

## From a golden past to a polymetallic future

**T**he discovery of gold in the late 1800s drew thousands of people to the far reaches of Alaska. In 1880, Joseph Juneau found large pieces of quartz mixed with gold in Southeast Alaska, and his find lured prospectors to the new town site of Juneau. A second boom hit two years later when gold deposits were found on Douglas Island, across the channel from Juneau, resulting in the creation of Treadwell Mine. Gold discoveries in 1896 launched the great Klondike gold rush. Thousands of prospectors passed through Alaska on their way to the Yukon, creating the town of Skagway. More finds of gold in 1898 drew boat loads of people to Nome's sandy beaches on the Seward Peninsula.

Another large gold strike was found in the Tanana Hills of Alaska's interior. Gold was found there in 1902 and the ensuing gold rush led to the founding of Fairbanks. This field would eventually become one of the most productive

in Alaska. Gold was being discovered throughout the state during these early years but the largest strikes were in Nome, Fairbanks, and Juneau.

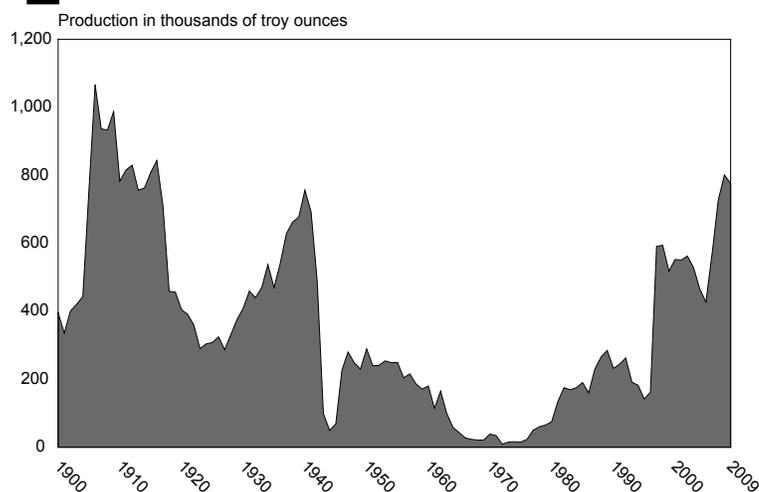
New mining practices also started to emerge during this time, as large companies began buying individual mining claims and hiring workers. Proceeds from stock sales were used to purchase equipment such as hydraulic hoses, draglines, and small dredges. New mills that could crush rock were built at the lode mines. The industrialization of gold mining practices continued until 1942, when President Franklin Delano Roosevelt ordered the closure of all nonessential mines to free up men for the war.

Meanwhile, the U.S Gold Reserve Act of 1934 kept gold prices fixed at \$35 an ounce, where they remained until 1972. Many of the mines that closed during the war remained closed post-war due to the low fixed price of gold and high costs of labor and construction. The Alaska-Juneau Mine was one of the mines that closed during the war. Attempts have been made to reopen this mine which is located near downtown Juneau, but all have failed so far.

### The price is right

It wasn't until the 1970s that interest in metal mining picked up again, after the U.S. government ended its practice of setting the price of gold. With less government intervention, the price of gold climbed to \$850 an ounce in 1980; however, by the year 2000, the price had fallen to \$250 per ounce. The past decade saw a steady climb in gold prices and by 2009, gold was trading at \$900 per ounce. (See Exhibits 2 and 3.)

### 1 A Golden Past Alaska's gold production, 1900 to 2009



Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys

## Gold still shines

Along with the recent resurgence in gold prices, statewide employment in gold mining also increased; employment rose by 604 jobs between 2000 and 2009. (See Exhibit 3.) Gold mining isn't the only hard-rock mining sector that has grown in recent years. Silver, zinc, coal, and lead have also added significantly to Alaska's economy. There were 2,126 mining jobs in 2009—an increase of more than 700 jobs since the recent low in 2004. (See Exhibit 4.)

## High growth and earnings

The overall trend for mining<sup>1</sup> employment has been growth, followed by a few years of stability or slight declines, and then more growth. Between 1980 and 2009, mining employment grew by 1,600 jobs and \$174.9 million in wage and salary earnings. (See Exhibit 4.)

