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MINERAL INDUSTRY OF ALASKA IN 1930

AND

ADMINISTRATIVE REPORT

BY

PHILIP S. SMITH

Mineral resources of Alaska, 1930
(Pages 1–115)

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MINERAL INDUSTRY OF ALASKA IN 1930

By PHILIP S. SMITH [1]

INTRODUCTION

The mineral industry of Alaska was for many years the dominant incentive for the development of the Territory. Later, as the other possibilities of the Territory became better known, other industries sprang up and partly reduced the preeminence of mining, though they have by no means displaced the hold that mining has on the welfare of the people. It is probably safe to say that to-day, although the annual value of the minerals produced in Alaska is second to that of the fish products, mining developments still hold first place in the general interest of most of the residents. 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 these resources and to disseminate pertinent information on them to the miner, prospector, or business man who might undertake their development. As a result several hundreds of reports have been issued by the Geological Survey describing the different mineral commodities or mining camps and setting forth, both in the text and by illustrations and maps, the facts that have been determined and the inferences that may be drawn from them. Among the significant activities relating to the mineral industry is the collection from time to time of 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 shortly after the end of the year to which the records relate. The present report, which is of this type, is the twenty-seventh 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

[1] The canvass of producers, the tabulation of their replies, and the general compilation of the statistics set forth in this report have been conducted principally by Miss L. H. Stone, 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, and 824.

Territory, the diversity of its mineral products, and the large number but small size of many of the enterprises make it impracticable to gather all of the desired information at first hand. The information used is therefore derived from many sources, which necessarily vary in reliability and completeness. Every effort is made, however, to verify all the statements and to give only those that appear to be well substantiated. Among the most reliable sources of information are the engineers and geologists who are sent out each year 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 Alaskan newspapers and certain papers published in the States that feature Alaskan 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 should be realized, however, that the data collected from one source, although strictly accurate, are likely to be computed on a different basis from equally reliable reports received from another source, so that considerable editing and revision must be done in trying to bring them to one standard. It is not possible to compute exactly all the factors involved so as to reduce the reports of production to a strictly uniform standard. However, though some minor uncertainties necessarily remain, the attempt is made to eliminate differences, so that the reports may be consistent within themselves 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, 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 printed are based on the average selling price for each of the individual mineral commodities for the year, as determined by the Bureau of Mines, and not on the prices actually received by the individual producers. It is recognized that this method of computation obscures the amount received by individual mines, but it is believed to afford a better representation of the industry as a whole. Furthermore, it probably does not introduce any material error in the totals, inasmuch as higher prices received by the more shrewd and efficient mine operators are about balanced by lower prices received by the less fortunate ones.

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 will not use any facts that are furnished in a way to disclose the production of individual plants nor allow access to its records in any way that will be 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.

Special acknowledgment is due to O. E. Kiessling 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 Department of the Treasury; 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, J. J. Corey, and Gerald FitzGerald, of the Geological Survey; the agents of the American Railway Express Co. in Alaska; Maj. Malcolm Elliott and other members of the Alaska Road Commission; the Alaska Weekly and Volney Richmond, of the Northern Commercial Co., of Seattle, Wash.; the Ketchikan Alaska Chronicle, of Ketchikan; the Hyder Weekly Herald, of Hyder; the Alaska Juneau Gold Mining Co., the Daily Alaska Empire, and J. C. McBride, of Juneau; the Cordova Daily Times, of Cordova; the Kennecott Copper Corporation, of Kennecott; J. B. O'Neill, of McCarthy; M. J. Knowles, of Chitina; the Seward Daily Gateway, of Seward; H. N. Evans, of Kanatak; A. F. Stowe, of Kodiak; the Anchorage Weekly Times and Alex Liska, of Anchorage; W. E. Dunkle, Q. A. Pyle, and H. W. Wilmoth, of Wasilla; Ivan L. Peterson and son, of Chickaloon; H. W. Nagley, of Talkeetna; Charles Zielke, of Nenana; C. W. Alexander, of Circle; the First National Bank, the Fairbanks Exploration Co., the Fairbanks Daily News-Miner, G. E. Jennings, Lynn Smith, F. B. Parker, Henry Cook, and Joe Henderson, of Fairbanks; A. J. Griffin, of Richardson; C. H. LaBoyteaux, of Livengood; Robert E. Steel, C. B. Haraden, and J. J. Hillard, of Eagle; C. E. M. Cole, of Jack Wade; Jay Buzby, of Hot Springs; Chris Thyman, of Rampart; Jessie M. Howard, of Tanana; George Jesse and William Growden, of Ruby; Frank Speljack, of Ophir; the Miners and Merchants Bank, of Iditarod; H. S. Wanamaker, of Wiseman; J. W. Wick, of Russian Mission; John Haroldson, J. L. Jean, and C. Michael, of Quinhagak; C. M. Link and George W. Hoffman, of Bethel; E. M. Whelan, of Medfra; Oliver Anderson, of McGrath; S. M. Gaylord, of Casadepaga; the Nome Nugget, Hammon Consolidated Gold Fields, the Miners and Merchants Bank, Lomen Bros., Col. E. R. Stivers and C. W. Thornton, of Nome; A. S. Tucker, of Bluff; Arthur W. Johnson, of Haycock; Ethel M. Marx, of Teller; Lewis Lloyd and James C. Cross, of Shungnak.

MINERAL PRODUCTION

GENERAL FEATURES

The total value of the mineral production of Alaska in 1930 was $13,812,000. This was furnished by a number of mineral products, of which gold and copper accounted for more than 92 per cent of the total. The value of the mineral production in 1930 was only about 86 per cent of that of 1929, showing a decrease of about

$2,250,000. At first sight this decrease might be interpreted as indicating a permanent decline in the mining industry. Such an interpretation, however, would be unwarranted and not in accord with the actual conditions. In fact, the world-wide stagnation of business and the accompanying depression that characterized 1930 seems to have been less acutely felt in Alaska than in most other countries. In such commodities as gold, whose price has remained constant, there was a gratifying increase of output. It was mainly at those mines which produced the commoner metals that the low prices paid for their output resulted in a serious decline. The sharpness of the decline in the prices paid for metals in the world market may be appreciated by the following comparison: Copper brought 13 cents a pound in 1930, or 74 per cent of the price in 1929; silver, 38.5 cents an ounce, or 72 per cent of the price in 1929; and lead, 5 cents a pound, or 77 per cent of the price in 1929. It may be of interest to note that had the prices for these three metals that prevailed in 1929 held good in 1930 the value of the output of 1930 would have been nearly $1,600,000 greater and the decrease from 1929 would have been only about $600,000. In this connection it should be realized that not only did the low price of metals have a direct effect on the actual value of the output but it had a very great indirect and less obvious effect in deterring operators from opening up new properties or maintaining a high rate of output from the mines already producing. In several places development work was considerably curtailed and retrenchments instituted in order to effect economies required by the depression of business that affected every line of industrial enterprise in the States and throughout the rest of the world.

In spite of the curtailment of new mining ventures that called for the direct outlay of funds, there was an evident undercurrent of revived interest in Alaska and its resources. Among the many persons who visited Alaska primarily as tourists there were some who were evidently combining business with pleasure by keeping on the alert to size up the opportunities the country had to offer, and some of them seem to have seen openings that might have appealed to their financial interests had general conditions been more propitious. During the summer of 1930 a select committee of the United States Senate visited Alaska, primarily for the purpose of studying all matters relating to the Alaska Railroad. Their investigation necessarily covered subjects of purely railroad concern but also included items of general significance. Their recognition of the importance that the mineral deposits might bear to the general welfare of the railroad and of the Territory as a whole gives promise of reviving interest in the search for deposits within the railroad belt and stimulates development of such deposits. As a result of their investigation

Congress made a liberal appropriation for more intensive examinations by the Government of the potential mineral areas so as to furnish a quantitative determination of the resources and aid prospectors in their work. It is hoped that the investigations thus provided for will not only contribute directly to the discovery of deposits that are capable of commercial development but will encourage others to renewed activity. Therefore, instead of resulting in unsympathetic restrictions, as some had feared, the committee's studies have led to understanding help in stimulating worth-while developments, which should assure prospective operators that their interest lies along identical lines with that of the Government, in that the success of each is essential for mutual well-being.

Each year brings more and more development throughout the Territory as a whole, and these improvements in general conditions are stimulating prospectors and others to search for new mineral deposits or undertake the development of deposits that were too difficult to exploit under less favorable conditions. Such improvements are bound to exert a continuing and growing force, so that each year Alaska is becoming less and less of an unknown frontier, and the hazards of mining under pioneer conditions are being reduced. Furthermore, the mere accumulation of experience produced by successful mining ventures builds up confidence and interest that induce the undertaking of other new enterprises and thus creates an ever-widening circle of stimulation.

TOTAL MINERAL PRODUCTION

From the time of the earliest records of mining in Alaska to the end of 1930 minerals to the value of more than $629,000,000 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 about 1898 the annual production ranged from negligible amounts to a maximum of about $2,000,000. 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 eight 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

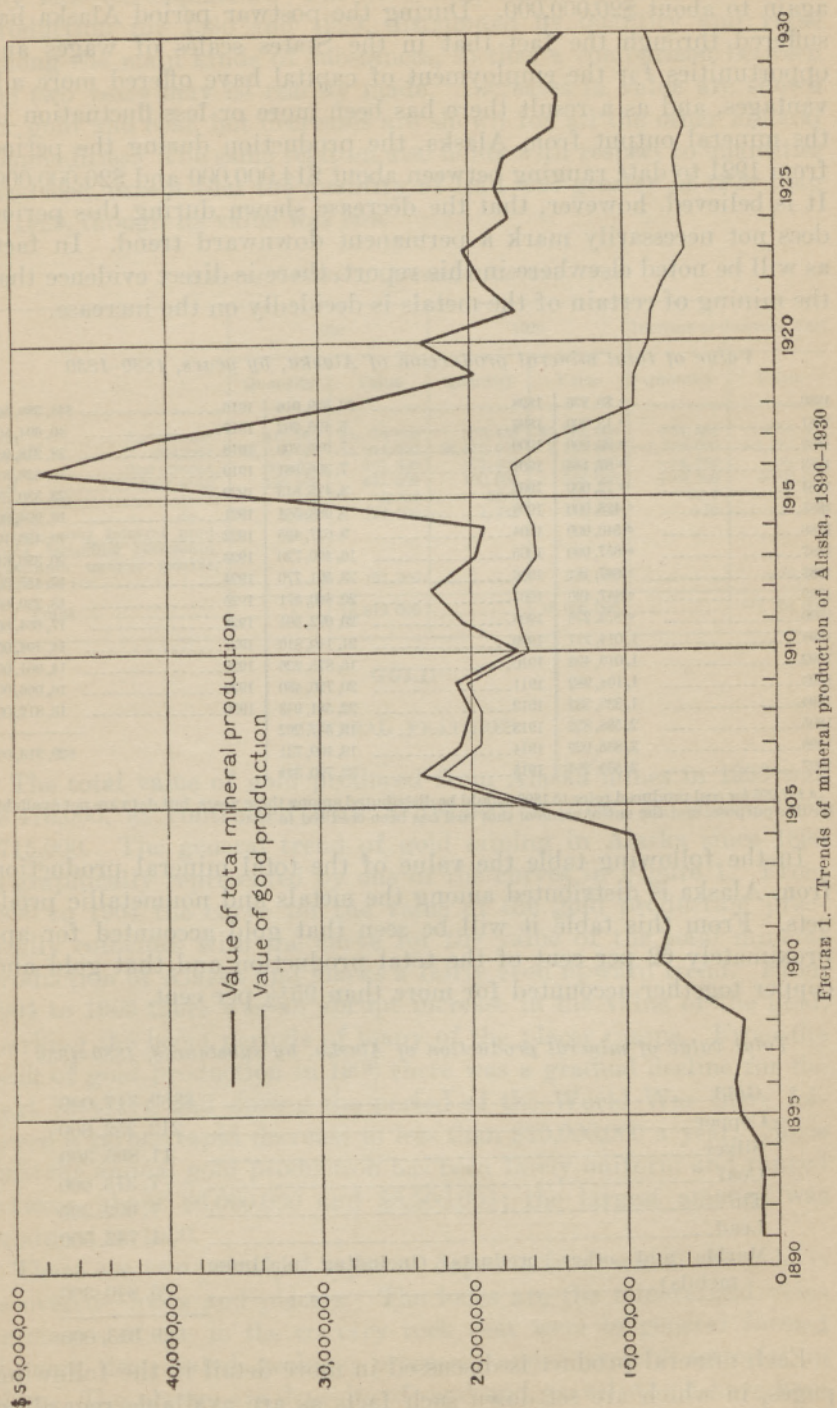

FIGURE 1.—Trends of mineral production of Alaska, 1890–1930

again to about $20,000,000. During the postwar period Alaska has suffered through the fact that in the States scales of wages and opportunities for the employment of capital have offered more advantages, and as a result there has been more or less fluctuation in the mineral output from Alaska, the production during the period from 1921 to date ranging between about $14,000,000 and $20,000,000. It is believed, however, that the decrease shown during this period does not necessarily mark a permanent downward trend. In fact, as will be noted elsewhere in this report, there is direct evidence that the mining of certain of the metals is decidedly on the increase.

Value of total mineral production of Alaska, by years, 1880–1930

1880	[a] $6,826	1898	$2,329,016	1916	$48,386,508
1881	[a] 15,000	1899	5,425,262	1917	40,694,804
1882	[a] 23,000	1900	7,995,209	1918	28,218,935
1883	[a] 67,146	1901	7,306,381	1919	19,626,824
1884	[a] 72,000	1902	8,475,813	1920	23,330,586
1885	[a] 425,000	1903	9,088,564	1921	16,994,302
1886	[a] 540,000	1904	9,627,495	1922	19,420,121
1887	[a] 657,000	1905	16,490,720	1923	20,330,643
1888	[a] 667,181	1906	23,501,770	1924	17,457,333
1889	[a] 847,490	1907	20,840,571	1925	18,220,692
1890	[a] 873,276	1908	20,092,501	1926	17,664,800
1891	1,014,211	1909	21,140,810	1927	14,404,000
1892	1,019,493	1910	16,875,226	1928	14,061,000
1893	1,104,982	1911	20,720,480	1929	16,066,000
1894	1,339,332	1912	22,581,943	1930	13,812,000
1895	2,588,832	1913	19,547,292		
1896	2,885,029	1914	19,109,731		629,313,000
1897	2,539,294	1915	32,790,344		

[a] $37,205 for coal produced prior to 1890 should be distributed among these years, but data are not available for this purpose, and the entire value of that coal has been credited to 1890.

In the following table the value of the total mineral production from Alaska is distributed among the metals and nonmetallic products. From this table it will be seen that gold accounted for approximately 62 per cent of the total production and that gold and copper together accounted for more than 95½ per cent.

Total value of mineral production of Alaska, by substances, 1880–1930

Gold	$389,317,000
Copper	212,252,600
Silver	11,895,300
Coal	7,373,000
Tin	1,092,300
Lead	1,742,500
Marble and other products (including platinum metals)	5,640,300
	629,313,000

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 1930 and 1929, distributed by quantity and value among the main kinds of substances, so that a comparison between the two years may be readily made. Increases in value are shown for gold and coal, but decreases are shown for all the other mineral commodities. The same relation also holds with respect to quantities produced, except that the quantity of lead was greater in 1930 than in 1929, though its value was less.

Mineral output of Alaska, 1930 and 1929

	1930		1929		Increase or decrease, 1930	
	Quantity	Value	Quantity	Value	Quantity	Value
Gold.....fine ounces..	410,020	$8,476,000	375,438	$7,761,000	+34,582	+$715,000
Copper.....pounds..	32,651,000	4,244,600	40,510,000	7,130,000	−7,859,000	−2,885,400
Silver.....fine ounces..	408,570	157,300	472,900	252,000	−64,330	−94,700
Coal.....short tons..	120,100	631,000	100,600	528,000	+19,500	+103,000
Tin, metallic.....do....	14.7	9,300	38.6	35,000	−23.9	−25,700
Lead.....do....	1,365	136,500	1,315	166,000	+50	−29,500
Miscellaneous mineral products, including petroleum, platinum metals, marble, gypsum, etc	.....	157,300	.....	194,000	.....	−36,700
Total	.....	13,812,000	.....	16,066,000	.....	−2,254,000

GOLD

GENERAL FEATURES

The total value of gold produced from Alaska mines in 1930 was $8,476,000, as contrasted with $7,761,000 in 1929, an increase of $715,000. 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 production 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 the value of the gold, marking the boom periods of many of the placer camps. From the peak of gold production in 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. Since 1920 the annual gold production has been fairly uniform and ranged between about $6,000,000 and $8,500,000; the largest amount was produced in 1930.

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 15 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 $389,317,000 in gold that has been produced from Alaska mines $258,962,000, or about 66½ per cent, has come from placers, and $130,355,000, or about 33½ per cent, from lodes. The relation between the outputs from these two sources of gold 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 lodes is more likely to show an increase than that from placers. There is nothing in the record to indicate that the peak of lode-gold production has yet been reached.

Gold produced in Alaska, 1880–1930

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	3, 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
	18, 833, 219	389. 317, 000	258, 962, 000	130. 355, 000

In the following table, which lists the sources from which gold was produced in 1930, all the ores from gold mines that yielded gold have been included, and the gold recovered from placers has been listed separately. It is a noteworthy feature that no gold is recovered from the Alaskan ores that are principally valuable for their

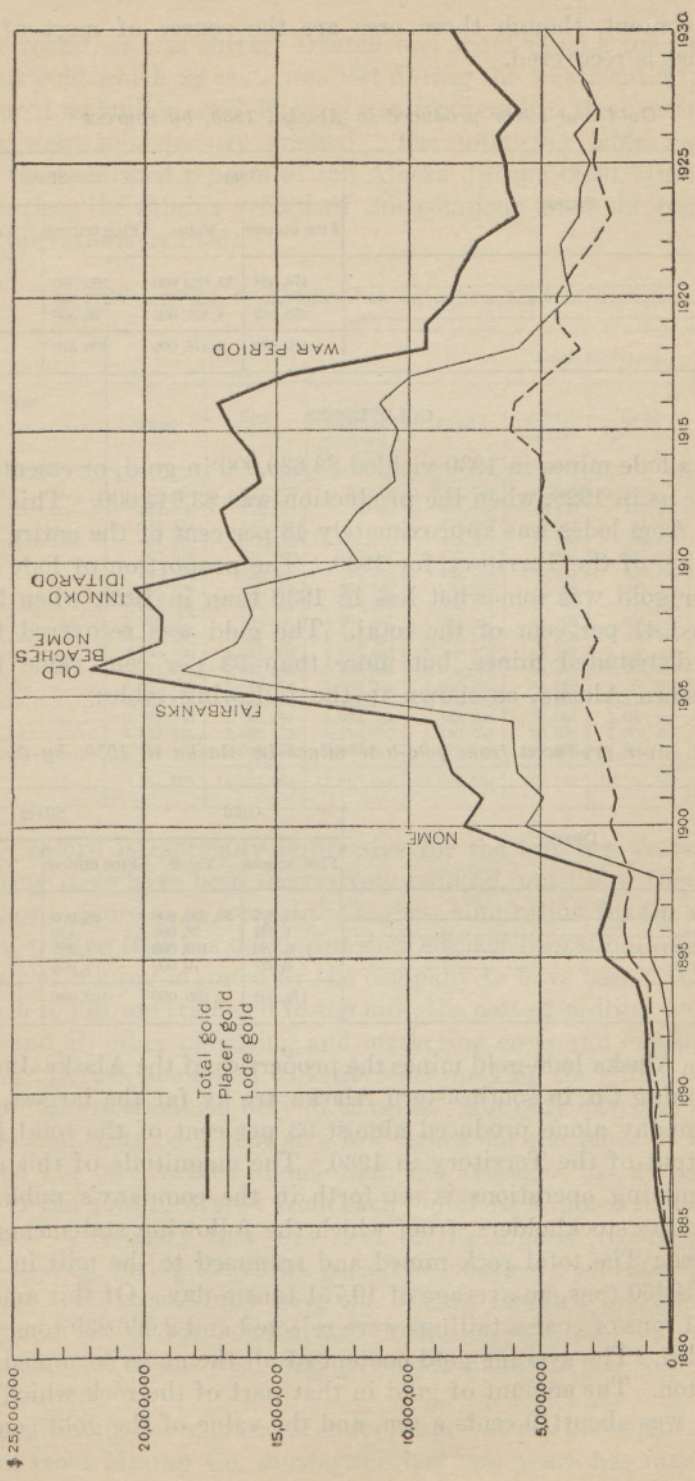

FIGURE 2.—Trend of value of gold production of Alaska, 1880–1930

copper content, though those ores are the source of most of the silver that is recovered.

Gold and silver produced in Alaska, 1930, by sources

Source	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
Gold ores	176,038	$3,639,000	102,080	$39,300
Copper ores			279,990	107,800
Placers	233,982	4,837,000	26,500	10,200
	410,020	8,476,000	408,570	157,300

GOLD LODES

Alaska lode mines in 1930 yielded $3,639,000 in gold, or essentially the same as in 1929, when the production was $3,644,000. This gold derived from lodes was approximately 43 per cent of the entire gold production of the Territory for 1930. The proportion of lode gold to placer gold was somewhat less in 1930 than in 1929, when lodes furnished 47 per cent of the total. The gold was recovered from widely distributed mines, but more than 93 per cent came from southeastern Alaska, as shown in the following table:

Gold and silver produced from gold-lode mines in Alaska in 1930, by districts

District	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
Southeastern Alaska	164,427	$3,399,000	98,960	$38,100
Willow Creek	1,741	36,000	470	180
Fairbanks district	6,483	134,000	1,585	610
Other districts	3,387	70,000	1,065	410
	176,038	3,639,000	102,080	39,300

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 almost 93 per cent of the total lode-gold output of the Territory in 1930. The magnitude of this company's mining operations is set forth in the company's published report to its stockholders, from which the following statements are abstracted: The total rock mined and trammed to the mill in 1930 was 3,924,460 tons, an average of 10,751 tons a day. Of this amount 1,858,221 tons of coarse tailings were rejected and 2,066,239 tons were fine milled. The average gold content of all the material mined was $1.10 a ton. The amount of gold in that part of the rock which was rejected was about 19 cents a ton, and the value of the gold content

of the rock that was further treated was about $1.90 a ton. Of this content gold worth 28 cents was lost during the treatment, $1.20 was recovered as bullion, and 42 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, 1893–1930

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	Lost in tailing.		$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, 022	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, 038, 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
	36, 361, 998	18, 679, 953	17, 682, 045	24, 984, 632	703, 351	16, 129, 872	26, 549, 835

This record is especially impressive for the last few years, when operating costs have been successively reduced, until now they stand at so low a figure as to compel the highest admiration for the mining administration that has developed such efficient operation. For 1930 the cost of mining is stated by the company to have been 28.69 cents for each ton of ore trammed to the mill, the cost of milling was 22.71 cents, and all other operating and marketing costs and expenses, including interest, amounted to 11.29 cents, making the entire cost for each ton of ore trammed only 62.69 cents. Not only have the mining and milling costs been kept at a low figure but the tenor of the ore handled has been rather higher than the average. As a result the value of the gold recovered from each ton of rock mined in 1930 was 85 cents—a recovery that was next to the highest recorded since 1915—that is, during the entire period of enlarged operations by this company. So successfully have the officials handled the company's affairs that all of the bonded and other indebtedness was paid off before the end of the year and payments of dividends were begun early in 1931.

In addition to the operations on its properties at Juneau, the Alaska Juneau Gold Mining Co. during the last two years has taken part

in the development of lode prospects in British Columbia, about 50 miles east of Juneau, in the Taku district. At this place extensive indications were found of ore carrying gold, silver, copper, lead, and zinc, and for a while prospecting was in progress. The explorations, however, did not disclose a workable ore body, and the present status of that project is summed up by President Bradley[3] in his annual report as follows:

> Because of the low price for base metals our venture work in the Taku River district on a 50–50 basis with the Treadwell Yukon Co. has been reduced to the bare necessities required to preserve our holdings there. The option on the Manville group has been dropped, and the active work of this 50–50 arrangement with the Treadwell Yukon Co. has now been transferred to the Juneau gold belt in the immediate vicinity of Juneau, where 10-year working options have been secured on two groups of mining claims. These groups cover 7,200 feet in length of the Juneau gold belt, and active prospecting work will begin on them this (1931) summer.

The next most productive gold mines in southeastern Alaska were those of the Hirst-Chichagof Mining Co. and of the Chichagoff Mines (Ltd.). The Hirst-Chichagof is near the head of Mine Bay, on the west coast of Chichagof Island, about 60 miles northwest of Sitka, and the Chichagoff Mines are in the same general region, at the head of Klag Bay. In the past these and the other gold mines on Chichagof Island have produced gold to the total value of more than $13,000,000, but in 1929 and again in 1930 the larger mines were engaged chiefly in reconstruction and development work, so that there was a marked falling off in production. This condition is believed to be temporary, and the preparatory work already accomplished or in contemplation should result in the early return of at least one of the properties to the list of large lode-gold producers. Thus it is reported that the new mill of the Hirst-Chichagof started production in December, 1930, and will be kept in constant operation by three shifts. In addition to the work that has been done on the surface at the mine, considerable new development work has been done underground to open up the ore body and to effect better means of transporting the ore. It is currently reported that negotiations are in progress looking toward the reopening of the Apex-El Nido property, near Lisianski Strait. This mine at one time produced considerable ore of high gold tenor, but the plans under consideration contemplate mining ore of lower mineral content in larger quantities, in the expectation that by so doing costs will be reduced and the yield of gold increased. Some prospecting has been done at a number of other points on Chichagof Island, and some finds that appear to be promising have been made.

[3] Bradley, F. W., Sixteenth annual report of the Alaska Juneau Gold Mining Co. for the year ended December 31, 1930, p. 3, 1931.

Elsewhere in southeastern Alaska only development and prospecting work was in progress. In the Hyder district the greatest activity seems to have centered around the properties on Banded Mountain and near-by areas at the head of the Chickamin River. Some ore of very high grade was found in that region a year or two before, and several prospectors have spent the open seasons in searching for workable leads. The greatest amount of work is reported to have been done on the claims held by Metcalf & Findley, and the results obtained are said to have been distinctly encouraging. Developments in the Hyder district as a whole were much hampered by the low price that prevailed for most of the metals during the year, so that several of the properties that heretofore have been producers were closed down, and prospecting work at a number of the others was considerably curtailed. The project for developing electric power at Davis Creek, on the west side of Portland Canal, a few miles south of Hyder, advanced to such a stage that practically all the preliminary work was completed, and the company only awaits issuance of a permit by the Federal Power Commission to undertake actual construction. The company expects that all of the power it develops will be utilized in the towns and mines in the vicinity of Hyder and Stewart and that it can be delivered at a much lower price than it can be produced by any other means.

