ALASKA’S MINERAL INDUSTRY, 1986

By T.K. Bundtzen, C.B. Green, James Deagen, and C.L. Daniels

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS
SPECIAL REPORT 40

STATE OF ALASKA
Steve Cowper, Governor
Fairbanks, Alaska
1987
FOREWORD

Special Report 40, ‘Alaska’s Mineral Industry - 1986,’ is the sixth annual report produced by the Department of Commerce and Economic Development Division of Minerals and Forest Products 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 1986, the value of the mineral industry to Alaska’s economy was $231.7 million, a decrease of 14 percent from 1985. With the exception of increased coal production, all other phases of mineral-industry activity declined: exploration expenditures by 2 percent, development expenditures by 29 percent, and sand-and-gravel production by 26 percent.

The volume of gold production decreased 16 percent, and the number of placer mines decreased 27 percent, despite a significant increase in gold prices from the previous year. Federal lawsuits related to mining activity on federal lands and uncertainties about water-quality regulations contributed significantly to the decrease in mining activity in Alaska. For the first time in 83 years, no gold was mined in the historic Kantishna mining district as a result of a lawsuit brought against the National Park Service.

Despite the overall decline in mining and exploration activity, several encouraging developments occurred in 1986. The decision was made by Cominco Alaska, Inc., to begin road and dock construction at the Red Dog zinc mine; action was taken by Amselco Minerals Company toward full development of the Greens Creek silver-gold mine; and Inspiration Gold, Inc., continued its exploration of offshore gold-placer deposits near Nome with the world’s largest bucketline dredge.

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ALASKA'S MINERAL INDUSTRY, 1986

By T.K. Bundtzen¹, C.B. Green², James Deagen³, and C.L. Daniels¹

Executive summary

During 1986, mineral-industry activity in Alaska substantially declined from previous years. Expenditures for exploration, development, and production totaled $269.9 million, down from $269.9 million in 1985, a reduction of about 14 percent (fig. 1; table 1). The number of people employed in various aspects of the industry dropped from 3,650 in 1985 to 2,950 in 1986. Principal mineral commodities produced during 1986 were 20.9 million tons of sand and gravel valued at $75.8 million, 160,000 oz of gold valued at $60.8 million, and 1.49 million tons of coal valued at $40.1 million. Sand and gravel, gold, and coal account for 89 percent of the 1986 total production value of $198.5 million. Building stone, tin, silver, antimony, tungsten, mercury, jade, soapstone, and peat make up the remaining 11 percent. Sand-and-gravel production dropped 26 percent from the previous year because of the substantial reduction in oil-and-gas infrastructure developments on Alaska's North Slope and reduced construction in urban areas of southcentral and southeastern Alaska. Both declines were caused by the plunge in oil prices during 1986.

The volume of gold production decreased 16 percent, and the number of mechanized placer mines—the principal producers of gold bullion—decreased 27 percent. Reasons for this decline are complex. Two federal lawsuits related to mining on federal lands in Alaska, along with continued uncertainties about State water-quality regulations, contributed to the decreased production. The Sierra Club vs. National Park Service (NPS) lawsuit was settled in 1986. With few exceptions, it prohibits mining in three national conservation units until the NPS completes environmental assessments, which could take several years. In 1985, 30 mining companies were operating in Denali National Park and Preserve, Wrangell-St. Elias National Park and Preserve, and Yukon-Charley Rivers National Preserve, but in 1986 only one small mine was still in operation. The result has been a loss of 176 jobs and over 22,000 oz of gold production. The 'BLM' lawsuit (Sierra Club vs. Penfold) filed in federal district court in Alaska in February challenged the methods used by BLM to manage mining activity on federal lands. As a result of the lawsuit, BLM was required to make individual environmental assessments for every placer mine in Alaska and to enforce retroactive land reclamation. This lawsuit may be resolved in mid-1987.

Alaska's turbidity requirement for mine discharge water continued to be a source of concern for Alaska's miners. Although few miners have been prosecuted, most are not in compliance with state law and may face court action. The cumulative effect of these and

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<td>$199,427,167</td>
<td>$275,068,872</td>
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<td>1985</td>
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<td>$226,599,250</td>
<td>$231,707,723</td>
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other issues contributed to a loss of 385 jobs in Alaska's placer-mining industry between 1985 and 1986. The most telling decline in mining activity took place in the eastern interior region, which saw a 49-percent drop in employment from the previous year. In marked contrast is the placer-gold industry in Canada's Yukon Territory, which saw a 5-percent increase in activity from the previous year (Debicki and Gilbert, 1986; Yukon Territory Northern Affairs Division, 1986). This growth is attributed to the nearly 23-percent increase in the average price of gold from 1985 to 1986.

Exploration expenditures in 1986 ($8.9 million) were comparable to those in 1985 ($8.1 million), but development expenditures dropped 29 percent ($24.3 million in 1985 vs. $17.4 million in 1985). In contrast, exploration expenditures in British Columbia increased from $78 million in 1985 to $100 million in 1986, and exploration expenditures in the Yukon Territory increased from $26 million in 1985 to $34 million in 1986.

Despite declines in Alaska's mineral activity, encouraging developments occurred in 1986, and there are several indications that 1987 will be a significantly better year. Important steps were taken to put the giant Red Dog zinc deposit in northwest Alaska into production. The initial construction phase of the port facility near Kivalina was completed, and contracts for design and construction of the facility were awarded to various contractors. On November 26, 1986, the COMINCO Board of Directors approved the full development of the zinc-lead-silver mine, which will result in about $400 million in construction expenditures over the next 4 yr. Initial production is scheduled for 1987.

A change in ownership and construction of a mine road highlighted 1986 developments at the Greens Creek gold-silver-base metals project on northern Admiralty Island in southeastern Alaska. AMSELCO MINERALS, INC. (a subsidiary of BRITISH PETROLEUM NORTH AMERICA), now owns 79 percent of the property after purchasing interests held by NORANDA MINING, INC., and ANACONDA MINERALS COMPANY. CSX OIL AND GAS and EXALAS RESOURCES CORPORATION own the remaining 21 percent. AMSELCO, the project operator, constructed nearly 7 mi of road and prepared the site for a 6,000-ft-long adit that will be the main haulage for the mine. Construction of the adit is scheduled to begin in late 1987.

In 1986, INSPIRATION GOLD, INC. (formerly INSPIRATION MINES, INC.), initiated offshore mining operations in Norton Sound. Production tests were conducted from mid-August to October using the world's largest bucketline dredge, the 'Bima'. 86 people, including 42 Nome residents, were employed. Full-scale production may commence in 1987 when the Bima returns from Seattle, where it is undergoing technical modifications. The dredge, which is capable of processing 40,000 yd³ of material per day, was formerly used to mine placer tin in Malaysia.

VALDEZ CREEK MINING COMPANY (formerly DENALI MINES, INC.) continued production and development of their properties in the Valdez Creek mining district east of Cantwell. An estimated 136 employees contributed to the production of 28,500 oz of placer gold. VALDEZ CREEK MINING COMPANY was Alaska's largest gold producer for the third consecutive year.

USIBELLI MINE, INC., produced 1.49 million tons of coal, over 700,000 tons of which were exported to the Korean Electric Power Company's power plant in Honam, Korea. The export contract was successfully renegotiated in the fall, and increased production is planned.

LOST RIVER MINING COMPANY continued placer-tin mining on the western Seward Peninsula. Tin production from their operation was the largest in the state in nearly 40 yr.

Other continuing significant mineral developments include the CHICHAROEN MINING CORPORATION joint venture north of Sitka, the ECHO BAY MINES, LTD., evaluation of the Alaska Duneau Gold Mine, the Quartz Hill molybdenum project near Ketchikan, the efforts of the FAIRBANKS EXPLOITATION COMPANY in the Fairbanks mining district, and several coal developments in the southeastern interior regions of the state.

The ALASKA MINERALS COMMISSION, which was created by the State Legislature in 1986, presented their findings to the Governor and Legislature in January 1987. The 11-member Commission is charged with making recommendations to mitigate the constraints on mineral development in Alaska.

Federal and state agencies conducted mineral-resource studies in Alaska under several cooperative programs. A 4-yr contract between the ALASKA DEPARTMENT OF NATURAL RESOURCES DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS (DGGS) and the U.S. BUREAU OF MINES (USBM) calls for geologic and mineral studies in the Skagway and Haines areas of southeastern Alaska. Under the agreement, DGGS conducts geologic mapping, and the USBM conducts detailed examinations of mineral prospects and mines. Several reports related to the studies were released in 1986 (Bundtzen, 1986; Bundtzen and Clatlick, 1986; Hoekzema and others, 1986; Gilbert and others, 1987).

In 1985, the U.S. Congress appropriated funds to the U.S. GEOLOGICAL SURVEY (USGS) for geologic mapping and mineral evaluations of the Steese-White Mountains National Recreation area. DGGS, under contract to the USGS, completed detailed geologic mapping, collected geochemical samples, and examined minerals and prospects in the study area (Smith, 1986). A final report will be available in September 1987.

The USGS and DGGS completed field work for a cooperative geologic and mineral-resource investigation in the
Iditarod Quadrangle, which includes the historic Innoko and Iditarod mining districts. The USGS also issued a bibliography that summarizes data releases and folio reports for the Alaska Mineral Resource Assessment Program (AMRAP). This program spans more than a decade of mineral research in Alaska by that agency (Winkler, 1986).

Several studies on Alaska's strategic-mineral resources were released by the USBM. Reports include the first documentation of an Alaskan niobium (columbium) resource near Manley Hot Springs and information on promising platinum resources north of Paxson and at Goodnews Bay (Barker and others, 1985; Southworth and Foley, 1986; Warner and others, 1986). DGGS released Special Report 37, 'Map of Alaska's coal resources,' which illustrates coal resources in the state in a hierarchy from regional provinces to basins, fields, districts, and occurrences. The 1:2,500,000-scale color map is accompanied by a brief text and data tables (Merritt and Hawley, 1986).

In June 1986, the Board of Regents of the University of Alaska approved a 1-yr certicate program in Mining Technology at Tanana Valley Community College in Fairbanks. The objectives of the program are to provide entry-level training for technical and supervisory positions with exploration, mining, environmental, and consulting firms and to provide career development for those already active in the minerals community.

This report includes six appendices that contain information about mineral-industry activities and issues. Appendix A lists active claims and new claims staked on state and federal land in 1984, 1985, and 1986. Appendix B lists the functions, key personnel, and mailing addresses of state, federal, and private agencies involved in mineral development activities in 1986. Appendix C lists selected significant mineral deposits in Alaska. Mining licenses issued by the Alaska Department of Revenue in 1986 are listed in Appendix D. Appendix E lists production estimates for nine metals in Alaska from 1980 through 1986, and appendix F lists production estimates for industrial minerals and coal for the same period.

Acknowledgments

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T.K. Bundtzen and C.L. Daniels (DGGS) mailed 1,050 questionnaires on mineral activity in Alaska. C.H. Stevenson and M.E. Brown (DOM) compiled claim statistics shown in appendix A and figures 3 and 4. Bundtzen wrote the executive summary, exploration, production, and part of the development sections and compiled statistics used in these sections. C.B. Green (DMFP) provided information on the Red Dog, Greens Creek, and Quartz Hill developments. James Deagen (DMFP) compiled most of the material concerning mineral potential on lands owned by Native corporations. L.L. Lueck (DGGS) compiled appendices A and B; Bundtzen, M.S. Robinson (DGGS), and Lueck compiled appendices C and D; and Bundtzen compiled production estimates for appendixes E and F. Green designed the initial report format and wrote the drilling section. Deagen oversaw cover design and printing of the report. John F.M. Sims, G.R. Bakins, Bundtzen, Daniels, Green, Deagen, T.L. Pittman (U.S. Bureau of Mines), and K.E. Adams (DGGS) reviewed and edited the report.

Exploration activity during 1986

INTRODUCTION

Mineral-exploration activity in Alaska in 1986 approximated the level established in 1985. Total reported exploration expenditures during 1986 were $8,914,744, compared to $9,150,000 in the previous year, a decline of 2 percent. Expenditures are listed by commodity and region in tables 2 and 3 and shown graphically in figure 2. The slight decline in exploration expenditures during 1986 is overshadowed by even larger declines in claim activity (figs. 3 and 4). The number of new claims staked declined 22 percent (5,315 in 1986 vs. 6,773 in 1985), and the number of active claims maintained on state and federal lands declined 14 percent (71,024 in 1986 vs. 81,782 in 1985).

Alaska's mineral-exploration industry is restructuring and stabilizing after the departure of major mineral firms during the last 2 to 3 yr, including ANACONDA MINERALS COMPANY (ANACONDA), AMERICAN SMELTING AND REFINING COMPANY (ASARCO), ENSERCH EXPLORATION (ENSERCH), EXXON MINERALS, NORANDA EXPLORATION, INC. (NORANDA), INSPIRATION DEVELOPMENT, HECLA MINING COMPANY, PHILLIPS MINERALS DIVISION, MOHAWK OIL AND GAS, INC., TETON EXPLORATION (TE-
During the 1970s, about $254 million was expended on mineral exploration in Alaska (Conwell, 1979). Of this, about 5 percent ($13 million) was expended in exploration for nonmetallic minerals and coal, and about 26 percent was directed towards exploration for precious metals (mainly gold ($66 million)). About 69 percent ($175 million) was expended in exploration for tin, zinc, copper, tungsten, nickel, and molybdenum.

Since the early 1980s, mineral exploration has been focused primarily on precious metals. Of the $196 million spent from 1981 to 1986 (table 2), 48 percent was expended in exploration for precious metals ($94 million), 40 percent was directed toward exploration for base metals ($78 million), and the remaining 12 percent ($24 million) was expended in search for nonmetallic minerals and coal. In the last 2 yr, nearly 70 percent of the Alaska exploration dollar was spent in search of precious metals. Nationwide about 90 percent of exploration expenditures were directed at gold and silver deposits (Metals Economics Group, 1986). Selected mineral-exploration projects in Alaska are shown in figure 6 and summarized below.

### NORTHERN REGION

The northern region covers the northern one-third of the state and includes the Brooks Range, De Long Mountains, and North Slope. Reported exploration expenditures in the region declined from $1,860,000 in 1985 to $601,000 in 1986. Limited assessment work was completed on various properties within the region, which includes the world-class Ambler mining district (Hitzman and others, 1982; 1986) and the Noatak zinc-lead-barite district (Moore and others, 1986). Access to the Ambler mining district is complicated by the distance to the nearest road, rail, or tidewater site. In addition, the district is surrounded by five national conservation units established in 1980 by the Alaska National Interest Lands Conservation Act (ANILCA).

#### METALS

**NANA REGIONAL CORPORATION** (NANA) explored for zinc, gold,
Brooks Range from the Kukpawruk to Wulik Rivers (loc. 1a-b, fig. 6). The AMBLER MINING COMPANY, a subsidiary of SUNSHINE MINING COMPANY (SUNSHINE), ceased work on most of its claim-holdings, including the Cliff, Bud, Kogo, Cynbad, and Tom-Tom massive-sulfide prospects in the Ambler mining district. Most of SUNSHINE'S properties were sold to NANA. Likewise, KENNECOTT sold property in the Ambler mining district to NANA, namely the Ruby Creek copper deposit, but held other property such as the Arctic Camp deposit, which contains nearly 40 million tons of ore that grade 4 percent copper and 5 1/2 percent zinc with credits of silver and gold (Schmidt, 1986).

WILD RIVER VENTURES (Wally and Bonnie Gordon) conducted geochemical analyses and test cuts on Lake Creek in the Wild Lake area and announced a gold-placer reserve of at least 10,000 oz with possibilities of further extensions of the paystreak (loc. 3, fig. 6; fig. 7). A lessee of LITTLE SQUAW GOLD MINING COMPANY conducted minor exploration work, including drill tests and rock and mineral analyses, on Little Squaw, Tobin, Big Squaw, and St. Mary’s Creeks in the Chandalar mining district. DODIES DREAM COMPANY explored the south fork of 12 Mile Creek (Wiseman mining district) by hand-prospecting methods, and BILL NORDEEN explored for placer deposits and produced from his claims on Emma Creek in the Wiseman mining district.

INDUSTRIAL MINERALS

ARCTIC SLOPE REGIONAL CORPORATION drilled a gravel deposit at the Kaktovik pit on Barter Island and proved up 3.5 million tons of aggregate in anticipation of future oil-and-gas development.

MRS. ORO STEWART located additional high-quality jade boulders on her Dahl Creek jade property and conducted routine assessment on claims formerly held by her husband, HERBERT IVAN STEWART, who passed away in June 1986.

COAL

ARCTIC SLOPE REGIONAL CORPORATION and ARCTIC SLOPE CONSULTING ENGINEERS (1986) completed feasibility studies for development of one or several open-pit coal mines in the Deadfall syncline area, northwest Alaska. The general findings of the 3-yr analysis are listed below:

1. Coal reserves, mainly located in the Deadfall syncline, are in a structurally simple area that allows conventional open-pit mining with a 4:1 stripping ratio.

2. At an annual production level of 100,000 tons, the Deadfall syncline deposit can supply coal to meet local needs for 400 yr.

3. Coal quality is high-volatile ‘B’ bituminous with an average (as-received) heating value of 12,000 Btu, ash content of 10 percent, moisture content of 5 percent, and sulfur content of 0.1 to 0.3 percent.

4. A 4-yr development schedule will require 21 permits, 5.4 mi of haul road, a 4,000-ft-long airstrip, and a dredged port facility. Total development costs are estimated at $16 million.

5. Coal could be produced and sold (in Kotzebue) for $91/ton compared to the present cost of $108/ton ($4.50/million Btu).

6. There are no major environmental constraints to mining.

The commercial viability of the proposed development may depend on whether the Red Dog project and future resource-development projects in the area select coal as their power source.

WESTERN REGION

The western region of Alaska includes the Seward Peninsula, the lower Yukon River (including the
Ruby-Poorman and Koyukuk-Hogatza mining districts), and the upper Kuskokwim-Innoko Rivers (including the Nixon Fork, Innoko, and Tolstoi mining districts). In 1986, expenditures in the western region totaled $582,800, down from $650,000 spent in 1985.

METALS

BATTLE MOUNTAIN GOLD COMPANY, formerly DUVAL CORPORATION, conducted the largest exploration project in the western region. The company employed 10 people for a 70-day field season to continue evaluating the Nixon Fork gold-copper-bismuth skarn deposits north of Medfra on the Kuskokwim River (loc. 8, fig. 6). ALSINCO, INC. (Fairbanks), completed 10,000 ft of rotary drilling for the project.

Using a crew of six, LOST RIVER MINING COMPANY mapped, sampled, and processed mineral deposits at the Cape Creek tin mine on the western tip of the Seward Peninsula (loc. 4, fig. 6).

ASPEN EXPLORATION CORPORATION (ASPEN; Denver) announced that it acquired a lode mining lease on the Nome coastal plain, south-central Seward Peninsula (loc. 6, fig. 6), from ALASKA GOLD COMPANY (Nome). The lease includes a 17,500-acre tract of mining claims, most of which were patented in the early 1900s. ASPEN President R.V. Bailey stated that the tract contains some of the most promising and accessible lode mineralization in Alaska. The lode targets may underlie rich placer-gold deposits mined by ALASKA GOLD COMPANY and its predecessor, USSR&M COMPANY (Nome, Fairbanks). ASPEN is assuming the 'mother lode' of the 4 million oz of placer gold is in bedrock of the coastal plain near Nome. Late in the season, ASPEN announced that it had discovered veins of up to 1.24 oz/ton gold during mineral evaluations of the lease tract.

CORNWALL PACIFIC ALASKA, INC., in a joint venture with NIGHT-HAWK RESOURCES, LTD., continued work on the Big Hurrah gold-tungsten-quartz vein deposit near Solomon, Seward Peninsula (loc. 7, fig. 6). Metallurgical studies of bulk samples collected in previous years were conducted, and preliminary estimates of total mineral reserves were compiled. The Big Hurrah deposit was mined from 1903 to 1907 and again from 1944 to 1952. At least 27,000 oz of gold were produced, making it the largest producer of lode gold on the Seward Peninsula (Read and Mehert, 1986).

The BERG-WETLESEN PARTNERSHIP, in joint venture with AU MINING COMPANY and PARTNERS MINING, drilled placer-gold and lode silver-lead-zinc deposits on Independence, Candle, and Mud Creeks, central Seward Peninsula.

YUKON MINING COMPANY (Anchorage) drilled and sampled mineralized zones on Golden Creek, a tributary to Illinois Creek, on the flank of the Kaysuh Hills, western Alaska. The principal prospects on Golden Creek are gold placers derived from nearby lode sources. FLAT CREEK MINING (Peter Haggland) drilled gold-placer prospects in the Ruby-Poorman mining district south of the Yukon River. TOLOSTOI MINING (Doug and Gail Sherrill) explored for tin, gold, and platinum on a tributary of the Innoko River (Boob Creek) that has been mined for gold and byproduct platinum since the early 20th century.

INDUSTRIAL MINERALS

Exploration drilling for riprap and leach stone to construct a seawall for Nome was conducted north of the city by KIEWIT CONSTRUCTION COMPANY.

COAL

Retherford and others (1996) completed a State-supported assessment of a proposed coal mine at Chicago Creek, northcentral Seward Peninsula (loc. 5, fig. 6). On the basis of 7,700 ft of rotary drilling, the reserve at Chicago Creek contains 4.7 million tons of coal of which 1.5 million tons can be mined at a stripping ratio of 1.7:1. The heating value of mined coal will probably average 7,500 Btu/lb, and ash and sulfur contents should be low. The researchers assumed two basic scenarios for developing the coal resource: 1) developing the coal at a rate of 50,000 ton/yr to supply the electric-power needs of Kotzebue, and 2) developing the coal at a rate of 150,000 ton/yr to supply the electric-power needs.

Figure 6. Selected mineral-exploration projects in Alaska, 1986.
needs of Kotzebue and the proposed
Red Dog Mine. Preliminary results
indicate that annual mining rates
of 50,000 tons or less may not be
competitive with imported coal or fuel
oil. However, annual rates of 150,000
tons could be competitively delivered to
Red Dog and Kotzebue power plants at
$42/short ton ($2.80/million Btu).

EASTERN INTERIOR REGION

The eastern interior region, the
source of half of all historical gold
production in Alaska, covers 16 quad-
rangles, including mineralized areas in
the Alaska Range and Yukon-Tanana
Upland. Exploration expenditures in the
region rose to $2,378,174 in 1986 from
$1,749,000 in 1985, an increase of
36 percent.

METALS

NERCO MINERALS COMPANY
(NERCO) signed an agreement with
MERIDIAN MINERALS COMPANY
(MERIDIAN), a subsidiary of BUR-
LINGTON NORTHERN, INC., to ex-
plore for gold and other minerals on
NERCO'S property in the Alaska Range
(loc. 12a-b, fig. 6). Under terms of the
agreement, NERCO'S exploration arm,
RESOURCE ASSOCIATES OF ALAS-
KA (RAA), conducted field work from
Healy to Tok; most of its efforts were
concentrated on gold prospects in the
Robertson and Tok River drainages,
eastern Alaska. In total, RAA crews of
15 to 20 people drilled 7,000 ft of core,
completed 100 mi² of geologic map-
ing, and ran 30,000 ft of magnetic and
VLF geophysical lines during the 1986
field season.

PATINO, INC., the United States
subsidiary of NORTHGATE EX-
PLORATION, LTD., investigated high-
grade zinc-lead-silver deposits on land
owned by DOYON, LTD. (Fairbanks),
at Step Mountain north of the Yukon
River (loc. 10, fig. 6).