During the last 10 years, Alaska's mining employment has outpaced the nation's by nearly 40 percent and most of Alaska's other private industries. (See Exhibits 5 and 6.) These numbers do not include the self employed who were especially important in the 141 placer mines operating across the state in 2009. Consequently, mining's contribution to employment and earnings in the state could be underestimated.<sup>2</sup>

Mining jobs have higher earnings than any other industry except oil and gas. In 2009, the average-annual earnings for a job in mining were \$91,100. That's nearly twice as much as the statewide average-annual earnings of \$46,600. (See Exhibit 7.)

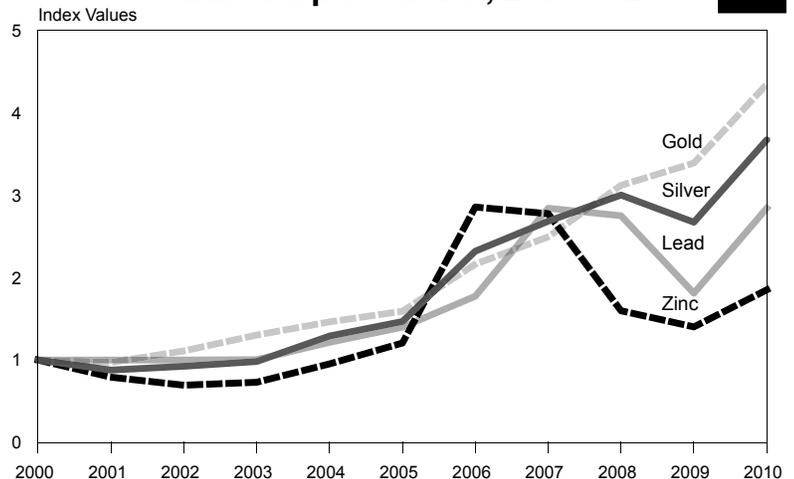
One reason for the high earnings is that the industry employs skilled occupations such as heavy equipment operators, miners, drillers, and others. (See Exhibit 8.) These types of occupations tend to pay well without requiring

<sup>1</sup> All references to mining in this article refer to mineral mining. This article does not include data related to oil and gas mining or exploration.

<sup>2</sup> Employment and earnings data do not include self-employed workers, fishermen, federal workers, uniformed military, and elected and appointed officials. There are many small scale mining operations around the state that are owner operated. These owner operators would be considered self-employed and therefore not counted in employment and earnings data.

## Prices Explain Renewed Interest 2

### Mineral price index, 2000 to 2010



Note: The index is based on the annual closing prices for gold, silver, lead, and zinc; 2010 prices are from August 15, 2010.

Source: United States Geological Survey

## Gold, Selected Historical Events

### 1880-1906

Gold is discovered throughout Alaska. The largest gold strikes are in Fairbanks, Nome, and Juneau. Gold production peaks in 1906 at 1,066,030 troy ounces. (See Exhibit 1.)

### 1917

The Treadwell mine on Douglas Island collapses and floods. At the time, it was the largest mine in the world. The mine's collapse began the descent of production levels in Alaska.

### 1933

President Roosevelt raises the price of gold from \$21 to \$35 an ounce and production levels increase.

### 1942

Franklin Delano Roosevelt issues Executive Order E-208 closing all nonessential mines to free up men for the war. By 1944, production levels for Alaska's gold had dropped to record lows. (See Exhibit 1.)

### 1967

Congress lifts the 25% gold reserve requirement for all outstanding bank notes, and gold prices begin to rise.

### 1971

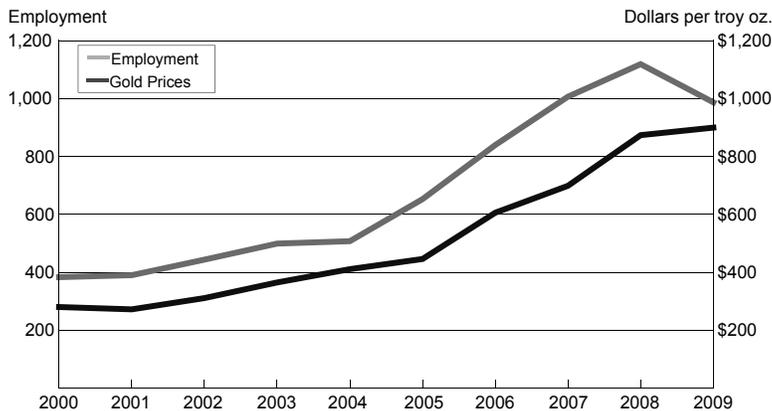
U.S. government abandons the practice of converting currency to gold.

### 1980

Prices are no longer set by the government and gold soars to \$850 per ounce. In the years that follow, production increases for Alaska.