In the Ketchikan district the developments which had been started in 1929 by the Solar Development Co. on the old properties near the Salt Chuck of Kasaan Bay were discontinued in June on account of the generally unfavorable condition of the metal market. The withdrawal of this company from more fully exploring these deposits is regarded as a distinct setback to the district as a whole. It is believed, however, that the amount of mineralization, of which evidence has been found in Kasaan Peninsula, is a guaranty that under more favorable conditions this or some other company will renew the search for profitable deposits in it. In this same general region renewed activity was also reported on the properties of the Kasaan Mines, near Hollis, and at the Rich Hill mine, on Kasaan Peninsula. The ore from the Rich Hill mine is mainly valuable for its copper content, but it always has carried some gold as well. At Moth Cove, on Revillagigedo Island, near the entrance of Thorne Arm, considerable prospecting work was done by J. L. Freeburn and associates on leads carrying principally copper, lead, and zinc minerals but also having subordinate quantities of gold. According to Stewart,[4] a mineralized zone having a length of at least 1,500 feet has been

[4] Stewart, B. D., Report on cooperation between Territory of Alaska and the United States in making mining investigations and in the inspection of mines for the biennium ending March 31, 1931, pp. 18–19, 1931.

demonstrated. The ore bodies occur in a schist country rock about 700 feet wide that is bounded both to the southwest and northeast by extensive intrusive masses of diorite. A little development work was also in progress near the old Sealevel mines, on the east shore of Thorne Arm. North of Ketchikan, in the vicinity of Smugglers Cove, revival of activity was reported at several of the old claims, and considerable machinery was shipped in with a view to equipping some of the properties so that their exploration could be carried on more vigorously.

In the Wrangell and Petersburg districts little mining work other than that required by law to retain possession of the claims was done. At Lake Bay, some 30 to 40 miles west of Wrangell, a crew of 10 to 12 men were employed part of the year in underground development on leads carrying mainly copper minerals but also containing subsidiary quantities of gold.

In the Juneau district, in addition to the mining work already mentioned, B. D. Stewart reports that some underground development was carried on at the Admiralty-Alaska property, on Funter Bay. The installation of a Diesel engine power plant and milling equipment, including flotation cells, was completed, and a few test runs of the ores were made, though the results of these tests have not been made public. There appears to have been a revival of prospecting throughout the Juneau belt, and many properties from Windham Bay to Berners Bay that have lain idle for years were reexamined with a view to determining the feasibility of resuming operations at them. Still farther north, in the Skagway district, at the Inspiration Point Co.'s mine, further underground development is reported to have been in progress.

The Willow Creek district, at the head of Cook Inlet, has long been one of the productive gold-lode camps of the Territory. In the period from 1912 to 1928 the annual production from this camp was practically always more than $100,000, and in the entire period since 1909, when the camp first began production, its gold output has been more than $3,600,000. In 1928 the destruction by fire of the buildings at the largest producer led to a great curtailment in production, and it was not until near the end of 1930 that reconstruction was completed and the mill running. The showing during the short period that the property was active in 1930 distinctly encouraged the belief that in a full season the output from the district will be comparable with that of the better years of this camp. The principal producing company in the Willow Creek district is that of the Willow Creek Mines (Inc.), which holds considerable property on Craigie Creek and gets its ore mainly from the Lucky Shot mine, on the northern slope of the valley of that stream. About 50 men were

employed in the construction of the mill, bunk houses, and other buildings required to house the personnel and equipment. The mill, which is of the Marcy type, has an estimated capacity of 50 tons a day, and at present is driven by a Diesel engine. It is expected, however, that later part of the flow of Craigie Creek will be diverted to yield hydroelectric power for furnishing current to drive the machinery and supply light, as there is an exceptionally good site for the installation of the necessary equipment not far from the camp.

Not much work has been done lately in explorations underground at this property, as the operators feel that an adequate amount of ore has already been blocked out to supply the mill for a considerable period, but this work will be resumed in the near future, after the necessity of giving first consideration to surface equipment and plant has been removed. Much of the ore that is being milled is said to have an average tenor of between $25 and $50 a ton, and much higher assay returns are by no means unusual for considerable stretches in the vein. Delay in freighting the necessary equipment was experienced because of the high pass that the old road crossed, which is blocked early in the fall by snow and is not open again until late in the following spring. In order to overcome the difficulties due to this cause, investigations were made of possible routes up Willow Creek to connect with the railroad directly rather than by the old road by way of Fishhook and Wasilla. The results of this study indicated that a feasible way could be developed, and considerable construction was undertaken by the Alaska Road Commission, so that before fall it was practicable to haul mine timbers by means of a tractor from a point on Willow Creek midway between the mine and the mouth of the stream, and further work to make a winter trail all the way to the railroad was in progress.

The next largest amount of prospecting work on Craigie Creek was on the property of the Marion Twin Mining Co., at the extreme head of the valley and extending over the divide into Purches Creek. Here seven men were employed during most of the open season in tracing the gold-bearing lodes that have been found and getting out several tons of ore for a mill test to be made at the company's mill some miles distant on the Little Susitna River. The veins that were being prospected are rather narrow, but they carry ore of high gold content, and the purpose of the exploration was to determine whether they would yield tonnage enough to warrant the construction of the necessary plant near the mine, because obviously it was not economical to handle the ore and freight it as was being done. No report has been made public regarding the conclusions reached as to future development, though it was evident that considerable rich ore had been disclosed in the course of the work. The company's old property at what was formerly known as the Gold

Mint was idle throughout much of the season. Several small camps did a little prospecting at other points in the Craigie Creek region. A short distance upstream from the old Gold Bullion camp Charles Bartholf and his partner found a vein on the north side of the valley that gave such good showings of gold that they put in considerable work in tracing it. On the divide between Craigie and Fishhook Creeks and extending for a considerable distance southward into the valley of the latter several gold-bearing leads have been prospected by Herman Kloss and associates. A ton of hand-sorted ore from this property was shipped to a smelter in the States and carried over $1,000 in gold. It was evident that even without close sorting there was probably ore of much lower tenor that might be profitably developed, and it seemed wise that attention should be given to a search for deposits that might yield a fairly large tonnage rather than to concentrate on the spectacular grades, which are likely to yield actually only small quantities of ore and whose development will be relatively expensive. The numerous abandoned shafts and mills that dot the slopes of Fishhook Valley are mute witnesses that mineralization is widespread, but they also point to the fact that many of the enterprises were undertaken without adequate assurance of the volume of ore available or of the capacity of the operators to solve the technical problems wisely.

Some production was reported from the Mabel mine, on the ridge west of the lower part of Archangel Creek, where mining was carried on at about the same scale as during the last few years. Farther up the valley of Archangel Creek some work was done at the Fern mine, but it consisted largely in the examination of the mine and adjacent region by a Canadian mining engineer, who spent about a month studying the general mining situation. A few one or two man camps were busy prospecting at other points in the Willow Creek district, but so far as reported none of them produced any gold except such as they made in the course of their sampling tests.

Lode mining in the Fairbanks district in 1930 showed an increase of more than 50 per cent over 1929, and the yield of gold was greater than for any other year since 1915. Altogether nearly $2,000,000 worth of gold has been recovered from the lodes near Fairbanks, and the indications are that much more activity in lode mining will be seen there in the near future. The two principal producing lode-gold areas in the Fairbanks district are more or less close to Ester Dome and Pedro Dome. In the Ester Dome tract the largest producing mines were those of the Mohawk Mining Co., near St. Patrick Creek, on the northeastern flanks of the dome, and of Borovich & Stevens, on the southwestern flanks. A crew of a dozen or more men were active during most of the open season at the Mohawk mine, and considerable custom ore was also treated at this company's

mill for some of the small scattered prospects along the northern slopes of the dome. The Elmes mine, which is about a mile west of the Mohawk mine, was idle throughout the season. North of the Mohawk some work was done by Grant and his associates in underground developments on the Irishman claim, and considerable quartz, with disseminated sulphides, was disclosed in the progress of the work and stacked upon the surface awaiting further treatment.

Rumors are common that the reopening of the old Ryan lode, on Ester Dome, is to be undertaken in the near future, but no actual work looking to this end is known to have been done. This is one of the largest quartz veins that has yet been discovered in the district, but its tenor is apparently so small that unless it is mined on an extensive scale it can not be profitably worked, and no large companies have yet been found who are willing to assume the risk that its development necessarily entails. The generally mineralized condition of practically all parts of Ester Dome leads to the belief that the time may not be far distant when it will prove worth while to investigate whether large-scale mining of selected zones may not yield better returns than the present system of attempting to follow narrow, rather irregular individual veins or stringers. Such a course would necessarily give ore of only a low gold content as compared with the ore that is being mined at present, but the much greater volume and lower costs of mining such ore should result in even greater profit.

In the region around Pedro Dome gold was produced from mines in the valleys of Cleary and Fairbanks Creeks, and prospecting and development were active at a number of other places. In the Cleary Creek Valley the most productive mines were those of the Cleary Hills Mining Co. and the Wackowitz Bros., both of which are on Bedrock Creek. Farther up the valley of Cleary Creek, on its tributary from the south, Willow Creek, renewed activity was reported to have been in progress at the Tolovana mine, which has been dormant for the past 15 years. This work was primarily of an exploratory character. Late in the summer negotiations were completed so that development work was resumed at the old Newsboy property, on the divide between Cleary Creek and Last Chance Creek, a tributary of Little Eldorado Creek. Owing to the destruction by fire of part of the buildings on the old Spaulding property, on Dome Creek, which had recently been used by Heath & Kearns in their mining work on the Wild Rose claim, and to their inability to renew their lease on satisfactory terms, the mine was idle during the early part of the season, but later this mine and the near-by Zimmerman claims were taken over by C. M. Hawkins and associates and development work continued. In the Fairbanks Creek district the greatest production was reported to have come from the mine at the head of the

valley, operated by L. J. McCarthy and associates. The Hi Yu group of claims, on Moose Creek, which has long been one of the main producing mines of the district, reported no production in 1930. At a few scattered prospects a little desultory work was in progress, but no new finds that are regarded as likely to become productive in the near future were reported.

Among the gold-lode producing districts grouped in the table on page 12 under the heading "Other districts," the most productive are the mines and prospects on Kenai Peninsula, including the Nuka Bay region, the region south of Hope, and the hills north of Girdwood; the old Pearson & Strand mine, on a tributary of Nixon Fork, in the Kuskokwim region; and the mines in the vicinity of Valdez, in the Prince William Sound region. In the Nuka Bay region the greatest amount of gold was recovered from the Sonny Fox mine, operated by Babcock & Downey. The work at this property during the year consisted in the installation of a 15-ton Denver mill and the construction of the necessary mill and compressor buildings, together with tram, dock, and other facilities required to aid production. At the mine about 1,000 feet of drifts and tunnels and 100 feet of raises have been driven. The ore is principally quartz, with sulphides, and the larger part of the gold is recovered by amalgamation. In addition to concentrates some crude ore is produced that is shipped directly to smelters in the States. The installation of the new mill and the other construction work necessarily restricted production in 1930, but from all accounts the conditions are favorable for a considerably greater production in 1931 if not subjected to interruptions.

Farther north on Kenai Peninsula development work was in progress in the valley of Porcupine Creek, at the head of Kenai Lake. Some experimental work was also done at a mine east of the Alaska Railroad, 2 miles south of Lawing. Near Gilpatricks and a short distance up Summit Creek, a tributary of Quartz Creek, the Alaska Oracle Mining Co. operated its mine and a small mill for most of the open season. Still farther north the Lucky Strike mine, on Palmer Creek, under the management of John Hirshey, reported great activity. The mill at this property was in operation throughout most of the open season and not only recovered much of the gold in the battery and on the plates but also produced several tons of concentrates on the table. The concentrates were shipped to a smelter in the States. Most of the tailings were impounded so as to be available for further treatment at a later time, and it is understood that a cyanide plant is to be erected for this purpose in 1931. In addition to the productive mines specifically mentioned above, there were other prospects widely scattered through the district at which some work was done during the year, though at most

of them it amounted to but little more than the assessment work required by law.

In the valley of Crow Creek, about 10 to 12 miles north of Girdwood, which is on the northern shore of Turnagain Arm, some prospecting and development work on gold lodes were in progress at several places, but the projects were all small and yielded only a little gold. There is, however, evidence of widespread mineralization in this district, and some of the ore that has been found is of high grade. The attempt to mine the small stringers that are especially rich has been very costly, as many of the openings are accessible only with great difficulty, and labor-saving devices, which might readily pay for themselves if the output were larger, are not at present warranted. It is said that one of the property owners entered into an arrangement whereby a crosscut tunnel was to be driven during the fall and winter of 1930–31 for a distance of 1,000 feet or so to intersect in depth some of the veins known on the surface, so as to determine their persistence and character, as well as to prospect more thoroughly the bedrock underlying his claims.

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. No details regarding the recent developments at this mine are available, but apparently from the output of gold the work must have been carried on somewhat more intensively than during 1929. An average force of four or five men were employed at this property throughout the year. Although no other mine in this district reported having produced any lode gold in 1930, it was said that prospecting was in progress at the old Whelan mine. This work consisted mainly in the digging of several surface trenches in search of veins worthy of more intensive examination. It is reported that in the course of this work some ore was found that appeared of sufficiently high grade to justify the owner in undertaking its development during the winter.

Interest in the development of quartz lodes in the Valdez and near-by parts of the Prince William Sound district in 1929 was shown by the entry of several new companies to undertake the operation of some of the old properties by finding new occurrences of ore. Of the more promising enterprises set under way in 1929 may be mentioned that of the Solar Development Co., to undertake the thorough examination of properties near Rua Cove, on Knight Island. After considerable drilling and other exploratory work further exploration by this company was discontinued in May, 1930, and the option given up. This decision was doubtless influenced, in part at least, by the low prices that prevailed for copper, lead, and zinc, which were the principal metals carried in the ores at these proper-

ties. In spite of the disappointment caused by the withdrawal of this company from this field there were several small properties in this general region that reported some production. Among the largest of these may be mentioned the Ramsey-Rutherford mine, about 10 miles north of Valdez; the Merrill mine, near Bettles Bay, in the Port Wells district; and the Devinney & Dolan and Little Giant properties, near Mineral Creek. At the Ramsey-Rutherford mine considerable underground work has been done and a good deal of ore has been blocked out. The ore is treated in a small stamp mill driven by a gasoline engine, and most of the gold is recovered in the battery boxes or on the plates. At the Merrill mine there was little new development. The plant was in operation about four months. The ore is treated in a 2-stamp Nisson mill, and such concentrates as are recovered are shipped to a smelter in the States for treatment. At the Little Giant mine about 20 feet of open cut and 30 feet of tunnel were driven during the year, and some surface construction was done. The ore from this property is treated in a 4-ton Ellis mill and only the free gold is recovered, though there is a considerable quantity of sulphides in the ore.

Prospecting for gold lodes was also continued at many other places throughout the Territory, though at none of them, so far as known, was any ore produced for sale. In the Copper River region several prospects were under development in the Kotsina-Chitina area. On the property of the Nabesna Mining Corporation, under the management of Carl Whitham, prospecting by shafts and drifts was continued in 1930, and the company proposes to undertake a more extensive development program during 1931, with the aim of getting the property onto a large producing basis as soon as possible. This mine was visited in 1930 by E. R. Pilgrim, associate Territorial mining engineer, whose report [5] contains much detailed information and a sketch map of the general geologic conditions. Pilgrim shows that the occurrences of gold ores at this place is very closely connected with intrusions of diorite, which cut massive limestones. In the McKinley Lake district, in the southern part of the Copper River Valley, a little work was done by the Lucky Strike Mining Co. on leads that it has been developing for a number of years. No details have been learned as to the results accomplished, and no gold is reported to have been produced in the course of that work.

In the Chandalar district, of the Yukon region, noteworthy new developments were reported to have been in progress during the year on the gold lodes that have been held for some time in the vicinity of Caro. During the summer the properties were visited by Hon.

[5] Pilgrim, E. R., Report on cooperation between the Territory of Alaska and the United States in making mining investigations and in the inspection of mines for the biennium ending March 31, 1931, pp. 60–66, 1931.

William Sulzer, who is one of the principal owners of the claims and keenly interested in their development. He is reported to have regarded conditions as he found them at the properties entirely satisfactory for renewed effort to open them up in the near future. The remoteness of the district, however, is a serious drawback that can not be overcome unless rather large developments that will justify putting in many necessary facilities are undertaken.

In the Susitna Basin there was no production of gold from lodes in 1930, but some prospecting was in progress west of the Chulitna River and in the Valdez Creek district. In the hills west of the Chulitna River, between Ruth and Eldridge Glaciers, Roy and Elmer Boedeker reported finding in 1930 several ledges of mineralized rock carrying considerable gold. The leads are said to be from 10 inches to 2 feet wide, to trend southeast, and to stand vertical in a country rock of slate and graywacke. The country is exceedingly difficult of access because of thick forests, raging streams, glaciers, and precipitous mountains, but at least two parties of prospectors are said to have visited the region, though they made little more than a hurried trip. Prospecting of gold quartz lodes in the Valdez Creek region in 1930 amounted to little more than performing the annual assessment work required by law to hold the claims. No work was done at the Mint Ruby silver mine during the year, but some prospecting was done in its general neighborhood.

In Seward Peninsula further development work was carried on at the Hed & Strand mine, north of Nome, but no reports have been received as to the work accomplished. A little search for gold lodes was made at a few other points in Seward Peninsula, but appears not to have disclosed workable deposits. Rumors were afloat that steps might be taken shortly to reopen the old Big Hurrah mine, in the Solomon district, but so far as learned nothing was done on the ground in 1930 to carry that purpose into effect.

GOLD PLACERS

GENERAL CONDITIONS

Placer mining in Alaska in 1930 returned gold worth nearly three-quarters of a million dollars more than the amount produced in 1929 and, on the whole, the industry seemed to be in a flourishing condition for still further increase in the near future.

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 the changes that have taken place in the industry. Thus in no year from the beginning of the industry in 1880 to 1898 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 12 years since that time it has fluctuated between that amount and $3,000,000; in 1930 it was $4,837,000.

The largest single cause of the increased production in 1930 is to be found in the fact that this was really the first year in which the large enterprise of the Fairbanks Exploration Co., in the Fairbanks district, was in complete running order and all of its equipment available for a full season's work. Production from this property began in 1928, but it was not until 1930 that all five of this company's dredges were available throughout the open season. Not only did the company enjoy a full season, but because of the unusually mild winter the season was exceptionally long. In fact, some of the dredges of the Fairbanks Exploration Co., after they started in the spring, were able to run continuously throughout the year and did not cease until well into January, 1931, though usually the dredges are closed down in November or certainly by early December.

The success of so many of the placer operations depends upon an adequate supply of water that weather conditions which afford abundant rainfall are regarded by the placer miner as especially fortunate. During the open season of 1930 throughout most of the interior of Alaska, in which many of the placer camps are situated, the rainfall was plentiful, so that the streams were maintained at a high stage. In fact, in parts of the region, especially that contiguous to Fairbanks, the rains during August and September were exceptionally heavy, so that some harm was done by floods that inundated Fairbanks, Nenana, and neighboring villages. The times of break-up of the streams in the spring and freeze-up in the fall were normal, though the lack of very severe weather in the fall and early winter made the climate of that period less rigorous than usual.

There appears to be some revival of interest in prospecting, though there are still only a few prospectors of the old-fashioned type in the hills. Many of the former prospectors who were the builders of the mining business in Alaska have grown too old to accomplish much, and many of the younger generation who might follow in their footsteps prefer the higher wages, lighter physical labors, and social attractions of the town to the lure of the hills. There seems,

however, to be an increasing interest among capitalists 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. Most of these areas do not appear to give promise of holding bonanza deposits that can be won cheaply. There are, however, 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. At the present time, it must be admitted, wages appear to be relatively higher and costs lower in the States than in Alaska, so that the wages obtainable offer no keen inducement for a new generation of prospectors to come to Alaska and take part in the search for new placers. This condition, however, is not regarded as permanent, and when conditions change active prospecting will be renewed in the Territory, for the opportunities that await the earnest worker still seem to be very great.

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. 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 much 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. 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 1930 and 1929

Region	1930	1929	Decrease or increase, 1930
Southeastern Alaska	$7,000	$10,000	−$3,000
Copper River region	98,500	83,000	+15,500
Cook Inlet and Susitna region	75,500	98,000	−22,500
Yukon Basin	3,416,800	2,058,000	+1,358,800
Kuskokwim region	44,800	165,000	−120,200
Seward Peninsula	1,191,200	1,698,000	−506,800
Northwestern Alaska	3,200	5,000	−1,800
	4,837,000	4,117,000	+720,000

SOUTHEASTERN ALASKA

Although southeastern Alaska is rich in gold lodes, 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 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 along 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 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 prospect of finding placers of local value.

As shown in the table on page 26, the entire placer production from southeastern Alaska in 1930 was worth only $7,000, or somewhat less than in 1929. All of this sum came from small camps, none of which employed more than two or three men or any but the simplest mining apparatus. In the Porcupine district, on the property where extensive preparatory work has been in progress for the last two or three years, no mining was in progress during 1930, and the only placer-gold production from that entire district is said to have come from a few small scattered camps where the work accomplished amounted to little more than that required by law to hold the claims. Considerably more than half the placer gold credited to southeastern Alaska came from the Yakataga district. The placer deposits in this district are all of the beach type, occurring in the stretch of coast where sorting by the ocean is effective. Their position exposes the workings to the waves of the Pacific, so that except under favorable weather conditions they can not be mined, and even then the use of extensive mechanical appliances is precluded. As a result only two or three small camps of two men or so each are engaged in mining, and though the amount of gold they produce is small, relatively to the size and expense of the operation it is large. Mining on this coast has been carried on at about the same scale as in 1930 for several years.

COPPER RIVER REGION

In the Copper River Valley there are two principal areas and one 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. As will be noted from the table on page 26, the value of the placer gold produced from the Copper River districts in 1930 was $98,500, or about $15,000 more than in 1929. In the Nizina district the bulk of the placer gold came from the properties of the Chititu Mines, on Chititu and Rex Creeks, and the Nicolai Placer Mines, on Dan Creek. About 50 men were employed at these two properties, and a few others were engaged in prospecting on their own account elsewhere in the district. At the Chititu and Rex Creek properties the season was marked not only by a production somewhat larger than during recent years, but by distinctly encouraging returns from prospecting carried on in some of the benches. At the Nicolai mines the results were not so satisfactory, as in places a firmly cemented gravel was encountered which could not be broken up by ordinary means, so that early in August mining work was suspended. On Copper Creek a

small camp of six men working under lease did some placer mining in the early part of the summer, but the conditions found caused them to stop work before the end of July, and no information as to whether work will be continued on this ground next year is available.

In the Chistochina district the Slate Creek Mining Co., on Slate Creek, was the only operator that reported any noteworthy production and was the only one in this district that did more than prospecting work. The production from this camp was somewhat more in 1930 than in 1929, and plans are said to be under way whereby there will be increased activity during 1931. In the Nelchina district all the mining was done by a few small camps consisting of only two or three men each, and the total production amounted to only a few thousand dollars. In the Tiekel district one property on Fourth of July Creek reported having taken out a little gold in the course of its prospecting work.

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 camps have been highly productive, though lately their output of gold has decreased, and only a few score miners are now at work where formerly there were hundreds. The output of placer gold from this region in 1930 showed a decrease of about $23,000 from that reported in 1929 and was approximately $75,500. The districts, named in order of their production, are the Yentna, Valdez Creek, and Kenai Peninsula.

In the Yentna-Cache Creek district, although the production appears to have been somewhat less than in 1929, there were some 24 separate camps employing between 40 and 50 men who were engaged in mining. By far the largest single operation in the district was that of J. C. Murray, who was hydraulicking benches on Cache Creek. It is understood that Mr. Murray was to withdraw from active mining work in the district at the end of the season of 1930 and that his properties henceforth will be leased to laymen for operation. Two other small outfits did some mining on Cache Creek proper and one on upper Cache Creek. On Falls and Short Creeks, tributaries of Cache Creek, on which mining had been done for several years, none of the properties are reported to have been mined during 1930, but on Thunder Creek, another tributary of Cache Creek, one camp did some productive mining. The new pay streak that was reported to have been found in the bed of Dollar Creek in 1929 was mined in 1930 by one camp consisting of three men, and

the yield of gold is reported to have been satisfactory. On Peters Creek four camps, consisting of one or two men each, were engaged in placer mining. Late in the season a considerable block of claims was acquired by the Peters Creek Placer Co., and plans were laid for larger undertakings on that stream next year. Mining camps of one to three men each were reported as active on Bird, Poorman, and Willow Creeks, which are tributary to Peters Creek. North of Peters Creek, in the valley of the Tokichitna River, some prospecting and development work was reported to be in progress, but no specific information is available as to the amount of gold obtained, though it was probably small. Southwest of the Yentna River, in the Kahiltna Valley and the Fairview district, there were only two or three small camps, consisting of one or two men each, and the production at most of them was little more than a meager grubstake. The largest production is said to have come from Notobac Creek. Late in the fall examination of placer ground in the vicinity of Mill Creek is said to have been undertaken by a mining engineer with a view to determining whether or not it had prospective value as dredging ground. No report of the results of this examination has been made public.

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 1930, the returns to the few placer operators who were in the district appear to have been especially satisfactory. The supply of water was abundant through the open season, and as a result the output was larger than it has been during recent years. The largest amount of gold came from hydraulic operations near the main stream and from some of the bench ground, especially on the left bank of Valdez Creek. Some of this ground was also worked by drift mining. Gold was also recovered from the placers on Lucky Creek, a tributary of Valdez Creek. Twelve men appear to be the total number of miners engaged in productive work in the Valdez Creek district during the year. The district is rather remote and inaccessible except by way of the pack trail that leads from the Alaska Railroad at Cantwell, so that many efforts have been made to induce the Alaska Road Commission to construct a suitable road into the district. Such a road would doubtless be of service in opening up the country, because at present the charges for freighting into the district are almost prohibitive for all but the richer deposits.

The producing placer camps on the Kenai Peninsula are situated mainly in the vicinity of Hope, Sunrise, and Girdwood. All of these

are small operations, the largest yielding only a few thousand dollars annually and some of them only a few hundred dollars. In the vicinity of Hope productive placer mining was reported on claims worked by Charles Harper and associates on the Resurrection River, which flows into Turnagain Arm near the town, and on Bear Creek, 1½ miles east of Hope. The ground worked on the Resurrection River lies a few miles south of Hope and is part of the property formerly known as the St. Louis claims. The placer is mined by hydraulicking with water that is brought down by flume and ditch from a point some distance up the Resurrection River. Two or three nozzles were used for driving the pay gravel into the boxes and for stacking the tailings. Many large boulders are found in the deposits and seriously increase the cost of mining.

Near Sunrise, placer mining was carried on at a number of small camps, the largest of which were on Canyon Creek and on Lynx Creek, which is a tributary to East Fork from the south. Considerable interest was aroused in the district during August by the fact that a new company was considering the development of claims near the town of Sunrise if drilling tests indicated the prospective value of the property. A drill was shipped in, but the results obtained were not such as to encourage the company to go further with the project, and work was discontinued. It is said that the tests indicated that the character of the gravel changed abruptly where the valley of Sixmile Creek approached close to Turnagain Arm, and that the mud and other deposits characteristic of the Arm, near Sunrise, carried practically no gold. Altogether in the Sunrise district there were not more than half a dozen properties that reported any production in 1930, and of these few returned more than a couple of thousand dollars and most of them yielded only a meager grubstake.

