ALASKA'S MINERAL INDUSTRY 2001: A SUMMARY

by
R.C. Swainbank[1] and D.J. Szumigala[2]

INTRODUCTION

This summary of Alaska's mineral industry activity for 2001 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 further compilation of information, particularly placer mining and industrial mineral data. This report is part of a cooperative venture between the Division of Geological & Geophysical Surveys (DGGS) and the Division of Mining, Land, & Water (DMLW) in the Department of Natural Resources (DNR) and the Division of Community & Business Development (DCBD) in the Department of Community & Economic Development (DCED). The estimates used in this summary are generally conservative due to incomplete data.

Table 1 shows the estimated value of the mineral industry in Alaska per year from 1981 to 2001, as divided between exploration and development investments and the value of the mined products. These preliminary values totaled $992 million in 2001, compared with $1,283 million in 2000, due to reduced expenditures for exploration ($22.1 million in 2001 versus $34.9 million in 2000), for development ($83.2 million in 2001 versus $141.7 million in 2000), and a large decline in the value of production ($886.9 million in 2001 versus $1,106 million in 2000). The decline in the value of metal production reflects substantial reductions in the average prices of most metals, which offset near-record production amounts.

The low metal prices also affected the ability of companies to raise capital for exploration, not only in Alaska but globally, and this trend is likely to continue into the year 2002. Compared to the past several years, exploration activity was more evenly distributed throughout Alaska. The eastern interior region saw a sharp reduction in activity, while the Seward Peninsula and southeastern Alaska experienced a rebirth in activity. Gold remained the major exploration commodity, but polymetallic and platinum-group-element (PGE) exploration increased from recent levels.

The decline in the amount expended on development in 2001 resulted mainly from the completion of the $105 million Mill Optimization Project at Red Dog Mine in northwestern Alaska early in the year, and also from the completion of the adit into the Liese orebody at Pogo Mine in the eastern interior region. Permitting and road and pit development at True North Mine west of Fort Knox Mine near Fairbanks was completed by mid year.

Throughput at the mill at Greens Creek Mine near Juneau set a record in 2001, but metal production was down due to milling of lower grade ore. Production at Red Dog Mine was comparable to that of the previous year, as fine-tuning of the mill continued well into the last quarter of

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

	Exploration (expenditure)	Development (expenditure)	Production (value)	Total (calculated)
1981	76.3	24.7	188.6	289.6
1982	45.6	41.6	196.4	283.7
1983	34.1	27.9	212.4	274.4
1984	22.3	53.4	199.4	275.1
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	552.6
1989	47.8	134.3	277.0	459.0
1990	63.3	14.3	533.0	610.6
1991	39.9	25.6	546.5	612.0
1992	30.2	29.6	560.8	620.6
1993	30.3	27.7	448.7	506.7
1994	31.1	45.0	507.5	583.6
1995	34.3	148.6	537.2	720.1
1996	44.7	394.0	590.4	1029.2
1997	57.8	168.4	936.2	1162.4
1998	57.3	55.4	921.2	1033.9
1999	52.3	33.8	1032.9	1119.1
2000	34.9	141.7	1106.4	1283.0
2001	22.1	83.2	886.9	992.2
TOTAL	**$803.6**	**$1,882.9**	**$10,541.2**	**$13,227.8**

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

[1]Alaska Division of Community and Business Development, Unit #7, 3677 College Rd., Fairbanks, Alaska 99709.
[2]Alaska Division of Geological & Geophysical Surveys, 794 University Ave., Suite 200, Fairbanks, Alaska 99709-3645.

the year. Production in 2002 at Red Dog is expected to increase by about 8 percent. At Fort Knox Mine, blending of the True North gold ore with the regular Fort Knox ore led to record production in 2001, and with a full year of operation, gold production is expected to increase in 2002. The number of placer gold mines and the amount of placer gold produced continued the steady decline since 1997.

EMPLOYMENT

The estimated total employment by the Alaska mineral industry in 2001 is 2,882 full-time-equivalent jobs. This is a drop of 301 jobs or 10 percent from the 3,183 jobs accounted for in 2000. Much of the decline was in development employment, as activity at Red Dog Mine and Pogo Mine wound down, but placer mine employment also continued the steady decline of the past 8 years (table 2).

EXPLORATION

Estimated exploration expenditures in Alaska during 2001 were approximately $22 million, a drop of about 37 percent compared to expenditures of $34.9 million in 2000. The value of mineral exploration was at its lowest point since 1987. Exploration expenditures by commodity are listed in table 3.

Northern Region

Teck Cominco Ltd. announced drilling results near Red Dog mine, owned by its wholly owned affiliate Teck Cominco American Inc. The Anarraaq deposit, 6 miles north of Red Dog Mine, was discovered by drill-testing a gravity anomaly in 1999. Further drilling in 2000 established an inferred resource of 19 million tons grading 15.8 percent zinc, 4.8 percent lead and 0.5 ounces per ton silver. A new deposit named Aktigiruq was also discovered 2.5 miles north-northwest of the. Anarraaq deposit. Drill hole 932, which was drilled in 2000, intersected significant zinc mineralization (13.8 feet of 30 percent zinc, 5 percent lead, and 0.1 ounces per ton silver at a depth of 2,285 feet) on a gravity feature centered on the Aktigiruq deposit. Eight additional drill holes were completed on this large gravity anomaly during the 2001 field season. All eight holes cut significant widths of sulfides (12 to 81 feet wide) and four of these holes intersected good grade (7 to 21 percent) zinc. Hole 1114, which is 2.1 miles north of Anarraaq, intersected the highest grade interval yet encountered in the Red Dog area, with 17 feet grading 45.8 percent zinc included within an interval of 78 feet grading 20.9 percent zinc.

Western Region

The Seward Peninsula was the center of activity for the western region of Alaska. Continuing exploration programs for gold and base-metal targets were joined by programs searching for tantalum–rare-metal mineralization and platinum-group-element mineralization.

Navigator Exploration Corp. reached an agreement with Greatland Exploration Ltd. whereby Navigator may earn a 100 percent interest in the Kougarok tantalum–tin property, 70 miles north-northeast of Nome by making a total of $3.4 million in payments and exploration expenditures over 5 years, subject to a 5 percent royalty. Navigator subsequently entered into an option agreement with Chapleau Resources Ltd. whereby Chapleau can earn a 50 percent interest by spending $1 million on exploration before December 1, 2003. Chapleau can earn a

Table 2. *Estimated Alaska mine employment, 1995–2001*[a]

	1995	1996	1997	1998	1999	2000	2001
Gold/silver mining							
Placer	975	825	780	710	591	470	254
Lode	38	138	415	345	296	274	337
Polymetallic	--	68	230	275	275	275	275
Base metals	397	407	478	466	549[b]	556	559
Recreational	255	260	270	255	240	250	210
Sand & gravel	577	598	700	658	590	603	580
Rock	200	149	123	121	128	150	112
Coal	120	115	118	128	121	121	121
Peat	30	38	42	40	38	36	32
Tin, jade, soapstone, ceramics, platinum	20	20	20	20	20	20	20
Mineral development	637	862	409	177	135	345	304
Mineral exploration	157	257	277	282	183	83	78
TOTAL	**3,406**	**3,737**	**3,862**	**3,477**	**3,166**	**3,183**	**2,882**

[a]Calculated on a 260-day work year.
-- Not reported.

60 percent interest by spending an additional $500,000 on or before December 1, 2004. The Kougarok property comprises approximately 4,000 acres, contains a 3,300-foot airstrip, and has state-maintained road access to within 30 miles of the site. Anaconda Minerals Co. spent $5.5 million on the Kougarok property from 1979 to1983 exploring for tin and work included 33,000 feet of diamond drilling, 3,600 feet of trenching, geological mapping, geochemical sampling, and detailed gravity surveys. Tantalum mineralization was encountered incidental to the tin exploration but was of limited economic interest at that time. Intercepts from Anaconda's drilling include 100 feet of 0.0425 percent tantalum (0.052 percent Ta_2O_5) and 378 feet of 0.0238 percent tantalum (0.029 percent Ta_2O_5).

Tantalum is a "high-tech" metal used primarily in electronic applications, special corrosion-resistant metal alloys, and medical prostheses. Tantalum is a good conductor of heat and electricity and is resistant to corrosion by acids. Demand for tantalum has grown at an average rate of 10 percent per year since 1992 and the trend is expected to continue for the foreseeable future.

