a byproduct of placer tin and silver.

Other mining companies active in the area include: Flat Creek Mining Company on Flat Creek; Mike Hartman on Poorman Creek; Yukon Mining Company (Joel Ramsted) on Illinois and Golden Creeks; Ross Novak on Boothby Creek; Conrad House on Swift Creek; Green Mining and Exploration on Long Creek; Mike Sweetsir on Trail Creek; Howard Miscovich on Poorman Creek; and Keith Tryck on Ophir Creek. South of the Ruby-Poorman district in the Tolstoi area, Rosander Mining worked middle Colorado Creek with a newly designed plant employing water recycling and containment. Castle Ridge Mining worked Alamin Mining Company's nearby Bear Creek ground, but reported disappointing results at the end of the season.

Eastern Interior Region

The eastern interior region was second only to the western region in gold production in 1990. An estimated 78,480 oz of refined gold were taken from the region's 115 gold mines in 1990, compared to a similar amount (79,300 oz) from the same number of mines in 1989. Employment levels were 495 or the same as the previous year. This area includes mining districts in the Yukon-Tanana Upland where many of Alaska's largest placer districts are located. Although larger operations do exist or are on the drawing board, placer and lode mining is dominated by relatively small businesses that employ four or fewer and operate more on the economic scale of a typical mid-west family farm or Alaskan commercial fishing venture.

The Fairbanks district was again the largest producer of gold in the eastern interior and the focus of accelerated exploration efforts for

hardrock minerals (fig. 32). We estimate that the district's 27 placer mines and two lode mines produced 27,800 oz of gold and 5,500 oz of byproduct silver worth \$10.7 million; the industry created about 190 jobs, including 158 at placer mines and 32 at lode mines. Employment and production estimates are about 20 percent lower than in 1989. This decrease is mainly attributed to reduced output from lode mines.

Citigold Alaska operated Alaska's only commercial lode heap leach gold mine, but at a much reduced scale from previous years. Their 1990 mine efforts at the **Ryan Lode Mine** on Ester Dome, northwest of Fairbanks, concentrated on removing gold and silver with sodium cyanide from existing heap-leach pads, and on exploration drilling of potentially new types of ore bodies. About 2,500 oz of gold and 2,200 oz of silver worth \$960,000 were mined from the heaps. The company continued to work out complex problems related to groundwater-well monitoring raised by Department of Environmental Conservation and issues raised by local special interest groups such as Common Ground, an Ester-based community organization. Company officials announced late in the year that negotiations were underway to sell the mine properties.

Polar Mining, Inc. was the largest gold mine in the eastern interior and one of the five largest producers of gold statewide. The company operated three mining enterprises during the year: (1) a large open-cast placer mine on Goldstream Creek adjacent to Ester Dome; (2) a smaller placer mine on Fairbanks Creek at the eastern end of the district; and (3) an experimental bulk sampling and mining operation on the Christina vein on Cleary Summit utilizing a ball mill and simple gravity recovery. The lode on Cleary Hill was leased from Fairbanks Exploration, a local mining group, and the two larger placer

properties were located on patented mining claims leased from the Alaska Gold Company. Polar Mining works 350 days per year in development and production. In 1990 the company had 28 year-round employees and as many as 15 seasonal workers.

Alaska Gold Company also leased placer ground to the following companies and individuals: Alf Hopen on Dome Creek; Walter and Ron Roman on Fish Creek (separate mines); and SVZAL on lower Eldorado Creek (a drift mining development).

Other Fairbanks district mine operations active in 1990 include: Cooks Mining on Fairbanks Creek; Jack Neubauer on Fox Creek; Don Stein on Pedro Creek; Andy Miscovich on Chatham Creek; Dwayne Savage on Last Chance Creek; Alex Twogood on Goldstream Creek; Jim Childs on Nugget Creek (a new venture on the north side of Ester Dome); Howard Lambert on Ester Creek; Carson Holt on Willow Creek; and Jerry Hassel and Roger Moore on Ready Bullion Creek (separate operations).

Don Read again operated a small drift mine on Treasure Creek on the north side of the district. He also reprocessed old tailings left from the pre-World War II drift mines—an activity that is expected to increase district wide in the next few years.

Roberts Mining operated their Dome Creek drift mine below the lower limit of USSR & M dredge tailings on that drainage (fig. 33). During the winter of 1990, the company brought to the surface about 15,000 yd³ of pay, which was stockpiled for summer sluicing. Gravels sluiced in 1990 exceeded the 0.04 oz/yd grade recovered in 1989, and an even larger take is expected in 1991. The two-man crew drills with a jack-leg, and blasts with ANFO, using gelatin

primers. Each round releases about 25 yd³ of pay and overburden.

The Circle mining district northeast of Fairbanks experienced mining activity levels more-or-less the same as 1989. The Circle district still contains the largest concentration of placer mines in Alaska, but is dominated by smaller operations (fig. 34). An estimated 52 Alaska Placer Mining Applications were processed, but only 37 of the companies actually sluiced pay.

Some of the larger operations of the 1990 season include: Paul and Company on Porcupine Creek; Greenhorn Mining (Stan Gelvin) on Crooked Creek; and Alaska Ventures (Vince Halverson) on Mammoth Creek. Other placer mines active in 1990 were Gold Post Mining on Deadwood Creek; Superstock Mining on Crooked Creek; Ron Wrede on Deadwood Creek; Points North (Bob Cacy) on Portage Creek; Jim Belfield on Switch Creek; Steve Olson on Eagle Creek; Dugger Mining Company on Mastodon Creek; Lyle Colledge and Vern Stepp on Bottom Dollar Creek; Magic Circle Mining on Deadwood Creek; Aurora Mining on Pup Creek; John Sipes on Deadwood Creek; Dick Blevins on Portage Creek; John Hendrickson on Sourdough Creek; George Seuffert on Cripple Creek; Last Hope Mining on Harrison Creek; Clyde Henry on 43 Pup; and Goldstream Exploration on Mastodon Creek.

Goldstream obtained a \$200,000 grant from the Alaska Science and Technology Foundation to design and implement a commercial washing plant and excavation method that reduces the amount of process water necessary for sluicing, and simultaneously reclaims land during placer mining. Test results showed that both objectives were achieved with a 50 yd³/hr operation that was



Figure 32. Alaska is currently the largest producer of placer gold in North America. There are 220 active operations in the state. This two-man operation at Democrat Bench is typical of many mines but is unusual in its high recovery efficiency. (Photo by Bruce Campbell)

Figure 33. In the early days of Fairbanks, many placer operations were underground drift mines. Goldbearing gravels were hauled to the surface all winter and then washed in the summer when water was available. Technology now enables miners to excavate old stream channels 100 to 140 ft below the surface. At the Dome Creek Drift Mine, father and son operators prepare to blast gravel at the work face. (Photo by Bruce Campbell)

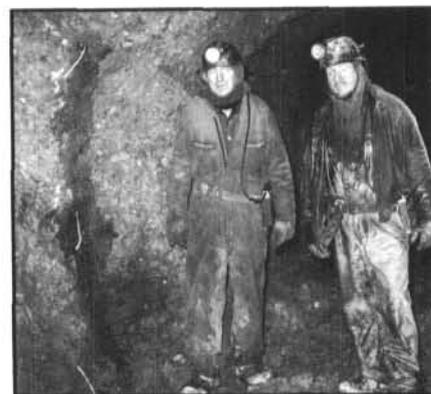




Figure 34. Efficient recovery is critical to the profitability of all placer operations. The owner and operator explains the action of the shot-loaded recovery boxes in his jig system. As the gravel is washed, heavy particles like gold sink through the ball bearings while lighter material is pulsed off. The gold is collected in the sump. (Photo by Bruce Campbell)

commercially operational in 1990 (fig. 35).

Three placer mines reported production in the Livengood district. Scott Rendich worked a small paystreak on Willow Creek, and Dick Geraghty mined pay on Olive Creek. Alaska Placer Development was again the largest placer mine in the area, as it has been for the last six or seven years. The company hydraulically stripped barren muck from the Livengood Bench and worked pay from a paystreak on an irregular limestone bedrock. Process waters were recycled through a complex recirculation system. The operation benefits from earlier attempts to mine the bench. In 1982 Livengood Joint Ventures, the previous mine developer, constructed a 160-acre containment pond below the mine workings. This pond is now effectively used

by Alaska Placer Development to contain waste water and mine effluent.

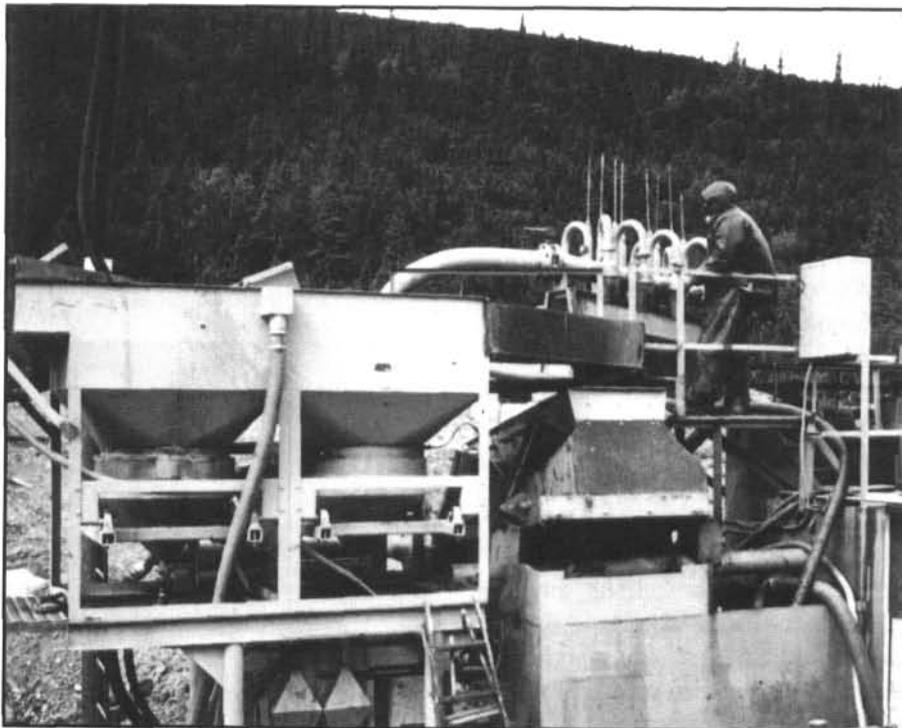
Judging from DGGs questionnaire returns and other state records, placer mine activity in the Eureka-Tofty and Rampart districts grew by more than 60 percent, from nine operations in 1989 to 15 in 1990. Alaska Placer Development, Inc., which mines pay in the Livengood district, started a new placer gold mine on American Creek in the Eureka district east of Manley Hot Springs.

Shoreham Resources worked Cache Creek in the Tofty district and was one of the largest placer mines west of the Fairbanks district within the eastern interior. The company recovered 1,074 oz of gold, 208 oz of silver and 2,600 pounds of tin from 26,000 yd³ of processed pay. Mechanical difficulties and excessive overburden, coupled with low gold prices, reduced profitability at the mine.

Other smaller placer mines worked include Robert Roberts on Skookum Creek; Iditarod musher Ric Swenson on Doric Creek; Orval McCormach on both American and Eureka Creeks; longtime mine operator Mike Krenzke on Eureka Creek; Jim Wood on Little Boulder Creek; Salter and Associates on Joe Bush Creek; Delima Placers, Inc. on both Colorado and American Creeks; Harold Bergman on both Cache and Sullivan Creeks; Vern Petefish on Little Boulder Creek; and Anna Russell on Trail Creek. Longtime Rampart district miner John Shilling sluiced pay on Slate Creek in the Rampart district, and Frank Wilford worked bench gravels on Hoosier Creek in the same district.

The historic Fortymile district, Alaska's oldest placer gold mining region, saw an even larger increase of mine activities than in the previous two years. The number of placer mines increased from nine in 1988, to 16 in 1989, to 28 in 1990.

Figure 35. Caring for the environment often generates new technology to resolve operational challenges in Alaska. Goldstream Exploration received a grant from the Alaska Science and Technology Foundation to develop a new system for washing placer gravels. This spiral jig washing plant reduces the amount of water needed while it allows for simultaneous reclamation of the property. (Photo by Bruce Campbell)



However, most outfits are small mechanized sluicing plants or scaled-up suction dredges normally associated with recreational mining or ground testing.

Mike Buzby worked on ground leased from the Alaska Gold Company on Chicken Creek; Black Velvet Mining Company mined on the South Fork of Fortymile River; Dome Creek Mining and Development sluiced on Dome Creek; Leo Regner worked Lillywig Creek; and Charles Hammond won gold from 45-Pup. Smaller operations include: Mike Chambliss and Clyde Baldwin on South Fork Fortymile River; Hank and Sons on Lost Chicken Creek; Maxwell Mine and Exploration and Al Ruddick on Canyon Creek; Ken Wise on Mosquito Fork, Fortymile River; Dave Moss on Liberty Creek; Freedom Mining and Exploration on Robinson Creek; Richard Goodson on Fortymile River; Hayden Exploration and Mining and Maxwell Exploration and Mining (separate operations) on Baby Creek; Lone Spruce Mining on Squaw Creek; Frank Lockner on 60 Mile River; Joe Trudeau on Jefferson Creek; Franklin O'Donnell on Moose Creek; Mike Williams on Kenyon Creek (a new operator); Steve Bills on O'Brien Creek; and Judd Edgerton on Robinson Creek.

Suction-dredge operators on the Fortymile River system included the following: Ostler Mining, Tom Erickson, John Roop, and Wesley Devore.

Dave Likins operated his New Zealand-type floating and washing plant on the Fortymile River. This plant is essentially a scaled-down recovery system similar to that used in bucket-line stacker dredges. Because the plant moves in its own pond, the mine simultaneously reclaims land while moving down the paystreak. The operation may have gained some undeserved notoriety when concerned environ-



mental activists characterized the operation as a large, bucket-line stacker dredge, instead of the relatively small operation that it actually is. Controversy continues to surface in news media reports of any mine activities along the Fortymile River, partly because of its 1980 designation as a National Wild and Scenic River.

Growth in the placer mining industry was notable in the camps along the north flank of the Alaska Range. In the Bonfield district east of Healy, the number of active placer mines increased from nine in 1989 to 12 in 1990 in spite of low gold prices (fig. 36). Alaska Unlimited, Inc., again operated the largest placer mine in the Bonfield district on Gold King Creek. Placer gold from this property is believed to be derived from Tertiary-aged Nenana Gravel or the Nenana coal-bearing group. Gypsy Luck Mining Company worked a smaller paystreak at Walker Creek near Gold King Creek. Small- to medium-sized operators working pay throughout the district include: P & P Mining on Newman Creek; Barney Harrod

Figure 36. During the 1990 production season, Alaska's placer mines produced an average of 892 oz of gold. This typical operation uses a dragline to collect the gravel which goes through the washing plant. Once production is completed, the dragline will be used to recontour the mine site and reclaim the area. (Photo by Bruce Campbell)

on Bonfield Creek; Old Yeller Mining and Kerry Knapp on Totatlanika River; Tom Faa on Moose Creek; The Four Stewards on Iron Creek; Glenn Parr on Walker Creek; the Annabelle Mine (Jim Roland) on Moose Creek; Tommy Van, Inc., on Flat Creek; Fred Cook on Portage Creek (another gold placer with a Tertiary sedimentary source); and Jackson Mining Company on Totatlanika River.

Some areas in the Alaska Range that have been dormant for years were tackled by small enterprising mining firms. Tok Gold and Exploration mined a small cut on Tok River near Stibnite Creek, an area better known for base metal deposits. In the Delta River district, Law Iosua and MVM Associates were

active on Rainy Creek, a placer stream known to contain platinum as well as gold. Richard Knutson processed pay on Broxson Gulch, another stream west of Rainy Creek known to contain platinum. Big Delta miner David Jensen produced gold from both July and McCumber Creeks near the Granite Mountains.

Southcentral Region

The cessation of mine activities at Cambior's **Valdez Creek Mine** from October 1989 to August 1990 is clearly reflected in production statistics of the southcentral region, which saw the largest statewide drop in production of gold. Our region-wide estimated production of 16,670 oz in 1990 is only one fifth of the 73,100 oz produced in 1989. Employment also dropped from 280 to 160, a decline of about 60 percent. However the decision to reopen the **Valdez Creek Mine** by its new operator, Cambior Mines, is good news for the region. Since operations began in 1984, the **Valdez Creek Mine** was the largest of Alaska's many gold producers for five of the last six years (Reger and Bundtzen, 1990). Previous mine production by Valdez Creek Mining Company concentrated on the development of several deeply buried paleo-channels, ancestral to modern day Valdez Creek.

Gold production began in October from the old hydraulic pit or Dry Creek Cut, which is, in part, an extension of the Tammany Channel system previously mined by both open-cut and underground methods. An estimated 11,700 oz of placer gold (8,031 oz refined) were recovered from 138,000 yd³ of processed pay during a five-week period. During 1990 Cambior concentrated on an expensive rerouting of Valdez Creek required by the Alaska Department of Fish and Game (ADF&G). The diversion is necessitated by the convergence of the upper pay channels and the

present water course of Valdez Creek. Fisheries in the main stream course are to be protected before ADF&G will issue the required permits. Cambior Mines employed 160-to-170 workers during production and stream diversion, and expect to produce substantial quantities of gold when full production is resumed in 1991.

Other much smaller placer mines worked pay in the Valdez Creek district. They include: Crooked Dog Mining on Grogg Creek, Howard McWilliams on Johns Creek, and Broad Pass Mining on Squaw Creek.

The Chistochina level of activity was about the same as in 1989. Hoffman Mining, with a crew of four, recovered gold, platinum, and silver from their Middle Fork Mine on the Chistochina River. George Livermore and William Beerman maintained production from mines on Ruby Gulch and Slate Creek, tributaries to Chistochina River.

The Willow Creek district supported three small operations: the Mrak placer mine and Magnum Resources International on Willow Creek (separate mines), and Lonesome Mining Company on the Little Susitna River.

The historic Cache Creek of Kahiltna district contains 23 individual Alaska Placer Mining Application Permits (APMA) mine sites; however, many of these remained dormant during the 1990 season. Most mines used small mechanized test plants suitable for fine gold recovery. Ed Ellis manually mined gold and platinum bearing pay on the Golden Bar Group—a river bar placer deposit—many miles away from presumed lode sources in the upper Cache Creek drainage. Jim Watkins mined a similar paystreak on nearby Falls Creek. Arne Murto continued to recover small amounts of platinum and gold from Martin Creek, in the upper Kahiltna River drainage about 25 mi southeast of Puntilla Lake. Martin Herzog

worked Cache Creek proper, as he has for a number of years.

Mining on the Kenai Peninsula was almost entirely confined to either recreational suction dredges or tourist-oriented mechanized plants. Outsider Mining Company (John Trautner) mined the Wagner Group near Girdwood by hand and with a suction dredge. Cynthia Toohey worked various locations throughout the old Hope district using minimal equipment. Wallace Saline mined Canyon Creek with a suction dredge.

The Nelchina district remained dormant for most of the season. Most mine questionnaire respondents indicated that assessment work was their principal activity.

Southwestern Alaska

The southwestern region includes such historic mining regions as the Innoko, Iditarod, Aniak (Nyac), and Goodnews Bay districts, which have accounted for about 10 percent of Alaska's gold and most of its mercury and platinum production. Questionnaires and state records indicate that 14,400 oz of gold and modest amounts of tungsten and mercury were recovered from the region's 26 placer mines. These figures indicate activity at about the same level as in 1989. Twenty-six mining companies employed 100 people throughout the area.

Nyac Mining Company operated the region's largest placer mine at the head of Bear Creek in the Nyac district, about 35 mi south of Aniak, on the lower Kuskokwim River. About 20 people at Nyac mined several hundred thousand yards of pay from a shallow bed-rock placer. The company controls claims throughout the Nyac district and previously mined gold with a 5 ft³ bucket-line dredge in upper Bear Creek. About 30 percent of the mechanics and support staff employed by Nyac Mining Com-

pany live in the village of Crooked Creek along the Kuskokwim River. These native Alaskans got their start in Alaska's mining industry working on a joint-venture exploration project managed by Westgold and Calista Native Corporation at the Donlin Creek hardrock-gold prospect northeast of Nyac.

Traditional long-time placer mining companies worked ground in the Innoko and Iditarod districts. Magnuson Mining Company worked patented claims in the Ganes Creek drainage, and explored the old Independence hardrock mine at the head of Carter Creek. The Golden Horn Mining Company (John Miscovich family operation) leased ground to R.R. Hensler, Inc., of California who operated on Otter Creek near Discovery Camp. This project, which re-mined dredge tailings with front-end loaders and a backhoe, was discontinued late in the season due to poor gold recovery. Richard Wilmarth took out a small cut while constructing a bedrock drain at the lower end of the paystreak on Chicken Creek in the Iditarod district. Results indicated that it was a worthwhile activity to sluice the development project's waste-rock. Julian Creek Mining Company again mined the seemingly endless paystreak on Julian Creek in the George River drainage. This paystreak was thought to have been exhausted years ago.

L.E. Wyrick and family expanded their operation on Granite Creek, also in the George River, and recovered substantial coarse gold from shallow pay zones near the head of the pup. The long-active Lyman Resources of Alaska did not mine their Donlin Creek placer deposits, but instead concentrated on construction of a new washing plant and exploratory sampling. Flat Creek Placers (Fullerton family operation) continued to conduct mining

operations on upper Flat Creek in the Iditarod district, but suffered a setback with the death of Richard Fullerton, who mined with brother John for more than 50 years in western Alaska. John O'Carroll mined on Spruce Creek bench, but had a disappointing year compared with previous seasons. Allan (Eep) Anderson worked old dragline tailings and some virgin ground on Yankee Creek west of Takotna. Paul Sayer both explored and mined Little and Ester Creeks near Ophir. R & W Mining resumed work on Ophir Creek which had been dormant for several years. Alvin Agoff was busy on Prince Creek south of Flat; this small venture continued to encounter pay under coarse colluvium at the base of Chicken Mountain.

There was a scattering of placer mines throughout remote regions of southwest Alaska—backwater areas within a backwater of Alaska. Dave Penz mined rich pay on Buster Creek near Russian Mission on the lower Yukon River. Fred Noden worked a relatively new operation on a small scale on Chanuk Creek on the Mulchatna River drainage north of Lake Clark. Richard Busk mined on ground formerly worked by Terry and Victoria Gill on Scynneva Creek in the Bonanza Hills also north of Lake Clark. LBMB Mining Company worked a small cut on Murray Gulch and New York Creeks south of the Horn Mountains along the Kuskokwim River. These two creeks were the sites of some of the earliest discoveries of gold in the Kuskokwim River area. Scott Greger activated the Taylor Creek placer mine in the Taylor Mountains south of Sleetmute. The mine had been dormant for some years. Holitna Basin Mining completed some testing of placer ground on 47-Creek also south of Sleetmute. The mine had been dormant for some years. Holitna Basin Mining com-

pleted some testing of placer ground on 47-Creek also south of Sleetmute, but did not recover a commercial quantity of gold.

Southeastern Region

Miners in the panhandle are pleased with the success of Kennecott Greens Creek Mining Company (**Greens Creek Mine**) on Admiralty Island. The **Greens Creek** deposit is located approximately 18 mi southwest of Juneau in a non-wilderness section of Admiralty Island National Monument. The exploited ore bodies are considered to be volcanogenic massive sulfide deposits in folded metasedimentary rocks of the Cannery Formation of Late Triassic age (Berg, 1984). Three main ore bodies have been identified as the north, central, and south zones. The individual ore zones are 200 to 700 ft wide, 1,200 to 2,000 ft long, and 6 to 80 ft thick. The ore bodies contain significant amounts of silver, lead, zinc, gold, barium, and copper. The first four of these commodities are commercially recovered.

During 1990 **Greens Creek Mine** milled 382,574 tons for a year-round average of 1,050 tons/day, and produced 7,636,501 oz of silver, 38,103 oz of gold, 33,457,084 pounds of lead and 74,006,086 pounds of zinc contained in concentrates. **Greens Creek Mine** was the nation's largest silver mine for the second consecutive year. The company resolved mill-loss problems encountered in its first (1989) year of operation by a flotation redesign and finer grinding methods. Puzzling underground dust explosions in 1989 were controlled by water saturation at the working face, although some minor dust explosions did occur in 1990.

Greens Creek employed 265 workers year-round during mine

operations and added about \$20 million to the economy of Juneau in salaries, goods, and services. Most employees live in Juneau and are transported daily aboard the catamaran *Alaska Dream*. An extensive exploration and development program is ongoing on the property. Reserve estimates at the commencement of mine activities were about 4.7 million tons of about 24 oz/ton silver,

0.18 oz/ton gold, 9.7 percent zinc, and 3.9 percent lead. Recovered (not in-place) grades during 1990 were 19.9 oz/ton silver, 0.09 oz/ton gold, 4.37 percent lead, and 9.7 percent zinc.

Small placer mines provided the remaining metal production in the southeastern region. Carl Glanville worked strandline deposits along the beachline near Yakataga at a daily rate of about

30 yd³. Snow Lion Mining Company (Jerry Fabrizio) worked claims on Porcupine Creek near Haines, but on scales similar to Glanville's Yakataga operation. Andrew Moritz, Jr. tested strandline deposits near Mt. Fairweather north of Glacier Bay National Park, but did not achieve commercial production in 1990.

INDUSTRIAL MINERALS



INTRODUCTION

The value of industrial mineral production in 1990 was \$62.9 million, a 2.4 percent increase from the \$61.4 million produced in 1989 (table 7). Sand, gravel, and stone made nearly equal gains from the previous year, mainly because of the improved construction climate in the Fairbanks and Anchorage urban areas (table 10). The industrial mineral industry in Alaska depends on in-state industry and government construction since virtually all commodities are used in

Alaska and are not exported. Results from 34 questionnaires and 15 additional phone calls indicate that most sand, gravel, and stone producers continue to be frustrated by generally weak demand for their products and increasing regulatory restrictions implemented by local, state, and federal agencies. Industrial mineral quarries have been included in recent legislation passed by the Alaska Legislature that requires rents, royalties, and reclamation requirements. Five

companies announced that they ceased operation in 1990 because of the overall unfavorable economic and regulatory climate.

Northern Region

Industrial minerals in the northern region are mainly used to build the infrastructure of Alaska's North Slope petroleum fields. More recently, they have been used also at the **Red Dog** zinc mine north of Kotzebue. These two sites have

Table 10. Reported sand and gravel production and industry employment in Alaska by region, 1990

Region	Companies reporting*	Tons	Estimated unit value	Total value	Number of employees
Northern	3	1,525,000	\$4.00	\$ 6,100,000	130
Western	2	818,000	\$4.00	3,272,000	25
Eastern/Interior	14	4,975,500	\$2.40	12,438,750	153
Southwestern	1	100,000	\$4.00	400,000	7
Southcentral	15	5,345,000	\$2.35	12,560,750	160
Alaska Peninsula	8	850,000	\$3.00	2,550,000	90
Southeastern	6	1,400,000	\$2.50	3,500,000	80
TOTAL	49	15,013,500 (13,617,000 tonnes)		\$40,821,500	645

*Thirty-four DGGs questionnaires and 15 phone canvass responses.

used about 1.5 million tons of sand and gravel. B.P. Exploration used 130,200 tons for maintenance and construction projects in western operating area of the Prudhoe Bay unit and at the Duck Island unit. ARCO Alaska reported mainly maintenance activities for drill sites and airport trench lines; approximately 100,000 tons of gravel were mined from several Kuparuk pit sites. The U.S. Bureau of Land Management permitted extraction of about 400,000 tons of gravel at 30 sites along the Dalton Highway for pipeline and road repairs. All of the remaining 900,000 tons of material were used in stream diversion, tailings pond repair, and road repair at the Red Dog project. An additional 600,000 tons of crushed stone was used as filler for various construction uses in the area. NANA Corporation continued to extract and market jade from its jade deposits in the Ambler River area. The late Ivan Stewart formerly mined and stockpiled raw jade for future processing (fig. 37).

