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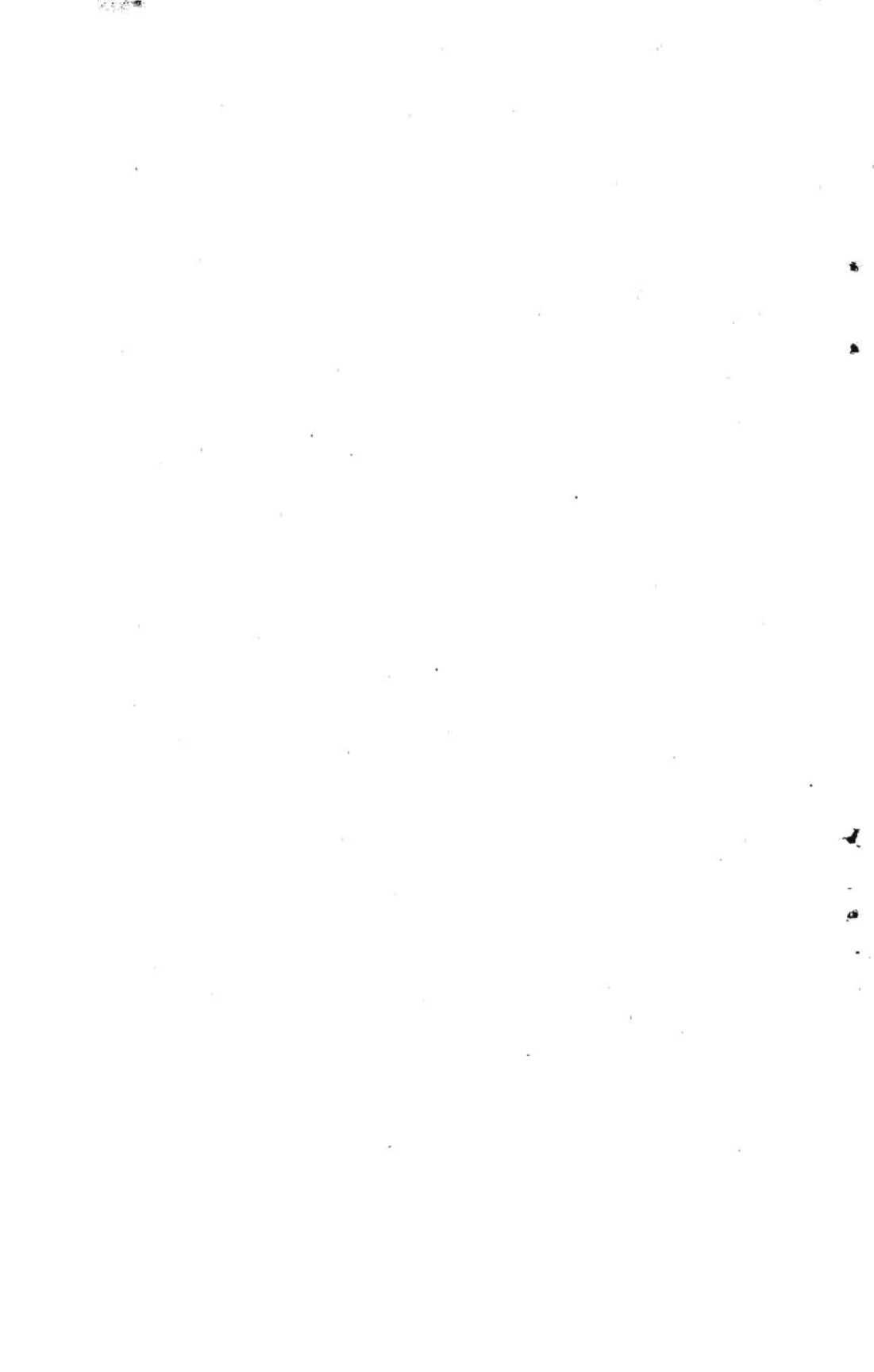
MINERAL INDUSTRY OF ALASKA IN 1940

BY
PHILIP S. SMITH

Mineral Resources of Alaska, 1940
(Pages 1-102)



