

Alaska's Mineral Industry 2015

Special Report 71

ALASKA DEPARTMENT OF NATURAL RESOURCES

Division of Geological & Geophysical Surveys

WITH ASSISTANCE FROM

Division of Mining, Land & Water

STATE OF ALASKA

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ALASKA'S MINERAL INDUSTRY 2015

Jennifer E. Athey, Melanie B. Werdon, Evan Twelker, and Mitch W. Henning

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Cover photo. Gold pan with clean-up from placer operation in the Nelchina mining district northeast of Anchorage.

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EXECUTIVE SUMMARY

This summary of the status of Alaska's mineral industry for 2015 is the 35th annual report produced by the Department of Natural Resources, Division of Geological & Geophysical Surveys with assistance from the Division of Mining, Land & Water. Published for more than one-third of a century, the annual report endeavors to provide a consistent, factual snapshot of mineral industry activity in Alaska, and also serves as the authoritative, historical record of mining in the state.

Exploration Expenditures



Development Expenditures



Estimated First Market Value



Alaska's Mineral Industry 2015

- The **TOTAL REPORTED VALUE** of Alaska's mineral industry decreased in 2015 to **\$3.13 BILLION**, almost 15 percent lower than its \$3.66 billion value in 2014. The total value is a composite of the year's expenditures on exploration and development plus the estimated first market value of the commodities produced. Gross income reported by mining operators indicated the continued strength of the industry by increasing nearly 3 percent in 2015, to \$2.50 billion, from \$2.43 billion in 2014.
- The estimated **FIRST MARKET VALUE OF PRODUCTION** dropped almost 16 percent in 2015, from \$3.28 billion in 2014 to **\$2.76 BILLION** in 2015. The decreased mineral production value in 2015 resulted from decreased metal production as well as lower metal prices. The average 2015 price for silver had the largest drop—nearly 21 percent.
- **ZINC WAS THE TOP METAL PRODUCED** in 2015, according to its production value of almost **45 PERCENT OF TOTAL ALASKA METAL PRODUCTION**. Gold followed at 37.5 percent, along with lead at 9.1 percent, and silver at 8.8 percent.
- **DEVELOPMENT EXPENDITURES** in Alaska rose 10 percent in 2015, to **\$309.9 MILLION**. Development expenditures at Alaska's major mines accounted for more than 92 percent of total development expenditures.
- Mineral **EXPLORATION EXPENDITURES** continued to drop in 2015 to **\$58.3 MILLION**, down more than 39 percent from the 2014 level of \$96.2 million. More than half of the state's exploration spending (54 percent) was conducted by the major mines.
- **MINING CLAIMS AND PROSPECTING SITES** covered approximately **3.8 MILLION ACRES** of Alaska in 2015, with 6,074 active Federal and 42,454 active State mining claims. Although State 40-acre claim staking decreased by almost 17 percent in 2015, the number of new State 160-acre claims, State prospecting sites, and Federal claims increased modestly.
- Mineral industry **EMPLOYMENT** in 2015 is estimated at **2,901 FULL-TIME-EQUIVALENT JOBS**, an overall decrease of about 66 jobs (2 percent) from 2014. The number of exploration jobs decreased by more than half to 116 jobs in 2015, whereas combined production and development jobs saw an almost 3 percent gain as 71 new jobs were reported.
- Estimated **REVENUES** in 2015 to the State of Alaska and municipalities from mineral-industry-specific fees, rent, sales, royalties, and taxes amounted to almost **\$114.9 MILLION**.

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Alaska's Mineral Industry 2015

Jennifer E. Athey¹, Melanie B. Werdon¹, Evan Twelker¹, and Mitch W. Henning²

INTRODUCTION

Alaska's mineral endowment is highly regarded by exploration and mining companies worldwide—the state is considered among the top two regions of the world for mineral potential³. Alaska's mineral potential is evident from historically significant production: placer gold from the Fairbanks and Nome mining districts, copper from the Kennecott area, lode gold from the Alaska–Juneau (A–J) and Treadwell mines near Juneau, and placer platinum from the Goodnews Bay mining district. Alaska's major metal deposits currently in production include Red Dog, Greens Creek, Pogo, Fort Knox, and Kensington mines. Usibelli Coal Mine produces coal for Interior Alaska and Pacific Rim destinations. The untapped Pebble, Donlin Gold, Money Knob, Arctic, and Bornite deposits collectively represent a significant proportion of domestic gold and copper resources, and indicate that there are still extremely large mineral deposits to be developed in Alaska. Significant recently discovered resources at the Graphite Creek deposit and the Bokan Mountain rare-earth-element deposit promise domestic sources of critical raw materials needed for twenty-first-century technologies. Without doubt, other Alaska mineral deposits remain to be discovered.

Economically viable projects are feasible in Alaska through partnerships of industry and the State—industry investment in Alaska's favorable geology and the State's commitment to responsible, responsive public-land stewardship. In 2015 Alaska ranked in the top six regions worldwide for Investment Attractiveness, which is a measure of both mineral potential and the effect of State and Federal government policies on investment³. Alaska, in its strategic Pacific Rim location, offers prospective land, sanctity of title, State-sponsored geological and geophysical mapping, a reasonable permitting process coordinated among agencies, a capable workforce, exploration incentives, and innova-

tive infrastructure equity-sharing programs. More than 190 million acres of Federal, State, and Native-owned lands are open for mineral-related activities and mining. This allows the mineral industry to be a driving force in the state's economy through significant local employment, infrastructure, and government revenue. It is the policy of the State of Alaska to encourage the settlement of its land and the development of its resources by making them available for maximum use consistent with the public interest.

Alaska's mineral industry continued to demonstrate its health even though metal prices and worldwide venture capital investment were down in 2015. Table 1 shows the estimated values of exploration and development investments in the industry. Gross income from mining operations as reported on Alaska Mining License Tax returns is shown for comparison with the estimated 'first market value' (estimated gross value of mineral products at first wholesale) of mineral production in Alaska. For purposes of this report, Alaska has been divided into seven geographic regions, shown in figure 1.

Exploration expenditures in Alaska, a sign of industry interest and future production values, were down 39 percent, from \$96.2 million in 2014 to \$58.3 million in 2015. Much of the decline in exploration investment resulted from the paucity of large exploration projects such as Pebble, whose loss disproportionately decreased the figures. The remainder of the drop in Alaska exploration is consistent with a 19 percent worldwide decrease in nonferrous exploration expenditures. Development expenditures in Alaska totaled \$309.9 million in 2015, up from \$281.7 million 2014. Even with the lack of significant data from a major mine, development expenditures in Alaska increased by 10 percent, primarily reflecting expenditures by Alaska's producers. SNL Metals & Mining noted the inverse relationship between grassroots exploration expenditures

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³Jackson, Taylor, and Green, K.P., 2016, Fraser Institute Annual Survey of Mining Companies, 2015: Vancouver, BC, Fraser Institute, 90 p. <https://www.fraserinstitute.org>

and mine-site exploration/development spending as being industry-wide; companies have shifted funds from generative projects to existing or developing mines to mitigate risk aversion⁴.

The estimated first market value of mineral production decreased 16 percent—from \$3.28 billion in 2014 to \$2.76 billion in 2015—a result of both lower commodity prices and decreased production nearly across the board. New to this report is gross income from mining operations as reported on Alaska Mining License Tax returns. Despite the decrease in production from 2014 to 2015, mining operations reported a slight increase (3 percent) in gross income. The lack of a one-to-one correlation between production values and gross income reflects inherent differences between the sources of the two numbers. Gross income is compiled from the Mining License Tax returns filed by all mining operators in Alaska and indicates the income received for commodities sold during the tax year, while the estimated first market value of mineral production is compiled for the calendar year, regardless of whether the commodities were sold that year. See the Government Revenues section for additional information from Mining License Tax returns.

Past-year statements issued by mining companies, including press releases and corporate annual and financial reports, as well as phone interviews, replies to questionnaires, and permitting paperwork, are factored

into the exploration, development, and production values. Due to inevitable incomplete reporting, the numbers compiled in this report are minimum estimates of the value of Alaska's mineral industry. Average metal prices used in the first market value calculations are based on average daily London PM closing price for gold and silver, and average weekly spot price on the London Metal Exchange for base metals. It is important to note that these prices are used to calculate the estimated first market value of metals produced in the state, but do not take into account the costs of mining, transportation, smelter charges, actual sales, or penalties. Coal prices are estimated from average coal prices for similar grade material around the Pacific Rim. Industrial materials prices are based on regional rates provided by some operators.

This report is a cooperative project between the Alaska Division of Geological & Geophysical Surveys (DGGs) and the Division of Mining, Land & Water (DMLW) in the Department of Natural Resources (DNR), with additional support from the Department of Labor and Workforce Development (DLWD) and the Department of Revenue (DOR). The agencies involved in producing this report are committed to producing a reliable annual commentary on mineral industry activity in Alaska, which is vital for informed decision-making by state and local governments, the Legislature, land managers, industry, Native corporations, and the public.

A NOTE ABOUT SOME OF THE DIFFERENCES BETWEEN THIS REPORT AND THOSE OF PREVIOUS YEARS

The formatting and presentation of data in some tables differ from previous editions of this report, reflecting changes in data collected and accounting practices by the mining industry, and an effort to present a more streamlined summary of mineral-resources activities in Alaska. Whenever possible, the authors have worked to maintain data consistency for seamless year-to-year comparisons. Most changes are described in the affected text and tables. Beginning this year, placer and materials (rock, sand, and gravel) mining in Alaska will be described using limited and proxy datasets. Recreational mining will no longer be tracked. As the authors modernize this annual report by utilizing digital data and technological advances, future products will also include substantial changes in the data sources used to compile the exploration, development, and production information, as well as the presentation of the economic data in the report.

⁴SNL Metals & Mining, 2016, World Exploration Trends 2016: Charlottesville, VA, SNL Metals & Mining, 12 p. <http://www.snl.com/Sectors/metalsmining>

Table 1. Reported annual exploration and development expenditures of the mineral industry, the estimated first market value of mineral production in Alaska, and gross income from Alaska mining operations (in millions of dollars), 1981–2015. Average annual values are given for 1981–1985, 1986–1990, 1991–1995, and 1996–2000; individual year totals are provided for 2001–2015.

Year	Exploration Expenditures (\$ millions)	Development Expenditures (\$ millions)	Estimated First Market Value (\$ millions)	Gross Income Mining Operations (\$ millions)
1981–1985	\$37.5	\$36.3	\$204.7	--
1986–1990	\$36.2	\$109.6	\$288.6	--
1991–1995	\$33.2	\$55.3	\$520.1	--
1996–2000	\$49.4	\$158.7	\$917.4	--
2001	\$23.8	\$81.2	\$917.3	--
2002	\$26.5	\$34.0	\$1,012.8	--
2003	\$27.6	\$39.1	\$1,000.7	--
2004	\$70.8	\$209.1	\$1,338.7	--
2005	\$103.9	\$347.9	\$1,401.6	--
2006	\$178.9	\$495.7	\$2,858.2	--
2007	\$329.1	\$318.8	\$3,367.0	--
2008	\$347.3	\$396.2	\$2,427.1	--
2009	\$180.0	\$330.8	\$2,455.6	--
2010	\$264.4	\$293.3	\$3,126.8	--
2011	\$365.1	\$271.9 *	\$3,507.7	--
2012	\$335.1	\$342.4	\$3,436.1	--
2013	\$175.5	\$358.8	\$3,418.7	--
2014	\$96.2	\$281.7	\$3,282.1	\$2,434.1
2015	\$58.3	\$309.9 *	\$2,759.2	\$2,499.8

Exploration, development, and first market values are provided in Alaska’s Mineral Industry reports published annually by DGGS/DMLW and DGGS/DCCED. Gross Income from mining operations is provided by the Alaska Department of Revenue through analysis of Mining License Tax return information.

* 2011 and 2015 total missing significant expected data
 -- = Not reported

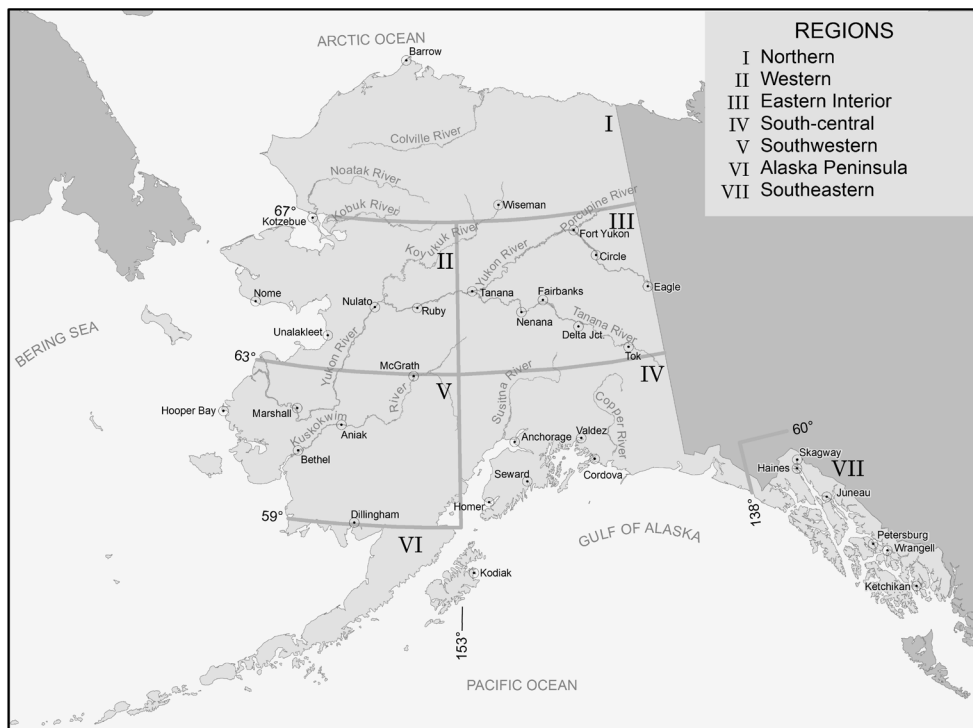


Figure 1. Regions of mineral activity as described in this report.

EMPLOYMENT

Total mineral industry employment in 2015 is estimated at 2,901 full-time-equivalent jobs, an overall decrease of about 66 jobs (2 percent) from 2014 (table 2). Exploration jobs, tracking with the limited number and size of publicly reported 2015 exploration projects, saw a sharp decrease of 137 jobs (54 percent) from 2014. Employment for nine lode exploration projects was estimated using their reported exploration expenditures and a project-cost-per-person ratio averaged from ten projects with reported, complete data. Production and development saw an increase of 71 jobs (3 percent). Most large operators do not differentiate production from development employment; consequently, prior to 2014 some development employment was included in the production employment figures, and development employment was underreported. Since 2014, development and production employment have been estimated for large operations based on their reported ratio of production/development expenditures. Development expenditures saw a moderate (10 percent) increase in 2015, which accounts for the 19 percent increase in 2015 development employment, to 555 full-time-equivalent jobs.

Traditional reporting sources from voluntary responses to questionnaires, Affidavits of Annual Labor, and Applications for Permits to Mine in Alaska (APMAs) were not widely used to collect 2015 employment data. Instead, employment information was largely researched from online public documents and employment and production data from the Mine Safety and Health Administration⁵. These datasets and sources represent a minimum estimate and an incomplete picture of mineral industry employment in Alaska. Changes in source data have variably affected employment reporting by commodity. For example, 2015 placer mining production employment apparently decreased by half, although a major portion of this drop likely reflects the transition from reporting the compilation of voluntary questionnaires and State documents to using the MSHA dataset. However, materials production (rock, sand, and gravel) employment increased by 82 percent; though still underreported, the MSHA dataset captures employment in this sector more completely than volunteer reporting through questionnaires. Recreational mining will no longer be tracked beginning with this report.

Table 2. Estimated Alaska mineral industry employment, 2006–2015^a, as compiled from public documents, MSHA reporting^b, personal communications, and other sources.

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Gold/silver mining										
Placer	242	208	282	399	405	439	477	432	241	120
Lode	704	808	739	832	1,008	1,085	1,206	1,176	1,054	1,047
Polymetallic mining	245	276	317	321	350	364	386	390	287	303
Base metals mining	457	457	475	413	550	586	530	550	446	475
Recreational mining	45	54	30	36	35	41	52	55	7	--
Industrial minerals										173
Sand and gravel	337	284	277	286	313	307	424	565	30	--
Rock	104	124	93	83	11	28	60	19	65	--
Coal ^c	95	102	110	117	140	140	144	120	115	112
Peat ^{c,d}	11	11	7	--	3	3	4	--	<1	--
Tin, jade, soapstone, ceramics, platinum	--	--	--	--	--	--	--	1	1	--
Production (total of above categories)	2,240	2,324	2,330	2,487	2,815	2,993	3,283	3,308	2,246	2,230
Mineral development	848	735	516	371	537	422	535	358	468	555
Mineral exploration	435	499	546	422	520	535 ^e	548	385	253	116
TOTAL	3,523	3,558	3,392	3,280	3,872	3,950	4,366	4,051	2,967	2,901

^a Reported man-days are calculated on a 260-day work year and 10-hour work day to obtain average annual employment unless actual average annual employment numbers are provided.

^b MSHA data: <http://arlweb.msha.gov/OpenGovernmentData/DataSets/MinesProdYearly.zip>

^c Coal and peat employment numbers are combined in 2009.

^d This figure does not include all of the man-days associated with peat operations; most of those man-days are included in sand and gravel numbers.

^e Average of 520–550 range reported for 2011.

-- = Not reported

See *Exploration, Development, and Production* sections for further details.

⁵Mine Safety and Health Administration, (MSHA); <http://arlweb.msha.gov/OpenGovernmentData/OGIMSHA.asp>, dataset 9. Last accessed October 18, 2016.

The Alaska Department of Labor and Workforce Development (DLWD) provided 2015 mining employment and wage statistics based on 111 reporting units (companies) consisting of 56 metal ore, 34 coal and nonmetallic-mineral quarrying, and 21 mining-support-activity units. Among companies in 2015, mining and support activities provided 2,985 jobs, up almost 3 percent from 2,906 jobs in 2014. Average wages for mining-sector jobs are some of the highest among major industries in Alaska, with a 2015 annual average wage of \$108,190, more than twice as much as the average \$53,721-per-year private-sector wage in Alaska. Total wages paid by non-oil-and-gas mining firms in 2015 were \$303,699,689, up slightly (2 percent) from 2014. Total wages paid by mining support firms in 2015 were \$14,395,968, a 109 percent increase from 2014 that might partially reflect reporting differences. The number of companies providing support activities increased by 17 percent, and annual average employment in this sector increased 90 percent over the last year⁶.

DLWD data show that nonmetallic mineral product manufacturing provided 295 jobs, which includes an average of 288 jobs in cement and concrete manufacturing for 2015. Primary metal manufacturing provided 17 jobs, while metal and mineral merchant wholesalers provided an average of 124 jobs during 2015. DLWD employment is based on wage records and includes part-time jobs but does not include the self-employed and working family members not covered under unemployment insurance. The majority of placer operators are self-employed and are therefore not counted in the DLWD data. Employment data may not include jobs in the exploration and development phases of mining at geological and engineering consulting firms, which are categorized in the engineering, environmental, or construction industries. Consequently, mining's contributions to employment and earnings in Alaska are likely understated by DLWD's dataset.

According to DLWD data, 18 boroughs or census areas reported non-oil-and-gas mining employment in 2015. Juneau, Anchorage, and Fairbanks North Star Borough (FNSB) each had more than 100 mining jobs. The City and Borough of Juneau and FNSB continue to vie for top spot with 762 and 756 jobs, respectively. FNSB reported a gain of 100 mining and natural resources jobs (7 percent) in 2015, for a 2015 monthly average of

1,500 jobs⁷. The FNSB mining jobs category includes the oil and gas industry, agriculture, forestry, fishing, and hunting as well as hard-rock and coal mining, quarrying, and mining support activities. FNSB statistics do not include self-employed workers and unpaid family workers, such as the majority of placer operators. Mining companies strengthen Alaska's local economies by employing Alaska residents from local communities and by purchasing supplies and services from hundreds of Alaska businesses.

GOVERNMENT REVENUES FROM ALASKA'S MINERAL INDUSTRY

In 2015 government revenue from Alaska's mineral industry totaled \$114.9 million. The 18 percent increase from 2014 is due primarily to increased revenues from Alaska Corporate Income Tax and Mining License Tax, which are reported for the fiscal year. Table 3 provides an itemized listing of estimated revenues paid to the State and municipalities. These revenues are incomplete and serve only as a minimum. The Department of Revenue reported that 459 taxpayers submitted Mining License Tax returns in 2015, of which 29 (6 percent) were liable for taxes on net taxable income from mining in the amount of \$571.7 million (table 4). Almost 200 taxpayers reported negative net taxable incomes from mining at an average loss of \$255,762 per taxpayer.

Recent declines in government revenue are consistent with a broad downturn in commodity prices, which has strained mining companies as well as jurisdictions that depend on minerals revenue. Fueled by greater demand from emerging markets, many resource-rich regions saw large increases in production and exploration between 2010 and 2013; however, a general pullback in exploration and development occurred worldwide in the last 2 years, with a general lack of investment and venture capital availability for 2014 and 2015. Falling revenue is not unique to Alaska, as many countries have seen dramatic revenue reductions because of sharp material price declines linked to slowing economic growth in China, the world's top metals consumer. This situation is comparable to the crisis the State of Alaska currently faces with continued slumping oil prices. Natural-resources-dependent jurisdictions are facing limited revenue potential as worldwide market forces drive commodity prices to multi-year lows. In

⁶State of Alaska Department of Labor and Workforce Development (DLWD), Research and Analysis Section, Quarterly Census on Employment and Wages (QCEW); last accessed September 29, 2016; <http://live.laborstats.alaska.gov/qcew/ee15.pdf>

⁷Fairbanks North Star Borough Community Research Quarterly: A Socio-Economic Review, winter 2015, v. 38, no. 4; last accessed September 29, 2016; <http://www.co.fairbanks.ak.us/cp/Community%20Research%20Quarterly/2015%20%20Q4.pdf>

Alaska this period saw revenue to state and local governments decline to \$97.3 million in 2014. Minerals prices were volatile, with many showing inability to maintain stable prices throughout 2015. While State government revenue from minerals and mining activity dropped considerably over recent years, it is important to note that historical yearly collections have fluctuated and 2015 numbers can be viewed more appropriately

as part of the general trend. Despite revenue and payment declines to local governments in 2014 and 2015, revenue remained strong in many locations. In Juneau, Fairbanks, and the Northwest Arctic Borough, revenue from mining-related activity was among the largest contributors to municipal and borough budgets. More information about various sources of revenues is available from individual agencies (appendix A).

Table 3. Reported and estimated revenues paid to the State of Alaska and municipalities by Alaska's mineral industry, 2009–2015. The figures in this table will change as data are reviewed and updated; the table has been significantly updated to reflect Department of Natural Resources and Department of Revenue reporting for previous years. See footnotes for reporting sources and dates.