Numerous placer-mining operators
throughout the eastern interior region
conducted mineral-exploration pro-
grams: C.W. CLEVELAND, INC., SAND H ENTERPRISES, DAE MINING,
EASTMAN/GIBSON PARTNERSHIP,
EARL H. BEISTLINE (fig. 8), RON
WREDE, ROBERT COY, RAY WOLF,
LYLE COLLEDGE, and BEACH
RIVER CORPORATION in the Circle
mining district; HERNING EXPLORATION AND MINING, OSCAR TWEITEN, FOUR BROTHERS MINING, SMITH BROTHERS MINING, and WALTER ROMAN in the Fairbanks mining district; FAIRBANKS MINING COMPANY and BOULDER CREEK MINING COMPANY in the Manley-Toft mining district; LESLIE MAXWELL, FRANK VANA, CHARLES HAMMOND, and KAVIC MINING COMPANY in the Fortymile mining district; and BILL SMITH, TOMMY VAN, INC., and D'LOG ENTERPRISES in the Bonnifield mining district. ROY FERRENBACH completed an exploratory shaft near Olnes in the Fairbanks mining district. Reported findings ranged from 'disappointing' prospects to placer reserves worth several million dollars.

FAIRBANKS EXPLORATION, INC., conducted aggressive claim acquisition and exploration and development programs in interior Alaska (loc. 9, fig. 6), including surface and underground work on its Vetter-McKibben, Newsboy Mine, and Any Creek gold-silver properties in the Fairbanks mining district and its Rainey Hollow gold-silver prospect in the Tolovana mining district. The corporation currently controls about 20,000 acres in the Fairbanks mining district and holds several past-producing lode-gold mines. In 1986, plans were implemented to obtain joint-venture and public-equity financing for development of the corporation's mineral holdings.

While searching for lode deposits of antimony, bismuth, and gold on Spruce Creek in the Fairbanks mining district, EXPLORATION GEO CONSULTANTS located a shaft that contained mineralized float. ROGER MCPHERSON, using a magnetometer, EM, geochemical analyses, and hand-dug test pits, evaluated the Grateful Dog lode claims near O'Connor Creek in the Fairbanks mining district. He encountered anomalous thorium, niobium, tantalum, and rare-earth elements in stockwork-like fissures in metaplutonic(? ) rocks of the area.

MACK THOENNES reported encouraging results in his search for base- and precious-metal lodes in the Lennegood Quadrangle.

COAL AND PEAT

USIBELLI COAL MINE, INC., conducted an exploration program on Two Bull Ridge that included a drilling program with E-log and core analyses. About 10,000 ft of rotary drilling was completed (loc. 11, fig. 6).

DIAMONDS

The recovery of three alluvial diamonds in 1982, 1984, and 1986 from widely separated placer-mining operations on Crooked Creek in the Circle mining district continued to attract interest in the lode- and placer-diamond potential of the Crooked Creek area. In 1985 and 1986, R.B. Forbes (under contract to DGGS), J.T. Kline (DGGS), and Al Clough (USBM) conducted reconnaissance studies of Crooked Creek gravels (fig. 9). Although tailings and pan-, sluice-, and jig-concentrate samples were examined for kimberlite indicator minerals and diamonds, none were found. These findings coincide with those of corporate geologists who also failed to find diamond indicator minerals during their studies on Crooked Creek.

Forbes and others (1987) reported that although primary sources of diamonds in the surrounding region have not been identified, the tectonic framework of both the Porcupine River region north of the Yukon River and of the Yukon-Tanana Upland schist terrane near its western edge may favor the occurrence(s) of kimberlitic rocks. The recent discovery of a carbonatite pluton near Toft (Warner and others, 1986) suggests that diamond-bearing rocks could exist in the Yukon-Tanana Upland.

SOUTHWESTERN AND ALASKA PENINSULA REGIONS

WILBUR AND ANN WILLIAMS reported exploration efforts at their Granite Creek property in the historic Iditarod mining district near Flat. CINNABAR CREEK, LTD., mapped and trenched placer and lode deposits of gold and mercury at their Taylor Mountains and Cinnabar Creek properties in the lower Kuskokwim River drainage.

CALISTA CORPORATION explored deposits in the Red Devil and Goodnews Bay areas and released data on promising lode-gold potential in the Marshall mining district (loc. 13, fig. 6; Turner, 1986). The WILMARTH BROTHERS searched for additional placer reserves at their Julian Creek Mine in the Iditarod-George River mining district and also sampled lode-gold mineralization at the head of Julian Creek. Radioactive minerals and mercury are commonly found in heavy-mineral concentrates from this area.
HOWARD BOWMAN followed up on magnetometer work conducted by
ARCTIC TESTING LABS on his placer claims at Portage Creek on the north
shore of Lake Clark.

LYMAN RESOURCES OF ALASKA, INC., drilled their Snow and Quartz
Gulch properties in the Donlin Creek area north of Crooked Creek and
produced gold from Quartz Gulch Mine (loc. 14, fig. 6). They will continue
exploring for additional minable bench ground on property leased from
CALISTA CORPORATION.

MAGNUSON MINING COMPANY
 drilled lower Game Creek in the Innoko
mining district in hopes of finding
additional gold reserves.

ALASKA APOLO GOLD MINES, LTD. (Phoenix, Arizona), drilled test
holes and completed minor roadwork on their Unga Island properties in
the Aleutian Islands. Drilling results indicate
1,400,000 tons of mineralized rock.
AMAX EXPLORATION also worked
gold properties in the Aleutian Islands.

SOUTHCENTRAL REGION

The southcentral region covers much of the southern flank of the
Alaska Range, the Talkeetna, Wrangell, and Chugach Mountains, and coastal
areas that include Cook Inlet and Prince
William Sound. Nenana, Willow Creek,
Nizina (Kennecook-McCarthy areas),
Sunrise, Yakutat, and Seldovia are historic mining districts in the region
where mining activities, mainly for
placer gold and industrial minerals, are
widespread. Exploration expenditures rose to $2,408,850 in 1986, compared
to $1,281,000 in 1985, an increase of
88 percent. The growth is attributed to
increased exploration for placer deposits and to continued evaluation of im-
portant coal resources.

METALS

NABESNA MINING PARTNERS
(Wayne Bolt) continued to evaluate the
Rambler and Nabesna gold deposits in the
Chisina mining district near the
White Mountain Mine, north flank of the
Wrangell Mountains (loc. 17, fig. 6).
Recent work on the Rambler deposit consisted of drilling seven test holes;
indicated reserves are 18,283 tons of
ore that grade 0.90 oz/ton gold and
1.16 oz/ton silver. From 1930 to 1941,
Nabesna Gold Mine, a classic gold-iron
skarn, yielded 86,000 oz of gold from
88,000 tons of ore mined from the
eastern rim of a diorite body (Wayland,
1943). Nearly 20,000 ft of diamond
drilling conducted in 1985-86 near the
old Nabesna Gold Mine uncovered a
previously unknown ore system on the
west side of the diorite body. More
exploration is planned for 1987. Recent
federal court actions may guarantee
access from the Tok "Cutoff" Highway
to the mine property along Nabesna
Road through the Wrangell - St. Elias
National Park and Preserve.

HAWLEY RESOURCE GROUP
and GOLDEN ZONE DEVELOP-
MENTS, LTD. (GOLDEN ZONE),
conducted a limited drilling program at
Golden Zone Mine in the Chulitna
mineral belt. Located about 9 mi from
the Alaska Railroad, the mineral deposit
is well situated and contains inferred
reserves of 5 million tons of 0.1 oz/ton
gold with credits of copper, arsenic,
and silver.

FINNEAR MINING AND EXPLOR-
ATION, INC. (Arne W. Martis),
continued work on property in the
Skwentna River drainage west of the
Cache Creek - Collinsville mining
district. The company continued to
evaluate promising lode and placer
deposits of gold, silver, platinum,
copper, and manganese and is planning
small-scale development of placers on
Owl Creek.

GOLD CORD DEVELOPMENT
CORPORATION (Dan Rashevsky)
conducted 400 ft of diamond drilling on
the Sheered Claims and Gold Cord Mine
in the historic Willow Creek mining
district.

The previously active VAN ZELST
GROUP did not conduct exploration on
"Kennecook-type" copper-silver-gold
deposits in the Nizina mining district,
southern Wrangell Mountains, pending
resolution of various economic and
political complications. The claims were
included in Wrangell - St. Elias National
Park and Preserve in 1980.

HENDRICKSON EXPLORATION
AND MINING reported exploratory
work at the Crown Point, Black Butte,
Skeet-Lechne, and Falls Creek gold
mines in the Seward mining district,
Kenai Peninsula. In addition to channel
sampling and geologic mapping, the
company upgraded access roads and
considered whether milled ores would be
more marketable than sorted ores.

NORTHERN LIGHTS EXPLORA-
TION COMPANY trenched for copper
and gold in the Chulitna mining district.

FRED NELIUS worked on a
high-grade antimony (stibnite) lode in the
Chulitna mining district near
Talkeetna. NELIUS is selectively hand-
cobbing high-grade ore while waiting for
a more favorable stibnite market.

NERCO conducted a limited drill-
ing and assessment program on the
"Zacky" gold skarn west of Paxson (loc.
16, fig. 6). Indicated reserves are 1.25
million tons of 0.17 oz/ton gold with
credits of copper and silver.

A three-man crew worked most of
the year for BLACK SANDS MINING
COMPANY (Philip Strange). They drove
crosscut, drilled two holes, and
retimbered old drifts on the Arch
property in the Willow Creek mining
district, Hatcher Pass area. The
company is preparing the property for
development and production in 1987 or

LENA FLEN MINERALS, INC.
(Dan Berkshire), worked on the Lucky
Strike, New Hope, and Sixmile gold
prospects in the Sunrise mining district,
Kenai Peninsula. Bulk sampling, geo-
logic mapping, and magnetometer sur-
veys constituted most of their efforts.

The largest exploration effort in
the region was that of the VALDEZ
CREEK MINING COMPANY, formerly
DENALI MINES, INC., which con-
tracted WGM, INC. (Anchorage), to drill
20,000 ft (reverse circulation) on the
Tammanny and adjacent paleochannels
east of Cantwell (loc. 15, fig. 6). This
property continues to produce more
gold than any other site in Alaska.

Other companies that reported
exploration on placer properties include
MIKE CONNER and J.T. STUBBLE-
FIELD in the Talkeetna-Chulitna
mining district; CLIFFORD DINGMAN,
GAME CREEK MINING COMPANY,
FREDERICK HAAS, and GOODROCK
PLACER ASSOCIATION in the Kenai
Peninsula mining districts; NORTH
CREEK MINING in the Nizina mining
district; the MATTHISEN-HUNT
PARTNERSHIP on Theodore River;
H&H CONTRACTORS in the Cache Creek-Collinsville mining district; and MURRAY JONES in the Valdez Creek mining district.

Several years ago ASPEN EXPLORATION CORPORATION (ASPEN) applied for State offshore-prospecting permits to evaluate a 258,000-acre site in Cook Inlet near Anchorage for possible economic concentrations of placer gold (loc. 19, fig. 6). After the application was denied by the State, ASPEN president R.V. Bailey filed a lawsuit to reverse the decision. In November 1986, the State announced that it would reconsider the denial.

ASPEN is also interested in a 38,000-acre tract between Ninilchik and Anchor Point on lower Cook Inlet. Issuance of a prospecting permit for this area is opposed by some residents and local fisherman who expressed concern for salmon and halibut fisheries in the area. However, Kenai Peninsula Borough Mayor Stan Thompson, a 30-yr commercial fisherman, supports the project because he believes the economic benefits would be substantial and the environmental impacts minimal. ASPEN estimates that a large offshore dredging facility could help employ 600 to 800 people and produce 3,000 to 4,000 oz of gold annually. The company has spent over $1 million during a 3-yr period, primarily in magnetometer surveys, and has contracted DAMES AND MOORES, INC., to conduct biological studies of benthic (bottom-dwelling) organisms in Cook Inlet. Bailey emphasized that ASPEN is presently seeking permits for prospecting only, and that they will not seek a mining permit until they document an economic reserve(s) in the Inlet. The State is expected to make a final decision on the permits in 1987.

VERN GRIFFEN reported that his mining claims had been condemned by the State and BLM to facilitate creation of a new entrance to the south side of Denali National Park and Preserve; hence his longtime exploration and mining activity ceased. BOBNIK MINING (Kenai Peninsula) conducted only assessment-level exploration last season due to regulatory problems.

COAL AND PEAT

PLACER, U.S., INC., completed 7,960 ft of exploratory drilling on their Center Ridge lease in the Beluga coal field near Anchorage (loc. 18, fig. 6). Announced reserves exceed 150 million tons of export-quality coal.

HAWLEY RESOURCE GROUP and ROCKY MOUNTAIN ENERGY completed bulk sampling and detailed geologic mapping at their Wishbone Hill properties near Palmer. Their activities are described in the Development section.

INDUSTRIAL MINERALS

HAWLEY RESOURCE GROUP completed road work to their Don Group industrial-grade limestone deposits in the Chuitina mining district. These deposits could be important raw-material sources for concrete and fiberglass if demand justifies in-state manufacturing of these products.

ENERGY PACIFIC CORPORATION (Anchorage) was contracted to find raw materials for the manufacture of fiberglass at a proposed plant in Anchorage. Lime, high-silica sand, quartzite, and diatomaceous-earth deposits will be examined.

SOUTHEASTERN REGION

The largest exploration expenditures in the state again took place in the southeastern region, which includes numerous mining districts along the mainland and on islands of the Alexander Archipelago. About 38 percent of the region—which contains high-quality deposits of base and precious metals—is open to mineral entry (Bolte et al., 1986). Proximity to tidewater provides excellent access to the properties. Total 1986 expenditures were $2,746,220, compared to $2,534,000 in 1985.

METALS

HOUSTON OIL AND MINERALS drilled, sampled, and mapped gold prospects throughout the Juneau Gold Belt north of Juneau, but specific details of their program are not available (loc. 22, fig. 6). ECHO BAY MINES, LTD. (ECHO BAY), continued to explore the Alaska Juneau (AJ) Gold Mine at Juneau (loc. 23, fig. 6). The company assumed the leases from BARRICK RESOURCES in late 1985. In 1986, ECHO BAY accessed the southern part of the AJ ore zone, drilled high-grade ore shoots, and completed a road to the Sheep Creek adit from Thane. The company retained WGM, INC., to calculate reserve estimates and conduct reclamation studies at the mine.

With a crew of 20, GREENS CREEK MINING COMPANY drilled and mapped the Greens Creek deposit on Admiralty Island. Activity at this property is described in the Development section.

LONG LAC MINERALS (Reno) trenches mineralized zones, reconstructed a portal, improved trails, and maintained their camp and equipment at the Katgani prospect on Dall Island. Similar work was conducted on their Ruby Tuesday polymetal deposit and Nihinack base- and precious-metal deposits on Prince of Wales Island (loc. 25, fig. 6).

GALACTIC RESOURCES continued to evaluate important nickel-cobalt reserves on Yakobi Island and Mirror Harbor in the western Chichagof Island region (loc. 21, fig. 6). Open-pit reserves at the Yakobi Island property (Takmakis orebody) are 16.2 million tons of 0.31 percent nickel, 0.18 percent copper, and 0.02 percent cobalt.

FREEPORT MINING COMPANY continued an aggressive exploration program in the Panhandle, but details of their efforts are not available.

DISCOVERY GOLD EXPLORATION, LTD. (Canada), continued to explore the Dawson Mine (loc. 24, fig. 6) and nearby prospects in the Hollis mining district on Prince of Wales Island (Herreid and Rose, 1986). The firm constructed a road to the site, collected channel samples for assay, and completed 15 rotary drill holes on the property. Inferred reserves reported grade 0.786 oz troy oz of gold. Additional drilling and reconditioning of underground workings are priorities for 1987.

GEDDES RESOURCES continued to explore the Windy Craggy copper-gold-cobalt deposit located in the northwestern British Columbia 15 mi north of the confluence of the Aisak and Takshinshin rivers, about 20 mi east of the U.S.-Canada border (loc. 20, fig. 6). Indicated reserves of 90 million tons of ore grade 3 percent copper and 0.1 percent cobalt with significant credits of gold. Several hundred million tons of lower grade mineralized rock are also
present. Work in 1985 and 1986 included completing a 3,000-ft-long airstrip and designing a 2,800-ft-long exploration drill that will be used to fan drill and bulk sample the deposit from the subsurface. About 26,000 ft of drill core from the deposit was relogged by MINERAL EXPLORATION RESEARCH, INC. (Canada), to determine if gold-bearing intersections were properly identified. The reassessment is necessary because gold was found in areas of sparse sulfides. Access to the deposit will be through Alaska via the port of Haines or through Canada down the Alsek River.

Several placer properties in southeastern Alaska were explored. JO JURGELEIT assessed the gold potential of gravels at the mouth of Porcupine Creek in the Porcupine mining district near Haines. BIG NUGGET MINING COMPANY also proved up mining reserves in the Porcupine Creek drainage; this past producer has been in litigation for several years. CASEY OFFICER explored Dave's Dream in a remote part of the Wrangell mining district, but details of the work were not reported.

**Mineral development in 1986**

**INTRODUCTION**

Mineral-development expenditures in Alaska totaled $24.33 million in 1986, compared to $34.12 million in 1985, a decline of 29 percent from the previous year (table 4). Decreased activity on various coal-development projects and completion of preconstruction activities at Quartz Hill and at other base-metal projects were responsible for most of the decline. Development expenditures for precious metals ($16.42 million) approximated those of 1985.

A major new development project in 1986 was the 'Bima' offshore dredging project near Nome. In addition, LA TEKO RESOURCES completed Alaska's first 'heap-leach' precious-metal-extraction test in the Fairbanks mining district. The Grant Gold Mine, also in the Fairbanks mining district, discontinued operation in 1985. However, development activities at the Red Dog and Greens Creek projects are expected to accelerate in 1987, which should contribute to a substantial increase in overall mineral-development expenditures.

Most projects and activities described in this section fit the fairly narrow definition of development—that is, activities preparatory to the mining process. However, some companies combined development and exploration expenditures in questionnaire returns.

**RED DOG PROJECT, COMINCO/NANA**

(Northern region (loc. 1, fig. 10))

Owner NANA REGIONAL CORPORATION (NANA) and operator COMINCO continued to develop world-class, black-shale-hosted, zinc-lead-silver-barite deposits at Red Dog Creek in the Wiluk River drainage, northwest Alaska. COMINCO geologists believe that Red Dog is a complex exhalative deposit that formed during the early development of a restricted sedimentary basin (Moore and others, 1986), whereas Lange and others (1985) believe the mineral deposit is the result of an evolving island arc adjacent to a late Paleozoic continental margin.

Drill tests indicate that the main Red Dog deposit has reserves of 85 million tons of ore that grade 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 (Giegerich, 1986). Preliminary mine and mill design call for production of 580,000 ton/yr of zinc-lead-silver concentrates, with an eventual increase to 700,000 ton/yr. By the early 1990s, the mine will be the largest producer of zinc in the western world if production schedules are met. Concentrates will be refined at COMINCO'S facilities at Trail, British Columbia, and in Japan and Europe.

On November 26, 1986, the Board of Directors of COMINCO approved development of the zinc-lead-silver mine at Red Dog with production scheduled to begin in 1991. Development of the mine site will follow completion of the road and port facility (fig. 11). Total capital expenditures to bring the mine into production are estimated at $250 to $300 million over the 4-yr development phase.

Several important steps were taken in 1986 on the Red Dog project: A final agreement for financing the road and port facilities was signed by the State of Alaska, COMINCO, and NANA; a letter of credit from several international banks guaranteeing repayment of state revenue bonds was secured; and a contract for the construction of

**Table 4. Mineral-development expenditures in Alaska by commodity, 1981-86.**

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</thead>
<tbody>
<tr>
<td>Base metals</td>
<td>$5,945,000</td>
<td>$10,270,000</td>
<td>$19,500,000</td>
<td>$16,710,500</td>
<td>$13,000,000</td>
<td>$7,260,000</td>
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<tr>
<td>Precious metals</td>
<td>11,460,000</td>
<td>19,320,000</td>
<td>7,112,500</td>
<td>15,058,555</td>
<td>16,897,755</td>
<td>16,417,172</td>
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<tr>
<td>Industrial and</td>
<td>7,000,000</td>
<td>4,251,000</td>
<td>1,000,000</td>
<td>579,000</td>
<td>1,830,000</td>
<td>124,000</td>
</tr>
<tr>
<td>structural materials</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Coal and peat</td>
<td>345,000</td>
<td>7,750,000</td>
<td>250,000</td>
<td>27,000,000</td>
<td>2,400,000</td>
<td>530,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$24,690,000</td>
<td>$41,591,000</td>
<td>$27,862,500</td>
<td>$55,348,055</td>
<td>$34,120,775</td>
<td>$24,331,972</td>
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</tbody>
</table>
dock and shoreside facilities sufficient to stage construction of the mine road and port was completed (figs. 12 and 13).

Terms for the repayment of revenue bonds issued by the Alaska Industrial Development Authority (AIDA) for construction of the 52-mi-long road and for port facilities to service the Red Dog Mine and other users were defined in the financing agreement signed by COMINCO and the State. The agreement assures the State of a repayment of principal and interest and a 6.5-percent return on the bond. Repayment is based on toll fees that will be determined by both the development cost of the mine system and the payments required to amortize the state's investment over 50 yr, plus a 6.5-percent return. The repayment fees may be increased if the price of zinc increases above an index level.

To further assure that the bonds are repaid, the State required that COMINCO secure a letter of credit guaranteeing repayment of bonds. The letter of credit for approximately $120 million was secured by COMINCO from three international banks and delivered to AIDA in October 1986.

A contract for $1.6 million was awarded to ENSERCH ALASKA CONSTRUCTION, INC. (Anchorage), for construction of a gravel pad and steel sheet-pile loading dock that will be used as a staging area for road and port-facility construction. Work began in July 1986, and construction was completed in September. Other contracts for development of the mine system have been awarded to the RALPH M. PARSONS COMPANY for mine planning, design, and construction and to FOSS MARITIME for the shuttle of concentrates from shore to ocean freighters in self-propelled lightering barges.

In September, COMINCO's major stockholder, CANADIAN PACIFIC, LTD. (CANADIAN PACIFIC), entered into an agreement to sell its 52.5-percent interest in COMINCO. The largest part of CANADIAN PACIFIC'S holding in COMINCO—31 percent of its equity—was purchased by a holding company with three participants: TECK CORPORATION of Canada (50 percent); METALLGESELLCHAFT of West Germany (25 percent); and MIM HOLDINGS of Australia (25 percent).

NOME MARINE-PLACER PROJECT, INSPIRATION GOLD, INC.
Western region (loc. 2, fig. 10)

In 1986, INSPIRATION GOLD, INC. (IGI; formerly INSPIRATION MINES, INC.), began an offshore gold-mining operation near Nome after several years of exploration and testing. Development of their offshore state mining leases moved a major step forward with the arrival of 'Bitna,' the world's largest offshore mining vessel (fig. 14). The dredge reached Nome on July 5 after being transported from Singapore by ocean-going barge. Production tests commenced on August 5 and continued until October 1.

During 1986, the project remained in the development stage.

The enormous offshore dredge, originally designed and used in the mining of tin, is 525 ft long and 150 ft wide with a displacement of nearly 15,000 metric tons. Five diesel generators produce several megawatts of power that approximate the total power requirements of Nome. Equipped with 137 buckets (4 ton, 33 ft³), the dredge has a capacity to wash 40,000 yd³ of gravel daily and work to water depths of 140 ft (fig. 15). Previous floating bucket-line dredges in Alaska had a maximum washing capacity of 10,000 yd³/day. The vessel was purchased from P.T. RIAN MINING COMPANY in Indonesia for $33 million.

