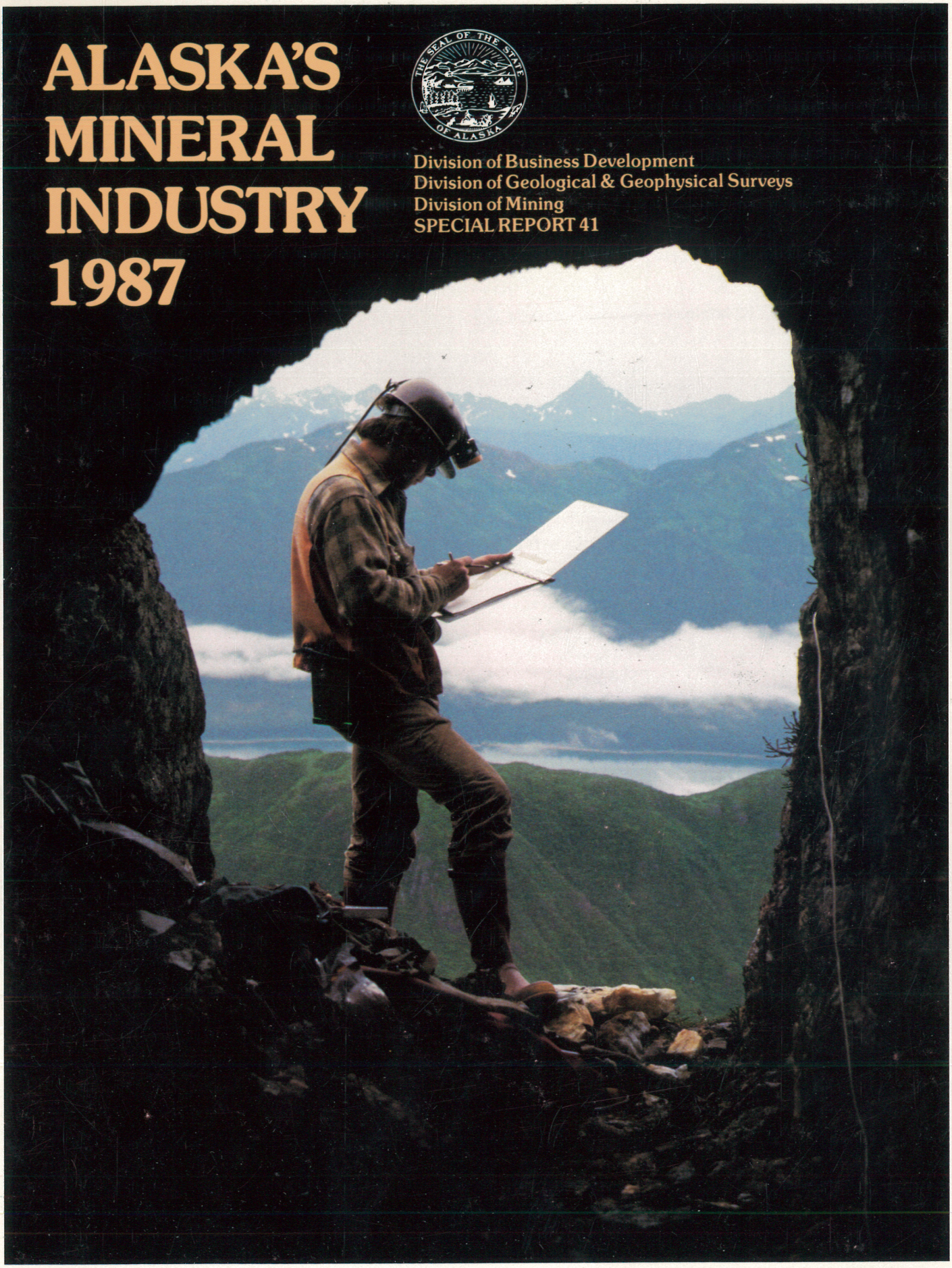
ALASKA'S MINERAL INDUSTRY 1987

Division of Business Development
Division of Geological & Geophysical Surveys
Division of Mining
SPECIAL REPORT 41



Front cover: A geologist with the U.S. Bureau of Mines examines the Denny prospect near Juneau. The Bureau of Mines has examined more than 200 properties as part of a 4-yr study of the Juneau mining district, southeastern Alaska. Photograph by Earl Redman, U.S. Bureau of Mines, 1985.

ALASKA'S MINERAL INDUSTRY, 1987

By T.K. Bundtzen, C.B. Green, R.J. Peterson, and A.F. Seward

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

SPECIAL REPORT 41

STATE OF ALASKA
Steve Cowper, *Governor*

Fairbanks, Alaska
1988

STATE OF ALASKA

DEPARTMENT OF COMMERCE AND ECONOMIC DEVELOPMENT
J. Anthony Smith, *Commissioner*

Division of Business Development
Larry Merculieff, *Director*

DEPARTMENT OF NATURAL RESOURCES
Judith M. Brady, *Commissioner*

Division of Geological and Geophysical Surveys
Robert B. Forbes, *Director and State Geologist*

Division of Mining
Gerald L. Gallagher, *Director*

Available from Alaska Division of Geological and Geophysical Surveys, 3700 Airport Way, Fairbanks, AK 99709, or 400 Willoughby Ave. (3rd floor), Juneau, AK 99801; and U.S. Geological Survey Public Information Office, 201 C St., Anchorage, AK 99513, or Information Specialist, 4230 University Drive, Anchorage, AK 99508. Also available from Division of Business Development, 1001 Noble St., Ste. 420, Fairbanks, AK 99701 or State Office Building, (9th floor), Juneau. Mail orders should be addressed to the DGGS office in Fairbanks.

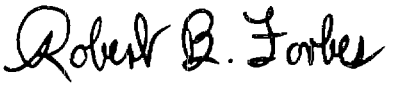
FOREWORD

Special Report 41, 'Alaska's Minerals Industry — 1987,' is the seventh annual report produced by the Department of Commerce and Economic Development Division of Business Development and the Department of Natural Resources Division of Geological and Geophysical Surveys and Division of Mining.

The primary objective of this report is to provide current information on Alaska's mineral industry. The report is wholly dependent on the cooperation of government agencies, private industry, and individuals who voluntarily provide information on their projects and activities.

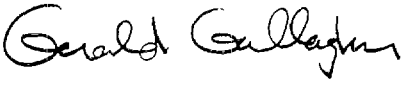
In 1987, the value of the mineral industry to Alaska's economy was $318.4 million, an increase of 37 percent from 1986. For the first year in two decades, the value of gold production exceeded the combined value of all other mineral production, including coal, sand and gravel, and stone. Exploration expenditures increased by 76 percent; three-quarters of these expenditures supported exploration for precious metals.

Development expenditures reached $100.3 million, the highest ever recorded for Alaska. Over 90 percent of this capital investment was for the construction of the Greens Creek and Red Dog mines. When these two mines reach full production, Alaska will host the nation's largest silver and zinc producers and the state will establish its role as an important international supplier of minerals.



Robert B. Forbes
Director and State Geologist
Division of Geological and Geophysical Surveys

Larry Merculieff
Director
Division of Business Development



Gerald L. Gallagher
Director
Division of Mining

Contents

FIGURES

TABLES

ALASKA'S MINERAL INDUSTRY, 1987

By T.K. Bundtzen[1], C.B. Green[2], R.J. Peterson[3], and A.F. Seward[4]

Executive summary

Positive changes took place in several sectors of Alaska's mineral industry in 1987. Expenditures and values for exploration, development, and production totaled $318.4 million, up from $231.7 million in 1986, an increase of 37 percent (fig. 1, table 1), and an increase of 18 percent from 1985. The number of people employed in various segments of the industry increased by 349 — to 3,299 in 1987 from 2,950 in 1986. Principal mineral commodities produced during 1987 were 229,700 oz of gold valued at $104.5 million, 16.7 million short tons of gravel valued at $42.7 million, and 1.51 million short tons of coal valued at $42.4 million. Gold, sand and gravel, and coal accounted for 94 percent of the 1987 total production value of $202.4 million. Building stone, tin, silver, tungsten, jade, platinum, soapstone, and peat made up the remaining 6 percent. For the first time in 20 yr, metal production values (primarily gold) exceeded those of sand and gravel, building stone, jade, and soapstone combined.

The value of sand and gravel production dropped 43 percent from 1986 because of decreased construction activity on Alaska's North Slope and in the state's urban areas. Road construction at the Red Dog and Greens Creek mine projects kept demand for sand and gravel products from falling to even lower levels.

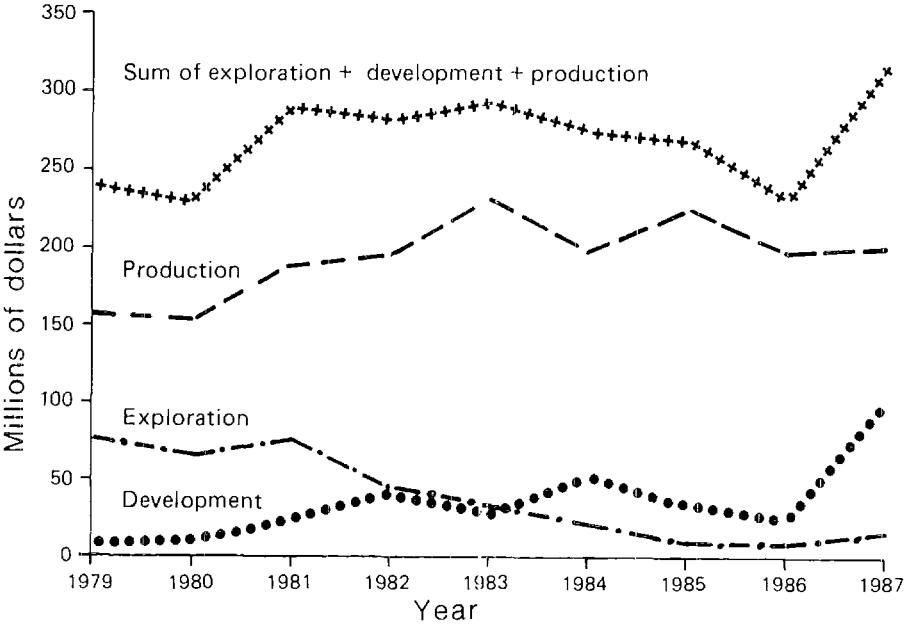


Figure 1. Value of mineral activity in Alaska, 1979-87.

Estimated gold production in 1987 was 229,700 oz, an increase from 1986 of 44 percent in volume and 71 percent in value. Mechanized placer mines produced 97 percent of the gold (223,200 oz). Expanded operations at several large projects accounted for the increase; the 10 largest mines produced 133,229 oz — 58 percent of the state's total gold production. These figures tend to mask the effects of regulatory and legal problems on small, family-operated placer mines. Between 1985 and 1986, the number of operating placer mines fell from 266 to 196, a 26-percent reduction; 1987

Table 1. *Total value of mineral industry in Alaska, 1985-87.*

	1985	1986	1987
Exploration	$ 9,150,000	$ 8,914,744	$ 15,734,061
Development	34,120,775	24,331,972	100,250,848
Production	226,599,250	198,461,007	202,389,898
TOTAL	$269,870,025	$231,707,723	$318,374,807

[1]Alaska Division of Geological and Geophysical Surveys, 3700 Airport Way, Fairbanks, AK 99709.
[2]Alaska Division of Business Development, 1001 Noble St., Ste. 420, Fairbanks, AK 99701.
[3]Alaska Division of Mining, 3700 Airport Way, Fairbanks, AK 99709.
[4]Alaska Division of Geological and Geophysical Surveys, 794 University Ave. (2nd floor), Fairbanks, AK 99709.

saw only a marginal increase to 202.

The greatest source of concern for small miners in 1987 was the lawsuit brought by the Sierra Club against the U.S. Bureau of Land Management (Sierra Club v. Penfold). A federal judge granted an injunction early in 1987 prohibiting BLM from authorizing any mining operation which will disturb more than 5 acres of land on any of four major interior Alaska drainages until BLM completes its cumulative environmental impact statements and other land-use evaluations. This injunction could halt some placer mining in key interior Alaska mining districts for 1 to 3 yr. Management decisions based on the EIS's will undoubtedly affect regulation of placer mining on other BLM lands in Alaska.

A second source of concern for small miners is the entry of the U.S. Army Corps of Engineers (Corps) into the regulatory process and the level of detail required in their permit applications. Spurred by a request from the U.S. Fish and Wildlife Service, and under threat of legal action by the Sierra Club, the Corps will require applications from most Alaska mining operators, beginning in the 1988 season. The Corps is working to streamline the permit process so most placer mines can operate under a general permit with standard stipulations and conditions.

Other problems facing miners are water-quality issues, a continuing court-ordered shutdown of mining in several national conservation units, and a legal challenge to the state's mining-claim location and leasing systems. Governor Steve Cowper, who has been supportive of resolving state regulatory problems for small miners, declared in a March 30, 1987 memo to three state resource-management agencies that the continuation of the status quo was unacceptable. Governor Cowper assigned priority status to the resolution of water-quality issues and further directed his Commissioners of Natural Resources, Environmental Conservation, and Fish and Game to take an active role in addressing federal and state regulatory and legal problems that adversely impact the mining industry.

While production levels and numbers of small placer mines have declined significantly from 1985, several larger operations have continued at high or expanded production levels. The western region, particularly the Seward Peninsula, enjoyed a large increase in gold mining activity. ALASKA GOLD COMPANY operated two upland dredges near Nome in 1987. In previous years, the scarcity of thawed placer reserves forced the company to operate only one of two available dredges. However, a large-scale thawing project in 1986 set the stage for renewed operation of the second dredge in 1987, and ALASKA GOLD was able to employ 125 people at the height of the season's operations. Each dredge processed 5,500-6,000 yd^3/day for a season total of about 1.4 million yd^3, nearly double 1986's production. WESTERN GOLD EXPLORATION AND MINING COMPANY (formerly INSPIRATION GOLD, INC.) operated its huge offshore bucket-line dredge, the 'Bima', for over 5 months in 1987 and produced 36,000 oz of refined gold. The Bima returned to Nome in June 1987 from winterizing in the Port of Tacoma where its gold-recovery system was modified.

Two other large-scale placer projects operated in Nome in 1987. WINDFALL MINING COMPANY and ANVIL MINING, INC. used conventional sluice boxes and large-scale earthmoving equipment to process upland placer reserves on land leased from the ALASKA GOLD COMPANY that is unsuitable for mining by dredge.

The VALDEZ CREEK MINING COMPANY, operating in southcentral Alaska, continued as one of the state's largest gold producers in 1987. During a 12-mo production period, 33,277 oz of refined gold were won from 362,000 yd^3 of pay gravel, a significant increase from last year's production. Ninety percent of the 136 company employees were Alaska residents. VALDEZ CREEK operated through the winter, and found from their experience that they can operate in temperatures of from -25° to -35°F before freezing problems shut them down.

LOST RIVER MINING (Len Grothe, owner) continued placer-tin mining at Cape Creek on the western Seward Peninsula and produced 288,000 lb of equivalent refined tin for world markets. This small mine remains one of America's largest primary mine sources of tin.

Special mention should be made of several projects with potentially exciting results while in preliminary production phases. CITIGOLD ALASKA, INC., a subsidiary of LA TEKO RESOURCES of Vancouver, British Columbia, completed its first year of a full-scale heap-leaching test, using earthmoving equipment to stack surface-mineable reserves of oxidized quartz-vein ore from the Ryan Lode property near Fairbanks; 88,000 tons of vein material was agglomerated, stacked on two pads, and leached, using sodium cyanide. CITIGOLD, who produced 6,100 oz of gold-silver bullion in 1987, was Alaska's largest lode producer of precious metals. A significant increase in production is anticipated in 1988. On a neighboring property, the Grant Gold Mine conducted drilling programs to delineate surface-mineable ore reserves for its mill. After extensive testing during summer and fall, the company reopened the mine on December 1, and in 30 days recovered 907 oz of refined gold from 5,662 tons of ore; 26 Fairbanksans were employed during the production period. The Grant Gold Mine had operated briefly in 1985, producing from underground ore reserves, but production was halted when one of the project's joint-venture partners terminated their participation. At Hatcher Pass north of Anchorage, ALASKA HARDROCK MINING COMPANY operated a 20-ton/day mill from January through October and milled 1,050 tons of high-grade ore from the old Independence Mine. Increased production is planned for 1988.

Alaska coal production in 1987 was 1.51 million tons, which came almost exclusively from the USIBELLI COAL MINE; 707,200 tons were burned in interior Alaskan power plants for electrical generation and steam heat; 644,708 tons were

shipped to the KOREA ELECTRIC POWER COMPANY (KEPCO) for power generation in their Honam plant; and 133,069 tons were shipped to the TAIWAN POWER COMPANY (TAIPOWER) to be tested as a blending coal. The results of TAIPOWER's blending tests have been favorable, and USIBELLI hopes to secure a modest export contract in the future. In mid-December, USIBELLI shipped 23,950 tons of steam coal to the ELECTRIC POWER DEVELOPMENT CORPORATION (EPDC) in Japan for a fluidized-bed system test.

Exploration expenditures during 1987 increased to $15.7 million, a 76-percent increase from the 1986 level of $8.9 million, which points to an expansion of the mineral-exploration industry in Alaska and a recovery from the slump of 1985 and 1986. Much of the increase took place in the southeastern Panhandle.

In the Juneau Gold Belt area, ECHO BAY MINES continued its examination of the Alaska Juneau Mine (AJ) and acquired one-half ownership and operating rights to the Kensington Mine. The AJ produced from 1913 to 1944 and was renowned for the profitable recovery of low grade ore there. Work at the AJ in 1987 consisted of preparing and shipping a 1,000-ton bulk sample from the Sheep Creek adit to Lakefield, Ontario for evaluation. The known reserves at the AJ when it closed in 1944 were 29 million tons of ore grading 0.039 oz/ton gold. In mid-1987, ECHO BAY, in partnership with COEUR D'ALENE MINES, acquired the Kensington Mine near Berners Bay from PLACID OIL for $20 million. Drill-indicated and geologically inferred gold reserves developed by PLACID at the Kensington Mine are estimated at 425,000 oz. In the same area, CURATOR AMERICAN, INC. conducted an extensive drilling program at the Jualin Mine.

ALASKA APOLLO GOLD MINES LTD. continued drilling and trenching on their Shumagin claim block on Unga Island and retained KILBORN ENGINEERING to evaluate their reserve data.

In southcentral Alaska, two drilling programs were performed on the Golden Zone property by GOLDEN ZONE DEVELOPMENT, LTD. A gold-bearing breccia pipe and vein systems on the property were primary exploration targets. Favorable drilling results were reported.

Several new exploration partnerships and agreements were formed in 1987 for precious metals exploration. In Nome, ASPEN EXPLORATION and PLACER DOME U.S., INC. formed a partnership to explore for upland lode sources of the Nome beach placers. Part of the effort included acquisition of land positions from multiple landowners, including the ALASKA GOLD COMPANY and Alaska native regional and village corporations. Initial work in 1986 located mineralized vein systems that crop out on a valley floor. Core drilling in 1987 indicated the vein system may be extensive.

In the interior region, DOYON, LTD. signed separate exploration agreements covering nearly 1 million acres with AMERICAN COPPER AND NICKEL and ELECTRUM RESOURCES. DOYON owns 12 million acres of Alaska land, much of which was selected for its mineral potential. Other native regional corporations reporting joint-venture exploration agreements with mineral firms include the ALEUT NATIVE CORPORATION, COOK INLET REGION, INC., SEALASKA, CALISTA CORPORATION, and BERING STRAITS NATIVE CORPORATION.

In the Fairbanks area, the FAIRBANKS EXPLORATION COMPANY announced an exploration agreement with BP MINERALS AMERICA. The companies are interested in exploring for and developing bulk-mineable lode-gold deposits. Other companies with Alaska precious-metal exploration programs or partnership agreements include NERCO MINERALS, GCO MINERALS, BHP-UTAH INTERNATIONAL, ALASKA APOLLO GOLD MINES LTD., BATTLE MOUNTAIN MINING COMPANY, ASHTON MINING, FREEPORT MCMORAN, CYPRUS GOLD, WESTERN MINING, COMINCO ALASKA, INC., LAC MINERALS, NEWMONT, TIMBERLINE MINERALS, and the MISCO-WALSH COMPANY.

In the Matanuska coalfield northeast of Anchorage, UNION PACIFIC MINERALS (formerly ROCKY MOUNTAIN ENERGY), in partnership with the IDEMITSU KOSAN COMPANY, completed a drilling and bulk-sampling program on state coal leases. IDEMITSU asked the state to begin the administrative process to open additional lands on the south side of the Matanuska Valley for coal-prospecting permits and leasing. The area has not been previously recognized as having high potential for coal. IDEMITSU, Japan's largest domestic oil company, recently built a coal import terminal in Tokyo Bay and uses coal in several of its refineries. IDEMITSU is primarily interested in high-volatile bituminous coals such as those found in the Matanuska Valley.

Mine development expenditures quadrupled from $24.3 million in 1986 to $100.3 million in 1987, the highest level ever recorded in Alaska. About 90 percent of this was spent for development of the Red Dog zinc mine in northwest Alaska and the Greens Creek silver-gold mine near Juneau.

In June 1987, the GREENS CREEK MINING COMPANY, owned by AMSELCO MINERALS (now BP MINERALS AMERICA), HECLA MINING, CSX OIL AND GAS CORPORATION, and EXALAS RESOURCES, decided to develop the Greens Creek mineral deposit. The property is located on Admiralty Island, 18 mi west of Juneau. Total development costs are estimated to be $105 million. According to current schedules, the mine will be producing concentrates in early 1989. The Greens Creek Mine will process an estimated 1,000 ton/day of ore and produce 84,000 ton/yr of concentrate containing 6.4 million oz silver, 36,000 oz gold, 25,000 tons zinc, and 9,000 tons lead. At this production rate, Greens Creek mine will become the largest silver producer in the United States. Mine concentrates have been presold to smelters in Europe and Asian countries. The

mine will employ about 200 workers who will commute by ferry from Juneau.

Construction is also underway on the Red Dog mine in northwest Alaska, owned by NANA REGIONAL CORPORATION and operated by COMINCO ALASKA, INC. The zinc-lead-silver deposit is unusual because it includes exceptionally high grades and large tonnages of ore that are amenable to opencut mining. The mine's stripping ratio of 0.8:1 is extremely low, compared to almost any type of surface mining other than sand and gravel. The decision to proceed to development at Red Dog was made in late 1986, and full-scale development began in 1987 with the construction of a pioneer road from a port site on the Chukchi Sea to the mine site 52 mi inland. The pioneer road was completed in late November 1987, 1½ mo ahead of schedule. Production is scheduled to begin in early 1990, and the first concentrate shipments will be shipped the following summer during the ice-free shipping season.

State and federal agencies continued mineral-resource investigations and published several reports. In 1986 and 1987, DGGS, under contract to U.S. Geological Survey (USGS), completed geologic mapping and geochemical studies and examined prospects and mines in the Steese-White Mountains National Recreation Area. A final report released in November 1987 indicated that promising resources of tin, silver, rare-earth elements, and gold exist in the study area. In a separate study, the U.S. Bureau of Mines (USBM) completed a placer resources evaluation of the Steese Recreation Area.

The Alaska Minerals Commission, which was formed by the State Legislature in 1986 to develop recommendations for mitigating constraints on mineral development in Alaska, presented an interim report to the Governor and Legislature in January 1988.

During 1987, the Division of Mining worked closely with the BLM and the Alaska Division of Land and Water Management to prioritize mineral-rich, state-selected lands for transfer to the state. Since 1986, the state has received title to 420,000 acres of these lands in central and western Alaska. The Division of Mining also worked with miners and the U.S. Environmental Protection Agency to help 150 mine operators obtain modifications related to turbidity requirements on their 1987-88 effluent discharge permits. A surface-mining permit was approved for the DIAMOND ALASKA coal project at Beluga. In the nearby Matanuska Valley, a lease tract was offered; the successful bidder, UNION PACIFIC MINERALS, will add this to existing coal leases being explored for potential sources of coal for export to Japan.

In cooperation with DGGS, private companies, and individuals, the USGS released Bulletin 1786, 'Significant metalliferous lode deposits and placer districts of Alaska,' (Nokleberg and others, 1987) a concise current summary of Alaska's metallic mineral resources.

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 Business Development (DBD). Of the seven reports since 1981, six have been published under the DGGS Special Report series.

We thank Alaska's miners, industry explorationists, consultants, sand-and-gravel companies, Native regional corporations, petroleum companies (using industrial minerals), and federal, state, and municipal agencies for their cooperation.

T.K. Bundtzen (DGGS) mailed 876 questionnaires on mining activity in Alaska, 242 of which were returned by private firms and individuals. C.H. Stevenson (DOM) researched the data in appendix A and figures 3 and 4 (discussed in the text). Bundtzen and C.B. Green (DBD) wrote all sections of the text. R.J. Peterson (DOM) compiled appendixes B and E, and Bundtzen compiled appendixes C, F, and G. R.A. Mann (DGGS) compiled appendix D from Department of Revenue records.

Green, Bundtzen, A.F. Seward, K.E. Adams, C.L. Daniels (DGGS), Eric Hansen (DOM), T.L. Pittman (USBM), and James Deagen (DBD) reviewed and edited the report.

Computer graphics support was furnished by S.A. Liss (DGGS), graphics and cartography by A.C. Schell (DGGS), and typesetting by B.J. Weiss (Department of Commerce and Economic Development).

Exploration activity during 1987

INTRODUCTION

Mineral exploration throughout Alaska increased in 1987 from 1985 and 1986 levels. Total reported exploration expenditures during 1987 were $15,734,061 compared to $8,914,744 in 1986, an increase of 76 percent. Expenditures are listed by commodity and region in tables 2 and 3 and shown graphically in figure 2. The highest expenditure level ($5.85 million; 37 percent of total) was recorded in the southeastern region.

Southcentral region and eastern interior region claimed 22 percent and 21 percent, respectively. Mineral exploration provided 33,769 person-days of employment — a full-time

Table 2. *Reported exploration expenditures in Alaska by commodity groupings, 1982-87.*

	1982	1983	1984	1985	1986	1987
Base metals	$31,757,900	$ 9,758,760	$ 4,720,596	$2,397,600	$1,847,660	$ 2,523,350
Precious metals	10,944,100	20,897,555	14,948,554	6,482,400	6,107,084	11,743,711
Industrial minerals	—	2,068,300	270,000	—	170,000	286,000
Coal and peat	2,900,000	1,338,454	2,065,000	270,000	790,000	1,150,000
Other[a]	15,300	70,000	279,500	—	—	31,000
TOTAL	$45,617,300	$34,133,069	$22,283,650	$9,150,000	$8,914,744	$15,734,061

[a] Includes jade, soapstone, uranium, and other unspecified commodities.
— no data available.

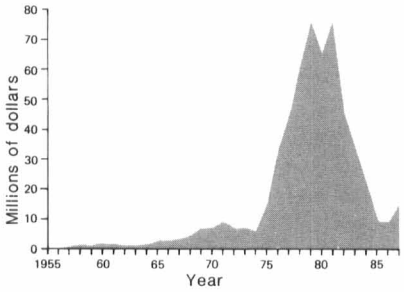


Figure 2. Mineral-exploration expenditures in Alaska, 1955-87.

equivalent of 98 jobs. Of total 1987 dollars expended, approximately 75 percent ($11.74 million) was spent in search of precious metals, congruent with nationwide trends. While exploration expenditures increased, the total number of active claims decreased (figs. 3 and 4). There were 68,348 active state and federal claims in 1987, compared to 71,014 active claims in 1986, a decrease of 4 percent. From late 1986 throughout 1987, BLM adjudicated claims and sent out abandonment decisions on 7,200 federal claims, some on state-selected lands, which were subsequently restaked as state mining claims.

During 1987, the state received tentative approval from BLM on 400,000 acres of land selections under the Statehood Act. These lands have been identified by government and private groups as having high mineral potential. The land transfer was made possible by a streamlined BLM procedure for conveyance of state-selected lands to tentatively approved state-owned status.

The U.S. Bureau of Mines (USBM) completed a three-part study (Maas, 1987; Roberts, 1985; Bottge, 1987; Bottge and Northam, 1987) which presents (1) an inventory of federal, state, Native, and private lands; (2) a comparison of mineral terranes to land availability categories; and (3) a comparison of mineral deposits and mineral terranes to land availability categories. The study shows that, as of October 1987, 30 percent of Alaska's 378 million acres of land is available for mineral exploration and development, 10 percent is available

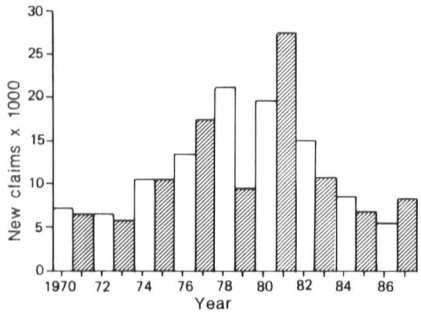


Figure 3. New claims filed in Alaska, 1970-87.

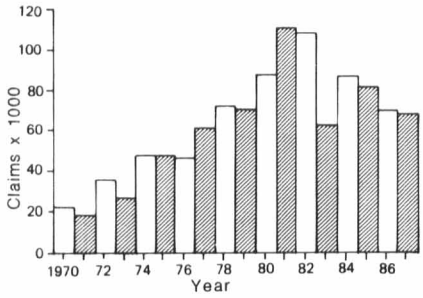


Figure 4. Claim assessment work filed in Alaska, 1970-87.

Table 3. *Reported exploration expenditures in Alaska by commodity and region, 1987.*

	Northern	Western	Eastern Interior	Southwestern	Southcentral	Southeastern	Alaska Peninsula
Base metals	$320,000	$ 25,000	$ 912,500	$210,000	$ 370,850	$ 685,000	$ —
Precious metals							
Placer	120,000	45,500	694,431	105,000	684,620	46,000	1,800
Lode	100,000	1,106,000	1,531,000	300,000	1,265,000	5,040,000	704,360
Coal and peat	50,000	—	—	—	1,100,000	—	—
Industrial minerals and gemstones	31,000	—	200,000	—	10,000	75,000	1,000
TOTAL	$621,000	$1,176,500	$3,337,931	$615,000	$3,430,470	$5,846,000	$707,160
Employment (person-days)	2,270	3,546	7,325	1,372	7,729	9,063	2,464

— no data available.

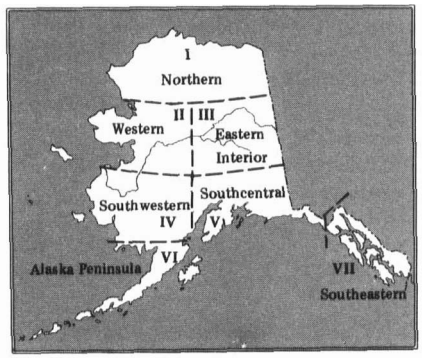


Figure 5. Regions of mineral activity in Alaska, 1987.

with restrictions, and 60 percent is closed to mineral entry. Only 18 percent of federal land is open to mineral entry, while 91 percent of state land is currently open to mineral entry. Most of Alaska's 12 landed Native corporations are willing to negotiate mineral exploration and development agreements.

The study also showed that 35 percent of Alaska (133 million acres) is underlain by recognized mineral terranes, but only 30 percent of this land is available for mineral exploration and development, so that only 11 percent of Alaska's total land area is both underlain by mineral terranes and available for mineral exploration and development. The remaining 89 percent of Alaska either is closed to mineral entry or is not underlain by mineralized terranes.

Only 36 percent of 3,300 mineral occurrences or deposits known to be on federal land are open to mineral exploration and development, while nearly 93 percent of the 2,100 mineral deposits known on state lands are open to mineral entry at this time. Figure 5 lists regions of mineral activity in Alaska.

NORTHERN REGION

The northern region covers one-third of the state and includes some of Alaska's most remote mineralized terrane within the Brooks Range and on the North Slope. Reported exploration expenditures increased in 1987 to $621,000 from $601,000 in 1986. Assessment work was completed on copper-lead-zinc properties in the Ambler district (western Brooks Range), on lead-zinc-silver-barite deposits in the Noatak district (De Long Mountains), and in several gold mining regions including the Shungnak, Koyukuk-Nolan, and Chandalar mining districts.

Metals

ARCTIC SLOPE CONSULTING ENGINEERS, under contract to ARCTIC SLOPE REGIONAL NATIVE CORPORATION (ASRC), explored for precious and base metals along the northern flank of the Brooks Range (loc. 1, fig. 6) north of the Red Dog deposit (loc. 2, fig. 6), and conducted geological studies in the National Petroleum Reserve-Alaska. ASRC lands comprise valuable coal, oil and gas, sand and gravel, and hard-rock mineral resources. Hard-rock mineral potential exists in the Noatak district, where deposits of zinc-lead-silver have been found at Kivliktort Mountain and Story and Drenchwater Creeks.

NANA REGIONAL CORPORATION (NANA) explored for zinc, gold, and silver also in the Noatak district (loc. 3, fig. 6). NANA owns 2.4 million acres of land including the Red Dog deposit (see Development section).

SUNSHINE MINING COMPANY (SUNSHINE), recently a joint partner with COOK INLET REGION, INC. (CIRI) in the Ambler district, sold its property (under AMBLER MINING COMPANY) to COMINCO ALASKA, INC. (COMINCO), and also dropped the claims it held in its own name. As a result, SUNSHINE's only position in the Ambler district is a 37-percent holding in the original AMBLER MINING COMPANY joint-venture property, which consists of a small retained royalty on property conveyed to COMINCO. LITTLE SQUAW GOLD MINING COMPANY did assessment work on precious metal deposits in the Chandalar mining district. PARADISE VALLEY MINING COMPANY (PARADISE VALLEY) continued mapping, ran geophysical surveys, and continued crosscut trench work in the Flat Creek drainage, 6 mi east of Wild Lake in

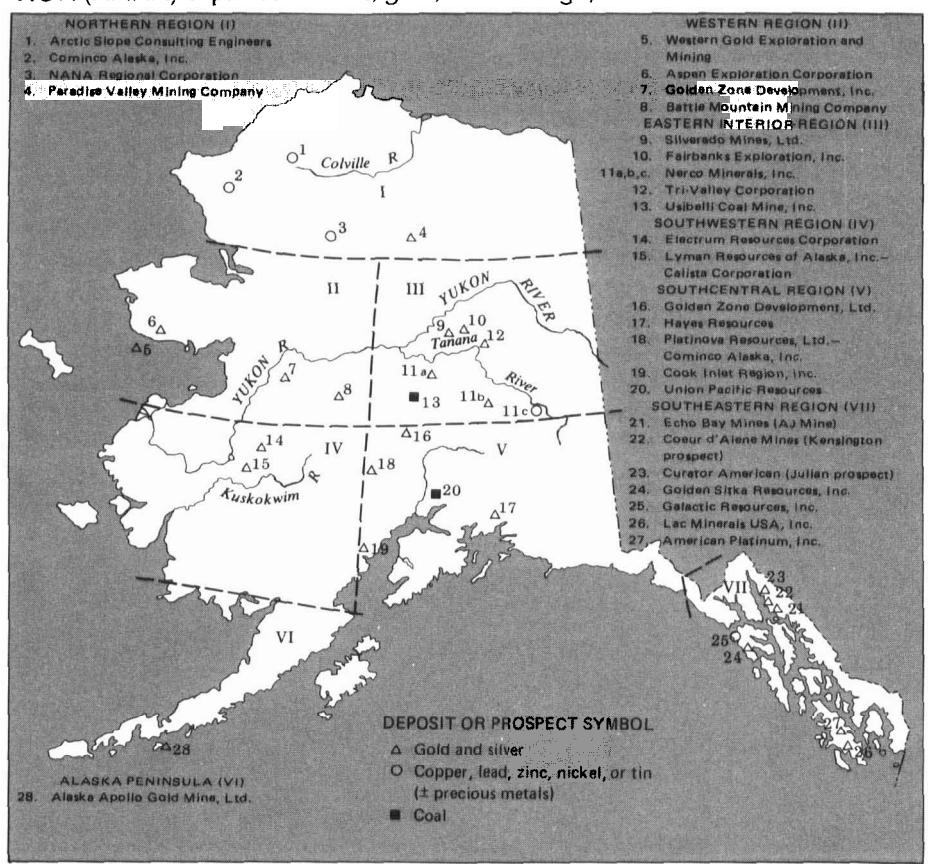


Figure 6. Selected mineral-exploration projects in Alaska, 1987

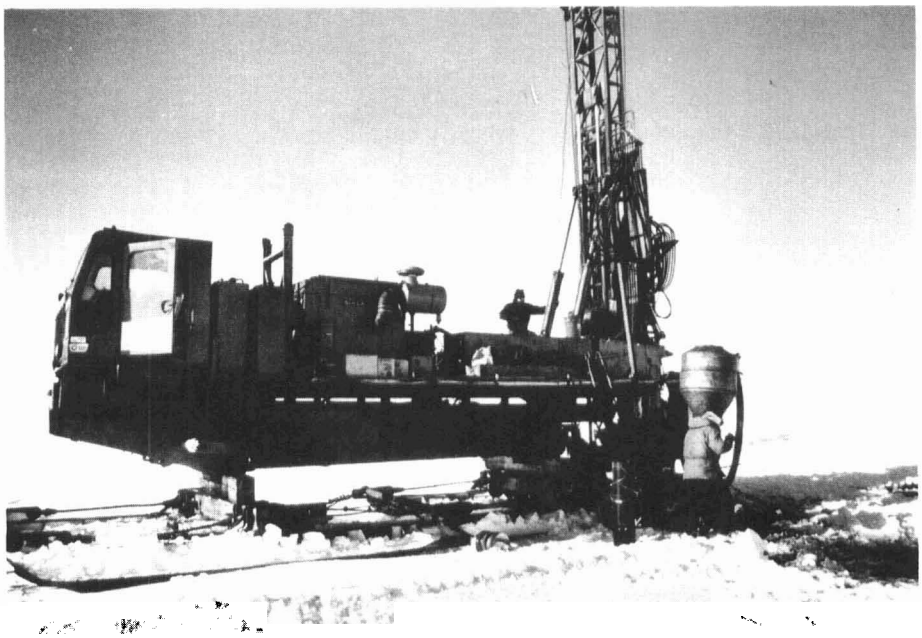


Figure 7. Sled-mounted drill rig operated at Inspiration Gold, Inc. (now West Gold) project on Norton Sound ice near Nome, western Alaska. Photograph by Stephen Jewett, 1987.

the central Brooks Range (loc. 4, fig. 6). PARADISE VALLEY has spent over $1 million since 1974, exploring properties in this area. ALSINCO MINING COMPANY drilled, assayed, and geologically mapped placer deposits on Eldorado Creek in the Koyukuk-Nolan district. PAUL DIONNE sunk a drift shaft on the Hammond River in the same district to explore deep placer deposits.