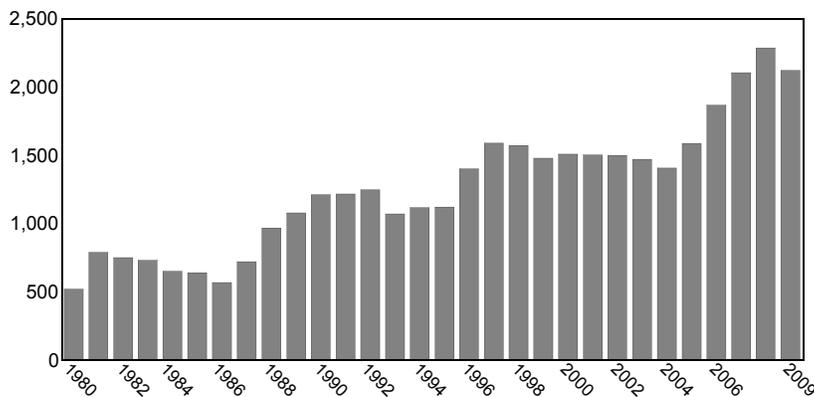
**Currently, gold is trading at more than \$1200 per ounce.**

### 3 Gold Mining Employment and Prices Alaska, 2000 to 2009



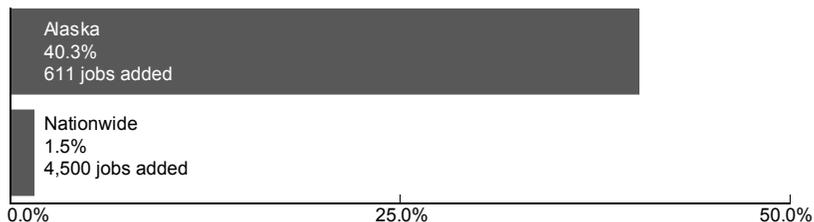
Note: Gold prices are based on average prices for the year rounded to the nearest dollar.  
Source: Alaska Department of Labor and Workforce Development Research and Analysis Section; United States Geological Survey, Mineral Commodity Summaries

### 4 Staggered Growth is Still Growth Alaska's Mining Employment, 1980 to 2009



Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

### 5 Alaska's Mining Industry Employment growth, 2000 to 2009



Note: Excludes oil and gas mining employment  
Source: Bureau of Labor Statistics and Alaska Department of Labor and Workforce Development, Research and Analysis Section

a college degree. For example, the average mining machine operator is paid approximately \$30 per hour.

### Residents bring home the metal

Nearly three-quarters of all wage and salary earnings from mining stay within the state due to Alaska residents making up about three-quarters of all workers in the mining industry.<sup>3</sup> In 2009, their wages totaled more than \$145.3 million, spread across the state. Workers in the industry live in 26 of Alaska's 29 boroughs and census areas, and they often reside in a different borough or census area than where they work.

The Fairbanks North Star Borough has 685 workers in the mining industry, the largest number in the state. Almost all of those workers are employed at the nearby Fort Knox Mine. Anchorage has the next largest number with 380 mine workers, but many of them work at mines outside of Anchorage. Juneau has 281 workers in the mining industry, the third largest in the state. The majority of those workers are at the Greens Creek or Kensington mines.

### Often the mother lode of employment

Mines are often the largest, or among the largest, employers in their borough or census area. Mines also tend to be located in remote areas where other employment opportunities are scarce. (See Exhibit 9.) In 2009, the Greens Creek, Red Dog, and Pogo mines were the largest private employers in Juneau, the Northwest Arctic Borough, and Southeast Fairbanks Census Area respectively. The Fort Knox Mine and the Usibelli Coal Mine are both the third-largest employers in their respective boroughs.<sup>4</sup> Increased employment at the newly

<sup>3</sup> Alaska residency is determined by matching the Alaska Department of Revenue Permanent Fund Dividend file with the Alaska Department of Labor and Workforce Development wage file. The PFD file is a list of Alaskans who either applied for or received a PFD. The wage file contains quarterly earnings and industry information on workers covered by unemployment insurance within Alaska. Those who aren't subject to unemployment insurance laws include self-employed workers, fishermen, the uniformed military, federal employees, and elected and appointed officials. Workers included in the wage file were considered Alaska residents if they applied for a PFD in either 2008 or 2009.

<sup>4</sup> Fort Knox Mine is located in the Fairbanks North Star Borough; Usibelli Coal Mine is located in the Denali Borough.

opened Kensington Mine will likely make it one of the top-ten private employers in Juneau after a year of full-scale production.