The Kougarok property contains a large magmatic–hydrothermal system with tantalum–tin mineralized greisens in strongly evolved fluorine–lithium granite. Similar deposits worldwide are important sources of tantalum and related rare-metal mineralization (lithium, beryllium, rubidium, cesium, scandium, etc.). Such granite deposits are generally larger (commonly in excess of 15,000–35,000 tons Ta_2O_5) than the largest tantalum pegmatite deposits (11,000–13,000 tons Ta_2O_5).

The Kougarok property is underlain by a large buried multi-phase intrusion that incorporates a number of satellite mineralized cupolas formed by tantalum-enriched albite–zinnwaldite granites. Most tantalum-enriched zones lie subjacent to the area of high-grade tin mineralization and remain open in all directions. Surface geochemical surveys have also identified a number of fluorine and rare-metal anomalies that require further follow-up work. Anaconda Minerals Co. identified tantalum–tin mineralization in the area know as the Main Plug. Surface geochemical sampling and prospecting undertaken by Navigator and Chapleau during 2001 identified additional strong mineralization potential at the Hill Top area (0.01 square mile area) 1,600 feet east of the Main Plug and the Real Top area (0.9 square mile area) approximately 2 miles south of the Main Plug area. Grab samples from the Hill Top area returned inductively coupled plasma (ICP) results ranging from 218 to 341 parts per million Ta_2O_5

Table 3. *Reported exploration expenditures in Alaska by commodity, 1982–2001*

	Base metals	Polymetallic[a]	Precious metals	Industrial minerals	Coal and peat	Other[b]	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	42,441,000	12,000	87,000	--	**57,267,000**
1999	3,869,000	3,168,000	44,891,000	1,000	--	410,000	**52,339,000**
2000	5,350,000	3,900,000	21,169,500	58,500	--	691,000	**31,169,000**
2001	106,000	4,690,000	16,162,000	60,000	--	1,106,000	**22,124,000**
TOTAL	**$86,309,566**	**$87,701,161**	**$524,333,243**	**$4,666,500**	**$16,877,750**	**$3,644,800**	**$723,533,020**

[a]Polymetallic deposits considered as a separate category for the first time in 1992.
[b]Includes diamonds.
N/A = Not available.
-- Not reported.

(0.022 to 0.034 percent Ta_2O_5), and the strong partitioning of tantalum and tin in these samples suggests close proximity to the roof of a granite intrusion. The Hill Top showing, which is up-dip from the previously known mineralization, may represent a significant, larger, new target for tantalum mineralization. Navigator and Chapleau plan to drill these targets in early 2002.

Quaterra Resources Inc. reached an agreement in principle with Altar Resources to acquire an undivided 100 percent interest in Altar's Think Zinc, Rocky Mountain Creek, and Sinuk River massive sulfide prospects on the Seward Peninsula by making staged payments of $500,000 in cash, issuing 500,000 shares, and completing $1,000,000 in exploration work over a 6-year period. A net smelter royalty (NSR) of 2.5 percent will also be retained by Altar, 1 percent of which may be purchased for $1,750,000. An initial payment of $10,000 and 200,000 Quaterra shares was made to Altar.

The Think Zinc, Rocky Mountain Creek, and Sinuk River prospects host potential volcanogenic massive sulfide mineralization that may be in the same package of rocks that host mineralization at Quaterra's Big Bar prospect and may represent the southern extension of the Ambler schist belt. The Rocky Mountain Creek prospect is the most advanced property in the group, with three drill holes. A 30-foot core hole intersected thin bands of massive sulfide, with the interval from 19 to 26 feet containing 1.7 percent lead, 2.31 percent zinc, 0.65 ounces per ton silver and 0.008 ounces per ton gold.

Quaterra completed gravity surveys on its four 100-percent-owned/optioned massive sulfide prospects and identified strong anomalies on each prospect. Allan Spector and Associates completed the gravity survey with a total of 393 gravity measurements taken at 200-foot intervals along lines spaced 400 feet apart. Three of the prospects, Think Zinc, Rocky Mountain Creek, and Big Bar, have well defined gravity anomalies with coincident geochemistry. The fourth, Sinuk River, has gravity anomalies adjacent to mineralized float. Overall, 11 gravity anomaly zones were identified with anomalies ranging from 0.5 to 1.0 milligals, with areas up to 800 feet wide and up to 2,000 feet long.

North Star Exploration Inc. (a subsidiary of EMEX Corp.) conducted geologic mapping, rock-chip sampling, and soil sampling with a follow-up diamond drill program consisting of five holes (2,924 feet) on two well identified targets on the Takotna Project in the Innoko and McGrath mining districts. Drill results indicate that gold was present in altered veins, in altered intrusive rocks, and in structures associated with Late Cretaceous and early Tertiary-age igneous complexes. Mineralized intercepts range in width from 2.5 to 43 feet and grade from 0.01 to 0.12 ounces per ton gold. Drill hole TH-01-01 had a 16-foot intercept beginning at 90 feet of 0.06 ounces per ton gold, and drill hole GG-01-2 had a 5-foot intercept beginning at 560 feet with a grade of 0.12 ounces per ton gold.

In the Farewell mining district, approximately 165 miles northwest of Anchorage, Platinum–Palladium Exploration Inc., also a subsidiary of EMEX Corp., conducted a major reconnaissance program for nickel, copper, and platinum-group-element occurrences in mafic to ultramafic intrusive rocks. Two known nickel–copper–platinum-group-element occurrences (Roberts PGM and Chip Loy) were defined by surface mapping and sampling and tested by diamond drilling (nine holes totaling 2,416 feet). Results from channel sampling at Roberts PGM include 1.5 feet of peridotite averaging 0.49 ounces per ton total platinum-group elements (platinum + palladium + iridium + osmium + rhodium + ruthenium), and 3 feet of peridotite averaging 0.29 ounces per ton total platinum-group elements. Mineralized drill intercepts from the Roberts PGM prospect include 15 feet averaging 0.03 ounces per ton platinum and 0.037 ounces per ton palladium starting at 277.5 foot depth in drill hole R-01-01B, and 5 feet (within a 15-foot mineralized interval) averaging 0.038 ounces per ton platinum and 0.054 ounces per ton palladium starting at 380 foot depth in drill hole R-01-03. The best reported drill intercept at the Chip Loy prospect is in drill hole CL-01-2, with 4.5 feet beginning at 77-foot depth of 1.54 percent nickel, 0.37 percent copper, 0.07 percent cobalt, and no reported platinum-group-element values.

Numerous other occurrences were identified in Platinum–Palladium's reconnaissance programs, suggesting the potential for a new nickel–copper–platinum-group-element district extending over 60 miles. Selected surface samples of peridotite and gabbro ranged up to 0.49 ounces per ton total platinum-group elements (platinum + palladium + iridium + osmium + rhodium + ruthenium) with 2.27 percent nickel and 1.31 percent copper. Further work is required in the Farewell district to define mineralization associated with these newly discovered mafic sills and their regional significance.

Altar Resources continued exploration on their gold prospects. The Dripping Gold Zone on the Bulk Gold property was identified by a 1,500-foot-long soil anomaly averaging 0.003 ounces per ton gold, with a high value of 0.13 ounces per ton gold. A shallow, hand-dug trench within this zone exposed a 6- to 12-inch-thick quartz vein that assayed 0.004 ounces per ton gold, greater than 6 ounces per ton silver, 7,750 parts per million copper, 388 parts per million bismuth, and 20 parts per million arsenic.

Eastern Region

Teck continued evaluating extensions of gold mineralization across the Pogo property, and continued an exploration program including diamond core drilling at the Napoleon property in the Fortymile mining district near the Alaska–Yukon border. Kennecott Exploration

continued an extensive drilling program at the Uncle Sam area near Delta Junction.

North Star completed an induced polarization (IP) survey, a ground magnetic survey, an auger drilling soil survey, and 6,991 feet of diamond drilling in 2001 at its Northway project (Road Metal) on the Alaska Highway. These surveys were conducted over a zone where gold, silver, and base-metal mineralization was intersected in two diamond drill holes in 2000. A large chargeability anomaly was located by the IP survey, which measures 1,650 feet by up to 1,600 feet, and is open along strike to the north and south, open to the west, and open at depth. The anomaly is immediately west of the mineralization encountered in the 2000 and 2001 drill programs and represents a significant new drill target with a large size potential.