Industrial Minerals

STEWART'S JEWEL JADE CLAIMS, INC. continued surface exploration for placer boulders of nephrite jade at Dahl Creek in the Kobuk district.

WESTERN REGION

Alaska's western region includes the highly mineralized Seward Peninsula (Nome, Fairhaven, Candle, Kougourok, Council mining districts), the lower Yukon River (Ruby-Poorman and Koyukuk-Hogatza mining areas), and the upper Kuskokwim and Innoko River drainages (Nixon Fork, Innoko, and Tolstoi mining districts). Expenditures doubled in 1987, from $582,800 (1986) to $1,176,500.

Metals

INSPIRATION GOLD, INC., now WESTERN GOLD EXPLORATION AND MINING COMPANY (WESTGOLD), completed extensive offshore exploration drilling for placer deposits (loc. 5, fig. 6). Contractor DENALI DRILLING completed over 12,000 ft of drilling, using a Becker reverse circulation hammer drill (fig. 7). WESTGOLD also conducted reflection seismology, side-scan sonar, and bathymetric studies on its offshore state mining leases where its 'Bima' bucket-line dredge now operates. The company recently estimated gold reserves of 1.1 million oz on their leases. WESTGOLD also conducted extensive surface exploration in the Mount Distin mineralized area north of Nome and staked a large block of lode claims late in the year.

Late in 1987, the U.S. Minerals Management Service proposed to offer for lease 350,000 acres of federal offshore continental shelf, adjacent to state leases held by WESTGOLD in Norton Sound, for nonfuel minerals, primarily gold (fig. 8). The State of Alaska will participate in preparation of the Environmental Impact Statements and Notice of Sale. The lease sale is expected to be held in July 1989.

ALASKA GOLD COMPANY (ALASKA GOLD) completed 4,000 ft of prospect drilling which examined frozen placers near Nome as future production feed for their two floating onshore dredges currently in operation.

ASPEN EXPLORATION CORPORATION (ASPEN) formed a joint venture with PLACER DOME U.S., INC. (PLACER DOME) for exploration and possible development of 17,500 acres of Nome upland mineral leases, acquired by ASPEN in 1986 from ALASKA GOLD, the BERING STRAITS NATIVE CORPORATION, and the SITNASUAK VILLAGE CORPORATION (loc. 6, fig. 6).

ASPEN had evaluated drill logs in 1986 from 8,000 churn drill holes

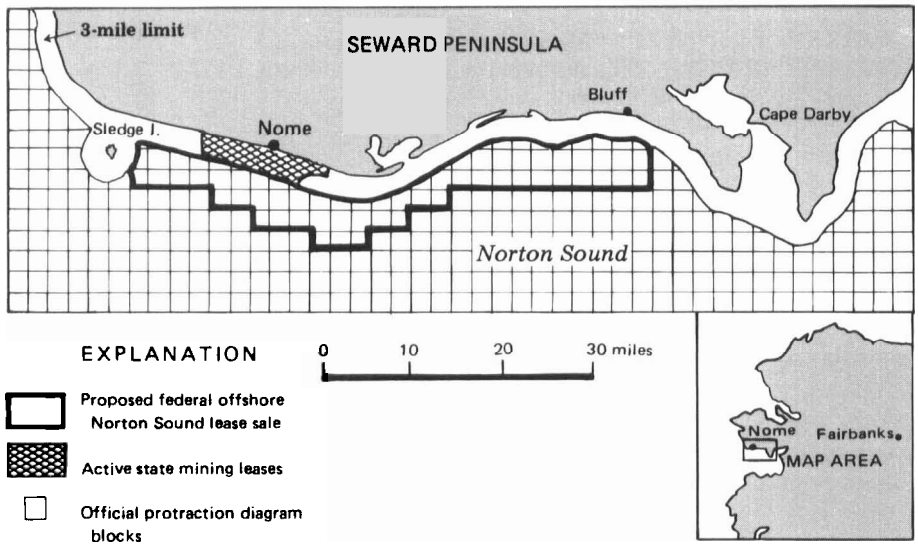


Figure 8. Offshore federal land proposed for Norton Sound lease sale, western Alaska.

drilled in 1985 and had done some initial trenching. PLACER DOME carried out a drilling and trenching program in 1987 costing more than $500,000 during its first year as project operator; 1987 exploration work focused on the Rock Creek drainage. Two diamond core drills and one rotary drill completed 15,000 ft of exploration drilling in a wide zone of gold-bearing quartz-feldspar vein swarms. The vein system is nearly vertical, and drilling intersected the system at depths to 600 ft. A tracked backhoe was used to dig trenches across the surface of the ore structure. One drill hole averaged 0.11 oz/ton gold from 5 to 190 ft and 0.20 oz/ton gold from 30 to 90 ft. A second station 55 ft downslope averaged 0.08 oz/ton gold from 5 to 195 ft. Two other holes inclined 45° yielded 0.05 to 0.06 oz/ton gold over similar intersections.

GOLDEN ZONE DEVELOPMENT, LTD. (listed on the Vancouver Stock Exchange with offices in Anchorage) explored for platinum-group metals on a 5,700-acre claim block east of the Kaiyuh Hills, in the Yuki River, an area underlain by ultramafic rocks similar to others worldwide which host platinum-group metals (loc. 7, fig. 6). GOLDEN ZONE indicates that river bars within the 25-mile complex consistently yield chromite, flour gold, and some platinum. An alluvial diamond was reported from this area shortly after World War II (Glover, 1949).

BATTLE MOUNTAIN MINING COMPANY (BATTLE MOUNTAIN) was again active in the Medfra area and conducted a drilling program at the Nixon Fork gold-skarn property (loc. 8, fig. 6; figs. 9 and 10). BATTLE MOUNTAIN also examined other metal prospects near Cloudy Mountain and in the Cripple Mountains near McGrath.

The BERG-WETLESEN PARTNERSHIP explored gold placers in the Candle and Kogruk Creek areas of the central Seward Peninsula and continued exploration of a silver-lead-zinc hard-rock property on Independence Creek. TOLSTOI MINING (Douglas Sherrer) sunk prospect shafts and sampled old dumps on Boob Creek, an historical producer of placer platinum and gold. FLAT CREEK MINING COMPANY and GREEN MINING AND EXPLORATION explored lode and placer deposits in the Ruby-Poorman district south of the Yukon River. FRANK WALTERS explored gold placers in the Nowitna drainage east of this area.

Figure 9. Nodwell being unloaded from C-119 cargo plane at Medfra, southwestern Alaska, for exploration work at Nixon Fork Gold Mine. Photograph courtesy of Battle Mountain Mining Company, 1987.

Figure 10. Cat train transporting drill supplies to Nixon Fork gold property near Medfra, southwestern Alaska. Photograph courtesy of Battle Mountain Mining Company, 1987.

EASTERN INTERIOR REGION

The eastern interior region, the source of much of the state's historical placer gold production, includes mineralized areas in the Alaska Range and Yukon-Tanana Upland. Exploration expenditures in 1987 were $3.34

million compared to $2.38 million in 1986, a 40-percent increase; it was the second consecutive year of exploration expenditure increases in the interior.

Metals

SILVERADO MINES LTD. conducted an aggressive exploration program throughout the Fairbanks mining district, emphasizing delineation of mineralized ore reserves for near-term production (loc. 9, fig. 6). Exploration targets included: (1) drilling the Ethel, Elmes, and Wandering Jew deposits on Ester Dome; (2) trenching mineralized areas near Eagle and Treasure Creeks; and (3) exploring near the Cleary Summit mineralized area. One drill hole on the Ethel vein averaged 0.12 oz/ton gold over a 100-ft interval. The Ethel mineralized structure is an unusual braided alteration piping system that consists of crosscutting gold-sulfide-bearing talcose schist, instead of the typical quartz-vein-hosted gold ores in the Fairbanks area. Positive results from the Ester Dome drilling program led to a December 1987 decision to reopen the 300 ton/day ball mill and cyanide vat-leach plant at the Grant Mine on Ester Dome — described in the Production section.

FAIRBANKS EXPLORATION INC. (FAIRBANKS EXPLORATION) announced in 1987 the signing of an agreement with BP MINERALS AMERICA, INC. (BP MINERALS) to form an exploration partnership, CLEARY SUMMIT JOINT VENTURE (CLEARY SUMMIT JV), which will focus on discovering and developing bulk-mineable lode-gold deposits on claim blocks held by FAIRBANKS EXPLORATION (loc. 10, fig. 6). FAIRBANKS EXPLORATION is a group of local investors who assembled a 15,000-acre land package of hard-rock gold claims in the Fairbanks area. BP MINERALS, as operator, retains the right to earn a fully-vested 51-percent interest in the project if it advances to the mine feasibility stage. In 1987, CLEARY SUMMIT JV reexamined drill core and other exploration work, to plan the direction and scope of 1988 work. Historically, only three percent of gold production in the Fairbanks district has come from lode deposits. FAIRBANKS EXPLORATION also conducted independent exploration in the Alaska Range and the Tolovana mining district during 1987. BP MINERALS is a consolidation of the assets of the KENNECOTT CORPORATION headquartered in Salt Lake City and AMSELCO MINERALS INC. of Denver — both have Alaska exploration experience. AMSELCO was the 1987 development operator of the Greens Creek Mine, and KENNECOTT, until a few years ago, was one of the most active mineral exploration companies in Alaska since the mid-1960s. Russell Babcock, former manager of Kennecott's Alaska interests, has been named a vice president of exploration for BP MINERALS.

RESOURCE ASSOCIATES OF ALASKA (RAA), the exploration arm of NERCO MINERALS, INC. (NERCO), conducted aggressive exploration throughout the eastern interior (loc. 11, fig. 6). The company sampled and drilled precious metal occurrences in the Delta mineral belt (Tok mining district) and the Liberty Bell deposit near Healy. The Liberty Bell property is an unusual copper-bismuth-arsenic-gold deposit similar to several mined in the Skellefte district of north-central Sweden (Rickard, 1986), while deposits in the eastern Alaska Range consist of both precious metal vein systems and Kuroko-like massive-sulfide deposits. NERCO, parent company of RAA, continued to fund research at the University of Alaska Fairbanks on hydrometallurgical recovery of metals from polymetallic sulfide ores. Positive research results could enhance economic potential of sulfide mineral deposits in remote Alaskan mining districts.

TRI-VALLEY CORPORATION assessed 400 claims and nearly 50 prospect sites in various districts of the eastern interior, focusing on the Tenderfoot district near Delta Junction (loc. 12, fig. 6).

AMAX EXPLORATION assessed mineral properties throughout the Bonnifield district south of Fairbanks, including the 'SMOG,' Dry Creek, and Totatlanika River deposits. AMERICAN COPPER AND NICKEL CO. INC. leased lands from DOYON, LTD. and began regional exploration of lands in the Rampart and Crooked Creek areas north of Fairbanks.

Exploration expenditures reported by small-scale placer mining companies and exploration firms throughout the region included costs of drilling, mapping, geophysical survey, and trenching for assessment of placer deposits. Companies reporting were V.F. HALVERSON-ALASKA VENTURES, CHARLES CLEVELAND, TEGGUN MINING COMPANY, and DBA POINTS NORTH (Circle district); JENSEN MINING, D'LOG MINING, FOUR BROTHERS MINING, and ARCTIC KNIGHTS MINING CO. (Bonnifield district); GLD MINING, DAE MINING, K.C. MINING CO., KILLIAN LAND CO., DENNIS SHEPPARD, and GEORGE and JIM LOUNSBURY (Fairbanks district); WILLFORD MINING, JOHN SHILLING, and SHIMSKY MINING (Rampart and Manley districts); 45 PUP MINING (Fortymile district); MARV LARSEN (Livengood district); and BTW MINING AND EXPLORATION CORPORATION and MARCHAK AND ASSOCIATES (Rainy Creek-Paxson area).

Mineral assessment studies in the Lime Peak-Mt. Prindle area north of Fairbanks have indicated high potential for lode-mineral deposits. The studies, carried out by the Alaska Division of Geological and Geophysical Surveys (DGGS), are part of a broader cooperative effort among DGGS, USGS, and USBM to assess mineral potential in the White Mountains National Recreation Area and the Steese National Conservation Area. Matching funds for the DGGS studies were provided through a grant from the USGS. Several lode target areas were identified. Tin, tantalum, and byproduct silver deposits are associated with granitic bodies that form Lime Peak and Mt. Prindle. Small syenite bodies on the western edge of the study area constitute potential sources of uranium and rare-earth elements. Alkalic felsite dikes and schists, believed to be correlated with the gold-bearing Cleary Sequence, are enriched in gold and spatially associated with known placer

deposits in Faith, Bachelor, Nome, and Homestake Creeks. Probabilistic assessments suggest that the Lime Peak-Mt. Prindle area contains as much tin and silver as a moderately sized producing tin district. Details of the area's geology and mineral resources are discussed in Smith and others (1987) and Warner and others (1988).

Coal

USIBELLI COAL MINE, INC. (USIBELLI) conducted exploration on its state coal leases in 1986 and 1987 (loc. 13, fig. 6). The company drilled 10,000 ft in 1986 and 3,500 ft in 1987, sampling coal seams in the Poker Flats and Two Bull Ridge areas. Exploration was aimed at evaluating reserves for development of a new mine pit in the Two Bull Ridge area. Reserves at the Poker Flats production pit have a 10-yr mine life at the present production rate of 1.5 million ton/yr. However, that life could be shortened significantly if the company were to secure incremental coal sales contracts in the near future. Because of the long lead time needed to secure permits, the company wants to locate and delineate its next production area so it can develop mining and reclamation plans.

USIBELLI also continued work on a road up Lignite Creek to access the Two Bull Ridge lease area and eventually to serve as the coal haulage road between the new pit and the company's crushing and train loading facilities on the Healy River. The company has 0.5 million tons of developed coal reserves at its Gold Run Pass pit that will also be accessed by the new road. Coal was mined from this pit when crushing and loading facilities were located near Suntrana Creek. Under the stipulations of USIBELLI'S new coal permit, the Gold Run Pass pit must be mined and reclaimed as soon as possible, and the new road will provide a much shorter route between the pit and the new Healy River facilities.

SOUTHWESTERN REGION

Exploration expenditures in southwestern Alaska climbed from $176,200 in 1986 to $615,000 in 1987, signalling a revival in minerals interest in this remote area. Most efforts are focused on precious metal targets centered around Late Cretaceous-early Tertiary volcanic and plutonic rocks in the area, the source of over 2.4 million oz of past gold production.

Metals

ELECTRUM RESOURCES CORPORATION (ELECTRUM), in joint venture with DOYON, LTD., conducted an extensive trenching program on Chicken Mountain in the historic Iditarod mining district (loc. 14, fig. 6). ONSTREAM RESOURCE MANAGERS, INC., field operator for ELECTRUM, assessed stockwork quartz-gold-cinnabar-sulfosalt deposits hosted in monzonite on Chicken Mountain which are the probable source of over 1 million oz of past gold production in the Iditarod district. More work is planned for 1988. At the nearby Golden Horn property on Otter Creek, GOLDEN HORN MINING COMPANY (John Miscovich) trenched and removed overburden from the Golden Horn-Black Creek monzonite prospect while testing ore for mineral processing.

LYMAN RESOURCES OF ALASKA, INC., in joint venture with CALISTA CORPORATION, explored placer- and lode-gold deposits in the Donlin Creek area north of Crooked Creek and evaluated ground for future placer production (loc. 15, fig. 6). CINNABAR CREEK ALASKA, INC. conducted geologic mapping, sample assay, and ground work from their Cinnabar Creek property in the Taylor Mountains Quadrangle and are awaiting final laboratory results. DON HARRIS tested placer and lode potential in the Moore Creek area northeast of Flat. JULIAN CREEK MINING COMPANY tested lodes and placers at Julian and Taylor Creeks, on John Hill, and at several localities in the Lower George River drainage of the middle Kuskokwim Basin.

SOUTHCENTRAL REGION

The southcentral region encompasses mineralized terranes on the southern flank of the Alaska Range, the Chugach and Wrangell Mountains, and the Kenai Peninsula. Despite extensive mineral closures in the region, exploration expenditures rose from $2.41 million in 1986 to $3.43 million in 1987 — an increase of 42 percent, comparable to the 40 percent increase in the eastern Interior. About one-third of the total was spent for coal exploration, and the remainder for lode-gold property evaluations.

Metals

In February 1987 the owners of Golden Zone Mine formed GOLDEN ZONE DEVELOPMENT, LTD., (GOLDEN ZONE) a public corporation listed on the Vancouver Stock Exchange. A stock offering funded two phased-exploration programs on the property 150 mi north of Anchorage (loc. 16, fig. 6). Prior to 1987 fieldwork, probable ore reserves of 535,000 tons averaging 0.24 oz/ton gold and 0.77 oz/ton silver were estimated at the Golden Zone property. The first exploration phase, from June to October 1987, involved surface trenching and sampling of the mineralized breccia pipe and adjacent structures. This work led to the discovery of gold mineralization in a porphyry dike, the Mayflower Lode, radiating from the breccia pipe, and in a fault dike structure known as the Bryn Mawr dike about 2,000 ft from the breccia pipe. The second phase of the program, involving 10,000 ft of core drilling, determined that the breccia pipe widened from about 350 ft at surface to 550 ft at a depth of 600 ft. In summary, the 1987 drilling program located fundamental extensions of the Golden Zone breccia pipe and traced the BLT shear zone another 400 ft, for a total strike-length of 1,500 ft. The combined drilling and trenching results show a proven and probable ore reserve of 1,164,870 tons grading 0.179 oz/ton gold, 0.675 oz/ton silver, and 0.207 percent copper, or an equivalent in-place reserve of 208,512 oz gold. Late in

the year, GOLDEN ZONE signed a letter of intent with UNITED PACIFIC GOLD LTD. (UNITED) in which UNITED would commit $6 million toward development of the property and earn a 50-percent interest in the venture.

HAYES RESOURCES, under an option agreement from DASHER RESOURCES, dewatered and partially rehabilitated the Cliff Gold Mine near Valdez, Alaska (loc. 17, fig. 6). Before World War II, the mine produced over 50,000 oz of gold from ore averaging better than 1 oz/ton gold. Work on the 550-ft level of the mine tested a 240-ft-long section of the 'Trustee Vein'; assays diluted across a mining width of 4 ft averaged 0.7 oz/ton gold. The Cliff Gold Mine property has never been tested with a diamond drilling program, and has no proven reserves. HAYES RESOURCES asked project consultants WGM, INC. to prepare an operations-capital cost statement needed to reopen the mine. At a production rate of 100 ton/day, 25,000 oz of gold could be produced annually. A work program for 1988 includes complete rehabilitation of underground workings and establishment of drill stations to test the Cliff and Trustee veins.

PLATINOVA RESOURCES LTD. (Toronto), in joint venture with COMINCO ALASKA, is exploring several gold-copper-silver vein systems in southcentral Alaska near Rainy Pass (loc. 18, fig. 6). Assay results from a test drilling program in 1987 included some high gold grades. According to PLATINOVA geologists, geophysics and geology indicate a minimum strike length of 2,100 ft for the mineralized zone. The joint venture, formed in February 1987, has consolidated its land holdings into six claim groups which will be the focus of an extensive, $1 million drilling program in 1988.

ON-LINE EXPLORATION SERVICES did work for several clients throughout southcentral Alaska, and conducted claim staking, land status evaluations, geophysical surveys for lodes and placers, and drilling programs.

FINNBEAR MINING AND EXPLORATION COMPANY, INC. tested gold-platinum-bearing placers in Owl Creek near Grass Valley in the Kahiltna River drainage. The company tested the pay zone with jigs, and later leached concentrates to recover sulfide(?)-bound gold and platinum.

NERCO continued sampling and drilling at the 'Zackly' gold-copper skarn near Paxson.

CHEVRON USA, INC. conducted surface geologic reconnaissance at Don Miller Hills and Mount Hamilton in Chugach National Forest. GLOBAL MINERALS evaluated both placer and lode targets throughout southcentral Alaska, including their Beluga River, Three Mile, Chedatna Lake, Misty, and South Peak claims. FREEPORT MCMORAN GOLD COMPANY (FREEPORT) conducted prospect examinations statewide, including a number in the Chulitna district of southcentral Alaska.

HUNT, WARE, AND PROFFETT conducted geologic mapping, geochemical assaying, and diamond drilling programs at the Johnson River gold-zinc-polymetallic massive-sulfide deposit, owned by COOK INLET REGION, INC. (loc. 19, fig. 6). The deposit is a steeply dipping stockwork of quartz-sulfide veinlets within a silicified zone surrounded by a zone of anhydrite alteration and hosted in Lower Jurassic tuffaceous sedimentary rocks just east of the Bruin Bay fault. This promising high-grade gold property is only a few miles from tidewater on Cook Inlet.

A number of smaller operations regionwide also searched for lode deposits. BLUEBELL MINING COMPANY explored high-grade gold lodes on the Kenai Peninsula. COASTAL EXPLORATION searched for copper on the West Fork of the Chistochina River southeast of Paxson, and GOLD CORD MINING COMPANY (Dan Renshaw) cleaned out an old adit and drilled at the Gold Cord Mine and the 'Sheared Claims' in the Hatcher Pass district north of Palmer.

CHUGACH ALASKA CORPORATION conducted inhouse evaluations of various metal properties on its lands in southcentral Alaska and worked on transportation studies for extending the Cordova road system to the Katalla oil field and Bering River coal deposits.

Exploration was carried out regionwide by small-scale placer mining companies: ED MARTIN, GOOD ROCK PLACER ASSOCIATION, FREDERICK HAAS, and JOHN TRAUTNER (Kenai Peninsula); FRED SWINGLER, H&H EXPLORATION AND MINING, and T.C. MINING COMPANY (Petersville-Talkeetna area); RECOVERY SYSTEMS (Nelchina district); MRAK PLACER, INC. and JIM HALLORAN (Hatcher Pass); and TALMO, INC. (Nizina district, Wrangell Mountains).

Industrial Minerals

JIM HALLORAN searched for and evaluated prospects of nephrite jade and antigorite in the Willow Creek-Hatcher Pass mining area and reported the discovery of a very large antigorite deposit. Magnetometer exploration methods were employed. SPRUCE SAND AND GRAVEL conducted mapping and quality-testing studies of armor-grade quarry stone also on the Kenai Peninsula.

Coal

UNION PACIFIC RESOURCES (UNION) (formerly Rocky Mountain Energy) formed a joint venture partnership with the IDEMITSU KOSAN COMPANY OF JAPAN (IDEMITSU) in 1987 to further explore its state coal leases (loc. 20, fig. 6). The partnership carried out a drilling and bulk sampling program in the Matanuska coalfield near Anchorage and completed 33 rotary drill holes on the leases. Bulk samples of six 55-gal. drums each were taken from four sites for detailed evaluation. Four drums from each six-drum sample were shipped to IDEMITSU'S coal-testing laboratory in Tokyo, and two were shipped to UNION facilities in Denver. The companies also completed a feasibility study during the year. In August, the partnership requested the Alaska Department of Natural Resources to begin the administrative process to lease additional lands on the south side of the Matanuska Valley, an area not previously recognized for high coal potential.

IDEMITSU, Japan's largest domestic oil company, recently completed a

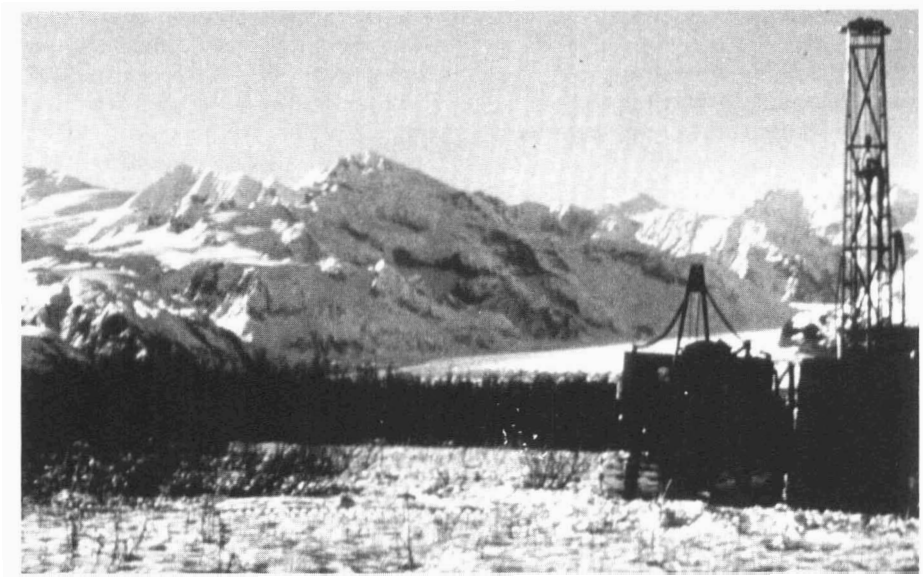


Figure 11. Drill rig at Beluga coalfield, southcentral Alaska. Photograph courtesy of Placer Dome U.S., Inc., 1987.

coal import terminal in Tokyo Bay and is using coal in several of its refineries. In addition, IDEMITSU is urging its industrial fuel customers to convert to coal and is pioneering a system of coal delivery and ash removal to make coal technology feasible for small industrial users in Japan. IDEMITSU is interested mainly in importing high-volatile bituminous coals such as those from the Matanuska Valley.

In the Beluga coalfield on the west side of Cook Inlet, PLACER DOME U.S. INC. drilled 4,100 ft on its coal leases (fig. 11).

SOUTHEASTERN REGION

Expenditures for exploration in the 'Panhandle' ($5.85 million) amounted to one-third of the statewide total and represent an increase of 113 percent from 1986 expenditures of $2.75 million. A variety of lode-gold-silver properties are being evaluated, from Ketchikan to Haines, with the largest efforts focused on the Juneau Gold Belt. Much of southeast Alaska lies within the Tongass National Forest, which is managed principally for multiple use; about 65 percent of the Tongass forest is currently open to mineral entry.

Metals

ECHO BAY MINES, through its project operators WGM, INC. of Anchorage, continued its examination of the Alaska Juneau (AJ) Gold Mine at Juneau (fig. 12; loc. 21, fig. 6). A 1,000-ton bulk sample was taken from the rehabilitated Sheep Creek adit and loaded on a barge for shipment to Lakefield, Ontario for evaluation.

The AJ ore zone consists of multiple, white-quartz veins separated by black gangue rock (Redman, 1987). Historically, the AJ hand-sorted gold-bearing quartz from the valueless gangue before milling. ECHO BAY had hoped to utilize a photometric sorting mechanism, but initial tests were not encouraging. In 1987, work started on the access road to the Sheep Creek adit. The 14-ft road built in 1986 was widened to 20 ft and regraded to accommodate 20-ton articulated dump trucks. WGM also continued an extensive underground diamond drilling program in 1987. When the AJ closed in 1944, the known reserves were 29 million tons of ore grading 0.039 oz/ton of gold. The AJ had operated since 1893 and was renowned for profitably mining low-grade ore.

In August 1987, COEUR D'ALENE MINES acquired the Kensington gold prospect on Lynn Canal about 50 mi north of Juneau (fig. 13; loc. 22, fig. 6). COEUR D'ALENE bid $20 million for the property formerly owned by PLACID OIL, who had filed for Chapter 11 bankruptcy. ECHO BAY

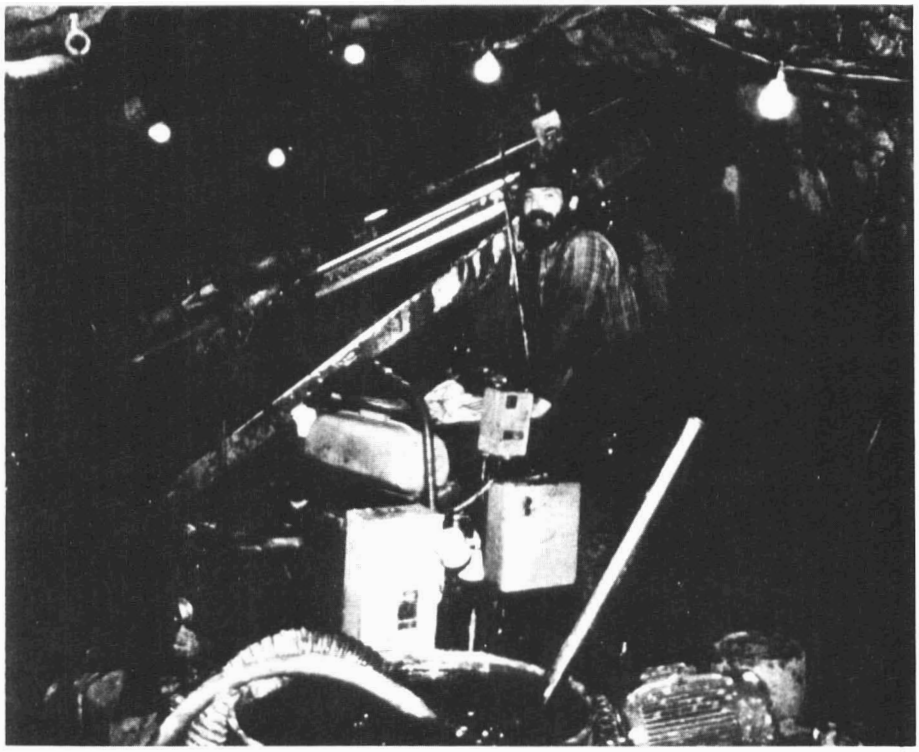


Figure 12. Exploratory drilling in Alaska Juneau gold mine, Sheep Creek adit area near Thane, southeastern Alaska. Photograph courtesy of Echo Bay Mining Company, 1987.

Figure 13. Surface workings at old Kensington mine, southeastern Alaska, circa 1909. Winter & Pond photograph, J.S. MacKinnon Collection, courtesy of Tom Pittman.

MINES acquired a 50-percent joint venture partnership with COEUR D'ALENE and became the project operator. In consideration for half-interest in the property, ECHO BAY conveyed to COEUR D'ALENE a 50-percent interest in ECHO BAY'S South American exploration properties. The Kensington produced briefly in the early 1900s and underwent a development test in the 1930s. The property is located on 49 patented and 118 unpatented claims and contains proven reserves of 425,000 oz of gold at an average grade of 0.239 oz, based on the exploration work by PLACID. In December 1987, ECHO BAY submitted to the U.S. Forest Service a proposal to construct a road from the Kensington mill site to tidewater at the abandoned community of Comet. Although ECHO BAY is also involved in the reevaluation of the AJ mine in Juneau, the two projects are being managed from separate offices.

CURATOR AMERICAN (CURATOR), a subsidiary of INTERNATIONAL CURATOR RESOURCES OF DENVER, leased claims from HYFAK MINING of Juneau to explore the Jualin prospect on Lynn Canal (loc. 23, fig. 6). The Jualin Mine produced 25,000 oz of gold from 1896 until its closing in the 1920s (fig. 14). CURATOR operated two drills at the Jualin and completed over 17,000 ft of core drilling in 1987. CURATOR has submitted a proposal to build a road from the Jualin mine site to tidewater at Berners Bay. Both the Jualin and Kensington deposits are part of a closely clustered group of gold deposits known as the Berners Bay mineralized area. ECHO BAY and CURATOR have agreed to cooperate on development of both projects.

A number of claims have been staked, and others recently leased, in the immediate Juneau area. HAZELTON, an Australian-based company, has taken samples at the AJ rock dump for metallurgical testing. HAZELTON also explored the GB (Grizzly Bear) claims near Taku Glacier. CURATOR has leased the Dream claim block near Sullivan Island, north of Juneau, from claim holders Eichman, Branson, and Henkins, and has filed additional claims around the Dream claims. CURATOR has also leased the Gold Fork on Carlson Creek near Mt. Juneau. REGAL MINING CO. has leased the Bessie Mine north of Juneau. FMC GOLD has leased the Peterson Mine, staked additional claims and conducted some exploratory drilling on the Treasury Hill claims near Auke Bay north of Juneau.

Limited fieldwork was done during 1987 at the Chichagof and Hirst-Chicagof properties north of Sitka (loc. 24, fig. 6). Ownership was restructured to finance additional exploration work in 1988. In March 1987, the project's joint venture partners pooled their interests to form GOLDEN SITKA RESOURCES INC. (GOLDEN SITKA). Percentage

Figure 14. Jualin mine, southeastern Alaska, circa 1914. Winter & Pond photograph, J.S. MacKinnon Collection, courtesy of Tom Pittman.

interests are: QUEENSTAKE RESOURCES, INC. (37.5 percent), VECTOR MINING, a subsidiary of TRIDENT VENTURES (30 percent), and EXPLORATION VENTURES COMPANY (32.5 percent).

In September, GOLDEN SITKA issued an initial public offering of 2 million shares of common stock through the Vancouver Stock Exchange. The offering raised over $2 million which will be used to fund continued exploration, beginning in February 1988. Golden Gate No. 4 adit at the Chichagof Mine will be reopened to locate the downward extension of the Big Croppings vein, which the company had previously delineated from surface and underground work, and the neighboring Hirst-Chichagof Mine will be dewatered so exploration work can begin on the 'Kay' ore shoot. The Chichagof and Hirst-Chichagof mines were once among the richest lode-gold producers in Alaska. The recorded production from both mines was 800,000 oz with an average head grade of 1.14 oz/ton. As of 1987, the joint venture partners had invested $3 million in the project.

GALACTIC RESOURCES LTD., in joint venture with TOUCHSTONE RESOURCES CO., continued to evaluate important nickel-cobalt-copper-platinum massive and disseminated sulfide deposits on Yakobi Island and at Mirror Harbor in the Chichagof mining district north of Sitka (loc. 25, fig. 6). Ground magnetics, core drilling, and stream-sediment sampling were the principal exploration activities. The GALACTIC-TOUCHSTONE JOINT VENTURE reported that the properties were being evaluated for their previously unassessed gold potential. Recent nickel prices ($5.70/lb in late December) may improve the feasibility of developing these properties.

LAC MINERALS USA, INC. (LAC), operator for NORANDA EXPLORATION INC., continued an aggressive exploration program focusing on precious-metal-enriched volcanogenic massive-sulfide deposits at the Niblack and the Ruby Tuesday (Polymetal) deposit on Prince of Wales Island and the Kaigani property on Dall Island (loc. 26, fig. 6). A combined total of 6,000 ft of diamond drilling was completed at the Niblack and Ruby Tuesday deposits. Although NORANDA EXPLORATION owns patented mining claims at Niblack and has staked additional federal claims, the state of Alaska designated approximately 940 acres of Niblack anchorage as a state marine wayside and park withdrawal. LAC believes that the withdrawal could jeopardize infrastructure development of a proposed mine. The U.S. Forest Service objected to the designation, on the basis of population criteria, and the federal court ruled in favor of the Forest Service. The Alaska Department of Natural Resources' current planning effort for Prince of Wales Island will attempt to mitigate this and other land-use conflicts so that the potentially important copper-zinc-gold deposits at Niblack may be prudently developed.

AMERICAN PLATINUM INC. continued to explore the Salt Chuck Mine on Prince of Wales Island, a former producer of copper, silver, gold, and palladium (loc. 27, fig. 6). Work near the old mine, which operated from 1902 to 1941, revealed several new contact zones similar to those classified in the reserve category at the main mined deposit, and underground sampling yielded assays ranging up to 7.8 percent copper, 0.7 oz/ton gold, 0.25 oz/ton palladium, and 0.007 oz/ton platinum. Exploration work was also conducted on the nearby Rush and Brown mine — another gold-copper producer of former years. Surface sampling yielded grades of up to 3.9 percent copper and 0.34 oz/ton gold.

NEWMONT EXPLORATION LTD. conducted geochemical and geologic mapping programs in the Haines mineralized belt, searching for precious-metal-enriched massive sulfide 'Kuroko-type' deposits.

USBM continued prospect-level examinations of gold, base metals, and industrial minerals in the Juneau area as part of a 4-yr effort under a federally-funded Juneau Gold Belt study. A new gold discovery was drilled near Haines, and sand and gravel was tested regionwide (fig. 15). In December 1987, USBM announced discovery of three new areas containing gold-silver-copper mineralization in the central Chilkat Mountains of southeast Alaska. The three sites are on federal lands open to mineral entry and development. One discovery consists of a 3-ft-wide zone of copper-arsenic-iron sulfides hosted

Figure 15. U.S. Bureau of Mines personnel processing sand-and-gravel sample near Anchor River, Juneau Gold Belt, southeastern Alaska, for aggregate testing. Photograph courtesy of U.S. Bureau of Mines, 1987.

in volcanic-sedimentary rocks, which grades up to 3.5 oz/ton gold, 2.1 percent copper, and contains credits of zinc and cobalt.

An extensive deposit of rare-earth elements (REE) was also identified on Prince of Wales Island by the USBM. Large REE resources were identified in quartz-albite dike systems near Bokan Mountain. While the deposits may be subeconomic at current prices, over 40 million tons of mineralized material have been inferred, much of it averaging 0.128 percent niobium and up to 1 percent combined REE. The Bokan deposits appear to be enriched in 'heavy' REE compared to other worldwide examples (Barker and Warner, 1987). REE, especially in the heavy yttrium subgroup, are finding new applications in superconductor fabrication and metal-oxide ceramics.