	2010	2011	2012	2013	2014	2015
State mineral rents and royalties^{a,b}						
State claim rentals	7,770,763	8,498,314	7,951,003	7,507,976	6,740,816	6,920,029
Production royalties ^c	1,591,643	5,416,473	8,982,259	9,808,575	7,004,376	4,608,137
Annual labor	157,848	760,884	357,500	542,588	389,807	321,419
Subtotal	\$ 9,520,254	\$ 14,675,671	\$ 17,290,762	\$ 17,859,139	\$ 14,134,999	\$ 11,849,585
State coal rents and royalties^b						
Rents	266,041	446,415	186,204	324,393	315,398	351,724
Royalties ^c	2,235,138	2,616,629	2,921,491	2,757,444	2,514,532	2,430,267
Bonus	--	--	3,025,000	--	38,005	111,000
Subtotal	\$ 2,501,179	\$ 3,063,044	\$ 6,132,695	\$ 3,081,837	\$ 2,867,935	\$ 2,892,992
State material Sales						
Mental Health	109,027	90,116	11,876	-7,854	115,493	69,163
Division of Land ^b	200,962	1,239,747	1,735,404	4,965,386	10,559,857	11,293,545
State Pipeline Coordinator's Office	5,910	309,600	30,746	340,786	105,330	197,644
Subtotal	\$ 315,899	\$ 1,639,463	\$ 1,778,025	\$ 5,298,318	\$ 10,780,680	\$ 11,560,352
State mining miscellaneous fees^b						
Filing fees	4,000	1,395	6,274	3,350	3,350	2,100
Bid Bonus	403,006	3,319,323	465,850	--	93,767	--
Penalty fees	43,405	238,115	532,959	205,453	122,035	43,307
Exploration incentive app filing fee	--	--	--	--	--	--
Bond pool payment	76,426	64,702	65,201	89,008	77,684	72,190
Surface mine investment interest	45,752	25,890	20,491	5,772	7,802	7,801
Surface coal mining app fee	23,502	7,534	2,200	22,800	1,300	21,700
APMA mining fees	19,873	30,741	45,055	32,953	26,511	24,302
Subtotal	\$ 615,964	\$ 3,687,700	\$ 1,138,030	\$ 359,337	\$ 332,448	\$ 171,399
Other Fees						
AIDEA - Facilities use fees ^d	14,807,000	13,500,000	12,600,000	11,986,000	11,986,000	11,356,000
State Fuel Taxes ^e	126,452	741,071	585,034	951,852	<i>Not reported</i>	<i>Not reported</i>
State corporate income tax ^f	-2,558,970	81,790,274	15,020,036	26,812,498	15,215,598	17,320,051
Mining License Tax ^g	29,725,100	49,588,119	40,695,833	46,787,690	23,457,300	38,665,209
STATE TOTAL	\$ 55,052,878	\$ 168,685,341	\$ 95,240,415	\$ 113,136,670	\$ 78,774,959	\$ 93,815,588
Payments to Municipalities ^h	14,238,251	20,378,242	21,529,472	29,412,224	18,525,615	21,041,152
TOTAL	\$ 69,291,129	\$ 189,063,583	\$ 116,769,887	\$ 142,548,894	\$ 97,300,574	\$ 114,856,740

^a Includes upland lease and offshore lease rentals. Figures are reported by calendar year by the Alaska Department of Natural Resources.

^b Figures are reported by calendar year by the Alaska Department of Natural Resources.

^c Reported on a cash basis; payments actually received during the given year.

^d AIDEA user fees for use of the State-owned roads and ports: the De Long Mountain Transportation System by Teck Alaska Inc., operator of the Red Dog Mine; and for use of the Skagway Ore Terminal by Minto Explorations Ltd., a subsidiary of Capstone Mining Corp. (formerly Sherwood Copper Corp.). AIDEA figures are reported by fiscal year.

^e In 2013, calculated on Fuel and Oil Expenditures from Mining Licenses Tax Form/Department of Revenue, assuming Alaska average fuel cost of \$6.09.

<https://www.commerce.alaska.gov/web/dcra/researchanalysis/fuelpricesurvey.aspx>

^f Only subchapter C corporations pay income tax. This report may not reflect 100% of the returns received in a year. The amount of corporate income tax reported in each fiscal year is the amount of tax actually received and may not agree with the amount reported on a corporation's tax return. This is due primarily to timing differences.

^g Includes metals, coal, and material for 2009–2011. In 2012 and later, Mining License Tax was not collected on materials.

<http://www.tax.alaska.gov/programs/programs/reports/Annual.aspx?60610&Year=2015>

^h Payments to Municipalities include property taxes, payments in lieu of taxes (PILT), severance taxes, and charitable donations. Data should be considered a minimum estimate. Data was compiled from public documents, personal communication, and questionnaires.

Table 4. Mining tax analysis by tax bracket for 2014 and 2015, based on Mining License Tax returns. Analysis excludes royalty-only taxpayers—those with positive royalties received but zero gross income from mining operations. Information provided by the Alaska Department of Revenue.

2014 (December 2013 – November 2014)									
Bracket	Marginal rate	No. of taxpayers	Gross income from mining operations	Net taxable income*	Net income as percentage of gross	Total tax liability	Average gross income	Average taxable income	Average tax liability
Under \$0	0%	194	\$225,708,606	\$ -65,853,227	-29%	\$0	\$1,163,446	-\$339,450	\$0
\$0 to \$40,000	0%	222	\$10,029,137	\$934,556	9%	\$0	\$45,176	\$4,210	\$0
\$40,001 to \$100,000	3%, 5%	20	\$3,823,854	\$951,405	25%	\$29,896	\$191,193	\$47,570	\$1,495
Over \$100,000	7%	15	\$2,194,531,323	\$470,191,692	21%	\$31,128,456	\$146,302,088	\$31,346,113	\$2,075,230
TOTAL		451	\$2,434,092,920	\$406,224,426		\$31,158,352			
2015 (December 2014 – November 2015)									
Bracket	Marginal rate	No. of taxpayers	Gross income from mining operations	Net taxable income*	Net income as percentage of gross	Total tax liability	Average gross income	Average taxable income	Average tax liability
Under \$0	0%	191	\$181,380,675	\$ -48,850,623	-27%	\$0	\$949,637	-\$255,762	\$0
\$0 to \$40,000	0%	239	\$9,153,739	\$888,451	10%	\$0	\$38,300	\$3,717	\$0
\$40,001 to \$100,000	3%, 5%	19	\$3,034,126	\$979,304	32%	\$32,218	\$159,691	\$51,542	\$1,696
Over \$100,000	7%	10	\$2,306,213,104	\$570,733,654	25%	\$37,822,688	\$230,621,310	\$57,073,365	\$3,782,269
TOTAL		459	\$2,499,781,644	\$523,750,786		\$37,854,906			

* Net income taxable under the Mining License Tax

Note: The 3% bracket (income \$40,000 to \$50,000) and the 5% bracket (\$50,000 to \$100,000) are combined for this analysis because of confidentiality issues that would arise if each bracket were reported separately. Taxpayers with negative income (under \$0) are not a separate bracket, but are reported separately to distinguish between large money-losing operations and small operations with zero or positive income.

MINERALS-RELATED GOVERNMENT ACTIVITIES

U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) Mineral Resources Program conducted multiple projects focused on the geologic framework and mineral resources of Alaska in 2015. Alaska Science Center research staff in Anchorage coordinated field-based studies of the tectonic and metallogenic evolution of (1) the Lake Clark and Neacola Mountains region, south-central Alaska, and (2) the Yukon–Tanana uplands, eastern Alaska. USGS also funded a new airborne magnetic survey covering the eastern Yukon–Tanana uplands (contracted and published by DGGS). Research staff at the Crustal Geophysics and Geochemistry Science Center in Denver field tested hyperspectral remote sensing to characterize surficial materials, geology, and potential mineral resources in Alaska. The project goal is to define the hyperspectral–geologic footprint of selected mineral deposits and to regionally extrapolate this knowledge to areas not well characterized.

Additionally, Alaska Science Center research staff, in cooperation with DGGS, evaluated selected mineral deposit types across Alaska by developing a new

GIS-based method to analyze existing geospatially-referenced datasets (for example, stream sediment and rock geochemistry, and lithology) to generate maps of estimated potential and the certainty of that estimate for a given group of mineral deposits or deposit types. Estimated mineral-resource potential and certainty were mapped for: (1) rare-earth elements, (2) placer and paleoplacer gold, (3) platinum-group elements, (4) carbonate-hosted copper, (5) sandstone uranium, and (6) tin–tungsten–molybdenum–fluorspar. These groups include most of the strategic and critical elements of greatest interest in current exploration. A description of the new method and results for the Bureau of Land Management Central Yukon Planning Area in north-central Alaska were published⁸.

Finally, the new digital geologic map of Alaska⁹ was published at the end of 2015. The map is a completely new compilation and is the first fully digital statewide geologic map of Alaska. The digital map has multiple associated databases that allow creation of a variety of derivative maps and other products.

⁸GIS-based identification of areas with mineral resource potential for six selected deposit groups, Bureau of Land Management Central Yukon Planning Area, Alaska: U.S. Geological Survey Open-File Report 2015–1021, 78 p., 5 appendices, 12 plates. <http://doi.org/10.3133/ofr20151021>

⁹Geologic map of Alaska: U.S. Geological Survey Scientific Investigations Map 3340, pamphlet 196 p., 2 sheets, scale 1:1,584,000. <http://doi.org/10.3133/sim3340>

DIVISION OF MINING, LAND & WATER

The Division of Mining, Land & Water (DMLW) manages Alaska's mineral (including coal) and water resources. DMLW mineral exploration, development, and leasing programs manage the 96 million acres of State-owned lands available for mineral exploration and mining. Coal is administered through the Surface Coal Mining Control and Reclamation, or Coal Regulatory, Program (CRP). The Division also allocates and manages the state's water resources on all lands in Alaska, adjudicates water rights, and provides technical hydrologic support. DWLM ensures dam safety for 76 jurisdictional dams in Alaska, including the large tailings dams at Red Dog and Fort Knox mines, and two smaller tailings dams at the Kensington and Nixon Fork mines.

In 2015 the Division's Large Mine Permitting Team (LMPT) coordinated the permitting activities of large mines in the state, including Red Dog, Fort Knox, Pogo, Kensington, and Greens Creek mines. The LMPT also consulted with owners of active, potential development projects (Bokan–Dotson Ridge, Chuitna Coal, Donlin Gold, Niblack, and Pebble projects) and inactive or reclaimed mines (Nixon Fork, True North, and Rock Creek mines), as well as engaged in the review of large hard-rock mining projects in Canada that have the potential to affect Alaska's interests that depend on trans-boundary rivers. The Division's CRP oversaw activities at Usibelli Coal Mine's properties; CRP also completed the renewal of the Wishbone Hill permit and is in the process of reviewing the permit applications for the Chuitna Project. The State issued a coal lease for exploration and development of the Canyon Creek area about 60 miles northwest of Anchorage.

DMLW's Public Access Assertion Defense section (PAADS) pursued State title to navigable and submerged lands that led to the State of Alaska receiving a Recordable Disclaimer of Interest (RDI) from the U.S. Department of Justice on July 27, 2015, for the Mosquito Fork of the Fortymile River. Through this action, State river-bottom mining claims on the Mosquito Fork prior to this decision are now valid and can be mined.

DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

The Division of Geological & Geophysical Surveys (DGGS) is responsible for the mineral assessment of the State's 96 million acres of land available for mineral entry. The Division maintains extensive, authoritative

repositories of geologic information and materials accessible to the public, and publishes new studies and data every year. DGGS's commitment to minerals-resource research and accessibility of geologic information promotes responsible development of Alaska's natural resources.

Alaska Geologic Materials Center

The Alaska Geologic Materials Center (GMC), maintained by DGGS, is the state's largest and most comprehensive archive of geologic samples. It is the key entity directed to understanding Alaska geology through the acquisition and preservation of physical collections, which assist in the discovery of mineral and energy resources. The GMC houses drill core from numerous Alaska mineral prospects, as well as DGGS rock samples and the Alaska collections of the U.S. Geological Survey (USGS), the former U.S. Bureau of Mines (BOM), and other agencies.

In October 2014, then-Governor Sean Parnell (photo 2) presided over a DGGS-hosted grand opening ceremony at the new GMC. In 2015 the GMC relocated its entire collection to the newly renovated 90,000-square-foot facility at 3651 Penland Parkway in Anchorage. In a six-week effort, more than 3 million pounds of rock



Photo 1. Geologic Materials Center staff orchestrated the transfer of more than 3 million pounds of rocks to the new GMC facility in 2015. PHOTO BY KURT JOHNSON, DGGS.

samples were moved from the former Eagle River facility, where more than half of the collection was stored in a collection of 57 outdoor metal shipping containers. The new facility features more than 5,000 eight-foot-wide industrial steel shelves (photo 1), as well as viewing areas with roller tables and high-lumen overhead lighting. As part of the facility's relocation, the GMC instituted a new barcode-based online information system to track the more than 580,000 samples in the collection's inventory. The browser-based search interface (maps.dggs.alaska.gov/gmc) allows users to build simple to complex queries through text- or map-based searches.

Mineral industry clients donated large volumes of mineral core to the GMC in 2015. Major donations were received from Alaska Earth Sciences, Bristol Bay Native Corporation, and Calista Corporation, which added more than 10,000 core boxes representing 13 prospects with 120 boreholes and nearly 1,000 pulp boxes covering three surface-sample geochemical study areas. Millrock Resources slabbed about 1,312 feet of core for bulk analysis. Archived "heavy" sand samples collected near Icy Bay in southeastern Alaska provided preliminary

evidence for potentially economically recoverable heavy minerals on Alaska Mental Health Trust lands.

Mineral Resources Section Activities

The DGGs Mineral Resources section assesses State land, and provides information on their potential to host Alaska's undiscovered mineral resources using its expertise in mineral deposit geology, geophysics, and geochemistry (table 5). Section staff conduct geophysical surveys, geologic mapping, mineral-resource assessments, and ore deposit research; they also track mineral industry exploration and discoveries, development, and production. Additionally, the Section's expertise and knowledge are sought to review other Departmental actions including State land selection conveyance prioritization, land-use plans, land disposal actions, review of Federal actions, and infrastructure planning.

The geophysical, geological, and resource surveys conducted by the Mineral Resources section not only inventory the potential for mineral resources, but they add value to the state in terms of current and future revenue.



Photo 2. In October 2015, then-Governor Sean Parnell led the grand-opening celebration and cut the ceremonial ribbon at the new Geologic Materials Center in Anchorage. PHOTO BY KEN PAPP, DGGs.

Table 5. New publications produced by the DGGs Mineral Resources section in 2015. Publications are all available from the DGGs website, <http://www.dggs.alaska.gov/pubs/advanced-search>.

GEOPHYSICAL SURVEYS AND REPORTS

- ▶ Idirarod survey data; report: <http://doi.org/10.14509/27081>
- ▶ Dishna River/Fox Hills/Beaver Creek report: <http://doi.org/10.14509/27326>
- ▶ Farewell/Middle Styx report: <http://doi.org/10.14509/29349>
- ▶ Tonsina survey data; report: <http://doi.org/10.14509/29169>
- ▶ Tok survey data; report: <http://doi.org/10.14509/29347>
- ▶ Updated Petersville mining district data; report: <http://doi.org/10.14509/29445>
- ▶ Updated Fortymile mining district survey; report: <http://doi.org/10.14509/29411>
- ▶ Updated Livengood mining district survey; report: <http://doi.org/10.14509/29412>
- ▶ Tanacross survey; report: <http://doi.org/10.14509/29514>

GEOLOGIC MAPS, REPORTS, AND GEOCHEMICAL DATA

- ▶ Geologic map; Talkeetna Mountains C-4 Quadrangle: <http://doi.org/10.14509/29470>
- ▶ Alpha Complex ultramafic Ni–Cu–PGE (poster): <http://doi.org/10.14509/29480>
- ▶ Geophysical/geological investigations, Tanacross (presentation): <http://doi.org/10.14509/29524>
- ▶ Geologic investigations in western Wrangellia (presentation): <http://doi.org/10.14509/29531>
- ▶ Alaska's mineral resources 2015 (AE&M presentation): <http://doi.org/10.14509/29546>
- ▶ Late Triassic Nikolai magmatic system, Wrangellia (poster): <http://doi.org/10.14509/29567>
- ▶ Seward Peninsula ⁴⁰Ar/³⁹Ar data: <http://doi.org/10.14509/29413>
- ▶ Seward Peninsula geochemical re-analyses: <http://doi.org/10.14509/29448>
- ▶ Haines area geochemical re-analyses: <http://doi.org/10.14509/29449>
- ▶ Kougarok area, Seward Peninsula geochemical re-analyses: <http://doi.org/10.14509/29450>
- ▶ Northeastern Alaska Range geochemical re-analyses: <http://doi.org/10.14509/29451>
- ▶ Tonsina area geochemical re-analyses: <http://doi.org/10.14509/29452>
- ▶ Zane Hills geochemical re-analyses: <http://doi.org/10.14509/29453>
- ▶ Talkeetna Mountains C-4 Quadrangle ⁴⁰Ar/³⁹Ar data: <http://doi.org/10.14509/29454>
- ▶ Tok area geochemical data: <http://doi.org/10.14509/29517>
- ▶ Wrangellia terrane geochemical data: <http://doi.org/10.14509/29518>
- ▶ Tonsina area geochemical data: <http://doi.org/10.14509/29519>
- ▶ Geologic maps of 44 quadrangles, eastern Alaska Range: <http://doi.org/10.14509/29444>
- ▶ Geologic map compilation; proposed Susitna–Watana dam area: <http://doi.org/10.14509/29446>
- ▶ Alaska's mineral industry 2014 (report): <http://doi.org/10.14509/29515>

Since 1993 the data products of the Airborne Geophysical/Geological Mineral Inventory (AGGMI) program have been an important component of successful resource exploration programs; products have contributed to the private-sector discovery of more than 22 million ounces of gold in the Salcha River–Pogo and Livengood areas (figure 2). State budget cuts impacted the AGGMI program, resulting in the loss of the program's permanent staff position and most of its annual funding for data collections and publication in July 2015. New geophysical surveys now rely on survey-by-survey funding through outside sources or the State of Alaska capital budget.

DGGs collected 4,500 square miles of airborne geophysical data and published more than 9,500 square

miles of data during 2015. The Tanacross fixed-wing magnetic survey, flown and published in 2015, was funded by the U.S. Geological Survey (USGS) Mineral Resources Program in support of its Yukon–Tanana terrane mineral-resource potential analysis. This survey fills gaps between previous State-funded datasets. Data collected in previous years from the Southern Dishna River, Fox Hills, Beaver Creek, Farewell, Middle Styx, Tok, and Tonsina helicopter-borne electromagnetic and magnetic surveys were published during 2015. Four older surveys, Livengood, Fortymile, Petersville, and Bonnifield, totaling 2,293 square miles, were updated and made available for download from DGGs's website (dggs.alaska.gov).

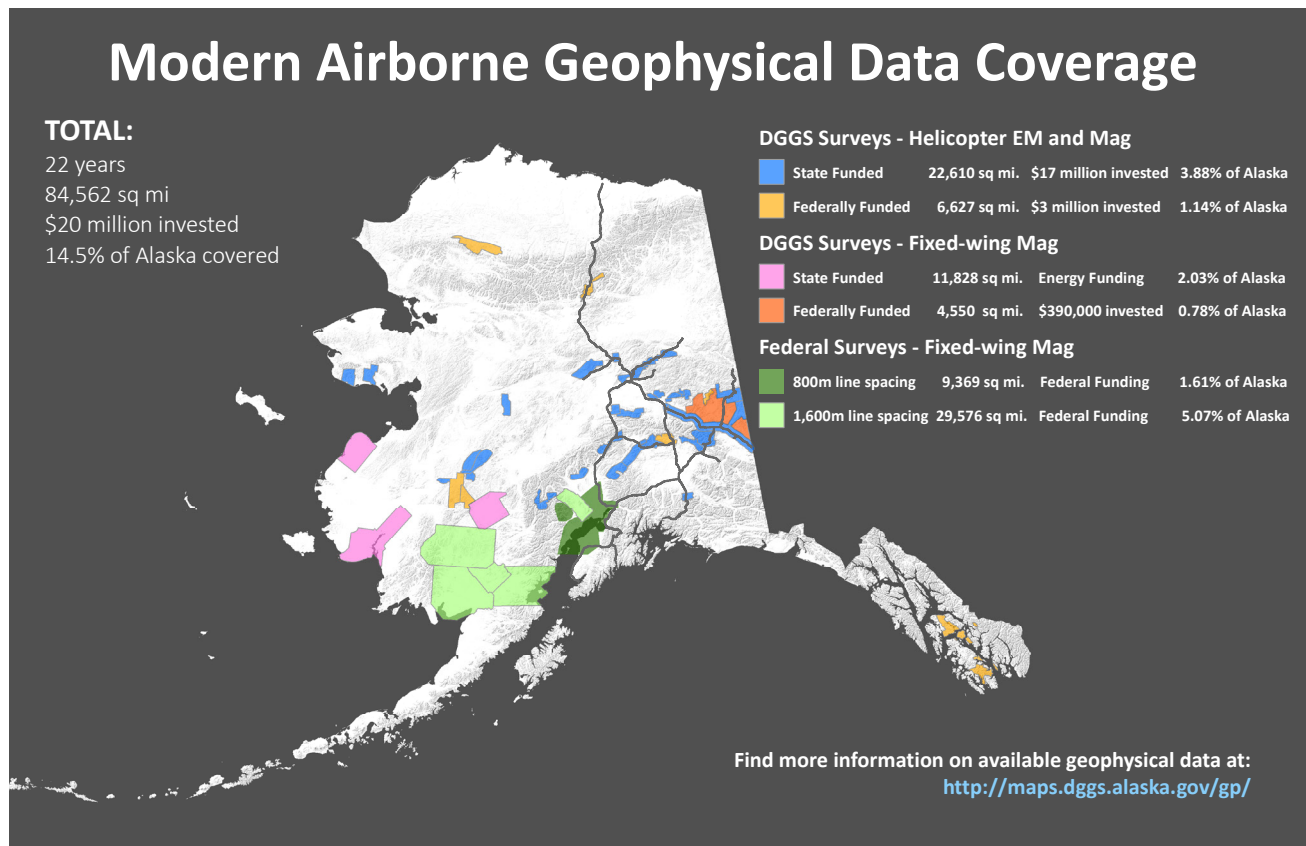


Figure 2. Modern airborne geophysical data coverage of Alaska, managed by Alaska Division of Geological & Geophysical Surveys and the U.S. Geological Survey over the past 22 years. Survey data is available from the division's website, <http://maps.dggs.alaska.gov/gp/>.

STRATEGIC & CRITICAL MINERALS (SCM) ASSESSMENT

The DGGS Strategic and Critical Minerals (SCM) Assessment project is designed to evaluate Alaska's potential to contribute domestically produced strategic and critical minerals that are required to meet the nation's needs for military and civilian high-tech equipment and electronics, as well as conventional- and green-energy technologies. In 2015 DGGS published 289 new, SCM-related geochemical analyses from the south-central Alaska Range and Tonsina area, and digitally compiled geochemical data and locations for 26,963 historical samples. As part of a cooperative agreement between the DGGS and the USGS, both agencies conducted a statewide GIS- and watershed-based analysis to identify areas with SCM potential, and reanalyzed 2,071 historical USGS sediment samples, upgrading them to modern analytical standards.