The 2001 drilling by North Star confirmed extensions of mineralized zones to depth in altered granite greisens, but did not intersect similar widths of mineralization as in the 2000 drill program. Gold and silver mineralization was encountered in five of the eight drill holes in the 2001 program. Mineralized intercepts include 7.8 feet at depth of 70.4 feet in drill hole RM-01-06 averaging 0.055 ounces per ton gold and 3.54 ounces per ton silver, 4.4 feet at depth of 693.3 feet in drill hole RM-01-13 averaging 0.19 ounces per ton gold and 0.97 ounces per ton silver, and 9.9 feet at depth of 1,361.1 feet in drill hole RM-01-13 averaging 0.061 ounces per ton gold and negligible silver.

Kinross Gold Corp. conducted exploration and definition drilling programs at the True North gold project. A mix of diamond and reverse-circulation drilling at True North Mine, largely in the Central and Sheppard zones, aided in converting resources to reserves and outlining mineralization limits. An interim reserve calculation completed in August indicated that 144,000 ounces of gold were added to the 611,000 ounces of probable reserves from year-end 2000 and more reserve ounces were expected by the end of 2001. In addition, drilling results at the newly identified West Zeppelin zone were encouraging.

The Gil property near Fort Knox Mine, a joint-venture property held by Kinross Gold Corp. (80 percent owner) and Teryl Resources Corp. (20 percent working interest), was explored by Fairbanks Gold Mining Inc., a wholly owned subsidiary of Kinross Gold Corp. Trenching was completed on the Main Gil prospect, and two trenches were excavated 2,500 feet east of Main Gil at a new prospect named Sourdough Ridge. The Sourdough Ridge prospect has widespread gold, bismuth, and arsenic soil anomalies with rock assays having gold mineralization up to 0.5 ounces per ton in east–west striking high-angle veins and fracture fillings. An extensive drill program program continued at Gil on the Main Gil, North Gil, and Sourdough Ridge prospects. Highlights of the 2001 drill program include hole 250 at Sourdough Ridge with an average grade of 0.02 ounces per ton gold over the 225-foot depth and a grade of 0.33 ounces per ton gold for the first 105 feet; hole 255 at the North Gil prospect with 75 feet of 0.036 ounces per ton gold starting at 40-foot depth, and a 50-foot intercept grading 0.050 ounces per ton gold in hole 256 (North Gil) starting at 190-foot depth.

Grayd Resource and Placer Dome U.S. Inc. struck a joint-venture deal in which Placer had an option to earn an undivided 51 percent joint venture interest in Grayd's wholly owned White Gold project by spending $3.1 million over a 4-year period. Grayd remained the operator and Placer agreed to finance a minimum of $350,000 in exploration expenditures on the property in 2001. The White Gold property, in the Delta mineral belt, has gold mineralization along a 5-mile-long trend on the property. Grayd had previously identified prospects, including the Shalosky showing, Hunter prospect, Kokance Hill prospect, Low showing, HD area, Flicks showing, and Goldberg area, by prospecting, soil sampling, and hand trenching.

Placer, with Grayd as operator, undertook a program of surface sampling, geophysics (max-min and magnetics), hand trenching, and drilling on the White Gold property. Surface sampling results include 270 out of 891 soil samples that assayed greater than 100 parts per billion gold and 50 out of 225 rock samples that assayed greater than 0.029 ounces per ton gold. A 21-foot portion of a hand trench at the Hunter Showing ran 0.28 ounces per ton gold (including 3.3 feet at 1.1 ounces per ton gold). At Low, a trench exposed 32.1 feet true width of altered and sulfide-bearing rock averaging 0.25 ounces per ton gold, including 12.5 feet grading 0.42 ounces per ton gold. Results at the Flicka showing have been lower grade, but a structure up to 56 feet wide with anomalous gold was exposed. A total of 5,720 feet was drilled in 12 holes, spread over a distance of 5 miles. All holes had anomalous gold intervals. Drilling intersected wide zones of silicification within structures and in adjoining wall rock. Higher-grade intersections included WG01-01 (4.3 feet grading 0.36 ounces per ton gold) at the Shalosky showing, WG01-02 (57.4 feet grading 0.035 ounces per ton gold) at the Shalosky showing in the southwestern part of the property, and WG01-10 (42.6 feet grading 0.035 ounces per ton gold) at the Goldberg prospect in the northeastern part of the property. Exploration in 2001 confirmed that the property hosts gold-bearing structures that have continuity both along strike and down dip. Placer Dome canceled its option on the White Gold property after completion of the exploration program. Placer paid all current mineral claim fees on the 309 claims the property comprises, and sufficient assessment work was completed to hold the property for several years.

Tri-Valley Corp., along with geologists from TsNIGRI, the principal Russian mineral research institute, explored

a new gold–arsenic–bismuth discovery on the Richardson gold project. Tri-Valley's 61-square-mile claim block is 65 miles south of Fairbanks between the Richardson Highway and the Alyeska Pipeline service road. Named the Hilltop Zone, the zone was sampled over an area 300 feet by 3,000 feet with 56 soil samples and 83 bedrock chip samples. The best 14 rock samples assayed gold grades ranging from 0.2 ounces per ton through 1.9 ounces per ton. Highly anomalous bismuth (up to 289 parts per million) and arsenic (greater than 10,000 parts per million) are associated with elevated gold values.

Gold mineralization in the Hilltop Zone is found in stratabound quartz–pyrite–arsenopyrite (with bismuth oxide minerals and native gold) veins and veinlets with sulfide-bearing alteration envelopes in quartz–feldspar, quartz–feldspar–mica, amphibole and amphibole–pyroxene gneiss. Sulfide quantity in quartz veins and veinlets is 3 to 5 percent. Some sample results of host rocks between veins assayed gold up to 0.05 ounces per ton. The discovery area is presently open on all sides and at depth and further results are pending. Tri-Valley is presently designing a limited core drilling program for next season to confirm and further define the content and extent of gold in the Hilltop Zone.

Western Keltic Mines Inc. and Rimfire Minerals Corp., with funding through an option agreement with Barrick Gold Corp., conducted fieldwork on the California and Surf properties in the Goodpaster area. Western Keltic currently has a 70 percent interest in the properties and can earn an additional 10 percent interest from Rimfire. The properties lie along the eastern extension of the Pogo Trend, an 8-mile-long southeast-trending belt of favorable geology that hosts the Pogo gold deposit and numerous other gold occurrences. The exploration program included auger soil sampling, mapping, a 516-line-mile airborne magnetics and radiometrics geophysical survey, and diamond drilling.

Data compiled from an airborne geophysical survey flown in 2001, over the entire property with prospecting, soil, silt, and rock geochemical data, identified four areas of follow-up, in addition to the Boundary Zone. The Southeast Surf zone, previously defined by reconnaissance work, remains an untested drill target. Three areas were highlighted by the magnetic and radiometrics data and follow-up in 2001 identified favorable soil geochemistry at the Blue, California North, and Beverly grids. All four zones exhibit favorable geological, geochemical, and geophysical characteristics including a combination of anomalous gold and/or bismuth, arsenic, antimony, and silver in association with prominent northwest-trending structures that lie at or near the contacts between gneissic rocks and granitic intrusive bodies and dikes. The widespread spacing of the grid lines in each area has not allowed for a clear understanding of the orientation of any mineralized zones, and grid lines must be extended to trace the full extent of open-ended anomalies. Drilling at the Boundary Zone on the California–Surf properties did not return any significant results. Barrick terminated their option on the property after the field season.

Zeus Exploration Inc., a subsidiary of EMEX Corp., drilled the intrusion-hosted East Divide gold–bismuth–copper prospect in the eastern Goodpaster mining district.

Ventures Resource Corp. discovered zinc, lead, and silver mineralization at its Fish and Little Whiteman prospects on the Veta property. The prospects are 3 miles apart and 27 miles from the Taylor Highway. At the Fish prospect, projection of a steeply dipping, vein-hosted zinc deposit has been traced 4,800 feet in a north–south direction by 300 soil grid samples. The zone cuts gently dipping calcareous quartz–feldspar–biotite schist, chloritic schist, and greenstone. Soil values, which range from 1,000 to well over 5,000 parts per million zinc, extend 1,700 feet down the host gully and across this trend for 50 to 100 feet upslope to the east and west of the gully bottom, indicating that the mineral system may be from 100 to over 200 feet wide. The only rock found along the projected zone is gossan rubble, distributed about 50 to 75 feet normal to vein projection, and apparently derived from massive to semi-massive sulfides, with up to 28.6 percent zinc, 0.88 percent lead, and 6.3 ounces per ton silver. Twenty rock samples contained more than 6 percent zinc. Rubble is found in a 2,400-foot segment straddling Trout Ridge. A rock sample near the south end of the grid contained 0.011 ounces per ton gold. Another potential vein zone is possible due to multi-element soil anomalies occurring 400 feet to the east of the above zone.