Western Region

Tidemark Corporation mined 98,000 tons of gravel with an estimated value of \$452,000 to repair and improve the Teller airport on the western Seward Peninsula. The Alaska Department of Transportation and Public Facilities (DOT&PF) used about 720,000 tons of gravel and compaction sand to repair various roads on the Seward Peninsula—a number of pits and vendors were involved in the repairs. An estimated 40,000 tons of stone were also used to repair the Nome seawall and at the Teller project.

Eastern Interior Region

The eastern interior region was again bouyed by large construction projects aimed at modernization of thoroughfare roads in the Fairbanks

area and fundamental repair work along the Alaska Highway. Fourteen companies and government agencies reported that 4.98 million tons of gravel and sand worth \$12.4 million were quarried throughout the area. The largest single project was the Geist Road Extension, which is designed to alleviate traffic congestion in west Fairbanks. Earthmovers Inc. was prime contractor for the job. Fairbanks Sand and Gravel mined 183,000 tons of sand and gravel from the floodplain of the Tanana River using a floating clamshell dredge. A crew of 11 operate the plant. R.B. Gravel Inc. recovered about 500 tons of mine tailings from their gold mine on Ready Bullion Creek for local private road jobs. Douglas Management mined 20,000 tons from their Peger Lake pit for contract work in the Fairbanks area. Shultz Excavating continued to be frustrated over an access dispute through Fort Wainwright to their pit sites. McPeak Sand and Gravel worked with Arctic-Redimix on several gravel construction needs.

DOT&PF reported eastern interior region use of sand and gravel at approximately 950,000 tons. This includes repair work on the Parks, Alaska and Dalton Highways within the eastern interior region, but could include some volume that may belong in the northern region of this report. The U.S. Bureau of Land Management permitted extraction of about 530,000 tons of gravel from 30 quarry sites mainly along the Dalton Highway from Fairbanks to Yukon River.

Yutan Construction Company reported that approximately 500,000 tons of basalt were quarried from their Browns Hill quarry off Badger road near Fairbanks. The company did not specify project or end product uses. Jim Caswell again mined and processed limestone from his Cantwell Quarry for



Figure 37. Jade from the Kobuk River in northwest Alaska is being crafted into a base for a memorial at the National Guard Armory near Eagle River. The jade was mined by Stewart's Photo, Inc., of Anchorage. (Photo by Jim Frey)

instate agricultural markets. About 800 tons worth an estimated \$60,000 were realized from the operation. Although a small project, Caswell has demonstrated that local specialized needs can be met with Alaskan industrial mineral sources. Agricultural lime sells for up to \$200/ton and until recently was entirely derived from Lower 48 sources.

Southcentral Region

The strongest statewide showing of industrial mineral use came from the Anchorage-Matanuska Valley areas. The construction industry appears to be making a mild comeback, and road repairs by DOT&PF increased in scope. For the first time in five years, the Alaska Railroad reported an increase in the amount of sand and gravel shipped from the Palmer-Wasilla area to Anchorage markets. The railroad estimated that 2,560,000 tons were hauled in four unit trains daily throughout the construction season, compared with about 1,935,000 tons hauled in 1989. Road repair and completion of the new Seward Highway modernization program near Potters Marsh were some of the reasons

cited for the increased use. Hermon Brothers mined gravel from their Schrock Pit in the Matanuska Valley. Spring Creek Gravel, Inc., supplied several screened gravel products for small projects throughout the Anchorage area from their Glenn Highway (Mile 204) pit. Lynn Sandvik re-opened his Palmer pit because of improved market conditions in the Anchorage area. AAA Valley Gravel, Inc., remained one of the principal suppliers for gravel in the Wasilla area. Other smaller operators in the valley include Jim Cline's Enterprises and Cremer Services.

Several pits operated in the Kenai-Soldotna area. Longtime producer Waldo Coyle mined gravel from his homestead along Beaver Loop Road near Kenai. Jackson Construction quarried modest amounts of gravel, stone and sand for local uses in the Soldotna area, but complained that current permitting requirements limit their enterprise to small local markets. Fairwell Gravel also mines small amounts of gravel in the Soldotna area for local uses.

Southwestern Regions

Metco, Inc. mined 60,000 tons of gravel worth \$63,000 from the Metco River bar near Seward using a rubber-tired scraper. Calista Corporation reported that about 100,000 tons of gravel and sand were used in their region for road construction and erosion control along the Kuskokwim River. No other respondents indicated aggregate production in the large and remote southwestern region.

Alaska Peninsula Region

The normally quiet Alaska Peninsula region reported a significant amount of industrial mineral use. Much of this was associated with the construction needs of an expanding commercial fishing onshore infrastructure. Westwood Foods contracted the Anchorage firm of Peratrovich, Nottingham and Drage to design and facilitate construction of a fish processing and surimi plant on Unalaska Island. The effort involved harbor reinforcement, foundation construction and road improvements that included the use of 90,000 tons of gravel and an undisclosed amount of rock. More stone and gravel use is planned in 1991 when construction begins on the \$6.9 million Unalaska Marine Center.

Moorecraft Construction was contracted by DOT&PF to repair and maintain the King Salmon-Naknek (Peninsula) Highway. Dutch Harbor Aggregate, Inc. quarried gravel from their South America pit for unspecified uses. Aleutian Materials (A.K. Construction Company) mined about 100,000 tons of gravel and sand on Kodiak Island for road and harbor maintenance. Likewise Brechan Enterprises leased the Bell Flats pit and mined gravel for use throughout the Kodiak Island Borough. Koniag, Inc., produced about 120,000 tons of riprap and pit rock in conjunction with logging operations on Afognak Island and at Womens Bay on Kodiak Island. The city of Kodiak mined about 700 tons of sand from Pillar Creek Beach for local municipal needs.

Southeastern Region

Our records, which are probably incomplete, show that 1.4 million tons of sand and gravel worth \$3.5 million and at least 1.2 million tons of rock worth \$7 million were quarried in the southeast region. As in previous years, the principal uses include maintenance of roads in the Juneau and Ketchikan municipal areas (sand and gravel) and logging road construction in the Tongass National Forest and on Native Corporation lands (stone).

Hildre Sand & Gravel sold pit-run gravel worth \$296,000 from their Acme Pit near Juneau all for local needs. Another Juneau operation, Red Samm Construction, Inc., recovered an additional \$200,000 of gravel from their pit in Mendenhall Valley. Ritchie Transportation Company bailed pit-run sand and gravel from their Stikine River site, but reported frustration with ever-changing environmental stipulations. The City of Thorne Bay leased their rock quarry to Russell Construction Company, who mined about 8,000 tons of riprap worth \$100,000 for use on Prince of Wales Island. The city of Ketchikan excavated 20,000 tons of shot rock worth \$100,000 for use in the Ketchikan city limits. Ron Thomas leased gravel near Hyder for local construction uses. The U.S. Forest Service indicated that over 600,000 tons of sand and gravel and an equal amount of stone was used to construct logging access roads in the Tongass National Forest.

COAL AND PEAT

Usibelli Coal Mine, Inc., was again Alaska's only coal producer (fig. 38). During 1990, the company sold 1,576,000 short tons from the **Usibelli Coal Mine** to several interior markets and to the Korean Electric Power Company in Honam, South Korea, which bought about half of the coal. The 1990 year-end total is a record for the company, which first began expanding its market to overseas buyers in 1984 after supplying Alaskan power plants for 40 years with steam coal from the Nenana coalfield near Healy, Alaska (fig. 39). The coal is rated a sub-bituminous-C with extremely low sulfur but high ash, factors that have contrasting marketability issues for the world's coal users.

Usibelli hopes to benefit from construction of a state-of-the-art

mine-mouth power plant at Healy known as the Healy Clean Coal Project. The Alaska Industrial Development and Export Authority submitted a bid to the Federal Department of Energy two years ago to receive grant funding of up to \$93 million to build a 50-mega-watt-rated power plant by the late 1990s. This plant would employ the latest clean-coal burning technologies (Green, 1990a, b). Golden Valley Electric Association (GVEA), who will operate and maintain the plant and purchase power, began holding public meetings late in the year. Usibelli will provide the fuel. The Alaska Power Authority received the permit application too late in the year for construction approval. Various utility board hearings are scheduled for 1991.

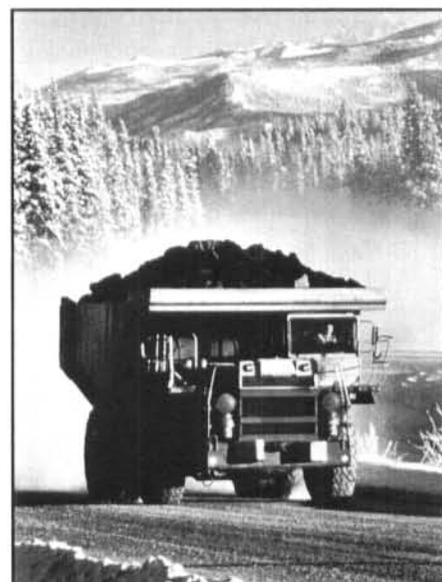


Figure 38. Usibelli Coal Mine operates year round at Healy, near Denali National Park. In 1990, Usibelli supplied coal to six interior power plants and exported roughly half of its 1.58 million tons of production to South Korea. As air quality standards in Pacific Rim nations grow more stringent, low sulphur coal from Usibelli and other Alaskan mines should be in greater demand. (Photo by Usibelli Coal Mine)

DRILLING ACTIVITY IN 1990

INTRODUCTION

Thirty-three companies reported significant drilling programs in 1990, 16 more than in 1989. Of these, 26 were hardrock programs, five were placer-drilling and two were for coal exploration or development. An additional seven placer mines reported some drilling, with a cumulative total of only 1,785 ft in rotary, churn or auger holes.

Table 11 compares the amount of drilling reported in 1990 with that reported annually since 1982, and differentiates between drilling for placer, coal and hardrock exploration. Some of the drilling in each category is either development or

production oriented, and is discussed in text. An additional 143,495 ft of blast-hole drilling associated with coal mining at Healy has not been included. The total footage drilled in 1990, 963,080 ft, (293,547 m), was up 42 percent from the corresponding total in 1989, despite the significant drop in both placer and coal drilling. These declines were more than compensated for by the 167 percent increase in hardrock core-drilling and the 25 percent increase in hardrock reverse-circulation rotary drilling.

Table 12 shows the regional variations in drilling activity, and

Figure 39. Part of the challenge of all-weather operations is equipment maintenance. In the Usibelli shop, mechanics service a 95-ton Dresser Haulpak truck. This truck can carry more coal than a railroad car. (Photo by Usibelli Coal Mine)



Table 11. Drilling footage reported in Alaska, 1982-90

	1982	1983	1984	1985	1986	1987	1988	1989	1990
Placer exploration	30,000	23,000	31,000	46,000	32,400	50,250	152,000	97,250	78,930
Placer thawfield	94,000	30,000	98,000	34,000	227,000	130,000	300,000	210,000	105,000
Total	<u>124,000</u>	<u>53,000</u>	<u>129,000</u>	<u>80,000</u>	<u>259,400</u>	<u>180,250</u>	<u>452,000</u>	<u>307,250</u>	<u>183,930</u>
Coal	80,000	12,000	25,700	8,700	28,800	19,900	26,150	38,670	18,195*
Total	<u>80,000</u>	<u>12,000</u>	<u>25,700</u>	<u>8,700</u>	<u>28,800</u>	<u>19,900</u>	<u>26,150</u>	<u>38,670</u>	<u>18,195</u>
Hardrock (core)	--	--	--	--	--	95,600	223,630	242,440	648,600
Hardrock (rotary)	--	--	--	--	--	19,500	130,220	89,790	112,355
Total	<u>200,000</u>	<u>180,500</u>	<u>176,000</u>	<u>131,700</u>	<u>50,200</u>	<u>115,100</u>	<u>353,850</u>	<u>332,230</u>	<u>760,955</u>
TOTAL (feet)	<u><u>404,000</u></u>	<u><u>245,500</u></u>	<u><u>330,700</u></u>	<u><u>220,400</u></u>	<u><u>338,400</u></u>	<u><u>315,250</u></u>	<u><u>832,000</u></u>	<u><u>678,170</u></u>	<u><u>963,080</u></u>
TOTAL (meters)	<u>(123,139)</u>	<u>(74,828)</u>	<u>(100,797)</u>	<u>(67,177)</u>	<u>(103,144)</u>	<u>(96,088)</u>	<u>(253,593)</u>	<u>(206,700)</u>	<u>(293,547)</u>

*143,495 feet of blasthole drilling not included.

-- = Not specifically reported. Prior to 1987 no distinction was made in reporting hardrock core and hardrock rotary drilling footage.

Table 12. Drill footage by region in Alaska, 1990

	Northern	Western	Eastern interior	South-central	South-western	Alaska Peninsula	South-eastern	TOTAL
Placer exploration	1,000	16,285	5,550	53,824	280	--	1,991	78,930
Placer thawfield	--	105,000	--	--	--	--	--	105,000
Total	<u>1,000</u>	<u>121,285</u>	<u>5,550</u>	<u>53,824</u>	<u>280</u>	<u>--</u>	<u>1,991</u>	<u>183,930</u>
Coal	--	--	6,700*	11,495	--	--	--	18,195
Total	<u>--</u>	<u>--</u>	<u>6,700</u>	<u>11,495</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>18,195</u>
Hardrock core	22,300	39,784	76,234	10,200	9,610	3,522	486,950	648,600
Hardrock rotary	--	23,155	77,200	12,000	--	--	--	112,355
Total	<u>22,300</u>	<u>62,939</u>	<u>153,434</u>	<u>22,200</u>	<u>9,610</u>	<u>3,522</u>	<u>486,950</u>	<u>760,955</u>
TOTAL (feet)	<u><u>23,300</u></u>	<u><u>184,224</u></u>	<u><u>165,684</u></u>	<u><u>87,519</u></u>	<u><u>9,890</u></u>	<u><u>3,522</u></u>	<u><u>488,941</u></u>	<u><u>963,080</u></u>
TOTAL (meters)	<u>(7,104)</u>	<u>(56,166)</u>	<u>(50,513)</u>	<u>(26,683)</u>	<u>(3,015)</u>	<u>(1,073)</u>	<u>(149,067)</u>	<u>(293,547)</u>

-- = No activity reported.

*Does not include 143,495 feet of blasthole drilling.

table 13 is a listing of companies reporting significant drilling projects in Alaska in 1990.

One of the more important milestones in drilling activity was the 5,000-ft deep diamond-drill hole into the **Treadwell** structure at Juneau. As far as can be determined, this was the deepest drill-hole ever completed in hardrock mineral exploration in Alaska (fig. 40).

PLACER DRILLING

Placer drilling, following the trend of the last two years, declined by about 60 percent in 1990 to 183,930 ft from the 307,250 ft reported in 1989. Most of the decrease can be attributed to the halving of thawfield drilling.

As in 1989, most of the exploratory placer drilling was concentrated in southcentral Alaska, mainly in the vicinity of the **Valdez Creek Mine**, where Cambior Alaska, Inc., and Caprock Corporation, in partnership with Rowallen Mine Partnership, reported significant drill programs in 1990.

Only 105,000 ft of thawfield drilling was reported at Nome by Alaska Gold Company, continuing the decline from a high of 300,000 ft in 1988. This decrease represents changing ground conditions in the vicinity of the company's dredges.

In some ways thawfield drilling, which has strongly influenced the state's overall drill footage during the last three years, is more akin to development or production drilling than to exploration drilling.

COAL DRILLING

Usibelli Coal Mine, Inc., completed drilling about 6,300 ft of reverse-circulation and auger holes in the Hoseanna Creek drainage, some for exploratory purposes and some for hydrology studies. An additional 143,495 ft of air-rotary blast-holes were drilled for production purposes.

At the **Wishbone Hill Mine**, Idemitsu Alaska, Inc., drilled about 11,500 ft of churn and core holes for development, geophysical logging and environmental baseline studies.

HARDROCK DRILLING

Reverse-circulation drilling increased 25 percent from the 89,790 ft drilled in 1989 to 112,355 ft in 1990. Core drilling increased much more dramatically from 242,440 ft in 1989 to 648,600 ft in 1990, an increase of 167 percent, though 61,500 ft of the total was for mine development, and 67,400 ft was considered production drilling. Even discounting this 128,900 ft, the remaining 519,700 ft of exploration core drilling is still an impressive 114 percent increase over the 1989 total.

Most of the increase can be attributed to advanced exploration at Echo Bay's **A-J**, **Treadwell** and **Kensington** projects at and near Juneau, and at Fairbanks Gold's **Fort Knox** project near Fairbanks. Continuing the trend of the last couple of years, about 82 percent of the hardrock exploration drilling in



Figure 40. New technology is opening opportunities for Alaska. This 5,000-ft drill hole under Gastineau Channel near Juneau intercepted the Treadwell Mine structure far below the deepest workings. It is the deepest hardrock drill hole in the state and utilized the most sophisticated navigational drilling technology. At its prime, the Treadwell had many shafts drilled under the ocean. It ceased operations in 1922 when it was thought uneconomic to pump out its flooded tunnels. (Photo by R.C. Swainbank)

Table 13. Companies reporting significant drilling projects, 1990

Alaska Gold	Fairbanks Gold
Alaska Placer Development	Flat Creek Mining
AMAX	Great Basin
American Copper & Nickel	Hecla
ASARCO	Hunt Ware & Proffett
Battle Mountain	Idemitsu Alaska
BHP-Utah	Kennecott Greens Creek
Cambior Alaska	Kennecott Potatoe Mountain
CanAlaska Resources	Magnuson Mining
Caprock Corporation	Moneta-Porcupine Mines
Central Alaska Gold Co.	Pasminco
Citigold Alaska, Inc.	Placer Dome (U.S.), Inc.
Cominco Exploration	Pulsar
Cominco Red Dog Mine	Sphinx Mining
Delta Mining Co.	Tenneco Minerals
Echo Bay	Usibelli Coal Mine
Echo-Bay-AJ	Vinta Exploration
Echo Bay-Kensington	

Alaska in 1990 was core drilling, with only 18 percent reverse-circulation. This compares with 71 percent in 1989 and 57 percent in 1988, and again reflects the advanced stage of many of the exploration projects.

Most of the drilling by Echo Bay at both the **A-J** and **Kensington Mines** was done to increase the reserve estimates. Pending issuance of permits, the **Kensington** is expected to begin development in 1992.

In 1990 **Echo Bay Mines, Inc.**, drilled a deep hole that began near Thane on the east side of the Gastineau Channel. The 5,000-ft hole intersected the Treadwell structure on the west side of the channel. After drilling through more than 2,800 ft of shearing below the channel, the pilot hole branched into four wedge holes to explore portions of the Treadwell structure. The "Navidril" system guided the bit as far as 5,000 ft from the collar of the hole on the east side of the channel.

Kennecott had a large exploratory drill program at and near the **Greens Creek Mine** in addition to 61,500 ft of development drilling and

47,400 ft of production drilling. Placer Dome (U.S.) also had a significant exploratory drill project at its **Jualin Mine** near the **Kensington** 50 mi north of Juneau.

In interior Alaska, Fairbanks Gold drilled 46,300 ft of core hole and 62,600 ft of reverse-circulation hole at their **Fort Knox** property and had smaller programs elsewhere. American Copper & Nickel Company drilled 17,434 ft of diamond-drill hole at the O'Dea Vein and on the Ethel Pit areas near the **Grant Mine** west of Fairbanks. They had several less ambitious programs elsewhere in the state. Citigold Alaska also operated a large and successful program at the **Ryan Lode** on Ester Dome.

In western Alaska, Central Alaska Gold Company operated an intensive drill program at the **Nixon Fork Mine** in preparation for a feasibility study while conducting several smaller programs throughout western and interior Alaska.

AMAX and ASARCO drilled prospects near Livengood, BHP-Utah had a program on the Seward

Peninsula. Battle Mountain drilled prospects on the Aleutian Islands and in southwest Alaska.

CanAlaska drilled 12,000 ft of reverse-circulation and 3,000 ft of diamond-drill hole on its **Rainbow Hill Project** in southcentral Alaska near Valdez Creek.

Cominco Exploration drilled the **Pebble Beach** copper-gold porphyry near Iliamna in southwest Alaska and had a smaller program in northern Alaska. About 20,000 ft of production drilling was reported from the **Red Dog Mine**.

Hunt, Ware & Proffett drilled about 7,000 ft of core hole at the **Johnson Prospect**, a gold-zinc-copper-lead prospect for which they are managing consultants.

Moneta Porcupine Mines, as part of a work commitment, drilled several holes in northern Alaska at the **Lik Prospect**. Pasmenco had a modest program in the Kandik River area of the eastern interior in 1990.

Pulsar Resources (U.S.), Inc., a wholly owned subsidiary of Hyder Gold, Inc., had a 5,500 ft core-drilling program in the Hyder district in the extreme southeast of Alaska in 1990.

METAL RECYCLING IN ALASKA, 1990

Metal recycling in Alaska suffered from depressed commodity prices and other complex market difficulties during the 1990 export season.

Estimated 1990 value of recycled metals is \$3.56 million, only 44 percent of the \$8.13 million credited in 1989. However, our 1990 volume and value estimates for commodities are influenced by both weaker commodity prices and fewer questionnaire responses. Only six of the 19 outlets known to be recycling metals provided specific production information. Obviously our volume and value estimates are conservative (table 14).

K & K Recycling of Fairbanks and Anchorage Recycling Center (ARC) are responsible for about 70 percent of nonferrous metal output. Both reported difficulties in obtaining materials from scrap piles, and traditional landfill sources. Paper and glass recycling was nearly nonexistent and ARC's Fairbanks outlet, Sandy's Recycling, closed out glass recycling shipments due to a lack of markets.

However, lead recycling took almost a 200 percent leap in volume from 1989 levels (table 14). Battery Specialists, Inc., in Anchorage and Alaskan Battery Supply reported that their lead recycling businesses con-

tinue to increase because of demand shown by west coast consignment buyers.

Alaska Metals Recycling (Anchorage) continued to operate its shredder and shipped roughly half the 12,500 tons of car bodies and structural steel credited to 1990 Alaskan production. Newell Recycling of San Antonio, Texas, reprocesses the Alaskan scrap onto saleable structural products.

Alaska Metals Recycling and the Alaska Support Industry Alliance dominated the ferrous scrap output. The Alliance is a consortium of North Slope petroleum companies that continued to manage the salvage operations of North Slope petroleum

Table 14. Scrap metal and glass exports from Alaska, 1989-90

Commodity	1989			1990		
	Quantity		Value	Quantity		Value
	(lbs)	(kg)		(lbs)	(kg)	
Copper-brass	1,250,000	567,000	\$1,437,500	585,000	265,064	\$ 600,000
Aluminum	2,900,000	1,315,440	2,175,000	1,500,000	679,650	580,000
Stainless steel	--	--	--	6,475	2,933	30,000
Car radiators	275,000	162,880	1,100,000	--	--	--
Zinc	--	--	--	40,000	18,124	20,000
Lead	1,208,000	547,488	507,360	3,600,000	1,634,040	1,260,000
Non-ferrous undistributed	1,480,000	671,328	--	--	--	--
Ferrous scrap	48,000,000	21,772,800	2,900,000	25,000,000	11,327,500	1,100,000
Glass	833,900	378,257	8,340	--	--	--
TOTAL			\$8,128,200			\$3,590,000

-- = None reported.

Table 15. Selected companies that export scrap metal and glass from Alaska, 1989-90

Company	Commodities recycled
Fairbanks	
K&K Recycling	Aluminum, copper, brass, ferrous scrap, nickel-cobalt alloys
Alum Recycling	Aluminum
Sandy's Recycling	Aluminum, glass, miscellaneous non-ferrous, radiators
Alaskan Battery Supply	Lead-based batteries
Anchorage	
Anchorage Recycling Center	Aluminum, glass, copper, brass, nickel-cobalt alloys
Prescott Equipment	Ferrous and non-ferrous scrap
Battery Specialists Inc.	Lead-based batteries
Alaska Metals recycling	Ferrous and non-ferrous scrap
Standard Steel and Metals	Ferrous scrap
Staino Steel	Stainless steel, miscellaneous scrap
M&M Company	Ferrous and non-ferrous scrap
ARCO Alaska	Ferrous scrap
Kenai-Soldotna	
Tuttle Inc.	Miscellaneous scrap
Hutton Enterprises	Miscellaneous scrap
Juneau	
E&L Auto Body	Aluminum, lead-based batteries, auto bodies, radiators
Auke Bay Cans	Aluminum, copper, brass, lead, zinc
North Tongass Salvage	Ferrous and non-ferrous scrap
Channel Sanitation	Aluminum, lead-based batteries
Ketchikan	
Jim Church	Non-ferrous scrap, auto bodies

producers. During 1990, the consortium cleaned up several old distribution sites, including Service City, the original infrastructure center for development of the North Slope oil fields.

Workers at the Service City site removed 6,000 tons of ferrous scrap, 10,000 gal of recyclable fuel, and 6,000 yd³ of solid waste (table 15).

RENTS, ROYALTIES, AND RECLAMATION: Progress on the implementation of 6i legislation

BACKGROUND

Prior to Alaska becoming a State in 1959, Congress enacted into public law the Alaska Statehood Act. Section 6 of the Act authorized Alaska to select 104.5 million acres of unreserved public land from the federal government in order to promote growth, development and self-sufficiency in the new State. The Statehood Act and Alaska's early legislative laws were enacted against the background of distinction that existed between the Federal Mining Law of 1872, the Mineral Lease Act of 1920, the School Lands Act of 1927, and provisions in other statehood acts which granted lands for the generation of school revenue. The school lands act applies to school land grants which required the minerals of such lands to be retained subject to lease as the state legislature may direct. Rent and royalty received from minerals mined would be used to help support education. Section 6i of Alaska's Statehood Act was patterned after the 1927 School Lands Act except the proceeds from rent and royalty received from leases were not required to be used for education only.

Section 6i of the Alaska Statehood Act reads as follows: "All grants made or confirmed under this Act shall include mineral deposits. The grants of mineral lands to the State of Alaska under subsections (a) and (b) of this section are made upon the express conditions that all sales, grants, deeds, or patents for any of the mineral lands so granted shall be subject to and contain a reservation to the State of

all of the minerals in the lands so sold, granted, deeded, or patented, together with the right to prospect for, mine, and remove the same. Mineral deposits in such lands shall be subject to lease by the State as the State legislature may direct: *Provided*, That any lands or minerals hereafter disposed of contrary to the provisions of this section shall be forfeited to the United States by appropriate proceedings instituted by the Attorney General for that purpose in the United States District Court for the District of Alaska."

Because of the distinction between the location-patent system embodied in the 1872 mining law, and mineral leasing under the 1920 Act, Alaskans wanted to retain this distinction that existed between mineral location and leasing in the Constitution which voters approved in 1956. Congress, however, wanted a universal "lease" requirement when it enacted section 6i of the Statehood Act in 1958. Because of opposition to this universal leasing requirement in Alaska, Congress stated in the act that a special election be held in Alaska obtaining the voters consent to all provisions of the Statehood Act. The Statehood Act also stated that voter approval of the Act would result in the Constitution being amended accordingly. In August, 1958, the people of Alaska voted in favor of the Act, and Alaska was admitted to the union as a state on January 3, 1959.

