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UNITED STATES DEPARTMENT OF THE INTERIOR

THE MINERAL INDUSTRY OF ALASKA IN 1935

GEOLOGICAL SURVEY BULLETIN 880—A

UNITED STATES DEPARTMENT OF THE INTERIOR
Harold L. Ickes, Secretary

GEOLOGICAL SURVEY
W. C. Mendenhall, Director

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MINERAL INDUSTRY OF ALASKA IN 1935

BY

PHILIP S. SMITH

Mineral resources of Alaska, 1935

(Pages 1–95)

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By PHILIP S. SMITH[1]

INTRODUCTION

The record of the Alaska mineral industry for 1935, here presented, is supplemented by records for earlier years, because in that way certain trends may be recognized which are not only of historical significance but are also useful in suggesting the course that the industry is likely to take in the future. This is a continuing service that has been rendered by the Geological Survey from almost the earliest years of active mining in Alaska, and the present report is the thirty-second of the series.[2]

To obtain the information recorded in these reports the Geological Survey, in addition to its other investigations of mineral resources, conducts an annual canvass of the entire mineral industry of Alaska. The collection of the facts requisite for the preparation of these annual statements involves difficulties, because the great size of the Territory, the diversity of its mineral products, and the large number but small size of many of the enterprises make it impracticable without undue delay and expense to gather all the desired information at first hand. The information used is therefore derived from many sources, which necessarily vary in reliability and completeness. Efforts are made, however, to reduce all the statements to a comparable basis and to give only those that appear to be well substantiated. Among the most reliable sources of information are the geologists and engineers who are sent out each year by the Geological Survey to conduct surveys in different parts of Alaska and who acquire not only much accurate information regarding the mineral production of the regions in which they work but also general information by contact with miners and operators in the course of their

[1] The canvass of producers, the tabulation of their replies, and general assistance in all phases of the office work connected with the preparation of the statistics set forth in this report have been carried through effectively by Kathleen S. Waldron, of the Alaskan branch of the United States 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, 722, 739, 755, 773, 783, 792, 810, 813, 824, 836, 844–A, 857–A, 864–A, and 868–A. The reports for 1902 and 1903 were included with other "contributions to economic geology" in Bulletins 213 and 225.

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 Survey, though some of this information is confidential and is not released for publication. Most of the larger Alaska newspapers and certain papers published in the States that feature Alaska matters are courteously sent by their publishers to the Geological Survey, and from these and the technical and scientific periodicals are gleaned many items regarding new developments.

In addition to all these sources the Geological Survey each year sends out hundreds of schedules—one to every person or company known to be engaged in mining in Alaska—on which are 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 gratifying evidence of the general appreciation of these annual summaries that so many of the operators cooperate fully and cordially with the Geological Survey by furnishing the information called for on the schedules as well as volunteering much other pertinent information.

It is apparent, however, that facts collected from one source, although of themselves strictly accurate, are likely to be computed or stated on a different basis from equally reliable reports received from another source, so that considerable editing and revision must be done to bring all to one standard. It is not possible to know exactly all the corrections that should be applied in order to reduce the reports of production to a strictly uniform standard. However, though some uncertainties necessarily remain, it is believed that they do not have significant effect on the results expressed and that the report is consistent within itself and with the other reports of this series which record the statistics of mineral production. The

restriction of the statistics in this report to those relating to production should be stressed, so that the reader will realize that while the statistics are comparable among themselves, they necessarily differ from those published by some of the other Government bureaus, because these are primarily records of production, whereas those issued by the Bureau of the Mint, for instance, relate to receipts at the offices of that Bureau, those issued by the Customs Service relate to shipments recorded at its stations, and those issued by other organizations may be computed on still other bases.

Another reason why the totals used in this volume for certain mineral commodities may differ from the reports received from other sources is that all values here stated are computed on the average selling price for each of the individual mineral commodities for the year and not on the prices actually received by the individual producers. It is obvious that this method of computation disregards the amount received by individual mines, but it is believed to afford a more useful representation of the industry as a whole. Thus the reports of the operators of small placer mines who sold their gold at a discount in local trade, or those of the larger producers from the value of whose gold deductions were made for shipping, insurance, and other expenses incident to handling, were so edited that the full value of the gold produced was recorded.

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

ACKNOWLEDGMENTS

The mining operators and prospectors of the Territory who have filled in and returned the inquiry blanks sent out by the Geological Survey have made this report possible. Special acknowledgment is also due to officers of the Bureau of Mines connected with mineral investigations and the Bureau of Foreign and Domestic Commerce; the collectors and other officers of the Alaska Customs

Service and of the Bureau of the Mint; the officers of the Forest Service; Col. O. F. Ohlson, Ralph Tuck, and other officers of the Alaska Railroad; F. H. Moffit, S. R. Capps, J. B. Mertie, Jr., R. H. Sargent, Gerald FitzGerald, Stephen Taber, and Paul Hopkins, of the Geological Survey; officers of the Alaska Road Commission; the Alaska Weekly and Volney Richmond, of the Northern Commercial Co., of Seattle, Wash., and the agents of this company, especially C. B. Haraden at Eagle, J. W. Farrell at Hot Springs, and L. L. Laska at McGrath; Ralph and Carl Lomen, of Seattle and New York; Charles F. Sandford, of Hyder; the Alaska Juneau Gold Mining Co., the Daily Alaska Empire, and J. J. Connors, of Juneau; the Ketchikan Alaska Chronicle, of Ketchikan; the Cordova Daily Times, of Cordova; the Valdez Miner, of Valdez; the Kennecott Copper Corporation, of Kennicott and New York; Carl Whitham and M. J. Knowles, of Chitina; W. J. Erskine, of Kodiak; Elwyn Swetmann, of Seward; the Bank of Alaska and the Anchorage Weekly Times, of Anchorage; W. E. Dunkle, of Luckyshot; H. W. Wilmoth, of Wasilla; Charles Harper, of Yentna; H. W. Nagley, of Talkeetna; Frank H. Waskey, of Dillingham; Jack Martin, of Unalaska; Charles Zielke, of Ferry; W. Yanert, of Beaver; Harry Greep, of Circle Springs; the First National Bank, O. J. Egleston, R. B. Earling and other officers of the Fairbanks Exploration Department, the Fairbanks Daily News-Miner, and G. E. Jennings, of Fairbanks; John B. Powers and J. J. Hillard, of Eagle; Thomas J. DeVane, of Ruby; the Miners & Merchants Bank of Iditarod; Alex Mathieson and Harry Donnelley, of Flat; Jessie M. Howard and Frank Speljack, of Ophir; H. S. Wanamaker, of Wiseman; J. W. Wick, of Russian Mission; E. M. Whelan, of Medfra; Lee S. Gardner, of Aniak; J. L. Jean, of Goodnews Bay; John Haroldson, of Quinhagak; the Nome Nugget, J. D. Harlan, of Hammon Consolidated Gold Fields, Grant R. Jackson, of the Miners & Merchants Bank, A. C. Stewart, and C. W. Thornton, of Nome; A. S. Tucker, of Bluff; Arthur W. Johnson, of Haycock; Lewis Lloyd and James Cross, of Shungnak; and Art M. Hansen, of Kotzebue.

MINERAL PRODUCTION

GENERAL FEATURES OF THE YEAR

The total value of the Alaska mineral production in 1935 was $18,312,000. This was furnished by several mineral products, but gold accounts for about 87 percent. Compared with the mineral production of 1934, the output in 1935 was $1,591,000 greater. This notable increase is, of course, a source of satisfaction to those concerned with the general development of the mining industry in the Territory, especially as it does not seem to have been attributable to

evanescent causes but was brought about by general increase in the output of a number of commodities that are likely to maintain or increase their current output for several years. Some of the conditions were perhaps more favorable than normal in 1935, and so are likely to be less favorable another year. These especially favorable conditions, however, were in a measure offset by certain adverse conditions, which also probably will not prevail regularly. After balancing these two opposing factors, it still seems justifiable to regard the mineral production of Alaska in 1935 as not abnormally good nor an amount that may not readily be reached and surpassed under the future conditions that may reasonably be expected.

The world is still in a condition that deters many from undertaking new enterprises involving uncertainties, and just as Alaska was among the last of the places to feel the results of the oncoming of the business depression it is also among the last to feel the benefits of emergence from that slough. Consequently it is still difficult for many of the holders of potential mining properties in the Territory to get the necessary financial backing for opening up their deposits. True, the increased price of newly mined gold has given a stimulus to the search for and development of some of the deposits that are principally valuable for gold, but the preliminary work necessary for putting such properties into condition to maintain large and continuous output is time consuming and costly.

The selling prices of the other metals that enter largely into Alaska's mineral output showed some advances and some declines in 1935 as compared with 1934. Thus silver, copper, and lead brought somewhat better prices than in the earlier year. The average selling price of newly mined silver was 71⅞ cents an ounce in 1935, as compared with 64⅔ cents in 1934; copper brought 8.3 cents a pound, against 8 cents; and lead brought 4 cents a pound, against 3.7 cents. On the other hand, the average prices in 1935 of platinum metals, tin, and quicksilver were somewhat lower than in 1934. Platinum metals brought $34.15 an ounce, against $34.50; tin 50.4 cents a pound, against 52 cents; and quicksilver, $71.99 a flask, against $73.87. The selling prices of coal and limerock appear to have been identical in the 2 years. It would be entirely unjustifiable to predict from the facts now in hand the future trend of prices, but if the former price of most of these mineral products, except gold and silver, is a safe criterion, and if the trend of the last few years is continued, there would seem to be reason for expecting in general higher rather than lower prices in the next few years.

Fortunately in the past the Alaska mining camps have been practically free from labor problems, but with the building up of enterprises requiring the employment of larger bodies of men there has

been increasing difficulty, and in 1935 one of the large gold mines suspended operation for a considerable period owing to friction between the men and the management, and several of the smaller properties experienced more or less trouble from the same cause. Uncertainty also as to whether the labor troubles that seriously hampered shipping in 1934 would be repeated in 1935 caused considerable uneasiness for a time but did not recognizably affect production.

Certain of the properties that customarily operate at least intermittently were idle during 1935. For example, there was no production of petroleum, marble, or quicksilver from the properties at Katalla, in the Alaska Gulf region; near Tokeen, in southeastern Alaska; and near Sleitmut, in the Kuskokwim region. None of the deposits at these places are exhausted, and cessation of production from them is regarded as due solely to extraneous causes, which will doubtless not continue long.

On the other hand, perhaps the most notable single occurrence of the year was the renewal of production of copper from the two large mines in the vicinity of Kennicott, in the Copper River region. These mines had been closed for 3 years, owing to the low price of copper, and their resumption of operation even on a reduced scale added considerably to the value of the mineral output of the Territory and aided somewhat in relieving unemployment in the whole Copper River region, both in the mines and their accessories and on the railroad that serves to connect the mines with the deep-water port of Cordova.

Another of the factors that was favorable to swelling the mineral output of the Territory in 1935 was that climatic conditions throughout were rather better than normal, giving both a long working season and fairly abundant water for power and other mechanical purposes. As is readily apparent, the length of the effective working season at many mines in a region like Alaska is rigorously controlled by the seasonal temperature, which affects many of the mining operations directly or indirectly through its effects on transportation. So, too, the quantity of rainfall as well as the run-off from the preceding winter's snows or the checking of water supplies by early frosts and freeze-up in the fall are matters of vital concern to the miner, who therefore makes his plans and controls his operations largely to meet the climatic factors as they are forecast or realized.

The lack of employment throughout many parts of the States proper has led some to look to Alaska as an outlet for their activities, and some have gone there to try their fortunes. It should be realized, however, that for more than a quarter of a century hardy pioneers who are at least somewhat experienced in mining have toiled over most of the more accessible parts of Alaska. A novice should therefore be warned that much more is required in finding a work-

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

In subsequent pages, in describing the individual mineral commodities, statements will be given as to specific factors that advanced or retarded certain developments in each of them, as well as general information on the accomplishments during the year.

TOTAL MINERAL PRODUCTION

From the time of the earliest records of mining in Alaska to the end of 1935 minerals to the value of nearly $700,000,000 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 is evident that prior to 1898 the annual production ranged from negligible amounts to a maximum of less than $3,000,000.

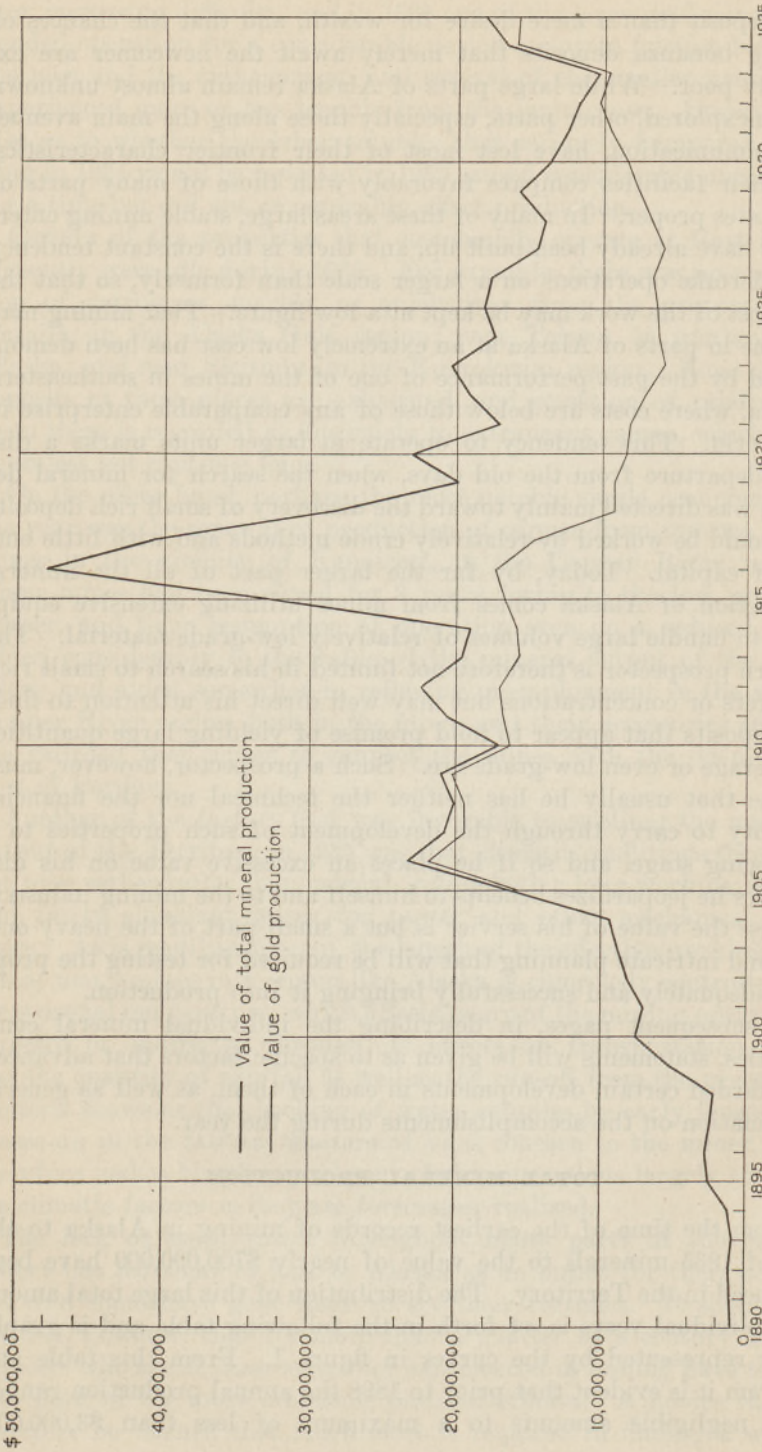

FIGURE 1.—Trends of mineral production of Alaska, 1890–1935.

After the discovery of the Canadian Klondike and the entrance of a swarm of prospectors and miners into Alaska the production quickly mounted until in 1906 it reached a high point that marks the mining of many of the rich placers in the Nome and Fairbanks regions. For the next 8 years the annual production fluctuated somewhat but ranged around $20,000,000. Then it mounted by leaps until it reached a maximum of more than $48,000,000 in 1916. This rapid increase was due to the growth of copper production under the stimulus of the World War, when prices advanced to unprecedented heights. By 1919 the war stimulation was over, and the annual production from Alaska dropped again to about $20,000,000. During the post-war period Alaska has suffered through the fact that in the States scales of wages and opportunities for the employment of capital have seemed to offer more advantages, and as a result there has been more or less fluctuation in the mineral output from Alaska, the production during the last few years ranging between $10,000,000 and $14,000,000, until in 1934, owing largely to the advance in the price of gold, it approached $17,000,000, and in 1935 it was considerably over $18,000,000.

Value of total mineral production of Alaska, by years, 1880–1935

1880	$6,826	1900	$7,995,209	1920	$23,330,586
1881	15,000	1901	7,306,381	1921	16,994,302
1882	23,000	1902	8,475,813	1922	19,420,121
1883	67,146	1903	9,088,564	1923	20,330,643
1884	72,000	1904	9,627,495	1924	17,457,333
1885	425,000	1905	16,490,720	1925	18,220,692
1886	540,000	1906	23,501,770	1926	17,664,800
1887	657,000	1907	20,840,571	1927	14,404,000
1888	667,181	1908	20,092,501	1928	14,061,000
1889	847,490	1909	21,140,810	1929	16,066,000
1890	873,276	1910	16,875,226	1930	13,812,000
1891	1,014,211	1911	20,720,480	1931	12,278,000
1892	1,019,493	1912	22,581,943	1932	11,638,000
1893	1,104,982	1913	19,547,292	1933	10,366,000
1894	1,339,332	1914	19,109,731	1934	16,721,000
1895	2,588,832	1915	32,790,344	1935	18,312,000
1896	2,885,029	1916	48,386,508		
1897	2,539,294	1917	40,694,804		698,628,000
1898	2,329,016	1918	28,218,935		
1899	5,425,262	1919	19,626,824		

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

In the following table the value of the total mineral production from Alaska is distributed among the various metals and nonmetallic products. From the table it will be seen that gold accounted for 64½ percent of the total value of the mineral production and that gold and copper together accounted for nearly 95½ percent.

Total value of mineral production of Alaska, by substances, 1880–1935

Gold	$450,681,000
Copper	215,941,400
Silver	12,424,000
Coal	9,877,100
Tin	1,150,100
Lead	2,157,300
Other mineral products (including platinum metals)	6,397,100
Total	698,628,000

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 1935 and 1934, distributed by quantity and value among the main kinds of substances, so that a comparison between the two years may be readily made. From this table it is apparent that there was an increase in both value and quantity of the production of silver, platinum, tin, copper, coal, and miscellaneous mineral products, and that there was an increase in the value of the lead, though it was produced in somewhat smaller amount.

Mineral output of Alaska, 1935 and 1934

	1935		1934	
	Quantity	Value	Quantity	Value
Gold—fine ounces	455,429	$15,940,000	457,343	$16,007,000
Copper—pounds	15,056,000	1,249,700	121,000	9,700
Silver—fine ounces	286,600	206,000	154,700	100,000
Coal—short tons	119,425	501,600	107,500	451,500
Tin, metallic—do	49.4	49,800	4.14	4,300
Lead—do	815	65,200	839.50	62,100
Platinum metals—ounces	8,685	259,700	2,555	85,600
Miscellaneous mineral products		40,000		800
Total		18,312,000		16,721,000

GOLD

GENERAL FEATURES

Throughout 1935 the price of gold remained fixed at $35 an ounce, the same as in 1934. It should be borne in mind, however, in all comparisons made with the records given of the earlier years, that

the price of gold before 1934 has been computed on the then prevailing price of slightly more than $20.67 an ounce. The value of the gold production of Alaska in 1935 was $15,940,000, against $16,007,000 in 1934, a negligible decrease of $67,000, or less than one-half of 1 percent. This value was not exceeded in any other year since 1916.

The general trend of gold mining in Alaska since 1890 is graphically represented by one of the curves in figure 1. From 1890 to 1904 the curve for the value of the gold produced practically coincides with the curve for the value of the total mineral production of Alaska and marks a fairly even upward trend. From 1904 to 1906 there was an abrupt increase in gold production, marking the boom periods of many of the placer camps. From the peak of 1906 there was a gradual decline for the next 10 years, and during the period of the World War there followed a rather rapid decrease to less than $10,000,000 a year. During the post-war period from 1920 to 1927 there was a still further decline in Alaska gold production, and it touched new lows in 1923 and 1927, when it was less than $6,000,000 a year. Since 1927 there has been in general a marked increase in the value and quantity of gold produced, until in 1934 and 1935 the value of the output was about $16,000,000.

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 20 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 annual production for each year from 1880 and the sources, from 1884, are graphically shown in figure 2. Of the $450,681,000 in gold that has been produced from Alaska mines $293,136,000, or about 65 percent, has come from placers and $157,545,000, or about 35 percent, from lodes. The relation between the outputs from these two sources has varied widely. Thus up to 1898 the lode production was greater than that from the placers. Then ensued a period of more than 20 years when the annual placer production far exceeded that from the lodes. Since 1919 the production from the two sources has showed approximately a constant ratio. There is reason to believe that the current rates of produc-

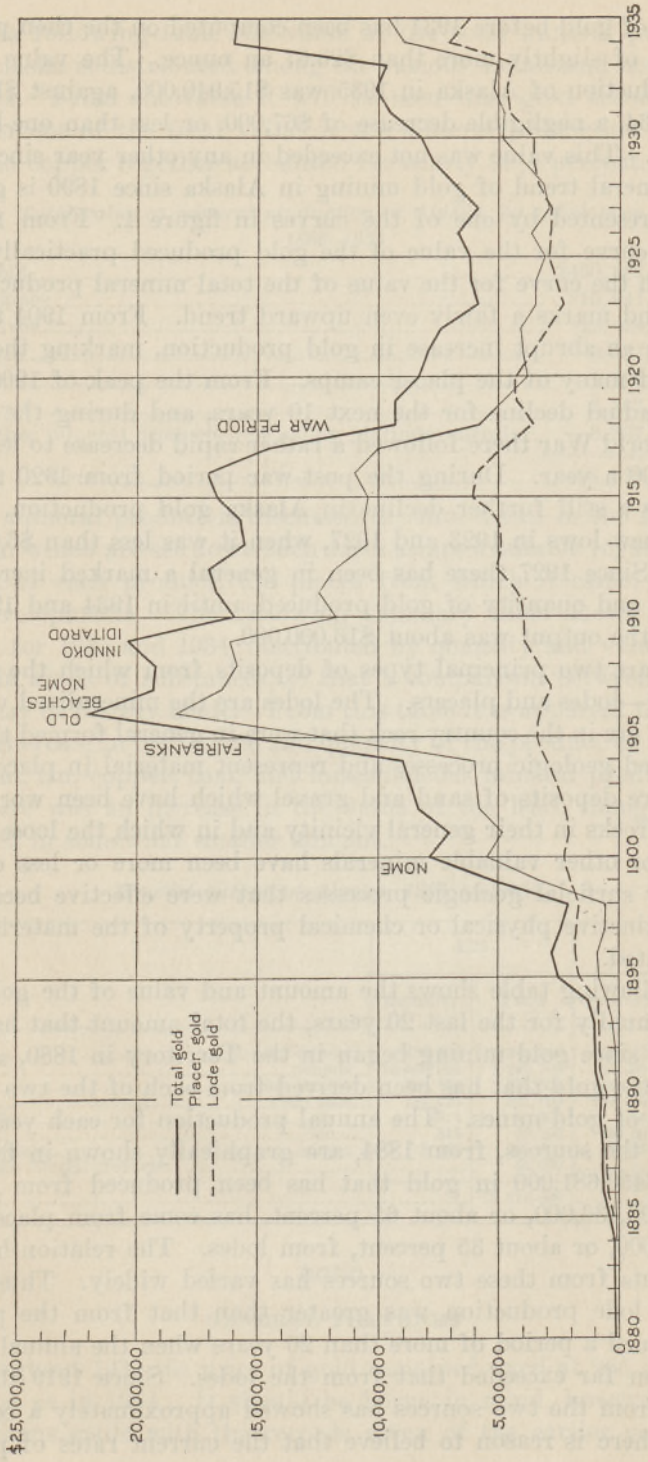

FIGURE 2.—Trend of value of gold production of Alaska, 1880–1935.

tion by no means mark rates that may not be maintained or exceeded in succeeding years. Although the output of placer gold will ultimately lessen, the production from the lode mines may be increased considerably.

