Special Publication

Bureau of Mines
Mineral Investigations in the Juneau Mining District, Alaska, 1984–1988

Volume 2.–Detailed Mine, Prospect, and Mineral Occurrence Descriptions

Introduction

UNITED STATES DEPARTMENT OF THE INTERIOR

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By Staff, Juneau Branch, Alaskan Field Operations Center

UNITED STATES DEPARTMENT OF THE INTERIOR
Manuel Lujan, Jr., Secretary

BUREAU OF MINES
T S Ary, Director

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ILLUSTRATIONS

UNIT OF MEASURE ABBREVIATIONS USED IN THIS REPORT

°	degree
°C	degree Celsius
ft	foot
g	gram
hp	horsepower
hr	hour
in	inch
kb	kilobar
lb	pound
Ma	million years before present
MM	million
oz	troy ounce
oz/ton	troy ounce per short ton
oz/yd^3	troy ounce per cubic yard
ppm	part per million
ppt	part per thousand
ton	short ton
yd^3	cubic yard

BUREAU OF MINES MINERAL INVESTIGATIONS IN THE JUNEAU MINING DISTRICT, ALASKA, 1984–1988

VOLUME 2—DETAILED MINE, PROSPECT, AND OCCURRENCE DESCRIPTIONS

By Staff, Juneau Branch, Alaska Field Operations Center

ABSTRACT

This publication summarizes the Bureau's activities as part of a study of the Juneau Mining District (JMD) during the period 1984-1988. The objectives of the program were to identify the type, amount, and distribution of mineral deposits in the district, determine ore reserves, study beneficiation technologies for the ore, make feasibility studies, and address economic and legislative effects on mineral development. The JMD study was a cooperative study involving the Bureau and the Alaska Division of Geological and Geophysical Surveys (ADGGS). Over 30 employee-years were spent by the Bureau on this project.

Bureau investigations in the JMD consisted of a district-wide investigation of industrial materials in addition to site-specific investigations of precious and base metals in five subareas. During the 4 years of the JMD study, more than 300 areas, mines, prospects, and occurrences were visited, which contain gold, silver, copper, zinc, lead, nickel, cobalt, tungsten, molybdenum, chromium, and platinum group metals (PGM). More than 59,000 feet of underground workings were mapped and sampled. More than 5,500 samples were taken; one diamond drilling program and three geophysical surveys were completed.

An up-to-date and complete mineral data base for the JMD did not exist prior to this study. The JMD study, which coincided with a tremendous increase in mineral interest and activity in the district, has proven to be valuable to both the minerals industry and land management agencies. The discovery of two new mineral occurrences and compilation of data on known mines, prospects, and occurrences have aided industry activity in the region. The study enabled timely data to be available to land management agencies at the Federal, State, and municipal levels.

INTRODUCTION

This is the final report in a series of publications on the Juneau Mining District (JMD). This volume contains detailed backup material on the results of Bureau of Mines (Bureau) investigations of mineral deposits, prospects, and mineral occurrences in the JMD during the period 1984–1988. Volume 1 consists of an executive summary of Bureau investigations. Volume 3 is a report on industrial minerals within the district.

The Bureau's work in the JMD was a 4-year study. The objectives of the program were to identify the type, amount, and distribution of mineral deposits in the district, determine ore reserves, study beneficiation technologies for the ore, make feasibility studies, and address economic effects on mineral development. The JMD study was a cooperative effort involving the Bureau and the Alaska Division of Geological and Geophysical Surveys (ADGGS). ADGGS personnel were responsible for geologic studies and mapping of selected areas, while Bureau personnel conducted site-specific examinations.

During the course of the study, more than 14 publications and presentations were prepared in order to report Bureau accomplishments in a timely manner. Most of those reports were area-specific and will be described in the subarea chapters of this volume.

The JMD, as the name is used in this study, was formally named by Ransome and Kerns in 1954 (*210*).[1] Its location and the locations of other mining districts in Alaska are based on geographic boundaries (fig. 1). The JMD is bounded by the crest of the Fairweather Range on the west, the Alaska-Canada border on the north and

[1] Italicized numbers in parentheses refer to items in the bibliography at the end of this volume.

east, and various marine waterways on the south. The waterways include, from west to east: Cross Sound, Icy Strait, Lynn Canal, Stephens Passage, and Tracy Arm. The JMD includes several historical mining areas that have been the sites of past mineral activity. The most famous of these is the Juneau Gold Belt, located near Juneau, Alaska. Another mining area mentioned in literature is the Porcupine placer mining district, located northwest of Haines, Alaska.