With some modifications, the Bitna is suitable for offshore dredging in Norton Sound. Mechanical modifications include weatherization of the structure and various changes required by the U.S. Coast Guard. Because the dredge was originally designed to process the tin-ore mineral cassiterite (specific gravity 7), pyrrite and other heavy minerals swamped the jig-recovery system. Thus the system is now being designed for placer-gold recovery (specific gravity 19). All modifications are currently being completed in Tacoma, and the dredge is scheduled to arrive in Nome on June 1.
The arrival and operation of the Bima provided a significant economic boost to the Nome community. Of the 86 people employed by IGI, 44 are Alaska hire, including 42 residents of Nome. The remaining 42 employees are specially trained personnel required to operate this complex mining machine. Nearly $70,000 per month was added to the local economy through salary and wages, and IGI provided vocational training in Nome. Approximately $75,000,000 was expended on development, and about 3,000 oz of gold were recovered in 1986 at a gross value of $1,200,000.

MISCELLANEOUS PLACER PROJECTS
(loc. 3a-d, fig. 10)

Placer-gold expenditures reported by 40 mining companies during 1986 totaled $11,008,172 or $275,000 per operation, compared to $131,000 per operation during 1985, $85,000 per operation during 1984, and $55,000 per operation during 1983 (table 5). When expenditures for INSPIRATION GOLD, INC., are removed, the average is $116,000 per operation, down 11 percent from 1985 levels.

Most respondents to the DGGS survey indicated that expenditures were for water-recycling systems, mine layout, development drilling, and retroactive reclamation under requirements initiated by BLM during the 1986 season. Concurrent reclamation efforts are further described in the production section. Selected major placer-development projects are summarized below.

In the southcentral Alaska Range, VALDEZ CREEK MINING COMPANY (VCMI) continued development drilling of the Tammany-channel preglacial stream placers (loc. 3a, fig. 10). The previous reserve base of 105,000 oz was substantially increased after 20,300 ft of reverse-air, churn, and rotary drilling; 50,000 ft of resistivity lines; and 17,000 ft of magnetometer surveys. The 1986 development program included the design and implementation of a unique washing plant equipped for winter operation (fig. 16). The plant includes an insulated pumphouse that draws water from a settling pond, completely insulated primary and secondary washing facilities, and jig and wilffrey tables. Additional development...
costs (not included in table 4) include construction of all-weather machine shops that are scheduled for completion in spring 1987 (fig. 17).

The GOLDEN HORN MINING COMPANY began a unique development project along the Golden Horn gold-tungsten-mercury-antimony shear zone in the historic Iditarod mining district (loc. 3b, fig. 10). Residual mineral deposits directly below the Golden Horn hard-rock mineral deposit were mined, and scheelite-rich heavy-mineral concentrates were collected with a standard sluice box. Quartz-vein float was stockpiled for further processing. Secondary recovery methods involved running mineral concentrates and quartz-vein float through a 3-ft-diam by 6-ft rod mill and a standard 24 ton/day Marcy ball mill (fig. 18).

Milled material was processed on a 4-ft-by-8-ft riffle table. Positive results in 1986 demonstrated the potential to mine bulk tonnages of weathered residual material derived from the Golden Horn shear zone. During the season, a 5-ton bulk sample of scheelite concentrate that contained inclusions of gold was shipped to processing facilities outside the state. Additional scheelite concentrates remain at the mine site awaiting test results.

MAMMOTH MINES (WILBUR CREEK MINE) began development of an underground drift mine in the Livengood mining district with a grant from the State's Placer Demonstration Project (loc. 3c, fig. 10). The 'bench' placer deposit is located west of the active channel of Wilbur Creek, a short tributary of the Tolovana River. The 80-ft-wide paystreak, estimated to contain 300,000 yd³ of auriferous pay, is capped by 65 to 135 ft of frozen overburden. Previously the property was mined hydraulically to remove the overburden, but limited space for adequate settling ponds made compliance with water-quality regulations difficult. The goal of the project is to develop an economically viable underground mining method applicable to many deeply buried placers in Alaska. Such a method would significantly reduce the amount of water use and discharge.

Development efforts at the drift mine included preparation of a summer stockpile site, construction of service and living quarters, further upgrading of the main service haulroad, installation of a culvert-lined portal, and initial mine operations (fig. 19). Purchased mine equipment includes a single-boom ATH 12 Secoma jumbo drill used to drive 8-ft-long blast holes (fig. 20), a 2-yd³ Wagner ST 20 'Scoop-tram' mucker, and a 12-yd³ highway-rated dump truck. Three blasting rounds produce about 200 yd³ of auriferous gravel per 12-hr shift. By the end of 1986, about 4,600 yd³ of pay had been stockpiled at a cost of 19.87/yd³.

ALASKAGOLD MINES, INC. (ALASKAGOLD), continued development work on their 81 claims at Cape Yakataga 100 mi east of Cordova (loc. 3d, fig. 10). Placer-gold strandline deposits were discovered at Yakataga at the turn of the century, and for 15 yr thereafter a small group of local miners worked the rich pay streaks by hand. Before WWI, about 9,771 oz of gold

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Table 5. Reported placer-gold development expenditures by region, 1986.

<table>
<thead>
<tr>
<th>Region</th>
<th>Number of operators</th>
<th>Expenditures</th>
</tr>
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<tbody>
<tr>
<td>Northern</td>
<td>1</td>
<td>$ 10,000</td>
</tr>
<tr>
<td>Western</td>
<td>4</td>
<td>7,840,000</td>
</tr>
<tr>
<td>Eastern interior</td>
<td>22</td>
<td>477,572</td>
</tr>
<tr>
<td>Southwestern</td>
<td>3</td>
<td>206,500</td>
</tr>
<tr>
<td>Southcentral</td>
<td>9</td>
<td>2,468,800</td>
</tr>
<tr>
<td>Southeastern</td>
<td>1</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>40</strong></td>
<td><strong>$11,008,172</strong></td>
</tr>
</tbody>
</table>
were recovered from the area. The Yakataga beach deposit consists of beach sands and fine gravels with local concentrations of heavy minerals—mainly red garnet and fine, flat gold. Because the latter is extremely difficult to capture, numerous recovery systems were tested, including flotation, tabling, leaching, amalgamation, and Knelson centrifugal and Flying Dutchman concentrators. Reichert MK VII spirals are expected to be the primary recovery units for the new 500 yd³/day washing plant that will go into production in 1987. To date, ALASKAGOLD has spent more than $700,000 developing the property.

HEAP-LEACH PROJECT, LA TEKO RESOURCES Fairbanks mining district (loc. 4, fig. 10)

CITIGOLD, INC., a subsidiary of LA TEKO RESOURCES, completed Alaska’s first heap-leach testing program at the Ryan lode in the Fairbanks mining district, eastern interior region. The Ryan lode is an intensely sheared mineralized zone on the southeastern flank of Ester Dome near Fairbanks. It has been a focus of mineral production and exploration activities since the early 20th century. Before 1975, nearly 10,000 tons of selected high-grade ores were produced from underground workings. Previous exploration work by ST. JOE AMERICAN CORPORATION showed that the gold-bearing shear zone is 20 to 130 ft wide and nearly 4,000 ft long. Drill-indicated reserves of 1.9 million tons of ore grade 0.13 oz/ton gold (to the 500-ft level), with credits of silver and antimony. During 1986, 3,500 tons of material grading 0.115 oz/ton gold were processed in the heap-leach project, and a total of 301.6 oz of gold was won at a 73.5-percent rate of recovery.

In October 1986, 750 ft of the shear zone were stripped and sampled, and 70,200 tons of 0.21 oz/ton gold ore were prepared for production. In addition, a carbon test plant that could be expanded to a full-production facility was installed on the property. Although the operating season for leaching is 5 mo, mining will occur year-round.

CHICHAGOF MINING DISTRICT PROJECTS, EXPLORATION VENTURES COMPANY (EXVENCO), also known as Chichagof Joint Venture Southeastern region (loc. 5, fig. 10)

Two mines under development in the Chichagof mining district on Klag Bay and Kimsham Cove 45 mi north of Sitka were at one time some of the richest hard-rock gold producers in Alaska. From 1918 to 1941, the Chichagof Mine produced 660,000 oz of gold and 200,000 oz of silver from 596,487 tons of ore; the average head grade was 1.2 oz/ton gold. From 1918 to 1943, the nearby Hirst-Chichagof Mine produced 131,000 oz of gold from 140,000 tons of ore. Both orebodies consist of near vertical quartz-gold-sulfide veins that intrude Sitka graywacke of Late Jurassic to Early Cretaceous age along the Chichagof and Hirst-Chichagof fault zones, respectively. The deposits at the main Chichagof Mine were worked to a vertical depth of 4,100 ft; the deepest workings are 2,800 ft below sea level.

Since 1981, the properties have been under evaluation by EXPLORATION VENTURES COMPANY (EXVENCO), a limited partnership based in Spokane, Washington. In 1983, QUEENSTAKE RESOURCES (QUEENSTAKE, Vancouver, B.C) acquired a 25-percent interest in the project. Currently the CHICHAGOF JOINT VENTURE consists of QUEENSTAKE, VECTOR MINING COMPANY, and EXVENCO. The project manager is EXVENCO.

Three major projects are underway at the mines: 1) reprocessing mill tailings, mainly at the Chichagof Mine; 2) developing the Big Croppings vein and Aurum and Sitka shear zones at the same site; and 3) evaluating the ‘Kay’ oreshoot in the Hirst-Chichagof Mine. At the Chichagof Mine, mill tailings amount to 450,000 tons of ore that average 0.11 oz/ton gold; bulk sampling of the Big Croppings vein indicates reserves of 60,000 tons of ore that grade 0.6 oz/ton gold. Six holes were drilled in the Aurum structure at the Chichagof Mine—with inconclusive results—and a 150-ft-long crosscut was driven into the main shear zone at the Hirst-Chichagof Mine to establish a drill station to evaluate the ‘Kay’ oreshoot. Additional fan drilling from the drill station is planned during 1987.

In 1986, the CHICHAGOF JOINT VENTURE completed reconstruction of the No. 2 shaft on the main level of the Chichagof Mine. The venture is also considering new mine designs, including a barge-mounted mill and plant that could be inexpensively moved to each property as mine development progresses.
In 1986, approximately 7 mi of road were constructed to connect the mine site on upper Greens Creek with 1½ mi of road built in 1985 from the dock site at Hawk Inlet on the west side of Admiralty Island. In 1987, AMSELCO will complete a feasibility study and begin additional development work, including construction of wastewater containment dikes and a 6,000-ft-long adit. Portal site preparation for the adit was initiated in October. The new adit will be located 430 ft below the existing exploration adit and will serve as the main ore haulageway. In addition to mine and mill facilities, an additional 5 mi of road must be built to connect the existing road system to a dock at Young Bay on the east side of Admiralty Island. The dock and connecting road will permit workers to commute by boat from Juneau. Estimated preliminary development cost for the project is $80 million.

The status of potentially mineralized lands that surround the core, perfectable, and perfected mining claims is still unresolved. In 1985, a complex land exchange was proposed in the U.S. Congress to resolve a number of landownership issues on Admiralty Island, including environmental, logging, and Native corporation interests. By the close of the 1986 session, Congress had failed to pass the proposal.

If a final decision is made in early 1987 to proceed with construction, the mine could be in production by late 1988 or early 1989. At a production rate of 1,000 ton/day, about 225 jobs would be created.

**Quartz Hill Molybdenum Project, U.S. Borax**

Southeastern region  
(loc. 7, fig. 10)

Limited field work was done on the Quartz Hill project during 1986. With molybdenum prices still below levels necessary to initiate mine development, U.S. Borax continued its environmental base-line studies and permitting activities. The timetable for reissuing the Revised Draft Environmental Impact Statement (RDEIS) was further delayed until early 1987 so that the Environmental Protection Agency (EPA) and the U.S. Forest Service could work...
out an agreement on a preferred alternative site for tailings disposal. The Wilson Arm disposal site became a viable alternative to the Boca de Quadra site when new bathymetric and compaction data indicated there was adequate space for mine tailings. Arguments in favor of the Wilson Arm site include restriction of mine development to a single drainage; elimination of the need for any development in a wilderness area; no significant differences in potential impacts between alternative sites; and a reduction in capital costs by an estimated $59 million. When the RDEIS is issued, there will be a 45-day period for public comment, after which the Final Environmental Impact Statement, together with a Record of Decision for the project, will be issued. This final phase is expected to take place sometime after mid-1987.

Reserve estimates for the mineral deposit exceed 1.5 billion tons of ore that average 0.136 percent molybdenite; 490 million tons of near-surface ore average 0.219 percent molybdenite. Mineralization is hosted in a 25-million-yr-old composite felsite stock that intrudes metamorphic rocks of the Coast Range batholith.

The Quartz Hill deposit contains about 10 percent of the free world's known reserves of molybdenum, an alloy used as a hardening agent in the steel industry. Depending on the price of metals, the mine could add from $267 to $457 million/yr to the nation's exports and up to $65 million/yr to the personal income of Alaskan residents—an amount equal to over 20 percent of the personal income in the Ketchikan Borough. The company has invested over $100 million in the project, of which 25 percent was spent on environmental studies. In 1983, a 5,000-ton bulk sample was tested at metallurgical facilities in Minnesota. Results indicate that relatively inexpensive milling methods could yield high-grade concentrates.

At the time of discovery, Quartz Hill was within the Tongass National Forest. In December 1978, when the Misty Fiords National Monument was proposed as a wilderness area, Quartz Hill was included. In 1980, with the passage of ANILCA, 119,000 acres around Quartz Hill were excluded from wilderness designation, and the project was allowed to proceed. Since 1985, data have been collected on meteorology, hydrology, water quality, vegetation, wildlife, coastal-and-marine biology, physical-and-chemical oceanography, archaeology, and socioeconomic factors.
by YUKON-ALASKA TRANSPORT COMPANY to the port of Skagway, Alaska (loc. 8a, fig. 10). At Skagway, concentrates were loaded into 40,000-ton-capacity vessels and transported to smelters in Australia (10 percent), Japan and Korea (45 percent), and Europe (45 percent) (fig. 23). Concentrates were previously hauled by road to Whitehorse and transferred to the White Pass and Yukon Railroad for the final leg to Skagway. CURRAGH spent $1 million for road paving and bridge improvements in Alaska during 1986. Employment levels at the port facilities in Alaska ranged from 15 to 35 people.

QUEENSTAKE RESOURCES, LTD. (QUEENSTAKE), and HAINES GYPSUM COMPANY are involved in the development of a high-grade gypsum deposit at O'Connor Creek 6 mi from the Haines Highway in British Columbia and about 60 mi from the port of Haines, Alaska (loc. 8b, fig. 10). On the basis of 10,000 ft of diamond drilling, the deposit is estimated to contain a minimum of 500,000 tons of ore that grades 88 percent gypsum, 7 percent anhydrite, and 5 percent carbonate. The gypsum, which is pure white, is suitable for cement and wallboard and may also be used as flux, paper filler, or in fertilizer and pharmaceuticals. In 1987, QUEENSTAKE plans to ship 50,000 tons of bulk samples through Haines for testing in industrial applications. If the tests are favorable, crushed and screened gypsum will be shipped through Haines. HAINES GYPSUM COMPANY is also exploring the possibility of constructing a wallboard plant in Haines and exporting a finished product to Pacific Rim markets.

SKYLINE EXPLORATIONS, LTD., is developing the Reg Gold Mine on the Skagit River (western British Columbia) about 40 mi east of Wrangell, Alaska (loc. 8c, fig. 10). The company met with Wrangell officials in 1986 and is exploring the possibility of housing up to 40 families in Wrangell. Production may begin in 1987 after completion of the mill.

COAL DEVELOPMENTS
STATEWIDE
(loc. 9a-c, fig. 10)

Coal developments in 1986 were concentrated in the southeastern region. ROCKY MOUNTAIN ENERGY (RME), a Colorado-based subsidiary of the UNION PACIFIC CORPORATION, and HAWLEY RESOURCE GROUP (HRG) continued feasibility and development studies on four state leases located in the Wishbone Hill district of the Matanuska coal field 45 mi northeast of Anchorage (loc. 9a, fig. 10). These leases, which are located in the western part of the district, contain 1,570 acres. In late 1984, RME and HRG acquired three competitive leases that total 5,200 acres in the eastern part of the district. Geologic mapping and channel sampling were conducted on the new leases during the 1986 field season. Subsequent drilling confirmed the presence of 18 million tons of bituminous coal in two blocks that can be mined by open-pit methods. Heat content of run-of-mine coal from this deposit varies from 8,700 Btu/lb in the west block to 11,000 Btu/lb in the east block. Typical washed-coal quality averages 12,460 Btu/lb, with 0.4 percent sulfur.

According to a 1986 study funded by RME and two Alaska utilities, a coal-fired power plant can be built in the lower Matanuska Valley in full compliance with environmental standards. RME's preliminary mine-feasibility studies indicate the western and eastern reserve blocks could supply a mine-mouth, fluidized-bed power plant and serve a small export market.

DIAMOND ALASKA COAL COMPANY (DIAMOND), a subsidiary of DIAMOND SHAMROCK CORPORATION, continued engineering, environmental-permitting, and marketing activities in the Beluga coal field near Anchorage (loc. 9b, fig. 10). DIAMOND'S feasibility studies project annual production rates of 2 to 10

Figure 19. Portal of Wilbur Creek drift mine, Livengood mining district, eastern interior Alaska. Photograph by Rose Rybachek, 1986.

Figure 20. Jumbo drill in underground drift mine at Wilbur Creek, Livengood mining district, eastern interior Alaska. Photograph by Rose Rybachek, 1986.
million tons, depending on market demand. The latter rate would produce 330 million tons of coal during a 34-yr mine life. According to the feasibility study, a 150-megawatt power plant in the Beluga field would cost from $300 to $475 million.

PLACER U.S., INC. (PLACER), continued to evaluate its Center Ridge property in the Beluga coal field (loc. 9c, fig. 10). The current reserve base includes 150 million tons of coal on 17,686 acres of state leases and 9,240 acres owned by COOK INLET REGION, INC., an Alaska native corporation. During 1986, an access road was constructed to the main development properties on Center Ridge (fig. 24).

Development plans include using the existing 1,475-ft-long pier at North Foreland near Tyonek, where 40,000 dwt ships could be loaded. Coal production of 1 million ton/yr will require $33 million in startup funds. PLACER met with Electric Power Development Corporation of Japan to examine marketing aspects of the operation.
Figure 22. Roadwork by Southcoast Construction Company from Hawk Inlet to Greens Creek, southeastern Alaska. Photograph courtesy of AMSLCO Minerals, Inc., 1986.

Figure 23. Ore carrier leaving Skagway with lead-zinc concentrates from Anvil Mine in Yukon Territory, Canada. Photograph by Al Clough, U.S. Bureau of Mines, 1986.
Mineral production in 1986

INTRODUCTION

The value of Alaska's mineral production in 1986 was $198.5 million, down 12.4 percent from the 1985 estimate of $226.6 million (table 6). Gross quantities and values for 1986 mineral commodities were 20.9 million tons of sand and gravel worth $75.8 million, 160,000 oz of gold worth $60.8 million, and 1.49 million short tons of coal worth $40.1 million, which comprise 89 percent of gross mineral dollar value. Building stone, tin, silver, antimony, peat, jade, soapstone, platinum, and mercury constitute the remaining 11 percent ($21.8 million). Principal gold, coal, and industrial-mineral extraction sites and mines are shown in figure 25.

Production statistics are based on data computed from 217 DGGS questionnaires returned by private companies and individuals, responses to a telephone survey of 51 companies that mine sand and gravel and nine that extract stone, and responses from the U.S. Bureau of Mines, U.S. Geological Survey, University of Alaska, precious metal refiners, and consultants. Historic production levels for gold, sand and gravel, and coal are compiled in figures 26, 27, and 28, respectively. A summary of production estimates for 13 minerals since 1880 (apps. E and F) shows that Alaska metal production has been dominated by gold.

Sand-and-gravel production decreased 26 percent in volume (28.2 to 20.9 million tons) and 32 percent in value ($112.1 to $75.8 million) from 1985. The substantial decrease can be attributed to reduced infrastructure development on the North Slope and a reduction in the number of construction projects in the southcentral and southeastern regions of the state. Building-stone production increased substantially because of the Nome seawall project, shoreline-facility construction on the Pribilof Islands, and the Bradley Lake hydroelectric-development project on the Kenai Peninsula.

Alaska tin production reached another high of 440,000 lb of cassiterite concentrate, but antimony production declined from 1985. The USIBELLI COAL MINE, INC., continued to export coal to Korea; most of the 10-percent increase in total coal production is attributed to this market (732,781 tons in 1986 vs. 616,000 tons in 1985).

Estimates of gold production in 1986 were improved by increased private-sector participation in the form of completed questionnaires with production estimates from 115 mechanized operations (up from 78 in 1985); company news releases and annual reports to stockholders; information from DGGS employees working in three of seven regions of the state (fig. 5);
## Table 6. Reported mineral production in Alaska, 1984-86.\(^a\)

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<tbody>
<tr>
<td>Gold (oz)</td>
<td>175,000</td>
<td>190,000</td>
<td>160,000</td>
<td>$63,000,000</td>
<td>$61,175,000</td>
<td>$60,800,000</td>
</tr>
<tr>
<td>Mercury (lb)</td>
<td>380</td>
<td>2,094</td>
<td>912</td>
<td>1,500</td>
<td>10,000</td>
<td>2,800</td>
</tr>
<tr>
<td>Antimony (lb)</td>
<td>135,000</td>
<td>65,000</td>
<td>45,000</td>
<td>225,792</td>
<td>98,000</td>
<td>67,500</td>
</tr>
<tr>
<td>Platinum (oz)</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
<td>W</td>
</tr>
<tr>
<td>Silver (oz)</td>
<td>20,000</td>
<td>28,500</td>
<td>24,000</td>
<td>159,000</td>
<td>171,000</td>
<td>134,400</td>
</tr>
<tr>
<td>Tin (lb)</td>
<td>225,000</td>
<td>300,000</td>
<td>340,000</td>
<td>400,000</td>
<td>650,000</td>
<td>890,000</td>
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<tr>
<td>Tungsten (stu)</td>
<td>NR</td>
<td>NR</td>
<td>120</td>
<td>NR</td>
<td>NR</td>
<td>22,800</td>
</tr>
<tr>
<td><strong>Subtotal</strong></td>
<td></td>
<td></td>
<td></td>
<td><strong>$63,786,292</strong></td>
<td><strong>$62,104,000</strong></td>
<td><strong>$61,917,500</strong></td>
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<tr>
<td>Industrial minerals, coal, peat</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Jade &amp; soapstone (ton)</td>
<td>5.5</td>
<td>W</td>
<td>2.0</td>
<td>$16,500</td>
<td>W</td>
<td>$12,000</td>
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<tr>
<td>Sand &amp; gravel (mt)</td>
<td>27.0</td>
<td>28.2</td>
<td>20.9</td>
<td>95,000,000</td>
<td>112,062,750</td>
<td>75,761,507</td>
</tr>
<tr>
<td>Building stone (mt)</td>
<td>2.7</td>
<td>2.5</td>
<td>4.2</td>
<td>16,000,000</td>
<td>12,150,000</td>
<td>20,320,000</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>$111,016,500</td>
<td>$124,212,750</td>
<td>$96,093,507</td>
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<tr>
<td>Coal (ton)</td>
<td>849,161</td>
<td>1,370,000</td>
<td>1,492,707</td>
<td>$23,775,000</td>
<td>$39,730,000</td>
<td>$40,100,000</td>
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<tr>
<td>Peat (yd³)</td>
<td>125,000</td>
<td>85,000</td>
<td>50,000</td>
<td>$859,375</td>
<td>$552,500</td>
<td>$350,000</td>
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<tr>
<td><strong>Subtotal</strong></td>
<td>$24,634,375</td>
<td>$40,282,500</td>
<td>$40,450,000</td>
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<td><strong>TOTAL</strong></td>
<td>$199,437,167</td>
<td>$226,599,250</td>
<td>$198,461,007</td>
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</tr>
</tbody>
</table>

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\(^a\)Production data from DGGS questionnaires, U.S. Bureau of Mines, precious-metal outlet data, interviews with mine operators, and other confidential sources.

