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MINERAL INDUSTRY OF ALASKA IN 1933

BY
PHILIP S. SMITH

Mineral resources of Alaska, 1933
(Pages 1–94)

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By PHILIP S. SMITH [1]

INTRODUCTION

Stimulation of its citizens to the wise development of the natural resources of their country is generally accepted as an especially appropriate function of government. This has been especially true of countries like the United States, where ownership of vast stretches of potential mineral-bearing land has imposed on the Government special obligations to manage those holdings to the benefit of all. Assistance to the mining industry of Alaska has therefore long been recognized as a Federal obligation, and through the Geological Survey efforts have been made to determine the distribution and extent of the Alaskan mineral resources and to disseminate all pertinent information about them to the miner, prospector, or business man who might undertake their development. As a result several hundred reports have been issued by the Geological Survey describing the different mineral commodities or mining camps of the Territory and setting forth, both in text and by illustrations and maps, the facts that have been determined and the inferences that may be drawn from them. Among the studies relating to the mineral industry is the collection of current information regarding the kinds and quantities of minerals produced and the places from which they came. To obtain this information the Geological Survey conducts an annual canvass of the mineral production of Alaska and makes the results available through reports published as soon as practicable after the end of the year to which the records relate. The present report, which is of this class, is the thirtieth of the series.[2]

The collection of the facts requisite for the preparation of these annual statements involves difficulties, because the great size of the Territory, the diversity of its mineral products, and the large number but small size of many of the enterprises make it impracticable

[1] The canvass of producers, the tabulation of their replies, and some of the compilation of the statistics set forth in this report have been made in association with Kathleen S. Waldron, of the Alaskan branch of the U.S. Geological Survey.

[2] The other volumes of this series, commencing with that for 1904, are Bulletins 259, 284, 314, 345, 379, 442, 480, 520, 542, 592, 622, 642, 662, 692, 712, 714, 722, 739, 755, 773, 783, 792, 797, 810, 813, 824, 836, 844, and 857.

to gather all the desired information at first hand. The information used is therefore derived from many sources, which necessarily vary in reliability and completeness. Efforts are made, however, to reduce all the statements to a comparable basis and to give only those that appear to be well substantiated. Among the most reliable sources of information are the geologists and engineers who are sent out each year by the Geological Survey to conduct surveys in different parts of Alaska and who acquire not only much accurate information regarding the mineral production of the regions in which they work but also general information by contact with miners and operators in the course of their travels to and from the field. Members of other Government organizations—for instance, the Bureau of Mines, the Bureau of the Mint, the Alaska Railroad, the Bureau of Foreign and Domestic Commerce, and the Customs Service—in the course of their regular duties collect many data which are extremely valuable in these studies and the use of which avoids unnecessary duplication in collecting records. Most of the banks, express companies, and other business organizations in Alaska collect for their own use data regarding mineral commodities of their particular districts. Some of these data are extremely pertinent to the general inquiry conducted by the Geological Survey, and through the cordial cooperation of many of these companies important facts have been made available to the Geological Survey, though some of this information is confidential and is not released for publication. Most of the larger Alaska newspapers and certain papers published in the States that feature Alaska matters are courteously sent by their publishers to the Geological Survey, and from these and the technical and scientific periodicals are gleaned many items regarding new developments.

In addition to all these sources the Geological Survey each year sends out hundreds of schedules—one to every person or company known to be engaged in mining—on which are a number of questions regarding the mining developments and production of each individual property during the year. These schedules when filled out by the operators of course constitute a most authoritative record. Unfortunately, however, not all of them are returned by the operators, and even some of the operators who return them have not all the specific data desired, misunderstand the inquiries, or reply in such a manner that the answers may not be correctly interpreted when the schedules are edited. It is a gratifying evidence of the general appreciation of these annual summaries that so many of the operators cooperate fully and cordially with the Geological Survey by furnishing the information called for on the schedules as well as volunteering much other pertinent information.

It is apparent, however, that facts collected from one source, although of themselves strictly accurate, are likely to be computed or stated on a different basis from equally reliable reports received from another source, so that considerable editing and revision must be done to bring all to one standard. It is not possible to know exactly all the corrections that should be applied in order to reduce the reports of production to a strictly uniform standard. However, though some uncertainties necessarily remain, it is believed that they do not have significant effect on the results expressed and that the report is consistent within itself and with the other reports of this series. The reader should realize that while the statistics given in these reports are comparable among themselves, they necessarily differ from those published by some of the other Government bureaus, because these are primarily records of production, whereas those issued by the Bureau of the Mint, for instance, relate to receipts at the offices of that Bureau, those issued by the Customs Service relate to shipments recorded at its stations, and those issued by other organizations may be computed on still other bases.

Another reason why the totals used in this volume for certain mineral commodities may differ from the reports received from other sources is that all values here stated, except for gold, are computed on the average selling price for each of the individual mineral commodities for the year and not on the prices actually received by the individual producers. It is obvious that this method of computation disregards the amount received by individual mines, but it is believed to afford a better representation of the industry as a whole. For gold, instead of adopting the average selling price, all computations and statements have been made on the standard former price of fine gold of $20.67 an ounce. This procedure was adopted because it appeared to furnish a better basis for comparison with the already published statistics of earlier years and removed much uncertainty in editing the reports from the field.

It is the constant aim of the compilers to make these annual summaries of mineral production as accurate and adequate as possible. The Geological Survey therefore bespeaks the continued cooperation of all persons concerned in the Alaska mineral industry and urges them to communicate any information that may lead to this desired end. It should be emphasized that all information regarding individual properties is regarded as strictly confidential. The Geological Survey does not use any facts that are furnished in a way that will disclose the production of individual plants nor allow access to its records in any way disadvantageous to either the individuals who furnish the information or those to whom it relates. So scrupulously

is this policy followed that in this volume it has been necessary to combine or group together certain districts or products so that the production of an individual may not be disclosed.

ACKNOWLEDGMENTS

In addition to all the mining operators and prospectors of the Territory who have filled in and returned the inquiry blanks sent out by the Geological Survey, special acknowledgment is due to O. E. Keissling and other officers of the Bureau of Mines and the Bureau of Foreign and Domestic Commerce, of the Department of Commerce; the collectors and other officers of the Alaska Customs Service and of the Bureau of the Mint, of the Treasury Department; the officers of the Forest Service, of the Department of Agriculture; Col. O. F. Ohlson and other officers of the Alaska Railroad; F. H. Moffit, S. R. Capps, J. B. Mertie, Jr., B. D. Stewart, R. H. Sargent, Ralph Tuck, J. J. Corey, C. F. Fuechsel, and Gerald FitzGerald of the Geological Survey; the agents of the American Railway Express Co. in Alaska; officers of the Alaska Road Commission; the Alaska Weekly and Volney Richmond, of the Northern Commercial Co., of Seattle, Wash., and the agents of this company, especially at Hot Springs, Ruby, and Circle; Ralph and Carl Lomen, of Seattle and New York; the Hyder Weekly Herald, of Hyder; the Alaska Juneau Gold Mining Co., the Daily Alaska Empire, and J. J. Connors, of Juneau; Jos. J. F. Ward, of Skagway; the Cordova Daily Times, of Cordova; J. B. O'Neill, of Cordova and Seattle; the Kennecott Copper Corporation of Kennecott and New York; Carl Whitham and M. J. Knowles, of Chitina; C. T. O'Neill, of McCarthy; Durell Finch, of Unalaska; W. J. Erskine, of Kodiak; the Anchorage Weekly Times, of Anchorage; Col. E. R. Stivers of Seward; W. E. Dunkle and Howard W. Wilmoth, of Wasilla; H. W. Nagley, of Talkeetna; Charles Zielke, of Ferry; C. C. Heid, of Nenana; the First National Bank, O. J. Egleston, J. D. Harlan, and other officers of the Fairbanks Exploration Co., the Fairbanks Daily News-Miner, L. S. Peck, of the Pacific Alaska Airways, Inc., and G. E. Jennings, of Fairbanks; Jessie M. Howard, of Tanana; C. E. M. Cole, of Jack Wade; John B. Powers, of Eagle; William Yanert, of Beaver; A. B. Webster, of Rampart; J. W. Farrell, of Hot Springs; George Jesse, of Poorman; Frank Speljack, of Ophir; the Miners & Merchants Bank, of Iditarod; Alex Mathieson and Harry Donnelley, of Flat; H. S. Wanamaker and Charles Irish, of Wiseman; J. W. Wick, of Russian Mission; Charles Mespelt, of Medfra; Oliver Anderson, of McGrath; John Haroldson, of Quinagak; J. L. Jean, of Goodnews Bay; the Nome Nugget, the

Northern Air Transport Co., Hammond Consolidated Gold Fields, Grant Jackson, of the Miners & Merchants Bank; A. C. Stewart and C. W. Thornton, of Nome; A. S. Tucker, of Bluff; Arthur W. Johnson, of Haycock; and Lewis Lloyd, of Shungnak.

MINERAL PRODUCTION

GENERAL FEATURES

The total value of the mineral production of Alaska in 1933 was $10,366,000. This was furnished by several mineral products, but gold accounts for more than 93 percent. The total value was about 89 percent of that of 1932, showing a decrease in practically all the commodities. It should be realized, however, that the price actually received for the gold was much in excess of the figure given in this report because, as already stated, the value of the gold production has here been computed on the basis of the old standard of $20.67 an ounce instead of the much higher price that prevailed during the late months of the year, when most of the placer gold produced was sold. Thus, the report from four of the larger gold mines show that they actually received for their gold in excess of $2,900,000 more than they have been credited with here.

For the other mineral products there was a slight improvement in average selling prices in 1933 as compared with 1932. Thus, the price of silver was nearly 7 cents an ounce and those of copper, lead, and tin, respectively, 0.2, 0.7, and 17.11 cents a pound higher in 1933 than in 1932. These increases, however, affected the total value of the production of these metals to an extent of less than $30,000 and were in part offset by the lower selling price of platinum, which dropped off about $6 an ounce.

No explanation of the current situation of the mineral industry of Alaska would be adequate that did not point out that it, like practically all business throughout most of the rest of the world, was affected by the general stagnation of enterprise and the sense of uncertainty that discouraged the undertaking of any expansion. Even in gold mining the advance in price took place so late in the season that, although it benefited mines already in operation, it could have little effect on production from new properties, as it takes time to get the proper equipment and do the necessary exploratory work. That the advance in the price of gold had a notable effect in stimulating prospecting and search for new ore bodies cannot be doubted, and there is every likelihood that some of the searches thus set under way will bear significant returns in ensuing years. For the other metals, however, the price changes were not sufficient to stimulate renewed activity, and the situation as

to these metals throughout the world is not such as to hold out much promise that the known Alaska deposits of them will prove attractive in the near future. It is certain that there are Alaska deposits not now productive that are worthy of critical examination, and there is every justification for expecting that with the general improvement in conditions that seems inevitable some of them may be profitably developed.

While large parts of Alaska remain almost unknown and unexplored, other parts, especially those along the main avenues of communication, have lost most of their frontier characteristics, and their facilities compare favorably with those of many parts of the States proper. In many of these areas large, stable mining enterprises have already been built up, and there is the constant tendency to undertake operations on a larger scale than formerly, so that the unit cost of the work may be kept at a low figure. That mining may be done in parts of Alaska at an extremely low cost has been demonstrated by the past performance of one of the mines in southeastern Alaska, where costs are below those of any comparable enterprise in the world. This tendency to operate in larger units marks a distinct departure from the old days when the search for mineral deposits was directed mainly toward the discovery of small rich deposits that could be worked by relatively crude methods and with little outlay of capital. Today by far the larger part of all the mineral production of Alaska comes from mines utilizing extensive equipment to handle large volumes of relatively low-grade material. The modern prospector is therefore not limited in his search to small rich stringers or concentrations but may well direct his attention to finding deposits that appear to hold promise of yielding large quantities of average or even low-grade ore. Such a prospector, however, must realize that usually he has neither the technical nor the financial capacity to carry through the development of such properties to a producing stage, and so if he places an excessive value on his discoveries he jeopardizes benefits to himself and to the mining industry, because the value of his service is but a small part of the heavy outlays that will be required for testing the property and equipping it adequately.

TOTAL MINERAL PRODUCTION

From the time of the earliest records of mining in Alaska to the end of 1933 minerals to the value of more than $663,595,000 have been produced in the Territory. The distribution of this large total among the individual years is set forth in the following table and is graphically represented by the curves in figure 1. From this table and diagram it will be evident that prior to 1898 the annual pro-

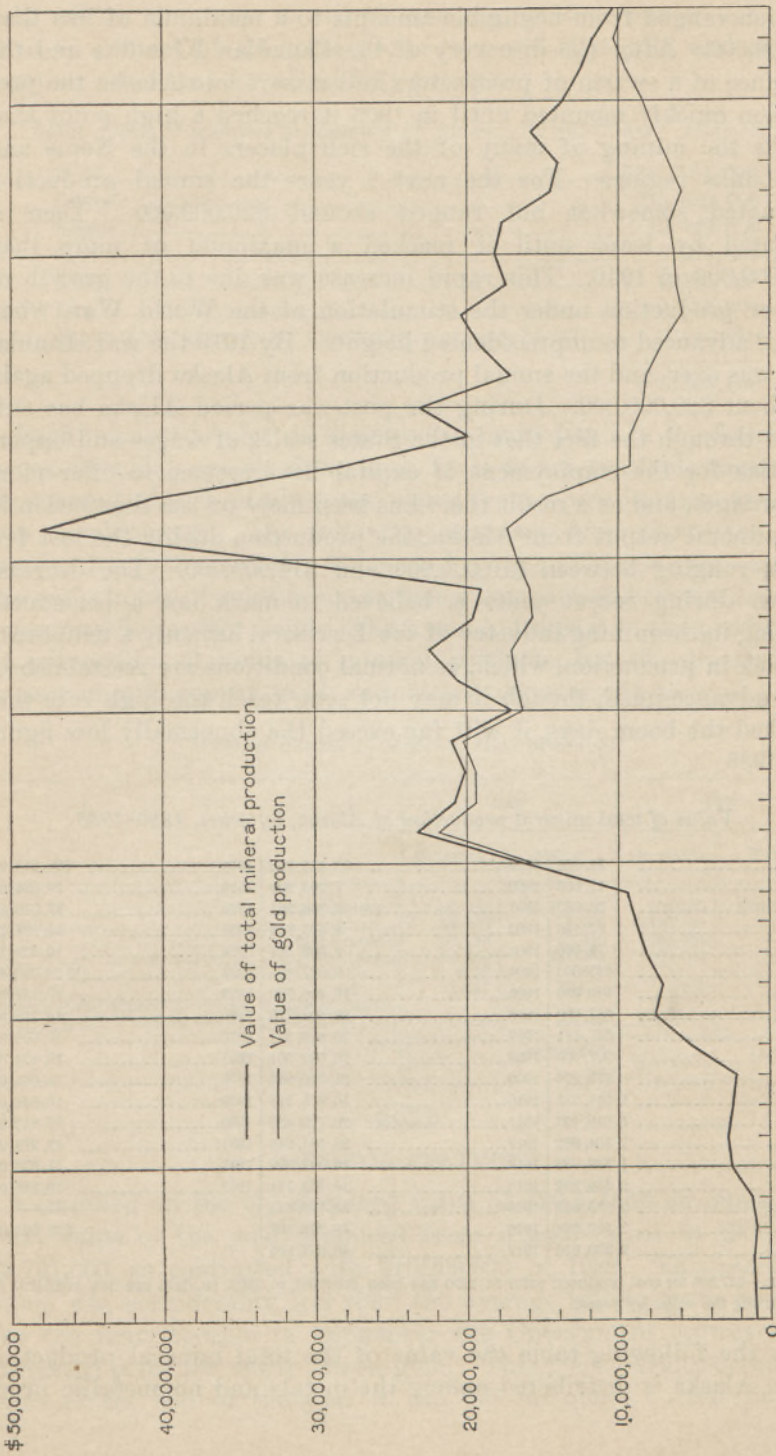

FIGURE 1.—Trends of mineral production of Alaska, 1890–1933.

duction ranged from negligible amounts to a maximum of less than $3,000,000. After the discovery of the Canadian Klondike and the entrance of a swarm of prospectors and miners into Alaska the production quickly mounted until in 1906 it reached a high point that marks the mining of many of the rich placers in the Nome and Fairbanks regions. For the next 8 years the annual production fluctuated somewhat but ranged around $20,000,000. Then it mounted by leaps until it reached a maximum of more than $48,000,000 in 1916. This rapid increase was due to the growth of copper production under the stimulation of the World War, when prices advanced to unprecedented heights. By 1919 the war stimulation was over, and the annual production from Alaska dropped again to about $20,000,000. During the post-war period Alaska has suffered through the fact that in the States scales of wages and opportunities for the employment of capital have seemed to offer more advantages, and as a result there has been more or less fluctuation in the mineral output from Alaska, the production during the last few years ranging between $10,000,000 and $14,000,000. The decrease shown during recent years is believed to mark not a permanent waning in the mining industry of the Territory, but only a temporary setback in production, which, as normal conditions are reestablished, will advance until, though it may not soon reach the high rate that marked the boom days, it will far exceed the abnormally low figure for 1933.

Value of total mineral production of Alaska, by years, 1880–1933

1880	$6,826	1899	$5,425,262	1918	$28,218,935
1881	15,000	1900	7,995,209	1919	19,626,824
1882	23,000	1901	7,306,381	1920	23,330,586
1883	67,146	1902	8,475,813	1921	16,994,302
1884	72,000	1903	9,088,564	1922	19,420,121
1885	425,000	1904	9,627,495	1923	20,330,643
1886	540,000	1905	16,490,720	1924	17,457,333
1887	657,000	1906	23,501,770	1925	18,220,692
1888	667,181	1907	20,840,571	1926	17,664,800
1889	847,490	1908	20,092,501	1927	14,404,000
1890	873,276	1909	21,140,810	1928	14,061,000
1891	1,014,211	1910	16,875,226	1929	16,066,000
1892	1,019,493	1911	20,720,480	1930	13,812,000
1893	1,104,982	1912	22,581,943	1931	12,278,000
1894	1,339,332	1913	19,547,292	1932	11,638,000
1895	2,588,832	1914	19,109,731	1933	10,366,000
1896	2,885,029	1915	32,790,344		
1897	2,539,294	1916	48,386,508		663,595,000
1898	2,329,016	1917	40,694,804		

NOTE.—$37,305 for coal produced prior to 1890 has been credited to 1890, as data are not available for distributing the value by years.

In the following table the value of the total mineral production from Alaska is distributed among the metals and nonmetallic prod-

ucts. From this table it will be seen that gold accounted for more than 63 percent of the total production and that gold and copper together accounted for about 95½ percent.

Total value of mineral production of Alaska, by substances, 1880–1933

Gold	$418,734,000
Copper	214,682,000
Silver	12,118,000
Coal	8,924,000
Tin	1,096,000
Lead	2,030,000
Other mineral products (including platinum metals)	6,011,000
	663,595,000

Each mineral product is discussed in more detail in the following pages, in which are set down such facts as are available regarding the amount of each product, the places from which it came, and any new developments. The following summary table shows the production for 1933 and 1932, distributed by quantity and value among the main kinds of substances, so that a comparison between the two years may be readily made. There was a decrease in the production of practically all kinds of mineral products, but the greatest decreases were in copper, gold, and miscellaneous products.

Mineral output of Alaska, 1933 and 1932

	1933		1932	
	Quantity	Value	Quantity	Value
Gold—fine ounces	469,286	$9,701,000	493,860	$10,209,000
Copper—pounds	29,000	1,900	8,738,500	550,500
Silver—fine ounces	157,150	55,000	234,050	66,000
Coal—short tons	96,200	481,000	102,700	513,500
Tin, metallic—do	2.92	2,300		
Lead—do	1,157	85,600	1,260	75,600
Miscellaneous mineral products, including petroleum, platinum metals, marble, gypsum, etc		39,200		223,400
		10,366,000		11,638,000

GOLD

GENERAL FEATURES

Computed on the old standard value of $20.671834 an ounce, the total value of the gold produced from Alaska mines in 1933 was $9,701,000, as contrasted with $10,209,000 in 1932. This standard value was considerably less than the average selling price of gold for the year, because in September the Government approved an increased price for newly mined gold. This price advanced rapidly until at the end of the year it was $35 an ounce. According to

computations made by C. W. Henderson, of the Bureau of Mines, the average price of gold for the entire year was approximately $25.50. Use of the former standard rather than this average price has seemed desirable so that the statistics for 1933 may be comparable with those for earlier years. Furthermore, so much of the production of gold from Alaska is seasonal that it probably sold for a much higher price than the yearly average. Therefore, adoption of that figure would have been equally misleading, and yet available data are inadequate to determine more precisely the appropriate current price prevailing when different lots of gold were sold.

The general trend of gold mining in Alaska since 1890 is graphically represented by one of the curves in figure 1. From 1890 to 1904 the curve for the value of the gold produced practically coincides with the curve for the value of the total mineral production of Alaska and marks a fairly even upward trend. From 1904 to 1906 there was an abrupt increase in gold production, marking the boom periods of many of the placer camps. From the peak of 1906 there was a gradual decline for the next 10 years, and during the period of the World War there followed a rather rapid decrease to less than $10,000,000 a year. During the post-war period from 1920 to 1927 there was a still further decline in Alaska gold production, and it touched new lows in 1923 and 1927, when it was less than $6,000,000 a year. Since 1927 there has been a marked increase in the output of gold, and although there was a slight falling off in the production for 1933, it is now nearly $10,000,000 a year—or higher than during any other year since 1917 except 1932.

There are two principal types of deposits from which the gold is recovered—lodes and placers. The lodes are the mineralized veins or masses of ore in the country rock that were in general formed through deep-seated geologic processes and represent material in place. The placers are deposits of sand and gravel which have been worn from the hard rocks in their general vicinity and in which the loose grains of gold or other valuable minerals have been more or less concentrated by surficial geologic processes that were effective because of some distinctive physical or chemical property of the material thus concentrated.

The following table shows the amount and value of the gold produced annually for the last 18 years, the total amount that has been produced since gold mining began in the Territory in 1880, and the value of the gold that has been derived from each of the two principal types of gold mines. The same information, except that the annual production for each year from 1880 is also included, is graphically represented by figure 2. Of the $418,734,000 in gold that has been produced from Alaska mines $274,478,000, or about 65½ percent, has

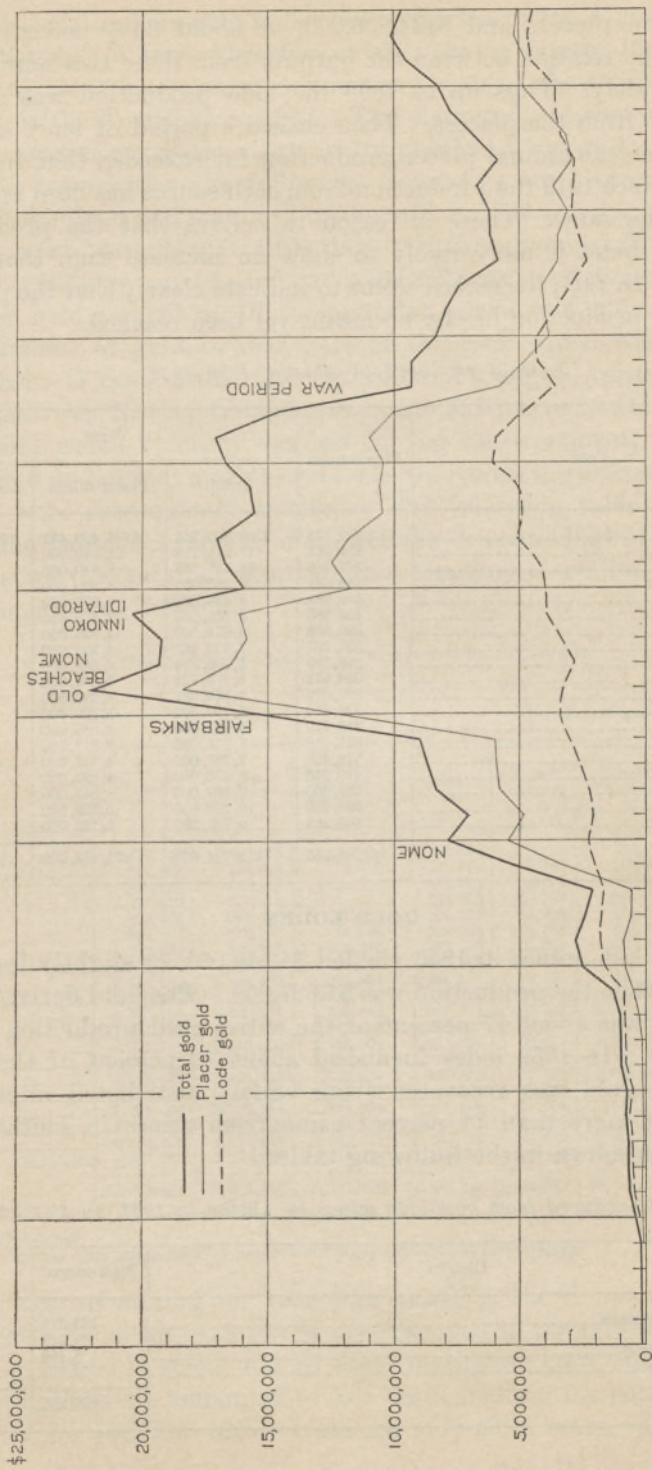

FIGURE 2.—Trend of value of gold production of Alaska, 1880–1933.

come from placers and $144,256,000, or about 34½ percent, from lodes. The relation between the outputs from these two sources has varied widely. Thus up to 1898 the lode production was greater than that from the placers. Then ensued a period of more than 20 years when the annual placer production far exceeded that from the lodes. Since 1919 the production from each source has been approximately the same. There is reason to believe that the production from the lodes is more likely to show an increase than that from placers. In fact, the record seems to indicate clearly that the peak of lode-gold production has by no means yet been reached.