Topography of the JMD is rugged, with elevations ranging from sea level to 15,300 feet at Mount Fairweather. Glaciers have contributed to the formation of most of the landscape features, and are still prevalent in much of the area. Of the 9,900 square miles encompassed by the JMD boundary, 16% is covered by salt water and 28% is covered by ice or permanent snow. The remaining 56% of the area, or approximately 5,600 square miles, is accessible land. Total area above sea level is approximately 8,300 square miles, or 5.3 million acres. The land above timberline, approximately 2,000 feet elevation (this varies greatly with location), is alpine, with little or no vegetation, while the land from sea level to 2,000 feet elevation is blanketed with a dense rain forest.

The dominant plant species in the rain forest include the economically valuable Sitka spruce and western hemlock, as well as other plants such as alder, yellow cedar, blueberries, and devil's club. Numerous avalanche chutes and recently deglaciated areas are populated by dense thickets of alder and willow. Poorly-drained areas of muskeg are found in some locations; these areas contain their own unique flora.

Population centers in the JMD include Juneau, which is the capital city of Alaska, and the communities of Haines and Skagway. Other settlements include Gustavus, Klukwan, and Excursion Inlet. Transportation between these communities is afforded by a variety of means, described below.

Haines and Skagway are connected to the Alaska Highway network via Alaska Route 7 and Klondike Highway 2, respectively. Land transport to British Columbia, Yukon Territory, interior Alaska, and the conterminous United States is afforded by those routes. Juneau, Gustavus, and Excursion Inlet have no road connection with other communities. Each community has its own road system, as shown in figure 1.

The White Pass and Yukon Route is a narrow-gauge railway that operated between Skagway and Whitehorse, Yukon Territory, between 1900 and 1982. A major reason for the shutdown of the railway was the closure of the Anvil lead-zinc mine in Yukon Territory. Concentrates from that mine had been transported to Skagway via the White Pass and Yukon Route. The mine reopened in June of 1986; however, in the interim Klondike Highway 2 had been constructed, and the Anvil concentrates are now being transported via truck to a terminal at Skagway, where they are put on deep-water vessels for shipment to smelters. The railway resumed operation in 1988 on a limited basis as a tourist attraction.

The communities of Juneau, Haines, and Skagway rely on ferries of the Alaska Marine Highway System for much of their transportation needs, as well as on other marine transport, such as barges. Scheduled air transport serves Juneau International airport, as well as paved strips at Haines, Gustavus, and Skagway. Amphibious and float-equipped aircraft serve all the communities in the JMD, and along with helicopters, provide access to the more remote locations.

Figure 2 shows the major land ownership categories in the JMD. The four major land administrators in the district are the U.S. Forest Service (USFS), the National Park Service (NPS), the U.S. Bureau of Land Management (BLM), and the State of Alaska. The Tongass National Forest covers roughly the eastern half of the JMD, and includes two wilderness areas. The Endicott River Wilderness is included entirely within the JMD, whereas only the northernmost portion of the Tracy Arm-Fords Terror Wilderness occurs within the JMD. Glacier Bay National Park covers the majority of the western half of the JMD, and the remainder, the northern portion, is a mixture of BLM-administered land and State land (also included in this portion is the Klondike Gold Rush National Historical Park).

Not shown on figure 2 are many small areas of Native and private land occurring as inholdings within the larger areas. Also note that the Boroughs of Haines and Juneau include vast tracts of land over which they hold rights of taxation.

The JMD was subdivided into the Glacier Bay, Juneau, and Skagway subdistricts by Ransome and Kerns. However, those subdivisions were not used in the current study; instead, the JMD was divided into the following five geographic subareas:

A. Haines-Klukwan-Porcupine
B. Glacier Bay
C. West Lynn Canal
D. Juneau Gold Belt
E. Coast Range

The location of the JMD and its geographic subareas are shown on figure 1. The division of the JMD into 5 subareas was predicated on the professional staff available to do the study, their expertise and experience, the amount of previous Bureau work in some areas of the district, and the logistical considerations inherent in a project covering such a large land area.

