

# ALASKA'S MINERAL INDUSTRY 1998:

## A SUMMARY

by D.J. Szumigala and R.C. Swainbank

**PRODUCTION**—The value of production from Alaska's mineral industry decreased 3.5 percent from the 1997 level to \$903.6 million. In general, increased production from Alaska's largest mines was offset by historically low metal prices. Red Dog Mine near Kotzebue increased production of lead, zinc, and silver and continues to be the world's largest producer of zinc. Greens Creek Mine near Juneau remains one of the largest producers of silver in the U.S., and continues to produce significant lead, zinc, copper, and gold. Fort Knox Mine near Fairbanks is Alaska's largest gold producer, and there was continued gold production from Nixon Fork Mine, Illinois Creek Mine, and several dozen placer mines distributed throughout Alaska. Sealaska Corporation began production of high-grade calcium carbonate, suitable for high-quality paper coatings and paint, from Calder Mine on Prince of Wales Island.

**DEVELOPMENT**—Expenditures dropped sharply from \$167.4 million spent in 1997 to \$55.4 million spent in 1998. Red Dog Mine completed its Production Rate Increase project in September. Fort Knox Mine added a SAG crusher and a number of in-pit projects. Greens Creek Mine continued development work to access its Southwest Orebody. Development work was completed at Calder Mine and the mine was brought into operation in August. Ongoing development work continued at numerous placer mines.

**EXPLORATION**—Exploration expenditures in Alaska during 1998 were \$56.4 million, down only 2 percent from 1997 levels, despite historically low metal prices and massive reductions in worldwide exploration budgets. Sixty-four percent of expenditures were spent in the eastern interior region of Alaska, sparked by continued exciting results from the Pogo property, continued exploration programs in the Fairbanks mining district, and renewed interest in the polymetallic mineral belt on the north flank of the Alaska Range. Significant resource calculations announced for several properties in the eastern interior region include 5.2 million ounces of gold at the Pogo property, 1.6 million ounces of gold at the Golden Summit property, and 3.1 million tons of 4.4 percent zinc, 1.9 percent lead, 0.2 percent copper, 2.73 ounces per ton silver and 0.016 ounces per ton gold calculated for the DC North horizon on the Dry Creek property. Gold exploration was also strong in southwestern Alaska, with an announced resource of 11.5 million ounces of gold at the Donlin Creek property and a resource of almost 1 million ounces at the Shotgun property.



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John McCluskey, President of Grayd Resource Corporation, inspects high-grade volcanogenic massive sulfide (VMS) exposure on the southern slope of Anderson Mountain, along the north flank of the Alaska Range. This is one of Grayd's eight non-contiguous properties in the Bonfield District.

**EMPLOYMENT**—Preliminary estimates calculate 3,452 full-time equivalent jobs for Alaska's mineral industry in 1998, a drop of approximately 11 percent from 1997. Most of the job loss was in the development sector. Gold production employment was also lower in 1998 due to no mining at Illinois Creek Mine and temporary closure of placer mining operations across Alaska.

**GOVERNMENT ACTIONS**—DGGS contracted for airborne geophysical surveys conducted in the Fortymile and Livengood mining districts and released results for airborne geophysical surveys flown in the Ruby, Talkeetna Mountains, Wrangell, and Wiseman areas. DGGS conducted mineral-related field programs in the Petersville and Chulitna areas previously surveyed by airborne geophysics. Greens Creek Mine won first place for underground mines in the Sentinels of Safety Award and Fort Knox Mine was second runner up for open-pit mines in the same contest. Jon Vander Wal received the 1998 Reclamation Award for Excellent Mine Reclamation from the Alaska Department of Natural Resources. A long-awaited land exchange between Kennecott Minerals Company and the U.S. government was completed during 1998 for 7,500 acres adjacent to Greens Creek Mine.



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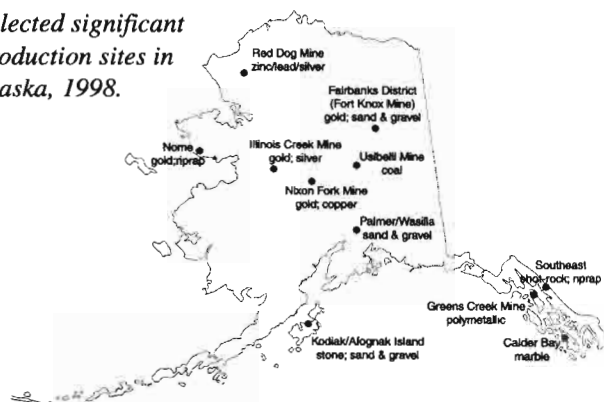
by  
D.J. Szumigala<sup>1</sup> and R.C. Swainbank<sup>2</sup>

## INTRODUCTION

This summary of Alaska's mineral industry for 1998 activities is made possible by information provided through phone interviews and replies to questionnaires mailed by the Alaska Division of Geological & Geophysical Surveys. The final report will be available later in the year after more compilation of information, particularly placer mining data and government agency reports. This report is part of a cooperative venture between the Division of Geological & Geophysical Surveys (DGGs) and the Division of Mining & Water Management in the Department of Natural Resources (DNR) and the Division of Trade & Development (DTD) in the Department of Commerce & Economic Development (DCEd). Generally, estimates used in this summary tend to be conservative due to incomplete data.

Table 1 shows the estimated value of the mineral industry in Alaska per year from 1981 through 1998, as divided into exploration and development investments and value of mined products. These preliminary values total \$1.015 billion, compared with \$1.162 billion in 1997, due mainly to the decline in development expenditures (\$55.4 million in 1998 versus \$168.4 million in 1997), and a slight decline in the value of production, particularly in the industrial minerals sector. As more information becomes available, the amount and value of rock, and sand and gravel production may be revised upward.

*Selected significant production sites in Alaska, 1998.*



Despite historically low metal prices, exploration expenditures during 1998 were \$56.4 million, down only 2 percent from the \$57.8 million invested in 1997 (table 1). During 1998, there were reductions in exploration budgets worldwide in the range of 10 to 30 percent, so Alaska actually fared quite well compared to the rest of the world. Sixty-four percent of exploration expenditures were spent in the eastern interior region of Alaska and 17.5 percent of exploration dollars were spent in southwestern Alaska. The eastern interior region received the most attention, with much activity around the Pogo

Table 1. Total value of the mineral industry in Alaska by year (in millions of dollars)

	Exploration (expenditure)	Development (expenditure)	Production (value)	Total
1981	\$ 76.0	\$ 26.4	\$ 188.6	\$ 291.0
1982	45.0	41.6	196.4	283.0
1983	34.1	27.8	232.4	294.3
1984	22.8	53.6	199.4	275.8
1985	9.2	34.1	226.6	269.9
1986	8.9	24.3	198.5	231.7
1987	15.7	100.3	202.4	318.4
1988	45.5	275.0	232.2	552.7
1989	47.8	134.3	277.0	459.1
1990	63.3	14.3	533.0	610.6
1991	39.9	25.6	546.5	612.0
1992	30.2	30.0	560.8	621.0
1993	30.3	27.7	448.7	506.7
1994	31.1	44.9	507.5	583.5
1995	34.3	148.6	537.2	720.1
1996	44.6	394.0	590.4	1,029.0
1997	57.8	168.4	936.2	1,162.4
1998	56.4	55.4	903.6	1,015.4
<b>TOTAL</b>	<b>\$692.9</b>	<b>\$1,626.3</b>	<b>\$7,517.4</b>	<b>\$9,836.6</b>

SOURCE: Alaska's mineral industry reports published annually by DGGs.