Gold produced in Alaska, 1880–1933

Year	Fine ounces	Value		
		Total	Placer mines	Lode mines
1880–1915	12,592,121	$260,302,243	$185,200,444	$75,101,799
1916	834,068	17,241,713	11,140,000	6,101,713
1917	709,049	14,657,353	9,810,000	4,847,353
1918	458,641	9,480,952	5,900,000	3,580,952
1919	455,984	9,426,032	4,970,000	4,456,032
1920	404,683	8,365,560	3,873,000	4,492,560
1921	390,558	8,073,540	4,226,000	3,847,540
1922	359,057	7,422,367	4,395,000	3,027,367
1923	289,539	5,985,314	3,608,500	2,376,814
1924	304,072	6,285,724	3,564,000	2,721,724
1925	307,679	6,360,281	3,223,000	3,137,281
1926	324,450	6,707,000	3,769,000	2,938,000
1927	286,720	5,927,000	2,982,000	2,945,000
1928	331,140	6,845,000	3,347,000	2,498,000
1929	375,438	7,761,000	4,117,000	3,644,000
1930	410,020	8,476,000	4,837,000	3,639,000
1931	459,900	9,507,000	4,842,000	4,665,000
1932	493,860	10,209,000	5,522,000	4,687,000
1933	469,286	9,701,000	5,152,000	4,549,000
	20,256,265	418,734,000	274,478,000	144,256,000

GOLD LODES

Alaska lode mines in 1933 yielded $4,549,000, or slightly less than in 1932, when the production was $4,687,000. The gold derived from the lodes was about 47 percent of the entire gold production of the Territory. In 1932 lodes furnished about 46 percent of the total. The lode gold was recovered from widely distributed mines, but somewhat more than 74 percent came from mines in southeastern Alaska, as shown in the following table:

Gold produced from gold-lode mines in Alaska in 1933, by districts

District	Fine ounces	Value
Southeastern Alaska	163,749	$3,385,000
Willow Creek	37,539	776,000
Fairbanks district	8,466	175,000
Other districts	10,304	213,000
	220,058	4,549,000

Of the Alaska lode-gold mines the properties of the Alaska Juneau Gold Mining Co. in southeastern Alaska are by far the largest, and that company alone produced over two-thirds of the total lode-gold output of the Territory in 1933. The magnitude of this company's mining operations is set forth in its published report to its stockholders, from which the following statements are abstracted: The total rock mined and trammed to the mill in 1933 was 4,085,960 tons, an average of over 11,300 tons a day. Of this amount 1,619,128 tons of coarse tailings was rejected and 2,466,832 tons was fine-milled. The average gold content of all the material mined was 98 cents a ton. The amount of gold in that part of the rock which was rejected was about 17 cents a ton, and the value of the gold content of the rock that was further treated was about $1.51 a ton. Of this content gold worth 24 cents was lost during the treatment, $1.03 was recovered as bullion, and 24 cents was recovered in the concentrates, which were subsequently smelted. The following table, compiled from the published reports of the Alaska Juneau Gold Mining Co., summarizes the mining record of this company since the beginning of its operations in 1893:

Production of Alaska Juneau mine, 1893–1933

Year	Ore (tons)			Metals recovered			
	Total	Fine milled	Coarse tailings rejected	Gold	Silver (ounces)	Lead (pounds)	Total value
1893–1913	507,254	330,278	176,976	$707,730	(a)	(a)	$707,730
1914–15	242,328	239,918	2,410	251,655	6,192	117,031	261,326
1916	180,113	180,113	----------	115,022	2,844	61,068	121,378
1917	677,410	677,410	----------	429,262	12,248	296,179	460,666
1918	592,218	574,285	17,933	430,124	11,828	273,297	459,445
1919	692,895	616,302	76,593	499,002	16,431	359,762	542,714
1920	942,870	637,321	305,549	732,870	23,348	487,574	791,389
1921	1,613,600	904,323	709,277	969,703	40,619	550,913	1,035,251
1922	2,310,550	1,108,559	1,201,991	1,296,157	49,405	687,315	1,388,679
1923	2,476,240	1,134,759	1,341,481	1,427,199	41,876	755,423	1,514,774
1924	3,068,190	1,367,528	1,700,662	1,907,374	63,191	1,256,857	2,055,782
1925	3,481,780	1,537,884	1,943,896	2,030,067	55,971	1,288,974	2,184,384
1926	3,829,700	1,649,678	2,180,002	1,931,052	52,333	1,300,915	2,067,836
1927	4,267,810	1,839,695	2,428,115	2,328,540	61,232	1,513,306	2,463,262
1928	3,718,140	1,795,191	1,922,949	3,142,808	77,591	2,058,655	3,316,019
1929	3,836,440	2,020,470	1,815,970	3,410,408	90,635	2,501,832	3,627,247
1930	3,924,460	2,066,239	1,858,221	3,375,659	97,607	2,640,771	3,551,950
1931	4,162,350	2,298,998	1,863,352	3,710,927	118,508	3,309,176	3,879,839
1932	4,001,630	2,414,469	1,587,161	3,133,122	94,519	2,509,263	3,236,183
1933	4,085,960	2,466,832	1,619,128	[b] 3,120,761	109,483	2,299,777	[b] 3,243,991
	48,611,938	25,860,252	22,751,686	34,949,442	1,025,861	24,248,088	36,909,845

[a] Lost in tailings.
[b] As computed from prices used by Geological Survey throughout this volume.

The cost of mining for 1933 was stated by the company to have been 26.03 cents for each ton of ore trammed to the mill, the cost of milling was 20.14 cents, and all other marketing costs and expenses, including interest, amounted to 5.63 cents, making the entire operating cost for each ton of ore trammed only 53.49 cents. This marks

an unusually low cost and is 0.36 cent below comparable figures for 1932. The tenor of the ore handled has been rather lower than the average. This does not indicate a real decrease in the value of the ore that could have been mined but rather reflects the wise policy that has been adopted during this period of high price of gold, whereby ore has been mined that might be unprofitable of extraction at another time. In other words, it seems to be an outstanding example of real conservation, by which the life of the known ore bodies has been prolonged through the recovery of ore that otherwise might have been below the economic limits.

During the year no notable new developments were reported at the mine. Progress was made in extending and enlarging the new shaft, which, it is expected, will be in operation by July 1934. Use of this shaft will not only be advantageous in affording a means of hoisting ore from the lower levels of the north ore body but will release certain of the winzes and other haulageways so that they may be available for prospecting and development work on the north ore body below the 1,000-foot level and on the south ore body below the Gold Creek tunnel level. No changes were made in the milling practice, but plans are under way for tests of a short-head cone crusher to see if, by its use, costs of fine crushing may be still further reduced.

In addition to the work on its main property the Alaska Juneau Gold Mining Co. is active in keeping in touch with mining developments throughout the region. Several properties in the Juneau district were examined, and much assaying was done for prospectors. No development work on any of these properties was undertaken by the company, and new mining ventures were entered into. The option held on a group of claims in the nearby British Columbia area, on the Tulsequah River, was given up, and the results obtained on the White Water properties, in the same general region, were such that the company states that it now proposes to drop its option on that group of claims.

The next most productive gold-lode district in southeastern Alaska is the western part of Chichagof Island. On this island the two principal mines are those of the Chichagoff Mining Co. and Hirst-Chichagof Mining Co., the former situated near Klag Bay, about 60 miles northwest of Sitka, and the latter near Kimshan Cove, a few miles beyond to the northwest. At the Chichagoff property no material new developments were reported to have been made during the year, the work having been continued along the same general lines as heretofore, though somewhat more actively and profitably. More than 270 feet of new shaft was sunk and nearly 2,800 feet of drifts and other underground openings driven during the year. A crew of 60 or more was maintained on the property throughout

the year for mining work and the operation of the mill. A large part of the gold is recovered as mill bullion, but some of the heavy minerals in the crushed ore are concentrated on the tables, and additional gold is recovered from these concentrates when they are treated at a smelter in the States, to which they are shipped. At the Hirst-Chichagof mine about 30 men were employed in the mill and underground. The principal new work was the further sinking of a shaft and the extension of prospecting and development work, especially on and somewhat below the 800-foot level. Considerable progress was also made in the remilling of some of the old tailings piles that had accumulated in the course of the earlier cruder operations of the property.

The successful development of these two larger properties on Chichagof Island and the increased price of gold have had a stimulating effect on the search for valuable mineral deposits through that entire area, and several companies and individuals have been active during the year reexamining and reopening some of the old properties that had been idle for many years, or have been searching to find new leads. Among the operations of this sort may be mentioned the revival of work at Pinta Bay, some 10 to 12 miles north of the Chichagoff mine, where a new concern known as the "New Chichagof Mining Syndicate" was engaged in putting in a new tramway to the mine and is reported to have installed a small prospecting mill with which it proposes to conduct extensive tests of the property. Continuation of work at the McKallick Chichagoff Gold Mines, Inc., is said to have been in progress, but no detailed report of the results has been furnished to the Geological Survey, and consequently probably little more than prospecting and development work was accomplished. Near the north end of Yakobi Island is the old El Nido mine, which a few years ago was one of the highly productive mines but has lately been dormant. Some work was done at this mine during 1933 but so far as could be learned was not sufficient to restore the mine to the list of producers. Still farther north, at Dundas Bay, on the north shore of Cross Sound, the Alaska Independence Mining Co. shipped in considerable mining equipment, including a compressor and air drills, and employed a crew of about seven in prospecting on the property.

As has been abundantly demonstrated in the past, there are almost innumerable places in southeastern Alaska where indications of mineralization have been observed, and at several of them some more or less extensive development work has been undertaken. Most of these ventures have through one cause or another been discontinued. With the revival of interest brought about by the increased price of gold many of these old properties are being carefully reexamined,

and several of them have disclosed conditions that have induced operators to take hold of them again and try to operate them profitably. No sharp separation can be made as to the properties that have experienced this revival and those that would naturally be in operation, so that in the following paragraphs the writer does not intend to convey the impression that work at all the properties mentioned would not have been undertaken except for this artificial stimulation. It may be of service at this place to enumerate some of the mining developments that have been in progress during the year in other parts of southeastern Alaska in addition to the more productive mines already mentioned. The geographic arrangement has been adopted; starting with the extreme eastern camp, at Hyder, then following with the southern districts adjacent to Ketchikan and Wrangell, then those in the more northern areas adjacent to Juneau, Admiralty Island, and the extreme northern part of the region.

Little detailed information has been received by the Geological Survey regarding recent developments in the Hyder district, east of Ketchikan. Apparently work was continued there on about the same scale and at about the same places as in 1932. The greatest amount of development work appears to have been done on claims along the flanks of Banded Mountain, near the head of the Chickamin River, and at the head of the West Fork of Texas Creek. Some steps were reported to have been taken late in the year looking to the refinancing of the Cantu Mining Co.'s claims. Although this may lead to renewed activity there in another year, it did not result in any active work on the claims in 1933. Rumors were also current that negotiations had been in progress for the reopening of the old Riverside property, but so far as could be learned the mine was inactive throughout the year.

In the Ketchikan district the greatest gold-lode activity was in progress at several properties near Helm Bay, Cleveland Peninsula. Of these the Gold Standard mine appears to have been the most productive and recovered considerable gold in the 5-stamp mill on the property and from the concentrates that were shipped to the States for smelting. The mine was in operation for about 9 months. A little work was in progress at the old Sealevel mine, on Thorne Arm, and a mining engineer made a through examination of the property in the interest of a purchaser, but the negotiations were not carried beyond the preliminary stages. In the vicinity of Hollis, on Prince of Wales Island, a small crew operating a small prospecting mill are reported to have done fairly well in reworking the tailings from one of the abandoned mines. A short raise was driven at the old Mount Andrews property, on Kasaan Peninsula, mainly for the purpose of

exploring for veins whose principal mineral of value is copper, though the ore from that mine also carries significant amounts of gold. A very small amount of gold is also reported to have been recovered from a test shipment of ore from the old Valparaiso property, near Dolomi, on Prince of Wales Island.

In the Wrangell district a crew of six were active most of the summer season in development work at the old Maid of Mexico property, on Woewodski Island. During part of this time the mill was in operation, and a small quantity of gold was recovered.

On Admiralty Island the most productive work was that at the properties of the Alaska Empire Gold Mining Co. and of the Admiralty Alaska Gold Mining Co., on Hawk Inlet and Funter Bay, respectively. The work at both places was directed mainly toward renovating the equipment and general development. At the Hawk Inlet property the mill was in operation for somewhat less than a month, during which, in addition to the mill bullion recovered, some concentrates were made that were shipped to a smelter in the States for treatment. At Windham Bay reorganization of several of the former groups of claims was effected under management of the Alaska Windham Gold Mining Co. Several tons of new machinery for the renovation of the mining and milling operations was purchased, and a crew of about 10 men were busy throughout most of the season in development work, in the expectation that this property would be put into shape for active production as rapidly as practicable.

In the Berners Bay district, a short distance north of Juneau, extensive examinations of the old Kensington and Comet properties were made in the interest of outside capitalists. As a result of these studies arrangements were made to take over the properties and go ahead with reopening them on a commercial scale. These negotiations were consummated so late in the season that little work on the ground in carrying out the new plans was effected in 1933. A small crew of four or so continued development and exploratory work at the old Amalga property, in the Eagle River district, north of Juneau, and assistance in getting in supplies was afforded by the improvement of the trail leading to the property from the end of the automobile road from Juneau. No new lode-gold developments are reported to have been undertaken in the Skagway and Porcupine districts, in the extreme northern part of southeastern Alaska. Occurrence of low-grade mineralization has long been known in parts of this area, but apparently none of the deposits have been shown to have such tenor as would attract outside capital under existing conditions.

The Willow Creek district, at the head of Cook Inlet, has long been the second most productive lode-gold district in the Territory, having produced gold worth nearly $5,750,000 since lode mining started there in 1909. The principal producing property in the district is that of the Willow Creek Mines, Inc., which holds a number of claims on Craigie Creek and gets its ore mainly from the Lucky Shot and War Baby mines, on the northern slopes of the valley of this stream. This company employs about 100 men in the various phases of mining and milling, and the property is in continuous operation throughout the year. During 1933 more than 1,900 feet of raises and 2,570 feet of drifts and crosscuts were driven, and the 40-ton concentrating, amalgamating, and cyaniding plant was operated. For many years the company has been heavily handicapped in bringing in its necessary supplies and equipment by the heavy grades encountered at places on the road that connects the mine with the railroad at Wasilla. Completion of a water-grade road from the railroad station at Willow has removed this difficulty, so that freighting to the mine is now much less difficult and costly. The extensive use of airplanes for transportation between the mine and Anchorage has done much to reduce the delays that formerly occurred when emergency repairs were required and has facilitated the movement of persons. A small landing field has been built a short distance from the main camp, and a larger field connected with the camp by a good automobile road has been made a few miles west of the camp. The ore that was milled during 1933 was mostly of high tenor, the average of much of the ore coming to the mill running nearly $50 in gold to the ton.

In 1931 a rather detailed examination of all the mines of the Willow Creek district was made by the Geological Survey, and the results of that examination were published in a report that became available in 1933. This report is accompanied by maps and detailed descriptions not only of the property of the Willow Creek Mines, Inc., but also of all the other producing mines in the district.[3]

On Craigie Creek a short distance north of the Willow Creek mines property development work that had been started the year before on the old Kempf property was continued during the early part of the season. Later, however, the work was stopped, and according to local rumors the equipment was removed and the project abandoned. At the head of Craigie Creek, on the property where the Marion Twin Mining Co. had been doing exploratory work for the preceding 2 years, no work was done in 1933. This area, together with adjoining parts of the Purches Creek Valley and that of the

[3] Ray, J. C., The Willow Creek gold lode district, Alaska: U.S. Geol. Survey Bull. 849–C, pp. 165–229, 1933.

Kashwitna, still farther north, was studied by S. R. Capps and Ralph Tuck, of the Geological Survey, in cooperation with the Alaska Railroad during the season of 1933, and a report of their findings is published as a separate chapter of this volume.

The other most productive mines in the Willow Creek area were the Fern mine, near the head of Archangel Creek, and the Gold Cord, near the head of Fishhook Creek. At the Fern mine the breakage of an essential part of the mill caused suspension of activities for a considerable time, but even so the production from the property was considerably greater than heretofore, so that the lessee was encouraged to undertake considerable prospecting work during the winter so as to have the mine in shape to keep the mill well supplied with ore during the coming season. In addition to the milling of much freshly mined rock, considerable quantities of old tailings that had been impounded from earlier workings were re-treated. The recovery of the gold that samples had shown these tailings to contain was not, however, as effective as had been expected. At the Gold Cord mine work was conducted somewhat less actively than in the preceding year and most of the efforts of the operators were directed toward underground developments, searching for bodies of higher grade ore that can be profitably handled with the equipment that is available.

Some prospecting that did not lead to any direct production was also in progress at a number of the other properties in the Willow Creek district, and reports are current that work on several of the properties that were idle in 1933—for instance, that of the Marion Twin Co., on the Little Susitna River—will be resumed in 1934. The showings already made gave a firm basis for the belief that excellent as was the showing of the Willow Creek camp in 1933, that record by no means marks the limit of the output that may be expected as developments now in progress are brought to a productive stage.

The third most productive lode-gold district in the Territory is in the vicinity of Fairbanks. Its output of lode-gold in 1933 was nearly the same as that for the preceding year, being estimated as $175,000 as against $180,000 in 1932. The total output of lode gold from the Fairbanks district during the period since 1910, when that type of mining began, has been about $2,500,000. There are two principal producing lode-gold areas more or less close to Fairbanks; one embraces the country adjacent to Pedro Dome and lies 15 to 20 miles north and east of the town, and the other embraces parts of Ester Dome and lies 6 to 10 miles west of the town. In the Pedro Dome area the largest production came from the property of the Cleary Hill Mines, near the junction of Bedrock and Cleary Creeks,

formerly known as the Rhoads-Hall mine. Smaller camps at which some development work was in progress and some gold was recovered are widely scattered throughout a more or less definite eastward-trending tract about 10 miles long. Among the other places in this area where some productive gold-lode mining was done during the year may be mentioned the old Hi-Yu property on Too Much Gold Creek, a tributary of Fairbanks Creek; the McCarty and American Eagle properties, near the head of Fairbanks Creek; and the old Soo claims, north of Dome Creek. Some exploratory work was done at the Newsboy property, at the head of Cleary Creek, and lode prospecting was in progress at a number of other claims but so far as reported to the Geological Survey did not make any notable contribution to the Territory's production of lode gold for the year.

In the Ester Dome area of the Fairbanks region search for gold lodes was carried on fully as energetically as heretofore, but all of the work there is done by small outfits with meager resources of capital and equipment, so that the mining is on a small scale and the production of gold correspondingly slight. However, some production was reported to have been made by at least half a dozen different camps, among which the largest was that of the Little Eva and the Ready Bullion mines. The Mohawk and Elmes mines are reported to have remained closed throughout the year.

A thorough examination of all the lode mines in the Fairbanks district was made in 1931 by J. M. Hill, of the Geological Survey. The results of his studies were published in 1933 [4] and furnish comprehensive and up-to-date information, together with many maps and cross-sections of the individual mines, which should be consulted by anyone desiring information not only as to the current operations, but also suggestions as to what appears to be the future of the district. He says:

> Much ground remains to be prospected more thoroughly. Very few properties are actually developed. The few producing mines could greatly expand their yield with more adequate finances for development and equipment and with more technically proficient direction.

Among the districts producing lode gold grouped together in the table on page 12 under the heading " Other districts " the most productive, arranged in the relative order of output, are the Nabesna district, which lies north of the Wrangell Mountains, in the Copper River region; Kenai Peninsula, including the Nuka Bay area, the area south of Hope, and the hills north of Girdwood; the Bonnifield district, north of the Alaska Range; the Nixon Fork district, in the Kuskokwim region; and the mines in the vicinity of Valdez, in the

[4] Hill, J. M., Lode deposits of the Fairbanks district, Alaska: U.S. Geol. Survey Bull. 849–B, pp. 29–163, 1933.

Prince William Sound region. In most of these districts the production came from a single mine, so that to avoid disclosing the individual output it has been necessary to combine the statistics.

In the Nabesna district the only producing gold-lode mine is that of the Nabesna Mining Corporation, which is sometimes referred to as the Carl Whitham mine, from the name of its principal owner and manager. This mine is on White Mountain west of the Nabesna River, between its tributaries Jack and Jacksina Creeks. As 1933 was only the second full year that the mine has been in operation, much experimental work is still in progress, and changes in equipment are being made to enable the mining and milling to be carried on more efficiently and cheaply. The principal addition to the plant during the year was the installation of a flotation plant to treat the slimes. The mill was in operation for about 4 months. Some 300 feet of new drifts were driven in developing the ore body. The extension of the road to the mine from the Richardson Highway at Gulkana has now been completed by the Alaska Road Commission, so that the difficulties hitherto experienced in bringing in supplies and equipment and taking out concentrates have been much lessened. The quality and extent of the ore so far developed have continued to be highly satisfactory to the owners, and they expect to continue operation on an even larger scale next year. The present practice of operating only during the open season necessarily restricts the volume of ore that can be handled and consequently the amount of gold produced but is imposed on the operators by the climatic conditions and their effect on the available water supply.

The principal districts in the Kenai Peninsula region in which some lode-gold production was reported in 1933 were Nuka Bay, Moose Pass-Hope, and Girdwood. The Nuka Bay district embraces country near the extreme southern part of Kenai Peninsula; the Moose Pass-Hope district embraces much of the country lying north of the Moose Pass station, on the Alaska Railroad, and extending to the old settlements of Hope and Sunrise on Turnagain Arm; the Girdwood district lies just north of Kenai Peninsula, extending a few miles northward from the shores of Turnagain Arm. The entire belt of rocks in which the deposits of these three districts occur is dominantly a deformed series of slate and graywacke which has locally been intruded by igneous dikes that are currently referred to as "greenstones." The veins occupy fractures of rather irregular form and moderate extent, and their gold content is largely free gold, though sulphides are by no means uncommon.

The principal producing mines in the Nuka Bay district are the Sonny Fox mine, largely owned and operated by Babcock & Downey, and the Alaska Hills mine, under the management of E. W. Barnett.

There are, however, more than a dozen other properties in the district on which some prospecting and development work was in progress. On the whole small-scale prospecting does not appear to have been so active during 1933 as in the preceding year, but rumors were afloat of a number of deals pending with a view to the undertaking of more intensive work. The district is still much handicapped by its remoteness and lack of frequent transportation facilities, but both of these handicaps could be removed if sufficient tonnage were developed, for the district is readily accessible to deep-water steamers and none of the properties are more than a short distance inland.