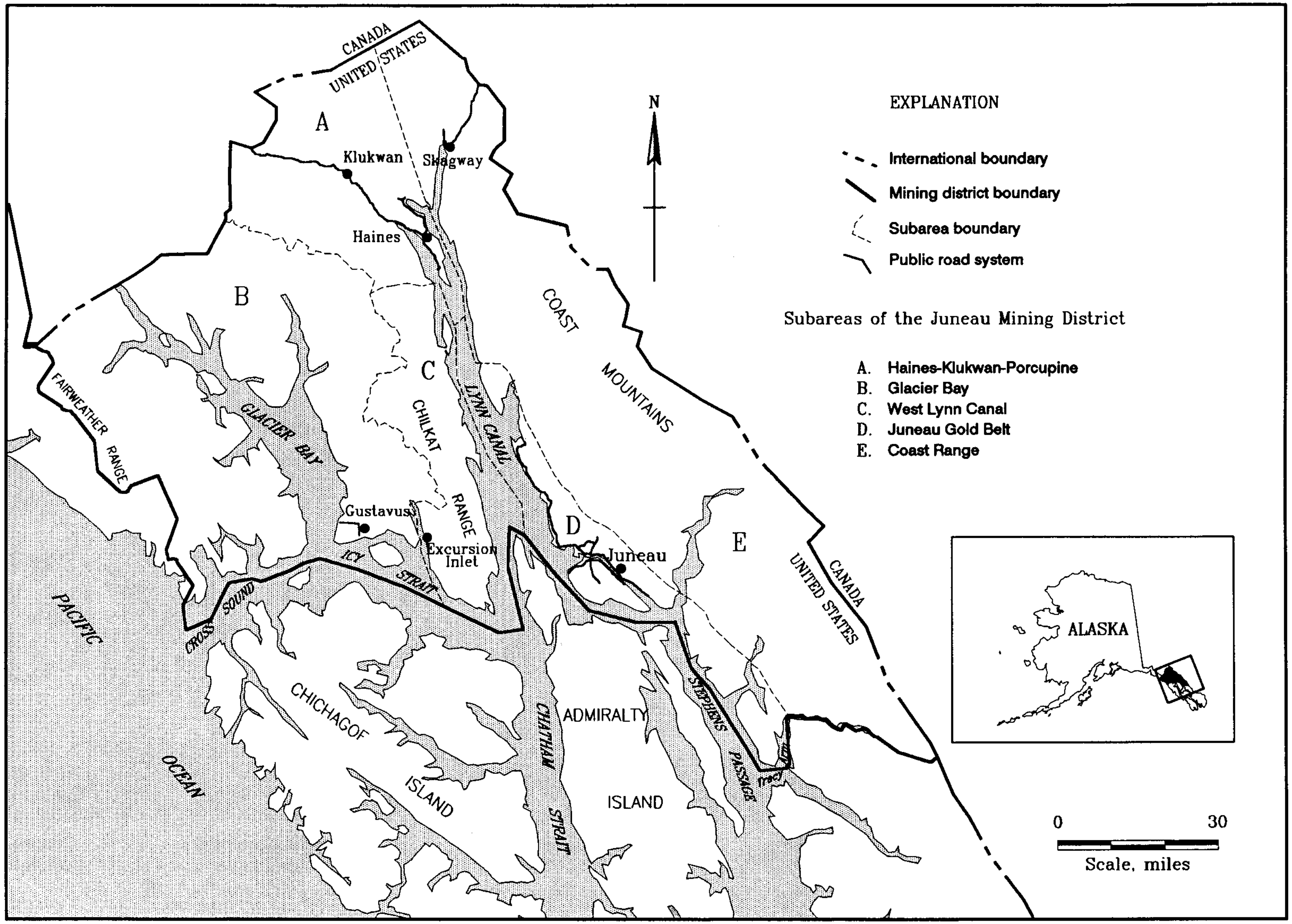

Figure 1.—Map showing location and subareas of the Juneau Mining District.