GEOLOGIC MAPPING AND GEOCHEMICAL SAMPLING

The DGGS Mineral Resources section filled a gap in Alaska's detailed geologic map coverage by publishing its 450-square-mile map of part of the Talkeetna Mountains in 2015. The new map and report are the result of

six weeks of fieldwork and more than 1,600 supporting analyses, including geochemistry and radiometric ages. DGGS documented rock types favorable to both nickel-copper-platinum-group elements (PGEs) and copper-gold-silver mineral deposits that occur in the area. PGEs are of particular interest because of their critical role in modern technology as well as insufficient U.S. production.

Additionally, in 2015 DGGS conducted field projects in the Tonsina and Tok areas. Follow-up geochemical sampling in the Tonsina mafic-ultramafic complex was conducted to complete year two of our evaluation of the area's chromium-copper-nickel-PGE potential. In 2015 DGGS also conducted reconnaissance field geologic mapping and geochemical sampling in the Tok area in preparation for a planned 6-week field project in 2016. The region has significant potential for hosting VMS (volcanogenic massive sulfides), structurally controlled and plutonic-related gold, skarn, and placer gold mineralization. Publications documenting these results can be obtained from the DGGS website (dggs.alaska.gov/publications/).

Table 6. Reported exploration expenditures in Alaska by commodity, 1981–2015. Exploration expenditures were estimated for one project using their reported employment and a project-cost-per-person-day ratio averaged from ten projects with reported, complete data.

	Base metals	Polymetallic ^a	Precious metals ^b	Industrial minerals	Coal and peat	Other ^c	Total
1981	\$ 28,262,200		\$ 35,273,200	\$ 10,300,000	\$ 2,341,000	\$ 127,000	\$ 76,303,400
1982	31,757,900		10,944,100		2,900,000	15,300	45,617,300
1983	9,758,760		20,897,555	2,068,300	1,338,454	70,000	34,133,069
1984	4,720,596		14,948,554	270,000	2,065,000	279,500	22,283,650
1985	2,397,600		6,482,400		270,000		9,150,000
1986	1,847,660		6,107,084	170,000	790,000		8,914,744
1987	2,523,350		11,743,711	286,000	1,150,000	31,000	15,734,061
1988	1,208,000		41,370,600	160,200	2,730,000		45,468,800
1989	3,503,000		43,205,300	125,000	924,296	5,000	47,762,596
1990	5,282,200		57,185,394	370,000	321,000	97,000	63,255,594
1991	4,789,500		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	0	30,209,000
1993	910,000	5,676,743	23,382,246	163,500	0	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	0	3,000	34,306,100
1996	1,100,000	11,983,364	31,238,600	400,000	0	0	44,721,964
1997	1,700,000	22,347,000	32,960,500	80,000	720,000	0	57,807,500
1998	1,000,000	13,727,000	42,441,000	12,000	87,000	0	57,267,000
1999	3,869,000	3,168,000	44,891,000	1,000	0	410,000	52,339,000
2000	8,545,000	3,933,000	21,579,000	58,500	0	736,100	34,851,600
2001	4,810,000	1,977,000	15,820,000	50,000	10,000	1,106,000	23,773,000
2002	1,700,000	5,162,000	17,342,000	185,000	0	2,113,000	26,502,000
2003	262,000	7,081,000	19,726,000	0	0	533,000	27,602,000
2004	3,100,000	40,237,000	26,954,000	213,000	50,000	258,000	70,812,000
2005	1,764,000	54,271,000	46,255,000	142,000	0	1,463,000	103,895,000
2006	5,069,000	81,073,000	89,793,000	20,000	2,394,000	580,000	178,929,000
2007	38,888,000	123,487,500	155,601,400	42,500	7,675,000	3,447,000	329,141,400
2008	30,116,000	163,030,000	134,885,000	0	0	19,238,000	347,269,000
2009	3,862,715	85,871,529	84,020,531	17,850	0	6,193,518	179,966,143
2010	6,392,519	122,955,321	125,364,382	19,000	6,520,200	3,104,199	264,355,621
2011	7,730,891	160,880,974	186,255,005	--	3,250,000	6,962,325	365,079,195
2012	18,161,211	150,339,009	152,444,311	--	W	14,129,838	335,074,369
2013	8,122,810	103,524,782	60,977,949	22,762	W	2,840,713	175,489,016
2014	8,310,433	29,836,240	51,759,541	32,221	W	6,300,413	96,238,848
2015	6,199,064	25,171,955	26,907,877	--	--	--	58,278,896
TOTAL	\$ 262,149,409	\$ 1,237,942,471	\$ 1,737,959,939	\$ 15,650,833	\$ 39,117,950	\$ 70,979,906	\$ 3,363,800,508

^a Polymetallic deposits considered a separate category for the first time in 1992.

^b Approximately \$0.94 million spent on platinum-group-element (PGE-Ni-Cu) exploration during 2014, included in the polymetallic category. Prior to 2013, PGE exploration was included in the precious metal exploration total

^c Includes rare-earth elements, magnetite sands, rock, gemstones, and graphite.

N/A = Not available

-- = Not reported

W = Withheld; data included in "Other" column

EXPLORATION

Mineral exploration expenditures in Alaska totaled \$58.3 million, down 39 percent from 2014 and down 84 percent from 2011, the peak of recent exploration expenditures (table 6 and figures 3 and 4). Alaska's exploration collapse parallels, but outpaces, global trends; worldwide exploration spending fell 19 percent in 2015 and 57 percent since its peak in 2012⁴.

Alaska's five operating metal mines conducted more than half of all exploration in 2015, spending a combined \$31.2 million, or 54 percent, of the statewide total. Despite this strength, mine site exploration budgets declined across the board as low metals prices continued to impact producers.

EXPLORATION

I. Northern Region

1. Lik—Zazu Metals Corp.
2. Red Dog Mine area—Teck Alaska Inc.
3. Upper Kobuk (Arctic and Bornite)—NovaCopper Inc.

II. Western Region

4. Graphite Creek—Graphite One Resources Inc.
5. Kugruk Mega Shear—NANA Regional Corp.

III. Eastern Interior Region

6. Livengood (Money Knob)—International Tower Hill Mines Ltd.
7. Shorty Creek—Freemgold Ventures Ltd.
8. Fairbanks District
 - a. Fort Knox and district—Fairbanks Gold Mining Inc.
 - b. Golden Summit—Freemgold Ventures Ltd.
 - c. Gil—Kinross Gold Inc.
9. PB and nearby claims—Kinross Gold Inc.
10. Richardson and Hilltop—Northern Empire Resources Corp.
11. Pogo—Sumitomo Metal Mining Pogo LLC
12. Tetlin—Contango ORE Inc.
13. Caribou Dome—Coventry Resources Ltd.

IV. South-Central Region

14. Whistler—Brazil Resources
15. Copper Joe—Kiska Metals Corp.

V. Southwestern Region

16. Terra—WestMountain Gold Inc.
17. Pebble—The Pebble Limited Partnership

VI. Alaska Peninsula Region

18. Alaska Peninsula—Millrock Resources Inc.
19. Unga-Popov—Redstar Gold Corp.

VII. Southeastern Region

20. Palmer—Constantine Metal Resources Ltd.
21. Kensington/Jualin—Coeur Alaska, Inc.
22. Greens Creek Mine—Hecla Greens Creek Mining Company
23. Bokan Mountain/Dotson Ridge—Ucore Rare Metals Inc.

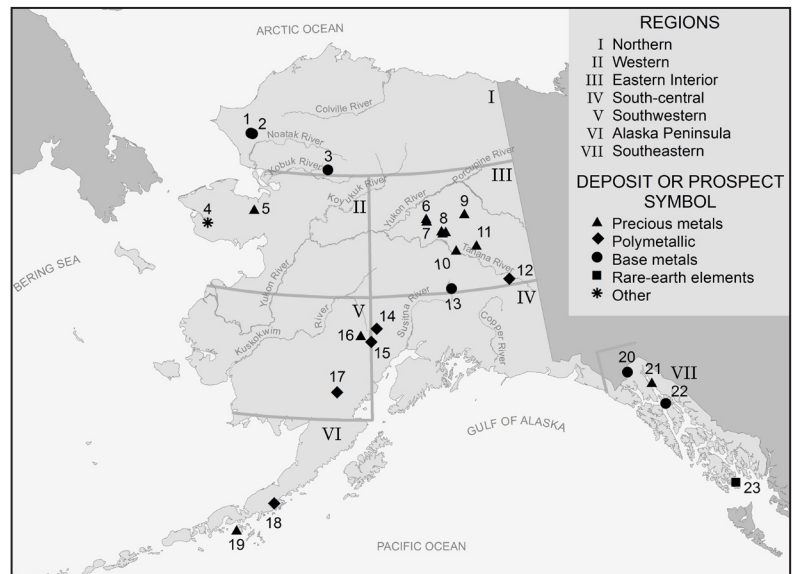


Figure 3. Selected exploration projects in Alaska, 2015.

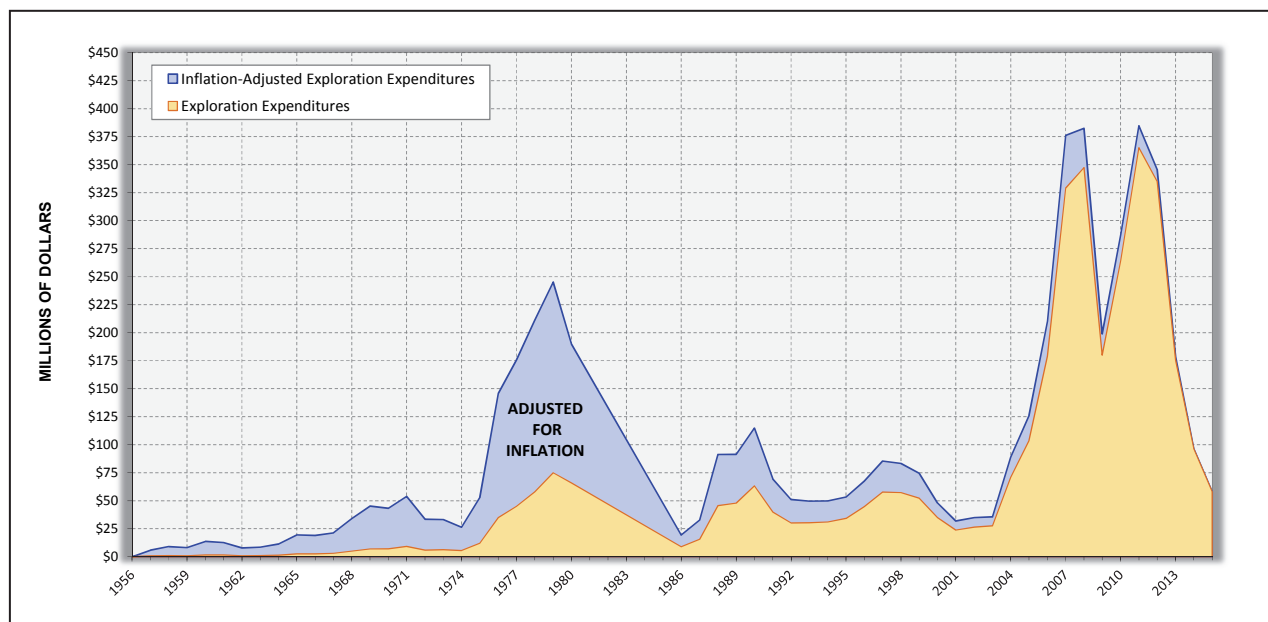


Figure 4. Alaska mineral exploration expenditures, 1956–2015. Blue curve in background is adjusted to 2015 dollars to account for inflation.

Table 7. Summary of State and Federal claim activity by acres, 1991–2015.

Year ^a	State Claims				State Prospecting Sites (160 acres)		Federal Claims (20 acre sites)	
	New (Active) 40 acre ^b	New (Active) 160 acre	Total (Active) 40 acre ^b	Total (Active) 160 acre	New	Total	New	Total
1991	3,277	0	37,862	0	747	1,723	1,299	23,222
1992	2,640	0	36,250	0	454	1,472	695	20,254
1993	2,120	0	34,340	0	1,412	2,259	601	9,298
1994	4,057	0	34,400	0	802	2,378	341	8,495
1995	4,512	0	30,464	0	1,030	2,725	376	7,766
1996	9,489	0	36,602	0	2,082	3,687	681	9,346
1997	8,678	0	42,836	0	2,480	5,305	1,872	11,320
1998	9,786	0	49,816	0	3,194	7,148	427	11,033
1999	11,978	0	56,107	0	1,755	7,600	308	10,176
2000	4,560	614	54,393	614	1,143	5,675	523	7,805
2001	858	907	49,627	1,503	27	3,091	464	8,248
2002	745	826	44,056	2,179	61	2,138	261	8,100
2003	856	2,603	38,076	4,387	101	1,857	676	8,424
2004	1,070	3,533	34,380	7,719	59	1,484	66	8,313
2005	806	4,502	34,066	11,551	128	1,612	411	7,826
2006	1,111	5,747	33,864	16,249	103	1,646	457	8,068
2007	576	6,031	31,305	20,208	57	1,625	933	8,872
2008	1,333	2,565	23,033	13,519	24	651	3,001	11,732
2009	1,142	2,793	24,340	16,381	40	335	1,057	10,431
2010	1,446	6,132	24,805	20,389	88	441	332	8,413
2011	1,932	4,893	24,319	21,970	180	273	284	8,438
2012	1,638	3,478	24,673	20,810	202	409	632	--
2013	1,622	2,155	24,883	17,347	28	209	289	6,916
2014	1,219	677	25,479	15,250	19	197	69	6,003
2015	1,014	711	26,493	15,961	21	218	71	6,074

Updated information provided by Alaska Department of Natural Resources and U.S. Bureau of Land Management.

^a After 2010, State claim and prospecting site totals are not directly comparable to previous years. Claim totals comprise Mining Claims (including "River Bottom Navigable" subtype) and Leasehold Locations whose claimants filed an Annual Affidavit of Labor, and claims initiated on State-selected land.

^b Includes claim fractions varying from 1 to 39 acres.

-- = Not reported

2015 EXPLORATION EXPENDITURES BY DEPOSIT TYPE

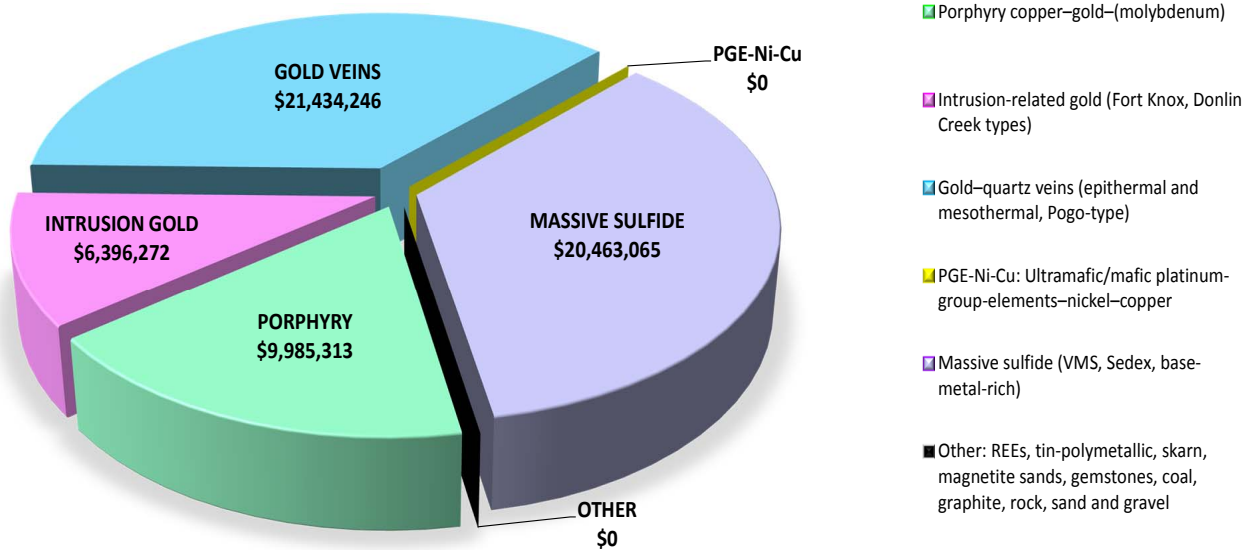


Figure 5. Exploration expenditures by deposit type, 2015. Chart does not include 2015 placer gold exploration expenditures.

The pipeline of early- to advanced-stage exploration projects saw even greater declines in activity. Excluding the operating mines, eight projects each spent more than \$1 million, down from 11 projects in 2014; an additional six projects individually spent more than \$100,000, compared to 28 projects in 2014. Early-stage exploration has been particularly hard hit, with many projects dormant. The total area of the state covered by mining claims and prospecting sites increased from about 3,610,740 acres in 2014 to about 3,769,840 acres in 2015 (an increase of more than 4 percent), but the total staked area was still well below totals from 2010–2013 (table 7). Many of Alaska's advanced projects have reached a stage of decreased exploration investment, focusing instead on optimization studies, permitting, or the search for additional financing.

Alaska mineral exploration had a few bright spots in 2015 that might set the stage for future activity. Figure 5 depicts highlights, including new high-grade gold zones found at the Tetlin project by partners Contango ORE and Royal Gold Inc., as well as Freegold Ventures Inc.'s discovery of new intrusion-related copper–gold–

silver mineralization in its inaugural drill program at Shorty Creek.

NORTHERN REGION

At the Red Dog Mine in northwestern Alaska, operator Teck Alaska Inc. continued infill and definition drilling ahead of mining in the Aqqaluk pit. At the end of 2015, proven and probable reserves at the mine stood at 62.4 million tons with an average grade of 14.6 percent zinc, 4.1 percent lead, and 2.15 ounces of silver per ton. Teck continued a strong exploration program on its Noatak claim block, drilling 41,000 feet in the Anarraaq–Aktigirug area about 8 miles northwest of Red Dog. No exploration occurred at the nearby Lik sediment-hosted zinc deposit held by Zazu Metals Corp. in a joint venture with Teck.

In the southwestern Brooks Range, NovaCopper Inc. continued resource definition, engineering, and environmental studies at its Upper Kobuk Mineral Project, a partnership with NANA Regional Corp. (photo 3). The 2015 program focused on advancing the Arctic copper–zinc–lead–silver–gold deposit toward feasibility



Photo 3. NovaCopper staff conducted fieldwork in Ambler project area. PHOTO PROVIDED BY BONNIE BROMAN, NOVACOPPER INC.

stage. The company invested \$5.5 million in exploration, engineering, and environmental studies, including a 10,000 foot infill and geotechnical drill program. More than 50 percent of the on-site employees were NANA shareholders and residents of northwestern Alaska.

WESTERN REGION

NANA Regional Corp. conducted an inaugural six-hole, 3,100 foot core drilling program on its Kugruk Mega Shear gold property in the Fairhaven District south of Kotzebue. NANA has conducted grassroots exploration on its ANCSA lands and adjoining State-owned lands since 2010, in the process delineating orogenic gold targets along a 40 mile trend (photo 4). The 2015 drill test of some of these targets intercepted gold mineralization associated with quartz veins, including one intercept of 0.598 ounce of gold per ton over 5.8 feet; three of six holes had intervals with greater than 0.292 ounce of gold per ton.

Graphite One Resources Inc. released an updated resource for its Graphite Creek property on the Seward Peninsula, upgrading a portion of the inferred resource to indicated status. The deposit now is estimated to contain 19.8 million tons grading 6.3 percent graphitic carbon indicated, with an additional 170.2 million tons inferred averaging 5.7 percent graphitic carbon (3 percent cutoff grade). The company did not complete any further exploration during 2015.

EASTERN INTERIOR

Sumitomo Metal Mining Pogo again accounted for the largest share of exploration in Alaska's active Eastern Interior region in 2015. The company spent \$15 million exploring multiple targets along a 3 mile trend, drilling 219,000 feet from both surface and underground platforms. This effort increased Pogo's global gold reserve by the equivalent of several years of production.

Fairbanks Gold Mining Inc., a subsidiary of Kinross Gold Corp., spent \$3.9 million on exploration at its open-pit, intrusion-hosted Fort Knox Mine and surrounding properties about 20 miles north of Fairbanks. This included 10,000 feet of core drilling and 14,000 feet of reverse-circulation drilling. Kinross also conducted grassroots lode gold exploration on several claim blocks in the Circle Mining District.

At the nearby Golden Summit project, Freegold Ventures Ltd. continued to work on preliminary economic assessment, metallurgical testing, and environmental



Photo 4. NANA Regional Corp. prospected in frost boils in the Kugruk Fault Zone and found a 0.044-ounce-of-gold-per-ton rock sample containing sulfide in quartz veins. PHOTO PROVIDED BY LANCE MILLER, NANA REGIONAL CORP.



Photo 5. Trench mapping was completed at Chatham trench on the Golden Summit property. PHOTO FROM FREEGOLD VENTURES LIMITED WEBSITE, [HTTP://WWW.FREEGOLDVENTURES.COM/I/MAPS/CHATHAMTRENCHMAP-PING.JPG](http://www.freegoldventures.com/i/maps/chathamtrenchmap-ping.jpg), LAST ACCESSED ON OCTOBER 19, 2016.

baseline studies (photo 5). To date, Freegold has a total identified resource of 361 million tons averaging 0.018 ounce of gold per ton, for a total of 6.53 million ounces of gold. International Tower Hill Mines Ltd. continued evaluation of its Livengood advanced-exploration-stage gold project about 75 road miles northwest of Fairbanks. The company's 2013 feasibility study outlined a 100,000-ton-per-day open-pit mine producing 7.8 million ounces of gold with an average head grade of 0.020 ounce per ton. The 2015 program included hydrologic and environmental baseline studies, as well as continued metallurgical and mine plan optimization.

At its Shorty Creek property near Livengood, Freegold Ventures Ltd. tested copper-gold porphyry targets with a four-hole, 3,500 foot drill program following up on geochemistry, airborne and induced-polarization geophysical surveys, and geologic mapping (photo 6). The best hole intercepted a 300 foot interval averaging 0.55 percent Cu, 0.004 ounce of gold per ton, and 0.205 ounce of silver per ton. This newly discovered mineralization occurs with intense alteration includ-



Photo 6. Chalcopyrite in drill core on the Shorty Creek property. PHOTO FROM FREEGOLD VENTURES LIMITED WEBSITE, [HTTP://WWW.FREEGOLD-VENTURES.COM/I/MAPS/SC/IMG/BG/2015-10-0513.02.05.JPG](http://www.freegold-ventures.com/i/maps/sc/img/bg/2015-10-0513.02.05.jpg). LAST ACCESSED ON OCTOBER 19, 2016.

ing silicification, sericite, biotite, and sulfide-bearing quartz veins.

Northern Empire Resources Corp. revitalized gold exploration in the Richardson district southeast of Fairbanks in 2015, bringing in joint-venture partner Sonoro Metals Corp. at its Hilltop property and completing additional work on its adjacent Richardson property. The properties host multiple styles of intrusive-related gold mineralization with geologic similarities to the Fort Knox and Pogo gold mines. Project work included recompilation of historical data, soil sampling, and trenching. Exploration highlights include a trench intercept averaging 0.271 ounce of gold per ton over 13 feet at the Hilltop property.