Farther north in the Moose Pass-Hope district the principal producing property continued to be the Lucky Strike mine, on Palmer Creek, long successfully developed by John Hirshey but for the last 2 years operated by R. B. Heaston. In addition, there are more than a dozen places where lode developments have been undertaken in the past, and at some of them active prospecting is still in progress. Among these the most intensive work was in progress throughout most of the season at the old Alaska Oracle property, on Summit Creek, about midway between Moose Pass station and Sunrise. Work at this place was being conducted by W. E. Dunkle, whose long familiarity with the whole region and eminently efficient management of the Willow Creek Mines properties, in the Willow Creek district, give assurance that if the property contains mineral deposits of value every effort will be made to bring them into productive operation. A comprehensive study of all the lode prospects in the Moose Pass-Hope district was made in 1931 by Ralph Tuck, of the Geological Survey, in cooperation with the Alaska Railroad, and the results of that study have recently been published so that they are available to anyone interested in having more details as to the lode and other mining developments in the district.[5]

In the Girdwood district, north of Turnagain Arm, the principal area in which the search for gold lodes was made in 1933 was near the head of Crow Creek, a tributary of Glacier Creek. The chief operating mine in this camp is the Monarch, under the management of H. I. Staser. In spite of the fact that much time had to be spent in various jobs of construction for the surface plant, considerable progress was made in mining and milling, so that the returns from the property were much larger than for any preceding year. A comprehensive study of the whole Girdwood district was made in 1931 by C. F. Park, Jr., of the Geological Survey, in cooperation with the Alaska Railroad. The results of that study,

[5] Tuck, Ralph, The Moose Pass-Hope district, Kenai Peninsula, Alaska: U.S. Geol. Survey Bull. 849–I, pp. 469–530, 1933.

describing the Monarch mine as well as the other lode and placer prospects in the district, were published in 1933.[6]

In the Bonnifield district productive lode mining was in progress only on the property of the Eva Creek Mining Co. This property is reached from the Alaska Railroad station at Ferry by a good automobile road about 14 miles long. The deposit has been known for many years, but it was not until late in the fall of 1931 that the owners felt that they were justified in placing a mill on the property and beginning productive mining. The deposit consists of a considerable body of mixed sulphides, largely arsenopyrite but with considerable amounts of bismuthinite, lying at a very flat angle in schists. Its position makes it particularly difficult to mine by ordinary methods without excessive caving, and consequently the costs were so high that it was questionable whether the returns justified the outlay. The ore as mined is crushed and concentrated in a small mill on the property, and the concentrates are hauled by truck to the railroad and thence shipped to a smelter in the States for treatment. The mine is kept in operation during only a part of the year, as climatic conditions and the exposed summit over which supplies must be hauled discourage attempts to operate it throughout the winter.

In the Kuskokwim Valley the only lode-gold production reported came from the old Pearson & Strand mine. on Ruby Creek, in the Nixon Fork district, which was operated by Charles Mespelt and associates. The mine was in operation throughout the year, but the mill was operated only during part of the summer, as owing to the exceedingly dry season only a little water was available for treating the ore. A crew of half a dozen or so was employed. Some prospecting was said to be in progress at the old Whelan mine and consisted mainly in the digging of several surface trenches in search of veins worthy of more intensive examination. During August the district was visited by J. B. Mertie, Jr., of the Geological Survey, and a report of his findings there and in other mining districts in the nearby regions is published elsewhere in this volume.

Gold-lode production from the Valdez district in 1933 was small, but the evidences of renewed mining activity were numerous, and work was in progress at some of the properties that had been idle for many years. Perhaps the most significant of these revivals was the projected reopening of the old Cliff mine, a short distance west of Valdez. The workings at this mine had been flooded by sea water some 20 years ago, but for some time before that catastrophe

[6] Park, C. F., Jr., The Girdwood district, Alaska: U.S. Geol. Survey Bull. 849–G, pp. 381–424, 1933.

the mine had yielded each year gold to the value of several hundred thousand dollars. The new enterprise was started late in the season and contemplated pumping out the mine so that a thorough examination could be made. The task proved much greater than was anticipated, however, so that part of the activity at the place was diverted to a search for other means of testing the property. It is understood that in this search evidence of mineralization was found somewhat inland from the earlier openings and farther from the sea and appeared to warrant further testing by means of a shaft and underground exploration. An interesting development in the use of the airplane in reaching tracts otherwise difficult of access is reported to have been tried out in this district whereby supplies have thus been taken to many of the properties in the high hills and among glaciers and perpetual snowbanks. Even if no landing can be made the supplies are safely dropped from the plane into the snow. It is said that if proper precautions in packing are used even eggs and dynamite have been delivered satisfactorily by this means. These statements may give the impression that the region is unduly difficult of access. This is not true, however, for while many of the prospects are situated in the high mountains and involve stiff climbs, few of them are more than 8 or 10 miles from the coast, where deep-water transportation is readily available, so that as a whole the district is far more accessible than many that are better known.

Prospecting for gold lodes was continued at many other places throughout the Territory, though at none of them, so far as reported to the Geological Survey, was any ore mined nor any gold produced except the little that may have been recovered in the course of testing the ore during development work. Considerable prospecting for gold lodes is reported to have been done in the Bremmer district, in the Copper River region. According to local reports, more than a dozen men were engaged in the search there during 1933, and as a result several leads that are regarded as promising have been found and partly opened up. The property on which most work is said to have been done is that of the Ramer Bros., on Golconda Creek. The ore is described as occurring in slates and graywackes that lie a short distance from the contact of a body of diorite. Although the leads have been traced for a considerable distance on the surface and appear to contain much ore of high grade, the owners very sensibly are bending their efforts to proving the real extent of the ore body and as yet are taking no steps toward putting a mill on the property, so that it will be at least another year before any production of gold can be expected from this property. Access to this district has been difficult, but a new landing field has been built, so that now most of the transportation is effected by the use of airplanes from McCarthy.

Elsewhere in the Copper River region little new prospecting for gold lodes has been done, though reorganization of some of the properties in the McKinley Lake district was effected late in the season, and more active development is expected to follow in 1934. In the vicinity of Tiekel surface prospecting disclosed several new veins that appear promising, and subsequently arrangements were made to put equipment on the ground for the purpose of more adequately testing some of the better showings by underground development. A number of gold-lode claims are still held in the Kotsina district, but no new developments of note are reported to have been made on any of these during the year.

In the Kantishna district the principal new development was an arrangement with outside capitalists to carry on extensive explorations of the Quigley properties, near Friday Creek. As a result, considerable equipment and supplies were freighted into this camp late in the season, and a crew of a dozen or so were sent in to do at least 1,000 feet of underground work, to test the value and extent of the mineralization in depth. Until the preliminary exploration is completed and the results are analyzed, no plans for future development can be made, but there is assurance that every effort will be made to start an extensive mining project here if practicable. A description of the many lode prospects in this district, based on investigations by F. G. Wells in 1931, in cooperation with the Alaska Railroad was published in 1933.[7]

In the Chisana (Shushanna) district considerable activity has been reported to have been shown in lode prospecting in the area between Erickson Gulch and Bonanza Creek, where more than 45 claims have been staked. A number of veins have been found lying near the contact with a granitic intrusive. They consist at the surface of a spongy-textured mass of deeply iron-stained quartz and apparently originally were heavily impregnated with sulphides. Owing to the remoteness of the region most of the supplies and equipment have had to be brought in by airplane. Some outside capital has been made available to continue prospecting work on the claims, but in the main the developments have been carried through by the owners with their own efforts and resources.

Near the head of Nugget Creek, in the Yentna district, in the Cook Inlet-Susitna region, gold-bearing veins have been found; and according to local reports some 100 feet of underground development work has been done in an attempt to disclose their real character.

In Seward Peninsula development work was in progress at a number of places on lodes containing gold, though so far as has been reported none of the deposits yielded gold in appreciable amounts.

[7] Wells, F. G., Lode deposits of Eureka and vicinity, Kantishna district, Alaska: U.S. Geol. Survey Bull. 849–F, pp. 335–379, 1933.

The projected developments of lodes in the Bluff and Solomon districts, reported in the volume of this series for 1932, did not reach such a stage that any material progress was made on the ground in carrying the plans into effect. Nevertheless considerable interest is still being displayed in carrying on these enterprises, and it is likely that before long some active work may be undertaken at one or both of these properties.

GOLD PLACERS

GENERAL CONDITIONS

Placer mining in Alaska in 1933 returned gold worth $5,152,000. This marks a slight decrease from the output of the preceding year, but it was larger than for any other year since 1918. The annual production of placer gold and certain other data relating to Alaska's gold production are represented graphically in figure 2. From this diagram may be traced many of the changes that have taken place in the industry. Thus in no year from the beginning of the industry in 1880–98 did the production of placer gold amount to as much as $1,000,000, and the average during that period was less than $280,000. In 1899 there was a sudden increase, marking the discoveries of Nome and some of the camps in the upper Yukon Valley, which were soon followed by the discovery of Fairbanks and many of the other camps of the interior. The resulting golden period lasted through 1916, during which the annual yield of placer gold averaged more than $10,000,000 and in 1906 reached the peak of nearly $19,000,000. In 1918, after the entry of the United States into the World War, placer production dropped to about $5,000,000 and in the 14 years since that time it has fluctuated between that amount and $3,000,000.

The decrease in placer-gold production in 1933 is to be attributed mainly to the fact that throughout interior Alaska, in which most of the placer camps are situated, the abnormally dry weather caused a serious shortage in the supply of water. Not only did this cause a lessened output at many of the mines that were operated, but many others had to suspend operations entirely. Even many of the larger companies which have built extensive ditches to bring in their needed supplies of water experienced such a shortage that they could not handle the normal volume of ground and consequently could not recover the usual amount of gold.

The trend of placer mining in Alaska for the past few years has been toward the development of large enterprises requiring the installation of expensive equipment such as dredges or other mechanical devices and the mining of relatively low grade deposits through careful control of costs. With the unemployment situation in the States and with the financial stringency that has made it difficult to raise funds for undertaking new enterprises, there has been some

revival of prospecting and the development of small properties by outfits of 2 or 3 men without much equipment. This practice, however, was in part checked by the dry weather in 1933 and later, when gratuitous relief was available for the unemployed, many took advantage of that easier means of eking out a livelihood. By the time the increased price of gold went into effect much of the normal placer season was past, so that except for the larger operating companies the increase had little stimulating effect, though doubtless next season it will result in greater placer-mining activity. With continued lack of employment in other fields it seems surprising that an even larger number of men have not turned to prospecting, as that occupation offers many attractions to a man who enjoys the simple life, working more or less as his own boss, when, where, and how he pleases, and with the allurement of possibly discovering a real prize as a result of his efforts. Such a career obviously should be undertaken only by the physically fit and those reasonably skilled in understanding nature's secrets and the ways of acquiring what she has to offer. The life of the prospector is hard, and success comes to few in any line of endeavor; but it is believed that Alaska still holds opportunities for the capable placer prospector to find tracts that, while not bonanzas, will well repay his best endeavors. There also seems to be an increasing interest among capitalists and others in the mining development of the Territory, and doubtless, as they hold out incentives for finding workable properties, they will discover men ready and willing to undertake the quest. Anyone who remembers the difficulties of the early days and sees the present enormously better facilities and lower costs, however, has little sympathy with the laments that are often heard as to the difficulties of carrying on prospecting work. It sometimes seems as if we had become so tied to automobiles, railroads, and wagon roads that we forget that the bulk of the placer gold of Alaska was produced practically without dependence on these facilities. It is believed that there are still large tracts of Alaska that have not yet been thoroughly prospected or adequately examined for large-scale placer operations. Although most of these areas do not appear to give promise of holding bonanza deposits that can be won cheaply, there are extensive areas in which, it is confidently believed, large, well-organized, and well-managed companies will find placers that can be mined profitably for many years.

PRODUCTION BY DISTRICTS

The description already given as to the methods used in collecting and interpreting the information that forms the basis of this report indicates that it is more difficult to obtain accurate facts regarding the production of placer gold than regarding any of the other items. This is due to the great number of small producers, who are widely

scattered and many of whom are in the most remote parts of the Territory. The gold they produce frequently passes through many hands before it finally reaches a mint or assay office, so that a single lot is difficult to trace, for it may appear in the reports of the individual and then lose its identity by being lumped with other gold by the storekeeper who took it in exchange for supplies, and still further consolidated by the bank, perhaps in some distant district, to which it was sent by the merchant, and its course perhaps still further obscured by being shipped to another bank before being turned in to the mint. Every reasonable effort has been made to check the information from different sources and to adjust discrepancies so far as possible. As a result it is believed that the figures given for the total placer production are in accord with the actual facts. The distribution of this total among the different districts, however, is open to more serious errors, as gold produced in one district, unless reported to the Geological Survey by the original producer, may be credited to some other district through which it passed in the course of trade. In spite of the possibility of some error in the distribution of placer gold among the different districts, the following table has been prepared to show the comparative standing of the different districts as accurately as possible. It should be remembered that in this table, as well as elsewhere throughout this volume, all statements of the value of the gold produced are based on the old standard price of gold at $20.67 an ounce. The largest amount came from the Yukon Basin, and the next largest from Seward Peninsula. Placer mining in each of the main regions will be discussed in some detail in the following pages, and the more notable events of the year will be recorded for each region.

Value of placer gold produced in Alaska in 1933 and 1932

Region	1933	1932	Decrease or increase, 1933
Southeastern Alaska	$3,000	$3,000	
Copper River region	51,000	68,000	−$17,000
Cook Inlet and Susitna region	121,000	114,000	+7,000
Yukon Basin	3,716,000	3,648,000	+68,000
Kuskokwim region	102,000	153,000	−51,000
Seward Peninsula	1,156,000	1,533,000	−377,000
Northwestern Alaska	3,000	3,000	
	5,152,000	5,522,000	−370,000

SOUTHEASTERN ALASKA

Although southeastern Alaska is rich in lodes of gold and other metals, its placers are of relatively small extent and yield only a little gold, because throughout most of the region the topography is mountainous, with precipitous slopes leading down from the crests of the

ridges to the ocean waters or to the valley floors and affording little or no lodgment for detrital material. Furthermore, so much of the region was occupied in the relatively recent past by glaciers that there is an almost complete lack of deposits produced through the long-continued sorting action that is so essential for the formation of rich placers. Even along the coast there are almost no beaches where concentration has long been effective. In the lowlands of the larger streams, in some of which great amounts of detrital material have been dumped by past geologic processes, sorting action such as is conducive to the formation of rich placers has been relatively slight, and much of the material handled by the streams has not been subjected to weathering and similar processes, which unlock the mineral grains of different kinds and thus promote their separation through physical differences. There is, therefore, small likelihood that southeastern Alaska as a whole holds much promise as a placer region, though in a few places where special geologic conditions prevail there is a chance of finding placers of value.

As shown in the table above, the entire placer production from southeastern Alaska in 1933 is estimated to have been worth only $3,000, so that even the largest operations were small camps of two or three men each who took out only enough gold to make a very modest grubstake. There are three areas in southeastern Alaska in which, in the past, placer mining has been active; namely, near Juneau, in the valley of the Porcupine River, and in the beaches between Lituya and Yakataga Bays. No placer mining is reported to have been in progress in the Juneau district in 1933, and only a little gold was recovered from the placers in the Porcupine district. Investigations were in progress in the Porcupine district with a view to determining why the large expenditures that had been made for a number of years past had not been more successful in bringing the property into production. Discovery of the causes will doubtless lead to their correction, and this should mean that before long operation of the claims will be undertaken. In the Lituya-Yakataga region placer mining was continued on about the same scale as it has been for several years. The placers there are all of the beach type, exposed to the waves of the Pacific Ocean. This position, though in a measure favorable for concentration of the beach material, is disadvantageous, because except under suitable weather conditions the placers cannot be mined, and even then the use of extensive fixed mechanical appliances is precluded by the necessity of removing them during times of storm.

COPPER RIVER REGION

In the Copper River Valley there are 2 principal areas and 1 minor area that yield placer gold, though there are a few small camps

widely scattered throughout the river basin. The principal areas, named in order of their production, are the Nizina and Chistochina districts, and the minor area is the Nelchina district. The value of the placer gold produced from the Copper River districts in 1933 was $51,000, or considerably less than in 1932. In the Nizina district the bulk of the placer gold came from the properties of the Chititu Mines, on Rex and Chititu Creeks, where mining continued on practically the same scale as heretofore. The other formerly large producer, the Nicolai Placer Mines, on Dan Creek, did not operate, but some work was done on its property under lease. The work here was severely handicapped by the small supply of water available and furthermore by the inadequacy of its head, so that the production was far less than usual. Plans are being made to develop a more effective water supply, but construction will not be undertaken until 1934. Continuation of prospecting and the production of a small amount of placer gold is reported by prospectors in the Bremner River region, to the south of the Chitina, especially in the vicinity of Golconda and Monahan Creeks. Work there has been confined mainly to simple prospecting methods of testing the deposits and has yielded only small amounts of gold recovered in the course of development. Apparently the results so far obtained indicate that the tenor of much of the ground that has been tested is too low to repay mining on a small scale by simple hand methods.

In the Chistochina district, at the northern limits of the Copper River Valley, the placer production came mainly from two camps, one on Slate Creek and the other near the head of the Middle Fork. Work at the property on Slate Creek was very much curtailed from the former scale in part because of litigation, which was not settled until the season had advanced far, and in part because of interruption of productive mining while the plant and equipment were being moved to a new location farther down the creek. The operators expect that at this new site the work will be carried on more intensively than it has been lately and that the time lost in preparatory work this year will be more than offset by a better yield in 1934.

In the Nelchina district, which is in the extreme western part of the Copper River region, all the mining was done by a few small camps consisting of only 2 or 3 men each, centering around Albert Creek, and the total production amounted to only a few thousand dollars.

COOK INLET-SUSITNA REGION

In the Cook Inlet-Susitna region, as the term is used in this report, are included the placer camps in Kenai Peninsula and adjacent country, the Yentna-Cache Creek district, and the Valdez Creek district, near the head of the Susitna River. In the past many of these dis-

tricts have been highly productive, but their annual production has dwindled until now in most of them the annual output is only a fraction of what it was, and in some of them only a few score miners are now at work where formerly there were hundreds. However, in 1933 the output of placer gold from this region showed an increase of about $7,000 over that reported in 1932 and is estimated to have been $121,000. In the relative order of their placer production in 1933 these districts ranked as follows: Yentna-Cache Creek, Valdez Creek, Kenai Peninsula.

In the Yentna-Cache Creek district there were somewhat more than 29 camps employing altogether between 70 and 80 men at which productive mining was in progress during 1933, and many other places where some prospecting work was done, though it amounted to little more than the annual required assessment work. By far the largest and most productive operations in the district were those carried on by the Peters Creek Placer Co., on Peters Creek, and by Murray & Harper, on a lease from J. C. Murray. In the drainage basin of Cache Creek there were in addition camps on Dollar, Falls, Thunder, and Nugget Creeks. In the Peters Creek Basin there were camps not only on the main stream but also on Bird and Willow Creeks. Among the items of general interest regarding the district perhaps the one of most significance was the revival of mining by the dredge formerly owned by the Cache Creek Dredging Co. and now operated by F. J. Engelhorn, for the Yentna Dredging Co. The dredge was digging in the main valley of Cache Creek, close to the junction of Nugget Creek. There the gravel is shallow, and it is necesary to dig for a considerable depth into bedrock. Prospecting of the benches of Dollar Creek resulted in the finding of considerable heavy gold. One nugget weighing more than 3 ounces is the largest that has been found in the district for some time, and pieces of gold weighing from half an ounce to an ounce are reported to have been not at all uncommon. The Alaska Exploration & Mining Co. was engaged in installing a large hydraulic plant on Bird Creek, a tributary of Peters Creek, and although somewhat short of water, reports a good season's output. The Peters Creek Placer Co. continued its extensive hydraulic operation on Peters Creek. The new ditch designed to bring a more nearly adequate supply of water to the ground was completed during the season. North of Peters Creek a few prospectors usually spend part of the season in the valley of the Tokichitna and some of its tributaries, but no direct word has been received by the Geological Survey of any such camps having been established there in 1933. Southwest of the Cache Creek area, in the valley of the Kahiltna River and in the Fairview district, and even as far south as the country adjacent to Beluga Mountain, a few small outfits did

some prospecting work, but the gross return in gold from all of this work was only a few thousand dollars. A short examination of the prospecting in the vicinity of Beluga Mountain was made by Ralph Tuck, of the Geological Survey, who believes that much of the gold there is derived from reconcentration of the glacial deposits near the area, though some occurring on bedrock and having a distinctive appearance may have been derived from a local bedrock source. This ground is difficult to mine cheaply because of the numerous boulders; moreover, the gold tenor is low, and the gold is not easy to recover because much of it is in very fine particles. Plans are being formulated, however, for further active prospecting of the property. On the whole the conditions in the Yentna-Cache Creek district seemed to indicate a noteworthy activity in placer mining and promise of a greater production from the district in the near future.

In the Valdez Creek region, which lies some 125 miles north of Anchorage, near the head of the Susitna River and about 40 miles in an air line east of the main line of the Alaska Railroad, prospecting for both lodes and placers has been going on for many years. Although no new finds were reported to have been made during 1933, the returns to the few placer operators who were in the district appear to have been especially satisfactory. The quantity of gold recovered was even more than that recovered in 1932, which was the largest amount that had been mined in the camp during any of the preceding 10 years. The largest amount of gold came from properties mined by John E. Carlson and associates, comprising both bench and creek claims. From 10 to 15 men were employed in mining on these claims, and the ground was worked principally by hydraulicking. Some placer gold was also recovered from placers on White Creek. The Valdez Creek district was one of the areas studied in considerable detail by a Geological Survey party in charge of C. P. Ross in 1931, and a report on that work is now available.[8]

The producing placer camps in the Kenai Peninsula region are situated mainly in the vicinity of Hope, Sunrise, and Girdwood. All the camps in the Hope-Sunrise district are small, the largest of them yielding only a few thousand dollars a year and some of them only a few hundred dollars or a meager grubstake to the operators. In the vicinity of Hope and Sunrise placer mining was carried on at practically the same places as in the last few years, the largest operations being on Canyon and Lynx Creeks, south of Sunrise, and at the Resurrection River, south of Hope. There were, however, an unusually large number of small outfits scattered

[8] Ross, C. P., The Valdez Creek mining district, Alaska: U.S. Geol. Survey Bull. 849–H, pp. 425–468, 1933.

widely throughout the district, some of which took out only a few ounces of gold but gave employment to several dozen men. All the producing camps were studied with especial thoroughness in 1931 by Ralph Tuck, of the Geological Survey, and are described in a report prepared by him.[9]

In the Girdwood district, which lies north of Turnagain Arm and includes the valleys of Glacier Creek and its tributary Crow Creek, the only placer property that reported any notable production of gold was that managed by A. S. Erickson about 4 miles north of Girdwood. The placer that is being mined is a thick deposit of bench gravel on the north side of Crow Creek. A well-planned and efficiently managed hydraulic plant has been in operation here for a number of years and has about reached the limit of the property that can be profitably mined under existing conditions. Neither at the old Girdwood property, upstream, nor at the property on California Creek, downstream from the ground mentioned above, was any placer mining in progress. A comprehensive examination of all the mineral deposits in this district was made in 1931 by C. F. Park, Jr., and his report on the different properties is now available.[10]

YUKON REGION

The Yukon Valley embraces a tremendous extent of territory, and scattered through it from one end to the other are many placer-gold camps. In the past gold has been reported from almost every stream in the entire basin, though the quantities in some have been so small as to be of no commercial significance. For convenience of description in this report all the producing placer camps in this vast area have been grouped into 17 more or less distinct tracts that are here called districts. It should be noted that the boundaries of these districts are by no means well defined and do not necessarily correspond with any of the legal subdivisions, such as the precincts or recording districts. In the main, the names here given to these districts have been chosen from some of the more prominent features occurring in them. The main purpose of this grouping is to combine areas having in general similar interests and similar conditions and to separate those that are dissimilar. This results in throwing some large tracts together and in splitting up some other parts of the Yukon Valley into several small districts. In some places the boundaries of the different districts almost overlap; in others the boundaries of one district lie far from those of its nearest neighbor.