In the early years of statehood, the legislature and state officials overlooked the Constitutional amendments and did not interpret the universal lease requirement to

apply to all of the (103 million acres) authorized to be selected by the state. Rather they interpreted it to apply only to lands where the state sold or otherwise disposed of the surface land, such as to local governments, etc., while retaining the minerals in the ground. In 1959, Alaska's first legislature implemented a law governing administration of lands owned by the new state. The 1959 legislation provided for the leasing of state land and the payment of rents and royalties for the extraction of coal, oil, gas, and other minerals governed by the Mineral Leasing Act of 1920. Other hardrock minerals such as gold and copper were made subject to discovery and location under Alaska mining laws which the legislature patterned after the Federal Mining Law of 1872.

In 1981, the commissioner of the Department of Natural Resources asked the state attorney general (AG) to review and analyze the meaning of section 6i. The AG issued an opinion that the leasing requirement in 6i would apply to all lands known to be mineral-in-character at the time that they were selected by the state. In 1982, the Alaska legislature amended the state's hardrock mining laws and authorized the commissioner to issue a production license to miners who wished to extract hardrock minerals. A production license was thought to be like a lease for purposes of section 6i.

In 1983, a coalition of environmental groups, Native village corporations, and fishing groups (Trustees for Alaska) filed a law suit in Superior Court stating that the State's hardrock mining

laws violate section 6i because the State does not receive rents and royalties in return for production licenses or leases and because the state defines the "lease" requirement to apply only to lands mineral in character when selected. The Superior Court ruled that coalition did not have standing to bring the law suit, since the coalition was not being harmed and had no personal stake or conflict with mineral resources being managed under existing laws. The Court held that since Section 6i provides that the minerals are "subject to lease by the State as the State legislature may direct," the legislature had discretion to allow revenue from a lease (or production license) to be in the form of labor rather than cash, rents or royalties. The Trustees for Alaska appealed to the State Supreme Court and in May, 1987 the Court said that the coalition does have standing as tax payers to bring the law suit since they are interested in preserving to the State the economic value of these lands. The Supreme Court also said the Alaska hardrock mining laws are "indistinguishable" from a mineral location system and that the laws do not meet the leasing requirements of Section 6i which mandates that the State receive rent or royalties for its leases. The Court concluded that Congress granted Alaska the mineral rights with the intention that revenue received would help fund the new State government. The State appealed the State's Supreme Court decision to the U.S. Supreme Court. The U.S. Supreme Court, after considering the case, decided in October 1987 not to hear the case and rejected the State's legal position.

IMPLEMENTATION

In May of 1989, the Alaska State legislature passed Senate Bill



Figure 41. In the 1990 legislative session, new standards were established for reclamation of mining sites after the completion of production. Permitting Section Chief Judd Peterson, Division of Mining, reports on the completion of the proposed reclamation regulations to the 1991 House Resources Committee. Members of the committee shown are, left to right, Rep. Ivan M. Ivan, Rep. Pat Carney, an unidentified aide, and Peterson. (Photo by Cindy Roberts)

129 which was its response to the 1987 Alaska Supreme Court decision in the 6i law suit Trustees for Alaska vs. Alaska. This bill amended two State mining statutes (Annual Labor and Abandonment) and enacted three new statutes (Annual Rental, Production Royalty and Reclamation). The legislature further directed the Commissioner of the Department of Natural Resources to adopt regulations to implement these new laws. Reclamation was further amplified with the passage of Senate Bill 544 in May of 1990, which related to reclamation of land and water and replaced the reclamation statutes of Senate Bill 129. Each of the major aspects of the 6i legislation, rents, royalties, and reclamation will be dealt with in turn.

Rents

The regulation changes which implemented the statutes in SB 129 were adopted and became effective on May 18, 1990. They dealt with mining, leasing, annual labor, annual rental, and claim abandon-

ment. In summary, the holder of each mining claim, leasehold location, or mining lease on State-owned land shall pay annual rental in advance for the right to continue to hold the mining claim, leasehold location, or mining lease. The annual rental amount is based on the number of years since the mining claim, leasehold location, or mining lease was first located. The progressive increase in rents is shown in table 16.

The rental for each year shall be credited against production royalty as it accrues for that year. A claim, lease hold location, or mining lease located on or before August 31, 1989, is considered to have been first located on August 31, 1989, for the purposes of determining the amount of rental under this section. The rental payment for the rental year that began at noon on September 1, 1989, must have been paid on or before June 29, 1990, or within 90 days after the date of posting of the Notice of Location, which ever was later. Rental payment for each subsequent rental year is due on

Table 16. Schedule of mineral rents on Alaska state lands, 1990

Number of years since last located	Rental amount per acre per mining lease	Rental amount for each 40-acre mining claim or lease-hold location
0-5	\$.50	\$ 20.00
6-10	\$1.00	\$ 40.00
11 or more	\$2.50	\$100.00

Table 17. Summary of mineral revenue statistics on state land, 1990

Annual rental receipts	\$653,000
APMA receipts	43,900
Payment in lieu of annual labor	25,000
TOTAL	\$721,900

September 1, and must be paid on or before November 30. Included in the rental portion of the legislation was the option to pay annual labor in the amount of \$100 per claim prior to the completion of the labor year rather than actually performing the labor (table 17 gives a summary of the mineral revenues on State lands for the 1990 assessment year). Changes were made to the "abandonment" language to make it clear that failure to pay the rent or royalty is considered abandonment of the claim.

Royalties

Royalties are addressed in Senate Bill 129, (6i legislation) under section 38.05.212 Production Royalty, which states that the holder of a mining claim, leasehold location, or mining lease shall pay a three percent net royalty on all minerals produced from lands subject to claim, leasehold location, or mining lease. The "holder" is defined as (a) a person owning and operating a mining property, (b) a person owning a mining property and receiving lease or royalty payments based on production from the property, (c) a person leasing a mining property from another person and operating the property, or (d) a person possessing a mineral interest in a producing property including royalty, working or operating interest, net profits, overriding royalties, and production payments. In short, both the

owner, the operator and any middle interests monetarily benefitting from a producing property need to pay production royalty. The regulations also state that annual rental due and paid under A.S.38.05.211 for a year shall be credited against the production royalty for that year.

Production royalty returns must be filed for each year after 1989 in which production occurs, or minerals produced from State land are sold, exchanged or otherwise disposed of. The production royalty returns are due every year on May 1 for the preceding calendar year and must be paid in currency. Payment "in kind" is not allowed. The first returns were due May 1, 1991 for the calendar year 1990, but have been delayed until November 30, 1991. Upon request, most of the financial information contained in the production royalty returns will be kept confidential.

A holder of a mining claim, leasehold location, or mining lease who fails to file a production royalty return when due, or who pays no portion of the production royalty when due, is deemed to have abandoned to the State all rights acquired under that State mining claim, leasehold location, or mining lease. If a production royalty payment is deficit but is otherwise timely paid, the holder of the mining claim, leasehold location, or mining lease has 60 days to pay the deficiency plus interest or must pay within 30 days of the date of the notice of the

department's negative decision after protesting the deficiency.

In addition to deeming abandoned a mining claim, leasehold location, or mining lease, the division may file suit to collect a production royalty payment in the event of non-payment or deficiency payment of a production royalty payment, or failure to file a production royalty report when due.

Reclamation

Reclamation was specifically required by Senate Bill 129 (the 6i legislation). This legislation stated that "the Commissioner shall require reclamation of State land from the effects of mining." These reclamation requirements were intended to spur comprehensive reclamation legislation in the next legislative session rather than to presently legislate. The 1990 legislature passed Senate Bill 544, The Reclamation Act, that required the Department of Natural Resources to prepare mining reclamation regulations and gave an effective date of the law as October 15, 1991 (fig. 41). Proposed reclamation regulations were to be submitted to the chairs of the Resource Committees of the 1991 legislature by DNR on January 15, 1991. This act establishes a new permit (a "reclamation permit") required of all mining operations in Alaska in addition to the existing approvals and operational permits required by state and federal agencies.

The act contains the following provisions:

- (1) Requires reclamation for all mining operations including sand and gravel and other materials.
- (2) Extends reclamation requirements to state, federal, and private land; subject to a grant of authority for DNR to enter into cooperative management agreements with state and federal agencies.
- (3) Requires submission and approval of a site-specific reclamation plan before mining may commence; subject to a small mine exemption for operators disturbing less than five acres at one location and having cumulative unreclaimed mined area of less than five acres at one location or gravel operators removing less than 50,000 yd³ in one location and having cumulative disturbed area of less than five acres in one location.
- (4) Reclamation bonding is made mandatory with a maximum bond ceiling of \$750 per acre; subject to the small mine exemption detailed in (3) above.
- (5) Gives DNR the authority to establish and manage a statewide bonding pool.
- (6) Establishes an "undue and unnecessary degradation" and returns to "stable condition" performance standards for reclamation. This parallels the BLM reclamation standard.
- (7) Establishes two categories of mining operations in regard to the bonding and permitting of reclamation activity:
 - (a) Mines that mine more than five acres in any year or have a cumula-

tive unreclaimed area of more than five acres at one location, or that remove greater than 50,000 yd³ of material in any one year and there is a cumulative disturbed area of more than five acres at one location must be bonded and submit a reclamation plan for approval.

- (b) Mines where less than five acres are mined at one location in any year and there is a cumulative unreclaimed mined area of less than five acres at one location; or where less than five acres and less than 50,000 yd³ of gravel or other materials are removed at one location in any year and there is a cumulative disturbed area of less than five acres at one location do not need approval of a preclamation plan and no bonding is required. This category of mines must simply give notice of the reclamation measures they will take to comply with the reclamation performance standards of the regulations. No reclamation permit or approval is required. These mines must still obtain operational permits required and other state and federal authorities.

Reclamation is currently required for state lands through special stipulations in the Miscellaneous Land Use Permit (MLUP) and for Federal lands through either notice or plan of operations (figs. 42 and 43). Requirements under the reclamation regulations are similar in character to those

currently required by both state and federal land managers. The main additional requirement is that of reclamation bonding. The primary tool for providing bonding is the establishment of a statewide bonding pool, and this pool is available to all operators regardless of land status. This pool should also satisfy BLM's pending bonding requirements for federal mining operations.

As of this writing, the legislature has instructed DNR to proceed with adopting final regulations through the standard public hearings process. In accordance with the act, reclamation regulations may not be adopted before October 15, 1991. Division of Mining is taking steps to implement the reclamation regulations to insure that the transition to the requirement of a new permit and subsequent additional paperwork is as smooth as possible.



Figure 42. Mining projects in Alaska must plan for reclamation even as they are developed. In this 1988 photo, TriCon Mining Company is involved in an "open cut" hardrock gold operation on the south flank of Ester Dome, near Fairbanks. (Photo by T.K. Bundtzen)



Figure 43. The same TriCon operation in this 1990 photo has been recontoured to minimize erosion and encourage revegetation. (Photo by John Wood)

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APPENDIX A
Total active claims and new claims staked in 1988, 1989, and 1990^a
(listed by quadrangle)^b

Quadrangle	Active claims assessment work			New claims staked						Total active claims ^c		
	1988	1989	1990	Federal			State			1988	1989	1990
				1988	1989	1990	1988	1989	1990			
13 Umiat	0	0	0	0	0	0	0	0	0	0	0	0
14 Sagavanirktok	0	0	0	1	0	0	0	0	1	1	0	0
15 Mt. Michelson	0	0	0	0	0	0	0	0	0	0	0	0
17 Point Hope	0	0	0	0	0	0	0	0	0	0	0	0
18 De Long Mts.	1,809	1,350	1,386	0	0	0	0	107	0	1,809	1,457	1,386
23 Phillip Smith Mts.	13	9	9	5	2	2	0	1	1	18	12	12
26 Noatak	184	187	66	0	0	0	0	0	0	184	187	66
27 Baird Mts.	299	130	114	0	0	0	0	0	2	299	130	116
28 Ambler River	110	104	110	0	0	0	0	0	7	110	104	117
29 Survey Pass	34	37	34	0	0	0	0	0	0	34	37	34
30 Wiseman	1,767	1,393	1,385	6	3	4	143	90	90	1,916	1,486	1,479
31 Chandalar	945	828	752	12	0	0	28	8	24	985	836	776
32 Christian	1	2	1	0	0	0	0	0	0	1	2	1
35 Kotzebue	16	0	0	16	0	0	0	0	0	16	0	0
36 Selawik	0	0	0	0	0	0	0	0	0	0	0	0
37 Shungnak	51	6	1	0	0	0	0	0	0	51	6	1
38 Hughes	54	54	54	0	0	0	0	0	0	54	54	54
39 Bettles	422	366	298	30	48	29	1	0	4	453	414	331
43 Teller	383	380	488	0	0	0	145	98	30	528	478	518
44 Bendeleben	1,138	1,107	839	9	2	0	158	249	32	1,305	1,358	871
45 Candle	463	453	486	8	0	0	9	16	16	480	469	502
47 Melozitna	134	131	125	6	0	0	0	9	4	140	140	129
48 Tanana	1,596	1,296	1,027	1	0	0	19	123	117	1,616	1,419	1,144
49 Livengood	3,290	3,578	3,335	0	0	0	428	328	116	3,718	3,906	3,502
50 Circle	3,944	4,582	3,394	0	0	41	1,397	446	301	5,341	5,028	3,736
51 Charley River	183	146	183	0	0	0	0	18	0	183	164	183
52 Nome	293	687	697	5	0	0	344	103	33	637	790	730
53 Solomon	881	329	396	24	0	0	40	256	16	945	585	412
54 Norton Bay	110	91	110	0	0	0	0	0	0	110	91	110
55 Nulato	3,178	3,175	3,175	10	0	0	0	78	0	3,188	3,253	3,175
56 Ruby	974	1,057	846	0	0	0	304	52	1	1,278	1,109	847
57 Kantishna River	275	244	243	0	1	9	0	0	0	275	245	252
58 Fairbanks	2,505	2,209	2,158	0	0	0	419	303	206	2,924	2,512	2,364
59 Big Delta	1,841	2,430	1,998	0	0	10	786	105	398	2,627	2,535	2,406
60 Eagle	2,256	2,480	1,973	118	0	1	558	113	129	2,932	2,593	2,103
63 Unalakleet	0	0	0	0	0	0	0	0	0	0	0	0
64 Ophir	474	654	657	0	0	0	192	36	9	666	690	666
65 Medfra	293	250	281	0	0	0	0	9	24	293	259	305
66 Mt. McKinley	319	313	233	0	0	0	0	0	20	319	313	253
67 Healy	3,289	3,301	4,307	736	135	605	172	187	84	4,197	3,623	4,996
68 Mt. Hayes	4,682	3,273	2,871	56	41	240	247	188	15	4,985	3,502	3,126
69 Tanacross	1,150	1,185	1,144	0	0	0	165	79	19	1,315	1,264	1,163
72 Holy Cross	9	0	5	0	0	0	0	0	0	9	0	5
73 Iditarod	620	1,586	1,399	646	54	0	437	63	10	1,703	1,703	1,409
74 McGrath	325	348	329	0	0	0	238	0	0	563	348	329
75 Talkeetna	1,884	2,197	1,758	5	0	0	181	141	111	2,070	2,338	1,869
76 Talkeetna Mts.	1,907	1,528	770	16	0	3	122	177	120	2,045	1,705	893
77 Gulkana	19	24	20	0	0	0	21	2	0	40	26	20
78 Nabesna	246	189	354	0	0	0	0	71	4	246	260	358
81 Russian Mission	58	48	51	5	0	0	0	0	0	63	48	51
82 Sleetmute	231	267	185	40	0	0	45	0	0	316	267	185
83 Lime Hills	28	122	102	0	0	0	0	0	0	28	122	102

^aTotal count based on all documents recorded through January 1, 1990.

^bQuadrangles numbered northwest to southeast according to DGGs-DOM numbering and Kardex systems.

^cExcluding an undetermined number of claims on state selected land.

Quadrangle	Active claims assessment work			New claims staked						Total active claims		
				Federal			State					
	1988	1989	1990	1988	1989	1990	1988	1989	1990	1988	1989	1990
84 Tyonek	4,632	5,340	5,137	0	0	0	63	11	26	4,695	5,351	5,163
85 Anchorage	906	407	689	9	2	0	71	89	181	986	498	870
86 Valdez	305	414	465	102	145	10	8	20	7	321	579	482
87 McCarthy	205	186	103	0	0	0	0	0	0	205	186	103
91 Bethel	454	485	380	24	0	0	37	48	0	515	533	380
92 Taylor Mts.	204	273	263	0	0	0	168	12	0	372	285	263
93 Lake Clark	395	588	387	0	0	0	150	10	0	495	598	387
94 Kenai	12	12	14	0	0	0	5	0	0	17	12	14
95 Seward	2,340	2,024	1,484	379	131	38	30	20	36	2,749	2,175	1,558
96 Cordova	15	0	0	0	1	0	0	0	0	15	1	0
97 Bering Glacier	310	283	274	0	0	0	0	0	0	310	283	274
101 Goodnews	2	39	75	0	0	0	39	0	0	41	39	75
102 Dillingham	7	0	0	0	0	0	0	0	0	7	0	0
103 Iliamna	572	700	780	0	0	0	720	133	86	1,292	833	866
104 Seldovia	13	9	10	0	0	0	0	0	0	13	9	10
105 Blying Sound	1	1	1	0	0	0	0	0	0	1	1	1
107 Icy Bay	6	4	0	14	0	0	0	0	0	20	4	0
108 Yakutat	1	1	1	0	0	0	0	2	0	1	3	1
109 Skagway	511	485	473	0	2	27	0	19	0	511	506	500
111 Mt. Fairweather	2	4	4	18	0	4	1	0	2	20	4	10
112 Juneau	3,428	3,251	3,947	890	293	255	62	49	54	4,380	3,593	4,056
113 Taku River	0	0	0	0	0	0	0	0	0	0	0	0
114 Sitka	644	432	289	9	0	94	11	0	4	664	432	387
115 Sumdum	147	143	121	14	19	97	0	0	0	161	162	218
116 Port Alexander	184	184	107	0	1	0	0	0	0	184	185	107
117 Petersburg	789	480	448	109	23	89	5	0	0	903	503	537
118 Bradfield Canal	122	107	361	35	262	134	0	0	0	157	469	495
119 Craig	780	905	943	337	262	24	57	0	0	1,174	1,167	967
120 Ketchikan	367	391	391	34	137	107	0	1	51	401	529	549
121 Dixon Entrance	184	181	186	74	0	65	0	0	0	258	181	251
122 Prince Rupert	9	0	0	0	0	0	0	0	0	9	0	0
123 Hagemeister Island	505	374	216	0	0	0	36	0	0	541	374	216
126 Mt. Katmai	0	0	0	0	0	0	0	0	0	0	0	0
127 Afognak	2	2	2	0	0	0	0	0	36	2	2	38
130 Karluk	0	0	0	0	0	0	0	0	0	0	0	0
133 Chignik	71	71	71	0	0	0	0	0	0	71	71	71
135 Trinity Islands	895	437	380	0	0	0	1	49	83	896	486	463
138 Port Moller	38	17	16	0	0	0	0	9	0	38	26	16
TOTAL	63,694	64,123	58,067	3,786	1,664	2,573	5,002	8,062	1,888	75,542	67,948	62,528

APPENDIX B
1990 Prospecting sites on state lands
Compiled by Erik Hansen (DOM)

	<u>Quadrangle</u>	<u>New sites</u>	<u>Extensions</u>	<u>Total</u>
30	Wiseman	6	0	6
31	Chandalar	6	4	10
35	Kotzebue	16	0	16
39	Bettles	6	0	6
43	Teller	15	0	15
44	Bendeleben	10	47	57
49	Livengood	6	37	43
50	Circle	80	116	196
52	Nome	7	0	7
53	Solomon	9	0	9
55	Nulato	1	0	1
58	Fairbanks	28	9	37
59	Big Delta	79	0	79
60	Eagle	2	9	11
64	Ophir	4	42	46
65	Medfra	7	0	7
67	Healy	39	33	72
68	Mt. Hayes	20	0	20
69	Tanacross	7	0	7
75	Talkeetna	39	0	39
76	Talkeetna Mts.	30	18	48
84	Tyonek	0	3	3
85	Anchorage	18	0	18
86	Valdez	34	0	34
112	Juneau	35	7	42
120	Ketchikan	6	0	6
135	Trinity Islands	8	0	8
	TOTAL	518	325	843

APPENDIX C

State and federal agencies, and private interest groups involved in mineral development activities, 1990

(Note: *The 1991 Service Directory of the Alaska Miners Association* lists technical and professional consultants and companies available for work in Alaska. The report is available for \$12 from the Association's Anchorage office. See p. 57 for the address.)

STATE OF ALASKA AGENCIES

DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT

State Office Building, 9th Fl.
P.O. Box D (mailing)
Juneau, AK 99811
(907) 465-2500

Commissioner - Dr. Glenn A. Olds

Function: Promotes economic development in Alaska.

Division of Economic Development

State Office Building, 9th Fl.
P.O. Box D (mailing)
Juneau, AK 99811
(907) 465-2017

Director - Paul Fuhs
Deputy Director - Tom Lawson
Development Specialist - Al Clough

1001 Noble St., Ste. 360
Fairbanks, AK 99701
(907) 452-7464

Development Specialist - Richard Swainbank

Function: Primary advocacy agency in state government for economic growth. Researches and publishes economic data on Alaska's mining industry. Provides information and assistance to new or developing businesses.

DEPARTMENT OF ENVIRONMENTAL CONSERVATION

3220 Hospital Dr.
P.O. Box O (mailing)
Juneau, AK 99811-1800
(907) 465-2600
Public Information (907) 465-2606

Commissioner - John A. Sandor

Function: Issues permits for activities, including mining, that affect air or water quality or involve land disposal of wastes. Sets air- and water-quality standards. Inspects, monitors, and enforces environmental quality statutes, regulations, and permits. Reviews all federal permits.

Northern Regional Office
1001 Noble St., Ste. 350
Fairbanks, AK 99701
(907) 452-1714

Regional Supervisor - William McGee

Southcentral Regional Office
3601 C St., Ste. 1350, Frontier Bldg.
Anchorage, AK 99503
(907) 563-6529

Permit Information (907) 563-6529
(collect calls accepted)
Regional Supervisor - Bill Lamoreaux

Nome District Office
P.O. Box 1815
Nome, AK 99762
(907) 443-2600
District Manager - Randy Romenesko

Southeastern Regional Office
9000 Old Glacier Hwy.
P.O. Box 32420 (mailing)
Juneau, AK 99803
(907) 789-3151
Permit Information (907) 465-2615
(collect calls accepted)
Regional Supervisor - Dick Stokes

DEPARTMENT OF FISH AND GAME

Capital Office Park
P.O. Box 3-2000 (mailing)
Juneau, AK 99802
Commissioner - Carl L. Rosier
(907) 465-4100

Habitat Division Director - Frank Rue
(907) 465-4105

Function: Protects habitat in fish streams and manages refuges, sanctuaries, and critical habitats. Requires permits for any work involving: the blockage of fish passage; equipment crossings or operation in streams with anadromous fish; use, diversion, or pollution of streams containing anadromous fish; construction, exploration, or development work in state game refuges, game sanctuaries, and critical habitat areas.

Central Regional Office
Habitat Division
1300 College Rd.
Fairbanks, AK 99701
(907) 451-6192
Regional Supervisor - Alvin Ott

Southcentral Regional Office
Habitat Division
333 Raspberry Rd.
Anchorage, AK 99518-1599
(907) 267-2335
Regional Supervisor - Lance Trasky

Southeastern Regional Office
Habitat Division
803 3rd St., 1st Fl.
P.O. Box 20 (mailing)
Douglas, AK 99824
(907) 465-4290
Regional Supervisor - Rick Reed

OFFICE OF MANAGEMENT AND BUDGET

Division of Governmental Coordination
431 North Franklin St.
P.O. Box AW (mailing)
Juneau, AK 99811-0165
(907) 465-3562
Director - Paul Rusanowski

Function: Conducts coordinated state review of permits for mining projects within Alaska's Coastal Management Zone. Provides information to applicants on project design for consistency with the policies and standards of the Alaska Coastal Management Program. Coordinates state response to direct federal actions, including proposed regulations, that affect Alaska's mining industry.

Northern Regional Office
675 Seventh Ave.
Station H (mailing)
Fairbanks, AK 99701-4596
(907) 451-2818
Project Coordinator - Patti Wightman

Southcentral Regional Office
3601 C St., Ste. 370, Frontier Bldg.
Anchorage, AK 99503-5930
(907) 561-6131
Project Coordinator - Patty Bielawski

Southeastern Regional Office
431 North Franklin St.
P.O. Box AW (mailing)
Juneau, AK 99811-0165
(907) 465-3562
Project Coordinator - Lorraine Marshall

DEPARTMENT OF NATURAL RESOURCES

400 Willoughby Ave., 5th Fl.
Juneau, AK 99801
(907) 465-2400
Commissioner - Harold Heinze

Function: Principal state agency that administers Alaska's state lands.

Division of Forestry

3601 C St., Ste. 1058, Frontier Bldg.
P.O. Box 107005 (mailing)
Anchorage, AK 99510-7005
(907) 762-2501
Director - Malcolm R. Dick, Jr.