Contango ORE Inc. and partner Royal Gold Inc. completed a 61-hole, 46,000 foot core drilling program at the Tetlin project south of Tok, a total expenditure of \$6.8 million. Phase I (29 holes) targeted seven previously defined geophysics- and geochemistry-based skarn targets outside the Peak Zone at the broader Chief Danny prospect. Phase II (32 holes) focused on resource definition and expansion in the Peak West, North Peak, and Blue Moon areas (photo 7). Highlighted drill intercepts include 23 feet averaging 0.579 ounce of gold per ton at North Peak, and 68 feet averaging 0.159 ounce of gold per ton from the Peak West zone. Contango's initial 2014 resource for the Peak Zone polymetallic skarn identified a total resource of 10.8 million tons averaging 0.085 ounce of gold per ton, 0.36 ounce of silver per ton, and 0.24 percent copper, or a gold equivalent of 1.1 million ounces.

Coventry Resources Ltd. optioned and resumed exploration of the Caribou Dome high-grade copper project, formerly known as Denali Copper (photo 8). The company completed a 14,000 foot exploration and validation drill program along a nearly half-mile mineralized trend. This program equaled more than 50 percent of the total core drilling conducted on the prospect during its entire history, from 1964 through 2014. Coventry identified numerous high-grade copper intercepts along the trend, including new massive-sulfide lenses and some previously unrecognized along-strike connectivity between lenses. Highlighted intercepts include 46.3 feet grading 9.9 percent copper, 23.0 feet grading 6.8 percent copper, and 11.5 feet grading 9.3 percent copper (drilled thickness). The company also continued to explore a broader, 5-mile-long mineralized trend using soil sampling and induced-polarization geophysical surveys.

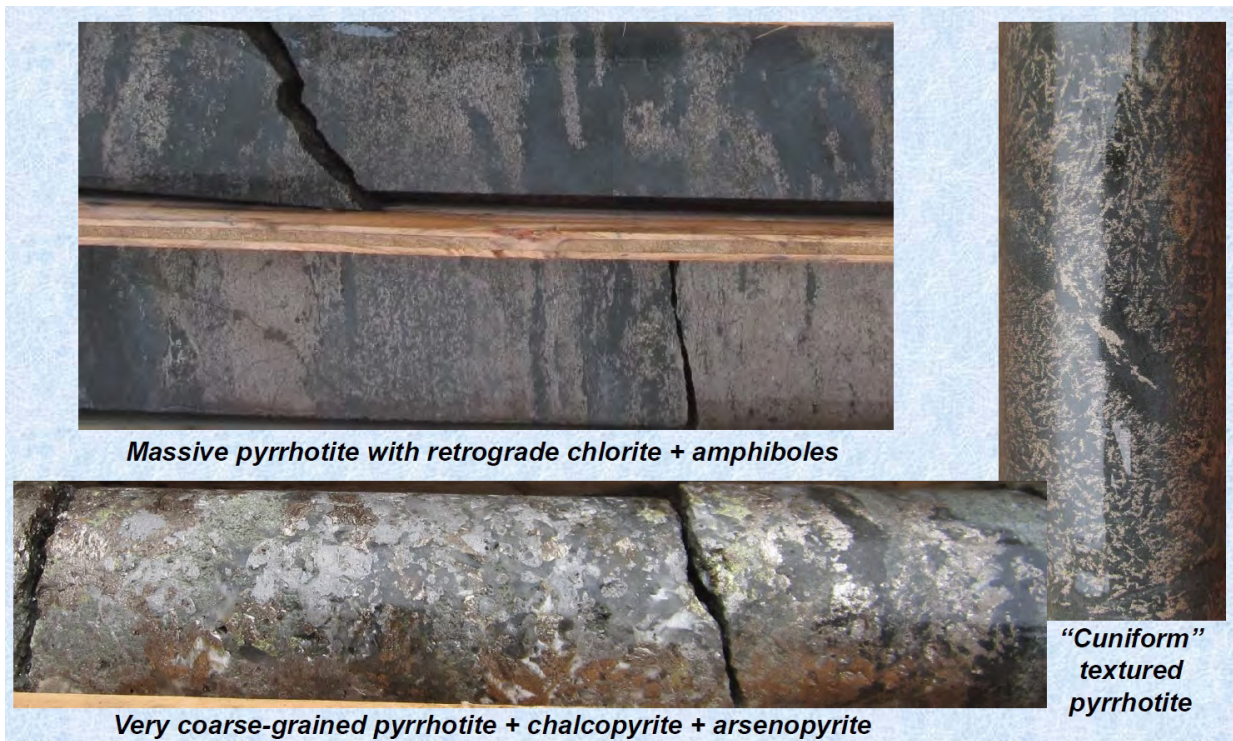


Photo 7. Examples of Peak Zone distal skarn textures on the Tetlin project property. PHOTO PROVIDED BY CURT FREEMAN, AVALON DEVELOPMENT CORP.



Photo 8. View of Caribou Dome property, looking northeast from an outcrop of sediment-hosted copper mineralization at Lense 6 (foreground) toward trenching at Lense 3 (background). PHOTO FROM COVENTRY RESOURCES WEBSITE, [HTTP://WWW.COVENTRYRES.COM/NEWS](http://www.coventryres.com/news). LAST ACCESSED ON OCTOBER 3, 2016.

SOUTH-CENTRAL REGION

First Quantum and Kiska Metals Corp. explored the early-stage Copper Joe porphyry copper–gold prospect in the western Alaska Range (photo 9). Work in 2015 focused on drill target development using magnetotelluric surveys and geologic mapping. First Quantum can earn an initial 51 percent by spending \$5 million by the end of December 2017.

No on-site work was performed at the nearby Whistler and Island Mountain porphyry copper–gold prospects during 2015. Brazil Resources Inc. purchased both properties from Kiska Metals in an all-share deal and intends to announce a revised resource estimate in 2016.



Photo 9. Rusty outcrop at Copper Joe property. PHOTO FROM KISKA METALS CORPORATION WEBSITE, [HTTP://WWW.KISKAMETALS.COM/I/PHOTOS/COPPERJOE/IMG0175.JPG](http://www.kiskametals.com/i/photos/copperjoe/IMG0175.JPG). LAST ACCESSED ON OCTOBER 19, 2016.

SOUTHWESTERN REGION

No exploration occurred at the Pebble Project, where operator Pebble Limited Partnership continues proceedings against the U.S. Environmental Protection Agency (EPA) in court. Northern Dynasty Ltd. became the sole owner of the deposit after partner Anglo American PLC abandoned the project in 2013. The Pebble deposit is currently the world's largest undeveloped resource of both copper and gold, with a total endowment of 81.8 billion pounds of copper and 107.9 million ounces of gold contained in 12 billion tons of ore grading 0.34 percent copper, 0.023 percent molybdenum, 0.009 ounce of gold per ton, and 0.043 ounce of silver per ton.

WestMountain Gold Inc. continued its bulk sampling program at Terra, a high-grade gold project approximately 125 miles west–northwest of Anchorage. The company processed bulk samples of Ben Vein mineralization at a rate of 1 ton per hour through its pilot mill. Ongoing construction worked toward upgrading the pilot mill to 3–5 tons-per-hour capacity. Ben Vein has an identified resource of 940,199 tons at 0.446 ounce of gold per ton, and 0.82 ounce of silver per ton (appendix D); geologic modeling indicates the high-grade vein is open to the north and at depth.

SOUTHEASTERN REGION

Exploration continued to keep reserves well ahead of production at Hecla Mining Co.'s silver-rich Greens Creek Mine near Juneau. Mining depletion and lower metal prices resulted in a net decrease in reserves to 7.2 million tons averaging 12.3 ounces of silver per ton, 0.09 ounce of gold per ton, 3.0 percent lead, and 8.1 percent zinc; however, definition drilling in the

NW and Deep 200 South zones promises to make up the deficit in the coming year. Underground exploration continues to follow these zones down dip, while surface drilling continues to explore the 23-square-mile land package in search of additional resources or an entirely new deposit.

Coeur Mining Inc.'s Kensington Mine north of Juneau announced an updated mine plan incorporating the recently discovered high-grade mineralization at Jualin. Exploration spending in 2015 totaled \$4 million and resulted in an initial resource estimate for the Jualin deposit. Proven plus probable reserves stood at 2.8 million tons of ore averaging 0.198 ounce of gold per ton, within a larger resource (including reserves, measured, indicated, and inferred resources) of 6.7 million tons averaging 0.263 ounce of gold per ton—an increase over year-end 2014 numbers. Underground development to reach the Jualin deposit is in progress.

At the Palmer project near Haines, Constantine Metal Resources Ltd. announced a new inferred mineral resource of 9.0 million tons grading 1.41 percent copper, 5.25 percent zinc, 0.009 ounce of gold per ton, and 0.926 ounce of silver per ton—nearly doubling the tonnage of the previous resource estimate. For 2015, earn-in partner Dowa Metals & Mining Co. Ltd. funded a \$5 million program including eight exploration drill holes, surface and borehole geophysical surveys, and regional prospecting. Drilling succeeded in extending South Wall EM Zone mineralization approximately 300 feet to the east and 200 feet up dip; intercept highlights include 14 feet grading 0.5 percent copper, 3.98 percent zinc, 1.762 ounces of silver per ton, 0.019 ounce of gold per ton, and 26 feet grading 1.33 percent zinc and

0.630 ounce of silver per ton (photo 10). In advance of future underground exploration and development, the partners also drilled one geotechnical hole and advanced engineering and environmental studies.

Ucore Rare Metals Inc. announced an updated mineral resource for its Dotson Ridge rare-earth-element (REE) deposit at Bokan Mountain. Results of the company's 2014 infill and exploration drill program upgraded most of the previously released inferred resource to the indicated category and defined an additional 1.16 million tons of new inferred mineralization grading 0.603 percent total rare-earth oxides. The deposit has a total inferred and indicated resource of 6.4 million tons at 0.602 percent total rare-earth oxides. Ucore continued to advance the project during 2015 by initiating construction of a \$3 million rare-earth separation pilot plant at an off-site location in Utah. The pilot plant will confirm the effectiveness of new beneficiation technologies at a bulk scale using Dotson Ridge mineralization as feedstock.

ALASKA PENINSULA REGION

In 2015 Redstar Gold Corp. drilled eight step-out holes at the Shumagin vein prospect, which is part of the company's Unga Gold project. Highlights of the drilling

program include 16 feet grading 0.273 ounce of gold per ton and 0.806 ounce of silver per ton, including 3.3 feet grading 1.23 ounces of gold per ton and 3.79 ounces of silver per ton. The precious-metal-bearing Shumagin vein system has a strike extent of more than 4,000 feet and a depth of at least 1,000 feet, as outlined by drilling and surface trenching. The Shumagin trend parallels the historically active Apollo–Sitka Mine vein system, which between 1886 and 1922 produced a reported total of approximately 150,000 ounces of gold at a grade of approximately 0.292 ounce per ton.

Millrock Resources Inc. and partner First Quantum Minerals Ltd. drill tested their Alaska Peninsula porphyry copper project in 2015. The project includes the Dry Creek (also known as Bee Creek), Mallard Duck Bay, and Kawisgag prospects on lands owned by Bristol Bay Native Corp. Two holes tested previously undrilled geophysical targets at the Dry Creek prospect; one encountered trace to weak chalcopryrite and more abundant molybdenite associated with porphyry-style veining and alteration. A 323-foot intercept of quartz–sericite–pyrite-altered, hornfelsed sediments averaged 0.19 percent copper, 0.009 percent molybdenum, and 0.001 ounce of gold per ton. No mineralization of significance was discovered at the Mallard Duck Bay prospect.



Photo 10. Drill setup at Constantine Metal Resources' South Wall Zone in the Glacier Creek prospect area of the Palmer property. PHOTO FROM CONSTANTINE METAL RESOURCES LTD. WEBSITE, [HTTP://WWW.CONSTANTINEMETALS.COM/ RESOURCES/PROJECTS/PALMER/KD_PAD_DRILLING_2015.JPG](http://www.constantinemetals.com/resources/projects/palmer/kd_pad_drilling_2015.jpg). LAST ACCESSED ON OCTOBER 19, 2016.

DEVELOPMENT AND PRODUCTION

This section combines development and production narratives; however, we continue efforts to tabulate development expenditures separately. Over the last 10 years the majority of development work has been conducted at mine sites, with development activities being integral to the mining operations. Additionally, there have been few purely development-stage projects. The development sector of the mining process refers to building infrastructure or conducting activities that facilitate production of mineral products. Development expenditures reflect actual expenditures at mines as well as sustaining capital. Sustaining capital includes equipment replacement and rebuilding, facility upgrades, and other expenditures that must be amortized or depreciated in accordance with tax laws; thus they are frequently reported as distinct line items in securities filings. Development activities, whether to build a new mine or make improvements to an existing mine, are often precursors to increased annual production or extended mine life. Production expenditures include those costs directly related to the production of metals.

Development and production estimates in this report are compiled from a variety of online sources, including annual reports, 10-K reports, and news releases by producers, and supplemented by questionnaires returned to DGGs by mining companies, phone calls, and emails. Additional information was derived from State of Alaska Affidavits of Annual Labor filed with the State Recorder's Office.

The average precious metal prices used in this report are the average daily London Metal Exchange (LME) price; base metal prices are the average weekly LME price (table 8). Some respondents reported actual unit values received for production; in cases where actual values were available, they were used in place of the average values. This report uses the First Market Value (estimated gross value of mineral products at first wholesale) for production; it does not represent actual sales or gross income of producers, and does not take into account mining, shipping, smelting, and other costs incurred by the producer.

Table 8. Average metal prices, 1996–2015.

Year	Gold \$/oz	Silver \$/oz	Copper \$/lb	Lead \$/lb	Zinc \$/lb
1996	387.60	5.19	1.03	0.37	0.49
1997	330.76	4.91	1.03	0.28	0.59
1998	293.88	5.53	0.75	0.24	0.46
1999	278.70	5.20	0.71	0.23	0.49
2000	279.10	4.96	0.82	0.21	0.51
2001	271.04	4.37	0.71	0.22	0.40
2002	310.06	4.61	0.41	0.21	0.35
2003	363.38	4.88	0.81	0.23	0.38
2004	409.72	6.67	1.29	0.40	0.47
2005	444.74	7.32	1.61	0.43	0.63
2006	603.46	11.55	3.02	0.58	1.47
2007	695.39	13.38	3.24	1.17	1.47
2008	871.96	14.99	3.12	0.94	0.84
2009 ^a	972.35	14.67	2.35	0.78	0.75
2010 ^a	1,224.53	20.19	3.42	0.97	0.98
2011 ^a	1,571.52	35.12	3.99	1.09	0.99
2012 ^a	1,668.98	31.15	3.61	0.93	0.88
2013 ^{a,b}	1,411.23	23.79	3.32	0.97	0.87
2014 ^{a,b}	1,266.40	19.78	3.11	0.95	0.98
2015 ^{a,b}	1,160.06	15.68	2.70	0.81	0.88

^a 2009–2015 gold and silver prices from Kitco cumulative average London PM fix; 2009–2012 copper, lead, and zinc from British Columbia Ministry of Energy and Mines.

^b 2013–2015 copper, lead, and zinc prices from U.S. Geological Survey Mineral Commodity Summaries, based on London Metal Exchange (LME), and LME average daily settlement.

DEVELOPMENT AND PRODUCTION DISCUSSION

Reported and estimated development expenditures in 2015 were 10 percent greater than in 2014, with seven projects reporting spending a total of approximately \$309.9 million. Projects that reported significant development expenditures are shown in figure 6; Red Dog, Fort Knox, Pogo, Kensington, and Greens Creek mines together spent more than \$285.6 million, with Fort Knox Mine having the largest ongoing development project in Alaska. SMM Pogo did not report likely significant development expenditures, and these figures are not compiled in this publication.

Employment related to development in 2015 is estimated at 555 full-time-equivalent employees. This development-employment figure is calculated by applying the proportion of development and production expenditures to the total employment at mine sites that do not distinguish between development and production employees. Precious metals projects comprised 61 percent of the development expenditures in 2015 (table 9). In the past 10 years, precious metals have been the impetus behind almost two-thirds of the annual development investment.

DEVELOPMENT

I. Northern Region

1. Red Dog Mine—Teck Alaska Inc.
2. Chandalar placer mine—Gold-rich NyacAu Placer LLC

II. Western Region

III. Eastern Interior Region

3. Fort Knox mine—Fairbanks Gold Mining Inc.
4. Pogo Mine—Sumitomo Metal Mining Pogo LLC
5. Usibelli Coal Mine—Usibelli Coal Mine Inc.

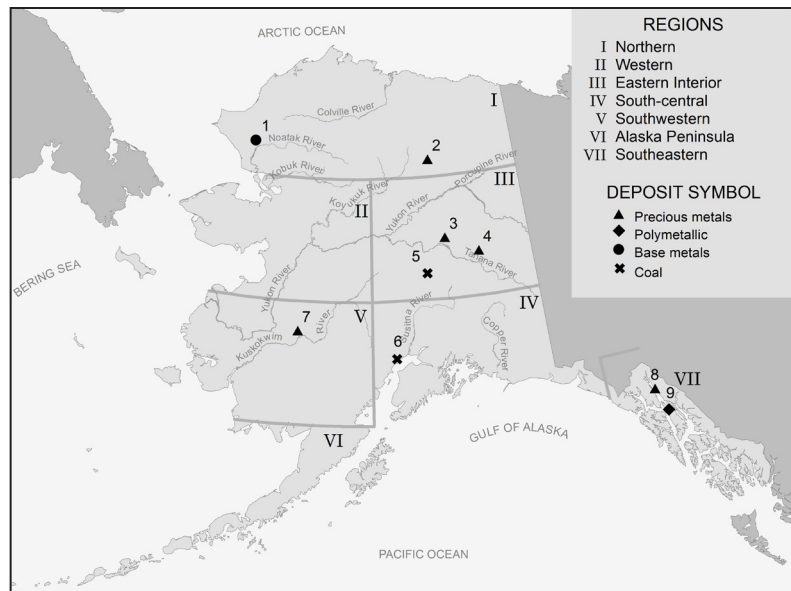
IV. South-Central Region

6. Chuitna Coal Project—PacRim Coal LP

V. Southwestern Region

7. Donlin Gold Project—Donlin Gold LLC

VI. Alaska Peninsula Region



VII. Southeastern Region

8. Kensington—Coeur Alaska Inc.
9. Greens Creek Mine—Hecla Greens Creek Mining Co.

Figure 6. Selected development projects in Alaska, 2015.

The total value of mineral production in Alaska during 2015 is estimated at \$2.76 billion, 16 percent less than the 2014 value of \$3.28 billion (table 10 and figure 7). Metals (gold, silver, lead, and zinc) account for \$2.70 billion (almost 98 percent of the total), coal adds up to \$41.2 million, and industrial minerals account for \$17.2 million. The negative change in Alaska mineral production in 2015 is due to falling metals prices across the board in addition to decreased production for metals overall, and despite increased production from Fort Knox, Greens Creek, and Kensington mines in 2015. Employment related to production in 2015 is estimated at 2,230 full-time-equivalent employees, a slight decrease (less than 1 percent) from production employment in 2014.

Zinc maintained its place as the leading mineral product of the state with a value of \$1.2 billion in 2015 (a decrease of 14 percent from 2014), and accounting for 44 percent of Alaska's production value (figure 8). The annual value of zinc production has exceeded that of gold since 2014 (appendix B). The value of gold production has decreased 35 percent to \$1.01 billion in 2015 since 2013's record value of \$1.55 billion.

Gold production from lode mines in the Eastern Interior and South-eastern regions totaled 873,984 ounces

in 2015, of which 78 percent was produced from the Fort Knox and Pogo gold mines in Eastern Interior region (figure 9). Kensington gold and Greens Creek polymetallic mines in southeastern Alaska, the third and fourth largest gold producers, accounted for the remainder of reported gold production. Gold production figures from 2015 do not include an estimated amount of placer gold produced, which during the past 5 years has averaged 74,360 ounces of gold or 8 percent of the total gold produced in Alaska annually (photo 11). Two placer operations, Taiga Mining (Western region) and Chandalar Gold (Northern region), reported significant development and production expenditures and gold production, respectively. Total employment related to gold production in 2015, from MSHA reporting and on-line sources, is 1,166 full-time-equivalent jobs; however, the 120 full-time-equivalent jobs attributed to placer gold mining as reported by MSHA is underreported and should be considered a minimum estimate.

The value of Alaska industrial minerals (rock, sand, and gravel) is at least \$17.2 million in 2015, based on production data reported on Alaska lands, not including Mental Health Trust lands or lands managed by the State Pipeline Coordinator's Office (figure 10 and appendix C). The total estimated volume of industrial minerals sold is 5.73 million tons for the three DNR land offices

Table 9. Reported mineral development expenditures in Alaska by commodity, 1982–2015.

Year	Base metals	Polymetallics ^a	Precious metals	Gemstones ^b	Industrial minerals	Coal and peat	Total
1982	10,270,000		19,320,000		4,251,000	7,750,000	41,591,000
1983	19,500,000		7,112,500		1,000,000	250,000	27,862,500
1984	10,710,500		15,058,555		579,000	27,000,000	53,348,055
1985	13,000,000		16,890,755		1,830,000	2,400,000	34,120,755
1986 ^a	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
1999	12,500,000	2,500,000	15,864,000		400,000	2,575,000	33,839,000
2000	100,000,000	16,400,000	24,699,000		611,000	--	141,710,000
2001	43,800,000	3,300,000	32,719,000		300,000	1,040,000	81,159,000
2002	--	5,700,000	26,655,000		250,000	1,450,000	34,055,000
2003	--	--	38,839,332		315,000	--	39,154,332
2004	17,700,000	6,215,000	177,440,081		4,991,434	2,760,000	209,106,515
2005	28,000,000	16,700,000	301,011,469		856,500	1,350,000	347,917,969
2006	31,200,000	26,183,280	420,759,203		1,566,000	15,985,000	495,693,483
2007	41,374,880	30,766,902	239,931,040		1,320,500	5,385,000	318,778,322
2008	45,000,000	24,000,000	319,702,594		205,113	7,260,000	396,167,707
2009 ^b	29,000,000	17,500,000	277,020,142	225,250	270,000	6,800,000	330,815,392
2010	42,000,000	16,300,000	225,793,300	200,000	--	9,000,000	293,293,300
2011	48,590,865	41,657,000	170,931,851	250,000	902,480	9,560,000	271,892,196
2012	35,234,500	62,184,000	235,642,406	--	5,290,870	4,021,544	342,373,320
2013	W	57,119,121	258,130,353	295,000	1,831,369	W	358,775,844
2014	W	W	199,909,824	700,000	756,495	--	281,735,787
2015 ^c	W	W	188,226,940	--	--	--	309,938,884
TOTAL	\$ 1,096,081,545	\$ 566,658,439	\$ 3,814,512,865	\$ 1,670,250	\$ 42,749,261	\$ 120,511,544	\$ 5,885,665,317

^a Polymetallics category added in 1986.^b Gemstone development category added in 2009.^c Significant development expenditures were not reported for precious metals in 2015.