Gold produced in Alaska, 1880–1935

Year	Fine ounces	Value		
		Total	Placer mines	Lode mines
1880–1915	12,592,121	$260,302,243	$185,200,444	$75,101,799
1916	834,068	17,241,713	11,140,000	6,101,713
1917	709,049	14,657,353	9,810,000	4,847,353
1918	458,641	9,480,952	5,900,000	3,580,952
1919	455,984	9,426,032	4,970,000	4,456,032
1920	404,683	8,365,560	3,873,000	4,492,560
1921	390,558	8,073,540	4,226,000	3,847,540
1922	359,057	7,422,367	4,395,000	3,027,367
1923	289,539	5,985,314	3,608,500	2,376,814
1924	304,072	6,285,724	3,564,000	2,721,724
1925	307,679	6,360,281	3,223,000	3,137,281
1926	324,450	6,707,000	3,769,000	2,938,000
1927	286,720	5,927,000	2,982,000	2,945,000
1928	331,140	6,845,000	3,347,000	2,498,000
1929	375,438	7,761,000	4,117,000	3,644,000
1930	410,020	8,476,000	4,837,000	3,639,000
1931	459,900	9,507,000	4,842,000	4,665,000
1932	493,860	10,209,000	5,522,000	4,687,000
1933	469,286	9,701,000	5,152,000	4,549,000
1934	457,343	16,007,000	8,955,000	7,052,000
1935	445,429	15,940,000	9,703,000	6,237,000
Total	21,159,037	450,681,000	293,136,000	157,545,000

GOLD LODES

Alaska lode mines in 1935 yielded $6,237,000 in gold, or $815,000 less than in 1934, when the production was $7,052,000. The gold derived from the lodes was about 39 percent of the entire gold production of the Territory. In 1934 lodes furnished about 44 percent of the total. The lode gold was recovered from widely distributed mines, but more than 75 percent came from mines in southeastern Alaska, as shown in the following table:

Gold produced from gold-lode mines in Alaska in 1935, by districts

District	Fine ounces	Value
Southeastern Alaska	134,200	$4,697,000
Willow Creek	17,714	620,000
Fairbanks district	12,086	423,000
Other districts	14,200	497,000
Total	178,200	6,237,000

Of the Alaska lode-gold mines the properties of the Alaska Juneau Gold Mining Co. in southeastern Alaska are by far the largest, and that company alone produced about two-thirds of the total lode-gold output of the Territory in 1935. The magnitude of the company's mining operations is set forth in its published re-

port to its stockholders,[3] from which the following statements are abstracted: The total rock mined and trammed to the mill in 1935 was 3,729,660 tons. Of this amount 1,638,185 tons of coarse tailings were rejected and 2,091,475 tons were fine milled. The average gold content of all the material mined was 0.0413 ounce to the ton. The amount of gold in that part of the rock which was rejected was about 0.0078 ounce to the ton, and the gold content of the rock that was further treated was about 0.0676 to the ton. Of this content 0.0108 ounce to the ton was lost during the treatment, 0.0533 ounce was recovered as bullion, and 0.0035 ounce 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, 1893–1935

Year	Ore (tons)			Metals recovered			
	Total	Fine milled	Coarse tailings rejected	Gold (ounces)	Silver (ounces)	Lead (pounds)	Total value
1893–1913	507,254	330,278	176,976	34,240	(1)	(1)	$707,730
1914–15	242,328	239,918	2,410	12,175	6,192	117,031	261,326
1916	180,113	180,113	----------	5,565	2,844	61,068	121,379
1917	677,410	677,410	----------	20,767	12,248	296,179	460,666
1918	592,218	574,285	17,933	20,809	11,828	273,297	459,445
1919	692,895	616,302	76,593	24,141	16,431	359,762	542,714
1920	942,870	637,321	305,549	35,456	23,348	487,574	791,390
1921	1,613,600	904,323	709,277	46,914	40,619	550,913	1,035,251
1922	2,310,550	1,108,559	1,201,991	62,707	49,405	687,315	1,388,679
1923	2,476,240	1,134,759	1,341,481	69,047	41,876	755,423	1,514,774
1924	3,068,190	1,367,528	1,700,662	92,277	63,191	1,256,857	2,055,782
1925	3,481,780	1,537,884	1,943,896	98,213	55,971	1,288,974	2,184,384
1926	3,829,700	1,649,678	2,180,022	93,423	52,333	1,300,915	2,067,837
1927	4,267,810	1,839,695	2,428,115	112,653	61,232	1,513,306	2,463,262
1928	3,718,140	1,795,191	1,922,949	152,047	77,591	2,038,655	3,316,019
1929	3,836,440	2,020,470	1,815,970	164,993	90,635	2,501,832	3,627,247
1930	3,924,460	2,066,239	1,858,221	163,312	97,607	2,640,771	3,551,950
1931	4,162,350	2,298,998	1,863,352	179,532	118,508	3,309,176	3,879,839
1932	4,001,630	2,414,469	1,587,161	151,578	94,519	2,509,263	3,236,183
1933	4,085,960	2,466,832	1,619,128	150,967	109,483	2,299,777	3,960,166
1934	4,302,600	2,387,138	1,915,462	128,015	86,458	1,662,894	[2] 4,582,559
1935	3,729,660	2,091,475	1,638,185	118,998	77,787	1,455,167	4,281,110
Total	56,644,198	30,338,865	26,305,333	1,937,829	1,190,106	27,366,149	46,489,692

[1] Lost in tailings.

[2] Gold in 1934 computed at $34.88 an ounce.

The cost of mining for 1935 was stated by the company to have been 34.96 cents for each ton of ore trammed to the mill, the cost of milling was 21.60 cents, and all other marketing costs and expenses amounted to 11.28 cents, making the entire operating cost for each ton of ore trammed only 67.84 cents. This indicates the exceedingly efficient operation of a deposit of this low-grade type, which could have been brought about only through capable management and the adoption of all technical means for maintaining and stimulating production in all stages of the enterprise.

[3] Alaska Juneau Gold Mining Co. 21st Ann. Rept., for the year ended December 31, 1935.

The production from this property was seriously reduced from capacity, owing to an enforced shut-down of more than a month and a half, caused by a strike and a lessened output for some time after work was resumed. The tenor of the ore mined was somewhat higher than in 1934, but whatever increased income might have been derived from that condition was offset by increased operating expenses and costs, brought about mainly by higher wages and higher prices of supplies. The growing problem of satisfactorily disposing of the huge accumulations of waste rock led to the abandonment of the old system of discharging it by tram and conveyor to the waste heaps near shore and the installation of a system of conveying it by barge some distance down the Gastineau Channel, where it could be dumped into deep water. Three new specially constructed self-dumping barges were built for this work, and their use is said to have satisfactorily solved a hitherto vexatious and costly problem in the treatment of the mined rock. In addition to the regular underground work on the company's old property, considerable preparatory work was done in putting the adjoining, newly acquired Perseverance mine into condition, so that before long its ore bodies may be mined. In this work about 1,700 feet of main haulageway was driven and about 1,350 feet of raises were opened up. At the same time that the Perseverance mine was purchased valuable water-power rights on Salmon Creek were also acquired. Certain of the installations for making the water available had badly deteriorated, and progress was made in rehabilitating the system so that it might be available especially for supplying power during the winter season. Delay in procuring the necessary lumber from mills in the States, because of labor troubles, prevented getting more than half of the reconstruction completed in 1935. The plant, however, should be in operation in 1936. In trying to better the milling practice through finer grinding and the use of flotation, experimentation that has been in progress for some time has shown a small additional recovery. It is therefore proposed to continue this investigation on a somewhat larger scale. Besides the work on the company's main properties, several other Alaska prospects were examined by its technical staff, but no development work was reported to have been undertaken by the company at any of them, though apparently late in the season arrangements were made whereby the company was instrumental in carrying through a plan for a new company to take up an extensive investigation of the old Treadwell properties. This would require the sinking of new shafts to depths below the old workings and crosscutting to ascertain the extent and tenor of any ore bodies that might be encountered. Apparently the enterprise is to be undertaken by a group that can obtain adequate financial

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backing, so that if the results of the underground work should justify the erection of a milling plant and the installation of extensive equipment they could readily be provided.

The next most productive lode-gold mines in southeastern Alaska are situated on the western coast of Chichagof Island. At this place are the properties of the Hirst-Chichagof Mining Co., near Kimshan Cove, some 65 miles northwest of Sitka, and the Chichagoff Mining Co., near Klag Bay, a few miles to the southeast. At the Hirst-Chichagof property during the year the shaft was deepened about 125 feet and about 500 feet of drift driven. The 10-stamp mill was in practically continuous operation, and a dividend was paid out of earnings. The milling process is reported to consist of crushing in the stamps to about 10-mesh, regrinding in a tube mill, amalgamation, and treatment of the pulp in flotation units. The ore is practically unoxidized and contains only a low percentage of the sulphides of lead, copper, antimony, and arsenic. At the Chichagoff Mining Co.'s property the principal new underground work of the year consisted in the sinking of about 200 feet of shaft and the driving of more than 1,300 feet of drift. No notable changes were made in the operation of the property. The milling was done in a 20-stamp mill, the free gold taken out by amalgamation, and the sulphides concentrated and sent to a smelter in the States for treatment.

The successful development of these two large properties on Chichagof Island and the high price of gold have had a stimulating effect on the search for valuable mineral deposits through that entire area, and several companies and individuals have been active during the year searching to find new leads, or reexamining and reopening some of the old properties that had been idle for many years. Among the operations of this sort may be mentioned the work that was in progress in the vicinity of Mineral Hill, near Kimshan Cove. A small production was reported to have been made from this property. Other properties in the neighborhood have also disclosed veins on which some development work is in progress. Near the north end of Yakobi Island is the old El Nido property, which a few years ago was one of the highly productive mines but lately has been relatively inactive. In 1935 a little development work was done on the property, with the result that some gold was recovered, and it is understood that plans for resumption of mining on a much larger scale are being formulated.

On Admiralty Island productive lode-gold mining was carried on at the properties of the Alaska Empire Gold Mining Co., a short distance north of Helm Bay. The increased milling facilities installed in 1934 contributed to making the output from this camp

somewhat larger than it has been in recent years. So far as reported, no productive lode mining was in progress on the property of the Admiralty Alaska Gold Mining Co., a few miles to the north, on Funter Bay.

Throughout the Juneau-Chichagof district, or the northern part of southeastern Alaska, in addition to these producing mines there were many other lode-mine developments in progress, which, though not yet placing the respective properties in the list of lode producers of notable amounts of gold, indicate the revival of interest in searching for and attempting to develop some of the more promising areas. Among the enterprises of this sort that seem to have been undertaken with the expectation of developing on a large scale, if at all, perhaps the one of most general local interest, has been the purchase of the old Kensington and Comet properties, in the Berners Bay area, north of Juneau. At one time these properties produced a large amount of lode gold, and it is believed that under capable management they may be successfully reopened and resume production. The work at this place during 1935 is reported to have consisted mainly in getting the buildings and surface equipment into shape and constructing an all-weather road that may later be extended to connect the mine and the existing main road northward from Juneau. Such a road, though useful, is by no means indispensable for the development of the property, because suitable docking facilities could be made available near the mine for ocean-going ships. So far as could be learned no new developments were made at the property of the Holland Alaska Gold Co., in the Herbert River area, north of Juneau. Some further preparatory work was done by the Alaska-Windham Gold Mining Co. in the Windham Bay area, south of Juneau, but failure to perfect plans for the general operation of the property put off productive mining for at least another year. Some sampling of lode deposits in the valley of Nevada Creek, in the southern part of Douglas Island, is reported to have been done by a crew of five men, and some prospecting was in progress in the Montana Creek Basin, north of Juneau.

In the Ketchikan district of southeastern Alaska the greatest production reported came from the Gold Standard mine, near Helm Bay, and from the property of the Alaska Gold & Metals Co., on Kasaan Peninsula. The Gold Standard mine and mill were in more or less continuous operation for about 8 months but had to suspend work to take care of necessary repairs to the flume and mill. The operators report finding an extension of mineralized rock to the west of what had hitherto been considered the footwall of the ore zone. At this property the ore is crushed and passed over amalgamating plates to a Wilfley table, the concentrates from which are shipped to a smelter in the States for treatment. No detailed report

has been received by the Geological Survey as to new developments at the mine of the Alaska Gold & Metals Co., but local reports indicate that the work there has tended more to an attempt to recover all the metals contained in the ore rather than concentrating on recovery of the palladium content of the ore, as was done for a while in the past. Elsewhere in the Ketchikan district there was a notable increase in the search for lode deposits and the reexamination of properties that had been dormant for several years. Thus, in the vicinity of Dolomi, on Prince of Wales Island, renewed activity was shown at the property formerly known as the Valparaiso mine, and the Alaska British Columbia Gold Mines, Ltd., is reported to have had a crew ranging from 5 to 30 men busy throughout the summer in preparatory and development work, looking toward placing the mine again in active production. Some delay in the plans for getting the property into operation was caused by a fire in the spring, which destroyed some of the surface plant. The litigation that had been pending for some time as to the ownership of the Sea Level mine was finally adjusted, and steps were immediately taken to expedite the work of getting the mine in shape for production. A small test shipment of ore was made to a smelter in the States, and the results are said to have been highly satisfactory.

Some drilling and prospecting was done on claims near the Sea Level mine by other groups of operators, but the results of that work have not been made public. The revival of interest in mining by the residents of the Ketchikan district has been marked, and during the year an extension course in prospecting and field methods of studying mineral deposits was given by an instructor from the University of Alaska at several of the towns, including Ketchikan. This course received enthusiastic support and had a remarkably large enrollment. Doubtless there were several other places in the Ketchikan district where prospecting or a small amount of development work was in progress, which, though not likely to lead to productive mining in the near future, is indicative of the renewed interest that is being taken in mining and is likely to lead to worth-while results if intelligently carried on, for it is believed that there are many areas in the district that are well worth intensive investigation.

In the Hyder district, which includes a considerable tract of country at the head of Portland Canal, no extensive productive lode mining was in progress, and even the sudden access of interest in prospecting that was awakened in 1934 by the great increase in the price of gold seems to have lessened greatly. So far as the Geological Survey is informed, the only production of lode gold in the district in 1935 came from a small test shipment of ore from the Last Chance mine. This ore, in addition to gold, carries a considerable amount of

silver-bearing galena and some sulphides of other metals. In spite of the small amount of mining now in progress on the American side of the boundary in the Hyder district, there is every reason to believe, so far as can be determined from geologic evidence, that the conditions which have produced the rich deposits on the British Columbia side of the line did not suddenly alter at the boundary but have affected portions of the Alaska area as well. It therefore follows that thorough search of those places is likely to lead to the establishment of a significant mining industry in the Alaska part of the district.

The Willow Creek district, at the head of Cook Inlet, has long been the second most productive lode-gold district in the Territory, having produced gold worth nearly $7,770,000 since lode mining started there in 1909. The principal producing property in the district is that of the Willow Creek Mines, Inc., which holds claims on Craigie Creek and gets its ore mainly from the Lucky Shot and War Baby mines, on the northern slopes of the valley of this stream. This company employs about 100 to 125 men in the various phases of mining and milling, and the property is in continuous operation throughout the year. The principal new work accomplished in 1935 at these mines was the driving of several thousand feet of drifts and other underground developments, in conformity with the general plans that had been followed for several years. The Lucky Shot is developed mainly by adits and drifts and raises or winzes run off from them. The War Baby is developed mainly by an inclined shaft with which the underground workings are connected. The mill is capable of handling some 40 tons of ore a day, and the treatment of the crushed ore consists of amalgamation of the table and flotation concentrates and cyanidation of the amalgamation tailings. The entire layout has been carefully planned and well carried out. Although the area has been rather difficult of access in the past, the construction of good roads to the camp, both from the south and from the west, now makes it easy to get in the necessary heavy supplies and equipment, and an excellent landing field for airplanes at the mill site makes the transportation of persons or emergency supplies between Anchorage and the mine a matter of only half an hour or so.

The second most productive mine in the Willow Creek district in 1935 was that of the Fern Gold Leasing Co., near the head of Archangel Creek. A crew of 15 to 20 men were employed practically continuously throughout the open season and a reduced number continued underground development work throughout the winter. A new 80-horsepower Diesel engine was installed in 1935 which not only furnished more adequate power for the many services in the mine

and mill but also supplied that power much more economically and conveniently. The experiments with treatment of the mill product by cyanidation that were made in an earlier year did not turn out to be as satisfactory as anticipated, and flotation units were installed in the mill in 1935 and are reported to have been thoroughly efficient. The concentrates are shipped to a smelter in the States for treatment. Some production of lode gold is also reported to have been made by the Marion Twin Gold Mining Co. at its property on Craigie Creek and by the Independence and Hi Grade mines on Fishhook Creek, and prospecting was in progress at several other places in the district. Plans for the consolidation of some of the old properties and the reopening of them on a better-planned and more technically directed basis were already under way during 1935. The showings already made throughout the district give a firm basis for the belief that the excellent record of the Willow Creek camp in 1935 by no means marks the limit of the output that may be expected as developments now in progress are brought to a productive stage.

The third most productive lode-gold district in the Territory is in the vicinity of Fairbanks. Its output of lode gold in 1935, as stated, was $423,000. This marks the greatest value of lode gold produced by this camp since 1910, when lode mines first began to operate in the district. The total output of lode gold from the Fairbanks district since 1910 has been about $3,300,000. There are two principal producing lode-gold areas more or less close to Fairbanks; one embraces the country adjacent to Pedro Dome and lies 15 to 20 miles north and east of the town, and the other embraces parts of Ester Dome and lies 6 to 10 miles west of the town. In the Pedro Dome area the largest production came from the property of the Cleary Hill Mines Co., near the junction of Bedrock and Cleary Creeks, formerly known as the Rhoads-Hall mine. The sinking of the main shaft and the opening up of additional areas underground have made it possible for the mine to increase its output notably. The weatherproofing of many of the buildings and surface plant was carried out during the summer with the aim of lengthening the working season and possibly of enabling mining and milling to be carried on uninterruptedly throughout the year. At the time of writing the mine is closed down and the crew of 15 to 20 men have been laid off for about 4 months. The flotation unit in the mill that was installed in 1934 continued to prove its value, and the well-equipped Diesel plant furnished adequate and economical power for all present needs. The second largest producing mine in the district is the Hi Yu mine, on Too Much Gold Creek, a tributary of Fairbanks Creek. Here not only were the underground developments continued successfully during the year and the milling plant operated

efficiently but many improvements in the surface buildings made. A new bunk house and mess house were built, and many conveniences installed, so that before long it will be entirely practicable to keep the plant running throughout the year. At the Newsboy mine, in the saddle between Cleary and Little Eldorado Creeks, some productive mining was in progress, and numerous improvements were made in the equipment of the milling plant. New grinding machinery was installed, and the flotation unit that was built in 1934 proved its effectiveness. Some gold was also recovered from the lodes on the Soo mine, north of Dome Creek, and a little work was in progress at the property of the Alaska Mining & Development Co., which includes the old Wyoming mine, on Bedrock Creek, east of the Cleary Hill mines. In fact, at a large number of places throughout a more or less definite eastward-trending belt extending from Pedro Dome small camps were engaged in the search for or development of lodes, which are common and rather widely scattered in this belt.

In the Ester Dome area of the Fairbanks district search for gold lodes was continued on essentially the same scale as heretofore, and some gold production was reported to have been made by six or eight properties. Probably the greatest amount of development work was done on the Mohawk mine, near Happy Creek, but most of it was directed toward putting the mine in shape for the future rather than increasing its immediate output. Certain litigation that had been pending for some time regarding lode properties in the vicinity of St. Patrick Creek was finally settled, and thus the way was cleared for undertaking a campaign to prospect its resources. There are still large areas on Ester Dome where surface showings are such as to encourage more intensive search, in the expectation that it will disclose deposits carrying a rather large quantity of high-grade ore that may be profitably developed.

Among the districts producing lode gold grouped together in the table on page 13 under the heading "Other districts" the most productive, named in the order of output, are the Nabesna district, which lies north of the Wrangell Mountains of the Copper River region; the vicinity of Valdez and other parts of the Prince William Sound region; Kenai Peninsula, including the Nuka Bay area, the area south of Hope, and the hills north of Girdwood; the Iditarod district; the Nixon Fork district, in the Kuskokwim region; and the Bremner district, south of the Chitina River, in the Copper River region. In practically all these districts the production in 1935 came from a single mine, so that to avoid disclosing the individual output it has been necessary to combine the statistics.

In the Nabesna district the only producing gold-lode mine is that of the Nabesna Mining Corporation, which is sometimes referred to

as the Carl Whitham mine, from the name of its principal owner and manager. This mine is on White Mountain, west of the Nabesna River, between its tributaries Jack and Jacksina Creeks. A good road to the mine from the Richardson Highway at Gulkana has now been completed and is available for trucking in supplies and equipment, thus greatly facilitating operations, though for speedy or emergency service the airplane is still extensively utilized. According to the published report of this company the principal underground work of the year was the driving of more than 2,300 feet of drifts and other openings and the mining of more than 16,400 tons of ore, which was trammed to the mill. At the mill six new flotation cells were put into operation and a cyanide plant was built to treat the concentrates. Not only will this plant handle the concentrates produced currently, but it will also begin the rehandling of the tailings of former years, which have been impounded and are estimated to have an average gold content of more than $11 a ton. A careful study of the milling practice was made, and as a result modifications were put into effect whereby the recovery from the ore milled is said to have been materially increased. Not only was there improved recovery in the mill, but the ore delivered to it seems to have had a somewhat higher average tenor than heretofore. In addition to the regular search for ore by underground methods the company carries on considerable exploratory work by means of diamond drilling. During 1935 more than 1,000 feet of such drilling was done, and the information it afforded has enabled the operators to plan their other development work much more systematically and effectively. Several new buildings and other conveniences were put up in the camp, including a fine large mess hall that will add greatly to the comfort of the personnel. The mine and mill are operated continuously throughout the year.

Lode-gold production in the Prince William Sound region came principally from the El Primero Mining & Milling Co., which was operating the old Granite mine, and from small properties in the vicinity of Valdez, notably the old Ramsay-Rutherford mine and those of Clarence Poy and associates on the Little Giant, Rose, and Star groups of claims. Details regarding recent developments at all these properties are not available, but during the open season of 1935 it was possible for Fred H. Moffit, of the United States Geological Survey, to visit some of them and to collect locally information regarding others. It has consequently seemed desirable to quote extensively the following notes prepared by him regarding the recent developments.

About 10 properties in the northern part of Prince William Sound may be listed as under development or as producing gold and employing from 1 to 18 or more men each. Most of this number are in the vicinity of Port Valdez, the

others are in the Port Wells district, in northwest Prince William Sound. In addition, it was estimated that about 20 men were prospecting in the district. Among the several properties the old Cliff mine, on the north side of Port Valdez east of Shoup Bay, is of special interest because of its earlier history as a gold producer, yet others are equally well known.

The mining property that for many years was known as the Cliff mine is being reopened by the Alaska Chugach Mines, Inc., with L. A. Levensaler and Charles Simenstad in charge. The mine is 10 miles west of the town of Valdez, in the low rounded spur between Port Valdez and Shoup Bay. The mill and other mine buildings are on a gravel bench east of the entrance to Shoup Bay and near the entrance to the mine, which is at the eastern limit of the bench and less than half a mile from Shoup Bay. This situation makes it possible for boats to land at a wharf close to the mill and gives convenient communication by water with Valdez.

The Cliff mine was formerly the largest gold producer on Prince William Sound, but it was closed nearly 20 years ago, and the workings below the level of the bay are now flooded by water that came in along the vein. Contrary to report, the mine was not abandoned precipitately because the sea broke through suddenly, for stoping in the lower workings was finished, and the pumps and machinery were withdrawn in an orderly manner. Mining in the upper levels was carried on for a time after the lower levels filled but finally ceased altogether. Proposals of reopening the mine have been heard from time to time, and just prior to the taking over of the property by the present operators such an attempt was made, but without success.

The Alaska Chugach Mines, Inc., began operations on the ground in March, and the work of reconditioning has gone on since then with a force of men that averaged about 12 during the summer. The mine, mill, and machinery had been maintained in good condition by the owners, but the other buildings had deteriorated, and the wharf had been destroyed by time and the sea. Accordingly a new office building was built, and quarters for the men were provided by repairing old buildings, but the wharf is not yet replaced.

The first work in the mine was a careful survey of the old openings above the flooded levels and an extensive program of sampling the ore bodies. After this, development work was started which was intended to lead to the beginning of mining and the operation of the mill early in 1936. No plans were contemplated for unwatering the lower levels or for any immediate prospecting below tidewater, as ore sufficient for present mill operation is in sight above it.

A second source of gold in addition to the ore that may be mined underground is tailings from previous operations. The tailings produced in the mill during the early years were discharged on the sand spit between the mine and Shoup Bay, where they accumulated over a considerable area in a sheet several feet thick. These old tailings were systematically sampled and were found to carry gold in quantity sufficient to make their re-treatment profitable. Accordingly it is planned to recover from them the gold they contain.

Reopening of the Cliff mine is looked on in the Valdez vicinity as one of the most important mining developments of the year.

The mining operations now being carried on by Clarence W. Poy and his associates on Mineral Creek, near Valdez, involve several claims, included among which is one that has long been known as the Big Four. The Big Four claim is near the top of the divide west of Brevier Creek, between Mineral Creek and the Shoup Glacier Basin, and the highest workings are about 4,800 feet above the sea. Brevier Creek is 10 miles by road from Valdez, but the road was not open for use in 1935, as one or more bridges had not yet been built. Money

for the construction was said to be available, however, and it was expected that the Alaska Road Commission would build the needed bridges and that the road would be in use in 1936.

The ore bodies of the Big Four claim are veins of iron-stained quartz in a slate bedrock and contain pyrite, galena, sphalerite, and free gold. Mr. Poy mined and milled ore from the Big Four in 1934, but his operations in 1935 were largely on two claims, known as the Little Giant and Rose Quartz, 2 miles east of the Big Four. Here the ore bodies are quartz veins containing pyrite, a little chalcopyrite or copper-bearing pyrite, and galena accompanying the gold. Mining was not in progress on these claims, but the summer had been devoted to the installation of a mill, which, together with the ore bunkers, is underground. The mill is between 2,000 and 2,500 feet above sea level and was about ready for operation in October, although at that time the higher country was already under snow. An interesting feature of this installation is that the equipment, including the ball mill, complete mining and milling accessories, building material, and fuel, were landed on the property by airplane. About 10 men were employed.

The Ramsay-Rutherford property is 8 miles in an air line northeast of Valdez, high on the mountain east of Valdez Glacier and about 3,500 feet above the sea. It is reached by crossing the outwash fan of Valdez Glacier and then following the ice for about 4 miles to the foot of the trail leading to the mine, 1½ miles distant. The distance to the mine by this route is about 10 miles. The property is one of the numerous gold-bearing deposits that were discovered in 1911, or thereabouts, and has had a varied history of development and production since then. At this time it is under lease to Jesse Taylor and Egar Petropov. The country rock is graywacke with a little interbedded slate or argillite. It is cut by quartz veins carrying sulphides, of which pyrrhotite is the most abundant. Other sulphides are pyrite, chalcopyrite, sphalerite, and galena. The gold is free and is associated with a little silver. The mine was equipped with a mill, buildings, and mining machinery, and in the long period of its operation many feet of shafts, drifts, and crosscuts have been driven. It was reported, however, that additional ore has been discovered recently and that new machinery will be installed to replace some of the out-of-date or worn-out machinery there now. In the early years all freight for the mine was carried by sled or pack train, but recently the airplane has been used, and 600 gallons of Diesel oil and several tons of other supplies were landed at the mine by this means in 1935, at a substantial saving in cost over the older methods. Four men were employed at the Ramsay-Rutherford in 1935, and the mill was in operation part of the time.