At Little Whiteman, a black-shale (argillite) hosted "stratabound" zinc–lead–silver prospect, 113 soil samples were collected by Ventures on a 400-foot grid added to a 1998 grid. The multi-metallic geochemical anomaly comprises a square mile, within which lead and zinc soil values exceed 100 parts per million and/or 250 parts per million, respectively. The target is open to the north and locally open to the west. In the core zone, values exceed 500 parts per million lead and 1,000 parts per million zinc in an area 300 to 800 feet across and up to 3,000 feet long. Frost-heaved gossan is present in four sample pits within the soil anomaly. Combined zinc–lead values range from over 6 percent to over 40 percent, with silver values up to 13 ounces per ton. Soil sample results from other pits in the anomaly that contain no gossan are also strongly anomalous, suggesting that mineralization underlies most, if not all, of the soil anomaly. Ventures believes that the geology, geochemical pattern, and mineralogy at Little Whiteman suggest a stratabound sedimentary exhalative (sedex) mineralization model. Ventures anticipates a drill program at the Fish and Little Whiteman prospects during 2002.

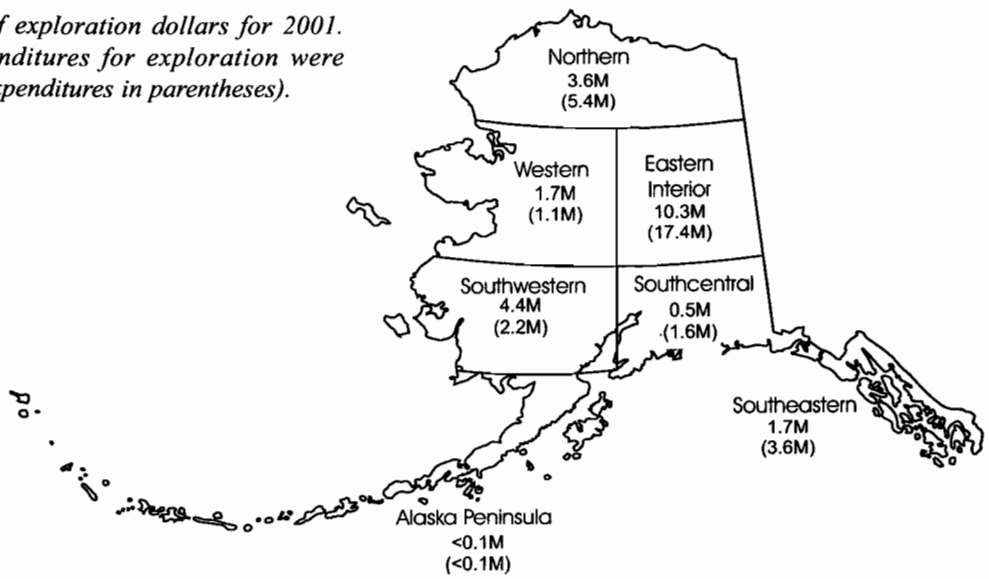
Ventures Resource Corp. reported positive drilling results at the Pebble Dike Hill prospect on the 13,000 foot by 7,000 foot Lead Creek portion of the Champion Property. Core holes LC-01-15 to LC-01-22 were drilled outward from lead–zinc–silver intersections in discovery holes LC-97-7 and LC-00-14. LC-01-15, 450 feet south of drill hole LC-00-14, intersected 50.6 feet of 11.7 ounces per ton silver and 5.1 percent lead at 357 feet, including 20.2 feet of 17.0 ounces per ton silver and 5.1 percent lead at 362.8 feet. LC-01-19, a 45-degree-angle hole, intersected 17.3 feet of low-gradebase metal mineralization at 473.8 feet, which may correlate with the LC-00-14 and LC-01-15 intersections. Drill hole LC-00-13, 500 feet northwest of LC-00-14, intersected 6.3 feet of 5.6 ounces per ton silver and 1 percent lead in intensely oxidized rock at 214 feet. Negligible mineralization was intersected in holes LC-01-16 to 22, located north, east, and south of LC-00-14 and LC-01-15, and in LC-01-22 to the east of LC-97-7.

Mineralization in drill holes LC-00-14, LC-01-15, and LC-01-19 is composed of secondary lead, silver, and zinc minerals and is hosted by oxidized segments of sandstone with a gentle easterly dip. Preliminary data suggest that drill holes LC-00-14 and LC-01-15 may be a in 200-foot-wide high-grade zone that extends up to 1,000 feet or more northwest and southeast of LC-00-14 and LC-01-15. A broad area west of drill holes LC-00-14 and LC-01-15 is untested.

Southcentral Region

Nevada Star Resource Corp. signed a letter of intent with Fort Knox Gold Resources Inc. to acquire an undivided 60 percent interest in Fort Knox's Canwell Glacier property by spending $600,000 and issuing 200,000 Nevada Star common shares to Fort Knox over a 4-year period, after which the companies will form a joint venture. The property consists of 44 state claims and is approximately halfway between Anchorage and Fairbanks. Nevada Star has committed to spending a minimum of $100,000 and to completing at least 1,000 feet of drilling during the first year of the agreement. Nevada Star will be the operator and conduct all exploration activities on the property. The Canwell property is subject to a 2 percent net smelter royalty (NSR) payable to American Copper & Nickel Co. Inc. (ACNC), a wholly owned subsidiary of Inco U.S. Inc. No exploration has been conducted on the property since 1998 and past exploration efforts totaling $400,000 in expenditures, including 5 drill holes totaling 2,922 feet, were designed to discover large nickel–copper massive sulfide ore deposits. Very little of that work was designed to look for platinum–palladium mineralization. Nevada Star is primarily interested in the property's potential for platinum-group element mineralization. The highest grade occurrences on the property occur within sulfides at the base of the Canwell mafic intrusive. A trench grab sample from the Upper Canwell Glacier showing assayed 0.12 ounces per ton platinum, 0.146 ounces per ton palladium, 0.06 ounces per ton gold, 6.92 percent nickel and 2.30 percent copper. A grab sample at the Odie showing assayed 0.455 ounces per ton platinum and 0.076 ounces per ton palladium. In addition to the high-grade values noted above, the Canwell showings are also enriched in other platinum-group elements with assay values up to 289 parts per billion iridium, 537 parts per billion osmium, 662 parts per billion ruthenium, and 105 parts per billion rhodium.

Shear Minerals Ltd. signed an amended agreement with Shulin Lake Mining Inc. for a 24 percent vested interest in the Shulin Lake diamond and gold property near Petersville. Under the new agreement terms, Shulin will contribute the next $150,000 in exploration expenditures



Regional distribution of exploration dollars for 2001. Statewide total expenditures for exploration were $22.1 million (2000 expenditures in parentheses).

including two drill holes. Golconda Resources Ltd. subsequently entered a joint-venture agreement with Shulin Lake Mining for the direct acquisition of a 40 percent interest in the property and the right to acquire another 11 percent of the property by incurring exploration expenditures of $1 million.

Shear Minerals Ltd. conducted ground geophysics on six high-priority drill targets as part of a winter exploration program at Shulin Lake. The ground geophysics followed a detailed airborne magnetic survey. Shulin Lake Mining Inc., as operator, completed a drill program testing three targets. The three holes, although up to 1.2 miles apart with outcropping Tertiary sandstone between the holes, intersected a rock type interpreted to be a mafic pyroclastic with volcanic crater facies characteristics. Tests carried out for diamond indicator minerals at Kennecott Canada's laboratories revealed a suite of eclogitic garnets, chrome diopsides, and diamond stability field chromites as well as olivine and pyroxenes. Golconda and its partners believe that this rock is most likely the source of the indicator minerals that had been discovered in surface and stream samples on the property. The partners plan to conduct additional exploration drilling in late winter 2002.

Elsewhere in the Yentna mining district, H & H Exploration & Mining panned for placer gold on Big Boulder Creek in the Collinsville portion of the Petersville mining area.

WGM Ltd. conducted an exploration program on Latitude Minerals Corp.'s Tonsina Platinum/Palladium property in southcentral Alaska. The area of focus was Sheep Mountain. Results were very encouraging with grab samples as high as 4 parts per million platinum and palladium and over 1 percent nickel. Latitude is currently negotiating an extension of the option agreement with WGM for the Tonsina property.