-- = Not reported

W = Figures withheld for confidentiality purposes. Expenditures are incorporated into the state total.

Table 10. Estimated mineral production in Alaska, 2013–2015^a.

Metals	2013	2014	2015	2013	2014	2015
Gold (ounces)	1,022,987	948,547	873,984	\$ 1,551,921,325	\$ 1,201,239,753	\$ 1,013,875,933
Silver (ounces)	13,453,367	15,388,901	15,147,249	320,121,318	304,392,456	237,508,864
Copper (tons)	38.62	--	--	278,591	--	--
Lead (tons)	126,707	155,183	151,247	245,811,580	294,847,225	245,126,547
Zinc (tons)	665,318	716,781	686,938	1,157,653,320	1,404,890,368	1,204,315,037
Platinum (ounces)	--	--	--	--	--	--
Subtotal				\$ 3,275,786,134	\$ 3,205,369,802	\$ 2,700,826,381
Gemstones and semi-precious stones						
Gemstones and semi-precious stones				\$ 1,900,000	\$ 120,000	\$ -
Subtotal				\$ 1,900,000	\$ 120,000	\$ -
Industrial Minerals						
Sand and gravel (million tons) ^c	7.8	0.5	5.7	\$ 79,589,173	\$ 6,837,950	\$ 17,176,622
Rock (million tons)	0.4	1.1	--	5,469,480	17,218,014	--
Subtotal				\$ 85,058,653	\$ 24,055,964	\$ 17,176,622
Coal and Peat						
Coal (tons) ^d	1,600,000	1,500,000	1,177,390	\$ 56,000,000	\$ 52,500,000	\$ 41,208,650
Peat (cubic yards) ^d	--	2,461	--	--	36,915	--
Subtotal				\$ 56,000,000	\$ 52,536,915	\$ 41,208,650
TOTAL				\$ 3,418,744,786	\$ 3,282,082,681	\$ 2,759,211,653

^a Production data from DGGS questionnaires, Internet research, interviews with operators, DOT&PF, and municipalities, regional corporations, and Federal land management agencies.^b Values for selected metal production were based on average prices for each year (unless other values were provided by the operator). Industrial minerals value for 2015 is based on Alaska DNR regional sale prices.^c Industrial minerals (rock, sand, and gravel) values are combined into the sand and gravel category in 2015.^d Coal and peat production values are combined in 2012 and 2013.

PRODUCTION

I. Northern Region

1. Red Dog Mine—Teck Alaska Inc.—zinc, lead, silver (germanium, indium, cadmium)
2. Chandalar placer mine—Gold-rich NyacAu Placer LLC—gold

II. Western Region

3. Hogatza placer mine—Taiga Mining Co.—gold

III. Eastern Interior Region

4. Fort Knox mine—Fairbanks Gold Mining Inc.—gold
5. Pogo Mine—Sumitomo Metal Mining Pogo LLC—gold
6. Usibelli Coal Mine—Usibelli Coal Mine Inc.—coal

IV. South-Central Region

V. Southwestern Region

VI. Alaska Peninsula Region

VII. Southeastern Region

7. Kensington—Coeur Alaska Co.—gold
8. Greens Creek Mine—Hecla Greens Creek Mining Co.—silver, gold, lead, and zinc

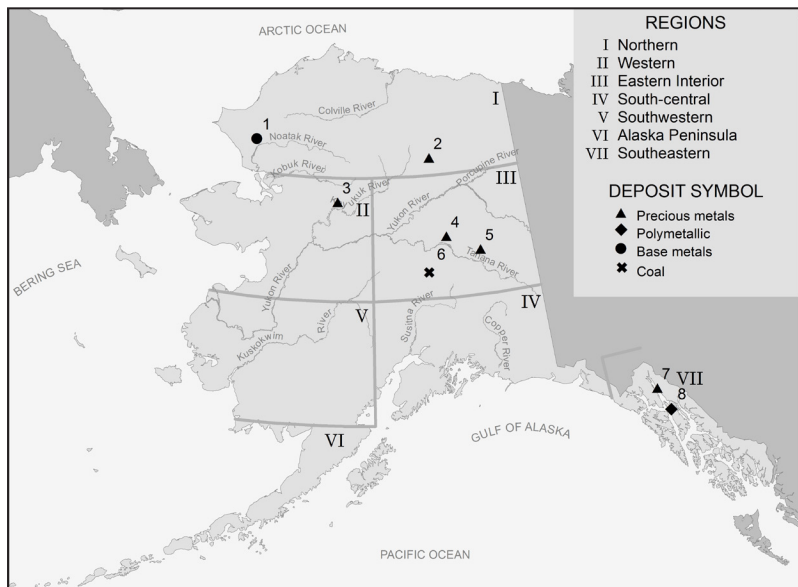


Figure 7. Selected production projects in Alaska, 2015.

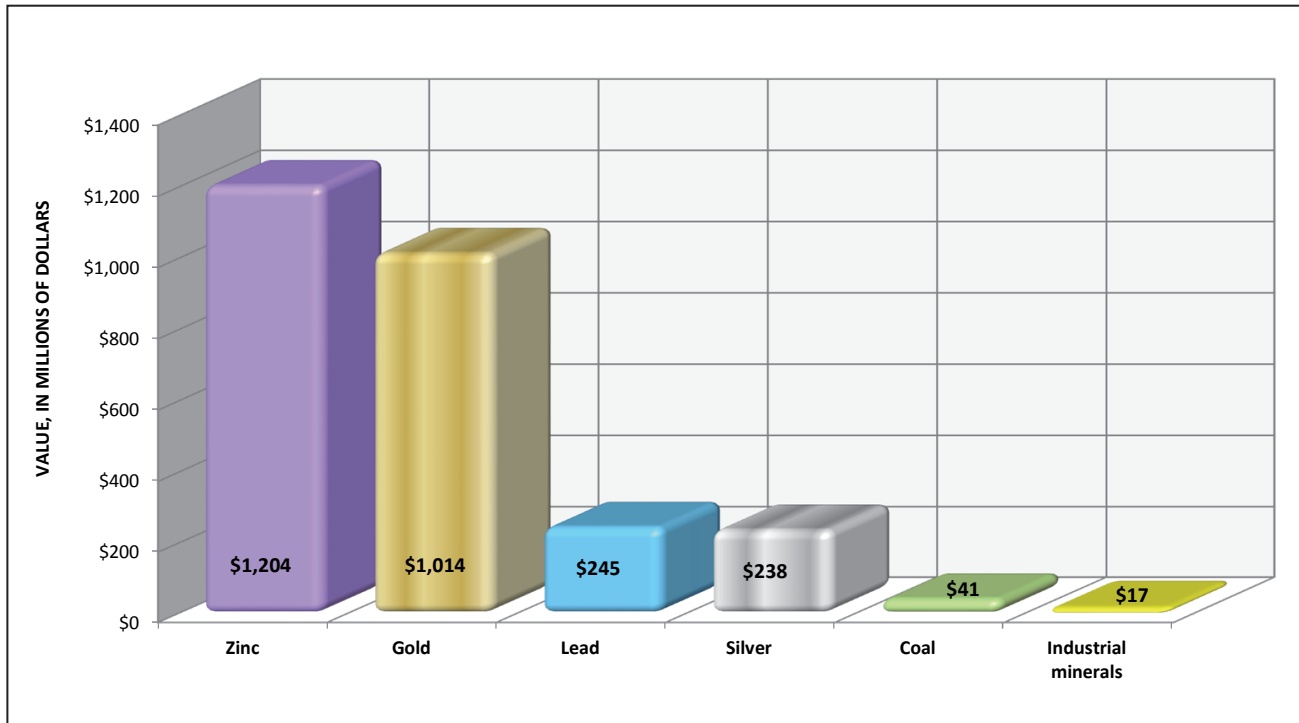


Figure 8. Estimated 2015 mineral production in Alaska by commodity.

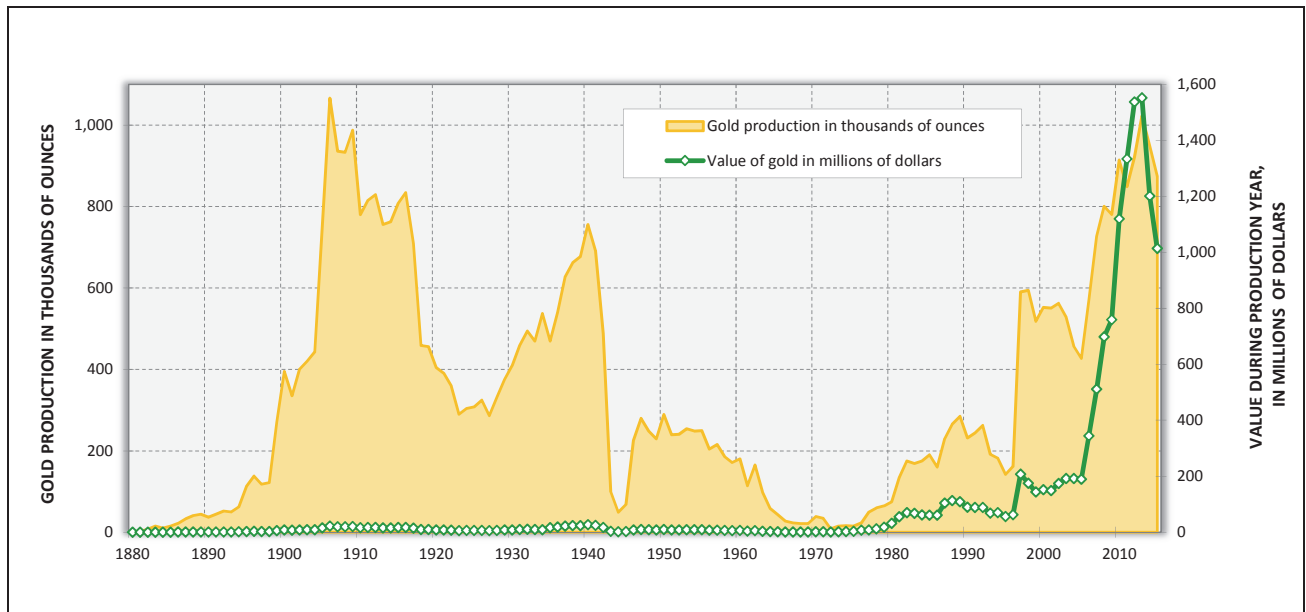


Figure 9. Historical gold production in Alaska, 1880–2015, and corresponding market value.



Photo 11. Small, floating “New Zealand-style” washplant from placer operation in south-central Alaska. Washplant functions similarly to the old-style bucket-line dredges, except these are usually fed via an excavator instead of a bucket line. This style of operation can reduce the amount of equipment involved to only a dozer, excavator, and the washplant; however, a good sized pond system and fairly wide valley are needed to lay out the system. PHOTO PROVIDED BY DNR, DIVISION OF MINING, LAND & WATER.

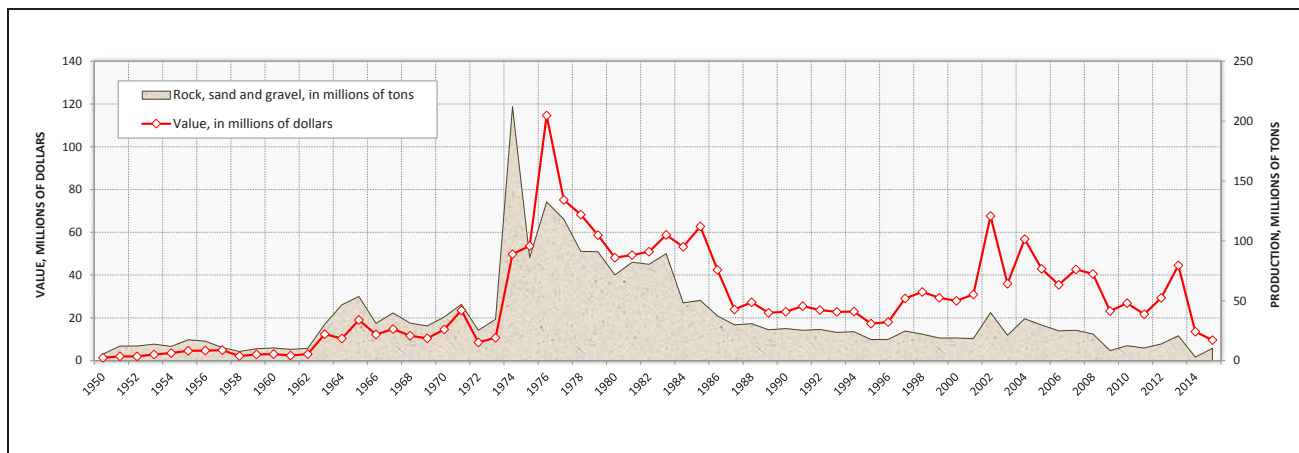


Figure 10. Rock, sand, and gravel production in Alaska, 1950–2015, and corresponding market value.

(table 11), of which the Northern region accounted for 62 percent of industrial minerals sold in the state. MSHA reported 173 full-time-equivalent jobs in the industrial materials sector in 2015. The 2015 production volume, value, and employment figures should be considered minimum estimates due to reporting shortfalls. These figures do not account for significant production of industrial minerals on private, Native, and Federal lands.

Alaska's Office of International Trade reported that Alaska shipped mineral ores and concentrates, metal ores and concentrates, and coal to at least 11 other countries in Europe, Asia, and North America in 2015. The Alaska 2015 export value was \$1.48 billion, down 17 percent from 2014 (table 12). Total exports include copper-gold concentrates from the Minto Mine in Yukon Territory, Canada, which were shipped through the AIDEA-owned terminal in Skagway, and coal exported through the Alaska-Railroad-owned coal-loading facility in Seward. Coal production declined by approximately 323,000 tons or 22 percent in 2015 (figure 11), primarily due to a reduction in coal exports. In the past decade, the value of coal exports has decreased 85 percent from the high of \$33 million in 2009 to \$5 million in 2015. The Usibelli Coal Mine section contains additional information about the decrease in exports and impacts to the mine.

Red Dog Mine

Red Dog Mine is one of the world's largest zinc mines, both in terms of resources and annual zinc production (table 13). Red Dog resources represent 3 percent of the world's resources and Red Dog reserves equate to 28 percent of world reserves. Red Dog Mine, located in northwestern Alaska, comprises three sediment-hosted zinc-lead sulfide deposits, which form relatively flat-

lying, lens-shaped ore bodies in thrust-fault-stacked slices: Main, Aqqaluk, and Qanaiyaq. The deposits are hosted in Mississippian- to Pennsylvanian-age marine clastic rocks and lesser chert and carbonate rocks. Sphalerite, pyrite, marcasite, and galena primarily occur in semi-massive to massive, fragmental, and vein textures and, rarely, as sulfide-sedimentary layering. Massive barite is common in and above the sulfide deposits.

Red Dog is operated by Teck Alaska Inc., and is 100 percent owned and operated by Teck Resources Ltd., under a partnership agreement with landowner NANA Regional Corp. Inc. (NANA). In accordance with the operating agreement between Teck and NANA governing the Red Dog mine, Teck pays NANA a 30 percent royalty on net proceeds of production. This royalty increases by 5 percent every fifth year to a maximum of 50 percent, with the next adjustment in October 2017. The NANA royalty charge in 2015 was \$137 million, compared with \$195 million in 2014.

Red Dog is a conventional open-pit mine utilizing a drill, blast, shovel, and truck mine cycle. To blend different ore types prior to milling, Red Dog uses a large, managed stockpile, which applies conventional grinding and sulfide flotation methods to produce zinc and lead concentrates. Outgoing concentrates and incoming fuel and supplies are transported through the Alaska Industrial Development and Export Authority (AIDEA)-owned DeLong Mountain Transportation System (DMTS), which includes a 52-mile-long road, concentrate and fuel storage, and shallow-water port facilities on the Chukchi Sea. Since inception AIDEA has received more than \$443 million in user fees for the DMTS; the port has an approximately 100-day annual shipping season. Highlights for 2015 at Red Dog

Table 11. Material (rock, sand, and gravel) sale volumes (in tons) by region reported on State-owned land, excluding Mental Health Trust lands and lands managed by the State Pipeline Coordinator's Office, for 2011–2015. These volumes do not include material produced from private, Native, or Federal lands, which are significant amounts. These figures serve as minimum amounts of material produced.

Region	2011	2012	2013	2014	2015
Northern (Fairbanks office)	2,890,304	3,501,387	4,991,349	9,247,223	3,559,580
South-Central (Anchorage office)	70,410	1,035,450	235,050	433,433	2,115,750
Southeast (Juneau office)	77,940	56,115	69,866	62,559	50,211
Total	3,038,654	4,592,952	5,296,265	9,743,214	5,725,541

Source: Department of Natural Resources, Division of Mining, Land and Water Southeast Regional Office (SERO), South-Central Regional Office (SCRO), and Northern Regional Office (NRO) Material Sale Tracking Spreadsheets. Prepared by Zoya Ponomareva.

^a DNR material sales volumes and revenues do not correlate, as volumes are attributed to the calendar year in which material was extracted while revenues are tracked on a cash basis (when received), which could be in the subsequent calendar year.

Table 12. Alaska international mineral export values (in millions of dollars).

Year	Mineral Ores and Concentrates ^a	Canada Copper Ores Through Skagway Terminal ^b	Precious Metals ^c	Coal ^d	Total Value of Mineral Exports
1996	\$249	--	> \$1	\$27	\$276
1997	369	--	> \$1	26	395
1998	317	--	> \$1	8	325
1999	359	--	> \$1	15	374
2000	293	--	1	16	310
2001	329	--	3	17	349
2002	380	--	47	9	436
2003	413	--	84	4	501
2004	505	--	110	14	629
2005	511	--	132	14	657
2006	1,094	--	110	10	1,214
2007	1,269	16	132	5	1,406
2008	691	103	144	23	858
2009	853	64	153	33	1,039
2010	1,336	37	214	25	1,575
2011	1,809	199	267	31	2,107
2012	1,502	169	84	32	1,618
2013	1,495	150	22	27	1,543
2014	1,750	186	11	17	1,778
2015	1,467	99	7	5	1,479

Sources: 1996–2013, U.S. Census Bureau, Origin of Movement Series; 2014–2015, Alaska Office of International Trade

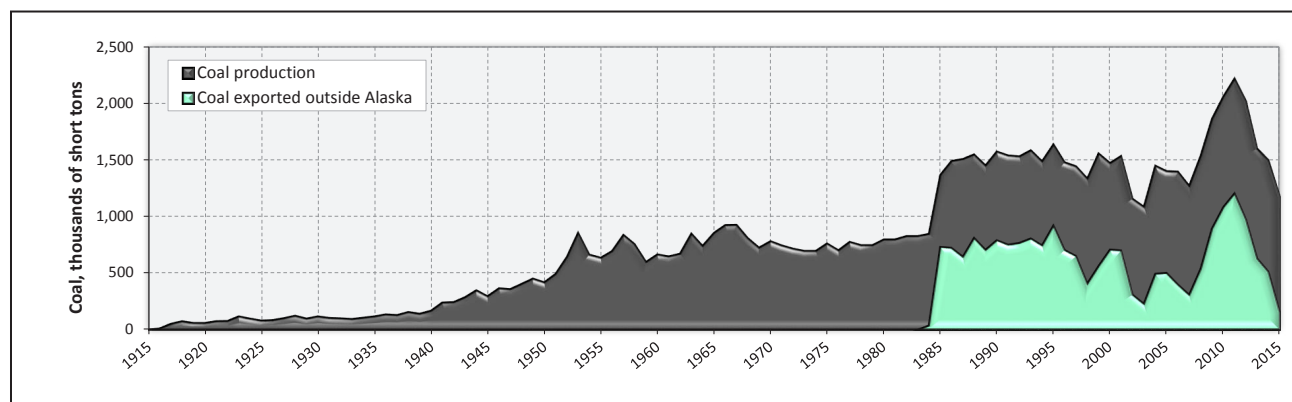
^a HS 26 Mineral Ores: Zinc ores and concentrates, lead ores and concentrates, copper ores and concentrates, silver ores, gold ores and concentrates, zirconium ore (only in 2009), and miscellaneous ores.

^b Value of Canada copper ores moving through Skagway that are included in Mineral Ores and Concentrates values

^c HS 71 Precious Metals: Gold doré, precious stones, and wrought jewelry

^d HS 27 Coal

Figure 11. Alaska coal production and exports, 1915–2015.



include initiation of a geosynthetic/composite pilot test of a conceptual design plan for covering the entire main waste stockpile surface (photo 12), and drilling 20 holes, totaling approximately 9,547 feet, in the Aqqaluk pit: 12 holes (4,216 feet) for geotechnical purposes and eight (5,331 feet) for resource infill and confirmation.

In 2015 Teck reported 62.4 million tons of proven and probable reserves at Red Dog Mine with an average grade of 14.6 percent zinc, 4.1 percent lead, and 2.15 ounces of silver, in a total identified resource of 62.6 million tons at 14.6 percent zinc, 4.1 percent lead, and 2.15 ounces of silver per ton (appendix D). Red Dog dominates Alaska's mineral-production value, as it has for a quarter century, accounting for approximately 51 percent of the entire value of Alaska's 2015 mineral

production. In 2015 Red Dog mined 3.89 million tons of ore, milled 4.44 million tons of ore, and produced 625,004 tons of zinc concentrate and 129,630 tons of lead concentrate. Annual average prices in 2015 for zinc were \$0.88 per pound. In 2015 Red Dog provided more than 630 full-time-equivalent jobs. Teck projects Red Dog's production of contained metal in 2016 will be between 600,800 and 628,300 tons of zinc and approximately 126,800 to 132,300 tons of lead. Most ore mined in 2016 is anticipated to come from the south wall of the Aqqaluk pit; minor ore from the Qanaiyaq pit may be processed through the mill during the latter part of 2016. Projected 2016 capital costs for Red Dog are approximately \$35 million, and projected cash operating costs for Red Dog are approximately \$230 million, not including transportation or royalties.

Table 13. Red Dog Mine production statistics, 1989–2015^a.