### Volatile prices affect production values for metals

Increased production from the Kensington Mine is also likely to increase statewide production values for metals. The global recession led to declines in metal prices, which caused Alaska's primary metal production values to drop sharply from \$3.2 billion in 2007 to \$2.3 billion in 2008—a decrease of \$960 million. (See Exhibit 10.) By the end of 2009, a strong recovery in metal prices caused metal production values to increase by \$50 million and landed Alaska at sixth in the nation for overall mineral production values. (See Exhibit 11.)

### More than metal

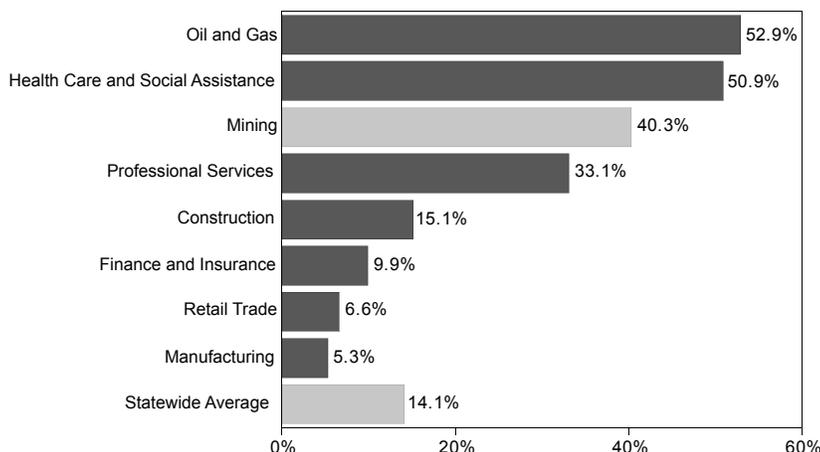
The value of Alaska's sand, gravel, and rock mining in 2008 was \$112 million—the highest value since 2004. Also in 2008, the value of coal production reached an all-time high of \$54 million. In 2009, employment in coal, sand, gravel, and all other nonmetallic mineral mining was at more than 300 jobs.<sup>5</sup> The lion's share of this employment was at the Usibelli Coal Mine, located in the Denali Borough.

The Usibelli Coal Mine, founded in 1943, is Alaska's oldest operating mine. It produced 1.9 million tons of coal in 2009. About half of

<sup>5</sup> Includes support activities

## Growth by Select Industries in Alaska

### Percentage employment change, 2000 to 2009



Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

## Alaska's Second Highest Paid Industry

### Average annual earnings, 2009



Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys

## Types of Mining

**Placer mining** is a method of using water to excavate, transport, concentrate, and recover heavy minerals from alluvial or placer deposits. Deposits mined using this technique include the gold-bearing sands and gravel that settle out from rapidly moving streams and rivers at points where the current slows down. Placer mining takes advantage of gold's high density, which causes it to sink more rapidly from moving water than the lighter siliceous materials with which it is found.

**Lode mining** can refer to ground level and underground mining of lode deposits —minerals that are bound to other rock requiring that the rock be crushed and pulverized before extraction of the minerals begins. After lode ore is crushed, recovery of the valuable minerals is done by one, or a combination of several, mechanical and chemical techniques.

**Surface mining** is commonly called strip mining, which is actually only one possible form of surface mining. This is a type of mining in which soil and rock overlying the mineral deposit (the overburden) are removed. Surface mining is used when deposits of commercially useful minerals or rock are found near the surface and the overburden is relatively thin or the material of interest is structurally unsuitable for tunneling —this is the case with sand and gravel mining.