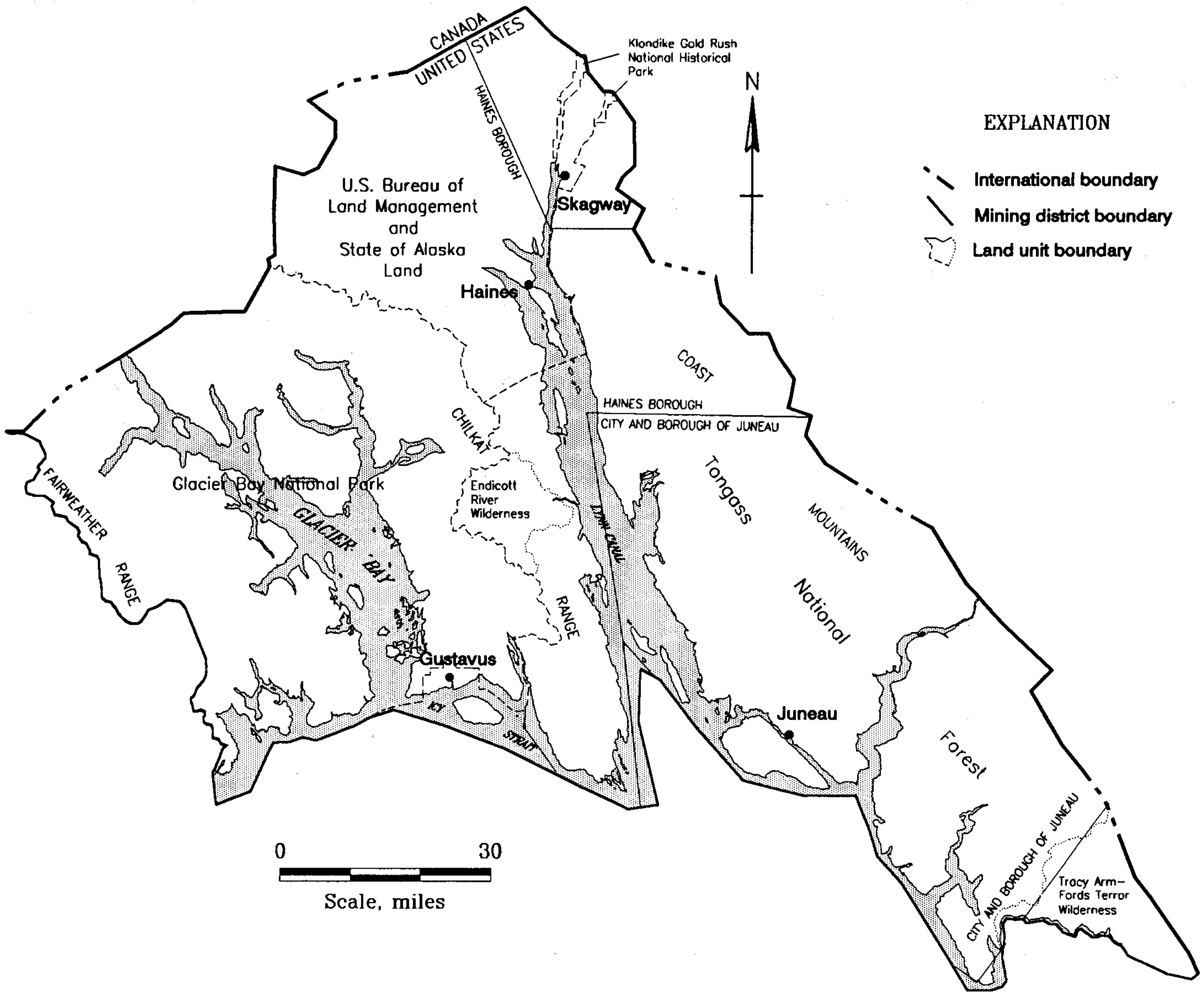

Figure 2.—Map showing major land units within the Juneau Mining District.

ACKNOWLEDGMENTS

Mining companies which cooperated in the JMD study include WGM, Inc., Echo Bay Mines, Ltd., Curator American, Inc., Salisbury and Associates, Newmont Exploration Limited, FMC Gold Co., Falconbridge Limited, BP Minerals America, Stryker Resources Ltd., Hawley Resource Group, Inc., AJT Mining Properties, Inc., Hyak Mining Company, Monument Resources, Regent Alaska, Inc., and others. Independent prospectors who contributed include Dale Henkins, Roger Eichmann, Merrill Palmer, Jim McLaughlin, Jo Jurgeleit, R.C. Manuel, Don LeGrand, and Joan Candy. State and Federal agencies which contributed include the ADGGS and U.S. Geological Survey (USGS). The NPS, USFS, City of Haines, Borough of Haines, and City and Borough of Juneau also cooperated in the study, as did personnel from Sealaska Native Regional Corporation. In addition to the work done by the ADGGS, personnel from the Bureau's Salt Lake City Research Center conducted beneficiation tests. The Bureau's Albany and Reno Research Centers were also involved in mineralogical and beneficiation studies. Personnel from the Bureau's Western Field Operations Center, Spokane, Washington, assisted in the industrial minerals portion of the project, and provided mine and mill models for economic evaluation of JMD mineral deposits. Personnel from the Bureau's Minerals Availability Program published the results of economic studies in the JMD (*14*, *258*).

HISTORY

The first recorded gold discoveries near the JMD occurred when placers were found in 1869 in the Juneau Gold Belt to the south of the JMD boundary. Joseph Juneau and Richard Harris found placer gold in 1880 at what is now called Gold Creek near present-day Juneau. Their search was aided by natives who showed Juneau and Harris gold they had found in the area. Extensive placer mining took place on Gold Creek, and eventually large low-grade lode gold deposits were discovered, several of which were in production by 1882.