Function: *Establishes guidelines to manage mining in state forests.*

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709-4699
(907) 451-2660
Regional Forester - Lester Fortune

Southcentral Regional Office
3601 C St., Ste. 1008, Frontier Bldg.
P.O. Box 107005 (mailing)
Anchorage, AK 99510-7005
(907) 762-2511
Regional Forester - Dave Wallingford

Southeastern Regional Office
400 Willoughby Ave., 5th Fl.
Juneau, AK 99801
(907) 465-2491
Regional Forester - Jim McAllister

Division of Geological & Geophysical Surveys

794 University Ave., Ste. 200
Fairbanks, AK 99709-3645
(907) 474-7147
Acting Director - Dr. Thomas E. Smith

Function: *Conducts geological and geophysical surveys to determine the potential of Alaskan land for production of metals, minerals, fuels, and geothermal resources; locations and supplies of construction materials; potential geologic hazards to buildings, roads, bridges, and other installations and structures; and other surveys and investigations as will advance knowledge of the geology of Alaska and general geologic inventories. Publishes a variety of reports that contain the results of these investigations. Advises the public and government agencies on geologic issues. Maintains a library of geologic bulletins, reports, and periodicals. Maintains a drill-core storage facility at Eagle River.*

Southcentral Regional Office
400 Willoughby Ave., 3rd Fl.
Juneau, AK 99801
(907) 465-2633
Geologist - Roman J. Motyka

Division of Land

3601 C St., Ste. 814, Frontier Bldg.
P.O. Box 107005 (mailing)
Anchorage, AK 99510-7005
(907) 762-2692
Acting Director - Ron Swanson

Function: *Manages surface estate and resources, including materials (gravel, sand, and rock). Handles statewide and regional land-use planning. Issues leases, material-sale contracts, mill-site permits, land-use permits, and easements for temporary use of state land and access roads.*

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709-4699
(907) 451-2700
Regional Manager - Rick Smith

Southcentral Regional Office
3601 C St., Ste. 1080, Frontier Bldg.
P.O. Box 107005 (mailing)
Anchorage, AK 99510-7005
(907) 762-2253
Regional Manager - Veronica Gilbert

Southeastern Regional Office
400 Willoughby Ave., Ste. 400
Juneau, AK 99801
(907) 465-3400
Regional Manager - Andrew Pekovich

Division of Mining

3601 C St., Ste. 800, Frontier Bldg.
P.O. Box 107016 (mailing)
Anchorage, AK 99510-7016
(907) 762-2165
Acting Director - Sam Dunaway
Mining Information - Bob Stuvek

Function: *Principal agency for management of mining and reclamation on state land in Alaska. Maintains a mining information office in Fairbanks. Issues property rights to leasable minerals; adjudicates locatable mineral filings. Issues permits for hard-rock and placer-mining activity. Maintains records of mineral locations, permits, and leases. Provides technical, legal, and land-status information. Administers the Alaska Surface Mining Control and Reclamation Act (ASMACRA), which includes permitting and inspection of coal mining activity and reclamation of abandoned mines.*

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709-4699
(907) 451-2790
Regional Manager - John Wood
Mining Information - Erik Hansen

Division of Parks and Outdoor Recreation

3601 C St., Ste. 1200, Frontier Bldg.
P.O. Box 107001 (mailing)
Anchorage, AK 99510-7001
(907) 762-2602
Director - Neil Johannsen

Function: *Manages approximately 3,000,000 acres of state park lands primarily for recreational uses, preservation of scenic values, and watershed. Responsible for overseeing mining access, recreational mining activity, and valid mining claim inholdings within state park lands.*

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709-4699
(907) 451-2695
Regional Manager - Mike Lee

Southcentral Regional Office
3601 C St., Ste., 1280, Frontier Bldg.
P.O. Box 107001 (mailing)
Anchorage, AK 99510-7001
(907) 762-2617
Regional Manager - Al Meiners

Southeastern Regional Office
400 Willoughby Ave., 3rd Fl.
Juneau, AK 99801
(907) 465-4563
Regional Manager - William Garry

History and Archaeology Section
3601 C St., Ste. 1278, Frontier Bldg.
P.O. Box 107001 (mailing)
Anchorage, AK 99510-7001
(907) 762-2626
Section Chief and State Historic Preservation Officer - Judith Bittner
State Archaeologist - Robert Shaw

Division of Water

3601 C St., Ste. 800, Frontier Bldg.
P.O. Box 107005 (mailing)
Anchorage, AK 99510-7005
(907) 762-2145
Director - Ric Davidge

Function: *Manages water resources of the state; issues water-appropriation permits and certificates; responsible for safety of all dams in Alaska; conducts surveys to determine the locations, quantity, and quality of ground and surface water.*

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709-4699
(907) 451-2772
Hydrologist - Scott Ray
Water Quality Lab - 474-7713

Eagle River Office
18225 Fish Hatchery Road
P.O. Box 772116 (mailing)
Eagle River, AK 99577-2116
(907) 696-0070
Section Chief - William E. Long

Southeastern Regional Office
400 Willoughby Ave., 3rd Fl.
Juneau, AK 99801
(907) 465-2533
Hydrologist - Rick Noll

DEPARTMENT OF PUBLIC SAFETY

450 Whittier St.
P.O. Box N (mailing)
Juneau, AK 99811
(907) 465-4322
Commissioner - Richard Burton

Division of Fish and Wildlife Protection

5700 East Tudor Rd.
Anchorage, AK 99507
(907) 269-5509
Director - Colonel Jack W. Jordan

Function: Enforce state laws, in particular AS Title 16. Acts as enforcement arm for Alaska Department of Fish and Game.

DEPARTMENT OF REVENUE

State Office Bldg.
11th Fl., Entrance A
P.O. Box 5 (mailing)
Juneau, AK 99811-0400
(907) 465-2300
Commissioner - Lee E. Fisher

Income and Excise Tax Audit Division

State Office Bldg.
P.O. Box 5A (mailing)
Juneau, AK 99811-0400
(907) 465-2343
Audit Office Supervisor - Paul Dick

Function: Issues licenses (including mining) for production and sale of minerals.

Division of Audit

550 W. 7th Ave.
Anchorage, AK 99501
(907) 276-5364
Director - Larry E. Meyers

Function: Administers mining-license tax, which is based on net income, including royalties. On application, will grant certificate of tax exemption for first year of new mining operations, except for mining of sand and gravel. Tax returns must be filed annually.

UNIVERSITY OF ALASKA

Fairbanks, AK 99775-0760

College of Natural Sciences

Department of Geology & Geophysics
Duckering Bldg., Rm 437
(907) 474-7565
Department Head - Samuel E. Swanson

Function: Provides undergraduate and graduate education in geology and geophysics and conducts basic and applied research in geologic sciences. Offers B.S., M.S., and Ph.D. program options in general geology, economic geology, petroleum geology, geophysics, and ice-snow-permafrost geophysics.

School of Mineral Engineering

Brooks Bldg., Rm. 209
(907) 474-7366
Acting Dean - Russell Ostermann

Function: Provides undergraduate and graduate education programs in geological engineering, mining engineering, mineral preparation engineering, and petroleum engineering. Offers mining extension programs in both urban and rural areas. Through research programs conducts laboratory and field studies to promote mineral and energy development.

Mineral Industry Research Laboratory (MIRL)

O'Neill Resources Bldg., Rm. 212
(907) 474-7135 or 7136
Acting Director - Russell Ostermann
Associate Director - P.D. Rao

Function: Conducts applied and basic research in exploration, development, and utilization of Alaska's mineral and coal resources with emphasis on coal characterization, coal preparation, mineral beneficiation, fine gold recovery, hydrometallurgy, and environmental concerns. Publishes reports on research results and provides general information and assistance to the mineral industry.

Mining Extension Program

Duckering Bldg., Rm. 469
(907) 474-7702
Director - James A. Madonna

Function: Offers prospecting and introductory mineral and mining courses under an open admissions policy.

Mining and Petroleum Training Service

University of Alaska Anchorage
155 Smithway, Ste. 104
Soldotna, AK 99669
Director - Dennis D. Steffy
Asst. Director - Debbie J. Kendrick
(907) 262-2786

Function: Provides direct training and assistance to mine operators, service and support companies and governmental agencies in mine safety and health, mining extension, vocational mine training and technical transfer. Specialized training services in hazardous materials, first aid and CPR, industrial hygiene and professional safety education and consulting are available on demand.

FEDERAL AGENCIES

U.S. DEPARTMENT OF THE INTERIOR

Office of the Secretary
1689 C St., Ste. 100
Anchorage, AK 99501
(907) 271-5485
Special Assistant to the Secretary -
Curtis V. McVee
Staff Coordinator - Ronald B. McCoy

Function: Coordinates the Department of the Interior's policy and stewardship with DOI bureaus for the management of over 200 million acres of public land in Alaska. The Special Assistant to the Secretary also serves as the Chairman of the Federal Subsistence Management Board.

Bureau of Land Management

Alaska State Office
22 West 7th Ave., #13
P.O. Box 13 (mailing)
Anchorage, AK 99513-7599
State Director - Edward F. Spang
Mineral Resources Deputy State Director -
John Santora
(907) 271-3343
Mineral Development Program Leader -
Earl Boone
(907) 271-4212
Surface Management Program Oversight -
Ruth Stockie
(907) 271-4434
Public Room - (907) 271-5960

Function: Administers federal public lands (except national parks, wildlife refuges, national monuments, national forests, and military withdrawals). Issues leases for all federal leasable minerals including oil and gas, coal, phosphates, and oil shale. Arranges for sale of minerals other than leasable or salable materials, including sand, gravel, or stone. Issues right-of-way and special-use permits. Monitors mining operations to insure protection of surface resources. Maintains land-status plats and issues patents. Records federal mining claims and annual assessment affidavits.

Anchorage District Office
6881 Abbott Loop
Anchorage, AK 99507
(907) 267-1200
District Manager - Dick Vernimen

Arctic District Office
1150 University Ave.
Fairbanks, AK 99709-3844
(907) 474-2302
District Manager - Dee Ritchie

Nome Field Office
P.O. Box 952 (mailing)
Nome, AK 99762
(907) 443-2177
Natural Resource Specialist - Norm Messenger

Glennallen District Office
P.O. Box 147 (mailing)
Glennallen, AK 99588
(907) 822-3217
District Manager - Gene Keith

Kobuk District Office
1150 University Ave.
Fairbanks, AK 99709-3844
(907) 474-2332
District Manager - Helen Hankins

Steese-White Mountain Office
1150 University Ave.
Fairbanks, AK 99709-3844
(907) 474-2351
District Manager - Roger Bolstad

Kotzebue Field Office
P.O. Box 262 (mailing)
Kotzebue, AK 99752
(907) 442-3430
Natural Resource Specialist - Vacant

Tok Field Office
P.O. Box 309 (mailing)
Tok, AK 99780
(907) 883-5121
Manager - Bob Burritt

Fairbanks Support Center and Land Information Office (Public Room)

1150 University Ave.
Fairbanks, AK 99709-3844
(907) 474-2250
Support Center Manager - James Murray

Function: Primary contact for information on Interior and northern regions.

U.S. Bureau of Mines

Alaska Field Operations Center
201 East 9th Ave., Ste. 101
Anchorage, AK 99501
(907) 271-2455
Chief - Donald P. Blasko
Branch Chief - Vacant

Function: Alaska programs are designed to help develop a viable mineral industry in Alaska with an emphasis on strategic minerals. The two main thrusts of the programs are to provide data on mineral reserves needed by government agencies at all levels, but particularly by Congress and land managers, and to generate, accumulate, and supply mineral data to the mining industry. All Alaska projects are parts of mutually supportive programs: mineral land assessment, minerals availability, minerals policy analysis, state activities, and technology transfer.

Alaska Technology Transfer Office
201 East 9th Ave., Ste. 101
Anchorage, AK 99501
(907) 271-2455

Juneau Branch Office
P.O. Box 20550 (mailing)
Juneau, AK 99802-0550
(907) 364-2111
Branch Chief - David Carnes

Fairbanks Field Office
794 University Ave.
Fairbanks, AK 99709
(907) 479-4277
Section Supervisor - Vacant

U.S. Fish and Wildlife Service
Region 7 Office
1011 East Tudor Rd.
Anchorage, AK 99503
(907) 786-3522
Regional Director - Walter O. Stieglitz
Assistant Regional Director (Fish and Wildlife Enhancement) - Rowan W. Gould

Function: Administers the federal public lands in national wildlife refuges, issues special-use permits for activities on refuges, reviews permits and applications for various mining activities on all private and public lands and waters, and provides information to regulatory agencies on fish and wildlife and their habitat. Makes recommendations to regulatory agencies to mitigate adverse environmental impacts.

Fairbanks Fish and Wildlife Enhancement Ecological Service/Endangered Species Branch
101 12th Ave., Rm. 232
Box No. 20 (mailing)
Fairbanks, AK 99701
(907) 456-0203
Acting Field Supervisor - Patrick Sousa

Juneau Fish and Wildlife Enhancement Federal Bldg., Rm. 417
P.O. Box 21287 (mailing)
Juneau, AK 99802
(907) 586-7240
Field Supervisor - Nevin Holmberg

Anchorage Fish and Wildlife Enhancement
605 West 4th Ave., Rm. 62
Anchorage, AK 99501
(907) 271-2888
Field Supervisor - Dave McGillivray

U.S. Geological Survey
4230 University Dr.
Anchorage, AK 99508-4663
(907) 561-1181
Chief, Branch of Alaskan Geology - Willis H. White

Function: Investigates and reports on physical resources; configuration and character of land surface; composition and structure of underlying rocks; and quality, volume, and distribution of water and minerals. Conducts 1:250,000-scale geologic mapping under the auspices of the Alaska Mineral Resource Assessment Program (AMRAP).

Alaska Distribution USGS Section (for maps and brochures)
Federal Bldg.
101 12th Ave.
Fairbanks, AK 99701
(907) 456-0244

U.S. Geological Survey Earth Science Information Center
Geologic Division
4230 University Dr., Rm. 101
Anchorage, AK 99508-4667
(907) 561-1181

National Park Service

Alaska Regional Office
2525 Gambell St.
Anchorage, AK 99503
(907) 257-2643
Regional Director - Boyd Evison
Chief, Minerals Management - Floyd Sharrock
(907) 257-2626
Mining Engineer - Lynn S. Griffiths
(907) 257-2629

Function: Administers lands within the national park system in Alaska. Manages valid prior-right mining claims in parklands through plans of operation under Mining in Parks Act, National Park Service regulations, and other applicable federal and state laws and regulations.

U.S. DEPARTMENT OF LABOR

Mine Safety and Health Administration

117 107th Ave. NE., Rm. 100
Bellevue, WA 98004
(206) 442-7037
Bellevue Field Office Supervisor - Walter Turner (administers portions of Alaska south of Yukon River)

Juneau Field Office
Federal Building
107 West 9th
P.O. Box 22049 (mailing)
Juneau, AK 99802
(907) 586-7165
Inspector - Bob Casey

Mine Safety and Health Administration

205 North 4th St., Rm. 103
Coeur d'Alene, ID 83814
(208) 667-6680
Coeur d'Alene Field Office Supervisor - Bill Wilson (administers portions of Alaska north of Yukon River)

Function: Administers health and safety standards to protect the health and safety of metal, nonmetal and coal miners. Cooperates with the State to develop health and safety programs and develops training programs to help prevent mine accidents and occupationally caused diseases. Under agreement with the Coal Mine Safety and Health Office, the MSHA metal/nonmetal section has assumed responsibility for enforcement and training activities at coal mines in Alaska.

Mine Safety and Health Administration

Coal Mine Safety and Health, District 9
P.O. Box 25367, DFC
Denver, CO 80225
(303) 231-5458
District Manager - William A. Holgate

Function: Administers health and safety standards according to the Code of Federal Regulations to protect the health and safety of coal miners; requires that each operator of a coal mine comply with these standards. Cooperates with the State to develop health and safety programs and develops training programs to help prevent coal or other mine accidents and occupationally caused diseases in the industry.

U.S. DEPARTMENT OF AGRICULTURE

U.S. Forest Service

Regional Office
Federal Bldg.
P.O. Box 21628 (mailing)
Juneau, AK 99802-1628
(907) 586-7847
Regional Forester - Michael A. Barton

Function: Helps meet national mineral and energy needs by encouraging and supporting environmentally sound mineral enterprises on national forest system lands. Provides joint administration of general mining laws on national forest system lands with the Bureau of Land Management. Cooperates with Department of Interior agencies in the review and issuance of mineral leases. Issues permits for disposal of sand, gravel, and stone.

U.S. ENVIRONMENTAL PROTECTION AGENCY

Region 10 Headquarters

1200 6th Ave.
Seattle, WA 98101
(206) 553-1200
Acting Regional Administrator -
Ms. Dana Rasmussen

Function: Issues National Pollutant Discharge Elimination System (NPDES) permits under the Clean Water Act to regulate effluent discharges. Maintains regulatory and review authority over wetland and NEPA/EIS-related issues.

Alaska Operations Office
222 West 7th Ave., #19
Box 19 (mailing)
Anchorage, AK 99513
(907) 271-5083
Assistant Regional Administrator -
Alvin L. Ewing

Alaska Operations Office
3200 Hospital Dr., Ste. 101
Juneau, AK 99801
(907) 586-7619
Chief, State Operations Section - Steven Torok

U.S. DEPARTMENT OF THE ARMY

Corps of Engineers

Regulatory Branch
P.O. Box 898
Anchorage, AK 99506-0898
District Engineer - Col. William W. Kakel
Write: Attention: NPACO-R-S, or
Call: Chief of Compliance Section
(907) 753-2712 or (800) 478-2712
(in Alaska only)

Function: Regulates work in navigable waters of United States and discharge of dredged or fill material into United States waters, including wetlands. Examples of regulated mining activities include construction of berms, dikes, diversion pads, stockpiles, and reclamation activities.

COOPERATIVE STATE-FEDERAL AGENCIES

Alaska Public Lands Information Center

250 Cushman St., Ste. 1A
Fairbanks, AK 99701
(907) 451-7352
Manager - Karla Zervos
Assistant Manager - Lenore Heppler

Function: Clearinghouse for general information about land and resources in Alaska. Information sources include U.S. Forest Service, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, U.S. Geological Survey, Alaska Departments of Natural Resources and Fish and Game, and Alaska Division of Tourism.

BOARDS AND COMMISSIONS

Alaska Minerals Commission

P.O. Box 80148
Fairbanks, AK 99708
(907) 479-6240
Chairman - Earl H. Beistline

Function: The Mineral Commission was created by the Alaska State Legislature in 1986 to make recommendations to the Governor and the Legislature on ways to mitigate constraints on the development of minerals in Alaska. The Commission has published reports in January 1987, January 1988, January 1989.

Citizens' Advisory Commission on Federal Areas

250 Cushman St., Ste. 4H
Fairbanks, AK 99701
(907) 456-2012
Chairperson - Lou Williams
Executive Director - Stan Leaphart
Administrative Assistant - Michael Welsh

Function: The Citizens' Advisory Commission on Federal Areas was established in 1981 by the Alaska Legislature to protect the rights of Alaskans to continue their traditional uses of federal lands throughout the state. This was done in response to Congressional enactment in December 1980 of the Alaska National Interest Lands Conservation Act (ANILCA), which placed millions of acres of federally owned lands into conservation system units with restrictive land-use and management requirements.

Alaska Water Resources Board

P.O. Box 107005
Anchorage, AK 99510
Chairperson - Peg Tileston
(907) 563-4375
Water Resource Board Coordinator -
Mary Lou Harle
(907) 762-2680

Function: The Alaska Water Resources Board serves as an advisory group to the Governor on all matters relating to use and appropriation of water in the state of Alaska. The board has been particularly supportive of water resources legislation, including amendments to the Alaska Water Use Act for reservations of water and instream uses, basin-wide water rights adjudications, and housekeeping amendments to improve water-rights adjudication. The board has taken a keen interest in the state's water quality programs and water quality standards.

Alaska Science & Technology Foundation

550 West 7th Ave., Ste. 360
Anchorage, AK 99501-3555
(907) 272-4333
Executive Director - John W. Sibert

Function: The Foundation was created to make public funds available for long-term investment in economic development and technological innovation within the state and to improve the health status of its residents. Through the awarding of grants for basic and applied research, the

Foundation will enhance the State's economy and help build its science and engineering capabilities.

CHAMBERS OF COMMERCE

Alaska State Chamber of Commerce

415 E St., Ste. 201
Anchorage, AK 99510
(907) 278-2722
Chairman - Dr. John Sims
President - George Krusz
Regional Manager - Kathleen Tarr

Function: The State Chamber of Commerce researches and formulates positions on Alaskan resource development. Recommendations for consideration are submitted to the State Chamber of Commerce board of directors.

Juneau Chamber of Commerce

217 - 2nd St., Ste. 201
Juneau, AK 99801
(907) 586-6420

Greater Fairbanks Chamber of Commerce

709 2nd Ave.
Fairbanks, AK 99701
(907) 452-1105

Anchorage Chamber of Commerce

437 E St., Ste. 300
Anchorage, AK 99501
(907) 272-2401

NONGOVERNMENTAL GROUPS AND ASSOCIATIONS

Alaska Miners Association, Inc.

Statewide Office
501 West Northern Lights Blvd., Ste. 203
Anchorage, AK 99503
(907) 276-0347
Statewide President - Neil MacKinnon
Executive Director - Steven C. Borell

Anchorage Branch

Chairman - Kevin Adler
501 West Northern Lights Blvd.,
Ste. 203
Anchorage, AK 99503
(907) 274-6473

Fairbanks Branch

Chairman - Josh Moore
P.O. Box 73069
Fairbanks, AK 99707
(907) 451-6650

Juneau Branch

Chairman - David Stone
P.O. Box 21684
Juneau, AK 99802
(907) 586-2255

Kenai Branch

Chairman - Dennis Steffy
c/o Mining & Petroleum Training
Service (MAPTS)
155 Smithway, Ste. 104
Soldotna, AK 99669
(907) 262-2788

Nome Branch

Chairman - Irene Anderson
P.O. Box 1974
Nome, AK 99762
(907) 443-5296

Alaska Women in Mining

Fairbanks Branch
Sandra Stillion, President
P.O. Box 83542
Fairbanks, AK 99708
(907) 455-6208

Anchorage Branch

Ronna Bissonette, President
P.O. Box 240334
Anchorage, AK 99524
(907) 276-6762

Society of Mining Engineers

P.O. Box 625002
Littleton, CO 80162-5002
(303) 973-9550

Alaska Section

Chairman - Richard Swainbank
1001 Noble St., Ste. 360
Fairbanks, AK 99701
(907) 452-7464

Southern Alaska Section

Chairman - Russell M. Kucinski
U.S. Nat'l. Park Service
11901 Rainbow Ave.
Anchorage, AK 99516
(907) 257-2634

Secretary Treasurer - John Rishel

WGM, Inc.
P.O. Box 100059
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Western Mining Council

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ORGANIZED MINING DISTRICTS

Circle Mining and Recording District

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Fairbanks Mining District

Don Stein, President
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Forty-Mile Miners Association

Mike Busby, President
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Juneau Mining District

Dr. Roger Eichman, President
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Kantishna Mining District

Sam Koppenburg, President
SRD Box 9070
Palmer, AK 99645

Iditarod Mining District

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Livengood-Tolovana Mining District

Rose Rybachek, President
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North Pole, AK 99707

Seward Mining District

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Valdez Mining District
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MINERAL EDUCATION PROGRAM

**ALASKA MINERALS AND ENERGY
RESOURCE EDUCATION FUND (AMEREF)**
P.O. Box 190927
Anchorage, AK 99519-0927
(907) 274-2211

Function: A nonprofit corporation formed to help prepare students in grades four through eight to make informed decisions about Alaska's mineral and energy resources.

Alaska Department of Education
P.O. Box F
Juneau, AK 99811-0500
(907) 465-2841
Commissioner - Jerry Covey
Educational Specialist - Terri Campbell, State
Coordinator of AMEREF

ENVIRONMENTAL ORGANIZATIONS

The following two organizations submitted addresses to be included in this appendix. They have been actively involved in mining issues statewide including water quality, reclamation rent, and royalty reform. Litigation has been sometimes used and resulted in court rulings. Both organizations state their primary interests and perspective as maintenance of environmental quality and adherence to environmental laws and regulations.

Trustees for Alaska
725 Christensen Dr., Ste. 4
Anchorage, AK 99501
Randall M. Weiner, Executive Director

Alaska Environmental Assembly
419 - 6th St., Ste. 328
Juneau, AK 99801
Executive Director - Karla Hart

APPENDIX D

Selected significant mineral deposits in Alaska^a (locations shown in figs. 44-46)

- Map no.**
- 1 **Lik-Su** - Major strata-bound massive sulfide (Zn-Pb-Ag-Cd-Ba) deposits in black shale and cert. Proven reserve (Lik) estimate of 24 million tons of 9 percent Zn, 3.1 percent Pb, and 1.4 oz/ton Ag.
 - 2 **Red Dog** - At least two major strata-bound massive sulfide deposits hosted in Pennsylvanian or Mississippian shale; similar to locality 1. Main deposit at Red Dog contains at least 85 million tons of 17.1 percent Zn, 5 percent Pb, 2.4 oz/ton Ag; nearby Hilltop deposit contains significant undisclosed reserves.
 - 3 **Drenchwater** - Mississippian and Lisburne Group shales and cherts contain three strata-bound base metal occurrences spatially related to acid volcanics. In the lowest unit a siliceous mudstone contains a 2-ft layer with up to 23 percent zinc. An overlying gray chert contains up to 11 percent zinc and up to 5 percent lead with some silver in fracture fillings. At the top of the overlying tuffaceous layer silver-bearing zinc and lead mineralization outcrops discontinuously for at least 6,500 ft, and contains up to 26 percent zinc and 51 percent lead in a grab sample.
 - 4 **Ginny Creek** - Epigenetic, disseminated Zn-Pb-Ag deposits with barite in sandstone and shale of Noatak Sandstone of Late Devonian through Early Mississippian age. Random grab samples of surface float contain 0.3 to 3.0 percent Zn and highly variable amounts of Pb and Ag.
 - 5 **Story Creek** - Epigenetic replacement deposits of Zn-Pb-Ag-Cu-Au hosted in brecciated zones in Devonian Kanayut Conglomerate or Lower Mississippian Kayak Shale. Grab samples of high-grade material contain up to 0.43 percent Cu, 34 percent Pb, 28.8 percent Zn, 0.04 oz/ton Au, and 30 oz/ton Ag.
 - 5a **Kivliktort Mountain** - Mineralized float is widespread on the north flanks of the mountain, apparently spatially related to the contact between shales at the base of the hills and coarse-grained siliceous clastic rocks on the upper slopes. Rock samples containing up to 30 percent zinc have been reported.
 - 6 **Whoopee Creek** - Epigenetic replacement deposits of Zn-Pb-Cu-Ag-Au-Cd in breccia zones in Devonian Kanayut Conglomerate or Lower Mississippian Kayak Shale. Random grab samples of mineralized material contain 0.24 percent Cu, 0.37 percent Cd, 46 percent Zn, 44 percent Pb, 0.14 oz/ton Au, and 14.8 oz/ton Ag.
 - 7 **Omar** - Epigenetic replacement deposits of Paleozoic age; include bedded barite occurrences. Grab samples contain 15.3 percent Cu, 0.15 percent Pb, 0.95 percent Zn, 0.05 percent Co, and 0.3 oz/ton Ag.
 - 7a **Frost** - Possible 9 million tons barite in pods, lenses and wavey-banded quartz-calcite-barite veins. Chalcopyrite and galena occur in the veins which cross cut Paleozoic limestone and dolomite for a minimum distance of 1 mile. Samples contain up to 13.2 percent Zn.
 - 8 **Bornite** - Major strata-bound Cu-Zn deposit in brecciated carbonate rock of Devonian age; 4.56 million ton orebody contains 4.0 percent Cu and accessory Zn and Co. Larger reserve estimate of 36.2 million tons of about 2 percent Cu and undisclosed amount of Zn and Co. At grade of 1.2 percent Cu, reserves are 100 million tons.
 - 9 **Arctic** - Major volcanogenic (Cu-Zn) massive sulfide deposit hosted in sequence of metarhyolite, metatuff, and graphitic schist of Devonian age; indicated reserves of 35 to 40 million tons grade 4.0 percent Cu, 5.5 percent Zn, 0.8 percent Pb, 1.6 oz/ton Ag, and 0.02 oz/ton Au.
 - 10 **Sun** - Major (Cu-Pb-Zn-Ag) massive sulfide deposit in sequence of middle Paleozoic metarhyolite and metabasalt; indicated 1976 gross-metal value of Cu, Pb, Zn, and Ag was over \$1 billion. Average grades are 1-4 percent Pb, 6-12 percent Zn, 0.5-7 percent Cu, 3-11 oz/ton Ag.
 - 11 **Smucker** - Middle Paleozoic volcanogenic massive sulfide deposit; 3,000 ft long and up to 190 ft wide contains significant tonnage of Cu-Pb-Zn ore that grades 1.5 percent Pb, 5 to 10 percent Zn, 3 to 10 oz/ton Ag, with minor Au.
 - 12 **Avan Hills** - Disseminated chromite in layered ultramafic rocks; grab samples contain up to 4.3 percent Cr with 0.015 oz/ton PGM.
 - 13 **Misheguk Mountain** - Chromite occurrences similar to those in Avan Hills.
 - 14 **Klery Creek** - Lode and placer Au deposits worked intermittently from 1909 through 1930s. Total production through 1931, mostly from placer deposits, estimated at 31,320 oz.
 - 15 **Ernie Lake** - (Ann Creek) Strata-bound massive sulfide occurrence in metarhyolite, metatuff, and marble. Gossan zones strongly anomalous in Cu-Pb-Zn and Ag.
 - 16 **Koyukuk-Nolan mining district** - Major placer Au district; from 1893 to present, produced more than 300,000 oz Au. Significant deep placer reserves remain.
 - 17 **Chandalar mining district** - Major Au producing district; substantial production in excess of 30,000 oz Au from lode and placer sources; lode gold found in crosscutting quartz veins that intrude schist and greenstone. Active development of placer deposits and lodes in progress. Estimated 45,000 tons at 2-4 oz/ton in partially explored veins.