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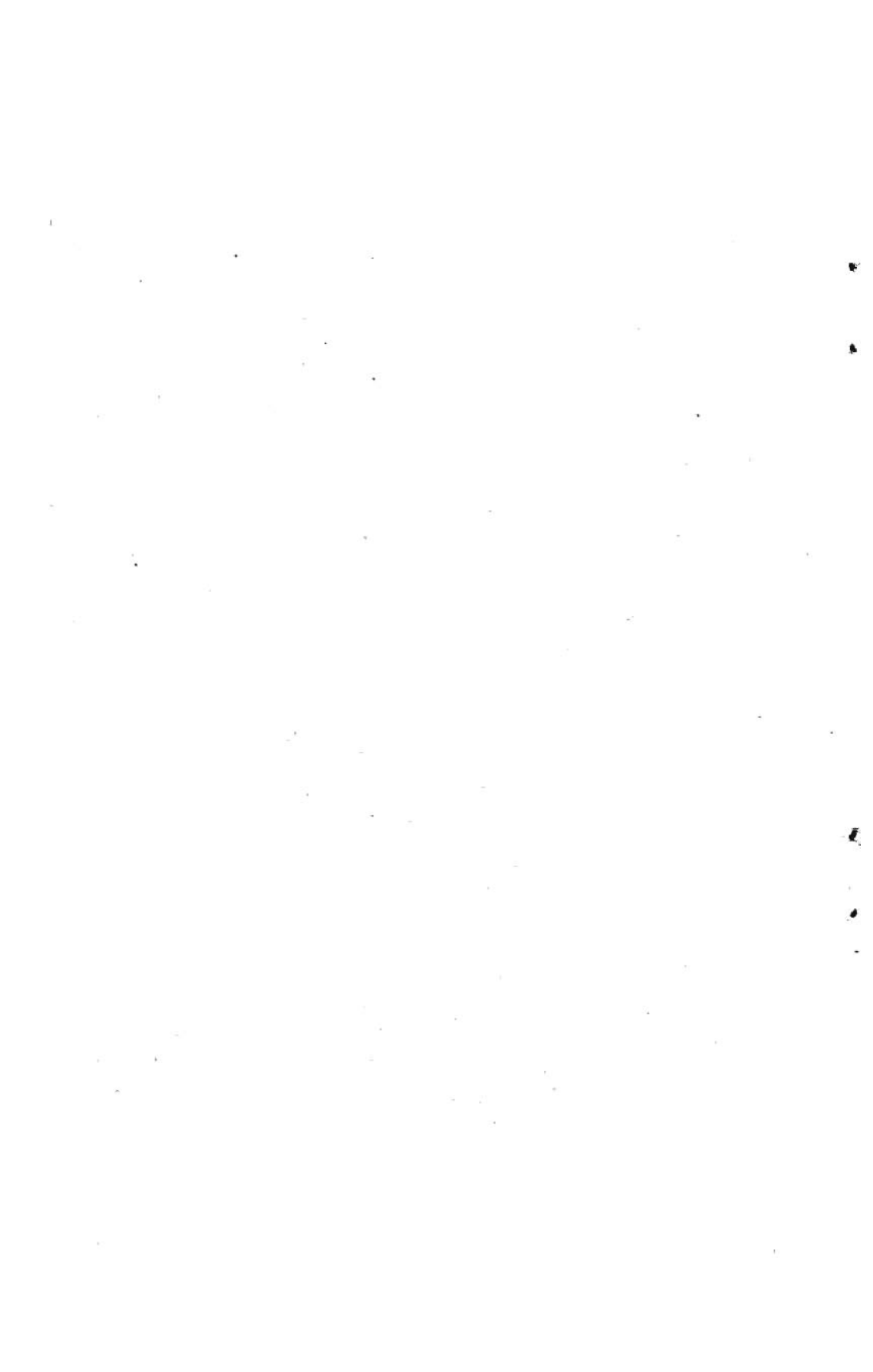


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MINERAL RESOURCES OF ALASKA, 1940

MINERAL INDUSTRY OF ALASKA IN 1940

By PHILIP S. SMITH¹

INTRODUCTION

The presentation of a yearly record of the Alaska mineral industry is a continuing service that has been rendered by the Geological Survey from almost the earliest years of extensive mining in Alaska, and the present report, for 1940, is the thirty-seventh of this series.² Such a record, especially when supplemented by the statistics for the preceding years, not only affords an authoritative summary of current and past conditions but also indicates trends that are of significance in suggesting the lines along which future developments of the industry are likely to proceed. These reports therefore serve miners, prospectors, and businessmen concerned with Alaska affairs as useful historical records, statements of contemporary conditions, and starting points on which some conjectures concerning future operations may be predicated.