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[9] Tuck, Ralph, The Moose Pass-Hope district, Kenai Peninsula, Alaska: U.S. Geol. Survey Bull. 849–I, pp. 469–530, 1933.

[10] Park, C. F., Jr., The Girdwood district, Alaska: U.S. Geol. Survey Bull. 849-G, pp. 381–424, 1933.

The gross output of placer gold from all the camps in the Yukon Valley in 1933 was worth $3,716,000, which is slightly more than the corresponding figure for 1932. This increase is rather notable, for there was a shortage of water owing to the unusually dry weather that prevailed during the early part of the mining season, which had an especially adverse effect on the smaller operators. The increase was brought about through greater production by the dredges and large operators, who are not so directly dependent upon favorable local precipitation during the season when sluicing is most active.

In the following table the districts are arranged in order of their placer production in 1933, and for comparison the production from the same districts in 1932 is given. The total is believed to be correct as stated, but the distribution of this total among the districts is open to some uncertainty, owing to the great number of small producers, their wide distribution, and the failure of some of them to supply the essential information. However, every reasonable precaution has been taken to guard against serious errors and to keep the estimates in accord with all the available facts, so that the figures stated are regarded for all practical purposes as accurate and comparable with similar figures for earlier years.

Value of placer gold produced in Yukon Basin, 1933 and 1932, by districts

District	1933	1932	District	1933	1932
Fairbanks and Richardson	$3,077,000	$2,785,000	Fortymile	$17,000	$28,000
Iditarod	261,000	364,000	Chisana	13,000	7,000
Innoko	76,000	107,000	Eagle	12,000	28,000
Circle	71,000	59,000	Kantishna and Bonnifield	10,000	10,000
Tolovana	50,000	62,000	Rampart	7,000	9,000
Hot Springs	48,000	72,000	Marshall	5,000	11,000
Ruby	48,000	72,000			
Koyukuk and Chandalar	21,000	34,000		3,716,000	3,648,000

In the foregoing table three small districts, the Richardson, Fort Gibbon, and Chandalar, have been grouped with the nearby larger districts, Fairbanks, Rampart, and Koyukuk, respectively, and two other small districts, the Kantishna and Bonnifield, have been combined. These combinations have been made to conform with earlier reports and to avoid disclosing confidential information regarding individual production from some of the small districts, where the bulk of the placer gold has come from only 1 or 2 mines. None of these small districts produced as much as $10,000, and some of them only a few thousand dollars.

The region adjacent to Fairbanks, here called the Fairbanks district, has long been and still is the main placer district in interior Alaska. The greatest amount of gold from this district was produced by dredges of the Fairbanks Exploration Co. on the Chatanika River and Cleary, Pedro, and Goldstream Creeks; and by lessees of the

property of the Fairbanks Gold Dredging Co. on Fairbanks Creek. Considerable placer gold was also recovered by hydraulic or open-cut methods, and a little by drift mining. Placer gold recovered by other methods than dredging came principally from Goldstream, Pedro, Sourdough, Ester, Vault, and Dome Creeks, and the Big Chena and some of the tributaries of the Chatanika River east of its junction with Cleary Creek. Several thousand dollars' worth of placer gold, in addition to that produced by the dredges, came from placers on Fairbanks Creek. There were also smaller camps in the valleys of several of the other streams, whose production, though individually only a few hundred or a few thousand dollars, in the aggregate swelled the total production for the district considerably.

The extensive mining project being carried on by the Fairbanks Exploration Co., embracing large tracts on Goldstream and Cleary Creeks and the Chatanika River, continued to be the outstanding placer-mining enterprise not only in the Fairbanks district but throughout the Territory. Although new problems are constantly arising and being solved in connection with the work on this project, the underlying plan and methods have been outlined so adequately and skillfully that the work is proceeding in systematic fashion and, except for details, in the same manner as heretofore. The unusually dry season, which affected so adversely many of the smaller operations, had little marked effect on the production of this large enterprise. However, it seriously handicapped some of the preparatory work that must be done before the ground is dredged, so that although not apparent now it may be reflected years later when the dredges start to mine the ground that should have been prepared this year. In addition to continuing its regular work in the areas mentioned above the company was especially active in exploration and preparatory work in the tract on Ester Creek which it had recently acquired. The construction work connected with this part of its project consisted in thoroughly testing the ground by drill holes and the construction of a power station and pumping plant on Chena Slough, from which a supply of water will be delivered to the newly constructed ditches and by them conducted to the ground that will be mined near the junction of Cripple and Ester Creeks. This ground will be dredged and handled in the same general manner as the company's other holdings, though deposits of muck as much as 160 feet thick overlying gravel as much as 80 feet thick present serious problems of operation and of designing suitable equipment that must be solved. This new work in the Ester Creek region has greatly enlarged the company's operations in this field and gives added assurance of the stability not only of the mining industry in this district but also of all forms of business activity in the contiguous

country. An interesting technical development of general significance to mining operators was the extensive use of geophysical methods of prospecting to determine many of the factors, such as depth of muck and depth to bedrock, etc., which must be known if orderly plans of operation are to be made. This work was of a general experimental type, but it appeared to give results surprisingly close to those obtained by the infinitely slower and more expensive methods of drilling or sinking exploratory shafts. According to reports, the methods were equally applicable to thawed or frozen ground, and many of the results checked within less than 1 percent of results obtained by underground measurements. It should be noted, however, that the methods require competent technical oversight and interpretation and cannot be carried on by untrained personnel.

East of the main mining area adjacent to Fairbanks are a number of small camps at intervals all the way to Richardson and south of that old settlement, including parts of Jarvis Creek and other tributaries of the Big Delta, south of the Tanana River. In years gone by, the Richardson or Tenderfoot camp had a rather large placer production, but at present there are not half a dozen men mining in that district. Therefore, the use of its name in combination with Fairbanks in this report is not so much to designate two separate camps as to indicate a single ill-defined area between Fairbanks on the west and Richardson on the east. Thus between what may be called the real Fairbanks district and the Richardson district considerable gold was taken out by fairly large camps on Big Chena, during at least part of the open season as well as by small camps on the Salcha River and its tributaries. No information has been furnished to the Geological Survey as to the placer mining south of Richardson in the valley of Big Delta and its tributaries. However, from current reports it appears probable that only a few prospectors were in that region and that such work as they did was mainly prospecting or preliminary development work.

The placer camps in the Iditarod district were the second most productive in the Yukon region, though they showed a considerable falling off from the high mark of 1932. The decrease is to be attributed almost entirely to the extremely dry weather, which caused many operators to quit early in the season and made others carry on their mining at a very reduced rate. As in the past, the largest amount of gold recovered in the district was obtained by 2 dredges—that of the J. E. Riley Investment Co., on Otter Creek about 2 miles south of Flat, and that of the North American Dredging Co., on Flat Creek—but there were in addition more than a dozen other properties each of which recovered at least several thousand dollars' worth of gold

during the season. In all it is estimated that about 125 men were engaged in productive mining in the district during 1933, and there were a few others who probably accomplished little more than prospecting or development. Next to the output from dredging, the largest amount of gold was recovered from mines using mechanical shovels or power-operated scrapers of one or another type. Among the largest mines of this kind are those of Olson & Co. on Happy Creek, of the Northland Development Co. on Flat Creek, of Loranger & Jensen on Willow Creek, of Duffy & Co. on Chicken Creek, and of Utilla & Ogris on Slate Creek. The last named was a new dragline plant that was established during the year and consequently spent much of the season in getting the equipment in running order; this plant therefore should do much more productive work another season. Hydraulic plants were also in operation by Miscovich & Roslund on Otter Creek, Salen on Granite Creek, Lusher on Malamute Creek, Strandberg and Sacco & Scott on Flat Creek, and Belanger, Thibault & LaChance on Willow Creek. The prospect of a considerable increase in the placer-gold output from the Iditarod region, when a greater supply of water is available and all the properties are able to work full time, seems assured.

Information regarding the Iditarod and Innoko districts and adjacent parts of the Kuskokwim district has been particularly complete this year, thanks to the cooperation of the many operators and to the fact that most of the camps were visited during the course of his field work by J. B. Mertie, Jr., of the Geological Survey. Some of the facts reported by Mr. Mertie have been incorporated in the appropriate paragraphs here, but his more complete report will be found in a subsequent chapter of this volume.

The unusually dry season seriously curtailed placer mining in the Innoko region so that for a month and a half during the middle of the season many of the properties were entirely idle or operating on a very much reduced schedule. So low was the water on many of the streams that transportation was impeded and there was a shortage of many of the supplies necessary for operation, such as Diesel oil, equipment, and foodstuffs, which are usually brought in by river boats. One new scraper plant that was being brought in up the Innoko was months on the journey that usually takes but a few days and finally had to be moved overland to the mining site and thus lost the whole working season. Here, as in many of the other districts, the largest output was obtained by dredges. There were three dredges in operation, one each on Little, Ganes, and Yankee Creeks. The dredges on Little and Ganes Creeks were operated by Waino Puntilla and the one on Yankee Creek by Archie Higgins. In addition to the dredges there were several other placer

camps on Little and Yankee Creeks and other camps on Ophir, Cripple, and Spruce Creeks, and Victor Gulch. Most of these camps were small, utilizing ordinary hydraulic methods. The camp of Wilson & Hard on Cripple Creek, was however, using a slack-line scraper, and this was the largest mining camp in the Innoko district with the exception of the dredge camps.

The Circle district was the principal one other than Fairbanks that showed an increase in placer-gold production in 1933 over 1932. This favorable showing was made in spite of the shortage of water for mining that marked the early part of the season. Apparently, it is to be attributed to the increased activity throughout the district in prospecting and mining by a large number of small outfits. According to local estimates more than 100 men were in the hills of this district. Although some drift mining was in progress during the winter, most of the productive mining was done by camps hydraulicking during the summer. As in the past, the greater part of the placer gold came from placers in the streams that head in the vicinity of Mastodon Dome and the highlands east and west of the dome and that derive their gravel mainly from the bedrock on the northern slopes of this upland. The largest outputs from the district as reported to the Geological Survey came from the properties of the C. J. Berry Dredging Co. and of John A. Anderson on Mastodon Creek and from that of the Independence Mining Co. on Independence Creek. There were, however, a number of smaller producers on these creeks, as well as on Miller, Switch, Deadwood, Ketchum, Holdem, Harrison, Porcupine, and Bonanza Creeks. All these creeks have long been the scene of productive mining. A small amount of gold was also recovered from placers at a new locality on Portage Creek, about due south of the Circle Hot Springs. The accessibility of this region by means of the Fairbanks-Circle automobile road and the roads and trails up many of the streams has enabled the reopening of ground that was of too low tenor to be mined profitably in the early years of high prices.

The Tolovana district, as the term is used in this report, embraces a considerable tract of country lying north and northwest of Fairbanks. In 1933, like most of the other placer camps of interior Alaska, it experienced an unusually prolonged shortage of water, which naturally lessened the amount of active mining in progress. As a result the output of gold is estimated to have been worth only about $48,000 in 1933, as against $62,000 in 1932. Relatively few of the producers in the district have furnished the Geological Survey with detailed reports as to their individual operations, so that it is not possible to give specific information as to the tracts where most work was done during the year. From such general information as

has been received it appears, however, that the bulk of the production came from essentially the same general areas as heretofore—namely, from Livengood Creek and its tributaries, Lillian, Ruth, Amy, and Gertrude Creeks, and Glen Gulch, and from some of the tributaries of Tolovana River east of Livengood Creek, mainly Olive and Wilbur Creeks and Lucky Gulch. One of the most significant developments in this district during the year was the extensive drilling campaign and other investigative work carried on by a new company on ground it has acquired under option on Livengood Creek and its tributaries. Some 4 miles of prospective placer ground is included in this project, and if the results of the investigations in progress are satisfactory they will lead to the building of one or more dredges and mining on a large scale. Progress was made in the construction of the road connecting the Tolovana district with Fairbanks, and this should greatly reduce the heavy costs of transportation, which now seriously retard development in this rather remote district.

The Hot Springs district, as the term is here used, consists of two rather widely separated tracts—one including the western part of the district from Tofty to Woodchopper Creek and extending as far west as American Creek, the other including the eastern part, which centers around Eureka Creek and is locally referred to as the "Eureka Creek district." The quantity of placer gold produced from this district in 1933 was the least that has been credited to it in many years. This decline is to be attributed to the lack of water for mining, for there was an increase in prospecting throughout the district, and owing to the higher price of gold there was a feeling that a number of properties which had lain dormant lately could be reopened and worked successfully if a normal water supply were available. It seems likely, therefore, that if the price is maintained a marked increase may be expected next year. The only dredge in the Hot Springs district, that of the American Creek Dredging Co., was not in operation during 1933. The work on the company's property consisted in hydraulicking off the overburden from a considerable tract of country so that it will be in shape to be dredged in 1934. Numerous rumors were afloat as to new operators expecting to come into the camp to develop large blocks of low-grade ground, but so far as could be learned none of these took definite shape in starting work on the ground.

The Ruby district as described in this report is a rather ill-defined area extending southward from the settlement at Ruby, on the Yukon, for 50 to 60 miles to include the settlement of Poorman and the various camps adjacent thereto. During the open season all the mining operations in this district were visited by J. B. Mertie, Jr.,

of the Geological Survey, and the following notes were compiled mainly from his records and the schedules sent in by the individual operators. Mr. Mertie's more complete report on this and nearby districts forms a separate chapter of this volume. There were two principal centers of mining activity in this district—one near Long, 25 miles south of Ruby, and the other near Poorman, some 25 miles farther south. In the area near Long there were 4 camps on Long Creek or a short distance up some of its small tributaries, 1 on Swift Creek about 3 miles west of Long, 2 on Trail Creek 6 to 8 miles east of Long, and 1 on Greenstone Creek about 8 miles south of Long. In the area adjacent to Poorman 5 outfits were mining on Poorman Creek or its tributaries within 2 miles of the town, 2 were on Solomon Creek, 2 were on Timber Creek and its tributary Flat Creek, and 2 were on Moose Creek 9 to 10 miles southwest of Poorman. Between the Long and Poorman settlements there was one mining camp each on Monument and Meketchum Creeks. No productive mining was in progress in 1933 on any of the creeks close to Ruby, though several of them in the past had yielded considerable placer gold. Some of the mining throughout the district is done by sinking shafts through the overburden to the pay streak, then excavating underground the worth-while portions of the placer and hoisting the material to the surface. The larger part of the output, however, comes from shallow surface workings or back ground that can be handled by ordinary hydraulic methods. The shortage of water not only prevented the normal amount of mining but resulted even in several of the operators failing to clean up completely the cuts they had made.

The Koyukuk district, as the term is here used, embraces a very large tract of country and consists of at least three rather widely separated areas in which placer gold has been mined. These subordinate areas are the Indian Creek-Hughes area, in the central part of the Koyukuk Valley; the Hogatza River area, somewhat north of Hughes and embracing country north of the Koyukuk River; and the upper Koyukuk area, which includes that part of the Koyukuk Valley lying north and northeast of Bettles and the country near Wiseman. Mining in the two more southern placer areas was practically negligible, and the Geological Survey has received no specific information regarding work there. The production of the northern part of the Koyukuk Valley was considerably less than in 1932 owing to shortage of water. All the camps are small, the largest consisting of only five men and only a small amount of mechanical equipment. Apparently only about 30 or 40 men are engaged in prospecting in the entire area, which embraces many thousand square miles. The records of the Geological Survey show that the largest production of placer gold in 1933 came from the

Hammond and Wild Rivers and Nolan and Archibald Creeks. Altogether there were some 20 camps in the entire region, widely distributed from the Alatna River on the west to the Bettles River on the east. Most of the placer mining in this area is done by ordinary hydraulic methods, but a fair share is done by underground drifting methods, by which some employment is furnished during the winter. The district as a whole is so inaccessible by ordinary means of transportation that costs of mining deposits in it are much higher than in more accessible regions. This has been a severe deterrent to capitalists and others who might be interested in exploring some parts of the region as thoroughly as should be done. Even the Geological Survey has made only partial surveys in this area, which seems to have promise of containing mineral deposits of value.

In the table on page 34 the production of placer gold in the Chandalar district has been combined with that of the Koyukuk. The yield from the Chandalar district is much less than that from the camps in the Koyukuk Valley. So far as reported, most of the placer gold from the Chandalar district in 1933 came from the property of Manuel Mello, on Little Squaw Creek, but some gold was produced by 2 small camps on Big Creek and 1 on Dictator Creek. The only other work on Little Squaw Creek was done by a prospector who sunk a shaft some 30 feet and drifted for about 40 feet, seeking to discover a workable deposit, but so far as reported he was unsuccessful in this attempt. The plan of extended exploration of the mineral resources of the Chandalar district, noted in the preceding volume of this series, apparently did not materialize, for so far as learned no work to put the plan into effect was undertaken on the ground.

The output of placer gold from the Fortymile district in 1933 was much less than it was in 1932, owing to the extremely dry weather, which caused the supply of water for mining to be sadly deficient. Although most of the placer gold comes from surface excavations and hydraulic work, there is usually considerable afforded by drift mining. In 1933, however, apparently only about a quarter of the production came from drift mines. Work at all these drift mines was done during part of the winter and utilized the services of about 30 men. The largest producer in the district was the mine of Charles Martin and associates on Jack Wade Creek. Two small camps were also at work on this creek, but one of the largest operations on the creek, though nonproductive, was the extensive drilling program that was under way to test a large tract so as to find out whether the placer there was such as to warrant the building of one or more dredges to mine it. This preliminary work was only about half completed during the current season but will be continued until it

has enabled the intending investors to determine the soundness of the project. On Walker Fork two small outfits were ground sluicing, and a crew of three men were constructing a ditch on the property of the Walker Fork Mining Co. This company is reported to have ordered the construction of a dredge to be shipped in to its property during the winter of 1933–34 so as to be ready to operate in the season of 1934. Altogether about 50 men were engaged in mining work in the Fortymile district during the summer of 1933 and in addition to the places named above had established camps on Chicken, Stonehouse, Ingle, Lost Chicken, Napoleon, Franklin, Davis, and Poker Creeks and on the bars of the North and South Forks and of the main Fortymile River.

Reports from the Chisana district (locally called Shushanna) are among the few received by the Geological Survey in which there are no unfavorable comments on the extreme drought of the past season. These reports also indicate that it is one of the few districts in which an increase in the production of placer gold was made. Altogether some 20 men were engaged in placer mining there, though most of them were working in groups of only one or two to a camp. Mining is reported to have been in progress most actively on Big and Little Eldorado, Bonanza, and Beaver Creeks. A new company on Little Eldorado Creek was fortunate in opening up a tract of ground in which considerable heavy gold occurs. One nugget from the claim is said to have weighed about 7 ounces. This coarse gold is rather rough and does not appear to have been transported far from its bedrock source—a fact that encourages the operators to plan continuing their work more intensively next year.

In the Eagle district the shortage of water reduced the output of placer gold to less than half that of 1932, which, however, was a year of especially abundant water supply. Among the streams having the largest production in the district were Fourth of July, American, Alder, Barney, Woodchopper, and Crooked Creeks and the Seventymile River. The largest camp consisted of only four men, and at several of the camps there was only one man each. Almost no winter mining is carried on in the district, the placers being worked by simple hydraulic or open-cut methods.

Placer mining in the Bonnifield district was carried on by a few small camps, the largest of which employed not more than four men, and none of them yielded gold worth more than a few thousand dollars. Among those reporting some production of gold during 1933 may be mentioned operators on Gold King, Marguerite, Moose, Platte, Portage, and Eva Creeks. The production from this district has been combined in the table on page 34 with that from the Kantishna district, but it may be stated that the placer gold from this

district was somewhat more than half of the combined total. In the Kantishna district there were altogether less than a dozen men engaged in placer mining or prospecting, and they were distributed through small camps on several of the creeks, notably Eureka, Little Moose, Glen, Yellow, Caribou, and Crooked Creeks. None of these camps, however, recovered gold worth more than a few hundred dollars. All the ground is shallow and is mined by simple methods. An examination of all the mineral deposits in the vicinity of Eureka was made by F. G. Wells in 1931, and the results of that work were published by the Geological Survey in 1933.[11] This study was directed particularly to the lodes of the district, but the report contains much information that pertains to the placer deposits.

Reports received by the Geological Survey regarding placer mining in the Rampart district indicate that about eight camps, the largest consisting of only four men, were active during 1933. Several of these operations recovered only a few hundred dollars' worth of gold. The greatest amount of gold seems to have come from properties on Little Minook, Quail, and Hunter Creeks. Some gold was also produced at camps in the valleys of Big Minook, Slate, and Hoosier Creeks. Prospecting was also done on the high gravel deposits of Idaho Bar. In the Gold Hill district, which lies west of the town of Tanana and in this report has for convenience been grouped with the Rampart district, a little prospecting was done in 1933 on Morelock and Grant Creeks. Only a little gold was recovered in this work, but it is significant as indicating the continuation of mining interest in this district. So far as could be learned, no prospecting was in progress on Mason Creek during the season of 1933.

The Marshall district, as the name is used in this report, includes practically all of the western part of the Yukon Valley below Holy Cross and is somewhat more inclusive than the so-called "Wade Hampton recording precinct." In this large area there is but very little placer mining or prospecting, and what there is is more or less localized at two points—one near Marshall and the other in the Stuyahok or Bonasila Valley. A few miles upstream from Marshall (Fortuna Ledge post office), Willow Creek, the source of most of the placer gold that in earlier years was mined in the Marshall district, joins the Yukon. It is reported that in 1933 only one prospector was working in the area. On Montezuma and Buster Creeks three men were mining the creek gravel and reported a return of more than wages for their season's work. About 50 miles northeast of Marshall, in the valley of the Stuyahok River, a tributary of the Bonasila River, a party of 4 men were mining with a hydraulic lift and

[11] Wells, F. G., Lode deposits of Eureka and vicinity, Kantishna district, Alaska: U.S. Geol. Survey Bull. 849–F, pp. 335–379, 1933.

plant. No details have been learned by the Geological Survey as to the progress of the work at this place, but the amount of gold recovered indicates that the camp must have suffered from the extremely dry season, which prevented full-time operation.

KUSKOKWIM REGION

Included in the Kuskokwim region are four principal districts where gold placers were mined in 1933. For convenience of description they may be called the Mount McKinley, Georgetown, Tuluksak-Aniak, and Goodnews Bay districts. The Mount McKinley district, as the term is here used, embraces all the eastern part of the Kuskokwim Valley, but the placer mining in it is more or less localized around McGrath, Takotna, and Medfra. The Georgetown district in the central part of the Kuskokwim Valley, and the settlement of Georgetown, on the Kuskokwim, about 45 miles in an air line south of Iditarod, is situated near the center of the southern border of the district. Although lying in the Kuskokwim drainage basin, the district has closer affiliation with the Iditarod district, to which it has better transportation facilities than to any of the Kuskokwim points. The Tuluksak-Aniak district is named from two rivers that traverse parts of it; the Tuluksak enters the Kuskokwim from the south some distance east of the settlement of Bethel, and the Aniak enters the Kuskokwim about 50 miles still farther upstream, to the east. Goodnews Bay is a small indentation of the coast on the east side of the Kuskokwim Bay, about 125 miles in an air line south of Bethel.

The production of placer gold in the Kuskokwim region in 1933 is estimated at $96,000, or only about two-thirds of its production in 1932. Considering the enormous area of the Kuskokwim region this amount is extremely small, but when it is remembered that there are less than 100 white miners in the whole region, that their activities are much handicapped by their remoteness from supplies, and that their expenses are consequently large and their funds small, the wonder is that the production is as large as it is. From such geologic information as is available regarding the Kuskokwim region, it seems certain that there are areas in this region that well deserve more intensive investigation and that there is a fair probability that close examination and intelligent prospecting in the vast totally unexplored areas that fall within its confines might disclose not only workable gold placers but also other valuable mineral deposits.