\(^b\)Average price of gold in 1986 assumed to be $380/oz; silver, $5.60/oz; antimony, $1.50/lb; mercury, $300/flask; tungsten, $190/stu; coal (FOB Healy), $26.86/ton; peat, $7/yd³; and building stone, $4.80/ton. Statewide sand and gravel averages $3.75/ton, but prices vary according to region (table 9).

W = withheld

mt = million ton

stu = short-ton unit

NR = Not reported

---

estimates from precious-metal refiners; and information from two informal surveys conducted by the mining community.

Results of the DGGS survey show that 160,000 oz of refined gold and 16,000 oz of byproduct silver were produced primarily by placer mines throughout the state, a decrease of 16 percent from the previous year. The decline occurred despite the fact that the average selling price of Alaska placer gold increased about 23 percent (from $325 to $380/oz) from January 1, 1985, to January 1, 1986.

An estimated 195 mechanized mines operated in 1986, down from 266 in 1985, a decline of about 27 percent. During 1986, employment ranged from one to 138 employees per mine, with an average of six employees per mine. A total of 1,155 miners were employed in mechanized mines during the 1986 season, compared to 1,540 employed in 1985. Activities of recreational miners (pick-and-shovel, long-tom, and suction-dredge projects) and claim holders doing annual assessment work also decreased during 1986: 95 operations employed 275 in 1985, whereas 80 operations employed 230 in 1986. The average placer mine (excluding recreational mining and assessment work) produced 820 oz of gold in 1986 vs. 720 oz of gold in 1985, which amounts to 139 oz/employee in 1986 compared to 124 oz/employee in 1985. These data suggest increased output and efficiency for individual mine operations during 1986.

These results are corroborated by other state statistics on mining activity. During 1986, the number of annual placer-mining applications (APMA) decreased 28.6 percent (718 in 1985 vs. 512 in 1986), and the number of State land-use permits for mining decreased 17.9 percent (201 in 1985 vs. 165 in 1986). Of 156 companies that responded to DGGS questionnaires, 26.2 percent that mined in 1985 did not operate in 1986.

An independent study conducted by the Placer Committee, Alaska Miners Association (AMA), indicates that the average placer miner has worked on Alaska gold properties for 17 yr and that the average placer mine employs 4.5 people, 35 percent of whom reside in villages and rural areas within the mining district (Tryck, 1986). The AMA study, which was conducted early in the year, predicted that up to 44 percent of currently active mining companies may eventually cease operation if regulatory issues are not resolved.

The mineral industry employed 2,950 people in 1986, down 19 percent from the 3,650 employed in 1985.
Mechanized gold mining continues to be the largest employer (39 percent), followed by sand and gravel (37 percent), recreational and assessment work (8 percent), building stone (7 percent), coal mining (4 percent), and miscellaneous extraction (4 1/2 percent). Individual employment in this survey does not consider seasonal vs. year-round employment. For example, most employees in the coal industry work year round, but many gold miners and sand-and-gravel and building stone operators work seasonally.

In 1986, the Sierra Club vs. National Park Service (NPS) lawsuit was settled. According to the settlement, 'temporary approvals' of mining operations in national parks in Alaska were rescinded. The government must follow strict regulations in granting access permits to mineral inholdings; individual environmental assessments of mines must be approved with plans of operations; and the government must prepare comprehensive environmental impact statements for the Wrangell - St. Elias National Park and Preserve, Denali National Park and Preserve, and Yukon-Charley Rivers National Preserve. Judge Von der Heydt's decision (July 22, 1985) included a clause that would allow the NPS to approve plans of operation on a case-by-case basis, but of 20 mining plans submitted during 1986, only three were approved, and only one operation produced gold in 1986. This compares to 30 mining operations that collectively produced 22,000 oz. of gold in 1985. Hence, a fair amount of the 1986 loss of gold production in Alaska could be linked to this single issue. During 1986, the NPS expended $3.2 million to study stream habitat, archaeological sites, and water-quality issues and to conduct biological transects across areas of mine concentrations within the NPS conservation units.

Three environmental groups were joined by Native groups in a lawsuit (Sierra Club vs. Penfold) that challenged BLM procedures regarding surface protection on federal mining claims. According to the 1976 Federal Land Policy and Management Act, the BLM is charged with administering mining activity on federal lands. The lawsuit maintained that the environment was not adequately protected by BLM. Because the preliminary court injunction could have halted up to 80 percent of placer mining in Alaska, the parties drew up an interim agreement that called for BLM officials to prepare environmental assessments of all mining plans before authorizing mine production; conduct onsite inspections, including collection of water-quality samples; and prepare subsistence hunting and fishing evaluations before approving mining plans. Because the miners were not parties to the lawsuit, they could not intervene. In mid-1986, Governor Bill Sheffield refused to intervene on behalf of the miners because he maintained that state involvement could expand the case onto state land and prolong the battle.

During 1986, 163 mines were visited by BLM field teams, and at least 37 operators were issued notices of noncompliance for inadequate reclamation practices. Miners are required to retroactively reclaim ground disturbed since 1981. According to the replies on 41 DOGS questionnaires, significant expenditures were made to comply with BLM reclamation requirements.

A third lawsuit (Trustees for Alaska vs. State of Alaska) challenged the State of Alaska's mining-location system. The Trustees for Alaska contend that Section 6(j) of the Statehood Act mandates that all former federal lands selected by the state be made available for mining by leasing rather than by traditional location-staking.

Table 7. Mineral industry employment in Alaska, 1986.**

<table>
<thead>
<tr>
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<th>Number of Employees</th>
</tr>
</thead>
<tbody>
<tr>
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<td>1,155</td>
</tr>
<tr>
<td>Recreational mining and claim assessment</td>
<td>230</td>
</tr>
<tr>
<td>Sand and gravel</td>
<td>1,100</td>
</tr>
<tr>
<td>Building stone</td>
<td>225</td>
</tr>
<tr>
<td>Coal mining</td>
<td>125</td>
</tr>
<tr>
<td>Peat</td>
<td>60</td>
</tr>
<tr>
<td>Tin, antimony, jade, mercury, and soapstone</td>
<td>55</td>
</tr>
</tbody>
</table>

*Does not include employment in mineral development and does not account for 21,816 person-days of work in mineral exploration.
methods. A decision on the lawsuit is expected in 1987.

State and federal water-quality standards based on the 1972 Federal Clean Water Act continue to be a source of concern for many placer miners. Through 1986, 20 operators in Alaska had been charged with state and federal water-quality violations and faced fines of up to $10,000 per day if convicted. In late spring 1986, the Environmental Protection Agency (EPA) ordered 24 more operations to comply with water-pollution laws and threatened prosecution if stipulations were not met. Additionally, the EPA threatened to terminate 96 mine permits and issued warnings to 405 mining companies.

Many miners believe the federal 0.2 ml/l settleable-solids limitation can be met using available technology, but argue that the 5 nephelometric-turbidity-unit standard (NTU) required by the State for mine discharge waters is not attainable. The Alaska State Legislature passed a bill (House Bill 627) that addressed state water-quality standards and provided some relief to the mining community. The bill was vetoed by Governor Bill Sheffield in June 1986.

**METALS**

**NORTHERN REGION**

Four mechanized placer mines in the Koyukuk-Nolan and Chandalar areas reported production of 4,500 oz of gold, down from 18 operators and 14,400 oz in 1985 (table 8). Historically, most gold from the northern region is produced from Emma, Linda, Archibald, and Nolan Creeks near Wiseman and Davis and Grubstake Creeks near Bettles, all part of the Koyukuk-Nolan mining district. BILL NORDEEN produced from his Emma Creek properties using a 112-yd3 shovel and conventional sluicing equipment. Nordeen attempted to upgrade his waste-water treatment and operating techniques to attain compliance with water-quality standards. JOHN HALL sank a shaft and drift along a paystreak on his Nolan Creek claims near Wiseman.

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**WESTERN REGION**

Responses to the DGGS questionnaire show that 42 mining operations in the western region produced 53,000 oz of gold in 1986, an increase of 33 percent from 1985. This region was the only area in the state that showed a significant increase in production activities. Nearly 85 percent of the production took place in mining districts on the Seward Peninsula; other productive areas include the Ruby-Poorman mining district in the Yukon River drainage and the Tolstoi mining district in the Innoko River drainage.

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Table 8. Reported refined gold production, number of operators, and industry employment in Alaska by region and mining district, 1985-86.

<table>
<thead>
<tr>
<th>Region and mining district</th>
<th>Mechanized units ([a] )</th>
<th>1985 Production (troy oz)</th>
<th>Number of employees</th>
<th>Mechanized units ([a] )</th>
<th>1986 Production (troy oz)</th>
<th>Number of employees</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Chandalar</td>
<td>18</td>
<td>14,400</td>
<td>70</td>
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<td>4,500</td>
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<td>Koyukuk-Nolan</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Western</td>
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<tr>
<td>Nome</td>
<td>40</td>
<td>40,000</td>
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<td>42</td>
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<tr>
<td>Kougarok</td>
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<td>Koyukuk-Hughes</td>
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<td>Circle</td>
<td>135</td>
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<td>Fairbanks</td>
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<td>Fortymile</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Manley-Eureka</td>
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<td></td>
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<td>Richardson</td>
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<td></td>
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<tr>
<td>Rampart</td>
<td></td>
<td></td>
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<td></td>
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</tr>
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<td>38</td>
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<tr>
<td>Nelchina</td>
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<tr>
<td>Innoko-Toistol</td>
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<td>125</td>
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<td>Iditarod-George River</td>
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<td>Nyac</td>
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<td>Crooked Creek</td>
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<td>Lake Clark-Mulchatna</td>
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<tr>
<td>Southeastern and Alaska Peninsular</td>
<td>3</td>
<td>100</td>
<td>7</td>
<td>3</td>
<td>150</td>
<td>6</td>
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<tr>
<td>TOTAL</td>
<td>266</td>
<td>190,000</td>
<td>1,545</td>
<td>195</td>
<td>160,000</td>
<td>1,155</td>
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</tbody>
</table>

\(a\) Mechanized-placer and small lode operations are included; small ‘recreational-assessment’ projects such as panning, long-tom sluicing, suction-dredging, and pick-and-shovel prospecting are not included. We estimate that 95 operations employed 275 people in 1985 and 80 operations employed 230 people in 1986.

Operate pending resolution of water-quality issues. In the Tolstoi region, ROSANDER MINING COMPANY employed a crew of seven on Colorado Creek; ALAMIN MINING again mined Bear Creek; and DEGNAN MINING took out a cut on Madison Creek. EASTERN INTERIOR REGION

An estimated 83 mechanized mines in the eastern interior region produced 45,350 oz of gold in 1986, compared to 135 mines and 66,000 oz in 1985. This amounts to a 39-percent drop in the number of producing mines, a 31-percent drop in the volume of production, and a 49-percent drop in employment (740 to 375 employees). The major reasons for the declines are the cumulative effects of water-quality issues, litigation, and exhaustion of mineral reserves.
During the early 1980s, the Circle mining district was Alaska's largest placer camp, with as many as 90 active mine setups. Of these, 40 to 50 mechanized units annually produced gold, and seasonal employment levels ranged from 400 to 750. However, in 1986 only 21 mine operations produced placer gold, down significantly from levels of activity in the previous 5 yr.

V.F. HALVERSON (Miller Creek) and GHD RESOURCES (Eagle Creek) were the largest and most successful gold-mining operations in the eastern interior region. Other companies active in the Circle mining district during 1986 were the F.E. COMPANY, COLD CACHE MINING, and GOLD DUST MINES on Bottom Dollar Creek; JAMES WILDE on Switch Creek; T.J. MINING on Faith Creek; RON WREDE and FLAT PICK MINING on Deadwood Creek; ACKMAN MINING on Harrison Creek; ROBERT COY and BOB CASEY on Portage Creek; STEVE WEBER and STAN GELVIN on Crooked Creek; RUSSELL MINING COMPANY and GEORGE HASKINS on Independence Creek; DICK LOUD on Mastodon Creek; and several small operations on Half Dollar, Squaw, and Ketchum Creeks.

With 12 mines in operation, 1986 activities in the Fortymile mining district were comparable to those in 1985. G.A. HANKS AND SONS operated on Lost Chicken Creek; AURUM PHILOSOPHORUM, INC., mined on Switch Fork of Chicken Creek; SMITH BENCH MINING PARTNERS took pay out of the Smith Bench of Fortymile River; 45 PUP MINING COMPANY (Charles Hammond) mined on 45 Pup Creek; and KAVIC MINING trenched on Jack Wade Creek. Mines on the Walker Fork produced gold, but details are unavailable. Suction-dredge operations did particularly well using various small-capacity floating units. EARL SCHENE reported that his mine was not permitted due to water-quality regulations. M.A. 'BEAR' PAVEY was unable to move heavy equipment across a bogggy area during the summer season, but will move mining equipment this winter in preparation for the 1987 season.

The Rampart and Manley Hot Springs mining districts produced at the same levels as last year. HOOSIER CREEK MINING completed another good year on Hoosier Creek; BOULDER CREEK MINING COMPANY (Les and Dorthy Pickes) took out a cut on Boulder Creek; and BILL CARLO produced at 'status quo' in the Rampart mining district. Longtime producers SHIMSKY MINING COMPANY and ZIMMERMAN EXPLORATION completed assessment work only on their claims on Omega and Eureka Creeks.

The level of activity was down in the Livengood mining district. The HANNEMAN-KNAEBEL PARTNERSHIP continued to sluice on the Livengood Bench, but they are running out of stripped reserves. NELSON MINING COMPANY worked on Amy Creek, but indicated that lack of water and developed reserves may force closure of the operations. We do not have records of 1986 mining activities on Olive and Ruth Creeks, which have produced placer gold in the past. MAMMOTH MINES' (Stan and Rose Rybacke) hydraulic-mining operation was halted due to court action by the Environmental Protection Agency, but the company did initiate underground mining in the winter months (see Development section). MAMMOTH faced fines of up to $700,000 for water-quality violations; resolution of court action is pending.

Activity in the Fairbanks mining district, Alaska's largest producing gold camp, was about the same as last year with eight companies in operation. Gold producers in the district included COOK'S MINING on Fairbanks Creek; WALTER ROMAN on Last Chance Creek; SMITH BROTHERS MINING on Nugget Creek; and OSCAR TWEITEN on Chatham Creek (fig. 30). Details of other operations on Lower Goldstream, Fish, Ester, and Eldorado Creeks were not available. JOHN RUBEL mined the Sparkle Group in the Tenderfoot mining district.

The Bonnifield mining district supported six operations in 1986, down from eight in 1985: one on California Creek, one on Tatlanika Creek, two on Moose Creek, one on St. George Creek, and one on the Totallanka River. D'LOG ENTERPRISES on Tatlanika Creek and JACK LACROSS on California Creek were the most successful producers. ART SCHMUCK and TOMMY VAN, INC., did not operate because of regulatory problems.

The most sobering regulatory problem in the eastern interior region was the wholesale shutdown of mining in the Kantishna mining district, an area with a long history of gold, silver, and antimony production. Both the Kantishna and Dunkle mining districts were included in the nearly 4 million acres surrounding Mount McKinley National Park (now Denali National Park and Preserve) that were added to the Park by ANILCA in 1980. In conjunction with ANILCA, the U.S. Congress mandated that a 3-yr study be conducted and that recommendations be made concerning future mining activity in these areas. In 1984, a joint federal-state study that was released by the Alaska Land Use Council asked Congress to open 103,435 acres in the Kantishna Hills to mining. This would include most of the previously active mines. The request recognized grand-
father rights on existing claims and recommended that additional lease options be implemented for mineralized areas identified in the study.

In 1985, some 17 mechanized placer operations mined gold in the Kantishna mining district, concentrating on various tributaries of Moose, Glacier, and Caribou Creeks. However, as a result of the 1985 Sierra Club vs. National Park Service lawsuit, the U.S. District Court prevented the National Park Service from issuing plans of operations to active mines. Although 14 companies applied for permits to mine gold in 1986, none were approved and there was no mining activity. For the first time since its discovery in 1905, no gold was produced in the Kantishna mining district. National Park Service officials have publically stated that they must comply with the Mining in Parks Act of 1975. Therefore, mining permits will be considered on a case-by-case basis to protect the miner and the environment. Final approvals may take several years.

Hardrock-mining activities in the eastern interior region were limited to the Fairbanks mining district. RUDY VETTER AND ASSOCIATES assembled a small 1 ton/day jaw crusher and roll mill and processed 34 tons of ore that averaged 4.2 oz/ton gold. Byproduct antimony ore and concentrates were also produced and shipped from the mine site. LA TEKO RESOURCES produced over 300 oz of gold from their heap-leach test at the Ryan Lode on Ester Dome.

SOUTHWESTERN REGION

DGGS surveys show that in southwestern Alaska 33 placer mines produced 18,000 oz of gold and 2,400 oz of silver, an increase of 6 percent from 1985. According to the Kuskokwim Area Plan released by the Department of Natural Resources, mining is the largest private sector employer (128) in the Kuskokwim River basin above Bethel. Nearly 75 percent of all employees were from local communities (Bundtzen and others, 1986a). Large operations in the southwest had a good season and benefitted from slightly improved output and an increase in gold prices. Regulatory difficulties did not affect the southwestern or western regions to the extent that they affected the eastern interior, southcentral, and northern areas of Alaska.

In the Innoko mining district, MAGNUSON MINING COMPANY exploited placer deposits from several mine setups on Ganes Creek, but reported a decline in production from 1985. BABE and EEP ANDERSON and SMOKEY STOVER continued to mine fractions, side pay, and tailings on Yankee Creek, and JOHN O'CARROLL worked deposits on Spruce Creek. PAUL SAYER and the NORCROSS-STONBERG PARTNERSHIP continued their long-time efforts on Little, Ester, and Avil Creeks near Ophir. Longtime Innoko miner and prospector JOHN WORTMAN passed away during the summer.

In the Iditarod and Moore Creek mining districts, GOLDEN HORN MINING COMPANY (formerly MISCOWALSH COMPANY or JOHN MISCOVICH family operation) mined stream, hillslope, and residual deposits immediately below workings of the GOLDEN HORN tungsten-gold mine. This unique operation also used secondary crushing and recovery techniques that are described in the Development section. GOLDEN HORN incurred a substantial expense in 1986 to reclaim mine tailings from the 1981-85 seasons.

DON HARRIS trenched on Moore Creek where auriferous tailings still yield economic pay. FLAT CREEK PLACERS stripped overburden to mine pay and constructed several large settling ponds on the Willow bench to comply with environmental regulations. The ALVIN AGHOFF family operation took out a cut on Prince Creek, and WILBUR and ANN WILLIAMS mined tailings on Granite Creek, a tributary to the George River. L.E. WYRICK had another successful year on Granite Creek and discovered gash veins of stibnite in his mine cut and bedrock drain (Bundtzen and others, 1986b).

JULIAN CREEK MINES worked Julian Creek for a short time late in the fall; this operation did not produce in 1985 due to water-quality enforcement by the Alaska Department of Fish and Game. LYMAN RESOURCES OF ALASKA, INC., prepared and mined ground leased from CALISTA CORPORATION in the Snow Gulch area. DAVE PENZ worked the Bonneyville Claim Group on Kako Creek in the Iliuit Mountains of the Marshall mining district. This is the first record of activity we have received from the Marshall area for many years.

The NORTHLAND DREDGING COMPANY'S 6-ft³-capacity floating
undisclosed amount of riprap to construct a shallow-water, steel sheet-pile loading dock and gravel pad that will be used as a staging area for construction of road and port facilities for the Red Dog zinc project in northwest Alaska. Work was started mid-summer and completed by September.

WESTERN REGION

The KIEWIT CONSTRUCTION COMPANY (KIEWIT) completed the 2-yr, $22 million state and federally funded Nome Seawall Project in September 1986. During the 2-yr construction period, nearly 700,000 tons of shot rock were excavated and hauled from sites near Nome. Excavation equipment included a front shovel, two loaders, three 85-ton haul trucks, and four 50-ton haulers. Nearly 100 people were seasonally employed during the 2-yr period. The rock quarry also supplied some sea-wall-quality stone for construction of harbor-containment projects in the Pribilof Islands. Some 340,000 tons of sand and gravel were used by the Department of Transportation and Public Facilities (DOTPF) to maintain the Nome-Kougarok and Nome-Council Road systems on the Seward Peninsula. The roads were damaged by breakup conditions and floods early in the year.

EASTERN INTERIOR REGION

Nearly 7.1 million tons of sand and gravel were quarried in the eastern interior region, a 317-percent increase from the 1985 level. The increase was due in part to general highway improvements in the eastern interior region and to construction activities by the private sector in preparation for the arrival of a U.S. Army Light Infantry Division at Fort Wainwright (Fairbanks). Other large projects near Fairbanks included the North Pole overpass (490,000 tons) and flood control along the Tanana River (480,000 tons). However, nearly 70 percent of total sand-and-gravel production was for completion of large DOTPF projects along the Alaska Highway from Delta to the United States-Canada border. Because of increases in activity, several Anchorage-based sand-and-gravel firms entered the interior and competed for various construction contracts.

FOUNTAINHEAD CONSTRUCTION, INC., continued their 2-yr-old suction-dredge operation near North Pole and drew from other pits region-wide with standard loaders and dump trucks. FAIRBANKS SAND AND GRAVEL produced 300,000 tons from their Tanana River flood-plain operation using a 4½-ft³ floating clamshell dredge. The company expressed concern about proposed changes in the State mining-tax regulations, which may adversely affect their economic viability.

EARTHMOVERS, INC., mined from pits throughout the Tanana River flood plain. One of their major construction projects was to modify International Airport Road (170,000 tons). H & H CONTRACTORS mined from pits along the Chena River at the same production level as in 1985. Other gravel companies include EVECO, INC., which mined tailings at Fox; INTERIOR EXCAVATION; ROGERS AND BABLER (based in Anchorage); and GARY NEWMAN TRUCKING.

The major DOTPF project in the eastern interior was rerouting the Alaska Highway between the Robertson River and Yerrick Creek west of Tok and between Miles 1256 and 1285 near the United States-Canada border. During the 18-no project, nearly 30 haul trucks, numerous loaders and tractors, and a crew of 200 moved 5 million tons of borrow and unclassified gravel.

YUTAN CONSTRUCTION COMPANY (Carroll-Vonora partnership) again mined basalt from their Browns Hill Quarry off Badger Road, but production levels (about 375,000 tons) were slightly lower than those in 1985. The basalt is used for road metal, ornamental stone, crushed fill for loach fields, and flood control (riprap) along the banks of the Tanana and Chena Rivers.

SOUTHWESTERN REGION

Sand and gravel and stone continued to be used in maintenance projects in southwestern Alaska. THE GALLIETT COMPANY and GEORGE SILIDES completed their $15-million erosion-control project at Bethel. Earlier estimates by the U.S. Army Corps of Engineers showed that the Kuskokwim River would erode about half of Bethel by the year 2030. The project used 6,950 ft of steel piling that was backfilled with sand and gravel excavated from Birch Tree crossing, which is located 100 mi upriver from Bethel. The Kuskokwim River is also eroding its banks at McGrath, but consultants have recommended that high-quality riprap be used to armor the banks against further erosion.