Year	Tons Milled	Ore Grade			Total Tons Concentrate Produced ^b	Contained Tons Zinc	Contained Tons Lead	Million Ounces Silver ^c	Employees
		Zinc (%)	Lead (%)	Silver (oz/ton)					
1989	33,300	20.4	7.6	3.6	8,532	--	--	--	228
1990	996,700	26.5	8.5	3.6	443,600	191,981	31,187	1.6	350
1991	1,599,300	22.5	6.6	2.8	521,400	234,510	43,815	1.46	331
1992	1,582,000	19.9	6.0	2.9	474,900	231,363	15,960	1.38	349
1993	1,874,600	18.4	5.7	2.8	539,800	255,149	24,788	1.51	376
1994	2,339,500	18.8	5.7	2.8	658,000	328,160	32,775	1.84	391
1995	2,485,900	19.0	5.8	2.8	753,600	358,676	55,715	3.62	397
1996	2,312,600	18.7	5.0	2.8	765,300	357,680	65,886	4.3	417
1997	2,127,000	20.3	5.2	2.9	799,400	373,097	69,284	4.27	479
1998	2,752,587	21.4	5.2	2.7	1,015,773	490,461	80,193	5.2	466
1999	3,282,788	21.3	5.2	2.7	1,207,160	574,111	97,756	6.21	539
2000	3,365,508	21.0	4.7	2.5	1,211,539	585,030	91,557	5.84	536
2001	3,560,430	19.8	5.0	2.5	1,215,837	570,980	105,000	5.9	559
2002	3,489,600	21.1	5.4	2.7	1,366,480	637,800	118,880	6.75	560
2003	3,476,689	21.7	6.2	3.1	1,410,892	638,569	137,679	7.7	388
2004	3,249,613	22.0	6.0	3.0	1,337,545	610,900	128,970	7.22	508
2005	3,402,831	21.7	5.6	3.0	1,330,717	626,112	112,766	1.97	449
2006	3,569,280	20.6	6.1	3.0	1,378,384	614,538	136,135	7.62	457
2007	3,726,910	20.2	6.1	3.1	1,428,014	633,511	146,152	11.55	459
2008	3,306,934	20.1	6.0	3.1	1,273,885	567,911	135,143	7.5	475
2009	3,729,119	20.9	5.9	3.1	1,445,870	642,096	144,954	8.12	413
2010	3,937,456	18.2	5.4	3.1	1,300,694	593,043	121,144	6.78	550
2011	4,048,000	19.1	5.0	3.0	1,182,060	572,208	84,033	5.19	586
2012	3,941,000	18.2	4.6	3.0	1,134,415	529,157	95,282	5.89	530
2013	4,243,899	17.0	3.9	NA	1,271,221	607,704	106,594	6.1	550 ^d
2014	4,739,302	16.6	4.4	NA	1,409,511	656,971	135,032	7.56	639 ^d
2015	4,437,950	14.1	2.9	NA	1,351,221	625,004	129,630	6.7	630 ^d
TOTAL	81,610,796				28,235,750	13,106,722	2,446,309	139.78	

^a Revised slightly from Special Report 51, *Alaska's Mineral Industry 1995*, based on new company data.

^b Totals for years 1990 through 1995 include bulk concentrate. Total for 2013 estimated from total metal produced for 2013.

^c Estimate calculated at 56 ounces per ton of lead metal produced to from 1990 to 2004 and 2006; as reported credit for 2005, net of treatment charges; calculated at 3.1 ounces per ton of ore for 2007; estimated as proportional with increase in zinc and lead in 2013; as reported in 2014; calculated based on recoverable silver from reported lead concentrate recovered in 2015.

^d Value reported by Department of Natural Resources

-- = No concentrate produced

NA = Not available



Looking N at SW corner of Main Waste Dump



Exploded view of SW corner

Photo 12. Teck initiated a geosynthetic/composite pilot test in 2015 to cover waste stockpiles. PHOTO FROM 4TH QUARTER & ANNUAL REPORT 2015 TO THE STATE OF ALASKA, POSTED ON STATE OF ALASKA, DEPARTMENT OF NATURAL RESOURCES, LARGE MINE PERMITTING WEBSITE, [HTTP://DNR.ALASKA.GOV/MLW/MINING/LARGEMINE/REDDOG/PDF/RD4Q2015_2016AR.PDF](http://DNR.ALASKA.GOV/MLW/MINING/LARGEMINE/REDDOG/PDF/RD4Q2015_2016AR.PDF). LAST ACCESSED ON OCTOBER 19, 2016.

Fort Knox Mine

Fort Knox Mine, operated by Fairbanks Gold Mining Inc., a wholly-owned subsidiary of Kinross Gold Corp., is approximately 25 miles northeast of Fairbanks, on primarily State of Alaska and private lands. The deposit is hosted in the multi-phase Fort Knox pluton, with gold occurring as grains ranging from <0.1 mm up to 2 mm on the margins of stockwork and sheeted quartz ± potassium-feldspar veins, veinlets, and quartz-filled shears. Sulfide minerals are rare (less than 0.1 percent) and consist mainly of bismuthinite and minor arsenopyrite as well as several varieties of bismuth-tellurium minerals, pyrite, pyrrhotite, scheelite, and molybdenite. The pluton and alteration are coeval at approximately 92 million years old, and the deposit is oxidized to the depth of drilling.

Fort Knox is an open-pit, truck-and-shovel operation using carbon-in-pulp (CIP), heap leach, and gravity processes to recover gold (photo 13). Production began in November 1996, and Kinross acquired 100 percent interest in the mine in 1998. Highlights of 2015 activities include completion of Stage 5 of the Walter Creek heap leach facility, a 14-foot raise to the tailings storage facility dam, and various reclamation activities. Phase 8 stripping activities continued, and mining of Phase 8 ore was initiated. In December the mine achieved 2 million safe hours worked. Total employment at Fort Knox was 657 full-time-equivalent positions. Fort Knox reported capital expenditures of \$140.8 million during 2015. Production increased compared with 2014, which is primarily attributed to higher mill grades; late in the

year mining transitioned into an area with lower grades. In 2015, 60.86 million tons of ore and waste were mined, with an average production rate of 166,700 tons per day. Mill throughput was 14.82 million tons, and 27.7 million tons were added to the Walter Creek heap leach. Combined 2015 gold recovery from the mill and heap leach was 401,553 ounces (table 14).

At the end of 2015, the total identified resource is 284.4 million tons at 0.013 ounce per ton, containing 1.9 million ounces of gold (appendix D); within that resource there are 162.4 million tons of reserves at 0.012 ounce of gold per ton, sufficient to carry the current mine plan into 2020. The planned final year for ore processed through the Fort Knox mill is 2018; after that time, all of the run-of-mine ore and ore stockpiles will be stacked on the Walter Creek heap leach. In 2016 mining is scheduled to continue in the Phase 8 final pit layback area with delivery of ore to the mill and the leach pad from 2015 until mining activities end in 2019. Projected mill throughput for 2016 is approximately 14.6 million tons with production of an estimated 246,000 ounces of gold; heap leach ore placement is projected to be 29.8 million tons with production of an estimated 142,000 ounces of gold.

Pogo Mine

The Pogo underground gold mine and associated facilities (photo 14) are 38 miles northeast of Delta Junction on land owned by the State of Alaska. Access to the mine is via a 49 mile all-season road from the Richardson Highway. Sumitomo Metal Mining Pogo

Table 14. Fort Knox Mine production statistics, 1996–2015.

Year	Tons mined (ore + waste)			Tons milled (ore)			Tons placed on heap leach ^b	Ounces Gold Produced	Employees
	Fort Knox	True North ^a	Total	Fort Knox	True North ^a	Total			
1996	16,684,000	0	16,684,000	769,700	0	769,700		16,085	243
1997	32,380,000	0	32,380,000	12,163,151	0	12,163,151		366,223	249
1998	33,294,000	0	33,294,000	13,741,610	0	13,741,610		365,320	245
1999	30,350,000	0	30,350,000	13,819,010	0	13,819,010		351,120	253
2000	35,600,000	0	35,600,000	15,000,000	0	15,000,000		362,929	253
2001	25,957,900	8,448,400	34,406,300	13,282,614	2,377,386	15,660,000		411,220	360
2002	24,583,500	11,461,000	36,044,500	11,887,200	3,371,800	15,259,000		410,519	360
2003	30,597,940	12,707,100	43,305,040	11,473,000	3,611,682	15,084,682		391,831	316
2004	44,187,000	3,763,000	47,950,000	12,917,966	1,675,854	14,593,820		338,334	427
2005	63,248,000	0	63,248,000	14,384,842	0	14,384,842		329,320	411
2006	51,070,000	0	51,070,000	14,839,297	0	14,839,297		333,383	406
2007	45,940,000	0	45,940,000	14,021,400	0	14,021,400		338,459	399
2008	46,300,000	0	46,300,000	15,110,000	0	15,110,000		329,105	449
2009	27,585,000	0	27,585,000	17,884,000	0	17,884,000		263,260	500
2010	42,400,000	0	42,400,000	14,560,000	0	14,560,000		349,729	525
2011	34,550,000	0	34,550,000	14,880,000	0	14,880,000		289,794	522
2012	63,120,000	0	63,120,000	14,550,000	0	14,550,000		359,948	565
2013	63,280,000	0	63,280,000	13,960,000	0	13,960,000		428,822	629
2014	49,240,000	0	49,240,000	14,920,000	0	14,920,000	28,500,000	387,285	649
2015	60,860,000	0	60,860,000	14,820,000	0	14,820,000	27,700,000	401,553	657
TOTAL	821,227,340	36,379,500	857,606,840	268,983,790	11,036,722	280,020,512	160,600,000	6,824,239	

^a True North Mine started production in 2001 and suspended production in 2004.

^b Walter Creek Heap leach facility started production in 2009, but was not tracked until 2014. Total includes 104.4 million tons placed on heap leach from 2009 through 2013.



Photo 13. View of Fort Knox Mine's open pit and conveyor system. PHOTO FROM KINROSS GOLD CORP. WEBSITE, [HTTP://S2.Q4CDN.COM/496390694/FILES/IMAGES/MEDIA_GALLERY/FORTKNOX/FORT-KNOX-CONVEYOR.JPG](http://S2.Q4CDN.COM/496390694/FILES/IMAGES/MEDIA_GALLERY/FORTKNOX/FORT-KNOX-CONVEYOR.JPG). LAST ACCESSED ON OCTOBER 19, 2016.

LLC (SMM Pogo) operates Pogo Mine on behalf of owners Sumitomo Metal Mining Co. Ltd. (85 percent) and Sumitomo Corp. (15 percent). Pogo utilizes spiral ramps and declines to access the ore, and cut-and-fill drift mining methods. A covered conveyor system feeds ore from the mine to the conventional SAG (semi-autogenous grinding) and ball mill grinding circuit, gravity circuit, and then to flotation and CIP (carbon-in-pulp) cyanidation processes. The mill treats approximately 2,500 tons per day.

The Pogo deposit consists of three distinct zones: the Liese, East Deep, and North Zone vein systems. The Liese and East Deep consist of stacked, shallow-dipping quartz veins, whereas the North Zone veins are steep and could be feeders to the Liese and East Deep. Individual veins range from 0 to 65 feet thick and have a variety of quartz vein filling and replacement textures, suggesting multiple episodes of mineralization. Gold occurs as 1–25 micron grains in arsenopyrite, along fractures, and as inclusions in native bismuth and other

gold–lead–bismuth–tellurium minerals. The age of the mineralization overlaps with nearby granitic intrusions at around 104 million years. There is lack of consensus over the origin of the veins, with evidence for both orogenic-vein and deep-seated intrusion-related-vein genesis.

SMM Pogo produced 283,000 ounces of gold in 2015 (table 15). All ore was produced from the East Deep zone, where ore grades matched or exceeded expectations, but unanticipated faults and fractures required additional ground control. Pogo reported having 350 full-time-equivalent employees on site in 2015. In September 2015 Sumitomo Metal Mining Pogo LLC announced a major milestone—their 3 millionth ounce of gold production at Pogo. In 2015 Pogo completed their \$18 million Water Treatment Plant 3 capital project, which will enhance Pogo's ability to stabilize discharge by being able to treat 74 million gallons of water per year. Pogo also completed their 2012–2015, \$36 million project to develop the East Deep ore body; mining of ore



Photo 14. View of Pogo Mine from the mine access road. PHOTO PROVIDED BY LORNA SHAW, SMM POGO.

Table 15. Pogo Mine production statistics, 2006–2015.

Year	Tons Ore Mined	Tons Ore Milled	Ounces of Gold Recovered	Recovery (%)	Head Grade Gold (oz/ton)	Employees ^a
2006	447,129	338,000	113,364	85.0	0.395	477
2007	715,665	715,400	259,820	84.4	0.430	339
2008	882,400	818,237	347,219	83.8	0.506	285
2009	944,823	930,836	389,808	88.2	0.475	272
2010	900,585	947,189	383,434	89.6	0.452	300
2011	892,725	929,020	325,708	89.6	0.392	310
2012	815,922	875,351	315,886	89.7	0.402	335
2013 ^b	963,229	875,351	337,393	90.2	0.395	320
2014	972,406	967,230	342,147	89.0	0.396	320
2015 ^c	--	--	283,000	--	--	350
TOTAL	7,534,884	7,396,614	3,097,779			

^a Includes contract employees; calculated as 11-hour days, 260 employee-days per year.

^b Silver production of 32,000 ounces was reported in 2013.

^c Production figures as reported by DNR, last accessed on 10/6/2016.

<http://dnr.alaska.gov/mlw/mining/largemine/pogo/>

-- = Not reported

from East Deep began in 2013. In 2015 Pogo completed construction of a paste backfill line and 14-foot-wide ventilation shaft from 1170 ramp to the surface near the 2150 portal. In August 2015 Pogo mine announced working more than 2 years without a lost-time injury.

Usibelli Coal Mine

Usibelli Coal Mine Inc. is a local, family-owned coal mining company in production since 1943, with 112 full-time-equivalent employees. The company mines coal from the Miocene Suntrana Formation from leases on State-owned lands in the Healy area. Usibelli has approximately 140 million tons of reserves on State leases. The main leases are in the Hoseanna Creek and Jumbo Dome areas. There are four active and past resources: Poker Flats produced about 27 million tons of coal since the 1970s and the site is now in full reclamation; Gold Run Pass, which is near the end of the reclamation process; Two Bull Ridge, which has 15 million tons of reserves with 3.5–8 cubic yards of overburden for each ton of coal, and multiple seams with the number 4 seam up to 32 feet thick; and Jumbo Dome with 83 million tons of reserve, and the number 4 seam 40 feet thick. All coal is subbituminous, low-sulfur coal.

Usibelli produced coal from its Two Bull Ridge and Jumbo Dome sites near Healy, with an output of 1,177,390 tons in 2015, down from 1.5 million tons in 2014. The majority of the coal is used for in-state

electrical power generation at seven Interior coal-fired power plants, with lesser amounts exported through the Alaska Railroad Corporation's export facility in Seward, which is operated by Aurora Energy Services LLC, a subsidiary of Usibelli. In 2015, 150,000 tons of coal were exported to Japan, but no shipments were made to other regular customers in Chile or South Korea. In the last quarter of 2015, exports stopped and the coal-loading facility was put into temporary closure status. Company officials attribute low export demand and a drop in price for Alaska coal to an oversupply in the global market as well as the strength of the U.S. dollar. Golden Valley Electric Association (GVEA), one of Usibelli's primary customers, is in the process of commissioning the Healy Number 2 power plant, a 50-megawatt, coal-fired electrical plant at the mouth of the Usibelli mine, which is expected to become fully operational in 2016 and is projected to use about 200,000 tons of coal per year. This increase in coal demand is partially offset by a predicted 55,000-ton decrease in coal consumption by the U.S. Air Force, as they plan to phase out their coal-fired power plant in Clear.

Kensington Mine

The Kensington underground gold mine and associated facilities are located in the Berners Bay mining district, about 45 miles north–northwest of Juneau. The project is owned and operated by Coeur Alaska Inc., a subsidiary of Coeur Mining Inc. Kensington is on private and U.S. Forest Service lands in the City and Borough of

Juneau, and access to the mine is by air or sea. Coeur Alaska controls two contiguous land groups: the Kensington and Jualin properties. Each property consolidates several historical mines and prospects that comprise the northwestern extent of the Juneau gold belt. Kensington mine began modern commercial production in 2010. The underground mine is accessed by a horizontal tunnel, and mining is accomplished by underground long-hole stoping and drift-and-fill methods (photo 15). Ore is processed in a flotation mill that produces a gold-bearing concentrate.

The Kensington ore deposit consists of multiple mesothermal quartz, carbonate, and pyrite vein swarms and discrete quartz–pyrite veins hosted in the Cretaceous Jualin diorite. Structure in the area is dominated by the Gastineau shear zone to the southwest, and the Kensington shear zone, which passes through the mine area. The gold occurs as native grains in quartz veins and is associated with pyrite and various gold–telluride minerals. Both shear-hosted and extensional quartz vein arrays are common at Kensington and form roughly north–south-trending zones that dip steeply east, although individual vein sets in the zones can dip at low angles, sub-parallel to the broader zones. The mineralization is approximately 55 million years old.

Coeur reported development capital expenditures of \$9.0 million for 2015. Approximately 669,837 tons of ore were mined, 659,786 tons were milled, and about 128,865 ounces of gold were produced from 21,829 tons of concentrate that were shipped to an off-site refinery (table 16). The gold output made this the best year of production from the main deposit at adjusted costs applicable to sales per ounce of gold of \$798—the lowest since operations began in 2010. As of December 31, 2015, Coeur reported proven and probable reserves of

2.8 million tons of ore at 0.198 ounce of gold per ton with 560,000 ounces of contained gold out of a total identified resource, inclusive of the proven and probable reserves, of 6.7 million tons at 0.263 ounce of gold per ton (appendix D). Coeur employed 332 full-time-equivalent employees at Kensington as of the end of 2015.

Highlights of 2015 activity at Kensington include the addition of ore-sorting technology to the mill flow sheet in November to improve recovery rates going forward. Payback of this \$1.8 million capital investment is expected to be achieved in the second quarter of 2016. Coeur also produced an initial resource estimate for the Jualin deposit at Kensington, and development of the high-grade deposit remains on schedule. The decline (ramp) length was increased by more than 2,000 feet, representing nearly 30 percent of the total required development to reach the ore body.

Jualin's inferred resource of 289,000 tons at 0.619 ounce of gold per ton is much higher grade than the average grade at Kensington. Permitting is underway for underground development at Jualin to provide access to underground drill stations. Drilling at Jualin to increase confidence levels of the existing Jualin resource and to expand the size of the ore body is expected to continue in 2016, with initial production expected in 2017. Coeur also plans to release a rescoped mine plan reflecting expected higher-grade, higher-margin production over an extended mine life at Kensington. Coeur projects that in 2016 Kensington will produce 115,000 to 125,000 ounces of gold at costs applicable to sales per ounce of gold of \$825 to \$875. Capital expenditures are estimated to be approximately \$30 million, focused on underground development of the Jualin deposit, further development of the Kensington and Raven ore bodies, and capitalized exploration.

Table 16. Kensington Mine production statistics, 2010–2015.

Year	Ore (tons milled)	Ore grade gold (ounce/ton)	Gold Recovery (%)	Gold produced (ounces)
2010 ^a	174,028	0.28	89.9	43,143
2011	415,340	0.23	92.7	88,420
2012	394,780	0.22	95.6	82,125
2013	553,717	0.21	96.6	114,821
2014	635,960	0.20	94.1	117,823
2015	659,786	0.20	94.9	128,865
TOTAL	2,833,611			575,197

^a Production started July 3, 2010



Photo 15. A roof bolter used underground at Kensington Mine to secure the roof. PHOTO PROVIDED BY COEUR ALASKA INC.

Greens Creek Mine

Greens Creek Mine, one of the world's largest and lowest-cost primary silver mines, is owned by Hecla Mining Co. (100 percent ownership since 2008) through its wholly-owned subsidiary, Hecla Greens Creek Mining Co. The mine opened in 1989 and, except for an approximately 2-year hiatus, has been in continuous operation since. Greens Creek Mine is in southeastern Alaska, in the Tongass National Forest on Admiralty Island, approximately 18 miles southwest of Juneau, on U.S. Forest Service and private patented land in the City and Borough of Juneau, which is completely enclosed within Admiralty Island National Monument. Access to the mine is by sea, then a 13-mile access road up from the port site.

The Greens Creek deposit is a polymetallic, stratiform, volcanogenic massive-sulfide deposit hosted by predominantly marine sedimentary, and Late Triassic mafic to ultramafic volcanic and plutonic rocks, which have been subjected to multiple periods of deformation.

Mineralization is present most often along the contact between a structural hanging wall of quartz–mica–carbonate phyllites and a structural footwall of graphitic and calcareous argillite.

The underground mine is accessed by a ramp from the surface and produces approximately 2,100–2,300 tons of ore per day via cut-and-fill and longhole stoping (photo 16). Ore is processed with a SAG/ball mill grinding circuit, a gravity circuit to recover electrum (a gold–silver alloy in the ore), and floatation to recover base metals—a silver-rich lead concentrate, a zinc concentrate, and a zinc-rich polymetallic bulk concentrate. Stopes are backfilled with a combination of mill waste (tailings) and cement.

In 2015, Greens Creek produced a total of 8,452,153 million ounces of silver, exceeding the prior year's production by more than 625,000 ounces of silver (table 17). The mine also produced 60,566 ounces of gold, an increase of 3.1 percent over 2014; 61,934 tons of zinc;

Table 17. Greens Creek Mine production statistics, 1989–2015.

Year	Tons Milled	Tons Concentrate	Metal Produced				Employees	
			Tons Zinc	Tons Lead	Tons Copper ^a	Ounces Gold		Ounces Silver
1989	264,600	--	187,007	9,585	--	23,530	5,166,591	235
1990	382,574	--	37,000	16,728	--	38,103	7,636,501	265
1991	380,000	--	41,850	16,900	--	37,000	7,600,000	238
1992	365,000	113,827	40,500	16,500	--	32,400	7,100,000	217
1993 ^b	77,780	--	9,500	3,515	--	7,350	1,721,878	217
1994 ^c	--	--	--	--	--	--	--	--
1995 ^c	--	--	--	--	--	--	--	--
1996 ^b	135,000	43,000	9,100	4,200	193	7,480	2,476,000	265
1997	493,000	--	46,000	19,000	1,300	56,000	9,700,000	275
1998	540,000	--	58,900	22,700	1,300	60,572	9,500,000	275
1999	578,358	--	68,527	25,503	1,400	80,060	10,261,835	275
2000	619,438	--	84,082	31,677	1,400	128,709	12,424,093	275
2001	658,000	--	63,903	22,385	1,400	87,583	10,900,000	275
2002	733,507	217,200	80,306	27,582	1,600	102,694	10,913,183	262
2003	781,200	--	76,200	24,800	--	99,000	11,707,000	295
2004	805,789	--	69,115	21,826	--	86,000	9,707,000	265
2005	717,600	--	58,350	18,600	--	72,800	9,700,000	265 ^d
2006	732,176	--	59,429	20,992	--	62,935	8,865,818	245 ^e
2007	732,227	--	62,603	21,029	--	68,006	8,646,825	276 ^f
2008	734,910	--	58,224	18,562	--	67,269	7,145,711	336 ^g
2009	790,871	--	70,379	22,253	--	67,278	7,459,170	321 ^h
2010	800,397	--	74,496	25,336	--	68,838	7,206,973	343 ⁱ
2011	772,069	--	66,050	21,055	--	56,818	6,498,337	364 ^j
2012	789,569	--	64,249	21,074	--	55,496	6,394,235	386 ^k
2013	805,322	--	57,614	20,114	--	57,457	7,448,347	390 ^l
2014	816,213	--	59,810	20,151	--	58,810	7,826,341	415
2015	814,398	--	61,934	21,617	--	60,566	8,452,153	418
TOTAL	15,319,998	--	1,565,128	493,684	8,593	1,542,754	202,457,991	

^a No copper credits in 1989–1993 and 2003–2015.^b Partial-year production.^c No production in 1994 and 1995 due to mine closure.^d Fifteen of these employees were assigned to development effort.^e Fifty employees were assigned to development and reported in that section's employment.^f Forty-five employees were assigned to development and reported in that section's employment.^g Nineteen employees were assigned to development and reported in that section's employment.^h Eighty-five employees were assigned to development and reported in that sector's employment.ⁱ Seventy-nine employees were assigned to development and reported in that sector's employment.^j Nineteen employees were assigned to development and reported in that sector's employment.^k Thirty-nine employees were assigned to development and reported in that sector's employment.^l All employees were assigned to the production sector.