Southwestern Region

The largest mineral exploration program in Alaska during 2001 was conducted by NovaGold Resources Inc. at Donlin Creek. A State of Alaska designated winter road connects the project to a commercial barge site on the Kuskokwim River at the village of Crooked Creek. The project has an all-season exploration camp for up to 75 people with an adjacent 5,000-foot runway that is directly serviced by commercial aircraft as large as C-130 Hercules freighters. Donlin Creek is one of the largest undeveloped gold resources in the world with a measured and indicated resource estimated to be 6.9 million ounces of gold grading 0.089 ounces per ton gold and an additional inferred resource of 6.0 million ounces of gold grading 0.082 ounces per ton gold at a 0.044 ounces per ton gold cutoff grade. This resource remains open at both ends and at depth with high potential for expansion. Using a higher cutoff grade of 0.10 ounces per ton gold, the measured and indicated resource is estimated to be 3.1 million ounces of gold grading 0.152 ounces per ton with an additional inferred resource of 2.4 million ounces grading 0.145 ounces per ton gold. The total potential higher-grade resource is 5.5 million ounces of gold grading 0.149 ounces per ton gold at a 0.10 ounces per ton gold cutoff grade. This higher-grade resource is the focus of the upcoming exploration program.

Gold mineralization occurs over a 4-mile trend along north–south and northeast-trending structural zones associated with disseminated and veinlet-controlled gold-bearing fine-grained sulfides. Gold mineralization primarily occurs within felsic to intermediate dikes and sills, but also as high-grade stockwork vein zones in the surrounding sedimentary rocks. Over $37 million has been expended on exploration at the Donlin Creek property since 1987, including over 400,000 feet of drilling and 70,000 feet of trenching, as well as comprehensive surface and airborne geophysics. Within the 308 diamond core holes completed by Placer Dome between 1995 and 2000, there are a total of 528 separate intercepts of greater than 0.146 ounces per ton gold with intercept lengths equal to or greater than 13 feet. Within those intercepts, 232 intervals exceed 32-foot lengths and an additional 86 intervals exceeded 66-foot lengths.

NovaGold Resources Inc. signed agreements with Placer Dome U.S. Inc and Calista Corp. to acquire a 70 percent interest in the 13-million-ounce Donlin Creek gold deposit. The deposit is on part of Calista Corp.'s 6.5 million acres of land. Under the terms of the definitive agreement, NovaGold will be the manager and operator and must expend $10 million within a ten-year period toward exploration and development to earn a 70 percent interest in the project. Placer has the option of then converting to a 5 percent net profits interest or to exercise a back-in right to re-acquire a majority interest in the project (70 percent Placer Dome/30 percent NovaGold) by expending three times the amount expended by NovaGold at the time the back-in is exercised and conducting a feasibility study.

NovaGold's exploration program commenced with on-site work including geologic mapping, sampling, and trenching. A new three-dimensional model revealed previously unrecognized controls to gold mineralization, including an east–west-trending antiformal structure that acted as a trap for gold-rich hydrothermal fluids within sills below an impermeable mudstone horizon. The potential of high-grade ore bodies is interpreted to extend along the fold axis in several directions, and may lead to discovery of new high-grade zones in other areas of folding. Drilling began on higher-grade targets in the Acma area and also included six holes further defining mineralization in the 400 Zone, 1,650 feet west of the Acma area. NovaGold completed 42 drill holes totaling 24,000 feet.

Of the 42 drill holes completed, 26 are offset holes that substantially expand the known higher-grade mineralization beyond the current resource area. The other 16 drill holes are in-fill holes that will upgrade "inferred" category resources to the higher "measured and indicated" category resources. All holes were drilled on 82- to 164-foot spacing and intersected significant intervals of ore-grade gold mineralization. Drilling was completed in late November 2001 and work began on updating the Donlin Creek resource estimate. Drilling for a preliminary feasibility study is anticipated to begin in March or April 2002.

Metallurgical analyses on Donlin Creek samples were completed by McClelland Labs of Reno, Nevada. Results show that concentration by a conventional sulfide flotation followed by pressure oxidation and carbon-in-leach cyanidation would be effective for higher-grade Donlin Creek ores and yield greater than 90 percent gold recovery.

Results from the NovaGold drilling program include some of the best gold intercepts from the property to date. Higher grade mineralization on the Acma target was expanded and appears to be continuous and consistent. Drill results demonstrated the potential for significant high-grade gold mineralization at other nearby targets like the 400 Zone that have only been tested by limited, widely spaced drill holes. There were 97 significant drill intersections in 42 drill holes from the 2001 first phase drill program. The weighted average of all significant intersections is 57.2 feet grading 0.20 ounces per ton gold. Some examples of significant drill intercepts include the near-surface 410-foot intersection grading 0.14 ounces per ton gold in hole DC01-587; hole DC01-604, which intersected 84 feet grading 0.22 ounces per ton including 27 feet grading 0.52 ounces per ton gold; and hole DC01-611 which intersected 385 feet grading 0.15 ounces per ton gold. Hole DC01-597, which intersected 479 feet grading 0.20 ounces per ton gold starting at 26-foot depth and is the best single intercept drilled to date on the Donlin Creek property.

The intersections from drill holes DC01-619 and DC01-625 represent a substantial downdip extension of the Acma zone to the southwest where mineralization remains open. Hole DC01-625 is a 265-foot offset to high-grade mineralization in hole DC01-605, which included 72 feet at 0.23 ounces per ton, and hole DC01-595 with 65.6 feet at 0.17 ounces per ton. This greatly expands the Acma zone to the southwest and towards hole DC99-573, 660 feet to the southwest, which included 174 feet at 0.12 ounces per ton. An extensive area to the southwest below alluvial cover remains untested, as does the area between the Acma Target and the 400 Zone. These open areas will be tested during the spring 2002 pre-feasibility drill program to determine the ultimate pit boundaries.

Hole DC01-607 intersected the widest zone of high-grade gold mineralization to date with 226 feet grading 0.41 ounces per ton gold, including 80 feet grading 0.89 ounces per ton gold and a 27.6-foot intersection grading 1.69 ounces per ton gold within the 80-foot high-grade interval. The DC01-607 intersection represents a downdip test of the wide zones of ore-grade mineralization encountered in hole DC01-586, which included 103 feet at 0.17 ounces per ton gold, 52.5 feet at 0.18 ounces per ton gold and 72.2 feet at 0.19 ounces per ton gold. These drill holes are the westernmost and southernmost holes in the Acma target. High-grade mineralization remains open in that direction. The Acma zone also remains open to the east where holes are planned to offset the high-grade zones encountered in hole DC01-600.

The six drill holes at the 400 Zone all intersected promising near-surface gold mineralization. Hole DC01-610 intersected 86.1 feet grading 0.16 ounces per ton. Hole DC01-620, the downdip test of the mineralization in DC01-610, intersected 66.8 feet grading 0.14 ounces per ton gold. These mineralization intercepts demonstrate that gold-in-soil anomalies at the 400 Zone are excellent indicators for potential new near-surface higher-grade mineralization outside of the Acma Target.

AMEC E&C Services Ltd. personnel joined the NovaGold technical team to review the geologic model, begin the quality assurance and quality control phase of the resource evaluation, and revise the three-dimensional geologic model. This new model will provide the framework for completing a resource estimate and economic scoping study. Detailed engineering work is underway to further refine the economic operating parameters for the higher-grade resource.

Northern Dynasty Minerals Ltd. acquired the rights to two options granted by Teck Cominco American Incorporated to Hunter Dickinson Group Inc. for its Pebble property in southwestern Alaska. Under the first option, Northern Dynasty can purchase 100 percent of the 36 claims hosting the Pebble deposit for $10 million and under the second option Northern Dynasty can acquire an interest ranging from 50 percent to 100 percent in the balance of the property (1,179 claims), which encompasses the giant mineralized system. Exploration by Cominco on the property in the 1980s outlined the 1-billion-ton Pebble copper–gold porphyry deposit that contains 6.6 billion pounds of copper and 10.9 million ounces of gold at grades of 0.3 percent copper and 0.01 ounces per ton gold. The Pebble deposit and its higher-grade core, of 59.5 million tons grading 0.54 percent copper and 0.016 ounces per ton gold, are incompletely defined, comprise only 5 percent of the potential mineralized system, and remain open to significant expansion. A recently completed field program has expanded the geophysical (induced polarization [IP]/chargeability) anomaly to a 13-mile length southwest

of the Pebble deposit, and up to 5.6 miles in width, for a total area of 34.4 square miles, and substantiated a series of at least six coalescing mineralizing centers. The IP anomaly potentially outlines one of the largest mineralized hydrothermal systems in the world and coincides with extensive copper–gold–molybdenum soil geochemical anomalies. Favorable porphyry-style alteration and surface copper mineralization are also present in very sparse surface exposures. Northern Dynasty is designing a major, multi-rig, core drilling program for 2002 to systematically assess new deposit-scale targets within the extensive copper–gold mineralized system and to fully define the higher-grade core of the known Pebble deposit.