SEALASKA CORPORATION (SEALASKA), who owns mineralized land throughout southeast Alaska, made a concentrated effort in 1987 to consolidate and review exploration data produced from its properties in past years. These data have been incorporated into a source document that discusses land status, geology, mining history, and mineral exploration opportunities peculiar to each of the Alaska Native Claims Settlement Act (ANCSA) withdrawals in southeast Alaska. The document is being made available to selected mineral exploration and development companies to stimulate their interest in southeast Alaska exploration opportunities — particularly those which exist on Sealaska lands. As a result of this effort, SEALASKA is negotiating with five private mineral corporations.

SEALASKA owns the subsurface rights to 23,073 acres in the Cube Cove-Lake Florence area of Admiralty Island, an area centered approximately 14 mi south of Greens Creek and underlain by rocks from the same geologic environment. The Pyrola deposit is immediately adjacent to SEALASKA lands. The lands are within the Admiralty Island National Monument.

SEALASKA has proposed a land exchange with the U.S. Forest Service whereby SEALASKA would exchange its subsurface rights in the Cube Cove-Lake Florence area for approximately 19,000 acres of subsurface rights within the Greens Creek drainage. The exchange would not involve any mining claims perfected by the GREENS CREEK MINING CO., but would open up for exploration those lands within the Greens Creek area that were closed by Alaska National Interest Lands Conservation Act (ANILCA).

The Brady Glacier nickel-copper deposit represents one of the more significant resource endowments of southeast Alaska. The deposit also contains recoverable quantities of cobalt and platinum-group metals. ANILCA affected access to the deposit by changing Glacier Bay National Monument to Glacier Bay National Park. Although access to the deposit is specified in the Park Enabling Act, National Park Service regulations and policies severely jeopardize future development of this deposit. SEALASKA is exploring a possible land exchange, with concomitant public policy and economic issues, to determine if this deposit could be made available for development.

In December 1987, SEALASKA Natural Resources Department announced formation of a Minerals Division which will be responsible for implementing a minerals program to explore, inventory, develop and manage Sealaska's subsurface estate. Initially, the division will be staffed by a full-time minerals manager, a part-time land technician, and related support staff.

ALASKA PENINSULA

Metals

ALASKA APOLLO GOLD MINES, LTD. (ALASKA APOLLO) continued drilling and trenching at the Shumagin claim block on Unga Island (loc. 28, fig. 6). The company operated a 6-10 man exploration camp from May 7 to September 15, and completed 14 drill holes totaling 6,079 ft, using a single skid-mounted drilling rig. The field crew dug a 70-ft trench which exposed the Union vein for six channel sample lengths.

In October 1987, ALASKA APOLLO retained KILBORN ENGINEERING, LTD. of Vancouver, B.C., to review the company's reserve calculations, to oversee metallurgical testing of a bulk mineral sample from the property, and to evaluate proposed mining methods and plans. On the basis of 1987 drilling and earlier work, KILBORN calculated drill-indicated reserves on the Union vein of 278,000 tons of ore grading 0.514 oz/ton gold and 2.47 oz/ton silver.

On the basis of these reserves, KILBORN estimates a 200 ton/day mining operation could be sustained for approximately 4 yr, or longer, if additional reserves were found. Metallurgical tests determined that cyanidation would be the most effective recovery method. KILBORN estimated a capital cost of $9.3 million, annual operating costs of $8.3 million, and annual revenues of $15.9 million.

BATTLE MOUNTAIN MINING COMPANY continued exploration of precious-metal-enriched caldera targets throughout the Alaska Peninsula region, with special focus on Popov Island in the Shumagin Islands.

EXPLORATION IN NORTHWESTERN CANADA

Exploration adjacent to Alaska's border in British Columbia and Yukon Territory again increased over the previous year; 1987 exploration expenditures in Yukon Territory rose $11 million (Can$), and $30 million (Can$) in British Columbia. High levels of exploration activity in recent years have led to significant mineral discoveries in both regions and have directly benefited the economies of adjacent Alaskan communities.

British Columbia

COMINCO LTD. and DELAWARE RESOURCES CORP. completed a 46,000-ft drilling program on the Snip gold property near the Iskut River in British Columbia, about 50 mi east of the City of Wrangell. The area has attracted at least a dozen other Canadian hard-rock exploration

programs. The Snip deposit is 2.5 mi from the SKYLINE RESOURCES (SKYLINE) Stonehouse, or 'Reg,' mine project on Johnny Mountain. The SKYLINE property began development construction in 1987 and forecasts production to begin in 1988 (see Development section). Drilling on the Snip deposit has defined a gold-bearing vein structure with a strike length of 3,600 ft and a vertical extent of 2,100 ft. Inferred reserves are 1.2 million tons grading 0.75 oz/ton gold. Exploration expenditures on the property through 1987 are estimated at $3 million (Can$). At peak activity, the project employed 40 people at the site; camp facilities have been winterized and work on an underground adit will begin in early 1988. As with SKYLINE'S Johnny Mountain Mine and other exploration projects in the area, Wrangell served as transportation and supply center during 1987, and its economy will continue to benefit from Canadian mining activities, especially if permanent access to the area is developed by road from Wrangell.

A second COMINCO exploration project is underway in British Columbia east of Juneau. In 1987, COMINCO LTD., with partner REDFERN RESOURCES, drilled over 12,000 ft of core on the Tulsequah Chief property. The deposit is located on the Tulsequah River, a tributary of the Taku River south of Juneau. From 1951 to 1957, COMINCO operated the Tulsequah Chief and shipped its ore down the Taku River. When the mine closed in 1957, remaining proven and probable reserves were 780,000 tons grading 0.07 oz/ton gold, 2.9 oz/ton silver, 8.0 percent zinc, 1.6 percent lead, and 1.3 percent copper. Juneau would serve as a transportation and supply center for the mine if it were to reopen.

At the Windy Craggy deposit in British Columbia north of Haines, Alaska, GEDDES RESOURCES completed driving 4,150 ft of underground adit in 1987. The tunneling project will be continued to a depth of 6,700 ft. In 1988, underground drilling stations will be established in the adit to define the gold zone, and bulk samples will be taken. The Windy Craggy deposit is estimated to contain 300 million tons of ore at a grade of 2.5 percent copper, 2 lb/ton cobalt, and measurable amounts of gold and silver. While the original exploration focus was on the copper and cobalt content of the deposit, the discovery of a gold-bearing carbonate zone led to the current exploration program. Windy Craggy is about 40 mi from the Haines Highway. If a mine were developed in the future, the city of Haines could become a transportation and supply center for the project.

The O'Connor River gypsum deposit lies just north of the U.S.-Canada border and 6 mi from the Haines Highway — about 80 mi northeast of the city of Haines. During 1986, the O'CONNOR RIVER GYPSUM JOINT VENTURE (O'CONNOR) completed 2,265 ft of diamond drilling which delineated 1.75 million tons of 88 percent gypsum ore suitable for use by the wallboard industry. In 1987, the company conducted beneficiation testing to determine if the product could be upgraded for other uses. In 1988, O'CONNOR plans to improve the project access road and to mine and ship 20,000-50,000 tons of gypsum to industrial users for bulk testing. O'CONNOR plans to ship its product through the Port of Haines by barge and will work on a port facility agreement with the City of Haines during 1988.

Yukon Territory

Exploration activity in the Yukon Territory rose significantly in 1987; 10,217 new hard-rock claims and 1,816 new placer claims were staked, compared to 6,007 hard-rock and 1,691 placer claims in 1986. In addition, the number of placer prospecting leases doubled from 176 in 1986 to 343 by November 1987. Significant exploration programs were conducted at OMNI RESOURCE'S Skukum Creek gold-silver property in Wheaton Valley, CHEVRON MINERALS' Mount Nansen gold property near Watson Lake, the WELLGREEN nickel platinum-copper deposit near Kluane Lake on the Alaska Highway, the CANAMAX CO. gold-silver Ketza River deposit near Faro and the Bellekeno and Silver King silver-lead-zinc vein extensions in the Mayo (Keno Hill) district of north-central Yukon. Successful exploration at the Mt. Skukum, Bellekeno, Silver King, and the Ketza River properties led to development decisions.

Mineral development in 1987

INTRODUCTION

Mineral-development expenditures in Alaska totaled $100.25 million in 1987, compared to $24.33 million in 1986, an increase of 312 percent from the previous year (table 4). The 1987 figure is the largest ever recorded for Alaska's mineral industry. Development expenditures for base metals rose 755 percent; for precious metals, 129 percent; and for industrial minerals, 52 percent. Coal development expenditures decreased 35 percent from 1986. Full-scale development programs at the Red Dog zinc deposit in northwest Alaska and the Greens Creek polymetallic deposit in southeast Alaska accounted for nearly 90 percent of the recorded expenditures (fig. 16).

Most projects described in this section fit the definition of development as it is applied to the mineral industry; that is, construction and engineering activities which follow exploration and feasibility determinations and precede actual production mining. However, the nature of small-scale placer mining causes many activities described in the placer development section to overlap exploration and production phases. Small placer operations are included here to highlight the significant investments being made by individuals and small companies to create new mines.

RED DOG PROJECT, COMINCO-NANA
Northern region
(loc. 1, fig. 16)

Development expenditures in Alaska on the Red Dog mine project were approximately $55 million during 1987, primarily for completion of a 52-mi pioneer road and construction camp facilities at the mine site. The Alaska Industrial Development and Export Authority (AIDEA) and COMINCO made further financial commitments of about $85 million for construction contracts, supply of mine equipment, and other development services and purchases. The $140 million committed or spent in 1987 represents about 40 percent of the total projected capital cost of the mine over the 4-yr development phase.

The Red Dog deposit has reserves of 85 million tons of ore that grade

Figure 17. Ship being unloaded near Kivalina port facility, Red Dog mine project, northern Alaska. Photograph courtesy of Cominco Alaska, Inc., 1987.

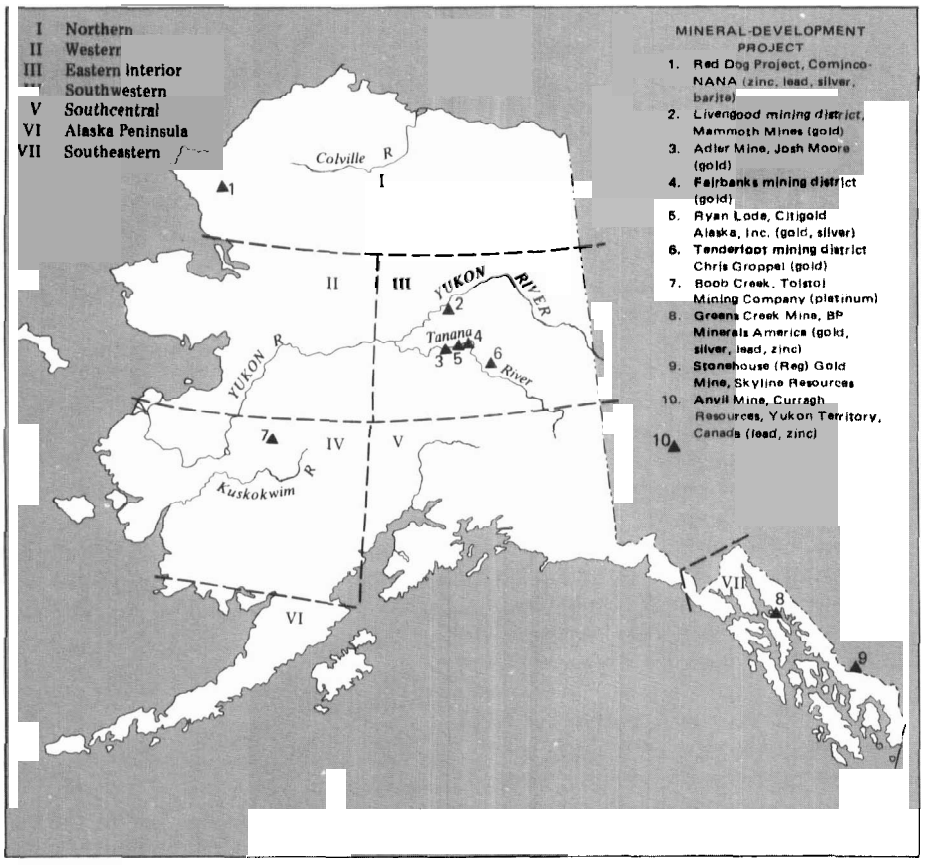


Figure 16. Selected mineral-development projects in Alaska, 1987.

17.1 percent zinc, 5.0 percent lead, and 2.4 oz/ton silver. It is the largest known unmined zinc reserve in the world, second only to the original Broken Hill deposit in New South Wales, Australia. The deposit is owned by NANA and the mine will be operated by COMINCO.

The decision to begin development of the mine was made by COMINCO'S Board of Directors in November 1986. A contract to build the 52-mi road connecting the Chukchi Sea port site and the mine site was awarded to ENSERCH ALASKA CONSTRUCTION, INC. (ENSERCH) in early 1987 (fig. 17). ENSERCH completed construction of the pioneer road late in November 1987, a month and a half ahead of schedule.

The pioneer road will be used by the GREEN CONSTRUCTION COMPANY (GREEN) to transfer its earth-moving equipment, stored at the port site earlier in 1987, to the mine site. GREEN received the contract to build the mine's tailing and fresh-water dams, prepare the mill site, construct a road between the airstrip and the mine, and begin stripping overburden

Table 4. *Mineral-development expenditures in Alaska by commodity, 1982-87.*

	1982	1983	1984	1985	1986	1987
Base metals	$10,270,000	$19,500,000	$10,710,500	$13,000,000	$ 7,260,800	$ 62,080,000
Precious metals	19,320,000	7,112,500	15,058,555	16,890,755	16,417,172	37,640,848
Industrial and structural materials	4,251,000	1,000,000	579,000	1,830,000	124,000	188,000
Coal and peat	7,750,000	250,000	27,000,000	2,400,000	530,000	342,000
TOTAL	$41,591,000	$27,862,500	$53,348,055	$34,120,775	331,972	$100,250,848

from the ore body. GREEN began earthmoving activities in January 1988.

During 1988, ENSERCH will complete the mine road, bringing it from 'pioneer' specifications up to final state design standards. The road is scheduled to be complete in time to be used during summer for transporting housing modules to the mine site. A port site facilities contract will be awarded early in 1988 for the erection of two fabricated metal buildings for unloading haul trucks from the mine site and storing concentrates. Completion of roads and mine facilities is planned in time for mine startup in 1990.

During 1987, almost 400 people were employed on the road and mine site projects. COMINCO estimates that project construction activities during 1988 will employ 350 to 450 people.

COMINCO has negotiated long-term contracts for the supply of concentrates to Asian, Canadian, and European smelters. When it reaches full production in 1992, Red Dog will produce 550,000 ton/yr of zinc concentrate, 100,000 ton/yr of lead concentrate, and 50,000 ton/yr of polymetallic concentrate suitable for processing in an Imperial smelter-type furnace.

PLACER PROJECTS STATEWIDE
(loc. 2, 4, 6 and 7, fig. 16)

Placer-gold expenditures reported by 39 placer operations during 1987 totaled $1.49 million — $38,200 per operation (compared to $116,000 per operation in 1986) — a decline of 67 percent from the previous year (table 5). Respondents to the DGGS survey indicated once again that expenditures were for construction of new recovery plants, water-recycling systems, and camps. Stripping of overburden was also mentioned.

Table 5. *Reported placer-gold development expenditures in Alaska by region, 1987.*

Region	Number of operators	Expenditures
Northern	1	$ 10,000
Western	4	306,000
Eastern Interior	18	508,560
Southwestern	6	72,000
Southcentral	8	572,288
Southeastern	2	21,600
TOTAL	39	$1,490,448

Drift mining activity during 1987 increased, in contrast to the general decrease in other placer activities by small companies. In most instances, small companies are developing and experimenting with underground mining and exploration techniques to determine if underground drift mining is feasible. Ten companies — seven in the eastern interior, two in the northern region, and one in the western region — reported activities ranging from shaft and portal construction to preliminary production tests on delineated placer reserves (table 6). MAMMOTH MINES continued mining a 'bench' placer deposit adjacent to Wilbur Creek in the Livengood-Tolovana district (loc. 2, fig. 16). The 80-ft-wide paystreak contains an estimated 300,000 yd³ of auriferous gravels; 1987 work was directed primarily at improving techniques to delineate economic pay zones missed in the previous season. Mine equipment included a single-boom ATH 12 Secoma jumbo drill, a 2-yd³ Wagner ST 20 'Scoop-tram' mucker, and a 12-yd³ dump truck. Three blasting rounds produced up to 200 yd³ of gravel per 12-hr shift.

CHRIS GROPPEL leased ground from WAYNE ANDERSON in the Tenderfoot district near Fairbanks and developed a 40-ft-deep paystreak in spring 1987 (loc. 6, fig. 16). GROPPEL used traditional techniques, including thawing with steam points, and hoisting with a Fairbanks self-

Table 6. *Placer underground drift development activities in Alaska, 1987.*

Company or individual	Drainage	Mining district	Number of Workers	Status of operation
Hall Mining	Linda Creek	Wiseman	2	Development drifting
Paul Dionne	Hammond River	Wiseman	2	Shaft construction
Tolstoi Mining	Boob Creek	Innoko	1	Shaft construction
Dick Grif	Wildcat Creek	Fairbanks	3	Shaft construction
Killion Land	Dome Creek	Fairbanks	3	Shaft de-icing and renovation
Steve Kirk	Smallwood Creek	Fairbanks	1	Shaft construction
MacDonald	Fish Creek	Fairbanks	2	Portal construction
Reading Mining	Independence Creek	Fairbanks	6	Decline construction
Groppel	Tenderfoot Creek	Richardson	3	Production/development of mine techniques
Mammoth Mines	Wilbur Creek	Livengood	4	Production/development of reserves
TOTAL			27	

dumping bucket and gin-pole, to haul approximately 250 yd^3 to the surface during the production test. His analysis shows that it is feasible for two miners to economically extract 1,500 yd^3 (at 0.17 oz/yd^3 grade) in an 8-mo season with this equipment.

Several companies explored and developed deep placers in the Fairbanks mining district (loc. 4, fig. 16). They include READING MINING (fig. 18) on Treasure Creek, DICK GRIF on Wildcat Creek, MACDONALD on Fish Creek, and MICK KILLION on Dome Creek (table 6). None of these projects reached production stage in 1987.

PAUL DIONNE and others (ECLIPSE MINING) developed deep ground on the Hammond River, Wiseman mining district, northern region; thawed gravels have prevented development of potentially rich gravels in past years. JOHN HALL drifted on Linda Creek and also in the Wiseman area, searching for rich pockets of placer gold.

TOLSTOI MINING COMPANY (Doug Sherrer) continued small scale development of platinum-gold reserves in his drifts on Boob Creek in the Innoko district west of McGrath (loc. 7, fig. 16). Like GROPPEL, in the Tenderfoot district, SHERRER used traditional steam points and hoists to mine his reserve.

Figure 18. Miner 'barring down' in Reading drift mine exploration-development project, Fairbanks mining district, eastern interior Alaska. Photograph by W.. Roberts, 1987.

HEAP-LEACH GOLD-SILVER DEVELOPMENTS (CITIGOLD-RYAN LODE AND LOUNSBURY-ADLER PROPERTIES)

Fairbanks mining district
Eastern interior region
(loc. 3 and 5, fig. 16)

CITIGOLD ALASKA INC. (CITIGOLD), a subsidiary of LA TEKO RESOURCES of Vancouver, B.C., constructed two lined, 50,000-ton-capacity pads, an activated-carbon gold recovery plant, and an agglomeration circuit, and completed its first year of a full-scale heap-leaching test at the Ryan Lode property on Ester Dome near Fairbanks (loc. 5, fig. 16). The project used earthmoving equipment to excavate surface-mineable reserves of oxidized quartz-vein ore (fig. 19). In

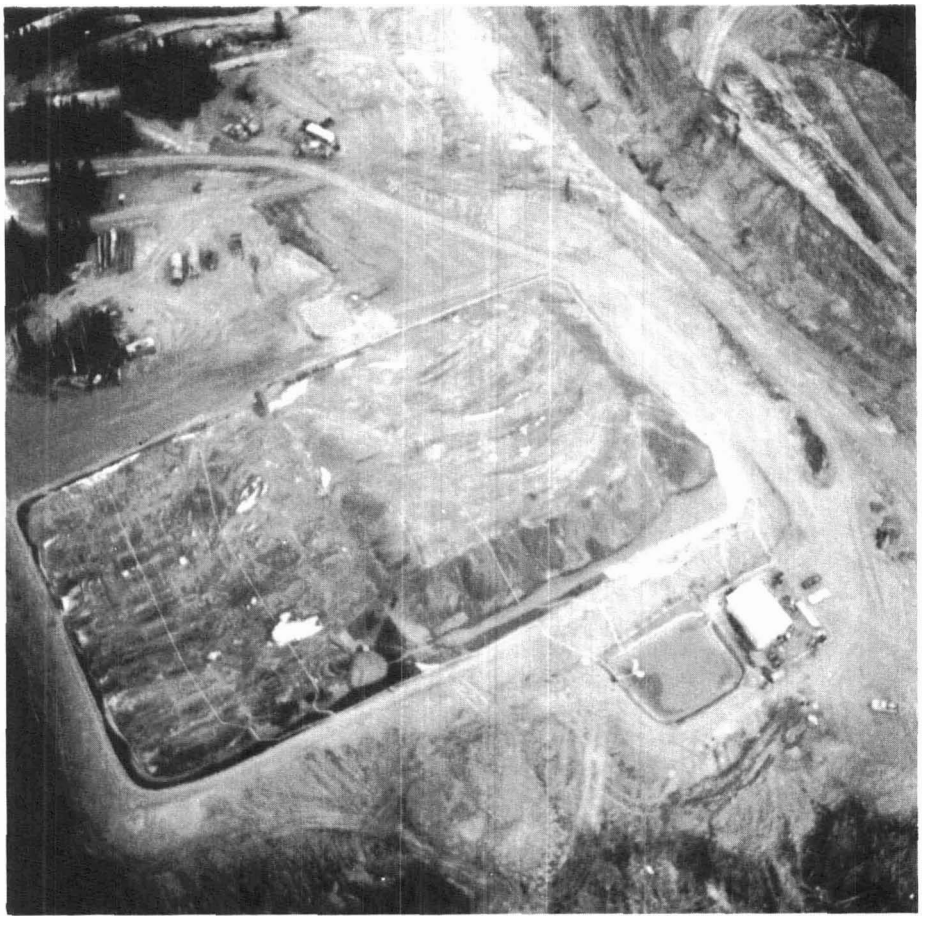


Figure 19. Aerial view of heap-leach facility at Citigold Alaska, Inc., mine site, Fairbanks mining district, eastern interior Alaska. Photograph by Josh Moore, 1987.

Figure 20. Backhoe trenching at Adler property on Ester Dome, Fairbanks mining district, eastern interior Alaska. Photograph by Josh Moore, 1987.

1987, the company mined, agglomerated, and leached 88,000 tons of ore, produced 6,100 oz of gold-silver bullion, and led Alaska in lode production of precious metals.

CITIGOLD has announced drill-indicated reserves of 2 million tons of ore, grading 0.13 oz/ton gold, along a strike length of 2,000 ft. In addition to mine development and test production in 1987, CITIGOLD trenched the surface exposure of the vein system at 20-ft intervals and sampled the structure to develop a mine plan for 1988.

The Adler gold deposit on the southern flank of Ester Dome was prepared for heap-leaching by JOSH MOORE under option from GEORGE AND JIM LOUNSBURY of Fairbanks (loc. 3, fig. 16; fig. 20). During the 1987 season, a 350-ft-long section of the Adler vein was excavated to a depth of approximately 27 ft, using a Komatsu backhoe. Approximately 5,000 tons of ore with assays ranging from 0.005 to 3.5 oz/ton gold were stockpiled for future crushing and leaching. Some 2,000 ft of 3-in. blasthole drilling was done, and several tons of explosives were used. Further development, including pad and recovery plant construction, is planned in 1988.

GREENS CREEK PROJECT, BP MINERALS AMERICA

Southeastern region

(loc. 8, fig. 16)

During June 1987, AMSELCO MINERALS INC. (now BP MINERALS AMERICA) announced approval by the GREENS CREEK JOINT VENTURE partners for the development of the Greens Creek mine on Admiralty Island near Juneau. The joint venture operation is managed by the GREENS CREEK MINING COMPANY, a subsidiary of BP MINERALS AMERICA. Joint venture partners are BP MINERALS AMERICA (53.1 percent), HECLA MINING (28.0 percent), CSX OIL AND GAS CORPORATION (12.6 percent) and EXALAS RESOURCES (6.3 percent).

The Greens Creek mine has been designed to produce 1,000 ton/day, 355 day/yr, predominantly from drift-and-fill mining, with cut-and-fill techniques used in steeply dipping areas of the ore body.

At full production, yearly mine output is expected to be 84,000 tons of concentrate containing 6.4 million oz of silver, 36,000 oz of gold, 25,000 tons of zinc, and 9,000 tons of lead. At this production rate, Greens Creek will become the largest producer of silver in the U.S. It is also notable that the mine's projected annual gold production would be 16 percent of the total gold produced in Alaska in 1987.

Development at the mine site actually began in 1986, with completion of a 9-mi road from the Hawk Inlet dock to the mine site on upper Greens Creek. A new portal also was collared and drifting begun on an adit to serve as the main ore haulageway.

In 1987, a 5-mi road was completed between the Hawk Inlet shiploading dock and a second dock site for commuting workers at Young Bay on the northeast side of Admiralty Island. In addition to road construction, work began on a number of other mine facilities, including site preparation for the mill and concentrator, tailings pond, and on-shore port facilities (fig. 21). Underground development work in 1987 consisted of advancing the main ore haulage drift 2,500 ft and completing 3,300 ft of definition drilling from underground drilling stations (fig. 22).

Production is scheduled to begin early in 1989. Total development costs are estimated at $105 million. At full production, the mine will have a workforce of about 200 mine, mill, engineering, service, and administration personnel. Direct income to Juneau area residents in wages, salaries and benefits is estimated to be $10 million annually. Other economic benefits to Juneau, the region, and the state will be increased sales of supplies and services, and engineering, service, and administration personnel. Direct income to state and local tax revenues.

As mandated by the mine's development permits with the U.S. Forest Service, workers will commute daily from Juneau. Greens Creek has contracted with ALLEN MARINE WAYS of Sitka for the construction of two catamaran ferries for the 30- to 35-min. daily commutes between Auke Bay and Young Bay, at a cost of about $4 million. The primary ferry will be 100 ft long and will have multiple backup systems for both safety and reliability, including three radar systems and four engines. ALLEN MARINE WAYS will operate the com-

Figure 21. Mill, portal, and tailings pond construction at Greens Creek Mine project, Admiralty Island, southeastern Alaska. Photograph courtesy of BP Minerals America, 1987.

Figure 22. Robert Greig instructs miners on jack-leg drill as part of University of Alaska Southeast mine-operator training at Greens Creek mine near Juneau, southeastern Alaska. Photograph courtesy of BP Minerals America, 1987.

muter service and will employ 16 people.

In an effort to maximize local hire when the mine begins operation, GREENS CREEK MINING COMPANY and the University of Alaska Southeast organized training classes to be held in Juneau in 1987 and 1988. Over 100 students are expected to complete the course and become eligible for entry-level jobs at the mine. Curriculum for the training program was developed by the Mining and Petroleum Training Service of the University of Alaska Anchorage.

Proven recoverable reserves at the mine total 3.5 million tons with grades of 24 oz/ton silver, 0.18 oz/ton gold, 9.7 percent zinc, and 3.9 percent lead. At a production rate of 355,000 ton/yr, mine life is estimated at 10 yr. However, there is a high potential for extending reserves on the company's nine core mining claims.

CANADIAN MINING DEVELOPMENTS THAT AFFECT THE ALASKAN ECONOMY

(loc. 9 and 10, fig. 16)

Construction of a 400-ton/day gold mine is underway 50 mi east of Wrangell in British Columbia. The Stonehouse (Reg) Gold Mine is being developed by SKYLINE RESOURCES of Vancouver, B.C. (loc. 9, fig. 16). The property was discovered in 1980 by prospector and SKYLINE President, Reg Davis, who tracked gold-bearing boulders to their mountain source. Since the discovery, some 50,000 ft of diamond drilling and 5,000 ft of underground drifting and raising has delineated a high-grade ore body. Most recent figures cite 121,000 tons of measured reserves grading 1.25 oz/ton gold, 236,900 tons of indicated reserves grading 0.56 oz/ton gold and 700,000 tons of inferred reserves grading 0.57 oz/ton gold. The ore is also reported to contain an average of 1 oz/ton silver as well as small amounts of copper, lead, and zinc.

Construction work began at the property in 1987, but bad weather in September and October delayed startup until early 1988. A lodge to house workers at the mine site was completed in December, and by year-end nearly all mill and mine equipment had been airlifted to the project.

Initial production at the rate of 200 ton/day will start in 1988, and the first year's output is estimated to be 60,000 oz of gold.

The new mine is 60 mi from the nearest Canadian road. Supplies and equipment will most likely be transported by barge up the Stikine River to the mouth of the Iskut River, where a 25-mi road would be built to the mine site. During 1987, the nearby city of Wrangell served as a staging ground for the airlift of men, supplies, and equipment into the Johnny Mountain project, as well as several other B.C. exploration projects working in the same area. Though labor and immigration laws between the U.S. and Canada limit direct employment opportunities for Americans at Canadian mines, Wrangell will continue to be an important transportation and supply center for the project, especially if Stikine River access is developed.

Mining companies developing four new mines in Yukon Territory reported development expenditures exceeding $20 million (Can$) — mainly in preparation for production of previously unmined ore deposits. CURRAGH RESOURCES, which continues to mine the Anvil massive-sulfide zinc-lead deposits near Faro, announced that the nearby Grum and Vangorda deposits were being developed for production (loc. 10, fig. 16). UNITED KENO HILL MINES initiated development of the Belokeno deposit near Elsa.

Mineral production in 1987

INTRODUCTION

The value of Alaska's mineral production in 1987 was $202.4 million, an increase of two percent from the 1986 estimate of $198.5 million (table 7). Gross quantities and values for 1987 mineral commodities were 229,700 oz of gold worth $104.5 million, 16.7 million tons of sand and gravel worth $42.7 million, and 1.51 million tons of coal worth $42.4 million, all of which totalled 94 percent of the total gross mineral dollar value. Building stone, tin, tungsten, jade, peat, platinum, and soapstone constituted the remaining 6 percent ($12.2 million). Principal metallic, nonmetallic, and coal mine and quarry locations are shown in figure 23.

Production estimates are based on data compiled from 177 DGGS questionnaires returned by private companies and individuals, responses to a telephone survey of 35 companies that mine sand and gravel and five that extract stone, and information provided by the USBM, USGS, University of Alaska, precious metal refiners, and consultants. Historic production levels for gold, sand and gravel, and coal are compiled in figures 24, 25, and 26, respectively. A summary of historical production estimates for nine metals, three industrial minerals, and coal since 1880 (apps. F and G) reveals that Alaskan mineral production has been dominated by gold.

Even though the total value of Alaskan mineral production changed little from 1986 to 1987, some major shifts took place within individual industries. Sand and gravel production decreased 20 percent in volume (from 20.9 to 16.7 million tons) and 44 percent in value. The substantial decrease reflects a generally weak Alaskan economy and reduced infrastructure development on Alaska's North Slope oil field where much of the industry has been focused in past years. Building-stone production also decreased 43 percent (from $20.3 to $11.6 million), mainly from a slackening in capital project construction. Construction of gravel pad, causeway, and other facilities planned at the North Slope in 1988 will increase sand and gravel production, and the Bradley Lake hydroelectric project and highway projects, if they proceed as planned, will contribute to a modest recovery of the building-stone industry.

Alaska tin production was 288,000 lb, a decrease of approximately 15 percent in volume from 1986. Weak tin markets continue worldwide and are probably responsible for the lower production volumes. The USIBELLI COAL MINE expanded coal production modestly, by about 1.5 percent, and shipped test-level coal volumes to Taiwan and Japanese power utilities.

Estimates of gold production are based on completed questionnaires from 104 mine operators and three precious metal refiners, stockholder reports, and informal surveys from mining districts.

DGGS survey results show that 229,700 oz of gold and 54,300 oz of silver were recovered from 202 placer mines and three small lode operators statewide (table 8). The increase of 44 percent in volume and 71 percent in value of 1987 gold production is attributable to expanded operations at several large projects. The 10 largest mines produced 133,229 oz of gold — 58 percent of the state's total gold output. But the increase in gold production does not accurately reflect the precarious position of small, family-operated placer mines that are being increasingly squeezed by regulatory and legal problems. Between 1985 and 1986 the number of placer mines shrank from 266 to 196, a reduction of 26 percent. In 1987, 202 placer mines operated, a marginal increase from 1986. More small mines operated in the remote

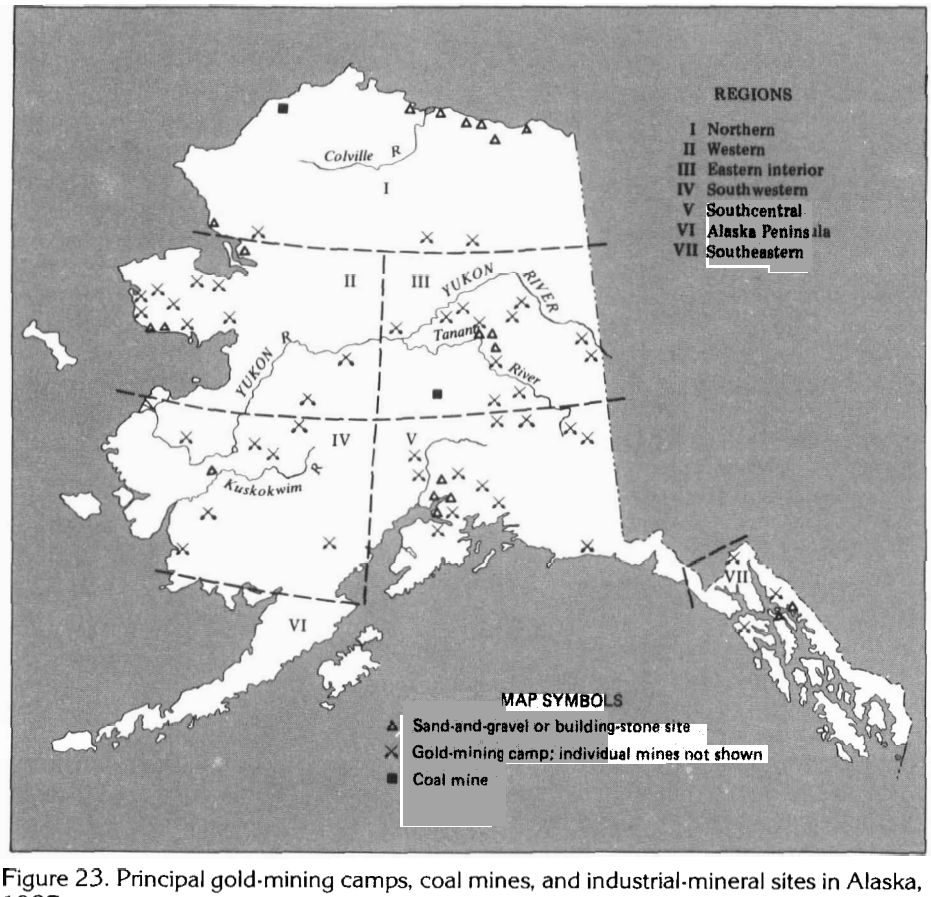


Figure 23. Principal gold-mining camps, coal mines, and industrial-mineral sites in Alaska, 1987.

Table 7. *Reported mineral production in Alaska, 1985-87.*[a]

Metals	Volume			Estimated values[b]		
	1985	1986	1987	1985	1986	1987
Gold (oz)	190,000	160,000	229,700	$ 61,175,000	$ 60,800,000	$104,516,230
Mercury (lb)	2,094	912	NR	10,000	2,800	NR
Antimony (lb)	65,000	45,000	NR	98,000	67,500	NR
Platinum (oz)	NR	W	W	NR	W	W
Silver (oz)	28,500	24,000	54,300	171,000	134,400	390,960
Tin (lb)	300,000	340,000	288,000	650,000	890,000	460,000
Tungsten (stu)	NR	120	160	NR	22,800	11,400
Subtotal				$ 62,104,000	$ 61,917,500	$105,378,590
Industrial minerals, coal, peat						
Jade & soapstone (ton)	W	2.0	3.6	$ W	$ 12,000	$ 78,000
Sand & gravel (mt)	28.2	20.9	16.7	112,062,750	75,761,507	42,659,808
Building stone (mt)	2.5	4.2	1.8	12,150,000	20,320,000	11,620,000
Subtotal				$ 124,212,750	$ 96,093,507	$ 54,357,808
Coal (ton)	1,370,000	1,492,707	1,508,927	$ 39,730,000	$ 40,100,000	$ 42,354,500
Peat (yd^3)	85,000	50,000	46,000	552,500	350,000	299,000
Subtotal				$ 40,282,500	$ 40,450,000	$ 42,653,500
TOTAL				$226,599,250	$198,461,007	$202,389,898

[a] Production data from DGGS questionnaires, U.S. Army Corps of Engineers, DOTPF; precious-metal outlet data, interviews with mine operators, and other confidential sources
[b] Values calculated from weighted and rounded averages of unit prices over the period studied.
W = withheld
mt = million ton
stu = short-ton unit
NR = not reported

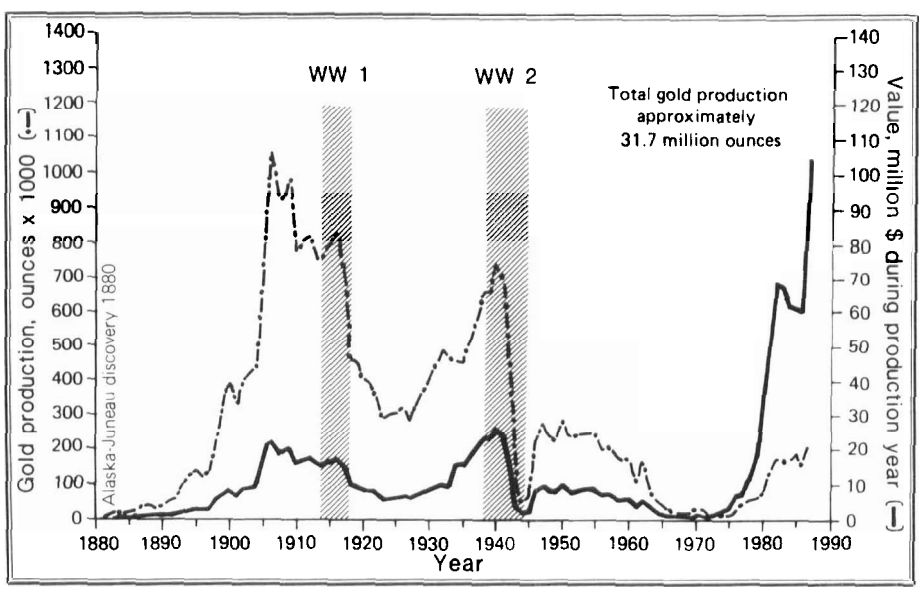


Figure 24. Gold production in Alaska, 1880-1987.

western, southwestern, and northern regions of the state than in the previous year. Placer-mining activities in the eastern interior and south-central regions, which were hard-hit by regulatory and legal issues in 1986, remained virtually unchanged from the previous year. Figure 47 and Appendix E illustrate the permitting process for placer mining.