North of Turnagain Arm, in the valleys of Glacier Creek and its tributary Crow Creek, the only placer property that reported any notable production of gold was that of Holmgren & Erickson, about 4 miles north of Girdwood. The placer that is being mined is bench ground on the north side of Cove Creek, where a face of gravel 25 to 30 feet high stands about 15 feet above the present stream. The deposit presents many puzzling geologic features, and its source is not evident, though certain aspects lead to the conjecture that much of the high gravel is more closely related to the valley of the main stream, Glacier Creek, whereas the gold appears to be derived from a more local Crow Creek source. The deposit presents many obstacles to easy mining, because much of it is frozen and does not break down readily under the attack of the hydraulic giants, and the lower part is full of large boulders that must be drilled and blasted before they can be got rid of through the sluice boxes. Somewhat south of this property, in a tract including the lower part of California Creek,

considerable development work was in progress by J. W. Dawson and associates. Much new construction and preparatory work was accomplished on this property, but when the region was visited in August no mining was in progress, and it is understood that none was undertaken later in the season.

In addition to the work in the main districts already enumerated a little placer mining was done at a few scattered places in the Cook Inlet-Susitna region, though the production from them was very small. A small amount of gold is reported to have been recovered from placers on Grubstake Creek, in the Willow Creek district—a deposit that has long been known and worked on a small scale each year. Small amounts of placer gold were also reported to have been mined at different points on Kodiak Island. Near Cape Alitak, in the extreme southern part of this island, showings of placer gold were reported to have been found on the Red River, and some local revival of interest occurred in 1930, when it was said that plans were under way to prospect these deposits. It is said that almost every year some natives resort to Tigidik Beach to recover enough placer gold to help pay for some of their needs. According to persons familiar with that region, the value of the gold thus taken out seldom amounts to more than a few hundred dollars.

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 little 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 a number of 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.

The gross output of placer gold from all the camps in the Yukon Valley in 1930 was worth $3,416,800, an increase of more than $1,350,000 over the corresponding figure for 1929. The increase, as already stated, is largely attributable to the extensive dredging work on the property of the Fairbanks Exploration Co., in the Fairbanks district, but was in no small measure due to the generally favorable weather conditions and fairly abundant water supply in 1930. In the following table the districts are arranged in order of their placer production in 1930, and for comparison the production from the same districts in 1929 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.

Value of placer gold produced in Yukon Basin, 1930 and 1929, by districts

District	1930	1929	District	1930	1929
Fairbanks and Richardson	$2,785,500	$1,145,000	Koyukuk and Chandalar	$17,800	$38,000
Iditarod	184,000	277,000	Eagle	16,000	16,000
Innoko	86,000	142,000	Kantishna and Bonnifield	8,600	10,000
Tolovana	82,000	118,000	Chisana	5,800	7,000
Hot Springs	78,500	82,000	Marshall	4,000	5,000
Circle	69,000	109,000	Rampart	3,500	5,000
Ruby	38,500	36,000			
Fortymile	37,600	68,000		3,416,800	2,058,000

In the foregoing table two small districts, the Richardson and Chandalar, have been grouped with the near-by larger districts, Fairbanks and Koyukuk, respectively, and two other small districts, the Kantishna and Bonnifield, have been combined. These combinations have been made so as to conform with groupings that have been made in 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 one or two 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 Chatanika River, Cleary and Pedro Creeks, and Goldstream; the Fairbanks Gold Dredging Co. on Fairbanks Creek; the Tanana Valley Gold Dredging Co. (Ltd.) on Fish Creek; and the Chatham Gold Dredging Co. on Chatham Creek, a tributary of Cleary Creek. Con-

siderable 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 Ester, Pedro, Vault, and Little Eldorado Creeks and the Big Chena and upper Chatanika Rivers and their tributaries. Several thousand dollars' worth of placer gold, in addition to that produced by the dredges, came from placers on Fairbanks and Fish Creeks. 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.

By far the most noteworthy mining feature of the Fairbanks district was the work accomplished on the extensive project of the Fairbanks Exploration Co., embracing the dredging of extensive tracts on Goldstream and Cleary Creeks and the Chatanika River, as well as ditch maintenance and operation of water supplies from sources as far distant as Faith Creek, near the head of the Chatanika. The actual mining operations on this project began in 1928 with the completion of the first of the company's five dredges, but the last dredge was not completed until September, 1929, so that 1930 was really the first year that the whole project was running on a full-time basis. The success of the operation depends on close coordination between the many different steps that intervene between the preliminary clearing of the surface and the recovery of the gold that lies beneath—operations that usually require about three years. Furthermore, many of the problems that have to be faced present new features that can be solved only after considerable experimentation, for they involve unusual conditions not encountered in dredging in more southern latitudes. The determination of the principles and the successful application of cold water to the thawing of the permanently frozen deposits that are being mined by this company in the Fairbanks district form a distinct contribution to the general art of mining that has been made by the engineers of this company and of those attached to the affiliated company in the Nome region. Except in volume of work accomplished, there was little change in the operations of the company during 1930. The plans had been laid with such forethought that they required little modification to execute, and the construction had been so adequately designed that there were few delays due to breakdowns. Even the relatively new long lines of ditches met satisfactorily the calls that were made on them to supply adequate amounts of water during periods of drought or to withstand excessive volumes during floods. Further details regarding the operation of these dredges are given in the section of this report on dredging (pp. 52–57).

The ill-defined district east of Fairbanks, here called the Richardson district, from the principal settlement in it, includes the old camp known as Tenderfoot, the Big Delta and Jarvis Creek area south of the Tanana, and parts of the Goodpaster and Salcha Valleys to the northeast and northwest. In this district about 12 men were reported to have done a little placer-gold mining or prospecting. The output of this entire district amounted to only a few thousand dollars in gold. One small camp on Tenderfoot Creek employed two men during the season. One camp of two men worked on Democrat Creek, a tributary of Banner Creek, and one prospector was reported to have taken out a little gold from Hinkley Gulch, which joins Buckeye Creek, also a tributary of Banner Creek. No details are available regarding the placer-mining operations on the other creeks here included in the Richardson district, and practically all of them were only development work. In the vicinity of the Jarvis Creek Basin, however, prospectors were at work on Savage Creek and on McCumber Creek and its tributary Morning Star, but all of this work is reported to have been merely of a prospecting character and to have yielded only a little gold. Some work is said to have been done in the valley of Big Delta Creek, but so far as reported this work consisted of little more than prospecting and preliminary development.

Placer mining in the Iditarod region was carried on in 1930 at a somewhat reduced rate from that of 1929, in spite of the generally favorable conditions whereby a fairly abundant supply of water was available for sluicing throughout most of the season. About 14 separate outfits, employing a total of 80 to 90 men, are reported to have done some productive mining during 1930, and there were, in addition, a few scattered prospectors who apparently recovered only negligible quantities of gold. The bulk of the gold recovered was mined by the dredges of the J. E. Riley Investment Co. on Otter Creek about 2 miles from Flat and the North American Dredge Co. on the site of the old town of Flat. On the whole, the returns from dredging were not as large as normal, and this probably accounts for much of the decrease in the production from the district. In addition to the dredge at Flat, three other outfits were mining on Flat Creek. The largest of these was the hydraulic plant of Strandberg & Son, near the head of the creek. The largest hydraulic and open-cut placer mining in the district was that done by the Chicken Creek Mining Co., under the management of William Duffy, who employed about 15 men. Several camps were maintained on Willow Creek, the largest of which were those of Manley and of Manley & Loranger. On Happy Creek, which is a tributary of Willow Creek, one camp employing six men had a fairly satisfactory season but expected a better one in 1931, as much time was lost in the installation of a

drag-line scraper. Three placer camps were hydraulicking on Otter Creek. There were two or three camps on other creeks in this same general district, including one each on Granite Creek and Malamute Pup.

Information received by the Geological Survey regarding placer mining in the Innoko region in 1930 has been less complete than usual, but it seems to indicate that much less gold was produced than in 1929. The principal reason for the decrease seems to have been that the dredges were not in operation much of the season. For instance, the dredge on Little Creek encountered considerable frozen ground and appears to have closed down early in July and to have remained idle during the rest of the season; the dredge on Yankee Creek was being reconstructed during most of the early part of the season, so that it was not ready to begin productive work until September; and the dredge on Ganes Creek was practically idle throughout the season. In addition to the dredges, the most productive camps in the district were those of Collins & Hard and Frank Meier, on Ophir Creek; Wilson & Hard and Greenberg & Jones, on Cripple Creek; Vibe and associates and Frank Speljack, on Little Creek; and Sidney Paulson, on Colorado Creek. In addition there were a few small camps whose production appears to have amounted at most to only a few hundred dollars. In spite of the apparently smaller output in 1930, there seem to be many indications that the district is likely to make a much better showing in 1931, when some of the development work that was accomplished in 1930 begins to bring in results.

In the Tolovana district, which in this report, as well as in the preceding volumes of the series, has been extended to include Nome Creek, a tributary of Beaver Creek, there was a falling off in placer-gold production in 1930 of about $36,000 from that of 1929. A large share of the placer gold produced in the district was mined by the dredge of the Nome Creek Dredging Co., under the management of Sam Godfrey. This dredge is reported to have produced less gold than in 1929, largely because much time was lost in getting it in running order in the spring and considerable development work was required during the season. Exclusive of the gold mined by this dredge, ordinarily about half of the placer gold produced by mines in the Tolovana district comes from drift mines, which are worked mainly during the winter and the pay dirt sluiced during the summer, and the other half comes from hydraulic or open-cut mines. During the winter of 1929–30, however, no drift mining is reported to have been in progress, so that the entire production reported came from placers operated only during the open season. One operator is reported to have started drift mining during the late fall and proposed to continue it during the winter of 1930–31. Most

of the larger producing mines are on Livengood Creek and its tributaries, Lillian, Ruth, and Gertrude Creeks. On Amy Creek, which is also a tributary of Livengood Creek, one outfit did considerable preparatory work incident to undertaking more extensive developments in 1931, but that work is not reported to have yielded any gold that is counted in this year's production. Some placer gold was also recovered from the Tolovana River and its tributaries east of Livengood Creek. Among these tributary streams the most productive was Olive Creek, which joins the Tolovana from the north, and Wilbur Creek, which enters it from the south.

The value of the placer gold produced in the Hot Springs district in 1930 was about the same as in 1929. About one-fourth of the gold from this district is recovered from drift mines and the other three-fourths from hydraulic and open-cut mines that are operated only during the summer. About 40 men were engaged in the drift mines and about 90 in the other placers, though many of the latter were men who had been drifting during the winter. In 1928 a considerable part of the placer gold output from the Hot Springs district was recovered by dredging. Unfortunately fiscal difficulties arose which caused the dredge to remain idle during 1929 and 1930. This condition is not generally regarded as indicating that the dredge would not be successful if given further trial, and as a consequence arrangements were in progress for the creditors to lease the dredge and resume mining. This plan, however, was not consummated in time to permit any productive dredging to be started in 1930. The Hot Springs district, as here defined, consists of two rather separated parts—one including the western part of the district, near Tofty, and the other the eastern part, which may be spoken of as the Eureka Creek section. In the vicinity of Tofty the largest operations were those of Bock & Hansen, on Deep Creek, and of Tillison & L'Heureux, on Sullivan Creek, but several smaller camps were active on Boulder, American, Woodchopper, Miller, and Quartz Creeks. In the Eureka Creek section of the Hot Springs district the largest operation was that of J. R. Frank & Co., on Eureka Creek, where considerable gold was recovered by hydraulicking. This company also has extensive holdings on Doric, Seattle, and Skookum Creeks. In addition to these larger camps there were a number of others of only one to five men each. On Pioneer, Thanksgiving, Glenn, Omega, and Gold Run Creeks the value of the gold produced by some of the smaller camps was only a few hundred dollars, but others produced several thousand dollars each.

The production of placer gold from the Circle district in 1930 was almost $40,000 less than in 1929 and was considerably less than in the preceding years when the dredge of the Berry Dredging Co. was in operation and there were many more miners in the district.

It is reported that arrangements have been perfected by which the dredge will be leased and moved to Deadwood Creek, a distance of about 20 miles, and put to mining again next season. From all accounts the water supply during most of the season was larger than normal, so that most of the operators had an adequate supply for mining. Altogether there were about 16 productive camps in the district in 1930 and they employed about 50 men. The largest hydraulic mining operations in the district were those of the Berry Holding Co., on Eagle Creek, and of the C. J. Berry Dredging Co. and J. A. Anderson, on Mastodon Creek. These mines employed about 23 men. On Mastodon Creek, in addition to the two large properties, there was one smaller camp that reported a reasonably satisfactory season. On Deadwood Creek and its tributary, Switch Creek, five small camps employing a total of 12 men maintained an output of gold comparable with that taken from this valley in 1929. A crew of half a dozen men were busy during much of the later part of the season on Deadwood Creek, putting in a ditch for use in 1931 in connection with the proposed dredging operations. On Independence Creek three small camps were engaged in mining. There were also camps of one to three men each on Bonanza, Harrison, Woodchopper, and Miller Creeks, but the production from none of them was worth more than a few thousand dollars.

Early in 1930 the papers of the country carried bold headlines announcing the discovery of rich gold placers in the vicinity of Poorman, a small settlement south of Ruby. The excitement caused by this announcement gripped people far and wide, and before long a veritable stampede was in progress. It was soon proved that the placer deposits which had been discovered were of commercial value but not of such extent or richness as to justify the great influx of stampeders. The new discoveries were in the general neighborhood where placer mining had been in progress for many years and appeared to be entirely comparable with the already known deposits in the region. The newcomers found much of the readily accessible ground already preempted, and so before long the tide turned and the stampeders drifted away, until by the end of the year practically all of them had departed and the camp had resumed its more normal aspects. The discoveries, however, did exert a stimulating influence on those who remained, and they have carried on their prospecting with quiet but persistent zeal and recovered considerable gold from a number of new creeks in the vicinity of Poorman. There is every reason to believe that as the search is continued other similar deposits will be found. In fact, thorough and intelligent prospecting is likely to be rewarded by worth-while discoveries of deposits which, though probably more or less localized and restricted, will repay their finders. The most productive creeks in the Poorman district were

Poorman Creek itself and its tributaries Moose and Beaver Creeks. Nevada and Eldorado Creeks, also tributaries of Poorman, have shown good prospects, and work in progress on them in the winter of 1930–31 was being watched with keen interest. Nearer Ruby and in some of the longer-known creeks some placer gold continues to be mined each year. Of these creeks the most productive in 1930 were Flat, Long, and Greenstone, but some gold is said to have been recovered from Tamarack, Meketchum, Bear Pup, and Big Creeks.

Placer mining in the Fortymile district yielded somewhat less gold in 1930 than in 1929. Part of the explanation lies in the fact that considerable development work was in progress, which cut down proportionately on productive mining. The water supply in the district was considerably below normal during most of the season when placers are worked, for although it was fairly abundant in the early part of the season and even excessive during September, it was very deficient from the latter part of June to the early part of September. The serious handicap that a mining company faces if the water supply is deficient has led the largest operating company in the district to consider rather favorably supplementing its already extensive hydraulic plant with a dredge in the near future. In the Fortymile district both drift mining and open-cut mining are practiced, though the amount of gold recovered from the drift mines is only a small part of the total. During the season of 1930, 17 separate camps, employing a total of about 40 men, were mining in the Fortymile district. The largest mine in the district is that of the Walker Fork Gold Corporation, which is on Walker Fork and operates a drag-line scraper. The Alaska Consolidated Gold Corporation, under the management of Lee Steele, acquired during the year extensive holdings on Dome and Chicken Creeks and plans, after it has perfected its arrangements, to carry on large-scale mining. The principal other streams from which placer gold was obtained are the Fortymile River, Franklin Gulch, and Napoleon Creek.

In the Eagle district the production of placer gold in 1930 appears to have been the same as in 1929. There were 9 camps, employing about 25 men, engaged in mining. The largest amounts of gold appear to have been produced by the July Creek Mining Co. on Fourth of July Creek and by Froelich, Kummer, Ott & Scheele on Crooked Creek, but some gold was recovered from Dome, Alder, American, Nugget, and Broken Neck Creeks and the Seventymile River. According to local reports there was at least a normal amount of water for mining available during most of the season—in fact, at places there was some difficulty because of too much water, heavy rains beginning in August and keeping up almost uninterruptedly until the freeze-up. The enlarged operations on Dome Creek were discontinued early in July. About a dozen men were employed at

this mine. The new hydraulic plant on Barney Creek, whose installation was begun in 1929, was completed during 1930 but accomplished only a small amount of mining by the end of the season.

There was a very marked shrinkage in the output of placer gold from the Koyukuk district in 1930—so great, in fact, that the production appears to have been less than at any other time during the last 30 years. Possibly some of the apparent shrinkage may be due to errors made by the compiler of these records, as the records from this district were meager, and some of its production may have been overlooked and credited to some other district. Part of the explanation of the decrease is to be found in the fact that the season opened rather late and closed early, and during most of the open season the rainfall was light. The usual supply of water from melting snow in the spring also failed to be of much service to the miners, because it ran off very early with the spring floods instead of being produced gradually and so being available for a longer time.

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. Reports from the area near the head of the Koyukuk indicate that about 20 different camps, employing about 40 men, were engaged in mining there in 1930. A large amount of work was done on Nolan Creek and on the benches near its mouth and for some distance upstream. Elsewhere in the general vicinity of Wiseman some placer gold was mined in 1930 on Wiseman, Smith, Vermont, Myrtle, Porcupine, and Minnie Creeks, all of which are tributaries of the Middle Fork of the Koyukuk River, or on streams that flow into these tributaries. Northeast of Wiseman, in the valley of Lake Creek, a tributary of the Bettles River, some placer mining was reported to have been in progress. The drilling that had been started to prospect some of the gravel on the South Fork of the Koyukuk River was discontinued. In the valley of the North Fork, which is the next large tributary of the Koyukuk River, west of Wiseman, about five men were mining during at least part of the summer. Still farther west, in the next large valley, that of the Wild River, considerable mining activity was shown along the main stream and in the valleys of its tributaries Surprise and Spring Creeks. About a dozen white men and eight natives were working

various claims that were reported to afford good showings of gold, though many of them presented difficulties to be overcome before they could be mined profitably. Still farther west, in the valley of the John River, four prospectors were reported to have spent the summer, but the outcome of their work was not reported. Much of the Koyukuk district lies in one of the more remote and inaccessible parts of Alaska, so that its development presents many obstacles, but the demonstrated extent and richness of its mineralization will inevitably lead to its development. However, success in bringing this about will call for the skill, persistence, and courage of the best miners and prospectors.

In the table on page 32 the placer-gold production of the Chandalar district has been combined with that from Koyukuk. The amount of gold that comes from the Chandalar is much less than that from the camps in the Koyukuk Valley. So far as reported, practically all the placer gold recovered from the Chandalar district in 1930 came from the properties of A. L. Newton, on Big Creek. A small amount of gold was also taken from a claim on Little Squaw Creek, but most of the work at this claim was of a prospecting character, consisting in crosscutting the valley to determine the position and extent of the old channel. Local reports state that a hydraulic outfit is being installed on Big Creek about a mile below the Newton property but that there has been considerable delay in getting it into operation because of difficulties experienced in freighting the necessary supplies to the property. A little prospecting was done at claims on Dictator and Tobin Creeks. At the Tobin Creek claims the prospects found are said to have been distinctly encouraging, and further crosscutting will be done.

The Geological Survey has received very little first-hand information regarding mining developments in the Chisana (locally called Shushanna) district. Apparently mining was in progress on not more than six properties during the year, and at most only about 12 men were employed. The water supply of the district is said to have been especially deficient, and as a result most of the operators lost much time, and some of them were forced to discontinue work entirely. A dam was built on Discovery claim, Bonanza Creek, but the water got so low that it ceased to be usable. No new discoveries were reported from this district, and the production appears to have come from the less accessible patches of ground that were passed over in the boom days of the camp. The largest amount of gold recovered from this district in 1930 appears to have come from placers on Little Eldorado Creek, owned by Carl F. Whitham and mined under lease by B. J. Davis. Three men were engaged in mining on this claim. It is interesting to note that in the course of sluicing several pounds

of copper nuggets were recovered in the concentrates. On Gold Run Barney McKinney and partner cleared several thousand square feet of bedrock but, like others in the district, were badly hampered by shortage of water.

Placer mining in the Bonnifield district was carried on by a total of about 20 men working in 8 or 10 small camps, the largest of which employed not more than four or five men. The greatest amount of gold was recovered from claims on Gold Run and on Grubstake Creek, a tributary of the Tatlanika River. Smaller camps on Marguerite, McAdams, and Moose Creeks produced not more than a few hundred dollars in gold each. The production from this district has been combined in the table on page 32 with that from the Kantishna district, but it may be stated that the placer gold from this district was considerably more than half of the combined total. In the Kantishna district there were altogether not a dozen men engaged in placer mining or prospecting, and they were distributed through a number of small camps on several of the creeks, notably Eureka, Little Moose, Glen, and Yellow 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.

Willow Creek was the source of most of the placer gold that was mined in the Marshall district in 1930. This stream enters the Yukon a few miles upstream from the settlement of Marshall (Fortuna Ledge post office) and heads in hills composed principally of Upper Cretaceous sediments and Paleozoic greenstones and related rocks. Within the hills Willow Creek flows in a narrow-floored valley whose deposits contain many large boulders that interfere seriously with mining. Only a few miners or prospectors still remain in the district, and consequently the annual work that they accomplish in prospecting this large tract of country is small. Some placer gold was also recovered from the gravel of Montezuma Creek. About 50 miles northeast of Marshall, in the valley of the Stuyahok River, a tributary of the Bonasila River, there was considerable activity in preparing for the installation of a hydraulic plant. It is reported that the pipe and other equipment were landed at a point on the Yukon about 9 miles from the claims and were to be hauled to the mine by dog teams during the winter of 1930–31. Construction and other preliminary work will doubtless require a large part of the season of 1931, so that the plant will probably not be in full running order until at least the second season. The results of this work will be watched with considerable interest, as it should throw light on the geology and mineral resources of this little-known tract.

Records received by the Geological Survey regarding placer mining in the Rampart district indicate that six camps were active during 1930, and most of these were small one-man operations that recovered only a few hundred dollars' worth of gold. The greatest amount of gold was recovered from the placers on Little Minook Creek, where there were two camps. Other camps that were reported as producing some gold were two on Hunter Creek, one on Little Minook Junior, and one on Slate Creek. Some winter work was done by one man at Idaho Bar, and prospecting was in progress during the summer on Hoosier Creek. 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 1930 on Grant, Mason, and Moran Creeks. Only a little gold was recovered in the course of this work, but it is significant as indicating a renewal of mining interest in this district, and on at least one of the properties the showings already found are said to be sufficiently good to convince the owner that they warrant the installation of a hydraulic plant.

KUSKOKWIM REGION

Included in the Kuskokwim region are four principal districts where gold placers were mined in 1930. For convenience of description they may be called the Mount McKinley, Georgetown, Tuluksak-Aniak, and Goodnews Bay districts. The Mount McKinley district 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 is in the central part of the Kuskokwim Valley, and work there centers more or less closely around the settlement of Georgetown, on the Kuskokwim, about 45 miles in an air line south of Iditarod. The Tuluksak-Aniak district is named from two rivers that traverse parts of it; the Tuluksak enters the Kuskokwim from the south about 40 miles east of the settlement of Bethel, and the Aniak enters the Kuskokwim about 50 miles farther upstream, to the east. Goodnews Bay is a small indentation of the coast on the east side of Kuskokwim Bay, about 125 miles in an air line south of Bethel.

The production of placer gold in the Kuskokwim region in 1930 showed a great decrease from 1929, largely owing to the fact that the dredge which for several years had been mining in the Tuluksak-Aniak district was closed down throughout the season and the company that owned it leased other dredging ground and equipment in Seward Peninsula. This move was not unexpected, as it had been announced by the company before stopping work the preceding fall, but it has certainly had a very marked effect on the produc-

tion of the region. So far as known, no other dredges were in operation elsewhere in the Kuskokwim region in 1930, though there appear to be places that would warrant careful inspection of their suitability for this sort of mining. The dredge that for many years was so productive in the Candle Creek Valley, near McGrath, was again idle, as it has been since 1928, and apparently no plans are now under consideration for its early reconditioning. In fact, it is reported that some of the machinery from this dredge has been removed to be used in one of the dredges in the Innoko district.

Reports regarding placer mining in the Mount McKinley district are extremely meager, and so far as could be learned most of the work was done by several one or two man camps at widely separated points, most of which, however, are adjacent to McGrath or in the hills north of the Kuskokwim farther upstream, near Medfra. Among the streams near Medfra from which some placer gold was produced in 1930 may be mentioned Ruby, Hidden, and Eagle Creeks and Holmes and Riddle Gulches. There were less than a dozen men employed in this work, and no notable new finds appear to have been made. The greatest amount of gold was recovered from the properties of F. E. Matthews, on Hidden Creek, and of Pearson & Strand, on Ruby Creek. Mining is carried on only during the summer, and most of it is done by ordinary open-cut or simple hydraulic methods. The principal stream on which placer mining was done in the vicinity of McGrath was Candle Creek, on which one camp was established. A small amount of productive mining was also reported to have been done on Moore and Black Creeks and Alder Gulch.

The vast, slightly explored or even totally unexplored area that is embraced in the Mount McKinley district is regarded as country that well deserves more thorough examination and intelligent prospecting, not only for workable gold placers but also for other mineral deposits.

Mining in the Georgetown district appears to have been restricted to work on Donlin Creek, where one camp was engaged in mining a bench deposit by means of a small hydraulic plant. Although only a small amount of gold was recovered, the returns in relation to the amount of work and expense involved appear to have been very satisfactory to the operators.

In the Tuluksak-Aniak district the main item of significance was the cessation of mining by the dredge of the New York Alaska Dredging Co., on Bear Creek. Considerable gold was recovered from placers on Marvel Creek, a tributary of the Salmon River, which in turn flows into the Aniak River, and from Canyon Creek, a tributary of the Kwethluk River, on the western slopes of the Kuskokwim Mountains, east of Bethel. The largest camp on Marvel

Creek was on ground owned by L. C. Hess. Seven men were employed at this camp, and the reports indicate an especially good season. The principal mine on Canyon Creek was in charge of O. K. Anderson and was worked by open-cut methods by four men. A few prospectors were reported to have been carrying on a search for placers on several of the streams that head in the general vicinity of Marvel Dome, and there is said to be some revival of interest in prospecting throughout the area, but returns from this work have not yet indicated any notable increase in the output of placer gold.