Many of the placer camps in the McGrath-Medfra portion of the Mount McKinley district were visited during the season of 1933 by a Geological Survey party in charge of J. B. Mertie, Jr., and a

complete report of his studies is given in a separate chapter of this volume. The following brief notes are based on his report and on the schedules returned by the various miners. The largest production from this district is reported to have come from properties operated by Waino Kaskinen on Moore Creek, a tributary of the Takotna River about 50 miles in an air line south of McGrath. At this place a crew of five men were employed. It is currently reported that extensive preparatory work was in progress on Moore Creek by one of the principal mining operators in the Iditarod district, who had recently acquired claims in the valley of that stream. The ground had previously been drilled and the stripping operations in 1933 should place the property in shape to become productive. Among other places where productive placer mining was in progress in the district may be mentioned Candle Creek, Hidden Creek and its tributaries, Birch, Eagle, and Alder Creeks, and near Vinasale. The mining on Candle Creek, which is a tributary of the Tatalina River, is on a property some 8 miles in an air line southwest of McGrath. Hidden Creek, about 32 miles in an air line northeast of McGrath, was the site of three small hydraulic operations. The occurrence of placer ground in the vicinity of Vinasale is a new discovery, as heretofore this had not been regarded as a likely placer region. Vinasale is about 20 miles in an air line south of McGrath. No details are available as to the occurrence of gold at this place except that the amount recovered was small.

Placer mining in the Georgetown district appears to have been restricted to Donlin and Julian Creeks. The mineralized areas on these streams lie only about 25 miles south of the town of Flat, in the Iditarod district, and as they are reached most easily from that district they might really be considered as outliers of the Iditarod deposits. They are about 20 miles in an air line respectively northwest and north of Georgetown, on the Kuskokwim. Two camps are reported to have been mining on Donlin Creek and one on Julian Creek. Revival of interest in this region has led to a concerted effort to have a suitable road built between Flat and Georgetown, so that better transportation facilities would be available for prospectors. South of Georgetown, in the valley of Holitna River, some placer gold is reported to have been found during the winter of 1932–33, and a number of claims were staked on which further prospecting was to be done during the open season. No details regarding this find have been received by the Geological Survey, and even the approximate position of the locality has not been learned. As the region has not been mapped, any statement as to the real significance of the find is pure speculation. However, from the probable geologic character of the region there is good reason to believe that

it may contain intrusive rocks which, at their contacts, have induced mineralization that might yield workable placers.

In the Tuluksak-Aniak district the bulk of the placer gold produced in 1933 came from the property on Bear Creek that is being mined by the dredge of the New York Alaska Gold Dredging Corporation. No detailed report of the operations of this company has been received by the Geological Survey, but it is understood that the work was conducted at essentially the same places as heretofore and at about the same rate. It is said that in the course of the work additional ground which would pay to work was disclosed, so that the life of the enterprise is prolonged by another 2 years, at least. Next in volume to the dredge production was the output from the hydraulic and open-cut mines. The largest of these are on Canyon and Marvel Creeks. Canyon Creek is a small tributary of the Kwethluk River, which in turn is a tributary of the Kuskokwim a short distance west of the settlement of Akiak. Marvel Creek is a tributary of the Salmon River, which flows into the Akiak River, and that stream in turn joins the Kuskokwim about 75 miles in an air line northeast of Akiak. The principal property on Canyon Creek was being operated by Kvamme & Andersen, and the one on Marvel Creek by Dahl & Wilson for Luther C. Hess. Several other small outfits of a few men each are also reported to have been working on some of the other streams that head in the same general group of hills, which, for want of a specific name, may be referred to as "Marvel Dome and vicinity." No detailed reports from any of these smaller camps have been received by the Geological Survey, and apparently they recovered only a little gold.

In the Goodnews Bay region the prospectors lately have been so much more interested in the search for platinum placers and their efforts have been so much better repaid that the search for gold placers and their development have been more or less abandoned. However, during 1933 there was some evidence of a return of interest in gold placers, especially in the vicinity of Wattamuse and Slate Creeks. This revival is in part due to finding some gold in the benches, which are interpreted by the owners as following the course of the old stream before it cut down its present channel. Three or four men worked on this ground, although considerably hampered by the lack of water caused by the dry weather. Furthermore, representatives of some of the larger operators visited the camp and, as a result of the showings, one made arrangements to have equipment put on the ground and to go ahead with mining it on a larger scale during 1934. Some of this new ground is said to carry nearly as high a gold content as any of that which was known in the boom days of

the camp. A little placer gold is reported to have been recovered at a small camp on Kow Kow Creek. No recent news has been received by the Geological Survey as to the progress of the extensive tests that have been under way for several years in the valley of the Arolic River with a view to finding out the value of some of the low-grade deposits that occur there.

SEWARD PENINSULA

Seward Peninsula mining suffered severely through the extremely dry summer of 1933, whereby its available supply of water, which is never too plentiful, was more than ever curtailed. As a result, the production from practically every district on the peninsula was less in 1933 than in 1932 and for the entire region was valued at only $1,156,000, as against $1,533,000 in the preceding year. This comparison would not show as unfavorable a relation had 1932 been a normal year. Instead, 1932 was a year of especially abundant water supply, and its placer gold production was worth over $300,000 more than that of the preceding year. In other words, if the production of 1933 is compared with that of 1931 it proves to be almost identical, the shortage in 1933 being only about $50,000. Therefore the decreased output, while a source of regret, is not alarming and in no sense is to be regarded as an indication of the waning of the mining industry as a whole in that region. In fact, as will be seen from statements in the following paragraphs regarding the individual districts, there are in almost every camp signs of the new enterprises springing up or old ones being enlarged that seems to promise well for the future of the mining industry in the region as a whole. A large part of the gold recovered from Seward Peninsula placers is mined by dredges. In 1933 gold worth $947,000, or about 82 percent of the placer output of the peninsula, was mined by 9 dredges, one or more of which were active in practically every one of the larger districts of the peninsula. Additional data regarding dredge mining on Seward Peninsula, as well as in other parts of Alaska, are given on pages 54–58.

In the relative order of their output of placer gold in 1933 the mining districts of Seward Peninsula stood as follows: Nome, Fairhaven (including the Candle and Inmachuk districts), Council, Solomon (including the Casadepaga River region), Kougarok, Bluff, the Koyuk River region, and Port Clarence. So much of the placer gold from some of these districts came from only one or two mines that it has not seemed advisable to publish the production of the separate districts, as it might disclose the output of the individual mines.

The outstanding enterprise in the Nome district, as well as in the whole of Seward Peninsula, continues to be that of the Hammon

Consolidated Gold Fields with its three dredges between Little and Dry Creeks and its extensive ditches and other equipment for properly conducting its work. Mining at this property was conducted on the same general lines as heretofore, two of the dredges mining near the site of the ancient beaches some distance inland from the shore and the other about half a mile inland from the present beach. A considerable force of men was also employed by the company at the hydraulic pit near Center Creek and in cleaning the rough bedrock exposed there to recover the gold that has penetrated far down along the cracks and crevices in the limy schist on which the old beach concentration took place. In 1932 it seemed that this large enterprise was nearing its conclusion, as the work was fast being carried to the property limits, and negotiations had failed to acquire additional ground in the neighborhood at satisfactory terms. Fortunately, early in 1933 the company was enabled to make satisfactory arrangements to mine much of the adjacent property and obtain additional ground, so that at least for several years more its work will not be interrupted by lack of ground to be mined. In spite of this happy settlement, the uncertainty that was caused while negotiations were in progress had a distinct effect in curtailing the output of the company in 1933. This was brought about because of the inability of the company to carry through in 1932 and earlier some of the preparatory work that is required in putting the ground in shape for dredging, such as stripping the ground, thawing it, and allowing it to stand or season afterward the requisite time.

There were also a number of open-cut mines on many of the creeks in the vicinity of Nome. Most of these mines were small and employed only a few men; the largest appears to have been that of the Monument Creek Mining Co., on Monument Creek, a tributary of the Nome River, where 7 to 9 men were employed throughout most of the open season. The manager of this company was also carrying on development work in the coastal-plain deposits south of Sunset Creek, with a view not only of testing out the gold contents of these deposits but also of determining an efficient way of mining those whose contents proved high enough. For this work a gasoline engine was used to elevate and stack tailings and to recirculate the water needed in sluicing. It is reported that this company purchased the old dredge on Osborn Creek and will dismantle it and move it to the property on Sunset Creek. It is also reported that the Bangor dredge, which had mined out the available placers on Anvil Creek and had been idle for several years, was dismantled and awaiting shipment to Deering, where it will be assembled for work on the Inmachuk River. West of Nome, in the valley of the Cripple River, some prospecting is reported to have

been in progress in the expectation of developing dredging ground, but no specific details as to the progress that was made have been reported to the Geological Survey.

The greatest amount of placer gold mined in the Fairhaven district came from three main tracts—Candle Creek, the Inmachuk River, and Bear Creek. Altogether somewhat more than 100 men were employed on different mining properties in this district in 1933. Candle Creek is a large tributary of the Kiwalik River from the west, close to the town of Candle. On Candle Creek and its tributaries, Patterson and Jump Creeks, the greatest amount of placer gold was recovered by the Keewalik Mining Co., which, in addition to its dredge, also mined some of its property by hydraulic methods. Production continued at essentially the same rate as heretofore, and no new developments of significance were reported. Altogether about six camps, employing a total of about 50 men, were mining on this creek and its tributaries. Farther up the Kiwalik River, on Quartz Creek, which enters from the east, a little productive placer mining was done, and on Gold Run, which enters the Kiwalik River from the west a few miles below Quartz Creek, some prospecting was in progress.

In the Inmachuk Valley the principal producer was the small dredge of the Forsgren Dredging Co., which was in operation at intervals throughout the season. Farther upstream in the Inmachuk River Valley was the hydraulic mine of A. V. Cordovado, on the Pinnell River a short distance upstream from its junction with the Inmachuk. Work at this place has been in progress for several years. Several small hydraulic-mining camps were established on nearby creeks. The largest of these was on Humboldt Creek, where four men had a fairly successful season. Altogether between 35 and 40 men were engaged in mining in the Inmachuk area in 1933. Some prospecting is reported to have been continued during the year in searching for the old stream courses that were buried under the great outpourings of Tertiary and later lavas which cover more than 1,000 square miles in the central part of Seward Peninsula. So far as learned this investigation has not yet disclosed workable placer deposits.

The third tract in which placers were mined in the Fairhaven district lies on Bear Creek on the eastern flanks of hills that form the divide between the Buckland and Kiwalik Rivers. No specific reports have been received as to the individual mining operations in that tract, and the absence of news indicates that there have not been any notable developments during the year. The production from this area seems to have been somewhat less than in recent years, and apparently not more than 10 men were engaged in mining there in 1933.

In the Council district, as in the other larger producing districts of Seward Peninsula, most of the placer gold produced in 1933 came from dredges. Two dredges were operated on Ophir Creek, one belonging to the Ophir Gold Dredging Co. and the other to the Northern Star Dredging Co. The latter was in the lower part of the valley, where the stream traverses the lowland of the Niukluk. The recovery of gold by the dredges in 1933 was slightly less than in the preceding year, though the amount of decrease was practically negligible. All the hydraulic and open-cut mines in the district are small, few of them employing more than two or three men. In addition to the dredges on Ophir Creek there were three open-cut mines in the valley of that stream. On Aggie Creek, a tributary of the Fish River, a small hydraulic plant was in operation throughout most of the open season. Small open-cut mines were also in operation on Crooked Creek and on Benson Gulch, a tributary of Melsing Creek. There were doubtless a few other small camps scattered through the district, but no direct reports have been received from them, and nothing is known about the progress of their work, though to judge from the total amount of gold received from this district by the banks, most of them made at best only a modest grubstake.

In the Solomon district by far the larger part of the placer gold produced was obtained by the dredge of the Spruce Creek Dredging Co., on Spruce Creek about 6 miles east of Solomon. The success of this dredge is of special significance not only as a contributor to the output of the district but also in encouraging further search in the coastal-plain deposits of the district for old placer concentrations, comparable in origin with those at Nome and likely to be of economic value where they were adjacent to mineralized bedrock. According to local reports, the so-called "Goldsmith dredge," which had been mining for several years on the Solomon River near the mouth of Coal Creek, was dismantled during the season and was to be transported overland to the Kougarok River, where it was to be reassembled. The principal open-cut mines were on West, Big Hurrah, Jerome, and Rock Creeks, Moran Gulch, and the Solomon River. Few of these smaller camps had an output of as much as several thousand dollars, and many of them yielded only a very modest grubstake. No definite information has been received by the Geological Survey as to any mining work in progress in the Casadepaga Valley, which lies immediately north of the valley of the Solomon River. Although there doubtless were some prospectors in this tract, the amount of gold they produced was apparently negligible.

Mining in the Kougarok district was much hampered by the lack of water during the year, and the production consequently fell off

considerably. The dredge that had been in operation on the Kougarok River near the mouth of Henry Creek was idle throughout the year owing to litigation and financial difficulties. It is expected that a new dredging enterprise will be started in the district shortly, as it is reported that a new operator had purchased the old Goldsmith dredge that was on the Solomon River. It was planned to utilize as much of the material from this old dredge as possible and with such new material as was necessary to build a new dredge on the Kougarok River. The most productive portion of the Kougarok district was that lying on and near to Coffee Dome, in the southern part of the district. Here several small hydraulic plants were active throughout most of the season. Near the head of the Kougarok in the vicinity of Taylor, especially on Macklin Creek and some of the nearby tributaries, a number of small outfits were mining and in the aggregate recovered considerable placer gold. At most of these properties simple open-cut methods of mining were employed, and few of them had any extensive mechanical equipment. Some mining is also reported to have been done at small camps on Dick Creek and in some of the valleys of the other small streams that head against the northern divide of the Kougarok River, but the output of these camps was worth at most only a few thousand dollars.

South of the Kougarok district, in the vicinity of Iron Creek, six men are reported to have done some hydraulic mining during the year. On American Creek, about 8 miles east of Iron Creek, one camp employing several men was said to have been engaged in constructing a ditch to lead water for use in hydraulicking placer ground on that stream. A little work was also in progress on Benson Creek. The entire production of gold from the Iron Creek area, however, was so small that it amounted to little more than wages for the few men concerned.

In the vicinity of Bluff the principal placer mining in 1933 was done on claims lying along the lower course of Daniels Creek. Mining at this place is carried on by a crew of about 15 men using a drag-line scraper which excavates the decomposed limestone bedrock and overlying unconsolidated deposits. Much of the ground is deep, and the gold penetrates far into the bedrock. Small amounts of placer gold were also produced from another property farther north up Daniels Creek and from claims on Eldorado and Swede Creeks. The recovery of small amounts of placer gold from California and Coca Cola Creeks, about 7 miles west of Bluff, has awakened some new interest in prospecting further in that area. It is understood that five or six men were working there at different times during the year, but no details as to the results have been furnished to the Geological Survey.

The Koyuk district, as the term is used in this report, includes most of southeastern Seward Peninsula and is so named from the principal stream that traverses it. Most of the placer deposits that are mined are on Dime Creek and a few of the other streams in the vicinity of Haycock. Although in the past one small dredge has been active in the district, in 1933 it did not operate, and most of the placer gold came from bench and creek placers mined by hydraulic or open-cut methods. One camp, that of the Haycock Mining Co., did some mining during the summer with a drag-line scraper. Six camps employed a total of about 17 men during the summer. Four of these camps were on Dime Creek and two on Sweepstake Creek.

Lying east of Seward Peninsula but more or less closely related to it and forming the eastern border of Norton Sound is the Bonanza district, so named from a small stream which has long been known to carry some placer gold. For convenience it has here been treated as part of the Koyuk district, though the productive parts of the two areas are widely separated. Prospecting has been carried on at several places in this general area in the past and for the last 2 or 3 years has been localized in the narrow coastal plain that lies between the waters of Norton Bay and the hills to the east. The bedrock in this part of the area consists mostly of dark slate and sandstone and thus differs markedly from the schist bedrock that occurs in most of the other placer camps in Seward Peninsula. The history of the coastal plain at this place, in the main, seems to have been comparable to that of the coastal plain at Nome and elsewhere in Seward Peninsula, so that prospecting for ancient beaches in this district is well justified. Whether the ancient beaches will prove to be gold bearing, however, depends on the occurrence of mineralization in the material that formed this coastal plain and, if it occurred, on the effectiveness of any subsequent concentration. The present production from this entire tract amounts at most to only a few hundred dollars a year.

The Port Clarence district, as the term is here used, includes the western part of Seward Peninsula, especially that part adjacent to Teller and the Imuruk Basin, including the district formerly known as "Bluestone", from the principal stream that traverses it. The production from the district in 1933 was valued at only a few thousand dollars, and probably there are not more than 15 to 20 men in it that are doing any mining. So far as learned from local reports, the greatest amount of gold was recovered by one camp on Coyote Creek and from smaller camps on Gold Run, Offield Creek, and the American River. In the valley of Burke Creek, which is a tributary of the Agiapuk River, prospecting was continued during the summer, and further exploration and the extension of the ditches to furnish a more adequate supply of water are contemplated.

NORTHWESTERN ALASKA

The Kobuk River Valley is the only one in northwestern Alaska that is reported to have been the scene of any placer mining in 1933. In this valley there are two principal areas where placer mining is being done. The western area is near Kiana, and the principal placer tract is in the valley of the Squirrel River and especially in the valley of its tributary Klery Creek. The eastern area is in the vicinity of Shungnak, a small settlement about midway between the head and mouth of the Kobuk River. Kiana is about 50 miles in an air line above the mouth of the Kobuk, and Shungnak is about 90 to 100 miles in an air line east of Kiana. Both of these tracts are so remote and so poorly served by any means of regular transportation or communication that their development is much retarded and hampered by high costs, unavoidable delays, and short working season.

The Geological Survey has received no direct specific reports from individuals mining in the vicinity of Kiana. Apparently very little mining is in progress there, and less than half a dozen persons are engaged in mining or prospecting in the neighborhood. Two small camps were in operation on Klery Creek, and search was in progress in the vicinity of Center Creek in the attempt to discover ground that might be suitable for dredging. Unfortunately, although drilling equipment and other machinery had been sent in to do the necessary exploration, funds for the work have not been forthcoming, and little has been accomplished in the actual testing of the area.

In the tract near Shungnak the placer deposits occur in the lowland adjacent to the Kobuk, close to the places where the small streams that come down from the hills to the north traverse that lowland, or in the valleys of the streams within this belt of hills. The source of the placer gold found in these deposits appears to be local, as in general it is rough and shows little evidence of having been transported far. This conclusion is further supported by many quartz veins carrying free gold in the metamorphic rocks that form the hills in which these streams rise or which they traverse. In 1933, 11 small camps, employing a total of about 25 men, part of whom are natives, were established on streams in the vicinity of Shungnak—4 on Dahl Creek, 3 on Shungnak River, and 1 each on Boulder, Riley, Lynx, and Pearl Creeks. Riley and Boulder Creeks are tributaries of the Kogoluktuk River, which joins the Kobuk some 3 or 4 miles east of Shungnak, and the Shungnak River enters the Kobuk about 15 miles west of Shungnak. Pearl Creek is a small tributary of the Shungnak River that heads in the hills near Riley Creek. The largest of these enterprises is that in the southern part of the valley of the Shungnak River. At this property mining is being done by

the use of a drag line scraper. Much of the season was spent in the construction of a ditch about 4 miles long to bring water under head to the ground that is to be mined near the southern face of the Cosmos Hills. The other properties in the district are being worked by small one- or two-man outfits using simple open-cut or hydraulic methods that require a minimum of equipment. On Dahl Creek during the season of 1933 a nugget weighing about 18 ounces was picked up. This section is so remote and so poorly served by regular transportation service that it is among the most difficult places in the country in which to carry on mining development. For the transportation of persons or small or light commodities airplanes make the district relatively accessible, and already some of the prospectors are using this means of travel extensively.

The only other place in the Kobuk Valley at which some prospecting for gold placers was in progress was apparently in the valley of the Ambler River some 50 miles west of Shungnak. No details regarding the results of this work have been received by the Geological Survey, but apparently the bedrock of this part of the region is schist cut here and there by granitic intrusives, and this geologic environment is regarded as favorable for the occurrence of mineralization. However, the intense glaciation that has affected those mountains is likely to have dispersed or buried earlier-formed placer deposits, so that except in protected places they may not remain, or they may be especially difficult to find.

DREDGING

Over 80 percent of all the placer gold produced in Alaska in 1933 was mined by dredges. The total gold thus recovered was $4,146,000, of which the greater part came from 14 dredges in the Yukon region and the rest from 9 dredges in Seward Peninsula and 1 each in the Cook Inlet-Susitna and Kuskokwim regions. This total is about $150,000 less than the amount recovered by dredges in 1932. The accompanying table gives the output of gold and yardage handled by Alaska dredges, beginning in 1903, the earliest year for which records are available.

The total value of the gold produced by dredges since 1903 is 20 percent of the total value of gold produced from all kinds of placer mining since 1880, and lately there has been a general tendency each year for a greater and greater percentage of the placer output to be mined by dredges. During 1933 the ratio of dredge production to the output from all other kinds of placer mining was nearly 80 to 20, and there are no signs of a diminution in dredge mining in the near future—in fact, an even higher ratio seems not unlikely.

Gold produced by dredge mining in Alaska, 1903–33

Year	Number of dredges operated	Value of gold output	Gravel handled	Value of gold recovered per cubic yard
			Cubic yards	
1903–15		$12,431,000		
1916	34	2,679,000	3,900,000	$0.69
1917	36	2,500,000	3,700,000	.68
1918	28	1,425,000	2,490,000	.57
1919	28	1,360,000	1,760,000	.77
1920	22	1,129,932	1,633,861	.69
1921	24	1,582,520	2,799,519	.57
1922	23	1,767,753	3,186,343	.55
1923	25	1,848,596	4,645,053	.40
1924	27	1,563,361	4,342,667	.36
1925	27	1,572,312	3,144,624	.50
1926	32	2,291,000	5,730,000	.40
1927	28	1,740,000	6,084,000	.29
1928	27	2,185,000	6,371,000	.34
1929	30	2,932,000	8,709,600	.336
1930	27	3,912,600	9,906,000	.395
1931	28	3,749,000	10,214,000	.367
1932	25	4,293,000	10,310,700	.416
1933	25	4,146,000	8,889,000	.466
		55,108,000		

In the foregoing table the figures given for yardage mined and value of the gold recovered per cubic yard are subject to some inaccuracy, because several of the dredge operators have not furnished specific information on those subjects for their individual properties, and the figures for these properties have therefore had to be estimated. In making these estimates the following procedure has been adopted to determine the unknown factors: Operators of dredges that produced approximately $3,834,446 in gold, or a little less than 92½ percent of the total mined by dredges, report that that amount came from 8,221,544 yards of gravel. The average yield thus shown is about 46.63 cents in gold to the cubic yard. Applying this average to determine the unreported yardage gives a total of 8,889,000 cubic yards, and this is the figure that has been used in the table. This procedure is obviously open to criticism, because the companies that reported fully the amount of gravel mined were the larger ones, and doubtless they worked ground of a lower tenor than that mined by some of the smaller companies. As a result, the average value adopted may be too low and consequently may indicate a larger volume of gravel than was actually handled. This method, however, has been followed for the last 9 years, so that the quantities and values given for 1933 are comparable with those reported for the preceding 9 years. If this value as stated is correct, it will be evident from the table that the average tenor of the ground dredged in 1933 was considerably higher than the average for 1927 to 1932, though considerably lower than the average for most of the preceding years.

The length of time that the different dredges were operated varied widely. The longest season reported was 255 days for one of the dredges of the Fairbanks Exploration Co., which was operating in the Fairbanks district of the Yukon-Tanana region. The longest season reported for any of the Seward Peninsula dredges was for one of the dredges of the Hammon Consolidated Gold Fields, at Nome, which mined for 121 days. The earliest date for beginning work in the spring and the latest date for ending work in the fall were reported by the Fairbanks Exploration Co., which began mining March 25 and did not stop its last dredge until December 4. The earliest and latest dates on Seward Peninsula were June 11 and October 9, both reported by the Hammon Consolidated Gold Fields. The average length of working season in 1933 of the 8 companies for which information is available, as determined from the beginning and ending dates reported by each company, irrespective of how many dredges it operated, was 120 days. Obviously, the shortness of the average season as compared with the record of 255 days for the longest working season was due not to climatic conditions, but to breakage or some other purely local cause at the different dredges. The lesson that is demonstrated by this dredging record is that throughout most of interior Alaska a moderate-sized dredge reasonably well handled may be expected to have at least an average working season of 4½ months, and that with skill and special provisions against unfavorable climatic conditions the dredging season may be extended for an additional period of 1 to 2 months in practically any of the placer camps south of the Arctic Circle. The longest dredging season yet recorded is that of one of the dredges of the Fairbanks Exploration Co. in 1930, which was in operation for 269 days. This unusually long season, however, was found to be undesirable, as the difficulties experienced outweighed the advantages gained.