Data on average gold grades of placer districts have been compiled using DGGS questionnaire responses from 1982 to 1987 (table 9). The data set represents about 25 percent of those mine operators who returned production information during the 6-yr period. Annual averages of weighted grades of processed placer gravels ranged from 0.0129 to 0.0182 oz/yd^3; the 6-yr average is 0.0149 oz/yd^3. The extremely high grades of pay mined by the VALDEZ CREEK MINING COMPANY since 1984 elevates the average grade by

Table 8. *Reported refined gold production, number of operators, and industry employment in Alaska by region and mining district, 1986-87.* [a]

Region and mining district	1986			1987		
	Number of operators	Production (oz)	Number of employees	Number of operators	Production (oz)	Number of employees
Northern	4	4,500	15	8	7,256	40
Chandalar						
Shungnak						
Koyukuk-Nolan						
Western	42	53,000	363	46	101,244	414
Nome						
Kougarok						
Koyukuk-Hughes						
Port Clarence						
Fairhaven						
Ruby						
Solomon						
Koyuk						
Council						
Eastern Interior	83	45,350	375	81	50,690	380
Circle						
Livengood-Tolovana						
Fairbanks						
Fortymile						
Manley-Eureka						
Richardson						
Bonnifield						
Rampart						
Southcentral	30	39,000	268	29	46,460	251
Cache Creek						
Chistochina						
Valdez Creek						
Kenai Peninsula						
Nelchina						
Southwestern	33	18,000	128	36	20,650	129
Innoko-Tolstoi						
Iditarod-George River						
Moore Creek						
Nyac						
Crooked Creek						
Lake Clark-Mulchatna						
Southeastern and Alaska Peninsula	4 [b]	150	6	5	3,400	35
TOTAL	196 [b]	160,000	1,155	205	229,700	1,249

[a] 1987 production reported from 202 mechanized placer and three lode operations statewide. Small 'recreational-assessment' projects that recover gold bullion from panning, pick-and-shovel prospecting, long-tom sluicing, and suction-dredging are not included.

[b] Revised upward from 1986 report.

about 0.001 oz/yd^3; the influence of this single mine is lessened when the larger data sets of 1986 and 1987 are included. The average volume of processed pay may also be influenced (upward) by data from several large operations in the sample set analyzed.

The average 1987 Alaskan placer mine produced 1,120 oz of gold and employed 6.2 individuals, compared to average production levels of 820 oz in 1986 and 720 oz in 1985. Gold production per employee was 178 oz in 1987, 139 oz in 1986, and 124 oz in 1985. These data point to increasing output and efficiency for the average Alaskan placer mine. Average grade (table 9) in placer deposits has not changed significantly over the 6 yr studied, but if production figures from six large operations (dredging and opencut mines on the Seward Peninsula and in southwestern Alaska) are subtracted, the average better represents the typical family-operated Alaskan gold-mining venture, which produced 680 oz and

employed 4.4 individuals. These data compare closely to average production and employment data from Yukon Territory, Canada, where the average Yukon placer mine in 1987 produced 660 oz of gold, employed 3.8 people, and was a small-scale, family-operated mine (Johnson, 1988).

The greatest impact on small miners in 1987, and possibly for the next few years, was a lawsuit brought by the Sierra Club against the U.S. Bureau of Land Management (BLM). In early 1987, a federal judge granted an injunction that could halt some placer mining in key interior Alaska mining districts for 1 to 3 yr. The federal injunction prohibits BLM from allowing any mine to operate that disturbs more than 5 acres of land on any of four major interior Alaska drainages — the Birch Creek, Fortymile River, Beaver Creek, and Chatanika River drainages — until the agency completes cumulative environmental impact statements (EIS) and other assessments on the lands in question. Management decisions based on the EIS's will undoubtedly influence regulation of placer mining on other BLM lands throughout the state. In December, Hagler, Bailly and Company (1987) prepared a report for the BLM that summarized the socioeconomic impacts of mining in the four mining regions affected by the forthcoming EIS; the document contains current production figures and other mining statistics provided by DGGS.

The U.S. Army Corps of Engineers (Corps) stepped into the regulatory process in 1987 as a result of a request from the U.S. Fish and Wildlife Service, and the threat of legal action by the Sierra Club. The Corps will begin requiring permits from Alaska mine operators for the 1988 season at a level of detail not previously required. The Corps is working to develop a standard permitting process which will allow most mines to operate under general monitoring stipulations and conditions.

Water-quality issues continue to be a problem, and the court-ordered shutdown of mining in several national conservation units persists. In addition, the state's mining-claim location

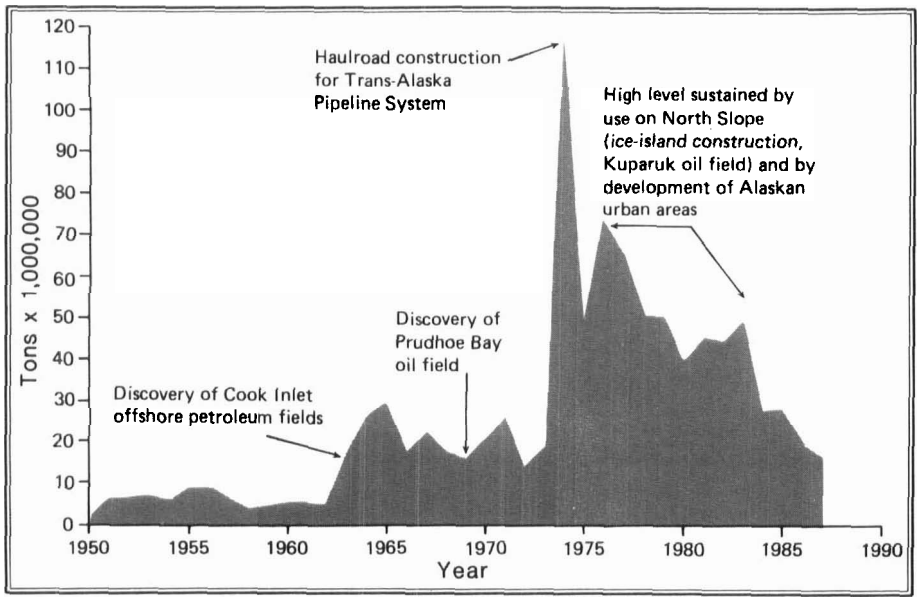


Figure 25. Sand-and-gravel production in Alaska, 1950-87.

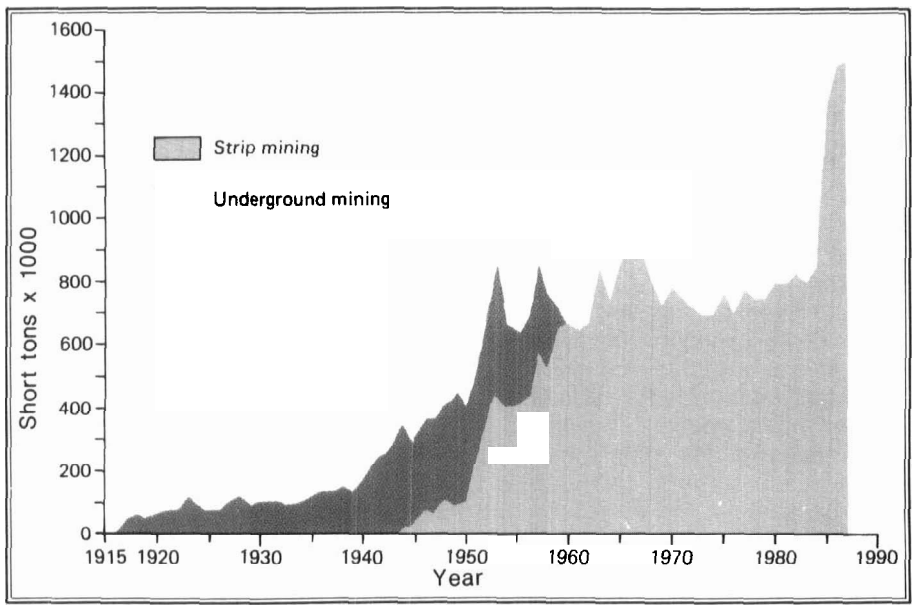


Figure 26. Coal production in Alaska, 1915-87.

Table 9. *Reported gold grade and yardage statistics from opencut Alaskan placer mines, 1982-87.* [a]

Year	Number of respondents	Refined gold grade (oz/yd³) Average	Refined gold grade (oz/yd³) Range	Pay gravel processed [b] annually (yd³) Average	Pay gravel processed [b] annually (yd³) Range
1982	23	0.0145	0.008-0.031	97,234	3,800-391,300
1983	18	0.0129	0.007-0.019	46,070	1,000-250,000
1984	18	0.0182	0.005-0.105	69,748	720-334,662
1985	19	0.0164	0.004-0.085	115,152	750-600,000
1986	38	0.0137	0.004-0.067	80,740	2,000-650,000
1987	33	0.0142	0.002-0.092	93,637	400-630,000
Averages		0.0149		83,763	

[a] Compiled from DGGS questionnaires.
[b] Volume and grade figures for large, floating onshore and offshore dredge operations, which averaged 675,000 yd³/unit, were not included.

and leasing system has been challenged in court. On March 30, 1987, Governor Cowper sent a memo to three state resource-management agencies, assigning priority status to the resolution of water-quality issues. He further directed his Commissioners of Natural Resources, Environmental Conservation, and Fish and Game to take an active role in addressing federal and state regulatory and legal problems that impact the mining industry.

Results from Department of Environmental Conservation (DEC) monitoring of 1987 placer mine operators showed positive changes in water quality in key placer-mining districts. A comparison of 1987 monitoring results to 1986 results revealed increasing implementation of innovative mining technologies. The use of tailings filters increased from 2 to 7; 100-percent water-recycling plants increased from 5 to 30; partial water-recycling units increased from 14 to 51; the use of flocculants increased from 2 to 8; and the use of gravel classificaton systems increased from 59 to 154. Operations with improperly designed settling ponds decreased from 38 to 12. The result was an improvement in overall water quality — 97 percent of Alaskan placer mines met the federal (0.2 ml/L) settleable solids standards. However, placer mines still have difficulty meeting the state's 5-NTU (nephelometric turbidity unit) turbidity standard.

Water quality within interior Alaska placer-mining areas defined under the Sierra Club v. Penfold lawsuit also showed marked improvement. According to DEC annual placer-mining field data, turbidity on Faith Creek (part of the Chatanika River drainage) dropped from 85 NTU in 1986 to 21 NTU in 1987. Turbidity decreased 25 percent in the Birch Creek drainage. Turbidity ranged from 2.6 to 3.5 NTU in the Walker Fork and Jack Wade Creek, both part of the Fortymile district; mines in both streams complied with the 5-NTU state standard.

A DEC-Alaska Miners Association (AMA) working group was formed during 1987 to examine various options concerning implementation of water-quality regulations. Funding was provided to research the possibility of amending state water-quality regulations for mixing zones and start-up variances. By year end, proposals by private groups, including AMA, were being reviewed by the Attorney General at DEC's request to determine if their implementation would fulfill stipulations of the Clean Water Act.

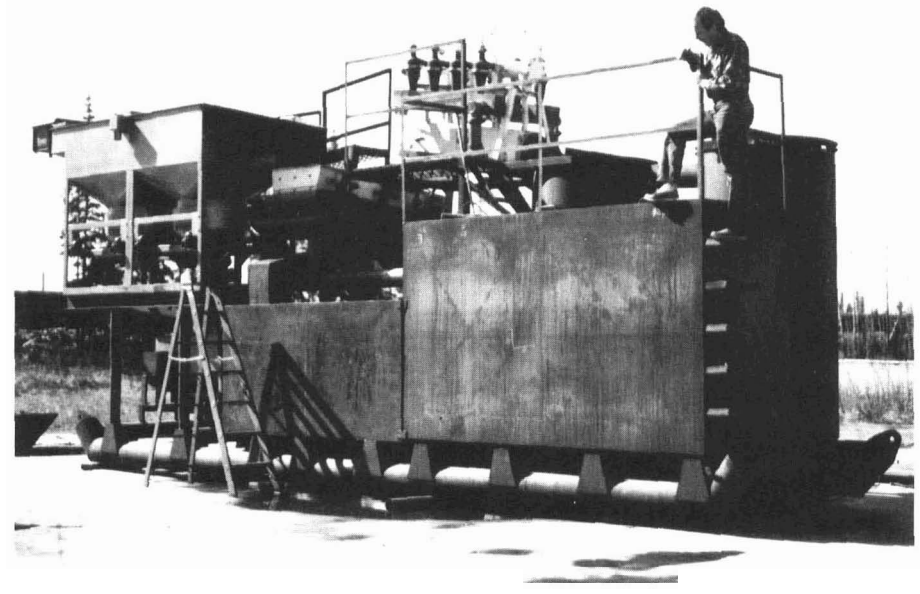


Figure 27. Mobile washing plant at Goldstream Exploration, Inc., Fairbanks, eastern interior Alaska. Photograph by T.K. Bundtzen, 1988.

Several companies worked on innovative placer plant designs that would enhance water quality and land reclamation. GOLDSTREAM EXPLORATION, INC., of Fairbanks constructed a two-phase, mobile placer-mining system with a 100-percent water-recycling system and a technique for reclaiming land while the mine is in operation (fig. 27). This plant consists of two components: (1) a skid-mounted grizzly-trommel system that initially classifies pay gravels; and (2) a separate skid-mounted plant that employs primary and secondary jigs, siltation concentration tanks, hydrocyclones, and flocculant treatment units. Coarse reject material from the trommel system is conveyed back into the mine pit while finer auriferous pay gravels enter the jig circuit via slurry pump. Waste materials from the jigs are recovered with sand filters and hydrocyclones, then pumped to storage areas for further reclamation of the mine cut. All waste water is returned to the washing circuits for reuse. If successful, the mobile unit could provide an alternative for extensive settling pond systems and would permit operation in confined areas. The unit will be tested in the Fairbanks district in 1988.

MLM, INC. (Lonnie McClung), also of Fairbanks, has developed a process in which placer gravels are treated through water alluviation techniques. Water rising through vertical columns at specific velocities carries off material of similar specific gravity (such as silt, sand, and fine-gravel particles). Material is initially classified through screening processes typical of many placer operations. By the use of a holding tank, vibrating screens and conveyors, the amount of water needed to recover gold from pay gravels may be decreased to less than 10 percent of what is needed in conventional sluicing processes. MLM, INC., plans pilot production tests in the Fairbanks area during the 1988 season.

The mineral industry directly employed 3,299 people during 1987, an increase of 12 percent over 1986 levels (table 10). Mechanized gold

mining — placer and lode — contributed 39 percent of the total; sand and gravel, 26 percent; mineral development, 13 percent; recreational and assessment work, 7 percent; building stone, 6 percent; coal, 4 percent; mineral exploration, 3 percent; and miscellaneous lode production, 2 percent. The employment statistics include both seasonal and year-round jobs.

METALS

Northern Region

Eight mining companies in the Koyukuk-Nolan, Wild Lake, and Chandalar areas reported combined production of 7,256 oz of gold, an increase of 61 percent from the 1986 total of 4,500 oz. However, some operators judged that districtwide activity levels were about the same during the 2 yr. Historically, much gold production has taken place in the Wiseman area near the pipeline corridor, where ALSINCO COMPANY mined the ELDORADO ASSOCIATION claims with crews of two to six, and PAUL DIONNE mined and drifted on the Hammond River. JIM SWAN worked placers on Gold Creek near the Dalton Highway north of Wiseman. JOHN HALL again worked placer deposits on Linda Creek. ECLIPSE MINING COMPANY conducted several operations along Nolan, Vermont, and Archibald Creeks on property leased or purchased from SILVERADO MINING COMPANY. TOM WALKER leased placer properties from LITTLE SQUAW MINING COMPANY in the Chandalar district and mined rich placer deposits on Tobin Creek. The previously productive lode deposits of the Mikado vein system remain inactive, but LITTLE SQUAW MINING COMPANY is seeking new lessees.

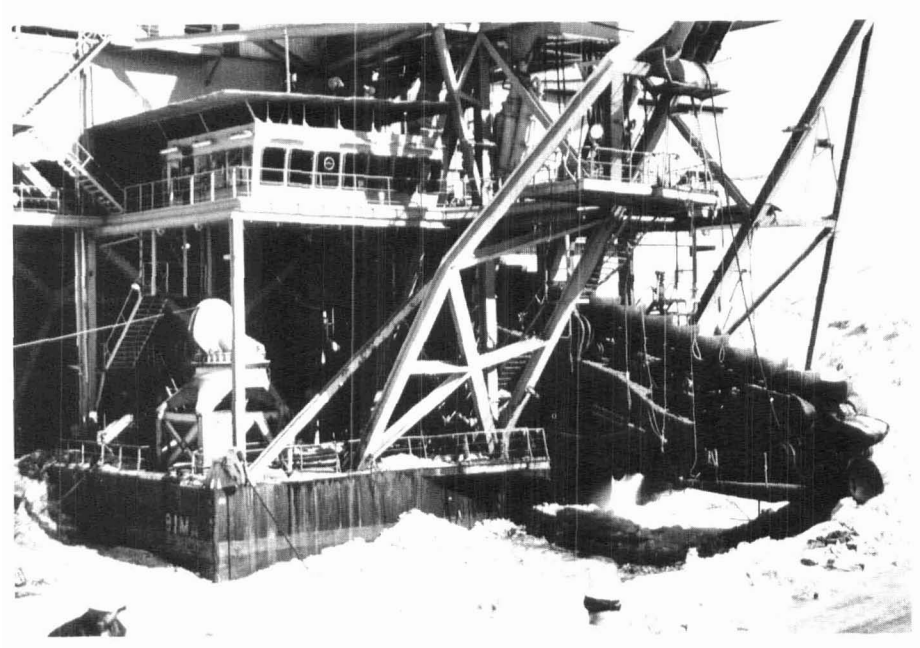


Figure 28. Bima dredge undergoing winter maintenance at Nome Causeway, western Alaska. Photograph by T.K. Bundtzen, 1988.

West of Wiseman, PARADISE VALLEY MINING COMPANY again operated a mechanized bulldozer-loader operation on Flat Creek 6 mi east of Wild Lake and 55 mi north of Bettles. PARADISE VALLEY also runs an extensive and profitable recreational mining venture from the same camp (see Recreational Mining section). WILD RIVER JOINT VENTURE operated surface placer claims nearby along Lake Creek at the south end of Wild Lake.

TIMBERLINE CREEK MINING, which had previously operated a placer mine on Weise Creek in the Shungnak district of western Brooks Range, was barred from operating by a court injunction against BLM in National Wildlife Federation v. Robert Burford. The injunction prohibits BLM from approving mining plans within the Squirrel River drainage except for claims filed prior to December 17, 1971.

Western Region

Responses to the DGGS questionnaire from 46 mining operations indicate that 101,244 oz of gold were produced in the western region — 44 percent of total 1987 gold production

Table 10. *Mineral-industry employment in Alaska, 1987.* [a]

Mineral industry	Number of employees
Gold and silver	
Placer	1,249
Lode	52
Recreational	245
Sand and gravel	868
Building stone	185
Coal mining	127
Tin, antimony, jade, mercury, and soapstone	55
Mineral development	427
Mineral exploration	91
TOTAL	3,299

[a] Jobs at gold and silver lode mines, coal mines, mineral development projects, and certain mineral exploration projects are full-time all year; others may be seasonal.

in Alaska. Nearly 70 percent of the 70,000-oz production increase statewide came from this important gold mining area. Much production activity centered around the historic gold mining town of Nome. WESTERN GOLD EXPLORATION AND MINING COMPANY (WESTGOLD), formerly INSPIRATION GOLD, INC., operated their offshore dredge, 'Bima,' from June 16 through November 23 and recovered 36,000 oz of refined gold. WESTGOLD was Alaska's top producing gold mine, and it plans to increase production in 1988. The 15,500-ton dredge was acquired in 1986 by INSPIRATION GOLD, INC., for mining on the company's 21,000 acres of state offshore mining leases in Norton Sound (fig. 8). The Bima is 525 ft long (including the stacker boom and bucket line), 150 ft wide, 14 stories high, and is described as the largest offshore dredge in the world (fig. 28). The dredge was originally commissioned in 1976 by BILLITON MINING for the recovery of tin in Indonesia and was reportedly named for a Malaysian goddess of fortune.

In 1986, the dredge completed a 40-day pilot test season in which it recovered 3,000 oz of gold, during summer weather that was described as the worst in 20 yrs. After being shipped by submersible barge to the Port of Tacoma for the winter of 1986-87 for modification of its jig recovery system and installation of a new bucket line, the dredge returned to Nome in early June 1987 and operated from June 16 through November 23. During the 1987 season, the dredge weathered 84-knot winds in a storm that was classified as Nome's worst in 50 yrs. The company reported that the modified dredge has a mining and processing capacity of 740 yd^3/hr.

During the short ice-free season, the Bima operates 24 hr/day, using two 12-hr work shifts. Crews are ferried from the company's Nome facilities to the dredge by a Bell 205 helicopter.

WESTGOLD employed 124 people during the production season and retained 65 to 70 employees during the 1987-88 winter for maintenance and docking at the Nome Causeway where an artificial ice ridge was built to shield the dredge from the Norton Sound pack ice (fig. 29).

The ALASKA GOLD COMPANY operated two floating, Yuba Class, bucket-line stacker dredges in the Nome district and roughly doubled production from last year, when only one dredge operated. Dredge No. 6 operated about 1 mi west of the Nome airport; Dredge No. 5 operated 2 mi north of Nome near the base of Anvil Mountain. Dredge No. 6 operated in 80-ft overburden and can dig to 59 ft below water level. Dredge No. 5 operated in 109-ft overburden and has a digging capacity of up to 85 ft below water level. Both dredges have 9-ft^3 buckets with a maximum capability of 7,000 yd^3/day; the dredges have been operating at 5,500 to 6,000 yd^3/day. Both dredging operations were successfully redesigned to accommodate water-recycling systems and complied with state and federal water standards. ALASKA GOLD employed 133 people during 1987. An aggressive season is planned for 1988. Winter stripping of frozen overburden was instituted in 1987 with satisfactory results, and ALASKA GOLD plans to continue this practice. ALASKA GOLD'S industrial storage area, which houses the now inactive amalgamation furnace installation near Nome, was investigated by EPA and found to be contaminated with toxic metals. In earlier years, gold had been collected with mercury amalgam on the dredge and recovered using retort furnaces north of Nome, but almagamation techniques were discontinued in the early 1980s. ALASKA GOLD hired HARDY AND LAWSON, INC., to study the problem and make recommendations for toxic substance removal, which is expected to result in a complete cleanup of the facilities area in 1988.

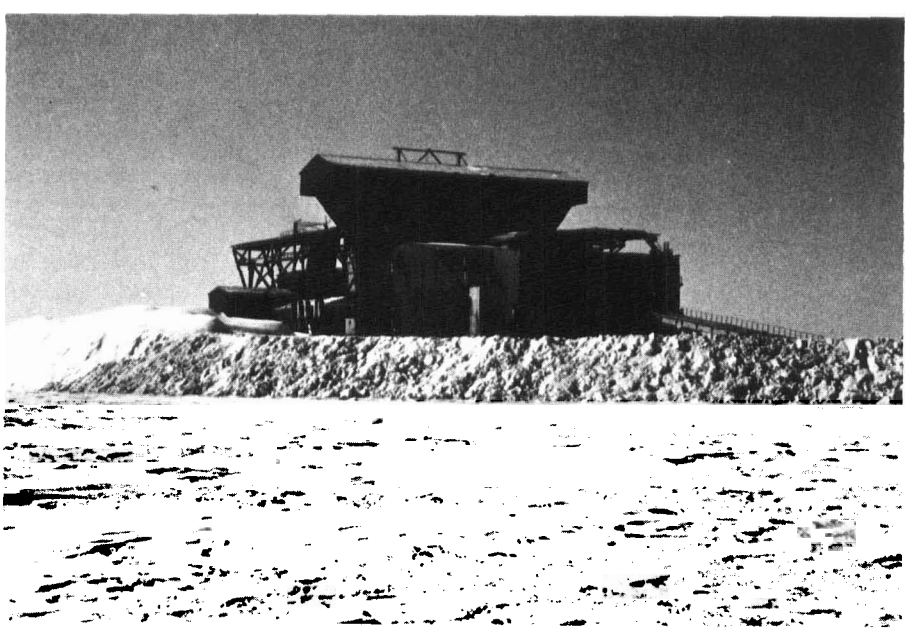


Figure 29. Bima dredge surrounded by artificial ice ridge constructed to protect dredge against Norton Sound pack ice during winter 1987-88. Photograph by Stephen Jewett, 1987.

WINDFALL MINING COMPANY continued work on placer leases from ALASKA GOLD and mined a large opencut 3 mi north of Nome with large-capacity scrapers and loaders. In the 1950s, ALASKA GOLD'S Dredge No. 3 had mined an east-west cut near the southeast base of Anvil Mountain but could not work the pay zone that WINDFALL is now exploiting. Company geologists have shown that the paystreaks occur in a complex interface between alluvial fans spreading off Anvil Mountain and the '3rd,' or 'Monroe,' beach north of Nome. High-angle faulting at the foot of Anvil Mountain helped recycle and

reconcentrate gold in the paystreaks. From mine cuts 200 ft long, 350 ft wide, and 35 to 75 ft deep, WINDFALL removed 900,000 yd^3, of which 630,000 yd^3 were washed in a 100-percent water-recycling recovery plant. Byproduct 4½-in. gravel aggregate from the operation was barged to a Yukon River village to be used for river erosion control, and 60,000 yd^3 of gravel was also used in the construction of the Nome port and causeway project finished in 1986. The company reclaimed and reseeded 9 acres of mine cuts from previous years in 1987 and will reclaim and reseed an additional 20 acres in 1988. WINDFALL employs 30 people, including two exploration geologists.

ANVIL MINING COMPANY operated a large-scale sluicing operation with 17 employees near the summit of Anvil Mountain and made plans to mine near the historic 'potato patch' (the site where several of Alaska's largest gold nuggets were recovered, including 72-, 79-, and 154-oz nuggets taken in the early 1900s).

Several other floating bucket-line dredges operated on the Seward Peninsula. The ENGSTROM and TWEET families each reported mining pay gravels with their 1½- and 3½-ft^3 bucket-line stacker dredges in the Kougarok district. GLOBAL RESOURCES successfully rebuilt a 2½-ft^3 bucket-line flume dredge that operated briefly in the fall on American Creek, about 35 mi north of Nome, and will be in full production during the 1988 season. Several large-scale opencut placer mines also operated in the western region. BERG WETLESEN PARTNERSHIP operated on Candle and Mud Creeks on northeastern Seward Peninsula, and in the Ruby-Poorman district FLAT CREEK MINING (James Haggland) mined on Flat Creek, SHORTY CREEK MINING (Keith Tryck) mined on Shorty Creek, CONRAD HOUSE mined on Swift Creek near Kaiyuh Hills, and GREEN MINING AND EXPLORATION mined on Long Creek. On Boob Creek, tributary to Mastadon Creek, TOLSTOI MINING and nearby SCHWAYER MINING CO. each operated small drift mines equipped with steam and hydraulic hoists to test and mine pay gravels for platinum as well as gold.

Figure 30. Crew of Lost River Mining Company tin mine at Cape Creek, Seward Peninsula, western Alaska. Photograph by Lost River Mining Company, 1987.

Figure 31. Washing plant at Lost River Mining Company tin mine, Seward Peninsula, western Alaska. Photograph by Len Grothe, 1987.

LOST RIVER MINING (LOST RIVER; Len Grothe) mined on Cape Creek, at the western tip of Seward Peninsula, and produced nearly 200 short tons of cassiterite concentrate, which yielded approximately 288,000 lb of equivalent refined tin (figs. 30 and 31). In past years, LOST RIVER shipped concentrates to the Textin smelter in Texas City, Texas, for refining, but also ships concentrates to Singapore, Malaysia, and Korea, where a marketable product — tin shakes — is produced and shipped to the United States for sale on a consignment basis. LOST RIVER'S mine plant includes a 5/8-in. coarse classifier, which feeds Hartz jigs, and a Denver mineral separator. The concentrates produced average 74 to 79 percent cassiterite.

Eastern Interior Region

Estimates in 1987 show 79 placer and two lode operators produced 50,696 oz of refined gold, similar to 1986 estimates of 83 mine operations and 45,350 oz of gold. The gold-mining industry in the eastern interior region has apparently stabilized from the 49-percent plunge in production and employment encountered from 1985 to 1986.

Activities in the Circle mining district, which includes the upper Chatanika and Birch Creek drainages, were at about the same level as in 1986. Twenty mine operations processed pay in 1987 compared to 21 in 1986. As in previous years, GHD RESOURCES (GHD) on Eagle Creek and V.F. HALVERSON in the Mammoth Creek drainage were the largest operations in the district. The operations collectively processed 292,000 yd^3 of gravel and employed 19 people during the 120-day working season. Because of the impending court-ordered closure of placer mines on federal lands in the Birch Creek drainage (Sierra Club v. Penfold) and impending exhaustion of reserves, GHD, one of the largest placer mines in the eastern interior region, terminated its mining venture on Eagle Creek in late August of 1987 and transported the washing plant and rolling stock to its Kiwalik Flats property in the Candle district of northeastern Seward Peninsula. GHD expects to be in full operation at the Candle location during the 1988 season. Unpatented mining claims held on Eagle Creek by GHD will be mined under a 'notice provision' of the Federal 3809 regulations at a much smaller scale with an anticipated annual capacity of 15,000 yd^3, less than 10 percent of the former operation.

Other companies active in the Circle district are MAGIC CIRCLE, INC., and FLAT PICK MINING on Deadwood Creek; PAUL AND COMPANY on Crooked Creek; S AND H ENTERPRISES on Bottom Dollar Creek; JIM WILDE on Switch Creek; SINGIN' SAM'S RAINBOW MINE on Ketchum Creek; BOB CACY on Portage Creek; POLAR MINING, FRED WILKINSON, and ALEXANDER MINING in the Mammoth-Independence Creek drainage; DOUG MILLS on Bonanza Creek; UNDERWOOD MINING, HELEN WARNER, and KEN MANNING on Porcupine Creek; WAYNE PEPLER on Holden Creek; and MARK WAYSON and STEVE PORTEN at an unspecified location. The 20 mining firms and partnerships in the Circle district created 113 jobs and produced 14,100 oz of gold, an estimated contribution of $6.3 million to interior Alaska's economy.

Activity slowed in the Livengood-Tolovana district. ALASKA PLACER DEVELOPMENT, INC., mined the Livengood Bench and hydraulically stripped overburden with a 100-percent water-recycling system. MAMMOTH MINES sluiced 4,500 yd^3 of pay gravels from their underground mining operation at Wilbur Creek, and the DICK GERAGHTY family sluiced on Olive Creek. ED MONTGOMERY mined upper Lillian Creek.

Eight companies mined in the Fortymile district, compared to 12 the previous year. KAVIC MINING, who have operated on Jack Wade Creek for several years, stated that they did not obtain necessary permits to mine. KAVIC indicated they have taken an option to mine ground in Yukon Territory, Canada, due to permitting problems created by the BLM lawsuit issue. W.M. MASSENGALE modified his plant in 1987 so that he can satisfy federal water-quality requirements for the 1988 season. KACHEMAK MINING CORPORATION mined on Willow Creek near Chicken, and HAM MINING COMPANY produced on the Mosquito Fork also near Chicken. Two small cuts were taken on 45 Pup Creek in the northern Fortymile district.

Activity in the Eureka-Tofty and Rampart districts was unchanged from previous years. YUKON MINING COMPANY (Joel Ramstad) mined Golden Creek in the Tozi-Moran area — also known for placer concentrations of tin. DON LUCAS, under lease from HOOSIER CREEK MINING COMPANY, took out several cuts on Hoosier Creek, and JOHN SHILLING mined on Slate Creek — both in the Rampart district. KELLY MINING operated a small placer mine on North Fork Creek in the Manley-Eureka area. Longtime miner BILL CARLO was again active on Hunter Creek in the Rampart mining district.

Activity in the Fairbanks mining district, which includes the upper Chatanika drainage, increased significantly and exceeded the Circle mining district in number of mines, persons employed, and bullion produced. Among 19 placer operators and two lode mines, 21,119 oz of gold worth $9.5 million were produced and 158 jobs were created (105 at placer mines and 53 at lode mines). Of these, 96 were jobs of 8 mo or more and 62 were less than 8 mo. SPHINX MINING at the junction of lower Fish and Fairbanks Creeks, and POLAR MINING on Sheep Creek collectively processed 730,000 yd^3 and were the largest placer operators in the district. Both operations initiated winter stripping efforts which used drilling and blasting to loosen frozen ground for excavation. POLAR MINING actually operated on three Fairbanks-area streams — Dome, Wolf, and Sheep Creeks. Other mine operators include CACY PATTON on Gilmore Creek; SMITH BROTHERS MINING on Smallwood Creek; DON STEIN on Twin Creek; EARTH MOVERS on Fish Creek; MISCOVICH MINING on Steamboat Creek; COOK MINING on Too Much Gold and Fairbanks Creeks; WALT ROMAN and RON ROMAN on upper Fish Creek (two separate mines); AL HOPEN on Upper Dome Creek; OSCAR TWEITEN on Chatham Creek; EVECO on Goldstream Creek; and TILLICUM MINING on Fox Creek. Two operators mined pay in the head of the Chatanika River — NELSON MINING on Hope Creek and MACINTOSH MINING on Faith Creek.

CITIGOLD ALASKA, INC., leached 6,100 oz of gold-silver bullion from the Ryan Lode on Ester Dome (described in detail in the Development section). Gold recovery from the ores was estimated by company officials to be 38 to 40 percent; leaching will continue from the two pads during the 1988 season.

After development and exploration of mineral reserves, TRICON MINING, INC., put the Grant mine and mill

facility (also on Ester Dome) back into production (figs. 32 and 33). The production decision was based largely on the discovery of a surface-mineable ore body — the Ethel shear zone — and its lateral equivalent, the Elmes vein, both about 2,500 ft northwest of the mill facility. One rotary drill hole intersected a 100-ft zone of 0.12 oz/ton gold while another cut across a 35-ft section that averaged 0.18 oz/ton gold. Results of 10 rotary drill holes on the Ethel deposit reveal a strike length of 250 ft, an average width of 30 ft, and an average grade of 0.16 oz/ton gold. The Ethel deposit is a plume-shaped zone of bleached, gray schist charged with disseminated sulfides, including lead-antimony sulfosalts and free gold. Nearly vertical crosscutting relationships with enclosing barren schists suggest the ore body is a structurally controlled alteration pipe of unknown vertical extent, unlike other quartz-sulfide-gold-vein fault deposits that typify vein-type ore bodies on Ester Dome.

At a projected production rate of 250 ton/day for the first 6 mo, TRICON expects to mill 45,000 tons of ore at 0.13 oz/ton gold. At 90 percent recovery, total production could be 850 to 900 oz/mo. In the first month of operation (December), 907 oz of refined gold were produced from 6,555 tons of ore at a profit of $118,000. The operation employed 38 people, including contractor personnel.

Mine activities picked up again in the Tenderfoot district between Fairbanks and Delta Junction. JOE WHITTLE mined a bench near Buckeye Creek leased from GILBERT MONROE. JOHN DAVIS continued a limited drift mining operation on upper Tenderfoot Creek, and CHRIS GROPPEL, leasing from WAYNE ANDERSON, drift-mined and stockpiled 250 yd^3 from a 45-ft-deep bench on Tenderfoot Creek, using traditional steam points, hoists, and gin-poles used in early 20th century drift mines. BOB LOVELESS and JOHN RUBEL continued to mine shallow placer deposits on Democrat Creek.