The lower camp and mill of the Cameron-Johnson claims are on the northwest side of Shoup Glacier, 7 miles by trail from Shoup Bay and 2,400 feet above sea level. Most of the trail is over the glacier ice. Several ore bodies at elevations ranging from that of the lower camp to 2,000 feet above it have been prospected. These veins consist of quartz filling fracture zones in a bedrock of graywacke and argillite. The vein minerals include gold, pyrite, galena, sphalerite, and arsenopyrite. Mining on the Cameron-Johnson claims, which are patented ground, has been suspended since the World War, but recently the property was leased by Mr. Rankin and associates, who started to reopen the mine late in 1935. Four men were employed, and supplies for their use were landed on the property by airplane at approximately one-third the transportation cost of earlier methods.

The property of the Alaska Mayfield Mines is about 7½ miles west of Shoup Bay on the south slope of a mountain that extends westward into Columbia Glacier. It is nearly 3,000 feet above sea level and may be reached

by trail through Anderson Pass, although both men and supplies have been delivered there in recent years by airplane. The country rock consists of slate and graywacke and is cut by a fissure along which are stringers, bunches, and lenses of mineralized quartz. As stated to the writer by Emil Helekal, president of the company, four men, including himself, were employed on the property in 1935. The work already done includes two tunnels, one about 65 feet above the other. The upper tunnel was driven along the vein about 150 feet, the lower one about 450 feet, making a total of about 600 feet. The work of driving these two tunnels was extended over a period of years, mostly from 1915 on, and the footage has probably been increased somewhat by the activities of 1935. An effort was being made in 1935 to raise funds for sinking a shaft on the vein and driving crosscuts to explore the vein and adjacent country rock.

The Rough and Tough property includes claims about 8½ miles northwest of Shoup Bay on a nunatak of Columbia Glacier. It is 2 miles west of the property long known as the Gold King and belongs to R. C. Reeve and Andrew Thompson, of Valdez. It was not visited by the writer but is described as a series of mineralized quartz veins at and near the contact of a granitic intrusion in graywacke and slate. No underground work has been done, but several tons of ore was recovered from open cuts in 1935. The gold is associated with silver and the sulphide minerals commonly found with the auriferous veins of the district. Materials for bunk house, supplies, and machinery were landed at the property by airplane. This means of transportation was expected to be used in bringing out the ore already recovered. One man was employed at the property in 1935.

The Granite mine is on the west side of Port Wells, north of Bettles Bay and between Hobo Bay and Harrison Lagoon. The vein was discovered in 1912 by M. L. Tatum and Jonathan Erving, who did the first work of development. In the following year the property was bonded by B. F. Millard, who organized the Granite Gold Mining Co. and established it as the largest gold producer of the Prince William Sound region at that time. Eventually the mine was purchased by L. H. Carvey, who organized the El Primero Mining Co. and has reequipped and operated the mine for several years. The gangue minerals are quartz, calcite, and a brownish-weathering carbonate. The metallic ore minerals include gold, pyrite, sphalerite, stibnite, galena, arsenopyrite, and chalcopyrite. It is reported that 12 men were employed in the mining and milling operations of 1935 and that the mill was operated throughout the season.

The Merrill property in early days was known as the Herman-Eaton prospect. It is about 1 mile from the head of Bettles Bay, in the Port Wells district, and is now the property of Ralph Merrill, of Valdez. The ore body is a gold-bearing quartz vein, cutting slate adjacent to a light-colored granitic dike. When this property was visited by the writer in 1925 a tunnel 550 feet long was being driven to tap at about the 200-foot level a well-defined vein that is exposed in a creek bed 400 feet above the beach. The work previously done included an inclined shaft on the vein and a drift 165 feet long at the bottom. Since 1925 much further work has been done. The gold production has been variable, at times highly satisfactory and at other times less so, depending on the variable content and extent of the deposit. A crew of five was employed in 1935, ore of better grade was discovered, and the mill was in operation with little interruption.

It was reported in the later part of the summer that promising ore had been found by Dominick Viette on his claims in Portage Pass, in the Port Wells

district. The property, known as the Viette claims, is 2 miles from tidewater and is under bond to a Canadian syndicate. A crew of five men was employed in 1935. Considerable development work was done, and it was stated that the operations would be continued at a reduced rate during the winter.

The principal districts in the Kenai Peninsula region in which some lode-gold production was reported in 1934 were Nuka Bay, Moose Pass-Hope, and Girdwood. The Nuka Bay district embraces country near the extreme southern part of Kenai Peninsula; the Moose Pass-Hope district embraces much of the country lying north of the Moose Pass station, on the Alaska Railroad, and extending to the old settlements of Hope and Sunrise on Turnagain Arm; the Girdwood district lies just north of Kenai Peninsula, extending a few miles northward from the shores of Turnagain Arm. The entire belt of rocks in which the deposits of these three districts occur and which extends even over into parts of the Valdez district is dominantly a deformed series of slate and graywacke which has locally been intruded by igneous dikes that are currently referred to as "greenstones." The veins occupy fractures of rather irregular form and moderate extent, and their gold content is largely free gold, though sulphides are by no means uncommon.

The principal producing mines in the Nuka Bay district are the Alaska Hills mine, under the management of J. T. Coffey, and the Sonny Fox mine, largely owned and operated by Babcock & Downey. There are, however, more than a dozen other properties in the district on which some prospecting and development work was in progress. On the whole, small-scale prospecting does not appear to have been so active during 1935 as in several of the preceding years, but rumors were afloat of several deals pending with a view to the undertaking of more intensive work. The district is still much handicapped by its remoteness and lack of frequent transportation facilities, but both of these handicaps could be removed if sufficient tonnage were developed, for the district is readily accessible to deep-water steamers, and none of the properties are more than a short distance inland.

Farther north in the Moose Pass-Hope district and, in fact, at intervals between Seward and Moose Pass are small gold-lode properties at which more or less prospecting and development work were in progress for at least part of the year. Among those properties at which some productive mining was done may be mentioned the old Primrose mine, the mine of the Crown Point Mining Co., and the Grant Lake property, all within a short distance of the Alaska Railroad, and the Gilpatrick mine, the Lucky Strike mine, and the Nearhouse property, which are somewhat more remote from the railroad though easily accessible from the excellent road that extends from Moose Pass through Hope to Palmer Creek. Attempts were

made by the owners to obtain the necessary funds from the Government for mining out the known ore at the Alaska Oracle mine that had been left in the course of earlier development work on the property, but so far as known the loan has not yet been made.

In the Girdwood district, north of Turnagain Arm, the principal area in which some development of gold lodes was in progress in 1935 was near the head of Crow Creek, a tributary of Glacier Creek. The chief operating mine in this camp is the Monarch, under the management of H. I. Staser. No detailed report has been received by the Geological Survey as to the recent activities at this mine. It is currently reported, however, that mining work has been continued somewhat more vigorously and that the supply of water for the mill has been improved so that an adequate supply is now available throughout the working season. The camp buildings have been made more comfortable, but as yet the operators have not attempted to carry on mining and milling during the winter. Two or three small camps were prospecting elsewhere in the headwater portion of Crow Creek, but they consisted of only one or two men each, and no record of their results is available.

The revival of mining at the Golden Horn mine, in the Iditarod district, was one of the notable new lode enterprises started in 1934. Prospecting and development work on the property was continued throughout the winter, but unfortunately, although considerable ore was taken out, the deposit was found to be not large enough to be developed on the scale the operator desired, and consequently by midsummer of 1935 the decision was reached to discontinue work there and give up the option. The ore that had been recovered in the course of development work was shipped to a smelter in the States for treatment, and the property reverted to its former owner. So far as can be learned, this test by no means indicates that small bodies of ore that could be worked profitably on a small scale do not occur on the property, but such work takes on more the aspects of pocket hunting, which obviously is not attractive to a large company that must see a considerable quantity of ore to pay for the equipment it must provide and the necessary expenses.

In the Kuskokwim Valley the only producing lode-mining area is in the vicinity of Nixon Fork, north of Berry Landing. The principal producing mine in this area is the Nixon Fork mine, operated by Mespelt & Co. The work at the Nixon Fork mine was continued throughout the year on about the same scale as heretofore, and the value of the output of gold was about the same. Only a small crew is engaged on the property, and the general practice has been to do most of the underground work during the winter and get a sufficient stock of ore on hand to supply the mill during the open season.

Then when water for milling becomes available the underground work is suspended and the men are mainly busy in the mill or in preparing for the next winter's work. The mill is equipped with 10 gravity stamps, but its capacity is limited by the small supply of water that is available in normal seasons.

In the Copper River region the only producing mine was that of the Bremner Mining Co., which is situated in the mountains near the head of Golconda Creek, a tributary of the Bremner River. Development work has been in progress at this place for several years and in 1934 had reached such a stage that the company felt justified in ordering a mill for the property. Unfortunately delays in getting the materials in, due in part to floods and interruption of service on the Copper River & Northwestern Railroad, retarded the construction, and much of the season of 1935 was spent in dead work, so that the mill was in operation only for a short period. A general account of conditions at the property is given in another part of this volume.[4]

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

Prospecting for gold lodes was continued at many other places throughout the Territory, though at none of them, so far as reported to the Geological Survey, was any ore mined or any gold produced except the little that may have been recovered in the course of testing the ore during development work. Among places of this sort may be mentioned the Bonnifield, Valdez Creek, Kantishna, Chulitna, Yentna, and Chisana districts and Seward Peninsula.

In the Bonnifield district the Prospect Mining Co., which in 1934 had been doing some exploratory work on California Creek, did a little further work there in 1935, but by midseason discontinued operations. The Eva mine, on Eva Creek, which had lain dormant for 2 years, was acquired late in the season by new interests, and under the name "Frank Short mine" a crew of miners commenced to put the old workings in shape and planned to continue underground explorations throughout the winter in search for a workable lead.

[4] Moffit, F. H., Recent mining developments in the Copper River region, Alaska: U. S. Geol. Survey Bull. 880–B.

Much credit for carrying through the complicated negotiations required to get this further test of this property is due to Mrs. Frank Erno, who was familiar with the mine when it was being operated under the former company.

In the Valdez Creek district the work started by the Alaska Exploration & Mining Co. on its Denali and Timberline properties is said to have been continued throughout most of the open season, as well as part of the winter. In the course of this work about 125 feet of tunnel was driven. A 15-ton ball mill was operated for a short time. Most of the ore is free-milling, the gold being recovered by amalgamation. Some sulphide minerals occur in the ore, and some of these were saved in the concentrates, but these were not sold or shipped.

In the Kantishna district the mineralized area in the vicinity of Eureka and Friday Creeks showed little activity in lode development during the year. Some negotiations were in progress for giving options to a capable mining company to carry on intensive exploration in the area, but so far as reported these had not gone through by the end of the year. This region is now becoming much more accessible through the completion of the road from McKinley Park station on the Alaska Railroad practically as far as Wonder Lake, and the occurrence of mineral deposits in it should prove attractive if suitable terms can be arranged.

Renewed activity was reported to have been shown at the Golden Zone mine, on the West Fork of the Chulitna River, and a crew of miners are said to have been busy throughout the open season in carrying on an intensive test of the property. In the Yentna district a new small company was preparing to take in a mill to test some of the vein matter that for some time has been known to occur near the head of Cache Creek.

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

In Seward Peninsula prospecting on lodes containing gold was in progress at several places, though so far as reported none of

the deposits yielded gold in appreciable amounts. Projected developments of lodes in the Bluff and Solomon districts have been discussed for several years, but no material progress has been made on the ground in carrying the plans into effect. Nevertheless considerable interest is still being displayed in carrying on these enterprises, and it is likely that before long active work may be undertaken at some of the properties.

GOLD PLACERS

GENERAL CONDITIONS

Placer mining in Alaska in 1935 returned gold worth $9,703,000. This marks a great increase in value as well as in quantity over the output of the preceding year. In fact, the quantity and value of the placer production were larger than for any other year since 1917. The annual production of placer gold and certain other data relating to Alaska's gold production are represented graphically in figure 2. From this diagram may be traced many of the changes that have taken place in the industry. Thus, in no year from the beginning of the industry in 1880 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 15 years from that time to 1933 it fluctuated between that amount and $3,000,000. In 1934 and 1935, owing to the great increase in the price of gold, the value of the output suddenly jumped to the abnormally high figure stated above.

The trend of placer mining in Alaska for the last few years has been toward the development of large enterprises requiring the installation of expensive equipment, such as dredges or other mechanical devices, and the mining of relatively low-grade deposits through careful control of costs. Such enterprises are not undertaken casually, nor can they be made productive quickly, so that in spite of the stimulation brought about by the increased price of gold there must necessarily be a considerable lag before the larger new enterprises become noteworthy producers. Small operations, which do not require such elaborate preparations, show less lag in attaining production, and consequently many small new prospecting ventures

have been started, and some have made good showings. The life of the prospector has in it much that is attractive to offer to a man who enjoys the simple life, working more or less as his own boss, when, where, and how he pleases, and with the allurement of possibly discovering a real prize as a result of his efforts. Such a career obviously should be undertaken only by the physically fit and those reasonably skilled in understanding nature's secrets and the ways of acquiring what she has to offer. Many of the incidents in the life of the prospector are hard, and outstanding success comes to few in any line of endeavor; but it is believed that Alaska still holds opportunities for the capable placer prospector to find tracts that, while not bonanzas, will well repay his best endeavors. There also seems to be an increasing interest among capitalists and others in the mining development of the Territory, and doubtless, as they hold out incentives for finding workable properties, they will discover men ready and willing to undertake the quest. Anyone who remembers the difficulties of the early days and sees the present enormously better facilities and lower costs, however, has little sympathy with the laments that are often heard as to the difficulties now involved in 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 known that there are still large tracts of Alaska that have not yet been thoroughly prospected or adequately examined for large-scale placer operations. Although most of these areas do not appear to give promise of holding bonanza deposits that can be won easily and cheaply, there are extensive areas in which, it is confidently believed, well-organized and well-managed companies will find placers that can be mined profitably for many years.

The season of 1935 was in general favorable for placer mining, as at most of the camps there was somewhat more than the usual amount of water for the operations of sluicing, thawing ground, and the many other purposes for which water is used in mining. Of course, the statement that water was more than usually plentiful does not necessarily mean that the placer miners had enough to satisfy them, for each plant always plans to use up to the limit of the supply available, so that in practice the plans usually exceed the supply. The temperature conditions were also favorable for the camps to start early in the spring and continue fairly late in the fall, so that they had a long working season. Labor in sufficient quantity was available in most of the camps, and no labor troubles of moment interrupted the operations. Litigation that had been hampering op-

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erations of some of the properties was successfully settled so that work could go ahead. New enterprises were springing up in almost all the camps, though many of them did not reach a producing stage in 1935, but they give assurance of continued placer production at a high rate for many years to come. Above all, there was a healthy spirit of optimism that indicated a revival of the old desire to push mining developments.

PRODUCTION BY DISTRICTS

The description already given as to the methods used in collecting and interpreting the information that forms the basis of this report indicates that it is more difficult to obtain accurate facts regarding the production of placer gold than regarding any of the other items. This is due to the great number of small producers, who are widely scattered and many of whom are in the most remote parts of the Territory. The gold they produce frequently passes through many hands before it finally reaches a mint or assay office, so that a single lot is difficult to trace, for it may appear in the reports of the individual and then lose its identity by being lumped with other gold by the storekeeper who took it in exchange for supplies, and still further consolidated by the bank, perhaps in some distant district, to which it was sent by the merchant, and its course perhaps still further obscured by being shipped to another bank before being turned in to the mint. Every reasonable effort has been made to check the information from different sources and to adjust discrepancies so far as possible. As a result it is believed that the figures given for the total placer production are in accord with the actual facts. The distribution of this total among the different districts, however, is open to more serious errors, as gold produced in one district, unless reported to the Geological Survey by the original producer, may be credited to some other district through which it passed in the course of trade. In spite of the possibility of some error in the distribution of placer gold among the different regions, the following table has been prepared to show the comparative standing of the different regions as accurately as possible. It should be remembered that in this table all statements relating to the value of the gold are based on the present standard price of $35 an ounce.

In the following table the different regions are arranged in geographic order from southeast to northwest. The largest amount of placer gold came from the Yukon Basin, and the next largest from Seward Peninsula. Placer mining in each of these main regions is discussed in some detail in the following pages, and the more notable events of the year are recorded for each region.

Value of placer gold produced in Alaska in 1935 and 1934

Region	1935	1934	Decrease or increase, 1935
Southeastern Alaska	$6,000	$4,000	+$2,000
Copper River region	105,000	59,000	+46,000
Cook Inlet-Susitna region	194,000	192,000	+2,000
Yukon Basin	6,837,000	7,115,000	−278,000
Kuskokwim region	228,000	246,000	−18,000
Seward Peninsula	2,327,000	1,329,000	+998,000
Northwestern Alaska	6,000	10,000	−4,000
Total	9,703,000	8,955,000	748,000

SOUTHEASTERN ALASKA

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

The entire placer production from southeastern Alaska in 1935 is estimated to have been worth only $6,000, so that even the largest operations were small camps of two or three men each, who took out only enough gold to make a very modest grubstake. There are three areas in southeastern Alaska in which, in the past, placer mining has been active—near Juneau, in the valley of the Porcupine River, and the beaches between Lituya and Yakataga Bays. No placer mining is reported to have been in progress in the Juneau district in 1935, though a small amount of gold was recovered in the course of casual one-man operations at two or three places. None of the placer claims in the Porcupine district afforded a production worthy of mention. There was, however, a revival of activity in testing some of the gravel

deposits of the Klehini River, with the expectation that if the tests confirmed the showings of some of the samples from surface cuts, large-scale mining might be undertaken. Renewed preparatory work is reported to have been in progress on the large group of claims of the Alaska-Sunshine Mining Co., formerly called the Porcupine Mining Co., but no gold was reported to have been recovered. In the Lituya-Yakataga district placer mining was continued on about the same scale as for several years. The placers there are all of the beach type, exposed to the waves of the Pacific Ocean. This position, though in a measure favorable for concentration of the beach material, is disadvantageous, because except under suitable weather conditions the placers cannot be mined, and even then the use of extensive mechanical appliances is precluded by the necessity of removing them during times of storm.

COPPER RIVER REGION

In the Copper River Valley there are two principal areas and one minor area that have yielded placer gold, though a few small camps are widely scattered throughout the river basin. The principal areas, named in order of their production, are the Nizina and Chistochina districts, and the minor area is the Nelchina district. The value of the placer gold produced from the Copper River region in 1935 was $105,000, or nearly double the amount that was recovered from the region in 1934. This large increase was due principally to renewed operation at one of the principal mining camps in the Nizina district, at which extensive reconditioning had been done in 1934. The bulk of the placer gold of this district came from the properties of the Pardners Mines Corporation, on Dan Creek, and of the Chititu placer mines, on Rex and Chititu Creeks. At the Pardners mine the extensive alterations and additional equipment that were installed in 1934, during which the property had no productive mining in progress, enabled the company to resume operations on an increased scale and carry on the work much more effectively, although the full utilization of the new layout was not available through the entire season. Work by the large company on Rex Creek was along the same general lines as in recent seasons but appears to have been somewhat more remunerative. In addition two small outfits were mining on lays farther up Rex Creek. Additional notes on some of the placer-gold properties in this district are contained in a report by Moffit that forms a separate part of this volume. Continuation of prospecting and the production of a small amount of placer gold are reported by prospectors in the Bremner River region, to the south of the Chitina, especially in the vicinity of Golconda and Monahan Creeks. Work there has been confined mainly to simple prospecting methods of testing the deposits and has yielded only small amounts of gold re-

covered in the course of development. Apparently the results so far obtained indicate that the tenor of much of the ground that has been tested is too low to repay mining on a small scale by simple hand methods.

At the head of the Copper River in the Chistochina district the discovery in 1934 of some attractive placer ground on one of the small tributaries of Ahtell Creek created considerable interest in that region, and several small outfits were engaged in mining and development work there in 1935. According to F. H. Moffit, who visited the diggings, the area occupied by the placer ground appears to be small, but the physical character of the gold indicates that it has not traveled far, so that the rich pay may be very much localized. Further notes on this area are given by Moffit[5] in a report that forms a separate part of this volume. In the Slate Creek area the work of cleaning away the heavy overburden swept into the working area by floods in 1934 consumed most of the open season, so that little productive mining was accomplished. According to the owners the dead work has been completed, so that the season of 1936 should mark a notable increase in the output from this district.

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

COOK INLET-SUSITNA REGION

In the Cook Inlet-Susitna region, as the term is used in this report, are included the placer camps in Kenai Peninsula and adjacent country, the Yentna-Cache Creek district, and the Valdez Creek district, near the head of the Susitna River. In the past many of these districts have been highly productive, but their annual production has dwindled until now in most of them it is only a fraction of what it was, and in some of them only a few score miners are now at work where formerly there were hundreds. However, a considerable amount of placer gold still comes from these camps, and in 1935 their production was valued at $193,000, or practically the same as in 1934, when the value was $192,000. In the relative order of their placer production in 1935 these districts ranked as follows: Yentna-Cache Creek, Valdez Creek, and Kenai Peninsula, though there was little difference between the output of the two last-named districts.

In the Yentna-Cache Creek district at least 100 men were engaged in productive mining and about 20 more were doing casual prospecting and development work, which in many localities amounted to little more than that required by law to hold the claims. By far the

[5] Moffit, F. H., op. cit. (Bull. 880–B)

most productive operations in the district were those of the Peters Creek Mining Co. on the lower part of Peters Creek, but there were several other outfits on Peters Creek as well as on Cache Creek and its tributaries. Some damage was done at a number of mining properties, especially those on the main Cache Creek, by heavy rainfall and resulting floods, which swept detritus over many of the areas that had been prepared for mining and buried the sluice boxes at several of the claims under 6 feet or more of gravel. As a consequence, much of the season was spent in dead work of clearing away the damage, rather than in productive mining. Further prospecting on Dutch Creek, north of the head of Bird Creek, is said to have disclosed some promising placer ground that apparently can be developed on a fairly extensive scale. North of Peters Creek a few prospectors usually spend part of the summer in the valley of the Tokichitna River and some of its tributaries, but so far as reported to the Geological Survey the only outfit of this kind in 1935 was one on Ramsdyke Creek.

Southwest of the Cache Creek area in the Kahiltna River Valley and in the Fairview district prospecting seems to have been especially active. On Lake Creek a considerable force employed by the Alaska Continental Gold Mines was busy most of the open season in exploratory work that looks to the installation of a dredge, if the findings warrant such action. In the Fairview district more than a year has been spent in drilling and sampling a considerable tract of prospective placer ground. This work is said to have afforded showings so satisfactory that active development is likely to be started there soon. Besides these large enterprises more than a dozen one- and two-man outfits in the Fairview district were prospecting, and some of them gained a modest grubstake.

The producing camps in the Kenai Peninsula region are situated mainly in the vicinity of Hope, Sunrise, and Girdwood. In the area near Hope special mining activity was noted in the northern part of the Resurrection Creek Valley, where three camps had an unusually successful season mining some of the deposits of the main streams near the mouth of Palmer Creek. These were the Palmer Creek Mining Co., on property formerly known as the St. Louis claims; the Hope Mining Co., on the old Mathison claims; and the Seward Mining Co., which was using a recently installed drag-line scraper. Near the head of Canyon Creek the newly organized Seward Placers, Inc., moved a considerable amount of gravel and overburden from its claims but was not able to clean much of the bedrock because of frost, so that work must await another season. Possibly the most notable event in this district was the purchase by the Kenai Gold, Inc., of the old Cache Creek dredge that used to mine in the Yentna district. This dredge was removed and transported to ground near

Sunrise, where it will be rebuilt. It will not be available for productive mining, however, until the season of 1936. In addition to these larger undertakings there were several smaller camps in the Hope and Sunrise districts, some of which yielded a few thousand dollars in gold and others only a meager grubstake. These smaller camps were situated at practically the same places as in the last few years, especially on Sixmile, Canyon, and Lynx Creeks.

In the Girdwood district, which lies north of Turnagain Arm and includes the valleys of Glacier Creek and its tributary Crow Creek, the only placer property that reported any notable production of gold was that managed by A. S. Erickson about 4 miles north of Girdwood. The placer that is being mined is a thick deposit of bench gravel on the north side of Crow Creek. A well-planned and efficiently managed hydraulic plant has been in operation here for several years and has about reached the limit of the property that can be profitably mined under existing conditions. Neither at the old Girdwood property, upstream, nor at the property on California Creek, downstream from the ground mentioned above, was any placer mining in progress.

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 1935, the returns to the few placer operators who were in the district appear to have been at about the same rate as during recent years. Both hydraulic and drift placer mining is carried on at different claims in the district. Among the places at which some placer gold was mined during the season were lower Valdez Creek, where Wallace Fairfield and Dan Ohman, with eight others, were hydraulicking, and Ole Nicola, with three associates, was mining, mainly by hand methods, and farther up the valley, where Fred Bucke, with four others during the winter and six others during the summer, did considerable drifting and sluicing. On Lucky Gulch three men were engaged in ground sluicing and drifting on claim no. 3 above Discovery.

YUKON REGION

The Yukon Valley embraces a tremendous extent of territory, and scattered through it from one end to the other are placer-gold camps. In the past, gold has been reported from almost every stream in the entire basin, though the quantities in some have been so small as to be of no commercial significance. For convenience of description in this report, all the producing placer camps in this vast area have been grouped into 18 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 chief purpose of this grouping is to combine areas having in general similar interests and similar conditions and to separate those that are dissimilar. This results in throwing some large tracts together and in splitting up some other parts of the Yukon Valley into several small districts. In some places the boundaries of the different districts almost overlap; in others the boundaries of one district lie far from those of its nearest neighbor.

The placer gold from all the camps in the Yukon Valley in 1935 had a gross value of $6,837,000, which is somewhat less than in 1934, when the value was $7,115,000. Although at first sight this decrease may appear large, it represents only about a 4-percent drop, which may well be accounted for as resulting from normal fluctuations. Certainly it is nothing that can be attributed to an actual waning of the industry. In fact, it seems evident from even a casual inspection of the camps that they are going ahead more vigorously now than they have for several years, and all the indications point to a considerably greater output in 1936 and one that will be maintained for years to come.