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gold deposit, where reserves increased to 5.2 million ounces, and in the polymetallic mineral belt on the north flank of the Alaska Range. In southwestern Alaska, the focus was also on gold. Total gold reserves increased to 11.5 million ounces at the Donlin Creek property, and there was other significant work throughout the Kusko-kwim mineral belt. In the northern and southeastern regions, base metal and polymetallic targets were the focus of exploration programs.

Although there was some development reported at most of the operating mines, there were no mega development projects in 1998. As a consequence of this lack of large projects, the reported development expenditures decreased substantially from 1997 levels (table 1).

Production increases were reported at the giant Red Dog Mine in northwestern Alaska and at the Greens Creek Mine in southeastern Alaska, but increased throughput was almost negated by low prices for metals. Likewise, the Fort Knox Mine increased throughput, but milled lower-grade ore, so total gold production was almost the same as in 1997. Lower average gold prices in 1998 (\$293.88 per ounce compared with \$330.76 in 1997) caused several long-time placer miners to sit out the 1998 mining season to wait for better markets.

As in years past we rely on company information to define exploration and development parameters. Average metal values are calculated from weekly average spot prices, and these values are used unless a company provides a different average sale price.

Preliminary indications are that over 12,000 new claims (480,000 acres) were staked on State lands dur-

ing 1998, with 5,800 claims abandoned in 1998. The number of active claims on State land is currently 41,157 (1.65 million acres). The numbers for new and active federal claims in Alaska are not available at this time. An estimated 21,200 new mining claim equivalents (claims at a maximum of 40 acres and prospecting sites at a maximum of 160 acres), covering a combined total of 838,000 acres, were staked on State lands in Alaska by October 1, 1998. The Alaska Division of Mining & Water Management estimates that at least 150,000 acres of State lands and maybe more have been staked during 1998 in the Goodpaster area near the Pogo prospect. The staking frenzy in the Goodpaster area continued throughout the winter. Current estimates are that 5,350 claims and 2,900 prospecting sites covering 678,000 acres of land have been staked and recorded in the Pogo area by late February 1999.

## EMPLOYMENT

The estimated total employment by the Alaska mineral industry in 1998 is 3,452 full-time equivalent jobs (table 2). This is a drop of 410 jobs or about 11 percent from the decade high of 3,862 jobs set in 1997. Overall, most of the employment drop is in the development sector, with less development projects in 1998 than in 1997 and major development work at the Red Dog Mine being completed by mid year. A slight decrease in the number of placer miners for 1998 is due to the low gold price and consequent temporary closure of several operations.

Table 2. *Estimated Alaska mine employment, 1992-98<sup>a</sup>*

	1992	1993	1994	1995	1996	1997	1998
Gold/silver mining							
Placer	1,251	1,205	1,150	975	825	780	710
Lode	N/A	N/A	--	38	138	415	345
Polymetallic	240	26	--	--	68	230	275
Base metals	349	376	311	397	407	478	466
Recreational	325	270	280	255	260	270	250
Sand & gravel	640	580	640	577	598	700	640
Building stone	145	205	210	200	149	123	120
Coal	115	109	115	120	115	118	128
Peat	40	49	55	30	38	42	40
Tin, jade, soapstone, ceramics, platinum	20	20	25	20	20	20	20
Mineral development	164	132	115	637	862	409	177
Mineral exploration	137	164	182	157	257	277	281
<b>TOTAL</b>	<b>3,426</b>	<b>3,136</b>	<b>3,083</b>	<b>3,406</b>	<b>3,737</b>	<b>3,862</b>	<b>3,452</b>

<sup>a</sup>Calculated on a 260-day work year.

N/A = Not available.

-- Not reported.

## PRODUCTION

Zinc was again the most valuable commodity produced in Alaska in 1998, followed by gold and silver. Table 3 shows estimated mineral production in Alaska for 1998, and for the two prior years. Gold and silver production was almost the same as in 1997, but the value of the gold was 11 percent less than a year ago. Zinc production increased 31 percent over the 1997 levels, but the zinc price was 28 percent higher in 1997 than in 1998, so the net gain in value in 1998 was diminished. A similar situation caused total produced lead value to be almost the same in 1998 as in 1997 despite increased production tonnage.

### Northern Region

The Red Dog Mine near Kotzebue is owned by NANA Regional Corporation, a Native (First Nations) corporation, and operated by Cominco Alaska Incorporated. The Red Dog zinc-lead-silver mine processed 2,752,587 tons of ore in 1998 grading 21.4 percent zinc, 5.2 percent lead and 2.7 ounces of silver per ton to produce 490,461 dry short tons (dst) of zinc and 80,193 dst of lead contained in 1,015,773 tons of concentrates. The

mine reported a \$60 million operating profit for 1998, compared to \$102 million for 1997. In September, the mine achieved the throughput anticipated by the \$200 million Production Rate Increase (PRI) project that began in 1996. The PRI project added a new grinding circuit that will increase production by 40 percent. The reserves in the four deposits explored to date at the Red Dog Mine are about 160 million tons with grades of 15.8 percent zinc, 4.4 percent lead and 2.39 ounces per ton silver. The Red Dog Mine employs 488 people, and expects to mine over 3 million tons of ore in 1999 during the first full year of increased throughput.

Tri-Con Mining Alaska Inc. resumed mining at its Nolan Creek gold placer operation near Wiseman, and continued mining through the winter. Several other small placer mines also reported some gold production in the northern region.