Activity levels increased in the Bonnifield district, and renewed activity occurred on streams with historical production in the central Alaska Range. ALASKA UNLIMITED COMPANY operated the largest placer mine in the eastern Interior south of the Tanana River; a crew of 10 processed 250,000 yd^3 of pay on Bonnifield Creek. JACK LACROSS continued his placer mining activities on California Creek. D'LOG MINING recovered gold in the Tatlanika Creek drainage. GREEN MINING produced gold on Morningstar and McCumber Creeks near Fort Greely — the first operations in this area in many years. MARCHUK AND ASSOCIATES

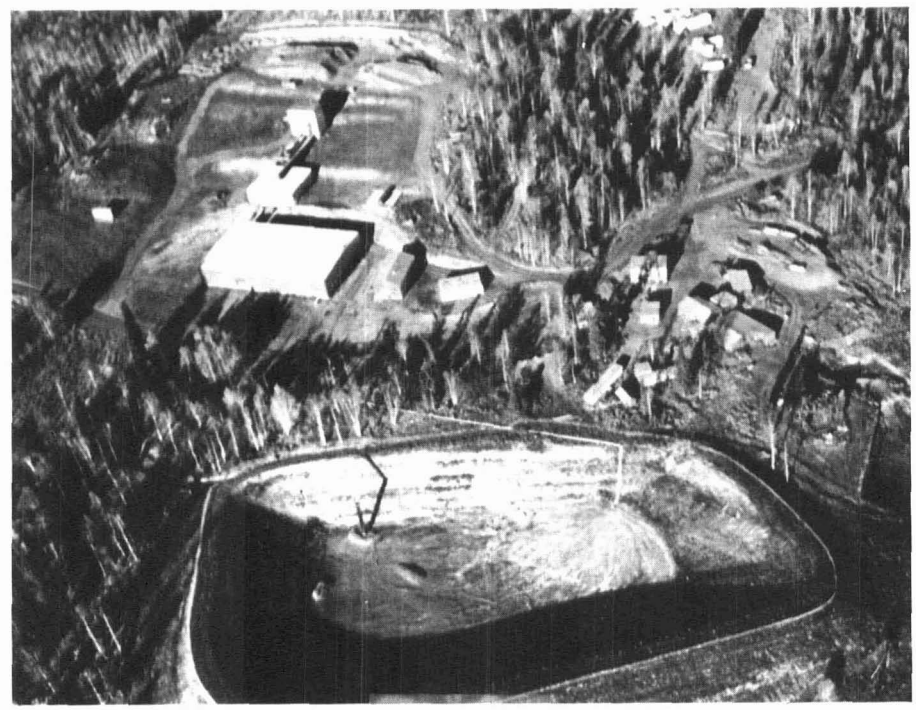


Figure 32. Aerial view of Grant mine, Fairbanks, eastern interior Alaska, prior to its reopening in December 1987. Photograph courtesy of Tricon Mining Company, 1987.

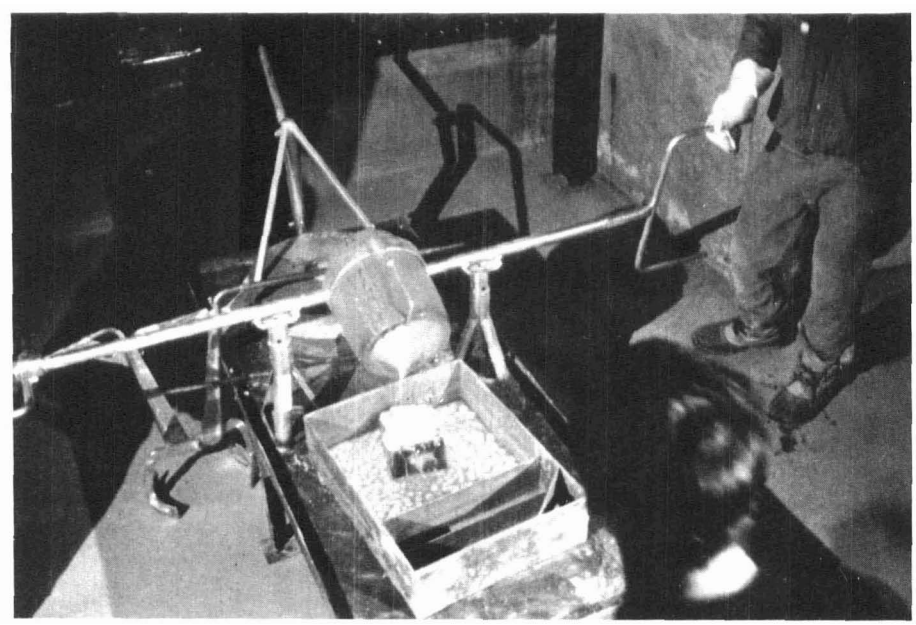


Figure 33. Dore' bar being poured at Grant mine, Fairbanks, eastern interior Alaska. Photograph courtesy of Tricon Mining Company, 1987.

Figure 34. Mine excavation at Golden Horn property, Flat, southwestern Alaska. Photograph by John Miscovich, 1987.

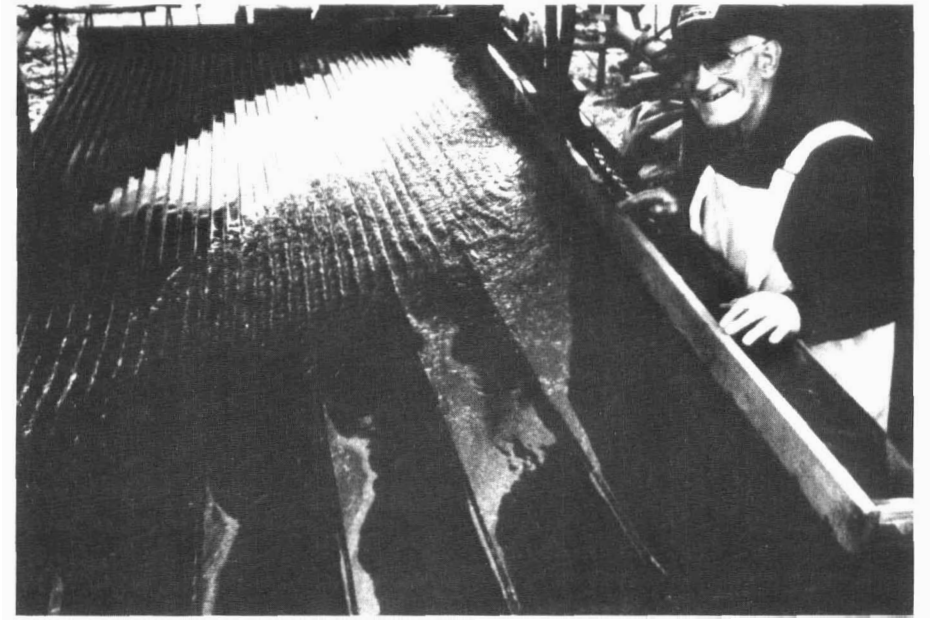


Figure 35. Processing scheelite-gold concentrates on Deister table at Golden Horn project, Flat, southwestern Alaska. Photograph by Mary Miscovich, 1987.

mined cuts in the Rainy Creek drainage west of Paxson, which is also a reactivated area.

Formerly producing mines in the Kantishna (Denali National Park and Preserve) and Coal Creek (Yukon-Charley Rivers National Preserve) areas, both included in the National Park and Preserve System by the ANILCA Act of 1980, remained shut down during 1987. A court order in the 1985 Sierra Club v. National Park Service (NPS) lawsuit enjoined NPS from issuing plans of operation to active mines until individual and cumulative environmental impacts were assessed. Of 30 mine operations affected, 17 were in the Kantishna area and three in the Woodchopper-Coal Creek district. During 1987, NPS continued biological, archeological, and water-quality studies and conducted numerous claim validity examinations.

NPS has presented for public comment proposed alternative actions including: (1) maintenance of status quo; (2) implementation of existing regulations with cumulative impact determinations for each mine site; (3) acquisition by condemnation or purchase of all mining claims; or (4) issuance of mineral patents on valid claims with surface restrictions. A draft EIS identifying the preferred alternative is expected to be issued in fall of 1988.

Southwestern Region

Thirty-six mine operations in southwestern Alaska recovered 20,650 oz of gold in 1987, an increase of 15 percent in production from 1986. Production in the Innoko and Iditarod mining districts continued at about the same level, but increased in the Marshall and Aniak mining districts, where new mines were reactivated in long-dormant mining camps. In the central Kuskokwim River basin, 129 persons employed by placer mines represent a significant part of private sector employment. Miners active in the Innoko mining district included WARREN MAGNUSON (Ganes Creek), JOHN O'CARROLL (Spruce Creek), PAUL SAYER (Ester and Little Creeks), JIM NORCROSS (Anvil Creek), and EEP ANDERSON (Yankee Creek). Some operators were disappointed in poor production results caused by water shortages and poor pay.

In the Iditarod district, ANN WILLIAMS took out a small cut on Granite Creek but ceased operations early because of water shortage. DON HARRIS continued limited production activities at Moore Creek and selectively reprocessed tailings mined in earlier years. The FULLERTON BROTHERS mined on Flat Creek and ALVIN AGHOFF mined on Prince Creek. The JULIAN CREEK MINING COMPANY recovered gold at Julian Creek from bulk samples taken at the upper unmined end of the drainage. GOLDEN HORN MINING COMPANY mined the Golden Horn gold-silver-tungsten polymetallic deposits (figs. 34 and 35) and continued to

process gold-tungsten-rich concentrates from residual placer mineral concentrations directly downslope. The Golden Horn deposits were stripped and yielded about 2,800 lb of scheelite-rich concentrates, which were processed through a rod mill and sent to facilities outside of Alaska for cyanide leaching and carbon-pulp extraction testing. The 1987 development work revealed new density and style of quartz-sulfide-gold veinlets and shears that comprise this quartz alkalic, monzonite-hosted gold-polymetallic system (Bull and Bundtzen, 1987).

Several operators worked placers in the Aniak district. TULUKSAK DREDGING COMPANY (Charles Awe) operated Nyac No. 4, their 5-½ft³ bucket-line stacker dredge on Bear Creek in the historic Nyac mining district. Built by the Washington Iron Works, Nyac No. 4 is the newest of a fleet of four 'gold boats' that began operation in the area after World War I. The dredge, which has a washing capacity of 5,000 yd³/day, began work in early June and shut down in the last week of October for a season total of about 140 days. Power for the Nyac No. 4 dredge, for the NORTHLAND DREDGING COMPANY'S Nyac No. 3 dredge (which did not operate in 1987), and for the mining camps of Tuluksak and Lower Bear Creek, is supplied by a small flume-style, hydroelectric power plant with a rated capacity of 450 kW (fig. 36). The original Pelton-wheel-driven electric power plant was rebuilt in 1960, and, during the winter of 1987-88, additional modifications will bring rated capacity up to 650 kW. TULUKSAK DREDGING COMPANY (TULUKSAK) also operated an opencut operation at the head of California Creek on their own mining claims and on land leased from CALISTA NATIVE CORPORATION (fig. 37). TULUKSAK employed at least 27 people — many from the local area — throughout the mining season, for dredging, opencut, and exploration activities. ADF&G and TULUKSAK are jointly researching the possibility of using abandoned dredge tailings ponds in the Bear Creek drainage for salmon-rearing habitat sites.

Figure 36. Hydroelectric power plant (left) and old Pelton-wheel plant (right) at Nyac camp, Aniak mining district, southwestern Alaska. Photograph by T.K. Bundtzen, 1987.

Figure 37. Tractor being repaired at Tuluksak Dredging Company on California Creek, Aniak mining district, southwestern Alaska. Photograph by T.K. Bundtzen, 1987.

LYMAN RESOURCES OF ALASKA (LYMAN), under lease agreement with CALISTA NATIVE CORPORATION, continued to mine a paystreak in Quartz Gulch of the Donlin-Crooked Creek mining district north of the Kuskokwim River. LYMAN conducted a drilling program to prove up additional placer reserves for their mine operation. STUYAHOK MINING COMPANY (Leonard Chase) reactivated the long-dormant Stuyahok camp on the lower Yukon River, part of the Marshall mining district of southwestern Alaska. Efforts in 1987 consisted primarily of mining tailings and testing previously unexplored portions of the stream drainage.

The DAVE PENZ family again operated the BUSTER CREEK mine, tributary of Kako Creek, about 15 mi from the Yukon River village of Russian Mission. The operation uses a self-designed trommel washing plant and recycles 100 percent of its process water.

JAMES WYLIE operated the Mountain Top mercury mine, 35 mi southwest of Sleetmute; details of Alaska's only active mercury mine were not reported.

Southcentral Region

Twenty-nine mining operations produced 46,460 oz. of gold in the southcentral region, an increase of 19 percent from 1986. This increase comes from expanded operations of the VALDEZ CREEK MINING COMPANY (VCMC), which produced 72 percent of the total regional output. Several mines remained closed by court order in the Nizina and Chisana mining districts of Wrangell-St. Elias National Park and Preserve, pending resolution of the 1985 'NPS' lawsuit. In 1987, VCMC overcame the problems encountered in 1986, when lower than expected grade coupled with pit-wall failures from groundwater seepage had caused revenues to fall short of those projected. Improvements in recovery and reserve delineation, and stabilization of pit walls, increased production from a revised company estimate of 16,800 oz worth $6.7 million in 1986 to 33,277 oz of gold worth $14.7 million in 1987. VCMC operates year-round with a winterized washing plant, water recycling, and haulage systems that can perform in temperatures of about -35°F before maintenance costs force closure of the mine. The company employs 136 people year-round and an additional 10 to 15 during summer exploration programs. Nearly 90 percent of mine employees are Alaska residents. VCMC reported a loss of $6.7 million for the year ending December 31, 1986, and losses of $2 million for the year ending December 31, 1987, despite fourth quarter (1987) earnings of of $658,000. The company forecasts a 1988 production of 56,000 oz of gold.

GOLD DUST MINES, INC., formerly active in the Circle mining district of the eastern interior region, mined the Chisana Discovery claim in the Chistochina River drainage and successfully used a magnetic separator to remove excess magnetic concentrates. GOLD DUST announced that 1.9 million yd of auriferous pay exists on the property. Also in the Chistochina mining district, HARRY AND JEAN SPEERSTRA used small-scale mining methods to work a placer cut in the Chisana River drainage, and RUSSELL HOFFMAN, who had obtained a plan of operation to mine in the Wrangell-St. Elias National Park and Preserve, moved his operation to Limestone Creek. TALMO MINING, who formerly operated on Dan Creek, ceased mining in the Wrangell-St. Elias National Park, but is attempting to start a recreational mining venture on the same claims. ARNOLD AND SALLY ECHOLA mined Gold and Wickersham Creeks south of Denali Highway with a small suction dredge.

Sixteen operators submitted Alaska placer-mining applications (APMAs) for the Cache Creek and Kahiltna mining districts west of Talkeetna, but few actually operated. Close monitoring of anadromous salmon streams and conflicts with recreationalists were cited in questionnaire returns as reasons for mine inactivity. D&O VENTURES worked Gold and Eldorado Creeks near Talkeetna.

MRAK PLACER MINE mined gold on the Eleanor claims in the Hatcher Pass area north of Palmer and spent the majority of the mining season reclaiming mined ground. MRAK used a D-8 Caterpillar tractor, a Terex 4-yd loader, and a 505 Korrin backhoe to complete reclamation.

Two small placer operators were active in the Kenai Peninsula area. ED MARTIN washed gravel on the Harwood Bench near Sunrise and JOHN TRACTOR mined on nearby Canyon Creek; both operations employed suction dredges as their principal mining method.

GIRDWOOD MINING mined on Crow Creek and recovered placer gold and sand and gravel for sale.

FINNBEAR MINING AND EXPLORATION continued small-scale development and mining of placer gold on Owl Creek in the Kahiltna-Collinsville mining area. Metallurgical testing of platinum-bearing material is currently underway.

Several lode-mining ventures worked gold-silver deposits during 1987. ALASKA HARD ROCK MINING COMPANY had placed into operation a 20 ton/day gravity mill circuit at the Willow Creek decline in the Hatcher Pass area in October 1986. The Willow Creek decline of the Independence Mine is 3 mi upvalley from the mill built by ENSERCH for processing ore from the Independence Mine, which operated briefly in 1982. By October 1987, ALASKA HARD ROCK MINING had milled 1,050 tons of high-grade ore mined from underground workings in the old Independence Mine. A newly formed company, ALASKA GOLD, INC., may reopen the 200 ton/day ENSERCH mill and develop the nearby Lucky Shot and Coleman veins for mill feed. ALASKA HARD ROCK MINING may also contribute mill feed to the former ENSERCH mill.

BLUEBELL MINING COMPANY mined underground at the Primrose hard rock claims near Sunrise on the Kenai Peninsula. BLUEBELL recovered both high-grade gold ore for mill feed and quartz crystals for sale as mineral specimens. Assay production amounted to 30 tons of high-grade ores; 10 tons of quartz crystals were also recovered and sold.

ALASKA STANDARD MINING designed and planned two separate mill facilities on the Kenai Peninsula. Plans are to construct one facility to process magnetite and non-sulfide ores in crushing, grinding, and flotation circuits. The second facility would utilize pyrometallurgical techniques to process 'penalty' ores rich in arsenic and other toxic substances. Both sites would be located near Homer, Alaska.

Southeastern Region

Five mining operations in southeastern Alaska recovered 3,400 oz of gold in 1987. While small compared to other regions, this was a significant increase from the 1986 production of 150 oz.

Metals mining in the southeastern region was again confined to the Porcupine mining district near Haines and the Yakataga area around the Gulf of Alaska. CUSAC INDUSTRIES ran a 500-yd/day operation most of the season near Yakataga and mined large volumes of heavy minerals from strandline deposits. Twin Richert

spirals were the principal gold recovery units. Fine gold was recovered from titanium-rich (ilmenite) sands. Gold grades were not as high as expected, but industrial-grade garnets could be a promising byproduct. Bulk samples of the garnet concentrates yielded good test results for abrasive applications.

Several mining companies operated in the Porcupine district near Haines. HEINZ COMPANY ran a large-scale operation on Porcupine Creek. JOHN SCHNAEBEL reactivated his opencut mine near the mouth of Porcupine Creek, and JO JURGELEIT operated a suction dredge nearby.

INDUSTRIAL MINERALS

The value of industrial-mineral production during 1987 was $54.4 million, a 43-percent decrease from the 1986 value of $96.1 million. The volume of sand and gravel produced decreased 20 percent, and the volume of quarry stone produced decreased by 57 percent. The near total cessation of infrastructure development on Alaska's North Slope and the weak economy statewide contributed to the declines. Some of the only bright spots in the sand and gravel industry were those projects connected with mineral development — the Red Dog and Greens Creek road construction jobs. About 6.5 million tons, 40 percent of the total 16.7 million tons of sand and gravel produced statewide, were used for DOTPF federally-funded road projects. The remainder went to North Slope, Red Dog, Greens Creek, and coastal marine facilities. Unit value also fell from previous years. Stiff competition for the few available construction contracts in the state brought the average value of sand and gravel from $3.75/ton in 1986 to $2.56/ton in 1987 (table 11). The value of building stone, however, increased from $4.80/ton in 1986 to $6.45/ton in 1987 as a result of several remote-area construction contracts. Sand-and-gravel companies employed 868 people during 1987, and rock quarries employed 185.

The industrial minerals industry may have hit the bottom of its cycle in 1987, and a modest recovery is probable. ARCO ALASKA and STANDARD ALASKA PRODUCTION COMPANY have announced plans to increase infrastructure development at Prudhoe Bay for the 1988 season, and federal funds for additional state road construction are anticipated by DOTPF.

Northern Region

Oil-field development projects on the North Slope of Alaska have been major consumers of sand and gravel since the early 1970s. More than 70 percent of total statewide aggregate usage during peak years has occurred on the Slope. However, statistics reported by ATLANTIC RICHFIELD COMPANY-ALASKA (ARCO) and STANDARD ALASKA PRODUCTION COMPANY in 1987 show the lowest level of consumption since oil was discovered at Prudhoe Bay in 1968. Most of the 560,000 tons of sand and gravel used by these two companies was for drill sites, road crossings, oil waste pit construction, airport and road gravel stockpiles, and general road maintenance. Only three new drill pads, which usually constitute a large percentage of gravel used, were built. AMERADA HESS, SHELL OIL COMPANY, EXXON, BP MINERALS AMERICA INC., and AMOCO, who have been active on the Slope in past years, did not report any gravel use in 1987.

ARCTIC SLOPE REGIONAL CORPORATION produced 100,000 yd³ of gravel worth $3.8 million from their Kaktovik gravel pit for oil-drilling activities in the Arctic National Wildlife Refuge. Eighteen people, 60 percent of whom are local Kaktovik residents, participated in the operation. Partners in the project were KAKTOVIK INUPIAT CORPORATION and SKW ESKIMO, INC., the contractor.

ENSERCH ALASKA SERVICES mined 2,832,501 tons of aggregate, borrow and shot rock, 110,000 tons of sand, and 2,400 tons of riprap to construct a 52-mi pioneer road linking the Red Dog mine with the Chukchi coast near Kivalina. The project was completed in December 1987, six weeks ahead of schedule. A second construction phase in 1988-89 will upgrade the road to state secondary road standards, to allow heavy-tonnage concentrate hauls and other transport use for mine development and production.

Gravel and sand production from the North Slope Borough's fleet of floating suction dredges was at a near standstill in 1987, from a reduction in Borough construction. Some of the dredges have been reported to be for sale.

Western Region

Production of industrial minerals in the western region was limited mainly to DOTPF road projects. The Nome Seawall Project was essentially completed in 1986. WINDFALL MINING COMPANY supplied 60,000 yd³ of gravel for the final phases of the project and barged an undisclosed amount of coarse (4½-in.) gravel ag-

Table 11. *Reported sand-and-gravel production and industry employment in Alaska by region, 1987.*

Region	Volume (short tons)	Number of respondents	Stated value ($)[a]	Number of employees
Northern	3,609,167	7	5.14/ton	362
Western	1,831,200	3	2.50/ton	40
Eastern interior	6,026,800	14	2.45/ton	220
Southcentral	4,288,107	14	2.42/ton	114
Southwestern	16,100	3	10.50/ton	28
Southeastern	862,000	—	3.00/ton	98
Alaska Peninsula	63,000	1	1.40/ton	6
TOTAL	16,696,374	42		868

[a] The stated value for each region is the weighted average of values taken from the DGGS questionnaires or from the telephone survey of private gravel operators, oil companies, and the Alaska Department of Transportation and Public Facilities (DOTPF). Northern-region production value only includes costs incurred by raw-extraction methods; lease and transportation expenses are not included.

gregate to be used for erosion control at a village on the lower Yukon River. DOTPF purchased 1.5 million tons of sand and gravel to maintain the Seward Peninsula road system.

Eastern Interior Region

Fourteen producers of sand and gravel reported 6.03 million short tons of production worth $15.4 million in the eastern interior, similar to the 7.1-million-ton level of 1986. Just under 1 million tons of riprap and quarry stone worth $3.4 million were produced from three sites in the region. The continuing high levels of sand-and-gravel and stone production in the eastern interior have been sustained by construction activities for the U.S. Army Light Infantry Division at Fort Wainwright (Fairbanks), the federally-funded DOTPF George Parks Highway project in south Fairbanks, erosion control projects in the Delta-Richardson Highway area, and pipeline maintenance by ALYESKA PIPELINE SERVICE CO. (ALYESKA) in the Richardson Highway area. DOTPF used 3.01 million tons of sand and gravel and 22,000 tons of shot rock for the Parks Highway project and extensive repair work along the Alaska Highway. Nearly 80 percent of the material used in the Fairbanks area was taken from Tanana River flood-plain deposits at sites ranging from North Pole to the Fairbanks International Airport area.

ROGERS AND BABLER INC., a construction company active in both the Anchorage and Fairbanks areas, mined from the Bradley and Wise pits near North Pole and Fairbanks using standard dragline and open pit methods. EARTHMOVERS INC. mined about 250,000 tons of sand and gravel from various pits throughout the Fairbanks area and reported their contracts were down 25 percent from the 1986 season. EVECO, H&H CONTRACTORS, and FAIRBANKS SAND AND GRAVEL reported similar declines in construction-related sand and gravel use.

The National Park Service contracted work to rebuild the Toklat River bridge and repair the road system in Denali National Park (fig. 38).

Small amounts of riprap and culvert armor were produced at Susie Q Creek near Black Rapids on the Richardson Highway, where DOTPF and ALYESKA both extracted stone for repair projects. Approximately 18,000 short tons were used for culvert armor projects on the Circle-Steese Highway.

YUTAN CONSTRUCTION COMPANY (YUTAN) extracted 435,000 short tons of basalt rock worth $1.71 million and minor gravel for various armor applications in the Fairbanks area. Twelve full-time and 10 part-time employees mine basalt at YUTAN'S Browns Hill Quarry on a year-round basis.

Figure 38. Sand-and-gravel operation mining aggregate for road and bridge repairs in Denali National Park, eastern interior Alaska. Photograph by T.K. Bundtzen, 1987.

Southwestern Region

The only reported sand and gravel use for this region was by DAVIS CONSTRUCTION INC. at Chuathbuluk on the Kuskokwim River, 20 mi upriver from Aniak. Residential construction for U.S. Housing and Urban Development (HUD) required 16,100 short tons of aggregate — all derived from the Mission Creek alluvial fan, a high quality aggregate source in this area.

Southcentral Region

Approximately 4.29 million tons of sand and gravel were mined in the southcentral region in 1987, compared to 5.4 million tons in 1986 — a decline of 21 percent. Activities decreased nearly 50 percent in the Anchorage area but increased substantially in the Valdez-Glennallen region, where 2.54 million tons (58 percent of the regional total) were used by DOTPF for road aggregate and fill material. The major work in the Anchorage area was done by EASTLAND, INC., rerouting portions of the Glenn Highway from Eagle River to Anchorage. Nearly 1.8 million tons (42 percent) of the regional total was hauled by the Alaska Railroad from pits in the Palmer-Wasilla area to the Anchorage metropolitan area (table 11). ANCHORAGE SAND AND GRAVEL, INC. furnished about half of this tonnage from their Palmer pit. Minor amounts of riprap were used for bridge reinforcement in the Valdez and Anchorage areas.

Alaska Peninsula Region

BRISTOL BAY NATIVE CORPORATION reported that 63,000 short tons were produced and sold for small construction projects throughout the Bristol Bay region.

Southeastern Region

Production of aggregate and stone rose 65 percent from 1986, as a result of 7 mi of initial road work at the Greens Creek Mine on Admiralty Island and increased use of borrow in the Sitka, Ketchikan, Haines, and Wrangell areas. Sand-and-gravel production around Juneau dropped nearly 50 percent, blunting the overall regional increase. HILDRE SAND AND GRAVEL (HILDRE) mined 60,000 tons of aggregate from their Acme pit north of Juneau, a 60-percent drop from levels of previous years. The City and Borough of Juneau mined and sold aggregate and competed with HILDRE and other private companies. DOTPF reported 280,000 tons of borrow, 140,000 tons of aggregate and 14,000 tons of riprap used throughout the Panhandle, mainly for road maintenance. Nearly 360,000 tons of mixed aggregate and fill were used to construct facilities for the Greens Creek project on Admiralty Island.

COAL AND PEAT

Alaska coal production in 1987 was 1.51 million short tons, almost all of which came from the USIBELLI COAL MINE; 707,200 short tons were burned in interior Alaska power plants for electrical generation and steam heat; 644,708 short tons were shipped to the KOREA ELECTRIC POWER COMPANY (KEPCO) for power generation in their Honam Plant; and 133,069 tons were shipped to the TAIWAN POWER COMPANY (TAIPOWER) to be tested as a blending coal (fig. 39). In mid-December, USIBELLI shipped 23,950 tons of steam coal to ELECTRIC POWER DEVELOPMENT CORPORATION (EPDC) in Japan for a fluidized-bed system test (table 12).

Subbituminous USIBELLI coal is low in Btus and high in moisture; however, it is very low in sulphur — a factor which may become increasingly important to Pacific Rim customers. Results from TAIPOWER'S blending tests in Taiwan have been favorable so far, and a modest export contract is anticipated in the future. The success of the TAIPOWER tests may stimulate other potential Pacific Rim buyers, including Japan, to consider using low-sulphur Alaskan coal to meet new environmental standards in these countries. Taiwan created their own environmental protection agency in September 1987, and declared the use of low-sulfur coal in power plants a national priority. USIBELLI has also been investigating means of upgrading their coal quality. In conjunction with the BROWN AND ROOT COMPANY, USIBELLI is considering the design of a new 150-megawatt mine-mouth power plant and co-generation facility that will utilize waste heat to dry a portion of the mine's coal production. If the moisture content can be lowered from 27 percent to about 1 percent, the product will become a low-sulphur, premium-grade bituminous coal.

Figure 39. Coal being loaded at Seward, southcentral Alaska, into 'Panamex' freighter for shipment to Taiwan Power Company, Taiwan. Photograph courtesy of Usibelli Coal Mine, Inc., 1987.

Table 12. *Market breakdown for 1987, Usibelli Coal Mine, Healy, Alaska.* [a]

Buyer	Coal (short tons)
Domestic	
Clear Air Force Base	81,368
Fort Wainwright (U.S. Army)	150,156
Eielson Air Force Base	151,612
Golden Valley Electric Association	141,358
Fairbanks Municipal Utilities System	121,754
University of Alaska-Fairbanks	53,128
Reliable Coal	7,824
Subtotal	707,200
Export	
Electric Power Development Corporation (EPDC), Japan	23,950
Korean Electric Power Company (KEPCO), Honam, Korea	644,708
Taipower, Taiwan	133,069
Subtotal	801,727
TOTAL	1,508,927

[a] Information provided by John F.M. Sims and Charles Body, Usibelli Coal Mine, Inc.

Current production from USIBELLI plays a vital role in supporting operation of the Alaska Railroad, which hauls the coal to interior Alaska power plants and to the Port of Seward for export. The state purchased the railroad in 1985 from the federal government, and declining North Slope and Anchorage area construction has made the railroad increasingly dependent upon coal and petroleum haulage from interior Alaska (table 13).

ARCTIC SLOPE CONSULTING ENGINEERS and consulting mining engineer STEVE DENTON, under a $210,000 grant from the North Slope Borough, studied the feasibility of mining coal at the remote village of Atqasuk, about 60 mi south of Barrow (fig. 40). The project tested coal for home heating to determine if it would be accepted as an alternative fuel by the villagers. Shallow past-producing beds 2 mi from Atqasuk were mined and approximately 135 short tons of bituminous coals were tested in 13 households. Preliminary results indicate that the locally-derived coal can compete economically with natural gas and fuel oil from the Barrow and Prudhoe petroleum fields.

Horticultural peat production continued its steep decline from peak 1985 levels. Production in 1987 is estimated at 46,000 yd^3, down from 50,000 yd^3 in 1986. In contrast to previous years, about 60 percent of the total was produced in Fairbanks, mainly by GREAT NORTHWEST LANDSCAPING. Much of Fairbanks area peat comes from ground leased from the University of Alaska. Demand for peat in the Anchorage market was weak and several firms ceased production while awaiting a rebound in the construction industry.

Figure 40. Atqasuk coal mining project, 60 mi south of Barrow, northern Alaska. Photograph courtesy of Arctic Slope Consulting Engineers, 1987.

Table 13. *Major commodity tonnages hauled by the Alaska Railroad 1975-87 (thousands of short tons).* [a]

Calendar year	Sand and gravel	Bulk petroleum	Coal	Other [c]	Total
1975	1	557	584	720	1,862
1976	104	624	607	853	2,188
1977	700	532	550	523	2,305
1978	727	374	593	484	2,178
1979	637	220	524	427	1,808
1980	396	252	590	503	1,741
1981	1,797	379	653	533	3,362
1982	2,754	439	654	656	4,503
1983	4,398	462	626	522	6,008
1984	6,537	498	642	595	8,272
1985	3,937	553	1,205	694	6,389
1986	2,200	750	1,343 [b]	712 [b]	5,005
1987	1,800	1,003	1,368	485	4,656

[a] Figures for 1975-83 modified from Secretary of Transportation (1984); figures for 1984-85 by W.F. Coghill, Alaska Railroad; figures for 1986-87 by Bruce Carr, Alaska Railroad, and Charles Body, Usibelli Coal Mines Inc.
[b] 1986 coal figures revised.
[c] Includes piggyback, general manufactured goods, forest, and agricultural products.

MINERAL PRODUCTION IN YUKON TERRITORY, CANADA

Mineral production in the Yukon Territory doubled in 1987. The total value of placer- and hard-rock mining production totaled $400 million (Can$). The Yukon Chamber of Mines predicts 1988 production could increase to $440 million (Can$) if stable metal prices prevail, existing mines maintain current production levels, and some new mines begin production.

Placer Mining

In 1987, placer mines in the Yukon Territory produced 132,792 oz of gold from 202 operations for an average of 660 oz each (Johnson, 1988). Production in 1987 was its highest since 1917, when about 200,000 oz were produced — mainly in the Klondike area. The Yukon placer industry employed 774 and represents a significant job source for the sparsely populated territory (28,000 according to the 1987 census). As in Alaska, most placer mining in the Yukon takes place in areas that have been mined since the turn of the century. In 1987, production centered in the Klondike and Sixty-

mile areas near Dawson, where 54 percent of total placer production took place. Dawson is also a popular tourist attraction for Alaskans and international visitors who travel there via the Taylor Highway. Other areas mined were Clear Creek-Barlow, Mayo-McQueston, Stewart River, Carmacks-Nansen, and Burwash-Haines Junction. Of 91 stream drainages mined, 21 produced 90 percent of the gold. Most placer operations are opencut mines equipped with rubber-tired loaders, D9L and D10L tractors, and scrapers to strip overburden and feed sluicers. A single 2½-ft³ floating bucket-line stacker dredge was operated by QUEENSTAKE RESOURCES on Clear Creek 70 mi east-southeast of Dawson. The QUEENSTAKE dredge was also Yukon's largest placer mine; 1.8 million yd³ were stripped and washed during the 1987 season. However, the 8-yr dredge program ended when reserves were exhausted, and demobilization began in September.

Lode Mining

The Faro mine, which reopened in June 1986, shipped 584,000 tons of lead-zinc concentrates through the Port of Skagway in 1987. CURRAGH RESOURCES (CURRAGH) bought the mine from DOME PETROLEUM, INC. (DOME) in 1985, three years after the mine had been closed in 1982 because of low zinc prices and DOME'S debt problems. In the face of much skepticism, CURRAGH restructured the mine's debts, and negotiated a $15 million (Can$) loan from the Canadian government (that CURRAGH has since paid back from cash flow); operating costs were reduced by half, the work force cut from 720 (in 1982) to 430, and the mine's production increased by 50 percent. Concentrates are trucked 680 mi from Faro, in the Pelly River area north of Whitehorse, to Skagway. Alaska maintains the state's segment of the road under a 1986 reciprocal agreement which guarantees a certain number of jobs for Alaskan port site workers in Skagway. Faro concentrates are shipped from Skagway to Japanese, Korean, and European smelters.

Lode gold-silver and silver-lead-zinc production continued at Mount Skukum and United Keno Hill operations in southern and central Yukon, respectively. Higher silver, zinc, and lead prices during the year allowed United Keno Hill Mines near Elsa to record an operating profit for the first time in several years.

Drilling activity in 1987

INTRODUCTION

Contract and in-house drilling of placer, coal, and hard-rock deposits totaled 315,250 ft in 1987, a 7-percent decrease from an adjusted figure of 338,400 ft drilled in 1986 (table 14). The decrease in footage is primarily the result of a decrease in thaw-field drilling for placer-dredging operations of ALASKA GOLD COMPANY in Nome. When thaw-field development drilling is excluded from 1986 and 1987 statistics, exploration drilling increases 66 percent in 1987 (from 111,400 ft in 1986 to 185,250 ft in 1987). The number of companies who conducted major drilling programs of all types also increased, from 13 in 1986 to 20 in 1987.

PLACER DRILLING

Contract and in—house placer drilling represented 57 percent of all drill footage in Alaska and totaled 180,250 ft in 1987. Excluding thaw-field drilling, reported placer exploration drilling increased 55 percent, from 32,400 ft in 1986 to 50,250 ft in 1987. Over 23,000 ft of exploration drilling was reported from the Seward Peninsula; 20,000 ft were drilled at the Valdez Creek Mine in southcentral Alaska.

The remaining 130,000 ft of placer drilling was done to install cold-water injection pipes for thawing frozen gravel ahead of the dredges operated by ALASKA GOLD COMPANY in Nome. The thaw-field footage was down significantly from 1986 levels when the company carried out an extraordinary program to prepare reserves for the startup of its second dredge. However, the 1987 footage exceeds thaw-field footages for all other years from 1981 and represents a major investment in the development of mining reserves for ALASKA GOLD'S two dredges in the 1988 season and beyond.

COAL DRILLING

Contract and in-house coal exploration drilling decreased 31 percent from adjusted 1986 totals. In 1986, USIBELLI COAL MINE performed 10,000 ft of exploration drilling that was not included in the reported total, resulting in an adjusted 1986 total for

Table 14. *Mineral-drilling footage in Alaska, 1982-87.*

	1982	1983	1984	1985	1986	1987
Placer	124,000	53,000	129,000	80,000	259,400	180,250
Coal	80,000	12,000	25,700	8,700	28,800 [a]	19,900
Hard rock	200,000	180,500	176,000	131,700	50,200	115,100
TOTAL	404,000	245,500	330,700	220,400	338,400 [a]	315,250

[a] 1986 coal footage and total footage revised upward.