^aThis generalized summary does not describe all the known 6,400 mineral occurrences and deposits known in Alaska. In cooperation with DGGs, the U.S. Geological Survey released Bulletin 1786: "Significant metalliferous lode deposits and placer districts in Alaska," which describes 262 significant metalliferous lodes and 43 placer districts.

- 18 Porcupine Lake** - Stratiform fluorite occurrences and argentiferous enargite, tetrahedrite associated with felsic volcanic rocks of late Paleozoic age. Reported grades of up to 25 to 30 percent fluorite reported, with grab samples of 4.8 percent Cu and 0.2 percent silver.
- 19 Wind River** - Strata-bound Pb-Zn massive sulfide prospects; reported grades of up to 5 percent Pb.
- 20 Esotuk Glacier** - Disseminated Mo-Sn-W-Pb-Zn mineralization in skarns associated with Devonian(?) schistose quartz monzonite. Grab samples contain up to 0.08 percent Sn and 0.15 percent W.
- 21 Bear Mountain** - Major stockwork Mo-W-Sn occurrence in intrusive breccia. Rock samples containing up to 0.8 percent molybdenum and 0.6 percent W occur within a 35 acre area where soil samples average more than 0.2 percent MoS_2 , and an adjacent 25 acre area where rubble contains wolframite has soils averaging greater than 0.12 percent WO_3 . Rubble crop in this area indicates a Tertiary porphyry system as the source of the molybdenum and tungsten.
- 21a Galena Creek** - steeply dipping veins contain up to 21 percent Cu, 3.5 percent Zn, and 1.3 percent Pb with 5-1/2 oz/ton Ag on the east side of the creek, and a large area of disseminated mineralization and veinlets contains predominantly zinc on the ridge west of the creek.
- 22 Cape Creek** - Major placer Sn producer. More than 500 tons Sn produced from 1935 to 1941; at least 500 tons produced in last 10 yr. Derived from Cape Mountain in contact zone of Cretaceous granite.
- 23 Buck Creek** - Major placer Sn producer. More than 1,100 tons Sn produced from 1902 to 1953.
- 24 Lost River** - Major Sn, fluorite, W, and Be deposit associated with Cretaceous Sn granite system. More than 350 tons Sn produced from skarn and greisen lode sources. Measured reserves amount to 24.6 million tons that grade 0.15 percent Sn, 16.3 percent CaF_2 , and 0.03 percent WO_3 , based on 45,000 ft of diamond drilling.
- 25 Ear Mountain** - Placer Sn district and Sn-Cu-Au-Ag-Pb-Zn skarn mineralization of Cretaceous age. Area also anomalous in uranium.
- 26 Kougarok Mountain** - Sn deposit hosted in quartz-tourmaline-topaz greisen of Cretaceous age. Grades may average 0.5 percent Sn and 0.01 percent Ta and Nb, but a high grade resource of 150,000 tons grading 1 percent + has been identified.
- 27 Hannum** - Stratiform, carbonate hosted Pb-Zn-Ag massive sulfide deposit of middle Paleozoic age in heavily oxidized zone that ranges from 30 to 150 ft thick. Mineralized zone reported to assay up to 10 percent Pb, 2.2 percent Zn, 0.04 oz/ton Au, and 1.76 oz/ton Ag.
- 28 Independence Creek** - Pb-Zn-Ag massive sulfide deposit; high-grade ore shipped in 1921 contained 30 percent Pb, 5 percent Zn, and 150 oz/ton Ag. Mineralization restricted to shear zone in carbonates
- 29 Sinuk River** - Stratiform Pb-Zn-Ag-Ba-F massive sulfide deposits and layered iron deposits of Paleozoic age. Mineralized zones extend over 8,000 ft along strike.
- 30 Nome mining district** - Major placer Au and lode Au producer. Production in excess of 4,348,000 oz Au. Sporadic Sb and W production in past.
- 31 Rock Creek** - About 6.6 million tons grading 0.072 oz/ton Au in vein swarms and strangers in an area 1,500 ft long, 500 ft maximum width and 300 ft deep.
- 32 Big Hurrah** - Epigenetic vein deposit in black slate and metasediments of York Slate. Deposit contains some W mineralization and has produced over 20,000 oz Au from nearly 50,000 tons milled ore. Proven, inferred, and indicated reserves total 104,000 tons that grade 0.61 oz/ton Au, 0.55 oz/ton Ag, and credits of WO_3 .
- 33 Solomon mining district** - Major placer Au district; produced over 250,000 oz Au.
- 34 Kachauik** - Uranium prospect in Cretaceous alkalic intrusive rocks. Highly anomalous geochemical values and U concentrations of 1,000 ppm reported.
- 35 Omalik** - Vein-type Pb-Zn-Ag massive sulfide prospect in Paleozoic carbonate rocks; from 1881 to 1900, produced 300 to 400 tons of Pb-Zn ore that averaged about 10 percent Pb and 40 oz/ton Ag. Grades of oxidized Zn ore reported to be up to 34 percent Zn.
- 36 Windy Creek** - Disseminated Mo-Pb-Zn mineralization in quartz veins and skarns with reported values as high as 0.15 percent Mo.
- 37 Quartz Creek** - Significant Pb-Zn-Ag mineralization; reported grades of 15 percent combined Pb-Zn and 10 oz/ton Ag.
- 38 Placer River** - Significant Mo-F mineralization disseminated in intrusive rocks. Reported values of 0.2 percent Mo.
- 39 Candle Creek** - Placer Au deposits with significant reserves. Placer concentrates reported to have significant U and galena concentrations.
- 40 Poovookpuk Mountain** - Porphyry Mo mineralization. Reported grades of up to 0.25 percent Mo.
- 41 Purcell Mountain** - Mo and Ag occurrences associated with Cretaceous alkalic igneous plutons, alaskite, and bostonite dikes.
- 42 Koyukuk-Hughes mining district** - Production of 230,000 oz Au from 1930 to 1975, mainly from Alaska Gold dredging operation at Hogatza; dredge reactivated in 1981, but deactivated in 1984. Nonfloat mechanized operation on Utopia Creek produced significant amount of placer Au from 1930 to 1962.
- 43 Flat mining district** - Major placer Au district; produced 1,535,701 oz Au through 1986. Potential exists for occurrence of significant lode-Au and lode-W reserves at Golden Horn deposit and other known lodes in region associated with shear zones and monzonite intrusive rocks of Late Cretaceous age.
- 43a Innoko-Tolstoi mining district** - Major placer Au district with significant lode Au-Sb-Hg potential; lode sources for placers are volcanic-plutonic complexes of Late Cretaceous age and dike swarms that intrude Mesozoic flysch; mining district produced 582,432 oz Au from placer deposits.

- 44** **Nixon Fork** - Promising Au-Cu deposits; Nixon Fork mine produced 57,000 oz Au from Late Cretaceous skarns associated with quartz monzonite-Devonian limestone contact zones. Indicated reserve of 320,000 oz gold in 285,000 tons of ore.
- 44a** **Illinois Creek** - Reserves (all categories) of 1.3 million tons at 0.093 oz/ton gold and 1.84 oz/ton silver, or 2.7 million tons of 0.059 oz/ton gold and 1.60 oz/ton silver.
- 45** **Bonanza Creek** - Skarn-type W mineralization along intrusive contact; no published information available.
- 46** **Ruby mining district** - Placer Au-Sn district; produced more than 420,000 oz Au from 1931 to 1960; mining district also contains Pb-Ag prospects with grades reportedly as high as 82 oz/ton Ag.
- 47** **Hot Springs mining district** - Placer Au-Sn district; produced more than 450,000 oz Au and over 720,000 lb cassiterite through 1981. Includes Eureka and Tofty subdistricts.
- 48** **Livengood-Tolovana mining district** - Placer Au district; produced more than 448,000 oz Au since discovery in 1914. Substantial reserves remain.
- 49** **Fairbanks mining district** - Seventh largest Au-producing district in United States; largest producer in Alaska. Produced about 8,000,000 oz Au from placer deposits. Major lode-Au and lode-Sb producer; produced more than 285,000 oz Au and over 4 million lb Sb from veins and shear zones through 1970. Production of W exceeded 4,000 tons since 1915, all derived from tectite and skarn near Cretaceous quartz monzonite.
- 49a** **Fort Knox** - Disseminated gold deposit within granodiorite/quartz monzonite pluton near Fairbanks. Prefeasibility study, 1990, indicates resource of 7.1 million oz, of which over 4 million oz may be recoverable from about 135 to 220 million tons of rock depending on the mining scenario.
- 49b** **Ryan lode** - Complex shear zone with high-grade gash-veins in schist with estimated reserves to a depth of 200 ft of 1.2 million tons. Work in 1990 identified the shear at a depth of 1,000 ft, and demonstrated a subparallel gold-bearing shear within monzodioritic igneous rocks open along strike and at depth, with estimated reserves to 100 ft of 350,000 tons grading 0.077 oz per ton.
- 49c** **Grant Mine** - A series of subparallel gold-bearing quartz veins in the schist and quartzite of Ester Dome. Indicated reserves, 1990, on one vein system, the O'Dea, are 212,000 tons of 0.36 oz/ton gold. Other similar vein systems have been identified within the property.
- 50** **Mt. Prindle** - Significant uranium-rare-earth mineralization in Mesozoic alkaline igneous rocks. Rock geochemical values of up to 0.7 percent uranium; up to 15 percent rare-earth elements reported.
- 51** **Twin Mountain** - Significant W mineralization associated with skarn development along contact zone of quartz monzonite stock of Cretaceous age.
- 52** **Circle mining district** - Currently Alaska's largest producing placer-Au district; produced 917,500 oz Au since discovery in 1893. Has significant potential for Sn, W, and Au mineralization from variety of lode sources.
- 53** **Three Castle Mountain, Pleasant Creek, Casca VABM** - Strata-bound Pb-Zn massive sulfide mineralization. Reported grades of up to 17 percent Zn and 2 percent Pb.
- 54** **Totatlanika River lode zone, Anderson Mountain, Dry Creek, Virginia Creek** - Significant volcanogenic Cu-Pb-Zn-Ag massive sulfide deposits of Devonian to Mississippian age in Bonfield mining district. Potential for high-grade deposits reported. Includes Liberty Bell strata-bound Au deposit and Sheep Creek; latter contains Sn and base metals.
- 55** **Delta massive sulfide belt** - Contains at least 30 known volcanogenic massive sulfide deposits and occurrences. Grades from 0.3 to 1.1 percent Cu, 1.7 to 5.7 percent Zn, 0.5 to 2.3 percent Pb, 0.7 to 2.0 oz/ton Ag, and 0.018 to 0.061 oz/ton Au; estimated potential reserve of 40 million tons for all deposits.
- 56** **Mosquito, Peternie** - Porphyry Mo prospects of early Tertiary age; reported grades of up to 0.17 percent Mo.
- 57** **Taurus** - Major porphyry Cu-Mo prospect of Paleocene age with at least 500 million tons of mineralization. Reported potential for large tonnage of 0.5 percent Cu and 0.05 percent Mo.
- 58** **Big Creek, Ladue** - Strata-bound Pb-Zn-Ag massive sulfide prospects in metavolcanic rocks.
- 59** **Slate Creek** - At least 55 million tons of 6.3 percent, high-quality chrysotile asbestos in serpentinized ultramafic rocks of Permian(?) age.
- 60** **Fortymile mining district** - Major placer Au district. Produced over 501,000 oz Au since discovery in 1886.
- 61** **Kantishna mining district** - Major placer Au and lode Ag-Au-Pb-Zn-Sb-W district. Produced more than 92,000 oz placer-Au, about 260,000 oz lode Ag, and several million lb Sb from shear zones and vein deposits hosted in Precambrian metamorphic units. Potential exists for significant Ag-Au-Pb-Zn deposits. Metalliferous strata-bound deposits occur in schist and quartzite.
- 62** **Stampede mine** - Major Sb deposit; produced more than 3.5 million lb Sb from large shear zone in Precambrian metamorphic rocks.
- 63** **Coal Creek** - Greisen-hosted Sn-Cu-W deposit in "McKinley" age pluton (55 Ma. old). Reported reserves of 5 million tons of ore that grade 0.28 percent Sn and 0.3 percent Cu with credits of W, Ag, and Zn.
- 64** **Golden Zone mine** - Major Au-Cu-Ag deposits in Late Cretaceous breccia pipe. Produced more than 1,581 oz Au, 8,617 oz Ag, and 42,000 lb Cu. Estimated reserves are 230,000 contained ounces of gold.
- 65** **Nim Prospect** - Porphyry Cu-Ag-Au deposit of Late Cretaceous age. Reported grades of up to 5.0 percent Cu and 9 oz/ton Ag.
- 66** **Valdez Creek** - 316,000 ounces of proven and probable reserves plus 313,000 ounces of possible reserves in paleoplacer channels.

- 67 Denali Prospect** - At least six small, strata-bound Cu lodes in volcanic sedimentary rocks of Triassic age that may contain 5 million tons ore that grade about 2 percent Cu with credits of Ag.
- 68 Chistochina** - Porphyry Cu prospects of Tertiary age and placer-Au district; produced more than 177,000 oz Au and small amount Pt from placer deposits.
- 69 Nabesna mine** - Classic high-grade Au skarn that envelopes quartz diorite of Jurassic(?) age; produced over 66,960 oz Au from about 88,000 tons of ore from 1930 to 1941.
- 70 Spirit Mountain** - Massive and disseminated Cu-Ni mineralization in mafic-ultramafic complex.
- 71 Kennecott deposits** - Major stratiform Cu-Ag massive sulfide deposits localized near contact between Chitstone Limestone and Nikolai Greenstone of Triassic age; contained some of highest grade Cu lodes mined in North America. From 1911 to 1938, produced more than 1.2 billion lb Cu and 10 million oz Ag from 4.8 million tons ore. Some reserves remain.
- 72 Binocular and other prospects** - Kennecott-type Cu-Ag massive sulfide deposits.
- 73 Bond Creek - Orange Hill** - Two major porphyry Cu-Mo deposits of Late Cretaceous age; reported inferred reserves of 850 million tons ore that grade 0.3 to 0.5 percent Cu and 0.03 percent Mo.
- 74 Carl Creek** - Porphyry Cu prospect in altered intrusive complex; similar to locality 73.
- 75 Baultoff** - Porphyry Cu prospect in altered intrusive rocks; inferred reserves of 145.1 million tons of 0.20 percent Cu similar to locality 73.
- 76 Horsfeld** - Porphyry Cu prospect; similar to locality 73.
- 77 Midas mine** - Significant strata-bound Cu (Ag-Au-Pb-Zn) massive sulfide deposit in volcanic sedimentary rocks of Tertiary Orca Group. Produced more than 3.3 million lb Cu from 49,350 tons ore.
- 78 Ellamar** - Strata-bound Cu-Zn-Au massive sulfide deposit in sediment of Eocene(?) Orca Group. Produced more than 16 million lb Cu, 51,307 oz Au, and 191,615 oz Ag from about 301,835 tons ore.
- 79 Willow Creek, Independence, Lucky Shot, War Baby** - Major lode-Au (Ag-Cu-Pb-Zn-Mo) in veins that cut Mesozoic quartz diorite. Produced more than 448,082 oz Au from lode sources and about 35,000 oz Au from associated placer deposits.
- 80 Latouche, Beatson** - Major strata-bound Cu-Zn-Ag massive sulfide deposits in Orca Group sedimentary rocks and mafic volcanic rocks. Produced more than 205 million lb Cu from 6 million tons ore. Inferred reserves of 4.53 million tons ore that grade 1 percent Cu, 1.5 percent Pb + Zn, and 1 oz/ton Ag may remain.
- 81 Rua Cove** - Major strata-bound Cu-Zn massive sulfide deposit in complex ore shoots enclosed in mafic volcanic rocks of Orca Group. Reported reserves of over 1.1 million tons ore that grade 1.25 percent Cu.
- 82 Red Mountain** - Significant Cr occurrence associated with layered ultramafic complex of Tertiary age at Red Mountain near Seldovia. More than 36,000 tons metallurgical-grade ore shipped through 1976; huge low-grade chrome resource may remain, of which 30 million tons grade 5.1 percent Cr₂O₃.
- 83 Red Devil** - Major Hg-Sb deposit; moderate-grade ore hosted in shear zones in Kuskokwim Group sedimentary rocks. More than 35,000 flasks Hg produced from 75,000 tons ore.
- 84 Nyac mining district** - Significant placer Au district. Aniak mining district (of which Nyac is a part) produced more than 230,000 oz Au from placer deposits.
- 85 Goodnews Bay** - Major placer Pt district; estimated to have produced over 540,000 oz refined Pt-group metals from 1934 to 1976; one of the largest known Pt-group metal resources in United States. Possible reserves of 60 million yd³ of deep, Pt-bearing gravels remain. Lode source believed to be Alaskan-type zoned ultramafic complex of Cretaceous age.
- 86 Apollo-Sitka mines** - Major lode Au deposits; produced more than 107,900 oz Au from ore that averaged about 0.22 oz/ton Au. Inferred reserves may amount to 748,000 tons that grade 0.76 oz/ton Au, 2.16 oz Ag, and several percent base metal.
- 87 Pyramid** - Late Tertiary porphyry Cu-Mo deposit; inferred reserves of 125 million tons ore that grade 0.4 percent Cu and 0.03 percent Mo reported.
- 88 Ivanof** - Late Tertiary porphyry Cu prospect; grades of up to 0.72 percent Cu reported. Potential for large tonnages.
- 89 Weasel Mountain, Bee Creek** - Porphyry Cu-Mo prospect of late Tertiary to Quaternary age; grades of up to 0.48 percent Cu and 0.035 percent Mo reported. Potential for moderate tonnages of low-grade mineralization.
- 90 Mike deposit** - Porphyry Mo prospect of late Tertiary age; grades of up to 0.21 percent Mo reported. Potential for large tonnages of low-grade Mo mineralization.
- 91 Rex deposit** - Porphyry Cu prospect similar to locality 90; grades of up to 0.3 percent Cu reported. Potential for moderate reserves of low-grade mineralization.
- 92 Kasna Creek** - Major stratiform Cu-Pb-Zn and skarn-sulfide deposits of Mesozoic age in mafic, volcanic, and sedimentary rocks; reported reserves of over 10 million tons ore that grade more than 1 percent Cu.
- 93 Sleitat Mountain** - High grade east-west-trending, topaz-quartz-tin-tungsten greisen system hosted in 57 Ma. old binary granite and in hornfels. Zone up to 3,000-ft-long and 500-ft-wide. One drill-hole showed 85 ft of 1.8 percent tin, 0.4 percent tungsten.
- 94 Jimmy Lake** - Complex Cu-Ag-Sn mineralization of late Tertiary(?) age; reported grades of up to 105 oz/ton Ag and 3 percent Cu.
- 95 Haines Barite** - Major stratiform Ba-Pb-Zn-Cu-Ag deposit in pillow basalt-dominated section of Paleozoic or Triassic age; consists of 48- to 60-ft-thick zone of 60-percent barite with upper zone (2 to 8 ft thick) of massive sulfides that contain 2 percent Pb, 3 percent Zn, 1 percent Cu, 2 to 4 oz/ton Ag, and 0.12 oz/ton Au. Estimated to contain 750,000 tons of 65 percent barite with metal credits.

- 96 Klukwan** - Major Fe-Ti deposits in zoned ultramafic complex of Mesozoic age; reported to contain 3 billion tons of material that contain 16.8 percent Fe and 1.6 to 3.0 percent Ti.
- 97 Nunatak** - Porphyry Mo deposit; reported reserves of 8.5 million tons ore that grade 0.125 percent Mo and 129 million tons of 0.04 percent Mo.
- 98 Brady Glacier** - Major Ni-Cu deposit in layered gabbro-pyroxenite complex of Tertiary age. Proven reserves of 100 million tons ore that grade 0.5 percent Ni and 0.3 percent Cu reported; also contains significant Co and Pt concentrations.
- 99 Mertie Lode and Funter Bay mining district** - Contains substantial reserves of lode Au mineralization. Past production totaled 10,000 to 15,000 oz Au. Deposits also contain significant Ni-Cu and Pb-Zn-Ag mineralization. Funter Bay deposit contains reported reserves of 560,000 tons that grade 0.34 percent Ni, 0.35 percent Cu, and 0.15 percent Co in gabbro-pipe system.
- 100 Alaska-Juneau** - Major lode Au deposit that consists of 100- to 300-ft wide zone that contains enechelon, gold-bearing quartz veins in metamorphic rocks; produced more than 3.52 million oz Au from 88.5 million tons ore from 1893 to 1944. Reserves (all categories), of 105.7 million tons of 0.05 oz/ton gold remain.
- 101 Chichagof and Hirst Chichagof** - Major lode-Au deposits in quartz veins that cut Mesozoic graywacke; produced more than 770,000 oz Au. Chichagof mine produced about 700,000 oz Au and 200,000 oz Ag; Hirst Chichagof mine produced about 67,980 oz Au and 20,000 oz Ag. Inferred lease reserves estimated to be 100,000 oz.
- 102 Mirror Harbor** - Ni-Cu mineralization in layered-gabbro complex of Mesozoic age; reported probable reserves of 8,000 tons of 1.57 percent Ni and 0.88 percent Cu and reported inferred reserves of several million tons ore that grade 0.2 percent Ni and 0.1 percent Cu.
- 103 Bohemia Basin** - Major Ni-Cu-Co mineralization in layered mafic complex similar to locality 102; reported reserves of 22 million tons ore that grade 0.33 to 0.51 percent Ni, 0.21 to 0.27 percent Cu, and 0.02 percent Co.
- 104 Apex-El Nido** - Significant lode Au-W deposits that occur as crosscutting veins in graywacke; produced more than 50,000 oz Au.
- 105 Greens Creek** - Major sediment-hosted Pb-Zn-Cu-Ag-Au volcanogenic massive sulfide deposit of Devonian or Triassic age; most recent reserve estimate is about 17.5 million tons ore that grades about 25.3 oz/ton Ag, 0.16 oz/ton Au, 10.8 percent Zn, and 4.1 percent Pb.
- 106 Sumdum** - Volcanogenic Cu-Pb-Zn massive sulfide deposit in Mesozoic metamorphic complex with potential strike length of over 10,000 ft. Inferred reserves of 26.7 million tons ore that grade 0.57 percent Cu, 0.37 percent Zn, and 0.3 oz/ton Ag reported.
- 107 Snettisham** - Fe-Ti deposit in mafic zoned-intrusive complex; reported grades of about 18.9 percent Fe and 2.6 percent Ti.
- 108 Tracy Arm** - Strata-bound Cu-Zn-Pb massive sulfide prospect in Mesozoic schist; over 1,100 ft long and up to 12 ft thick. Reported grades of 1.5 percent Cu, 3.9 percent Zn, 0.76 oz/ton Ag, and 0.013 oz/ton Au.
- 109 Red Bluff Bay** - Significant chrome mineralization in Mesozoic ultramafic complex (probably ophiolite); reported reserves of 570 tons of material that grade 40 percent Cr and 29,000 tons that grade 18 to 35 percent Cr.
- 110 Cornwallis Peninsula** - Volcanogenic Cu-Pb-Zn-Ag-Ba massive sulfide deposit of Triassic(?) age; reported grades of up to 20 percent Pb-Zn and 23 oz/ton Ag.
- 111 Castle Island** - Stratiform barite deposit of Triassic age hosted in carbonate and pillow basalt; about 856,000 tons of raw and refined barite produced from 1963 to 1980; also contains Zn, Pb, and Cu sulfides. Reported to be mined out.
- 112 Ground Hog Basin** - Area contains several stratiform massive sulfide prospects in Mesozoic schist and gneiss whose origins are unknown. Reported grades of up to 8 percent Pb, 29 oz/ton Ag, and 0.5 oz/ton Au. Area also contains potential for porphyry Mo deposits.
- 113 Snipe Bay** - Ni-Cu deposit in zoned mafic-ultramafic complex; inferred reserves of 430,000 tons of 0.3 percent Ni, 0.3 percent Cu, and 0.13 oz/ton Ag reported.
- 114 Kasaan Peninsula** - Major skarn-type Cu-Fe-Au massive sulfide deposit of Jurassic age; area has produced over 28 million lb Cu and 55,000 oz Ag. Reported reserves of 4 million tons ore that grade 50 percent Fe and less than 2 percent Cu.
- 115 Salt Chuck** - Cu-PGM-Ag-Au deposit in contact zone between pyroxenite and gabbro within Alaskan-type zoned mafic-ultramafic pluton. From 1900 to 1941, 5 million lb Cu, over 20,000 oz PGM, and Au and Ag credits were produced from 325,000 tons ore.
- 116 Union Bay** - Significant Fe-Ti mineralization in ultramafic complex; area also contains Pt and V concentrations.
- 117 Hyder mining district** - Area produced more than 25,000 tons high-grade W-Cu-Pb-Zn-Ag ore from 1925 to 1951 from crosscutting ore shoots in Texas Creek granodiorite of Tertiary age. Area also contains potential for porphyry Mo-W mineralization and massive sulfide-skarn Pb-Ag-Au-W deposits.
- 118 Jumbo** - Cu-Fe-Mo-Ag skarn deposit; produced more than 10 million lb Cu, 280,000 oz Ag, and 7,000 oz Au from 125,000 tons ore from classic, zoned magnetite-Cu skarns associated with epizonal granodiorite pluton of Cretaceous age. Reported reserves of 650,000 tons ore that grade 45.2 percent Fe, 0.75 percent Cu, 0.01 oz/ton Au, and 0.08 oz/ton Ag.
- 119 Copper City** - Stratiform Cu-Zn-Ag-Au massive sulfide deposit hosted in late Precambrian Wales Group. Reported grades of up to 12.7 percent Cu, 2.7 percent Zn, 2.5 oz/ton Ag, and 0.2 oz/ton Au.
- 120 Quartz Hill** - World-class porphyry-Mo deposit in composite felsic pluton (25 Ma. old); proven reserves of 1.5 billion tons ore that grade 0.136 percent MoS₂, including 490 million tons with grades of 0.219 percent MoS₂.
- 121 Niblack** - Volcanogenic Cu-Pb-Au-Ag massive sulfide deposit hosted in Precambrian(?) Wales Group or Ordovician to Silurian Descon Formation; produced more than 1.4 million lb Cu, 11,000 oz Au, and 15,000 oz Ag.