-- = Not reported

and 21,617 tons of lead. Hecla considers silver to be the primary product of Greens Creek and claims a cash cost of production, after byproduct credits, of \$3.91 per ounce of silver. As of December 31, 2015, Hecla reported proven and probable reserves of 7.2 million tons of ore at 12.3 ounces of silver per ton, 0.09 ounce of gold per ton, 3.0 percent lead, and 8.1 percent zinc containing 88.7 million ounces of silver, sufficient for a remaining mine life at Greens Creek of 10 years. The total identified resource, including proven and probable reserves, is 11.7 million tons at 12.3 ounces of silver per ton, 0.09 ounce of gold per ton, 2.9 percent lead, and 7.6 percent zinc, containing nearly 143 million ounces of silver (appendix D). Mine Safety and Health Administration (MSHA) reported 418 full-time-equivalent employees

at Greens Creek in 2015. In addition to reporting a banner production year, Greens Creek reported a very successful underground drilling program, adding new resources that are expected to replace mineral reserves over the next 2 years. Construction of the tailings expansion project continues, with approximately \$14 million being invested in this project in 2015. When completed, this project will result in an additional 10 years of tailings storage capacity. Production in 2016 is expected to be 8.3 million ounces of silver.

Chandalar Placer Mine

The Chandalar gold mine, centered on the Little Squaw placer gold deposit in northern Alaska, is operated by Goldrich NyaAu Placer LLC, a 50/50 joint venture be-



Photo 16. Greens Creek Mine reported a successful 2015 underground drilling program that added new resources expected to replace mineral reserves over the next two years. PHOTO FROM HECLA MINING COMPANY, [HTTP://WWW.HECLA-MINING.COM/WP-CONTENT/UPLOADS/2015/11/HECLA-GREENSCREEK-11_DSC2452.JPG](http://www.hecla-mining.com/wp-content/uploads/2015/11/HECLA-GREENSCREEK-11_DSC2452.JPG). LAST ACCESSED ON OCTOBER 20, 2016.

tween the Goldrich Mining Co. and NyacAu LLC (photo 17). In 2015, over 35 days in July/August, the joint venture partners removed overburden and produced 4,400 ounces of placer concentrate, which is expected to yield about 3,500 ounces of refined gold. To date, \$23 million has been invested to get the placer mine up and running. Resources are estimated to be 250,000 ounces of placer gold in a 10.5-million-cubic-yard alluvial deposit with an average grade of about 0.0243 ounce of gold per cubic yard. For 2016, projected production is expected to be about 23,100 ounces of gold.

Donlin Gold Project

The Donlin Gold project, 270 miles west of Anchorage, is the major development project in the state. It is operated by Donlin Gold LLC, equally owned and supported by NovaGold Resources and Barrick Gold Corp., under an exploration and mining mineral lease agreement with Calista Corp., the area's ANCSA regional corporation, and a surface-use agreement with

the Kuskokwim Corp., which comprises ten villages on the middle Kuskokwim River.

The Donlin deposit is hosted in and around a Late Cretaceous rhyodacite dike swarm that intrudes graywacke and shale of the Cretaceous Kuskokwim Group. Mineralization in the main ACMA–Lewis resource consists of quartz, quartz–carbonate, and sulfide (pyrite–arsenopyrite) veins. Gold is tightly bound in the lattice of arsenopyrite. Donlin is classified as a low-sulfidation epithermal deposit.

Donlin's current total identified resource is 698 million tons at 0.061 ounce per ton gold containing 45 million ounces of gold (appendix D). The proposed project, based on a proven and probable reserve of 556 million tons containing 33.8 million ounces of gold, would have a mine life of 27.5 years, with a projected annual production rate of 1.1 million ounces of gold. The proposed operation calls for an open-pit mine that extracts 420,000 tons of material per day; the mill would process

59,000 tons of material per day through flotation, pressure oxidation, and CIP leach facilities. The proposed project would include the mine, mill, tailings facility, 600-person camp, airport, road to a river port on the Kuskokwim River, and a saltwater port at Bethel. The mine and mill would require a 150-megawatt power plant, and the current plan also includes a 14-inch, 315-mile-long natural gas pipeline from Cook Inlet.

In November 2015, the U.S. Army Corps of Engineers (USACE) published the Donlin Gold LLC draft environmental impact statement (EIS); public review of the draft, meetings, and a 5-month comment period were conducted from November 2015 through April 2016. The Corps will review and respond to all comments on the Draft EIS in a Final EIS, which the Corps anticipates will be published in 2017. NovaGold reported 2015 expenditures of \$11 million toward its share of the joint venture, and anticipates expenditures exceeding \$9 million in 2016.

Chuitna Coal Project

The Chuitna Coal project is a major coal mining and export development project being designed and proposed by PacRim Coal LP as a surface coal mine with contemporaneous reclamation to recover an estimated 300 million tons of subbituminous ultra-low-sulfur coal. The resource is in the Beluga coal field of south-central Alaska on Alaska Mental Health Trust lands, approximately 45 miles west of Anchorage on the west side of Cook Inlet. The current project proposal consists of a surface coal mine and associated support facilities, mine access road, coal transport conveyor, personnel housing, airstrip facility, a logistics center, and coal export terminal. The current project predicts a minimum 25-year mine life with an annual production rate of up to 12 million tons. PacRim is currently working on updating their permit application after making significant changes to their proposed project.



Photo 17. Panoramic view of Chandalar placer gold operations. PHOTO FROM GOLDRICH MINING COMPANY, [HTTP://WWW.GOLDRICHMINING.COM/IMAGES/CHANDALAR/GALLERY/2015/CHANDALAR-MINE-2015-1.JPG](http://www.goldrichmining.com/images/chandalargallery/2015/chandalarmine-2015-1.jpg). LAST ACCESSED ON JANUARY 1, 2015.

DRILLING

Eight companies publicly reported significant drilling programs in Alaska in 2015 (table 18). Total drilling by 14 operators across all sectors in 2015 was 937,769 feet, up 86 percent from about half a million feet of drilling in 2014 (table 19). Exploration drilling totaled 489,470 feet in 2015, 85 percent more footage than the 264,487 feet drilled in 2014. About 377,983 feet or 77 percent of exploration drilling was conducted by lode mines looking to increase their reserves and extend mine life. Development drilling totaled 309,914 feet, and production drilling totaled 138,385 feet. Despite

the general depression of the mining industry fueled in part by limited financing and lower commodity prices in 2015, Alaska's mines continue to invest in their operations and the state.

Drilling was primarily compiled from public company reports and online information, and represents a minimum amount for 2015. Placer exploration drilling in 2015 was not compiled, and development and production drilling is also likely underreported. Blast-hole drilling during production at Alaska's large lode mines was not tracked.

Table 18. Companies publicly reporting significant drilling programs in Alaska in 2015.

Coeur Alaska Inc.
 Constantine Metal Resources Ltd.
 Contango ORE Inc.
 Coventry Resources
 Kinross Gold Corp. (Fairbanks Gold Mining Inc.)
 NovaCopper Inc.
 Sumitomo Metal Mining Pogo LLC
 Teck Alaska Inc.

Table 19. Drilling footage reported in Alaska, 1982–2015.

Year	Placer Exploration	Placer Thawing	TOTAL PLACER	TOTAL COAL	Hardrock Core ^a	Hardrock Rotary ^a	TOTAL HARDROCK	TOTAL FEET DRILLED
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	95,600	19,500	115,100	315,250
1988	152,000	300,000	452,000	26,150	223,630	130,230	353,860	832,010
1989	97,250	210,000	307,250	38,670	242,440	89,790	332,230	678,150
1990	78,930	105,000	183,930	18,195	648,600	112,355	760,955	963,080
1991	51,247	130,000	181,247	16,894	205,805	110,850	316,655	514,796
1992	6,740	65,000	71,740	12,875	211,812	148,022	359,834	444,449
1993	25,216	--	25,216	--	124,325	127,990	252,315	277,531
1994	21,000	--	21,000	8,168	347,018	91,692	438,710	467,878
1995	27,570	--	27,570	--	363,690	51,795	415,485	443,055
1996	61,780	--	61,780	8,500	524,330	134,527	658,857	729,137
1997	38,980	--	38,980	13,998	523,676	180,834	704,510	757,488
1998	33,250	--	33,250	2,300	505,408	45,670	551,078	586,628
1999	6,727	--	6,727	--	369,863	78,934	448,797	455,524
2000	15,480	--	15,480	--	418,630	127,638	546,268	561,748
2001	1,100	--	1,100	36,151	240,318	75,750	316,068	353,319
2002	1,250	--	1,250	--	385,290	103,612	488,902	490,152
2003	10,108	--	10,108	2,000	270,456	100,178	370,634	382,742
2004	107,526	--	107,526	--	415,628	36,024	451,652	559,178
2005	3,360	--	3,360	--	592,497	41,780	634,277	637,637
2006	8,759	--	8,759	7,500	765,363	54,173	819,536	835,795
2007	19,575	--	19,575	50,539	830,478	268,112	1,098,590	1,168,704
2008	1,216	--	1,216	26,869	874,634	250,278	1,124,912	1,152,997
2009	1,244	--	1,244	W	403,275	260,059	663,334	664,578
2010	10,427	--	10,427	11,601	688,911	216,768	905,679	927,707
2011	3,150	--	3,150	W	883,272	175,181	1,058,453	1,061,603
2012	13,282	--	13,282	7,704	1,082,439	14,182	1,096,621	1,117,607
2013	17,986	--	17,986	W	933,194	17,800	950,994	968,980
2014	7,227	--	7,227	W	487,106	9,736	496,842	504,069
2015	--	--	--	W	923,324	12,795	937,769	937,769

^a Core and rotary drilling not differentiated prior to 1987.

-- = Not reported

W = withheld for confidentiality; included in hardrock rotary or core.

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The production of this publication depends upon the collaboration of many agencies and organizations. Listed here are staff from the major agencies and organizations who provided mining-related information. Conor Bell (Department of Labor and Workforce Development) provided updated mining employment and wage information. William Bishop (Alaska Department of Revenue), Brenda Applegate (Alaska Industrial De-

velopment and Export Authority), Karsten Eden (Alaska Mental Health Trust Land Office), Katie Farley (State Pipeline Coordinator's Office), Cristin Cowles-Brunton (DNR/Support Services Division), and Annette Ziegman (Denali Borough) provided government revenue data. Zoya Ponomareva (DMLW) provided information on the industrial minerals sector, as well as Robert Ellefson and Edward Klimasauskas (U.S. Bureau of Land Management) and Steve Hohensee (U.S. Forest Service). Deborah Morgan (Alaska Governor's Office/Office of International Trade) provided commodity export information. Jamey Jones (U.S. Geological Survey) and Kurt Johnson and Gina Graham (DGGS) provided information on government activities in Alaska in 2015. Jennifer Athey, Melanie Werdon, and Evan Twelker (DGGS) and Mitch Henning (DMLW) compiled the data and prepared the body of the text, tables, and appendices. The booklet's design, layout, and cover are by Kara Lewandowski (DGGS); graphic illustrations were created and updated by Jennifer Athey (DGGS); and Paula Davis (DGGS) edited the text.

APPENDICES

APPENDIX A

HELPFUL LINKS FOR THE MINERAL INDUSTRY IN ALASKA



DEPARTMENT OF NATURAL RESOURCES

- Recording Fees | http://dnr.alaska.gov/ssd/recoff/fees_RO.cfm
- Public Information Center | <http://dnr.alaska.gov/commis/pic/>
- State Uniform Commercial Code (UCC) Documents Search | <http://dnr.alaska.gov/ssd/recoff/>

Division of Mining, Land & Water

- Mining Applications and Forms | <http://dnr.alaska.gov/mlw/forms/>
- Fact Sheets | <http://dnr.alaska.gov/mlw/factsht/>
- Annual Placer Mining Application (APMA) 2015 | <http://dnr.alaska.gov/mlw/forms/14apma/>
- Annual Rental | http://dnr.alaska.gov/mlw/factsht/mine_fs/annualre.pdf
- Leasing State Land | http://dnr.alaska.gov/mlw/factsht/land_fs/lease_land.pdf
- Land Lease & Contract Payment Information | http://dnr.alaska.gov/mlw/factsht/land_fs/lease_contract_payment_info.pdf
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- DNR Production Royalty Form | http://dnr.alaska.gov/mlw/forms/mining/royalty_fm.pdf
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- Interactive Maps | <http://maps.dggs.alaska.gov/>
- Geologic Maps of Alaska: Online Map Search Tool | <http://maps.dggs.alaska.gov/mapindex/>
- Unpublished Geology-Related Data (Alaska Geologic Data Index) | <http://maps.dggs.alaska.gov/agdi/>
- Geologic Materials Center | <http://dggs.alaska.gov/gmc/>
- Geochemical Sample Analysis Search (WebGeochem) | <http://www.dggs.alaska.gov/webgeochem/>
- Minerals Report Questionnaire | http://www.dggs.alaska.gov/minerals_questionnaire

Alaska's Minerals Data & Information Rescue in Alaska (MDIRA) Project Websites

- MDIRA Portal Home Page | <http://akgeology.info/>
- Alaska Mining Claims Mapper | <http://akmining.info/>
- Land Records Web Application | <http://dnr.alaska.gov/Landrecords/>
- State Recorder's Office Search | <http://dnr.alaska.gov/ssd/recoff/searchRO.cfm>
- Alaska Resource Data Files | <http://ardf.wr.usgs.gov/>
- USGS Alaska Geochemical Database (NURE, RASS, PLUTO...) | <http://pubs.usgs.gov/ds/637/>
- Guide to Alaska Geologic and Mineral Information | <http://doi.org/10.14509/3318>
- Alaska State Geo-Spatial Data Clearinghouse | <http://www.asgdc.state.ak.us/>



DEPARTMENT OF COMMERCE, COMMUNITY, AND ECONOMIC DEVELOPMENT

- Minerals Information | <https://www.commerce.alaska.gov/web/ded/dev/mineralsdevelopment>
- Community and Regional Information | <https://www.commerce.alaska.gov/web/dcra/ResearchAnalysis>
- Alaska Industrial Development and Export Authority (AIDEA) | <http://www.aidea.org>
- AIDEA Supports Mining | www.aidea.org/Programs/ProjectDevelopment/30YearsofMiningSupport



DEPARTMENT OF REVENUE

- Mining License Tax | <http://www.tax.alaska.gov/programs/programs/index.aspx?60610>
- Motor Fuel Tax Claim for Refund | <http://www.tax.alaska.gov/programs/programs/forms/index.aspx?60210>
- Alaska Motor Fuel Tax Instructions | <http://www.tax.alaska.gov/programs/documentviewer/viewer.aspx?5086f>

APPENDIX B

PRIMARY METALS PRODUCTION IN ALASKA, 1880–2015^a

Year	Gold ^b		Silver		Mercury		Antimony		Tin		Lead		Zinc		Platinum ^d		Copper		Chromium		
	(oz)	(ms)	(oz)	(ms)	(flask ^c)	(ms)	(lb)	(ms)	(lb)	(ms)	(tons)	(ms)	(tons)	(ms)	(oz)	(ms)	(lb)	(ms)	(tons)	(ms)	
1880–99	1,153,889	523.9	496,101	\$329.0	--	--	--	--	--	--	250	\$17.0	--	--	--	--	--	--	--	--	
1900–09	6,673,173	137.9	1,324,580	779.5	--	--	--	--	304,000	\$112.2	369	32.8	--	--	--	--	29,549,486	\$4.8	--	--	
1910–19	7,209,094	149.0	7,058,235	5,107.5	--	--	2,760,000	W	1,640,000	805.9	3,565	470.2	--	--	914	\$116.5	515,253,817	109.9	2,200	W	
1920–29	3,373,336	69.8	6,407,375	5,160.8	117	\$7.6	W	W	317,800	163.9	7,961	1,084.1	--	--	5,750	484.9	643,576,929	93.3	--	--	
1930–39	5,345,205	150.8	3,250,173	1,889.8	31	2.3	1,616,000	\$228.3	1,024,400	502.1	10,791	914.3	--	--	102,615	5,427.1	184,522,000	19.5	--	--	
1940–49	3,137,447	109.8	794,842	577.0	3,094	724.3	2,062,080	311.1	319,200	230.3	3,096	405.2	--	678	225,285	12,623.3	433,700	0.2	7,409	\$250.9	
1950–59	2,297,827	80.6	321,669	292.9	18,185	4,370.0	2,663,520	3,697.6	1,144,000	1,310.5	177	38.6	--	--	107,927	9,403.9	106,000	0.1	21,442	1,975.8	
1960–69	711,870	26.6	59,300	70.7	13,996	3,098.0	228,800	267.8	--	--	40	9.9	--	--	111,556	13,618.5	352,000	0.1	--	--	
1970–79	324,906	55.8	54,700	250.5	4,040	1,694.0	1,473,000	1,714.0	166,000	949.0	20	8.0	--	--	41,604	6,826.0	--	--	--	--	
1980	75,000	32.0	7,500	111.0	--	--	--	--	120,000	984.0	31	29.0	--	--	--	--	--	--	--	--	
1981	134,200	55.2	13,420	111.3	W	W	--	--	106,000	700.0	--	--	--	--	900	200.0	--	--	--	--	
1982	175,000	69.9	22,000	198.0	--	--	--	--	198,000	1,365.0	--	--	--	--	W	W	--	--	--	--	
1983	169,000	67.6	33,200	332.0	--	--	22,400	45.0	215,000	1,100.0	--	--	--	--	W	W	--	--	--	--	
1984	175,000	62.1	20,000	159.0	5	1.5	135,000	225.8	225,000	400.0	--	--	--	--	W	W	--	--	--	--	
1985	190,000	61.2	28,500	171.0	27	10.0	65,000	98.0	300,000	650.0	--	--	--	--	W	W	--	--	--	--	
1986	160,000	60.8	24,000	134.4	12	2.8	45,000	67.5	340,000	890.0	--	--	--	--	W	W	--	--	--	--	
1987	229,707	104.5	54,300	391.0	--	--	--	--	288,000	460.0	--	--	--	--	W	W	--	--	--	--	
1988	265,500	112.8	47,790	282.0	W	W	--	--	300,000	950.0	--	--	--	--	25	13.8	--	--	--	--	
1989	284,617	108.7	5,211,591	27,300.0	--	--	--	--	194,000	672.0	9,585	7,700.0	--	19,843	--	--	--	--	--	--	
1990	231,700	89.2	10,135,000	50,675.0	--	--	--	--	57,000	200.0	44,220	30,954.0	--	181,200	--	--	--	--	--	--	
1991	243,900	88.3	9,076,854	39,110.0	--	--	--	--	6,800	22.1	69,591	33,403.7	--	278,221	--	15	5.3	--	--	--	
1992	262,530	88.5	9,115,755	34,913.0	--	--	--	--	1,500	5.9	68,664	31,585.0	--	274,507	--	--	--	--	--	--	
1993	191,265	68.6	5,658,958	24,333.0	--	--	--	--	21,000	50.6	38,221	13,759.6	--	268,769	--	3	1.2	--	--	--	
1994	182,100	70.3	1,968,000	10,391.0	--	--	--	--	--	--	36,447	25,512.9	--	329,003	--	5	2.1	--	--	--	
1995	141,882	56.0	1,225,730	6,655.0	--	--	--	--	--	--	58,098	34,428.6	--	359,950	--	1	0.4	--	--	--	
1996	161,565	62.6	3,676,000	19,078.0	--	--	--	--	--	--	70,886	52,284.0	--	366,780	--	2	0.8	780,000	0.8	--	
1997	590,516	207.3	14,401,165	70,710.0	--	--	--	--	--	--	88,560	49,593.0	--	419,097	--	--	3,440,000	3.5	--	--	
1998	594,191	174.6	14,856,000	82,154.0	--	--	--	--	--	--	102,887	49,386.0	--	549,348	--	--	3,800,000	2.9	--	--	
1999	517,890	144.3	16,467,000	85,628.0	--	--	--	--	--	--	125,208	57,596.0	--	643,642	--	--	4,200,000	3.0	--	--	
2000	551,982	154.1	18,226,615	90,404.0	--	--	--	--	--	--	123,224	51,754.0	--	669,112	--	--	2,800,000	2.3	--	--	
2001	550,644	149.3	16,798,000	73,408.0	--	--	--	--	--	--	127,385	56,049.0	--	634,883	--	--	2,800,000	2.0	--	--	
2002	562,094	174.3	17,858,183	82,326.0	--	--	--	--	--	--	146,462	61,514.0	--	718,103	--	--	3,200,000	2.3	--	--	
2003	528,191	191.9	18,589,100	95,300.0	--	--	--	--	--	--	162,479	64,279.0	--	714,769	--	--	--	--	--	--	
2004	456,508	192.3	16,947,270	113,056.9	--	--	--	--	--	--	150,796	120,636.8	--	680,015	--	--	--	--	--	--	
2005	427,031	189.9	11,670,000	85,382.0	--	--	--	--	--	--	131,366	115,230.0	--	684,462	--	--	--	--	--	--	
2006	570,129	344.1	16,489,394	190,415.9	--	--	--	--	--	--	157,128	183,629.3	--	673,967	--	--	--	--	--	--	
2007	726,933	511.1	20,203,985	270,402.1	--	--	--	--	--	--	167,181	389,532.2	--	696,115	--	--	87,627	0.3	--	--	
2008	800,752	698.2	14,643,735	219,496.4	--	--	--	--	--	--	153,705	287,428.4	--	626,135	--	--	--	--	--	--	
2009	780,657	759.1	15,617,436	229,159.3	--	--	--	--	--	--	167,204	260,838.2	--	712,496	--	--	--	--	--	--	
2010	914,462	1,119.8	13,991,297	282,523.5	--	--	--	--	--	--	146,480	284,171.2	--	667,539	--	--	--	--	--	--	
2011	848,945	1,334.1	11,683,967	410,340.9	--	--	--	--	--	--	113,649	247,755.2	--	696,793	--	5,000	8,609.3	1,058	0.0	--	
2012	921,240	1,537.5	12,313,877	383,573.6	--	--	--	--	--	--	126,234	234,795.2	--	647,481	--	--	--	--	--	--	
2013	1,022,987	1,551.9	13,453,367	320,121.0	--	--	--	--	--	--	126,707	245,811.6	--	665,318	--	--	--	--	--	--	
2014	948,547	1,201.2	15,388,901	304,392.5	--	--	--	--	--	--	155,183	294,847.2	--	716,781	--	--	--	--	--	--	
2015	873,984	1,013.9	15,147,249	237,508.9	--	--	--	--	--	--	151,247	245,126.5	--	686,938	--	--	--	--	--	--	
Other ^e	46,727,397	\$13,711.4	360,832,114	\$3,855,105.5	1,438	--	--	--	7,287,700	\$12,523.5	3,044,297	\$3,532,609.6	--	14,581,945	--	71,946	17,091.9	1,394,994,184	\$245.3	39,051	\$3,426.7
TOTAL	46,727,397	\$13,711.4	360,832,114	\$3,855,105.5	1,438	--	11,070,800	\$6,655.1	7,287,700	\$12,523.5	3,044,297	\$3,532,609.6	--	14,581,945	--	71,946	17,091.9	1,394,994,184	\$245.3	39,051	\$3,426.7