### Western Region

Alaska Gold Company continued its open-pit placer mining on Submarine Beach west of Nome, with gold production similar to its 1997 level. The company intends to continue mining with a reduced workforce and attempt to weather low gold prices. Late in the year,

Table 3. Estimated mineral production in Alaska, 1996-98<sup>a</sup>

	Quantity			Estimated values <sup>b</sup>		
	1996	1997	1998	1996	1997	1998
<b>Metals</b>						
Gold (ounces)	161,565	590,516	588,892	\$ 62,622,594	\$207,287,000	\$172,802,000
Silver (ounces)	3,676,000	14,401,165	14,856,000	19,078,440	70,710,000	82,154,000
Copper (tons)	390	1,720	1,900	803,400	3,543,000	2,850,000
Lead (tons)	70,086	88,560	102,887	52,284,000	49,593,000	49,386,000
Zinc (tons)	366,780	419,097	549,348	361,646,000	494,888,000	505,400,000
<b>Subtotal</b>				<b>\$496,434,434</b>	<b>\$826,021,000</b>	<b>\$812,592,000</b>
<b>Industrial minerals</b>						
Jade and soapstone (tons)	2.0	2.0	2.0	\$ 25,000	\$ 25,000	\$ 25,000
Sand and gravel (million tons)	9.9	13.8	9.8	32,203,260	51,913,000	36,848,000
Rock (million tons)	3.0	3.2	3.0	23,557,637	20,000,000	18,750,000
<b>Subtotal</b>				<b>\$ 55,785,897</b>	<b>\$ 71,938,000</b>	<b>\$ 55,623,000</b>
<b>Energy minerals</b>						
Coal (tons)	1,481,000	1,446,000	1,339,000	\$ 38,000,000	\$ 38,048,000	\$ 35,233,000
Peat (cubic yards)	38,000	38,500	38,000	175,000	192,000	190,000
<b>Subtotal</b>				<b>\$ 38,175,000</b>	<b>\$ 38,240,000</b>	<b>\$ 35,423,000</b>
<b>TOTAL</b>				<b>\$590,395,331</b>	<b>\$936,199,000</b>	<b>\$903,638,000</b>

<sup>a</sup>Production data from DGGs questionnaires, phone interviews with mine and quarry operators, Alaska Department of Transportation and Public Facilities, and federal land management agencies.

<sup>b</sup>Values for selected metal production based on average prices for each year; for 1998—gold (\$293.88/ounce) unless other value provided by operator; silver (\$5.53/ounce); copper (\$0.75/lb); zinc (\$0.46/lb); lead (\$0.24/lb). All other values provided by mine operators. Value rounded to nearest \$1,000.

NovaGold Resources Inc. announced an agreement to purchase all assets of Alaska Gold from Mueller Industries for \$8 million. Assets include the Rock Creek lode gold prospect near Nome (750,000 ounce gold resource) 14,000 patented acres near Nome, 8,500 patented acres near Fairbanks, royalty incomes from producing placers (2,000 ounces per year) and more than \$7 million in plant, equipment, parts, and supplies.

Illinois Creek gold mine, located about 40 miles south of Galena, continued leaching 1.35 million tons of ore left on the leach pads from 1997 mining operations. The operator, USMX of Alaska Inc., filed for Chapter 11 bankruptcy in May, and Dakota Mining Company, the parent company, was struggling during the latter part of the year against foreclosure by N.M. Rothschild & Sons Bank. There was no new mining, but if a buyer can be found it is anticipated that mining will resume in 1999.

Production at Real del Monte Mining Corporation's Nixon Fork Mine, an underground gold-copper skarn deposit near McGrath, was about the same as in 1997, and exploration identified new reserves beneath the C-3300 orebody. The summer of 1998 was very wet throughout western and interior Alaska, which caused inflow problems underground, but this inflow is expected to be temporary.

Half a dozen small gold placer mines reported production in the Ruby-Poorman and McGrath areas. A 294-ounce gold nugget was found in the Ruby area during the summer. This nugget is almost twice the weight of the largest placer nugget previously reported from Alaska. There were also about ten smaller placer mines operating on the Seward Peninsula in 1998, but low gold prices were a concern to all.

### **Eastern Interior Region**

The largest mining operation in the area is Fort Knox Mine, a gold producer located about 15 miles northeast of Fairbanks. The mine employs 260 people, and produces about 1,000 ounces of gold per day from 36,000 to 44,000 tons of ore. In June 1998, Kinross Gold Corporation merged with Amax Gold Incorporated, the operator since 1996. Amax's parent company, Cyprus Amax Minerals Company, holds 31 percent of the outstanding shares of Kinross Gold Corporation.

Kinross now operates Fort Knox Mine, and has added new equipment to optimize production. A recent study shows that the mine creates a total of \$107 million in local purchases including \$35 million directly, and creates an additional 312 indirect jobs locally. About \$4.4 million of local property taxes are generated annually by the mine and its employees, and average residential electricity rates in the Fairbanks area have been reduced by about 7 percent by the mine. The Fort Knox

Mine was the second runner-up for the Sentinels of Safety Award in October in the open-pit metal mine category, with 258,989 work hours without a fatality or lost-time accident.

Three medium-sized placer gold mines and about 50 smaller operations continued to mine throughout ten interior mining districts despite historic low gold prices. All placer miners mentioned that profit margins are low. Several long-time placer miners decided to put their operations on hold pending a rise in the price of gold.

Low coal prices continue to plague Usibelli Coal Mine at Healy, and no coal was shipped to Korea on the Alaska Railroad after October. Production by 125 workers in 1998 was 1,339,000 tons, with only 409,000 short tons shipped to Honan, South Korea. Offsetting this decline, mine-mouth power plants used 300,000 short tons, with the new Clean Coal Plant using 154,000 tons. Much of the 50 MW capacity of the Clean Coal Plant is used by Fort Knox Mine.

Several rock, sand and gravel, and peat operations were active in the eastern interior in 1998, but production totals are incomplete at this time.

### **Southcentral Region**

Only two small placer gold mines and five industrial pits (sand and gravel) reported production in 1998. Road construction projects created a strong demand for sand, gravel, and rock products. Data from these road projects will be available at a later date.

### **Southwestern Region**

Two medium-sized and three small placer gold mines reported production. A minor amount of sand and gravel was produced in the region.

### **Southeastern Region**

Production at Kennecott Minerals Company's Greens Creek Mine, which is 29.73 percent owned by Hecla Mining Company, increased to 540,000 tons in 1998, from which 9.498 million ounces of silver, 60,572 ounces of gold, 58,900 tons of zinc, and 22,700 tons of lead were recovered. The mine, located 20 miles west of Juneau, employs 275 people directly. Kennecott anticipates an increase in throughput for 1999.

A long-awaited land swap between Kennecott Minerals Company and the U.S. government was completed during 1998. Kennecott received the rights to 7,500 acres adjacent to Greens Creek Mine in exchange for 189 acres of purchased private inholdings in other national monuments. After mining is completed, all acreage at Greens Creek Mine, including patented acreage, will revert to the federal government, and a royalty will be paid during mining of the exchanged land.

Kennecott also received first place in October in the national Sentinels of Safety Award for underground metal mines. Greens Creek Mine operated 434,236 work-hours without a fatality or lost-time accident in 1997.

Farther south, at the northwest end of Prince of Wales Island, Sealaska Corporation, an Alaska Native (First Nations) corporation, mined 150,000 tons of high-grade calcite at its Calder Bay limestone quarry, and shipped 20,000 tons for testing to several facilities outside Alaska. This production is the culmination of several years of testing and development by the corporation, which has created a subsidiary, Sea-Cal LLC, to manage the operations. In turn, Sea-Cal has contracted mining to Eastwind, a division of Norcon Incorporated, itself a subsidiary of VECO Incorporated. The mine employs 15 full-time workers.