The production of placer gold in the Goodnews Bay district in 1930 showed some improvement over that for the preceding year, though far less than it was in earlier years. Only three camps, of one man each, are reported to have mined placer gold in the district in 1930. These camps were on Wattamuse, Bear, and Olympic Creeks. The interest that has been awakened in searching for placers carrying platinum in the country to the south of Goodnews Bay has evidently called away many of the prospectors who heretofore have been searching for gold. As a result the production of gold from this district has gone down while the production of platinum has gone up. Very little gold is found associated with platinum in the placers that are being worked, notably on Clara, Squirrel, Platinum, and Fox Creeks, all tributary to Salmon Creek, which in turn empties into Chagvan Bay. Further notes on this work are given in the section of this report which treats of platinum. Perhaps the most important mining event of the year in the district was the resumption of drilling in the Arolic River Valley to test the possibilities of that region. This work was done by the Pioneer Gold Dredging Co., with a crew of six men using a hand drill. The deposits that are being tested consist of unfrozen deep gravel that would be difficult to mine economically, except by means of a dredge. An extensive tract is being examined, so that it is not expected that the drilling will be completed or that the company will reach a decision as to the practicability of development until at least another season's field work has been done.

SEWARD PENINSULA

The production of placer gold from Seward Peninsula in 1930 was $1,191,200, or about half a million dollars less than in 1929. It should be realized, however, that 1929 was a year of exceptionally large production in Seward Peninsula, the largest since 1917. Therefore the comparison does not indicate a permanent downward trend of the industry, but only that the high level of 1929 was not maintained. Part of the falling off in production is to be attributed to the early closing down of mining work at one of the large dredges, which was dismantled to be moved to a new location some 1½ miles

distant. The amount of water available for mining was in general adequate throughout the season—in fact, persons inconvenienced by the rainfall describe the season as distinctly wet. No noteworthy new finds were reported as having been made during the year, but several new enterprises were started, as mentioned in the following paragraphs.

Approximately $1,053,000, or over 88 per cent of the total gold recovered from Seward Peninsula placers, was mined by 12 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 in a later section of this report. In the relative order of their output of placer gold in 1930 the mining districts of Seward Peninsula stood as follows: Nome, Fairhaven (including the Candle and Inmachuk districts), Council, Solomon (including the Casadepaga River region) the Koyuk River region, Kougarok, Port Clarence, and Bluff. 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 region, 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 Wonder Creeks, its scores of claims, and its extensive ditches and other equipment for properly conducting its work. Early in September this company discontinued mining with the large No. 2 dredge and spent the rest of the season dismantling it preparatory to moving it across the tundra to Center Creek. The actual moving was not undertaken until cold weather had frozen the surface of the ground enough to bear the great weight of the dredge. On Newton Gulch, near Nome, the Dry Creek Dredging Co. reported a successful season. East of Nome, on Hastings Creek, the reconstructed dredge was mining during part of the season. Details regarding the results accomplished are not available, but though it was run for only a short time its performance was apparently satisfactory. The Osborn Mining Co., which operates a dredge on Osborn Creek, east of the Nome River, apparently experienced many difficulties in mining its ground, so that it discontinued work early in the season without having accomplished much productive work. A short distance outside the town limits of Nome a mechanical mining device, made up largely of discarded parts from old dredges and other mining apparatus, was completed late in the season and was used long enough to return some gold to its operators. In addition to the dredges, small open-cut mines were being developed on several of the creeks adjacent to Nome. Most of these mines

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 Snake River, where eight men were employed for most of the open season. The generally favorable stage of water throughout most of the district caused many of these smaller operators to have a fairly successful year, and although the production from many of the individual mines did not exceed a few hundred dollars each, they collectively contributed a considerable amount to the total production of the district.

The greatest amount of placer gold mined in the Fairhaven district came from three main tracts—Candle Creek, the Inmachuk River, and Bear Creek. 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 dredge of the Keewalik Mining Co. This dredge and the claims belonging to the company were leased to the New York Alaska Gold Dredging Co., which formerly was dredging in the Tuluksak-Aniak district, in the Kuskokwim region. The company appears to have had a successful season, though it seems to have made no finds of especially rich ground and carried on the work at about the same rate as that at which the company that gave the lease had been working during recent years. 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 hydraulic mine of A. V. Cordovado, on the Pinnell River a short distance upstream from its junction with the Inmachuk. At this property about 24 men were employed throughout the open season. Unfortunately, owing to the very wet season, the operators of this property had much difficulty in keeping the ditches in repair, and this work resulted in taking much time of the men away from productive mining. As a consequence the cut that was being hydraulicked was not finished, and none of the sluice boxes were cleaned up to recover the gold they contained. The cut will doubtless be completed early in the spring of 1931, and if other conditions are favorable the production of that year should be especially large, as it will represent nearly two seasons' work. A little placer mining and prospecting was carried on at other points in the valley of the Inmachuk and its tributaries. Prospecting was continued in search of any auriferous channels that might have been buried under the lava flows that cover large tracts at the heads of the Inmachuk and the neighboring

streams adjacent to Imuruk Lake. This search has been in progress for several years, but no deposits that appear to warrant mining have yet been reported, though indications of placers have been encountered in many of the shafts that have been sunk in the course of this work. It is reported that negotiations have been in progress looking toward the acquisition of an extensive tract in the Inmachuk region, with a view to installing a dredge there if conditions prove to be suitable.

The third tract in which placers were mined in the Fairhaven district, that on Bear Creek, lies east of the 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, but the absence of news indicates that there have not been any notable developments during the year and that the production was probably maintained at about the same rate as in the last few years, when not more than a few thousand dollars was produced annually.

In the Council district, as in the other larger producing districts of Seward Peninsula, most of the placer gold produced in 1930 came from dredges. Two dredges, one belonging to the Ophir Gold Dredging Co. and the other to the Northern Star Dredging Co., mined on Ophir Creek and report fairly good operating conditions. One hydraulic mine was also being operated on Ophir Creek, and small outfits were working on Melsing Creek and its tributary, Benson Gulch. A little gold was also recovered from Rock and Aggie Creeks, which are tributaries of the Fish River. Although there were several individual prospectors scattered through the region adjacent to Council, the amount of mining has been so reduced that in 1929 the office at Council for recording claims was officially closed, the district was formally made part of the Nome district, and all the records were removed to Nome.

In the Solomon district by far the larger part of the placer gold in 1930 was recovered by the dredges of the Goldsmith Dredging Co. and the Spruce Creek Dredging Co. The dredge of the Goldsmith Dredging Co. is situated in the Solomon River near the mouth of Coal Creek. The gravel that it is mining is shallow, and in places considerable seasonal frost is encountered, but by keeping close to the present stream the operators are able to avoid much of the frozen ground. The dredge of the Spruce Creek Dredging Co. is situated on Spruce Creek, about 6 miles east of Solomon, which through most of its course is flowing in a valley carved in coastal-plain sediments. This dredge was formerly used for mining on Shovel Creek by the Shovel Creek Dredging Co. Much of the season of 1930 was spent in reconditioning this dredge after it had been brought to its new site, so that only part of the season was available for productive mining.

In that period, however, it seems to have demonstrated that it is success in its new location, and doubtless its output will be much in creased in 1931 if it can utilize the full open season.

North of the valley of the Solomon River is the valley of th Casadepaga River. At one time considerable placer gold was wo from the gravel deposits of the tributaries of this river, but lately th amount recovered has been insignificant. The small dredge formerl known as the Peck dredge, which had been mining along the mai river, was badly damaged by ice during the break-up in the spring o 1930 and was out of commission all the year. A little developmen work was done near the mouth of Ruby Creek, and a mechanica device of novel pattern was built there in 1930 but was completed to late to produce any significant amount of gold.

The Koyuk district, as the term is used in this report, include most of southeastern Seward Peninsula and is so named from th principal stream that traverses it. Most of the placer deposits tha are mined are on Dime Creek and a few of the other streams in th vicinity of Haycock. Although there is one small dredge in the dis trict, the bulk of its placer gold came from bench and creek placer mined by hydraulic or open-cut methods. One camp, employing tw men, was mining during the winter, and five camps, employing a tota of about eleven men, during the summer. All these camps were o Dime Creek except one on Sweepstake Creek.

Placer mining in the Kougarok district, in central Seward Penin sula, was done entirely by hydraulic and open-cut methods. Most o the camps in the Kougarok district were small one or two man affairs and the largest employed only three or four men. Their individua output of gold was small, none reporting a yield of more than a few thousand dollars. These camps were situated not only in the valley of the Kougarok River and its tributaries, but also in some of th more remote valleys. One of the rather remote properties is that o the Dick Creek Mining Co., on Dick Creek, which lies north of th Kougarok and flows into the Serpentine River. At this place a unique method of stacking tailings has been in use for several years The ground for most of the season was of very low grade, but jus before the end of the season it prospected much better, and the owner look forward to a much larger production in 1930. The old Bering or Matthews dredge, which was sunk in the Kougarok River, wa bought by the Henry Creek Gold Dredging Co., which expended considerable work and money on overhauling it and putting it int shape. The task took longer than was expected, and the costs were s heavy that for a while the company was financially embarrassed These difficulties were finally adjusted, but not in time for the dredg to engage in productive mining in 1930. Most of the rehabilitatio

has been accomplished, so that it will probably be in shape to do considerable mining in 1931 of the placer deposits in the area adjacent to Henry Creek.

South of the Kougarok district, in the vicinity of Iron Creek, four 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 engaged in constructing a ditch to lead water for use in hydraulicking placer ground on that stream. The entire production of gold from the Iron Creek region, however, was so small that it amounted to little more than wages for the men concerned.

In the Port Clarence district a little placer gold was mined on the Bluestone River and some of its tributaries, especially Windy and Gold Run Creeks. A little placer gold was also mined on Coyote Creek, which enters Grantley Harbor about 2 miles east of Teller, and on Ilene and Burke Creeks. No first-hand information is available regarding mining operations in the region north of Teller, but it is reported that one camp on the Agiapuk River produced a little placer gold and that there were also one or two prospectors in that region. For the last few years reports have been current that a dredge was to be installed on an extensive tract of placer ground on the Bluestone River. No further steps appear to have been taken during 1930 to carry out this plan. Several other projects to build dredges in the Port Clarence district have been rumored, but none apparently have advanced far enough to be regarded as more than possibilities. Thus it is stated that a company was dismantling one of the old dredges in the Nome region preparatory to transporting it to Deese Creek, some 4 miles east of Teller, where it was to be reconstructed, and to commence mining. It was also reported that dredging might be undertaken in the near future on Budd Creek, a tributary of American Creek, which in turn is a tributary of the Agiapuk River.

In the Bluff area, which lies east of Solomon and which for convenience is often grouped with the Solomon district, only a few small placer mines were operated in 1930. The largest amount of placer gold came from a mine on Koyana Creek and one on Swede Gulch, but some was also taken from claims on Daniel, California, Silver Bow, and Eldorado Creeks. No work was done in 1930 on the beach claims at Bluff, which had been equipped during an earlier year with a scraping plant.

Lying east of Seward Peninsula but more or less closely related to it is the Bonanza district, so named from the small stream in it which has long been known to carry some placer gold. Prospecting has been carried on at several places in this general area

and for the last two or three years has been especially active 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 bedrock throughout 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 region is well justified. Whether the ancient beaches will prove to be gold bearing, however, depends on the occurrence of mineralization in the material that has 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.

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 1930. 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.

In the area near Kiana three men were reported to have done a little prospecting and recovered a small amount of gold from two separate patches of placer ground on Klery Creek and its tributaries. The proved occurrence of gold in this area is an incentive for further search for workable deposits, but the field of search is so large and the number of prospectors to do that work is so small that progress in really testing out its worth is extremely slow. The present total production of gold from this tract amounts to little more than a meager grubstake for the workers.

In the tract that lies 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 the finding of many quartz veins carrying free gold in the metamorphic rocks that form the hills in which these streams rise or which they traverse. In 1930 five small camps, employing a total of 11 men, were established on streams in the vicinity of Shungnak. Two of these were on Dahl Creek and one each on Lynx Creek, California Creek, and the Shungnak River. Lynx and California 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. The largest producing camp is that on California Creek, where about four men are employed and mining is carried on by hydraulicking. On the Shungnak River most of the work was directed toward testing and prospecting the ground to determine the practicability of mining on a large scale by dredging or hydraulicking. This work was done by the Alaska Kobuk Mines (Inc.), under the general direction of Col. G. W. Rathjens, formerly of the Fairbanks Exploration Co., and under the direct field management of C. E. Alexander. The most intensive work by this group has been done near the northern border of the Kobuk lowland, a short distance south of the point where the Shungnak River leaves the hills. A light drill rig that can be moved readily from place to place is used in prospecting, as it is difficult to reach bedrock by other means, owing to the wetness of the ground. Four men have been employed more or less continuously on this work, and although no public announcement of the results has been made, there is little doubt that they are sufficiently encouraging to make the company feel that continuation of the work is abundantly justified. The remoteness of the district makes mining there expensive, as transportation facilities for moving heavy supplies and equipment are meager. 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.

In addition to the prospecting near Shungnak already mentioned, one man is reported to have done some winter work on Agnes Creek, a tributary of the Ambler River, some distance north and west of Shungnak. No information has been received regarding the results of that work, but the very absence of news about it suggests that no finds of much economic importance were made. It is also reported that a party of three men spent much of the winter and spring of 1929–30 on the Reed River, which is a tributary from the north near the head of the Kobuk. Their time is said to have been spent in trapping and prospecting, but no information is available regarding the results of their search for minerals.

DREDGING

More than 81 per cent of all the placer gold produced in Alaska in 1930 was mined by dredges. The total gold recovered by dredges was $3,912,600, of which the greater part came from 15 dredges in the Yukon region and the rest from 12 dredges in Seward Peninsula. This total exceeds by almost a million dollars the amount recovered by dredges in 1929, and the increase is largely due to increased production from the new large dredges installed in the Fairbanks region. This total exceeds the amount heretofore produced by dredges in any year since this method of mining was started in Alaska. The accompanying table gives the output of gold by Alaska dredges beginning in 1903, the earliest year for which records are available.

Gold produced by dredge mining in Alaska, 1903–1930

Year	Number of dredges operated	Value of gold output	Gravel handled (cubic yards)	Value of gold recovered per cubic yard
1903–1915		$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	5,730,006	.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
		42,920,000		

The total value of the gold produced by dredges since 1903 is about 16.5 per cent of the total value of gold produced from all kinds of placer mining since 1880, and lately there has been a constant tendency each year for a greater and greater percentage of the placer output to be mined by dredges. During 1930 the ratio of dredge production to the output from all other kinds of placer mining was nearly 81 to 19, and there are no signs of a diminution in dredge mining in the near future—in fact, an even higher ratio seems not unlikely.

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 $3,697,330 in gold, or a little less than 94½ per cent of the total mined by dredges, report that that amount came from 9,361,307 yards of gravel. The average yield thus shown is about 39½ cents in gold to the cubic yard. Applying this average to determine the unreported yardage gives a total of 9,906,000 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 large volume of gravel than was actually handled. This method, however, has been followed for the last seven years, so that the quantities and values given for 1930 are comparable with those reported for the preceding six years. If this value as stated is correct, it will be evident from the table that the average tenor of the ground dredged in 1930 was considerably higher than the average of the ground dredged in the years 1927 to 1929, 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 269 days for one of the dredges of the Fairbanks Exploration Co., which was operating in the Fairbanks district of the Yukon-Tanana region. This stands as the record for the longest working season that has been attained by any of the dredges operating in Alaska. The longest season reported for any of the Seward Peninsula dredges in 1930 was for one of the dredges of the Hammon Consolidated Gold Fields, at Nome, which mined for a period of 168 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 April 21 and did not stop its last dredge until January 16, 1931. The earliest date for beginning dredging on Seward Peninsula in 1930 was May 20, and the latest date for ending was November 5, both reported by the Hammon Consolidated Gold Fields. The average length of working season in 1930 of the eight dredges for which information is available (and in determining this average only one dredge each is counted for the Fairbanks Exploration Co., the Hammon Consolidated Gold Fields, and the Fairbanks Gold Dredging Co. (Ltd.) instead of the five, three, and two operated by these companies, respectively) was 139 days. Obviously, the shortness of the average season as compared with the record of 269 days was not due to climatic conditions but to breakage or some purely local reasons at the different dredges. The lesson that is demonstrated by the record of the long working season of the dredge at Fairbanks is that for moderate-sized dredges handled skillfully a season of

more than 200 days may be achieved at almost any camp in interior Alaska and that under ordinary conditions a working season of more than 150 days may be attainable by most modern dredges almost anywhere in the Territory south of the Arctic Circle.

Although, as stated, the longest working season for any one dredge so far reported was attained in 1930, it must not be inferred that climatically this was an exceptional season. The record for 1929 shows a working season at one of the Fairbanks dredges of 232 days. In 1926 a dredge began work in the Cache Creek district of the Cook Inlet-Susitna region on May 5 and a dredge in the Nome region did not shut down until December 4—in other words, these two dredges spanned a working period of 213 days.

The following is a list of dredges that did some productive mining during 1930:

Yukon Basin:	
Fairbanks district—	
Chatham Gold Dredging Co.	Chatham Creek.
Fairbanks Exploration Co. (5)	Goldstream and Cleary Creeks.
Fairbanks Gold Dredging Co. (Ltd.) (2)	Fairbanks Creek.
Tanana Valley Gold Dredging Co. (Ltd.)	Fish Creek.
Iditarod district—	
North American Dredge Co.	Otter Creek.
J. E. Riley Investment Co.	Do.
Innoko district—	
Felder-Gale & Higgins	Yankee Creek.
Flume Dredge Co.	Little Creek.
Gibbs & Eison	Ganes Creek.
Tolovana district—Nome Creek Dredging Co.	Nome Creek.
Seward Peninsula:	
Council district—	
Northern Star Dredging Co.	Ophir Creek.
Ophir Gold Dredging Co.	Do.
Fairhaven district—New York Alaska Gold Dredging Corporation	Candle Creek.
Koyuk district—Dime Creek Dredging Co.	Dime Creek.
Nome district—	
Dry Creek Dredging Co.	Newton Gulch.
Hammon Consolidated Gold Fields (3)	Old beach line.
Hastings Creek Dredging Co.	Hastings Creek.
Osborn Mining Co.	Osborn Creek.
Solomon district—	
Goldsmith Dredging Co.	Solomon River.
Spruce Creek Dredging Co.	Spruce Creek.

During 1930 five dredges that had been active in 1929 were idle, but some mining was done by two old dredges that had not been in operation in 1929. The net result of these changes was that the total number of active dredges in 1930 was 27. The dredges that were active in 1929 but idle in 1930 were the dredge of the American

Creek Dredging Co., in the Hot Springs district; one of the dredges on Ganes Creek, in the Innoko district; the Bear Creek dredge, in the Tuluksak-Aniak district of the Kuskokwim region; the Bangor dredge, in the Nome district; and the Casadepaga dredge, in the Casadepaga district of Seward Peninsula. The two old dredges that renewed mining in 1930 were those of the Spruce Creek Dredging Co. in the Solomon district and the Hastings Creek Dredging Co. in the Nome district. The Spruce Creek dredge was formerly owned by the Shovel Creek Dredging Co. but was sold in 1929 and moved to its new site on Spruce Creek, about 6 miles east of Solomon. The Hastings Creek dredge had long been idle, but a start was made on reconditioning it in 1929, and that work was completed during the spring and early summer of 1930. Neither of these dredges was ready to operate throughout the season of 1930, so that their production was not as large as it should be another year. Although not properly to be credited to the list of dredges that began operations in 1930, it may not be out of place to mention here the two dredges of the Fairbanks Exploration Co., which were built in 1929 but were completed so late that they contributed only a little of the placer gold that was mined that year, so that their first full year of mining was 1930. One of the dredges was built in the old Wagner mining pit, a short distance east of the town of Fox, and the other was built just opposite the old settlement of Cleary, on Cleary Creek, below the point where the large siphon crosses that stream. All the five dredges now owned by the Fairbanks Exploration Co. are models of up-to-date, efficient machines so designed as to be adapted to the special conditions that will be met in the individual places they are to mine.

Much of the placer ground at practically all the places where dredges are now working in Alaska is more or less completely 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 the largest force of workmen required comprises those employed in the various tasks connected with the thawing of the ground in advance of mining. In addition to the labor costs for thawing operations, there is need for large supplies of water, both for thawing and also 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 settling of the ground has not taken place.

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 all 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 who would be able to carry through any enterprise they undertook. Among the places in the Yukon region thus indefinitely discussed are part of the Beaver Creek lowlands, the lower or northern part of Nome Creek, various tracts in the vicinity of Chicken in the Fortymile district, an area on Central Creek in the Circle district, and parts of the Livengood Valley in the Tolovana district. Mention has already been made of the prospecting in progress on the Arolic River, in the western part of the Kuskokwim Valley, where a considerable force of men were engaged in drilling during most of the open season of 1930. In the Seward Peninsula region the rumors concern tracts of the Bluestone River, in the Port Clarence district south of Imuruk Lake, and on Budd Creek and the Agiapuk, north of Imuruk Lake; parts of the Inmachuk and near-by tracts on Goodhope River, in the western part of the Fairhaven district; and part of the coastal plain to the east of Norton Sound, in the vicinity of Bonanza. In the northern Alaska region prospecting for the purpose of determining the practicability of installing a

dredge has been done near Shungnak, in the central part of the Kobuk Valley. In addition to the projects mentioned above, some of which may be regarded as, perhaps, approaching a prospective stage, there are, of course, many others that have not yet advanced so far, though some of them may be even more meritorious and may be developed first.

COPPER

Deposits containing some copper minerals are found throughout most of the length and breadth of Alaska. During 1930, however, nearly all of the Alaska copper came from two mines in the Copper River region that are operated practically as a unit, though owned by different companies, and one mine on Latouche Island that is owned and operated by the same company that operates the two mines in the Copper River region. Besides the copper recovered from these mines, a few pounds of copper was reported to have been recovered in 1930 at a smelter in the States from ores and concentrates shipped from southeastern Alaska. Also some placer copper was shipped to the smelter from the gold placers in the Nizina district. The total amount of copper recovered from Alaskan ores in 1930 has been taken as 32,651,000 pounds, valued at $4,244,600. The bare statement of the quantity of copper produced is more or less meaningless, however, unless the basis on which it is computed is stated, because in all the processes that the ore undergoes, from the time it is broken out of the vein in the mines until all of the metallic copper that can be recovered from it is finally placed on sale, there are inevitable losses, so that at no two stages is the amount of copper exactly the same. Even though the losses incurred in these different stages are small compared with the amount recovered, the quantities involved are so large that even a small percentage of loss is equivalent to many thousands of pounds. For instance, with a production in the neighborhood of 33,000,000 pounds, a loss of only 1 per cent is equivalent to 330,000 pounds. It is, therefore, obviously essential to recognize just what stage in the process of converting ore into metal is represented by the figures given. As an illustration of this condition, the following facts, taken from the report of the Mother Lode Coalition Mines Co.,[6] are significant:

This company in 1930 mined 27,486 tons of ore that assayed on the average 20.31 per cent of copper, which would be equivalent to 11,164,800 pounds of copper. Shipments to the smelter from the mine, however, were reported to contain only 9,646,800 pounds of copper. Evidently there is a difference of more than 1,500,000 pounds of copper between the amount that might be said to have

[6] Mother Lode Coalition Mines Co., Twelfth Ann. Rept., for 1930, p. 3, 1931.

been produced as viewed by the operator and the amount that really started to enter the channels of trade as viewed by the shipper. Part of this discrepancy is due to holding in storage at the company's property some of the ore, and part of it is due to inevitable losses that occurred while the ore was passing through the milling treatment preparatory to being shipped. But even the statement of copper shipped is open to misinterpretation, because some that was shipped may have been drawn from storage and not mined during the year it was shipped. After the ore has reached the smelter there is a difference between its theoretical copper content and the amount that, after smelting and refining, is ready for sale. The foregoing explanation may serve to indicate why authoritative statements as to mineral output, taken from different sources, may appear to differ widely. For the purpose of the present report the quantity of copper in the ore and concentrates that were shipped is adopted as the amount of copper yielded by Alaskan mines during 1930. The total copper-bearing ore mined in Alaska in 1930 is estimated to have been 531,000 tons. When this ore had been concentrated or was otherwise prepared and ready for shipment to the smelter, it had been reduced to approximately 51,900 tons, which had a copper content of 32,651,000 pounds.

In attempting to set a value for this copper many methods may be employed, and the results will vary widely. Obviously it would be inaccurate to value all the copper in the ore as it comes from the mine at the current market price for the metal as it comes from the smelter, because not all of it is recovered, and most of it is not in the form of metal and so is not worth the full price of metallic copper. Although the same conditions are also in a measure true of the ore and concentrates that are shipped to the smelter, the losses that they undergo in the smelting process are generally much less. As a consequence it has been the practice of the Geological Survey to compute the value of the Alaska output on the assumption that the copper in the ore and concentrates, as shipped to the smelter, is worth the average price at which metallic copper sold during the year. The average price of all copper sold in the United States in 1930, according to computations by the Bureau of Mines, was 13 cents a pound. The total value of the copper in the ore and concentrates shipped from Alaska mines during the year is therefore regarded as $4,244,600. It is recognized 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 it during periods of low prices. The figures relating to the value of the Alaska output of copper can not, 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 value of the copper production for earlier years as stated in these reports.

In the following table are shown the amount and value of the copper produced in Alaska since the earliest recorded mining of copper took place. For the last five years there has been a gradual decrease in the output. Between the production of 1929 and that of 1930 there was a decrease of about 7,860,000 pounds in quantity and of nearly $2,886,000 in value.

Copper and silver produced at Alaska copper mines, 1880, 1900–1930

Year	Ore mined (tons)	Copper		Silver	
		Pounds	Value	Fine ounces	Value
1880		3,933	$826		
1900–1915	1,232,396	220,773,969	35,031,225	2,351,726	$1,297,756
1916	617,264	119,654,839	29,484,291	1,207,121	794,286
1917	659,957	88,793,400	24,240,598	1,041,153	857,911
1918	722,047	69,224,951	17,098,563	719,391	719,391
1919	492,644	47,220,771	8,783,063	488,034	546,598
1920	766,095	70,435,363	12,960,106	682,033	743,416
1921	477,121	57,011,597	7,354,496	544,311	544,311
1922	581,384	77,967,819	10,525,655	623,518	623,518
1923	731,168	85,920,645	12,630,335	715,040	586,333
1924	761,779	74,074,207	9,703,721	572,078	383,292
1925	860,023	73,855,298	10,361,336	596,607	412,131
1926	670,000	67,778,000	9,489,000	605,190	377,600
1927	645,000	55,343,000	7,250,000	525,100	297,800
1928	579,500	41,421,000	5,965,000	350,430	205,000
1929	590,400	40,510,000	7,130,000	351,730	187,400
1930	531,000	32,651,000	4,244,600	279,990	107,800
	10,918,000	1,222,640,000	212,252,600	11,653,000	8,685,000

The general trend of the copper-mining industry in Alaska is graphically shown by the curve in Figure 3, which shows the output of copper in pounds for each year from 1900 to 1930. On the same diagram has also been plotted the average price of copper for each year. It is significant to note that up to very recent times there has been a very close relation between the price of copper and the Alaska output. In other words, when the price of copper was high there was a corresponding stimulation in output, and when prices were lower the output fell off. The foregoing statement applies only to trends and does not at all mean that a certain price for copper will bring out a certain tonnage. For instance, in 1907, when the price of copper was 20 cents a pound, only 6,308,000 pounds was produced, whereas in 1927, with a price of about 13 cents a pound, the output was 55,343,000 pounds, or nearly nine times as much. Interpretation of the conditions, however, shows that in 1907 an increase in price over the preceding year was accompanied by an increase in output, and in 1927 a decrease in price was accompanied by a decrease in output.