- 122 Bokan Mountain** - Numerous U-Th prospects associated with Jurassic peralkaline intrusive complex; from 1955 to 1971, produced more than 120,000 tons ore that graded about 1 percent U_3O_8 . Also contains 40 million tons of 0.126 percent niobium and up to 1 percent REE metals.
- 123 Kemuk Mountain** - Magmatic Fe-Ti deposit hosted in Cretaceous(?) pyroxenite. Inferred reserves of 2.4 billion tons that average 15 to 17 percent Fe, 2 to 3 percent TiO_2 , and 0.16 percent P_2O_5 .
- 124 McLeod** - Porphyry Mo deposit that contains quartz-molybdenite fissure veins in quartz-feldspar porphyry. Chip samples contain up to 0.09 percent Mo.
- 125 Johnson River** - Epigenetic(?) quartz-sulfide stockwork or massive sulfide deposit hosted in volcanoclastic, pyroclastic, and volcanic rocks of Jurassic Talkeetna Formation. Average grades of 9.4 to 24.8 percent Zn, 2.8 percent Pb, 1.7 percent Cu, and 0.6 to 1.2 oz/ton Au reported.
- 126 Nimiuktuk River** - Small hill of massive, high-grade barite estimated to contain at least 1.5 million tons barite. Widespread stream-sediment Ba anomalies in area indicate further barite potential.
- 127 Kensington** - Stockworks of quartz veins in sheared and chloritized quartz diorite produced 10,900 tons grading 0.18 oz/ton gold prior to 1930. Estimated to contain at least 12.8 million tons grading 0.148 oz/ton gold.
- 128 Jualin** - Five quartz-fissure veins in Cretaceous quartz diorite, more than 15,000 ft of underground workings; produced 48,387 oz gold, mainly prior to 1930. Reserves estimated at 1.07 million tons of 0.349 oz/ton gold.
- 129 Pebble Beach** - Cu-Au porphyry with identified resource of 200 million tons 0.4 Cu with 0.012 oz/ton gold, including 50 million tons 0.5 percent copper and 0.015 oz/ton gold. Not yet fully explored.

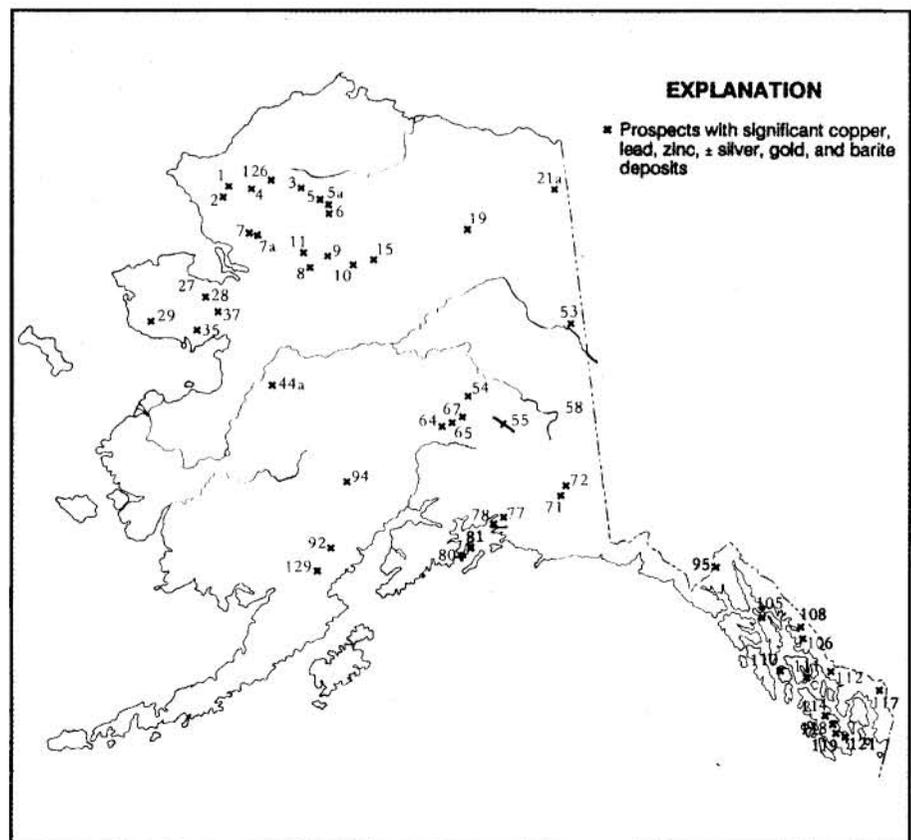


Figure 44. Map showing significant copper, lead, zinc, (+) silver, gold, and barite deposits in Alaska, 1990. (See appendix D for deposit descriptions.)

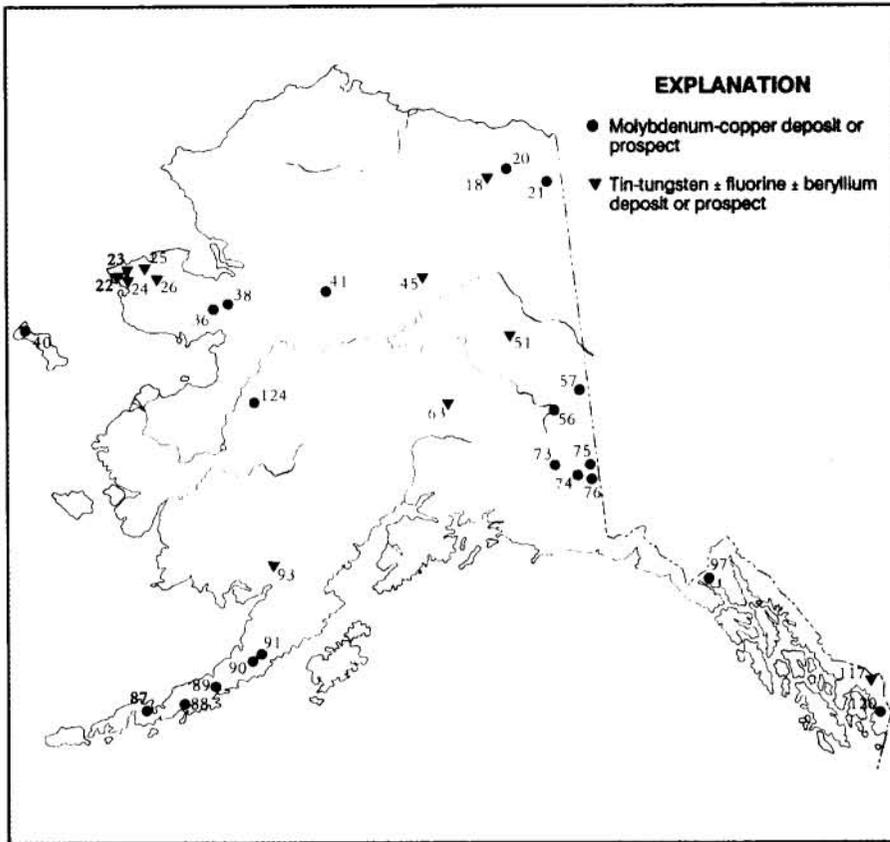


Figure 45. Map showing locations of significant molybdenum-copper, and tin-tungsten (+) fluorite and beryllium deposits in Alaska, 1990. (See appendix D for deposit descriptions.)

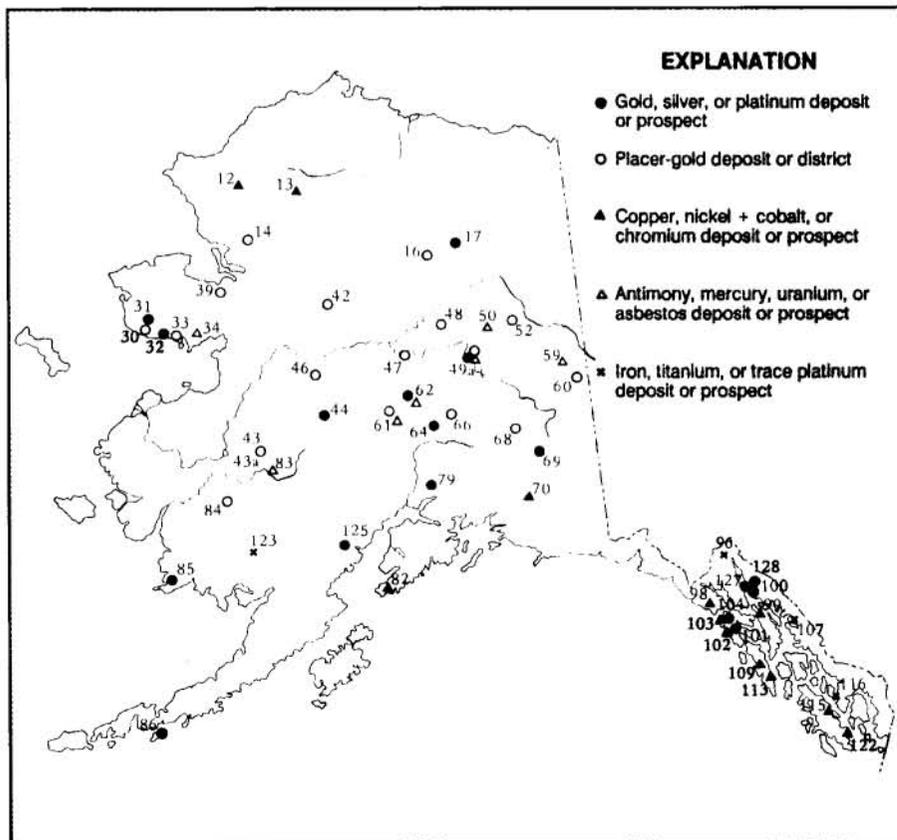


Figure 46. Map showing significant gold, silver, platinum, and strategic mineral deposits in Alaska, 1990. (See appendix D for deposit descriptions.)

APPENDIX E

Mining licenses issued by Alaska Department of Revenue, 1990

ADD-VENTURES LTD. 720 M St., Ste. 200 Anchorage, AK 99501	AMAX GOLD EXPLORATION INC. Edward Montgomery 350 Indiana St. Golden, CO 80401	BEAVER LOOP SAND & GRAVEL Mary Doyle HCO1 Box 1225 Kenai, AK 99611 (sand and gravel)	BOULDER CREEK MINING CO. Dorothy Fickes P.O. Box 72618 Fairbanks, AK 99707
ALASKA AGGREGATE CORP. John L. Brewer (3) 240 West 68th Ave. Anchorage, AK 99518 (sand and gravel)	AMERICAN ARCTIC CO. Rocky McDonald P.O. Box 81035 Fairbanks, AK 99708	BEEHIVE MINING Layne Gardner 1967 Yankovich Rd. Fairbanks, AK 99709	GLENN & LELA BOUTON 665 Farmers Loop Rd. Fairbanks, AK 99712
ALASKA GOLD CO. Alice E. Bayless P.O. Box 28 Chicken, AK 99732	GERALD IRVIN ANDERSON P.O. Box 362 Anchorage, AK 99515	WILLIAM J. BEERMAN 2416 S 1st St. Yakima, WA 98901	CARL A. BRACALE, JR. 733 W. 4th Ave., #605 Anchorage, AK 99501
ALASKA GOLD CO. Roy Ferrenbach 1215 Bunnell, Apt 11 Fairbanks, AK 99712	WAYNE & RANDI ANDERSON 1901 Cheechako Dr. Fairbanks, AK 99709	TERESA ROXANNE BELL Box 552 Coopers Landing, AK 99572	KEHAULANI BELFIELD & JOHN BRENNAN P.O. Box 74875 Fairbanks, AK 99707
ALASKA GOLD CO. Joseph F. Fisher (2) P.O. Box 640 Nome, AK 99762	ANNABELLE MINE James Roland 710 McGrath Rd. Fairbanks, AK 99712	BEN GILLETTE ESTATE Bert Pettigrew P.O. Box 1230 Nome, AK 99762	ROBERT BRILEY P.O. Box 72335 Fairbanks, AK 99707
ALASKA GOLD CO. Al Hopen (2) P.O. Box 1170 Fairbanks, AK 99707	ADAM ARNAVIK SR. P.O. Box 95 Togiak, AK 99678	RHINEY BERG P.O. Box 809 Fairbanks, AK 99707	BROAD PASS MINING CO. Jesse D. Smith P.O. Box 1070 Willow, AK 99688
ALASKA GOLD HARVESTORS Philbin, Brad/Michelson, Lloyd P.O. Box 875305 Wassila, AK 99687	ARNESON CRUSHING Merwin Arneson P.O. Box 737 Palmer, AK 99645 (sand and gravel)	ARTHUR & JEANNE BERGLUND HC 1 Box 62755 Palmer, AK 99645	DONALD BROWN Box 1313 Kenai, AK 99611 (sand and gravel)
ALASKA LIME CO. James Caswell P.O. Box 196 Cantwell, AK 99729 (limestone)	ASSOCIATED CONSTRUCTION Joseph J. Rollins (2) P.O. Box 266 Anchor Point, AK 99556 (sand and gravel)	BIG G MINING, INC. Hank Gradney P.O. Box 74400 Fairbanks, AK 99707	JOHN BROWN 1689 Goldstream Rd. Fairbanks, AK 99709
ALASKA PLACER DEVELOPMENT Karl Hanneman (2) P.O. Box 81467 Fairbanks, AK 99708	AURORA MINING Lester Lines P.O. Box 10-3820 Anchorage, AK 99510	STEVEN BILLS Box 101 Eagle, AK 99738	MIRIAM BROWN Box 1313 Kenai, AK 99611 (sand and gravel)
ALASKA VENTURES Morris Wolters 622E SR4 Cuthlamet, WA 98612	AURORA MINING Schafer, Beatrice/Russell, Terry P.O. Box 55074 North Pole, AK 99705	RUSSELL L. BIRDELL P.O. Box 1908 Cave Creek, AZ 85331	ROBERT BROWN P.O. Box 2947 Soldotna, AK 99669
ALBERT CREEK MINING Calvin W. Hutcheson P.O. Box 33 Eagle River, AK 99577-0033	AURORA MINING DBA LESTER LINES Charles Wentworth Cleveland P.O. Box 10-3820 Anchorage, AK 99510	B J MINING Jack Zupan P.O. Box 82911 Fairbanks, AK 99708	OPAL BRUHN P.O. Box 8022 Nikiski, AK 99635
ALEUTIAN MATERIALS P.O. Box 1188 Woodinville, WA 98072 (sand and gravel)	PAUL BARELKA (3) 1215 9th Ave. Fairbanks, AK 99701	PATRICK BLISS 711 H St., Ste. 450 Anchorage, AK 99501	NORMAN BUCY 3638 Dunkirk Ct. Anchorage, AK 99502
	TOD BAUER P.O. Box 871502 Wasilla, AK 99687	ROBERT WAYNE BLONDEAU P.O. Box 602 Valdez, AK 99686	JOHN R. BURNS P.O. Box 5 Chicken, AK 99732
		BLUE WATER MINING Harold Nevers 8148 Pinewood Dr. Juneau, AK 99738	BUSHMASTER MAN CO. Jimmy Schneider Box 774407 Eagle River, AK 99577

CAMP CREEK MINING Alvin and Eric Kile Box 140424 Anchorage, AK 99514	CLOUD/BELL Joe Cloud HC 001 Box 875 Kenai, AK 99611	CROOKED DOG MINING Charles/Henshaw, Byron, Barnes P.O. Box 193 Cantwell, AK 99729	EEP'S EQUIPMENT RENTALS & MINING Allan G. Anderson Dog St. Taktotna, AK 99675
CANADA TUNGSTEN MINING CO. LTD. Tungsten, Inc. 1600-1066 West Hastings St. Vancouver, BC V6E 3X1 Canada	ROBERT J. COLZANI P.O. Box 1955 Nome, AK 99762	VERL DOUGLAS CUSHMAN, SR. Rt 3, Box 1 Blackfoot, ID 83221	EMPIRE EXPLORATION INC. Dennis Garrett P.O. Box 142593 Anchorage, AK 99514
CANDLE MINING CO. Kenneth R. Upchurch 8810 Rendon Dr. Anchorage, AK 99507	COMINCO ALASKA INC. P.O. Box 1230 Kotzebue, AK 99752 (lead and zinc)	D & J MINING David Penz Box 29 Russian Mission, AK 99657	KRISTER ERIKSSON P.O. Box 872809-199 Wasilla, AK 99678
CARLO & SONS MINING 2113 Southern Fairbanks, AK 99701	COMINCO ALASKA EXPLORATION M. A. Millholland (3) 5660 B St. Anchorage, AK 99518	JIMINMAN, JIM DEAL HC02 7630 Palmer, AK 99645	TOM ERICKSON General Delivery Eagle, AK 99738
ROBERT DENNIS CARLSON 17732 A. James Wy. Eagle River, AK 99577	COMINCO ALASKA EXPLORATION Phil St. George 139E 51st Ave. Anchorage, AK 99503	DELIMA PLACERS Don P. Delima Manley Hot Springs, AK 99756	DANIEL L. EVEN P.O. Box 82092 Fairbanks, AK 99708
CASTLE CREEK MINES Fred R. Hall P.O. Box 72037 Fairbanks, AK 99701	COMPASS MINING CO. John B. Hall P.O. Box 2700 Fairbanks, AK 99707	DEPEM Donald Stein 105 Dunbar Ave. Fairbanks, AK 99701	THOMAS E. FAA SR MP 260 Parks Hwy. Healy, AK 99743
CENTRAL ALASKA EXPLORATION CORP. Robin S. Tolbert 2173 University Ave. S. Fairbanks, AK 99709	CARL CONGDON 925 Commerce St. Fairbanks, AK 99709	LESLEY DEVORE P.O. Box 74 Chicken, AK 99732	FAIRBANKS EXPLORATION INC. Kelly Dolphin/ Curtis J. Freeman (15) P.O. Box 82549 Fairbanks, AK 99708
ELLIS DUANE CHAMBLISS P.O. Box 31 Chicken, AK 99732	FREDERICK COOK 269 1/2 Richardson Hwy Delta Junction, AK 99737	JOHN T. DEWAN P.O. Box 870257 Wasilla, AK 99687	FAIRBANKS GOLD CO. James Pray P.O. Box 102792 Anchorage, AK 99510
CHICKAMAN MINING CO. Earl Schene Box 66 Chicken, AK 99732	RICHARD COOK 2000 Sturbridge Circle Anchorage, AK 99507	ROY A. DIEHL General Delivery Anchorage, AK 99501	FAIRBANKS GOLD INC. Electrum Resources Corp. 394 Hamilton Ave. Fairbanks, AK 99701
JIM CHILDS P.O. Box 56587 North Pole, AK 99705	COOK'S MINING John Cook (2) P.O. Box 70393 Fairbanks, AK 99707	RODERICK DUNN Box 350 Talkeetna, AK 99676	FAIRBANKS GOLD INC. Daniel Nye 355 Burard St., Ste. 2100 Vancouver BC Canada V6C 2G8 or P.O. Box 73726 Fairbanks, AK 99707-3726
CIRCLE MINING CO. Frank R. Warren (2) P.O. Box 11 Central, AK 99730	FRED G. CORNELIUS 1615 Madison Dr. Fairbanks, AK 99709	RICHARD DUTHIE P.O. Box 1920 Fairbanks, AK 99701	FAIRBANKS SAND & GRAVEL, INC. P.O. Box 1511 Fairbanks, AK 99707 (sand and gravel)
CITIGOLD ALASKA INC. Robert Emerson 3400 International Wy., Ste. B Fairbanks, AK 99701	FRANK COUCH 149 Farnsworth Soldotna, AK 99669	EARLY WINTERS MINING CO. Lee G. Wilson 3605 Arctic #988 Anchorage, AK 99503	FAIRVIEW MINING CORP. Edward Mooney 6711 Foothills Dr. Anchorage, AK 99504
CLARA BEA INC. B.W. Comstock (2) P.O. Box 853 Kotzebue, AZ 99752	CRISWELL MINING & EXPLORATION Herbert F. Fassler Box 670181 Chugiak, AK 99567	JUDD EDGERTON HC01 Box 6937-V Palmer, AK 99645	HERBERT F. FASSLER P.O. Box 670181 Chugiak, AK 99567
DOUGLAS M. CLARK 711 H St., Ste. 450 Anchorage, AK 99501	W.R.C. CROLEY Ole Olson P.O. Box 191 Tok, AK 99780	ED'S GRAVEL PIT Joanna Hollier P.O. Box 366 Kenai, AK 99611 (sand and gravel)	

- FINNBEAR MINING & EXPLORATION CO.
Arne Murto
P.O. Box 850
Kasilof, AK 99610
- FLAT CREEK MINING CO.
James P. Haggland
P.O. Box 81464
Fairbanks, AK 99708
- FLAT CREEK PLACERS
John E. Fullerton
General Delivery
Flat, AK 99584
- FLAT PICK MINING
Gordon Fulton
P.O. Box 118
Central City, AK 99730
- MITCH FLEMING
P.O. Box 9102
Coldfoot, AK 99701
- JAMES, SR. & SHARON FOGARTY
3034 Dyke Rd.
North Pole, AK 99705
- FOUR BROTHERS MINING
Hery Clark Billings
P.O. Box 81117
Fairbanks, AK 99708
- 40 MILE MINING CO.
William Morris
P.O. Box 33
Chicken, AK 99732
- 45 PUP MINING
Charles R. Hammond
P.O. Box 7
Chicken, AK 99732
- PATRICIA S. FRANKLIN
1213 Coppet
Fairbanks, AK 99709
- FRANKLIN EXPLORATION MINING CO.
Oliver Reese
1601 Elm St., Ste. 2364
Dallas, TX 75201
- FREEDOM MINING & EXPLORATION
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1985 Becker Ridge
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- ROY GEORGE
1334 San Blanco Dr.
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Fairbanks, AK 99701
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Dougious Nicholson
3865 Ullrbahn
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4400 Many Tell Ave.
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Red Devil, AK 99656
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Glen and Shirley Parr
Route 1 MP 260
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- ALBERT M. HAGEN
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- HARDSHIP MINING CO.
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Anchorage, AK 99508
- EVERETT HARRIS
P.O. Box 962
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- HARRISON CREEK MINING CO.
P.O. Box 61185
Fairbanks, AK 99706
- DONALD/BALDWIN
CLYDE HART
P.O. Box 22
Chicken, AK 99732
- MICHAEL GEORGE HARTMAN
P.O. Box 74921
Fairbanks, AK 99707
- PETER HASSON
P.O. Box 13-171
Trapper Creek, AK 99683
- EDWIN HATCH
Box 1801
Nome, AK 99762
- HAYDEN EXPLORATION & MINING
Forest A. Hayden
P.O. Box 110930
Anchorage, AK 99511
- HEALINGER MINING CO.
James R. Healey
P.O. Box 210212
Auke Bay, AK 99821
- HECLA MINING CO.
6500 Mineral Dr.
Coeur D'Alene, ID 83814
- HEFLINGER MINING & EQUIPMENT
Carl F. Heflinger
665 10th Ave., # 307
Fairbanks, AK 99701
- JACK HENDRICKSON
Box 10154
Fairbanks, AK 99710
- CLYDE HENDRY
1271 9th Ave., Apt. 206
Fairbanks, AK 99701
- HERICKS & BELFIELD
James W. Belfield
P.O. Box 1934
Fairbanks, AK 99707
- MARTIN M. HERZOG
14250 Sabine St.
Anchorage, AK 99516

HILDRE SAND & GRAVEL CO.
Chuck Porter
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Juneau, AK 99802
(sand and gravel)

HOFFMAN MINING
Russell Hoffman
HC60 Box 153
Copper Center, AK 99573

HOLITNA BASIN MINING
& EXPLORATION
Mark Farrar
P.O. Box 1032
Hood River, OR 97031

HOLLYWOOD ROAD SAND
& GRAVEL
William Elkins
HC 30, Box 12860
Wasilla, AK 99687
(sand and gravel)

CARSON HOLT
P.O. Box 284
Ester, AK 99725

HOMER & WILLIAM
HOOGENDORN
Box 84
Nome, AK 99762

HOPE MINING CO.
A. Johnson
P.O. Box 101827
Anchorage, AK 99510

CONRAD H. HOUSE
924 Kellum St., #101
Fairbanks, AK 99701

HUNTER CREEK MINE
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INGLE CREEK MINING
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JAB DEVELOPMENT
Jeff Raymor
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JACKSON MINING CO.
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Fairbanks, AK 99709

J.B.R. INC.
David Ritter
P.O. Box 32292
Juneau, AK 99803

DANIEL JENSEN (3)
Box 12
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Loomis, CA 95650

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James Luhrs, Jr. and Marua Dejong
3333 Lake Shore Dr. #8
Anchorage, AK 99517

CURTIS JOHNSON
602 Stewart St.
Fairbanks, AK 99701

KARL J. BASSETT &
DELL E. JOHNSON
P.O. Box 61537
Fairbanks, AK 99706

TOMMY & MYRTLE JOHNSON
P.O. Box 608
Nome, AK 99762

JONES & CO.
Jones W. Deering (2)
P.O. Box 1120, HCR 68
Moose Pass, AK 99631

KEN JOUPPI
2294 Walrus Ct.
North Pole, AK 99705

KACHEMAK MINING CORP.
Robert C. Busby
47660 Falls Creek Dr.
Homer, AK 99603

RICHARD D. KARR
P.O. Box 60782
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K.C. MINING CO.
Kenneth C. Hanson
P.O. Box 10657
Fairbanks, AK 99710

KDT EXPLORATION
& MINING CO.
Kevin Thompson
P.O. Box 875534
Wasilla, AK 99687

ROBERT W. & SUSAN J. KELLER
Box 113
Healy, AK 99743

KELLY MINING
Timothy Joseph Kelly
General Delivery
Manley, AK 99756

KENNECOTT EXPLORATION INC.
Walter Meyers
4600 Kietzke, Bldg. L-230
Reno, NV 89502

KIANA CORP.
Debra Schnabel
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Haines, AK 99827
(sand and gravel)

KIN-ALASKA
Bob Flounders
3331 E. Huffman Rd.
Anchorage, AK 99516

SUSAN KNAPMAN
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HC04-9068
Palmer, AK 99645

LAWRENCE KORDECKI (2)
300 Howland Rd., #3
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JAN KRALIK
Box 1793
Nome, AK 99762

KRISTI-PHYLEE
James Parry
P.O. Box 71656
Fairbanks, AK 99701

RUDY W. KRIZAK
General Delivery
Nome, AK 99762

KURT'S CONSTRUCTION
Kurt Ueek
1900 Granite View Dr.
Delta Junction, AK 99737
(sand and gravel)

JACK LACROSS
P.O. Box 331
Soldotna, AK 99669

LAKBEY INC.
S. Allen Vezey
1216 Range View Rd.
North Pole, AK 99705

LAKEVIEW ENTERPRISE INC.
Philip Rahoi
1000 Lakeview Terrace Dr.
Fairbanks, AK 99701
(sand and gravel)

HOWARD LAMBERT
P.O. Box 87
Ester, AK 99725

JUANITA R. LARSON
9499 Brayton Dr. #116
Anchorage, AK 99507

LAST CHANCE MINING CO.
Walter Roman
Illinois St.
Fairbanks, AK 99707

LAST HOPE MINING
Donald Lasley
P.O. Box 84438
Fairbanks, AK 99708

HARRY JOINES & STELLA
DARLENE LAVENDER
General Delivery
Boundary, AK 99790

LAW IOSUA/GOLDEN SLIPPER II
Joe Hall
711 Hillcrest
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L & B MINING
D.B. Parent
1015-10th Ave.
Fairbanks, AK 99701