The following is a list of the dredges that did some productive mining during 1933:

Cook Inlet-Susitna region:
- Yentna district:
  - Yentna Dredging Co — Cache Creek.

Yukon Basin:
- Fairbanks district:
  - Fairbanks Exploration Co. (5) — Goldstream and Cleary Creeks.
  - Fish Creek Mining Co — Fish Creek.
  - J. R. Murphy, lessee from Fairbanks Gold Dredging Co., Ltd. (2) — Fairbanks Creek.
  - Chatham Gold Dredging Co — Chatham Creek.
- Iditarod district:
  - North American Dredging Co — Flat Creek.
  - J. E. Riley Investment Co — Otter Creek.

Yukon Basin—Continued	
Innoko district:	
Puntila and associates (2)	Ganes and Little Creeks.
Higgins and associates	Yankee Creek.
Kuskokwim region, Tuluksak-Aniak district:	
New York-Alaska Gold Dredging Corporation	Bear Creek.
Seward Peninsula:	
Council district:	
Northern Star Dredging Co	Ophir Creek.
Ophir Gold Dredging Co	Do.
Fairhaven district:	
Keewalik Mining Co	Candle Creek.
Forsgren Dredging Co	Inmachuk Creek.
Nome district:	
Dry Creek Dredging Co	Dry Creek.
Hammon Consolidated Gold Fields (3)	Old beach line.
Solomon district:	
Spruce Creek Dredging Co	Spruce Creek.

During 1933 5 dredges that had been active in 1932 were idle, but mining was done by 5 dredges that had not been in operation in 1932, so that the total number of active dredges in 1933 was 25, the same as in 1932. The dredges that were active in 1932 but idle in 1933 were, in the Yukon region, the dredge of the American Creek Dredging Co., on American Creek, in the Hot Springs district; in Seward Peninsula, that of the Henry Creek Gold Dredging Co., on the Kougarok River, in the Kougarok district; the dredge of McCarthy & Panos, on the "second beach" in the Nome district; and those of the Ruby Dredging Co., on Ruby Creek, and the Goldsmith Dredging Co., in the Solomon district. The dredges that were in operation in 1933 and not in 1932 were, in the Cook Inlet-Susitna region, that of the Yentna Dredging Co., on Cache Creek, in the Yentna district; in the Yukon region, those of the Fish Creek Mining Co., on Fish Creek, and the Chatham Gold Dredging Co., on Chatham Creek, in the Fairbanks district; one of the small dredges on Ganes Creek and that of Higgins and associates, on Yankee Creek, in the Innoko district.

Much of the placer ground at practically all the places where dredges are now working in Alaska is frozen, so that extensive plants for thawing it must be available. This adds heavily to the cost of the work, and unless the thawing has been done adequately it slows up or actually checks mining. Most of the dredge camps are now using cold water for thawing, though in the past steam or hot water was thought to be necessary. At any large dredging operation, such as at Nome or Fairbanks, miles of pipe are used for the thawing process, and a larger force of workmen is required in the various tasks connected with the thawing than in actual mining. In addition to the labor costs for thawing operations, there is need for large

quantities of water, both for thawing and for sluicing. Adequate supplies of water for most of the dredging camps in interior Alaska and Seward Peninsula are difficult to find and costly to develop. In places it has been necessary to go scores of miles to get water under sufficient head and then lead it by means of long ditches and siphons to the mining ground. The regulation of this water and the maintenance of the ditches require the constant attention of a considerable force of men throughout the working season, especially if the construction is new and the ground has not settled.

The success of most of the good dredges already built has induced many individuals and companies to reexamine formerly known extensive deposits that were too low in tenor to be worked by any of the methods that require less capital. As a result rumors are heard regarding dredging projects to be undertaken on placer ground from one end of interior Alaska to the other. Unquestionably these projects deserve most careful consideration, and some of them will doubtless be successfully carried through, but there is a tendency to regard the dredge as a magic method by which even worthless deposits may be mined at a profit, so that a word of caution may not be amiss to those who are considering investment in some of the projects. The amount of money needed to finance the building of a dredge and furnish the necessary equipment is so great that the cost of a report by a competent engineer is relatively insignificant, and such a report should be obtained as almost the first step in any well-advised project. Furthermore, adequate prospecting in advance, although apparently costly, well repays the outlay, as it prevents unwise commitments and enables the competent manager to effect savings through constructive planning.

Rumors are so numerous of places where prospecting is said to be contemplated or in progress, with a view to determining their suitability for dredging operations, that it is difficult to distinguish those that are merely forlorn hopes from those that are being seriously considered by persons or companies who would be able to carry through any enterprise they might undertake. It has therefore seemed inexpedient to attempt to list here all the places that have been mentioned as being under consideration. However, in earlier parts of this report describing the different placer districts mention has been made of some of the enterprises that have been most extensively discussed. It should be realized, however, that although some of them may be regarded as approaching a real prospective stage others will inevitably be dropped, and that in all probability there are many others that, though they have not yet advanced so far as to be extensively discussed, may be even more meritorious and may be developed first.

COPPER

The production of copper from Alaska mines in 1933 was insignificant, the total quantity being estimated as 29,000 pounds, as contrasted with more than 8,700,000 pounds in 1932. This practical suspension of the industry was brought about by the extremely low price paid for copper, which led the two principal copper mines in the Territory to choose the alternative of closing rather than a heavy operating loss. As a result the only copper produced from Alaska ores in 1933 was that recovered as a minor byproduct in the treatment of ores whose principal value lay in the other metals they contained, notably gold. The necessity for suspension of the large Alaska copper mines is not only to be regretted as a serious direct loss to the mining industry of the Territory, but has perhaps an even greater indirect effect through curtailment of the transportation facilities formerly required to bring the ore to the coast and carry it to the smelters in the States for treatment.

In the foregoing estimate of copper production no account is taken of certain shipments in 1933 of copper ore mined in earlier years. The published reports of the Kennecott Copper Corporation and of the Mother Lode Coalition Mines Co. state that while the mines were not in operation 1,099,597 pounds and 383,111 pounds of copper, respectively, were collected in the course of cleaning up the concentrating plants at the two properties from ore that had been mined in previous years. As this had been included in the estimates of mine production for earlier years, however, its inclusion in the accompanying records of production for 1933 would be a duplication.

The value of the copper produced in Alaska from ores mined in 1933 has been computed on the basis of the average selling price for the year, which, according to the Bureau of Mines, was 6.4 cents a pound. At this average price the total value is $1,900. It is realized that this method of calculating the value does not take into account the fact that an efficient and fortunate selling agent would take advantage of fluctuations in the price of copper and thus dispose of as much as possible during periods of high prices and hold as much as possible during periods of low prices. The figures given for the value of the Alaska output of copper cannot, therefore, be regarded as representing the amounts received by the different companies for their copper. They do, however, serve to indicate within close limits the magnitude of the industry and are comparable with the figures for earlier years as stated in these reports. For a considerable period in the early part of the year copper sold at the refineries at less than 5 cents a pound, and during that period it dropped to a low of 4.775 cents, which is believed to mark the lowest price at which this metal has ever sold. This extraordinary decline, of

course, does not mark a condition affecting only copper derived from Alaska ores but is a world-wide situation that has come about through growing production and decreasing consumption.

In the following table are shown the amount and value of the copper produced in Alaska since the earliest recorded mining of copper. For the last few years there has been a great decrease in the output, and the output in 1933 marks a lower point than had been touched in any other year in the period since 1900. In fact, for 1933 the output may be regarded as practically wiped out.

Copper produced by Alaska mines, 1880, 1900–1933

Year	Ore mined (tons)	Copper	
		Pounds	Value
1880		3,933	$826
1900–1915	1,232,396	220,773,969	35,031,225
1916	617,264	119,654,839	29,484,291
1917	659,957	88,793,400	24,240,598
1918	722,047	69,224,951	17,098,563
1919	492,644	47,220,771	8,783,063
1920	766,095	70,435,363	12,960,106
1921	477,121	57,011,597	7,354,496
1922	581,384	77,967,819	10,525,655
1923	731,168	85,920,645	12,630,335
1924	761,779	74,074,207	9,703,721
1925	860,023	73,855,298	10,361,336
1926	670,000	67,778,000	9,489,000
1927	645,000	55,343,000	7,250,000
1928	579,500	41,421,000	5,965,000
1929	590,400	40,510,000	7,130,000
1930	531,000	32,651,000	4,244,600
1931	88,000	22,614,000	1,877,000
1932	56,900	8,738,500	550,500
1933		29,000	1,900
		1,254,021,500	214,682,000

In the foregoing table no quantity of ore mined is shown in the appropriate column for 1933. This has been omitted because the copper produced in that year was but a minor byproduct from the gold ores mined, which are not at all comparable with the ores reported for the preceding years, mined primarily for their copper content.

The general trend of the copper-mining industry in Alaska is graphically indicated by one of the curves in figure 3, which shows the output of copper for each year from 1900 to 1933. On the same diagram has been plotted the average price of copper for each year. The diagram tells its own story of the growth of the copper industry from a start in the early boom days of the Territory through fabulous strides in the days of the World War, when all nations were clamoring for copper and paying almost any price to get it and Alaska copper production rose to nearly 120,000,000 pounds a year, then fluctuating up and down until 1923, when the trend became definitely downward and at an accelerating rate, until it almost touched bottom in 1933.

The foregoing summary doubtless gives a gloomier impression of the future of the Alaska copper industry than is perhaps warranted. By no means have even the known deposits of copper been exhausted, so that had the price of copper stayed up, the mines would doubtless have continued to operate, but it would have been folly to do so in the face of heavy financial loss. It must be remembered, however, that the mines near Kennicott, which have contributed perhaps 90 percent of the Alaska copper, have been mining a unique deposit, not comparable with any other known deposit in the world, so that inevitably their mineral wealth is being depleted, and there is no justification for expecting that their loss will be offset by new discoveries of equally marvelous lodes.

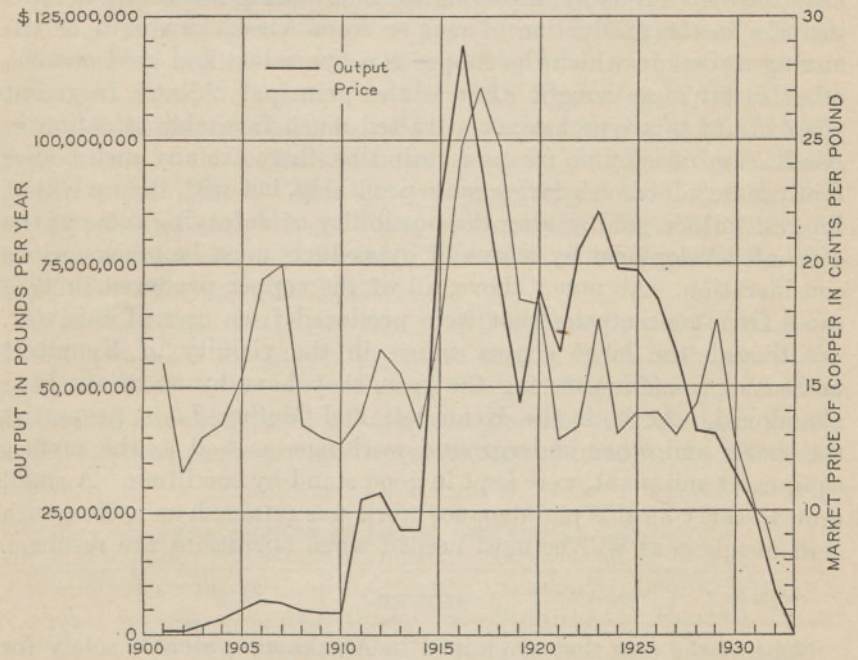

FIGURE 3.—Copper produced from Alaska mines, 1900–1933, and fluctuations in the price of copper during that period.

That there are other places in Alaska where copper minerals occur is well known. That some of these deposits contained enough copper to enable them to be worked at a profit under past conditions is a matter of history. For instance, the old Beatson mine, on Latouche Island, during its period of activity yielded copper ore worth millions of dollars, and some of the old mines in southeastern Alaska, notably in the Ketchikan district, contributed ore worth a few million dollars. It is extremely doubtful whether any of the known copper deposits that are not now being mined can be worked at a profit under present

conditions. As a consequence, practically all field investigation of these properties has been discontinued and doubtless will not be resumed until the price of copper has materially advanced. That there may be deposits, as yet unknown, which might repay development is possible, but the incentive to search for them is so small and the probability of failure so great that prospectors are not willing to take the gamble. At present, therefore, search for new copper deposits or development of those already known has practically ceased. Obviously, no forecast can be made as to when these conditions are likely to change. Various remedial or palliative measures have been proposed which might encourage the copper-mining industry, but it seems doubtful whether much improvement can be looked for in the near future. Probably, the thing that may bring about any notable increase in the production of copper from Alaska ores will be the mining of ores in which the copper is a byproduct and gold or some other metal more sought after is the principal object. In recent years ore of this type has not attracted much favorable attention in Alaska, and it is by no means certain that there are any such bodies that can be mined on a larger scale profitably, but with the revival of interest in lode-gold mining the possibility of defraying some of the costs of development by means of byproducts must be given serious consideration. As noted above, all of the copper produced in 1933 came from concentrates that were produced from ores of this sort.

Although the large copper mines in the vicinity of Kennicott made no production during the year, they have by no means been abandoned. At both the Kennecott and Mother Lode properties the shafts and other underground workings, as well as the surface equipment and plant, were kept in good stand-by condition. A small crew to carry on this maintenance work was retained, as well as such staff members as will be most needed when operations are resumed.

SILVER

None of the ores that are mined in Alaska are valuable solely for the silver they contain, and by far the greater part of the silver that is produced occurs as a relatively minor constituent in ores whose principal value lies in some other metal. As is evident from the following table, more than 70 percent of the silver that has been produced from Alaska in the past has been derived from the ores that are valuable mainly for their copper content. How small the percentage of silver is that occurs in these copper ores may be gathered from the fact that seldom is it as much as 2 ounces to the ton of ore and the average amount recovered is rarely as much as 1½ ounces to the ton. Inasmuch as none of the mines classified as

distinctly copper mines were in operation during 1933, it follows that no silver is credited to that source either. It should be remembered, however, that in the course of cleaning up the old milling plants at these copper properties some ore that had been credited as mined in earlier years was sent to the smelters for treatment. This ore is estimated to have contained more than 14,000 ounces of silver which, however, has not been included in the tabulation for 1933 because it was not mined in that year.

All the gold-lode mines yield some silver in addition to their gold. Thus the mine of the Alaska-Juneau Gold Mining Co., though worked principally for gold, yielded 109,483 ounces of silver in 1933, according to the company's published report. The extremely small proportion of silver in the ore from this mine is shown by the fact that this quantity of silver came from 2,466,832 tons of rock that was fine milled—in other words, the quantity of silver recovered was about 0.04 ounce to the ton. The silver from all the gold-lode mines amounted to 128,150 ounces and was worth $44,850. Some silver is also contained in all the gold that is recovered from Alaska placer mines. This silver is not recognizable, as it is intimately alloyed with the gold and is recovered only after the gold is treated chemically or refined. The total silver from this source was 29,000 ounces, worth $10,150.

Data regarding the production of silver have been referred to in several places in the preceding pages and included in some of the tables that cover the production of other metals. For convenience the sources, quantity, and value of the production from each source in 1933 as well as for the earlier years are set forth in the following table:

Silver produced in Alaska, 1880–1933, by sources

Year	Total		Copper lodes		Gold lodes		Gold placers	
	Ounces	Value	Ounces	Value	Ounces	Value	Ounces	Value
1880–1918	8,389,398	$5,598,314	5,327,852	$3,666,820	1,319,889	$931,396	1,741,657	$1,000,098
1919	629,708	705,273	488,034	546,598	108,691	121,734	32,983	36,941
1920	953,546	1,039,364	682,033	743,416	246,292	268,458	25,221	27,490
1921	761,075	761,075	545,229	545,229	193,281	193,281	22,565	22,565
1922	729,945	729,945	622,978	622,978	80,598	80,598	26,369	26,369
1923	814,649	668,012	715,040	586,333	77,237	63,334	22,372	18,345
1924	669,641	448,659	572,078	383,292	75,284	50,440	22,279	14,927
1925	698,259	482,495	606,929	419,294	67,186	46,445	24,144	16,756
1926	690,000	430,500	605,190	377,600	59,940	37,400	24,870	15,500
1927	627,800	356,000	525,100	297,800	79,400	45,000	23,300	13,200
1928	454,700	266,000	350,430	205,000	80,340	47,000	23,930	14,000
1929	472,900	252,000	351,730	187,400	94,370	50,300	26,800	14,300
1930	408,570	157,300	279,990	107,800	102,080	39,300	26,500	10,200
1931	352,000	102,000	193,850	56,200	129,800	37,600	28,350	8,200
1932	234,050	66,000	81,150	22,900	115,300	32,500	37,600	10,600
1933	157,150	55,000	----------	----------	128,150	44,850	29,000	10,150
	17,043,391	12,117,937	11,947,613	8,768,660	2,957,838	2,089,636	2,137,940	1,259,641

From the foregoing table it is evident that not only has there been a more or less regular decline in the quantity of silver during the past decade but also a marked decrease in the value of silver that was produced. This has been due to the drop in the selling price of silver from $1 or more an ounce in 1919 to 1922 to the low price of 28.2 cents an ounce in 1932. The average selling price of silver in 1933 is estimated by the Bureau of Mines as 35 cents, but this is still much lower than the price that prevailed in any year prior to 1931. Various measures to increase the price of silver by legislation have been under consideration. The striking decline in the average selling price of silver is clearly shown by the following table:

Average selling price of silver, 1880–1933

Year	Cents an ounce	Year	Cents an ounce
1880–1918	66.7	1927	56.7
1919	112.0	1928	58.5
1920	108.0	1929	53.2
1921	100.0	1930	38.5
1922	100.0	1931	29.0
1923	82.0	1932	28.2
1924	67.0	1933	35.0
1925	69.1		
1926	62.4	Average for period	71.1

The development in Alaska of ores that are valuable principally for their silver content is necessarily attended by many more difficulties and expenses than are likely to be met in developing gold mines. Among the most obvious reasons for this difference are the much lower value per unit of weight of the silver and the fact that more elaborate and expensive processes are usually required to recover silver in a readily salable metallic state than to recover gold. As a result, it is more or less unwarranted at this time to attempt to develop or even to search for silver lodes in remote parts of Alaska unless the ore has an especially high tenor. Therefore, although silver-lead lodes have been reported at many places in interior Alaska, none of them have been very thoroughly examined or seriously considered by capitalists. It is true that some shipments of silver-lead ores have been made from interior Alaska, especially from the Kantishna district, north of the Alaska Range, but although the ore was of high grade and the price of silver three times as much as at present, the expense of transporting it to smelters in the States and having it smelted consumed practically all the profits. In southeastern Alaska, however, where the region is much more accessible to deep-water transportation and all operating costs are lower, there have been many attempts to find and develop silver-lead deposits. The greatest amount of work of this kind has been done in

the region at the head of Portland Canal, near the international boundary. The richest deposits that have been found lie on the Canadian side of the boundary, and it is there that the famous Premier silver and gold mine is situated. The geologic conditions on the Alaska side of the boundary, in the Hyder district, as it is locally called, in places seem to be comparable to those on the Canadian side and this similarity has sustained interest in the search for profitable silver and gold deposits there. Several claims have been taken up and more or less prospecting and development work done. The much greater unit price of gold and its more ready recovery have focused the search on gold lodes rather than on silver lodes, so that some of the claims that in the early days of the camp showed indications of prospective value mainly in silver and lead have been neglected. This does not mean, of course, that rich showings would necessarily be overlooked, but simply that work has not been pressed on deposits that appeared only moderately promising. In the past mines in the Hyder district have made shipments of silver ore or concentrates to smelters in the States, but in 1933, so far as has been reported to the Geological Survey, no such shipments were made. Undoubtedly some ore carrying more or less silver was excavated in the course of the prospecting and development work, but this does not appear in the estimates of 1933, as its quantity and value are not known.

A little development and prospecting work on silver-lead ores is reported to have been done during the year on claims lying a short distance north of the settlement of Wrangell. The Inspiration Point Mining Co. is said to have discontinued work on its property north of Skagway, where indications of silver-lead lodes had been reported to have been somewhat developed a few years ago. In the Susitna Valley of west-central Alaska, about 9 miles east of Chulitna station on the Alaska Railroad, where a unique deposit containing ruby silver was found some 3 or 4 years ago, the property lay practically idle throughout the season of 1933. In the Nixon Fork district of the Kuskokwim region Mertie noted some galena deposits that carry in addition to their lead and silver enough gold to make their development attractive.

LEAD

The lead produced from Alaska ores in 1933 is estimated to have been 2,314,000 pounds, or about 200,000 pounds less than in 1932. This decrease is to be attributed to the lesser amount of ore handled by the gold mines, because practically all the lead is recovered as a byproduct from the gold ores. In spite of the decrease in quantity, the higher selling price that prevailed in 1933—3.7 cents a

pound against 3 cents in 1932, according to estimates made by the Bureau of Mines—gave the lead output a higher value than in the preceding year, though far below the value attained in the period from 1924 to 1928, when a lesser production was worth many thousand dollars more than that of 1933.

Lead produced in Alaska, 1892–1933

Year	Tons	Value	Year	Tons	Value	Year	Tons	Value
1892	30	$2,400	1907	30	$3,180	1922	377	$41,477
1893	40	3,040	1908	40	3,360	1923	410	57,400
1894	35	2,310	1909	69	5,934	1924	631	100,899
1895	20	1,320	1910	75	6,600	1925	789	140,571
1896	30	1,800	1911	51	4,590	1926	778	124,400
1897	30	2,160	1912	45	4,050	1927	1,008	127,000
1898	30	2,240	1913	6	528	1928	1,019	118,000
1899	35	3,150	1914	28	1,344	1929	1,315	166,000
1900	40	3,440	1915	437	41,118	1930	1,365	136,500
1901	40	3,440	1916	820	113,160	1931	1,660	126,000
1902	30	2,460	1917	852	146,584	1932	1,261	75,600
1903	30	2,520	1918	564	80,088	1933	1,157	85,600
1904	30	2,580	1919	687	72,822			
1905	30	2,620	1920	875	140,000		17,588	2,029,600
1906	30	3,420	1921	759	68,279			

In Alaska no ores are mined solely for their lead content. Practically all the lead produced is recovered as a byproduct in the course of gold or silver mining, the concentrates containing lead being shipped to smelters in the States for treatment to recover the different metals they contain. Practically all of the lead that is reported in the foregoing table as produced in 1933 was recovered in the course of treatment of the gold ores of the Alaska Juneau Co.'s mines in southeastern Alaska. According to the published reports of this company, it recovered about four-sevenths of a pound of lead from each ton of ore that is mined and trammed to the mill, or a little less than 1 pound of lead from each ton of ore that is fine milled. Lead ores are widely known throughout the Territory, and in the past shipments valuable at least in part for their lead content have been made from many areas in southeastern Alaska, especially the Hyder district; from the Yukon-Tanana region, especially the Kantishna district; and even from far-away Seward Peninsula, at the Omalik mine; and from the Kobuk district in the vicinity of Shungnak. Lead is, however, a heavy, low-priced commodity which requires rather elaborate treatment to produce in readily salable metallic form, and these drawbacks, coupled with the extremely low current price for the metal, act as deterrents to the development of lead deposits in remote regions. The outlook for any notable increase in the production of this metal, therefore, seems to depend on the stimulation of the mining of other metals and the consequent increase in their production. That this increase in mining lodes of mixed metallic content is likely to take place is regarded as a certainty,

and that some of the silver-lead deposits which are now lying idle will be opened up again seems almost equally certain. As general business conditions throughout the world improve an increase in the output of lead from Alaska ores is looked for with considerable assurance.

PLATINUM METALS

Platinum is one of a group of several metals which, because they are closely related in physical and chemical character, are often not differentiated by name or are not even identified specifically in the usual forms of assay or analysis but are spoken of as the " platinum metals ", or, even more loosely, as " platinum." Platinum, palladium, osmium, and iridium are some of the individual members of this group. Some of these metals have been found in lodes and in placers in Alaska. The total quantity of platinum metals produced in Alaska in 1933 is estimated to have been about 792½ crude ounces or 605 fine ounces, which at $30.75, the average market price for platinum as computed by the United States Bureau of Mines, was worth about $18,600.