CALISTA CORPORATION developed their riprap-quality basaltic picrite quarry (owned by KUTISARAH VILLAGE CORPORATION) at Goodnews Bay. Markets are currently being sought for the stone.

SOUTHCENTRAL REGION

Use of sand and gravel in the most populated region of the state continued to decline from record levels established in 1983-84. During 1986, 5.4 million tons were used, compared with 10.1 million tons in 1984, a decline of 46 percent. About 2.2 million tons (41 percent) of gravel used region-wide were hauled from pits in the Palmer-Wasilla area to Anchorage on the Alaska Railroad, only about a third as much as was hauled in 1984 (table 10). During the 1986 construction season, the Alaska Railroad operated four 80-car trains daily.

Nearly 80 percent of the 1986 rail haul originated from Wasilla-Palmer pits operated by ANCHORAGE SAND AND GRAVEL and ROGERS AND BABLER, INC. Both companies indicated that their gravel reserves in the Palmer area exceed 35 million tons, which should satisfy construction needs in the Anchorage area for the foreseeable future. ROGERS AND BABLER also drew from their Chugiak pit and operated a crusher in Anchorage.

GREEN CONSTRUCTION COMPANY and EAGLE DOME AGGREGATE, INC., both active in the Anchorage gravel business, ceased mining operations during the year.

WALDO AND RUBY COYLE produced pit-run gravel from private property on the Kenai Peninsula, and CHUGACH ALASKA CORPORATION sold aggregate to users from sources on their lands. BRASS MONKEY RANCH did not mine in 1986, although they have produced small amounts of gravel in previous years. DOTPF used about 20,000 tons of pit-run gravel from property administered by the U.S.
TURES, a supplier of gravel to military and civilian users on Unalaska Island, was permanently dissolved in 1986.

**ALASKA PENINSULA REGION**

Sand-and-gravel and building-stone production increased significantly from previous years due to several large State and federal capital-improvement projects. EARTHMOVERS, INC. (Fairbanks), was contracted to prepare dock and airport facilities at King Salmon. The company used 380,000 tons of sand and gravel to accomplish these tasks. Long-time gravel-operator ALEUTIAN AGGREGATE VENTURES, a supplier of gravel to military and civilian users on Unalaska Island, was permanently dissolved in 1986.

Major construction projects in the region were the $13.5-million port-facility projects on St. George and St. Paul Islands, Pribilof Islands Group, BRICE, INC. (BRICE), and S & S CONSTRUCTION (Anchorage) were awarded contracts to construct containment facilities for the two ports. The Pribilof Islands are located in one of the highest energy marine environments in Alaska, and destructive storms commonly damage shoreline facilities. In 1984, the harbor on St. Paul Island was extensively damaged by a storm; work there has focused on rebuilding the harbor seawall facility.

Modeling of wave height and wave energy for the St. George Project was performed at Oregon State University and at the Danish Hydraulic Institute for PERATROVIC, NOTTINGHAM, AND DREDGE, the design firm for the project. This work showed that harbor reinforcement requires rocks that range from 1.7 to 10.0 tons in weight. BRICE is using two 400,000-lb Liebherr Corporation (German) excavators originally used to mine Australian uranium deposits. The 7-yd³ shovels and a 1,200-lb ripper shanks on the excavators are used to move and emplace the material that lines the seawalls. The St. George operation has used 185,000 yd³ (320,000 short tons) of basalt adjacent to the harbor; an 8-acre boat basin was created from the rock quarry.

Because the Pribilof Islands commercial fur-seal harvest lost essential

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**Table 10. Major commodity tonnages hauled by the Alaska Railroad 1975-86 (thousands of short tons).**

<table>
<thead>
<tr>
<th>Calendar year</th>
<th>Sand and gravel</th>
<th>Bulk petroleum</th>
<th>Coal</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1975</td>
<td>1</td>
<td>567</td>
<td>584</td>
<td>720</td>
<td>1,862</td>
</tr>
<tr>
<td>1976</td>
<td>105</td>
<td>624</td>
<td>607</td>
<td>859</td>
<td>2,188</td>
</tr>
<tr>
<td>1977</td>
<td>700</td>
<td>532</td>
<td>556</td>
<td>523</td>
<td>2,305</td>
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<tr>
<td>1978</td>
<td>727</td>
<td>374</td>
<td>593</td>
<td>484</td>
<td>2,178</td>
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<tr>
<td>1979</td>
<td>637</td>
<td>220</td>
<td>524</td>
<td>427</td>
<td>1,808</td>
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<tr>
<td>1980</td>
<td>396</td>
<td>252</td>
<td>590</td>
<td>503</td>
<td>1,741</td>
</tr>
<tr>
<td>1981</td>
<td>1,797</td>
<td>379</td>
<td>653</td>
<td>533</td>
<td>3,362</td>
</tr>
<tr>
<td>1982</td>
<td>2,754</td>
<td>459</td>
<td>654</td>
<td>656</td>
<td>4,503</td>
</tr>
<tr>
<td>1983</td>
<td>4,398</td>
<td>462</td>
<td>626</td>
<td>622</td>
<td>6,008</td>
</tr>
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<td>1984</td>
<td>6,537</td>
<td>498</td>
<td>642</td>
<td>596</td>
<td>8,272</td>
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<tr>
<td>1985</td>
<td>3,937</td>
<td>553</td>
<td>1,205</td>
<td>694</td>
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<tr>
<td>1986</td>
<td>2,200</td>
<td>750</td>
<td>1,438</td>
<td>617</td>
<td>5,005</td>
</tr>
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</table>

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**Forest Service (Mile 27, Copper River Highway) to repair roads in the Cordova area.**

Construction for the 90-megawatt Bradley Lake Hydroelectric Project, Alaska’s largest capital-improvement undertaking, was initiated in 1986, and site preparation was 70 percent complete during the year. ENSERCH ALASKA CONSTRUCTION, INC., was awarded $23 million to build the road, airstrip, dock, construction camp, and other facilities at Bradley Lake. The construction involved excavation of sand and gravel and shot rock from three pits near the project area. If the Bradley Lake Project continues, stone and sand-and-gravel use is expected to increase from 1987 to 1990, when the dam and power plant are scheduled to be built.

**SOUTHEASTERN REGION**

Estimated sand-and-gravel usage in the Panhandle region for 1986 is 510,000 tons, a decrease of 16 percent from 1985. As in other areas of the state, the major reason for the drop in production is declining State revenues.

The largest single producer of aggregate was again HILDRE SAND AND GRAVEL (JUNEAU REDI MIX, INC.), which produces gravel for concrete, plaster, gunnite, and fill from their Lemon Creek pits in Juneau. This company produced nearly a third of the total aggregate used in southeast Alaska.

Other producers in the region include RED-SAMM CONSTRUCTION, INC., CHANNEL CONSTRUCTION, INC. (Juneau), and ISLAND CONSTRUCTION, INC. Longtime shot-rock quarry-operator KETCHikan REDI MIX AND QUARRY did not report activities for the year.

**COAL AND PEAT**

Coal mining had another good year in 1986, with production increasing from record levels set in 1985. USIBELLI COAL MINE, INC., the only operating coal mine in the state, produced 1,492,707 tons of subbituminous-C coal from the Nenana coal field in the eastern interior region (table 11). This is a 10-percent increase from 1985 and exceeds by over 50 percent the combined production records set by mine operators in the Matanuska and Nenana coal fields in the 1960s. During 1986, 147 unit trains carried 5,100 to 5,500 tons of coal each to Seward, where coal is loaded onto 60,000-dwt-capacity (Panamax) ships bound for the KOREAN ELECTRIC POWER COMPANY (KEPCO) at Honam, South Korea (fig. 32).
In September and October 1986, competition from Canadian and Australian producers that supply coal to KEPCO resulted in difficult contract renegotiations among the ALASKA RAILROAD, SUN EEL SHIPPING COMPANY (Seward), USIBELLI COAL MINE, INC., and KEPCO. Specific results of the renegotiated contract are confidential, but the overall result will be a 15-percent price reduction in coal that is shipped to the Honam Power Plant. The USIBELLI prices are now more competitive with prices quoted by the Australian and Canadian companies.

Peat production continued to decline from peak levels in 1984 primarily because of a decline in construction activity. In 1986, 50,000 yd$^3$ worth $350,000 were used mainly in landscaping and horticulture in the Anchorage and Fairbanks areas (table 6). This represents a 41-percent decrease from 1985 production levels and a 60-percent decrease from 1984 levels. Anchorage peat distributors include GORDER EXCAVATING, A & A SERVICES, and NORTHWEST LANDSCAPING; Fairbanks distributors include COX ENTERPRISES and GREAT NORTHWEST LANDSCAPING, who produced from pits in the College and Chena Pump Road areas.

Table 11. Market breakdown for 1986, Usibelli Coal Mine, Healy, Alaska.$^a$

<table>
<thead>
<tr>
<th>Site location</th>
<th>Coal (short tons)</th>
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<tr>
<td>Clear Air Force Base</td>
<td>82,907</td>
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<tr>
<td>Fort Wainwright (U.S. Army)</td>
<td>184,789</td>
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<tr>
<td>Eielson Air Force Base</td>
<td>166,353</td>
</tr>
<tr>
<td>Fort Richardson (U.S. Army)$^b$</td>
<td>4,970</td>
</tr>
<tr>
<td>Golden Valley Electric Association</td>
<td>149,963</td>
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<tr>
<td>University of Alaska (Fairbanks)</td>
<td>47,503</td>
</tr>
<tr>
<td>Fairbanks Municipal Utilities System</td>
<td>123,453</td>
</tr>
<tr>
<td>Reliable Coal (home heating in eastern interior region)</td>
<td>9,988</td>
</tr>
<tr>
<td>Sun Eel shipments to Honam, Korea</td>
<td>722,781</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1,492,707</strong></td>
</tr>
</tbody>
</table>

$^a$Information provided by John F.M. Sims, Vice President of Marketing, Usibelli Coal Mine, Inc.

$^b$Only for annual testing of coal-fired boilers formerly in use at this installation.

Drilling activity in 1986

INTRODUCTION

Contract drilling of placer, coal, and hard-rock deposits totaled 328,400 ft in 1986, a 49-percent increase from the 220,400 ft drilled in 1985 (table 12). Nearly 70 percent of the 1986 total drill footage consisted of thaw-field drilling for placer-dredging operations (ALASKA GOLD COMPANY) in Nome. When thaw-field development drilling is excluded from total footage, exploration drilling decreases 68 percent, from 314,000 ft in 1982 (when drilling statistics were first collected) to 101,400 ft in 1986.

Excluding thaw-field activity, placer exploration drilling decreased 30 percent, from 46,000 ft in 1985 to 32,400 ft in 1986. Hard-rock drilling decreased 62 percent, from 131,700 ft in 1985 to 50,200 ft in 1986. The number of companies that conducted major drilling programs in Alaska decreased from 19 in 1985 to 13 in 1986 (table 13), reflecting the drop in hard-rock drilling footage. Only coal drilling increased, more than doubling from 8,700 ft in 1985 to 18,800 ft in 1986.
Table 12. Contract mineral-drilling footage in Alaska, 1982-86.

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Placer</td>
<td>124,000</td>
<td>53,000</td>
<td>129,000</td>
<td>80,000</td>
<td>259,400</td>
</tr>
<tr>
<td>Coal</td>
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<td>12,000</td>
<td>25,700</td>
<td>8,700</td>
<td>18,800</td>
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<tr>
<td>Hard rock</td>
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<td>180,500</td>
<td>176,000</td>
<td>131,700</td>
<td>50,200</td>
</tr>
<tr>
<td>TOTAL</td>
<td>404,000</td>
<td>245,500</td>
<td>320,700</td>
<td>220,400</td>
<td>328,400</td>
</tr>
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</table>

Table 13. Companies that conducted major drilling programs in Alaska, 1986.

- Alaska Gold Company
- Battle Mountain Gold Company
- Chiechagof Joint Venture
- Cominco Alaska, Inc.
- Valdez Creek Mining Company
- Diamond Alaska Coal Company
- Echo Bay Mines
- GHD Resources
- Golden Zone Development Ltd.
- Greens Creek Mining Company
- Houston Oil & Minerals
- Nerco Minerals Company
- Placer U.S., Inc.

PLACER DRILLING

Contract placer drilling, which represented 79 percent of total drill footage in Alaska, totaled 259,400 ft in 1986. Exploration drilling accounted for only 32,400 ft of the total footage, with over half of that footage drilled at the VALDEZ CREEK MINING COMPANY's project in southcentral Alaska.

The remaining 227,000 ft of placer footage consisted of thaw-field development drilling for the ALASKA GOLD COMPANY in Nome. In winter, the frozen gravels are drilled to bedrock and water pipe is inserted in the drill holes. During the following summer, water is injected into the pipes to percolate through and thaw the gravel for dredging. The substantial footage drilled in 1986 represents a major investment in preparing a large yardage of reserves for dredging in future years.

COAL DRILLING

Before spring breakup, the DIAMOND ALASKA COAL COMPANY drilled nearly 11,000 ft to further assess the quality of their coal reserves in the Beluga coal field. PLACER U.S., INC., also completed additional exploration drilling on their coal deposits in the Beluga coal field. No drilling was reported in the Matanuska or Bering River coal fields in 1986. USIBELLI COAL MINE, INC., completed 10,000 ft of rotary drilling to prove up additional reserves in the Poker Flats area. Because this drilling was done in-house, the footage is not included in the total drill footage.

HARD-ROCK DRILLING

In 1986, drilling on hard-rock deposits totaled 50,200 ft, a decline of 62 percent from the 1985 total of 131,700 ft. This drop reflects the completion of major exploration projects, the reduction in the number of active companies, and the present focus on precious metals.

No drilling was done on the Red Dog or Quartz Hill deposits because the exploration phases of those programs have been completed. Exploration drilling continued at the Greens Creek deposit, although the program was much smaller than in 1985 when the company was mandated by ANILCA to complete exploration on part of the project claims.

The number of companies with major drilling programs on hard-rock deposits declined from 14 in 1985 to eight in 1986. Many companies active in 1986 are maintaining their Alaska properties and may resume exploration-related drilling programs in the future. However, ENSERCH EXPLORATION and NORANDA EXPLORATION disposed of their holdings and ceased all exploration activities in Alaska.

ECHO BAY MINES, LTD. (ECHO BAY), the operator of several Canadian mines, was the only new company to begin a drilling program in Alaska in 1986. Following up on preliminary work done in 1985, ECHO BAY conducted a significant drilling program to reevaluate remaining reserves at the historic Alaska Juneau Mine in Juneau.

Over 90 percent of the hard-rock footage in 1986 was drilled on precious-metal deposits; only one company continued exploration-related drilling on base-metal deposits. This reflects a 3-yr trend in which metals exploration in Alaska has increasingly focused on precious metals.

Mineral resources and mineral potential of lands owned by native regional corporations

INTRODUCTION

The Alaska Native Claims Settlement Act (ANCSA), passed in December 1971, provided for the conveyance of approximately 44 million acres of land to Alaska natives. Under the terms of ANCSA, 12 landed regional corporations (fig. 33) and numerous Native village corporations within the regions were formed to select and manage the land settlement. The entitlement of each regional corporation is based on land areas covered by the region and on the number of Native corporation stockholders.

Under ANCSA, the village corporations receive title to the surface estate of approximately 22 million acres. The regional corporations receive title to the subsurface estate of the village lands, title to surface and subsurface estates for approximately 16 million additional acres, and subsurface title for much of 2 million acres of special-purpose lands. The balance of the land settlements is for 3.7 million acres, which comprises the settlement for seven Native village corporations located on five revoked reserves. These seven...
village corporations hold title to both the surface and subsurface estates of their former reserves, which were created prior to ANCSA.

As major land owners, the Native regional corporations may contribute substantially to Alaska’s mineral industry. The corporations selected much of their land entitlement on the basis of mineral potential and are currently involved in broad-based mineral exploration and joint-venture agreements and in secondary activities that support mineral exploration and mining.

Ten of the 12 landed corporations provided information on mineral resources and mineral potential for this report.

**ARCTIC SLOPE REGIONAL CORPORATION**

ARCTIC SLOPE REGIONAL CORPORATION (ASRC) is located in northern Alaska (fig. 33), with headquarters in Barrow and an office in Anchorage. Their land entitlement of 4.7 million acres includes mineral rights to coal, oil and gas, sand and gravel, and hardrock minerals. Mineral interests are focused on bituminous coal in the Deadfall syncline area near Cape Beaufort; chromite deposits in the De Long Mountains; and precious metals, strategic minerals, and Red Dog-type zinc-lead-silver mineral deposits in other areas of the Brooks Range.

Bituminous and subbituminous coal reserves of the North Slope are among the largest in the United States (Merritt and Hawley, 1986). ARCTIC SLOPE CONSULTING ENGINEERS (ASCE), a subsidiary of ASRC, conducted a detailed study of coal reserves in the Deadfall syncline area on the Chukchi Sea coast (loc. 3, fig. 34) and published a study of the feasibility of using coal as an energy source for western Alaska.

Significant mineral deposits may exist in the Noatak mining district, a 50-mile-wide belt that stretches from Point Hope on the Chukchi Sea east to Anaktuvuk Pass in the north-central Brooks Range. Known mineral deposits include zinc-lead-silver deposits at Kiviklort Mountain (loc. 4, fig. 34) and on Story (loc. 5, fig. 34) and Drenchwater (loc. 6, fig. 34) Creeks.

Gravel resources of the corporation have been used in North Slope oil-field development, and several large gravel reserves have been identified by ASCE near Kaktovik (loc. 1, fig. 34) and Barrow (loc. 2, fig. 34). These reserves may be of future value to ASRC and local village corporations.

Additional information on mineral resources of the ASRC region is available from Charles Barnwell, Geologist, ARCTIC SLOPE CONSULTING ENGINEERS, 313 E Street (Ste. 2), Anchorage 99501.

**NANA REGIONAL CORPORATION**

NANA REGIONAL CORPORATION (NANA), headquartered in Kotzebue, stretches across 2 million acres in western Alaska (fig. 33). NANA owns the zinc-lead-silver deposit at Red Dog (loc. 7, fig. 34) and selected land in the Ambler mining district (loc. 9, fig. 34), including property in the Bornite area around the copper and zinc deposits in the Cosmos Hills (loc. 8, fig. 34).

The Red Dog zinc-lead-silver property (see Development section) is the largest undeveloped zinc deposit in the world. Proven reserves total 85 million tons of ore that grade 17 percent zinc, 5 percent lead, and 2.4 oz/ton silver. Construction of an access road from the coast to the mine should begin in mid-1987, and mineral production is scheduled for early 1991. Red Dog is being developed as a joint venture between NANA and COMINCO ALASKA, INC.

In addition to the base-metal potential of NANA lands, there is a high lode-gold potential, particularly for ‘Hemlo’-type gold deposits at the west end of the Ambler mining district and for auriferous stockwork quartz veins in the York Slate on the Seward Peninsula. Good potential also exists for the discovery of placer-gold deposits. On Kleri Creek north of Kiana (loc. 11, fig. 34), substantial amounts of placer gold have been produced. A bucketline dredge operated on the creek for several years, but current operations use conventional earthmoving equipment. The potential exists for significant placer reserves at the confluence of Kleri Creek and the Squirrel River.

South of Deering, placer gold has been produced from the Inmachuk...
Figure 34. Selected mineral properties held by Arctic Slope, NANA, Bering Straits, Doyon, Ltd., and Cook Inlet Region, Inc. (CIRI), regional corporations, 1986.
River and its tributaries (loc. 13, fig. 34), where at least four gold dredges operated before 1940. Excellent potential for additional pay exists below the lower limit of the previous mining operations and adjacent to active mining claims.

Auriferous paleochannels, about 1,200 ft wide, are the source of much of the gold derived from the Ilnachuk River. The paleochannels, which are partly buried under Quaternary basalt flows, have been exploited primarily with drift mining techniques, but in one location the channels beneath the volcanic rock were hydraulically mined.

AMBLER VILLAGE CORPORATION, a subsidiary of NANA, owns property in the southern part of the Jade Mountains (loc. 10, fig. 34), where high-quality jade is produced. Jade reserves on the village lands have not been quantified, but the potential exists for substantial tonnages of the semi-precious stone.

The Chicago Creek coal deposit (loc. 12, fig. 34) is located on land controlled by DEERING VILLAGE CORPORATION, another NANA subsidiary. According to a recent evaluation by the State, the coal can be used for heat, power, and economic development (Retherford and others, 1986). Recent drilling under a State-supported contract indicates that economically exploitable reserves exist in the area.

The NANA region has substantial gravel reserves. Every major river valley contains gravel, and every village has a nearby gravel source to meet local needs.

Additional information on the mineral resources of the NANA region is available from John Rense, Vice President-Resources, NANA REGIONAL CORPORATION, 4706 Harding Drive, Anchorage 99517.

BERING STRAITS NATIVE CORPORATION

The land entitlement for BERING STRAITS NATIVE CORPORATION (BERING STRAITS) consists of nearly 2 million acres on the Seward Peninsula (fig. 33). Lands selected by BERING STRAITS and related village corporations have significant mineral potential. BERING STRAITS has its headquarters in Nome, with offices in Anchorage.

The Nome area (loc. 22, fig. 34) is historically one of Alaska's primary gold-producing regions. Since the discovery of gold on Anvil Creek in 1898, at least 4.5 million oz of placer gold have been produced. Other placer deposits in the Council (loc. 19, fig. 34), Solomon (loc. 21, fig. 34), and Kohlrook (loc. 14, fig. 34) areas have produced substantial quantities of gold, and there is good potential for the discovery of additional placer deposits. Pay-channels delineated by previous exploration work and tailings from prior placer-mining operations may represent additional economic reserves.

On the outskirts of Nome, the ALASKA GOLD COMPANY, a subsidiary of SHARON STEEL, has delineated over 1 million oz of proven gold reserves and operates two bucketline dredges. Land adjacent to the patented mining claims may contain placer gold in paying quantities. Exploration work funded by BERING STRAITS has resulted in the discovery of carbonate rocks that contain anomalous amounts of gold. Several other types of gold deposits were found, but detailed follow-up work has not been initiated.

UTAH INTERNATIONAL, INC., has an exploration agreement with BERING STRAITS for selected lands, including the Bluff area (loc. 20, fig. 34), which is known for its strata-bound lode-gold potential. Rich placer deposits downstream from Bluff were mined in past years.

BERING STRAITS controls the land around the Lost River tin-tungsten-fluorite-beryllium deposits (loc. 18, fig. 34; loc. 24, app. C). Thorough exploration of the area may result in discovery of additional deposits. Preliminary work indicates that Potato Mountain (loc. 17, fig. 34), located northwest of Lost River on BERING STRAITS land, is a promising tin prospect.

Additional information on mineral resources of the BERING STRAITS region is available from Dan Fondell, Executive Vice President-Chief Executive Officer, BERING STRAITS NATIVE CORPORATION, 3111 C Street (Ste. 200), Anchorage 99503.

DOYON, LTD.

The land entitlement for DOYON, LTD., includes approximately 12.5 million acres with mineral rights. By the end of 1986, 5.1 million acres of land had been conveyed to the corporation. The DOYON region, which encompasses approximately one-third of Alaska (fig. 33), extends from the Brooks Range to the Alaska Range and from the Alaska-Yukon border almost to Norton Sound. DOYON headquarters are located in Fairbanks.