LBMB MINING CO.
Robert Bormand
1536 W. Marinette
Exeter, CA 93221

L & R MINING
Ted Hale Leonard
Box 51
Salcha, AK 99714

RAY LESTER
732 Old Steese Hwy., #8
Fairbanks, AK 99712

BILL & CLARA LIGHT
P.O. Box 74804
Fairbanks, AK 99707

DAVID W. LIKINS
P.O. Box 106
Eagle, AK 99738

LILLIAN CREEK MINE INC. Ronald Tucker Box 60334 Fairbanks, AK 99706	MAGNUM RESOURCES INTL. INC. Lawrence D. Wood 1900 Foundry Wy. Wasilla, AK 99687	ORVAL MCCORMMACH P.O. Box 15 Manly Hot Springs, AK 99756	KENNETH BARNES & ANDREW MORITZ 254 River Rd. Chehalis, WA 98532
GEORGE LIVERMORE 3302 Dorbrandt, #4 Anchorage, AK 99503	MAGNUSON MINING CO. Warren Magnuson P.O. Box 55 McGrath, AK 99627	MCGRAW'S GRAVEL SALES INC. Dormand McGraw, Jr. P.O. Box 185 Sitka, AK 99835 (sand and gravel)	WILLIAM MORGAN (2) 600 West 58th Unit J Anchorage, AK 99518
FRANK GEORGE LOCHNER 2825 Opal Ave. Fairbanks, AK 99709	ALBERT (MICK) MANNS MINING CO. Paradise Valley Bettles, AK 99726	HOWARD MCWILLIAMS P.O. Box 221603 Anchorage, AK 99522	MOSQUITO MINERS David C. Haase P.O. Box 83478 Fairbanks, AK 99708
LONE SPRUCE MINING George Strickler General Delivery Boundry, AK 99790	NIKOLAI MARCHUK P.O. Box 89 Delta Junction, AK 99737	KEITH MENDENHALL P.O. Box 1406 Fairbanks, AK 99707	DAVID MOSS P.O. Box 681 Tok, AK 99780
LONESOME MINING CO. Charles Timothy Jackson SR Box 2893GG Wasilla, AK 99687	MARTIN MINING CO. Edward Martin P.O. Box 521 Cooper Landing, AK 99572	MESPELT & ALMASY MINING CO. Theodore Almasy Nixon Fork Mine McGrath, AK 99627	MRAK PLACER MINE William Mrak P.O. Box 1963 Palmer, AK 99645
RICHARD LOUD 742 Bennet Rd. Fairbanks, AK 99712	CLEON MARTINSON 7204 227th Place SW Mt. Lake Terrace, WA 98043	METCO INC. Frank Dieckgraeff HCR 64, Box 300 Seward, AK 99664 (sand and gravel)	JACK MURPHY P.O. Box 825 Valdez, AK 99686
LINDON LOUDERMILK 10441 Loudermilk Circle Anchorage, AK 99516	DOUGLAS MARTINSON (8) P.O. Box 52 Nome, AK 99762	RUSS MILLER 5955 Liberty Ct. Wasilla, AK 99687	NANA REGIONAL CORP. (2) 4706 Harding Dr. Anchorage, AK 99517
JAMES LOUNSBURY P.O. Box 983 Fairbanks, AK 99707	ELMER MARTINSON (2) P.O. Box 452 Nome, AK 99762	MILLER CREEK MINING CO. Fred D. Wilkinson P.O. Box 1 Central, AK 99730	N.B. TWEET & SONS Cheryl Jong P.O. Box 503 Teller, AK 99727
MARIN LOVUS 2326 St Elias Dr. Anchorage, AK 99517	MARVEL DOME MINING CO. Mark Matter P.O. Box 44 Aniak, AK 99557	MINEX ALASKA INC. Yoram Palkovitch P.O. Box 103 Girdwood, AK 99587	N.B. TWEET & SONS Douglas Tweet (2) Box 503 Teller, AK 99778
LUCKY CREEK MINE LTD. PARTNERSHIP Claude Morris P.O. Box 547 Girdwood, AK 99587	MASCOT MINING INC. Thomas Bryant County Rd. One P.O. Box 264 Ridgway, CO 81432	ANDREW MISCOVICH (2) Box 162 Fairbanks, AK 99707	NERCO EXPLORATION CO. Vincent Monzulla 2920 Monzulla Lane Fairbanks, AK 99712
LUCKY 7 MINING CO. Ronald Roman P.O. Box 71614 Fairbanks, AK 99707	DIANE MATHISEN 2261 Belmont Dr. Anchorage, AK 99517	JOHN MISCOVICH (2) General Delivery Flat, AK 99584	JACK NEUBAUER General Delivery Fairbanks, AK 99701
LYLE COLLEDGE P.O. Box 60478 Fairbanks, AK 99706	MAT-SU AGGREGATE Merwin Arneson P.O. Box 737 Palmer, AK 99645 (sand and gravel)	MISCOVICH MINING CO. Howard Miscovich P.O. Box 262 Galena, AK 99741	NEWMONT EXPLORATION LTD. 1 United Bank CTR 1700 Lincoln Denver, CO 80203
LYMAN RESOURCES IN ALASKA INC. Spencer Lyman P.O. Box 192 McGrath, AK 99627	MAXWELL MINE & EXPLORATION Leslie Maxwell 3910 Loc Sault Ave. Anchorage, AK 99516	LARRY MOLLING 3025 E. 15th Ave. Anchorage, AK 99508	FRED NODEN P.O. Box 47 Dillingham, AK 99576
MAGIC CIRCLE MINING Stephen Weber 332 Slater Dr. Fairbanks, AK 99701	RICHARD MCCALLUM Box 70138 Fairbanks, AK 99707	MELVIN/LOIS MONTGOMERY 1836 Davenport Rd. Delta Junction, AK 99737	NORAM MINING INC. John Jacobsen 308 G St., Ste. 209 Anchorage, AK 99501
		GERALD HASSEL & ROGER MOORE 288 Rumbling Rd. Fairbanks, AK 99712	WILLIAM NORDEEN P.O. Box 9013 Coldfoot, AK 99701

ROGER NORDLUM Box 171 Kotzebue, AK 99752	PACIFIC MINING INC. James Stone 1300 E. 74th Anchorage, AK 99518	RALPH JAMES PORTER Box 72 Soldotna, AK 99669	REDMOND MINING CO. Richard Redmond General Delivery Nome, AK 99762
NORTH STAR INVESTMENT CO. Doris Coiner P.O. Box 157 Cantwell, AK 99729	TOMMY PARTEE Box 607 Sterling, AK 99672	NEIL POWERS 9191 Old Seward Hwy., Ste. 21 Anchorage, AK 99515	WADE REESE P.O. Box 141086 Anchorage, AK 99514
NORTHERN LIGHTS MINING INC. 544 North 600 West Cedar City, UT 84720	CACY PATTON P.O. Box 1505 Fairbanks, AK 99707	WILLARD POWERS (2) 4202 E. University Dr. Phoenix, AZ 85034	LEO REGNER P.O. Box 2733 Fairbanks, AK 99707
ROSS NOVAK (2) P.O. Box 83200 Fairbanks, AK 99708	PAUL & CO. George R. Homer P.O. Box 60610 Fairbanks, AK 99707	P & P MINE Paul White 2551 Peede Rd. North Pole, AK 99705	RESOURCE EXPLORATION & DEVELOPMENT James P. Conway HC02 Box 7660 Palmer, AK 99645
NUGGET MINING CO. John Terwilliger Box 92 Mile 1316 AK Highway Tok, AK 99780	PAUL & CO. Paul Manuel Box 83102 Fairbanks, AK 99708	PRINCE CREEK MINING CO. Alvin Agoff Flat, AK 99584	RGV & BONANZA MINING Douglas Miller P.O. Box 127 Central, AK 99730
NYAC MINING Tuluksak Dredging Ltd. 737 E St. Anchorage, AK 99501	DAVID PENZ Box 29 Russian Mission, AK 99657	P & S MINING CO. Paul Deveny 1432 Second Ave. Fairbanks, AK 99701	RICHARD BUSK & FAMILY Richard L. Busk P.O. Box 100971 Anchorage, AK 99510
DANIEL NYE (2) 1733 University Ave., Apt. F-10 Fairbanks, AK 99709	WAYNE PEPPLER 1006 22nd St. Fairbanks, AK 99701	JERRY PUSHCAR Box 160A Nome, AK 99762	EARL RIDNER P.O. Box 40154 Clear, AK 99704
FRANKLIN O'DONNELL 7110 Canaday Rd. Salcha, AK 99714	ROY PHILPOTT 115 Charles St. Fairbanks, AK 99701	QUARTZ CREEK EXPLORATION CO. Milo Ellsworth Flothe P.O. Box 242 Sterling, AK 99762	LYNN & MICHAEL RILL 2702 Kuskokwim St. Fairbanks, AK 99701
ALAN OLSON Candle, AK 99728	GARY PIKE 575 Canora St. North Pole, AK 99705	R.A. HANSON CO. INC. R.A. Hanson (3) P.O. Box 7400 Spokane, WA 99207	JOHN RITTER P.O. Box 73792 Fairbanks, AK 99707
STEVEN OLSON P.O. Box 82330 Fairbanks, AK 99708	PLACER DOME U.S. INC. John Barnett P.O. Box 034357 Juneau, AK 99803	RAINBOW MINING Dennis Gilbraeth P.O. Box 10048 Fairbanks, AK 99710	ROBBIE'S BONANZA MINE Roger Roberts Mile 536 Old Iditarod Trail Ophir, AK 99672
OMEGA MINING CO. Richard Ott P.O. Box 2748 Fairbanks, AK 99707	PLACID OIL CO. J. C. Jones 3900 Thanksgiving Tower Dallas, TX 75201	RASMOS Robert Rasmussen P.O. Box 875464 Wasilla, AK 99687 (sand and gravel)	MICHAEL ROBERTS P.O. Box 82182 Fairbanks, AK 99708
ON-LINE EXPLORATION SERVICES Kevin Adler 11976 Wildemess Dr. Anchorage, AK 99516	DAN & CINDY PLANO HC 33 Box 2872 Wasilla, AK 99687	RAY BILLINGS 16035 Brown Ln. Cottonwood, CA 96035	ROBERT ROBERTS P.O. Box 225 Tok, AK 99780
RICHARD OSBORNE P.O. Box 5210 Madison, WI 53705	POINTS NORTH Robert Cacy P.O. Box 106 Central, AK 99730	RB GRAVEL SALES Gerald L. Hassel (2) P.O. Box 49 Ester, AK 99725 (sand and gravel)	MICHAEL STORMONT & ROBERT ROBERTS 828 2nd Ave. Fairbanks, AK 99701
JAMES WALKER & DANA OSTLER 2021 Pembroke St. Anchorage, AK 99504	POLAR MINING INC. Dan May (2) 4545 Woodriver Dr. Fairbanks, AK 99709	RCL MINING Ray Vogt 2108 Central Ave. Fairbanks, AK 99701	ROCK PRODUCTS INC. Nanette E. Arneson P.O. Box 876010 Wasilla, AK 99687-6010
OUTSIDER MINING CO. John Trautner Box 909 Girdwood, AK 99587	POLAR MINING INC. Robert Bettisworth 4545 Woodriver Dr. Fairbanks, AK 99701		JOHN ROOP Box 44 Chicken, AK 99732

ROSANDER MINING CO. Ronald Rosander Box 129 McGrath, AK 99627	JOHN SCHNABEL P.O. Box 149 Haines, AK 99827	HOWARD SMITH P.O. Box 1369 Nome, AK 99762	SUPERSTOCK MINING George Superdock P.O. Box 30088 Central, AK 99730
ROWALLAN MINE PARTNERSHIP Vince Halverson P.O. Box 318 Clam Gulch, AK 99568	WERNER SCHUSTER HC 03, Box 8080 Palmer, AK 99645	WALTER BAGNELL & RANDY SMITH 7516 Zurich St. Anchorage, AK 99507	JAMES SWAN 452 Winter Ave. Fairbanks, AK 99712
ROYAL OAK RESOURCES LTD. James Prescott 200-1055 W. Hastings St. Vancouver, BC V6E 2E9 Canada	JACKIE SEE 541 Riviera Ct. Fullerton, CA 90635	WILLIAM SMITH 906 Cunningham Anchorage, AK 99501	TOM SWARTWOOD HC03 Box 8100 L Palmer, AK 99645
JOHN RUBEL 8183 Richardson Hwy. Salcha, AK 99714	GEORGE SEUFFERT P.O. Box 156 Central, AK 99730	SMK-2 MINING Michael Sweetsir P.O. Box 170 Ruby, AK 99768	SWENSON MINING Richard Swenson P.O. Box 16082 Two Rivers, AK 99716
ERNEST RUSSELL P.O. Box 33 Manley Hot Springs, AK 99756	S & H CO. Gerald L. Hassel P.O. Box 49 Ester, AK 99725	SNOW LION MINING CO. Jerry Fabrizio 14121 Puget Sound Blvd. Edmonds, WA 99827	WAYNE TACHICK Box 3503 Soldotna, AK 99669
RYBACHEK MINING Stanley Rybachek P.O. Box 55698 North Pole, AK 99705	W. SHAFFER (3) 316 Rio Verde El Paso, TX 79912	HANS SOBANJA P.O. Box 10196 Fairbanks, AK 99710	TAIGA MINING CO. 415 W. 8th Anchorage, AK 99501
WILLIAM C. MORTERUD & WALLACE P. SALINE P.O. Box 231 Girdwood, AK 99587	SHANNON MERRITT Al Cerepa P.O. Box One Kenai, AK 99611	SPERNAK & SON INC. James Spernak 8223 Sand Lake Rd. Anchorage, AK 99502 (sand and gravel)	NOEL S. TANNER P.O. Box 1369 Nome, AK 99762
SALTER & ASSOC. INC. Ed Salter Box 30 Manley Hot Springs, AK 99756	DENNIS SHEPARD (2) P.O. Box 82504 Fairbanks, AK 99708	SPHINX AMERICA INC. (4) P.O. Box 81978 Fairbanks, AK 99708	TAYLOR'S & TAYLOR'S MINING CO. Larry Taylor P.O. Box 101 Eagle, AK 99738
SANDVIK ENTERPRISES Lynn Sandvik HC0 2 Box 7480-2 Palmer, AK 99645 (sand and gravel)	SHORT GULCH MINING CO. LTD. Jill Taylor P.O. Box 9 Ruby, AK 99768	SPRUCE CREEK MINING CO. John O'Carroll Ophir McGrath, AK 99627	TEGGUN MINING CO. Paul Nelson Rt 2 Box 753 Soldotna, AK 99669
HAROLD SAULE 2840 E. 142 Ave. Anchorage, AK 99516	SILVERADO MINES U.S. INC. Box 12542, Ste. 2580 Vancouver, BC V6E 3X2 Canada	PAUL STEINHACKER 151 East 71 St. New York, NY 10021	TENNECO MINERALS CO. 5301 Longley Ln., #113 Reno, NV 89511
BUDDY SAUNDERS 1939 Jack St. Fairbanks, AK 99709	JOHN SIPES 2741 Perimeter Dr. North Pole, AK 99705	STEPP-A-LONG Vern Stepp 290 Pearl Dr. Fairbanks, AK 99712	THANKSGIVING MINING John Schilling (2) Box 81425 Fairbanks, AK 99708
DWAYNE SAVAGE P.O. Box 10613 Fairbanks, AK 99710	SAM SKIDMORE P.O. Box 470 Fairbanks, AK 99707	JACKIE STEWART 209 Marika St., Apt 3 Fairbanks, AK 99701	THE MINING CO. John McClain P.O. Box 74949 Fairbanks, AK 99707
PAUL SAYER Box 10 Homer, AK 99603	SKOOKUM MINING John Cole P.O. Box 10139 Fairbanks, AK 99710	ROSALYN STOWELL 308 Haines Ave. Fairbanks, AK 99701	THE MINING MANAGE- MENT CORP. Stella Lavender P.O. Box 91725 Anchorage, AK 99509
ROGER SAYER P.O. Box 73513 Fairbanks, AK 99707	SLATE CREEK MINING Lloyd Swenson Box 9061 Goldfoot, AK 99701-9998	PHILIP STRANGE P.O. Box 871478 Wasilla, AK 99687	MARTHA THOMAS Box 9023 Coldfoot, AK 99701
PAUL METZ, BARRY/DONNELLAN, & RICHARD SCHMOL P.O. Box 73606 Fairbanks, AK 99707	JOHN SLATT 5914 Highway 30 West The Dalles, OR 97058	GARY SUPERMAN HC01-1510 Kenai, AK 99611	

TILLESON MINING & RECLAMATION Harold Tilleson P.O. Box 55823 North Pole, AK 99705	USIBELLI COAL MINE INC. P.O. Box 1000 Healy, AK 99743 (coal)	WHITE BEAR MINING Harry Faulkner, Sr. P.O. Box 1307 Bethel, AK 99559	RON WREDE P.O. Box 71 Central, AK 99730
TOK GOLD MINING & EXPLORATION James Steward 106.5 Mile Tok Cut Off Tok, AK 99780	TOM VAN OSTRAND P.O. Box 314 Healy, AK 99743	DOROTHY WILCOX 433 M St. Anchorage, AK 99501	L.E. WYRICK P.O. Box 261 McGrath, AK 99627
TOKLAT MINING & EXPLORATION George Jennings 1200 E 68th #102 Anchorage, AK 99518	MICHAEL VIAL P.O. Box 889 Candle, AK 99728	FRANK WILLFORD Box 10570 Fairbanks, AK 99710	GEORGE YODER 1527 Henry St. North Pole, AK 99705
CAMDEN & CYNTHIA TOOHEY (3) P.O. Box 113 Girdwood, AK 99587	BETTY WAGNER-KRUTZSCH P.O. Box 2496 Del Mar, CA 92014	ANN WILLIAMS Flat, AK 99584	ROBERT YOUNG P.O. Box 211 Talkeetna, AK 99676
ROBERT TOPOROWSKI P.O. Box 83825 Fairbanks, AK 99708 3825	DARRELL WALKER 56810 East End Rd. Homer, AK 99603	MICHAEL WILLIAMS (2) P.O. Box 603 Tok, AK 99780	YUKON MINING CO. INC. Joel Ramstad P.O. Box 101454 Anchorage, AK 99510
TRANS ALAS-CAN GOLD 3605 Artic Blvd., 1382 Anchorage, AK 99503	GERALD WALKER 11477 Miners Wy. Rough & Ready, CA 95975	CRAIG WILLIAMSON 1724 Old Pioneer Wy. Fairbanks, AK 99709	YUTAN CONSTRUCTION CO. Lewis Vondra P.O. Box 71775 Fairbanks, AK 99707
TREASURE CREEK MINING Donald Read P.O. Box 1638 Fairbanks, AK 99707	JOHN WALSH P.O. Box 2095 Nome, AK 99762	DAVID WILMARTH Box 111037 Anchorage, AK 99511	LES PAUL ZERBE 356 Louise Ln. Fairbanks, AK 99709
TRI-CON MINING CO. Edward Armstrong (3) P.O. Box 83730 Fairbanks, AK 99708	MORRIS WALTERS 622E SR4 Cuthlamet, WA 98612	RICHARD WILMARTH Red Devil, AK 99656	EDWARD ZIEGLER P.O. Box 121 Central, AK 99730
TRINITY MINING Cheryl Jong P.O. Box 1107 Nome, AK 99762	ROSS WALTON 1247 Hartzog Loop North Pole, AK 99705	GEORGE WILSON HC03 Box 8360 Palmer, AK 99645	GEORGE ZIMMER P.O. Box 140174 Anchorage, AK 99514
TRI-VALLEY CORP. Lynn Blystone 2001 Westwind Dr., #14 Bakersfield, CA 93301	HELEN WARNER P.O. Box 80674 Fairbanks, AK 99708	HELEN WILSON 8446 Bearberry St. Anchorage, AK 99502	
ROBERT MCCLANAHAN II/III & JOE/TOM TRUDEAU General Delivery Chicken, AK 99732	JIM WATKINS P.O. Box 2871 Palmer, AK 99645	LAURA WILSON-SHEMEL HC 31 Box 5187 A Wasilla, AK 99687	
JOHN TURNER 409 Dunkel Fairbanks, AK 99701	DOUGLAS WEATHERS P.O. Box 8082 Nikiski, AK 99635	KENNETH WISE General Delivery Chicken, AK 99732	
ALEX TWOGOOD (2) P.O. Box 60203 Fairbanks, AK 99706	VERNON WEAVER (2) P.O. Box 74 Chicken, AK 99732	GORDON WOLFF 618 W 86th Ave. Anchorage, AK 99515	
LESLIE UNDERWOOD Box 53 Central, AK 99730	ANDREW WESCOTT 1132 Lakeview Terrace Fairbanks, AK 99701	WOLFF MINING Robert Wolff Boundary Tok, AK 99780	
	WESTERN ARTIC MINING Kerry Blake P.O. Box 543 Nome, AK 99762	MORRIS WOLTERS 622E SR4 Cuthlamet, WA 98612	
	WGM INC. Ronald Sheardown P.O. Box 100059 Anchorage, AK 99510	JAMES WOOD P.O. Box 58597 Fairbanks, AK 99711	
		CHARLES WOODRUFF P.O. Box 2278 Fairbanks, AK 99707	

APPENDIX F

Primary metals production in Alaska, 1880-1990^a

Year	Gold		Silver		Mercury		Antimony		Tin		Lead		Zinc		Platinum		Copper		Chromium	
	(oz)	(m\$)	(oz)	(t\$)	(flask ^b)	(t\$)	(lb)	(t\$)	(lb)	(t\$)	(tons)	(t\$)	(tons)	(m\$)	(oz)	(t\$)	(lb)	(m\$)	(tons)	(t\$)
1880-1899	1,153,889	23.85	496,101	329.0	--	--	--	--	--	--	250	17.0	--	--	--	--	--	--	--	--
1900	395,030	8.17	73,300	45.5	--	--	--	--	--	--	40	3.4	--	--	--	--	--	--	--	--
1901	335,369	6.93	47,900	28.6	--	--	--	--	--	--	40	3.4	--	--	--	--	250,000	0.04	--	--
1902	400,709	8.28	92,000	48.5	--	--	--	--	30,000	8.0	30	2.5	--	--	--	--	360,000	0.04	--	--
1903	420,069	8.68	143,600	77.8	--	--	--	--	50,000	14.0	30	2.5	--	--	--	--	1,200,000	0.16	--	--
1904	443,115	9.16	198,700	114.9	--	--	--	--	28,000	8.0	30	2.5	--	--	--	--	2,043,586	0.28	--	--
1905	756,101	15.63	132,174	80.2	--	--	--	--	12,000	4.0	30	2.6	--	--	--	--	4,805,236	0.75	--	--
1906	1,066,030	22.04	203,500	136.4	--	--	--	--	68,000	38.6	30	3.4	--	--	--	--	5,871,811	1.13	--	--
1907	936,043	19.35	149,784	98.8	--	--	--	--	44,000	16.8	30	3.2	--	--	--	--	6,308,786	1.26	--	--
1908	933,290	19.29	135,672	71.9	--	--	--	--	50,000	15.2	40	3.4	--	--	--	--	4,585,362	0.61	--	--
1909	987,417	20.41	147,950	76.9	--	--	--	--	22,000	7.6	69	5.9	--	--	--	--	4,124,705	0.54	--	--
1910	780,131	16.13	157,850	85.2	--	--	--	--	20,000	8.3	75	6.6	--	--	--	--	4,241,689	0.54	--	--
1911	815,276	16.85	460,231	243.9	--	--	--	--	122,000	52.8	51	4.5	--	--	--	--	27,267,778	3.40	--	--
1912	829,436	17.14	515,186	316.8	--	--	--	--	260,000	119.6	45	4.1	--	--	--	--	29,230,491	4.82	--	--
1913	755,947	15.63	362,563	218.9	--	--	--	--	100,000 ^c	44.1 ^c	6	0.6	--	--	--	--	21,659,958	3.35	--	--
1914	762,596	15.76	394,805	218.3	--	--	--	--	208,000	66.6	28	1.3	--	--	--	--	21,450,628	2.85	--	--
1915	807,966	16.70	1,071,782	543.3	--	--	520,000	W	204,000	78.8	437	41.1	--	--	--	--	86,509,312	15.14	--	--
1916	834,068	17.24	1,379,171	907.4	--	--	1,200,000	W	278,000	121.0	820	113.2	--	--	8	0.7	119,654,839	29.50	--	--
1917	709,049	14.66	1,239,150	1,020.6	--	--	500,000	W	200,000	123.3	852	146.6	--	--	53	5.5	88,793,400	24.40	1,100	W
1918	458,641	9.48	847,789	847.8	--	--	540,000	W	136,000	118.0	564	80.1	--	--	284	36.6	69,224,951	17.10	1,100	W
1919	455,984	9.42	629,708	705.3	--	--	--	--	112,000	73.4	687	72.1	--	--	569	73.7	47,220,771	8.80	--	--
1920	404,683	8.37	953,546	1,039.7	--	--	--	--	32,000	16.1	875	140.0	--	--	1,478	160.1	70,435,363	13.00	--	--
1921	390,558	8.07	761,085	761.1	45	1.5	--	--	8,000	2.4	759	68.3	--	--	40	2.7	57,011,597	7.40	--	--
1922	359,057	7.42	729,945	729.9	--	--	--	--	2,800	0.9	377	41.5	--	--	29	2.8	77,967,819	10.50	--	--
1923	289,539	5.98	814,649	668.1	--	--	--	--	3,800	1.6	410	57.4	--	--	--	--	85,920,645	12.60	--	--
1924	304,072	6.29	669,641	448.6	2	0.3	--	--	14,000	7.1	631	100.9	--	--	28	2.6	74,074,207	9.70	--	--
1925	307,679	6.36	698,259	482.4	44	3.6	W	W	28,600	15.4	789	140.6	--	--	10	1.2	73,055,298	10.30	--	--
1926	324,450	6.70	605,190	377.0	22	1.7	W	W	16,000	10.4	778	124.4	--	--	3,570	274.5	67,778,000	9.49	--	--
1927	286,720	5.97	350,430	215.0	--	--	--	--	53,400	34.0	1,008	127.0	--	--	--	--	55,343,000	7.25	--	--
1928	331,140	6.85	351,730	187.0	--	--	--	--	82,000	41.0	1,019	118.0	--	--	120	9.0	41,421,000	5.96	--	--
1929	375,438	7.76	472,900	252.0	4	0.5	--	--	77,200	35.0	1,315	166.0	--	--	475	32.0	40,570,000	7.13	--	--
1930	408,983	8.47	408,570	157.3	--	--	--	--	29,400	9.3	1,365	136.5	--	--	--	--	32,651,000	4.24	--	--
1931	459,000	9.51	352,000	102.0	15	1.2	--	--	8,200	2.0	1,660	126.0	--	--	393	14.0	22,614,000	1.88	--	--
1932	493,860	10.20	234,050	66.0	8	0.5	--	--	--	--	1,260	75.6	--	--	--	--	8,738,500	0.55	--	--
1933	469,286	9.70	154,700	55.0	--	--	--	--	5,800	2.3	1,157	85.6	--	--	605	18.6	29,000	0.02	--	--
1934	537,281	8.78	154,700	100.0	--	--	--	--	8,200 ^c	4.3	839	62.1	--	--	2,555	85.6	121,000	0.06	--	--
1935	469,495	16.43	286,600	206.0	--	--	--	--	98,800	49.8	815	65.2	--	--	8,685	259.6	15,056,000	1.25	--	--
1936	540,580	18.92	484,306	375.0	--	--	--	--	226,000	105.0	941	86.6	--	--	5,654	241.9	39,267,000	3.72	--	--
1937	627,940	21.98	494,340	382.0	--	--	962,000	147.6	372,000 ^c	202.3 ^c	823	97.1	--	--	9,823	313.4	36,007,000	4.74	--	--
1938	662,000	23.17	479,853	310.0	8	0.6	444,000	54.8	210,000	89.1	994	91.5	--	--	41,000	2,460.0	29,760,000	2.98	--	--
1939	676,780	23.68	201,054	136.5	--	--	210,000	25.9	66,000	38.0	937	88.1	--	--	33,900	2,034.0	278,500	0.04	--	--
1940	755,900	26.45	191,679	136.3	156 ^c	130.9	306,000	42.8	92,000	52.0	840	72.0	--	--	28,886	1,093.0	110,000	0.02	--	--
1941	692,314	24.23	199,700	142.0	W	W	774,000	87.3	93,600 ^c	61.0 ^c	742	58.0	--	--	22,630	813.0	144,000	0.02	--	--
1942	487,657	17.07	135,200	96.0	W	W	316,000	41.0	5,600	2.5	523	44.0	--	--	22,000	779.0	48,000	0.01	--	--
1943	99,583	3.49	31,700	22.0	786	153.4	368,000	33.3	2,000 ^c	1.0 ^c	200	22.0	--	--	27,900	1,020.0	54,000	0.01	5,564	186.3
1944	49,296	1.73	15,240	10.8	841	165.0	70,080	30.0	--	--	44	5.8	--	--	33,616	2,017.0	4,000	0.01	1,845	64.6
1945	68,117	2.38	9,983	6.2	275	180.0	W	W	--	--	11	1.8	--	--	22,949	1,377.0	10,000	0.01	--	--
1946	226,781	7.93	41,793	26.3	699	68.7	W	W	--	--	115	25.0	--	--	22,882	1,418.7	4,000	0.01	--	--
1947	279,988	9.79	66,150	46.3	127	10.6	52,000	16.1	2,000	2.2	255	76.5	226	0.15	13,512	1,351.2	24,000	0.06	--	--
1948	248,395	8.69	67,341	58.7	108	7.8	88,000	29.3	10,000	10.8	317	88.9	226	0.15	13,741	1,209.2	28,000	0.07	--	--
1949	229,416	8.03	36,056	32.4	102	7.9	88,000	31.3	114,000	100.8	49	11.2	226	0.15	17,169	1,545.2	7,700	0.02	--	--