There was no reported production from the few small placer mines in this region in 1998, but several quarries and gravel pits produced material for local use. The U.S. Forest Service was again a major user of road maintenance material.

## DEVELOPMENT

Development expenditures in 1998 dropped sharply from \$167.4 million spent in 1997 to \$55.4 million spent in 1998 (table 4). The drop in development expenditures reflects the lack of many large mineral development projects in Alaska during 1998. Employment figures and development expenditures in Alaska by commodity and region are listed in table 5.

### Northern Region

The only major development in the area was completion of the Red Dog Mine Production Rate Increase project, which contributed, by September 1998, to a 35 percent increase in production from 1997 levels.

The project increased fuel storage capacity at both the mine and port, increased concentrate storage at the port, increased accommodation space at the mine, added more mining equipment, added a new gyratory crusher, and upgraded the mine's recovery system. About 200 people worked for over half of the year on the project.

Tri-Con Mining reported a modest amount of development activity at its placer operation on Nolan Creek, as did Gold Dust Mines at its placer operation near Chandalar.

### Western Region

Most development work in the region was in drilling and drifting at Real del Monte Mining Corporation's Nixon Fork Mine, but work was hampered by wet conditions. Three placer mines in the region also reported a minor amount of stripping and road construction.

### Eastern Interior Region

Many placer mines in this region reported some development work, mainly rehabilitation of roads and buildings, or stripping frozen muck, but the major development work in the region was at Kinross Gold's Fort Knox Mine. After the merger with Amax Gold Inc. in June, Kinross added a 120-ton SAG recycle crusher to increase mill throughput by about 10 percent to 45,000 tons per day. In-pit development drilling of 10,000 feet of reverse circulation and 22,000 feet of core added to the proven and probable reserves. Other projects included dewatering of tailings and increasing the height of the tailings dam.

Reclamation continued at La Teko Resources Incorporated's Ryan Lode Mine near Fairbanks, where a 155,000-ton leach pad is being rehabilitated. Several placer mines in the region also reported reclamation work.

Development work at Usibelli Coal Mine near Healy consisted of road construction for the Two Bull Ridge operation at Healy. Usibelli Coal Mine Inc. also applied for permits for a new 6.7-million-ton operation at the 684-acre Rosalie Mine in the Healy River valley south of its existing Poker Flats, Two Bull Ridge, and Gold Run Pass operations.

### Southcentral Region

Several of the numerous sand and gravel operations in this region reported some development, and the Chuitna Group was involved in market development for the coals in the Beluga Field at its Chuitna Coal Mine.

*Regional distribution of development dollars for 1998. Statewide total expenditures for development were \$55.4 million (1997 expenditures in parentheses).*

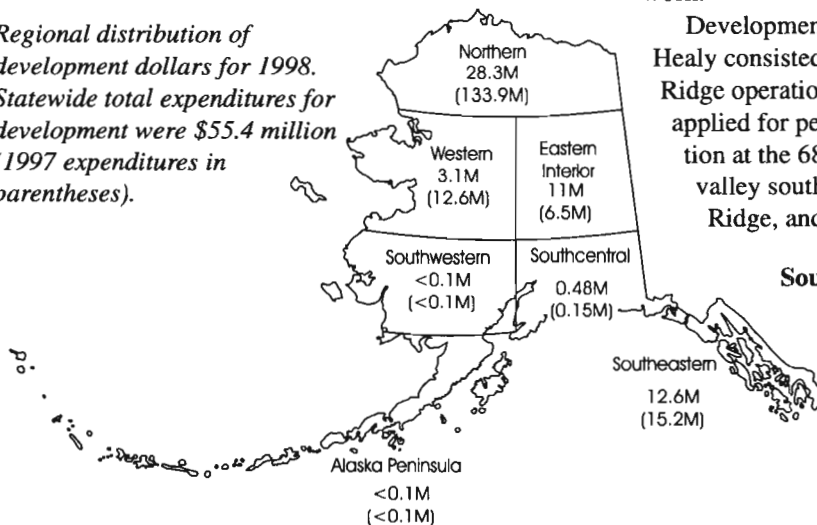


Table 4. Reported mineral development expenditures in Alaska by commodity, 1982-98

	Base metals	Polymetallics	Precious metals	Industrial minerals	Coal and peat	Total
1982	\$ 10,270,000	\$ N/A	\$ 19,320,000	\$ 4,251,000	\$ 7,750,000	\$ 41,591,000
1983	19,500,000	N/A	7,112,500	1,000,000	250,000	27,862,500
1984	10,710,500	N/A	15,058,555	579,000	27,000,000	53,348,055
1985	13,000,000	N/A	16,890,755	1,830,000	2,400,000	34,120,755
1986	3,260,800	8,000,000	12,417,172	124,000	530,000	24,331,972
1987	38,080,000	48,000,000	13,640,848	188,000	342,000	100,250,848
1988	165,500,000	69,000,000	40,445,400	--	--	274,945,400
1989	118,200,000	411,000	6,465,350	7,000,000	2,196,000	134,272,350
1990	--	4,101,000	7,136,500	30,000	3,079,000	14,346,500
1991	--	8,000,000	14,994,350	262,000	2,318,000	25,574,350
1992	80,000	4,300,000	23,151,300	404,000	1,655,000	29,590,300
1993	--	10,731,136	15,103,000	433,500	1,400,000	27,667,636
1994	10,000,000	5,000,000	27,392,850	5,000	2,545,000	44,942,850
1995	11,200,000	9,590,000	127,165,750	426,000	200,000	148,581,750
1996	60,000,000	60,100,000	273,042,000	495,000	400,000	394,037,000
1997	133,880,000	7,300,000	26,299,000	500,000	410,000	168,389,000
1998	28,000,000	5,600,000	15,602,000	5,355,000	850,000	55,407,000
<b>TOTAL</b>	<b>\$621,681,300</b>	<b>\$240,133,136</b>	<b>\$661,237,330</b>	<b>\$22,882,500</b>	<b>\$53,325,000</b>	<b>\$1,599,259,266</b>

N/A = Figures not available prior to 1986.

-- Not reported.