No new developments of note were reported at the productive mines of the Kennecott Copper Corporation at Kennecott, in the Copper River region, during 1930. The ore from this property, as in the past, was largely high-grade copper sulphide and carbonate containing considerable silver but no gold. The highest-grade ore is sacked and shipped directly to the smelters, but the lower-grade ores are concentrated before shipment. According to the published statements of this company,[7] 58,493 tons of ore was mined during

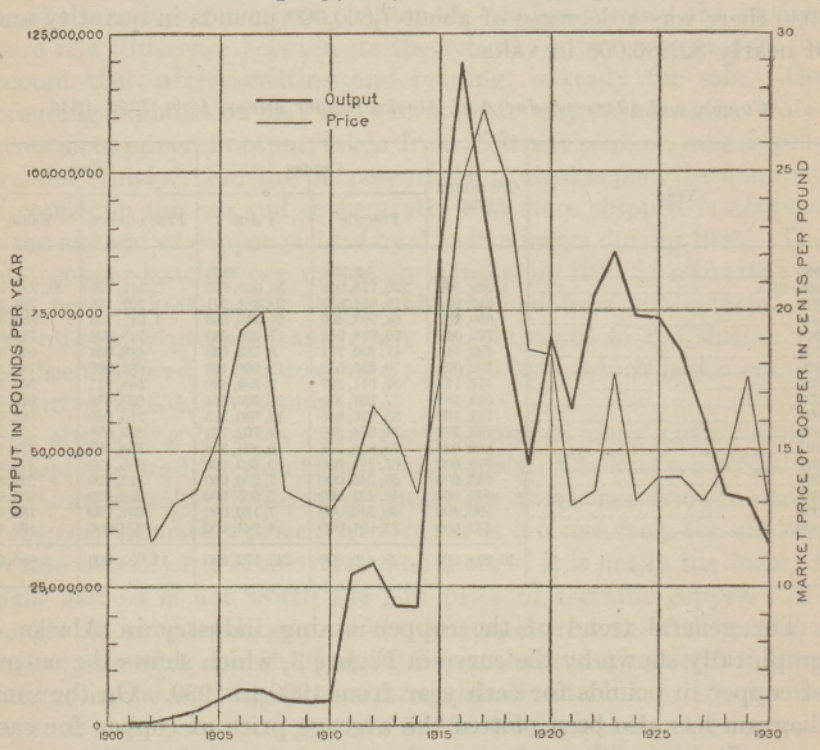

FIGURE 3.—Copper produced from Alaska mines, 1900–1930, and fluctuations in the price of copper during that period

the year, which was estimated to have an average content of 14.62 per cent of copper and 2.46 ounces of silver to the ton. At the mine of the Mother Lode Coalition Mines Co., which is contiguous to the properties of the Kennecott Copper Corporation and is operated by that corporation, although the accounting and bookkeeping are conducted separately, the ore is essentially the same, being a high-grade copper sulphide and carbonate containing considerable silver. The report of this company [8] shows that during the year 27,486 tons

[7] Kennecott Copper Corporation Fifteenth Ann. Rept., for 1930, p. 7, 1931.
[8] Mother Lode Coalition Mines Co. Eleventh Ann. Rept., for 1930, p. 3, 1931.

of ore was mined, which had an estimated content of 20.31 per cent of copper and 3.24 ounces of silver to the ton.

The ore of the Beatson mine of the Kennecott Copper Corporation, on Latouche Island, is entirely different from that of the mines in the Copper River region, just described, being a low-grade copper-iron sulphide, mined by a system of caving. All the ore is concentrated at mills near the mine, and only the concentrates are shipped to the smelter in the States. According to the published report of this company, 444,799 tons of ore was produced in 1930, which had an estimated content of 1.12 per cent of copper and 0.233 ounce of silver to the ton. This mine has long been one of the great mines in the Territory and has produced large quantities of copper. With all mining properties there comes a time when the ore bodies that can be economically mined become exhausted and the property ceases operation. This stage in the history of the Beatson mine was reached in 1930, and in November it was closed down and part of the plant dismantled. At the rate that this mine was producing in 1930 and at the price that prevailed for copper in that year, the cessation of this mine is likely to be reflected in the copper production of Alaska by a drop in value of more than a million and a quarter dollars.

Some of the copper produced in Alaska in 1930 came from float copper nuggets recovered in placer-mining operations. Copper nuggets of this sort have been found for many years in the course of gold-placer mining in the Nizina district of the Copper River region, and at some of the properties the copper is put aside when the gold is being separated from the concentrates of the other heavy minerals. In the course of time these accumulations of copper nuggets are shipped to the smelter, and the copper is recovered. In 1930 a small shipment of copper was made from this source, and it has been credited to the production of that year, though possibly the material may have been collected during a period of several years.

The hope that other copper properties at which some prospecting work was in progress in 1929 might be proved to have economic value and yield some copper in 1930 was not realized, because work at all the larger properties was discontinued during the year, the implication being that no extensive bodies of ore were discovered. One of the places where copper-lode prospecting that had been in progress in 1929 was discontinued in 1930 was on Kasaan Peninsula, Prince of Wales Island, in the Ketchikan district. Here the Solar Development Co., a subsidiary of the Consolidated Mining & Smelting Co. of Canada, had been doing considerable underground investigation and development at the old Salt Chuck mine and the

Rush & Brown properties. The work had apparently been progressing satisfactorily, but with the continuing drop in the price of copper it at last became evident that further work was not warranted, and in June, 1930, the company is reported to have given up the lease and withdrawn from the field. Practically the same situation developed in the Prince William Sound region, where the same company had been carrying on extensive drilling and other exploration work on property of W. S. Dickey near Rua Cove, Knight Island. No detailed statement of the reasons for discontinuance of work at this place was given out by the company, but in the early part of the summer of 1930 the decision was reached that work was to be stopped and the options given up. It is to be regretted that these two mineralized areas did not prove sufficiently attractive to compel development, but in the face of great overproduction of copper and accompanying decline in price other action could hardly be expected, and it is not at all unlikely that when the price rises to former levels prospecting on these properties will be resumed by this or some other company.

Another of the undeveloped copper properties on which active prospecting had been in progress but was discontinued during 1930 was in the Chitistone district, of the Copper River region. In 1929 some high-grade ore of the same general type as that at the Kennecott mines was discovered on the Nelson properties, on Glacier Creek. The discovery appeared so promising that the Kennecott Copper Corporation entered into an arrangement with the owner whereby it would explore the ground. A crew of 15 to 20 miners were employed to carry on the explorations, but early in 1930 the company decided to stop further work, largely, it is understood, on the ground that the explorations had not disclosed an ore body of sufficient size to be of interest to the company, which did not desire to go into a small undertaking. This conclusion, therefore, does not deny the fact that some excellent ore occurs on the property and that there may be enough to warrant the opening of a small mine on it. The keenness of the Kennecott Copper Corporation to find and develop ore deposits in the region tributary to the Copper River & Northwestern Railroad gives assurance that the test was conducted with thoroughness and represented a real effort to develop a large productive mine.

More or less prospecting and development work is reported to have been done at several of the mines in the Copper River region and adjacent country that have produced some copper in the past, but so far as learned none of them shipped any ore during 1930. Among

these properties may be mentioned the Copper Creek mines, in the Kotsina district, and the copper property of the Alaska Nebesna Corporation, north of the Alaska Range. Plants for more active development at both these properties are contemplated in the near future. No work was reported to have been in progress during the year at the Green Butte mine, on McCarthy Creek. Some renewal of interest in mining of all kinds was manifested in the Valdez district, and as a result not only have some of the old gold mines reopened, as already noted, but there has been some prospecting for lodes of copper and other metals. The low price of all metals except gold, however, has deterred most prospectors from being interested in the search for deposits of these other metals unless the ores also carry considerable quantities of gold.

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. Thus, as shown by the table below, silver to the value of $107,800 was received in 1930 from ores that are valuable principally for copper. This source alone accounts for nearly 70 per cent of all the silver that was produced in Alaska in 1930. The amount of silver in the copper ore, however, is actually very small, as is shown by the fact that the average silver content of all the copper ore that was reported amounted to two-thirds of an ounce to the ton, and the ore from the mine that reported the highest average silver content contained only 3.24 ounces to the ton.

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 97,607 ounces of silver in 1930, according to the company's published report.[9] The silver from all the gold-lode mines amounted to 102,080 ounces, and it was worth $39,300. 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 26,500 ounces, worth $10,200.

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

[9] Alaska Juneau Gold Mining Co. Sixteenth Ann. Rept., for 1930. p. 13, 1931.

the sources and the quantity and value of the production from each source in 1930 and 1929 are set forth in the following table:

Silver produced in Alaska in 1930 and 1929

Source	1930		1929	
	Ounces	Value	Ounces	Value
Gold lodes	102,080	$39,300	94,370	$50,300
Gold placers	26,500	10,200	26,800	14,300
Copper lodes	279,990	107,800	351,730	187,400
	408,570	157,300	472,900	252,000

Perhaps the most striking fact that is brought out by the foregoing table is the decrease in both quantity and value of the silver produced in 1930. However, although the decrease in quantity was about 14 per cent, the decrease in value was about 37 per cent. The explanation of this difference lies in the selling price of silver in the two years. According to the computations of the Bureau of Mines, the average market price of silver in 1930 was 38.5 cents an ounce, as against 53.3 cents in 1929. If the price of 53.3 cents had prevailed in 1930, the value of the silver production of Alaska in that year would have been over $60,000 more than the value stated. It should be remembered that the bulk of the silver produced is merely an accessory to the other metals, notably copper and gold, so that its output fluctuates more or less widely, being dependent on the production of the other metals. This does not always hold true in detail, for obviously the proportion of the different metals, even in the same ores, is not constant.

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 unfeasible 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 more than two and a half times as much as at present, the expense of trans-

porting 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 Alaskan side of the boundary, in the Hyder district, as it is locally called, in places seem to be comparable to those in the adjoining district 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 has led to focusing 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 more or less neglected. This does not mean, of course, that rich showings would be overlooked, but only 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 1930, so far as has been reported to the Geological Survey, none of them made such shipments. 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 1930, 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. North of Skagway the Inspiration Point Mining Co. is reported to have continued work on its property, where indications of silver-lead lodes that are said to appear promising have been found. 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 three or four years ago, no active work was in progress, and the property lay practically idle throughout the season of 1930.

The remarkably efficient development of the Mayo deposits, in Yukon Territory east of Dawson, and the successful handling of the ore from that remote camp encourage the belief that methods are being made available whereby even deposits in the remote regions of Alaska, if they afford a considerable tonnage of rich ore, may be mined in spite of adverse physical conditions. With the

improved transportation facilities that are already available in Alaska many regions that were formerly almost inaccessible are less difficult to reach, and these facilities are being constantly improved and will doubtless be still further extended as the opening up and development of the Territory as a whole inevitably takes place. The current low price of silver, however, acts as a strong deterrent against attempting to mine silver deposits at this time. In spite of talk of legislative action to raise the price of silver, there seems to be little likelihood that action of this sort will be taken in the near future, and as a result silver mines even more advantageously situated than those now known in Alaska are closing down or materially curtailing their output.

LEAD

The lead produced from Alaska ores in 1930 amounted to 2,730,000 pounds, an increase of 100,000 pounds over the production of 1929. This stands as the greatest quantity of lead that Alaska has ever produced in a single year. The value of the output at 5 cents a pound, the average market price of the lead sold in the States in 1930, according to the Bureau of Mines, was $136,500. This marks a considerable falling off in value, due to the fact that lead brought 1.3 cents a pound more in 1929. Had the lead that was produced in 1930 brought the same price as that of the preceding year, instead of showing a decreased value of about $30,000, it would have shown an increase of more than $35,000.

Lead produced in Alaska, 1892–1930

Year	Tons	Value	Year	Tons	Value	Year	Tons	Value
1892	30	$2,400	1906	30	$3,420	1920	875	$140,000
1893	40	3,040	1907	30	3,180	1921	759	68,279
1894	35	2,310	1908	40	3,360	1922	377	41,477
1895	20	1,320	1909	69	5,934	1923	410	57,400
1896	30	1,800	1910	75	6,600	1924	631	100,899
1897	30	2,160	1911	51	4,590	1925	789	140,571
1898	30	2,240	1912	45	4,050	1926	778	124,400
1899	35	3,150	1913	6	528	1927	1,008	127,000
1900	40	3,440	1914	28	1,344	1928	1,019	118,000
1901	40	3,440	1915	437	41,118	1929	1,315	166,000
1902	30	2,460	1916	820	113,160	1930	1,365	136,500
1903	30	2,520	1917	852	146,584			
1904	30	2,580	1918	564	80,088		13,510	1,742,500
1905	30	2,620	1919	687	72,822			

In Alaska no ores are mined solely for their lead content. Practically all the lead produced is recovered as a by-product 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. The larger part of the lead that is reported in the foregoing table as produced in 1930 was recovered in the

course of treatment of the gold ores of the Alaska Juneau mines, in southeastern Alaska. According to the published reports of this company, it produced 2,640,771 pounds of lead in addition to other metals during 1930. This represents a recovery of a little less than two-thirds of a pound of lead from each ton of ore that is mined and trammed to the mill, or about 1¼ pounds of lead from each ton of ore that is fine milled.

Information regarding the recent developments on Alaskan ores that contain lead as well as other metals is given in other parts of this report, especially in those that describe the gold and silver lodes. 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 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 thus it offers little incentive to development 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 as well. 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 in the near future seems almost equally certain. An increase in the output of lead is therefore 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 1930 is estimated to have been approximately 385 fine ounces, which at $44, the average market price for platinum as computed by the Bureau of Mines, was worth about $16,900.

The only occurrence of a metal of this group in a lode that has produced any appreciable quantity was at a mine formerly operated by the Alaska Palladium Co. on Kasaan Peninsula, Prince of Wales

Island, about 30 miles west of Ketchikan. The principal platinum metal found at this mine was palladium. Unfortunately, decrease in the price paid for palladium and some internal difficulties resulted in the closing of this mine in the fall of 1926, and it has not been reopened. As this mine while it was running produced several hundred thousand dollars' worth of platinum metals a year and in addition a good deal of gold and some copper, its cessation of production has not only made a very decided drop in the Alaskan output of platinum metals but has been felt in the total mineral production of the Territory.

The only platinum metals that were mined in Alaska in 1930 were recovered from placers in the Goodnews Bay region, south of the mouth of the Kuskokwim River, and from Dime Creek, in the Koyuk district, Seward Peninsula. The occurrence of platinum in the Goodnews Bay region has been known for several years, but interest has recently been revived in the district because of its greatly increased production, though with the tremendous drop in the price of platinum metals in the last year or so that interest has waned conspicuously. In spite of exaggerated statements regarding the richness of these deposits that have been made from time to time in the press it is true that placer deposits containing platinum, worth continued careful prospecting, occur in this district, and that several men were engaged during the summer of 1930 in the search for places where concentration has been great enough to form deposits that can be worked at a profit. The most extensive work is reported to have been done in the vicinity of Salmon Creek, a small stream lying between Goodnews and Chagvan Bays, about 2 miles north of the native village of Kiniginagimut. This region has not been surveyed, and the position of the different streams in that region is not accurately known to the writer. According to local reports, however, the camps that produced some platinum in 1930 were on Clara, Squirrel, and Platinum Creeks and Fox Gulch. What little is known about the geology of the district appears to encourage the belief that conditions favorable for the presence of platinum minerals may exist there. Nothing has yet been found, however, that justifies any rush of prospectors into the region in the hope of finding easily won riches. The recovery of so much platinum by so small a force of men as is now mining in the region certainly warrants a complete survey and examination to determine its mineral possibilities. Some difficulty has been experienced by the platinum miners in disposing of their product at satisfactory prices. This condition was especially marked during 1929 and 1930, when the prices paid for platinum fluctuated widely, but on the whole showed a marked decline. As is probably not generally known, 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 Alaskan producer from the purchaser in the eastern United States is time consuming to conduct and rather difficult for either party to manage satisfactorily.

The Seward Peninsula deposits have been known for a long time and have been more or less continuous producers, though their annual yield has amounted to only a few ounces.

Although no other places in Alaska are known to have produced platinum metals that were sold in 1930, 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 near-by 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. Some platinum is reported to have been found in the gold ores of the Nuka Bay region, in Kenai Peninsula. This report has not been definitely verified, and its accuracy seems doubtful, as the general geology of that district is unlike that in known platinum fields and does not appear favorable for the occurrence of the metal.

TIN

Alaska's tin production in 1930 showed a marked falling off in both quantity and value from 1929 and was only about one-tenth of the annual production for the period from 1912 to 1917, when the industry was at its height. As with so many of the other metals, the drop in price—from more than 45 cents a pound in 1929 to 31.7 cents in 1930—acted as a strong deterrent against active development. The output of tin was all derived from placers, and consequently the ore reported represents really concentrates running from 68 to 72 per cent of metallic tin. The output of tin ore was about 21 tons, containing a metallic tin content of 14.7 tons. These statistics relate to the production only and should not be confused with shipments, because about 25 tons produced in earlier years was shipped during 1930, and 17 tons produced during 1930 was not disposed of by the end of that year. None of the tin is treated in Alaska to recover its tin content in the form of metal, so that ultimately all of it is shipped to outside smelters. Practically all of the ore that is shipped is sent to Singapore for reduction.

Tin produced in Alaska, 1902–1930

Year	Ore (tons)	Metal (tons)	Value	Year	Ore (tons)	Metal (tons)	Value
1902	25	15	$8,000	1918	104.5	68	$118,000
1903	42	25	14,000	1919	86	56	73,400
1904	23	14	8,000	1920	26	16	16,112
1905	10	6	4,000	1921	7	4	2,400
1906	57	34	38,640	1922	2.3	1.4	912
1907	37.5	22	16,752	1923	3	1.9	1,623
1908	42.5	25	15,180	1924	11	7	7,028
1909	19	11	7,638	1925	22.2	13.8	15,980
1910	16.5	10	8,335	1926	12.85	8	10,400
1911	92.5	61	52,798	1927	37.5	26.7	34,000
1912	194	130	119,600	1928	58.6	41	41,000
1913	98	50	44,103	1929	51.6	38.6	35,000
1914	157.5	104	66,560	1930	21	14.7	9,300
1915	167	102	78,846				
1916	232	139	121,000		1,828	1,145	1,092,300
1917	171	100	123,300				

On the whole, the year 1930 was marked by very little activity in the search for tin throughout the Territory, and little hope of revival of interest is to be expected until the price offered for the metal is considerably higher than at present. That there are deposits of tin-bearing minerals that may be developed at a suitable price can not be doubted, though it is impossible to predict what that price would have to be in order to call out a specified tonnage. Although all the tin produced in 1930 came from placer deposits, lode deposits carrying tin are known and have been developed to a greater or less extent in the past. The tin lodes that have been mined are all limited to the area in western Seward Peninsula near York and Tin City. In this connection it may be significant to state that during the year tin minerals were discovered by Maurice Haycock, of Princeton University, in the silver-lead ores from the Hyder district. According to information received from Prof. A. F. Buddington regarding this discovery, it may be said that restudy with the quartz spectrograph of some of these ores has proved a tin mineral to be present in grains of microscopic size. Mr. Haycock believes that the tin mineral may be teallite (SnS.PbS) or a tin sulphide or some new undescribed tin-lead sulphide not stannite. This occurrence is of no immediate direct importance as a source of commercial tin, owing to the microscopic amounts of the mineral present, but it is of great mineralogic interest and significant in giving additional information regarding geologic conditions that prevailed while the ores with which it is associated were being formed.

In addition to the places already mentioned from which the placer tin produced in 1930 came, there are many other places in the Territory where placer tin has been found in sufficient quantities in the past to be of more than mineralogic interest. These include the Ruby district, especially in the vicinity of Cox Gulch and Big Creek; the Gold Hill district near Tanana, especially on Grant and Moran

Creeks; and the Hot Springs district, especially on Deep and Miller Creeks in the vicinity of Tofty.

COAL

The coal produced from Alaska fields in 1930 showed an increase of about 10,000 tons over the amount produced in 1929, and the output of more than 120,000 tons has been exceeded only in one year in the entire period that coal mining has been conducted in Alaska. In other words, the production of coal in Alaska is showing a fairly constant increase. It must be remembered, however, that the industry is still only small, for a total production of around 120,000 tons a year is not as much as many of the moderate-sized mines in the States produce individually, and the Alaska product does not even supply the local markets. About 61,000 tons of coal was imported from fields outside of Alaska in 1930, and no Alaska coal was exported. A comparison of the records of coal production and consumption in Alaska for the entire period for which records are available is afforded by the following table:

Coal produced and consumed in Alaska, 1880–1930

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bituminous coal from Washington [a] (short tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia [a] (short tons)	Total coal consumed (short tons)
	Short tons	Value			
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
	1,333,254	7,373,000	1,273,916	1,674,460	4,281,630

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

In the table the total value of the coal produced in Alaska in 1930 is stated to have been $631,000. This value can be regarded only as a fair approximation, because the 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 basis on which to compute 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 of all the coal mined in Alaska in 1930 was approximately $5.25 a ton, which is the same as in 1929 and is about 50 cents a ton less than the average for the entire period shown in the table.

The Alaska coal came principally from three mines—two in the Matanuska field and one 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., in the valley of Moose Creek. Mining at the Alaska-Matanuska property at a rate of around 100 tons a day was carried on until November, when it dropped off abruptly, so that during December the entire production was only a few hundred tons. The sudden cessation of work was the result of the award to another company of the new contract for railroad coal. At the Evan Jones mine throughout most of the year the production fluctuated widely, depending on the market demand for the product, some months showing an average output of more than 100 tons a day and other months a total production of only a few hundred tons. However, late in the year the company was awarded the contract to supply the coal used by the railroad, and mining on a scale of several thousand tons a month was resumed. In addition to the two principal producing mines in the Matanuska field a little work was in progress at the Pioneer mine, in the southern part of the Moose Creek Valley, and small quantities of coal were produced at the Ross Heckey property, on Coal Creek, in the eastern part of the Matanuska Valley near Chickaloon. The coal from the Heckey property is especially good for blacksmithing, and for several years the Alaska Railroad has operated a homemade coke oven, using this coal to make such coke as it requires for local use. The coke is strong and of good quality, and it seems entirely possible that a more extended use of this coal for that purpose, not only by the railroad but by others, will be made.

The old Government-owned mine at Eska was maintained in a more or less stand-by condition throughout the year, so that if anything should happen that might endanger the supply of coal needed to run the railroad it could be quickly reopened and mining resumed. The coal washery that was built several years ago at Sutton to take care of the coal produced by the Government-operated mines at Eska and Chickaloon but had not been used for a long time and was no longer worth retaining was abandoned and razed, such material as could be salvaged for other construction being utilized by the railroad and the machinery being stored.

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. In the early part of the year mining at this property was carried on at a fairly uniform rate, but when it became known that the Chatanika branch of the Alaska Railroad would probably be discontinued the rush of orders for coal from those operators who wished to get in a supply of coal before the closing of the road led to a marked increase in output. The heavy rains in late August and the floods of early September did much damage in the Healy Creek Valley by washing out long stretches of track and sweeping away parts of the coal tipple. This seriously interfered with the shipment of coal from the mine, but every effort was made to repair the damage as quickly as possible, so that, although shipments fell off seriously in September, by October repairs had been completed and coal was being delivered at a higher rate than formerly, in order to catch up on the arrearage, and this high rate was maintained throughout the rest of the year, with only a slight reduction in December. The plant of the Suntrana mine has been well laid out and is now equipped with the necessary modern machinery to handle 200 tons or more 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 near-by fields and, as a consequence, is not used in the railroad locomotives. This mine was in continuous operation throughout 1930 and yielded more than half of all the coal mined in Alaska during that year.

A few miles east of the Suntrana mine is a coal property on which some work has been done for several years. In June, 1930, the Secretary of the Interior granted rights in this property, including more than 2,000 acres, to R. F. Roth. The terms of this arrangement require the outlay of considerable money by Mr. Roth and his associates each year during the period that he holds the rights, so that much development work will have to be in progress in order to comply with the terms. That there is considerable coal on the property can not be doubted, for the same general series of beds as are being developed farther down the creek undoubtedly pass through it, but it is handicapped by the greater distance that the coal must be hauled and the fact that the local market it might serve is already at least moderately well supplied. Success of this new enterprise will therefore be largely dependent on the operators' ability to mine the coal more cheaply than their competitors or furnish a higher quality of coal.

At mile 341 on the Alaska Railroad the Mount McKinley Bituminous Coal Corporation has done considerable exploration of a coal bed that crops out west of the track. Several hundred feet of tunnel

and some stoping had been done on this ground when a fault was encountered and work discontinued. In 1930 several of the stockholders and others interested in the company spent some time in further exploration and development work with the aim of determining the continuity and commercial value of the beds. The coal is a high-grade bituminous coal with a rather low ash and moisture content. An extensive deposit of coal of this grade would probably find a ready market, as its use would obviate the necessity of hauling the Matanuska coals across the Alaska Range in order to supply demands for high-grade coal at points north of the mountains.

The Harkrader coal property of the Admiralty Island Coal Co., in southeastern Alaska near Juneau, on which some coal was mined in 1929, was inactive during 1930. Difficulties in management and finance are given as the principal causes of the abandonment of work at this place. According to B. D. Stewart the conditions for mining are in general favorable, but only further work can determine adequately the extent of the deposits or, what is perhaps of even more importance, the cost of mining and making the coal available for shipment. The solution of these problems, as well as the transportation and marketing of the coal, will require careful study if the enterprise is to be successful.

Elsewhere in Alaska there are numerous deposits of coal, and from some of them small supplies are taken to supply local needs. In northwestern Alaska, in the vicinity of Wainwright, are extensive coal beds that furnish some coal to the people living in that region. According to estimates, more than 100 tons of coal from these deposits was mined in 1930, mostly by natives, and carried by them in their skin boats to Wainwright, where it was disposed of. Much of this coal was loaded aboard the *Boxer*, the boat belonging to the Office of Education, and delivered to schools along the coast that are under the jurisdiction of that bureau. This coal has long been known, but as the coal mined is that lying close to the surface and is weathered and mixed with much dirt it is not of as good quality as the coal that is shipped in from other fields. In fact, it is said that the local people prefer to import coal from outside rather than use the local coal, even though the outside coal costs nearly three times as much. It is believed that the apparent inferiority of this local coal is not inherent in the coal but is due to the methods of mining and the fact that the coal is taken too close to the outcrop. In order that this coal might be properly protected, the President by Executive order set aside for the exclusive use of the Office of Education a tract about a mile square along the eastern shore of Wainwright Inlet in which thick coal beds are known to occur. This action was taken to enable the bureau to

control this tract and regulate the use and exploitation of the coal exposed, so that the native schools under its jurisdiction might always have a near-by source from which to obtain fuel.

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 1930. 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 too much potential value to be allowed to remain idle long, 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.