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

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 and Letha M. Scott, of the Alaskan branch of the 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, 868-A, 880-A, 897-A, 910-A, 917-A, and 926-A. The reports for 1902 and 1903 were included with other "contributions to economic geology" in Bulletins 213 and 225.

basis and to give only those that appear to be well substantiated. Among the most reliable sources of information are the geologists and engineers who are sent out each year by the Geological Survey to conduct surveys in different parts of Alaska and who acquire not only much accurate information regarding the mineral production of the regions in which they work but also general information by contact with miners and operators in the course of their travels to and from the field. Members of other Government organizations—for instance, the Bureau of Mines, the Bureau of the Mint, The Alaska Railroad, the Bureau of Foreign and Domestic Commerce, and the Customs Service—in the course of their regular duties collect many data which are extremely valuable in these studies and the use of which avoids unnecessary duplication in collecting records. Most of the banks, express companies, and other business organizations in Alaska collect for their own use data regarding mineral commodities of their particular districts. Some of these data are extremely pertinent to the general inquiry conducted by the Geological Survey, and through the cordial cooperation of many of these companies important facts have been made available to the 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 general 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, 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. Though some uncertainties necessarily remain, it is believed that they do not have a 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. The term "production," however, is rather indefinite because it may refer to the raw ore as it is broken from the ledge, to the metal content of the placer gravel before it has been sluiced, or to any of the later stages that intervene before the final product is disposed of in usable form. Thus, the miner produced so much ore, the millman so much concentrates, the smelter so much metal of varying degrees of purity, the refiner so much pure metal. Between each of these stages there are inevitable losses of the valuable metals contained in the material treated, so that at no two stages is the amount "produced" the same. The cost would far exceed the value of the results for the Geological Survey to attempt to collect records as to the quantities of the different mineral commodities produced at each of these several stages. Consequently, it has been necessary to adopt the stage that seemed to represent one of the common determinable and significant steps. For most materials this has been considered to be the stage when the true content of valuable minerals can be closely determined and the material is in shape to be disposed of on that basis. In other words, the metals contained in the rock but lost in the tailings would not be considered "produced," but the ore mined, though not milled or smelted, would be credited with the metallic content that could reasonably be expected to be recovered from it after such treatments. Unless there are obvious inconsistencies the individual reports showing the quantities of minerals produced are accepted as final.

Diverse statements from different sources arise also through various methods of computing the value of the mineral commodities. It has been the standard practice in these volumes to base all computations of values on the average selling price for the year and not on the prices actually received by the individual producers. Obviously, 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, who may have made deductions for shipping, insurance, and other expenses incident to handling their product, were so edited that the full value of the gold produced was recorded. Because of this method of computing the values of the different commodities, if for no other reason, the statistics necessarily differ greatly from those that might be collected to show net profit, or other data.

It is the constant aim of the compilers to make these annual summaries of mineral production as helpful, 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 facts relating to individual properties are regarded as strictly confidential. The Geological Survey does not use any information that is furnished in such a way as to disclose the production of individual plants, nor does it allow access to its records in any way disadvantageous either to the individuals who furnish the information or to 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.

The foregoing statements, emphasizing as they do the scope and contents of these annual summaries of the mineral industry of Alaska, should not cause the reader to overlook the fact that these annual summaries contribute but part of the service the Geological Survey furnishes the public regarding Alaska. Indeed the greater number of the publications of the Geological Survey on Alaska describe in considerable detail the results of intensive examinations in the field by its technical staff of the individual tracts of the Territory, such as specific mining camps or districts. Already several hundred such reports, illustrated by maps, diagrams, and pictures, have been issued to describe the topography, geology, and mineral deposits of the selected areas. In order that the more significant of these reports and maps that are available for sale or other distribution by the Government may be made known to those who may be interested, an index map, which shows graphically the areas covered by these publications, is included in this volume as plate 1 (in pocket). A list, by titles, is printed on the back of the map.

ACKNOWLEDGMENTS

Among the private individuals and companies who have been especially courteous in supplying information of general significance

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MINERAL PRODUCTION

GENERAL FEATURES OF THE YEAR

The total value of the Alaska mineral production in 1940 was \$28,470,000. This was furnished by a number of different mineral products, but gold accounts for nearly 92 percent. Compared with the mineral production of 1939, the output in 1940 was \$3,174,000, or about 12½ percent more. This increase was due principally to the especially large output of placer gold, but the values of the total output of each of the other mineral products, except lead, copper,

and limerock were somewhat greater than in the preceding year. Indeed the value of the mineral production from Alaska in 1940 has been exceeded in only 4 years during the whole period that mining has been in progress in the Territory. Three of these years, 1915-17 inclusive, marked the enormous output of copper during the World War, and the fourth, 1938, exceeded in the value of its production that of 1940 by only \$137,000.

The total production of minerals from the Territory in 1940, as stated, reflects the complex interaction of many different factors, some favorable and others adverse, some affecting a single commodity and others applying to the industry as a whole. Those factors affecting a single kind of product will be discussed in later pages where the commodity in question is treated specifically. Here it is proposed to refer briefly to some of the factors that had general application.