On Douglas Island, across Gastineau Channel from Juneau, the Treadwell mining complex was developed into a world-class underground gold mine by 1887. A disastrous cave-in and subsequent flooding in 1917 permanently closed three of the four mines that made up the complex. The last mine in the complex closed in 1922 after total production of 3.2 million ounces of gold.

The Alaska Juneau Mine resulted from the consolidation of many holdings in the vicinity of Gold Creek. The mine was profitable between 1897 and 1910; in 1914 a large-scale mine and mill were started. After some initial difficulties, the mine operated as a world-class underground mine between 1928 and 1944. Total production exceeded 2.9 million ounces of gold.

The Klondike gold rush in Yukon Territory, starting in 1896, brought a flux of miners through the JMD. During 1898, prospectors working as packers on the Dalton trail, an alternative route to the more famous Chilkoot and White passes, discovered placer gold at Porcupine Creek near present-day Haines. The Porcupine district was the site of considerable placer mining activity between 1898 and 1936, and small operations are currently active.

The Reid Inlet area in present-day Glacier Bay National Park was an active area between 1938 and 1954; several thousand ounces of gold were produced from underground lodes during that period.

Mines in the JMD have produced more than 6.7 million ounces of gold, 3.1 million ounces of silver, and 45 million pounds of lead. The vast bulk of this production came from the Treadwell and Alaska Juneau mines, both of which were the largest and lowest-grade gold mines in the world while they were active. Figure 3 is a graphic representation of lode gold production in the JMD. Production figures from all mines in the JMD are provided in the subarea chapters of this report.

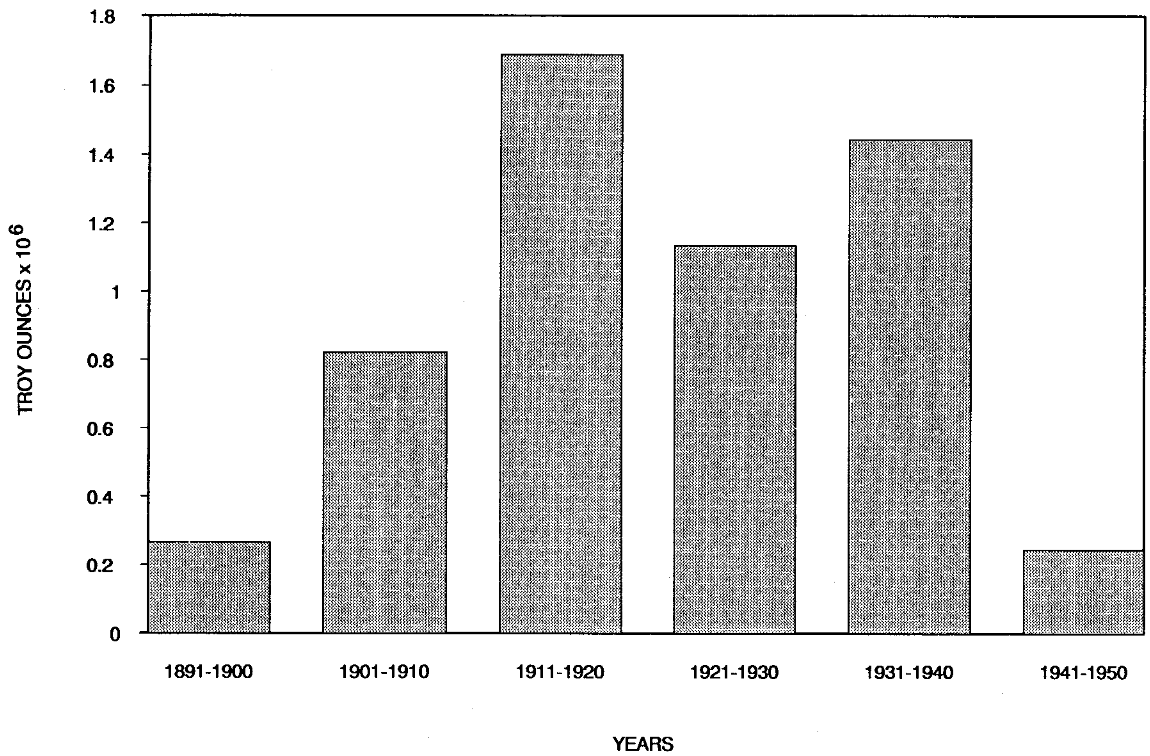

Figure 3.—Graph showing lode gold production from the Juneau Mining District.