# 8 Highly Skilled Workers Needed

## Top 20 occupations in mining

Rank	Occupation Title	Average Annual Earnings <sup>1</sup>	Required Education Level
1	Mining Machine Operators, All Other	\$58,360	Moderate-term on-the-job training
2	Extraction Workers, All Other	\$54,560	Moderate-term on-the-job training
3	Mobile Heavy Equipment Mechanics, Except Engines	\$60,510	Postsecondary vocational award/Associate degree
4	Millwrights	\$58,560	Long-term on-the-job training
5	Mining and Geological Engineers, Including Mining Safety Engineers	\$95,200	Bachelor's degree
6	Earth Drillers, Except Oil and Gas	\$49,860	Moderate-term on-the-job training
7	Construction Laborers	\$49,190	Moderate-term on-the-job training
8	Environmental Engineering Technicians	\$58,760	Postsecondary vocational award/Associate degree
9	Chemical Technicians	\$50,020	Postsecondary vocational award/Associate degree
10	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	N/A	Moderate-term on-the-job training
11	Laborers and Freight, Stock, and Material Movers, Hand	\$35,520	Short-term on-the-job training
12	Crushing, Grinding, and Polishing Machine Setters, Operators, and Tenders	\$50,380	Moderate-term on-the-job training
13	Loading Machine Operators, Underground Mining	N/A	Moderate-term on-the-job training
14	Electricians	\$67,480	Long-term on-the-job training
15	Industrial Truck and Tractor Operators	\$38,490	Short-term on-the-job training
16	Plant and System Operators, All Other	\$72,390	Long-term on-the-job training
17	Truck Drivers, Heavy and Tractor-Trailer	\$49,480	Moderate-term on-the-job training
18	First-Line Supervisors/Managers of Mechanics, Installers, and Repairers	\$76,150	Work experience in a related occupation
19	General and Operations Managers	\$78,580	Bachelor's plus experience/Master's degree/First professional degree/Doctoral degree
20	Excavating and Loading Machine and Dragline Operators	\$50,680	Moderate-term on-the-job training

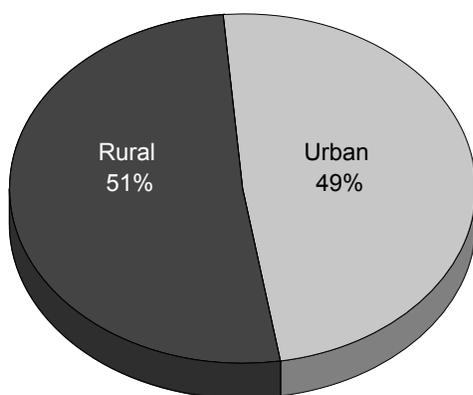
<sup>1</sup> May 2009 Alaska wage rates are statewide averages. Data are from the Occupational Employment Statistics (OES) survey and represent the average hourly wage for that occupation across all industries.

N/A = not available

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

# 9 2009 Mining Employment

## Half of all jobs were in rural Alaska



Note: Urban Alaska includes Anchorage, Fairbanks North Star Borough, and Juneau

Source: Alaska Department of Labor and Workforce Development, Research and Analysis Section

this coal was used to generate power, and the remainder was shipped out of state.

### The next big thing

Mining employment often doesn't include jobs in the exploration and development phases of a project. These jobs are often found in the engineering, environmental, or construction industries. Exploration and development dollars can be used as an indicator of future mining activity.

Spending on exploration and development took off in 2004, rising to an all time high of \$744 million in 2008. (See Exhibit 12.) Part of the increase came from simultaneous construction at Pogo, Kensington, and Rock Creek mines; but most came from exploration expenditures made by Alaska's largest prospective mines—Donlin Creek and Pebble. Ground sampling continued in 2009 at Pebble and Donlin Creek mines, but statewide exploration spending dropped by \$178 million, largely because these two mines moved into the pre-permitting phase.

Donlin Creek and Pebble are Alaska's high-profile mining prospects.<sup>6</sup> The Donlin Creek gold deposit, discovered in 1988, is located near Crooked Creek along the Kuskokwim River in the Bethel Census Area. There are an estimated 29 million ounces of gold resources<sup>7</sup> resulting in an anticipated mine life of about 20 years and an estimated workforce of 600. The 27,000 acre property is owned by the Calista and Kuskokwim Corporations, but the project is managed by the NovaGold and Barrick Gold Corporations.

The Pebble Mine is a copper-gold-molybdenum project that was discovered in 1987. It is located 200 miles southwest of Anchorage near Iliamna in the Lake and Peninsula Borough. The 98,600 acre property is on state owned land, and the project is managed by Northern Dynasty Minerals Ltd. and Anglo American. The total estimated resources at Pebble are 72 billion pounds of copper, 91 million ounces of gold, and 4.8 billion pounds of molybdenum.<sup>8</sup> According to estimates, there could also be commercially significant amounts of silver, rhenium, and palladium. The mine has an expected life of over 60 years and an estimated workforce of more than 1,000 employees.

Both of these mines expect to apply for permits in 2011.

### Mining the future

Alaska has more than 190 million acres of federal, state, and Native lands open for mineral-related activities and mining.<sup>9</sup> This potential combined with high mineral prices suggests that mining will continue to play a vital role in Alaska's long-term economic future—just as it did in the past.