NovaGold Resources Inc. completed an agreement with Cominco American Ltd. to acquire a 100 percent interest in the 1-million-ounce Shotgun deposit approximately 110 miles south of the 13-million-ounce Donlin Creek deposit in the Kuskokwim mineral belt. Cominco American retains a 5 percent net profits interest on the Shotgun property and receives from NovaGold the remaining 50 percent interest in the nearby Sleitat tin deposit, subject to a 5 percent net profits interest to NovaGold. NovaGold drilled the Shotgun deposit in 1998 and estimated an inferred gold resource of 980,000 ounces, with recoveries in excess of 90 percent using conventional cyanide leaching.

A new zone of anomalous platinum mineralization was found at Susie Mountain in the Goodnews Bay area of Calista Corp.'s land by Corral Creek Corp. The Susie Southwest Zone extends at least 2,100 feet along strike, is delineated by rock samples with platinum values in the 100–500 parts per billion, and contains rock samples with up to 0.078 ounces per ton platinum.

John Miscovich completed additional trenching and bulk-sampling of residual placer and underlying bedrock on his properties in the Flat area.

Southeastern Region

Kennecott Minerals Co. and Hecla Mining Co. continued a large exploration program near the jointly owned Greens Creek Mine near Juneau and identified downdip extensions of the silver-rich 200 South orebody. Medallion Resources Ltd. maintained its claims on the Salt Chuck palladium–copper–gold property and conducted minimal platinum-group-element exploration.

Quaterra and International Freegold Mineral Development Inc. entered into a joint-venture agreement to further explore a zoned Ural-Alaska type platinum-group-element (PGE) prospect at Union Bay, about 35 miles north of Ketchikan. Quaterra has the option to earn a 50 percent interest in the Union Bay PGE property by spending $1 million on exploration and development, making staged cash payments to International Freegold totaling $100,000 over the next 4 years, and issuing International Freegold 200,000 shares of its common stock. Quaterra will be the operator during the earn-in period, with work directed by its Alaskan-based consultant, Avalon Development Corp. The joint venture encompasses International Freegold's 2,500-acre Union Bay property plus significant additional placer and lode claims recently staked by Quaterra, which extend the joint holdings to an approximate area of 7 miles by 3 miles or nearly 13,500 acres. The partners now control most of the prospective ground in Union Bay.

The 3-mile by 5-mile Union Bay complex has zonal features characteristic of a Ural-Alaska complex, progressing from a 0.6-mile dunite core on the southeastern side through wehrlite and magnetite-bearing olivine clinopyroxenites to hornblendite and gabbro on the margins. The other part of the complex appears as a western, subhorizontal lopolith folded along a later-staged west–northwest-trending axis.

Six zones of platinum–palladium mineralization were discovered through extensive rock chip sampling and mapping. It is believed that these zones make up one greater reef structure. High-grade outcrop PGE mineralization now extends along two east–west corridors for a distance of 3 miles in the north corridor and 1.2 miles in the south corridor. Both remain open along strike with mineralization occurring over a vertical distance of at least 1,800 feet. The first zone discovered at Union Bay, the North zone, contains potential economic-grade platinum and palladium values, with several 0.50 to 0.55 ounces per ton platinum and palladium sample results, over a minimum 1,300-foot strike length. The zone appears to be between 200 and 400 feet wide. Continuous 5-foot rock chip samples taken at the North zone returned combined platinum and palladium grades ranging from 0.100 to 0.52 ounces per ton. PGE mineralization is associated with podiform magnetite, chromite stringers, late shear fabric, and abundant pyroxenite dikes.

The largest zone discovered to date is the Mt. Burnett zone with a current strike length of over 2,500 feet. Combined platinum and palladium values ranged up to 0.335 ounces per ton. The zone remains open along strike. Other zones discovered include the Lexus zone (400 feet of strike with combined platinum and palladium values up to 0.146 ounces per ton, as well as one sample containing greater than 2 percent chromium and 558 parts per million nickel) where mineralization is hosted in interbedded dunite and pyroxenite and is accompanied by magnetite and chromite, and the Jaguar zone (1,200 feet of strike with combined platinum and palladium values up to 0.097 ounces per ton). In addition, reconnaissance sampling of the Cobra east and the Cobra west zones returned sample grades up to 0.257 and 0.105 ounces per ton combined platinum and palladium, respectively. Exploration to date suggests that platinum–palladium mineralization occurs in one or more stratiform layers or horizons similar to the platiniferous reefs in the Stillwater and Bushveld complexes that can

be traced discontinuously over an area 5 miles long and 3 miles wide.

A four-hole drilling program totaling 1,168 feet of diamond drilling was completed at the Union Bay property. Angle holes UB01-1 and UB01-2 were scissored under North Zone outcrops where previous surface sampling and rock-saw trenching had returned values up to 0.525 ounces per ton platinum and palladium. The holes were designed to test downdip continuity of a northwesttrending PGE-bearing horizon defined by previous mapping and sampling. Hole UB01-1, drilled to the west, intersected this horizon at a depth of 62 feet, with a 1.5-foot interval assaying 0.327 ounces per ton platinum and palladium. Mineralization is hosted in pyroxenite with disseminated and vein type magnetite. Hole UB01-2 was drilled to the northeast and intersected 2 feet of lower grade mineralization beginning at 164 feet averaging 0.013 ounces per ton platinum and palladium. It is possible that the high-grade horizon intersected in hole UB01-1 was cut out or diluted by post-mineral pyroxenite dikes.

Holes UB01-3 and UB01-4 were drilled at Mt. Burnett, about 2 miles west of the North Zone, where previous surface sampling returned values up to 0.335 ounces per ton platinum and palladium. Both holes intersected anomalous platinum and palladium in multiple horizons up to 29 feet thick hosted primarily in hornblende pyroxenite containing disseminated and vein type magnetite. Values ranged up to 0.032 ounces per ton platinum and palladium over a 1-foot interval in hole UB01-4.

Quaterra staked and recorded 94 federal claims and 11 State of Alaska claims at Duke Island, approximately 30 miles southeast of Ketchikan. The Duke Island complex consists of two separate, well exposed, zoned ultramafic bodies. The Judd Harbor body is almost 2 miles in diameter and the Hall Cove body is about 3½ miles in diameter. The Judd Harbor and Hall Cove complexes have been interpreted to be parts of the same intrusive body at depth. Both bodies are comprised of a dunite and peridotite core surrounded by concentric zones of olivine clinopyroxenite, hornblende-magnetite clinopyroxenite, and gabbro.

Interpretation of an induced polarization (IP) survey completed at Duke Island by Zonge Engineering suggests that the extremely low resistivity (high conductivity) values encountered on all four lines of the survey may be due to the presence of massive sulfides. The interpretation is consistent with the observation that net-textured sulfides formed by gravity separation from an ultramafic magma may signal the presence of massive-sulfide mineralization below the iron-stained outcrops on Duke Island. Outcrop samples taken from this zone returned assay results up to 1.95 percent copper, 0.25 percent nickel, and 0.029 ounces per ton platinum and palladium. Extensive soil sampling in the same area has averaged 2,241 parts per million copper, 401 parts per million nickel, 210 parts per million cobalt, 175 parts per billion platinum, and 129 parts per billion palladium.

The IP survey and surface geochemical sampling has outlined a zone of potential mineralization that extends 3 miles in length, at least 400 feet in depth from surface, and up to 1,300 feet in width. The zone is open to the northwest where it appears to plunge 200 feet below the surface. The IP survey covers an area of only 0.6 by 0.6 miles along a prospective trend that is 6 to 10 miles long. Samples, taken from a recessive-weathering zone of orange–red iron staining, contain from 5 percent to 30 percent residual fine-grained sulfides (pyrite, pyrrhotite, and chalcopyrite), some in net-texture form. Mineralization is hosted in pyroxenite and hornblende pyroxenite that appear to intrude dunite and wehrlite of the Duke Island ultramafic complex along a northwest-trending linear. Much of the outcrop and subcrop occur in low, boggy areas with heavy red–brown clay.