GENERAL GEOLOGY AND MINERAL DEPOSIT TYPES

Mineral-oriented studies in the JMD began before the turn of the 20th century. Most of the studies were by the USGS, the Bureau, and by Territorial/State agencies. Locations of published studies are shown in figure 4, which is cross-referenced to the bibliography section.

Most of the effort to understand the geology of the region has been expended by the USGS, except in the Haines-Klukwan-Porcupine subarea where the ADGGS has been active during this study. A general discussion of the geology of the JMD is taken from publications by USGS personnel (*28*, *41*, *42*, *43*, *47*), and includes a discussion of the major mineral deposit types in the district.

The JMD is composed of five tectonostratigraphic terranes: 1) the Alexander terrane, including the Craig and Admiralty subterranes, 2) Wrangellia, 3) the Gravina terrane, 4) the Chugach terrane, and 5) the Stikine terrane (fig. 5).

The Alexander terrane dominates the mining district. It is composed predominantly of metamorphosed Paleozoic through Triassic clastic sediments (shale, siltstone, graywacke, and sandstone) and limestone with areas of mafic and felsic volcanic rocks. The units host volcanogenic sulfide deposits and vein deposits.

Wrangellia is restricted to a narrow belt near the western edge of the district. It is composed of Triassic metamorphosed mafic volcanics with some limestone and argillite. Volcanic units in the Johns Hopkins Inlet area of Glacier Bay host volcanogenic massive sulfide bodies.

The Gravina terrane is an overlap assemblage of Jurassic to Cretaceous flysch (argillite and graywacke) with basaltic to andesitic volcanic rocks. The terrane lies unconformably on top of the Alexander terrane and hosts vein deposits and a few volcanogenic massive sulfide horizons.

The Chugach and Stikine terranes bound the west and east sides of the mining district, respectively. The Chugach terrane is composed of Jurassic to Cretaceous graywacke, shale, and mafic volcanic rocks. This terrane has been intruded by mafic/ultramafic plutons which contain the large Brady Glacier nickel-copper deposit. Carboniferous to Jurassic mafic to felsic volcanic rocks with interbedded clastic sedimentary rocks and limestone