Table 5. Reported mineral development expenditures and employment in Alaska by commodity and region, 1998

	Northern	Western	Eastern interior	South-central	South-eastern	Total
<b>Development expenditures</b>						
Base metals	\$28,000,000	\$ --	\$ --	\$ --	\$ --	\$28,000,000
Polymetallic	--	--	--	--	5,600,000	5,600,000
Precious metals						
Placer	267,000	8,000	208,000	110,000	--	593,000
Lode	--	3,100,000	9,894,000	15,000	2,000,000	15,009,000
Coal and peat	--	--	750,000	100,000	--	850,000
Industrial minerals	--	--	100,000	255,000	5,000,000	5,355,000
<b>TOTAL</b>	<b>\$28,267,000</b>	<b>\$3,108,000</b>	<b>\$10,952,000</b>	<b>\$480,000</b>	<b>\$12,600,000</b>	<b>\$55,407,000</b>
<b>Development employment</b>						
Employment						
Workdays	24,490	1,040	10,155	688	9,600	45,973
Workyears <sup>a</sup>	94	4	39	3	37	177
Number of companies reporting <sup>b</sup>	3	2	13	6	4	28

-- No expenditures reported.

<sup>a</sup>Based on 260-day workyear.<sup>b</sup>Some companies active in more than one area.

No development expenditures or employment reported for Alaska Peninsula in 1998.



**Southeastern Region**

Development work at Kennecott Minerals Company's/Hecla Mining Company's Greens Creek Mine consisted of underground drilling and drifting to continue access to the Southwest Orebody, and to better define existing reserves. Sealaska Corporation finished development of its Calder Bay limestone quarry, access road, and a port facility capable of handling freighters up to 680 feet. The \$14 million project began in 1996, and is now ready to begin shipments either in dedicated or split-load vessels.

**EXPLORATION**

Minimum exploration expenditures throughout Alaska during 1998 were \$56.4 million, down only 2 percent from the \$57.8 million invested in 1997 (table 1) despite massive reductions in exploration budgets worldwide. Expenditures and employment figures by commodity and region are listed in table 6. Exploration expenditures in Alaska by commodity for the past 17 years are listed in table 7.

**Northern Region**

Cominco Alaska Inc. and Kennecott Exploration Company dominated exploration activities in Alaska's northern region during 1998. Cominco Alaska conducted exploration at the Red Dog Mine, located north of Kotzebue. Cominco also had a 12,600-foot drill program at the Paalaaq deposit north of the Red Dog Mine Main Pit. Kennecott Exploration had an exploration program in the western part of the Ambler Copper Belt on the south flank of the Brooks Range, and Kennecott Minerals had a modest drill program at the Arctic deposit farther to the east. The results of the Bureau of

Land Management airborne geophysical survey of the Wiseman area were released, and BLM geologists continued their evaluation of the area.

**Western Region**

Exploration activities and expenditures in the western region of Alaska were less than in 1997. A few relatively small programs were conducted in the Nome area, mainly on land owned by the Bering Straits Native Corporation (BSNC), and in the Kuskokwim Mountains northeast of Donlin Creek.

Consolidated Aston Resources had a four-core hole drilling and exploration program on the Fred Creek and Energizer prospects near the Mt. Distin prospect owned by BSNC, located approximately 20 miles north of Nome. Drilling intersected two zones of gold mineralization in brecciated and sheared schist and marble—178 feet of 0.013 ounces of gold per ton and 61 feet of 0.015 ounces of gold per ton at the Fred Creek prospect.

Altar Resources continued exploration for gold at the Bulk Gold prospect 23 miles north of Nome and collected four bulk samples that were analyzed to contain between 0.017 and 0.035 ounces of gold per ton. A 3,800-foot by 1,600-foot gold-in-soil anomaly was identified by Altar Resources on their Wild Bunch property located 150 miles northeast of Nome near Candle. Altar also conducted a soil sampling survey on their Think Zinc property located 54 miles northeast of Nome. Base and precious metal soil anomalies were identified in a 1,600-foot by 800-foot area, and another area had coincident gold and silver soil anomalies along a 5,000+ foot northeast-trending structure.

At Real del Monte's Nixon Fork Mine located northwest of McGrath, underground drilling added new gold reserves beneath the C-3300 orebody. Reserves were increased to 55,000 ounces at an average gold grade of 0.87 ounces per ton.

North Star Exploration had a modest exploration program in the northern Kuskokwim Mountains near Colorado Creek. NovaGold Resources also had a small reconnaissance program in the same area.

**Eastern Interior Region**

The Eastern Interior region had more than 50 percent of the Alaska exploration activity in 1998, mainly in the Yukon-Tanana Uplands east of Fairbanks, and in the Bonnifield mining district along the north flank of the Alaska Range between Healy and Delta. Sixty-four

*Regional distribution of exploration dollars for 1998. Statewide total expenditures for exploration were \$56.4 million (1997 expenditures in parentheses).*

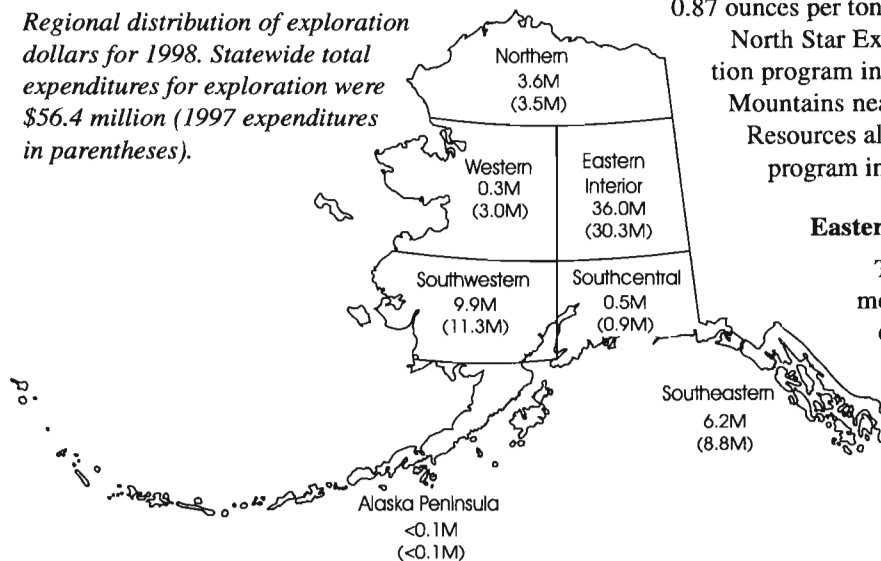


Table 6. Reported exploration expenditures and employment in Alaska, 1998

	Northern	Western	Eastern interior	South-central	South-western	South-eastern	Total
<b>Exploration expenditures</b>							
Base metals	\$1,000,000	\$ --	\$ --	\$ --	\$ --	\$ --	\$ 1,000,000
Polymetallic	2,550,000	20,000	7,191,000	300,000	76,000	3,590,000	13,727,000
Precious metals							
Placer	57,000	87,000	393,000	12,000	16,000	99,000	664,000
Lode	--	200,000	28,367,000	127,000	9,771,000	2,500,000	40,965,000
Coal and peat	--	--	--	87,000	--	--	87,000
Industrial minerals	--	--	--	--	--	--	--
Other <sup>a</sup>	--	--	--	--	--	--	--
<b>TOTAL</b>	<b>\$3,607,000</b>	<b>\$307,000</b>	<b>\$35,951,000</b>	<b>\$526,000</b>	<b>\$9,863,000</b>	<b>\$6,189,000</b>	<b>\$56,443,000</b>
<b>Exploration employment</b>							
Employment							
Workdays	3,610	954	50,443	704	9,847	7,380	72,938
Workyears <sup>b</sup>	14	4	194	3	38	28	281
Number of companies reporting <sup>c</sup>	7	8	56	9	7	11	98

-- Not reported.