Attempts to find other and less local markets for Alaska coal have been pressed, and evidence that these efforts are bringing results is shown by the fact that several of the Government activities in Alaska specify Alaska coal in the call for bids. Some of the canneries in the Cook Inlet and Alaska Peninsula regions have also been induced to place trial orders for Alaska coal instead of importing it from the States. One of the main deterrents to an even wider use of these coals is the unreliability of supply and service. At present there are no suitable loading facilities and no regular lines of transportation that can be relied on to handle any considerable volume of coal at some of the remote canneries. As a consequence the canneries, whose season is at best very short, choose to bring in their coal rather than rely on a source that might leave them in the lurch at an inopportune time. The absence of facilities for handling coal for shipment at Seward has caused considerable agitation for the construction of necessary bunkers and other equipment, and doubtless these will be built when the demand for them is more clearly demonstrated. It is but another illustration of the difficulty of deciding which move should be made first—the building of bunkers, etc., to assist in stimulating the more extensive use of the coal or the booking of more orders for coal in the expectation that this will lead to the installation of proper handling facilities. Obviously, as far as possible, the two should move together.

PETROLEUM

The only petroleum produced in Alaska comes from the wells of the Chilkat Oil Co., in the Katalla field. 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. A small refinery is operated at Katalla by the company, and the products—gasoline and distillate—find a ready market near at hand, especially for use by the fishing fleet near Cordova. According to the annual report of this company, no new developments worthy of special mention were made during the year, and the production of oil was maintained at a somewhat smaller rate than in the preceding year.

The small domestic production of petroleum from the Katalla field is not at all 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 that is brought out by the data of the subjoined table is the constant increase since the war in the amount of gasoline and related lighter products of distillation imported. This increase is 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.

Petroleum products shipped to Alaska from other parts of the United States, 1905–1930, 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	13, 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
	403, 329, 053	80, 041, 419	20, 714, 000	9, 778, 095

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

Search for new oil fields in Alaska has not been vigorously carried on during the last few years, and in 1930 drilling was done at only two places, in addition to 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 it in no way implies that that search has even a remote chance of being successful.

One of the two places where prospecting for oil by the use of the drill was in progress in 1930 was in the Katalla field not far from the tracts that were producing oil. This work was done on ground formerly held by an old English company which was among the pioneers in this field. A drill rig was shipped in from the States in the summer of 1929 and was taken to the ground soon afterward, and much of the early part of 1930 was spent in preparatory work. No specific details regarding the work accomplished are available to the writer, but it is understood that by fall the drill had been put into commission and about 150 feet of hole had been drilled. It is generally assumed that the oil that may be found in this tract does not lie at a depth of more than 2,000 feet or so, but the geologic conditions under which it occurs are not well understood, so that the result of the drilling will be watched with keen interest, not only for the information it will afford regarding the specific tract tested but also for its bearing on the general region perhaps even as far east as Yakataga. Rumors of other developments to be undertaken in prospecting for oil in the Katalla field have also been current, but none of them seem to have advanced to the stage of field work in 1930. It is also reported that a new agreement had been entered into for the exploration of the well-known oil claims of Mike Sullivan on Johnson Creek, in the Yakataga field. The company that will undertake this work is said to be the Hammond Oil Co., and the first hole, which will not be started until 1931, will probably be near the site selected by the geologist of the General Petroleum Co. when that company was interested in the field two years ago.

The only other place where drilling for oil was in progress in 1930 was 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 1929 the hole had reached a depth of about 1,360 feet. The well

was drilled to a depth of about 1,300 feet with a Star rig, but that was subsequently replaced by a Standard rig. During 1930 drilling was continued as rapidly as practicable, but the work suffered many interruptions and vexatious delays, so that finally in the early fall drilling was discontinued when the hole had reached a depth of about 1,465 feet. The cuttings recovered at intervals during the year indicated greenish igneous rock, probably a sill or dike, from a depth somewhat below 1,315 feet nearly to 1,375 feet, and thence nearly to the bottom practically continuous black shale with some coal. The last sample, at 1,465 feet, seems to indicate proximity to another dike or sill, as it includes abundant chips of epidote, quartz, and chlorite, probably of igneous origin, mixed with the shale fragments. Although disappointed at the slowness with which the work is proceeding and at the many obstacles that have had to be overcome, the owners still regard the showings as sufficiently promising to warrant continuance of drilling another season, so that the question as to whether or not oil occurs there may be definitely settled. The geologic conditions in the vicinity of the well, so far as known, are not those usually found in the areas in the States where the larger commercial pools of oil occur, and a geologist can not but entertain grave doubts as to the occurrence of oil in that locality. 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, that it is earnestly hoped that the enterprise may be successful.

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 1930 in the broadest sense of that word, but with the exception of stone none of them were reported to have been produced and sold in quantities that represent a value of more than a few hundred dollars for any single commodity.

In the following table, as well as in certain of the other tables accompanying this report, all these minerals that were produced 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 that have been described in this report but are included in this table or 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 1930, 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, gypsum, marble, and other products, 1901–1930 [a]

Year	Value	Year	Value	Year	Value
1901	$500	1912	$165,342	1923	$229,486
1902	255	1913	286,277	1924	348,728
1903	389	1914	199,767	1925	454,207
1904	2,710	1915	205,061	1926	444,500
1905	710	1916	326,737	1927	162,000
1906	19,965	1917	203,971	1928	164,000
1907	54,512	1918	171,452	1929	194,000
1908	81,305	1919	214,040	1930	157,300
1909	86,027	1920	372,599		
1910	96,408	1921	235,438		5,640,300
1911	141,739	1922	266,296		

[a] $117,000 of placer platinum metals mined prior to 1926 and $237,500 of antimony mined prior to 1927 not distributed by years but carried in total.

As noted above, the largest single enterprise that is included under this section is the quarrying of great quantities of high-grade limestone rock in southeastern Alaska that is transported to Seattle in the company's own vessels and used in the company's own plant for the manufacture of cement. This operation, which is rather new, as it was started in 1928, is carried on by the Pacific Coast Cement Co. It is reported that in the course of two years' operation the company has carried its plans through successfully and is well satisfied with the results. The quarry from which the rock is taken is on Dall Island, between Baldy Bay and Tlevak Strait, about 40 miles west of Ketchikan. The general practice at this place is to drill the limestone in the quarry, blast it down, and haul it to the crushing plant, where it is broken down to suitable size and stored near the wharf ready for loading on the steamer for Seattle, where it is discharged, the round trip, including loading

and unloading, taking less than 10 days. Owing to the fact that the producer, transporter, and consumer are all one and the same company, it is difficult if not impossible to arrive at a true market price for the limestone produced by this company. In the table given above it has been necessary to adopt a more or less arbitrary price for the limestone, as a means of including this product with the other mineral resources. The price adopted, however, is believed to be extremely conservative, so that the total value of the output as given probably understates the real value.

For a number of years marble in considerable quantities was quarried and shipped from a number of points in southeastern Alaska. The industry later dwindled, so that more recently there has been only one company that has produced any notable amounts of marble, and in 1930 even this company—the Vermont Marble Co.—reports that it quarried no new stone at its Alaska properties. The quarries that are owned by this company are near Tokeen and Calder, on the west coast of Prince of Wales Island, but the finishing plants to which the rough stone is sent are in Tacoma, Wash., and San Francisco, Calif. The stone has been in great demand throughout the west coast and has been used in many of the most imposing buildings, principally for interior trim and decoration. Limestone is widely distributed throughout southeastern Alaska, and, according to Burchard,[10] 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.

Antimony ores are widely distributed throughout Alaska, and in the past considerable quantities were produced and shipped from the Territory. During 1930, however, only prospecting or development work appears to have been done on any of the antimony properties. Among those at which some work was done may be mentioned the deposit at Cape Caamano, the southern tip of Cleveland Peninsula, in the Ketchikan district, and the Shannon claim near Slippery Creek and at other points in the foothills of the Alaska Range south of the Kantishna district. No work other than assessment work is reported to have been done at the old antimony prospect on Stampede Creek, and the proposed extensive development of it seems to have been dropped. The present low price of antimony and the remoteness of these deposits in interior Alaska do not encourage persons to undertake their development at this time.

Prospecting and development work is said to have been continued on the known nickeliferous sulphides of the Chichagof district, in

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

southeastern Alaska, but no ore is reported to have been produced for sale during the year.

No detailed information has been received by the Geological Survey regarding the developments during the year at the quicksilver deposits in the Kuskokwim Valley. It is currently reported that at the Parks property, lying north of the Kuskokwim River, between Georgetown and the mouth of the Holitna River, a little quicksilver ore was mined and a small amount of metal recovered in a crudely built homemade furnace that was in operation for a short time. None of the other quicksilver deposits in the Kuskokwim Valley are reported to have made any production during the year, and it is believed that no work other than the assessment work required by law was done at any of them.

At the head of Olive Creek, in the Livengood region, J. B. Hudson and associates are reported to have made several test runs on quicksilver ore from a deposit that was discovered in that region about two years ago. No specific report regarding the work at this property has been received by the Geological Survey, but it is understood that the ore is crushed in an arrastre and that the owners expected to have a small retorting equipment installed before the end of the year. In the vicinity of Bluff, in the Seward Peninsula region, development work was continued by the Alaska Mercury Corporation on lodes carrying quicksilver minerals on Swede Creek. Two men were employed at this place almost continuously throughout the year driving a tunnel to explore the leads. The results are said to be encouraging, and the owners propose to have the work continued. Ore carrying cinnabar has been found at several places along the northern front of the Alaska Range, and specimens were collected by the Geological Survey party under F. H. Moffit from claims owned by W. Shannon near Slippery Creek. The amount of cinnabar so far discovered in the rock does not appear to be sufficient to indicate that it is capable of development under present conditions in a region so remote as that in which the specimens were taken.

Molybdenum, one of the elements used in connection with the making of 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. During 1930 interest was revived in the deposits containing molybdenite that are found in veins in the Groundhog Basin, near Wrangell, and on Baker Island, and a company was formed to promote their development. No details are known as to the actual work accomplished on this enterprise, but several of the local Alaska papers have carried notes that a crew of several men were on the properties during the summer cutting samples and doing extensive prospecting.

Little new development took place during 1930 on the many kinds of nonmetallic mineral products that occur in Alaska. The deposits of asbestos near Bear Creek, on Admiralty Island, at which some development work was reported to have been in progress in 1929, was apparently not further exploited during 1930, and it is understood that the stopping of work was due to certain problems of management and finance which had not been worked out to the satisfaction of all the persons having an interest in the property. No further work is reported to have been done on the asbestos deposits in the vicinity of Shungnak in the Kobuk district of northwestern Alaska. This region is so remote and difficult of access that there seems little reason to believe that the deposits can be economically mined or likely to be developed in the near future. In this same region deposits of jade have long been known, and in 1929 some was shipped to persons in the States in the hope that a market for it might be found. Although it is reported that this shipment was successfully disposed of, no subsequent shipments, so far as the Geological Survey could learn, have been made.

During 1930 there has been a renewal of interest in the search for barite deposits in southeastern Alaska. This mineral, which is sometimes known as heavy spar, resembles calcite or limestone, except for its greater weight, and for the fact that it is a sulphate of barium and not a carbonate of lime. It is reported that a company was formed to mine one of the barite deposits on the west coast of Prince of Wales Island, in the Ketchikan district. So far as could be learned, this project had not by the end of 1930 reached a stage in which active field work was in progress or in which definite plans for the development had been formulated.

The Pacific Coast Sulphur Co. was recently organized under the laws of the Territory to develop the sulphur deposits on Akun Island, in the Aleutian group. It is understood that this company proposes to excavate the sulphur-bearing material by means of a steam shovel and transport it to the beach by an aerial tram, from which it will be shipped in vessels that will find a protected anchorage in Lost Harbor, near the scene of these operations. So far as could be learned, no active steps have yet been taken to do any actual construction work on this project.

A new Alaska enterprise that does not strictly relate to mineral deposits but is in a way so closely allied to them that mention of it here seems warranted is the attempt to utilize some of the enormous deposits of peat that occur in the Territory, and experiments have been under way to determine the value of the peat as an aid to agriculture. According to statements by H. C. Gauss,[11]

[11] Cong. Record, Feb. 16, 1931, p. 5235.

Samples of the peat deposits near the Alaska Agricultural College and School of Mines have been found to be more favorable than other samples of peat for use as an absorbent of the character indicated. This peat has been found to combine without difficulty with the active agents employed and without the aggregation of finer particles which has been experienced with other peats used. It seems also to be in a favorable condition to respond to the action of micro-organisms, which is an essential element in the process from a commercial point of view.

If the Alaska peats should prove to have the desirable qualities that the tentative tests seem to indicate, they may well form the basis for a considerable industry, as the volume of the peat deposits in parts of the Territory is enormous.

Although the various mineral commodities here grouped under the heading "miscellaneous mineral products" yield small monetary returns—approximately $157,000 in 1930—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 that they are destined to become even more significant as the development of Alaska proceeds.

ADMINISTRATIVE REPORT

By Philip S. Smith

INTRODUCTION

The task of obtaining information regarding the mineral resources of Alaska and assisting the industry in every practicable way has for many years devolved upon the Alaskan branch of the Geological Survey, and each year Congress appropriates certain funds to support the work. The technical results obtained are published in official reports and other suitable places as rapidly as possible after the work to which they relate has been completed. During the third of a century that this work has been in progress the Geological Survey has published many hundred reports on various phases of the mineral industry of Alaska, and these have been accompanied by several hundred maps of different parts of the Territory. Practically every known mineral-producing camp has been visited by the geologists, engineers, and topographers of the Geological Survey, and reports regarding these camps have been issued.

The object of the present report, therefore, is not to set forth or to discuss the technical results of the investigations of mineral resources but rather to summarize the general scope of the work accomplished during the year just closed, so as to give an understanding of the plans that have been in progress, their state of completion, and such analysis of the fiscal matters related to them as will indicate the purposes for which the expenditures were made. In other words, this report is designed to furnish a general accounting of the stewardship of the affairs that have been intrusted to the Alaskan branch. Such an accounting, however, would fail of its utmost service unless it also outlined the needs and plans for the future development of the work, so that notes on these subjects will also be included.

In attempting to set forth the recent activities of the Geological Survey in its Alaska work difficulty is at once encountered in that the work is essentially a continuing project with no clearly marked steps or interruptions to serve as distinct breaks from which to report progress. In general the work bears little relation to the calendar year or to any other fixed period. Many of the field projects

start in May and may last a few months or several years, but some have been started in February and others in July or August. The fiscal year, which so clearly forms a basis for defining much of the other Government work, has little significance in reporting on the Geological Survey's work in Alaska, especially because most of the appropriations for the Alaska work are made immediately available on the passage of the act through which the money is appropriated. For example, the appropriations for the Alaska work in the act providing funds for the Interior Department covering the fiscal year 1931 became effective May 14, 1930, and the funds were available for expenditure at any time after that date until June 30, 1931. During part of that period, from February 4 to June 30, 1931, the similar appropriation contained in the act of 1932 was available; and part of the work continued in the fiscal year 1931 was started and paid for from funds carried in the appropriation act for 1930. Under these conditions it is evident that except for the obvious limitations the determination as to which of these appropriations should be charged with a certain project was more likely to be based on administrative convenience than on any real difference in the character or object of the work.

To describe as two jobs what was undertaken really as a single project, simply because parts of it were paid for from different appropriations, would obviously fail to give a correct perspective of the work in its entirety to a person who was more interested in that aspect than in mere accounting procedure. For this reason the projects have been described principally on the basis of seasons, though it should be realized that "field season" is an indefinite term and that not all the time devoted to a project is spent in the field. Thus the field season of 1930 for many projects began early in the spring, when the field men began to assemble their supplies and equipment or otherwise to prepare themselves for the tasks to which they were assigned. The period of actual field operations was followed in the fall and winter of 1930 and the spring of 1931 by the office and laboratory studies required in working up the field notes and preparing the reports on the results accomplished. The last stages of this work may have gone on more or less coincidentally with the beginning of preparations for the field season of 1931 and may have ceased only when the geologists or engineers left headquarters to undertake the new projects—in fact, the final revision of the reports, the reading of the proof, and the countless other details incident to publication in finished form may not have been completed even in the succeeding season.

Certain of the projects naturally fall better into other periods. For example, the statistical studies of mineral production relate to the calendar year, though the most intensive part of the work falls

in the early part of the year succeeding that to which the statistics relate. Thus, though collection of data and sending out of questionnaires for the 1930 canvass went on throughout 1930, the bulk of the replies were not received until the end of that year, and the final compilations could not be made until practically all replies that were likely to be sent in were in hand, which was well into the spring of 1931. Although the project of collecting these data relating to the calendar year 1930 might logically be counted as belonging to either or both years, the work is assigned to the year to which the statistics relate, namely, to 1930.

Two rather distinctly different kinds of technical work are performed by the Alaskan branch—one of a general investigational type and the other of a semiadministrative type in connection with the supervision of the leases granted by the Government covering coal, oil, and other mineral lands. Each is not only distinct in character but is supported by funds from different appropriations. Consequently a rather sharp line can be drawn between the two. For convenience the work of the first type will be referred to briefly as work on mineral resources and that of the second type as leasing work.

WORK ON MINERAL RESOURCES

MANUSCRIPTS AND PUBLICATIONS

The principal products of the Alaska work of the Geological Survey are the reports and maps made by the members of the Alaskan branch based on original surveys or investigations. These are considered an integral part of every project, and they stand as the tangible expression of the outcome of the investigations they describe. They are almost the only authoritative means by which the results achieved are brought to the attention of the public, who are the Geological Survey's clients and who must decide whether or not their needs have been met. It does not matter how much the investigator may have learned in the course of his studies or how significant his interpretations may be, the knowledge or the interpretations are of little service until they are set down in definite form, published, and disseminated, so that they may be known and put to work. For this reason special attention is called to the following list of the manuscripts that are in various stages of preparation or publication.

During the year six such official reports have been issued:

Notes on the geology of upper Nizina River, by F. H. Moffit (Bulletin 813–D).

Mineral resources of Alaska—Report on progress of investigations in 1928, by Philip S. Smith and others (Bulletin 813).

Geography and geology of northwestern Alaska, by Philip S. Smith and J. B. Mertie, jr. (Bulletin 815).

Mineral industry of Alaska in 1929, by Philip S. Smith (Bulletin 824–A).

Administrative report, 1929–30, by Philip S. Smith (Bulletin 824–A).

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).

The following reports are in course of editing or printing:

The occurrence of gypsum at Iyoukeen Cove, Chichagof Island, by B. D. Stewart (Bulletin 824–E).

The Slana district, upper Copper River region, by F. H. Moffit (Bulletin 824–B).

The Lake Clark-Mulchatna region, by S. R. Capps (Bulletin 824–C).

Mining in the Circle district, by J. B. Mertie, jr. (Bulletin 824–D).

Glaciation in Alaska, by S. R. Capps (Professional Paper 170–A).

A geologic reconnaissance of the Dennison Fork district, by J. B. Mertie, jr. (Bulletin 827).

Eight reports have been completed by their authors and approved for publication:

Mineral industry of Alaska in 1930, by Philip S. Smith.

Administrative report, 1930–31, by Philip S. Smith.

The Kantishna district, by F. H. Moffit.

Mining developments in the Tatlanika and Totatlanika Basins, by F. H. Moffit.

The eastern portion of Mount McKinley Park, by S. R. Capps.

Geography and geology of Lituya Bay, by J. B. Mertie, jr.

The Tatonduk-Nation district, by J. B. Mertie, jr.

Surface water supply of southeastern Alaska, by F. F. Henshaw.

Seven short papers on the mineral production of Alaska and various phases of the work of the Alaskan branch were published as press bulletins.

Two maps were issued during the year, as follows:

Topographic map of Goodnews Bay district, by R. H. Sargent and W. S. Post; scale, 1:250,000. Issued in a preliminary photolithographic edition.

Topographic map of Valdez and vicinity, by J. W. Bagley, C. E. Giffin, and R. H. Sargent; scale, 1:62,500. Published for sale.

The following maps have been prepared and transmitted for publication:

Topographic map of Revillagigedo Island, by R. H. Sargent; scale, 1:250,000. Compiled principally from aerial photographs taken by the Alaska Aerial Survey Expedition of the Navy Department, 1926 and 1929. Issued in a preliminary photolithographic edition.

Topographic map of Mount Spurr region, by R. H. Sargent and Gerald FitzGerald; scale, 1:250,000. To be published for sale.

Topographic map of Lake Clark-Mulchatna region, by Gerald FitzGerald and R. H. Sargent; scale, 1:250,000. To be published for sale. This and the Mount Spurr map are compiled from surveys in recent years in the Skwentna, Mount Spurr, Chakachamna-Stony, and Lake Clark-Mulchatna districts.

Alaska map E (reprint, extensively revised); scale, 1:2,500,000. To be published for sale.

Alaska map A (reprint, revised); scale, 1:5,000,000. To be published for sale.

Topographic map of Lower Matanuska Valley (reprint, revised), by R. H. Sargent; scale, 1:62,500. To be published for sale.

In addition, practically all the published reports are accompanied by maps, the bases of which have been made principally from surveys conducted by the topographers of the Alaskan branch.

Progress was also made in the preparation of a map of the Nushagak region, scale 1:250,000, compiled from surveys conducted in 1930, and maps of portions of the Taku and Wrangell districts, compiled principally from aerial photographs taken by the Alaska Aerial Survey Expedition of the Navy Department for use as bases for topographic maps and for field studies.

Several other maps are in early stages of preparation.

Besides the official reports, several articles were prepared by the scientific and technical members of the Alaskan branch for publication in outside journals, and 41 public lectures were given regarding the general work of the branch or some of its special features. Most of these were prepared unofficially but represent by-products of the regular work and serve to reach special audiences not readily reached by the official publications. Among these articles may be mentioned the following:

Some popular misconceptions concerning Alaska, by Philip S. Smith.

Geographic and geologic evidence relating to the connection of Siberia and northwestern Alaska, by Philip S. Smith.

Random notes on recent ice as a geologic agent, by Philip S. Smith.

Alaska and the Geological Survey, by Philip S. Smith.

Photographing Alaska from 2 miles in the air, by R. H. Sargent.

Paleozoic stratigraphy of the upper Yukon, by J. B. Mertie, jr.

Safety work in mines, by B. D. Stewart.

PROJECTS IN PROGRESS DURING THE SEASON OF 1930

The work done by the Geological Survey in connection with the study of the mineral resources of Alaska is so diverse that it can not be reduced to common terms capable of unified tabulation or coordinated description. Part of it embraces areal surveys that are readily definable in terms of square miles mapped, but other parts concern examinations in mining camps which cover only small tracts and yet may require an outlay of time and effort in laboratory researches or office studies that exceeds the scope of the original field investigations. The most comprehensive idea of the work of the Alaskan branch in 1930 may therefore be gained best from a brief description of each of the projects undertaken during that season.

In addition to the routine duties of administration and of supplying information in answer to hundreds of inquiries received from

the public and from other branches of the Government, the different members of the branch took part in one or more of the 10 principal projects that were carried on during the season of 1930. Seven of these projects involved field work, and three required only work in the office. The seven field projects were reconnaissance topographic mapping of parts of Revillagigedo Island, in southeastern Alaska; mining and related studies in the Taku district and other parts of southeastern Alaska; geologic investigations related to the mineral resources of the Kantishna and Bonnifield districts, on the northern flanks of the Alaska Range in central Alaska; geologic investigations related to the mineral resources of the Chulitna district and near-by areas in the Broad Pass section, on the southern slopes of the Alaska Range; reconnaissance topographic surveys north of Bristol Bay, in the Wood River-Nushagak district of southwestern Alaska; geologic investigations of the mineral resources of the unsurveyed tract north of the Yukon adjacent to the international boundary; and general studies related to the mineral resources of the Territory as a whole. The projects involving no direct field work were compilation of base maps from the aerial photographs taken by the Navy Department in southeastern Alaska, the annual canvass of mineral production, and the miscellaneous office duties at the Juneau office.

The topographic mapping project in southeastern Alaska is a continuation of mapping parts of Revillagigedo Island, on which Ketchikan is situated, and of the adjacent mainland. This project was started in the field season of 1928, during which about 1,000 square miles was mapped. It is part of the major program of topographically mapping as rapidly as practicable, with the funds and personnel available, the whole of that part of southeastern Alaska that was covered by airplane photographs taken by the Navy Department in 1926 and 1929. The early accomplishment of the mapping of the entire region is highly desirable, because so much of the region contains indications of mineralization that the Geological Survey should make available information regarding their distribution and other significant features. Moreover, the maps would also serve as bases for other Government institutions and persons having to do with the development of the other resources of the region—for instance, the Forest Service and others who are vitally interested in the development of the power and pulpwood resources. In the area near Ketchikan mineralization is widespread, and in the past several mines in this area have produced fairly large amounts of gold, and at present several small properties are being developed. The region is also the scene of a large potential power and paper-pulp project that is being fostered by the Forest Service. The topographic mapping on Revillagigedo Island was done by R. H. Sargent for

publication on a scale of 4 miles to the inch. The methods were in the main similar to those usually followed in making field surveys by means of the plane table, but had the somewhat unusual feature that a base showing drainage and shore lines had been prepared in advance of the field work by compilation from aerial photographs. The major framework of the region having thus been more or less blocked out, the topographer could devote his time more largely to the representation of relief. In the course of the precise instrumental observations it was found that the drainage base as compiled required extensive adjustment in detail. It seems obvious, however, that the saving effected in the topographic mapping by having the base available much more than offset the cost of photographing and compilation. In fact, after one has attempted to force his way through the dense tangle of vegetation and up the steep slopes of this region for even a mile or two he becomes convinced that any other method of mapping the country would be unjustifiably costly. The transportation of the party in the field was effected by a power boat, which also served as a camp, and the party in addition to the topographer consisted of a station assistant and the two members of the boat crew. The field work began May 14 and ended September 19, and a tract of 944 square miles was mapped.

In 1929 considerable excitement was aroused by the announcement of the discovery of sulphide ores containing copper, zinc, lead, and gold in the Taku district, east of Juneau, and a rush of prospectors followed. Verification of the report that considerable tracts hitherto regarded as composed mainly of deep-seated igneous rocks and therefore unpromising as prospective mineral areas were really occupied by other rocks and might therefore repay prospecting made it desirable that an authoritative statement should be prepared by the Geological Survey, based on a thorough field examination of the area. Consequently B. D. Stewart, of the Juneau office, was assigned to the task, but delays and interruptions, due to one cause or another, prevented him from reaching the region until August 5. In the ensuing two months he spent altogether about five weeks in the district, during which he visited as many of the prospects and as much of the area as time and other conditions permitted. The results of these studies are in course of preparation, but they can not be brought to a conclusion without supplementary field work, which has been provided for in the projects for the field season of 1931. The finding of new deposits in this region has had a marked effect in stimulating prospecting for ore deposits throughout the Juneau district. From what is now known regarding the general geologic conditions, the chances of discovering somewhere in that region deposits that may materially add to the mineral output of Alaska seem well worth the search. Part of the delay of getting the Taku

work started was due to the heavy snow that remained late on many of the hills and gulches where surveys would have to be made. While awaiting the disappearance of the snow Mr. Stewart utilized part of his time in June and July in field examinations of some of the mining properties in the Hyder and Ketchikan districts. Somewhat over three weeks was spent in this work, during which he collected much information that was published in a Territorial report.