Quaterra completed four diamond drill holes (1,469 feet total) in the central portion of a 3-mile-long zone of copper–nickel–PGE mineralization on Duke Island. The late 2001 drill holes were drilled from two drill pads approximately 740 feet apart centered on a coincident rock geochemical and IP geophysical anomaly. Previous rock sampling within this area returned anomalous values ranging up to 2.8 percent copper, 0.25 percent nickel and 0.029 ounces per ton combined platinum and palladium. These samples are associated with a highly conductive IP anomaly flanked by extensive chargeability anomalies to the northeast and southwest. Two holes collared in outcrops containing massive to semi-massive pyrrhotite plus chalcopyrite in the central portion of the IP anomaly intercepted disseminated, semi-massive and massive sulfides (pyrrhotite, chalcopyrite, and trace pyrite) from the collar to termination depth, and neither hole exited the mineralized envelope. Host rocks are predominantly olivine pyroxenites to pyroxenite with variable amounts of serpentinization. Holes DK01-3 and DK01-4 were collared 750 feet southeast of holes 1 and 2 in the original discovery area of the property. Hole DK01-3 intercepted disseminated, semi-massive and massive pyrrhotite and subordinate chalcopyrite hosted in pyroxenites from the collar to termination depth (252 feet) and did not exit the mineralized envelope. Host rocks are predominantly olivine pyroxenites to pyroxenite with variable amounts of serpentinization. Hole DK01-4 intercepted mineralization and host rocks similar to those in DK01-3 to a depth of 188 feet, at which point the hole entered olivine-rich wehrlite and dunite. Sporadic copper mineralization below 188 feet is correlative with moderate chargeability anomalies outlined by the IP survey.

Based on the drill results, sulfide mineralization in the Discovery zone is at least 130 feet wide and remains open to the south, northwest, and at depth. Sulfides and host

silicates appear to crosscut earlier bedded dunite–wehrlite cumulate rocks which in turn crosscut older pyroxenite and wehrlite units. Comparison of the geology and mineralization at Duke Island with other known Cu–Ni–PGE deposits suggests it is similar to several ultramafic-hosted occurrences in China, including the world-class Jinchuan deposit (600 million tons grading 1.2 percent nickel and 0.7 percent copper).

Given the close correlation between surface/drill geochemistry and three-dimensional limits of mineralization derived from IP surveys, the company is planning to conduct additional surface and airborne geophysical surveys prior to conducting additional drilling on the project in 2002.

DEVELOPMENT

Development in 2001 was reported at the Red Dog, Fort Knox, True North, Usibelli, Kensington, and Greens Creek mines. There was also a small amount of development at many of the gravel pits, rock quarries, and placer gold mines.

At Red Dog most of the development reported was in finishing the Mill Optimization Project and providing a more sanitary loading and unloading environment for the new fleet of trucks used to carry concentrates from the mine to the port site. Almost 18,000 feet of in-pit development drilling was also reported.

In early 2001 Fairbanks Gold Mining Inc. constructed about 10 miles of new road between its True North Mine and Fort Knox Mine, under difficult winter conditions, and with some steep terrain. The road was designed to minimize noise, light, and dust impacts on nearby residences, and as a safety feature a major bridge was constructed to carry the main highway over the haul-road. A fleet of nine 60-ton end-dump haul trucks was purchased for hauling the ore; each truck was outfitted with special hooded headlights and silencers on the muffler, also to avoid impact on the neighborhood.

At Usibelli Coal Mine near Healy, development work concentrated on preparation of the Two Bull Ridge pit as the primary production area when the Poker Flats pit is exhausted.

Development at the Pogo property north of Delta Junction was mainly associated with permitting, and also facility optimization, as was the development at Coeur Alaska's Kensington and Jualin mines north of Juneau.

Most of the development at Greens Creek Mine consisted of drilling and drifting at the mine and permit application to expand the solid waste storage capacity.

PRODUCTION

Table 4 shows the estimated mineral production and value for 2001 and the prior two years. Although the value of the metals declined due to low metal prices, the relative importance of the products—zinc, gold, silver, and lead—remained the same for the last three years.

Northern Region

During the year 2001 Teck Corp. bought controlling interest of Cominco Ltd., and the new company became Teck Cominco Ltd. The Alaskan subsidiary is now Teck Cominco Alaska Inc., and it operates the Red Dog Mine near Kotzebue on behalf of the owner, NANA Regional Corporation. During 2001 the mine milled a record 3,560,430 tons of ore to produce 570,980 dry short tons (dst) of contained zinc, 105,000 dst of contained lead, and an estimated 5.9 million ounces of silver. The head grades were 19.8 percent for zinc, 5.0 percent for lead, and 2.5 ounces per ton for silver, resulting in a slight decline in the amount of contained zinc, and a slight increase in the amount of lead from the previous year.

The mine employs about 560 people, including miners, millworkers, maintenance, and portsite workers. Accommodations and food are provided by NANA–Marriott, and trucking is contracted to NANA–Lynden. During the summer shipping and supply season an additional 90 workers are hired for approximately three months, and four tugs are used to haul barges out to deeper water to load and offload ocean-going freighters.

Red Dog is a conventional open-pit operation, using only three dozers, three 15-cubic-yard loaders, and five 85-short-ton haul trucks, with a water/sand truck, two graders, and two utility loaders. Due to the high grade of the ore the equipment is only about 45 percent utilized.

Several small placer gold mines reported production in the northern region during 2001, mainly near Wiseman, and there was production from many of the sand and gravel pits near the North Slope oilfields.

Western Region

American Reclamation Group LLC continued to leach gold from about 750,000 tons of ore at the Illinois Creek open-pit gold–silver mine south of Galena, and intends to continue mining in 2002. Several small placer mines on the Seward Peninsula near Nome and near McGrath also reported some production. Sand and gravel was produced from pits in the Nome area on land owned by Alaska Gold Co., a subsidiary of NovaGold Resources Inc., and a substantial quantity of rock was used in reconstruction of the runway at McGrath.

Eastern Interior Region

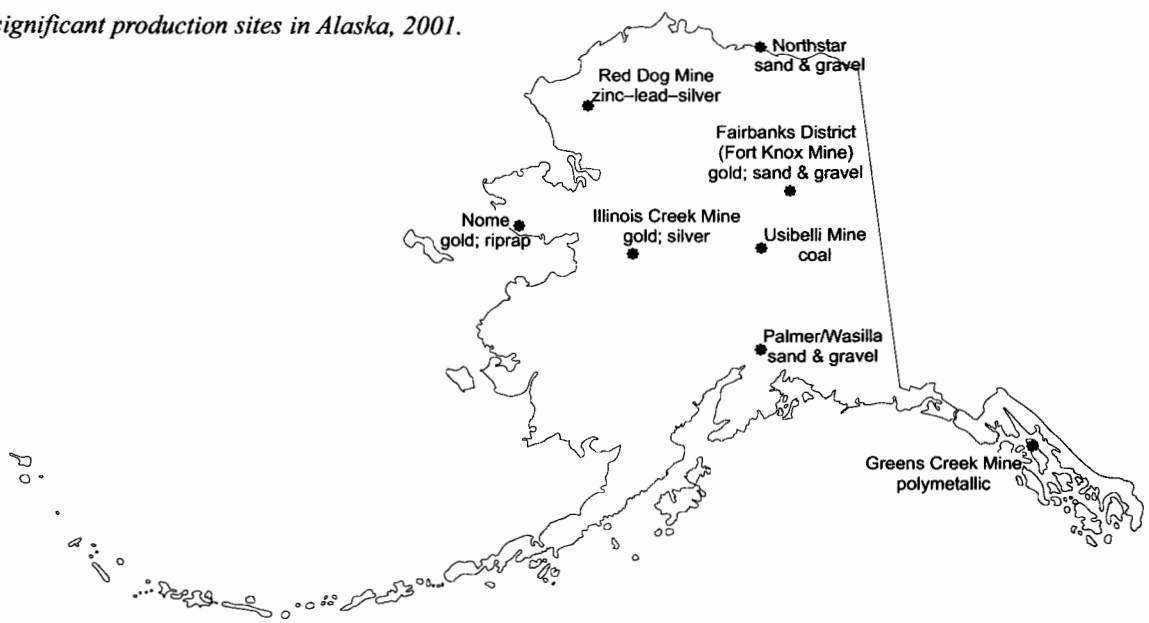
In April 2001 Fairbanks Gold Mining Inc. (FGMI), a subsidiary of Kinross Gold Corporation, began mining at the Hindenburg Pit of True North Mine about 8 miles northwest of its mine and mill at Fort Knox. The new mine became fully operational in July. The ore, averaging about

Table 4. *Estimated mineral production in Alaska, 1999–2001*[a]