<sup>a</sup>Jade, platinum, gemstones.

<sup>b</sup>Based on 260-day workyear.

<sup>c</sup>Some companies were active in several areas.

No exploration expenditures or employment reported for Alaska Peninsula in 1998.

Table 7. Reported exploration expenditures in Alaska by commodity, 1982-98

	Base metals	Polymetallic <sup>a</sup>	Precious metals	Industrial minerals	Coal and peat	Other	Total
1982	\$31,757,900	\$ N/A	\$ 10,944,100	\$ --	\$ 2,900,000	\$ 15,300	\$ 45,617,300
1983	9,758,760	N/A	20,897,555	2,068,300	1,338,454	70,000	34,133,069
1984	4,720,596	N/A	14,948,554	270,000	2,065,000	279,500	22,283,650
1985	2,397,600	N/A	6,482,400	--	270,000	--	9,150,000
1986	1,847,660	N/A	6,107,084	170,000	790,000	--	8,914,744
1987	2,523,350	N/A	11,743,711	286,000	1,150,000	31,000	15,734,061
1988	1,208,000	N/A	41,370,600	160,200	2,730,000	--	45,468,800
1989	3,503,000	N/A	43,205,300	125,000	924,296	5,000	47,762,596
1990	5,282,200	N/A	57,185,394	370,000	321,000	97,000	63,255,594
1991	4,789,500	N/A	34,422,039	92,000	603,000	2,000	39,908,539
1992	1,116,000	3,560,000	25,083,000	25,000	425,000	--	30,209,000
1993	910,000	5,676,743	23,382,246	163,500	--	125,000	30,257,489
1994	600,000	8,099,054	18,815,560	225,000	2,554,000	810,000	31,103,614
1995	2,770,000	10,550,000	20,883,100	100,000	--	3,000	34,306,100
1996	1,100,000	11,983,364	31,238,600	400,000	--	--	44,721,964
1997	1,700,000	22,347,000	32,960,500	80,000	720,000	--	57,807,500
1998	1,000,000	13,727,000	41,629,000	--	87,000	--	56,443,000
<b>TOTAL</b>	<b>\$76,984,566</b>	<b>\$75,943,161</b>	<b>\$441,298,743</b>	<b>\$4,535,000</b>	<b>\$16,877,750</b>	<b>\$1,437,800</b>	<b>\$617,077,020</b>

<sup>a</sup>Polymetallic deposits considered as a separate category for the first time in 1992.

N/A = Not available.

-- Not reported.

percent of exploration expenditures in Alaska during 1998 were spent in the eastern interior region.

Most staking activity for this region, estimated at approximately 150,000 acres of new claims and prospect sites, was in a northwest-southeast corridor extending from Fairbanks to the Canadian border, with Teck-Sumitomo's Pogo deposit at the approximate mid-point. The staking activity in the Goodpaster area near Pogo is currently one of the hottest area "plays" in North America.

After a 93,000-foot core-drill program at the Pogo property in 1998, Teck revised the resource estimate of the Upper and Lower Liese Zones to approximately 10 million tons at a grade of 0.52 ounces of gold per ton using a 0.1 ounce per ton cutoff grade (5.21 million ounce gold resource). A third, deeper and higher-grade zone has been encountered in two drill holes, and the Upper Liese Zone has been extended to the north. The deposit is open to the southeast and the northwest. Drilling at the Pogo property has been focused at the northwest end of an 8-mile zone of high-grade rock and soil samples.

WGM Incorporated and Sumitomo Corporation continued exploration, including soil sampling and drilling, in the Black Mountain and Brink areas to the southeast of the Pogo property. North Star Exploration Inc. had a joint-venture agreement with Doyon Limited, an Alaska Native (First Nations) corporation, for lands around the Pogo block. Other companies, including a large number of junior Canadian mining companies, acquiring land positions near Teck's Pogo property in 1998 included NovaGold Resources, Western Keltic Mines, Rimfire Minerals Corporation, Hyder Gold Incorporated, AngloAlaska Gold, Almaden Resources, Williams Creek Explorations, Engineer Mining Corp., Fairfield Minerals, Pacific Bay Minerals, Bear Mountain Exploration Services, Achieva Development Corporation, Snowfield Resources, Kennecott Exploration, and Newmont Exploration.

Ventures Resource Corporation, in a joint venture with Doyon Limited, with equity funding from Teck, continued exploration of its strategically located Carrie and Veta mid-stage targets near the Pogo property. A limited drill program within one of four parallel 2.5-mile-long by 1,000-foot-wide zones at the Carrie Creek prospect cut mineralization with anomalous gold values. Surface samples of up to 1.6 ounces of gold per ton have been reported from these zones at higher elevations on the property.

The Alaska Division of Geological & Geophysical Surveys contracted for an extensive airborne geophysical survey of the Fortymile area, which created a mini staking rush in March, well before the results were released in January 1999. Numerous individuals also

participated in the staking rush, which has reportedly spread into the Yukon Territory.

In the Richardson district east of Fairbanks, Tri-Valley Corporation discovered widespread gold mineralization in two new zones near the Democrat Dike prospect. Tri-Valley processed a 100,000-ton bulk sample from the Democrat Dike prospect to define the grade and size distribution of gold mineralization. Analytical results from this sample have not been released. Tri-Valley optioned a portion of their 44-square-mile claim block to Redstar Resources Corporation during early 1998; after Redstar defaulted on the agreement, Tri-Valley reached a letter of agreement with Placer Dome Exploration Incorporated for further exploration. Kinross Gold Corporation also acquired a land position in the Richardson district. Late in the year, Golden Phoenix Minerals Incorporated and Kennecott Exploration Company agreed to land-consolidation measures in the same area.

In the Fairbanks area, Kinross Gold Corporation drilled at JV partner Teryl Resource Corporation's Gil East prospect with encouraging results of up to 160 feet of 0.09 ounces per ton, and began acquisition of other properties in the area. The indicated and inferred resource at the Gil prospects is 10.7 million tons at 0.042 ounces per ton gold (450,000 ounces). Kinross merged with Amax Gold in June, and also merged with La Teko Resources Limited by February 1999. These mergers are consolidating land packages throughout the Fairbanks mining district.