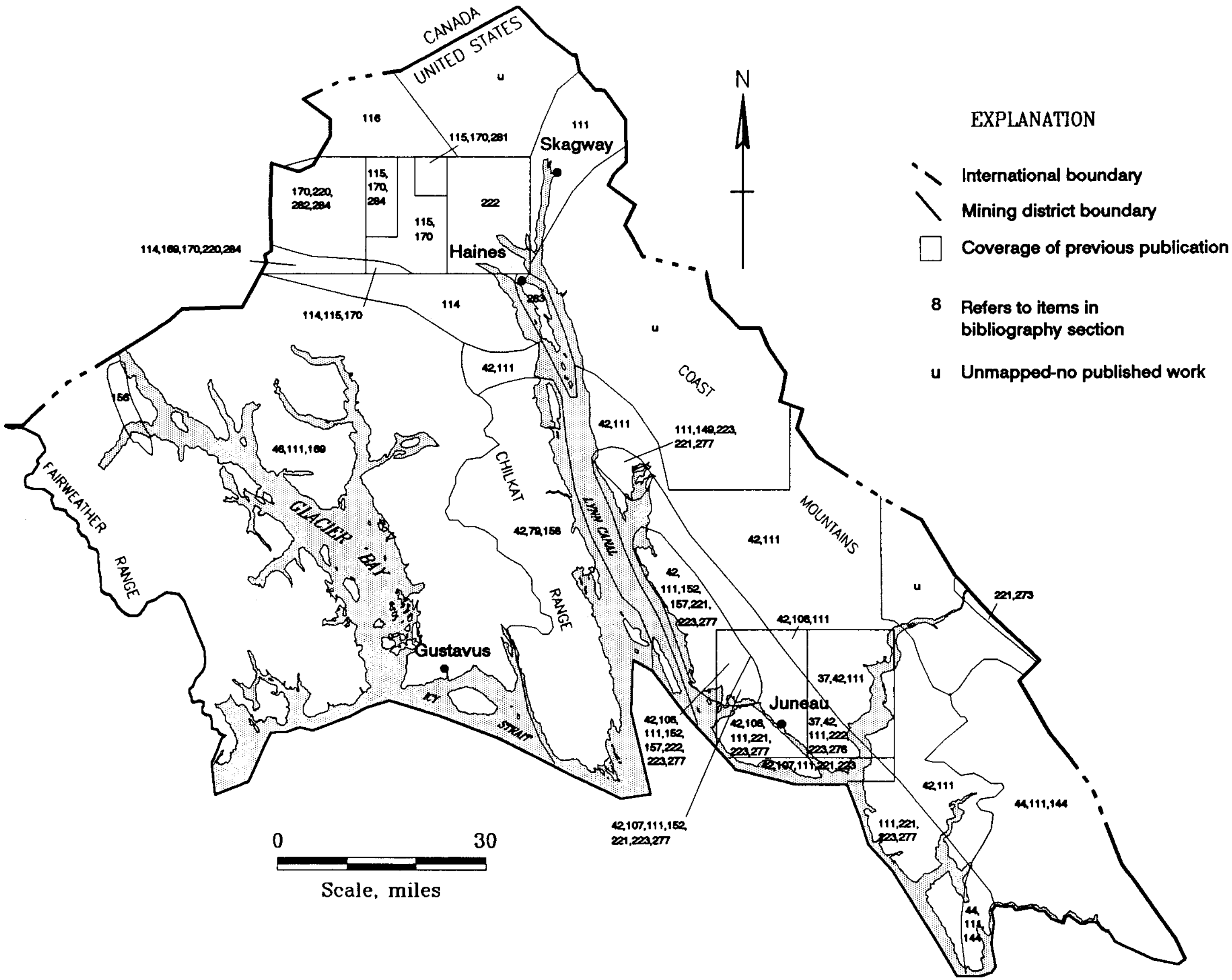

Figure 4.—Map showing previous mineral-related publications in the Juneau Mining District.