In the following table the districts are arranged in order of their placer production in 1935, and for comparison the production from the same districts in 1934 is given. The total is believed to be correct as stated, but the distribution of this total among the districts is open to some uncertainty, owing to the great number of small producers, their wide distribution, and the failure of some of them to supply the essential information. However, every reasonable precaution has been taken to guard against serious errors and to keep the estimates in accord with all the available facts, so that the figures stated are regarded for all practical purposes as accurate and comparable with similar figures for earlier years.

Value of placer gold produced in Yukon Basin, 1935 and 1934, by districts

District	1935	1934	District	1935	1934
Fairbanks and Richardson	$5,317,000	$5,474,000	Koyukuk and Chandalar	$61,000	$50,000
Iditarod	458,000	574,000	Chisana	21,000	18,000
Innoko	269,000	367,000	Kantishna and Bonnifield	21,000	17,000
Hot Springs	165,000	91,000	Eagle	20,000	21,000
Circle	124,000	149,000	Rampart and Fort Gibbon	8,000	9,000
Fortymile	121,000	59,000			
Tolovana	95,000	130,000	Total	6,837,000	7,115,000
Ruby	85,000	127,000			
Marshall	72,000	29,000			

In the foregoing table three small districts, the Richardson, Fort Gibbon, and Chandalar, have been grouped with the nearby larger districts, Fairbanks, Rampart, and Koyukuk, respectively, and two other small districts, the Kantishna and Bonnifield, have been combined. These combinations have been made to conform with earlier reports and to avoid disclosing confidential information regarding individual production from some of the small districts, where the bulk of the placer gold has come from only one or two mines. It may be stated, however, that the Koyukuk and Chandalar districts produced in 1935, respectively, $43,000 and $18,000, and the Bonnifield and Kantishna districts produced, respectively, $17,000 and $4,000. None of the other small districts that have been combined with larger ones produced as much as $5,000 in placer gold in 1935.

The region adjacent to Fairbanks, here called the "Fairbanks district", has long been and still is the main placer district in Alaska. The greatest amount of gold from this district was produced by dredges of the United States Smelting, Refining & Mining Co., Fairbanks Exploration Department, on the Chatanika River and Cleary, Pedro, and Goldstream Creeks and by lessees of the property of the Fairbanks Gold Dredging Co. on Fairbanks Creek. Considerable placer gold was also recovered by hydraulic or open-cut methods, and a little by drift mining. Placer gold recovered by other methods than dredging came principally from Goldstream, Pedro, Sourdough, Ester, Vault, and Dome Creeks, and the Big Chena and some of the tributaries of the Chatanika River east of its junction with Cleary Creek. Several thousand dollars' worth of placer gold, in addition to that produced by the dredges, came from placers on Fairbanks Creek. There were also smaller camps in the valleys of several of the other streams, whose production, though individually only a few hundred or a few thousand dollars, in the aggregate swelled the total production for the district considerably.

The extensive mining project being carried on by the United States Smelting, Refining & Mining Co., Fairbanks Exploration Department, embracing large tracts on Goldstream and Cleary Creeks and the Chatanika River, continued to be the outstanding placer-mining enterprise not only in the Fairbanks district but throughout the Territory. At present the work of this company may be considered to be divisible into three more or less separate enterprises that are closely knit together in their broader aspects. Two of these parts embrace the productive mining in progress on Goldstream and Cleary Creeks, and the third is the preparatory work in progress on Ester Creek and in its vicinity. The work on Goldstream and Cleary Creeks was essentially a continuation of the dredging that had been in progress on these streams for several years. Three modern dredges were engaged in this work on Goldstream Creek and

two on Cleary Creek, and both projects were supplied mainly by a long ditch line that picked up its water far up the Chatanika River and led it by ditches, flumes, and gigantic siphons to the areas where it was put to work. The careful planning of each step of the process of preparing the ground for dredging and the excavation of the material so as to avoid rehandling has done much in keeping the mining work going ahead at a high rate of efficiency, and, although interruptions have occurred from time to time through failure of materials to stand up to the tasks imposed on them, they have been surprisingly few, and this speaks highly for the technical skill and administrative ability with which the entire operation has been conducted. Reference to the Goldstream and Cleary areas as being the producing areas should not be understood as meaning that preparatory work is not in progress there also. It takes at least 3 years to prepare a tract for dredging, as the surface vegetation must be taken off, the overburden thawed and disposed of, and the frost in the gold-bearing gravel thoroughly removed before it can be excavated. All these processes are going on simultaneously in different parts of these so-called producing areas. In the Ester Creek area only preparatory work is still in progress, as several million yards of overburden must be removed and part of the underlying gravel thawed before a dredge can be effectively utilized. It will probably be 1937 before productive mining on any significant scale will be undertaken in this area. The great thickness of the gravel in places and its complex composition raise many technical problems which must be taken care of in designing the dredge that will be installed. Water for most of the development work in the Ester Creek project is pumped from Chena Slough to a nearby high-line ditch by which the water is distributed to the different parts of the area. This new work in the Ester Creek area will greatly prolong the operations of this company in the Fairbanks district and thus give added assurance of the stability, not only of the mining industry in this camp but also of all forms of business activity in the contiguous country and in fact throughout much of interior Alaska.

East of the main mining area adjacent to Fairbanks are a number of small camps at intervals all the way to Richardson and south of that old settlement, including parts of Jarvis Creek and other tributaries of the Big Delta, south of the Tanana River. In years gone by the Richardson or Tenderfoot camp had a rather large placer production, but at present there are not half a dozen men mining in that district. Therefore, the use of its name in combination with Fairbanks in this report is not so much to designate two separate camps as to indicate a single ill-defined area between Fairbanks on the west and Richardson on the east. Thus between what may be called the real Fairbanks district and the Richardson district con-

siderable gold was taken out by fairly large camps on Big Chena, during at least part of the open season, as well as by small camps on the Salcha River and its tributaries. No information has been furnished to the Geological Survey as to the placer mining south of Richardson in the valley of Big Delta and its tributaries. However, from current reports it appears probable that only a few prospectors were in that region and that such work as they did was mainly prospecting or preliminary development work.

The placer camps in the Iditarod district, in the west-central part of the Yukon region, retained their standing of the previous year of being the second most productive in the region. The production from this district in 1935 is estimated to have been $458,000, or somewhat less than in 1934. This decrease is attributed to the fact that in 1934 there was an abnormally good supply of water, and the newly established price of gold stimulated especial activity in the camp. Altogether there were nearly 150 men engaged in placer mining in the district, besides a score or more who were engaged in prospecting and related work that did not yield any notable amount of gold. As in the past, the largest amount of gold recovered in the district was obtained by two dredges—that of the J. E. Riley Investment Co., on Otter Creek about 2 miles south of Flat, and that of the North American Dredging Co., on Flat Creek. In addition to the dredges there were five other outfits on Otter Creek and its tributaries, five on Flat Creek, one on Happy Creek, three on Willow Creek, one on Granite Creek, and two on Chicken Creek, all of which recovered considerable placer gold. Most of the larger producers in these other outfits employed mechanical shovels or power-operated scrapers of one type or another. However, a large production was reported from several camps that used hydraulic methods, and considerable gold was recovered by the smaller outfits that were only shoveling in. One of the largest of the mechanical shovels so far installed in the district is said to be equipped with a bucket having a capacity of 3 cubic yards operated from a boom 100 feet long. Much of the open season at the property on Willow Creek, where this machine is to be used, was lost in getting the equipment on the ground and putting it into working condition, so that its full capacity was by no means tested in the season of 1935.

Detailed reports from the Innoko district were far less complete than from many of the other camps in the Yukon region, but general information shows that it maintained its former position as the third largest producer in the region. Here, as in most of the other districts in which dredging is active, the largest amount of gold was recovered by this method of mining. Four dredges contributed to this total—two on Ganes Creek and one each on Yankee and Little Creeks. In addition there were one or more outfits on Ganes, Ophir,

Little, Spruce, Spaulding, and Esperanto Creeks and Bedrock, Spaulding, and Victor Gulches, in what is known locally as the Ophir district, and in the so-called Cripple Creek district, which lies somewhat to the northeast of these camps, there were the Cripple Creek Mining Co., Wilson & Hard, and Warner & Associates, on Cripple Creek, and Paulson & Associates on Colorado Creek. The Cripple Creek Mining Co. is the largest producer in the district, employing 25 or more men during the working season and mining with a modern well-equipped drag-line scraper. Wilson & Hard are mining downstream from that outfit with a slack-line scraper, employing a crew of about 10 men. The camp on Colorado Creek is mining with a hydraulic lift and has a crew of about three men.

The Hot Springs district, as the term is here used, consists of two rather widely separated tracts—one including the western part of the district from Tofty to Woodchopper Creek and extending as far west as American Creek, the other including the eastern part, which centers around Eureka Creek and is locally referred to as the Eureka Creek district. The district showed a remarkable increase in production in 1935 over that of 1934. This was brought about by the continued successful operation of the dredge of the American Creek Operating Co., the beginning of effective mining by a large modern drag-line scraper in the Sullivan Creek Valley, and the stimulation of output by the smaller operators, many of whom were able to step up their output materially because of the larger amount of water they had available for mining. Besides the dredge and scraper already mentioned as mining in the Tofty area, the largest camp was that of Albrecht & Hanson, but smaller camps were working on American and Boulder Creeks. In the Eureka Creek area the principal production came from Glen Gulch, but considerable quantities of placer gold were recovered from the deposits on Pioneer and Rhode Island Creeks, Eureka Creek and bench, Chicago Creek, and Omega Creek. There were several prospectors at other places throughout the district, and undoubtedly in the aggregate their finds swelled the total, though individually they got only small amounts.

A slight falling off in the placer production of the Circle district in 1935 seems to have been due to the fact that the water supply was considerably less than in 1934, so that the production of many of the smaller operators was cut down. However, there were at least 9 camps, employing 12 men, drifting during the winter, and 19 camps, employing more than 60 men, engaged in the various kinds of placer mining during the summer. The item of most general significance regarding mining developments in the Circle district is probably that relating to the construction of a new dredge on Coal Creek by Gold Placers, Inc., under the supervision of E. N. Patty. By the middle of September practically all the equipment

for the dredge had been landed on the ground, and construction work was to be begun at once, though necessarily it will be well into the season of 1936 before productive mining will be commenced. The dredge is said to be equipped with 3½-foot buckets and will be operated by a 165-horsepower Diesel engine. Water for cold-water thawing and other purposes will be brought to the ground to be mined by a ditch about 2 miles long, which has already been built. Among the creeks reporting the largest output in the Circle district were Independence, Mastodon, Porcupine, Miller, Switch, Deadwood, Harrison, and Half Dollar, but smaller amounts were recovered from Coal, Bonanza, and Ketchum Creeks, and some prospecting and a small amount of development work was done on at least half a dozen other streams in the district.

The Fortymile district more than doubled its preceding year's output, owing in large measure to the fact that the Walker's Fork Gold Corporation had its first full year of productive mining and to the general increased activity among even the smaller producers. Somewhat over 50 outfits, most of them small and employing only one or two men each, were mining in addition to the dredge operation and the men employed in preparation for the two additional dredges that are to be built in the region. As in the past, in addition to the work on the Walker Fork property, the greatest number of camps were on Jack Wade Creek and its tributaries, but several camps were mining on and near Franklin Gulch, in the vicinity of Chicken, including Meyers Fork and Lost Chicken and Ingle Creeks, and more than 12 outfits on the bars and at accessible spots along the Fortymile River near Steel Creek. A single outfit was reported on each of Dome, Canyon, Buckskin, Joe Wilson, and Napoleon Creeks. In addition to the productive work in progress the district is greatly interested in the proposed installation of two additional dredges that are to be built near Chicken and Jack Wade Creeks by the Alaska Gold Dredging Corporation and the Jack Wade Creek Dredging Co., Inc., respectively. Crews of men were busy preparing the sites for the construction of these dredges, and it is reported that the necessary material and equipment for them was landed at Fortymile in the fall and will be hauled to their destinations during the winter, so that construction may be started as early in the spring as practicable.

The Tolovana district, as the name is used in this report, embraces a considerable tract of country lying north and northwest of Fairbanks. It has long been difficult to reach, except by airplane or by a circuitous, time-consuming journey, but the construction of a road connecting it with Fairbanks, which is fast becoming available for travel in all weathers, will doubtless aid much in its development, as well as open up some of the intervening tracts. The output of placer gold in

1935 was somewhat less than in 1934, a condition that is probably to be explained by the fact that production in 1934 was abnormally large and therefore not a fair gage of the output that may reasonably be expected. Much of the current production of placer gold from the Tolovana district is obtained by drift mining, though there are shallow diggings, especially adjacent to the Tolovana River. The occurrence of deep placers that give employment throughout the year has a very stabilizing effect on the camp as a whole, though the difficulty of getting sufficient water often necessitates leaving the gold-bearing dumps unsluiced for more than a year. The extensive prospecting work that had been in progress for more than 2 years to test the placer ground in parts of the Livengood Valley was finally discontinued, though no details as to the reason for that decision were made public. According to the reports received by the Geological Survey, the following operators were mining during 1935: Chris Stadelman, Bill Mahan, and Tony Silva on Livengood Creek; Bentley Falls and Mandich & Jurich on Lillian Creek; Luckman & West and Fiske Bros. & Wickstrom on Amy Creek; Hess, Douglas & Lowe on Gertrude Creek; and Bentley Falls on Ruth Creek. On the tributaries of the Tolovana River east of Livengood the only work reported to the Geological Survey was that of Haley & Magnussen on Wilbur Creek. Some extensive drilling was undertaken on Nome Creek below the site of the old dredge to see whether or not an area could be outlined that would be suitable for dredging. The results of these tests have not yet been made public.

The Ruby district as described in this report is a rather ill-defined area extending southward from the settlement at Ruby, on the Yukon, for 50 to 60 miles to include the settlement of Poorman and the various camps adjacent thereto. By far the larger part of the production from this district is recovered by drift mining, which is done mostly during the winter, and the dumps are sluiced during the following open season when water is available. There are two principal centers of mining activity in the district—one near Long, about 25 miles south of Ruby, and the other near Poorman, some 25 miles farther south. In the area near Long only one camp is reported to have been producing during 1935. This was on Long Creek, where A. J. Burke, with a crew of five men, using drifting methods, was active during part of both the winter and summer seasons. In the area adjacent to Poorman several outfits were mining on Poorman Creek or some of its tributaries, within 2 to 3 miles of the town. Among these camps may be mentioned those of Harry Jensen, John Monaghan, and J. F. Shropshire on Poorman Creek; Vik & Sutro on Spruce Creek; Collins on Tamarack Creek; and Shropshire on Moose Creek, which is 9 to 10 miles southwest of Poorman, near a

small settlement locally called Placerville. There were several other camps which did not report the results of their season's work to the Geological Survey.

The greatest percentage of increase in placer production for the year was shown by the Marshall district, in western Alaska, which increased from $29,000 in 1934 to $72,000 in 1935. The Marshall district, as the name is used in this report, includes practically all of the western part of the Yukon Valley below Holy Cross and is somewhat more inclusive than the so-called "Wade Hampton recording precinct." In this large area there is relatively little placer mining or prospecting, and this more or less localized at two points—one near Marshall and the other in the Stuyahok or Bonasila Valley. The great increase is largely due to revival of mining on Willow Creek, to the east of Marshall settlement. The largest camp on this stream is that of Johnston & Ostnes, as laymen, using hydraulic methods and disposing of the tailings with a slack-line scraper having a 1-yard bucket and operated by a 3-drum engine. Twelve men were employed on this property during the summer. Also in the vicinity of Marshall some mining was done on Montezuma Creek, where two men were employed most of the summer. About 50 miles northeast of Marshall, but still considered in the Marshall district, in the valley of the Stuyahok River, a tributary of the Bonasila River, a party of four men were mining with a hydraulic elevator and plant. No specific details have been learned by the Geological Survey as to the progress of the work at this place, but the amount of gold recovered indicates that the camp must have had a fairly satisfactory season, though without notable new developments.

The Koyukuk district, as the term is here used, embraces a very large tract of country and consists of at least three rather widely separated areas in which placer gold has been mined. These subordinate areas are the Indian Creek-Hughes area, in the central part of the Koyukuk Valley; the Hogatza River area, somewhat north of Hughes and embracing country north of the Koyukuk River; and the upper Koyukuk area, which includes that part of the Koyukuk Valley lying north and northeast of Bettles and the country near Wiseman. Mining in the two more southern placer areas was practically negligible, and the Geological Survey has received no specific information regarding work there. The production in 1935 from the camps in the northern part of the Koyukuk Valley was about the same in quantity as in 1934 though more than in 1933. The bulk of the production seems to have centered around Nolan Creek and its tributaries, especially Archibald Creek. Among the other streams on which there were productive mining camps were the Hammond River, Wakeup, Smith, Mailbox, Vermont, and Myrtle Creeks, the

Wild River, the South Fork of the Koyukuk River, and Sheep and Porcupine Creeks. More meager grubstakes are reported to have come from a number of one- or two-man camps at half a dozen or more places through this vast northland tract. The project of exploring certain extensive tracts on Twelvemile Creek, noted in the annual volume for 1934, appears to have been at least temporarily abandoned.

In the table on page 38 the production of placer gold in the Chandalar district was combined with that of the Koyukuk, because in 1934 there were only two placer producers in the Chandalar, and to state the output from the district would have disclosed confidential information. In 1935, however, there were three or more producers in the Chandalar, so that it has become permissible to state that the placer production of the district is estimated to have been $18,000. The largest production in the Chandalar district came from Little Squaw Creek, where there are two mines, one operated by Manuel Mello and the other by Carlson & Buckley. The second most productive creek was Tobin, where work was done by Ellis Anderson. A smaller amount of placer gold was recovered from property on Big Creek, mined by A. L. Newton. All the properties except the one on Big Creek are reported to be developed as drift mines.

Placer mining in the Bonnifield district in 1935 showed a considerable increase over that in the same district in 1934. According to the reports which have reached the Geological Survey, nine camps did productive mining in 1935. Of these the largest was that of the Gold King Hydraulic Mining Co., on Gold King Creek, where six men were employed almost continuously during the open season. Small one- or two-man camps were mining on Moose and Platte Creeks (two each) and Grubstake, Marguerite, Homestake, Bonnifield, and Eva Creeks (one each). A little prospecting was also in progress in the valley of the Wood River. Practically all the ground mined is shallow, so that open-cut methods were employed at all the above-mentioned camps, though ground that can be drifted is known to occur in the district and has been mined in the past.

In the table on page 38 the production of placer gold from the Kantishna district has been combined with that from the Bonnifield district, because in the past the production from some of the camps was so small that to state it separately would have disclosed confidential information. However, in 1935 there were enough active camps in each district to permit giving the separate figures, which were $4,000 for the Kantishna district and $17,000 for the Bonnifield district. In 1935 about six small camps did some productive mining in the Kantishna district. The largest of these was on Eureka Creek. Among other streams on which some productive mining was done were Caribou and Yellow Creeks.

Reports from the Chisana district, locally called Shushanna, indicate that the season of 1935 was generally regarded as better than the average. This seems to have been due not so much to any single new development as to the general revival of activity throughout the district. Altogether some 20 men were engaged in placer mining or prospecting, and mining was carried on in at least 5 separate sites. The largest camp was that of the Nelson Mining Co. on Bonanza Creek, which employed six or more men through a large part of the season. Mining is also reported to have been in progress at camps on Bonanza, Little Eldorado, and Gold Run Creeks.

In the Eagle district the placer-gold production in 1935 was practically identical in amount and value with that of the preceding year and came from essentially the same general areas. The largest camp in the district appears to have been that of Richard Bauer on Fourth of July Creek, in the Nation River area, at which five men were employed. Other camps employing from one to four men each were reported to have mined on Crooked, American, Barney, Broken Neck, Falls, Nugget, Alder, and Flume Creeks, the Discovery Fork of the American Creek, and the Seventymile River. All together there appear to have been about 14 separate small outfits, consisting of about 30 men, at work in the district.

Reports received by the Geological Survey regarding placer mining in the Rampart district indicate that about a dozen camps, employing about 30 men, were active during 1935. Several of these operations recovered only a few hundred dollars' worth of gold each. The greatest amount of gold seems to have come from properties on Little Minook, Quail, and Hunter Creeks. Some gold was also produced at camps in the valleys of Big Minook, Little Minook, Jr., Bear, Slate, and Hoosier Creeks. Prospecting was also continued on the high gravel deposits of Idaho Bar. It is understood that the project of consolidating a considerable tract in the district, so as to work it by extensive mechanical equipment, was dropped after the results of the preliminary investigations were analyzed. In the area lying north and west of the town of Tanana, sometimes known as the Gold Hill area or part of the Fort Gibbon precinct, which in this report has for convenience been grouped with the Rampart district, a little prospecting was done in 1935 by two camps on Morelock Creek and one camp on Moran Gulch. Only a little gold was recovered in this work, but it is significant as indicating the continuation of mining interest in this district.

KUSKOKWIM REGION

Included in the Kuskokwim region are four principal districts where gold placers were mined in 1935. For convenience of de-

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

The production of placer gold in the Kuskokwim region in 1935 is estimated at $228,000. This marks a decrease of $18,000 from the output of the same region during 1934 and obviously is a minor fluctuation of no real significance, for 1934 was a year of much more than the usual output.

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

In the Mount McKinley district, as in the past, there were three main areas in which placer mining was in progress in 1935. One of these is the Moore Creek area, about 50 miles southwest of McGrath, where the hydraulicking outfit of Waino Kaskinen, employing five men, was the largest individual producer in the district. Moore Creek is a tributary of the Takotna River. On Candle Creek, a tributary of the Tatalina River, one small camp was established about 8 miles in an air line south of McGrath. In the Hidden Creek Valley and on some of the creeks tributary to it three small hydraulic

plants were in operation, the largest of which was on Holmes Gulch. No details are available as to the amount of gold recovered from any of these individual camps, except the one on Holmes Gulch, but apparently none of them produced more than a few thousand dollars' worth of gold.

Placer mining in the Georgetown district appears to have been restricted to Donlin and Julian Creeks. The mineralized areas on these streams lie only about 25 miles south of the town of Flat, in the Iditarod district, and as they are reached most easily from that district they might really be considered as outliers of the Iditarod deposits. They are about 20 miles in an air line respectively northwest and north of Georgetown, on the Kuskokwim. The principal producing camp was one on Julian Creek, where eight men were employed throughout the open season. Revival of interest in this region has led to a concerted effort to have a suitable road built between Flat and Georgetown, so that better transportation facilities would be available for prospectors. South of Georgetown repeated reports of discovery of promising placer ground in the valley of the Holitna River have led to a number of scouting parties going into different parts of the area to see what they can find. No details regarding the results of this prospecting have been received by the Geological Survey, and even the approximate position of the locality has not been learned. As the region has not been mapped, any statement as to the real significance of the find is pure speculation. However, from the probable geologic character of the region, there is good reason to believe that it may contain intrusive rocks which, at their contacts, have induced mineralization that might yield workable placers.

In the Tuluksak-Aniak district the bulk of the placer gold produced in 1935 came from the property on Bear Creek that is being mined by dredges of the New York-Alaska Gold Dredging Corporation. This company had for several years been mining with a single moderate-sized dredge, but in 1935 a smaller pontoon dredge, constructed by the Washington Iron Works, was shipped in and assembled on the ground. A remarkably short time was spent in getting the new dredge into operation, for it is said that only 22 days after it was freighted to the dredging site it was erected and at work. The company is reported to have experienced an unusually long working season, having been in operation from April 10 to November 9, a span of 214 days.

Next in volume to the dredge production was the output from the hydraulic and open-cut mines. The largest of these are on Canyon and Marvel Creeks. Canyon Creek is a small tributary of the Kwethluk River, which in turn is a tributary of the Kuskokwim a short distance west of the settlement of Akiak. Marvel Creek is a

tributary of the Salmon River, which flows into the Aniak River, and that stream in turn joins the Kuskokwim about 75 miles in an air line northeast of Akiak. The principal property on Canyon Creek was being operated by Kvamme & Co., and the one on Marvel Creek by Dahl & Wilson for Luther C. Hess. Several other small outfits of a few men each are also reported to have been working on some of the other streams that head in the same general group of hills, which, for want of a specific name, may be referred to as "Marvel Dome and vicinity." No detailed reports from any of these smaller camps have been received by the Geological Survey, and apparently they recovered only a little gold.

In the Goodnews Bay region the prospectors lately have been so much more interested in the search for platinum placers and their efforts have been so much better repaid that the search for gold placers and their development have been more or less abandoned. However, in 1935 there was some revival of interest in gold mining, and small outputs were reported from Wattamuse, Kow Kow, and Butte Creeks. It is also reported that there has been considerable scouting done in the Goodnews Bay district looking to the consolidation of holdings so that an operation of moderately large scale might be undertaken. Several new light-weight drills have recently been shipped into the district, most of which are to be used in prospecting the platinum-bearing placers, but some are said to be intended for testing some of the potential gold-placer areas.

No recent news has been received by the Geological Survey as to the progress of the extensive tests that have been under way for several years in the valley of the Arolic River with a view to finding out the value of some of the low-grade deposits that occur there.

SEWARD PENINSULA

The production of placer gold from Seward Peninsula in 1935 is estimated at $2,327,000, or nearly $1,000,000 more than in 1934. Though a large part of this increase is to be attributed to the operation of an additional dredge and more intensive work at all of its properties by the Hammon Consolidated Gold Fields, much of it was also due to the facts that several additional dredges were in operation in other parts of the peninsula and that practically every district in it showed a markedly greater output than in the preceding year. It should be noted also that the placer production from Seward Peninsula in 1934 was below the average for a number of years because of a shortage of water and because mining operations were badly hampered by a strike on the west coast of the States whereby shipments were missent, delayed, and otherwise mishandled. Furthermore, the largest operator in the Nome district had been

unable to prepare sufficient ground ahead to mine intensively in 1934, so that its production was far below normal. Contrasted with these conditions, the year 1935 was one of rather above the normal precipitation, so that water supplies were kept at a fairly constant and high stage, preparatory work that had been done in the earlier year made extensive tracts ready for mining, and many enterprises that had been started in response to the increased price of gold that was established late in 1933 began to come into full operation in 1935. It is evident from the foregoing facts that while they explain the increase in the placer output in 1935 they by no means involve conditions that are unique and unlikely to prevail in subsequent years. In other words, there is no indication that the rate of production reached in 1935 will not hold good for some time to come. In fact, to judge from the increased mining activity shown generally throughout the peninsula and the enterprises already under way which have not yet reached the stage of active production, it would seem reasonable to predict an increase rather than a decrease in the rate in the next few years.