Recent mineral exploration on DOYON lands indicates that the area contains diverse geologic environments with recognized mineral potential. The geology of the region includes intermediate to felsic intrusive rocks, volcanic centers, skarn, Precambrian greenstone belts, quartz veins in schists, and both alkalic and ultramafic complexes. Several hundred prospects and areas of anomalous mineralization have been identified. The most clearly identified prospects include volcanicogenic massive sulfides, carbonate- and shale-hosted lead and zinc, vein and disseminated gold and silver, porphyry copper, stockwork molybdenum, placer gold and tin, lode tin, tungsten skarns, vein mercury and antimony, sedimentary and hydrothermal uranium, and coal. Further evaluation is necessary to determine the type and economic potential of most deposits.

DOYON holds substantial lands in several well-known historic placer-gold districts, including the Iditarod mining district (loc. 36, fig. 34), which has produced over 1.6 million oz of gold, and the Candle Creek (loc. 32, fig. 34), Rampart (loc. 25, fig. 34), Hughes (loc. 27, fig. 34), and Ruby (loc. 28, fig. 34) mining districts, which have produced 100,000 to 500,000 oz of gold each.

Silver is the major exploration target in several areas of precious-metal mineralization. The most promising areas include intrusive-volcanic complexes in the Kuskokwim Mountains, where disseminated and vein silver deposits grade up to several ounces silver per ton.

Disseminated and skarn copper and molybdenum mineralization associated with intermediate to felsic intrusive rocks have been identified on DOYON lands, East of Grayling (loc. 33, fig. 34), drill-hole data confirmed ore-grade mineralization, and petrologic studies indicate that a stockwork molybdenum deposit is present within 1,000 ft of the surface.

Near Medina (loc. 31, fig. 34) and at Step Mountain (loc. 23, fig. 34),
A world-class chrysotile-asbestos district has been defined near Slate Creek (loc. 24, fig. 34) in the Yukon-Tanana Upland. Three surface deposits have drill-indicated reserves of 55 million tons of 6.35 percent asbestos fiber.

Very limited field work suggests that several ultramafic complexes on DOYON lands are favorable environments for chromite, nickel, and platinum-group metals.

Additional information on mineral resources of the DOYON region is available from Morris Thompson, President, DOYON, LTD., 201 1st Avenue, Fairbanks 99701.

COOK INLET REGION, INC.

COOK INLET REGION, INC. (CIRI), owns 601,360 acres of fee-simple estate, 21,852 acres of surface estate, and 516,678 acres of subsurface estate (fig. 33). The lands contain significant deposits of minerals, coal, and gravel.

Late in 1985, ANACONDA MINERALS COMPANY (ANACONDA) transferred their mineral holdings in Alaska (with one exception) to CIRI. The holdings are located throughout the state and include significant prospects for precious metals, tin, and chromium. As part of the Anaconda acquisition, CIRI obtained the largest mineral-exploration data base in Alaska. Descriptions of several properties are listed below:

Kougarok tin-tantalum prospect (loc. 15, fig. 34): This prospect is located on the Seward Peninsula, 80 mi north of Nome (Puchner, 1986). High-grade tin mineralization in geysenized granite was discovered at Kougarok Mountain in 1979. From 1980 to 1988, exploration on the prospect consisted of detailed mapping, geochemical and geophysical surveys, 33,000 ft of drilling, and over 3,000 ft of trenching. High-grade tin mineralization at Kougarok occurs in geysenized granitic plugs, dikes, and sills of Cretaceous age that intrude a sequence of pelitic schist and marble. Low-grade tin mineralization occurs as veins and stockworks within the schist. A high-grade tin resource of more than 150,000 tons that grades better than 1 percent tin has been outlined, and up to 0.1 percent tantalum is found in selected zones.

Kelly Creek prospect (loc. 16, fig. 34): This prospect is located on the Seward Peninsula at Quartz Creek, 45 mi northwest of the end of the Nome-Taylor Highway. The prospect consists of three zones of anomalous gold, arsenic, mercury, and antimony associated with graphitic schist and schistose marble. Drilling intersected disseminated gold mineralization in graphitic schist over widths of 40 to 75 ft; average grade is 0.035 oz/ton gold.

Illinois Creek mining district (loc. 29, fig. 34): This district includes numerous precious- and base-metal prospects located in the Katuyuh Mountains, 60 mi southwest of Galena. Mineralization was discovered during a regional reconnaissance program in 1980. Subsequent work included trenching, drilling, regional exploration, and construction of a large camp and airstrip. The two most promising prospects in the district are on Illinois and Waterpump Creeks. On Illinois Creek, trenching and drilling outlined a gossan body (120 ft wide and over 1/2 mi long) that contains significant gold in oxidized zones that may be amenable to open-pit mining.

Waterpump Creek prospect (loc. 30, fig. 34): High-grade silver-lead-zinc mineralization has been identified at this prospect. The shallow oxidized zone of the deposit contains silver that grades from 5 to 20 oz/ton. The deeper sulfide zone contains about 20 percent combined lead and zinc with silver credits.

Farewell mining district (loc. 35, fig. 34): Deposits in the mining district are located on the north flank of the Alaska Range, 150 mi northwest of Anchorage. Government investigations (Reed and Elliott, 1968) and industry reconnaissance studies in 1980 and 1981 located 15 deposits of polymetallic sulfide mineralization. Only six deposits have been evaluated in detail, and only two have
been drilled. At the Dall prospect, black shale hosts structurally controlled massive-sulfide mineralization (1 to 4 percent copper and 12 oz/ton silver). The mineralized zone ranges from 12 to 30 ft wide and extends to at least 500 ft along a strike length of at least 1 mi. At the 6920, Tin Creek, and Little Bird prospects, the mineralization appears to be classic, low-temperature, fracture-controlled lead-zinc-silver skarns that occur as replacement bodies in limestone (Szumigala, 1987). In addition to sulfide mineralization, the 6920 prospect contains appreciable gold that grades to 0.36 oz/ton, and the Little Bird prospect contains tungsten and other base and precious metals.

Red Mountain chrome deposit (loc. 1, fig. 35): This deposit is located on the Kenai Peninsula, 140 mi south of Anchorage, and is accessible by road from Soldova. Through the ownership of patented claims and fee-simple title, CIRI controls about 75 percent of the property with the highest mineral potential. Chromite mineralization at Red Mountain is hosted by a layered ultramafic body 4 mi long and 2 mi wide. About 37,000 tons of high-grade chromite ore were produced intermittently from 1942 to 1976. Based on estimates by the U.S. Bureau of Mines, about 100,000 tons of 26.6 percent chromite ore remain in at least five high-grade zones. More than 20 million tons of open-pit, minable resources that grade 5.6 percent chromite have been outlined in low-grade stringer zones (Foley and others, 1985); considerable potential exists for additional tonnage at depth. The Red Mountain deposit is one of the largest low-grade chrome resources in North America.

Johnson River mineralized area (loc. 2, fig. 35): CIRI holds mineral rights to over 20,000 acres in this mineralized area, which is located in Lake Clark National Park Preserve, 130 mi southwest of Anchorage on the west side of Cook Inlet. The Johnson River mineralized area contains several important gold-zinc prospects in the volcanic and volcanioclastic rocks of the Jurassic Talkeetna Formation. Detailed work on the main Johnson River deposit outlined significant gold-zinc mineralization with credits of copper and lead in a steep quartz-stockwork zone. CIRI negotiated a Letter of Agreement with HOWARD KECK to conduct further exploration of the deposit, which is being evaluated as a potential underground high-grade gold mine.

Manhattan gold-silver-lead-zinc prospect (loc. 17, fig. 35): This prospect is located on the Alaska Peninsula, 30 mi south of Port Heiden and 20 mi north of Chignaik. The prospect consists of multiple steeply dipping sulfide veins that cut a northeast-trending ridge of andesite porphyry. Surface assays over vein widths of 2 to 4 ft grade 0.5 oz/ton gold, 9 oz/ton silver, and 15 percent lead and zinc. Vein intercepts that contain similar amounts of gold have been drilled to 400 ft. Additional exploration is required to determine the feasibility of mining.

Additional information on mineral resources in the CIRI region is available from Kurt Humphrey, Manager, Oil and Gas Administration, COOK INLET REGION, INC., 2525 C Street (Ste. 500), P.O. Drawer 4-N, Anchorage 99509.

CALISTA CORPORATION

CALISTA CORPORATION's land entitlement totals about 7 million acres in southwestern Alaska (fig. 33). Prior to selecting their land entitlement, CALISTA conducted a 3-yr mineral inventory of the CALISTA region to identify lands with mineral-resource potential. As a result of the survey, lands in several historic placer-gold districts and lands near the Goodnews Bay placer-platinum district (loc. 13, fig. 35), which contains the country's largest identified platinum deposit, were selected. Historic recovery from the district exceeded 641,000 oz of unrefined platinum-group metals (PGM). CALISTA's land selection includes both the Red and Susie Mountain ultramafic complexes, which are the source of the PGM at Goodnews Bay. CALISTA is presently negotiating with owners of the Goodnews Bay Mine to evaluate the district's undeveloped potential, to reprocess the placer tailings, and to develop unmined, deep placer reserves.

Forty placer-gold deposits with recorded production are present in the CALISTA region. Nearly all deposits were discovered during the early 1900s by prospectors who participated in the Nome stampede. Although many placer operations didn't evolve past hand-mining methods and were active for only a few years, the Bear (loc. 9, fig. 35), Tululsak (loc. 8, fig. 35), and Marvel (loc. 10, fig. 35) prospects and streams in the Marshall mining district (Stuyahok River (loc. 4, fig. 35), and Kako (loc. 5, fig. 35) became profitable gold producers using either floating dredges or sluicing operations. All placer mines in the CALISTA region were closed by government order in World War II, and only the Wattamuse Mine and mines in the Naknek mining district on Bear and Tululsak Creeks reopened. In addition to the sizable number of former placer producers, numerous drainages in the CALISTA region host fine-gold placers of undetermined economic potential. These drainages include Bogus Creek (loc. 7, fig. 35), the Aerolic River (loc. 12, fig. 35), and tributaries of the lower Yukon River.

Most gold placers in the CALISTA region are either along the lower Yukon River or on the west flank of the Kilbuck Mountains. Both terranes are composed of Mesozoic 'greenstone belts' that are potential hosts of intrusive- and exhalative-type gold deposits. In addition, two auriferous hot-spring jasperoid sinter have been discovered on the west flank of the Kilbuck Mountains, which indicate that the area may also host a younger, epithermal gold deposit.

CALISTA has fielded its own exploration program for the past 2 yr. During the 1986 field season, CALISTA geologists mapped and sampled the Marshall mining district and 'rediscovered' the Arnold prospect on upper Willow Creek (loc. 6, fig. 35). The prospect, which was originally discovered in 1913, is a stockwork breccia in greenstone tuff that has been sheared and cut by several hydrothermally altered alite-diocrate and quartz-porphyry dikes. The gold occurs in late-
Figure 35. Selected mineral properties held by Cook Inlet Region, Inc. (CIRI), Calista, Koniag, Inc., and Aleut regional corporations, 1986.
stage quartz veins that assay 0.12 to 2.72 oz/ton gold with an average uncut assay of 0.9 oz/ton gold. The property has not been drilled.

The Stuyahok River placer deposit (loc. 4, fig. 35) was examined by CALISTA in 1985. The main deposit lies in the headwaters of the Stuyahok River in an area of subdued relief and no outcrop; at least one-third of the payskreak has not been mined. The most interesting aspect of this property is its lode potential.

In 1916, placer gold was discovered on Wattamuse Creek (loc. 11, fig. 35) and, except during the war, the mine produced until 1961. The creek drains a Cretaceous granite stock that intrudes marine anodesite, slate, and chert of early Mesozoic age. Intrusive gabbro contains gold that grades 0.1 oz/ton.

The Donlin Creek placer area (loc. 3, fig. 35), currently leased by CALISTA to LYMAN RESOURCES OF ALASKA, INC., is located in the Aniak gold-mercury district in the middle Kuskokwim region. The area is underlain by a thick sequence of Upper Cretaceous marine sedimentary rocks that have been cut by a northeast-trending swarm of Tertiary rhyolite porphyry dikes. Donlin Creek has been a sporadic producer of placer gold, which occurs in benches and tributaries on the south side of the creek, since its discovery in 1910. On the ridge south of the creek, a series of rhyolitic porphyry dikes are exposed in trenches. Gold associated with sillinite and pyrite occurs along the sheared contact of the dikes and in thin shear zones within and adjacent to the intrusive rock. CALISTA sampled the property in the early 1970s and in 1985. Anomalous gold values were traced for 3 mi along strike of the rhyolite. Ten- and 25-ft channel samples yielded 2.05 oz/ton uncut gold and 0.98 oz/ton gold, respectively.

Additional information on mineral resources in the CALISTA region is available from Mike Neimeyer, Vice President, Land and Natural Resources, CALISTA CORPORATION, 516 Denali Street, Anchorage 99501.

BRISTOL BAY NATIVE CORPORATION

The BRISTOL BAY NATIVE CORPORATION (BBNC) entitlement in-
cludes 3.1 million acres of land east of the Aleutian Islands and west of Cook Inlet (fig. 33). This area consists of coastal lowlands, volcanic terrain, and broad river valleys. Mountains on the west, north, and northeast are composed primarily of sedimentary rocks, including shale, siltstone, graywacke, and limestone, with minor igneous intrusions. Limited mineral exploration has shown that the most prevalent metallic minerals are gold, silver, copper, zinc, lead, molybdenum, tin, tungsten, and iron; the region also has coal resources.

In the early 1980s, RESOURCE ASSOCIATES OF ALASKA initiated an exploration program on BBNC lands in southwest Alaska, but many areas in the region have not been explored.

Additional information on mineral resources in the BBNC region is available from Mike Mark Anthony, Mining Engineer-Land Planner, BRISTOL BAY NATIVE CORPORATION, P.O. Box 100220, Anchorage 99501.

KONIAG, INC.

The KONIAG, INC., area includes Kodiak Island, Afognak Island, and the eastern Alaska Peninsula between Kujulik Bay and Becharof Lake (fig. 33). Kodiak Island, particularly the northwestern half, contains gold, silver, copper, lead, zinc, and tungsten deposits. Along the western beaches of the island, placer deposits of gold, magnetite, pyrite, chromite, and platinum have been mined on a small scale in recent decades. A small tungsten deposit occurs on Chalet Mountain (loc. 14, fig. 35), 10 mi west of Kodiak, and a small copper deposit is located on the northwest side of Siktulidak Island (loc. 15, fig. 35). The presence of chromite and platinum placers suggests that additional lode deposits may be associated with a belt of intrusive rocks also located along the northwest coast of Siktulidak Island. Coal outcrops are located near Ayakolik and on Sikkinaq Island (loc. 16, fig. 35), where coal was gathered from the beaches by early explorers.

Additional information on mineral resources in the KONIAG region is available from Frank Pagano, President, KONIAG, INC., 201 Kashavernoff (Ste. 6), Kodiak 99615.

ALEUT CORPORATION

The ALEUT CORPORATION has rights to about 1.4 million acres of subsurface estate and 50,000 acres of fee-simple estate in the lower Alaska Peninsula and Aleutian Islands (fig. 33).

Numerous prospects for gold, silver, coal, porphyry copper, and other base metals have been identified in exploration programs conducted on ALEUT lands by KENNECOTT CORPORATION, FREEPORT MINING COMPANY, UNC Teton, RESOURCE ASSOCIATES OF ALASKA, HOU- STON OIL AND MINERALS, and QUINTANA-DUVAL. Descriptions of several prospects are listed below:

Pyramid Peak (loc. 18, fig. 35): A copper-molybdenite monzonite porphyry that intrudes black siltstones of the Cretaceous Hoodoo Formation. Estimated to contain 113 million tons of 0.403 percent copper with credits of molybdenite in a smaller but richerchaloczite blanket. Drilled for copper; follow-up sampling indicated anomalous gold and silver.

Canoe Bay (loc. 19, fig. 35): A rhyolite-porphyry dome intruded into a thick clastic pile. Stockwork development displays anomalous gold, silver, mercury, and arsenic throughout the 1-mi² project area.

Aguilla-Orange Mountain-Shumagin trend (loc. 20, fig. 35): An epithermal vein and stockwork system that contains the Orange Mountain prospect, a 2.7-mi² area of brecciation and intense silica alteration that displays potential for both large-tonnage disseminated-gold deposits and smaller, bonanza-type gold-silver vein deposits. Anomal-ous gold that grades 0.083 oz/ton, silver that grades 0.76 oz/ton, mercury, tellurium, tellurium, and bismuth are found in the area; property has been tested with three drill holes.

Apollo-Sitka trend (loc. 21, fig. 35): An epithermal vein that may contain extensions of mineralization associated with the Apollo-Sitka Mine, which produced 197,900 oz of 0.22-oz/ton gold from 1892 to 1912.
Hog prospect (loc. 22, fig. 35): Volcanic breccia-hosted silver-gold mineralization in the ring-fracture zone of the Unga caldera. The prospect area is anomalous in silver that grades 7.9 oz/ton, gold that grades 0.04 oz/ton, arsenic, and mercury; property has been tested with six drill holes.

Walrus Peak (loc. 23, fig. 35): A shear zone with strong anargyilitic alteration produced by a solfataric system; contains anomalous gold that grades 0.186 oz/ton, silver that grades 0.1 oz/ton, arsenic, and mercuroy.

Kigunak (loc. 24, fig. 35): A volcanic-hosted, multiphase granodiorite intrusive with alteration indicative of acidic hydrothermal fluids (kaolinite, sericite, silica, and alunite). Areal extent of gold mineralization is difficult to determine because of ash cover; channel samples average 0.10 oz/ton gold and 0.56 oz/ton silver; property has been tested with five drill holes.

Steeple Mountain (loc. 25, fig. 35): The prospect is similar to Kigunak prospect with extensive zones of silicification, quartz-stockwork veining, potassium flooding, and detectable gold that ranges from 0.005 to 1.3 ppm.

Additional information on mineral resources in the ALEUT region is available from Wayne Lewis, Director of Lands and Minerals, ALEUT CORPORATION, 4000 Old Seward Highway, One Aulet Plaza (Ste. 300), Anchorage 99503-6028.

AHTNA, INC.

The AHTNA, INC., region includes the Wrangell Mountains, Chugach Mountains, Gulkana upland, Lake Louise plateau, Copper River basin, and parts of the Alaska Range (fig. 33). Most of Alaska's historical copper and lode-silver production are from deposits on AHTNA property in the Kennebok mining district (loc. 1, fig. 38). AHTNA is a joint-venture partner in the Valdez Creek placer operation (loc. 2, fig. 36) near the Denali Highway (see Development section). The geology of the AHTNA region is favorable for metallic-mineral deposits, including gold, copper, silver, zinc, and strategic minerals. However, federal land withdrawals have severely limited the potential for new discoveries.

Additional information on mineral resources in the AHTNA region is available from Roy Ewan, President, AHTNA, INC., Drawer G, Copper Center 99573.

CHUGACH ALASKA, INC.

Land holdings of CHUGACH ALASKA, INC., headquartered in Anchorage, are situated along 150 mi of the Alaska coast from lower Cook Inlet to Icy Bay and include the cities of Cordova, Valdez, Seward, and Whittier (fig. 33). The region is rich in minerals and has produced 216 million lb of copper and 141,000 oz of gold, including 54,000 oz of byproduct gold mined from copper deposits (Moffit and Fellows, 1950).

The Port Valdez and Port Wells areas contain notable lead-zinc deposits. In the Port Valdez area, mineralization occurs in the uplands on the north side of Valdez Arm and near the Cliff Mine (loc. 3, fig. 36). In the Port Wells area, the mineralized zone is a few miles wide at the north end of College Fjord, widening to 30 mi at the south end between Portage Pass and Eagle Bay. The Granite Mine (loc. 5, fig. 36), an area of promising mineral potential, is located at Golden. According to PIONEER RESOURCES, INC., known mineral resources and prospects at Port Wells contain about 300,000 oz of gold that grade 0.65 oz/ton gold.

 placer-gold deposits are located in beach sands on Middleton Island (loc. 10, fig. 36) and in the dry channel of the Copper River. Other fine-grained, low-grade placer deposits are located in many streams in the King's Bay, Unalaska, Port Wells, Valdez Arm, Copper River, and Louie River areas. CHUGACH ALASKA has selection rights to beach placer properties at Cape Yakataga near those being developed by ALASKAGOLD MINES, INC. (see Development section).

Significant copper mineralization is found at Knight (loc. 7, fig. 36) and LaTouche (loc. 9, fig. 36) Islands and at Ellamar (loc. 4, fig. 36). Sedimentary-hosted copper deposits with significant credits of gold have been identified at Ellamar, LaTouche Island, and on the south side of Port Fidalgo. The Bentzons Mine on LaTouche Island is responsible for 90 percent of the copper produced in the Prince William Sound region.

Manganese is found in low concentrations on Chenega Island (loc. 8, fig. 36), and a chrome deposit has been identified in the English Bay and Port Graham areas. Cobalt and nickel, which are associated with many of the copper deposits described above, have been identified at Miners River.

In the Bering River area (loc. 6, fig. 36), extensive coal deposits (estimated at 3.6 billion tons that cover 80 mi²) are present in four formations. Parts of the coal seams are structurally dismembered. The eastern half of the coal field contains mainly anthracite, whereas the western half consists primarily of subbituminous coal. The coals have low ash and moisture contents and high heating values (from 12,000 to 15,000 Btu's).

For additional information on mineral resources in the CHUGACH region, contact Pio Park, Manager, Exploration, CHUGACH ALASKA, INC., 3000 A Street (Ste. 4000), Anchorage 99503.

SEALASKA CORPORATION

The SEALASKA CORPORATION selected lands throughout southeastern Alaska (fig. 33). As of December 1986, 102,700 acres had been patented and 365,700 acres had been conveyed by the federal government to the corporation.

SEALASKA partially identified its subsurface resource potential with two reconnaissance exploration surveys that were conducted from 1975 to 1979. The surveys covered about 40 percent of each withdrawal area (except Yakutat) and included literature review, field exploration, geochemical surveys of stream sediments, rock-chip assays, and limited follow-up investigations of mineral anomalies. About 6,000 stream-sediment samples and 500 rock samples were collected and analyzed for mineral values. In addition, SEALASKA catalogued and studied several thousand rock, stream-sediment, and drill-core samples collected by private industry and state and federal agencies.
SEALASKA recently completed atlases that list resource inventories and land-management programs for their lands. Included in the atlases are descriptions of surface resources, timber, and topography and land-management and geologically hazardous areas. The subsurface resource inventory lists known minerals and energy occurrences, discusses studies conducted in areas that have available subsurface data, identifies areas that have no subsurface data, and briefly describes geologic investigations that may improve the data base.

Minerals with potential for commercial development include lead, zinc, molybdenite, copper, silver, and gold; a potential for development of calcium-rich limestone exists. Areas of mineral potential include Prince of Wales withdrawal areas (Hydaburg, Craig, Klawock, Kassan, and Cholmondelay Sound (loc. 15, fig. 36)) and Chichagof, Dali, Kupu, and Admiralty Islands.

Four areas with especially high mineral potential are located near Trocadero Bay, Sunny Hay Mountain, Black Bear, and Shinaku Inlet in the Craig-Klawock area on Prince of Wales Island. The Trocadero Bay area (loc. 14, fig. 36) has moderate to high geochemical values of copper, zinc, and silver with trace amounts of gold and appears to have a mineralized shear zone in Paleozoic metasedimentary and metavolcanic rocks. In the Black Bear Lake area (loc. 17, fig. 36), mineralized veins contain anomalous concentrations of molybdenite-copper and lead-zinc.