Table 15. *Companies that conducted major drilling programs in Alaska, 1987.*

Alaska Apollo Gold Mines Ltd.
Alaska Gold Company
Ashton Mining
Berg-Wetlesen
Curator American, Inc.
Cominco Alaska, Inc.
Echo Bay Mines
GCO Minerals Co.
Golden Zone Development, Ltd.
Greens Creek Mining Co.
Hunt, Ware & Proffett
Inspiration Gold, Inc.
Lac Minerals U.S.A., Inc.
Misco-Walsh Mining Co.
Nerco Minerals, Inc.
Placer Dome U.S., Inc.
Silverado Mines, Ltd.
Union Pacific Resources
Usibelli Coal Mine, Inc.
Valdez Creek Mining Company

coal drilling of 28,800 ft. Coal drilling programs in 1987 were conducted in the Beluga, Matanuska, and Nenana coalfields. PLACER DOME U.S., INC. drilled 4,100 ft on its coal leases in the Beluga coalfield on the west side of Cook Inlet near Anchorage. UNION PACIFIC RESOURCES, in partnership with IDEMITSU KOSAN of Japan, drilled 300 ft of core and used rotary drills to sample an additional 12,000 ft on its state leases in the Matanuska coalfield. In the Nenana field, USIBELLI used both rotary and core drilling to sample 3,500 ft in the Poker Flats and Two Bull Ridge areas.

HARD-ROCK DRILLING

In 1987, drilling on hard-rock deposits totaled 115,100 ft, more than double the 1986 total of 50,200 ft. The drilling programs were carried out predominantly by domestic and international companies reinvesting profits from producing precious-metal mines, or by companies who have successfully raised exploration risk capital for Alaska projects during a market period of strong precious-metal prices. Over 96 percent of the hard-rock footage in 1987 was drilled on precious-metal deposits. Only two companies reported drilling programs on base-metal deposits.

The number of mining companies with major drilling programs on hard-rock deposits increased in 1987 from 9 to 13. Nearly all regions of the state had mineral exploration drilling programs. The two most active regions were southeast Alaska (36,800 ft) and interior Alaska (29,000 ft).

No drilling was done on the Red Dog or Quartz Hill deposits because the exploration phases of these programs have been completed.

Alaska's metal recycling industry

Since World War II a growing number of small companies and businesses have selectively recycled scrap metals from military surplus, left-over material brought north during the Alyeska pipeline project, and junk left by a growing Alaskan population. Specific data for this industry is difficult to obtain, but results from a survey reveal that at least 40 small metal 'scrappers' collect, bale, and ship nonferrous scrap metal to out-of-state markets. Four larger recycling companies ship nonferrous scrap metal and also process garbage, paper, plastics, and ferrous metals for shipment to dealers such as Reynolds Aluminum in Seattle, and to Pacific Rim markets. The largest integrated operators are K&K Recycling (Fairbanks), and Anchorage Recycling Center, Alaska Metal Recycling and Standard Steel & Metals (all of Anchorage).

Incomplete records show that 1987 value of Alaskan scrap and recycled metals exceeded $8.41 million (table 16). Because many small companies did not disclose product value, and statewide survey efforts were incomplete, the total shown in table 16 is probably understated. Several companies also strip gold and silver from electronic equipment and platinum from catalytic convertors, and these export values are not itemized in table 16. Existing records show approximately 160 people were employed in the industry statewide.

One of the more ambitious efforts in the state is that of Bernie Karl and Barnie Kopf, co-owners of ENVIRONMENTAL RECYCLING INC., an Alaskan business which assumed operation of the Fairbanks North Star Borough landfill in October 1987. For many years, only a small percentage of the estimated tons of trash arriving at the landfill everyday was recycled.

Table 16. *Scrap metal exports from Alaska, 1987.* [a]

Commodity	Volume (lbs)	Value[b]
Copper products	1,789,680	$2,147,616
Aluminum	1,165,960	1,748,940
Stainless steel	45,000	292,500
Super alloys (nickel-chromium-cobalt)	25,000	200,000
Magnesium	680	1,000
Lead	474,800	189,920
Ferrous metals	90,000,000	3,825,000
TOTAL		$8,409,976

[a] Information provided by K & K Recycling and OBF's Alum Can Recycle Center (Fairbanks), Anchorage Metal Recycling Center, Alaska Metal Recycling, Standard Steel and Metals, and M&M Company (Anchorage).

[b] Value estimated using average 1987 metal commodity prices: copper ($1.20/lb); aluminum ($1.50/lb); high-grade stainless steel ($6.50/lb); composite super alloys ($8.00/lb, minimum estimate); lead ($0.40/lb); and magnesium ($1.47/lb). Value of ferrous metal export estimated to be $85/ton.

Bernie Karl, a former Circle mining district placer miner, reports that ENVIRONMENTAL RECYCLING plans to recycle 80 to 90 percent of the landfill trash and produce scrap metals, plastic pellets, paper fuel pellets, and organic compost. Using a $1 million loan from a local bank and a $2.5 million loan from the Farmers Home Loan Administration, ENVIRONMENTAL RECYCLING purchased a dual-circuit plant designed by Lundell Manufacturing of Cherokee, Iowa, with cyclones, gravity shredders, a mass shredder, and various compactors to make plastic and fuel pellet products. The system will process 55,000 tons of waste annually and save $980,000 in operating costs; in addition, many former employees of the Borough landfill were rehired by ENVIRONMENTAL RECYCLING after the transfer of operations. Total capitalization costs over a 4- to 5-yr period are estimated at $7 million.

ENVIRONMENTAL RECYCLING is investigating the manufacture of plastic railroad ties suitable for wet or humid construction applications.

K&K RECYCLING, owned by the same principals as ENVIRONMENTAL RECYCLING, exports metal scrap from their 51-acre yard near North Pole, Alaska. A crew of 16 sorts, compacts, and ships metal scrap in 40,000-lb-capacity vans to metal dealers in other states (fig. 41). K&K has recently negotiated agreements with ALYESKA PIPELINE, STANDARD ALASKA PRODUCTION COMPANY, EXXON, ALASKA RAILROAD, and several military installations to remove and export recycled scrap from remote sites in interior and northern Alaska; some of the metal 'garbage' was previously buried. Recycled jet turbine engine parts, and scrap containing high-technology alloy metals such as nickel and cobalt, are now in demand. Nickel prices have recently climbed to record highs and nickel-rich scrap currently commands premium prices. K&K's first large shipment of exclusively ferrous metal scrap was shipped from Fairbanks to the coast via the Alaska Railroad; 15,000 tons of unspecified scrap — mainly structural steel and compacted car bodies — made up the bulk of the shipment.

Figure 41. Bernie Karl (right) of K&K Recycling, North Pole, eastern interior Alaska. Baled aluminum and copper wire at rear center await shipment. Photograph by T.K. Bundtzen, 1987.

Anchorage-based recycling centers also ship aluminum, copper, superalloy metals, and ferrous and precious-metal scrap to markets outside Alaska. TOM TURNER of the ANCHORAGE RECYCLING CENTER produces baled or barreled copper, brass, and aluminum products, but does not deal in ferrous metals. ANCHORAGE RECYCLING primarily recycles paper, but will purchase scrap metal on a case-by-case basis. Since 1978, ANCHORAGE RECYCLING CENTER has paid premium prices for small lots of copper, brass, and aluminum provided by nonprofit organizations and individuals. As a result, over 800 groups provide the recycling center with scrap on an annual basis. ANCHORAGE RECYCLING operates a modern HRB high-density bailer which compacts 50 percent more than standard bailers.

ROD LEWIS of ALASKA METALS RECYCLING recently constructed a $2 million metal shredder at his south Anchorage recycling complex and expects to market the processed material to Pacific Rim nations in 1988. Ferrous scrap was previously shipped to destinations along the West Coast; in 1987, ALASKA METALS RECYCLING shipped an estimated 30,000 tons of ferrous scrap at a gross value of $85/ton to Seattle. The company also purchased selected lots of copper, brass, stainless steel, and aluminum from Alaskan junk yards and shipped baled products to several West Coast dealers. 'Scrappers' like ROD LEWIS and GERRY POIRER of STANDARD STEEL AND METALS INC. have been exporting metal scrap since the early 1960s.

Until recently, the scrap metal business was confined to small companies exporting modest lots of nonferrous, unsorted scrap to West Coast markets — mainly Seattle consignment buyers. However, as the value of the U.S. dollar declines, Pacific Rim industries are looking at Alaskan sources for rebar, structural steel, and other metal scrap products. If these trends continue, the metal recycling industry will grow over the coming years.

Recreational mining in Alaska

A new and growing segment of the Alaskan mineral industry is that of recreational mining. Some enterprising tourist lodge-camp facilities provide lodging, transportation, food, and mining equipment to recreational miners from other states and foreign countries. Often these 'miners' are not novices, in spite of their tourist status. They return year after year to do what they enjoy, as others might travel here to fish or hunt. Some are local people who enjoy mining as a hobby. Other recreational mining can be simple gold-panning along rivers and streams for small amounts of placer gold. As in the metal recycling industry, recreational mining data is difficult to quantify. Three tourism-oriented companies, GLOBAL RESOURCES INC., PARADISE VALLEY MINING, and LITTLE ELDORADO GOLD CAMP, reported revenues of over $1.4 million and clients numbering over 4,000 during 1987. In addition, at least 280 local recreational miners reported working their own claims with their own equipment.

GLOBAL RESOURCES INC. (GLOBAL) near Nome is the largest recreational mine business in Alaska. GLOBAL is affiliated with the Gold Prospectors Association of America (GPAA), which has a nationwide membership of almost 2 million. GLOBAL owns a 2,000-acre patented claim block on Cripple River about 15 mi west of Nome — the Cripple River mine resort — which provides not only small-scale mining opportunities, but also fishing, rafting, and field classes in mine-oriented geology. Lodging, instruction, and equipment are provided.

In 1987, GLOBAL reactivated the old American Creek 2½-ft³ bucket-line flume dredge built in 1935, 35 mi north of Nome. The dredge operated for a short time late in the 1987 season, and it will operate commercially during all of 1988. In future years, GLOBAL will offer tourists and GPAA members an opportunity to participate as dredge crew members. GLOBAL also reopened the Casadepega and Big Four mining camps in a remote area of central Seward Peninsula and will offer similar opportunities to tourists at the Cripple River mine resort. In eastern Seward Peninsula, GLOBAL renovated the Omalik silver-lead hard-rock mine. Classes in metal detection and ore sampling will be offered to tourists at the Omalik mine in 1988.

Since 1979, PARADISE VALLEY MINING COMPANY (PARADISE VALLEY) has simultaneously operated an opencut placer mine and a recreational 'tourist miner' facility in the Wild Lake area of the central Brooks Range. Co-owners Mick and Cecila Manns supply metal detectors, gold-panning, and suction dredge equipment for use in a 6,000-acre claims area which comprises eight creek drainages near Wild Lake (fig. 42). Nuggets as large as 10¾ oz have been found by recreational miners in recent years. Lodging, food, and equipment are all included in the package deal. PARADISE VALLEY revenues of over $250,000 were reported in 1987.

LITTLE EL DORADO GOLD CAMP (LITTLE EL DORADO) on 160 acres of claims in Fox, 11 mi north of Fairbanks, was started in 1985 after owner Andy Wescott decided that tourists coming north to the interior wanted to see and experience a bit of gold mining on their own. LITTLE EL DORADO obtained a U.S. Small Business Administration loan to repair part of the old defunct Tanana Valley Railroad, buy mining equipment, and construct a tent camp for visiting recreational miners. Now, up to 50 passengers seated in open-sided cars can travel a 1-mi rail route. Wescott explains the environmental impacts of placer mining to visitors at the camp and instructs them about buying, staking, and selling mining claims. LITTLE EL DORADO also sponsors gold panning demonstrations at Alaskaland and other functions around Fairbanks. Six hundred tourists visited LITTLE EL DORADO in 1985; by 1987 the number increased 500 percent to about 3,000. Often, visitors who show the most enthusiasm are from Europe and the Orient. As many as 4,000 visitors are expected to pan and mine gold at the LITTLE EL DORADO camp in 1988 and learn about the Alaskan interior's mining industry.

Goldstream Dredge No. 8, also located in Fox, is another tourist venture aimed at highlighting the mining industry of interior Alaska. Dredge No. 8 was one of eight floating bucket-line stacker dredges that the USSR&M COMPANY (now ALASKA GOLD COMPANY) operated in the Fairbanks district from 1928 to 1965. Dredge No. 8 was equipped with 8-ft³ buckets and had a processing capacity of 6,000 yd³/day; it operated at lower Goldstream Creek from 1928 to 1960, when it was permanently shut down and partially dismantled. JOHN REEVES purchased Goldstream No. 8 and rebuilt the camp for a tourist enterprise with gold panning, placer mining demonstrations, and other mine-related activities. EVECO, INC., which operates a combined sand-and-gravel pit and placer-gold mine nearby, offers the

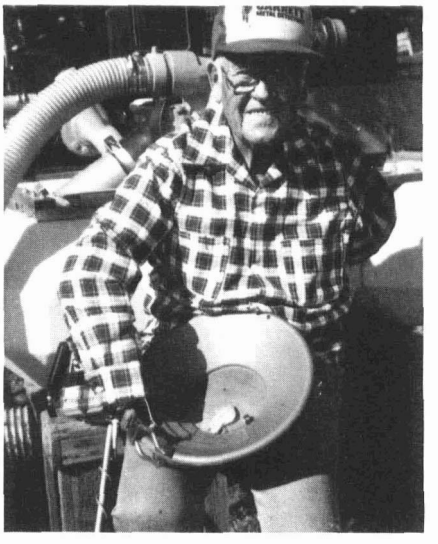


Figure 42. Recreational miner displaying 5.5 oz nugget, Paradise Valley Mining Company, Wild Lake area, central Brooks Range, northern Alaska. Photograph by Mick Manns, 1987.

visiting tourists a glimpse of a modern, efficient placer-mining operation that meets state and federal environmental standards.

Alaska's recreational miners not directly connected with commercial lodge-camp facilities continue to purchase mine equipment and instructional materials from small local companies such as ALASKA PROSPECTORS COMPANY in Fairbanks and ALASKA PROSPECTING AND DIVING SUPPLY in Anchorage. Rough estimates based on DGGS questionnaires and various other information sources indicate that at least 245 people in 1987 were involved in recreational mining and claim assessment activities, not including visitor/clients at such facilities as GLOBAL, PARADISE VALLEY, and LITTLE EL DORADO (fig. 43).

Recreational miners usually confine their activities to gold districts in alpine regions, because overburden thickness there is not a barrier to mining bedrock paystreaks. Mining districts in the central Brooks Range, Wrangell Mountains, Fortymile River drainage, Central Alaska Range, Kenai Peninsula, and the Porcupine district (near Haines) are the most popular for recreational miners. Coastal gold mining areas that contain auriferous beach deposits (such as in Nome) have long been exploited with long-tom and rocker methods.

Figure 43. Recreational miner running suction dredge, interior Alaska. Photograph courtesy of Leah Madonna, 1987.

Some of the recent popularity of recreational mining may be linked to Alaska's economic recession, which has motivated people to try to supplement their incomes with small-scale gold mining. However, most observers believe that the growth potential of this industry is based largely on interest generated by both tourist-oriented companies and individuals engaged in recreational mining for fun and profit.

Industrial mineral development

A variety of industrial minerals such as limestone, building stone, sand and gravel, gypsum, barite, clay, asbestos, diatomaceous earth, and garnet have been exploited in Alaska (Bundtzen and others, 1982). With the exception of limestone, barite, and garnet mining in southeastern Alaska, production of these low-unit-value commodities has been in the form of raw extractable products for construction activities in Alaska. The possibilities of exporting industrial mineral products to Pacific Rim nations should not be ignored. For example, 24 of 39 commodities imported by the Republic of Korea during the years 1981-85 were nonmetallic industrial minerals — worth $1.8 billion in 1985 alone (Bundtzen, 1988). Japan and Taiwan import even larger volumes of these commodities. Interest has been expressed recently by several Japanese firms over the feasibility of developing high-quality chemical-grade and ornamental-stone-quality limestone resources in southeastern Alaska. Between 1900 and 1948, both limestone types were quarried and marketed to other states from mines on Prince of Wales and Dall Islands, west of Ketchikan.

More recently, interest has been expressed in developing cement and agricultural-grade limestone in southcentral Alaska. ALASKA LIMESTONE COMPANY (James Caswell) is developing a small chemical-grade limestone deposit 6 mi north of Cantwell. In 1987, bulk sampling and site construction at the Cantwell quarry was completed, and by December the first components of a 100-ton/day ball mill and processing plant had arrived. ALASKA LIMESTONE plans to produce 20,000 ton/yr during initial operation and may increase when demand warrants.

References cited

Barker, J.C., and Warner, J.D., 1987, USBM inventories Alaskan rare-earths deposits: Engineering and Mining Journal, v. 88, no. 2, p. 42-44.

Bottge, R.G., 1987, Availability of land for mineral exploration and development in north-central Alaska: U.S. Bureau of Mines Special Publication, 33 p.

Bottge, R.G., and Northam, J.J., 1987, Availability of land for mineral exploration and development in south-central Alaska: U.S. Bureau of Mines Special Publication, 45 p.

Bull, K.F., and Bundtzen, T.K., 1987, Greisen and vein mineralization of the Black Creek Stock, the Flat area, westcentral Alaska:Geological Society of America Abstracts with Programs, v. 19, no. 16, p. 362.

Bundtzen, T.K., 1988, New directions in the development of the Alaskan mineral industry for the small miner, in Albanese, M.A., and Campbell, Bruce, eds., Proceedings, 9th Annual Alaska Conference on Placer Mining: Alaska Division of Geological and Geophysical Surveys Report, p.175-183.

Bundtzen, T.K., Eakins, G.R., and Conwell, C.N., 1982, Review of Alaska's mineral resources: Alaska Office of Mineral Development Report, 102 p.

Glover, Arthur E., 1949, The sump pump: Jessens Weekly, April 8, 1949, p. 1-2.

Hagler, Bailly and Company, 1987, Economic analysis of placer mining in interior Alaska: Prepared for U.S. Bureau of Land Management Office of Minerals Policy Analysis, contract RA-2058-1, 86 p., with appendices.

Johnson, R.W., 1988, Yukon placer mining industry—1987: 10th Annual Alaska Placer Conference Paper, unpublished report, 11 p.

Maas, Ken, 1987, Land availability for mineral exploration and development in Alaska: U.S. Bureau of Mines Open-file Report 10-87, 34 p., scale 1:250,000, 33 sheets.

Nokleberg, W.J., Bundtzen, T.K., Berg, H.C., Brew, D.A., Grybeck, Donald, Robinson, M.S., Smith, T.E., and Yend, Warren, 1987, Significant metalliferous lode deposits and placer districts of Alaska: U.S. Geological Survey Bulletin 1876, 103 p., scale 1:2,500,000, 2 sheets.

Redman, E.C., Maas, Ken, Clough, Al and Kurtak, Joseph, 1987, Juneau Gold Belt area 1986 update: U.S. Bureau of Mines Open-file Report 49-87, 41 p.

Rickard, David, ed., 1986, The Skellefte field: 7th International Association for the Genesis of Ore Deposits Symposium and Nordkalott Project Excursion Guide 4, no. 62, 54 p.

Roberts, W.S., 1985, Availability of land for mineral and exploration and development in southeast Alaska: U.S. Bureau of Mines Special Publication, 34 p.

Smith, T.E., Pessel, G.H., and Wiltse, M.A., eds., 1987, Mineral assessment of the Lime Peak-Mt. Prindle area, Alaska: U.S. Geological Survey Grant No. 14-08-001-G-1276, unpublished report, 322 p., scale 1:63,360, 13 sheets.

Warner, J.D., Dahlin, D.C., and Brown, L.L., 1988, Tin occurrences near Rocky Mountain (Lime Peak), east-central Alaska: U.S. Bureau of Mines Information Circular 9180, 24 p.

APPENDIX A
Total active claims and new claims staked in 1985, 1986, and 1987 [a] (listed by quadrangle) [b]

	Quadrangle	Active claims assessment work			New claims staked						Total active claims		
					Federal			State					
		1985	1986	1987	1985	1986	1987	1985	1986	1987	1985	1986	1987
13	Umiat	0	1	0	0	0	0	0	0	0	0	1	0
14	Sagavanirktok	0	0	0	2	1	1	0	0	0	2	1	1
15	Mt. Michelson	0	0	0	0	0	0	0	0	0	0	0	0
17	Point Hope	0	547	0	0	0	0	0	0	0	0	547	0
18	De Long Mts.	6,772	4,617	2,104	0	0	0	0	0	0	6,772	4,617	2,104
23	Philip Smith Mts.	6	36	13	11	19	12	2	10	3	19	65	28
26	Noatak	2,298	905	532	0	0	0	2	15	0	2,440	920	532
27	Baird Mts.	15	89	225	101	2	0	5	0	0	121	91	225
28	Ambler River	1,476	839	294	0	0	0	0	0	0	1,476	839	294
29	Survey Pass	384	346	94	0	0	0	0	0	0	384	346	94
30	Wiseman	1,505	1,755	1,468	160	30	17	25	30	66	1,690	1,815	1,551
31	Chandalar	1,111	909	899	105	22	3	119	12	62	1,335	943	964
32	Christian	1	1	1	0	0	0	0	0	0	1	1	0
36	Selawik	2	0	0	2	0	0	0	0	0	2	0	0
37	Shungnak	69	71	59	2	0	0	0	0	0	71	71	59
38	Hughes	118	54	54	0	0	0	4	0	0	122	54	54
39	Bettles	539	597	508	37	7	17	0	4	27	576	608	552
43	Teller	1,566	1,388	1,312	0	0	0	0	15	0	1,566	1,403	1,312
44	Bendeleben	1,343	1,363	1,302	13	4	5	41	24	48	1,397	1,391	1,353
45	Candle	423	557	449	15	0	14	19	78	24	457	635	487
47	Melozitna	108	32	76	0	0	32	0	27	19	108	59	127
48	Tanana	1,605	1,518	1,461	0	0	0	24	71	175	1,629	1,589	1,636
49	Livengood	2,942	3,719	3,596	1	0	0	362	189	301	3,305	3,908	3,897
50	Circle	3,740	3,268	3,600	0	2	2	105	351	606	3,845	3,621	4,208
51	Charley River	263	263	193	0	0	0	0	4	0	263	267	193
52	Nome	486	358	518	0	0	0	35	59	17	521	417	535
53	Solomon	1,045	829	200	12	1	0	36	39	64	1,093	869	264
54	Norton Bay	110	110	0	0	0	0	0	0	0	110	110	0
55	Nulato	3,213	3,173	3,500	6	16	14	0	144	0	3,219	3,333	3,514
56	Ruby	1,951	1,152	1,107	0	0	0	85	9	4	2,036	1,161	1,111
57	Kantishna River	318	299	287	0	0	1	0	0	0	318	299	288
58	Fairbanks	2,341	2,127	2,699	8	75	0	373	195	346	2,722	2,397	3,045
59	Big Delta	1,402	1,056	1,146	1	55	31	75	60	408	1,478	1,171	1,585
60	Eagle	2,269	2,069	2,357	4	0	0	240	163	60	2,513	2,232	2,417
63	Unalakleet	0	0	0	0	0	0	0	0	0	0	0	0
64	Ophir	587	384	500	0	0	9	62	8	13	649	392	522
65	Medfra	583	502	539	0	0	1	34	56	48	617	558	588
66	Mt. McKinley	382	287	174	0	0	0	0	0	0	382	287	174
67	Healy	3,579	3,790	3,249	127	704	256	173	150	185	3,879	4,644	3,690
68	Mt. Hayes	4,203	3,515	4,196	289	56	249	194	337	95	4,686	3,908	4,486
69	Tanacross	645	751	486	0	0	18	121	168	193	766	919	697
72	Holy Cross	14	14	14	0	0	0	0	0	0	14	14	14
73	Iditarod	524	565	514	3	13	1	69	4	152	596	582	667
74	McGrath	396	109	167	0	0	0	37	0	0	433	109	167
75	Talkeetna	2,899	1,935	2,179	62	0	0	488	209	51	3,449	2,144	2,230
76	Talkeetna Mts.	2,298	1,292	1,600	82	0	0	138	129	127	2,518	1,421	1,727
77	Gulkana	131	16	19	2	0	0	3	0	13	136	16	32
78	Nabesna	411	440	280	0	8	0	4	7	0	415	445	280
81	Russian Mission	115	50	2	0	1	0	0	0	0	115	51	2
82	Sleetmute	270	295	332	0	0	0	0	28	33	270	323	365
83	Lime Hills	360	368	135	0	0	0	4	4	16	364	372	151
84	Tyonek	5,990	6,575	5,177	0	0	0	254	492	53	6,244	7,067	5,230
85	Anchorage	1,300	1,052	1,135	2	0	3	205	231	115	1,507	1,283	1,253
86	Valdez	157	283	299	0	9	8	1	24	293	158	316	600
87	McCarthy	308	170	66	0	0	0	0	0	0	308	170	66
91	Bethel	371	600	66	0	0	0	59	0	4	430	600	70
92	Taylor Mts.	408	283	386	0	0	0	0	0	9	408	283	395
93	Lake Clark	431	411	318	0	0	0	50	0	0	481	411	318
94	Kenai	9	2	5	0	0	0	0	6	5	9	8	10
95	Seward	1,715	1,444	1,261	331	164	557	108	58	95	2,154	1,666	1,913
96	Cordova	23	23	15	0	2	0	0	0	0	23	25	15
97	Bering Glacier	539	231	604	0	0	0	34	22	300	573	253	904
101	Goodnews	9	26	6	0	0	0	0	0	0	9	26	6

[a] Totals are based on 1985, 1986, and 1987 assessment affidavits and location notices received by DGGS and DOM by December 31, 1987. Only documents received by December 31, 1987, are included in this appendix. Because BLM does not require that annual assessment work for federal claims be filed until December 31 of the assessment year, many affidavits are not received and counted until January of the following year, which can lead to discrepancies in some totals.

[b] Quadrangles numbered northwest to southeast according to DGGS-DOM numbering and Kardex systems.

APPENDIX A — Continued

		Active claims assessment work			New claims staked						Total active claims		
					Federal			State					
	Quadrangle	1985	1986	1987	1985	1986	1987	1985	1986	1987	1985	1986	1987
102	Dillingham	18	18	18	0	0	0	0	0	0	18	18	18
103	Iliamna	255	23	86	0	0	0	102	0	0	357	23	86
104	Seldovia	70	13	87	0	0	0	0	0	0	70	13	87
105	Blying Sound	3	2	2	0	0	0	0	0	0	3	2	2
107	Icy Bay	6	6	11	0	0	0	0	18	0	6	24	11
108	Yakutat	0	2	1	0	0	0	0	0	0	0	2	1
109	Skagway	515	468	209	5	15	5	109	7	4	629	490	218
111	Mt. Fairweather	37	4	6	0	2	0	0	0	1	37	6	7
112	Juneau	1,783	1,184	2,173	253	211	1,213	89	68	38	2,125	1,463	3,424
113	Taku River	92	0	0	0	0	0	0	0	0	92	0	0
114	Sitka	739	717	785	40	0	20	0	1	0	779	718	805
115	Sumdum	350	140	45	4	0	54	2	0	0	356	140	99
116	Port Alexander	184	184	0	0	0	0	0	0	0	184	184	0
117	Petersburg	677	1,164	1,497	753	50	129	8	2	0	1,438	1,216	1,616
118	Bradfield Canal	21	8	8	0	4	240	0	0	0	21	12	248
119	Craig	575	702	502	49	112	182	24	38	0	648	852	684
120	Ketchikan	474	430	261	71	152	148	9	0	0	554	582	409
121	Dixon Entrance	512	517	333	1	2	22	0	0	0	513	519	355
122	Prince Rupert	8	8	8	0	0	1	0	0	0	8	8	9
123	Hagemeister Island	338	338	0	0	0	0	0	0	0	338	338	0
126	Mt. Katmai	0	0	0	0	0	0	0	0	0	0	0	0
127	Afognak	1	2	3	0	0	0	0	0	0	1	2	3
130	Karluk	0	0	0	0	0	0	0	0	0	0	0	0
133	Chignik	55	110	51	0	0	0	0	0	0	55	110	51
135	Trinity Islands	131	161	158	0	0	0	146	12	982	277	173	1,140
138	Port Moller	89	44	51	0	0	0	0	1	0	89	45	51
	TOTAL	75,009	65,705	60,072	2,554	1,739	3,274	4,219	3,579	5,002	81,782	71,014	68,348

APPENDIX B
State, federal, and private agencies involved in mineral development activities, 1987

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 — J. Anthony Smith

Function: Promotes economic development in Alaska.

Division of Business Development
State Office Building, 9th Fl
P.O. Box D (mailing)
Juneau, AK 99811
(907) 465-2094
Director — Larry Merculieff
Development Specialists —
Thyes Shaub, James R. Deagen

1001 Noble St., Ste. 420
Fairbanks, AK 99701
(907) 452-7464
Development Specialist — Charles B. Green

Function: Primary advocacy agency in state government for economic growth. Researches and publishes economic data on Alaska's mining industry, and 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 — Dennis D. Kelso

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
Anchorage, AK 99503
(907) 563-6529
Permit Information (907) 563-6529
(collect calls accepted)
Regional Supervisor — Bill Lamoreaux

Southeastern Regional Office
9000 Old Glacier Hwy.
P.O. Box 2420 (mailing)
Juneau, AK 99803
(907) 789-3151
Permit Information (907) 465-2615
(collect calls accepted)
Regional Supervisor — Deena Henkins

DEPARTMENT OF FISH AND GAME
Capital Office Park
P.O. Box 3-2000 (mailing)
Juneau, AK 99802
(907) 465-4100
Commissioner — Don W. Collinsworth
(907) 465-4100
Director, Habitat Division — 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.

Also advises land-management agencies by preparing compilations of fish, wildlife and habitat, and public-use information; assessing habitat requirements and potential impacts; setting guidelines and recommendations for preventing, reducing, or mitigating fish, wildlife, habitat, and human harvest losses.

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) 267-2283
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
P.O. Box AW (mailing)
431 North Franklin St.
Juneau, AK 99811-0165
(907) 465-3562
Director — Robert L. Grogan

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 — Elizabeth Benson

Southcentral Regional Office
2600 Denali St., Ste. 700
Anchorage, AK 99503-2798
(907) 274-1581
Project Coordinator — Patty Bielawski

Southeastern Regional Office
P.O. Box AW (mailing)
431 North Franklin St.
Juneau, AK 99811-0165
(907) 465-3562
Project Coordinators — Diane Mayer, Barb Sheinberg

DEPARTMENT OF NATURAL RESOURCES
400 Willoughby Ave., 5th Fl.
Juneau, AK 99801
(907) 465-2400
Commissioner — Judith M. Brady
Deputy Commissioner — Lennie Boston-Gorsuch
Deputy Commissioner — Tom Hawkins

Principal state agency that administers Alaska's state lands.

Division of Forestry
400 Willoughby Ave., Ste. 400
Juneau, AK 99801
(907) 465-2491

Function: Establishes guidelines to manage mining in state forests.

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99709
(907) 479-2243
Regional Forester — Lester Fortune

Southcentral Regional Office
3601 C St., Frontier Bldg., 10th Fl.
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-2117
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 and Geophysical Surveys
3700 Airport Way
Fairbanks, AK 99709
(907) 451-2760
State Geologist — Robert B. Forbes
Deputy State Geologist — 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; the locations and supplies of ground water and construction materials; the potential geologic hazards to buildings, roads, bridges, and 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 and a drill-core storage facility at Eagle River.

Eagle River Office
18225 Fish Hatchery Rd.
P.O. Box 772116 (mailing)
Eagle River, AK 99577
(907) 696-0070

Juneau Office
400 Willoughby Ave., 3rd Fl.
Juneau, AK 99801
(907) 465-2533

Division of Land and Water Management
3601 C St., Frontier Bldg.
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-4355
Director — Margaret J. Hayes

Function: Manages surface estate and resources, including materials (gravel, sand, and rock) and water. Handles statewide and regional land-use planning. Issues water-appropriation permits and certificates, leases, material-sale contracts, mill-site permits, land-use permits, and easements for temporary use of state land and access roads. Responsible for safety of all dams in Alaska.

Northern Regional Office
3700 Airport Way
Fairbanks, AK 99701
(907) 479-2243
Regional Manager — Jerry Brossia

Southcentral Regional Office
3601 C St., Frontier Bldg., Ste. 1080
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-2251
Regional Manager — Veronica Gilbert

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

Division of Mining
3601 C Street, Ste. 800
P.O. Box 107016 (mailing)
Anchorage, AK 99510-7016
(907) 762-2163
Director — Gerald L. Gallagher

Function: Principal agency for management of mining industry 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 (ASMCRA), which includes permitting and inspection of coal-mining activity and reclamation of abandoned mines.

Fairbanks Office
3700 Airport Way
Fairbanks, AK 99709
(907) 451-2790
Regional Manager — Judd Peterson
Mining Information Office — Carole H. Stevenson

Juneau Office
400 Willoughby Ave., Ste. 400
Juneau, AK 99801
(907) 465-2478
Mining Information Office — Frances Pillifant

Division of Parks and Outdoor Recreation
P.O. Box 107001 (mailing)
Anchorage, AK 99510-7001
Director — Neils 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.

Northcentral Region
3700 Airport Way
Fairbanks, AK 99709
(907) 451-2695
Regional Manager — Mike Lee

Southcentral Region
P.O. Box 107001 (mailing)
Anchorage, AK 99510-7001
(907) 762-2616
Regional Manager — Al Meiners

Southeastern Region
400 Willoughby Ave., Ste. 300
Juneau, AK 99801
(907) 465-4563
Regional Manager — Linda Kruger

DEPARTMENT OF PUBLIC SAFETY
450 Whittier St.
P.O. Box N (mailing)
Juneau, AK 99811
(907) 465-4322
Commissioner — Art English

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 S (mailing)
Juneau, AK 99811-0400
(907) 465-2300
Commissioner — Hugh Malone

Income and Excise Tax Audit Division
P.O. Box SA (mailing)
Juneau, AK 99811-0400
(907) 465-2343
Director — Steven E. Kettel
Audit Office Supervisor — John Hansen

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

Division of Audit
State Office Bldg.,
11th Fl., Entrance A
P.O. Box SA (mailing)
Juneau, AK 99811-0400
(907) 465-2320
Director — Steven E. Kettel

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
Brooks Bldg., Rm. 408
(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
Dean — Donald J. Cook

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)
210 O'Neill Resources Bldg.
(907) 474-7135 or 7136
Director — Donald J. Cook
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.

FEDERAL AGENCIES

U.S. DEPARTMENT OF THE INTERIOR

Bureau of Land Management
Alaska State Office
701 C St.
P.O. Box 13 (mailing)
Anchorage, AK 99513
State Director — Michael Penfold
Mineral Resources Deputy State Director — John Santora
(907) 271-3343
Mineral Development Program Leader — Earl Boone
(907) 271-4441
Surface Management Program Leader — Linn Gum
(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 — John Rumps

Fairbanks Support Center and Land Information Office (primary contact for information on Interior and northern regions)
1541 Gaffney Rd.
Fairbanks, AK 99703
(907) 356-5345
Support Center Manager — James Murray
Information Operator — (907) 356-2025

Arctic District Office
1541 Gaffney Rd.
Fairbanks, AK 99703
(907) 356-5132
District Manager — Thomas Dean

Nome Field Office
P.O. Box 952 (mailing)
Nome, AK 99762
(907) 443-2177
District Manager — Fred Payton

Glennallen District Office
P.O. Box 147 (mailing)
Glennallen, AK 99588
(907) 822-3218
District Manager — Gene Terland

Kobuk District Office
1541 Gaffney Rd.
Fairbanks, AK 99703
(907) 356-5385
District Manager — Roger Bolstad

Steese-White Mountain Office
1541 Gaffney Rd.
Fairbanks, AK 99703
(907) 356-5312
District Manager — Don Runberg

Kotzebue Field Office
P.O. Box 262 (mailing)
Kotzebue, AK 99752
(907) 442-3430
District Manager — Bob Gal

Tok Field Office
P.O. Box 307 (mailing)
Tok, AK 99780
(907) 883-5121
Manager — Jim Sisk

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 — Robert B. Hoekzema

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 Field Office
P.O. Box 020550 (mailing)
Juneau, AK 99802-0550
(907) 364-2111
Assistant Chief — David Carnes

Fairbanks Field Office
206 O'Neill Resource Bldg.
905 Koyukuk Ave. North
University of Alaska
Fairbanks, AK 99775-5140
(907) 479-4277
Section Supervisor — James C. Barker

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 Services/Endangered Species Branch
101 12th Ave.
Box No. 20 (mailing)
Fairbanks, AK 99701
(907) 456-0203
Field Supervisor — Paul Gertler

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 — Robert Bowker

U.S. Geological Survey
4230 University Dr.
Anchorage, AK 99508
(907) 271-4138
Chief, Branch of Alaskan Geology — Donald L. Grybeck

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

Public Inquiries Office (for information and publications)
4230 University Dr., Rm. 101
Anchorage, AK 99508-4664
(907) 561-5555

National Park Service
Alaska Regional Office
2525 Gambell St.
Anchorage, AK 99503
(907) 271-2643
Regional Director — Boyd Evison
Mining Engineer — Lynn S. Griffiths
Chief, Mining Division — Floyd Sharrock

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)

Mine Safety and Health Administration
205 N. 4th St., Rm. 103
Coeur d'Alene, ID 83814
(208) 667-6680
Coeur d'Alene Field Office Supervisor — Larry Weberg (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. Inspectors and trainers travel from Bellevue, Washington, and Coeur d'Alene, Idaho as there are no MSHA offices in Alaska. Note: 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 80225-0367
(303) 236-2740
District Manager — John M. DeMischiei

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) 442-1200
Regional Administrator — Robie Russell

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
701 C St.
Box 19 (mailing)
Anchorage, AK 99513
(907) 271-5083
Assistant Regional Administrator — Alvin L. Ewing
Environmental Protection Specialist — Jo Drechsler

Alaska Operations Office
3200 Hospital Dr., Ste. 101
Juneau, AK 99801
(907) 586-7619
Air/Waste Team Leader — Steven Torok

U.S. DEPARTMENT OF THE ARMY

Corps of Engineers
Regulatory Branch
P.O. Box 898
Anchorage, AK 99506-0898
District Engineer — Colonel William T. Gregory, Jr.
Write: Attention: NPACO-R-S, or
Call: Chief of Compliance Section (907) 753-2724 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 AGENCY

Alaska Public Lands Information Center
250 Cushman St., Ste. 1A
Fairbanks, AK 99701
(907) 451-7352
Manager — Deanne Adams
Assistant Manager — Chuck Lennox

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 published its initial report in January 1987, and an interim report in January 1988.