A large part of the gold recovered from Seward Peninsula placers is mined by dredges. In 1935 gold worth $1,980,000, or more than 85 percent of the placer output of the peninsula, was mined by 19 dredges, one or more of which were active in practically every one of the larger districts of the peninsula. Additional data regarding dredge mining in this and other parts of Alaska are given on pages 59–63.

In the relative order of their output of placer gold in 1935 the mining districts of Seward Peninsula stood as follows: Nome, Council, Fairhaven (including the Candle and Inmachuk districts), Kougarok, Bluff, Solomon (including the Casadepaga River region), Port Clarence, and the Koyuk River region (including the areas adjacent to and east of the head of Norton Sound). 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 individuals.

The outstanding placer enterprise in the Nome district, as well as in the whole of Seward Peninsula, and the second largest in the Territory continues to be that of the Hammon Consolidated Gold Fields, with its three dredges in the valley of the Snake River and tributaries near Nome, its extensive ditches, some of which are more than 20 miles long, and its other equipment for properly conducting its work. Some discussion of the situation at this property is given on page 60. This whole property in 1935 was operating at near a capacity load during most of the season, not only in excavating the pay gravel but in the necessary preparatory work on adjacent tracts, so that the dredges would be able to work uninterruptedly when a year

or more later they were ready to mine that particular tract. The complex interrelation between the many diverse processes that must smoothly mesh together if the enterprise is to function efficiently has called for high engineering talent and resourcefulness and a capable and alert field personnel, all of which the company has had to a marked degree.

Three other dredging companies were operating in the Nome district in the season of 1935—the Alaska Sunset Mines Co., on Sunset Creek; the Dry Creek Dredging Co., on Dry Creek; and the Greenstone Mines, Inc., on Osborne Creek. The Sunset Creek dredge was installed in 1934 and had not yet been thoroughly squared away on productive mining in that year, and in 1935 considerable alterations and additions were made to its power plant. Consequently, considerable time was lost in this construction work and the dredge shut down for the season early in October. It is understood, however, that the owners feel well satisfied not only with the immediate results of the season's work but also with the indications given by that work as to the general tenor of its ground, on which it will be mining for several years. The Dry Creek Dredging Co. is operating on ground adjacent on the east to the area being mined by the Hammon Consolidated Gold Fields—in fact, part of the ground on which it is working is too shallow to be mined by a large dredge and is being worked under a lay from the Hammon company. The dredge of the Greenstone Mines, Inc., is the reconditioned dredge that has been in the district for several years and has locally been known as the "Dexter Creek dredge." This dredge started mining near the junction of St. Michael and Osborne Creeks and probably will ultimately mine up both of these streams.

There were also small open-cut mines in operation on many of the creeks in the vicinity of 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 Nome River, where 12 to 15 men were employed throughout most of the open season. The productive work on this place was slowed down owing to the amount of dead work that had to be done in moving the set-up to a new site as the ground at the former site was cleaned up. Considerable prospecting and a small amount of production were noted on the northwestern slopes of Anvil Mountain and vicinity, in the search for high-level channels of what are apparently former courses of Anvil Creek. Some of these channels that have been uncovered and worked out reveal astonishingly intricate stages in the development of the area. The entire sequence of events connected with these changes has by no means been deciphered, and further intensive study of the field relations should be of great significance,

not only theoretically but also in directing more profitable search for these old channels, some of which seem to carry considerable pay gravel. Altogether within a radius of 20 miles of Nome there were nearly a score of small camps engaged in placer mining. According to current reports more men were engaged in prospecting than there had been for several years, and there was practically no unemployment among any of the whites who were physically fit to work, especially as in addition to the mining work there was much construction, road building, etc., to reconstruct the town after its disastrous fire late in the fall of 1934. It is reported that early in the season a representative of large mining interests made some examinations in the vicinity of Nome, with the view of advising his principals as to the desirability of acquiring mining ground in the district. Apparently his conclusions were not in favor of taking such steps, though no statement of the findings was made public.

The Council district appears to have been the second most productive placer district in Seward Peninsula in 1935. The great increase in the amount of gold mined there seems to have been due to the successful season enjoyed by the four dredges that were in operation. These dredges were situated as follows: In the flood plain and gravel benches of the Niukluk River near and at the place where Ophir Creek leaves the hills, the dredge of the Council Dredging Co. and that of the Northern Star Dredging Co.; on Ophir Creek, the dredge of the Ophir Gold Dredging Co.; and on Melsing Creek, the so-called Kimball dredge. All the hydraulic and open-cut mines in the district are small, few of them employing more than two or three men each. In addition to the dredges on Ophir Creek there were three or four open-cut mines in the valley of that stream and its tributaries, Sweetcake and Crooked Creeks and Albion Gulch, employing altogether perhaps 8 to 10 men. On Aggie Creek, a tributary of the Fish River about 10 miles east of Council, a small hydraulic plant was in operation throughout most of the open season. One or two small open-cut mines were also in operation in the valley of Melsing Creek and its tributaries. There were doubtless a few other small camps scattered through the district, but no direct reports have been received from them, and nothing specific is known about the progress of their work, although to judge from the total amount of gold received from this district by the banks, most of them made at best only a modest grubstake.

The placer gold mined in the Fairhaven district comes from three main tracts—Candle Creek, the Inmachuk River, and Bear Creek. Altogether somewhat more than 100 men were employed on different mining properties in this district in 1935. Candle Creek is a large tributary of the Kiwalik River from the west, close to the town of Candle. The principal mining operation in this part of the district

is that of the Arctic Circle Exploration, Inc., which has acquired the former holdings of the Keewalik Mining Co. and has added to them several adjacent properties as well as some that are more remote. As the new operators did not acquire the property until late in 1934, much of that year, as well as 1935, was spent in desired reconditioning of the property. The main mining tract is to be developed by the use of a dredge and by hydraulicking, so that a number of difficult technical problems have to be worked out if the operations are to be arranged so as to proceed smoothly and without interruption. Apparently these problems still remain to be solved satisfactorily. In spite of the difficulty of getting a new project under way efficiently, this was by far the largest producer in the area in 1935. Besides the large company there is one fairly large independent camp on Candle Creek and several small camps scattered in the area not far from Candle. Farther from 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. A little mining was also in progress on the Kugruk River.

In the Inmachuk Valley the principal producer was the Forsgren Dredging Co., which was in operation at intervals throughout most of the season. This company in the past had been operating a small, nearly worn-out dredge, but it is reported that the dredge has been reconditioned so that now it is reasonably effective for one of its size. Farther upstream in the Inmachuk Valley the former highly productive camp of the Cordovado Mining Co., on the Pinnell River a short distance above its junction with the Inmachuk, continued to stand idle throughout 1935. Unfortunate financial and legal difficulties have so involved the property that it is uncertain when they can become unsnarled so that mining may be resumed. Several small hydraulic plants were established on nearby creeks. The largest of these was on Humboldt Creek, which is understood to have had a fairly successful season. Some prospecting is reported to have been continued during the year in a search for the old stream courses that were buried under the great outpourings of Tertiary and later lavas, which cover more than 1,000 square miles in the central part of Seward Peninsula. According to H. E. Stull, who has done most of this exploratory work, his recent investigations have disclosed deposits which he considers to be rich enough to mine and return a good profit.

The third tract in which placers were mined in the Fairhaven district lies on Bear Creek on the eastern flanks of hills that form the divide between the Buckland and Kiwalik Rivers. No specific reports have been received as to the individual mining operations in that tract, and the absence of news indicates that there have not been

any notable developments during the year. The production from this area seems to have been somewhat less than in recent years, and apparently not more than 10 men were engaged in mining there in 1935.

Few of the operators in the Kougarok district have furnished the Geological Survey with detailed information regarding their mining activities during 1935, and as no Survey representative has visited the district lately specific information as to recent developments is by no means as complete or authoritative as desired. Information from general sources, however, makes it evident that the camp enjoyed a specially large production, owing to the favorable water conditions and the increased activity that has been shown at most of the camps in the district. The old Coal Creek dredge that was moved from the Solomon district in 1933–34 was operated under lease in 1935 by the Fox Bar Dredging Co. Hydraulic mining is also said to have been in progress at several places, both in the Dahl Creek area near Coffee Dome and farther north along the valley of the Kougarok and its tributaries and even north of the divide of that basin in the valley of Dick Creek. At most of these properties simple open-cut methods of mining were used, and few of them had any extensive mechanical equipment. Apparently the largest production from any of these camps was between $5,000 and $10,000, and several of the smaller ones recovered only a few hundred dollars in gold.

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

Almost the entire placer production from the Bluff district was afforded by the high-line scraper plant installed near the mouth of Daniels Creek. About 30 men are employed at this camp, and the output of gold from it in 1935 was maintained at essentially the same high rate as in 1934. The material mined consists of both stream and bench gravel and a considerable amount of the decomposed surface of the underlying bedrock, which is mainly a metamorphic limestone. The excavation of this material is carried to such a depth that in places the bottom of the pit is below sea level.

In the Solomon district by far the larger part of the placer gold produced was obtained by the dredge of the Spruce Creek Dredging Co., on Spruce Creek, about 6 miles east of Solomon. Most of the

ground that was mined was distinctly creek gravel, but some spots of beach material were encountered. The ground is shallow, few of the deepest places being more than 18 feet deep. The conditions for mining appear to have been especially good, as the working season was longer than usual and rather less frost was encountered. On the average a crew of six men was employed. Only a few open-cut mines were in operation on the Solomon River and its tributaries. Of these the largest producer appears to have been the H. J. Haney Mining Co., on Big Hurrah Creek. In the valley of the Casadepaga River, which heads against and lies north of the Solomon River, the bulk of the placer production for the year came from the dredge of the Casa Gold Mines Co., situated on the main river about 2 miles from the mouth of Ruby Creek. This is a new steel pontoon dredge, equipped with 1¾-foot buckets close-connected, and a considerable part of the season was lost in erecting and moving the boat to the digging site, but in spite of the time thus lost a satisfactory recovery of gold was made for the season. The company is said to control the placer claims that cover the course of the river for a distance of about 9 miles. Some open-cut mining was doubtless in progress on some of the streams in the Casadepaga Valley, but no specific reports as to the results have been received by the Geological Survey, and it is presumed that few, if any of them, yielded more than a modest grubstake during 1935.

Placer mining in the Port Clarence district was decidedly on the upgrade in 1935, owing principally to the beginning of operation of three dredges. These were situated on Gold Run, a tributary of the Bluestone River, on Dese Creek, and on Swanson Creek. The largest was that on Gold Run, owned and operated by the Bartholomae Oil Corporation. This dredge was hauled from Teller and in less than 3 months had been assembled and had begun productive mining. It is of the flume type and is equipped with 2¾-foot buckets. The ground mined in the season of 1935 was in a rather narrow part of the valley and was difficult to dredge because of the large size and number of boulders, many of which had to be dragged out of the dredging pit by tractors. Some difficulty was also experienced from the backing up of the stream in the narrow part of the valley. This difficulty, as well as the abundance of boulders, will probably lessen as the dredge works upstream and enters a wider part of the valley floor. The dredge on Dese Creek is owned and operated by N. B. Tweet & Sons. It was badly iced in during the preceding winter, so that much time was lost in 1935 in getting it into operating condition. It is a small dredge of the flume type. The dredge on Swanson Creek is operated by C. L. Peck, who has had much former experience in dredging in the Casadepaga area. In addition, there were a few open-cut mines in operation in the dis-

trict, of which the largest seems to have been on Gold Run. Renewed activity is said to have been shown on Sunset Creek, north of Grantley Harbor.

The Koyuk district, as the term is used in this report, includes most of southeastern Seward Peninsula and is so named from the principal stream that traverses it. Most of the placer deposits that are mined are on Dime Creek and a few other streams in the vicinity of Haycock. The largest amount of placer gold mined in this district was recovered by the dredge of the Dime Creek Dredging Co. from claim 4. Altogether in this district there were, in addition to the dredge, one drift mine operated during the winter and five open-cut mines that have been worked during the summer. The total number of men employed in productive mining was between 15 and 20. The drift mine and three of the open-cut mines were on Dime Creek, and the other two open-cut mines were on Sweepstake Creek, a few miles to the west.

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

NORTHWESTERN ALASKA

The Kobuk River Valley is the only area in northwestern Alaska that is reported to have been the scene of any placer mining in 1935. In this valley there are two principal areas where placer mining is being done, though report has been received that two prospecting parties were in the Selawik Valley during the open season. 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 Kiana area there has been considerable activity on Klery and Central Creeks, which are tributaries of the Squirrel River from the north. The greatest amount of gold was recovered by the Klery Placers, Inc., which installed a dragline scraper on claim no. 6 below and did much preliminary work in the construction of a landing field, trails, diversion channels, and dams, as well as making extensive tests of the gravel of Klery Creek for a long distance upstream from the point at which productive work was in progress. Inasmuch as the equipment was not landed at the Squirrel River until August 7, it is evident that a great deal was accomplished in the short time that remained before it was necessary to shut down for the year, on September 22. The results so far achieved are said to have been so satisfactory that the company will resume operations as early in 1936 as practicable and expects, with a full season at its disposal, to make notable progress.

In the tract near Shungnak the placer deposits occur in the lowland adjacent to the Kobuk, close to the places where the small streams that come down from the hills to the north traverse that lowland, or in the valleys of the streams within this belt of hills. The source of the placer gold found in these deposits appears to be local, as in general it is rough and shows little evidence of having been transported far. This conclusion is further supported by the occurrence 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 1935, 8 small camps, 2 of which accomplished little more than assessment work, employed a total of about 15 men, part of whom were natives, on streams in the vicinity of Shungnak—3 on Dahl Creek, 1 on the Shungnak River, and 1 each on Boulder, Riley, Lynx, and California Creeks. Riley and Boulder Creeks are tributaries of the Kogoluktuk River, which joins the Kobuk some 3 or 4 miles east of Shungnak, and the Shungnak River enters the Kobuk about 15 miles west of Shungnak. The extensive prospecting that was started some years ago in the valley of the Shungnak River does not seem to have disclosed placers that were attractive to those financing that work, for no further work was done at the place in 1935, though it is understood that the promoter of the project still regards the area

favorably. This section is so remote and so poorly served by regular transportation service that it is among the most difficult places in the country in which to carry on mining development, and therefore placers must either be especially extensive or have an especially high gold content to prove attractive. For the transportation of persons or small or light commodities airplanes make the district relatively accessible, and already some of the prospectors are using this means of travel extensively.

DREDGING

Over 79 percent of all the placer gold produced in Alaska in 1935 was mined by dredges. The total gold thus recovered was $7,701,000, of which the greater part came from 16 dredges in the Yukon region and the rest from 19 dredges in Seward Peninsula and 2 in the Kuskokwim region. This total is about $1,000,000 more than the value of the gold recovered by dredges in 1934, and the quantity is about 28,000 fine ounces more. The accompanying table gives the value of the gold output and the yardage handled by Alaska dredges, beginning in 1903, the earliest year for which records are available.

The total value of the gold produced by dredges since 1903 is nearly 24 percent of the total value of gold produced from all kinds of placer mining since 1880, and lately there has been a general tendency each year for a greater and greater percentage of the placer output to be mined by dredges. During 1935 the ratio of dredge production to the output from all other kinds of placer mining was nearly 79 to 21, and there are no signs of a diminution in dredge mining in the near future—in fact, an even higher ratio seems not unlikely.

Gold produced by dredge mining in Alaska, 1903–35

Year	Number of dredges operated	Value of gold output	Gravel handled (cubic yards)	Value of gold recovered per cubic yard (cents)
1903–15		$12,431,000		
1916	34	2,679,000	3,900,000	69
1917	36	2,500,000	3,700,000	68
1918	28	1,425,000	2,490,000	57
1919	28	1,360,000	1,760,000	77
1920	22	1,129,932	1,633,861	69
1921	24	1,582,520	2,799,519	57
1922	23	1,767,753	3,186,343	55
1923	25	1,848,596	4,645,053	40
1924	27	1,563,361	4,342,667	36
1925	27	1,572,312	3,144,624	50
1926	32	2,291,000	5,730,000	40
1927	28	1,740,000	6,084,000	29
1928	27	2,185,000	6,371,000	34
1929	30	2,932,000	8,709,000	33.6
1930	27	3,912,600	9,906,000	39.5
1931	28	3,749,000	10,214,000	36.7
1932	25	4,293,000	10,310,700	41.6
1933	25	4,146,000	8,889,000	46.6
1934	30	6,725,000	10,445,000	64.4
1935	37	7,701,000	12,930,000	59.6
Total		69,534,000	[1] 121,191,000	[1] 47.1

[1] Since 1915.

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 $7,004,622 in gold, or a little less than 91 percent of the total mined by dredges, report that that amount came from 11,760,753 yards of gravel. The average yield thus shown is about 59.56 cents in gold to the cubic yard. Applying this average to determine the unreported yardage gives a total of 12,930,000 cubic yards, and this is the figure that has been used in the table. This procedure is obviously open to criticism, because the companies that reported fully the amount of gravel mined were the larger ones, and doubtless they worked ground of a lower tenor than that mined by some of the smaller companies. As a result the average value adopted may be too low and consequently may indicate a larger volume of gravel than was actually handled. This method, however, has been followed for the last 11 years, so that the quantities and values given for 1935 are comparable with those reported for the preceding 11 years.

Obviously the extremely high value per cubic yard in 1935 was due principally to the increase in price of gold, for if the old standard price of gold had prevailed in 1935 the average value per cubic yard would have been a little more than 35 cents a yard, or considerably less than the average for the entire period since 1915, shown in the table.

The length of time that the different dredge companies were operating varied widely. The longest season reported for 1935 was 261 days for dredges of the United States Smelting, Refining & Mining Co., Fairbanks Exploration Department, operating in the Fairbanks district of the Yukon-Tanana region. This was slightly less than the working season for dredges in 1934, which marked an all-time record for Alaska of 275 days and was also set by the Fairbanks Exploration Department. The longest season reported for any of the Seward Peninsula dredge companies in 1935 was 176 days for the Hammon Consolidated Gold Fields at Nome. The earliest date for beginning work in the spring of 1935 and the latest date for ending work in the fall were reported by the Fairbanks Exploration Department, which began mining March 20 and did not stop its last dredge until December 5. The earliest and latest dates in 1935 on Seward Peninsula were June 1 and November 17, both reported by the Hammon Consolidated Gold Fields. The average length of the working season in 1935 of the 15 companies for which information is available, exclusive

of those that were completed only in time to make the test run of a few days, as determined from the beginning and ending dates reported by each company, irrespective of how many dredges it operated, was 120 days. Obviously, the shortness of this average season as compared with the record of 261 days for the longest working season was due not to climatic conditions, but to breakage or some other purely local cause at the different dredges. The lesson that is demonstrated by these dredging records is that throughout most of interior Alaska a moderate-sized dredge reasonably well handled may be expected to have an average working season of at least 4 months, and that, with skill and special provisions against unfavorable climatic conditions, the season may be extended for an additional period of 1 to 2 months in practically any of the placer camps south of the Arctic Circle.

The following is a list of the dredges that did some productive mining during 1935:

Yukon Basin:	
Fairbanks district:	
United States Smelting, Refining & Mining Co., Fairbanks Exploration Department (5)	Goldstream and Cleary Creeks.
J. R. Murphy, lessee from Fairbanks Gold Dredging Co. (2)	Fairbanks Creek.
Fish Creek Mining Co	Fish Creek.
Fortymile district: Walker's Fork Gold Corporation	Walker Fork.
Hot Springs district: American Creek Operating Co	American Creek.
Iditarod district:	
North American Dredging Co	Flat Creek.
J. E. Riley Investment Co	Otter Creek.
Innoko district:	
Waino F. Puntila (2)	Ganes and Little Creeks.
Felder & Gale	Yankee Creek.
Ganes Creek Dredging Co	Ganes Creek.
Kuskokwim region:	
Tuluksak-Aniak district: New York Alaska Gold Corporation (2)	Bear Creek.
Seward Peninsula:	
Casadepaga district: Casa Gold Mines Co	Casadepaga River.
Council district:	
Northern Star Dredging Co	Ophir Creek.
Ophir Gold Dredging Co	Do.
Council Dredging Co	Niukluk River.
Charles E. Kimball	Melsing Creek.
Fairhaven district:	
Forsgren Dredging Co	Inmachuk Creek.
Arctic Circle Exploration, Inc. (formerly Keewalik Mining Co.)	Candle Creek.

Seward Peninsula—Continued.	
Kougarok district: Fox Bar Dredging Co. (formerly Coal Creek Dredging Co.)	Kougarok River.
Koyuk district: Dime Creek Dredging Co	Dime Creek.
Nome district:	
Hammon Consolidated Gold Fields (3)	Snake River area.
Dry Creek Dredging Co	Dry Creek.
Alaska Sunset Mines Co	Sunset Creek.
Greenstone Mines, Inc	Osborne Creek.
Port Clarence district:	
N. B. Tweet & Sons	Dese Creek.
Bartholomae Oil Corporation	Gold Run.
Charles L. Peck	Swanson Creek.
Solomon district: Spruce Creek Dredging Co	Spruce Creek.

The dredge of the Chatham Creek Dredging Co., on Chatham Creek, in the Fairbanks district, which was active in 1934, was idle in 1935. Eight dredges that were not in operation in 1934 were active in 1935—in the Kuskokwim region one dredge of the New York Alaska Gold Dredging Corporation; and in the Seward Peninsula region those of the Casa Gold Mines Co., on the Casadepaga River, in the Solomon-Casadepaga district; the Council Dredging Co., on the Niukluk River; and the Charles E. Kimball dredge on Melsing Creek, in the Council district; the Greenstone Mines, Inc., and one dredge of the Hammon Consolidated Gold Fields, in the Nome district; and the Bartholomae Oil Corporation, on Gold Run Creek, and the Charles L. Peck dredge, on Swanson Creek, in the Port Clarence district. Two companies in the Seward Peninsula region took over and operated properties that heretofore have borne other names—the Fox Bar Dredging Co., formerly the Coal Creek Dredging Co., in the Kougarok district; and the Arctic Circle Exploration Co., formerly the Keewalik Mining Co., in the Fairhaven district.

In addition to the foregoing, dredges of the following companies were under construction in 1935 but not completed in time to contribute materially to that season's output: In the Cook Inlet-Susitna region, the Kenai Gold, Inc., in the Kenai district; in the Yukon region, Gold Placers, Inc., in the Circle district, and the Alaska Gold Dredging Corporation and the Jack Wade Creek Dredging Co., in the Fortymile district; and in the Seward Peninsula region, the Kougarok Consolidated Placers Co., in the Kougarok district.

Much of the placer ground at practically all the places where dredges are now working in Alaska is frozen, so that extensive plants for thawing it must be available. This adds heavily to the cost of the work, and unless the thawing has been done adequately it slows up or actually stops mining. Most of the dredge camps are now using cold water for thawing, though in the past steam or hot water was thought to be necessary. At any large dredging operation, such

as at Nome or Fairbanks, miles of pipe are used for the thawing process, and a larger force of workmen is required in the various tasks connected with the thawing than in actual mining. In addition to the labor costs for thawing operations, there is need for large quantities of water, both for thawing and for sluicing. Adequate supplies of water for most of the dredging camps in interior Alaska and Seward Peninsula are difficult to find and costly to develop. In places it has been necessary to go scores of miles to get water under sufficient head and then lead it by means of long ditches and siphons to the mining ground. The regulation of this water and the maintenance of the ditches require the constant attention of a considerable force of men throughout the working season, especially if the construction is new and the ground has not settled.

The success of most of the good dredges already built has induced many individuals and companies to reexamine formerly known extensive deposits that were too low in tenor to be worked by any of the methods that require less capital. As a result, rumors are heard regarding dredging projects to be undertaken on placer ground almost from one end of interior Alaska to the other. Unquestionably these projects deserve most careful consideration, and some of them will doubtless be successfully carried through, but there is a tendency to regard the dredge as a magic method by which even worthless deposits may be mined at a profit, so that a word of caution may not be amiss to those who are considering investment in some of the projects. The amount of money needed to finance the building of even a small dredge and furnish the necessary equipment is so great that the cost of a thorough 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. Obviously, for the preparation of a reliable report, considerable prospecting and testing of the ground must be done to determine the quantity and tenor of the materials to be handled. Furthermore, adequate prospecting in advance well repays the outlay, because, in addition to preventing unwise commitments, it enables the competent manager to effect savings by constructive planning throughout the life of the project.

SILVER

None of the ores that are mined in Alaska are valuable solely for the silver they contain, and by far the greater part of the silver that is produced occurs as a relatively minor constituent in ores whose principal value lies in some other metal. As is evident from the following table, more than 70 percent of the silver that has been produced from Alaska in the past has been derived from the

ores that are valuable mainly for their copper content. How small the percentage of silver is that occurs in these copper ores may be gathered from the fact that seldom is it as much as 2 ounces to the ton of ore, and the average amount recovered is rarely as much as 1½ ounces to the ton. For 1935 it is estimated that 134,400 ounces of silver was derived from the copper ores and was recovered in the course of treatment at smelters in the States.

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 77,787 fine ounces of silver in 1935, according to the company's published report. The extremely small proportion of silver in the ore from this mine is shown by the fact that this quantity of silver came from 2,091,475 tons of rock that was fine milled—in other words, the quantity of silver recovered was less than 0.038 ounce to the ton. The silver from all the gold-lode mines amounted to 106,600 ounces and was worth $76,600. 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 45,600 ounces, worth $32,800.