Hydaburg, located on southwestern Prince of Wales Island, contains two large areas of sulfide-mineral potential. Copper, zinc, and silver have been identified in the Soda Bay area, which is
composed of Paleozoic metasediments and altered volcanics. Local faulting and shearing appear to be responsible for the structurally complex altered volcanics.

In the Hetta Inlet area, metamorphic rocks of the Precambrian or Paleozoic ages have been intruded by mafic to intermediate igneous rocks of Mesozoic age. Sulfide minerals are found as epigenetic mineralization that consists of veinwork massive sulfides in faults and fissures or contact-metamorphic replacement lodes in bedded rocks, especially in the Jumbo Basin area (loc. 16, fig. 36). Minerals with moderate to high economic potential include copper, lead, silver, zinc, barite, and iron. The Hetta Inlet area is geologically similar to the Kasaan Peninsula (loc. 13, fig. 36), where copper-iron deposits have been produced commercially. Most of the 42 million lb of copper and several hundred thousand ounces of gold and silver produced on Prince of Wales Island came from the Hetta Inlet and Kasaan Peninsula regions. Summaries of the geologic framework of these areas are presented in Herreid and others (1978) and Gehrels and Saleeby (1987).

The Dall Island area (loc. 18, fig. 36), a withdrawal of KLUHKAN VILLAGE CORPORATION, is located on central Dall Island off the southwest corner of Prince of Wales Island. The porphyry and massive-sulfide mineral potential of the area is promising. SEALASKA currently owns about 36,865 acres of surface and subsurface estate on Dall Island. A geologic reconnaissance of the area by SEALASKA outlined an extensive area with anomalous lead-zinc geochemical values in carbonate and sedimentary rocks of Paleozoic age. Mineralized float and veinwork indicate the presence of Cretaceous to Jurassic porphyritic intrusive rocks. Other than logging roads in east-central Dall Island, access to the island is by air or boat from Ketchikan, about 60 mi to the east.

Geologic reconnaissance work by SEALASKA indicates lead, zinc, and traces of silver over an extensive area near Kake (loc. 12, fig. 36). High to very high geochemical values of galena, sphalerite, and chalcopyrite have been found in a structurally complex area of Paleozoic metasedimentary rocks. The geologic setting is similar to that of the Greens Creek deposit on northern Admiralty Island.

SEALASKA also has important land positions in the Juneau Gold Belt (loc. 11, fig. 36), Alaska’s largest producer of lode gold.

For further information on mineral resources in the SEALASKA region, contact Robert Loescher, Vice President, Resource Management, SEALASKA CORPORATION, One Sealaska Plaza (Ste. 400), Juneau 99801.

References cited

Arctic Slope Consulting Engineers, 1986, Western Arctic coal development project - Executive summary: Anchorage, Report to Alaska Department of Community and Regional Affairs, Contract L6 210071, 35 p.


Herreid, Gordon, and Rose, A.W., 1986, Geology and geochemistry of
the Hollis and Twelvemile Creek area, Prince of Wales Island, southwestern Alaska: Alaska Division of Mines and Geology Geologic Report 17, 32 p., scale 1:35,000, 2 sheets.


Yukon Territory Northern Affairs Division, 1986, Yukon mining and exploration review: Department of Indian Affairs and Northern Development Special Paper, 33 p.
**APPENDIX A**

Total active claims and new claims staked in 1984, 1985, and 1986.*

*(listed by quadrangle)*

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* Totals are based on 1984, 1985, and 1986 assessment affidavits and location notices received by DGGS and DOM by December 31, 1986. Only documents received by December 31, 1986, 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. Assuming that this effect is random, the large overall drop in annual assessment work and total number of active claims from 1985 to 1986 is probably significant.

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APPENDIX B

State, federal, and private agencies involved in mineral-development activities, 1986

STATE OF ALASKA AGENCIES

A. Department of Commerce and Economic Development (DCE)

State Office Building, 9th Fl.
P.O. Box D (mailing)
Juneau, AK 99801
(907) 465-2000
Commissioner - J. Anthony Smith

Function: Promotes economic development in Alaska.

Division of Mines and Forest Products
State Office Building, 9th Fl.
P.O. Box D (mailing)
Juneau, AK 99801
(907) 465-2004
Director - ThyesShaun
Development Specialist - James R. Deaen

1001 Nobie St., Ste. 420
Fairbanks, AK 99701
(907) 452-7464
Development Specialist - Charles R. Green

111 Steedman, Ste. 204
Ketchikan, AK 99901
(907) 225-4690
Development Specialist - Frank Seymour

Frontier Building
3601 C St., Ste. 722
Anchorage, AK 99503
(907) 562-2728
Development Specialist - Bill Aberle

Function: Primary advocacy agency in state government for mining industry. Provides liaison between state government and private sector. Researches and publishes economic data on Alaska's mining industry.

B. Department of Natural Resources (DNR)

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, conducts inspections, monitors, enforces environmental-quality standards, regulations, and permits. Reviews all federal permits.

Northern Regional Office
675 4th Ave., Ste. J
P.O. Box 1601 (mailing)
Fairbanks, AK 99701
(907) 452-1714

Permit Information (907) 452-2340
(collect calls accepted)
Regional Supervisor - Laury Dietrich

Southeastern Regional Office
437 E St., Ste. 200
Anchorage, AK 99501
(907) 274-2653

Permit Information (907) 279-0254
(collect calls accepted)
Regional Supervisor - Bill Lamoineaux

Southeastern Regional Office
9000 Old Glacier Hwy.
P.O. Box 2420 (mailing)
Juneau, AK 99801
(907) 280-3151
Permit Information (907) 465-2615
(collect calls accepted)
Regional Supervisor - Deena Henkins

C. Department of Fish and Game (ADF&G)

Capital Office Park
P.O. Box 52000 (mailing)
Juneau, AK 99802
(907) 465-4100
Commissioner - Don W. Collinsworth

(907) 465-4105
Acting Director, Habitat Division - Bruce Baker

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 crossing; or operation in streams with anadromous fish; use, diversion, or pollution of streams containing anadromous fish; construction, excavation, 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 Road
Fairbanks, AK 99701
(907) 451-6192

Southeastern Regional Office
Habitat Division
333 Raspberry Rd.
Anchorage, AK 99514-1599
(907) 267-2283

Southeastern Regional Office
Habitat Division
803 3rd St., 1st Fl.
P.O. Box 20 (mailing)
Douglas, AK 99834
(907) 465-4200

D. Department of Natural Resources (DNR)

400 Willoughby Center, 5th Fl.
400 Willoughby Ave. (mailing)
Juneau, AK 99801
(907) 465-2400

Commissioner - Judith M. Brady
Deputy Commissioner - Lonnie Boston-Griese
Deputy Commissioner - James K. Harnott

Principal state agency that administers Alaska's state lands.

1. Division of Forestry

3601 C St., Frontier Bldg., 13th Fl.
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-4492
Director - John Galea

Function: Establishes guidelines to manage mining in state forests.

2. Division of Geological and Geophysical Surveys (DGGS)

794 University Ave., 2nd Fl.
794 University Ave., Baselment (mailing)
Fairbanks, AK 99709
(907) 452-7147
State Geologist: Robert B. Forbes
(907) 762-9225
Deputy State Geologist (Acting): Wyatt G. Gilbert

Function: Conducts geological and geophysical surveys to determine the potential of Alaska 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 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
P.O. Box 772116 (mailing)
Fish Hatchery Road
Eagle River, AK 99577
(907) 694-0970

Juneau Office
400 Willoughby Center, 3rd Fl.
400 Willoughby Ave. (mailing)
Juneau, AK 99801
(907) 465-2553

3. Division of Land and Water Management (DLWM)

3601 C St., Frontier Bldg.
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-4355
Director - Thomas J. Hawkins

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 esements for temporary use of
state land and access roads.
Responsible for safety of all dams
in Alaska.

Northern Regional Office
4420 Airport Way
Fairbanks, AK 99709
(907) 479-2243
Regional Manager - Jerry Brosna

Southcentral Regional Office
3601 C St., Frontier Bldg.
P.O. Box 7005 (mailing)
Anchorage, AK 99510
(907) 762-2251
Regional Manager - Margaret J. Hayes

Southeastern Regional Office
400 Willoughby Center, 4th Fl.,
400 Willoughby Ave.
Juneau, AK 99801
(907) 465-3100
Regional Manager - Paula T. Burgess

4. Division of Mining (DOM)
3601 C Street, Ste. 800
P.O. Box 107516
Anchorage, AK 99510-7016
(907) 465-2103
Director - Gerald L. Gallagher

Function: Principal agency for
management of mining industry on
state land in Alaska. Maintains a
Mining Information Office in Fair-
banks. Issues property rights to
leaseable minerals; adjudicates locat-
able mineral filings. Issues per-
mits for hardrock and placer-
mining activity. Maintains records
of mineral locations, permits, and
leases. Provides technical, legal, and
land-status information. Ad-
mnisters the Alaska Surface Mining
Control and Reclamation Act
(ASMCRA), which includes per-
mitting and inspection of coal-
mining activity and reclamation of
abandoned mines.

Fairbanks Office
794 University Ave., 2nd Fl.
(907) 474-7147
Mining Information Office staff -
Mildred F. Brown and
Carole H. Stevenson

E. Department of Public Safety
450 Whittier St.
P.O. Box N (mailing)
Juneau, AK 99811
(907) 465-3222
Commissioner - Art English

1. Division of Fish and Wildlife
Protection
5700 East Tudor Rd.
Anchorage, AK 99507
(907) 269-5509
Acting Director - Captain J.R.
Nutzungs

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

F. Department of Revenue
State Office Bldg.
11th Fl., Entrance A
P.O. Box 9 (mailing)
Juneau, AK 99811-0400
(907) 465-2300
Commissioner - Hugh Malone

1. Division of Public Services
1111 West 8th St., Rm. 108
Juneau, AK 99811-0400
(907) 465-2302
Director - Sally Smith

Function: Issues licenses (including
mining, for production and sale of
minerals, and Alaska Business
Licenses) and may require filing of
nonresident affidavits and bond-
ing.

2. Division of Audit
State Office Bldg.,
11th Fl., Entrance A
P.O. Box 9 (mailing)
Juneau, AK 99811-0400
(907) 465-2302
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 3½ yr of
new mining operations, except for
mining of sand and gravel. Tax re-
turns must be filed annually.

G. University of Alaska
Fairbanks, AK 99775-0760

1. College of Natural Sciences
Department of Geology & Geophysics
Brooks Bldg., Rm. 408
(907) 474-7565
Department Head - Don M. Triplehorn

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. programs; options in general
geology, economic geology, petro-
leum geology, geophysics, and
ice/snow-permafrost geophysics.

2. School of Mineral Engineering
Brooks Bldg., Rm. 209
(907) 474-7366
Dean - Donald J. Cook

Function: Conducts laboratory and
field studies related to minerals and
mining. Offers various degree op-
tions in mineral, geological, and
petroleum engineering.

Mineral Industry Research Laboratory
(MIRL)
210 O'Neil Resources Bldg.
(907) 474-7125 or 7136
Director - Donald J. Cook
Associate Director - P.D. Hao

Function: Conducts applied and
basic research on location, devel-

FEDERAL AGENCIES

A. U.S. Department of the Interior

1. Bureau of Land Management (BLM)
Alaska State Office
701 C St.
P.O. Box 12 (mailing)
Anchorage, AK 99513
State Director - Michael Penfold
Public Room - (907) 271-5960

Function: Administers federal pub-
lic lands (except National Parks,
Wildlife Refuges, National Monu-
mments, National Forests, and
military withdrawals). Issues leases
for all federal leaseable minerals in-
cluding oil and gas, coal, phos-
phates, and oil shale. Arranges for
sale of minerals other than lease-
able or salable materials, including
sand, gravel, or stone. Issues right-
overway and special-use permits.
Monitors mining operations to in-
sure protection of surface re-
sources. Maintains land-status plats
and issues patents. Records federal
mining claims and annual-asses-
ment affidavits.

Anchorage District Office
6681 Abbott Loop
Anchorage, AK 99507
(907) 267-1200
District Manager - John Rump

Fairbanks Support Center and Land
Information Office (primary
contact for information on
Interior and northern regions)
1541 Gaffney St.
Fairbanks, AK 99703
(907) 356-6345
Support Center Manager - James
Murray
Information Operator -
(907) 356-2625

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

Glennallen District Office
1541 Gaffney St. (mailing)
Fairbanks, AK 99703
(907) 822-3218
District Manager - Gene Terland

2. U.S. Bureau of Mines
Alaska Field Operations Center
301 East 9th Ave., Ste. 401
Anchorage, AK 99501
(907) 271-2455
Chief - Donald P. Blanko
Anchornage Supervisor -
Robert 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 resources 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 nationally supported programs: Mineral Land Assessment, Mining and Metallurgical Research, Minerals Availability, Minerals Policy Analysis, and State Activities.

3. Field Data (Concluded)

Region I

905 Ishikari State

Office Supervisor: Robert Herkowits

(based in Anchorage)

Fairbanks Field Office

601 O'Neil Resource Bldg.

University of Alaska

Fairbanks, AK 99775-5146

(907) 479-1277

Office Supervisor: Robert Herkowits

(based in Anchorage)

Fairbanks Field Office

2011 East Tower Rd.

Anchorage, AK 99503

(907) 760-2002

Regional Director: Robert Gilmore

Assistant Regional Director (Habitat Resources) - Robert Jacobsen

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

Box No. 20 (mailing)

101 12th Ave.

Fairbanks, AK 99701

(907) 456-0203

Field Supervisor - Tony W. Booth

Juneau Field Office

Federal Bldg., Rm. 417

P.O. Box 1287 (mailing)

Juneau, AK 99802

(907) 586-7240

Field Supervisor - Waine Oien

Anchorage Fish and Wildlife

Enhancement

Sunshine Plaza, Ste. B

411 West 6th Ave.

Anchorage, AK 99501

(907) 271-4575

Field Supervisor - Robert Bowker


1230 University Dr.

Anchorage, AK 99508

(907) 271-4383

Chief, Division of Alaskan Geology -

Donald L. Gavrich

Function: Conducts research 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 Division Center (for maps and brochures)

Federal Bldg.

101 12th Ave.

Anchorage, AK 99701

(907) 566-0244

Public Inquiries Office (for information and publications)

4320 University Dr., Rm. 101

Anchorage, AK 99508-4663

(907) 561-4355

5. National Park Service (NPS)

Alaska Regional Office

2255 Gambell St.

Anchorage, AK 99503

(907) 271-2343

Regional Director - Boyd Esten

Mining Engineer - Lynn S. Griffiths

Function: Administers lands within the National Park System in Alaska. Manages and oversees 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.

II. U.S. Department of Labor

1. Mine Safety and Health Administration (MSHA)

117 10th Ave., N.W., Rm. 100

Bellevue, WA 98004

(206) 412-7037

Western District, Subdistrict Manager - Martin Root

Function: Administers mine-health and safety programs for mines other than coal. Conducts training and safety conferences for federal and state mine inspectors and mining personnel. Conducts research in mine safety.

2. Mine Safety and Health Administration

Coal Mine Safety and Health, District 9

P.O. Box 25107, DPC

Denver, CO 80222-0207

(303) 236-2710

District Manager - John W. Burton

Function: Administers health and safety programs 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. Coordinates 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. Coal Mine Inspectors travel from Denver, Colorado, to Price, Utah, to inspect mines in Alaska because no field offices are located here.

C. U.S. Department of Agriculture

U.S. Forest Service (USFS) Regional Forester

Federal Bldg.

P.O. Box 621628 (mailing)

Juneau, AK 99802

(907) 586-7847

Regional Forester - Michael A. Burton

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

D. U.S. Environmental Protection Agency

Alaska Operations Office

701 I St.

Box 19 (mailing)

Anchorage, AK 99513

(907) 271-5083

Assistant Regional Administrator -

Alvin L. Kung

Regional Headquarters

1200 6th Ave.

Seattle, WA 98101

(206) 442-1200

Regional Administrator - Robie Russell

Function: Issues National Pollution Discharge Elimination System (NPDES) permits under the Clean Water Act to regulate effluent discharges.

Alaska Operations Office

3200 Hospital Dr., Ste. 101

Juneau, AK 99801

(907) 566-7611

Attn: Steven Torok

E. Department of the Army

U.S. Army Corps of Engineers

Regulatory Branch

P.O. Box 897

Anchorage, AK 99506-0897

District Engineer -

Colonel William T. Gregory, Jr.

Write: Attention: NPACOR-S, c/o: Tony Skordal (907) 727-2712 or (907) 322-2173 (in Anchorage 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 roads, bridges, docks, piers, stockpiles, dikes, and canals.
COOPERATIVE STATE-FEDERAL AGENCY
Alaska Public Lands Information Center
250 Cushman St., Ste. 1A
Fairbanks, AK 99701
(907) 451-7392
Manager - Deeanne Adams
Assistant Manager - Chuck Lemnux


NONGOVERNMENTAL GROUPS AND ASSOCIATIONS
Alaska Miners Association, Inc.
Roger Bumsfand, Statewide President
Curt McVee, Executive Director
Statewide Office
501 West Northern Lights Blvd., Ste. 203
Anchorage, AK 99503
(907) 276-0347

Anchorage Branch
Norm Luk, Chairman
501 West Northern Lights Blvd., Ste. 203
Anchorage, AK 99503
(907) 274-6475

Fairbanks Branch
Del Ackels, Chairman
P.O. Box 72069
Fairbanks, AK 99707
(907) 451-6050

Juneau Branch
John Mulvigan, Chairman
P.O. Box 1884
Juneau, AK 99802
(907) 364-3141

Kenai Branch
Dennis Steffy, Chairman
P.O. Box 1684
Anchorage, AK 99503
(907) 274-6475

Mat-Su Valley Branch
Jim Bolekeley, Chairman
501 West Northern Lights Blvd., Ste. 203
(907) 274-7522

Nome Branch
Ron Engstrom, President
P.O. Box 242
Nome, AK 99762
(907) 445-2986

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

Society of Mining Engineers (SME)
Center No. D
Littleton, CO 80120
(303) 973-9560

Alaska Section
Mount A. Wilke, Chairman
794 University Ave., Basement
Fairbanks, AK 99708
(907) 471-7117

David Moneval, Secretary-Treasurer
University of Alaska
Fairbanks, AK 99775
(907) 474-6877

Southern Alaska Branch
Charles Drummond, Chairman
2550 Gambell St., Rm. 107
Anchorage, AK 99503
(907) 271-1213

Jeanine Schmidt, Secretary-Treasurer
4200 University Dr.
Anchorage, AK 99508
(907) 561-1131

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

Bill Slater, President
Alaska Section
P.O. Box 6900
Anchorage, AK 99502
(907) 338-4200

Miners Advocacy Council
Josh Moore, President
Leslie Noyes, Executive Director
P.O. Box 83009
College, AK 99708
(907) 561-1131

Miners Rights Action Group
Ken Manning
P.O. Box 83025
College, AK 99708
(907) 479-1890

Northwest Mining Association
414 Porton Blvd.
Spokane, WA 99201
(509) 324-1158

Pacer Miners of Alaska
John Korobkin
1967 Yankovich Rd.
Fairbanks, AK 99707
(907) 479-0471

Resource Development Council for Alaska, Inc.
Boyd Brownfield, President
807 G St., Ste. 200
P.O. Box 105366 (mailing)
Anchorage, AK 99510-0516
(907) 276-0700

Western Mining Council
Ken P. Peniston, Chairman
Oscar H. Bailey, President
Old Nash Rd.
Seward, AK 99664
(907) 224-6063

ORGANIZED MINING DISTRICTS
Circle Mining and Recording District
Steve Weber, President
e/o Del Ackels
P.O. Box 8151
Fairbanks, AK 99708

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

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

Juneau Mining District
Roger Eichman, President
P.O. Box 12076
Juneau, AK 99802

Kantishna Mining District
Sam Koppenburg, President
SRD Box 9079
Palmer, AK 99645

Koyukuk Mining District
Robert Anmiller, President
P.O. Box 7209
North Pole, AK 99705

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

Seward Mining District
Tom Williams, President
Box 36
Hope, AK 99606

Valdez Mining District
Chad Morris, President
P.O. Box 517
Girdwood, AK 99581

Yentna Mining District
John Jacobson, President
700 Aki Pl.
Anchorage, AK 99501
APPENDIX C

Selected significant mineral deposits in Alaska
(locations shown in figs. 37 through 39)

Map no.

1. Lithic - Major strata-bound massive-sulfide (Zn-Pb-Ag-Cd-Ba) deposits in black shale and chert. Proven reserve (LkE) 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 Pennsylvania or Mississippian shale; similar to locality 1. According to COMINCO (February 1982), main deposit at Red Dog contains at least 17 million tons of 7.1 percent Zn, 5 percent Pb, 2.4 oz/ton Ag; nearby Hilltop deposit contains significant undiscovered reserves.

3. Drenheath - Strata-bound (Pb-Zn-Ag) massive-sulfide occurrence associated with black shale, chert, andesitic volcanic rocks; 60- to 120-ft exposure averages 17.4 percent Zn, 3.0 percent Pb, and 3.3 oz/ton Ag; numerous sulphides and strong geochemical anomalies between localities 1 and 4.

4. Giny Creek - Epigenetic, disseminated Zn-Pb-Ag deposits with barite in sandstone and shale of Nootka Sandstone of Late Devonian through Early Mississippian age. Random grab samples of mines near location 1 contain 0.3 to 3.0 percent Zn and variable amounts of Pb and Ag.

5. Story Creek - Epigenetic replacement deposits of Zn-Pb-Ag-Cu-Au hosted in breciated zones in Devonian Kanayut Conglomerate or Lower Mississippian Kayak Shale. Grab samples of high-grade material contain up to 0.63 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-Ag-Cu-Au-Cd in breccia zones in Devonian Kanayut Conglomerate or Lower Mississippian Kayak Shale. Grab samples of mineralized material contain 0.43 percent Cu, 0.37 percent Pb, 44 percent Zn, 0.14 oz/ton Au, and 14.8 oz/ton Ag.

7. Omar - Epigenetic replacement deposits of Paleozoic andesite; includes banded barite occurrences. Grab samples contain 15.3 percent Cu, 0.15 percent Pb, 0.95 percent Zn, 0.05 percent As, 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; Largest reserve estimate of 36.2 million tons of about 2 percent Cu and undisclosed amount of Zn and Co.

9. Arctic - Major volcanicogenic (Cu-Zn) massive-sulfide deposit hosted in sequence of metarhyolite, metatuff, and volcaniclastic rock 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 volcanic massive-sulfide deposit; contains significant tonnage of Cu-Pb-Zn ore that grades 1.5 percent Cu, 5 to 10 percent Zn, 3 to 10 oz/ton Ag, with minor Au.

12. Avon Hills - Disseminated chromite in layered ultramafic rocks; grab samples contain up to 2.5 percent Cr.

13. Mission Mount - Chronic occurrence similar to those in Avon Hills.


15. Ferris Lake - (Ann Creek) Strata-bound massive-sulfide occurrence in metarhyolite, metatuff, and marble; Gossan zones strongly anomalous in Cu-Pb-Zn and Ag.

16. Kukukta-Neekla-Ak mining district - Major placer-Au district; substantial production in excess of 30,000 oz Au from lode and placer sources; lode gold found in crosstopping 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 34.2 percent fluorite.

19. Kuskulna - Strata-bound Pb-Zn massive-sulfide prospects; reported grades of up to 5 percent Pb.

20. Eastuk Glacier - Disseminated Mo-Sn-W-Pb-Zn mineralization in skarns associated with Devonian (?) schistose quartz monzonite. Grab samples contain up to 0.3 percent Sn and 0.16 percent W.