For many years it has been realized that the success of the Government-owned railroad in Alaska would depend in no small measure on the development of the mineral resources along its route, so that they would afford tonnage to be moved. The general manager, Col. O. F. Ohlson, felt that some assistance might be given by the Geological Survey in aiding this development, and therefore in 1929 asked its help. Unfortunately, plans miscarried that year, but the request was renewed in 1930, and two parties were sent to do whatever they could to solve the problem of finding tonnage for the railroad. The obligation to give all the assistance possible was keenly felt, not only as a friendly act owed to the railroad but also as a very real responsibility on the Geological Survey's own account toward the mineral industry and, through it, the development of the Territory, for help to either must help the other. In fact, the real object of Congress, as stated in the organic act of the railroad, was not so much to build a railroad as it was to develop the Territory. The two Geological Survey parties sent into the railroad region in 1930 were in charge of F. H. Moffit and S. R. Capps.

The special areas studied by Mr. Moffit were the Kantishna district and near-by country west of the railroad and part of the Bonnifield district east of the railroad. An account of the work and its results is given as a separate chapter in this volume. As the principal object of this work was to determine what tonnage could be developed for the railroad, little attention was given to placers and attention was focused on examination of the lodes. During the six weeks that Mr. Moffit was in the Kantishna district he examined practically all the lode prospects that were reported to show sufficient mineralization to have possible economic value, not only in the Kantishna district proper but also along the northern flanks of the Alaska Range from Slippery Creek eastward to the great bend of Muldrow Glacier. The prospects exhibited a wide range in character of mineralization, some having their principal metallic value in gold, others in silver and lead, and still others in antimony, copper, zinc, or quicksilver. Travel in the field was accomplished with a small pack train, and camp was maintained with the aid of two helpers. After the completion of the Kantishna surveys Mr. Moffit transferred his outfit to the Bonnifield district, where he had an opportunity to examine

some of the tracts on which placer mining had been in progress for many years and also the lode developments on Eva Creek. At these claims the metallic minerals are strongly developed and consist largely of arsenopyrite, an arsenic and iron sulphide, with lesser amounts of chalcopyrite, a copper and iron sulphide, and bismuthinite, a bismuth sulphide. The principal value of the ore is in the gold that occurs with the sulphides. The exceedingly unfavorable weather conditions that began late in August and resulted in floods early in September prevented the accomplishment of as extensive investigations as had been planned, and field work was discontinued September 9.

The party in charge of S. R. Capps examined the geology and mineral resources of a tract on the south side of the Alaska Range extending eastward from the head of the West Fork of the Chulitna River to the Nenana River. Parts of this area were known to be mineralized, and in addition its survey was undertaken to permit the construction of a complete section across the range and thus contribute to the interpretation of the geologic history of the range and throw light on its relation to the occurrence of ore deposits. Mr. Capps started field work on this project at Colorado June 9 and carried it on uninterruptedly until the weather conditions brought it to an end at Cantwell September 11. The party included also a cook and a packer, who was in charge of the pack train of eight horses used in transporting the camp gear, supplies, and equipment. An area of about 300 square miles was surveyed geologically on reconnaissance standards, and an area of about 180 square miles that had been surveyed in earlier years was more intensively studied and its geology thoroughly revised, so as to bring it into adjustment with the latest information on the region as a whole. The results of Mr. Capps's work in this region are given in a separate chapter of this volume.

In southwestern Alaska north of Bristol Bay was one of the largest unsurveyed tracts still remaining in Alaska. Reports received from prospectors and indications that were seen in the nearest areas that had been examined by the Geological Survey gave reason to believe that parts of this tract might contain mineral deposits that could perhaps be exploited successfully. It was recognized, however, that these were mere surmises, and in order that more authoritative information might be available it seemed desirable that the Geological Survey should survey the tract and determine these conditions as well as the major features of the topography and other geographic facts. A start was made on this work in 1930 by a party in charge of Gerald FitzGerald. Actual field work began June 5 and ended September 8. During that period an area of 2,400 square miles was surveyed topographically for publication on a

scale of 4 miles to the inch, with a contour interval of 200 feet. In the course of the work about 125 miles of river traverse was made on a field scale of 1:96,000 (1½ miles to the inch), using micrometer and rod readings, with a contour interval of 100 feet. The party, which included Mr. FitzGerald and two camp assistants, traveled mainly in a small boat equipped with outboard motor. Surveys were made of practically the whole of the Wood River and the group of four large lakes that drain into it, of the Snake River and the large lake in the northern part of its valley, and of the Nushagak River as far north as its junction with the Nuyakuk River at Koliganek. Although these surveys have an immediate value in portraying all the topographic features of the region they cover, they are also of large service in guiding the formulation of comprehensive plans for further topographic and geologic reconnaissances of the entire tract lying between Bristol Bay and the Kuskokwim River. Mr. FitzGerald in getting to and from his area of work from Anchorage utilized airplane service for the transportation of himself, one assistant, and some equipment. He thereby not only saved much valuable time but got a general preliminary view of the whole region that was to be surveyed—a proceeding that greatly facilitated the subsequent work.

Another large area in Alaska that has long remained unsurveyed and little visited, even by casual trappers, is the triangular tract lying between the Yukon and Porcupine Rivers west of the international boundary. A start was made on gaining some knowledge of this region through reconnaissance geologic surveys in 1930 by a party in charge of J. B. Mertie, jr. As no topographic map was available to show even the major features of the country or to serve as a base on which to plat the geologic observations, a drainage map of the southeastern part of the area was prepared as one of the results of the traverses and plane-table sketches of the geologist. The party, consisting of Mr. Mertie and three camp asistants traveling with a small pack train, started field work on the Yukon at the mouth of the Tatonduk River June 5 and ended field work for the season September 2. In that period the drainage and geologic features of an area of 500 square miles were mapped adequately for publication on the usual reconnaissance scale. Knowledge of the geology of this region is regarded as of special significance in assisting to an understanding of the geologic events that have occurred in the whole of central Alaska and to a determination of the relative times of some of the mineralization. The work so far done has disclosed one of the most complete sections of strata representing the early Paleozoic and pre-Paleozoic eras that is known anywhere in Alaska, and consequently the value of working it out thoroughly

can hardly be overestimated. There are also indications that intrusions of deep-seated igneous rocks, which elsewhere in Alaska have been instrumental in introducing mineralizing solutions, occur in unexplored parts of this region, so that search for them is an additional incentive for completing the examination.

One other piece of field work that was done during the season of 1930 by a member of the staff having headquarters in Washington was the customary broad survey of recent developments in the mining industry as a whole, with special visits to some of the more active mining camps or those that have not been recently visited by members of the Geological Survey. This work was done by Philip S. Smith, chief Alaskan geologist. Leaving Washington late in June he stayed some time with the topographic party of Mr. Sargent in southeastern Alaska, to become familiar with that work and to study how best to follow it up with the geologic surveys requisite for the investigation of the mineral resources of the region. In passing through Juneau he had opportunity for brief consultation with B. D. Stewart, of the local Geological Survey office, and with officials of other bureaus whose work bears close relations to that of the Geological Survey. Mr. Smith then went to Anchorage for consultation with Colonel Ohlson regarding the mineral investigations in progress and desired by the Alaska Railroad and made personal studies in all the productive mining camps adjacent to the railroad between Seward and the Willow Creek gold-lode district. In the course of this work he examined the camps in the Moose Pass-Sunrise-Hope district, the Girdwood-Crow Creek district, the Matanuska coal fields, and the Willow Creek district, as well as many small scattered camps at intervening points. In August, under instructions from Washington, Mr. Smith joined the special senatorial investigating committee under the chairmanship of Senator Howell and stayed with that committee throughout its sojourn in the country adjacent to the railroad, so as to make available any information regarding mineral resources that might be called for. The party traversed the entire length of the railroad to Fairbanks and visited many of the settlements and accessible mining camps. On the departure of the committee for the States Mr. Smith returned to Fairbanks to make supplementary studies, especially of the gold-lode developments and the larger placer-mining camps. After further consultation with the officials of the railroad and others in regard to the work of the Geological Survey, he returned to Washington early in October. The general familiarity with the mining industry of the Territory as a whole that may be gained on an inspection trip of this sort is regarded as essential in keeping track of recent developments and laying out plans for future work of the

Geological Survey so that they will fit the needs of the mining industry.

Some of the results of the season's work on the field projects described in the foregoing paragraphs, as well as that done in earlier years, may be expressed in terms of the area covered. In the following table the areas reported are based on the field season and not on the fiscal year, and therefore no account is taken of the work that was started during the field season of 1931 but remained uncompleted at the end of the fiscal year 1931. This procedure has been adopted in part because at the end of the fiscal year most of the field parties were out of communication and so could not report how much they had accomplished, but in part because, as already explained, the field season is regarded as a more practicable unit of measurement.

Areas surveyed by Geological Survey in Alaska, 1898–1930, in square miles

Field season	Geologic surveys			Topographic surveys		
	Exploratory (scale 1:500,000 or smaller)	Reconnaissance (scale 1:250,000)	Detailed (scale 1:62,500 or larger)	Exploratory (scale 1:500,000 or smaller)	Reconnaissance (scale 1:250,000)	Detailed (scale 1:62,500 or larger)
1898–1929	75,150	[a] 176,330	4,277	55,630	209,905	4,066
1930	500	480			3,344	
	75,650	176,630	4,277	55,630	213,249	4,066
Percentage of total area of Alaska	43.7			46.5		

[a] Includes 180 square miles revised extensively in 1930, included also under 1930, and therefore counted only once in the total.

The scale most commonly adopted for Alaska surveys, either geologic or topographic, is the reconnaissance scale (1:250,000), in which about 4 miles (250,000 inches) on the ground is represented by 1 inch of paper on the map, with a contour interval of 200 feet. This scale has been chosen because all the larger features of the country can be represented by it, so that it is adequate for most general purposes, and at the same time the map can be made expeditiously and cheaply. For work requiring less detailed mapping the exploratory scale of 8 to 10 miles to the inch has been adopted. For detailed work the usual scale that has been adopted is 1 mile to the inch, but even larger scales are used if required. The surveys of the region near the mines at Juneau were on a scale of about one-third of a mile to the inch.

In the table given above only the net areas surveyed are listed in the appropriate column, though, of course, most of the areas that have been surveyed geologically have also been surveyed topographically. It is by no means unusual that areas surveyed hastily at

first are later resurveyed with more precision on the same or a larger scale, and if the areas thus revised were not excluded from the totals the same areas would be counted twice. It is for this reason that an area of 180 square miles which was reexamined geologically in 1930 has been deducted from the total in the column of reconnaissance geologic surveys. The necessity for resurveying some areas in more detail is generally not due to faulty execution of the earlier surveys but to the desirability of covering a large tract rapidly at first. Then as development takes place in certain parts of that large tract more accurate and detailed work may be required to furnish the needed information. To cover the entire tract with that same degree of care would unduly delay the work and cost far more than would be warranted. Therefore the resurvey of certain areas here and there as required is really the most economical and logical procedure. Even in tracts where more detailed work is known to be needed it is usually best to make first a relatively rapid, inexpensive survey, so as to supply immediate needs, and then to follow this up with the necessarily slower, more expensive detailed surveys. This policy may be well illustrated by the procedure that was adopted in surveying the Seward Peninsula placer camps. Before the winter of the year in which the rich deposits of this region had been discovered two Federal geologists had made hurried studies of the known productive areas, and within two or three months after the return of these geologists from this camp, during the height of the first stampede to Nome, a rough exploratory map and report on the environs of Nome were published by the Geological Survey. During the next field season reconnaissance surveys were made of the entire region within 100 miles of Nome, and these in turn within a few years were succeeded by detailed mapping and reports on smaller tracts in the vicinity of the richest camps.

The office project of compiling for cartographic use the aerial photographs made by the Navy Department in southeastern Alaska was continued actively throughout the fiscal year. At the present rate it will be more than a decade before even the material that is now in hand can be worked up. Some idea of the magnitude of the job may be gained from the fact that it has required the services of one man for about a solid year merely to mount properly for cartographic use the thousands of photographic prints resulting from the expedition of the Navy Department in 1929. The next step in the process is to take from the photographs all significant topographic data requisite for the making of a drainage map. The methods employed are analogous to those used by the engineer in making surveys in the field, though necessarily the details of procedure differ widely. During 1930 drainage maps of this sort were compiled for areas of about 400 square miles in the Taku district

near Juneau and of 500 and 600 square miles in the region between Wrangell and the earlier mapped area north of Ketchikan. This work was in charge of R. H. Sargent, who devoted much of his own time to it and was assisted by V. S. Seward, topographic engineer, and J. I. Davidson, draftsman, for the equivalent of four to five months each and occasionally by other members of the branch. The preparatory work was done by H. A. Kerns. The application of topographic methods to the recovery of cartographic data from these airplane photographs has presented many difficulties, for the country covered by them has such strong relief that unless there was exceptionally great overlap between successive pictures it was often impossible to obtain satisfactory ties. The individual pictures made in each flight had to be adjusted to one another, then the flight series as a whole had to be fitted to such control points at opposite ends as were available, and successive flight series reconciled. In some of the prints critical features could be recognized only after intensive examination with the stereoscope. The successful compilation of the photographic data into a satisfactory drainage map required in each step manipulative accuracy, technical skill, and discriminating judgment.

The collection of statistics regarding the output of minerals from Alaska each year is carried on mainly from the Washington office, but the wide acquaintance of the field men and their surveys in different parts of the Territory make them a source of much definite information. In addition, many of the other Government organizations, such as the Bureau of Mines, the Bureau of the Mint, and the Customs Service, collect data within their respective fields which contribute to the general subject. Most of the banks, express companies, and other organizations conducting business in Alaska collect for their own use data regarding mineral commodities in their particular districts, some of which are freely placed at the disposal of the Geological Survey. Most of the larger Alaska newspapers, as well as certain papers published in the States that feature Alaska matters, are courteously sent to the Geological Survey by their publishers, and from them many items regarding new developments are gleaned. In addition the Geological Survey sends out hundreds of schedules—one to each person or company that is known to be engaged in mining in Alaska—which call for information regarding the developments and production at each property during the year. From all these sources a large volume of authoritative information is obtained. These annual production reports are conducted on the basis of the calendar year, but the work of canvassing the producers and assembling the data is practically continuous. In fact, during the period from January to June, 1931, data relating to two separate calendar years, 1930 and 1931, were being collected coinciden-

tally. The statistical data for 1930 were compiled principally by Miss L. H. Stone, and the material was coordinated and the resulting report prepared by the chief Alaskan geologist. The report on the mineral industry in 1930 is given on pages 1–83.

The Geological Survey maintains in Alaska two district offices, one at Juneau and one at Anchorage. The main duties of the personnel attached to these offices relate to mineral leasing, but a part of their service relates to general investigations of mineral resources. Under this arrangement approximately two-fifths of the time of B. D. Stewart, who supervises the local offices, is allotted to general investigations of mineral resources, including, besides office duties, visits to different parts of the Territory as conditions warrant. The field work assigned to Mr. Stewart in 1930 under this allotment of time is described on pages 91–92. Mr. Stewart's long familiarity with mining matters throughout the Territory and his availability for consultation at Juneau have made his advice much sought by many of the Federal and Territorial agencies in Alaska, including the Alaska Railroad, the Forest Service, the governor, and members of the Territorial legislature, as well as by many of the individual operators and prospectors. The Alaska offices also act as local distributing points for publications of the Geological Survey and assist in furnishing the main office at Washington with information on many phases of the mineral industry of the Territory. The coordination of the investigative work done from the Alaska offices with that done from the Washington office is still being worked out in detail, but the aim is to make such an adjustment that the combination will be able to give better and greater service to the mining industry at less expense.

Each of the projects described above involves considerable office work in examining and testing the specimens collected, preparing the illustrations and maps, and writing the reports. In addition, considerable work of this sort was also done on projects that had been started in earlier years but not completed. Some of the work on these earlier projects represents only the normal routine of seeing a report through the press, such as proofreading the text and illustrations, but some represents the advancement of studies that for some reason or other were not finished during the year in which the project was undertaken.

In all the office work on the technical reports the members of the Alaskan branch have received much assistance and valuable advice from their associates in other branches of the Geological Survey. T. W. Stanton, G. H. Girty, J. B. Reeside, jr., Edwin Kirk, David White, and E. W. Berry, paleontologists, have examined and reported on the fossils collected in the course of the field surveys. The map and text editors have been helpful in critically scrutinizing the

Alaska maps and reports that were in course of preparation to see that they should conform so far as practicable to the best Geological Survey standards.

All the clerical work of the branch in the Washington office has been performed under the direction of Lucy M. Graves, who has been assisted by Lillian H. Stone and Lillian F. Nelson. The clerical work in the Anchorage office was performed by Harriet V. LaZelle. All the ordinary drafting work other than that performed by the topographers of the branch has been done by J. I. Davidson. Some drafting requiring ability in special lines was done by members of the drafting section of the topographic branch and by Miss M. K. Sumner, of the section of illustrations, and all drawings used for reproduction in the official reports were made by the illustrators in the section of illustrations.

PROJECTS FOR THE SEASON OF 1931

Eleven projects chargeable to funds appropriated directly to the Geological Survey have been approved for the season of 1931. These projects had been under way for only a short time at the end of the fiscal year, and no specific details were available regarding the work actually accomplished, but an outline of the principal objects may be given. Eight of these projects that involve field work are reconnaissance topographic mapping in the Wrangell-Ketchikan district, southeastern Alaska; mining studies in the Taku district, near Juneau, and at other points in southeastern Alaska; geologic investigations in the vicinity of Glacier Bay; reconnaissance topographic mapping in the Klutina Lake district in the Copper River Valley; reconnaissance geologic studies in the Alaska Range region at the head of the Copper River; geologic and topographic reconnaissance surveys in the Tikchik Lakes district of southwestern Alaska; geologic reconnaissance of parts of the Yukon-Tanana region, central Alaska; and general studies of mining developments throughout Alaska. Three projects that do not directly involve field work are the annual canvass of the mineral production from Alaska in 1931, the continued compilation of drainage maps from the photographs resulting from airplane flights in southeastern Alaska by the Navy Department, and general work of the Geological Survey field officers at Anchorage and Juneau.

The topographic mapping in the Ketchikan-Wrangell district in southeastern Alaska is a continuation of the mapping done in the Ketchikan district in 1928 and 1930, whereby an area of about 1,900 square miles was mapped. The work done in 1931 will tie to this earlier work and then carry it northward as far as time and other conditions permit. The mapping of this region is especially needed

by the Geological Survey in its studies of mineral resources, because the region contains several localities where strong indications of mineralization have been found and mines have from time to time been worked. Desire for a map of this region has also been expressed by officials of the Forest Service and others who are concerned with the development of the power and pulpwood resources of the entire southeastern Alaska region. The work of this Geological Survey party, which is in charge of R. H. Sargent, topographic engineer, should be much facilitated by the fact that a drainage map of the area, compiled from the aerial photographs taken by the Navy Department, will be available, so that the work of Mr. Sargent's party will consist mainly in determining the elevation of the natural features and sketching the contours. Doubtless in the course of this work the more precise ground methods will disclose places where readjustment of the map compiled from the photographs will be required. Such changes, however, will probably be more in the nature of refinements of position than the correction of any noteworthy discrepancies. Mr. Sargent will be assisted in this work by V. S. Seward, topographer, and by a recorder and other field helpers. The party will have a large power boat to serve as camp as well as for transportation. Field work began early in May and will be continued as late in the season as the work can be done effectively—to judge from past experience, about the middle of September.

The Taku project is a continuation of investigations that were started in 1930. B. D. Stewart will be in charge of this work and will be assisted by such field helpers as are required. As the season is late in opening up in this district and as the whole of Mr. Stewart's time during the field season may not be required to finish the surveys there, he has been authorized to make such investigations in other mining camps as time and other conditions permit, preference being given to starting a rather detailed examination of the mineral-bearing lodes on Chichagof Island and vicinity. Mr. Stewart has also been called on to testify in court regarding certain mining claims in the Hyder district and doubtless in the course of that work will be able to collect recent information regarding general mining developments in that district. In addition, the many calls that are made on Mr. Stewart for assistance in Territorial mining matters will probably require time either in the field or in analysis of field observations.

Several years ago field investigations of the region adjacent to Glacier Bay, west of Juneau, were carried on by F. E. and C. W. Wright, but the results were not completed in form for publication, and the manuscript was laid aside in the hope that it might be brought to completion. In the lapse of time the accumulation of information from other regions has made even the part that had

been done obsolete, so that new field studies were required to bring the whole up to date. Early in 1931 it was learned that through cooperation with the Bureau of Mines the services of C. W. Wright, who is now a member of that bureau, might be made available, and this seemed an especially favorable opportunity to get the work done. The principal object of the work will be to collect information regarding the general geology and mineral resources of the region. Incidentally, the party should obtain much information regarding the advances and retreats of the glaciers of the region that will be of much general interest as well as of technical service to glacial students. Mr. Wright will be accompanied by Prof. Harry Fielding Reid, of Johns Hopkins University, and such other assistants or field helpers as are required. He left Washington about June 20 and plans to spend about one and one-half months in intensive field work and to complete the manuscript on his return in the fall.

Lying west of the Richardson Highway between Tonsina and Copper Center, in the Copper River Valley, and including Klutina and Tonsina Lakes, is a tract of country that was not surveyed when the country near it to the north and east was mapped. A topographic map of this region has been much needed for geologic studies in tracing the formations that occur in the Chitina region, east of the Copper River, westward toward the mapped areas in the Cook Inlet-Susitna region. As a preliminary to these geologic studies a topographic party in charge of C. F. Fuechsel, with a pack train and the necessary field assistants, was sent into the region in 1931 for the purpose of mapping as much of the country as time and other conditions permit. Mr. Fuechsel started work early in June. Much of the region to be mapped is rugged, mountainous country, so that the precise area that will be covered and the routes that will be followed can not be predicted but must be determined by the conditions that arise in the course of the work.

That part of the Alaska Range between the head of the Copper River and the part of the Tanana Valley lying east of the Delta River and extending as far as the international boundary has been surveyed in only a most hasty manner a long time ago, and the results have never been adequately published. This region lies near camps that have produced considerable quantities of gold, and here and there through it indications of other kinds of mineralization have been reported. It is therefore a tract of economic importance, which should be adequately mapped and studied. The reconnaissance geologic and topographic work required in this tract will take three or more field seasons. A start on the geologic examination of this region was made in 1929 by a small exploratory party in charge of F. H. Moffit, but his work was much handicapped by lack of a suitable map, and only general studies were undertaken.

It was hoped that this work could be continued in 1930 with a more adequate party, but the necessity for utilizing Mr. Moffit's services in connection with the studies in the vicinity of the Alaska Railroad required that it be postponed. In 1931, however, it has been arranged for Mr. Moffit to resume his general studies in this region, though still without the aid of a suitable topographic map and with only a small party consisting of two camp men and a pack train of nine horses. Work began early in June and will continue as late into September as forage for the horses can be obtained. Although parts of the region are remote, other parts lie not far distant from the Richardson Highway, which links the towns of Valdez and Chitina with Fairbanks, and progress in construction of the side road to the Chistochina district is making still more of the region reasonably accessible.

In southwestern Alaska a combined topographic and geologic party in charge of Gerald FitzGerald, topographer, with P. A. Davison, geologist, will carry forward the work started by Mr. FitzGerald in 1930 of mapping as large a tract as practicable of the unsurveyed area lying between Bristol Bay and the headwaters of the Holitna and other near-by tributaries to the Kuskokwim River. In the main this work is so planned that the surveys will be continued up the Nushagak River from the point where the work of 1930 left off, and thence westward so as to cover the Tikchik Lakes and adjacent country. During most of the time the party will travel in a light boat with outboard motor, but frequent trips will be made during which it will be necessary to back-pack all required supplies and equipment. As no geologist accompanied the expedition of 1930, when the lakes at the head of the Wood River, south of the Tikchik Lakes, were mapped, it has been planned that, if practicable during the later part of the season, when the topographic work is likely to be mainly in the lowlands of the Nushagak River, the party shall split, the geologist traversing part of the hitherto surveyed areas and not rejoining the topographer until they both reach the coast at the end of the season. The personnel and technical equipment of the party were transported by airplane from Anchorage to Dillingham, where supplies and other equipment were procured. Work began June 9 and will probably end about the middle of September.

Ever since the earliest investigations of Alaska's mineral resources by the Geological Survey, its parties have traversed parts of the great belt of country lying between the Yukon and Tanana Rivers. The numerous and extensive reports from these parties, working under different conditions and with different points of view, have furnished an enormous volume of technical data of varying degrees of completeness and up-to-dateness. For several years progress has been made

on the project of going over all these old records, reconciling differences, correlating similar features, and otherwise knitting these diverse records into a properly organized report that should state comprehensively the best current interpretation of the geologic history of this region. This work has reached an advanced stage, but before it can be completed certain problems require further field examination. To do this work J. B. Mertie, jr., with a party of three camp assistants and a small pack train, landed at Rampart and started inland. During the summer he will visit parts of the Rampart and Hot Springs districts and, if time and other conditions permit, will swing eastward into the Livengood or Tolovana district, perhaps ending the season at Fairbanks about the middle of September. It is believed that this work will complete all the field studies that will be necessary for the report that is in preparation. This does not, of course, mean that all problems relating to this region have been solved or that no further investigations in the region will be needed. In fact, the fundamental idea back of the whole project is that by summarizing the existing knowledge and bringing it up to date the way to future advancement in understanding the complex history of the region may become clearer, so that the summary, instead of being a climax, may really be a firm foundation from which to start further studies.

The general survey of Alaska mining conditions to be conducted by the chief Alaskan geologist during the season of 1931 will resemble similar work in the past, though the individual points visited will necessarily differ. Detailed plans can not be stated in advance, as they will necessarily depend very largely on the conditions that are found in the field and the availability of transportation. It is expected that a considerable part of the time in the field will be spent with the parties engaged in work in the vicinity of the Alaska Railroad; but it is hoped that time will also permit studies in some of the larger producing camps as well as in some of the more remote tracts that have not recently been visited by members of the Geological Survey. Owing to duties in Washington the actual field work will not be started until after the 1st of July.

The collection of statistics regarding the mineral output of Alaska in 1931 will in general be similar to the work done on the corresponding project in 1930. It should be completed about the middle of 1932.

The second of the office projects that has been approved for the season of 1931 is the further compilation of drainage maps from the thousands of photographs resulting from the printing of the films taken by the Navy aviators in southeastern Alaska in the season of 1929. It is essential that drainage maps of this sort covering at least 2,000 square miles should be compiled before the field season

of 1932 begins, as otherwise the topographic mapping will have to be delayed or put off. It is proposed, however, not to limit the amount compiled to that required for immediate topographic use but to press on the project of completing the compilation of all the photographs now in hand as rapidly as funds and personnel permit, because even without topography these maps are in much demand by the Forest Service and other Government organizations and private individuals who are active in development throughout southeastern Alaska.