Data regarding the production of silver have been referred to in several places in the preceding pages and included in some of the tables that cover the production of other metals. For convenience the sources, quantity, and value of the production from each source in 1935 as well as for the earlier years are set forth in the following table:

Silver produced in Alaska, 1880–1935, by sources

Year	Total		Copper lodes		Gold lodes		Gold placers	
	Ounces	Value	Ounces	Value	Ounces	Value	Ounces	Value
1880–1918	8,389,398	$5,598,314	5,327,852	$3,666,820	1,319,889	$931,396	1,741,657	$1,000,098
1919	629,708	705,273	488,034	546,598	108,691	121,734	32,983	36,941
1920	953,546	1,039,364	682,033	743,416	246,292	268,458	25,221	27,490
1921	761,075	761,075	545,229	545,229	193,281	193,281	22,565	22,565
1922	729,945	729,945	622,978	622,978	80,598	80,598	26,369	26,369
1923	814,649	668,012	715,040	586,333	77,237	63,334	22,372	18,345
1924	669,641	448,659	572,078	383,292	75,284	50,440	22,279	14,927
1925	698,259	482,495	606,929	419,294	67,186	46,445	24,144	16,756
1926	690,000	430,500	605,196	377,600	59,940	37,400	24,870	15,500
1927	627,800	356,000	525,100	297,800	79,400	45,000	23,300	13,200
1928	454,700	266,000	350,430	205,000	80,340	47,000	23,930	14,000
1929	472,900	252,000	351,730	187,400	94,370	50,300	26,800	14,300
1930	408,570	157,300	279,990	107,800	102,080	39,300	26,500	10,200
1931	352,000	102,000	193,850	56,200	129,800	37,600	28,350	8,200
1932	234,050	66,000	81,150	22,900	115,300	32,500	37,600	10,600
1933	157,150	55,000	----------	----------	128,150	44,850	29,000	10,150
1934	154,700	100,000	----------	----------	118,250	76,440	36,450	23,560
1935	286,600	206,000	134,400	96,600	106,600	76,600	45,600	32,800
Total	17,484,691	12,423,937	12,082,013	8,865,260	3,182,688	2,242,676	2,219,990	1,316,001

From the foregoing table it is evident that not only has there been a more or less regular decline in the quantity of silver produced during the past decade until reaching the lowest point of all, 154,700 ounces in 1934, but there has also been a marked decrease in the value of silver that was produced. This has been due to the drop in the selling price of silver from $1 or more an ounce in 1919 to 1922 to the low price of 28.2 cents an ounce in 1932, though in 1935 the price reached a higher point than in any other year since 1925. The average selling price of silver in 1935 is estimated by the Bureau of Mines as 71.875 cents. Various measures to increase the price of silver by legislation have been under consideration. The striking decline in the average selling price of silver until the last 2 years is clearly shown by the following table:

Average selling price of silver, 1880–1935

Year	Cents an ounce	Year	Cents an ounce	Year	Cents an ounce
1880–1918	66.7	1925	69.1	1932	28.2
1919	112.0	1926	62.4	1933	35.0
1920	108.0	1927	56.7	1934	64.6
1921	100.0	1928	58.5	1935	71.9
1922	100.0	1929	53.2		
1923	82.0	1930	38.5	Average for period since 1918	66.8
1924	67.0	1931	29.0		

Although, as stated above, none of the Alaska mines are operated at the present time exclusively for the silver content of their ores, the property of the Prospect Mining Co. on California Creek, in the Bonnifield district of the Yukon region, constitutes a near exception to this statement. The ore from this property carries some gold, considerable copper, and a little lead, but its most valuable component is silver. Not enough work has been done at this place to furnish full information as to the mode of occurrence or the extent of mineralization at this place. Such evidence as has been obtained indicates that signs of mineralization are fairly widespread in that valley. The country rock, however, is mainly schist, and it does not tend to form openings of much continuity or size in which the deposition of ore minerals could effectively take place. Only a small crew has been employed, and the site of the prospecting is rather difficult of access, so that the costs of getting the ore mined, transported to the Alaska Railroad, and thence carried to a smelter in the States, have necessarily been high. As a consequence, the operators discontinued work in September, without, however, stating whether or not they would resume next season. The showings already made appear to warrant further search in the general area for deposits of this type that can be developed commercially.

On Portage Creek, in the Susitna Basin about 9 miles east of Chulitna station on the Alaska Railroad, a mineral deposit on property of A. W. Johnson, containing among other minerals considerable ruby silver, has been known for several years. Some prospecting has been carried on at intervals through the past, and some ore has been shipped from the property. In 1935 it was visited by Ralph Tuck, of the Alaska Railroad, and the writer, and some samples were collected. These were assayed by Paul Hopkins, of the United States Geological Survey laboratory at Fairbanks, with the following results:

Assays of samples from Johnson property on Portage Creek

Assay no.	Description	Gold (ounce per ton)	Silver (ounces per ton)	Total value
G 156	44-inch channel sample on mineralized dike, new discovery	0.01	2.80	$2.31
G 157	44-inch channel sample on mineralized dike 5 feet below G 156	.04	55.40	40.18
G 158	30-inch channel sample on footwall of mineralized dike in sheared slate, new discovery	.01	3.60	2.87
G 159	45-inch channel sample on east side of mineralized dike, near camp	.06	.60	2.52
G 160	3-foot channel on west wall of main lead near apex, old discovery	.01	14.80	10.71

The distribution of minerals in the lode evidently is quite variable, but some of the results given above are sufficiently good to encourage further prospecting, to see if shoots cannot be found that will maintain a high enough tenor to pay for working.

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

develop silver-lead deposits. The greatest amount of work of this kind has been done in the region at the head of Portland Canal, near the international boundary. The richest deposits that have been found lie on the Canadian side of the boundary, and it is there that the famous Premier silver and gold mine is situated. The geologic conditions on the Alaska side of the boundary, in the Hyder district as it is locally called, in places seem to be comparable to those on the Canadian side, and this similarity has sustained interest in the search for profitable silver and gold deposits there. Several claims have been taken up and more or less prospecting and development work done. The much greater unit price of gold and its more ready recovery have focused the search on gold lodes rather than on silver lodes, so that some of the claims that in the early days of the camp showed indications of prospective value mainly in silver and lead have been neglected. This does not mean, of course, that rich showings would necessarily be overlooked, but simply that work has not been pressed on deposits that appeared only moderately promising. In the past mines in the Hyder district have made shipments of silver ore or concentrates to smelters in the States, but in 1935, so far as the Geological Survey is informed, only one small shipment of ore, carrying considerable silver as well as other metals, was made as a test from one of the mines near Hyder.

COPPER

The production of copper from Alaska mines in 1935 is estimated as 15,056,000 pounds, valued at $1,249,700. This is an enormous increase over 1934—in quantity of nearly 15,000,000 pounds and in value of $1,240,000—but these are insignificant figures compared with the Alaska copper production for the period from 1915 to 1927, when it practically never fell to less than 50,000,000 pounds a year, with a value of at least $7,000,000. In 1916 it reached the high mark of 119,654,839 pounds, with a value of $29,484,291. This great increase in 1935 marks a revival from the almost complete cessation of the Alaska copper industry that marked the years 1933 and 1934 and is due mainly to the resumption of production at the famous mines in the Copper River Valley near Kennicott. In 1933 and 1934 the only copper produced from Alaska ores was that recovered as a minor byproduct in the treatment of ores whose principal value lay in the other metals they contained, notably gold. In 1935 some of this byproduct copper was also recovered, but it formed only a small part of the total compared with that produced by the mines whose principal value lay in the copper content of their ores.

The value of the copper produced in Alaska from ores mined in 1935 has been computed on the basis of the average selling price for the year, which, according to the Bureau of Mines, was 8.3 cents a

pound, or 0.3 cent higher than in 1934. At this average price the total value is $1,249,700. It is realized that this method of calculating the value does not take into account the fact that an efficient and fortunate selling agent would take advantage of fluctuations in the price of copper and thus dispose of as much as possible during periods of high prices and hold as much as possible during periods of low prices. The figures given for the value of the Alaska output of copper cannot, therefore, be regarded as representing the amounts received by the different companies for their copper. They do, however, serve to indicate within close limits the magnitude of the industry and are comparable with the figures for earlier years as stated in these reports.

In the following table are shown the amount and value of the copper produced in Alaska since the earliest recorded mining of copper. For the last few years there has been a great decrease in the output, reaching in 1933 a lower point than had been touched in any other year in the period since 1900.

Copper produced by Alaska mines, 1880, 1900–1935

Year	Ore mined (tons)	Copper		Year	Ore mined (tons)	Copper	
		Pounds	Value			Pounds	Value
1880		3,933	$826	1926	670,000	67,778,000	$9,489,000
1900–1915	1,232,396	220,773,969	35,031,225	1927	645,000	55,343,000	7,250,000
1916	617,264	119,654,839	29,484,291	1928	579,500	41,421,000	5,965,000
1917	659,957	88,793,400	24,240,598	1929	590,400	40,510,000	7,130,000
1918	722,047	69,224,951	17,098,563	1930	531,000	32,651,000	4,244,600
1919	492,644	47,220,771	8,783,063	1931	88,000	22,614,000	1,877,000
1920	766,095	70,435,363	12,960,106	1932	56,900	8,738,500	550,500
1921	477,121	57,011,597	7,354,496	1933		29,000	1,900
1922	581,384	77,967,819	10,525,655	1934		121,000	9,700
1923	731,168	85,920,645	12,630,335	1935		15,056,000	1,249,700
1924	761,779	74,074,207	9,703,721				
1925	860,023	73,855,298	10,361,336	Total		1,269,198,500	215,941,400

In the foregoing table no quantity of ore mined is shown in the appropriate column for either 1933, 1934, or 1935. This has been omitted for the years 1933 and 1934 because the copper produced in those years was but a minor byproduct from the gold ores mined, which are not at all comparable with the ores reported for the preceding years, mined primarily for their copper content, and for 1935 the amounts were omitted because the large copper-producing companies no longer publish that information.

The general trend of the copper-mining industry in Alaska is graphically indicated by one of the curves in figure 3, which shows the output of copper for each year from 1900 to 1935. On the same diagram has been plotted the average price of copper for each year. The diagram tells its own story of the growth of the copper industry from a start in the early boom days of the Territory through fabulous strides in the days of the World War, when all nations were

clamoring for copper and paying almost any price to get it and Alaska copper production rose to nearly 120,000,000 pounds a year, then fluctuating up and down until 1923, when the trend became definitely downward and at an accelerating rate, until production practically ceased in 1933 and remained at an extremely low point in 1934 and then turned sharply up in 1935.

The ore mined primarily for its copper content, as noted above, came from mines in the Copper River region near Kennicott, owned by the Kennecott Copper Corporation and the Mother Lode Coalition Mines Co. and operated as more or less a single unit, except for accounting purposes. The ore at these mines consists mainly of

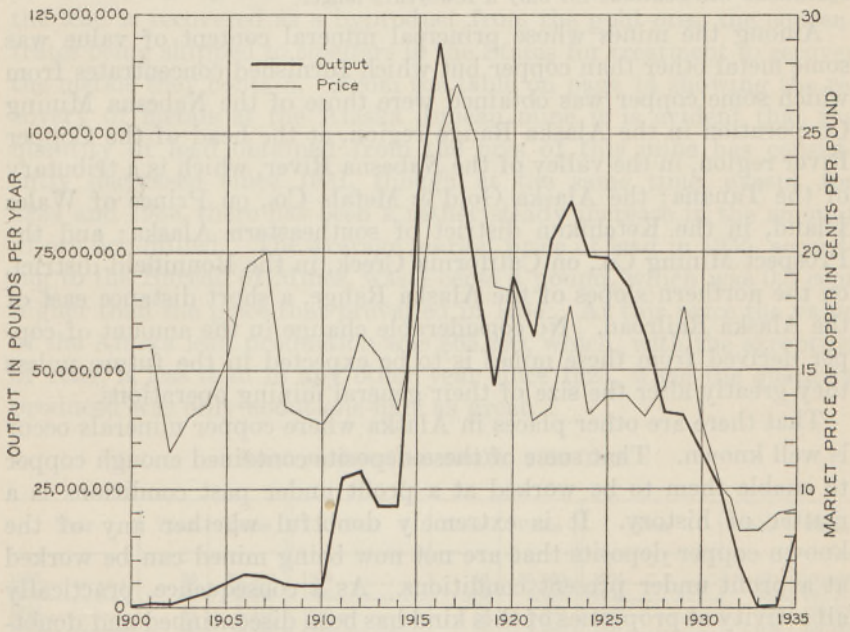

FIGURE 3.—Copper produced from Alaska mines, 1900–1935, and fluctuation in the price of copper during that period.

high-grade copper sulphide and carbonate containing considerable silver but no gold. The ore deposits lie near the contact of a thick limestone formation and an effusive greenstone. The deposits are of a unique type and have yielded hundreds of millions of pounds of copper in the 25 years that they have been actively mined. In 1932 production at these mines was discontinued, owing mainly to the low price of copper, though the shafts and underground workings as well as the surface equipment and plant were kept in good stand-by condition. Except for such maintenance work and prospecting the properties remained idle through 1933 and 1934, so that their reopening in 1935 was looked on with great satisfaction. It should be

realized, however, that all ore deposits are exhaustible, so that renewal of operations at these mines necessarily brings nearer the time of their ultimate cessation. That this is clearly recognized by the officials of both companies is shown by the statements contained in their respective annual reports, as follows:

> While it is planned to continue explorations, if no new ore bodies are discovered as a result thereof, the remaining life of the Alaska property will be only a few years.[6]
>
> Exploration work will continue, but by far the greater portion of the area considered favorable for the discovery of new ore bodies has already been eliminated by the work carried on during the last 12 years. If no new bodies of substantial size are discovered the remaining life of the mine is short, and operations will continue for only a few years longer.[7]

Among the mines whose principal mineral content of value was some metal other than copper but which furnished concentrates from which some copper was obtained were those of the Nabesna Mining Corporation in the Alaska Range region, at the head of the Copper River region, in the valley of the Nabesna River, which is a tributary of the Tanana; the Alaska Gold & Metals Co., on Prince of Wales Island, in the Ketchikan district of southeastern Alaska; and the Prospect Mining Co., on California Creek, in the Bonnifield district, on the northern slopes of the Alaska Range, a short distance east of the Alaska Railroad. No considerable change in the amount of copper derived from these mines is to be expected in the future unless they greatly alter the size of their general mining operations.

That there are other places in Alaska where copper minerals occur is well known. That some of these deposits contained enough copper to enable them to be worked at a profit under past conditions is a matter of history. It is extremely doubtful whether any of the known copper deposits that are not now being mined can be worked at a profit under present conditions. As a consequence, practically all activity at properties of this kind has been discontinued and doubtless will not be resumed until the price of copper has materially advanced. That there may be deposits, as yet unknown, which might repay development is possible, but the incentive to search for them is so small and the probability of failure so great that prospectors are not willing to take the gamble. At present, therefore, search for new copper deposits or development of those already known has practically ceased. Obviously, no forecast can be made as to when these conditions are likely to change. Various remedial or palliative measures have been proposed which might encourage the copper-

[6] Kennecott Copper Corporation 21st Ann. Rept., for the year ended December 31, 1935, p. 7, New York, 1936.

[7] Mother Lode Coalition Mines Co. 17th Ann. Rept., for the year ended December 31, 1935, p. 1, New York, 1936.

mining industry, but it seems doubtful whether much improvement can be looked for in the near future. Probably the only thing that is likely to keep the production of copper from Alaska ores from declining seriously will be the more extensive mining of ores in which the copper is a byproduct and gold or some other metal more sought after is the principal object.

LEAD

The lead produced from Alaska ores in 1935 is estimated to have been 1,630,000 pounds, or about 49,000 pounds less than in 1934. This negligible decrease is to be attributed to the lesser content of lead in the ore produced by the gold mines, because practically all the lead is recovered as a byproduct from the gold ores, the concentrates being shipped to smelters in the States for treatment to recover the metals they contain. From the table on page 14 showing the recovery of metals at the Alaska Juneau mine it is evident that the quantity of lead obtained from the ores of this mine has consistently decreased since 1931, though at the same time, except for 1934 and 1935, there has been a rather steady increase in the amount of ore fine-milled. The average market price of lead in 1935, according to the Bureau of Mines, was 4 cents a pound, which was 0.3 cent higher than the price that prevailed in 1934. At this price the value of the Alaska lead production was $65,200, which, with the exception of 1934, is less than in any other year since 1923, when the quantity produced was only about one-half as great.

Lead produced in Alaska, 1892–1935

Year	Tons	Value	Year	Tons	Value	Year	Tons	Value
1892	30	$2,400	1908	40	$3,360	1924	631	$100,899
1893	40	3,040	1909	69	5,934	1925	789	140,571
1894	35	2,310	1910	75	6,600	1926	778	124,400
1895	20	1,320	1911	51	4,590	1927	1,008	127,000
1896	30	1,800	1912	45	4,050	1928	1,019	118,000
1897	30	2,160	1913	6	528	1929	1,315	166,000
1898	30	2,240	1914	28	1,344	1930	1,365	136,500
1899	35	3,150	1915	437	41,118	1931	1,660	126,000
1900	40	3,440	1916	820	113,160	1932	1,261	75,600
1901	40	3,440	1917	852	146,584	1933	1,157	85,600
1902	30	2,460	1918	564	80,088	1934	840	62,100
1903	30	2,520	1919	687	72,822	1935	815	65,200
1904	30	2,580	1920	875	140,000			
1905	30	2,620	1921	759	68,279	Total	19,243	2,156,900
1906	30	3,420	1922	377	41,477			
1907	30	3,180	1923	410	57,400			

Practically all of the lead that is reported in the foregoing table as produced in 1935 was recovered in the course of treatment of the gold ores of the Alaska Juneau Co.'s mines in southeastern Alaska. According to the published reports of this company, it recovered about three-eighths of a pound of lead from each ton of ore that is mined

and trammed to the mill, or a little less than seven-tenths of a pound of lead from each ton of ore that is fine-milled. Among other Alaska mines that shipped concentrates to smelters in the States in 1935 from which some lead was obtained may be mentioned those of the Nabesna Mining Corporation; the Golden Horn Mining Co., in the Iditarod district; the Chichagoff Mining Co. and the Hirst-Chichagof Mining Co., on Chichagof Island, southeastern Alaska; and one property in the Hyder district.

Lead ores are widely known throughout the Territory, and in the past shipments valuable at least in part for their lead content have been made from many areas in southeastern Alaska, especially the Hyder district; from the Yukon-Tanana region, especially the Kantishna district; and even from far-away Seward Peninsula, at the Omalik mine, and from the Kobuk district in the vicinity of Shungnak. Lead is, however, a heavy, low-priced commodity which requires rather elaborate treatment to produce in readily salable metallic form, and these drawbacks, coupled with the low current price for the metal, act as deterrents to the development of lead deposits in remote regions. The outlook for any notable increase in the production of this metal, therefore, seems to depend on the stimulation of the mining of other metals and the consequent increase in the production of lead as a byproduct. That this increase in mining lodes of mixed metallic content is likely to take place is regarded as a certainty, and that some of the silver-lead deposits which are now lying idle will be opened up again seems almost equally certain. As general business conditions throughout the world improve, an increase in the output of lead from Alaska ores is looked for with considerable assurance.

PLATINUM METALS

Platinum is one of a group of several metals which, because they are closely related in physical and chemical character, are often not differentiated by name or are not even identified specifically in the usual forms of assay or analysis, but are spoken of as the "platinum metals" or, even more loosely, as "platinum." Platinum, palladium, osmium, and iridium are some of the individual members of this group. Some of these metals have been found in lodes and in placers in Alaska. The total quantity of platinum metals produced in Alaska in 1935 is estimated to have been a little more than 8,685 ounces, which had an estimated value of $259,700. In the past it has been the practice in these volumes to express the production of platinum in Alaska in terms of fine ounces, but the complex constitution of the larger amount of the platinum metals recovered recently makes such computation almost worthless, so that for 1935 only the

weight of clean metallic platinum metals is stated in Troy ounces, and the price given is arrived at by taking into account all the available factors, including price paid the producer, current market price of the major component of the special lot, and an item for loss on melting. The complex composition of some of the product of the Goodnews Bay district is shown by the following statement of tests made for the largest operator in the district:

A representative return of one shipment shows the following metal content:

	Percent
Gold	0.37
Platinum	68.88
Iridium	15.63
Palladium	.48
Rhodium	1.04
Ruthenium	.44
Osmium	3.48
Loss on melting	9.68

The percentages of these metals vary slightly in the different shipments.

The foregoing statements apply only to the material from the placers in the Goodnews Bay district and not to the palladium concentrates from southeastern Alaska nor to the placer platinum from Seward Peninsula.

The outstanding development in the placer platinum-mining industry in Alaska, as well as anywhere in the United States proper, was in the Goodnews Bay district, in the lower Kuskokwim region, where a well-mechanized plant and several smaller outfits produced by far the larger part of the Alaska output for the year. The property of the larger plant, that of the Good News Bay Mining Co., is equipped with a dragline scraper of the same general type and construction as the same operators have used so successfully on their gold-placer ground in the Iditarod district. Nearly 60 claims are now controlled by this company, and between 15 and 20 men are employed in its work. In addition to this large company there were several small outfits mining by ordinary open-cut and sluicing methods. The principal streams from which the platinum metals in the Goodnews Bay district were derived, named in the order of the size of their output in 1935, were Squirrel, Fox, Clara, and Dowry Creeks. All these streams are tributaries of the Salmon River, which enters Kuskokwim Bay about 12 miles south of Goodnews Bay. It is significant to note in connection with the source of the placer-platinum metals in this district that in a sample of basic dike rock from Squirrel Creek, analyzed by Paul Hopkins, of the Fairbanks laboratory of the Geological Survey, platinum metals were positively identified.

Another significant item as to the platinum metals developed in the Territory was the continuation of work at one of the old mines on Kasaan Peninsula, in the Ketchikan district of southeastern Alaska, and the recovery of considerable palladium in the concentrates from its ores. This mine had not been in operation in the period from 1926 to 1934, but during its period of activity it had produced platinum metals, mainly palladium, worth several hundred thousand dollars. The company that is undertaking the development of the ore is the Alaska Gold & Metals Co., and it is understood that the work in 1935 continued to be more of a test than a productive mining operation and was done to get the necessary information to determine whether more extensive opening up of the property was justified. The platinum metals in this mine form only a small part of the metallic content of the ore, which contains considerable amounts of gold and copper—in fact, so small a part do the platinum metals form that the individual particles cannot be identified in the ore by the unaided eye. Practically all the material handled in these tests was old tailings and dumps from the earlier mining that had been done on the property.

The only other region in Alaska where some platinum metals are reported to have been recovered in 1935 is Seward Peninsula. In that region a few ounces of platinum metals were recovered from gold placers on Dime Creek, a tributary of the Koyuk River, and on Quartz Creek, a tributary of the Kiwalik River, in the Koyuk district, and in nearby areas in the extreme eastern part of the peninsula. The Koyuk district has long been a small though consistent producer of platinum as a byproduct. The streams derive their gravel in large part from the hills formed of Mesozoic basic effusive rocks which have been cut by granite intrusives and in part from lower country in which Paleozoic schists and limestones predominate. No bedrock source of the platinum metals has yet been discovered. It may be of interest, as suggesting the possibility of the northward extension of the source of platinum-bearing material like that in the Koyuk district, to state that in the analysis of some black sands from the Selawik Valley Paul Hopkins, of the Fairbanks laboratory, identified platinum metals.

Although no other operators in Alaska are known to have produced and sold platinum metals in 1935, it is not at all unlikely that small amounts may have been produced elsewhere and held by their producers. Places where platinum has been recognized are widespread through other parts of Alaska, and some of them in other years have produced platinum that has been sold. Among these places may be mentioned the Chistochina district of the Copper River region; Metal Creek, in the Kenai district; some of the beach placers

of Kodiak Island, in southwestern Alaska; the Kahiltna River and nearby streams, in the Yentna district of the Susitna region; Boob Creek, in the Tolstoi area of the Innoko district; Granite Creek, in the Ruby district of the Yukon region; and some streams in the Marshall district, in the western part of the Yukon region.

TIN

For many years Alaska has been a small but regular producer of tin, and in the course of the more than 30 years since tin minerals were discovered in Seward Peninsula and later elsewhere in the Territory, it has shipped tin worth more than $1,150,000. During this period the greatest annual production was in 1916 and was equivalent to 139 tons of metallic tin. In the period between 1920 and 1935 the average yearly output has been only about 13 tons. In 1935, however, there was a great increase in tin production, brought about mainly through a new company, the American Tin Fields, Inc., starting work in the vicinity of Tin City, near the extreme western tip of Seward Peninsula. Mining at this place is done by a power shovel that dumps over a movable grizzly, which eliminates the larger rocks and lets the finer material discharge into a bin and thence into autotrucks, by which it is carried to the sluices and mill, about a mile distant. Three lines of sluice boxes are so constructed that the feed can readily be diverted from one to another when the clean-up of a line becomes necessary, without interrupting the flow. The concentrates from the sluices are still further cleaned by passing through jigs. Water for the operation of the sluice boxes and the mill is obtained by pumping sea water from Bering Sea, which is practically at the door of the mill, so that an unfailing supply is always obtainable. The large accomplishment of this company is especially remarkable in view of the facts that its material and equipment were landed on the beach about the middle of July, that in addition to its mining operations it had to put up its camp and other buildings and build a good road more than a mile long, and that its season ended in September.

In addition to this new camp there were several smaller ones at various points in the same general region that produced small amounts of tin by ordinary open-cut methods of placer mining. A small amount of placer tin was also recovered from the gold-mining operations in the Hot Springs district of the Yukon region. At present all the Alaska tin is sent to Singapore for reduction, but doubtless if there were a constant dependable supply available, some arrangements would be made to handle it in the States.