^a From published and unpublished state and federal documents. Where state and federal figures differ significantly, state figures are used. Please refer to previous editions of this appendix for year-to-year production information for years 1900 to 1979.
^b Gold production adjusted to be consistent with mining district production totals. As of 2015, does not include placer gold production.
^c 76-lb flask.
^d Not traceable by year.
^e Not reported.
 W = withheld

APPENDIX C

PRODUCTION OF INDUSTRIAL MINERALS, COAL, AND OTHER COMMODITIES IN ALASKA, 1880–2015^{a,b}

Year	Coal		Sand and Gravel ^c		Rock ^d		Barite		Other ^e
	short tons	m\$	short tons	m\$	short tons	m\$	short tons	t\$	\$
1880–1899	19,429	\$0.1	--	--	7,510	\$0.0	--	--	--
1900–1909	33,214	0.2	--	--	15,318	0.2	--	--	\$246,403
1910–1919	210,806	1.2	--	--	50,014	0.3	--	--	2,014,788
1920–1929	937,860	5.2	--	--	494,417	2.7	--	--	2,523,754
1930–1939	1,222,797	5.5	42,332	\$0.0	689,676	2.8	--	--	899,767
1940–1949	3,189,026	20.2	1,758,504	0.7	286,341	1.3	--	--	27,124,158
1950–1959	6,632,641	59.7	65,804,686	55.1	1,843,560	5.2	--	--	25,443,427
1960–1969	7,849,000	58.8	163,315,000	176.7	2,034,000	4.2	225,000	\$1,200.0	34,143,000
1970–1979	7,405,000	89.0	489,522,000	1,004.9	47,930,000	137.4	502,000	8,217.0	77,501,000
1980	800,000	16.0	40,000,000	86.0	3,700,000	15.4	50,000	2,000.0	97,500
1981	800,000	17.6	46,000,000	88.2	4,200,000	19.3	--	--	256,000
1982	830,000	18.0	45,000,000	91.0	3,400,000	15.6	--	--	150,000
1983	830,000	18.0	50,000,000	105.0	5,270,000	25.0	--	--	242,000
1984	849,161	23.8	27,000,000	95.0	2,700,000	16.0	--	--	875,875
1985	1,370,000	39.7	28,184,080	112.1	2,500,000	12.0	--	--	559,000
1986	1,492,707	40.1	20,873,110	75.8	4,200,000	20.3	--	--	384,800
1987	1,508,927	42.4	16,696,374	42.7	1,805,000	11.6	--	--	388,400
1988	1,551,162	44.3	17,264,500	48.8	3,600,000	24.7	--	--	389,000
1989	1,452,353	41.5	14,418,000	39.9	2,914,000	20.3	--	--	1,492,000
1990	1,576,000	45.0	15,013,500	40.8	3,200,000	22.1	--	--	400,000
1991	1,540,000	39.0	14,160,011	45.5	3,000,000	22.5	--	--	462,000
1992	1,531,800	38.3	14,599,746	42.2	2,900,000	23.0	--	--	430,000
1993	1,586,545	38.1	13,162,402	40.6	3,561,324	26.2	--	--	465,000
1994	1,490,000	36.8	13,518,321	41.0	3,843,953	27.0	--	--	459,500
1995	1,640,000	41.3	9,847,550	30.9	2,811,152	22.1	--	--	182,500
1996	1,481,000	38.0	9,890,463	32.2	3,000,045	23.6	--	--	200,000
1997	1,446,000	38.1	13,800,000	51.9	3,200,000	20.0	--	--	217,000
1998	1,339,000	35.2	12,363,450	57.3	1,636,200	14.0	--	--	215,000
1999	1,560,000	41.1	10,600,000	52.4	1,640,000	18.0	--	--	190,000
2000	1,473,355	38.8	10,600,000	49.9	5,200,000	36.6	--	--	203,000
2001	1,537,000	48.1	10,360,000	55.2	3,091,000	27.2	--	--	205,000
2002	1,158,000	37.4	22,412,000	120.7	3,152,000	31.4	--	--	200,000
2003	1,088,000	38.1	11,868,001	64.1	861,382	10.4	--	--	175,000
2004	1,450,000	50.8	19,576,092	101.5	7,312,050	106.2	--	--	2,732,554
2005	1,402,174	49.1	16,620,009	76.5	2,803,172	22.6	--	--	809,642
2006	1,397,500	48.9	13,953,465	63.4	2,369,738	23.8	--	--	1,057,500
2007	1,273,004	44.6	14,163,676	76.1	2,211,954	25.5	--	--	1,085,500
2008	1,538,000	53.8	12,461,685	72.4	2,485,820	39.5	--	--	1,159,502
2009	1,861,714	65.2	7,072,037	41.4	1,837,090	27.2	--	--	3,678,930
2010	2,061,000	72.1	6,977,297	48.0	290,852	4.3	--	--	2,303,950
2011	2,220,000	77.7	5,862,851	38.7	499,722	6.4	--	--	3,200,000
2012	2,018,759	70.7	7,799,994	52.3	1,050,762	15.8	--	--	--
2013	1,600,000	56.0	11,622,045	79.6	364,632	5.5	--	--	1,900,000
2014	1,500,000	52.5	526,509	6.8	1,147,869	17.2	--	--	120,000
2015	1,177,390	41.2	5,725,541	17.2	--	--	--	--	--
Other	--	--	--	--	2,300,000 ^f	W	79,000	W	--
TOTAL	78,930,324	\$1,776.8	1,330,435,230	\$3,420.4	153,410,553	\$952.5	856,000	\$11,417.0	\$196,782,450

^a From published and unpublished state and federal documents. Where state and federal figures differ significantly, state figures are used.

^b Please refer to previous editions of this appendix for year-to-year production information for years 1900 to 1979.

^c As of 2015, rock, sand, and gravel are reported as a combined commodity.

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

^e Includes 2.4 million lb U₃O₈ (1955–1971); 505,000 tons gypsum (1905–1926); 286,000 lb WO₃ (intermittently, 1916–1980); 94,000 lb asbestos (1942–44); 540,000 lb graphite (1917–1918 and 1942–1950); and undistributed amounts of zinc, jade, peat, clay, soapstone, miscellaneous gemstones, and other commodities (1880–present).

^f Marble quarried on Prince of Wales Island, southeastern Alaska (1900–1941).

m\$ = millions of dollars

t\$ = thousands of dollars

-- = not reported

W = withheld

APPENDIX D

IDENTIFIED MINERAL RESOURCES OF ALASKA DEPOSITS

DEPOSIT—Type—Metal Suite	PHASE	CATEGORY	TONS OF RESOURCE	Cu %	Cu thousand pounds	Pb %	Pb thousand pounds	Zn %	Zn thousand pounds	Au oz/ton	Au thousand ounces	Ag oz/ton	Ag thousand ounces	Mo %	Mo thousand pounds	TREO-Y %	TREO-Y thousand pounds	Graphite %	Graphite thousand pounds
KENSINGTON — Gold veins — Precious metals (gold)	Proven		338,000							0.198	67.0								
	Probable		2,487,000							0.198	493.0								
	Measured		347,000							0.277	96.0								
	Indicated		1,485,000							0.284	422.0								
	Advanced Exploration		2,059,000							0.335	690.0								
Total		6,716,000								0.263	1,768.0								
LIMS — Gold veins — Precious metals (gold)	Exploration (0.5 g/t Au cut-off, open pit)	Inferred	9,170,000							0.029	267.0								
	Production	Probable								1,768.3									
POGO — Gold veins — Precious metals (gold)	Production	Indicated								2,732.8									
	Total									4,501.1									
TERRA — Gold veins — Precious metals (gold, silver)	Exploration (5 g/tonne Au cut-off)	Indicated	128,913							0.387	49.8	0.88	112.7						
	Exploration (5 g/tonne Au cut-off)	Inferred	811,286							0.456	369.8	0.81	553.9						
	Total		940,199							0.446	415.6	0.82	766.6						
WILLOW (Lucky Shot) — Gold veins — Precious metals (gold)	Exploration (7 g/tonne Au cut-off)	Measured	12,700							0.832	10.5								
	Exploration (7 g/tonne Au cut-off)	Indicated	74,100							0.693	51.6								
	Exploration (7 g/tonne Au cut-off)	Inferred	5,800							0.702	4.1								
	Total		92,600							0.715	66.2								
DONNIN — Intrusion gold — Precious metals (gold)	Development	Proven	8,468,971							0.068	573.0								
	Development	Probable	547,984,194							0.061	33,276.0								
	Development	Measured	52,910							0.074	53.0								
	Development	Indicated	40,210,802							0.065	5,104.0								
	Total		698,356,574							0.061	45,000.0								
FORT KNOX — Intrusion gold — Precious metals (gold)	Production	Proven	52,624,000							0.012	628								
	Production	Probable	109,765,000							0.014	1,394								
	Production	Measured	7,801,000							0.012	103								
	Production	Indicated	97,824,000							0.013	1,320								
	Total		284,354,000							0.013	3,666								
GOLDEN SUMMIT — Intrusion gold — Precious metals (gold)	Exploration (Dolphin oxide deposit)	Indicated	19,828,590							0.019	383.0								
	Exploration (Dolphin oxide deposit)	Inferred	11,959,371							0.018	208.0								
	Exploration (Dolphin sulfide deposit)	Indicated	68,133,163							0.019	1,300.0								
	Exploration (Dolphin sulfide deposit)	Inferred	26,476,583							0.018	4,637.0								
	Total		364,397,697							0.018	6,528.0								
MONEY KNOB (Luvengood) — Intrusion gold — Precious metals (gold)	Advanced Exploration	Proven	478,941,634							0.020	9,621.5								
	Advanced Exploration	Probable	22,190,181							0.020	454.0								
	Advanced Exploration	Measured	326,839,666							0.018	4,785.5								
	Advanced Exploration	Indicated	56,073,119							0.016	846.0								
	Total		1,117,255,400							0.018	20,000.0								
NIKON FORK — Intrusion gold (lean) — Precious metals (gold)	Development (last producer)	Indicated	270,430							0.481	130.0								
	Development (last producer)	Inferred	118,000							0.512	60.5								
	Total		388,430							0.491	190.5								
VIMASALE — Intrusion gold — Precious metals (gold)	Exploration	Indicated	3,760,000							0.043	162.0								
	Total		59,100,000							0.032	1,865.0								
ANARRAQ (Red Dog satellite) — Massive sulfide — Base metals (lead, zinc, silver)	Exploration	Inferred	19,000,000			4.8	1,824,000	15.8	6,004,000			2.10	39,300						
	Total		26,287,650	3.26	1,713,000	0.76	400,900	4.45	2,338,000	0.021	550.0	1.55	40,800						
ARCTIC — Massive sulfide — Polymetallic (copper, lead, zinc, gold, silver)	Advanced Exploration	Inferred	3,707,035	3.22	239,000	0.58	43,200	3.84	285,000	0.017	60.0	1.21	4,500						
	Total		29,994,685	3.25	1,952,000	0.74	444,100	4.37	2,623,000	0.020	610.0	1.51	45,300						
BORNITE — Massive sulfide — Polymetallic (copper)	Exploration (in pit, 0.5% cut-off)	Indicated	44,600,000	1.02	913,000														
	Exploration (in pit, 0.5% cut-off)	Inferred	92,700,000	0.95	1,768,000														
	Total		201,000,000	1.58	6,354,000														

Note: Values have not been updated for 2015.

APPENDIX E

CONVERSION CHART, U.S. CUSTOMARY UNITS/METRIC UNITS

<i>To convert from:</i>	<i>to:</i>	<i>multiply by:</i>
WEIGHT/MASS/ORE CONTENT		
ounces (avoirdupois)	grams	28.3495
ounces (troy)	grams	31.1035
pounds	kilograms	0.4536
short tons	metric tons (tonnes)	0.9072
grams	ounces (avoirdupois)	0.03527
grams	ounces (troy)	0.03215
kilograms	pounds	2.20462
metric tons (tonnes)	short tons	1.10231
parts per million (ppm)	parts per billion (ppb)	1,000
parts per million (ppm)	ounces per ton	0.0292
parts per million (ppm)	grams/metric tons (tonnes)	1.00
LENGTH		
miles	kilometers	1.60934
miles	yards	1,760
miles	meters	1,609.34
yards	meters	0.9144
feet	meters	0.3048
feet	centimeters	30.48
feet	millimeters	304.8
inches	centimeters	2.54
inches	millimeters	25.4
kilometers	miles	0.621371
meters	yards	1.09361
meters	feet	3.28084
millimeters	feet	0.00328
millimeters	inches	0.03937
centimeters	inches	0.3937
AREA		
square miles	square kilometers	2.59
square miles	acres	640
acres	square meters	4,046.86
acres	hectares	0.40486
square yards	square meters	0.836127
square feet	square meters	0.092903
square inches	square centimeters	6.4516
square inches	square millimeters	645.16
square meters	acres	0.000247105
square kilometers	acres	247.105
square kilometers	square miles	0.386102
square meters	square feet	10.7639
square meters	square yards	1.19599
hectares	acres	2.47105
hectares	square meters	10,000
square centimeters	square inches	0.155
square millimeters	square inches	0.00155
VOLUME		
cubic yards	cubic meters	0.764555
cubic feet	cubic meters	0.0283168
cubic inches	cubic centimeter	16.3871
cubic meters	cubic yards	1.30795
cubic meters	cubic feet	35.3147
cubic centimeters	cubic inches	0.0610237
gallons (U.S.)	liters	3.78541
liters	gallons (U.S.)	0.264172
milliliters	ounces (fluid)	0.033814
ounces (fluid)	milliliters	29.5735

TEMPERATURE	
<i>To convert from:</i>	<i>to:</i>
degrees Fahrenheit	degrees Celsius
degrees Celsius	degrees Fahrenheit
	do this:
	subtract 32, multiply by 5, divide by 9
	multiply by 9, divide by 5, add 32

Source: www.google.com/unit-converter

Mining districts ^a	Production (in refined troy ounces)		
	Total	Placer	Lode
1 Lisburne district	0	0	0
2 Noatak district	7,800	7,800	0
3 Wainwright district	0	0	0
4 Barrow district	0	0	0
5 Colville district	0	0	0
6 Canning district	0	0	0
7 Sheenjek district	0	0	0
8 Chandalar district	70,278	52,878	17,400
9 Koyukuk district	378,075	378,075	0
10 Shungnak district	15,000	15,000	0
11 Kiana & Selawik districts	40,607	40,607	0
12 Fairhaven district (Candle subdistrict)	254,265	254,265	0
13 Fairhaven district (Inmachuk subdistrict)	349,975	349,975	0
14 Serpentine district	4,536	4,536	0
15 Port Clarence district	42,358	42,358	0
16 Kougarak district	191,712	191,712	0
17 Nome (Cape Nome) district	5,043,465	5,043,465	0
18 Council district	1,047,042	1,020,042	27,000
19 Koyuk district	84,462	84,462	0
20 Hughes district	403,671	403,671	0
21 Kaiyuh district	149,703	5,400	144,303
22 Anvik district	7	7	0
23 Marshall district	124,506	124,506	0
24 Bethel district	42,953	42,953	0
25 Goodnews Bay district	31,202	31,202	0
26 Aniak district	613,407	613,407	0
27 Iditarod district	1,565,226	1,562,296	2,930
28 McGrath district	364,672	133,307	231,365
29 Innoko district	757,219	757,063	156
30 Ruby district	478,023	478,023	0
31 Kantishna district	99,307	91,401	7,906
32 Hot Springs district	604,926	604,926	0
33 Melozitna district	14,630	14,630	0
34 Rampart district	204,845	204,845	0
35 Tolovana district	547,556	547,556	0
36 Yukon Flats district	0	0	0
37 Circle district	1,125,341	1,125,341	0
38 Black district	2	2	0
39 Eagle district	52,166	52,166	0
40 Fortymile district	602,758	602,758	0
41 Chisana district	144,521	78,021	66,500
42 Tok district	288	288	0
43 Goodpaster district	3,100,130	2,051	3,098,079
44 Fairbanks district	15,404,602	8,282,595	7,122,007
45 Bonfield district	108,983	102,283	6,700
46 Richardson subdistrict of Fairbanks district ^b	121,828	119,528	2,300
47 Delta River district	11,732	11,732	0
48 Chistochina district	186,604	186,604	0
49 Valdez Creek district	533,167	531,586	1,581
50 Yentna district	204,980	204,980	0
51 Redoubt district	105	105	0
52 Bristol Bay Region	1,570	1,570	0
53 Kodiak district (53b)—Alaska Peninsula Region (53a)	112,409	4,809	107,600
54 Homer district	17	17	0
55 Hope & Seward districts	135,252	70,252	65,000
56 Anchorage district ^c	460	460	0
57 Willow Creek district	667,841	58,841	609,000
58 Prince William Sound district	137,802	102	137,700
59 Nelchina district	15,016	15,016	0
60 Nizina district	148,500	148,500	0
61 Yakataga district	18,041	18,041	0
62 Yakutat district ^d	13,200	2,200	11,000
63 Juneau district (partial)	82,540	82,540	0
64 Juneau (64a) & Admiralty (64b) districts	9,908,402	82,390	9,826,012
65 Chichagof district	770,000	0	770,000
66 Petersburg district	15,000	15,000	0
67 Kupreanof district	0	0	0
68 Hyder district	219	219	0
69 Ketchikan district	62,002	4,002	58,000
70 Bering Sea Region	0	0	0
71 Aleutian Islands Region	0	0	0
Unknown (undistributed) ^e	29	29	0
TOTAL (refined Troy ounces)	47,216,934	24,904,395	22,312,539
	(1,469 metric tons)		

^a Mining district names and boundaries revised slightly from those defined by Ransome and Kerns (1954) and Cobb (1973). Sources of data: U.S. Geological Survey, U.S. Bureau of Mines, and Alaska Territorial Department of Mines records 1880–1930; U.S. Mint records 1930–1969; State of Alaska production records 1970–2013. Entries of "0" generally mean no specific records are available.

^b Not included in total for Fairbanks district.

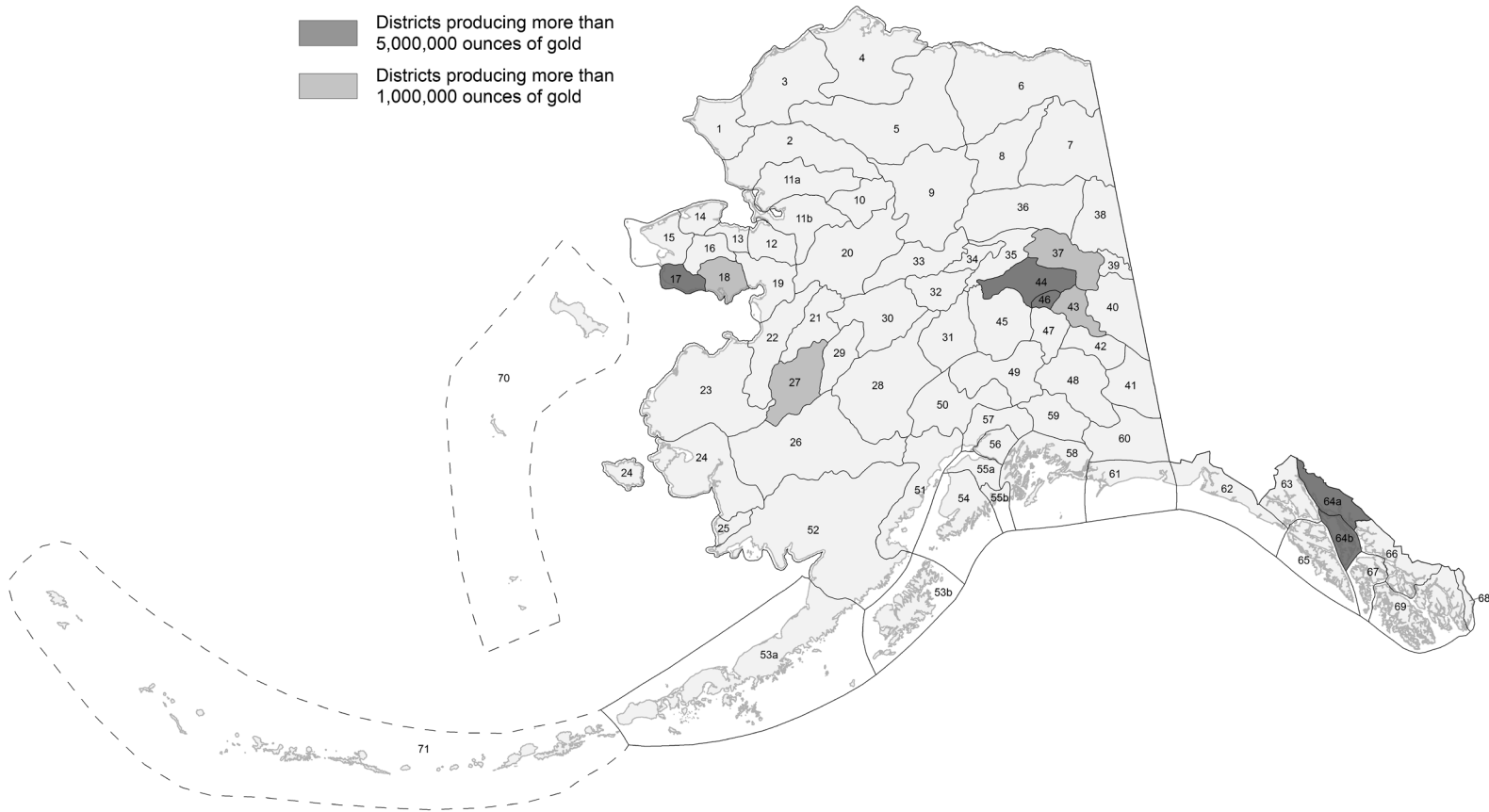
^c Most placer gold production included in Willow Creek district.

^d Includes lode production from Glacier Bay area and placer production from Lituya Bay area.

^e Production that cannot be credited to individual districts due to lack of specific records or for reasons of confidentiality.

TOTAL GOLD PRODUCTION IN ALASKA BY MINING DISTRICT, 1880-2015

- Districts producing more than 5,000,000 ounces of gold
- Districts producing more than 1,000,000 ounces of gold



^a Mining district names and boundaries revised slightly from those defined by Ransome and Kerns (1954) and Cobb (1973). Sources of data: U.S. Geological Survey, U.S. Bureau of Mines, and Alaska Territorial Department of Mines records 1880–1930; U.S. Mint records 1930–1969; State of Alaska production records 1970–2013. Entries of “0” generally mean no specific records are available.

^b Not included in total for Fairbanks district.

^c Most placer gold production included in Willow Creek district.

^d Includes lode production from Glacier Bay area and placer production from Lituya Bay area.

^e Production that cannot be credited to individual districts due to lack of specific records or for reasons of confidentiality.

Note: Table does not contain new placer gold production as of 2015. Also, several totals were corrected; most significantly, gold production from Kensington Mine was incorrectly included with the Juneau (partial) district 63 in 2014. This production has been moved to the Juneau & Admiralty district 64.