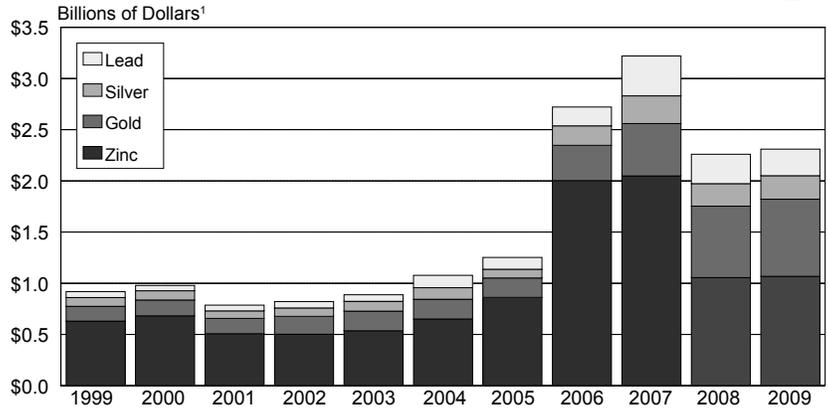
<sup>6</sup> See the Alaska Department of Commerce Web site for a list of potential mining projects: <http://www.commerce.state.ak.us/oed/minerals/advmine.htm>

<sup>7</sup> According to the Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, *Alaska's Mineral Industry 2009- A Summary*

<sup>8</sup> See footnote 7

<sup>9</sup> See the Department of Natural Resource's report, *Alaska's Mineral Industry 2008*, <http://www.commerce.state.ak.us/oed/minerals/pub/sr63.pdf>

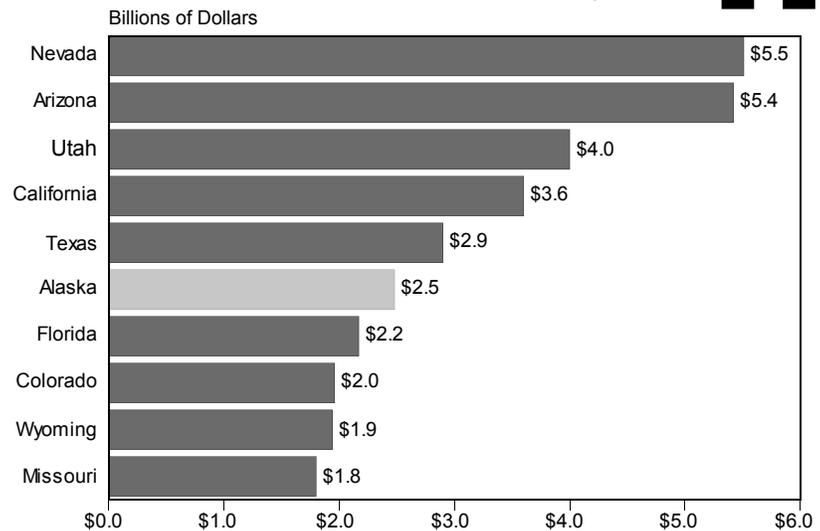
## A Decade of Production Values 10



<sup>1</sup>Values are in nominal dollars.

Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys

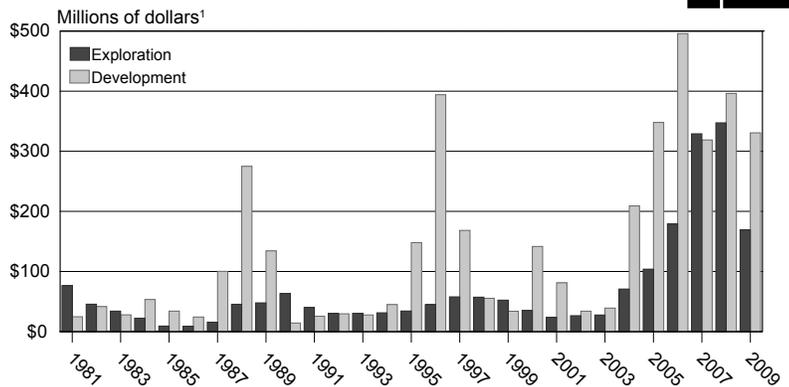
## Alaska Ranks Sixth in Production 11



Note: Includes all nonfuel minerals

Source: United States Geological Survey, Mineral Commodity Summaries 2008 and 2009