By far the greater part of the platinum metals produced in Alaska in 1933 was recovered from placers in the Goodnews Bay district, south of the mouth of the Kuskokwim River, but a small amount came from gold placers in the Koyuk district of Seward Peninsula. From 15 to 20 persons were engaged in mining in the Goodnews Bay district in 1933. The occurrence of platinum in this district has been known for several years, and considering the small number of persons engaged in mining and the simple equipment used the quantity of platinum metals recovered is large. The principal streams from which the platinum metals came, named in order of their output in 1933, were Clara, Squirrel, Fox, and Platinum Creeks, tributaries of the Salmon River that enters Kuskokwim Bay about 12 miles south of the entrance of Goodnews Bay. All the ground that has been mined so far has been shallow creek diggings from 4 to 18 feet deep. The productive streams head on the eastern slope of Red Mountain, a mass of intrusive basic rock of general dunitic or pyroxenitic composition in which, according to Reed,[12] there is a northward-trending body of gabbro 4 to 5 miles long and one-fourth to one-half mile wide. Some granite and quartz diorite and a small tract of sedimentary rocks occur in the area. The most noteworthy new development in the district during the year was the acquiring of an extensive tract embracing most of the developed claims as well as much of the contiguous unprospected ground by Andrew Olson and associates, who are among the principal mining operators

[12] Reed, Irving, in Stewart, B. D., Mining investigations and mine inspection in Alaska, biennium ending Mar. 31, 1933, pp. 103–126, 1933.

in the Iditarod district. This association proposes to undertake extensive mining operations on the properties at once. Success with the use of drag-line scraper equipment in the other camp has led these operators to plan the installation of one or more plants of this sort now and the addition of others as rapidly as conditions warrant such action. The same operators have also acquired more than 30 claims in the valley of the Salmon River, which will be explored as possible dredging ground. The undertaking of a large-scale development of this sort in this district should have a very stimulating effect on the mining activities in the whole district, not only through its own work but also through serving as a center from which prospectors and others will extend their searches throughout the district, which up to now has been but inadequately reconnoitered. It is also currently reported that a search was made for the lodes from which the platinum minerals were derived, and although no workable lodes have yet been discovered some of the results are sufficiently encouraging to induce further search.

Some difficulty is experienced by the platinum miners here in disposing of their product at satisfactory prices. None of the Government mints or assay offices pay for platinum sent to them, so that the producer must sell to private purchasers, and the transaction becomes one of bargaining, which at the distance that separates the Alaska producer from the purchaser in the eastern United States or abroad is time-consuming to conduct and rather difficult for either party to manage satisfactorily.

The only other region in Alaska where some platinum metals are reported to have been recovered in 1933 is Seward Peninsula. In that region a few ounces of platinum metals were recovered from gold placers on Dime Creek, a tributary of the Koyuk River, and on Quartz Creek, a tributary of the Kiwalik River, in the Koyuk district, and in nearby areas in the extreme eastern part of the peninsula. The Koyuk district has long been a small though consistent producer of platinum as a byproduct. The streams derive their gravel in large part from the hills formed of Mesozoic basic effusive rocks which have been cut by granite intrusives and in part from lower country in which Paleozoic schists and limestones predominate. No bedrock source of the platinum metals has yet been discovered.

Although no other places in Alaska are known to have produced platinum metals in 1933, it is not at all unlikely that small amounts may have been produced elsewhere and held by their producers. Places where platinum has been recognized are widespread through other parts of Alaska, and some of them in other years have produced platinum that has been sold. Among these places may be mentioned

the Chistochina district of the Copper River region; Metal Creek, in the Kenai district; some of the beach placers of Kodiak Island, in southwestern Alaska; the Kahiltna River and nearby streams, in the Yentna district of the Susitna region; Boob Creek, in the Tolstoi area of the Innoko district; Granite Creek, in the Ruby district of the Yukon region; and some streams in the Marshall district, in the western part of the Yukon region. In the past a considerable production of platinum metals came from lodes in southeastern Alaska operated by the Alaska Palladium Co., on Kasaan Peninsula, Prince of Wales Island, about 30 miles west of Ketchikan. This mine has not been in operation since 1926, but during the time it was running it produced several hundred thousand dollars' worth of platinum metals, mainly palladium, as well as a good deal of gold and some copper. The platinum metals formed only a small part of the total metallic content of the ore—so small a part, indeed, that they could not be identified in the ore by the unaided eye.

TIN

For a number of years Alaska has been a small but regular producer of tin, and in the course of the 30 years since tin minerals were discovered in Seward Peninsula it has shipped tin worth more than a million dollars. In 1933, however, according to such records as have been received by the Geological Survey, only a few thousand pounds of the ore were mined in Alaska. This, however, marks some slight renewal of activity in the industry, because in 1932 no tin ore was mined. The decline in Alaska tin mining by no means indicates that the known tin deposits have been exhausted but is believed to have been caused by the extremely low price offered for tin—an average of about 22 cents a pound in 1932 and of 39 cents in 1933—and the fact that some of the former Alaska shippers of tin ore had not sold all the ore that they had produced and shipped in earlier years. The Alaska ore requires smelting to yield its tin in a metallic form, and as there are no smelters in Alaska or even in the States that make a practice of treating ore of this sort, most of it is shipped to Singapore for reduction. Resumption of tin mining in Alaska, when conditions of world business improve, can be predicted with assurance, but until the price paid for tin is considerably higher than at present there is little hope that the mining operations will be conducted on more than a small scale. Tin lodes that have been mined have long been known in the western part of Seward Peninsula near York and Tin City, but the bulk of the past production has come from placers in which the tin minerals, because of their weight, have been concentrated. Most of the placer

tin that has been mined in the past has come from the York district, in western Seward Peninsula, and from the Hot Springs district, in the Yukon region.

The complete record of tin production from Alaska is given in the accompanying table:

Tin produced in Alaska, 1902–33

Year	Ore	Metal	Value	Year	Ore	Metal	Value
	Tons	*Tons*			*Tons*	*Tons*	
1902	25	15	$8,000	1919	86	56	$73,400
1903	42	25	14,000	1920	26	16	16,112
1904	23	14	8,000	1921	7	4	2,400
1905	10	6	4,000	1922	2.3	1.4	912
1906	57	34	38,640	1923	3	1.9	1,623
1907	37.5	22	16,752	1924	11	7	7,028
1908	42.5	25	15,180	1925	22.2	13.8	15,980
1909	19	11	7,638	1926	12.85	8	10,400
1910	16.5	10	8,335	1927	37.5	26.7	34,000
1911	92.5	61	52,798	1928	58.6	41	41,000
1912	194	130	119,600	1929	51.6	38.6	35,000
1913	98	50	44,103	1930	21	14.7	9,300
1914	157.5	104	66,560	1931	5.6	4.1	2,000
1915	167	102	78,846	1932	----------	----------	----------
1916	232	139	121,000	1933	----------	2.9	2,300
1917	171	100	123,300		----------	1,151.9	1,096,000
1918	104.5	68	118,000				

COAL

The coal produced from Alaska fields in 1933 is estimated to have been 96,200 tons. This marks a decrease of only about 6,000 tons from the amount produced in 1932, so that the decline is to be regarded simply as a minor fluctuation in the rate of production. In addition to the coal mined in Alaska, 35,533 tons of coal was imported from fields outside Alaska, and no Alaska coal was exported. The consumption of coal in Alaska in 1933 was thus approximately 132,000 tons, or about 13,000 tons less than in 1932 and about 40,000 tons less than the average for the preceding 10 years, a decrease brought about by lessened importations. A comparison of coal production and consumption in Alaska for the entire period for which records are available is afforded by the table on page 71.

In the table the total value of the coal produced in Alaska in 1933 is stated to have been $481,000. This value can be regarded only as a fair approximation, because records are not available for precise determination of the actual selling price of the coal. Much of the coal is purchased by the Alaska Railroad on contract for large quantities, so that the price paid by the railroad is not an accurate index of the price paid for the lots sold to the smaller consumers, who in the aggregate buy a large part of the output and pay much higher prices. From all the available information, and by weighting the resulting estimate as closely as practicable, it appears that the

average price for all the coal mined in Alaska in 1933 was about $5 a ton, which is the same as in 1932 and is considerably less than the average for the entire period shown in the table.

Coal produced and consumed in Alaska, 1880–1933

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bituminous coal from Washington	Imported from foreign countries, chiefly bituminous coal from British Columbia[a]	Total coal consumed
	Short tons	Value			
			Short tons	*Short tons*	*Short tons*
1880–1915	71,633	$456,993	679,844	1,079,735	1,831,212
1916	12,676	57,412	44,934	53,672	111,282
1917	54,275	268,438	58,116	56,589	168,980
1918	75,816	413,870	51,520	37,986	165,322
1919	60,894	345,617	57,166	48,708	166,768
1920	61,111	355,668	38,128	45,264	144,503
1921	76,817	496,394	24,278	33,776	134,871
1922	79,275	430,639	28,457	34,251	141,983
1923	119,826	755,469	34,082	43,205	197,113
1924	99,663	559,980	40,161	41,980	181,804
1925	82,868	404,617	37,324	57,230	177,422
1926	87,300	459,000	35,620	34,254	157,174
1927	104,300	548,000	35,212	27,225	166,737
1928	126,100	662,000	39,184	32,521	197,805
1929	100,600	528,000	32,762	24,172	157,534
1930	120,100	631,000	37,128	23,892	181,120
1931	105,900	556,000	30,772	17,796	154,468
1932	102,700	513,500	28,422	13,959	145,081
1933	96,200	481,000	21,524	14,009	131,733
	1,638,054	8,924,000	1,354,634	1,720,224	4,712,912

[a] Compiled from reports from Bureau of Foreign and Domestic Commerce. No figures on imports before 1899 are available.

The Alaska coal came principally from 3 mines—2 in the Matanuska field and 1 in the Nenana or Healy River field. The two mines in the Matanuska field were those of the Evan Jones Coal Co., at Jonesville, and of the Alaska-Matanuska Coal Co., later the Alaska Premier Coal Corporation, in the valley of Moose Creek.

The mine supplying most of the locomotive and power fuel for the Alaska Railroad was that of the Evan Jones Coal Co. Throughout July, August, and September productive work was practically suspended at this property, but during the rest of the year it was being operated on a daily average rate of production of about 100 tons. Not only did this company supply the railroad with a large part of its fuel, but it filled many domestic orders for coal and was active in trying to develop new markets by furnishing coal to some of the canneries in southwestern Alaska and to territorial and Federal organizations throughout the Territory. During the period while productive mining was in progress a crew of 30 or more men were employed in surface and underground work on the property.

At the property of the Alaska-Matanuska Coal Co. the new management, which had taken over operations late in the fall of 1932,

encountered difficulties which finally caused it to allow the mine to revert to the former owners, so that during March, April, and May the property reported no production. Work was resumed by the old company in June, however, and continued through November. Shortly thereafter, in the attempt to draw too much coal from a weakened area, water broke in and completely flooded the workings and thus put the mine out of commission. It would hardly be practicable to attempt to pump the mine out, and the owner was considering as an alternative the sinking of a new slope farther east if financial assistance could be obtained to defray the cost. Nothing had been done up to the end of the year, however, to put any plan for reopening the mine into effect. During the time the mine was in operation it was yielding on the average more than 50 tons a day and giving employment to 15 or more persons underground and on the surface. No work was done on the company's other property, situated some 3 miles farther east, nearer the head of Moose Creek.

Two miles east of the Premier mine the Wishbone Hill Coal Co. started opening up one of the old properties, leased the use of the narrow-gage railroad that connects with the standard-gage track at Premier, and produced a few thousand tons of coal. No mining was in progress during the year at the Pioneer coal mine, on Moose Creek about a mile above its mouth, nor at the Ross Heckey property, on Coal Creek south of Chickaloon. The old Government-owned mine at Eska was idle throughout the year, but it was maintained in a more or less stand-by condition, so that if anything should happen which might endanger the supply of coal needed to run the railroad it could be reopened quickly and mining resumed. The expense of repairing the damage caused to the railroad by floods in 1932 and the absence of enterprises justifying the maintenance of the branch railroad line between Sutton and Chickaloon caused the authorities to discontinue operations in this section in 1933, and to make a further saving of expense by removing the track and salvaging such material as could be used elsewhere. The old grade was turned into a tractor road, by which the small amount of traffic to Chickaloon and to the Nelchina district, farther west, is partly served.

In the Nenana coal field the only producing property was the Suntrana mine of the Healy River Coal Corporation, on the Healy River, about 4 miles east of the junction of that stream and the Nenana River. The plant of this mine has been well laid out and is now equipped with the necessary modern machinery to handle about 200 tons of coal a day. The largest single user of coal from this property is the Fairbanks Exploration Co. for furnishing power to its dredges and in its large placer-mining operations in the vicinity

of Fairbanks. The coal has a somewhat lower heating value than that from the Matanuska and nearby fields and, as a consequence, is not used in the railroad locomotives, but the shorter haul makes its use more economical in many parts of the interior. This mine was in continuous operation throughout 1933 and yielded considerably more than half of all the coal mined in Alaska during that year. During the year renewed efforts were made to broaden the market for the coal from this mine, and it is understood that arrangements were made whereby a considerable quantity was shipped to Cordova for local use.

Small amounts of coal are reported to have been mined during the year at the old Chicago Creek mine, in the valley of the Kugruk River, in northern Seward Peninsula; at a recently opened deposit near Unalakleet, east of Norton Sound; and at several points along Kuk Lagoon, south of Wainwright, in northern Alaska. The coal from these different properties was used only locally and had no significant effect on the general Alaska coal situation, except to confirm the statement, often made before, that throughout the Territory there are many areas containing coal adequate for local use. So far as the Geological Survey is informed, no production was made during the year from the known coal deposits on Admiralty Island, in the Juneau district, where some activity had lately been shown. In the Bering River field, where extensive deposits ranging in composition from bituminous coal to anthracite have long been known, prospecting or other development work relating to the coal resources was apparently at a standstill in 1933. Rumors of renewed activity in this field were heard from time to time, and requests for extensions of some of the Government permits for coal prospecting there were received. It is evident that this field has much potential value, but it is also evident that the present coal consumption of Alaska is not such as to stimulate large companies to undertake extensive projects and that until there is a greater demand for their product or until they are prepared to invade a more distant market, where competition will be more severe, they will not enter this field. Furthermore, the development work already done in this field indicates that some complex geologic conditions will be encountered, so that desultory prospecting by small, poorly financed, or technically unskilled operators holds little promise of success, and full development must await a company that is able to go into the matter in a large way and to bear the necessary expense of exploring a new field.

The whole problem of the development of Alaska's coal resources is exceedingly complex, for while there are in the Territory large areas occupied by coal-bearing rocks, the local demands are fairly well supplied by existing mines, and to attempt to enter a larger field

requires large outlays for developing mines and the market. Obviously many consumers are unwilling to commit themselves to any specific agreements to purchase until they are sure that the coal offered them is available at a satisfactory price, and the mining operator, of course, in the initial stages can offer little definite assurance as to costs and availability of his product until he has some certainty as to his market. Certainly many of the steps that must be taken if any extensive use of Alaska coal is to be made require that the enterprise must be undertaken on such a scale as will justify the outlay for the essential facilities. This means that a considerable tonnage must be marketed, but the attempt to dispose of a large tonnage of Alaska coal will bring it into competition with coals from other areas and in places where the competitive conditions appear to be almost insuperable for the Alaska product. Many of the competitive conditions are changing, however, so that the situation must be subjected to constant review. Of course, as Alaska develops and becomes more settled its people and industries will call for more and more coal, and in meeting this demand Alaska coals will have great competitive advantage over those from outside sources. That growth, however, probably will be relatively slow but none the less sure.

PETROLEUM

The only petroleum produced in Alaska comes from the wells of the Chilkat Oil Co., in the Katalla field, near the coast of south-central Alaska. This company obtains oil from several relatively shallow wells, few of which are more than 1,000 feet deep and none more than 2,000 feet. The wells penetrate beds that are identified as of Tertiary age. According to the report of the company, no new drilling was done during 1933. A small refinery is operated at Katalla by the company, and the products—gasoline and distillate, which are of especially high quality—find a ready market near at hand, especially for use by the fishing fleet near Cordova. So far as learned by the Geological Survey, production from this property was continued in 1933 on essentially the same scale as in recent years. During the later part of December a fire destroyed the boiler house and some of the adjoining property, but fortunately it did not reach nearby storage tanks or spread through the plant, so that the damage was relatively slight.

The small domestic production of petroleum from the Katalla field is not adequate to supply even local needs, and the demand for large quantities of petroleum products throughout the Territory is met principally by imports from the States. The most notable feature shown by the subjoined table is that from the end of the war through 1929 there was a constant increase in the amount of gasoline and related lighter products of distillation imported. This

increase was called for by the growing use of power in fishing boats and other water craft, in the canneries, in many mining developments, and in the operation of means of transportation, such as automobiles, and gas cars or engines on practically all the railroads. Beginning with 1930, however, there was a decided drop in the quantity of petroleum products shipped into Alaska. But in 1933 there was an upturn in the consumption of most of these petroleum products. The decrease in the first 3 years of this period is interpreted as only a temporary drop in the consumption, brought about by the general decline in all business activities, and the increased consumption in 1933 is regarded as due to the improvement in general business conditions.

Petroleum products shipped to Alaska from other ports of the United States, 1905–33, in gallons [a]

Year	Heavy oils, including crude oil, gas oil, residuum, etc.	Gasoline, including all lighter products of distillation	Illuminating oil	Lubricating oil
1905	2,715,974	713,496	627,391	83,319
1906	2,688,940	580,978	568,033	83,992
1907	9,104,300	636,881	510,145	100,145
1908	11,891,375	939,424	566,598	94,542
1909	14,119,102	746,930	531,727	85,687
1910	19,143,091	788,154	620,972	104,512
1911	20,878,843	1,238,865	423,750	100,141
1912	15,523,555	2,736,739	672,176	154,565
1913	15,682,412	1,735,658	661,656	150,918
1914	18,601,384	2,878,723	731,146	191,876
1915	16,910,012	2,413,962	513,075	271,981
1916	23,555,811	2,844,801	732,369	373,046
1917	23,971,114	3,256,870	750,238	465,693
1918	24,379,566	1,086,852	382,186	362,413
1919	18,784,013	1,007,073	3,515,746	977,703
1920	21,981,569	1,764,302	887,942	412,107
1921	9,209,102	1,403,683	2,021,033	232,784
1922	15,441,542	1,436,050	2,095,675	345,400
1923	12,285,808	4,882,015	473,826	454,090
1924	14,412,120	5,554,859	566,431	506,364
1925	16,270,746	6,993,560	562,844	580,321
1926	14,000,664	5,069,584	328,615	730,924
1927	17,628,744	8,141,574	516,306	620,450
1928	13,000,176	8,025,402	463,134	715,082
1929	17,347,344	6,847,050	589,340	878,094
1930	13,801,746	6,317,934	401,646	701,946
1931	12,282,480	5,532,912	338,310	450,870
1932	14,167,104	4,755,660	297,780	338,310
1933	16,277,962	5,677,644	412,230	347,806
	446,056,599	96,007,635	21,762,320	10,915,081

[a] Compiled from reports from Bureau of Foreign and Domestic Commerce.

Search for new oil fields in Alaska has practically been discontinued during the last few years, and in 1933 no drilling was done at any place, other than on the property of the producing company already mentioned. Hundreds of permits for prospecting for oil that have been issued by the Government and cover tracts in all parts of Alaska are outstanding in the hands of individuals or companies, but most of them were evidently taken up solely for speculative purposes and will lapse if no active work is done under them. As prospecting permits for oil are issued on application, without

regard to the merits of the land involved as a favorable place in which to search for oil, the investing public should be warned that a permit from the Government is only what it purports to be—permission to search for oil—and in no way implies that the search has even a remote chance of being successful. Furthermore, the public should realize that prospecting permits if within the law are readily granted by the Government at a nominal charge and so should be warned against unscrupulous companies that offer their services in obtaining permits for their clients at a charge far in excess of any reasonable fee for any service they render and for any payment they make to the Government.

No drilling for oil was in progress in 1933 in the Matanuska Valley, a few miles west of Chickaloon, on the property of the Peterson Oil Association. Drilling at this place started in 1926, and when work was suspended for the winter of 1931 the hole had reached a depth of about 1,465 feet. During 1932 and 1933 the work was at a standstill, although the manager was on the property for a short time during the open season. The geologic conditions in the vicinity of the well, so far as known, are not those usually found in areas in the States where larger commercial pools of oil occur, and a geologist cannot but entertain grave doubts as to the occurrence of oil in that locality. However, the finding of a commercial accumulation of oil would be of so much benefit to the region as a whole, as well as to the operators, and so much time and money have already been spent in the enterprise that if any doubt remains as to the possibility of finding oil there it would be too bad to stop drilling before that question is definitely settled, either by striking oil or by demonstrating that further search would be fruitless. It is to be regretted that the same amount of time and money was not invested at places that seemed to show more promise of containing oil.

Interest in prospecting for oil in the Iniskin-Chinitna district of the Alaska Peninsula region was revived during 1933 by certain California oil men who have acquired interests in many of the permits that have been issued covering most of that field and who spent some time on the properties during the open season with a view to formulating plans for undertaking drilling tests in the near future. No announcement was made as to the results of these investigations, but apparently the principals were satisfied with the conditions they found and are likely to reach a definite decision as to their course of action as soon as certain property and fiscal matters can be arranged.

MISCELLANEOUS MINERAL PRODUCTS

The list of minerals of value that have been found in Alaska is long. In addition to those described in the preceding sections of this report others which have at one time or another been produced

in quantities large enough to have more than local significance and some of which have been and still are the basis of profitable mining industries include, among metallic products, antimony, arsenic, bismuth, chromium, iron, manganese, mercury or quicksilver, molybdenum, nickel, tungsten, and zinc; and among nonmetallic products, asbestos, barite, building stone, clay, garnet, graphite, gypsum, jade, limestone, marble, and sulphur. Without doubt small quantities of practically all these materials were "produced" in 1933 in the broadest sense of that word, but none of them were reported to have been produced and sold in quantities that represent a value of more than a few thousand dollars at most, and for any single commodity rarely more than a few hundred dollars.

In the following table, as well as in certain of the other tables in this report, all these minerals that were produced only by a single operator or in quantities so small that to list them separately would disclose the production of individual operators have been grouped together under the collective term "miscellaneous mineral products." Among the mineral products included in the table of miscellaneous mineral products that have also been described in this report are platinum metals and petroleum. The inclusion of petroleum in this list is due to the fact that at present there is only one producer in the Territory, and therefore it has not been permissible to disclose the quantity or value of the product. The inclusion of platinum metals is a relic of the period when practically the entire production of platinum metals in Alaska came from one mine and so could not be disclosed. Now that there are many producers it is appropriate to state their combined production, and this has been done, but in order that there may be a fair comparison of the production of the minerals grouped together as miscellaneous products in earlier years with those same products in 1933, it has been necessary to include the value of the platinum metals in this table.

Value of output of miscellaneous mineral products of Alaska, including platinum, petroleum, quicksilver, stone, antimony, gypsum, marble, and other products, 1901–33 [a]

Year	Value	Year	Value	Year	Value
1901	$500	1913	$286,277	1925	$454,207
1902	255	1914	199,767	1926	444,500
1903	389	1915	205,061	1927	162,000
1904	2,710	1916	326,737	1928	164,000
1905	710	1917	203,971	1929	194,000
1906	19,965	1918	171,452	1930	157,300
1907	54,512	1919	214,040	1931	108,000
1908	81,305	1920	372,599	1932	223,400
1909	86,027	1921	235,438	1933	39,200
1910	96,408	1922	266,296		
1911	141,739	1923	229,486		6,011,000
1912	165,342	1924	348,728		

[a] $117,000 of placer platinum metals mined prior to 1926 and $238,000 of antimony mined prior to 1927 not distributed by years but carried in total.