Citizens' Advisory Commission on Federal Areas
515 7th Ave., Ste. 310
Fairbanks, AK 99701
(907) 456-2012
Chairman — Vern Wiggins
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
Chairwoman: Peg Tileston
(907) 561-0540
Water Resource Board Coordinator: Mary Lou Harle
(907) 762-2680

Function: The Alaska Water Resources Board was created by Art. 3 of AS 46.15, the Water Use Act of 1966. This seven-member citizen 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 Commissioner of Environmental Conservation is an ex-officio member, and the Commissioner of Natural Resources is the executive secretary and provides staff assistance for the board. Members are appointed by the Governor, subject to confirmation by the Legislature. Board members represent a geographic diversity and a variety of occupations and professions associated with water resources. 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.

CHAMBERS OF COMMERCE

State Chamber of Commerce
State Natural Resources and Energy Committee
957 West Bury Dr.
Anchorage, AK 99503
(907) 561-2332
Co-Chairman — Douglas Stark

Function: Standing committee for 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.

Greater Fairbanks Chamber of Commerce
Mineral Development Committee
P.O. Box 74446
Fairbanks, AK 99707
(907) 452-1105
Co-Chairmen — Jeff Burton, Rocky Rhodes

Function: Supports the placer-mining industry, vocational education, RS2477 Rights-of-way, and government agencies that support and perform research in mineral development.

Anchorage Chamber of Commerce
415 F St.
Anchorage, AK 99501

Natural Resource Committee
Chairperson — Dave Cuddy
Coal and Minerals Subcommittee
941 East Dowling Rd., Ste. 300
Anchorage, AK 99518
(907) 562-4673

Function: Monitors and supports mining activity in southcentral Alaska area as well as activities statewide that impact Anchorage.

NONGOVERNMENTAL GROUPS AND ASSOCIATIONS

Alaska Miners Association, Inc.
Rich Hughes, Statewide President
Curt McVee, Executive Director
Statewide Office
501 West Northern Lights Blvd., Ste. 203
Anchorage, AK 99503
(907) 276-0347

Anchorage Branch
Norm Lutz, Chairman
501 West Northern Lights Blvd., Ste. 203
Anchorage, AK 99503
(907) 274-6473

Fairbanks Branch
Roger Burggraf, Chairman
P.O. Box 73069
Fairbanks, AK 99707
(907) 451-6650

Juneau Branch
John Mulligan, Chairman
P.O. Box 21684
Juneau, AK 99802
(907) 364-3144

Kenai Branch
Dennis Steffy, Chairman
c/o Mining & Petroleum Training Service (MPTS)
155 Smith Way, Ste. 104
Soldotna, AK 99669
(907) 262-2788

Nome Branch
Joe Fisher, President
P.O. Box 242
Nome, AK 99762
(907) 443-5272

Alaska Women in Mining
Caroline Roland, President
P.O. Box 83743
Fairbanks, AK 99708
(907) 452-1022

Society of Mining Engineers
Caller No. D
Littleton, CO 80162-5002
(303) 973-9550

Alaska Section
Milton A. Wiltse, Chairman
794 University Ave., Basement
Fairbanks, AK 99709
(907) 474-7147

David Maneval, Secretary-Treasurer
University of Alaska
210 Brooks Bldg.
Fairbanks, AK 99775
(907) 474-6877

Southern Alaska Branch
Charles Drummond, Chairman
2525 Gambell St., Rm. 107
Anchorage, AK 99503
(907) 271-4213

American Institute of Professional Geologists
7828 Vance Dr., Ste. 103
Arvada, CO 80003
(303) 431-0831

Ross Schaff, President
Alaska Section
Pouch 6900
Anchorage, AK 99502
(907) 338-4200

Miners Advocacy Council
Josh Moore, President
P.O. Box 73824
Fairbanks, AK 99707
(907) 452-6227

Northwest Mining Association
William C. Booth, President
414 Peyton Bldg.
Spokane, WA 99201
(509) 624-1158

Placer Miners of Alaska
John Korobko, President
P.O. Box 73756
Fairbanks, AK 99707
(907) 479-0471

Resource Development Council for Alaska, Inc.
Joseph R. Henri, President
Becky L. Gay, Executive Director
807 G St., Ste. 200
P.O. Box 100516 (mailing)
Anchorage, AK 99510-0516
(907) 276-0700

Western Mining Council
Kenai Peninsula Chapter
Oscar H. Bailey, President
Old Nash Rd.
Seward, AK 99664
(907) 224-5963

ORGANIZED MINING DISTRICTS

Chistochina Mining and Recording District
Del Ackels, President
P.O. Box 2151
Fairbanks, AK 99707

Circle Mining and Recording District
Susan Knapman, President
P.O. Box 1872
Fairbanks, AK 99730 (summer address)
1215 Choctaw
Fairbanks, AK 99705 (winter address)

Fairbanks Mining District
Don Stein, President
105 Dunbar
Fairbanks, AK 99701

Forty-Mile Miners Association
David Kukowski, President
General Delivery
Chicken, AK 99732

Juneau Mining District
Roger Eichman, President
P.O. Box 20765
Juneau, AK 99802

Kantishna Mining District
Sam Koppenburg, President
SRD Box 9070
Palmer, AK 99645

Iditarod Mining District
John Miscovich, President
1093 North Greengrove St.
Orange, CA 92667

Livengood-Tolovana Mining District
Rose Rybachek, President
P.O. Box 73069
Fairbanks, AK 99707

Seward Mining District
Tom Williams, President
Box 66
Hope, AK 99605

Valdez Mining District
Claud Morris, President
P.O. Box 547
Girdwood, AK 99581

Yentna Mining District
John Jacobsen, President
700 Ash Pl.
Anchorage, AK 99501

APPENDIX C
Selected significant mineral deposits in Alaska
(locations shown in figs. 44 through 46)[a]

Map no.

1 **Lik-Su** — Major strata-bound massive-sulfide (Zn-Pb-Ag-Cd-Ba) deposits in black shale and chert. 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. According to COMINCO (February 1982), 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** — Strata-bound (Pb-Zn-Ag) massive-sulfide occurrence associated with black shale, chert, and felsic volcanic rocks; 60 by 120-ft exposure averages 17.4 percent Zn, 3.0 percent Pb, and 3.3 oz/ton Ag; numerous sulfide occurrences and strong geochemical anomalies between localities 1 through 4 and locality 7.

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.

6 **Whoopee Creek** — Epigenetic replacement deposits of Zn-Pb-Cu-Ag-Au-Cd in breccia zones jn Devonian Kanayut Conglomerate or Lower Mississippian Kayak Shale. Random grab samples of mineralized material contain 0.24 percent Cu, 0.37 percent Cd, 44 percent Zn, 0.14 oz/ton Au, and 14.8 oz/ton Ag.

7 **Omar, Frost** — 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.

8 **Bornite** — Major stratiform Cu-Zn deposit in carbonate rock of Devonian age; 4.56-million-ton ore body 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.

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.

11 **Smucker** — Middle Paleozoic volcanogenic massive-sulfide deposit; 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 2.5 percent Cr.

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.

18 **Porcupine Lake** — Stratiform fluorite occurrences associated with felsic volcanic rocks of late Paleozoic age. Reported grades of up to 25 to 30 percent fluorite reported.

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. Grab samples contain up to 1 percent Cu, 0.16 percent Zn, and 0.002 percent Mo.

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.

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.

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 Precambrian or 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 **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.

32 **Solomon mining district** — Major placer-Au district; produced over 250,000 oz Au.

33 **Kachauik** — Uranium prospect in Cretaceous alkalic intrusive rocks. Highly anomalous geochemical values and U concentrations of 1,000 ppm reported.

34 **Omalik** — Stratiform or 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.

---

[a] This generalized summary does not describe all the 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' (Nokleberg and others, 1987), which describes 262 significant metalliferous lodes and 43 placer districts.

35 **Windy Creek** — Disseminated Mo-Pb-Zn mineralization in quartz veins and skarns with reported values as high as 0.15 percent Mo.

36 **Quartz Creek** — Significant Pb-Zn-Ag mineralization; reported grades of 15 percent combined Pb-Zn and 10 oz/ton Ag.

37 **Placer River** — Significant Mo-F mineralization disseminated in intrusive rocks. Reported values of 0.2 percent Mo.

38 **Candle Creek** — Placer-Au deposits with significant reserves. Placer concentrates reported to have significant U and galena concentrations.

39 **Poovookpuk Mountain** — Porphyry Mo mineralization. Reported grades of up to 0.25 percent Mo.

40 **Purcell Mountain** — Mo and Ag occurrences associated with Cretaceous alkalic igneous plutons, alaskite, and bostonite dikes.

41 **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 place Au from 1930 to 1962.

42 **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.

43 **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.

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 ton since 1915, all derived from tactite and skarn near Cretaceous quartz monzonite.

50 **Mt. Prindle** — Significant uranium-rare-earth mineralization in Mesozoic alkaline igneous rocks. Rock geochemical values of up to 0.1 percent 308_{U}; 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 Bonnifield 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 **Purkypile** — Significant Ag-Sn-Be mineralization associated with 'McKinley' pluton (55 m.y. old). Grades of up to 4.5 percent Sn reported. Potential exists for U and W mineralization.

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. Proven reserves of about 10 million tons of 0.1 oz/ton Au with Cu and Ag reported.

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 **Coal Creek** — Greisen-hosted Sn-Cu-W deposit in 'McKinley' age pluton (55 m.y. 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.

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 Chitistone 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.

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 yd^3 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 1,453,600 tons that grade 0.317 oz/ton Au, 1.37 oz Ag, and several percent base metals.

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 **Magnetite Cove** — Massive magnetite-skarn deposit; grades of up to 30 percent Fe reported; also contains Zn-Cu-Ag mineralization.

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 1 to 5 billion tons of material that contain 11 to 20 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 0.026 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 en-echelon, 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 of 29 million tons of .039 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.

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 3.6 million tons ore that grades 25.3oz/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 m.y. old); proven reserves of 1.5 billion tons ore that grade 0.136 percent Mo, which includes 490 million tons with grades of 0.219 percent MoS_2.

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 **Illinois Creek** — Epigenetic(?) and replacement deposits that contain Cu-Pb-Zn-Ag-Au possibly associated with altered quartz monzonite porphyry and schist.

126 **Johnson River** — Epigenetic(?) quartz-sulfide stockwork or massive-sulfide deposit hosted in volcaniclastic, 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.

127 **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.

128 **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 4.2 million tons grading 0.239 oz/ton gold.

129 **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.

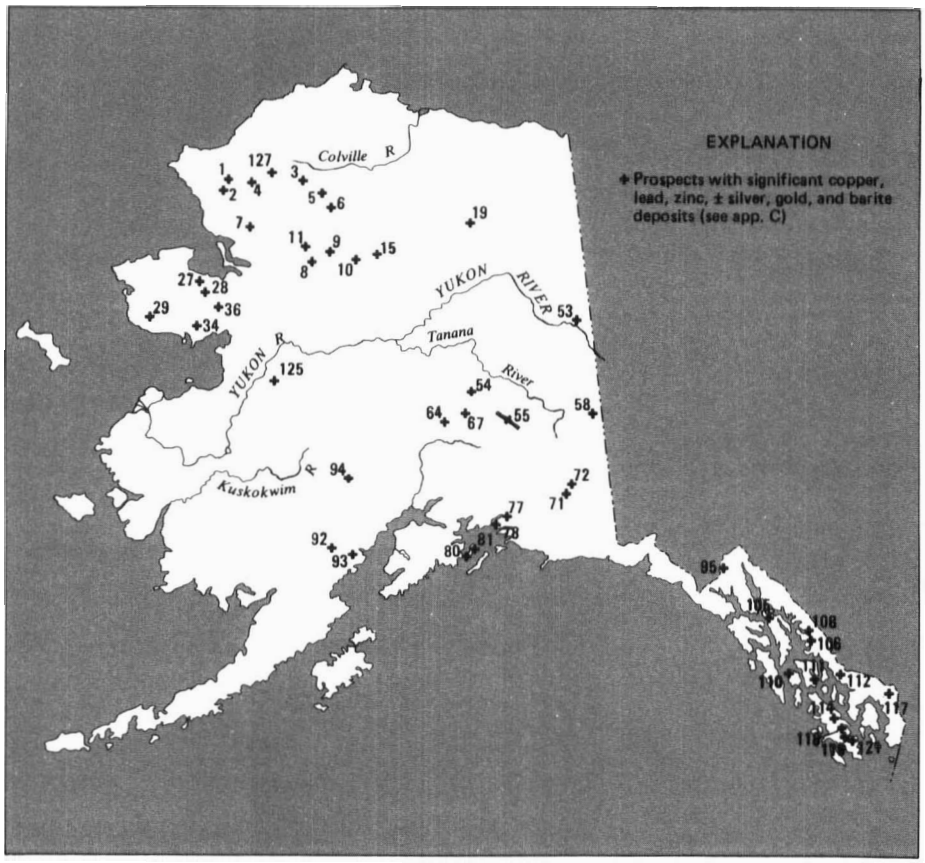


Figure 44. Significant copper, lead, zinc ± silver, gold, and barite deposits in Alaska, 1987. See appendix C for deposit descriptions.

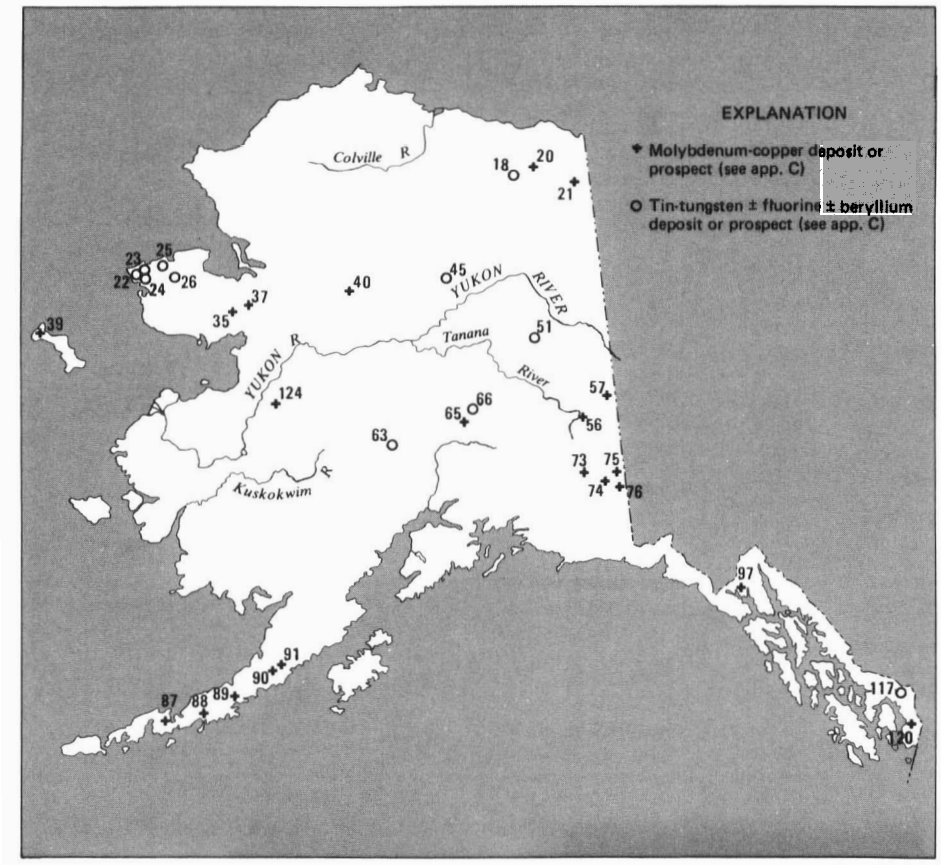


Figure 45. Significant molybdenum—copper; and tin—tungsten ± fluorine and beryllium deposits in Alaska, 1987. See appendix C for deposit descriptions.

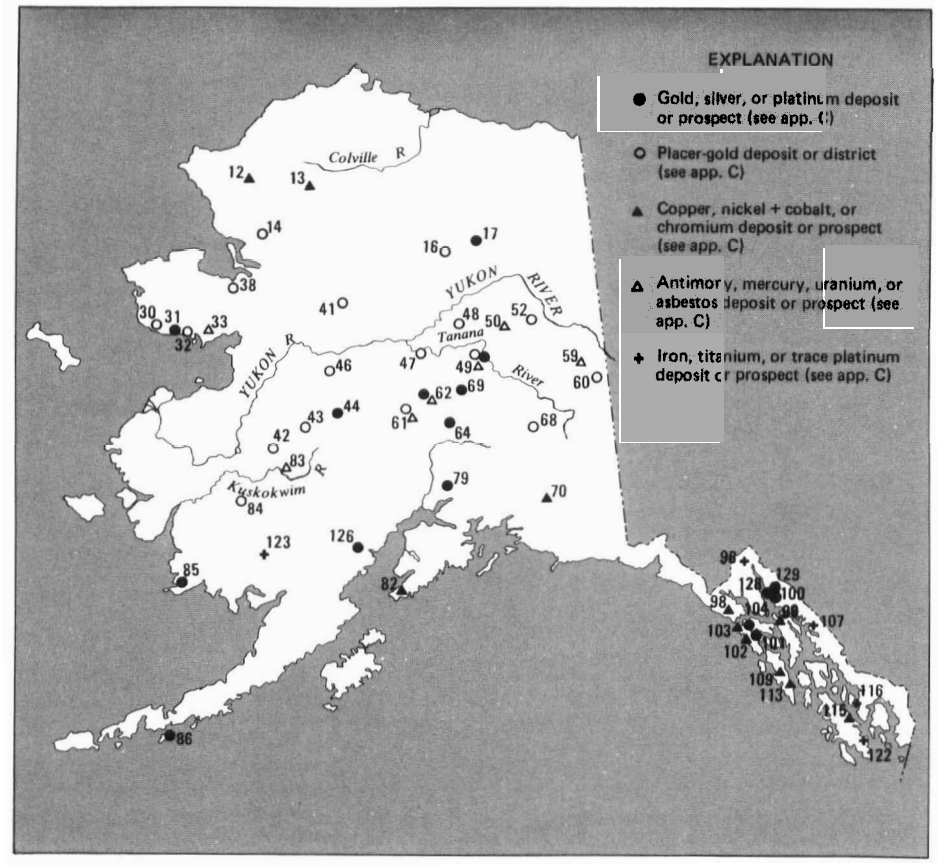


Figure 46. Significant gold, silver, platinum, and strategic-mineral deposits in Alaska, 1987. See appendix C for deposit descriptions.

APPENDIX D
Mining licenses issued by the Alaska Department of Revenue, 1987 [a]
(placer gold + silver unless otherwise noted)

ACHMAN, ROLAND
P.O. Box 61185
Fairbanks, AK 99706

ACKELS, DEL (2)[b]
Box 2151
Fairbanks, AK 99707

ALAMIN MINING CORP.
112 Park Ave.
International Falls, MN 56649

ALASKA AGGREGATE CORP. (4)
7800 Lake Otis Pkwy.
Anchorage, AK 99507
(sand and gravel)

ALASKA GOLD CO. (8)
P.O. Box 640
Nome, AK 99762

ALASKAGOLD MINES, INC.
510-700 West Pender St.
Vancouver, BC., Canada V6C 1G8

ALASKA LIMESTONE COMPANY
James Wallis Caswell
P.O. Box 196
Cantwell, AK 99729

ALASKA MINERAL RESOURCES COMPANY
1660 Wynkoop, No. 1000
Denver, CO 80202

ALASKA MINING CO., INC.
Box 111244
Anchorage, AK 99517

ALASKA PLACER DEVELOPMENT, INC.
Box 81467
Fairbanks, AK 99708

ALASKA PLACER MINING CO. (2)
Box 1150
Phoenix, AZ 85001

ALASKA UNLIMITED CO.
Richard D. Karr
P.O. Box 60782
Fairbanks, AK 99706

ALDER CREEK MINES (3)
Patricia S. Franklin
1213 Coppet
Fairbanks, AK 99709

ALDRIDGE, WILLIAM JOSEPH
Box 1334
Palmer, AK 99645

ALYESKA OIL & EXPLORATION (4)
Edward Stugart
Box 737
Tok, AK 99780

AMERICAN CREEK PARTNERS
Box 81467
Fairbanks, AK 99708

ANABELLE MINE
James G. Roland
710 McGrath Rd.
Fairbanks, AK 99712

ANCHORAGE SAND & GRAVEL CO., INC.
1813 East 1st Ave.
Anchorage, AK 99501
(sand, gravel)

ANDERSON, DENNIS & LLOYD MICKELSON
R.R. 3, Box 269
Frazee, MN 56544

ANDERSEN, RALPH S.
Box 162
McGrath, AK 99627

ANDERSON, WAYNE S.
1901 Cheechako Dr.
Fairbanks, AK 99709

ANVIL MINING INC. (2)
Box 1694
Nome, AK 99762

ANVIL MINING INC.
Mat Su Inc. & Blackaro
1705 Ship Ave.
Anchorage, AK 99501

ARNARIAK, ADAM
Box 95
Togiak, AK 99678

ARNETT, LESLIE
502 McKinley View Dr.
Fairbanks, AK 99712

AUSTIN, JEFFREY M.
P.O. Box 1303
Seward, AK 99664

B.C. ENTERPRISES
Barry L. Clay
P.O. Box 25
Ruby, AK 99768

B.C. MINING
Clifford E. Knowledge
2207 John Evans Ln.
Fairbanks, AK 99712

BALDWIN, FRANK
1061 Ervine St. West
The Dalles, OR 97058

BARRY HOLDING CO.
9300 View Dr.
Juneau, AK 99801

BARRY HOLDING CO.
Box X
Taft, CA 93268

BASS, DONALD Q.
General Delivery
Central, AK 99730

BATTEST, HAROLD
912 6th Ave.
Fairbanks, AK 99701

BAUER, ROD A.
Box 104413
Anchorage, AK 99510

BAYLESS, HOWARD
Drawer F
Copper Center, AK 99573

BEATTIE, THOMAS M.
P.O. Box 21
Hope, AK 99605

BEAVER STATE MINING
Richard J. McCallum
Box 138
Fairbanks, AK 99707

BEDCOCK, JACK G.
SR 3, Box 30160
Fairbanks, AK 99701

BEDROCK COMPANY
Cacy Patton
Box 1505
Fairbanks, AK 99707

BEEHIVE MINING
Layne Gardner
284 Cindy Dr.
Fairbanks, AK 99701

BEERMAN, W.J.
2416 S. 1st St.
Yakima, WA 98901

BEISTLINE, EARL H.
P.O. Box 80148
Fairbanks, AK 99708

BELL, ROCKY & BILL
Box 353
Sterling, AK 99672

BERG, RHINEHART (4)
General Delivery
Candle, AK 99728

BERGLUND, ARTHUR & JEANNE
SR A, Box 6275
Palmer, AK 99645

BEVARD, KEITH E.
Box 912
Delta Junction, AK 99737

BEYER, DAVID W.
P.O. Box 103812
Anchorage, AK 99510

BIG G MINING INC.
Hank Gradney
Box 74400
Fairbanks, AK 99707

BIG VELVET MINING CO.
General Delivery
Chicken, AK 99732

BLAIR, BOYD
Mile 260 Parks Highway
Ferry, AK 99790

BLAKE, KERRY
Box 36
Nome, AK 99762

BLASINGAME, WALLACE E. (2)
Box 1920
Fairbanks, AK 99707

BLISS, PATRICK J.
3105A Lakeshore Dr., Ste. 103
Anchorage, AK 99517

BLONDEAU, ROBERT W.
Box 602
Valdez, AK 99686

BLOOM, GARY L.
Box 71
Hope, AK 99605

BMS INC.
Clifford H. Driskell
235 East 9th Ave.
Anchorage, AK 99501

BOLSTRIDGE/PARTEE ASSOC. (4)
Basil Bolstridge & Tom Partee
SR 2, Box 246
Sterling, AK 99762

BOULDER CREEK MINING CO.
Lester J. & Dorothy M. Fickes
P.O. Box 2618
Fairbanks, AK 99707

BOURSAN, JOSEPH G.
3356 E. Evans Dr.
Phoenix, AZ 85032

BOUTON, GLENN D. & LELA (2)
665 Farmers Loop Rd.
Fairbanks, AK 99712

BRANDL, PHILIP
14251 Sabine St.
Anchorage, AK 99516

BRISTER, DONALD E.
P.O. Box 8-658
Anchorage, AK 99508

BRODIS, ROGER F.
SRB 7543
Palmer, AK 99645

BROWN, DAVID L.
Box 902
Hope, AK 99605

BROWN, T.E. & BROWN, B.J.
Box 532
Cooper Landing, AK 99572

BRYANT, T.L.
Box 264
Ridgeway, CO 81432

BUCKMEIER, DARRELL J.
7540 Upper O'Malley Rd.
Anchorage, AK 99516

BUCY ASSET MANAGEMENT
Norman R. Bucy
2213 W. 46th
Anchorage, AK 99502

---

[a] Only licenses for 1987 that were received by DGGS — DOM (Fairbanks) by January 15, 1988, are listed.

[b] Numbers in parentheses indicate the number of separate mining licenses issued to a single individual, partnership, or company. In 1987, 572 licenses were issued to 497 operators. In 1986, 592 licenses were issued to 487 operators, and in 1985, 848 licenses were issued to 638 operators.

BUGLI, JOHN
Box 21
Soldotna, AK 99669

BURGIN, ROBERT A.
P.O. Box 343
Sutton, AK 99674

BURNS, JOHN R.
Box 5
Chicken, AK 99732

BUSK, RICHARD
Box 100971
Anchorage, AK 99510

C & R MINING
Clifford E. Knowlton & Robert Am
Box 10069
Fairbanks, AK 99710

CACY, ROBERT J., JR.
Box 106
Central, AK 99730

CALISTA CORPORATION (2)
516 Denali St.
Anchorage, AK 99501

CANDLE MINING CO.
8810 Rendon Rd.
Anchorage, AK 99507

CARLO & SONS MINING CO.
2113 Southern
Fairbanks, AK 99701

CASSITERITE PLACERS (2)
General Delivery
Manley Hot Springs, AK 99756

CASTLE CREEK MINES INC.
Fred & Patricia Hall
Box 83557
Fairbanks, AK 99708

CEREPA, AL
Box 1
Kenai, AK 99611

CHANDALAR ENTERPRISES
Dick Beeman
2289 Franklin St.
Fairbanks, AK 99709

CHASE BROTHERS
Leonard Chase
641 Eastview
Fairbanks, AK 99712

CHICKMAN MINING CO.
Earl L. Schene
Box 66
Chicken, AK 99732

CHILDERS, WESLEY
Box 686
Fall City, WA 98024

CHRISTOPHERSON, DIANE E.
2261 Belmont Dr.
Anchorage, AK 99517

CHULITNA FORKS PLACER MINING CLAIM
Mark D. Veit
743 East 9th Ave.
Anchorage, AK 99501

CIRCLE MINING COMPANY (3)
Frank R. Warren
Box 11
Central, AK 99730

CITIGOLD ALASKA INC.
T.E. Babcock
P.O. Box 75210
Fairbanks, AK 99707-5210

CLARA BEA INC.
David Vial & B.W. Comstock
Box 853
Kotzebue, AK 99752

CLEVELAND, CHARLES W.
10520 Azalea Glen Rd.
Glendale, OR 97442

COLD CACHE MINING CO.
Robert C. Marcy
695 Roberts Roost Rd.
Fairbanks, AK 99712

COLE, JOHN H.
Box 10139
Fairbanks, AK 99710

COLLEDGE, LYLE (2)
P.O. Box 60478
Fairbanks, AK 99701

COLZANI, ROBERT
2501 Loring St.
San Diego, CA 92105

COMPASS MINING CO.
John B. Hall
Box 2700
Fairbanks, AK 99707

CONGDON CONSTRUCTION & MINING
Carl J. Congdon
925 Commerce St.
Fairbanks, AK 99701

CONNER, MIKE
SRB Box 7343A
Palmer, AK 99645

COOK, ALFRED & DAN SOLECKI
774 May St.
Calumet City, IL 60409

COOK'S MINING
Mary Cook
Box 393
Fairbanks, AK 99707

COOL, ROGER
Box 765
Dallesport, WA 96817

COYLE, WALDO OR RUBY
1412 Barababa Dr.
Kenai, AK 99611
(gravel)

CRABB, JAMES A.
P.O. Box 10
Central, AK 99730

CROLEY, LOLA
Box 191
Tok, AK 99780

CULLETT, THERESA A. SPEAKER
Box 16042
Two Rivers, AK 99716

D & H ENTERPRISES
Roger Severson, Partner
Box 149
Crestview Ln.
Eagle River, AK 99577

DALE, MINING, INC.
3644 Eddie Rd.
North Pole, AK 99705

DAVIS, JOHN & DEE
SR 10 Mile 77 Richardson Hwy.
Fairbanks, AK 99701

DEGNAN MINING CO.
Joseph A. & Caroline H. Degnan
Box 45
McGrath, AK 99627

DELTA CONCRETE PRODUCTS INC.
R. Douglas McCollum
Box 289
Delta Junction, AK 99737

DELTA DEVELOPMENT
Harold J. Teiken
Box 286
Delta Junction, AK 99737

DEMPSEY, DANIEL K.
Box 790
Valdez, AK 99686

DENNIS, ERNEST L.
SRC 8525
Palmer, AK 99577

DENVENY, PAUL
218 6th Ave.
Fairbanks, AK 99701

DEVORE, WESLEY
665 3rd Ave.
Redwood City, CA 94063

DIGGERS, WADE JOSEPH
Box 70
Central, AK 99730

DIONNE, PAUL & SUE
via Cold Foot
Wiseman, AK 99701

DIPPEL, DONALD E.
Box 157
Lehi, UT 84043

DITMAN, ROBERT, JR. & JOHN F. MELVIN
P.O. Box 230503
Anchorage, AK 99523

DOBNIK MINING
Box 101122
Anchorage, AK 99510

DOGGER, MICHAEL B.
5218 Halfmoon Dr.
Colorado Springs, CO 80915

DOME CREEK MINING & DEVELOPMENT
General Delivery
Chicken, AK 99732

DOUBLE D MINING CO.
Dell E. Johnson
Box 61537
Fairbanks, AK 99706

DOWN UNDER MINING
Jesse Hasha
1173 Choctaw
North Pole, AK 99705

DUNLAP, JIM
520 5th Ave.
Fairbanks, AK 99701

E R MINING
Roy Hilpott
115 Charles St.
Fairbanks, AK 99701

EARLY WINTERS MINING CO.
Lee Wilson
3605 Arctic No. 988
Anchorage, AK 99503

ECLIPSE MINING CO. (2)
3700 Rabbit Creek Rd.
Anchorage, AK 99507

EEP'S EQUIPMENT RENTAL & MINING
Allen G. Anderson
Dog Alley
Takotna, AK 99675

ELDORADO MINING CORP.
R.C. Sheardown
3512 Campbell Airstrip Rd.
Anchorage, AK 99504

ELLIS, ED (3)
Box 824
Cooper Landing, AK 99572

ELJAQUHARI, MAHMOUD
Box 104442
Anchorage, AK 99510

EMERSON, ROBERT C.
1811 Phillips Field Rd.
Fairbanks, AK 99701

ENGSTROM DREDGING CO.
Ronald H. Engstrom
Box 536
Nome, AK 99762

ERICKSON, FRED I.
Box 871312
Wasilla, AK 99687

ERICKSON, SVEN D.
Box 871312
Wasilla, AK 99687

ERIKSON, KRISTER
Box 872809-199
Wasilla, AK 99687

ERLANDSON, ARVID
c/o Box 74490
Fairbanks, AK 99707

ESPERANZA RESOURCES CO. INC.
Richard L. McIntosh
Box 84246
Fairbanks, AK 99708

EVECO MINING, INC.
Alice Ellingson
1818 Old Steese Hwy. North
Fairbanks, AK 99701

EVERSOLE, JOHN & ANDREW
733 West 4th Ave., No. 773
Anchorage, AK 99501

FAA, THOMAS E. (2)
General Delivery
Healy, AK 99743

FAIRBANKS EXPLORATION INC. (5)
P.O. Box 82549
Fairbanks, AK 99708
(various lode & placer)

FAIRBANKS GROUP ASSOC.
SR Box 51736
Wasilla, AK 99687

FAITH MINING CO.
Jack J. Stewart
Rt. 1, Box 640
Gladewater, TX 75647

FARLEY EQUIPMENT INC.
7011 Old Seward Hwy.
Anchorage, AK 99518

FAULKNER, JEANNINE &
HARRY E., SR.
P.O. Box 1307
Bethel, AK 99559

FELDMAN, GARY
520 5th Ave.
Fairbanks, AK 99701

FELTON CONSTRUCTION CO.
Box 7099
Missoula, MT 59807
(gravel)

FERN DEVELOPMENT CO., INC.
Box 872148
Wasilla, AK 99687

FEVER CITY MINING INC.
Tom Wells
Box 2073
Fairbanks, AK 99701

FINNBEAR MINING & EXPLORATION CO. INC.
Box 150
Anchor Point, AK 99556

FISHER, HOWARD R.
Box 406
Kasilof, AK 99610

FLAT CREEK MINING CO. INC. (2)
Howard Miscovich
Box 81464
Fairbanks, AK 99708

FLAT PICK MINING
Gordon Fulton & Fred Schenk
Box 118
Central City, AK 99730

FLEMING, MITCHELL
Coldfoot, AK 99701

FORREST, JAMES
Box 61106
Fairbanks, AK 99706

FOUR BROTHERS MINING
H. Clarke Billings
Box 81117
Fairbanks, AK 99708

FOX GULCH TRIO
John Turner, Wayne Williams
409 Dunkel
Fairbanks, AK 99701

FREEMAN, CURTIS J.
Box 74261
Fairbanks, AK 99707
(various)

FULLERTON, JOHN E. &
RICHARD S.
Flat Creek Placers
General Delivery
Flat, AK 99584

FUSSELL/NORTON/DROUIN
Box 84474
Fairbanks, AK 99708

GHD RESOURCES PARTNERS, LTD.
Box 10499
Fairbanks, AK 99710

GAEDE, MARK & GARY LINDMAN
Box 3121
Soldotna, AK 99669

GALLAGHER, PAUL, JR.
1341 Silverberry Dr.
Fairbanks, AK 99712

GATES, WILLARD E.
General Delivery
McGrath, AK 99627

GEBHARD, MICHAEL E.
330 L St.
Anchorage, AK 99501

GELVIN, STANLEY M. & EDWIN C.
Box 94
Central, AK 99730

GEORGE, ROY T.
61 Clark St., No. 2
Salinas, CA 93901

GERAGHTY MINING
Richard W. Geraghty
405 Juneau St.
Fairbanks, AK 99701

GERTH, JIM
Sourdough, AK
via Glennallen, AK 99588

GIBSON, WAYNE
1610 Southern
Fairbanks, AK 99701

GIDDINGS, GLEN G.
326 Highway 21 South
Republic, WA 99166

GILLETTE, BEN
General Delivery
Nome, AK 99762

GIRDWOOD MINING CO.
McCarthy, Reynolds, McLinn
3605 Arctic Blvd., No. 476
Anchorage, AK 99503

GLANVILLE, CARL & DESSIE
HCR Box 1195
Anchor Point, AK 99556

GLOBAL MINERALS LTD. (2)
Joseph S. LaSpesa
90 Dorchester Rd.
Buffalo, NY 14213
(gravel)

GLOBAL RESOURCES, INC.
Box 1042
Nome, AK 99762

GOLDDIGGERS
Mary A. Staton & Muriel Lewis
3515 Industrial Ave.
Fairbanks, AK 99701

GOLDEN EAGLE MINING
Boundary, AK 99790

GOLDEN SLIPPER II
Joe B. Hall
237 Ina
Fairbanks, AK 99701

GOLDPOST MINING CO.
Richard Lindsten
Box 23
Central, AK 99730

GORESEN, EDMUND J.
P.O. Box 91
Seward, AK 99664

GOTTSCHALK, MICHAEL T.
SR Box 22138
Fairbanks, AK 99701

GRANITE INVESTMENT INC.
Box 104462
Anchorage, AK 99510

GRANITE MT. MINING
Thomas & Myrtle Johnson
P.O. Box 608
Nome, AK 99762

GRANT LAKE DEVELOPMENT CO. INC.
SR Box 600
Seward, AK 99664

GRATEFUL DOG MINING CO.
Roger B. McPherson
1563 Jones Rd.
Fairbanks, AK 99709

GREAT AMERICAN MINING
George R. Haskins
Box 1777
Fairbanks, AK 99707

GREATLAND EXPLORATION LTD.
R.C. Sheardown
3512 Campbell Airstrip Dr.
Anchorage, AK 99502
(various)

GREBE, GORDON S.
3605 Arctic, No. 1109
Anchorage, AK 99503

GREEN MINING & EXPLORATION
Douglas Green
Box 61455
Fairbanks, AK 99706

GRIEVE, ROBERT C.
Box 28
Eielson Air Force Base, AK 99506

GUMAER, MARK & ROBIN
General Delivery
Nome, AK 99762

GUTHRIE MINING
P.O. Box 61367
Fairbanks, AK 99701

GUTHRIE MINING
H. Paul Guthrie
RD No. 2
Mesick, MI 49668

HADLEY, A.A.
Box 889
Bella Vista, CA 96008

HAGEN, ALBERT M. RTM CO. INC.
General Delivery
Manley Hot Springs, AK 99756

HALL, ESSE
3521 E. 42nd, No. 202
Anchorage, AK 99508

HALVERSON, VINCENT E. &
MORRIS D. WOLTERS
Alaska Ventures
3307 W. 81st Ave.
Anchorage, AK 99503