## Exploration and Development 12

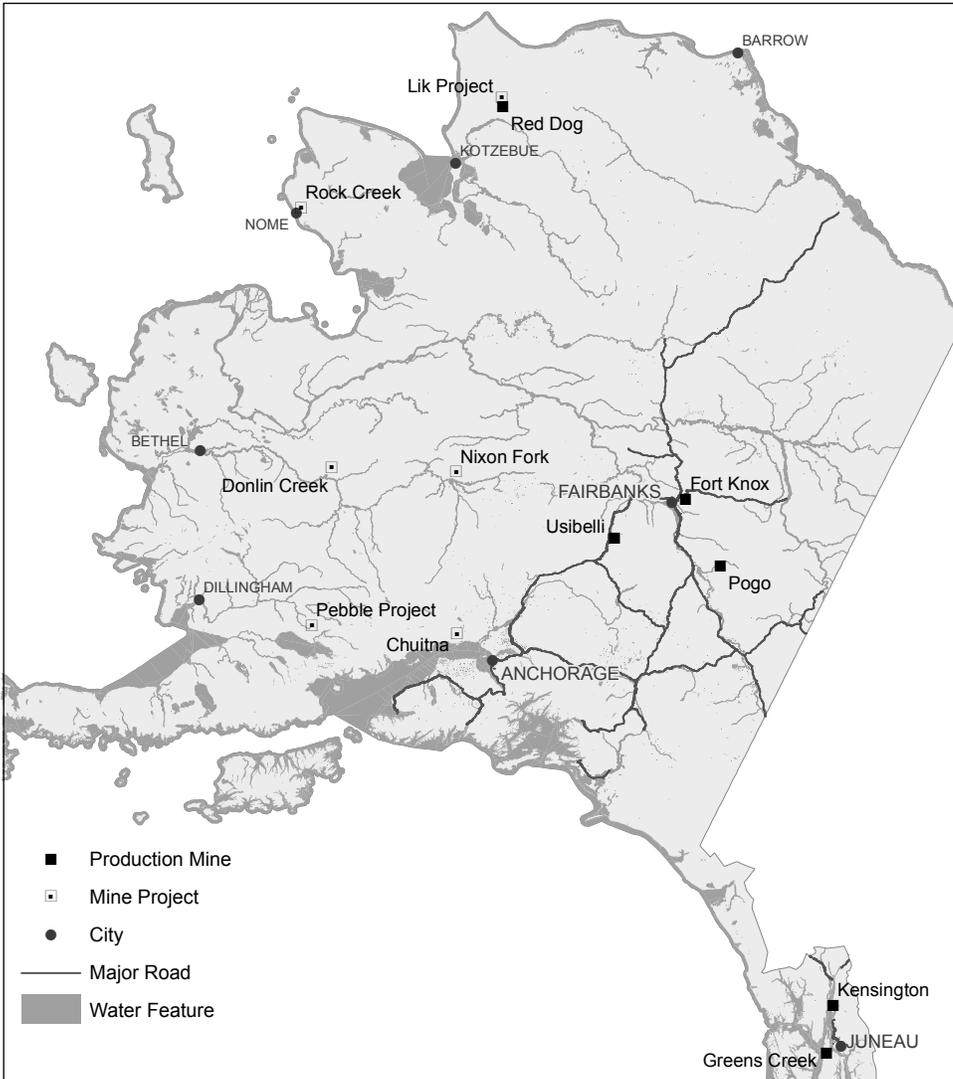


<sup>1</sup> Values are in nominal dollars.

Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys

# Alaska Mines

## Mines in Production and Planned Projects



### Production Mines

#### **Fort Knox Mine**

Commissioned in 1997  
Production in 2009:  
263,260 gold equivalent ounces<sup>1</sup>

#### **Greens Creek Mine**

Commissioned in 1989  
Production in 2009:  
7.5 million ounces of silver  
67,269 ounces of gold  
70,379 tons of zinc  
22,253 tons of lead

#### **Kensington Mine**

Production began in June of 2010  
Proven and probable reserves:  
1.5 million ounces of gold

#### **Pogo Mine**

Commissioned in 2006  
Production in 2009:  
389,808 ounces of gold

#### **Red Dog Mine**

Commissioned in 1990  
Production in 2009:  
145,000 tons of lead concentrate  
642,100 tons of zinc concentrate  
8.114 million ounces of silver

#### **Usibelli Coal Mine**

Commissioned in 1943  
Production in 2009:  
1,861,714 tons

### Projects

#### **Chuitna Coal Project**

*Under development/in construction*  
Proven reserves reported to be 771 million tons

#### **Donlin Creek Project**

*In advanced exploration status*  
Proven and probable reserves of 29.3 million ounces of gold, measured resources of 6 million ounces of gold

#### **Lik Project**

*In advanced exploration status*  
Indicated resources of 3.3 billion pounds of zinc, more than 1 billion pounds of lead, and more than 31 million ounces of silver  
Note: Does not include inferred resources

#### **Nixon Fork Mine**

*Under development /in construction*  
Exploration is currently underway to confirm previous reports of mineral resources.