As is evident from the table the entire group of miscellaneous products contributed but a very small amount to the total of Alaska's mineral production. The part that the platinum and petroleum bore has been discussed in earlier sections of this report. The great falling off in the value of these miscellaneous mineral products is due to the fact that mining operations on many of the commodities that heretofore have each year contributed products worth tens and hundreds of thousands of dollars had been suspended owing to general business stagnation. One of the hitherto large mining enterprises is the quarrying of marble by the Vermont Marble Co. from its properties near Tokeen and Calder, in southeastern Alaska. No productive mining was done there during 1933, though the property was kept in condition so that work could be resumed promptly when required. The stone from these quarries is widely used in most of the larger and better buildings in the whole Pacific coast region, being especially in demand for interior trim and decoration. Ordinarily the company ships its rough stone from Alaska to finishing plants it maintains in Tacoma, Wash., and San Francisco, Calif. There is, of course, no vestige of a reason to believe that the cessation of quarrying during the year means the permanent closing of the property. It only marks a halt in production until sales of the product now on hand deplete the stock so that replacements are needed, and there is every indication that this will occur shortly so that the quarries will again be running in 1934. Limestone and marble are widely distributed throughout southeastern Alaska, and, according to Burchard,[13] many different grades, some even approaching statuary quality, are found in the region. It therefore seems strange that more of these limestone and marble deposits, many of which are favorably situated with respect to deep-water transportation, have not been profitably developed.

Another large enterprise that hitherto has been an important producer in this group but was inactive in 1933 is the quarrying of high-grade limestone rock which is ground and mixed with other materials to manufacture a cement that is much in demand. In recent years the Superior Portland Cement, Inc., operating under lease from the Pacific Coast Cement Co., has carried on such an enterprise on Dall Island, in the Ketchikan district of southeastern Alaska. From the quarries at this locality the limestone was shipped to the company's plant near Seattle, where it was further treated. No production was reported from this place in 1933, but the lessors expect that work may be resumed there in 1934.

[13] Burchard, E. F., Marble resources of southeastern Alaska: U.S. Geol. Survey Bull. 682, pp. 29–39, 1920.

Information received by the Geological Survey indicates that although some prospecting for quicksilver was in progress in 1933 the output was very small. The place where the most extensive deposits known in Alaska have been developed in the past is in the central part of the Kuskokwim region, near Sleitmut. The principal mine in this district is that of E. W. Parks. Usually some quicksilver is retorted from the ore and sold for local use by the nearby placer miners. There are a few other quicksilver properties in this general area, but at those the work in progress consisted of little more than the assessment work required to hold the claims. In Seward Peninsula, near Bluff, quicksilver ore has long been recognized and some development work done on it. In 1933 some ore was mined here but not retorted or otherwise disposed of. In the hills adjacent to the Pah River, a tributary of the Kobuk from the south, some quicksilver ore has been found and a little test pitting done to disclose the extent and character of the mineralization. The remoteness of the area makes exploration of the property difficult and expensive. Quicksilver has been recognized in the placer concentrates from streams in many parts of the Territory, but the lodes from which it came were apparently small stringers, and, except in the places already mentioned and the Hot Springs district of the Yukon region, none of them appear to be likely to afford ore that can be mined under present conditions.

Molybdenum, one of the elements used in making certain special steels, is found in a number of mineralized areas throughout Alaska. The principal source of this metal is the mineral molybdenite, in which it is combined with sulphur as a sulphide. So far as is known, however, the only place where any attempt has been made to develop a property for its molybdenum content is on Baker Island, in southeastern Alaska. This property, owned by the San Antonio Metals Co., has not been visited lately by any Geological Survey party, and the following information is based largely on items that have appeared in local newspapers which seem reliable. According to these reports a small crew has been doing exploratory work with such success that plans for the early erection of a mill are under consideration. In addition to its molybdenum content the ore is said to carry sufficient gold to defray in considerable measure the cost of operation. A good landlocked harbor near the property affords opportunity to land supplies and equipment economically.

Antimony ores are widely distributed throughout Alaska, and in the past considerable quantities were produced and shipped from the Territory. In 1933, however, so far as reported to the Geological Survey, no antimony ores were sold, and no prospecting is known to

have been done on lodes solely valuable for the antimony they contain. However, according to reports received from the owner, the annual assessment work required by law was kept up on the property near Point Caamano, about 20 miles north of Ketchikan, at which prospecting has been in progress for several years. Many of the lodes of the other minerals, notably gold, contain considerable stibnite, the sulphide of antimony, and in the course of mining them some antimony is necessarily taken out, though most of it is lost in the tailings. At a few mines, as in the Fairbanks district, some of the larger masses of stibnite are laid aside until enough has accumulated to be worth shipping. The present low price of antimony and the remoteness of most of these deposits in interior Alaska do not encourage their development at this time.

Prospecting is said to have been continued on the known nickeliferous sulphides of Chichagof and Admiralty Islands, in the northwestern part of southeastern Alaska, but no ore is reported to have been produced for sale during the year. The desirability of developing a domestic nickel supply, from both a commercial and a national standpoint, has revived interest in these Alaskan deposits, especially those at Funter Bay, Admiralty Island, where extensive tests have been made of the deposits. The mineralization has occurred in a thick diabase sill, and the metallic minerals are chiefly the sulphides of iron, copper, and nickel, carrying some gold and silver. Power for generation of electricity could be developed at a site at the outlet of Lake Kathleen, some 30 miles south of the mine. Estimates made by engineers after thorough examination of the property indicate that the ore reserves there carrying probably 1 percent of nickel may contain as much as 5,000,000 tons.

The ore from the Eva Quartz Mining Co.'s property near Ferry, in the Bonnifield district, which is mined principally for the gold it contains, also carries considerable bismuthinite, a sulphide of bismuth, from which bismuth might be obtained if desired. This element, however, is a detriment in the ordinary smelter treatment, so that its presence instead of being a source of revenue is usually penalized by the smelters.

In the course of gold placer mining operations at a number of camps some tungsten minerals, notably scheelite, are at times recognized in the concentrates. Lately the amount of this material has been so small that no effort is made to save it, though in the past at a few properties the quantity recovered made it worth while to let it accumulate and from time to time ship it to the States for sale. In 1933 a few hundred pounds of tungsten ore was collected by one of the operators in the Nome district, but it was not sold.

Outside of a small amount of prospecting and assessment work no productive mining is reported to have been in progress at any of the chrome-ore deposits in the southern part of Kenai Peninsula, where ores of this sort have long been known and at times have been marketed. In the vicinity of Red Mountain especially large bodies of chrome ore have been known for some time, but what average chrome content can be maintained under commercial conditions, what will be the cost of mining it and transporting it to the market, and what profit will be left after it is sold are matters that still require investigation.

Little new development of the many kinds of nonmetallic mineral products that occur in Alaska took place during 1933. Extensive use was made of the widespread gravel deposits for railroad ballast and road construction, and with sand they entered largely into the concrete mixtures required in the more permanent structures that were built. Reports have been current of attempts to develop the sulphur deposits that are known to occur in the craters of some of the volcanoes of the Aleutian Islands and nearby portions of the Alaska Peninsula. So far as could be determined, however, none of these plans have yet been brought to actual developments on the ground.

Although the various mineral commodities here grouped under the heading "miscellaneous mineral products" yield small monetary returns—about $40,000 in 1933—yet their diversity, their wide distribution, and the interest that is being displayed in the search for them indicate that they already play an important part in the mineral economics of the Territory and are destined to become even more significant as the development of Alaska proceeds.

SELECTED LIST OF GEOLOGICAL SURVEY PUBLICATIONS ON ALASKA

[Arranged geographically]

All these publications can be obtained or consulted in the following ways:

1. The reports are sold, at the prices indicated, by the Superintendent of Documents, Washington, D.C., to whom remittances should be sent by money order. No copies are available of those marked with an asterisk (*); they may be consulted at many public libraries.

2. The maps whose prices are stated are sold by the Geological Survey and not by the Superintendent of Documents. On an order for maps amounting to $5 or more at the retail price a discount of 40 percent is allowed.

3. Maps marked "Free on application" are published in extremely small numbers, primarily for acquiring corrections for the preliminary map that would be useful in the preparation of final editions.

4. Copies of all Government publications are furnished to the principal public libraries throughout the United States, where they can be consulted by those interested.

GENERAL

REPORTS

*The geography and geology of Alaska, by A. H. Brooks. Professional Paper 45, 1906, 327 pp.

Mineral industry of Alaska in 1933, by Philip S. Smith. Bulletin 864–A, 1934, 10 cents. The preceding volumes in this series and years covered are Bulletins *259, 1904; *284, 1905; 314, 1906, 30 cents; 345, 1907, 45 cents; 379, 1908, 50 cents; 442, 1909, 40 cents; 480, 1910, 40 cents; 520, 1911, 50 cents; 542, 1912, 25 cents; *592, 1913 (592–A, 15 cents); 622, 1914, 30 cents; 642, 1915, 35 cents; 662, 1916, 75 cents; *692, 1917 (692–A, 5 cents); *712, 1918; *714, 1919; *722, 1929 (722–A, 19 cents); *739, 1921; 755, 1922, 40 cents; *773, 1923; 783, 1924, 40 cents; 792, 1925, 25 cents; 797, 1926, 80 cents; 810, 1927, 50 cents; 813, 1928, 40 cents; 824, 1929, 20 cents; 836, 1930, 75 cents; 844–A, 1931, 10 cents; 857–A, 1932, 10 cents.

Railway routes from the Pacific seaboard to Fairbanks, by A. H. Brooks. In Bulletin 520, 1912, pp. 45–88. 50 cents.

Geologic features of Alaskan metalliferous lodes, by A. H. Brooks. In Bulletin 480, 1911, pp. 43–93. 40 cents.

Alaska coal and its utilization, by A. H. Brooks. Bulletin 442–J, reprinted 1914, pp. 47–100. 10 cents.

The preparation and use of peat as a fuel, by C. A. Davis. In Bulletin 442, 1910, pp. 101–132. 40 cents.

*Methods and costs of gravel and placer mining in Alaska, by C. W. Purington. Bulletin 263, 1905, 273 pp.

*Geographic dictionary of Alaska, by Marcus Baker (second edition, prepared by James McCormick). Bulletin 299, 1906, 690 pp.

Tin mining in Alaska, by H. M. Eakin. In Bulletin 622, 1915, pp. 81–94. 30 cents.

Antimony deposits in Alaska, by A. H. Brooks. Bulletin 649, 1916, 67 pp. 15 cents.

*The use of the panoramic camera in topographic surveying, by J. W. Bagley. Bulletin 657, 1917, 88 pp.

Mineral springs of Alaska, by G. A. Waring. Water-Supply Paper 418, 1917, 114 pp. 25 cents.

*Chromite deposits in Alaska, by J. B. Mertie, Jr. In Bulletin 692, 1919, pp. 265–267.

The future of Alaska mining, by A. H. Brooks. Bulletin 714–A, 1921, pp. 5–57. 25 cents.

Preliminary report on petroleum in Alaska, by G. C. Martin. Bulletin 719, 1921, 83 pp. 50 cents.

The Mesozoic stratigraphy of Alaska, by G. C. Martin. Bulletin 776, 1926, 493 pp. 75 cents.

The Upper Cretaceous flora of Alaska, by Arthur Hollick, with a description of the Upper Cretaceous plant-bearing beds, by G. C. Martin. Professional Paper 159, 1930, 123 pp., 87 pls. 80 cents.

Glaciation in Alaska, by S. R. Capps. In Professional Paper 170, 1932, pp. 1–8. 35 cents.

Past placer-gold production from Alaska, by Philip S. Smith. Bulletin 857–B, 1933, pp. 93–98. 5 cents.

In preparation

The Tertiary flora of Alaska, by Arthur Hollick, with a chapter on the geology of the Tertiary deposits, by Philip S. Smith. Professional Paper 182.

Past lode-gold production from Alaska, by Philip S. Smith.

TOPOGRAPHIC MAPS

Map of Alaska (A); scale, 1:5,000,000; 1931. 10 cents retail or 6 cents wholesale.

Map of Alaska (C); scale, 1:12,000,000; 1929. 1 cent retail or five for 3 cents wholesale.

Index map of Alaska, including list of publications; scale, 1:5,000,000; 1934. Free on application.

Relief map of Alaska (D); scale 1:2,500,000; 1923. 50 cents retail or 30 cents wholesale.

Map of Alaska (E); scale, 1:2,500,000; 1931. 25 cents retail or 15 cents wholesale.

SOUTHEASTERN ALASKA

REPORTS

*The Juneau gold belt, by A. C. Spencer, pp. 1–37, and A reconnaissance of Admiralty Island, by C. W. Wright, pp. 138–154. Bulletin 287, 1906, 161 pp.

Reconnaissance on the Pacific coast from Yakutat to Alsek River, by Eliot Blackwelder. In Bulletin 314, 1907, pp. 82–88. 30 cents.

The Ketchikan and Wrangell mining districts, by F. E. and C. W. Wright. Bulletin 347, 1908, 210 pp. 60 cents.

*The Yakutat Bay region, by R. S. Tarr and B. S. Butler. Professional Paper 64, 1909, 183 pp.

Occurrence of iron ore near Haines, by Adolph Knopf. In Bulletin 442, 1910, pp. 144–146. 40 cents.

Geology of the Berners Bay region, by Adolph Knopf. Bulletin 446, 1911, 58 pp. 20 cents.

The Eagle River region, southeastern Alaska, by Adolph Knopf. Bulletin 502, 1912, 61 pp. 25 cents.

*The Sitka mining district, by Adolph Knopf. Bulletin 504, 1912, 32 pp.

*The earthquakes at Yakutat Bay, in September 1899, by R. S. Tarr and Lawrence Martin. Professional Paper 69, 1912, 135 pp.

*A barite deposit near Wrangell, by E. F. Burchard. In Bulletin 592, 1914, pp. 109–117.

*Mineral deposits of the Yakataga district, by A. G. Maddren. In Bulletin 592, 1914, pp. 119–153.

*Geology and ore deposits of Copper Mountain and Kasaan Peninsula, by C. W. Wright. Professional Paper 87, 1915, 110 pp.

*The structure and stratigraphy of Gravina and Revillagigedo Islands, by Theodore Chapin. In Professional Paper 120, 1918, pp. 83–100.

*Geology and mineral resources of the west coast of Chichagof Island, by R. M. Overbeck. In Bulletin 692, 1919, pp. 91–136.

*The Porcupine gold placer district, by H. M. Eakin. Bulletin 699, 1919, 29 pp.

*Notes on the Salmon-Unuk River region by J. B. Mertie, Jr. Bulletin 714–B, 1921, pp. 129–142.

*Marble resources of southeastern Alaska, by E. F. Burchard. Bulletin 682, 1920, 118 pp.

Water-power investigations in southeastern Alaska, by G. H. Canfield. Bulletin 722–B, 1922. 5 cents. Similar previous reports in Bulletins 642, 1916, 35 cents; 662, 1918, 75 cents; *692, 1919; *712, 1920; *714, 1921.

Ore deposits of the Salmon River district, Portland Canal region, by L. G. Westgate. Bulletin 722–C, 1922, pp. 117–140. 5 cents.

Mineral deposits of the Wrangell district, by A. F. Buddington. Bulletin 739–B, 1923, pp. 51–75. 10 cents.

Mineral investigations in southeastern Alaska in 1924, by A. F. Buddington. In Bulletin 783, 1926, pp. 41–62. 40 cents. Similar report for 1923 in Bulletin *773, 1925, pp. 71–139.

Aerial photographic surveys in southeastern Alaska, by F. H. Moffit and R. H. Sargent. In Bulletin 797, 1929, pp. 143–160. 80 cents.

*Geology of Hyder and vicinity, southeastern Alaska, with a reconnaissance of Chickamin River, by A. F. Buddington. Bulletin 807, 1929, 124 pp.

Geology and mineral deposits of southeastern Alaska, by A. F. Buddington and Theodore Chapin. Bulletin 800, 1929, 398 pp. 85 cents.

The occurrence of gypsum at Iyoukeen Cove, Chichagof Island, by B. D. Stewart. In Bulletin 824, 1932, pp. 173–177. 20 cents.

Notes on the geography and geology of Lituya Bay, by J. B. Mertie, Jr. In Bulletin 836, 1933, pp. 117–135. 75 cents.

Surface water supply of southeastern Alaska, 1909–1930, by F. F. Henshaw. In Bulletin 836, 1933, pp. 137–218. 75 cents.

In preparation

Glacier Bay and vicinity, by F. E. and C. W. Wright.

TOPOGRAPHIC MAPS

*Juneau gold belt, Alaska; scale, 1:250,000; compiled. In Bulletin 287, 1906. Not issued separately.

Juneau special (No. 581A); scale, 1:62,500; 1904, by W. J. Peters. 10 cents retail or 6 cents wholesale.

Berners Bay special (581B); scale, 1:62,500; 1908, by R. B. Oliver. 10 cents retail or 6 cents wholesale. Also contained in *Bulletin 446, 1911.

Kasaan Peninsula, Prince of Wales Island (No. 540A); scale, 1:62,500; by D. C. Witherspoon, R. H. Sargent, and J. W. Bagley. 10 cents retail or 6 cents wholesale. Also contained in *Professional Paper 87, 1915.

Copper Mountain and vicinity, Prince of Wales Island (No. 540B); scale, 1:62,500; by R. H. Sargent. 10 cents retail or 6 cents wholesale. Also contained in *Professional Paper 87, 1915.

Eagle River region; scale, 1:62,500; by J. W. Bagley, C. E. Giffin, and R. E. Johnson. In Bulletin 502, 1912. 25 cents. Not issued separately.

Juneau and vicinity (No. 581D); scale, 1:24,000; 1918, by D. C. Witherspoon. 20 cents retail or 12 cents wholesale.

Hyder and vicinity (No. 540C); scale, 1:62,500; 1927, by R. M. Wilson. 10 cents retail or 6 cents wholesale. Also published in *Bulletin 807, 1929.

Revillagigedo Island; scale, 1:250,000; 1931, by R. H. Sargent (preliminary edition). Free on application.

Wrangell district; scale, 1:250,000; 1932, by R. H. Sargent and V. S. Seward (preliminary edition). Free on application.

Sumner Strait and vicinity; scale, 1:250,000; 1933, by R. H. Sargent and V. S. Seward (preliminary edition). Free on application.

CONTROLLER BAY, PRINCE WILLIAM SOUND, AND COPPER RIVER REGIONS

REPORTS

Mineral resources of the Mount Wrangell district, by W. C. Mendenhall and F. C. Schrader. Professional Paper 15, 1903, 71 pp. 30 cents.

*Geology of the central Copper River region, by W. C. Mendenhall. Professional Paper 41, 1905, 133 pp.

Geology and mineral resources of the Controller Bay region, by G. C. Martin. Bulletin 335, 1908, 141 pp. 70 cents.

Mineral resources of the Kotsina-Chitina region, by F. H. Moffit and A. G. Maddren. Bulletin 374, 1909, 103 pp. 40 cents.

Mineral resources of the Nabesna-White River district, by F. H. Moffit and Adolph Knopf, with a section on the Quaternary, by S. R. Capps. Bulletin 417, 1910, 64 pp. 25 cents.

Reconnaissance of the geology and mineral resources of Prince William Sound, by U. S. Grant and D. F. Higgins. Bulletin 443, 1910, 89 pp. 45 cents.

Geology and mineral resources of the Nizina district, by F. H. Moffit and S. R. Capps. Bulletin 448, 1911, 111 pp. 40 cents.

Headwater regions of Gulkana and Susitna Rivers, with accounts of the Valdez Creek and Chistochina placer districts, by F. H. Moffit. Bulletin 498, 1912, 82 pp. 35 cents.

*Coastal glaciers of Prince William Sound and Kenai Peninsula, by U. S. Grant and D. F. Higgins. Bulletin 526, 1913, 75 pp.

The McKinley Lake district, by Theodore Chapin. In Bulletin 542, 1913, pp. 78–80. 25 cents.

Geology of the Hanagita-Bremner region, by F. H. Moffit. Bulletin 576, 1914, 56 pp. 30 cents.

*Mineral deposits of the Yakataga district, by A. G. Maddren. In Bulletin 592, 1914, pp. 119–153.

*The Port Wells gold-lode district, by B. L. Johnson. In Bulletin 592, 1914, pp. 195–236.

The gold and copper deposits of the Port Valdez district, by B. L. Johnson. In Bulletin 622, 1915, pp. 140–188. 30 cents.

*The Ellamar district, by S. R. Capps and B. L. Johnson. Bulletin 605, 1915, 125 pp.

*The Chisana-White River district, by S. R. Capps. Bulletin 630, 1916, 130 pp.

A water-power reconnaissance in South-central Alaska, by C. E. Ellsworth and R. W. Davenport. Water-Supply Paper 372, 1915, 173 pp. 20 cents.

Copper deposits of the Latouche and Knight Island districts, Prince William Sound, by B. L. Johnson. In Bulletin 662, 1917, pp. 193–220. 75 cents.

The Nelchina-Susitna region, by Theodore Chapin. Bulletin 668, 1918, 67 pp. 25 cents.

The upper Chitina Valley, by F. H. Moffit, with a description of the igneous rocks, by R. M. Overbeck. Bulletin 675, 1918, 82 pp. 25 cents.

*Platinum-bearing auriferous gravels of Chistochina River, by Theodore Chapin. In Bulletin 692, 1919, pp. 137–141.

*Mining on Prince William Sound, by B. L. Johnson. In Bulletin 692, 1919. Similar previous reports in Bulletins *592, 1914; 622, 1915, 30 cents; 642, 1916, 35 cents; 662, 1918, 75 cents.

*Mineral resources of Jack Bay district and vicinity, by B. L. Johnson. In Bulletin 692, 1919, pp. 153–173.

*Nickel deposits in the lower Copper River Valley, by R. M. Overbeck. In Bulletin 712, 1919, pp. 91–98.

The Kotsina-Kuskulana district, by F. H. Moffit and J. B. Mertie, Jr. Bulletin 745, 1923, 149 pp. 40 cents.

The metalliferous deposits of Chitina Valley, by F. H. Moffit. In Bulletin 755, 1924, pp. 57–72. 40 cents.

*The occurrence of copper on Prince William Sound, by F. H. Moffit. In Bulletin 773, 1925, pp. 141–158.

Notes on the geology of the upper Nizina River, by F. H. Moffit. In Bulletin 810, 1930, pp. 143–163. 50 cents.

The Slana district, upper Copper River region, by F. H. Moffit. In Bulletin 824, 1931, pp. 111–162. 20 cents.

The Suslota Pass district, upper Copper River region, by F. H. Moffit. Bulletin 844–C, 1933, pp. 137–162. 15 cents.

In preparation

Geology of the Tonsina district, by F. H. Moffit.

The geology and mineral resources of the Chitina Valley and adjacent areas, by F. H. Moffit.

TOPOGRAPHIC MAPS

Central Copper River region; scale, 1:250,000; by T. G. Gerdine. In *Professional Paper 41, 1905. Not issued separately. Reprint in Bulletin 498, 1912. 35 cents.

*Headwater regions of Copper, Nabesna, and Chisana Rivers; scale, 1:250,000; by D. C. Witherspoon, T. G. Gerdine, and W. J. Peters. In Professional Paper 41, 1905. Not issued separately.

Controller Bay region (No. 601A); scale, 1:62,500; 1907, by E. G. Hamilton and W. R. Hill. 35 cents retail or 21 cents wholesale. Also published in Bulletin 335, 1908. 70 cents.

Headwater regions of Nabesna and White Rivers; scale, 1:250,000; by D. C. Witherspoon, T. G. Gerdine, and S. R. Capps. In Bulletin 417, 1910. 25 cents. Not issued separately.

*Chisana-White River district; scale, 1:250,000; by C. E. Giffin. In Bulletin 630, 1916. Not issued separately.

Latouche Island, part of; scale, 1:21,120; by D. F. Higgins. In Bulletin 443, 1910. 45 cents. Not issued separately.

Chitina quadrangle (No. 601); scale, 1:250,000; 1914, by T. G. Gerdine, D. C. Witherspoon, and others. Sale edition exhausted. Also published in Bulletin 576, 1914. 30 cents.

Nizina district (No. 601B); scale, 1:62,500; by D. C. Witherspoon and R. M. La Follette. In Bulletin 448, 1911. 40 cents. Not issued separately.

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*Prince William Sound; scale, 1:500,000; compiled. In Bulletin 526, 1913. Not issued separately.

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