The item for Alaska offices in the foregoing list of projects for 1931 that do not require field work includes such duties of the personnel attached to the Juneau and Anchorage offices as are not related to a definite field project or regarded as distinctly administrative. This is not a new undertaking but is to provide for miscellaneous duties which have heretofore been included in the leasing activities but which for 1932 are regarded as more properly falling within the scope of the mineral investigations. It is probable that as the details of the change are worked out a part of the allotment for this work will be used for definite field projects.

RAILROAD PROJECT

The most extensive project undertaken by the Geological Survey in Alaska in 1931 is supported by funds not appropriated to it directly but transferred for its use by the Alaska Railroad. For brevity this may be referred to as the railroad project. The direct cause of this project may be traced to the study of the Alaska Railroad made during the summer of 1930 by a select committee composed of Senators Howell, Kendrick, and Thomas. During their investigations they were impressed, among other things, by the necessity of determining rather specifically the amount of tonnage that the railroad might expect from the mineral deposits that occur within a reasonable distance of its tracks. Development of this idea led to the inclusion in the item for the Alaska Railroad in the Interior Department act of the provision "that not to exceed $250,000 of this fund shall be available for continuation of the investigation of mineral and other resources of Alaska to ascertain the potential resources available which will affect railroad tonnage." As a result of this act arrangements were entered into whereby the Geological Survey is to conduct these investigations in such manner and at such places as are approved by the responsible railroad officials. Plans were drawn up by the Geological Survey and approved by the manager of the railroad, and the funds necessary to start the work were supplied for examinations in the following areas: Anthracite Ridge, Copper Mountain, Kantishna, Valdez Creek, Chulitna, Fair-

banks, Willow Creek, Girdwood, and Moose Pass. The plans also include an examination of the nonmetallic mineral resources throughout the railroad belt and the maintenance of a geologist throughout the year to serve as general representative to advise with the manager on mining and geologic matters, to work with prospectors and make available the results of the surveys, and to serve as a medium of coordination between the railroad and other agencies engaged in this program. G. A. Waring is the geologist who will carry on the nonmetalliferous investigations. The geologist who will be stationed at Anchorage throughout the year has not yet been selected but will be one of those who have been assigned to the field projects during the summer.

Although the problem is approached with much interest, it is realized at the outset that satisfactory solution will be beset with many difficulties. In the first place, the very things that would be advantageous to the railroad would be deterrent to a mining enterprise; that is, long railroad hauls or movement of large tonnages. Furthermore, the development of large mining enterprises is not a matter lightly undertaken or quickly accomplished, so that early returns from any investigations such as the Geological Survey could make would hardly be likely. However, the Geological Survey approaches the task with the firm belief that there are mineral deposits in the areas listed that sooner or later will be productive.

In all the areas mentioned mineralization has long been known, from most of them ore has been shipped in the past, and in several of them there is currently more or less production. The problem therefore in the main is to discover new deposits of ore or to stimulate production from deposits already known and to indicate the conditions under which ore occurs, so as to guide prospectors and others in their search for new deposits. All the areas have already been examined by Survey geologists in a manner regarded as adequate for reconnaissance standards, so that the new work will be of a much more detailed and intensive character and the examinations will be directed toward quantitative determination of possible mineral tonnage rather than more general theoretical studies. Work on all these projects is in general charge of S. R. Capps, who got the field work started early in June and will keep it going as late in the fall as practicable. From the later part of July Mr. Capps will be assisted in his general supervision of the work by D. F. Hewett, geologist. Through the courtesy of the Bureau of Mines the samples collected by the different parties will be analyzed at the laboratories of the bureau in Alaska, the coal samples in the coal-testing laboratory at Anchorage and the metallic and nonmetallic minerals other than coal in the laboratory at Fairbanks

conducted in cooperation with the Alaska Agricultural College and School of Mines. Cooperation has also been courteously offered by the Alaska Road Commission, through its president, Maj. Malcolm Elliott, in placing its facilities at the disposal of the parties in those areas where the commission is carrying on work.

The Anthracite Ridge region, as the name implies, contains deposits of coal, some of which are of anthracite quality. The region is intersected by many faults, and the beds are cut by or interlaminated with igneous intrusive rocks. Only by very detailed work can the amount of coal be determined. It is therefore proposed that both geologic and topographic mapping, on a scale of 5 inches to the mile, will be undertaken. This project is in charge of Ralph W. Richards, geologist, and the topographic work will be done by L. O. Newsome. In addition to a study of the surface exposures the party will do much stripping of the surface and test pitting. Then, if conditions appear to warrant it, core drilling to test the beds in depth will be undertaken. The tract that will be most carefully studied is only 7 or 8 miles long by 2 to 3 miles wide. It lies about 15 miles east of Chickaloon on the Matanuska branch of the Alaska Railroad. About 20 men will be needed for various phases of the work. They will maintain the necessary camps within the area, and their supplies will be brought in from Chickaloon by pack train.

In the Kantishna and Copper Mountain districts, which lie 60 miles or more west of the Alaska Railroad and north of the Alaska Range, silver-lead, zinc, copper, antimony, and gold lodes have been long known, and ore has been shipped from some of the lodes, though, because of the remoteness of the region, it has not well repaid the operators in spite of the fact that some of it had a value of over $100 a ton. As no detailed maps of either of these tracts are available, a separate topographic party has been assigned to each to make maps of the mineralized areas on a scale of 1 mile to the inch. S. N. Stoner, topographer, is in charge of the party at Copper Mountain, and S. C. Kain is in charge of the topographic work in the Kantishna district. In each district investigations of the geology and ore deposits will be carried out as thoroughly as possible—in the Kantishna district by F. G. Wells, who will also act as chief of the combined geologic and topographic party, and at Copper Mountain by J. C. Reed. Both parties have the necessary camp assistants, and pack trains will bring in their supplies from the end of the road that is being constructed through the Mount McKinley National Park and now extends within about 20 miles of Copper Mountain.

The Valdez Creek district lies about 50 miles due east of Cantwell, a station on the Alaska Railroad not far from Broad Pass. Gold

lodes occur in this district, but have been only slightly developed. To assist in the determination of the extent and character of the mineralization a small geologic party in charge of C. P. Ross will carry on reconnaissance surveys. After the Valdez Creek work is finished Mr. Ross plans to spend some time in the Chulitna region, where lodes carrying mixed sulphides have been slightly opened up in the past.

In the Willow Creek and Fairbanks districts gold lodes are being productively mined, and in the past the ores from each have yielded gold worth more than a million dollars. The mines are all small, and the efforts of the operators are necessarily directed toward finding and developing small rich veins, which do not afford tonnage of significance to the railroad. The Geological Survey's studies in these districts will therefore be directed largely toward determining the volume of low-grade ores that might be profitably developed if worked on a large scale, though at the same time the parties will not neglect to look for higher-grade deposits or fail to note any facts that might help prospectors or others to understand the way in which the ore bodies have been formed, so that the search for lodes may be more intelligently directed. The work in the Fairbanks district will be carried on by J. M. Hill and in the Willow Creek district by J. C. Ray.

North of Turnagain Arm and about 40 miles east of Anchorage, in the neighborhood of Girdwood, gold placers have been worked for many years, and in the hills at the head of the valleys in which they occur, notably at the head of Crow Creek, rich gold ores have been found and some underground development work done. This area has not been surveyed in detail, and only the larger aspects of its geology have been determined. In this area a combined topographic and geologic party in charge of W. G. Carson, topographer, with C. F. Park, geologist, will map on a scale of 1 mile to the inch as much of the country as time and other conditions permit. The geology of the region is complex, but the proved occurrence of extensive mineralization in it is a stimulating incentive to solve the problems of distribution and make careful quantitative estimates of the amount of ore that it might yield under various assumptions as to the probable costs of mining.

Extending for nearly the whole length of Kenai Peninsula southward from Turnagain Arm is an extensive series of black slates and shales which in many places are cut by intrusive igneous rocks and which are intersected by quartz veins and stringers, the whole being more or less mineralized. Many small prospects and small productive mines have been opened within this belt. A more detailed study than has heretofore been given to this belt, in order that the origin

and extent of its distribution may be more clearly understood, will be made by a party in charge of Ralph Tuck. The greater number of old prospects have been in that part of the belt from Moose Pass northward to Turnagain Arm at Hope and Sunrise, and it is in this part of the belt that Mr. Tuck will doubtless do the greater part of his field work.

EXPENDITURES

The funds directly appropriated for the work of the Geological Survey on Alaska's mineral resources during the field season of 1930 were made available through the Interior Department appropriation acts for 1930 and 1931. The specific purpose for which the funds were appropriated, as stated in the acts, was " for continuation of the investigation of the mineral resources of Alaska." Each act contained a provision for making the funds appropriated available for expenditure immediately on the approval of the act. The act of 1930 was approved March 4, 1929, and the act of 1931 was approved May 14, 1930. The act of 1930 appropriated $67,500; the act of 1931, $75,000. The funds used during the field season of 1931 were made available through the Interior Department appropriation act for 1931, already noted, and the act for 1932, which appropriated $84,500.

In April, 1931, in order to finance the work which the Geological Survey was requested to perform in the interest of the Alaska Railroad, transfers of funds amounting to $30,000 for direct expenditure by the Geological Survey were made by the railroad. These funds were considered available for expenditure only up to the end of the fiscal year, but a supplementary transfer of $50,500 to continue the work until about the end of the calendar year 1931 was made, and further transfers will be requested as additional funds are required. All the funds transferred were carried in the regular Interior Department appropriation acts for 1931 and 1932.

Although there is no direct relation of the field season to the fiscal year, the amount of money spent during any field season closely approximates the amount of money appropriated for the corresponding fiscal year. Thus the expenditures for starting parties in the field season of 1930 in advance of July 1 that were paid from one appropriation are about balanced by the expenditures for parties that started in the season of 1931 in advance of July 1 and were paid from the next appropriation. In other words, the sum of the expenditures during a field season, though paid from different appropriations, is essentially identical with the total amount of the appropriation available for a single year, unless there has been a marked change in the amount of money appropriated for the two fiscal years.

Expenditures from funds appropriated for investigation of mineral resources of Alaska for the fiscal year 1930–31

Projects for the season of 1930	$12,939
Projects for the season of 1931	17,690
Administrative salaries, July 1, 1930, to June 30, 1931	3,173
All other technical and professional salaries, July 1, 1930, to June 30, 1931	29,766
All other clerical and drafting salaries, July 1, 1930, to June 30, 1931	8,307
Office maintenance and expenses	3,125
	75,000

In the first two items in the foregoing statement no charges are included for the salaries of any of the permanent employees of the branch, as all these are carried in the three following items. Proper proportional charges for these services, as well as for the expenditures listed as office maintenance and expenses, might well have been made in these first two items, for practically every expenditure made by the branch relates more or less directly to these projects. Thus the administrative officers are concerned primarily with the successful accomplishments of these projects, the scientific and technical personnel is maintained solely to carry out these projects, the clerical and drafting force is required to help in preparing the reports and maps and in attending to the innumerable details connected with the task of properly conducting the projects, and all the office supplies and other equipment purchased are really incidental to the task of carrying through the projects.

The expenditures for the projects of 1930 from the appropriation for 1931 amounted to $12,939, which includes $6,890 for geologic and general investigations and $6,049 for topographic work. A similar analysis of the expenditures for the season of 1931 shows that expenditures from funds for the fiscal year 1931 amounted to $17,690, of which $9,300 was for geologic work and $8,390 for topographic work. Of the $30,629 allotted to field projects for both seasons from the appropriation for 1931, $16,190, or about 53 per cent, was allotted to geologic or related general work and $14,439, or 47 per cent, to topographic work.

The item for administrative salaries in the foregoing table includes only those salaries that are directly related to general administration and does not include charges for administration such as each party chief is called on to perform with regard to the party in his charge, though that work requires considerable time and much administrative skill to discharge properly. During the fiscal year 1931 the chief Alaskan geologist was engaged in field work until October and later spent the equivalent of one and a half months on

the preparation of the statistical report, as well as six and a half months in the preparation of other reports. Part of Mr. Stewart's salary has been included in this item, as the local administration of the Alaska offices is in his charge. The low cost of administration is due principally to the fact that the administrative officers are engaged also in technical projects, to which is therefore charged a proportional part of their salaries. This makes for low cost of administration but lessens the amount of time spent in real directive handling of many of the affairs of the branch and would not be at all practicable except with a branch whose personnel has long been familiar with the work to be done and is well qualified to solve for itself many of the problems that arise.

The item for clerical and drafting salaries covers the salaries of the chief clerk, two junior clerks, and a draftsman in the Washington office and part of the salary of a clerk in the Anchorage office. Approximately three-fourths of the time of one of the junior clerks in the Washington office is given to the canvass and compilation of data regarding the production of minerals in the Territory. The draftsman is engaged in all kinds of map preparation, involving the compilation of cartographic material and the preparation of fair copy therefrom for use in direct reproduction or for record. The present clerical and drafting personnel is entirely too small to handle the volume of business that passes through the office. As a result many things conducive to the proper conduct of the work are unduly rushed or laid aside, thus crippling or retarding the work. This condition was the result of curtailments in appropriations, which have been met by curtailments in the office force, so as to make as much money as possible available for the field projects. This procedure is having an injurious effect on the work as a whole and is really uneconomical.

The item for office maintenance and expenses in the table includes all the miscellaneous expenses incident to the general conduct of the work that are not directly part of a definite project. It includes purchase and repair of the technical instruments used, the photographic and related work required in the course of the compilation and preparation of the maps, and the printing of field photographs. Other expenditures that fall under this item are telegrams, stationery, technical books, services rendered by other units of the Geological Survey, such as making thin sections of rocks and minerals needed in microscopic examinations, and shipment of material not to be used in designated projects. One of the largest single expenses charged to this item was the photolithographic reproduction of a topographic map of the Goodnews Bay region, which was submitted for publica-

tion as an advance edition subject to correction at a cost of about $300. Surveying instruments represent an expenditure of about $1,000 that is included in this item. As will be seen, the total charged against this item represents an amount equivalent to about 4 per cent of the total appropriation.

In the following tables has been set down the cost of the work, including field expenses and the salaries paid from different appropriations, by geographic regions or by classes of work. Only the salaries of the permanent force are included in the column of salaries. The wages paid to temporary assistants, camp hands, and other seasonal employees are included in the columns headed "Expenses." The figures for the portions of the salaries charged against each project are only approximately accurate, for the whole time of a geologist or topographer assigned to a project is charged against that project, whereas much of his time in the office is required for miscellaneous duties. The columns o fsalaries, except as specifically noted, do not include administrative salaries or clerical salaries, and the columns of expenses do not include items charged to office maintenance or expense. For these reasons, as well as because two different appropriation years are tabulated together, the total given in the last column does not equal, even approximately, the total given in the table on page 110, which represents a single fiscal year. Furthermore, the expenses from the appropriation for 1932 are necessarily all estimates, as actual expenditures will not be known until the end of the field work in the winter or until the completion of the report next spring. The figures used therefore simply represent the allotments or estimates that have been made for the different projects.

Approximate cost and distribution of work, by geographic divisions, for the season of 1930

Region and work	Appropriation for 1930		Appropriation for 1931		Total
	Expenses	Salaries	Expenses	Salaries	
Southeastern Alaska, Ketchikan reconnaissance topography	$2,400	$867	$4,288	$3,000	$10,555
Southeastern Alaska, Taku, etc., reconnaissance mining			1,590	1,040	2,630
Railroad region, Kantishna-Bonnifield mineral resources	2,500	867	1,443	3,466	8,276
Railroad region, Chulitna-Broad Pass reconnaissance geology	2,050	933	1,012	3,733	7,728
Southwestern Alaska, Nushagak reconnaissance topography	2,500	667	1,761	2,667	7,595
Interior Alaska, Yukon-Nation reconnaissance geology	3,250	800	2,270	3,200	9,520
General mining developments			575	3,467	4,042
Mineral statistics				[a] 2,195	2,195
Phototopographic map compilation				3,890	3,890
	12,700	4,134	12,939	26,658	56,431

[a] Includes 9 months' salary of clerk.

Approximate cost and distribution of work, by geographic divisions, for the season of 1931

Region and work	Appropriation for 1931		Appropriation for 1932		Total
	Expenses	Salaries	Expenses	Salaries	
Southeastern Alaska, Wrangell-Ketchikan reconnaissance topography	$3,500	$1,300	$5,100	$4,767	$14,667
Southeastern Alaska, Taku, etc., reconnaissance mining			1,800	1,733	3,533
Southeastern Alaska, Glacier Bay reconnaissance geology	500		2,500		3,000
Copper River region, Klutina Lake reconnaissance topography	3,400	603	3,900	1,928	9,831
Copper River region, headwaters Copper reconnaissance geology	2,800	867	4,900	4,333	12,900
Southwestern Alaska, Tikchik Lakes region, reconnaissance geology and topography	2,975	884	2,925	4,333	11,117
Interior Alaska, Yukon-Tanana reconnaissance geology and mineral resources	4,350	800	2,150	4,000	11,300
General mining developments	165	50	1,500	3,467	5,182
Mineral statistics				[a] 2,200	2,200
Phototopographic map compilation				2,718	2,718
Alaska offices			510	1,100	1,610
	17,690	4,504	25,285	30,579	78,058

[a] Includes 9 months' salary of clerk.

LEASING WORK

Part of the activities of the Alaskan branch are related to the proper conduct of mining work on the public mineral lands that have been or may be leased to private individuals or corporations under certain laws. Funds for this work throughout the United States are provided in a general item contained in the Interior Department appropriation act, under the following language: "For the enforcement of the provisions of the acts of October 30, 1914, October 2, 1917, February 25, 1920, and March 4, 1921, and other acts relating to the mining and recovery of minerals on Indian and public lands and naval petroleum reserves." Appropriations carried for this item are available only during the specified fiscal year. The amount that is allotted for the different districts, including Alaska, is determined by the relative needs of each district. For the fiscal year 1931 the allotment for Alaska leasing work was $10,000, the same as in the preceding fiscal year.

In order that the policies and practices that have been developed by the leasing unit of the conservation branch of the Geological Survey for handling the much larger volume of similar work in the States should be maintained in Alaska and at the same time the specialized knowledge of Alaskan affairs possessed by the Alaskan branch should be utilized, the general conduct of the leasing work in Alaska is in a measure shared between the two branches, the office work in Washington being done principally by the conservation branch and the field work by the Alaskan branch. The field work is

done by the same engineers who conduct such work on mineral resources as is assigned to the Alaska local offices. B. D. Stewart, supervising engineer, who has headquarters at Juneau, is in immediate charge of the field work, assisted by J. J. Corey, coal-mining engineer, at Anchorage. The use of the same personnel and facilities for both the leasing work and the work on mineral resources makes it extremely difficult and at times uncertain to distinguish accurately between the two. Except from an accountant's point of view, however, the distinction is of little importance. The point of real importance is that by this close cooperation or consolidation of interests duplication of activities is avoided, costs are lowered, and the technical facilities are focused on the main problem, which is the development of the Territory's mineral resources. During the fiscal year 1931 about three-fifths of Mr. Stewart's time, all of Mr. Corey's time, and two-thirds of the time of a clerk in the Anchorage office are considered to have been devoted to the leasing work. The charges for the maintenance of the local office are shared between the leasing and mineral-resources work on ratios of about 3 to 1. In the fiscal year 1931 the allotment for field expenses was approximately $1,500, an amount that is inordinately low and that proved adequate only because the Alaska Railroad has extended to the limit its services in facilitating the movement of the engineers.

The primary purpose of the leasing work is to supervise the operations under the coal and oil leases or permits that have been granted by the Government and to advise and consult with the proper authorities, both Federal officers and private applicants, regarding lands that may be under consideration for a lease or permit. Practically all the coal mining and much of the oil prospecting in Alaska is done on public lands by private individuals or companies under leases or permits issued by the Secretary of the Interior. The interest of the Government in these lands requires not only that these grants shall be a source of revenue to the Nation but that proper methods of extracting the minerals shall be employed, thus preventing waste or damage to the property, and that the lives, health, and welfare of those engaged in the work shall be properly safeguarded. Practically all the producing coal mines that have been opened in the Territory are in the region adjacent to the Alaska Railroad. The Government has therefore an especial interest in their successful operation. For this reason the Federal engineers have given intensive study to the problems confronting these mines and have been especially active in supervising their operations, not only to see that the terms of the leases are observed but also to be of as much assistance as possible to the small operators who are opening them, by giving them competent technical advice and aiding them in making their ventures successful. Among the

points to which special attention has been given are the installation and maintenance of safe and efficient tramming and hoisting equipment, the adequate ventilation of the mines, the reduction of explosion and blasting hazards, and the providing of adequate pillars in advance of all mining operations. This service is appreciated by the operators, and the relations between them and the engineers are extremely cordial and friendly, with no hint of the antagonism that sometimes exists between inspector and inspected.

At the present time almost no active drilling for oil is being done in Alaska under Government permit, and consequently little of the time of the engineers is spent in the supervision of oil developments. There are, however, many tracts of public land in Alaska that appear to hold promise of containing oil, and hundreds of prospecting permits for oil have been issued by the Government throughout the length and breadth of the Territory. It would ordinarily be the practice for the Federal engineers to check up on these permits occasionally by field visits, but the field force available is altogether too small to attempt to make even a casual examination of most of the tracts under permit. Under present conditions it is therefore necessary to rely mostly on local unofficial reports, especially as these indicate no active oil prospecting in progress in any but two of the fields. In this connection it should be pointed out that the number of engineers needed to look after the Government's mineral lands in Alaska is not comparable with the number required in certain of the States. Neither is the need to be measured by the revenues received by the Government, nor by the number of leases or permits outstanding. In Alaska the open season is so short, the distances so great, and the regular means of transportation so slow and infrequent that either a proportionately much larger force must be maintained, or supervision in the more remote parts must be reduced to a mere gesture.

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 price is 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 per cent is allowed.

3. 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.

The Alaskan mining industry in 1930 by Philip S. Smith. In Bulletin 836, 1932, — cents. The preceding volumes in this series and years covered are Bulletins 259, 1904, 15 cents; 284, 1905, 25 cents; 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 (714–A, 25 cents); 722, 1920, 25 cents; 739, 1921, 25 cents; 755, 1922, 40 cents; 773, 1923, 40 cents; 783, 1924, 40 cents; 792, 1925, 25 cents; 797, 1926, 80 cents; 810, 1927, 50 cents; 813, 1928, 40 cents; 824, 1929, — cents.

Railway routes from the Pacific seaboard to Fairbanks, Alaska, 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.

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Geology of the Eagle-Circle district, by J. B. Mertie, jr. Bulletin 816, 1930, 168 pp. 50 cents.

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Kantishna district, by F. H. Moffit. In Bulletin 836, 1932, pp. ——. — cents.

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Circle quadrangle (No. 641); scale, 1:250,000; 1911, by T. G. Gerdine, D. C. Witherspoon, and others. 50 cents retail or 30 cents wholesale. Also in Bulletin 538, 1913, 20 cents.

Koyukuk and Chandalar region, reconnaissance map; scale, 1:500,000; by T. G. Gerdine, D. L. Reaburn, D. C. Witherspoon, and A. G. Maddren. In Bulletin 532, 1913, 25 cents. Not issued separately.

Fairbanks quadrangle (No. 642); scale, 1:250,000; 1911, by T. G. Gerdine, D. C. Witherspoon, R. B. Oliver, and J. W. Bagley. 50 cents retail or 30 cents wholesale. Also in Bulletin 337, 1908, 25 cents, and Bulletin 525, 1913. 55 cents.

Fortymile quadrangle (No. 640); scale, 1:250,000; 1902, by E. C. Barnard. 10 cents retail or 6 cents wholesale. Also in Bulletin 375, 1909, 30 cents.

Rampart quadrangle (No. 643); scale, 1:250,000; 1913, by D. C. Witherspoon and R. B. Oliver. 20 cents retail or 12 cents wholesale. Also in Bulletin 337, 1908, 25 cents, and part in Bulletin 535, 1913, 20 cents.

Fairbanks special (No. 642A); scale, 1:62,500; 1908, by T. G. Gerdine and R. H. Sargent. 20 cents retail or 12 cents wholesale. Also in Bulletin 525, 1913, 55 cents.

Bonnifield region; scale, 1:250,000; by J. W. Bagley, D. C. Witherspoon, and C. E. Giffin. In Bulletin 501, 1912, 20 cents. Not issued separately.

Iditarod-Ruby region; scale, 1:250,000; by C. G. Anderson, W. S. Post, and others. In Bulletin 578, 1914, 35 cents. Not issued separately.

Middle Kuskokwim and lower Yukon region; scale, 1:500,000; by C. G. Anderson, W. S. Post, and others. In Bulletin 578, 1914, 35 cents. Not issued separately.

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The Fairhaven gold placers, Seward Peninsula, by F. H. Moffit. Bulletin 247, 1905, 85 pp. 40 cents.

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Geology of the Seward Peninsula tin deposits, by Adolph Knopf. Bulletin 358, 1908, 71 pp. 15 cents.

Geology and mineral resources of the Solomon and Casadepaga quadrangles, Seward Peninsula, by P. S. Smith. Bulletin 433, 1910, 234 pp. 40 cents.

A geologic reconnaissance in southeastern Seward Peninsula and the Norton Bay-Nulato region, by P. S. Smith and H. M. Eakin. Bulletin 449, 1911, 146 pp. 30 cents.

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* The gold and platinum placers of the Kiwalik-Koyuk region, by G. L. Harrington. In Bulletin 692, 1919, pp. 368–400.

Metalliferous lodes of southern Seward Peninsula, by S. H. Cathcart. In Bulletin 722, 1922, pp. 163–261. 25 cents.

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Pliocene and Pleistocene fossils from the Arctic coast of Alaska and the auriferous beaches of Nome, Norton Sound, by W. H. Dall. Professional Paper 125–C, 1921, 15 pp. 10 cents.

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Seward Peninsula; scale, 1:500,000; compiled from work of D. C. Witherspoon, T. G. Gerdine, and others, of the Geological Survey, and all other available sources. In Water-Supply Paper 314, 1913, 45 cents. Not issued separately.

Seward Peninsula, northeastern portion, reconnaissance map (No. 655); scale, 1:250,000; 1905, by D. C. Witherspoon and C. E. Hill. 50 cents retail or 30 cents wholesale. Also in Bulletin 247, 1905, 40 cents.

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Nulato-Norton Bay region; scale, 1:500,000; by P. S. Smith, H. M. Eakin, and others. In Bulletin 449, 1911, 30 cents. Not issued separately.

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Surveys in northwestern Alaska in 1926, by Philip S. Smith. In Bulletin 797, 1928, pp. 125–142. 80 cents.

Preliminary report on the Sheenjek River district, Alaska, by J. B. Mertie, jr. In Bulletin 797, 1928, pp. 99–123. 80 cents.

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Geography and geology of northwestern Alaska, by Philip S. Smith and J. B. Mertie, jr. Bulletin 815, 1930, 351 pp. $1.

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Koyukuk River to mouth of Colville River, including John River; scale, 1:1,250,000; by W. J. Peters. In Professional Paper 20, 1904, 40 cents. Not issued separately.

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