#### **Pebble Copper–Gold–Molybdenum Project**

*In advanced exploration status*  
Total global resource contains approximately: 72 billion pounds of copper, 91 million ounces of gold, and 4.8 billion pounds of molybdenum

#### **Rock Creek**

*On care and maintenance status*  
0.5 million ounces of probable gold reserves, 1.9 million ounces of measured and indicated resources, and 0.3 million ounces of inferred gold resources

Note: Reserves can be proven or probable and are an economic entity. Resources are measured, indicated, or inferred and have undergone less cost analysis and sampling than reserves.

<sup>1</sup> Gold equivalent ounces includes silver ounces that are produced, sold, and converted to a gold equivalent based on the ratio of the average spot market prices for the commodities for each period.

Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys, Alaska's Mineral Industry 2009- A Summary : <http://www.dggs.alaska.gov/webpubs/dggs/ic/text/ic060.PDF>

# A Brief Summary of Mining Activity in Alaska and the Mineral's Industrial Applications

Mineral Name/ Chemical Symbol	Mineral Summary
Gold (Au)	Gold has been mined in Alaska since the 1880s. Roughly 80 percent of gold in the U.S. is used for jewelry. Other current uses include electronics, currency, and dental applications.
Lead (Pb)	Minor amounts of lead have been mined in Alaska since the 1880's. Except for a brief swell in the late 1920's, production growth started in 1989. Most lead is used in acid-lead batteries that power many different types of equipment. It is also currently used for ammunition, alloys like bronze and a variety of other industrial applications. Environmental concerns have caused a reduced role for lead in gasoline, paint additives, solder, and pipes.
Zinc (Zn)	Zinc production had a brief stint from 1947 to 1949. The 1989 opening of the Red Dog Mine raised production levels. Over half of domestic zinc is used for galvanizing. Zinc is also an important component in alloys like bronze and brass.
Copper (Cu)	Copper production started in 1901 and peaked in 1916 with the help of the Kennecott Mine near McCarthy. It slowly petered out by the 1960's. Minimal production was reported between 1996 and 2002. The bulk of copper use is in construction and electronics, but it is also used for many types of machinery and consumer products.
Antimony (Sb)	Used in flame retardants and shrapnel alloys, antimony production was reported during the first and second World Wars from 1914 to 1918 and again in 1937. Also used in lead-acid batteries and plastic, antimony mining continued sporadically in Alaska until the mid-1980's.
Chromium (Cr)	This ingredient for stainless steel was produced in Alaska from 1942 to 1943 and 1954 to 1957 in minimal amounts.
Platinum (Pt)	Platinum was dredge-mined in Southwest Alaska and is a by-product of copper mining. It is used in vehicles as a catalyst for air-pollution abatement. Platinum's properties make it useful for many chemical and electronic technologies. It is also made into jewelry.
Tin (Sn)	Tin production was first reported for Alaska in 1902 and halted in 1993. Tin is used for tin cans, containers, and electronics. Other uses include construction, vehicles, and solder.
Mercury (Hg)	Production of this transition metal was reported to some degree from 1940 to 1973, though not in high economic amounts. This toxic metal was historically used in thermometers, batteries, cosmetics, and paint. Due to EPA restrictions mercury is now mostly used for chlorine caustic soda. It occurs as a by-product of gold mining and was once used by miners to separate gold from placer gravels.
Molybdenum (Mb)	There is no history of molybdenum mining in Alaska, but it is a prospective product of the Pebble Mine. This metal is used in steel alloys and superalloys.
Coal	Coal doesn't have a set formula because it is classified as a rock, not a pure mineral. Coal is composed of mostly carbon, oxygen, and hydrogen. Coal occurs in a variety of forms depending on metamorphic grade and volatile concentration. Usibelli Coal Mine produces subbituminous coal that is used as fuel for electricity generation. Alaska has produced coal in every decade since the 1880's and had record production in 2009.

*Source: Alaska Department of Natural Resources, Division of Geological and Geophysical Surveys; United States Geological Survey, Mineral Commodity Summaries 2009*