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

Tin produced in Alaska, 1902–35

Year	Ore (tons)	Metal (tons)	Value	Year	Ore (tons)	Metal (tons)	Value
1902	25	15	$8,000	1920	26	16	$16,112
1903	42	25	14,000	1921	7	4	2,400
1904	23	14	8,000	1922	2.3	1.4	912
1905	10	6	4,000	1923	3	1.9	1,623
1906	57	34	38,640	1924	11	7	7,028
1907	37.5	22	16,752	1925	22.2	13.8	15,980
1908	42.5	25	15,180	1926	12.85	8	10,400
1909	19	11	7,638	1927	37.5	26.7	34,000
1910	16.5	10	8,335	1928	58.6	41	41,000
1911	92.5	61	52,798	1929	51.6	38.6	35,000
1912	194	130	119,600	1930	21	14.7	9,300
1913	98	50	44,103	1931	5.6	4.1	2,000
1914	157.5	104	66,560	1932			
1915	167	102	78,846	1933		2.9	2,300
1916	232	139	121,000	1934		4.14	4,300
1917	171	100	123,300	1935		49.4	49,800
1918	104.5	68	118,000				
1919	86	56	73,400	Total		1,205.44	1,150,100

As to the future of the tin industry in Alaska the facts at hand are not yet sufficiently definite to warrant expressing any fixed conclusions, but a personal visit to parts of the tin fields of western Seward Peninsula gave the writer certain very definite impressions as to the desirability of much further prospecting there. Some of the principal points may be summarized as follows: The tin deposits have been proved to be rather definitely associated with granitic intrusives, so that the area to be prospected critically can be more or less closely defined. There are such intrusive masses at intervals of nearly 100 miles so that there is a large area in which workable deposits of placer tin may be found. Much of the placer material at present being mined has undergone almost no transportation from its bedrock source, as is shown by the perfection of many of the crystals of tin ore recovered. There is, however, the possibility that other agents than streams may have effected concentration of some of the material from tin-mineralized areas, and old beach concentrations of that sort should by no means be overlooked. The tenor of much of the placer ground being mined runs from 20 to 30 pounds of tin ore to the cubic yard of material, which, at a price of 50 cents a pound for metallic tin and with the ore containing about 75 percent of tin, gives a value per cubic yard that seems extremely attractive. The conditions for mining offer some drawbacks, as there are no trees in the region, so that it is extremely difficult in most places to get even enough wood to maintain a campfire; much of the bedrock is limestone, so that in few places is there enough fresh water to maintain even a meager sluicing operation; and the climate is bad and the season short. On the other hand, few parts of the prospective tin

area are far from the sea, so that transportation charges are moderate and sea water might be advantageously used for many of the mechanical operations at the plant; the limestone bedrock offers good footing over much of the country and allows the construction of adequate inexpensive roads; and the use of airplanes makes the district by no means inaccessible, the flying time from Nome being only about an hour. There is also the likelihood that in the course of placer operations areas of bedrock that were sufficiently mineralized to be worked as lodes might be disclosed and thus an industry established that might be carried on uninterruptedly throughout the year, more or less regardless of weather conditions.

COAL

The coal produced from Alaska fields in 1935 is estimated to have been 119,425 tons. This marks an increase of 12,000 tons and has been exceeded in only 3 years since coal mining began in the Territory, and even in those years it was exceeded at most by less than 7,000 tons and in 2 of the years by less than 700 tons. In addition to the coal mined in Alaska, 42,261 tons of coal was imported from fields outside Alaska, and no Alaska coal was exported. The consumption of coal in Alaska in 1935 was thus about 161,700 tons, or about 11,000 tons more than in 1934 but about 10,000 tons less than the average for the years from 1923 to 1932, a decrease reflected in lessened importations. A comparison of coal production and consumption in Alaska for the entire period for which records are available is afforded by the table on page 78.

In this table the total value of the coal produced in Alaska in 1935 is stated to have been $501,600. This value can be regarded only as a fair approximation, because records are not available for precise determination of the actual selling price of the coal. Much of the coal is purchased by the Alaska Railroad on contract for large quantities, so that the price paid by the railroad is not an accurate index of the price paid for the lots sold to the smaller consumers, who in the aggregate buy a large part of the output and pay much higher prices. From all the available information, and by weighting the resulting estimate as closely as practicable, it appears that the average price of the coal mined in Alaska in 1935 may be taken as $4.20 a ton. This is the same as the estimated price in 1934 but is 80 cents a ton less than the price that was considered to be the average for 1933 and for the immediately preceding years and is about $1.25 less than the average price that prevailed during the period from 1880 to 1933.

Coal produced and consumed in Alaska, 1880–1935

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bituminous coal from Washington [1] (short tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia [1] (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
1931	105,900	556,000	30,772	17,796	154,468
1932	102,700	513,500	28,422	13,959	145,081
1933	96,200	481,000	21,524	14,009	131,733
1934	107,500	451,500	28,317	14,675	150,492
1935	119,425	501,600	26,554	15,707	161,686
Total	1,864,979	9,877,100	1,409,505	1,750,606	5,025,090

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

Practically all the Alaska coal mined in 1935 came from two mines—one in the Matanuska field and one in the Nenana or Healy River field. The principal mine in the Matanuska field was that of the Evan Jones Coal Co., at Jonesville, but a small amount of coal was produced from the Wishbone Hill Coal mine, operated by the New Black Diamond Coal Co., in the valley of Moose Creek, also in the Matanuska field. The mine in the Healy River field is owned and operated by the Healy River Coal Corporation.

The mine supplying practically all the locomotive and power fuel for the Alaska Railroad was that of the Evan Jones Coal Co. During June the production of the mine was reduced to a minimum, but during much of the rest of the year the mine was being operated on a daily average rate of production of nearly 140 tons. Not only did this company supply the railroad with a large part of its fuel but it filled many domestic orders for coal and was active in trying to develop new markets by furnishing coal to some of the canneries in southwestern Alaska and to Territorial and Federal organizations throughout the Territory. During the period while productive mining was in progress, a crew of 30 or more men were employed in surface and underground work on the property.

At the Wishbone Hill mine of the New Black Diamond Coal Co., which was formerly known as the Rawson mine, the main work has

been of a prospecting or developing type, in the course of which a small amount of coal has been mined and delivered under contract to the Alaska Railroad. Only a small crew has been employed on this property, and most of the time the greater number of these men have been used on surface work. The mine is connected with the standard-gage branch of the Alaska Railroad at Premier by a narrow-gage track, on which the coal cars are handled by a small engine leased to the operators of the mine. At the Premier terminus of this narrow-gage line an elevated siding was built so that the cars could dump directly into the standard-gage cars without rehandling the coal, as had been necessary in the past.

The mine of the Alaska Matanuska Coal Corporation which had formerly been one of the principal coal mines in the Moose Creek area but which was accidentally flooded late in 1933, lay idle throughout the year. No work was done on the company's other property, some 3 miles farther east, nearer the head of Moose Creek. No mining was in progress during the year at the Pioneer coal mine, on Moose Creek about a mile above its mouth, nor at the Ross Heckey property, on Coal Creek south of Chickaloon.

In the Nenana coal field the only producing property was the Suntrana mine of the Healy River Coal Corporation, on the Healy River, about 4 miles east of the junction of that stream and the Nenana River. The plant of this mine has been well laid out and is now equipped with the necessary modern machinery to handle readily 200 tons or more of coal a day, as well as excellent quarters for the comfort and convenience of the personnel and adequate protection against the hazards of fire or floods. The largest single user of coal from this property is the United States Smelting, Refining & Mining Co., Fairbanks Exploration Department, for furnishing power to its dredges and in its large placer-mining operations in the vicinity of Fairbanks, and constantly growing demands by that company for more power are calling for an increasing quantity of coal. The Healy River coal is also extensively used for power and domestic fuel at many other points in Alaska, including Cordova and points along the Alaska Peninsula, and a growing market is being built up through reliable quality and service. The coal has a somewhat lower heating value than that from the Matanuska and nearby fields and as a consequence is not used in the railroad locomotives, but the shorter haul makes its use more economical in many parts of the interior. This mine was in continuous operation throughout 1935 and yielded considerably more than half of all the coal mined in Alaska during that year.

Small amounts of coal are reported to have been mined during the year at the old Chicago Creek mine, in the valley of the Kugruk River,

in northern Seward Peninsula; and at two or three points along Kuk Lagoon, south of Wainwright, in northern Alaska. The coal from these different properties was used only locally and had no significant effect on the general Alaska coal situation, except to confirm the statement, often made before, that throughout the Territory there are many areas containing coal adequate for local use. So far as the Geological Survey is informed, no production was made during the year from the known coal deposits on Admiralty Island, in the Juneau district, where some activity had lately been shown. In the Bering River field, where extensive deposits ranging in composition from bituminous coal to anthracite have long been known, prospecting or other development work relating to the coal resources continued apparently to be at a standstill in 1935. Rumors of renewed activity in this field were heard from time to time, and extensions of some of the Government permits for coal prospecting there have been asked for, as the old permits were near their expiration. It is evident that this field has much potential value, but it is also evident that the present coal consumption of Alaska is not such as to stimulate large companies to undertake extensive projects and that until there is a greater demand for their product or until they are prepared to invade a more distant market, where competition will be more severe, they will not enter this field. Furthermore, the development work already done in this field indicates that some complex geologic conditions will be encountered, so that desultory prospecting by small, poorly financed, or technically unskilled operators holds little promise of success, and full development must await a company that is able to go into the matter in a large way and to bear the necessarily uncertain expense of exploring a new field.

The whole problem of the development of Alaska's coal resources is exceedingly complex, for while there are in the Territory large areas occupied by coal-bearing rocks, the local demands are fairly well supplied by existing mines, and to attempt to enter a larger field would require large outlays for developing mines and the market. Obviously, many consumers are unwilling to commit themselves to any specific agreements to purchase until they are sure that the coal offered them is available at a satisfactory price, and the mining operator, of course, in the initial stages can offer little definite assurance as to costs and availability of his product until he has some certainty as to his market. Certainly many of the steps that must be taken, if any extensive use of Alaska coal is to be made, require that the enterprise be undertaken on such a scale as will justify the outlay for the essential facilities. This means that a considerable tonnage must be marketed, but the attempt to dispose of a large tonnage of

Alaska coal will bring it into competition with coals from other areas and in places where the competitive conditions appear to be almost insuperable for the Alaska product. Many of the competitive conditions are changing, however, so that the situation must be subjected to constant review. Of course, as Alaska develops and becomes more settled, its people and industries will call for more and more coal, and in meeting this demand Alaska coals will have great competitive advantage over those from outside sources. That growth, however, probably will be relatively slow but none the less sure.

Although having no effect on the current production of coal, some recent developments in the vicinity of Eska, in the Matanuska field, have considerable significance. As stated above, there is only one Alaska mine that is producing coal of a quality acceptable for use in the locomotives of the Alaska Railroad, and this condition has prevailed since the fall of 1933. This situation became a matter of grave concern to the officials responsible for the maintenance of the Alaska Railroad, because of dangers inherent to coal mining and the uncertainties of geologic conditions that may be encountered in a relatively undeveloped field of complex structure like the Matanuska area. To be prepared for any contingency the Government had long ago acquired and held the unit known as the "Eska lease" and had developed a coal mine from which in the past it had taken considerable coal. Even after active mining there had been discontinued the mine had been kept in a stand-by condition so as to be available to supply coal in an emergency. Unfortunately the storms of 3 years ago had washed out much of the track to this mine and had done other serious damage. Even if the track were relaid it would be subject to damage by any flood, and the end of the track would be far from the unmined coal beds underground, entailing high costs for tramming. After consideration of the various phases of the problem it was decided in 1934 to relocate the track where it would be safe from floods and to pick a new site for driving a crosscut to intersect the coal measures at a considerable distance west of the old openings. The site for this crosscut was selected largely on the advice of Ralph Tuck, geologist of the railroad staff, and the work of driving it was carried on during most of that open season. In the spring of 1935 the work was resumed, and in accordance with the geologic predictions the desired coal beds were found and thus a supply of fuel for the railroad assured in any emergency. Short entries will be turned off on the coal and suitable airways driven and the mine kept in a stand-by condition. A full description of the geology of the area near Eska and the correlation of the coal croppings, accompanied by a detailed map and sections, has been prepared by Dr. Tuck and will be published as a separate chapter of this

volume.[8] It is hoped that this valuable investigation of the surface exposures and the old workings may be extended as time permits, so as to furnish an interpretation of the structure and relations of the coal beds from Eska westward to the limits of the Moose Creek area.

PETROLEUM

For a number of years there has been a small but significant production of petroleum from wells of the Chilkat Oil Co. in the Katalla district, on the coast east of the mouth of the Copper River. According to the published report of this company the boiler house and contents at the refinery were destroyed by fire late in December 1933, and it has not yet been considered desirable to replace the building and equipment, because the outlook was not encouraging for the profitable operation of the property. Until such time as this refinery equipment is replaced there will be no production from the property. The wells from which the company obtained its oil were relatively shallow, few of them being more than 1,000 feet deep and none of them more than 2,000 feet. The bedrock near the surface at the wells is of Tertiary age, but there is considerable uncertainty as to whether these rocks are the source of the oil or whether it may not come from older beds lower in the stratigraphic column. In the past the products of the refinery operated by this company—gasoline and distillate, which are of especially high quality—found a ready market near at hand, especially for use by the fishing fleet near Cordova.

Even when the Chilkat Oil Co.'s property is in operation the small domestic production of petroleum from the Katalla field is not adequate to supply local needs, and the demand for large quantities of petroleum products throughout the Territory is met principally by imports from the States. The most notable feature shown by the subjoined table is that from the end of the war through 1929 there was a constant increase in the amount of gasoline and related lighter products of distillation imported. This increase was called for by the growing use of power in fishing boats and other water craft, in the canneries, in many mining developments, and in the operation of means of transportation, such as automobiles, and gas cars or engines on practically all the railroads. Beginning with 1930, however, there was a decided drop in the quantity of petroleum products shipped into Alaska. But in 1933 there was an upturn in the consumption of most of these petroleum products, and in 1935 the imports of heavy oils almost doubled and the imports of gasoline increased over 1,000,000 gallons. The decrease in the first 3 years of this period is interpreted as only a temporary drop in the consumption, brought

[8] Tuck, Ralph, Eska Creek coal deposits, Matanuska Valley, Alaska: U. S. Geol. Survey Bull. 880–D (in preparation).

about by the general decline in all business activities, and the increased consumption later is regarded as due to the improvement in general business conditions and the greatly increased use of petroleum and its products in mining, the road-construction program, and the various developments that are taking place which utilize power-driven machines.

Petroleum products shipped to Alaska from other ports of the United States, 1905–35, in gallons [1]

Year	Heavy oils, including crude oil, gas oil, etc.	Gasoline, including lighter products of distillation	Illuminating oil	Lubricating oil
1905	2,715,974	713,496	627,391	83,319
1906	2,688,940	580,978	568,033	83,992
1907	9,104,300	636,881	510,145	100,145
1908	11,891,375	939,424	566,598	94,542
1909	14,119,102	746,930	531,727	85,687
1910	19,143,091	788,154	620,972	104,512
1911	20,878,843	1,238,865	423,750	100,141
1912	15,523,555	2,736,739	672,176	154,565
1913	15,682,412	1,735,658	661,656	150,918
1914	18,601,384	2,878,723	731,146	191,876
1915	16,910,012	2,413,962	513,075	271,981
1916	23,555,811	2,844,801	732,369	373,046
1917	23,971,114	3,256,870	750,238	465,693
1918	24,379,566	1,086,852	382,186	362,413
1919	18,784,013	1,007,073	3,515,746	977,703
1920	21,981,569	1,764,302	887,942	412,107
1921	9,209,102	1,403,683	2,021,033	232,784
1922	15,441,542	1,436,050	2,095,675	345,400
1923	12,285,808	4,882,015	473,826	454,090
1924	14,412,120	5,554,859	566,431	506,364
1925	16,270,746	6,993,560	562,844	580,321
1926	14,000,664	5,069,584	328,615	730,924
1927	17,628,744	8,141,574	516,306	620,450
1928	13,000,176	8,025,402	463,134	715,082
1929	17,347,344	6,847,050	589,340	878,094
1930	13,801,746	6,317,934	401,646	701,946
1931	12,282,480	5,532,912	338,310	450,870
1932	14,167,104	4,755,660	297,780	338,310
1933	15,340,962	5,677,644	412,230	337,806
1934	16,174,662	6,791,232	421,218	515,508
1935	29,254,008	7,890,750	375,816	549,696
Total	490,548,269	110,689,617	22,559,354	11,970,285

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

Search for new oil fields in Alaska has practically been discontinued during the last few years, and in 1935, so far as reported to the Geological Survey, no drilling for oil nor even any active prospecting was done at any place in the Territory. There are, however, several places in the Territory where indications of oil and structural features that appear to be well worth testing have been found.

In connection with the general development of oil claims both in Alaska and the States there is a widespread misunderstanding as to the real significance of Government permits for exploration for oil. Hundreds of such permits have been issued by the Government and cover tracts in all parts of Alaska and are outstanding in the hands of individuals or companies, but most of them were evidently taken up solely for speculative purposes and will lapse if no active work

is done under them. As prospecting permits for oil are issued on application, without regard to the merits of the land involved as a favorable place in which to search for oil, the investing public should be warned that a permit from the Government is only what it purports to be—permission to search for oil—and in no way implies that the search has even a remote chance of being successful. Furthermore, the public should realize that prospecting permits if within the law are readily granted by the Government at a nominal charge and so should be warned against unscrupulous individuals who offer their services in obtaining permits for their clients at a charge far in excess of any reasonable fee for any service they render and for any payment required by the Government.

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 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 1935 in the broadest sense of that word, but few of them were reported to have been produced and sold in quantities that represent a value of more than a few hundred dollars, and so far as could be determined the total value of the production in 1935, of all the mineral products not described in the earlier pages of this report, was $40,000. However, it should be noted that in the following table, as well as in certain of the other tables in this report, all the minerals that were produced only by a single operator or in quantities so small that to list them separately would disclose the production of individual operators have been grouped together under the collective term "miscellaneous mineral products." Among the mineral products included in this table that have also been described elsewhere in this report are the platinum metals. 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

1935, it has been necessary to include the value of the platinum metals in this table.

Value of output of miscellaneous mineral products of Alaska, including platinum, petroleum, quicksilver, stone, antimony, gypsum, marble, and other products, 1901–35 [1]

Year	Value	Year	Value	Year	Value
1901	$500	1914	$199,767	1927	$162,000
1902	255	1915	205,061	1928	164,000
1903	389	1916	326,737	1929	194,000
1904	2,710	1917	203,971	1930	157,300
1905	710	1918	171,452	1931	108,000
1906	19,965	1919	214,040	1932	223,400
1907	54,512	1920	372,599	1933	39,200
1908	81,305	1921	235,438	1934	86,400
1909	86,027	1922	266,296	1935	299,700
1910	96,408	1923	229,486		
1911	141,739	1924	348,728	Total	6,397,100
1912	165,342	1925	454,207		
1913	286,277	1926	444,500		

[1] $117,000 of placer platinum metals mined prior to 1926 and $238,000 of antimony mined prior to 1927 not distributed by years but carried in total.

It is evident that if the value of the platinum produced in 1935 is deducted from the foregoing total value of these miscellaneous products for the year the remainder becomes only $40,000—an almost negligible amount when contrasted with the value of these other products in some of the earlier years. This condition, however, is regarded as marking merely a temporary situation that will speedily change, because there are many mineral resources that not only await development but have been the base of extremely profitable enterprises in recent past and have by no means been exhausted. For example, one of the hitherto large mining enterprises is the quarrying of marble by the Vermont Marble Co. from its properties near Tokeen and Calder, in southeastern Alaska. No productive mining was done there during 1935, though the property was kept in condition so that work could be resumed promptly when required. The general practice of this company has been to operate these quarries actively at intervals and supply all the stone it needed for the ensuing 2 or 3 years, during which time the quarries are kept only in a stand-by condition. The stone from these quarries is used in most of the larger and better buildings in the whole Pacific coast region, being especially in demand for interior trim and decoration. Ordinarily the company ships its rough stone from Alaska to finishing plants it maintains in Tacoma, Wash., and San Francisco, Calif. There is, of course, no basis for believing that the cessation of quarrying during the year means the permanent closing of the property. It only marks a halt in production until sales of the product now on hand deplete the stock so that replacements are needed, and there is every indication that this will occur shortly so that the quarries will again be running. Limestone and marble are widely distributed through-

out southeastern Alaska, and, according to Burchard,[9] many different grades, some even approaching statuary quality, are found in the region. It therefore seems certain that some of these limestone and marble deposits, many of which are favorably situated with respect to deep-water transportation, will ultimately be profitably developed.

The quarrying of limestone as an ingredient of cement afforded much the larger part of the amount credited here to miscellaneous minerals in 1935. This enterprise is conducted by the Superior Portland Cement, Inc., of Seattle, operating under lease from the Pacific Coast Cement Co. The quarries at which this high-grade limestone is mined are on Dall Island, in the Ketchikan district of southeastern Alaska. From the quarries at this locality the rough stone is shipped in barges to Seattle, where it is treated and mixed with the other constituents of the cement. This property has been productive for several years, but it was not in operation in 1934, and in 1935 it was operated only from April through September.

Cinnabar, the principal ore of quicksilver, has been recognized in the placer concentrates from streams in many parts of the Territory, but in most of these places the lodes from which it came were apparently small stringers that appear little likely to afford ore that can be mined under present conditions. In the central and western parts of the Kuskokwim Valley there are, however, extensive areas of cinnabar mineralization which have long been known and which appear to hold promise of containing quicksilver deposits that may be profitably developed, though much further exploration will be required to determine their real value. The place in this region where the greatest amount of development work has been done is on the property of E. W. Parks, about 10 miles in an air line downstream from the junction of the Holitna with the Kuskokwim. During 1935 arrangements were made for extensive prospecting of the property by a well-qualified mining engineer and small crew, with a view to putting it into production if the tests proved satisfactory. This work was not started until late in the summer, so that it will be at least another year before definite decision as to the value of the ground can be reached. The successful opening up of a commercial field in this part of Alaska would have much significance not only in its direct returns but indirectly, as establishing a new center from which development of all kinds might be extended into the little-known areas of the Kuskokwim Valley, and therefore developments at this place will be watched with especially keen interest. In Seward Peninsula, near Bluff, quicksilver ore has long been recog-

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

nized, and some development work has been done on it. In 1935 a little ore was mined here but not retorted or otherwise disposed of.

Antimony ores are widely distributed throughout Alaska, and in the past considerable quantities were produced and shipped from the Territory. In 1935, however, so far as reported to the Geological Survey, no antimony ores were sold, and no prospecting is known to have been done on lodes solely valuable for the antimony they contain. Many of the lodes of the other minerals, notably gold, contain considerable stibnite, the sulphide of antimony, and in the course of mining them some antimony is necessarily taken out, though most of it is lost in the tailings. At a few mines, as in the Fairbanks district, some of the larger masses of stibnite are laid aside until enough has accumulated to be worth shipping. In the Fortymile district one prospector is said to have opened up some antimony ore on Mount Veta, but no ore has been shipped from the property. According to newspaper reports some interest has been shown in the possibility of marketing some of the antimony ore found in association with gold veins in the vicinity of Williams Peak, near Cordova, in the Copper River region.

A little prospecting is said to have been continued on the known nickeliferous sulphides of Chichagof and Admiralty Islands, in the northwestern part of southeastern Alaska, but no ore is reported to have been produced for sale during the year. Some excitement was caused by the reported find of extensive nickel-bearing deposits in the Goodpaster Valley, east of Fairbanks. Samples from this area contain nickeliferous minerals but they are not abundant enough to be regarded as constituting an ore, especially when occurring in so remote an area as the one in question. The find is significant, however, in showing the presence of nickel in the region, and further prospecting seems well warranted to see whether richer deposits may be found. The desirability from both a commercial and a national standpoint of developing a domestic source of nickel is obvious, and encouragement should be given to determine more fully the resources of any areas in Alaska that are known to contain nickel-bearing minerals.

Of no direct commercial importance but of technical and scientific interest is the fact that in assay G 298, made by the Fairbanks laboratory of the Geological Survey of a sample from Kasaan Peninsula, in the Ketchikan district of southeastern Alaska, a tellurium-bearing mineral was recognized. This mineral has been tentatively identified as petzite, a gold-silver telluride.

Outside of a small amount of prospecting and assessment work, no productive mining is reported to have been in progress at any of the chrome-ore deposits in the southern part of Kenai Peninsula, where

ores of this sort have long been known and at times have been marketed. In the vicinity of Red Mountain especially large bodies of chrome ore have been known for some time, but what average chrome content can be maintained under commercial conditions, what will be the cost of mining it and transporting it to the market, and what profit will be left after it is sold are matters that still require investigation. According to newspaper accounts some prospecting for chromite ore was carried on during 1935 near Red Bluff Bay, Baranof Island, in southeastern Alaska, and a number of claims staked there. Samples from these claims are said to have carried from about 48 to 52 percent Cr_2O_3. No details regarding the developments, future plans, or specific ownership of these claims have been received by the Geological Survey.

Little new development of the many kinds of nonmetallic mineral products that occur in Alaska took place during 1935. Articles of incorporation have been filed with the Territorial officials by the Alaska Gypsum Co. The company states that it proposes to develop gypsum deposits throughout the Territory, but evidently it will be concerned chiefly with areas near the known deposits in southeastern Alaska. Extensive use was made of the widespread gravel deposits for railroad ballast and road construction, and with sand they entered largely into the concrete mixtures required in the more permanent structures that were built. Reports have long been current of attempts to develop the sulphur deposits that are known to occur in the craters of some of the volcanoes of the Aleutian Islands and nearby portions of the Alaska Peninsula. According to newspaper reports a newly organized company called the Alaska Northwest Sulphur Co. has acquired extensive holdings on Akun Island, which it proposes to develop in connection with certain sulphur properties it owns in Washington State, to supply sulphur to the paper-pulp mills in the Pacific Northwest. The accounts stated that the company expected to have the property in operation before the end of the year, but so far as known this expectation was not fulfilled.