International Freegold Mineral Development Incorporated explored the large Golden Summit property, located north of Fairbanks and the Fort Knox Mine, with equity financing from Barrick Gold Corporation. Several new targets were identified, and drilling on these and existing targets encountered gold grades of 0.1 to 0.3 ounces per ton over significant widths. A vertical drill hole at the Dolphin prospect produced a continuous 800-foot section averaging 0.021 ounces of gold per ton. Freegold estimates total resources of the Golden Summit property at 1.6 million ounces of gold, with 50 percent of the reserves in the proven/probable category.

Placer Dome Exploration Incorporated leased part of the Ester Dome holdings of Silverado Gold Mines Limited during 1998. Drilling by Placer Dome confirmed depth extensions of the Ready Bullion and Silver Dollar veins on the southwest part of the hill, and encountered gold intercepts as high as 2.66 troy ounces per short ton (OPT) over 19.7 feet at the Rhyolite prospect on the north side of Ester Dome.

Newmont Exploration Limited concentrated on engineering and metallurgical studies of La Teko Resources' True North property. Metallurgical tests found

gold recoveries were between 85 percent to 95 percent for non-sulfide coarse material from the 1.3-million-ounce gold resource oxide zones at the Hindenburg and Shepard prospects. Deeper, more sulfide rich samples from the Hindenburg and the Shepard prospects had gold recoveries ranging from 61 percent to 68 percent. Exploration activities on the True North property during 1998 were largely auger soil sampling programs. Of particular interest is a 400-foot by 1,000-foot gold-arsenic-antimony anomaly occurring southwest of the True North trend.

In the Bonfield mining district east of Healy, Grayd Resources Corporation at its Dry Creek project had the most active exploration program. Grayd's 11,894-foot drilling program extended the volcanogenic massive sulfide (VMS) zone at Red Mountain to almost 5,000 feet of drill-tested extent, within a 15,000-foot trend indicated by geology and geophysics. This DC North zone includes the Fosters Creek, Lago Creek and Discovery areas, where high-grade zones up to 40 feet thick with 10 percent combined lead-zinc and several ounces of silver have been drilled. Some drill holes cut over 200 feet of mineralization in the central part of the trend. An inferred resource of 3.1 million tons of 4.4 percent zinc, 1.9 percent lead, 0.2 percent copper, 2.73 ounces per ton silver and 0.016 ounces per ton gold has been calculated for the DC North horizon. Metallurgical tests show excellent recovery potential. About 2 miles to the northeast is the WTF zone, where a resource of 3 million tons of 6 percent zinc, 2.5 percent lead, 0.1 percent copper, 5.06 ounces of silver and 0.026 ounces per ton gold has been identified. The relationship between the two deposits, if any, remains unknown. Other companies active in the area include Inmet Mining Corporation, Camnor Resources Limited, and Golden Phoenix Minerals Incorporated.

Farther east near Tok, Grayd Resource Corporation funded a joint venture with American Copper & Nickel Company (ACNC). The JV exploration program increased total resources for several Delta Belt VMS deposits to 19 million tons of 4 percent zinc, 2.7 percent lead, 0.6 percent copper, 2.13 ounces per ton silver and 0.055 ounces per ton gold. In the adjacent Rumble Zone, the Grayd-ACNC JV found samples with up to 0.6 ounces per ton gold in the 5-mile-long White Gold trend. ACNC also explored for platinum group elements on the south flank of the central Alaska Range in a JV funded by Fort Knox Gold Resources Limited.

In the Circle mining district, Newmont Exploration Limited and Golden Phoenix Minerals Incorporated staked numerous claims and consolidated some claim groups. Camnor Resources Limited had the most active program in the Circle district and reported 20 feet of 0.044 ounces per ton gold mineralization in a trench at

the Switch Creek area of the 3,000-acre Discovery Gulch property.

### **Southcentral Region**

Exploration was minimal in the southcentral region of Alaska during 1998, with small programs by Diamond Gold Corporation for copper and gold at Mount Yenlo north of Anchorage, by Kennecott Exploration Company at Iron Creek in the Talkeetna Mountains, and by Fort Knox Gold Resources Limited at the Gunsite gold property east of Talkeetna. Several prospects occur within the Gunsite property, including the Sheep Creek showing at Prescott Point, quartz-bornite-chalcopyrite veins on Penger Mountain, and both veins and disseminated copper at Gunsite Pass. Grab samples of the veins at the Penger and Gunsite prospects analyze up to 10.9 percent copper, 1.6 ounces per ton silver and about 0.16 ounces per ton gold.

The Alaska Division of Geological & Geophysical Surveys had geologic mapping and geochemical sampling projects in areas previously covered by airborne geophysical surveys in the Chulitna and Petersville mining districts. Geologic maps resulting from the 1998 programs will be released by June 1999.

### **Southwestern Region**

Exploration activity in the southwestern region of Alaska included work by Placer Dome Exploration Incorporated at Calista Corporation's (a regional Native [First Nations] corporation) Donlin Creek property, and by NovaGold Resources Incorporated at Cominco American Incorporated's Mose gold property in the Shotgun Hills, located about 80 miles to the south. Gold at both properties is associated with 60-73 Ma, high-level, granitic bodies and these bodies intrude Cretaceous shale, siltstone, and graywacke.

NovaGold Resources Incorporated drilled 19 HQ-size core holes totaling about 10,200 feet at the Mose target on the Shotgun property. They estimated a 980,000-ounce gold resource with a grade of 0.03 ounces per ton gold, at a cutoff grade of 0.014 ounces per ton. The first core hole drilled in the 1998 program intersected 557 feet of gold mineralization hosted by stockwork quartz veining and disseminated sulfides grading 0.036 ounces of gold per ton beginning at the surface. NovaGold also fielded a robust regional exploration program in the Kuskokwim Mountains at Colorado Creek and Julian Creek.

Prior to the 75,000-foot drill program in 1998, Placer Dome Exploration Incorporated announced a 6.76 million-ounce gold resource in 67 million tons at its Donlin Creek project. Most of the resource is in the southwestern portion of the mineralized complex, but there are several other areas yet to be explored.

The gold resource was increased by the 1998 core drilling program to 11.5 million ounces in 63 million tons, with 5.4 million ounces in the measured and indicated category.

Ventures Resource Corporation drilled seven holes, for a total of approximately 1,500 feet, at its Chicken Mountain prospect near Flat. The core drilling encountered anomalous gold mineralization in five drill holes, including a 25-foot interval of 0.1 ounces per ton and a 20-foot interval grading 0.086 ounces per ton.

**Southeastern Region**

Exploration expenditures in the southeastern region of Alaska during 1998 were only about half of those in 1997. Coeur Alaska drilled some of the deeper reserves at the Kensington gold mine, located about 50 miles north of Juneau, and Kennecott Minerals Company drilled both underground and on surface near the Greens Creek Mine, located about 20 miles west of Juneau. Kennecott's exploration at the Greens Creek Mine identified significant ore-grade mineralization in the 200S Extension area (adjacent to the Southwest Ore Zone) and in the West Bench area. Kennecott Exploration Company had an independent regional program in the vicinity of Duncan Canal.