21. Bear Mountain - Major stockwork Mo-Sn-W-Sb 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-Au producer. More than 550 tons Sn produced from 1935 to 1941; at least 500 tons produced in last 10 yr.

23. Buck Creek - Major placer-Au 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 host dolines. Measured resources amount to 25 million tons that grade 0.15 percent Sn, 16.3 percent CaF2, and 0.03 percent WO3, based on 45,000 ft of diamond drilling.

25. Ear Mountain - Placer-Sn district and Zn-Cu-Ag-Pb-Zn skarn mineralization of Cretaceous age. Area also anomalous in uranium.

26. Designer - Major placer-Au district; produced 300 to 400 tons of Pb-Zn ore that averaged about 10 percent Pb, 2.2 percent Zn, 0.04 oz/ton Au, and 1.76 oz/ton Ag.

27. 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 zones in carbonates.

28. Simon River - Stratiform Pb-Sn-Au-Ba massive-sulfide deposits and layered iron deposits of Precambrian or Paleozoic age. Mineralized zones extend over 8,000 ft along strike.


30. Big Hornosh - 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 WO3.

31. Salmon mining district - Major placer-Au district; produced over 250,000 oz Au from 1930 to 1975.

32. Kachakauk - Uranium prospect in Cretaceous alkaline intrusive rocks. Highly anomalous geochemical values and U concentrations of 1,000 ppm reported.

33. Omalak - 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 4 oz/ton Ag; Grades of oxidized Zn ore reported to be up to 54 percent Zn, 3.5 percent Pb, and 0.08 percent Sn.

34. Wind River - Stratiform fluorite occurrences associated with felsic volcanic rocks of Late Paleozoic age. Reported grades of up to 25 to 30 percent fluorite reported.

35. Detuk Creek - Major placer-Au deposit and lode-Au producer. Reported grades of up to 10 oz/ton Au.


40. Puncell Mountain - Mo and Ag occurrences associated with Cretaceous alkaline igneous rocks, alkali, and andesite dikes.


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This list is not a definitive summary of Alaska's significant mineral deposits or mineral belts; numerous state and federal summaries provide more detailed information about individual deposits.
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 resources at Golden Horn deposit and other known lodes in region associated with shears and monzonite intrusive rocks of Late Cretaceous age.
43 Innoho-Tolstoi mining district - Major placer-Au district with significant lode Au-Sb-Pi potential; lode sources for placers are volcano-sedimentary and intrusive rocks of Late Cretaceous age and dike intruded Near Meesozic intrusive rocks; 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 and 50,000 oz Cu from Late Cretaceous shears 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 and 320,000 lb cassiterite through 1981, includes Eureka and Toothy subdistricts.
47 Livengood-Sulaw mining district - placer Au-Sn district; produced more than 425,000 oz Au since discovery in 1914. Substantial reserves remain.
48 Fairbanks mining district - Seventh largest Au-producing district in United States; largest producer in Alaska. Produced more than 7,750,000 oz Au from placer deposits. Major lode-Au and lode-W mines produced more than 62,000,000 oz Au and over 4 million lb Ag from veins and shear zones through 1970. Production of W exceeded 4,000 ton since 1916, all derived from tactite and skarn near Cretaceous quartz monzonite.
50 Mt. Pritchell - Significant uranium mineralization in Mesozoic alkaline igneous rocks. Rock geochemical values of up to 0.1 percent 308U; up to 15 percent rare earth elements associated.
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 885,000 oz Au since discovery in 1983. Has significant potential for Sn, W, and Au mineralization from variety of lode sources.
53 Three Castle Mountain, Pleasant Creek, Casca YAM - Stratiform Pb-Zn massive-sulfide mineralization. Reported grades of up to 17 percent Zn and 2 percent Pb.
54 Fortymile mining district - Major placer-Au district. Produced over 417,000 oz Au since discovery in 1886.
56 Kianka mining district - Major placer-Au and lode Ag-Au-Pb-Zn-Sb-W district. Produced more than 92,000 oz Au placer Ag, about 20,200,000 oz Zn, 60,000 oz 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 stratiform deposits occur in schist and quartzite.
58 Stampede Mine - Major Pb-Zn deposit; produced more than 3.5 million lb Sb from large shear zone in Precambrian metamorphic rocks.
61 Puvirnituq - Significant Ag-Sn-Bi 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.
62 Golovin Zinc Mine - Major Cu-Au deposit in Late Cretaceous breccia pipe. Produced more than 1.5,81 oz Ag, 8,617 oz Au, and 42,000 lb Cu. Proven reserves of about 10 million tons of ore that grade 0.1 percent Cu with Ag and Cu reported.
63 Nin Prospect - Porphyry Cu-Ag-Au deposit of Late Cretaceous age. Reported grades of up to 6.0 percent Cu and 9 oz/ton Ag.
64 Coastal Creek - Grischu-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 0.32 percent Cu with credits for W, Au, and Zn.
67 Denali Prospect - At least six small, strata-bound Cu deposits in volcano-sedimentary rocks of Tertiary age that may contain 5 million tons of ore that grade about 2 percent Cu with credits for Au.
68 Chitokhina - 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 66,866 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 Kenneckett - Major stratiform Cu-Ag massive-sulfide deposits located near contact between Chitistone Limestone and Nokshick 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.
72 Sinoil - Other prospects - Kenneckett-type Cu-Ag massive-sulfide deposits.
73 Bond Creek - Orange Hill - Two major porphyry Cu-Mo deposits of Late Cretaceous age that reported inferred reserves of 1.5 million oz Cu and 0.3 percent Cu and 0.6 percent Mo.
74 Carl Creek - Porphyry-Cu prospect in altered intrusive complex; similar to locality 73.
75 Bobcat - Porphyry-Cu prospect in altered intrusive rocks; inferred reserves of 145.1 million tons of ore that grade 0.37 percent Cu similar to locality 73.
76 Hurafeld - Porphyry-Cu prospect; similar to locality 73.
77 Tetessa - Significant Cu occurrence associated with stratiform Cu-Ag-Pb-Zn-Ag massive-sulfide deposits in Tertiary sedimentary rocks of Tertiary age.
78 Wito - Strata-bound Cu-Zn-Au massive-sulfide deposit in sediment of Eocene(? ) age; 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 Au lode (Ag-Cu-Pb-Zn-Mo) in veins that cut Mesozoic quartz diorite; produced more than 44,882 oz Au from lode sources and about 30,600 oz Ag from associated placer deposits.
80 Latouche, Baseam - Major strata-bound Cu-Zn-Ag massive-sulfide deposits in Orca Group sedimentary rocks and mafic volcanic rocks. Produced more than 250 million lb Cu from 6 million tons ore, inferred reserves of 45.3 million tons ore that grade 1 percent Cu, 1.5 percent Pb-Zn, and 1 oz/ton Ag may remain.
81 Rau Cove - Major strata-bound Cu-Zn-Ag massive-sulfide deposit in complex ore shoots in deformed, mafic volcanic rocks. Some ore that grade 1.25 percent Cu and 1.5 percent Pb-Zn.
82 Red Mountain - Significant Cu occurrence associated with layered ultramafic complex of Tertiary age at Red Mountain near Soldavna. More than 36,000 million Cu metalurgical grade ore produced through 1976; huge low-grade chamosite resource may remain.
83 Red Devil - Major Hg-Sb deposit; moderate-grade ore hosted in shears in the Kuskokwim Group sedimentary rocks. More than 35,000 flasks Hg produced from 76,000 tons ore.
84 Nake mine district - Ni-Cu-Au deposit. Atkin mining district (of which Alcan 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 549,000,000 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. Lodestone sourced be Alaskan-type; Pt-ore mineralization may remain.
86 Apollo-Sicha Mines - Major lode-Au deposits; produced more than 107,000 oz Au from ore that averaged about 0.22 oz/ton Au. Inferred reserves may amount to 1,645,000 tons that grade 0.18 oz/ton Au, 0.03 oz Ag, and several percent base metals.
87 Pyramid - Late Tertiary porphyry Cu-Au deposit; inferred reserves of 325 million tons ore that grade 0.4 percent Cu and 0.03 percent Ag reported.
88 Trans - Late Tertiary porphyry-Cu-Au deposit; geologic data of up to 0.7 percent Cu reported. Potential for large tonnages.
89 Wessel Mountain, Bee Creek - Porphyry-Cu-Au deposit of late Tertiary to Quaternary age, grades of up to 0.48 percent Cu and
SPECIAL REPORT 10

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 Rocky 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 Precambrian or Triassic age; consists of 48- to 60-foot-thick zone of 80 percent barite with upper zone (3 to 8 ft thick) of massive sulfides that contains 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 metallic credits.

96 Kluwan - 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 0.62 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 Cu-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 grade that 0.34 percent Ni, 0.26 percent Cu, and 0.15 percent Co in gabbro-pipe system.

100 Alaska-Juneau - Major lode-Au deposit that consists of 100- to 300-foot-wide zone that contains en echelon, gold-bearing quartz veins in metamorphic rocks; produced more than 3.52 million oz Au from 85.5 million tons ore from 1893 to 1944.

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, 200,000 oz Ag, and 50,000 oz Pb; 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 of the inferred reserves of several million tons ore that grade 0.2 percent Ni and 0.1 percent Cu.

103 Bahenimia Basin - Major Ni-Cu-Cu mineralization in layered mafic complex similar to locality 102; reported reserves of 22 million tons ore that grade 0.52 to 0.61 percent Ni, 0.21 to 0.57 percent Cu, and 0.04 percent Co.

104 Apex - El Nido - Significant lode-Au-W deposits that occur on crossing veins in graywacke; produced more than 50,000 oz Au.

105 Greens Creek - Major sediment-hosted Pb-Zn-Cu-Ag-Au volcanic-sedimentary massive-sulfide deposit of Devonian or Triassic age; most recent reserve estimate is 3.6 million tons ore that grade 25.3 oz/ton Ag, 0.16 oz/ton Au, 10.8 percent Zn, and 41 percent Pb.

106 Sandanum - Volcanogenic Cu-Pb-Zn massive-sulfide deposit in Mesozoic metamorphic complex with potential strike length of over 10,000 ft. Inferred reserves of 20.7 million tons ore that grade 0.57 percent Cu, 0.3 percent Zn, and 0.3 oz/ton Ag reported.

107 Stretsham - Fe-Ti deposit in mafic zoned-intrusive complex; reported grades of about 18.9 percent Fe and 2.8 percent Ti.

108 Tracy Arm - Stretsham-Cu-Zn-Pb massive-sulfide prospect in Mesozoic schist; over 1,300 ft long and up to 12 ft thick. Reported grades of 1.5 percent Cu, 3.9 percent Zn, 0.78 oz/ton Ag, and 0.013 oz/ton Au.

109 Red Bluff Bay - Significant chrome mineralization in Mesozoic ultramafic complex (probably phlogopite), reported reserves of 570 tons of material that grade 40 percent Cr and 29,000 tons that grade 18 to 55 percent Cr.

110 Coppernum Peninsula - Volcanogenic Cu-Pb-Zn-Ag-Au 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 carbonic and pillow basalt; about 56,000 tons of rare 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 containing 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 Salaper 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 Kasan Peninsula - Major diatreme Cu-Pb-Au massive-sulfide deposit of Jurassic age; area has produced over 29 million lb Cu and 55,000 oz Au. Reported reserves of 4 million tons ore that grade 50 percent Fe and less than 2 percent Cu.

115 Salt Chuck - Cu-Pb-Ag-Au deposit in contact zone between gabbro and gneiss within Alaska batholith zoned mafic-ultramafic pluton. From 1900 to 1911, 5 million lb Cu, over 20,000 oz Au, and Cu 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 Hyde mining district - Area produced more than 23,000 tons high-grade W-Cu-Pb-Zn-Ag ore from 1935 to 1951; from cross-cutting 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-Pb-Ag-Au-Ag-Au deposit; produced more than 10 million lb Cu, 200,000 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 600,000 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 460 million tons ore with grades of 0.219 percent Mo.

121 Nibbake - Volcanogenic Cu-Pb-Au-Ag massive-sulfide deposit hosted in Precambrian(? ) Wales Group or Ordovician to Silurian Deacon Formation; produced more than 1.4 million lb Cu, 13,000 oz Au, 1,000 oz Ag, and 9,000 oz Pb.

122 Boston Mountain - Numerous U-Th prospects associated with Jurassic potassic intrusives; from 1955 to 1971, produced more than 120,000 tons ore that graded about 1 percent U$_3$O$_8$.

123 Kemuk Mountain - Magmatic Fe-Ti deposit hosted in Cretaceous(? ) pyroxenite, inferred reserves of 2.4 million tons that average 15 to 17 percent Fe, 2 to 3 percent TiO$_2$, and 0.16 percent P$_2$O$_5$.

124 McLeod - Porphyry-Mo deposit that contains quartz-polymethyl ditinovius veins in quartz-feldspathic porphyry. Chip samples contain up to 0.09 percent Mo.

125 Illinois Creek - Esquire deposit and replacement deposits that contain Cu-Pb-Zn-Ag-Au possibly associated with altered quartz monzonite porphyry and schist.

126 Johnson River - Esquire(? ) quartz-sulfide stockwork or massive-sulfide deposit hosted in volcanodiorite, pyroclastic, and volcanic rocks of Jurassic Talkotna Formation. Average grades of 0.4 to 2.48 percent Zn, 2.8 percent Pb, 1.7 percent Cu, and 0.6 to 1.2 oz/ton Au reported.

127 Nimiak 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 potential.
APPENDIX D
Mining licenses issued by the Alaska Department of Revenue, 1986a (placer gold + silver unless otherwise noted).

AAA VALLEY GRAVEL, INC.
William J. Fayer.
P.O. Box 372155
Wasilla, AK 99657
(sand, gravel)

AGHABIN, ROLAND R.
P.O. Box 61185
Fairbanks, AK 99706

ALASKA AUGHRIDGE CORP.
(2) 7800 Lake Otis Parkway
Anchorage, AK 99507
(sand and gravel)

ALASKA COPPER-NICKEL PROPERTIES
Newmont Exploration Limited
2nd Floor, 26th Fl.
New York, NY 10010
(exploration)

ALASKA GOLD CO. (2)
P.O. Box 840
Nome, AK 99762

ALASKAGOLD MINES, INC.
Fenno 
Toffy 
Karl 
P.O. Box 5886
Anchorage, AK 99501

ALASKA PLACER DEVELOPMENT, INC.
Cowden Placer, Inc., and
Dahlin Mining Corp.
2200 N. 21st St.
Phoenix, AZ 85016

ALASKA SILVINA MINES
Joseph C. Marcus
P.O. Box 144
Fairbanks, AK 99707
(silver, lead & other)

ALBRIGHT CREEK MINING CO.
Calvin W. Hutchinson
P.O. Box 50
Eagle River, AK 99577

ALDEBURG MINES
Patricia S. Franklin
1251 Cooper
Fairbanks, AK 99709

ALOHANA GOLD INDUSTRIES
LTD.
2010 Crown St.
Vancouver, BC, Canada V6N 3B8

ALYESKA OIL & EXPLORATION INC
(c/o Edward R. Sugart)
P.O. Box 787
Tok, AK 99780

AMANDA PLACER
Stephen and Kathryn Alterman &
Kevin and Constance McFadden
Timber Creek
Bottles Field, AK 99726

AMERICAN COPPER & NICKEL CO., INC.
(c/o ICO UNITED STATES, INC.
John J. Fawcett
One New York Plaza
New York, NY 10001
(exploration)

AMERICAN CREEK PARTNERS
Don DeLene
P.O. Box 31367
Fairbanks, AK 99706

ANCHORAGE SAND & GRAVEL CO.
1813 East 1st Ave.
Anchorage, AK 99503
(sand, gravel)

ANDERSON, CARL J.
P.O. Box 106601
Anchorage, AK 99510

ANDERSON, GARY (2)
Coral Associates of Alaska, Inc.
122 First Ave.
Fairbanks, AK 99701

ANDERSON, RALPH S.
P.O. Box 362
McGath, AK 99737

ANDERSON, WAYNE S. & RANDI
SR Box 30013
1901 Chilkoot Dr.
Fairbanks, AK 99701

ANNASARA ENTERPRISES
Colin W. Turner & James M. Davies
P.O. Box 871354
Wasilla, AK 99657

ANVIL MINING INC.
Alaska Gold Co.
General Delivery
Juneau, AK 99802

ARNARIAK, ADAM
P.O. Box 55
Togiak, AK 99678

ATTWOOD, WILLIAM (2)
Richard Sandeen
P.O. Box 77168
Fairbanks, AK 99706

AULT, ROBERT W. & LYNDA S.
P.O. Box 82356
Fairbanks, AK 99708

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

BPC ALASKA CORP.
Robert M. Smith
24 Hazelton Ave.
Toronto, Ontario, Canada M6K 2Z2

BTW MINING & EXPLORATION CORP.
1410 East 11th Ave.
Anchorage, AK 99516

BAYFIELD, J.W. & R.J. HENRIKSS
P.O. Box 941
Fairbanks, AK 99707

BECKMAN, JERRY J.
Box 32
Stevens, AK 99710

BEILL, ALBERT L.
B.C. ENTERPRISES
Ruby, AK 99768

BELFORD, JERRY M.
P.O. Box 1052
Bass, AK 99723

BELFORD, JERRY M.
P.O. Box 1052
Bass, AK 99723

BENGEL, ARTHUR & JEANNE
St. A, Box 627
Palmer, AK 99645

BIG WINDY MINING CO.
Charles Freeman
P.O. Box 7246
Fairbanks, AK 99707

BLACK SANDS MINING CO.
Philip D. Strange
P.O. Box 874718
Wasilla, AK 99687

BLACK VELVET MINING CO. (3)
(c/o Don Covan)
Roy T. George
D.C. Plus, No. 2
Selma, CA 93867

BLUE BELL MINING CO.
David J. Moore
Box 1150
Seward, AK 99664

BLUE BELL MINING CO.
David J. Moore
Box 1150
Seward, AK 99664

BODIN, STEVEN A.
P.O. Box 10622
Fairbanks, AK 99716

BOULDER CREEK MINING
Lester J. & Dorothy M. Pickers
P.O. Box 50
Fairbanks, AK 99716

BOUTON, GLENN D. & SELLA (3)
66 Forest Lane Rd.
Fairbanks, AK 99716

BRIAN HALL GEOLOGICAL CONS. & CONTRACTING
Quill Hill Mining Corp.
P.O. Box 84
No. 800-661 W. Haslohs St.
Vancouver, B.C., Canada V6B 5A6

BROOKS MINES
Wayne McCurry
303 W. Everett Rd.
Everett, WA 98201

BROOKS MINES
Wayne McCurry
303 W. Everett Rd.
Everett, WA 98201

BROOKS MINES
Wayne McCurry
303 W. Everett Rd.
Everett, WA 98201

BROWN, THOMAS
P.O. Box 532
Cooper Landing, AK 99572

BROWNE, THOMAS
P.O. Box 532
Cooper Landing, AK 99572

BROWNE, THOMAS
P.O. Box 532
Cooper Landing, AK 99572

BROWNE, ROBERT W. & PETER J.
2334 Northeast 4th Ave.
Portland, OR 97216

BRUHN, OPAL J.
P.O. Box 662
Nikiski, AK 99635

b Only licenses for 1986 that were received by DOGAM (Fairbanks) by January 15, 1987, are listed.
Numbers in parentheses indicate the number of separate existing licenses issued to a single individual, partnership, or company. In 1986, 592 licenses were issued to 487 operators. In 1985, 446 licenses were issued to 439 operators, and in 1984, 484 licenses were issued to 425 operators.
WINDELL GOLD MINING CORP.
P.O. Box 1320
Nome, AK 99762

WINDY CREEK TIMBERLINE MINING CO. (2)
Roy & Irene Tansy
P.O. Box 231
Copper Center, AK 99573

WINGETTE, INC.
Ed Satter
General Delivery
Manley Hot Springs, AK 99756

W. MARTIN EXPLORATION, INC.
Chena Mining Co.
P.O. Box 211
Talkeetna, AK 99676

WOLCCOTT, JIM L.
P.O. Box 390283
Anchorage, AK 99520

WOLFF, ROBERT V.
General Delivery
Boundary, AK 99760

WOLTERS, MORKUS
Barry Holding Co.
9300 View Dr.
Juneau, AK 99801

WORLD WIDE MINES
Howard P. Guthrie
RR 2
Mesick, MI 49668

WRIGHT P.M., INC.
George Holt
1/4 Mile Van Horn Rd.
Fairbanks, AK 99701

WYATT, FRED & HANK GRADNEY
P.O. Box 1381
Fairbanks, AK 99707

WYLIE, JAMES R.
P.O. Box 208
Aptos, CA 95003-0208
mercury

WYMAN, LEWIS B. & DAVE SWEET
General Delivery
Chicken, AK 99732

WYMAN, WILLIAM F., C.M. READER, & HUGO LINDFORS
P.O. Box 255
Nome, AK 99762

WYICK, J. E.
P.O. Box 1381
Fairbanks, AK 99707

WYMAN, WILLIAM F., C.M. READER, & HUGO LINDFORS
P.O. Box 255
Nome, AK 99762

WYMAN, WILLIAM F., C.M. READER, & HUGO LINDFORS
P.O. Box 255
Nome, AK 99762

WYMAN, WILLIAM F., C.M. READER, & HUGO LINDFORS
P.O. Box 255
Nome, AK 99762

WYMAN, WILLIAM F., C.M. READER, & HUGO LINDFORS
P.O. Box 255
Nome, AK 99762

YUKON MINING CO., INC. (2)
P.O. Box 101454
Anchorage, AK 99510

ZIMMER, GEORGE W. (2)
P.O. Box 8174
Anchorage, AK 99508

ZIMMERMAN, JOSEPH D.
General Delivery
Manley Hot Springs, AK 99756
### APPENDIX E

**Metals production in Alaska, 1880-1986.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Gold (oz)</th>
<th>Gold (std.)</th>
<th>Silver (oz)</th>
<th>Silver (std.)</th>
<th>Mercury (flask³)</th>
<th>Antimony (lb)</th>
<th>Tin (lb)</th>
<th>Lead (tens)</th>
<th>Platinum (oz)</th>
<th>Copper (lb)</th>
<th>Chromium (tons)</th>
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<tr>
<td>1886</td>
<td>1,153,500</td>
<td>2,685</td>
<td>296,100</td>
<td>23,998</td>
<td>8,170</td>
<td>46,700</td>
<td>84,000</td>
<td>2,500</td>
<td>7,000</td>
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<td>1887</td>
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*References are listed in DGGS Public Data File 86-10.
1. Final data.
2. Preliminary data.
3. When state and federal figures differ significantly, data from federal are used.
4. Not available for year.
5. Copper production is based on refined metal and is about 17,000 oz.
7. td = Thousand dollars.
8. m = Million dollars.
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<th>Year</th>
<th>Gold</th>
<th>Silver</th>
<th>Mercury</th>
<th>Antimony</th>
<th>Tin</th>
<th>Lead</th>
<th>Platinum</th>
<th>Copper</th>
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Upper left: Bill Shaffer (GHD Resources) with pan of gold from the GHD Resources' Eagle Creek placer mine, Circle mining district, Alaska. Photograph by Earl Beistline, 1986.

Upper right: Geologists from the U.S. Bureau of Mines use a portable drill to sample a prospect in southeast Alaska. Photograph by Jeff Foley, 1986.

Center left: Barge prepares to unload construction equipment at the port site for the Red Dog Mine, Chukchi Sea, northwest Alaska. Photograph by Lisa Parker, 1986.

Center right: Sluice box fed by a dragline is used to process gold-bearing gravels at the John Cook placer mine located near Fairbanks, Alaska. Photograph by Charles Green, 1986.