Although the various mineral commodities other than platinum metals here grouped under the heading "miscellaneous mineral products" yielded negligible monetary returns in 1935, yet their diversity, their wide distribution, and the interest that is being displayed in the search for them indicate that they already play an important part in the mineral economics of the Territory and are destined to become even more significant as the development of Alaska proceeds.

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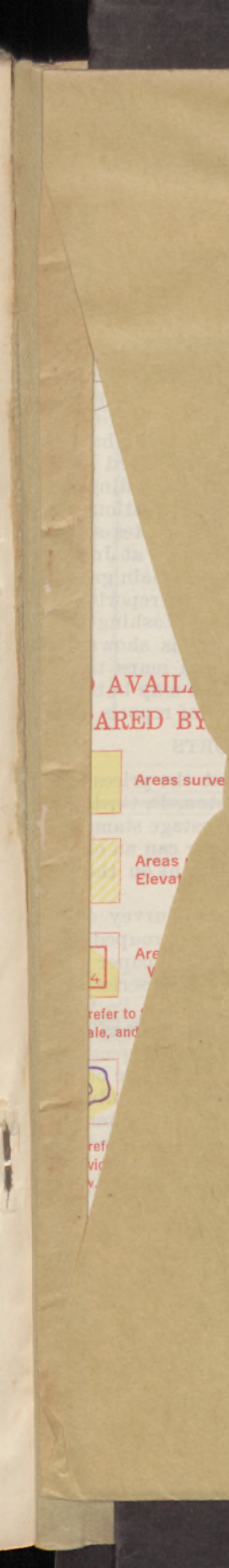

DEPARTMENT OF THE INTERIOR
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MAP OF ALASKA

Compiled by Alaskan Branch from all available authentic sources, chiefly from maps of the U. S. Geological Survey and the U. S. Coast and Geodetic Survey

Scale 1/5000000
Approximately 80 miles to 1 inch

50 0 50 100 150 200 Miles
50 0 50 100 150 200 Kilometers

Edition of 1936

INDEX MAP

SHOWING AREAS COVERED BY

SELECTED AVAILABLE REPORTS AND MAPS OF ALASKA PREPARED BY THE U. S. GEOLOGICAL SURVEY

Areas surveyed topographically.

Areas mapped from aerial photographs. Elevations not shown.

Areas covered by maps for sale by U. S. Geological Survey, Washington, D. C.

Numbers refer to the list of separate maps on the back of this sheet, which gives title, date, size, scale, and price of the maps.

Areas covered by Survey reports for sale by Superintendent of Documents, Government Printing Office, Washington, D. C.

Numbers refer to the list of reports on the back of this sheet, which gives details concerning the individual reports. Reports covering areas too small to be clearly shown are indicated by arrow.

NOTE.—Certain reports and maps that cover large areas or general subjects are not indicated on this index map but are included in the lists on the back of the map.

SELECTED LIST OF GEOLOGICAL SURVEY PUBLICATIONS ON ALASKA

The Geological Survey for more than a third of a century has been investigating the mineral resources of Alaska, and in the course of this work has published hundreds of maps and reports covering different parts of the Territory. The Geological Survey publications that are available and that may be of most general use are given in the following lists, and the areas covered are indicated on the index map on the face of this sheet. The publications specifically noted are by no means all those on Alaska that have been issued by the Geological Survey. Many others that can no longer be obtained from any official source or that have been superseded by later issues have been omitted from this index circular but are included in the Survey's general list, "Publications of the United States Geological Survey (not including topographic maps)", and in other finding lists and catalogs. Files of Government publications are on deposit in many libraries and educational institutions throughout the United States and Alaska, where they can be consulted. Among the principal Alaska libraries are those at Juneau and Fairbanks.

The publications noted in this index are of two main groups—separate maps, which are for sale by the Geological Survey, Washington, D. C., and reports, which are for sale by the Superintendent of Documents, Government Printing Office, Washington, D. C. On the face of the index map information relating to maps sold separately is shown in red, whereas that relating to other publications is shown in purple. Reports and maps that cover large areas or that are on general subjects are not indicated on the face of the map but are grouped under the sub-heading "General" in the list of separate maps and the list of reports that follow.

REPORTS

The book publications listed below are sold at the prices indicated by the Superintendent of Documents, Government Printing Office, Washington, D. C., to whom remittances should be made by postal money order, express order, or check; postage stamps will not be accepted.

No discount is allowed on orders for reports, nor can an order for reports in combination with maps be counted in determining the allowable discount on the maps; the charge for maps will be the same as if they were ordered separately.

The three classes of reports of the Geological Survey on Alaska as listed are professional papers, bulletins, and water-supply papers and are grouped below under these series. On the face of the index map the number of a professional paper is preceded by the letter P. All other numbers printed in purple refer to the bulletin series, as the water-supply papers are not indicated on the map though listed below.

Reports covering general subjects or very large areas are listed only under the heading "General" and are not indicated on the index map.

Some of the reports listed were published as separate chapters, which later were assembled into volumes. Separates are designated by publication number and letter indicating the chapter, as 622–E. If the separate chapter is no longer available, but the complete volume in which it was printed can still be obtained, this fact is noted, and the price given is that for the complete volume, which contains several other articles.

Special notice should be taken of the dates of publication given in the following lists, because they are significant in indicating the recency of issue of the reports and maps.

In referring to maps contained in the reports listed below only the principal maps are noted, and the following designations are used: G, geologic map; T, topographic map; GT, geologic map on topographic base; plane, without indication of surface relief.

General Reports

PROFESSIONAL PAPERS:

125–C. Pliocene and Pleistocene fossils from the Arctic coast of Alaska and the auriferous beaches of Nome, Norton Sound, Alaska, by W. H. Dall. 1919. pp. 23–37, illus. In Professional Paper 125. 60 cents.

159. The Upper Cretaceous floras of Alaska, by Arthur Hollick, with a description of the plant-bearing beds, by G. C. Martin. 1930. 123 pp., illus. 80 cents.

170–A. Glaciation in Alaska, by S. R. Capps. 1932. pp. 1–8, illus., maps (plane, 1:5,000,000) 15 cents.

182. The Tertiary flora of Alaska, by Arthur Hollick, with a chapter on the geology of the Tertiary deposits, by P. S. Smith. 1936. 185 pp., illus., map (plane, 1:5,000,000). $1.

BULLETINS:

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

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

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

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

649. Antimony deposits of Alaska, by A. H. Brooks. 1916. 67 pp., illus., map (plane, 1:5,000,000). 15 cents.

719. Preliminary report on petroleum in Alaska, by G. C. Martin. 1921. 83 pp., illus., maps (GT, 1:62,500 and 1:250,000; G, 1:125,000 and about 1:1,000,000). 50 cents.

739–D. The occurrence of metalliferous deposits in the Yukon and Kuskokwim regions, by J. B. Mertie, Jr. 1923. pp. 149–165. 5 cents.

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

836–C. Surface water supply of southeastern Alaska, 1909–30, by F. F. Henshaw. 1933. pp. 137–218, illus. 10 cents.

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

880–A. Mineral industry of Alaska in 1935, by P. S. Smith. 1937. pp. 1–95, illus. — cents. Other volumes in this series have been issued for each year since 1904. The more recent of these are 868–A, 1934, 10 cents; 864–A, 1933, 10 cents; 857–A, 1932, 10 cents; 844–A, 1931, 10 cents; 836–A, 1930, 20 cents; 824–A, 1929, 20 cents.

WATER-SUPPLY PAPERS:

314. Surface water supply of Seward Peninsula, by F. F. Henshaw and G. L. Parker, with a sketch of the geography and geology by P. S. Smith and a description of methods of placer mining by A. H. Brooks. 1913. 317 pp., illus., map (T, 1:500,000). 45 cents

342. Surface water supply of the Yukon-Tanana region, by C. E. Ellsworth and R. W. Davenport. 1915 343 pp., illus., map (T, 1:250,000). 45 cents.

345–F. The discharge of the Yukon River at Eagle, by E. A. Porter and R. W. Davenport. 1915. pp. 67–77, illus. 5 cents.

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

418. Mineral springs of Alaska, by G. A. Waring. 1917. 114 pp., illus. 25 cents.

Other Reports

PROFESSIONAL PAPERS:

95–D. An ancient volcanic eruption in the upper Yukon Basin, by S. R. Capps. 1916. pp. 59–64, illus. 5 cents.

109. The Canning River region of northern Alaska, by E. de K. Leffingwell. 1919. 251 pp., illus., maps (GT and T, 1:250,000; plane, 1:125,000 and 1:1,000,000). 75 cents.

BULLETINS:

278. Geology and coal resources of the Cape Lisburne region, by A. J. Collier. 1906. 54 pp., illus., map (GT, about 1:800,000). 15 cents.

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

335. Geology and mineral resources of the Controller Bay region, by G. C. Martin. 1908. 141 pp., illus., maps (GT and T, 1:62,500). 70 cents.

347. The Ketchikan and Wrangell mining districts, by F. E. and C. W. Wright. 1908. 210 pp., illus., maps (G, about 1:890,000, and GT, 1:250,000). 60 cents.

374. Mineral resources of the Kotsina-Chitina region, by F. H. Moffit and A. G. Maddren. 1909. 103 pp., illus., maps (GT and T, 1:250,000). 40 cents.

417. Mineral resources of the Nabesna-White River district, by F. H. Moffit and Adolph Knopf, with a section on the Quaternary, by S. R. Capps. 1910. 64 pp., illus., maps (GT and T, 1:250,000). 25 cents.

433. Geology and mineral resources of the Solomon and Casadepaga quadrangles, Seward Peninsula, by P. S. Smith. 1910. 234 pp., illus., maps (GT and T, 1:62,500). 40 cents.

443. Reconnaissance of the geology and mineral resources of Prince William Sound, by U. S. Grant and D. F. Higgins. 1910. 89 pp., illus., maps (G, 1:250,000, and GT, 1:21,120). 45 cents.

446. Geology of the Berners Bay region, by Adolph Knopf. 1911. 58 pp., illus., maps (GT and T, 1:62,500). 20 cents.

448. Geology and mineral resources of the Nizina district, by F. H. Moffit and S. R. Capps. 1911. 111 pp., illus., maps (GT and T, 1:62,500). 40 cents.

449. A geologic reconnaissance in southeastern Seward Peninsula and the Norton Bay-Nulato region, by P. S. Smith and H. M. Eakin. 1911. 146 pp., illus., maps (GT and T, 1:250,000, and T, 1:500,000). 30 cents.

485. A geologic reconnaissance of the Iliamna region, by G. C. Martin and F. J. Katz. 1912. 138 pp., illus., maps (GT and T, 1:250,000). 35 cents.

498. Headwater regions of Gulkana and Susitna Rivers, with accounts of the Valdez Creek and Chistochina placer districts, by F. H. Moffit. 1912. 82 pp., illus., maps (GT and T, 1:250,000). 35 cents.

500. Geology and coal fields of the lower Matanuska Valley, by G. C. Martin and F. J. Katz. 1912. 98 pp., illus., maps (GT and T, 1:62,500, and GT, 1:250,000). 30 cents.

501. The Bonnifield region, by S. R. Capps. 1912. 64 pp., illus., maps (GT and T, 1:250,000). 20 cents.

502. The Eagle River region, southeastern Alaska, by Adolph Knopf. 1912. 61 pp., illus., maps (GT and T, 1:62,500). 25 cents.

520–K. Geologic investigations along the Canada-Alaska boundary, by A. G. Maddren. 1912. pp. 297–314. In Bulletin 520. 50 cents.

525. A geologic reconnaissance of the Fairbanks quadrangle, by L. M. Prindle, F. J. Katz, and P. S. Smith. 1913. 220 pp., illus., maps (GT and T, 1:62,500 and 1:250,000). 55 cents.

532. The Koyukuk-Chandalar region, by A. G. Maddren. 1913. 119 pp., illus., maps (GT and T, 1:500,000). 25 cents.

Other Reports—Continued

BULLETINS—Continued.

533. Geology of the Nome and Grand Central quadrangles, by F. H. Moffit. 1913. 140 pp., illus., maps (GT and T, 1:62,500). 60 cents.

535. A geologic reconnaissance of a part of the Rampart quadrangle, by H. M. Eakin. 1913. 38 pp., illus., maps (GT and T, 1:250,000). 20 cents.

536. The Noatak-Kobuk region, by P. S. Smith. 1913. 160 pp., illus., maps (GT and T, 1:500 000). 40 cents.

538. A geologic reconnaissance of the Circle quadrangle, by L. M. Prindle. 1913. 82 pp., illus., maps (GT and T, 1:250,000). 30 cents.

576. Geology of the Hanagita-Bremner region, by F. H. Moffit. 1914. 56 pp., illus., maps (GT and T, 1:250,000). 30 cents.

605. The Ellamar district, by S. R. Capps and B. L. Johnson. 1915. 135 pp., illus., maps (GT and T, 1:62,500). 25 cents.

607. The Willow Creek district, by S. R. Capps. 1915. 86 pp., illus., maps (GT and T, 1:62,500). 25 cents.

608. The Broad Pass region, by F. H. Moffit and J. E. Pogue. 1915. 80 pp., illus., maps (GT and T, 1:250,000). 25 cents.

622–E. The gold and copper deposits of the Port Valdez district, by B. L. Johnson. 1915. pp. 140–188, illus., map (sketch, about 1:125,000). In Bulletin 622. 30 cents.

622–H. Quicksilver deposits of the Kuskokwim region, by P. S. Smith and A. G. Maddren. pp. 272–291, illus.; Gold placers of the lower Kuskokwim, with a note on copper in the Russian Mountains, by A. G. Maddren, pp. 292–350, map (sketch, 1:500,000). 1915. 15 cents.

630. The Chisana-White River district, by S. R. Capps. 1916. 130 pp., illus., maps (GT and T, 1:250,000). 20 cents.

631. The Yukon-Koyukuk region, by H. M. Eakin. 1918. 88 pp., illus., maps (GT and T, 1:500,000). 20 cents.

655. The Lake Clark-central Kuskokwim region, by P. S. Smith. 1917. 162 pp., illus., maps (GT and T, 1:250,000). 30 cents.

662. Mining on Prince William Sound, by B. L. Johnson. 1918. pp. 183–192. 75 cents. Similar previous report in Bulletin 622, 1915, 30 cents.

662–C. Copper deposits of the Latouche and Knight Island districts, Prince William Sound, by B. L Johnson. 1918. pp. 193–220, map (G sketch, about 1:375,000). In Bulletin 662. 75 cents.

662–D. The gold placers of the Tolovana district, by J. B. Mertie, Jr. 1918. pp. 221–277, illus., map (G, 1:250,000). 10 cents.

662–G. Lode deposits near the Nenana coal field, by R. M. Overbeck. 1918. pp. 351–362, map (sketch about 1:410,000). 5 cents.

664. The Nenana coal field, Alaska, by G. C. Martin. 1919. 54 pp., maps (GT on township plats, 1:31,680). $1.10.

667. The Cosna-Nowitna region, by H. M. Eakin. 1918. 54 pp., illus., maps (GT and T, 1:250,000). 25 cents.

668. The Nelchina-Susitna region, by Theodore Chapin. 1918. 67 pp., illus., maps (GT and T, 1:250,000). 25 cents.

675. The upper Chitina Valley, by F. H. Moffit, with a description of the igneous rocks, by R. M. Overbeck. 1918. 82 pp., illus., maps (GT and T, 1:250,000). 25 cents.

683. The Anvik-Andreafski region, by G. L. Harrington. 1918. 70 pp., illus., maps (GT and T, 1:125,000 and 1:250,000). 30 cents.

687. The Kantishna region, by S. R. Capps. 1919. 116 pp., illus., maps (GT and T, 1:250,000). 25 cents.

722–F. Metalliferous lodes of southern Seward Peninsula, by S. H. Cathcart. 1922. pp. 163–261, illus. 20 cents.

733. The geology of the York tin deposits, by Edward Steidtmann and S. H. Cathcart. 1922. 130 pp., illus., map (GT, 1:250,000). 30 cents.

739–B. Mineral deposits of the Wrangell district, by A. F. Buddington. 1923. pp. 51–75, illus., map (G sketch, 1:500,000). 10 cents.

742. Chromite of Kenai Peninsula, by A. C. Gill. 1922. 52 pp., illus., map (GT, 1:250,000). 15 cents.

745. The Kotsina-Kuskulana district, by F. H. Moffit and J. B. Mertie, Jr. 1923. 149 pp., illus., maps (GT and T, 1:62,500). 40 cents.

754. The Ruby-Kuskokwim region, by J. B. Mertie, Jr., and G. L. Harrington. 1924. 129 pp., illus., maps (GT and T, 1:250,000). 50 cents.

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

755–C. Geology and mineral resources of the region traversed by the Alaska Railroad, by S. R. Capps. 1924. pp. 73–150, illus., map (G sketch, about 1:950,000). In Bulletin 755. 40 cents.

755–D. The Cold Bay-Chignik district, by W. R. Smith and A. A. Baker. 1924. pp. 151–218, illus., map (G sketch, about 1:750,000). 15 cents.

789. The Iniskin-Chinitna Peninsula and the Snug Harbor district, by F. H. Moffit. 1927. 71 pp., illus., maps (GT and T, 1:62,500 and 1:250,000). 50 cents.

791. Geology of the upper Matanuska Valley, by S. R. Capps, with a section on the igneous rocks by J. B. Mertie, Jr. 1927. 92 pp., illus., maps (GT and T, 1:62,500). 30 cents.

792–B. Geology of the Knik-Matanuska district, by K. K. Landes. 1927. pp. 51–72, map (G sketch, about 1:330,000). 5 cents.

792–C. The Toklat-Tonzona River region, by S. R. Capps. 1927. pp. 73–110, illus., map (G sketch, 1:500,000). In Bulletin 792. 25 cents.

797–E. Aerial photographic surveys in southeastern Alaska, by F. H. Moffit and R. H. Sargent. 1929. pp. 143–160, illus., map (plane, 1:250,000). In Bulletin 797. 80 cents.

797–F. Geology and mineral resources of the Aniakchak district, by R. S. Knappen. 1929. pp. 161–237, map (GT, 1:250,000). In Bulletin 797. 80 cents.

800. Geology and mineral deposits of southeastern Alaska, by A. F. Buddington and Theodore Chapin. 1929. 398 pp., illus., maps (G, 1:500,000 and 1:1,000,000). 85 cents.

807. Geology of Hyder and vicinity, southeastern Alaska, with a reconnaissance of Chickamin River, by A. F. Buddington. 1929. 124 pp., illus., maps (GT and T, 1:62,500). 35 cents.

810–B. The Chandalar-Sheenjek district, by J. B. Mertie, Jr. 1930. pp. 87–139, illus., maps (G and T, 1:500,000). 25 cents.

813–C. Mining in the Fortymile district, by J. B. Mertie, Jr. 1930. pp. 125–143, illus. 5 cents.

813–D. Notes on the geology of the upper Nizina River, by F. H. Moffit. 1930. pp. 143–166, map (GT, 1:250,000). 15 cents.

815. Geology and mineral resources of northwestern Alaska, by P. S. Smith and J. B. Mertie, Jr. 1930. 351 pp., illus., maps (GT and T, 1:500,000). $1.

816. Geology of the Eagle-Circle district, by J. B. Mertie, Jr. 1930. 168 pp., illus., map (G, 1:250,000). 50 cents.

824–B. The Slana district, upper Copper River region, by F. H. Moffit. 1932. pp. 111–124, map (G sketch, about 1:500,000). 5 cents.

824–D. Mining in the Circle district, by J. B. Mertie, Jr. 1932. pp. 155–172, map (sketch, 1:500,000). 5 cents.

824–E. The occurrence of gypsum at Iyoukeen Cove, Chichagof Island, by B. D. Stewart. 1932. pp. 173–181. 5 cents.

827. Geologic reconnaissance of the Dennison Fork district, by J. B. Mertie, Jr. 1931. 44 pp., illus., maps (GT and T, 1:250,000). 45 cents.

836–B. Notes on the geography and geology of Lituya Bay, by J. B. Mertie, Jr. 1933. pp. 117–135, illus. 5 cents.

836–D. The eastern portion of Mount McKinley National Park, by S. R. Capps, pp. 219–300, illus., map (GT, 1:250,000); The Kantishna district, by F. H. Moffit, pp. 301–338, illus.; Mining development in the Tatlanika and Totatlanika Basins, by F. H. Moffit, pp. 339–345, illus. 1933. 35 cents.

836–E. The Tatonduk-Nation district, by J. B. Mertie, Jr. 1933. pp. 347–443, illus., map (G, 1:125,000). 15 cents.

844–C. The Suslota Pass district, upper Copper River region, by F. H. Moffit. 1933. pp. 137–162, map (GT, 1:250,000). 15 cents.

844–D. Mineral deposits of Rampart and Hot Springs districts, by J. B. Mertie, Jr., pp. 163–226, illus., map (sketch, 1:250,000); Placer concentrates of Rampart and Hot Springs districts, by A. E. Waters, Jr., pp. 227–246. 1934. 10 cents.

844–E. Reconnaissance of northern Koyukuk Valley, by Robert Marshall. 1934. pp. 247–264, map (plane, 1:500,000). 5 cents.

849–B. Lode deposits of the Fairbanks district, by J. M. Hill. 1933. pp. 29–163, illus., map (GT, 1:62,500). 35 cents.

849–C. The Willow Creek gold lode district, by J. C. Ray. 1933. pp. 165–229, illus., map (GT, 1:62,500). 20 cents.

849–D. The Mount Eielson district, by J. C. Reed. 1934. pp. 231–287, illus., maps (GT and T, 1:62,500 and 1:24,000). 25 cents.

849–E. Mineral deposits near the West Fork of the Chulitna River, by C. P. Ross. 1933. pp. 289–333, illus., map (GT, 1:125,000). 15 cents.

849–F. Lode deposits of Eureka and vicinity, Kantishna district, by F. G. Wells. 1933. pp. 335–379, illus., map (GT, 1:62,500). 20 cents.

849–G. The Girdwood district, by C. F. Park, Jr. 1934. pp. 381–424, illus., map (GT, 1:62,500). 25 cents.

849–H. The Valdez Creek mining district, by C. P. Ross. 1933. pp. 425–468, illus., map (GT, 1:125,000). 15 cents.

849–I. The Moose Pass-Hope district, Kenai Peninsula, by Ralph Tuck. 1933. pp. 469–530, illus., map (GT, 1:250,000). 15 cents.

857–C. The Curry district, by Ralph Tuck. 1934. pp. 99–140, illus., map (GT, 1:250,000). 10 cents.

857–D. Notes on the geology of the Alaska Peninsula and Aleutian Islands, by S. R. Capps. 1934. pp. 141–153, map (sketch, about 1:10,000,000). 5 cents.

857–E. Core drilling for coal in the Moose Creek area, by G. A. Waring. 1934. pp. 155–173, illus., map (sketch, 1:62,500). 10 cents.

861. Geology of the Anthracite Ridge coal district, by G. A. Waring. 1936. 57 pp., illus., maps (G and GT, 1:12,000 and 1:62,500). — cents.

862. The southern Alaska Range, by S. R. Capps. 1935. 101 pp., illus., maps (GT, 1:250,000). 70 cents.

864–B. The Willow Creek-Kashwitna district, by S. R. Capps and Ralph Tuck. 1935. pp. 95–113, illus., map (GT, 1:250,000). 5 cents.

864–C. Mineral deposits of the Ruby-Kuskokwim region, by J. B. Mertie, Jr. 1936. pp. 115–255, illus., map (G sketch, 1:63,360). 25 cents.

866. Geology of the Tonsina district, by F. H. Moffit. 1935. 38 pp., illus., map (GT, 1:250,000). 40 cents.

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BULLETINS:

868–B. Kodiak and vicinity, by S. R. Capps.
868–C. Upper Copper and Tanana Rivers, by F. H. Moffit.
868–D. The Kaiyuh Hills, by J. B. Mertie, Jr.
872. Geology of the Yukon-Tanana region, by J. B. Mertie, Jr.
880–B. Recent mineral developments in the Copper River region, by F. H. Moffit.

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Designation on index	Title of map	Author	Date of publication	Size of map (inches)	Scale of map	Contour interval (feet)	Retail price (cents)
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	Map of Alaska (B) (2 sheets).	do	1935	54 by 75 combined	1:1,500,000	do	100
	Map of Alaska (C)	do	1929	10 by 15	1:12,000,000	do	1
	Relief map of Alaska (D)	do	1923	33 by 50	1:2,500,000	do	50
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Other Maps

1	Hyder and vicinity	R. M. Wilson	1927	16 by 17	1:62,500	100	10
2	Revillagigedo Island	R. H. Sargent	1931	13 by 16	1:250,000	200	10
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7	Sumner Strait and vicinity.	do	1933	21 by 26	1:250,000	200	25
8	Chichagof-Baranof Islands.	R. H. Sargent, J. I. Davidson.	1936	21 by 41	1:250,000	None	10
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15	Kodiak and vicinity	Gerald FitzGerald	1933	10 by 12	1:250,000	200	10
16	Kamishak Bay-Katmai region.	R. H. Sargent, R. K. Lynt.	1927	38 by 41	1:250,000	200	25
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18	Goodnews Bay district	R. H. Sargent, W. S. Post.	1930	12 by 15	1:250,000	200	10
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31	Kotsina-Kuskulana district.	D. C. Witherspoon	1922	19 by 21	1:62,500	100	10
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38	Circle quadrangle	T. G. Gerdine, D. C. Witherspoon, and others.	1911	31 by 36	1:250,000	200	50
39	Fairbanks quadrangle	do	1911	31 by 36	1:250,000	200	50
40	Fairbanks special	T. G. Gerdine, R. H. Sargent.	1908	16 by 35	1:62,500	25	20
41	Rampart quadrangle	D. C. Witherspoon, R. B. Oliver.	1913	18 by 30	1:250,000	200	20
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44	Casadepaga quadrangle.	do	1907	15 by 18	1:62,500	25	10
45	Nome quadrangle	do	1906	15 by 18	1:62,500	25	10
46	Grand Central quadrangle.	do	1906	15 by 20	1:62,500	25	10
47	Northwestern Alaska	Gerald FitzGerald, R. K. Lynt, and others.	1930	42 by 52	1:500,000	200	50

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