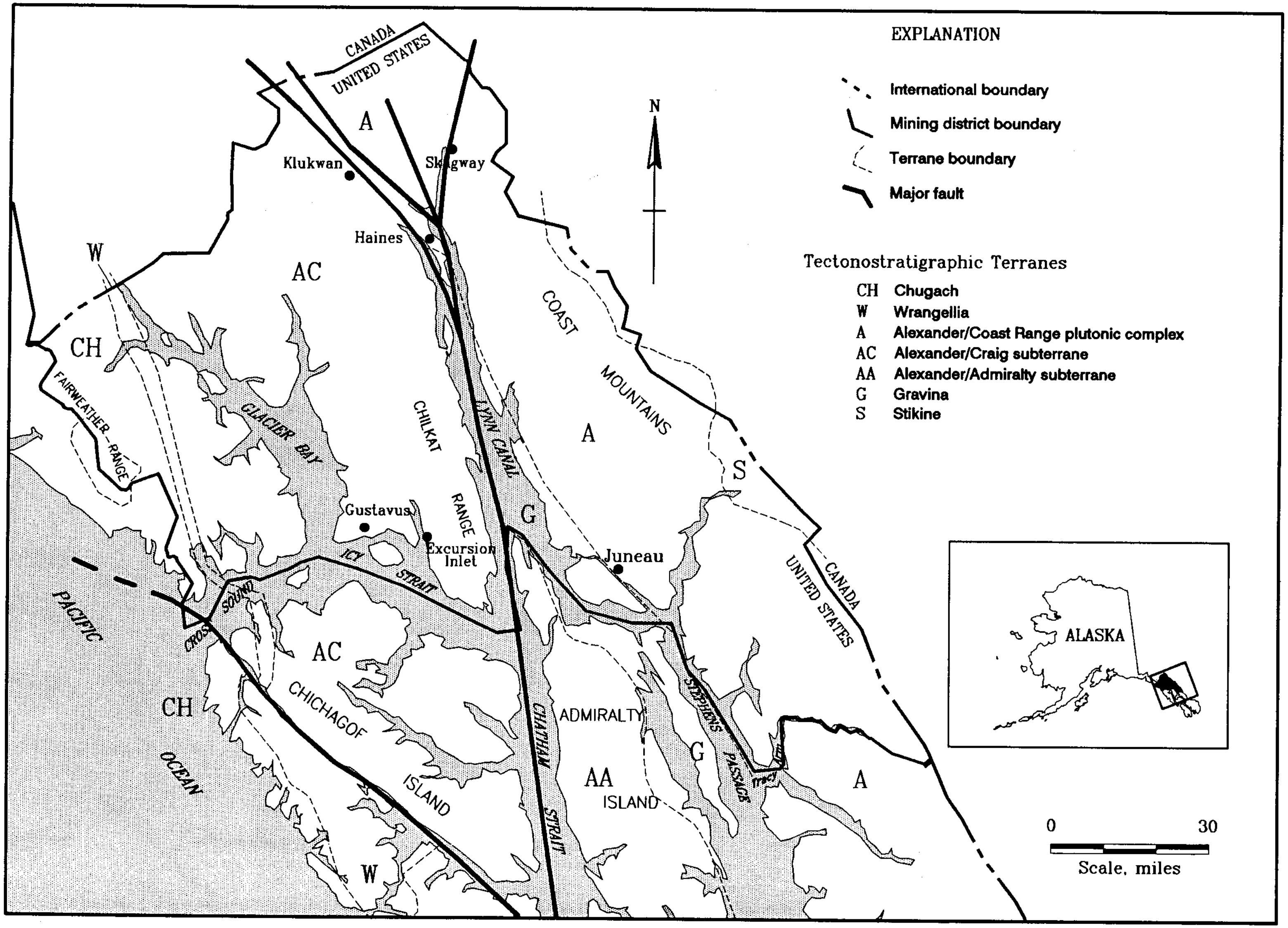

Figure 5.—Map showing geologic setting of the Juneau Mining District.

form the Stikine terrane, which occurs in the Coast Range subarea. The Stikine terrane hosts volcanogenic massive sulfide deposits in nearby areas of British Columbia.

The JMD has also been intruded by plutonic rocks which range in composition from ultramafic to granite and in age from about 114 Ma to possibly as young as 5 Ma. Most plutonic rocks are between 75 Ma and 35 Ma. Skarns, porphyry copper and molybdenum deposits, and magmatic oxide or sulfide deposits are associated with the various plutonic bodies.

Most of the rocks in the JMD, except for rare Tertiary terrestrial clastic rocks, have undergone at least one metamorphic event. Greenschist-grade regional metamorphism has affected almost all of the rocks in the area west of and including the Juneau Gold Belt. In the vicinity of Four Winds Peaks, northwest of Haines, and from the Juneau Gold Belt to the Canadian border, the rocks have been subjected to progressive regional metamorphism. Metamorphic grade increases from lower greenschist on the southwest to amphibolite on the northeast. Extremely high-grade metamorphic rocks exist in the core of the Coast Range plutonic-metamorphic complex.

The district is cut by a number of major strike-slip faults, the most significant of which is the Chatham Strait fault, extending along Lynn Canal, which bisects the mining district. A number of subsidiary faults splay from this major feature.

The terranes in the JMD host a variety of mineral deposit types. The most important of these are vein gold, volcanogenic massive sulfide, polymetallic vein, porphyry, skarn, and magmatic oxide or sulfide. The following deposit descriptions are standardized based in part on the compilation of mineral deposit models by Cox and Singer (*86*).

The vein gold deposits are mostly low-sulfide gold-quartz veins hosted in regionally metamorphosed volcanic and sedimentary rocks. These deposits, which include the Alaska Juneau, Treadwell, Reid Inlet, and Road Cut, are found in the Alexander and Gravina terranes.

Volcanogenic massive sulfide deposits consist primarily of zinc- and copper-bearing deposits typically hosted in marine volcanic rocks of intermediate to felsic composition or related sediments. These deposits are classified as Kuroko massive sulfides and are found in the Alexander, Wrangellia, and Gravina terranes. Examples are the Main Deposit, Orange Point, Sweetheart Ridge, and Nevada Creek.

The polymetallic vein deposits contain gold- and silver-bearing quartz-carbonate veins with associated base metal sulfides and are related to shallow, felsic intrusives hosted in sedimentary or metamorphic rocks. Such deposits, like the Lost Silver Ledge, are found in the Alexander terrane.

Porphyry deposits consist of copper and/or molybdenum mineralization with gold and occasional tungsten in stockworks, veins, and disseminations hosted in altered felsic intrusive and adjacent country rocks. Three types of porphyry deposits were identified in the JMD: 1) porphyry copper, 2) porphyry copper-molybdenum, and 3) low-fluorine porphyry molybdenum deposits. Copper and copper-molybdenum porphyries are found in the Alexander terrane while low-fluorine porphyries are found in the Alexander and Stikine terranes. Examples are the Mount Ogden, Nunatak molybdenum and Margerie Glacier deposits.

Skarn deposits are composed of copper or zinc with associated gold, silver, and lead hosted in calc-silicate rocks adjacent to plutons. They are found throughout the JMD in all terranes and include the Massive Chalcopyrite, Inspiration, and Clair Bear prospects.

Magmatic oxide or sulfide deposits are associated with mafic-ultramafic complexes and consist of magmatic segregations of iron oxides or nickel-copper sulfides. Cobalt, gold, and PGM are also associated with this deposit type. The mafic-ultramafic complexes are located in two northwest-trending parallel belts that extend the length of the JMD. The western belt contains the Crillon-LaPerouse plutons which host the Brady Glacier nickel-copper deposit. The eastern belt includes the Klukwan and Snettisham iron deposits and the Mount Leland ultramafic body.

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