	Quantity			Estimated values[b]		
Metals	**1999**	**2000**	**2001**	**1999**	**2000**	**2001**
Gold (ounces)	517,890	551,982[c]	536,373	$144,262,000	$154,058,000	$145,379,000
Silver (ounces)	16,467,000	18,226,615	15,580,000	85,628,000	90,404,000	68,085,000
Copper (tons)	2,100	1,400	1,400	2,982,000	2,296,000	1,988,000
Lead (tons)	125,208	123,224	124,317	57,596,000	51,754,000	54,699,000
Zinc (tons)	643,642	669,112	624,032	630,769,000	682,494,000	499,226,000
Subtotal				**$921,237,000**	**$981,006,000**	**$769,377,000**
Industrial minerals						
Jade and soapstone (tons)	2.0	2.0	2.0	$ 25,000	$ 25,000	$ 25,000
Sand and gravel (million tons)	10.6	10.6	12.5	52,418,000	49,855,000	58,750,000
Rock (million tons)	2.34	5.2	1.5	18,010,000	36,588,000	10,500,000
Subtotal				**$ 70,453,000**	**$86,468,000**	**$69,275,000**
Energy minerals						
Coal (tons)	1,560,000	1,473,000	1,537,000	$ 41,048,000	$38,768,000	$48,108,000
Peat (cubic yards)	38,000	35,600	36,000	165,000	178,000	180,000
Subtotal				**$ 41,213,000**	**$38,946,000**	**$48,288,000**
TOTAL				**$1,032,903,000**	**$1,106,420,000**	**$886,940,000**

[a]Production data from DGGS questionnaires, phone interviews with mine and quarry operators, Alaska Department of Transportation and Public Facilities, and federal land management agencies.
[b]Values for selected metal production based on average prices for each year; for 2001—gold ($271.04/ounce unless other value provided by operator); silver ($4.37/ounce); copper ($0.71/lb); zinc ($0.40/lb); lead ($0.22/lb). All other values provided by mine operators. Values rounded to nearest $1,000.
[c]Hardrock gold 513,373 ounces, placer 23,000 ounces.

Selected significant production sites in Alaska, 2001.



0.063 ounces per ton, is trucked to the mill at Fort Knox Mine at a rate of about 10,000 tons per day, where it is blended with about 30,000 tons of Fort Knox ore, averaging about 0.0231 ounces per ton. A total of 15.66 million tons of ore was milled in 2001 to produce 411,221 ounces of gold, with a workforce of 360.

About 20 placer gold mines in the eastern interior region reported at least some production.

At Usibelli Coal Mine near Healy, the only operating coal mine in the state, approximately 1,537,000 tons of coal were mined from the Poker Flats and Two Bull Ridge pits. About 699,000 tons of that were exported through the Port of Seward to Korea, with the remainder sold to six power plants in Interior Alaska. The Poker Flats pit is almost exhausted, with reserves for only two more years, but the box cut at Two Bull Ridge is almost complete, and permits for the nearby Rosalie area are expected in the near future.

Several quarries and gravel pits in the eastern interior region produced material for roadwork, mainly on the Taylor Highway and the Fairbanks area.

Southcentral Region

There was only minor production of placer gold in this region in 2001, from mines in the Willow Creek, Petersville, Girdwood, and Hope areas.

The Alaska Railroad hauled a record 3,450,000 tons of gravel from pits near Palmer to the Anchorage area, and production was reported from five other operations throughout the area.

Southwestern Region

Only four placer gold mines reported production in this region in 2001. Production of sand and gravel was reported at Platinum and Kalskag for local work, and at Igiugig and Egegik for projects in Togiak, Naknek, Dillingham, and Pedro Bay.

Southeastern Region

The only major mine in the southeastern region, Greens Creek Mine, is 29.73 percent owned by Hecla Mining and 70.27 percent by Kennecott Minerals Co. In 2001 it milled a record 658,000 tons of ore grading 12.12 percent zinc, 4.75 percent lead, 21.76 ounces per ton silver and 0.194 ounces per ton gold to produce 53,052 dry short tons (dst) of zinc; 19,317 dst of lead; 9,682,000 ounces of silver; and 73,153 ounces of gold.

Two placer mines reported minor gold production in 2001, and about 30 rock, sand, and gravel pits and quarries, many operated by the U.S. Forest Service, produced material for local road maintenance.

DRILLING

Preliminary drilling totals are 305,679 feet of core drilling and 72,650 feet of reverse-circulation drilling. Hardrock core footage in 2001 is approximately 70 percent of the 416,017 feet reported drilled in 2000. Reverse-circulation drilling footage dropped to 1999 levels and almost 50 percent of the 127,638 feet reported drilled in 2000. Hardrock reverse-circulation drilling was restricted to the eastern Interior region. Tables 5 and 6 summarize the drilling activity in the state during 2001 by region and type of drilling. Major drill programs were conducted by Teck Cominco Ltd. in the Red Dog area, by NovaGold Resources Inc. at the Donlin Creek deposit, by Kinross Gold Corp. in the Fairbanks mining district at Fort Knox and True North mines, and by Kennecott Minerals Co. at Greens Creek Mine.

GOVERNMENT AFFAIRS

During 2001 the State of Alaska resumed airborne geophysical surveys under the auspices of the Division of Geological & Geophysical Surveys (DGGS). Three areas were selected: the northeastern extension of the Upper Chulitna area in the vicinity of Broad Pass–Cantwell; part

Table 5. *Drilling footage by region in Alaska, 2001*

Type of drilling	Northern	Western	Eastern interior	South-central	South-western	South-eastern	TOTAL
Placer subtotal	--	--	**500**	--	--	--	**500**
Coal subtotal	--	--	**36,151**	--	--	--	**36,151**
Hardrock core	53,100	2,916	92,131	1,000	26,924	129,608	305,679
Hardrock rotary	--	--	72,650	--	--	--	72,650
Hardrock subtotal	**53,100**	**2,916**	**164,781**	**1,000**	**26,924**	**129,608**	**378,329**
TOTAL (feet)	**53,100**	**2,916**	**201,432**	**1,000**	**26,924**	**129,608**	**414,980**

-- = Not reported.
Note: 363,181 feet of blasthole drilling reported (incomplete).

Table 6. *Drilling footage reported in Alaska, 1982–2001*

Year	Placer Exploration	Placer Thawing	**TOTAL PLACER**	**TOTAL COAL**	**TOTAL HARDROCK**	Hardrock Core[a]	Hardrock Rotary[a]	**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**	505,408	45,670	**585,168**
1999	6,727	--	**6,727**	--	**448,797**	369,863	78,934	**455,524**
2000	15,480	--	**15,480**	--	**546,268**	418,630[b]	127,638	**561,748**
2001	500	--	**500**	**36,151**	**378,329**	305,679	72,650	**414,980**

[a]Core and rotary drilling not differentiated prior to 1987.
[b]92,900 feet of core drilling was underground.
- - = Not reported.
Note: 363,181 feet of blasthole drilling reported for 2001 (incomplete).

of the Bonnifield district east of Healy; and part of the Goodpaster mining district southeast of the Pogo deposit. The results are expected to be released in early 2002.

DGGS geologists spent three weeks conducting geologic ground-truthing, including geologic mapping and geochemical sampling, in the Salcha River–Pogo (SRP) geophysical survey area of the Big Delta Quadrangle. A team of DGGS geologists also spent one month conducting geological mapping and geochemical sampling in the Eagle A-1 Quadrangle of the Fortymile area. New geologic maps of the Eagle A-2 Quadrangle based on previous fieldwork were released in 2001, and new geologic maps based on 2001 fieldwork will be released in May 2002.

BLM geologists began field investigations in the Aniak mining district as part of a 5-year study. The BLM geologists were aided by geologists from Calista Corp. and DGGS.

Reclamation awards were given to several operations in 2001: Mike Busby, a longtime miner in the Fortymile mining district, received the Governor's Award for Mined Land Reclamation for reclamation of Nora Bench on Chicken Creek; James Oudekerk was recognized for reclamation on Rex Creek near Healy; Flint Wolf and Cy Bras received a 2001 Award for Mined Land Reclamation for voluntary cleanup of old fuel tanks from Twelvemile Creek in the Fortymile district; and Placer Dome Inc. received a Reclamation Award for work on Ester Dome near Fairbanks.

The minerals industry paid almost $7 million to the State of Alaska in 2001, of which slightly over $2 million was for mining license taxes. An additional $9.7 million was paid to municipalities, and mining companies were the largest taxpayers in the City & Borough of Juneau, and the Fairbanks North Star, Denali, and Northwest Arctic boroughs. Overall, payments to the state and the boroughs totaled $16.76 million, slightly more than in 2000.