HAM MINING CO.
Box 65
Chicken, AK 99732

HAMMOND, CHARLES R.
General Delivery
Chicken, AK 99732

HANKS, G.A. & SONS
Box 2533, Hwy. 16
West Sacramento, CA 95691-2098

HANSLER ENTERPRISES
Fred Hansler
2004 W. Wall
Midland, TX 79701

HARMS & CO. (2)
Donald Harms
Box 49
McGrath, AK 99627

HARTMAN, MICHAEL G.
2876 Monarch Rd.
Fairbanks, AK 99712

HART, JOHN & JUDITH
P.O. Box 58334
Fairbanks, AK 99701

HATCH, EDWIN L.
Box 1801
Nome, AK 99762

HAYDEN EXPLORATION & MINING
Forest A. Hayden
Box 110930
Anchorage, AK 99511

HEADWATERS EXPLORATION
Gregory S. Korman & Loren Dodds
1351 Virginia Ct.
Anchorage, AK 99501

HEFLINGER MINING & EQUIPMENT CO.
Box 82390
Fairbanks, AK 99708

HEFLINGER MINING CO.
Carl F. Heflinger
665 10th Ave., No. 307
Fairbanks, AK 99701

HENDRICKSON, JACK, JR.
P.O. Box 10154
Fairbanks, AK 99710

HENRICKS, BOB & JAMES BELFIELD
Box 1934
Fairbanks, AK 99707

HERZOG, MARTIN M. & JEAN A.
14250 Sabine St.
Anchorage, AK 99516

HOFFMAN MINING
Russell D. Hoffman
SRB Box 153
Copper Center, AK 99573

HOLBROOK, CLYDE & LOREN KEATING
Rt. 2, Box 226
Sterling, AK 99672

HOOGENDORN, HOMER E. & WM, SR.
Box 84
Nome, AK 99762

HOOPER, GERALD W.
Box 2750
Palmer, AK 99645

HOPE MINING CO.
Box 101827
Anchorage, AK 99510

HOPEN, ALF
Box 74246
Fairbanks, AK 99707

HORNER, GEROGE
Box 60610
Fairbanks, AK 99707

HOUSE/KRIZAK MINING
General Delivery
Nome, AK 99762

HOUSTON, LARRY E. & SMALLBRIDGE, JOHN R.
6421 Rockridge Dr.
Anchorage, AK 99516

HOW, WILLIAM H.
Box 105
Hope, AK 99605

HUBBARD, LLOYD D.
No. 8
Manley Hot Springs, AK 99756

HUGHES, KENNETH A. III
Box 586
Teller, AK 99778

HUMPHREY, H.M. & COY HILL
Box 1920
Fairbanks, AK 99707

HUNTER, CLAYTON
8707 Somers Place
Anchorage, AK 99502

IARIO, WANDA B.
Box 4-1721
Anchorage, AK 99509

INTERIOR ALASKANA ASSOC.
742 Bennett Rd.
Fairbanks, AK 99712

J.C. ANPAS, INC.
Charles A. Paskvan
379 Division St.
Fairbanks, AK 99712

JACHIM, WILLIAM A.
1125 Cartleb Ct.
Fairbanks, AK 99712

JACKSON MINING CO.
Roy E. Traxler & Naimy Birklid
936 Coppet St.
Fairbanks, AK 99709

JACKSON, ROD
3953 James Dr.
Anchorage, AK 99504

JENSEN, DANIEL D.
Box 12
Delta Junction, AK 99737

JILES, O.J.
5250 Auburn Folsom Rd.
Loomis, CA 95650

JOBARICK, ENT
2561 Steese Hwy.
Fairbanks, AK 99712

JOHNSEN, MARY
Thunderbird Apts. No. 7
3865 Peger Rd.
Fairbanks, AK 99701

JOHNSON MINING
Brian C. Johnson
7205 N.E. 156th St.
Bothell, WA 98011

JONES & COMPANY
W. Deering Jones
Mile Post 49-3/4, Seward Hwy.
Moose Pass, AK 99631

K C MINING CO.
Kenneth C. Hanson
Box 10657, Steese Branch
Fairbanks, AK 99710

K & K MINING CO.
Keith R. Mitchell
10841 Livingstone St.
Anchorage, AK 99516

KACHEMAK MINING CORP.
Willow Creek Mining Partnership Ltd.
Box 72
Chicken, AK 99732

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

KAKO MINE
David Penz
Russian Mission, AK 99657

KALBERG, PETER
Box 598
Anchor Point, AK 99556

KALOUS, JOE
7950 Steese Hwy.
Fairbanks, AK 99712

KANGAS, ALBERT W. (2)
Box 1
Ruby, AK 99768

KANTISHNA MINES LTD.
2020 Lake Otis Pkwy.
Anchorage, AK 99508

KANTISHNA MINING CO. INC.
Box 100466
Anchorage, AK 99510

KAVIC MINING CO.
George Robinson
Box 149
Tok, AK 99780

KELLIHER MINING
Box 216
Nome, AK 99762-0216

KELLY MINING
General Delivery
Manley, AK 99756

KENCO MINING
8810 Rendon Dr.
Anchorage, AK 99507

KENNETH A. LUND CO.
Box 74775
Fairbanks, AK 99701

KILE, ALVIN OR ERIC
Box 140424
Anchorage, AK 99514

KLK INC.
Sam Koppenberg
SRD Box 9070
Palmer, AK 99645

KNIK GRAVEL PIT
Jim L. McCourt
P.O. Box 871666
Wasilla, AK 99687
(gravel)

KNUDSON, RICHARD
Box 210168
Anchorage, AK 99521

KORMAN, GREGORY & LOREN DODDS
1351 Virginia Ct.
Anchorage, AK 99501

KREMER, ROBERT G. & BETTY
381 Pauline
Anchorage, AK 99504

KRENAKE, MARK
Box 422
Nenana, AK 99760

KRISTI PHYLEE MINING
James M. Parry
Box 1656
Fairbanks, AK 99707

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

L & B MINING
D.B. Parent & D.A. Young & M Dozette
1015 10th Ave.
Fairbanks, AK 99701

L B J MINING INC.
1013 E. Dimond Blvd.
Box 144
Anchorage, AK 99515

LaCHANCE DE TARIAINEN
Keith LaChance & Candi Tariainen
Rt. 1, Box 869
Kenai, AK 99611

LACROSS, JACK
Box 331
Soldotna, AK 99669

LANGE, ROBERT L.
5002 Cambridge Way
Anchorage, AK 99503

LAPPI, ARTHUR J. (2)
Box 101094
Anchorage, AK 99510

LARSON, JUANITA
3301 Commercial Dr., No. 9
Anchorage, AK 99501

LAYLAND FAMILY & GRAVEST INC.
4300 E. 3rd
Anchorage, AK 99508

LEONARD, HARRY
Wiseman, AK 99701

LESTER, RAY
732 Old Steese Hwy., No. 8
Fairbanks, AK 99712

LIGHT, BILL & CLARA
313 Minnie St.
Fairbanks, AK 99701

LILLIAN CREEK MINE INC.
P.O. Box 60334
Fairbanks, AK 99706

LINDPHIL MINING CO.
Box 1848
Nome, AK 99762

LITTLE SQUAW GOLD MINING CO.
Box 184
Spokane, WA 99210

LIVENGOOD PLACERS INC.
6245 North 24th St.
Phoenix, AZ 85016

LONE SPRUCE MINING
George R. & William R. Strickler
16900 Ransom Ridge Rd.
Anchorage, AK 99516

LOPETRONE, ROBERT
10601 Matsuschin Bay Circle
Anchorage, AK 99502

LOSONSKY, STEVE M.
Box 80321
Fairbanks, AK 99708

LOST RIVER MINING
Box 411
Nome, AK 99762

LUCAS, BOBBY
P.O. Box 871481
Wasilla, AK 99687

LUCAS, DONALD L. (2)
1803 Kepner Ave.
Anchorage, AK 99504

LUCY CREEK MINE
Claude H. Morris, Jr.
Box 547
Girdwood, AK 99587

LUCKY '7' MINING CO.
Ronald Roman
Box 1614
Fairbanks, AK 99707

LYMAN RESOURCES IN ALASKA INC.
Box 192
McGrath, AK 99627

M & M MINING
Rodney D. Mitchell
3133 Chena Hot Springs Rd.
Fairbanks, AK 99712

M & P LTD
Berg Craigen
Mile 90 Taylor Hwy.
Box 24
Chicken, AK 99702

MAGIC CIRCLE INC.
1096 Shoshone St.
North Pole, AK 99705

MAMMOTH MINE
Rose Rybachek
P.O. Box 55698
North Pole, AK 99705

MANNS, MICK AND CECILIA
55 Mile N of Bettles
Bettles, AK 99726

MANIA MINING
Scott B. Thorngren
336 Farewell
Fairbanks, AK 99701

MARMOT MINING & EXPLORATION INC.
Box 1789
Palmer, AK 99645

MARTIN, EDWARD D., JR. (3)
Box 3166
Palmer, AK 99645

MASON, ARNOLD J.
203 East St.
Fairbanks, AK 99701

MASTEL, FRED W.
6400 O'Malley Rd.
Anchorage, AK 99507

MATHEWS, RAY
General Delivery
Tok, AK 99780

MAXWELL MINE & EXPLORATION
Leslie L. Maxwell
3910 Loc Sault Ave.
Anchorage, AK 99516

McCASTER, JIMMY
Box 774407
Eagle River, AK 99577

McCRARY, WAYNE (2)
2020 Wetmore
Everett, WA 98201

McINTOSH, RICHARD L.
P.O. Box 84246
Fairbanks, AK 99708

McISAAC, GARRY N.
P.O. Box 531
Abbotsford, B.C., Canada V2S 5Z5

McWILLIAMS MINING
Howard F. McWilliams
Box 101317
Anchorage, AK 99510

MELDRUM, BILL
Chicken, AK 99732

MENDENHALL, KEITH, JR.
Box 1406
Fairbanks, AK 99707

MERRINGTON, JACK
5081 Laurel St.
Anchorage, AK 99507

MERRITT, SHANNON
377 Banner Ln.
Soldotna, AK 99669

MESPELT & ALMASY MINING CO.
Nixon Fork Mine
McGrath, AK 99627

MEYERS, BUD-VENNSILL-JOHNSTON
627 Gaffney
Fairbanks, AK 99729

MIKNICH, CHARLES M.
3600 Taiga Dr.
Anchorage, AK 99516

MILLER, HERSHEL D.
Box 289
Mary Dale Ct.
Soldotna, AK 99669

MILLER, MARY E.
Box 101654
Anchorage, AK 99510
(gravel)

MILLER, RUSS & JIM HALLORAN
6725 Blackberry
Anchorage, AK 99502

MILLER, VERNON
Skyline Dr.
Fairbanks, AK 99712

MISCOVICH, ANDREW W.
Box 1489
Fairbanks, AK 99707

MITCHELL, HAROLD
Rt. 1, Box 287
Baraga, MI 49908

MOORE, ROGER B. (5)
Box 4335
Kenai, AK 99611

MORGAN, JAMES
Box 48
Hope, AK 99605

MORRIS, GEORGE A.
Box 16242
Two Rivers, AK 99716

MRAK PLACER MINE
Mrak, Herman & Aklestad, Herman
Box 1963
Palmer, AK 99645

MUNJAR, SAMUEL L., SR.
1316 Bedrock
Fairbanks, AK 99701

MULLIKIN, DONALD E. (2)
Box 790
Homer, AK 99603

N B TWEET & SONS
Box 503
Teller, AK 99778

NEUBAUER, JACK
Manley Hot Springs, AK 99756

NISTLER ENTERPRISES
Paul B. Nistler
P.O. Box 952
Delta Junction, AK 99737

NODEN, FRED
Box 47
Dillingham, AK 99576

NORCROSS-STONEBERG MINING CO.
James H. Norcross
Box 242
Willow, AK 99688

NORDEEN, WILLIAM H.
Emma Creek
Coldfoot, AK 99701

NORTHERN BONANZA
Richard Busk
Box 100971
Anchorage, AK 99510

NUGGETT ESTATE MINING CO.
Edward W. & Grace J. Montgomery
Box 60430
Fairbanks, AK 99706

NUTTING, JACK OR PAT
202 Longacres
Grants Pass, OR 97527

O'CARROLL, JOHN J.
Ophir
McGrath, AK 99627

OHMAN, WILLIAM A.
Box 10094
Fairbanks, AK 99709

OLD YELLER MINING
Mile 260 Parks Hwy.
Healy, AK 99743

OLSON, ALAN G. & VICTOR E. LOYER
Box 165
Palmer, AK 99645

OLSON, STEVEN (2)
Box 10035
Fairbanks, AK 99710

OSBORN, LLOYD J.
Box 876053
Wasilla, AK 99687

OSBORNE, RICHARD H.
Box 5210
Madison, WI 53705

OTECO INC.
6455 N.E. Columbia Blvd.
Portland, OR 97218-2996

P & P MINING
Paul W. White & Patrick D. Peede
2551 Peede Rd.
North Pole, AK 99705

PMX TOTEM MINES
David McClurg
Box 129
Kiana, AK 99749

PAGE, MAURICE E.
Box 46
Chicken, AK 99732

PARDNERS MINING (3)
c/o Bill Herman
Box 722
Palmer, AK 99645

PARENT, BRUCE
1015 10th Ave.
Fairbanks, AK 99701

PARKER, GLADYS H.
P.O. Box 552
Fairbanks, AK 99701

PARKER, HAROLD F. (2)
General Delivery
Talkeetna, AK 99676

PASQUAL, PETE III
Wiseman
c/o Coldfoot, AK 99726

PAYCHECK MINING
Stella D. Lavender
General Delivery
Boundary, AK 99790

PAVEY MINING/ MARION A. (2)
4751 Drake
Fairbanks, AK 99701

PAYNE, MAC
1079 Victor
North Pole, AK 99705

PAYNE, MAC
Box 56644
North Pole, AK 99705

PAUL & CO.
Paul Manuel
Box 83102
Fairbanks, AK 99708

PETERS CREEK MINING CO.
Floyd & Ann Howell
2222 Lord Baranof
Anchorage, AK 99517

PETERSON, FRANCES
P.O. Box 473
Nome, AK 99762

PETERSON, GARY (2)
P.O. Box 822
Homer, AK 99603

PETERSON, WALTER (2)
Box 55171
North Pole, AK 99705

PETTIT, ARGILE E.
Box 2591
Palmer, AK 99645
(precious metals)

PHILLIPS, WALTER T. & STANLEY LINDSKOOG
Box 3304
Homer, AK 99603

PHILPOTT, ROY
115 Charles St.
Fairbanks, AK 99701

PLACERS, MICHAEL
1610 Southern
Fairbanks, AK 99701

PLACID OIL CO.
J.C. Jones
3900 Thanksgiving Tower
Dallas, TX 75201

PLACK, PHILIP E. & PAUL W.
P.O. Box 2325
Palmer, AK 99645

PLOCKWIETZ, CARL
General Delivery
Nome, AK 99762

POLAR MINING INC. (3)
4545 Woodriver Dr.
Fairbanks, AK 99709

PORTAGE CREEK MINING CO.
George Bailey
Box 2052
Fairbanks, AK 99701

PORTER, RALPH J.
Box 72
Soldotna, AK 99669

POWERS, WILLARD B. & HAROLD H. RUPPERT
Box 1441
Santa Ana, CA 92702

PRINCE CREEK MINING CO.
Alvin H. Aghoff
General Delivery
Flat, AK 99584

PROSPECTING GEOPHYSICS CO.
Robert G. Reinhardt & John Kerrigan
3728 W. 61st
Anchorage, AK 99501

PSENAK CONSTRUCTION
Box 1365
Palmer, AK 99645

RGA MINING & BONANZA MINING (2)
Douglas L. Miller
Box 127
Central, AK 99730

R & R MINING (3)
General Delivery
Talkeetna, AK 99676

R & W MINING
Martin & Robert Wortman
General Delivery
Takotna, AK 99675

RADER, MATHEW W.
8525 Rangeview
Anchorage, AK 99504

RADTKE, PHIL
14251 Sabine St.
Anchorage, AK 99516

RAINES, LINDY & LARRY
1313 Skyline Dr.
Fairbanks, AK 99712

RAMEIER, DALE
Box 10189
Fairbanks, AK 99710

RAY WOLF MINING INC.
Ray D. Wolf
Box 625
Cave Junction, OR 97523

READER, C.M. & HUGO LINDFORS
Box 355
Nome, AK 99762

RED TOP MERCURY MINES INC. (2)
Box 81
Dillingham, AK 99576

RENDER, LEON G.
2035 Lorry Dr.
North Pole, AK 99705

RENSHAW, A.L. & SHELLEY M. GRANT
8010 Little Dipper No. B
Anchorage, AK 99504

RESOURCE ASSOCIATES OF ALASKA INC. (3)
122 1st Ave.
Fairbanks, AK 99701

REYBURN, ERIC
406 12th Ave.
Fairbanks, AK 99707

RICHTER, FRED
Box 1285
Fairbanks, AK 99707

RIDNER, EARL R.
P.O. Box 40154
Clear, AK 99704

ROBERTSON MINING CO.
Juan P. Robertson
4723 E. Mohave Pl.
Paradise Valley, AZ 85253

ROSS, EDWARD
Box 61017
Fairbanks, AK 99706

ROTTER, RAY
General Delivery
Wiseman, AK 99790

ROWALLAN MINE PARTNERSHIP
Joseph A. Malatesta Sr. & Assoc.
Box 318, Clam Gulch
Mile 123 Sterling Hwy.
Clam Gulch, AK 99568

RUBEL, JOHN D.
8183 Richardson Hwy.
Salcha, AK 99714

RUBLE, ROY L. (2)
Box 80351
Fairbanks, AK 99708

RUSSELL, ERNEST C.
General Delivery
Manley, AK 99756

RUSSELL, GENE
Box 21
Central, AK 99730

S & H ENTERPRISES
Box 180 HCR 4
Deer River, MN 56636

SALTER ASSOCIATES
Ed Salter
General Delivery
Manley, AK 99756

SANFORDS GRADING SERVICE
James G. Sanford
Box 1171
Palmer, AK 99645
(stone, sand, & gravel)

SAYER, PHILIP
Box 10
Homer, AK 99603

SCHNABEL, JOHN J.
P.O. Box 149
Haines, AK 99827

SCHURR, JOHN & ANDRE SANDERS
1905 Persinger Dr.
North Pole, AK 99705

SCUFFART, GEORGE W., JR.
Box 156
Central, AK 99730

SELMON, EVERETT
1062 Pine Point Rd.
Republic, WA 99166

SEVERSON, ROGER A.
Box 149 Crestview Ln.
Eagle River, AK 99577

SHEMEL, STEVEN E.
S.R. 5187-A
Wasilla, AK 99687

SHILLING, JOHN A. (2)
Box 81424
Fairbanks, AK 99708

SHORT GULCH MINING CO. LTD.
P.O. Box 9
Ruby, AK 99768

SILVA, JAMES D.
11551 Via Appia Way
Anchorage, AK 99515

SILVERADO MINING CO.
Box 2357
Fairbanks, AK 99701

SIMMONS, THOMAS G.
General Delivery
Anchor Point, AK 99556

SIMPSON, JOHN W. & JOHN J. BRENNAN
17147 Belarde
Anchorage, AK 99516

SIMONSON, RALPH
Rt. 2, Box 67A
Elgin, OR 97827

SINGIN' SAM'S RAINBOW MINE
Garland H. Achman
Box 149
Tok, AK 99780

SIPES, JOHN W.
Box 55254
North Pole, AK 99705

SLATT, JOHN
6914 Hwy. 30 W.
The Dalles, OR 97058

SMITH EQUITIES
7100 Homer Dr.
Anchorage, AK 99518

SMITH, SHERMAN C.
Box 770
Cooper Landing, AK 99572
(lime)

SMK 2 MINING (2)
Michael A. Sweetsir
Box 18
Ruby, AK 99768

SMITH, WILLIAM L.
906 Cunningham
Anchorage, AK 99501

SYNDER, DONALD
61 Clark St., No. 2
Salinas, CA 93901

SOULE, BETTY M. & HAROLD L.
2840 E. 142nd Ave.
Anchorage, AK 99516

SPHINX AMERICA INC.
Box 81978
Fairbanks, AK 99708

STAHL, HELEN M.
5817 Winding Way
Anchorage, AK 99504

STEPOVICH, VUKA
Box 81978
Fairbanks, AK 99708

STEPP, VERNON E.
290 Pearl Dr.
14.9 Chena Hot Springs Rd.
Fairbanks, AK 99712

JIM STEWARD
835 Faultline Ave.
North Pole, AK 99705

STEWART, HERBERT I. (2)
(estate of)
531 W. 4th Ave.
Anchorage, AK 99501

STUDINAK, GERALD
352 Breeze Rd.
Fairbanks, AK 99712

SUTTON, PHIL
Box 9061
Coldfoot, AK 99701

SWAN, JAMES W.
452 Winter Ave.
Fairbanks, AK 99712

SWENSON, LLOYD D.
1843 Bridgewater
Fairbanks, AK 99701

T.J. MINING
SRD Box 9068
Palmer, AK 99645

TAINTER, KENNETH
Rt. 7, Box 3
International Falls, MN 56649

TAYLOR, ARLEY R.
923 W. 11th
Anchorage, AK 99501

TAYLOR, TOMI B.
General Delivery
Trapper Creek, AK 99688

THE MINING CO.
John E. McClain
Box 436
Soldotna, AK 99669

THICKE, HENRY A.
Rt. 1
Bangor, WI 54614

THOMAS, JOHN C.
2994 Dyke Rd.
North Pole, AK 99705

3 D MINING CO.
Dennis E. Wyatt
SRC Box 8100-L
Palmer, AK 99645

THURMAN OIL & MINING
Jim Thurman & Wally Simmons
925 Aurora Dr.
Fairbanks, AK 99709

THURMAN OIL & MINING (3)
925 Aurora Dr.
Fairbanks, AK 99709

THURNEAU, NEIL
Boundary, AK 99790

TITCHENAL, ROBERT & SHIRLEY
7808 Honeysuckle Dr.
Anchorage, AK 99502

TILLICUM RESOURCES INC.
1615 Madison Dr.
Fairbanks, AK 99709-5533

TOOHEY, CYNTHIA D. (2)
Box 113
Girdwood, AK 99587

TOUPE, WALLACE M.
122 First Ave.
Fairbanks, AK 99701

TRAUTNER, JOHN J.
Box 909
Girdwood, AK 99587

TREASURE CREEK MINING (2)
Donald M. Read
Box 1638
Fairbanks, AK 99707

TRIBBLE, HOMER D.
Jim River
c/o 2301 Peger Rd.
Fairbanks, AK 99701

TRI-CON MINING, INC. (5)
Box 83830
Fairbanks, AK 99708

TRINITY GOLD INC.
John H. Preston
P.O. Box 523
Kodiak City,
Kodiak Island, AK 99615

TRINITY MINING
N.B. Tweet & Sons
Box 503
Teller, AK 99778

TRUE NORTH MINING
323 6th Ave., No. 169
Fairbanks, AK 99701

TRYCK, KEITH
P.O. Box 310
Girdwood, AK 99578

TUCKER, ROBERT
3101 Rose St.
Anchorage, AK 99508

TUCKER, RONALD K.
P.O. Box 60334
Fairbanks, AK 99706

TULUKSAK DREDGING LTD. (2)
737 E St.
Anchorage, AK 99501

TUNDRA EXPLORATION
D.B. Vial & D.W. Comstock
General Delivery
Candle, AK 99790

UHER, M. & E., H.E. KRISMAN, G. & L. FERGUSON
16500 Chasewood Ln.
Anchorage, AK 99616

UNDERWOOD, DAVID
Box 53
Central, AK 99730

UNLUCKY O
Kenneth E. Dunshie
4579 Woodriver Dr.
Fairbanks, AK 99709

VAIL, MICHAEL L.
General Delivery
Candle, AK 99728

VAN OSTRAND, TOM C.
Box 314
Mile 249 Parks Hwy.
Healy, AK 99743

VEGOREN, EARL
Box 274
Delta Junction, AK 99737

VETTER, RUDY
Box 342
Fairbanks, AK 99707

VICKERY, EULA
Box 213
Kenai, AK 99611

VIDAL, ANGEL C.
433 M St.
Anchorage, AK 99501

VOGLER, JOE
Box 110
Fairbanks, AK 99707

VOGLER, JOSEPH E.
Box 40
Fairbanks, AK 99707

WADE REESE MINING CO.
Wade Reese
Box 141086
Anchorage, AK 99514

WALKER, G.T.
Box 6385
Wetaskiwin, Alberta
T9A 2G3, Canada

WALKER, TOM
Box 90690
Fairbanks, AK 99710

WALSH, JOHN D.
Box 179
Nome, AK 99762

WARNER, HELEN H.
Box 80674
Fairbanks, AK 99708

WAYSON, MARK N.
999 Ballaine Rd.
Fairbanks, AK 99709

WELCOME, ROBERT
17625 N.E. 65th St.
Redmond, WA 98052

WESCOTT, ANDREW G. & PAMELA
1132 Lakeview Terrace
Fairbanks, AK 99701

WESTON, THOMAS & RICHARD STOUGH
Box 711
Wrangell, AK 99929

WESTLAKE, LARRY
General Delivery
Kiana, AK 99749

WHALEY, FRANK H. & NEVA
30220 Coyote Run
Valley Center, CA 92082

WHALEY, LON, E.
Box 377
Girdwood, AK 99587

WILD RIVER VENTURES
Edward G. Wallace, Jr.
General Delivery
Bettles, AK 99726

WILKES, FRED
1013 E. Dimond Blvd.
Box 144
Anchorage, AK 99515

WILKINS, DENNIS
General Delivery
Willow, AK 99688

WILKINSON, FRED
Box 2702
Fairbanks, AK 99707

WILLFORD, FRANK E. & VIVIAN D.
Box 10570
Fairbanks, AK 99710

WILLIAMS, DOVER T.
Box 81466
Fairbanks, AK 99708

WILLIAMS, RUSSELL H.
Box 1505
Fairbanks, AK 99707

WILLIAMS, WILBUR A. & ANN J.
Flat, AK 99584

WILSON, HARRY H.
Box 47
Chicken, AK 99732

WINDFALL GOLD MINING CORP.
P.O. Box 1929
Nome, AK 99762

WOLCOTT, JIM L.
Box 200283
Anchorage, AK 99520

WOLD, GORDON
3605 Arctic, No. 561
Anchorage, AK 99503

WOLFF, ROBERT V.
Boundary
via Tok, AK 99780

WOOD, BUD
Box 9
Hope, AK 99605

WOODMAN, SUMNER S.
Box 1185
Homer, AK 99603

WOODRUFF, CHARLES B.
Box 2278
Fairbanks, AK 99707

WRIGHT, DONALD R.
Box 61617
Fairbanks, AK 99706

WRIGHT, JULES
Manley, AK 99756

WYATT, FRED
Box 1384
Fairbanks, AK 99707

WYMAN, LEWIS B.
Box 3285
Palmer, AK 99645

WYRICK, L.E. & M.A.
Box 261
McGrath, AK 99627

YOUNG, ROBERT V.
Box 211
Talkeetna, AK 99676

YOUNG, ROBIN A.
Box 101377
Anchorage, AK 99510

YRJANA, ALBERT M.
Box 5
Ruby, AK 99768

YUKON MINING CO. INC. (2)
Box 101454
Anchorage, AK 99510

YUTAN CONSTRUCTION CO.
Carroll-Yondra Inc.
Box 1775
Fairbanks, AK 99707

ZERBE, LES P.
356 Louise Ln.
Fairbanks, AK 99701

ZIMMER, GEORGE W.
Box 140174
Anchorage, AK 99514

APPENDIX E
Placer mine permitting process

In order to conduct placer exploration or mining activities in the State of Alaska, permits and licenses are required from as many as 12 state and federal agencies outlined in figure 47. At least three different applications must be submitted: the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers require separate applications from prospective miners, and the Annual Placer Mining Application (APMA) is submitted to the state Division of Mining. Division of Mining reviews the APMA for completeness and, after acceptance, distributes copies to 11 other state and federal agencies. Permits may or may not be required and issued by the various agencies, but they are all given the opportunity to make that decision. This process relieves the operator of much duplication of effort in the permitting process.

Agencies who review the APMA may: (1) issue the required permit with applicable stipulations; (2) request more information from the operator before issuing a permit; (3) take no action because no permit is required from that agency; or (4) deny the permit, either under their statutory and regulatory authority or by court injunction. This 'one stop' permitting process allows operators to receive all permits and licenses required other than permits required by the federal Clean Water Act. Permits under the Clean Water Act are issued by the EPA and the Corps of Engineers and include wastewater discharge permits from EPA and wetlands permits from the Corps of Engineers. As shown on the permit diagram, an operator must apply directly to each agency to obtain permits.

If the mining operation is in an Alaska coastal district, a coastal management consistency determination must be made. The Division of Governmental Coordination gathers input from all resource agencies, as well as the affected coastal district, to formulate this determination, and the proposed project must be judged consistent with the approved district plan before operational permits may be issued.

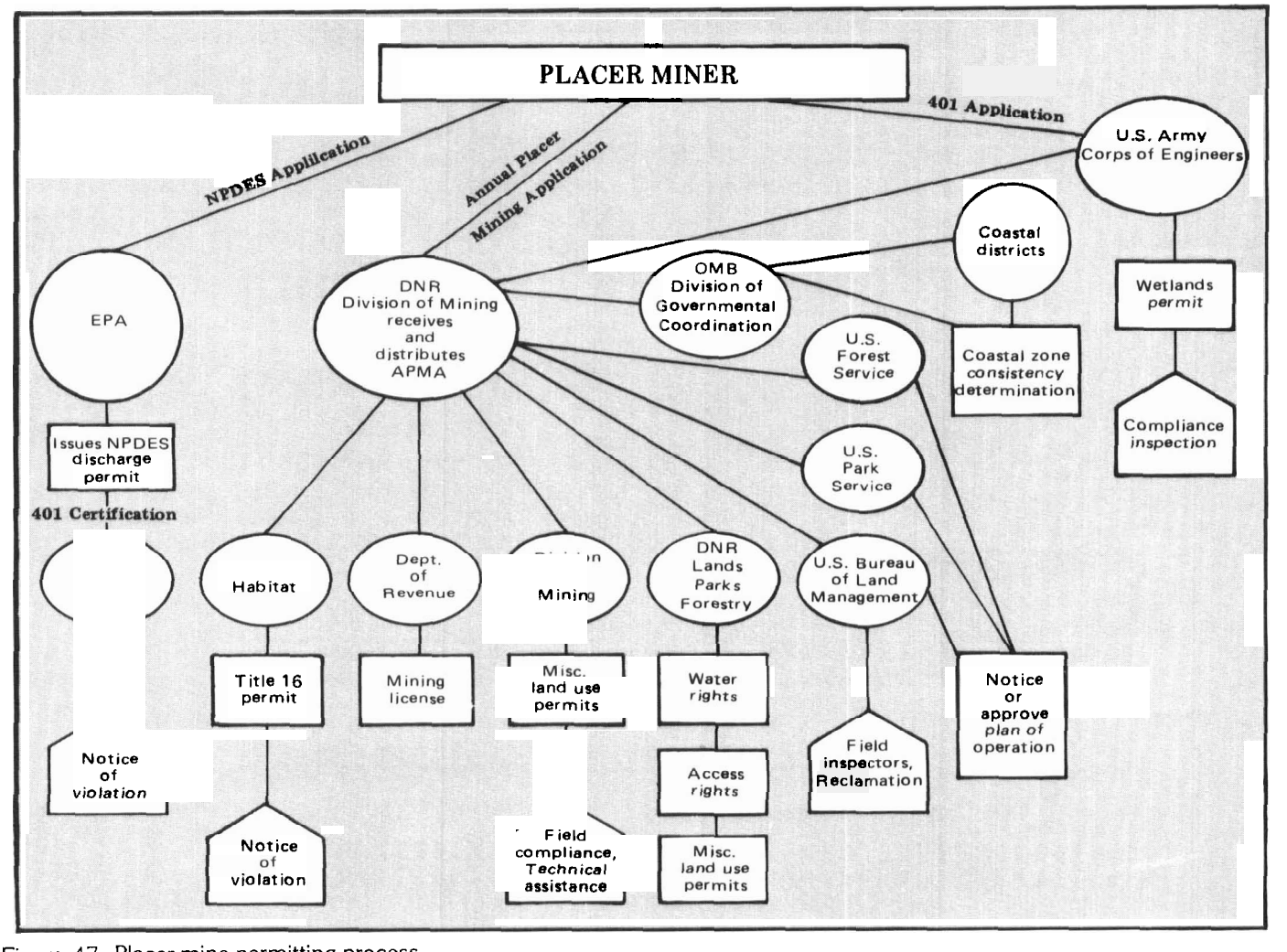


Figure 47. Placer-mine permitting process.

APPENDIX F
Primary metals production in Alaska, 1880-1987.[a]

Year	Gold		Silver		Mercury		Antimony		Tin		Lead		Platinum		Copper		Chromium	
	(oz)	(md)	(oz)	(td)	(flask[b])	(td)	(lb)	(td)	(lb)	(td)	(tons)	(td)	(oz)	(td)	(lb)	(md)	(tons)	(td)
1880-1899	1,153,889	23.85	496,101	32.9	—	—	—	—	—	—	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	457,343	16.01	154,700	100.0	—	—	—	—	8,200[c]	4.3	839	62.1	2,555	85.6	121,000	0.06	—	—
1935	455,429	15.94	286,600	206.0	—	—	—	—	98,800	49.8	815	65.2	8,685	259.6	15,056,000	1.25	—	—
1936	526,000	18.43	484,306	375.0	—	—	—	—	226,000	105.0	941	86.6	5,654	241.9	39,267,000	3.72	—	—
1937	582,085	20.37	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	665,114	23.28	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	747,943	26.18	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

[a] References from T.K. Bundtzen, DGGS, Fairbanks.

[b] 76-lb flask.

[c] When state and federal figures differ significantly, state figures are used.

[d] Not traceable by year.

[e] Crude platinum; total production of refined metal is about 575,000 oz.

W = Withheld.
— = Not reported.
td = Thousand dollars.
md = Million dollars.

APPENDIX F — Continued

Year	Gold		Silver		Mercury		Antimony		Tin		Lead		Platinum		Copper		Chromium	
	(oz)	(md)	(oz)	(td)	(flask[b])	(td)	(lb)	(td)	(lb)	(td)	(tons)	(td)	(oz)	(td)	(lb)	(md)	(tons)	(td)
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	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	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	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	W	W	—	—	288,000	460.0	—	—	W	W	—	—	—	—
Other [d]	—	—	—	—	1,438	W	—	—	—	—	—	—	333,936	46,940.3	—	—	—	—
TOTAL	31,700,612	1,321.45	19,969,895	15,769.3	40,945	9,910.5	11,070,800	6,655.1	6,707,400	10,622.9	26,300	3,014.8	668,497 [c]	65,792.1	1,373,793,932	228.04	39,051	3,426.7

APPENDIX G
Production of industrial minerals, coal, and other commodities in Alaska, 1880-1987[a]

Year	Gold (s. tons)	Gold (md)	Sand and gravel (s. tons)	Sand and gravel (md)	Building stone[b] (s. tons)	Building stone[b] (md)	Barite (s. tons)	Barite (td)	Other[c] (dollars)
1880-1899	19,429 [d]	0.14 [d]	—	—	7,510	0.04	—	—	—
1900	1,200 [d]	0.20 [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
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

[a] Production histories for most commodities are summarized in Bundtzen (1982), Bundtzen and Smith (1982), and Bundtzen and others (1982).

[b] Building-stone production figures for 1880-1937 are for the southcentral and interior regions of Alaska only.

[c] Includes 2.4 million lb U_3O_8 (1955-71); 505,000 tons gypsum (1905-26); 286,000 lb WO_3 (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).

[d] When 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 md) and federal (42,614,000 s. tons; 88.96 md). The federal estimate was not added to total production.

[e] Production not traceable by year.

[f] Marble quarried on Prince of Wales Island, southeastern Alaska (1900-41).

W = Withheld.
— = Not reported.
td = Thousand dollars.
md = Million dollars.

APPENDIX G — Continued

Year	Gold (s. tons)	Gold (md)	Sand and gravel (s. tons)	Sand and gravel (md)	Building stone [b] (s. tons)	Building stone [b] (md)	Barite (s. tons)	Barite (td)	Other [c] (dollars)
1946	368,000	2.36	W	W	—	—	—	—	2,005,241
1947	361,220	2.55	W	W	—	—	—	—	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	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	803,000	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	16.0	—	—	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
Other [e]	—	—	—	—	2,300,000 [f]	W	79,000	W	—
TOTAL	35,953,568	455.63	994,196,084	1,933.13	83,206,836	288.29	856,000	11,417.0	172,849,872

Back cover: *Upper left — Miner Anthony Williams emerges from underground after completing a shift at the AJ Mine near Juneau. Photograph by Thyes Shaub, Alaska Division of Business Development, 1987.*

Upper right — A 28-oz placer-gold nugget was mined by John Miscovich from the Golden Horn claims group in the Otter Creek drainage, Iditarod mining district, western Alaska. Photograph by K.F. Bull, 1987.

Center left — The NYAC No. 4 dredge of the Tuluksak Dredging Co. operates on Upper Bear Creek in the Aniak mining district, western Alaska. Photograph by T.K. Bundtzen, Alaska Division of Geological and Geophysical Surveys, 1987.

Center right — Underground miners Henry Castongay and Dave Riggleman wire blast-hole explosives at the Greens Creek mine on Admiralty Island near Juneau, Alaska. Photograph by Tom Crafford, Greens Creek Mining Co., 1987.

Bottom — A bulldozer spreads gravel over geotextile fabric during construction of the Red Dog mine pioneer road in northwest Alaska. Photograph courtesy of Cominco Alaska, Inc., 1987.