1950	289,285	10.13	52,638	48.0	W	W	W	W	158,000	170.3	144	27.5	--	--	W	W	12,000	0.03	--	--
1951	239,628	8.38	32,870	29.8	28	W	1,718,000	2,061.6	138,000	198.0	21	7.2	--	--	W	W	2,000	0.01	--	--
1952	240,571	8.42	31,825	28.7	40	W	740,000	1,406.0	180,000	243.9	1	0.3	--	--	W	W	--	--	W	W
1953	253,771	8.88	35,387	32.1	1,023	270.0	W	W	98,000	105.9	--	--	--	--	W	W	--	--	W	W
1954	248,511	8.70	33,694	31.8	1,046	276.0	--	--	398,000	409.9	--	--	--	--	W	W	8,000	0.02	2,953	208.0
1955	249,294	8.73	33,693	30.4	43	12.0	--	--	172,000	182.5	1	0.3	--	--	W	W	2,000	0.01	7,082	625.3
1956	204,300	7.33	26,700	24.1	3,414	837.0	134,400	150.0	--	--	1	0.3	--	--	W	W	--	--	7,200	711.5
1957	215,467	7.54	28,862	26.0	5,461	1,349.0	71,120	80.0	--	--	9	3.0	--	--	W	W	--	--	4,207	431.0
1958	186,000	6.53	24,000	22.0	3,380	774.0	--	--	--	--	--	--	--	--	W	W	10,000	0.03	--	--
1959	171,000	5.99	22,000	20.0	3,750	852.0	--	--	--	--	--	--	--	--	W	W	72,000	0.04	--	--
1960	180,000	6.30	23,000	21.0	4,450	938.0	W	W	--	--	--	--	--	--	W	W	82,000	0.04	--	--
1961	114,228	3.99	--	--	4,080	816.0	--	--	--	--	--	--	--	--	W	W	184,000	0.06	--	--
1962	165,142	5.78	--	--	3,843	711.0	--	--	--	--	--	--	--	--	W	W	--	--	--	--
1963	99,000	3.48	6,100	9.0	400	76.0	W	W	--	--	5	1.1	--	--	W	W	--	--	--	--
1964	58,000	2.05	7,200	6.0	303	95.0	46,400	60.3	--	--	--	--	--	--	W	W	22,000	0.01	--	--
1965	43,000	1.51	5,000	6.0	180	104.0	46,400	60.3	--	--	14	4.0	--	--	W	W	64,000	0.03	--	--
1966	27,325	0.96	7,000	9.0	185	101.0	16,000	19.2	--	--	19	4.3	--	--	W	W	--	--	--	--
1967	22,948	0.80	6,000	9.0	161	79.0	20,000	22.0	--	--	--	--	--	--	W	W	W	W	--	--
1968	21,000	0.81	3,000	6.5	156	78.0	6,000	6.0	--	--	--	--	--	--	W	W	--	--	--	--
1969	21,227	0.88	2,000	4.2	238	100.0	94,000	100.0	--	--	2	0.5	--	--	W	W	--	--	--	--
1970	38,400	1.38	4,000	7.0	3,100	1,260.0	365,000	410.0	--	--	--	--	--	--	W	W	W	W	--	--
1971	34,000	1.36	2,000	4.0	675	285.0	68,000	74.0	34,000	47.0	--	--	--	--	W	W	--	--	--	--
1972	8,639 ^c	0.56	1,000	2.0	125	44.0	160,000	185.0	W	W	--	--	--	--	W	W	--	--	--	--
1973	15,000 ^c	1.86	13,200	22.0	70	52.5	420,000	515.0	10,000	12.0	6	2.0	--	--	W	W	--	--	--	--
1974	16,000 ^c	2.56	1,500	3.5	70	52.5	80,000	95.0	W	W	--	--	--	--	W	W	--	--	--	--
1975	14,980 ^c	3.35	6,000	25.0	--	--	120,000	145.0	22,000	60.0	--	--	--	--	W	W	--	--	--	--
1976	22,887 ^c	6.90	6,500	24.0	--	--	160,000	165.0	W	W	14	6.0	--	--	W	W	--	--	8,000 ^c	1,200.0 ^c
1977	50,000	7.80	8,000	20.0	--	--	W	W	W	W	--	--	--	--	--	--	--	--	--	--
1978	60,000 ^c	12.00	6,000	50.0	--	--	W	W	W	W	--	--	--	--	--	--	--	--	--	--
1979	65,000 ^c	18.00	6,500	93.0	--	--	100,000	125.0	100,000	830.0	--	--	--	--	--	--	--	--	--	--
1980	75,000 ^c	32.00	7,500	111.0	--	--	--	--	120,000	984.0	31	29.0	--	--	--	--	--	--	--	--
1981	134,200 ^c	55.20	13,420	111.3	W	W	--	--	106,000	700.0	--	--	--	--	900	200.0	--	--	--	--
1982	175,000 ^c	69.90	22,000	198.0	--	--	--	--	198,000	1,365.0	--	--	--	--	W	W	--	--	--	--
1983	169,000 ^c	67.60	33,200	332.0	--	--	22,400	45.0	215,000	1,100.0	--	--	--	--	W	W	--	--	--	--
1984	175,000 ^c	62.13	20,000	159.0	5	1.5	135,000	225.8	225,000	400.0	--	--	--	--	W	W	--	--	--	--
1985	190,000	61.18	28,500	171.0	27	10.0	65,000	98.0	300,000	650.0	--	--	--	--	--	--	--	--	--	--
1986	160,000 ^c	60.80	24,000	134.4	12	2.8	45,000	67.5	340,000	890.0	--	--	--	--	W	W	--	--	--	--
1987	229,707	104.51	54,300	391.0	--	--	--	--	288,000	460.0	--	--	--	--	W	W	--	--	--	--
1988	265,500	112.84	47,790	282.0	W	W	--	--	300,000	950.0	--	--	--	--	25	13.8	--	--	--	--
1989	284,617	108.7	5,211,591	27,300.0	--	--	--	NR	194,000	672.0	9,585	7,700.0	19,843	29,400.0	--	--	--	--	--	--
1990	231,700	89.20	10,135,000	50,675.0	--	--	--	--	57,000	200.0	44,220	30,954.0	181,200	253,680.0	--	--	--	--	--	--
Other ^d	--	--	--	--	1,438	--	--	--	--	--	--	--	--	--	333,936	46,940.3	--	--	--	--
TOTAL	32,356,471	1,628.22	35,364,276	94,322.4	40,945	9,910.5	11,070,800	6,655.1	7,258,400	12,444.9	80,105	41,663.1	201,013	283,000.4	668,522^e	65,805.9	1,373,793,932	228.04	39,051	3,426.7
(metric)	(1,003,956		(1,097,282		(1,411,521		(5,021,714		(3,292,410		(72,655		(182,346		(20,793		(623,152		(35,419	
kg)	kg)		kg)		kg)		kg)		kg)		tonnes)		tonnes)		kg)		tonnes)		tonnes)	

^aFrom 34 state and federal documents.

^b76-lb flask.

^cWhen state and federal figures differ significantly, state figures are used.

^dNot traceable by year.

^eCrude platinum; total production of refined metal is about 575,000 oz.

W = Withheld.

-- = Not reported.

t\$ = Thousand dollars.

m\$ = Million dollars.

APPENDIX G

Production of industrial minerals, coal, and other commodities in Alaska, 1880-1990

Year	Coal		Sand and gravel		Building stone ^a		Barite		Other ^b
	(s. tons)	(m\$)	(s. tons)	(m\$)	(s. tons)	(m\$)	(s. tons)	(t\$)	(\$)
1880-1899 ^c	19,429	0.14	--	--	7,510	0.04	--	--	--
1900	1,200 ^d	0.02 ^d	--	--	510	0.01	--	--	--
1901	1,300 ^d	0.02 ^d	--	--	700	0.01	--	--	500
1902	2,212 ^d	0.02 ^d	--	--	800	0.01	--	--	255
1903	1,447	0.01	--	--	920	0.01	--	--	389
1904	1,694	0.01	--	--	1,080	0.02	--	--	2,710
1905	3,774	0.02	--	--	970	0.02	--	--	740
1906	5,541	0.02	--	--	2,863	0.03	--	--	19,965
1907	10,139	0.05	--	--	3,899	0.03	--	--	54,512
1908	3,107 ^d	0.01 ^d	--	--	2,176	0.03	--	--	81,305
1909	2,800	0.02	--	--	1,400	0.01	--	--	86,027
1910	1,000 ^d	0.01 ^d	--	--	W	W	--	--	96,408
1911	900 ^d	0.01 ^d	--	--	W	W	--	--	145,739
1912	355 ^d	0.01 ^d	--	--	W	W	--	--	165,342
1913	2,300	0.01	--	--	W	W	--	--	286,277
1914	1,190	0.01	--	--	W	W	--	--	199,767
1915	1,400	0.03	--	--	W	W	--	--	205,061
1916	12,676	0.05	--	--	W	W	--	--	326,731
1917	54,275	0.27	--	--	W	W	--	--	203,971
1918	75,816	0.41	--	--	W	W	--	--	171,452
1919	60,894	0.35	--	--	50,014	0.29	--	--	214,040
1920	61,111	0.36	--	--	37,044	0.27	--	--	372,599
1921	76,817	0.49	--	--	59,229	0.31	--	--	235,438
1922	79,275	0.43	--	--	54,251	0.30	--	--	266,296
1923	119,826	0.76	--	--	83,586	0.41	--	--	229,486
1924	99,663	0.56	--	--	35,294	0.26	--	--	348,728
1925	82,868	0.40	--	--	32,193	0.19	--	--	454,207
1926	87,300	0.46	--	--	33,283	0.20	--	--	423,000
1927	104,300	0.55	--	--	41,424	0.22	--	--	--
1928	126,100	0.66	--	--	63,347	0.31	--	--	--
1929	100,600	0.53	--	--	54,766	0.26	--	--	194,000
1930	120,100	0.63	--	--	66,234	0.33	--	--	157,300
1931	105,900	0.56	--	--	59,175	0.29	--	--	108,000
1932	102,700	0.53	--	--	54,167	0.27	--	--	223,400
1933	96,200	0.48	--	--	56,291	0.28	--	--	--
1934	107,500	0.45	--	--	64,234	0.36	--	--	46,155
1935	119,425	0.50	--	--	74,049	0.38	--	--	46,755
1936	136,593	0.57	--	--	76,379	0.38	--	--	45,807
1937	131,600	0.55	--	--	50,057	0.25	--	--	147,048
1938	159,230	0.62	--	--	189,090	0.21	--	--	125,302
1939	143,549	0.60	42,332	0.02	--	--	--	--	--
1940	170,174	0.88	515,011	0.10	--	--	--	--	--
1941	241,250	0.97	530,997	0.09	--	--	--	--	1,367,000

^aBuilding-stone production figures for 1880-1937 are for the southcentral and interior regions of Alaska only.

^bIncludes 2.4 million lb U₃O₈ (1955-71); 505,000 tons gypsum (1905-26); 286,000 lb WO₃ (intermittently 1916-80); 94,000 lb asbestos (1942-44); 540,000 lb graphite (1917-18; and 1942-50); and undistributed amounts of zinc, jade, peat, clay, soapstone, miscellaneous gemstones, and other commodities (1880-1985).

^cProduction not traceable by year.

^dWhen state (territorial) and federal figures differ significantly, state figures are used. Figures for sand and gravel production in 1974 show state estimates (118,740,000 s. tons; 240.94 m\$) and federal (42,614,000 s. tons; 88.96 m\$). The federal estimate was not added to total production.

^eMarble quarried on Prince of Wales Island, southeastern Alaska (1900-41).

m\$ = Million dollars.

t\$ = Thousand dollars.

-- = Not reported.

W = Withheld.

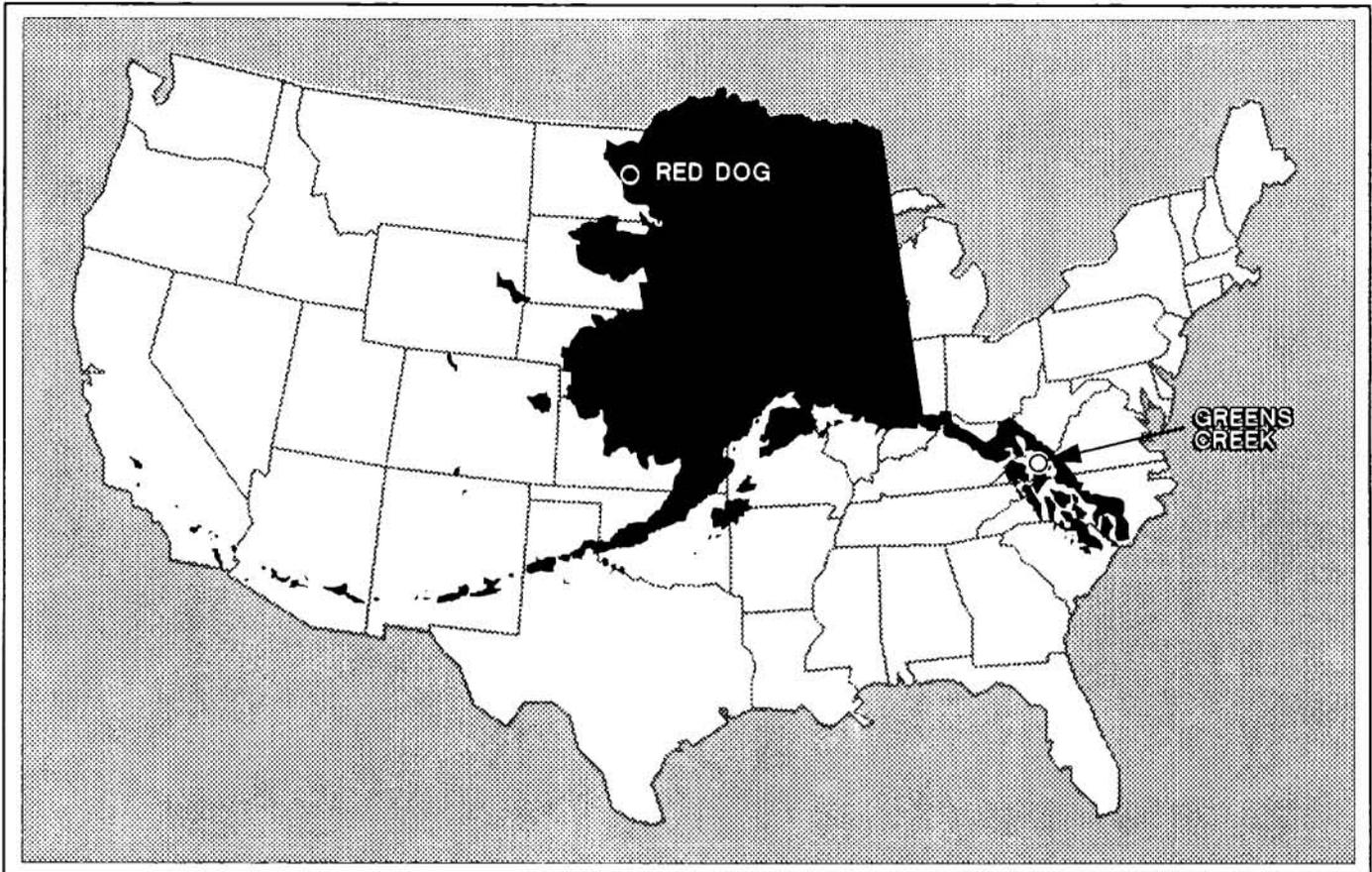
Year	Coal		Sand and gravel		Building stone ^a		Barite		Other ^b
	(s. tons)	(m\$)	(s. tons)	(m\$)	(s. tons)	(m\$)	(s. tons)	(t\$)	(t\$)
1942	246,600	0.99	W	W	--	--	--	--	1,124,000
1943	289,232	1.84	W	W	--	--	--	--	--
1944	352,000	2.37	712,496	0.50	--	--	--	--	2,350,309
1945	297,644	1.87	W	W	--	--	--	--	5,910,704
1946	368,000	2.36	W	W	--	--	--	--	2,005,241
1947	361,220	2.55	W	W	219,000	1.00	--	--	5,927,319
1948	407,906	2.79	W	W	67,341	0.33	--	--	1,257,699
1949	455,000	3.60	W	W	W	W	--	--	7,181,886
1950	421,455	3.03	3,050,020	2.38	W	W	--	--	2,100,000
1951	494,333	3.77	6,818,000	3.54	W	W	--	--	3,600,000
1952	648,000	5.77	6,817,800	3.54	W	W	--	--	9,052,000
1953	861,471	8.45	7,689,014	5.08	47,086	0.17	--	--	1,231,350
1954	666,618	6.44	6,639,638	6.30	283,734	0.47	--	--	1,572,150
1955	639,696	5.76	9,739,214	8.24	265,740	0.29	--	--	1,552,427
1956	697,730	6.37	9,100,000	8.30	50,000	0.02	--	--	1,551,500
1957	842,338	7.30	6,096,000	8.79	528,000	1.95	--	--	2,751,000
1958	759,000	6.93	4,255,000	3.87	615,000	2.07	--	--	695,000
1959	602,000 ^d	5.88 ^d	5,600,000	5.10	54,000	0.20	--	--	1,338,000
1960	669,000 ^d	5.95 ^d	5,892,000	5.35	80,000	0.30	--	--	975,000
1961	650,000 ^d	5.87 ^d	5,241,000	4.19	--	--	--	--	--
1962	675,000 ^d	6.41 ^d	5,731,000	5.36	--	--	--	--	--
1963	853,000	5.91	16,926,000	22.01	W	W	W	W	2,589,000
1964	745,000	5.01	26,089,000	18.49	W	W	W	W	4,912,000
1965	860,000 ^d	5.88 ^d	29,959,000	33.93	W	W	W	5,296,000	
1966	927,000	6.95	17,457,000	21.79	W	W	44,000	350.0	6,167,000
1967	930,000	7.18	22,300,000	26.25	W	W	W	W	4,924,000
1968	812,000 ^d	5.03 ^d	17,515,000	20.73	W	W	91,000	W	4,117,000
1969	728,000 ^d	4.65 ^d	16,205,000	18.62	1,954,000	3.90	90,000	850.0	5,163,000
1970	786,000 ^d	5.28 ^d	20,375,000 ^d	26.07 ^d	6,470,000	10.01	134,000 ^d	1,875.0	7,994,000
1971	748,000 ^d	5.05 ^d	26,391,000	41.99	2,658,000	5.07	102,000 ^d	1,075.0	--
1972	720,000 ^d	6.26 ^d	14,187,000	15.21	652,000	3.01	W	W	--
1973	700,000 ^d	6.23 ^d	19,350,000	19.01	5,967,000	12.00	112,000	1,792.0	12,846,000
1974	700,000	7.34	118,740,000 ^d	240.94 ^d	5,484,000	12.95	110,000	1,895.0	14,495,000
			42,614,000	88.96					
1975	766,000	7.81	48,145,000	95.78	8,877,000	26.65	2,000 ^d	30.0	12,731,000
1976	705,000	8.00	74,208,000 ^d	204.73 ^d	6,727,000	20.09	W	W	14,019,000
1977	780,000 ^d	12.00 ^d	66,126,000	134.25	4,008,000	17.47	--	--	14,486,000
1978	750,000	15.00	51,100,000	122.00	3,437,000	14.65	22,000	750.0	--
1979	750,000	16.00	50,900,000	104.90	3,650,000	15.45	20,000	800.0	930,000
1980	800,000	16.00	40,000,000	86.00	3,700,000	15.40	50,000	2,000.0	97,500
1981	800,000	17.60	46,000,000	88.20	4,200,000	19.30	--	--	256,000
1982	830,000	18.00	45,000,000	91.00	3,400,000	15.60	--	--	150,000
1983	830,000	18.00	50,000,000	105.00	5,270,000	25.00	--	--	242,000
1984	849,161	23.75	27,000,000	95.00	2,700,000	16.00	--	--	875,875
1985	1,370,000	39.73	28,184,080	112.06	2,500,000	12.00	--	--	559,000
1986	1,492,707	40.10	20,873,110	75.76	4,200,000	20.32	--	--	384,800
1987	1,508,927	42.35	16,696,374	42.66	1,805,000	11.62	--	--	388,400
1988	1,551,162	44.30	17,264,500	48.75	3,600,000	24.65	--	--	389,000
1989	1,452,353	41.46	14,418,000	39.88	2,914,000	20.34	--	--	1,492,000
1990	1,576,000	44.99	15,013,500	40.82	3,200,000	22.10	--	--	400,000
Other ^d	--	--	--	--	2,300,000 ^a	W	79,000	W	--
TOTAL	40,560,083	586.20	1,040,892,084	2,062.58	93,139,836	355.38	856,000	11,417.0	175,130,877
(metric	36,787,945		944,089,120		84,474,831		776,563		
tonnes)			tonnes)		tonnes)		tonnes)		

METRIC CONVERSION FACTORS

Factors for converting U.S. customary units to international metric units are as follows:

To convert from	To	Multiply by
MASS		
ounce, troy (oz tr)	kilogram (kg)	0.0311
ounce, avoirdupois (oz avdp)	kilogram (kg)	0.0283
pound, avoirdupois (lb)	kilogram (kg)	0.4536
ton, short (2,000 lb)	tonne (mg)	0.9072
tonne (mg)	ton (2,000 lb)	1.102
LENGTH		
foot (ft)	meter (m)	0.3048
mile (mi)	kilometer (km)	1.609
AREA		
mile ² (mi ²)	kilometer ² (km ²)	2.590
acre	hectometer ² (hm ²)	.4047
VOLUME		
yard ³ (yd ³)	meter ³ (m ³)	0.7646
gallon	liter	3.785

ALASKA IN TRUE SCALE COMPARED WITH THE LOWER 48

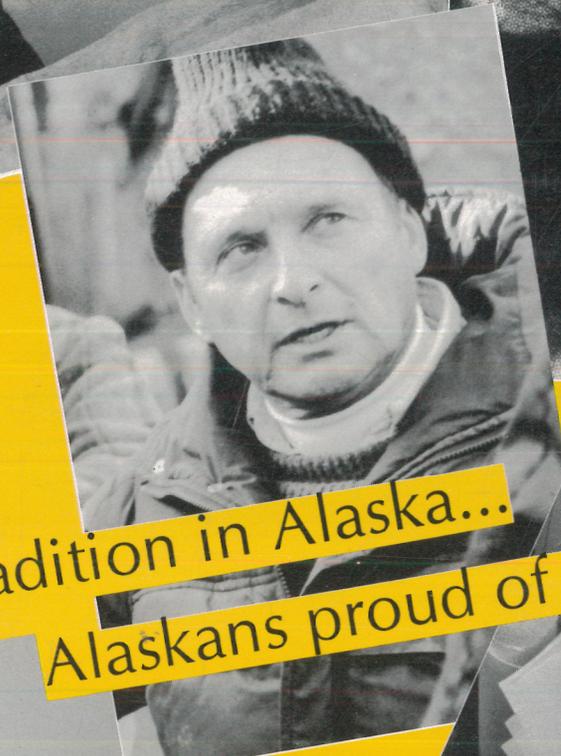




Echo Bay



Cominco



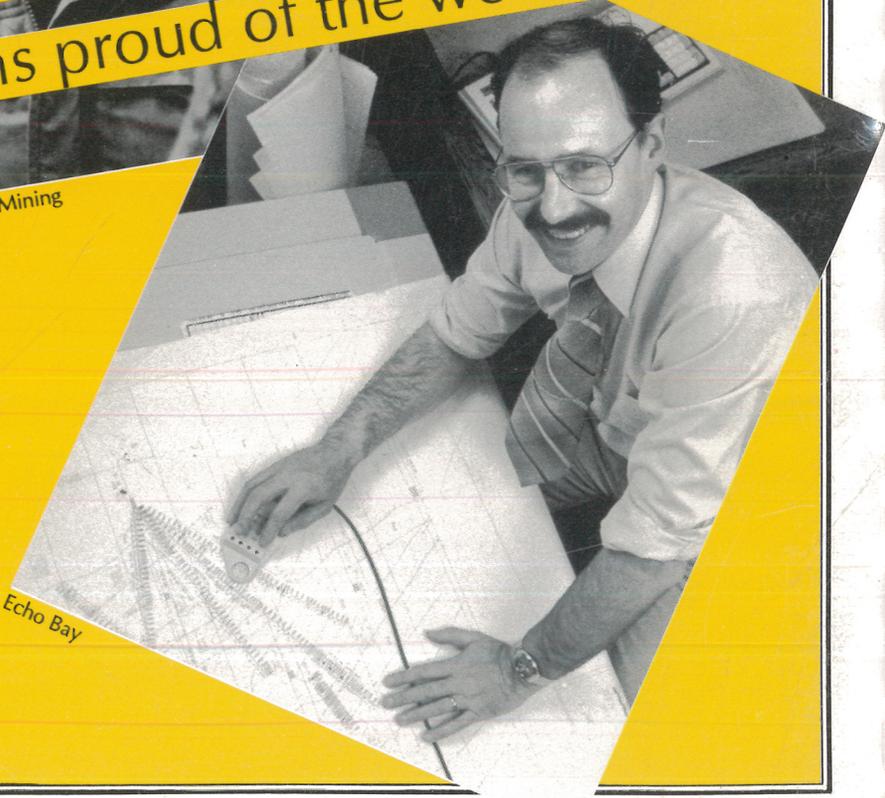
Division of Mining

a proud tradition in Alaska...

Alaskans proud of the work they do



Cominco



Echo Bay