A joint venture between Atna Resources Limited and Rubicon Minerals Corporation began exploration of the large Palmer claim group near Haines for VMS mineral-

ization. The 1998 field program consisted of geologic mapping, geophysical surveys, and drilling. Four diamond drill holes with a total of 3,256 feet were drilled to test continuity of previously identified base-metal mineralization. Abacus Minerals Corporation secured permits in June for underground exploration of its Niblack property, located near Ketchikan.

There was renewed interest in the Duncan Canal area near Wrangell following release of a geophysical survey in that area contracted by the Alaska Division of Geological & Geophysical Surveys in cooperation with the U.S. Bureau of Land Management and the City of Wrangell. BLM and USGS conducted geologic mapping and geochemical sampling within the geophysical survey area.

**DRILLING**

Tables 8 and 9 summarize the drilling activity in the state during 1998 by region and type of drilling. There was a rather sharp decline in the total footage drilled, from 757,488 feet in 1997 to 585,168 feet in 1998. The decline in hardrock reverse-circulation drilling, from 180,834 feet in 1997 to only 45,670 feet in 1998, is particularly dramatic, but in part reflects the maturing of a number of prospects into advanced exploration, where it is necessary to acquire the additional information that core drilling provides.

Table 8. Drilling footage reported in Alaska, 1982-98

Year	Placer Exploration	Placer Thawing	TOTAL PLACER	TOTAL COAL	TOTAL HARDROCK	Hardrock Core <sup>a</sup>	Hardrock Rotary <sup>a</sup>	TOTAL FEET
1982	30,000	94,000	124,000	80,000	200,000	--	--	404,000
1983	23,000	30,000	53,000	12,000	180,500	--	--	245,500
1984	31,000	98,000	129,000	25,700	176,000	--	--	330,700
1985	46,000	34,000	80,000	8,700	131,700	--	--	220,400
1986	32,400	227,000	259,400	28,800	50,200	--	--	338,400
1987	50,250	130,000	180,250	19,900	115,100	95,600	19,500	315,250
1988	152,000	300,000	452,000	26,150	353,860	223,630	130,230	832,010
1989	97,250	210,000	307,250	38,670	332,230	242,440	89,790	678,150
1990	78,930	105,000	183,930	18,195	760,955	648,600	112,355	963,080
1991	51,247	130,000	181,247	16,894	316,655	205,805	110,850	514,796
1992	6,740	65,000	71,740	12,875	359,834	211,812	148,022	444,449
1993	25,216	--	25,216	--	252,315	124,325	127,990	277,531
1994	21,000	--	21,000	8,168	438,710	347,018	91,692	467,878
1995	27,570	--	27,570	--	415,485	363,690	51,795	443,055
1996	61,780	--	61,780	8,500	658,857	524,330	134,527	729,137
1997	38,980	--	38,980	13,998	704,510	523,676	180,834	757,488
1998	33,250	--	33,250	2,300	549,618	503,948 <sup>b</sup>	45,670	585,168

<sup>a</sup>Core and rotary drilling not differentiated prior to 1987.

<sup>b</sup>183,655 feet of core drilling was underground.

-- = Not reported.

Note: Blasthole drilling not reported. Approximately 2,500,000 feet in 1998.

Table 9. *Drilling footage by region in Alaska, 1998*

Type of drilling	Northern	Western	Eastern interior	South-central	South-western	South-eastern	TOTAL
<b>Placer subtotal</b>	<b>2,000</b>	<b>1,000</b>	<b>30,250</b>	--	--	--	<b>33,250</b>
<b>Coal subtotal</b>	--	--	--	<b>2,300</b>	--	--	<b>2,300</b>
Hardrock core	18,578	14,855	188,443	--	90,916	191,156	<b>503,948<sup>a</sup></b>
Hardrock rotary	--	--	45,670	--	--	--	<b>45,670</b>
<b>Hardrock subtotal</b>	<b>18,578</b>	<b>14,855</b>	<b>234,113</b>	--	<b>90,916</b>	<b>191,156</b>	<b>549,618</b>
<b>TOTAL (feet)</b>	<b>20,578</b>	<b>15,855</b>	<b>264,363</b>	<b>2,300</b>	<b>90,916</b>	<b>191,156</b>	<b>585,168</b>

-- = Not reported.

<sup>a</sup>183,655 feet of core drilling was underground.

Note: Blasthole drilling not reported. Approximately 2,500,000 feet in 1998.

No drilling footage reported for Alaska Peninsula in 1998.

## GOVERNMENT ACTIONS

During 1998, the Alaska Division of Geological & Geophysical Surveys (DGGs) released maps of the results of airborne magnetic and electromagnetic surveys of the Talkeetna Mountains and Ruby areas, and also of the U.S. Bureau of Land Management surveys of the Wrangell and Wiseman areas. DGGs also contracted for geophysical surveys of the Fortymile River area east of the Pogo property and of the Livengood area northwest of Fairbanks. These maps were released in January 1999.

The U.S. Geological Survey continued work with the Alaska Division of Mining & Water Management (DMWM) on water-quality baseline studies in the Fortymile River drainage. Preliminary results of these studies were released and a similar joint effort was proposed to begin similar studies in 1999 for the Goodpaster River drainage.

Two mines in Alaska received safety awards in 1998. Greens Creek Mine won first place for underground mines in the Sentinels of Safety Award, with 434,236 work-hours without a fatality or lost time accident in 1997. Fort Knox Mine was second runner up for

open-pit mines in the same contest, with 258,989 work-hours without a fatality or lost-time accident in 1997. Jon Vander Wal received the 1998 Reclamation Award for Excellent Mine Reclamation from the Alaska Department of Natural Resources for his work on Thistle Creek in the Bonnifield district near Healy.

In 1996 Congress passed and President Clinton signed into law a land exchange between Kennecott Minerals Company and the U.S. Forest Service that would provide Greens Creek Mine with access and mineral rights to an additional 7,500 acres surrounding the Greens Creek property. The land exchange was finally consummated in 1998. The land surrounding Greens Creek Mine, which was previously closed to exploration, has excellent mineral potential and may substantially extend Greens Creek's reserves and mine life.

The U.S. Army is asking the U.S. Congress for extensions of military land withdrawals covering 871,537 acres of Interior Alaska. Many of these lands have a high potential for gold mineralization and are currently closed to mineral activities. The U.S. Army is seeking 50-year extensions to the military withdrawals. Decisions on the extensions are pending.



*Excavator and bulldozer trench on Lewis Ridge, Donlin Creek property, southwestern Alaska. Trench is approximately 1,300 feet long and part of a 3.7-mile trenching program by Placer Dome Exploration Incorporated during the 1997 and 1998 field seasons. Light-colored rock is igneous dikes and sills, and darker rocks are Kuskokwim Group shale and graywacke.*

**DEPARTMENT OF NATURAL RESOURCES**  
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