Among the general conditions that affected the mining industry of Alaska as well as the rest of the world in 1940 was the increase in the price of most mineral commodities, except gold, that prevailed during that year as compared with 1939. In general, this increase did not amount to more than a few percent over the unit price of the commodity during the preceding year, and in the aggregate probably does not account for more than a few tens of thousands of dollars of the increase.

In the computations made for this report the following are the unit prices that have been used for 1940: Gold, \$35 an ounce; silver, 71.1 cents an ounce; platinum metals, \$37.84 an ounce; tin, 50 cents a pound; lead, 5 cents a pound; copper, 11.3 cents a pound; antimony, 14 cents a pound; and mercury, \$176.86 a flask of 76 pounds. The unit price of the silver is based on the assumption that all Alaska silver qualified under the Executive order that set the price for all newly mined silver from domestic ores. The unit price stated for the platinum metals has been arrived at by applying the prices cited by the Engineering and Mining Journal for certain members of the platinum group of metals against the approximate composition of the Alaska product as determined in the past. It is realized that this is at best an estimate that may be far from the actual price received for the various lots that were sold, but it is believed to be of the correct order of magnitude and comparable with the record of other years, as reported in this series of volumes. All the other unit prices stated are those that have been determined by the specialists of the Bureau of Mines from their statistical records.

In general, labor conditions throughout the Territory were satisfactory during 1940. The strictly seasonal character of much of the employment in Alaska necessarily causes a heavy demand for competent workers during the summer, followed by a heavy lay-off

of personnel during the winter. This, however, is a well-recognized condition and causes little disruption of the normal economics of the region, for those workers who do not fill continuing jobs either leave the Territory for the winter or employ their time in prospecting or in attending to their own affairs. The enormous amount of emergency defense construction throughout many parts of the Territory in 1940 and the resulting drain on all sources to furnish the needed personnel made heavy inroads on many of the mines for their skilled workers. In fact, the output of several of the mines was considerably decreased through inability to secure suitable craftsmen or through the inordinately heavy turn-over they experienced. Although attempts to force some of the larger placer plants of interior Alaska to be operated on a closed-shop basis caused some temporary unsettlement during the early part of the open season, the matter was finally laid aside for further consideration in 1941.

Certain of the minerals that have been mined at least intermittently in the past were not mined in 1940. For example, there was no production of petroleum products from the oil wells near Katalla or elsewhere in the Territory, no marble from the quarries on Prince of Wales Island in southeastern Alaska, and no chromite from the deposits in the southern part of Kenai Peninsula. To this list might be added a number of other mineral commodities that in the past have been mined from Alaska deposits. As none of the deposits at the places specifically named have been exhausted, the cessation of production from them is regarded as due solely to extraneous causes, which doubtless will not long prevail.

The foregoing outline of the general features of the year 1940 not only shows clearly that the record for that year has been good but also holds out encouraging prospects for the future. Although this optimism is probably very well justified, it seems desirable to interject a word of caution to those who might be carried away by the glamour that distance always gives to things with which we are not fully acquainted and who might thus be tempted to feel that Alaska is waiting to disclose its bounty to the chance seeker. Such dreamers should realize that for more than a third of a century hardy pioneers, who are at least somewhat experienced in mining, have toiled over most of the more accessible parts of Alaska, seeking its riches. A novice should therefore be warned that much more is required in finding a workable deposit than a mere desire for wealth, and that the chances of finding bonanza deposits that merely await the summons of the newcomer to disclose their treasures are extremely poor. It is expensive and not the job for a novice to get far off the beaten tracks in the search of new areas for prospecting. Although 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 performances of many of its mines. This is especially true of one of its lode 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 unless he has extensive technical or financial ability he is not fitted 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 in finding a prospective deposit is usually but a small part of the heavy outlays and intricate planning that will be required for testing the property adequately and bringing it successfully into production.

TOTAL MINERAL PRODUCTION

From the time of the earliest records of mining in Alaska to the end of 1940, minerals to the value of over \$831,580,000, or more than 115 times the purchase price of the Territory, have been produced by its mines. 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 1899 the annual production ranged from negligible amounts to a maximum of less than \$3,000,000. After the discovery of the Canadian Klondike and the entrance of a swarm of prospectors and miners into Alaska, the production quickly mounted, until in 1906 it reached a high point that marks the mining of many of the rich placers in the Nome and Fairbanks regions. For the next 8 years the production fluctuated somewhat but ranged around \$20,000,000

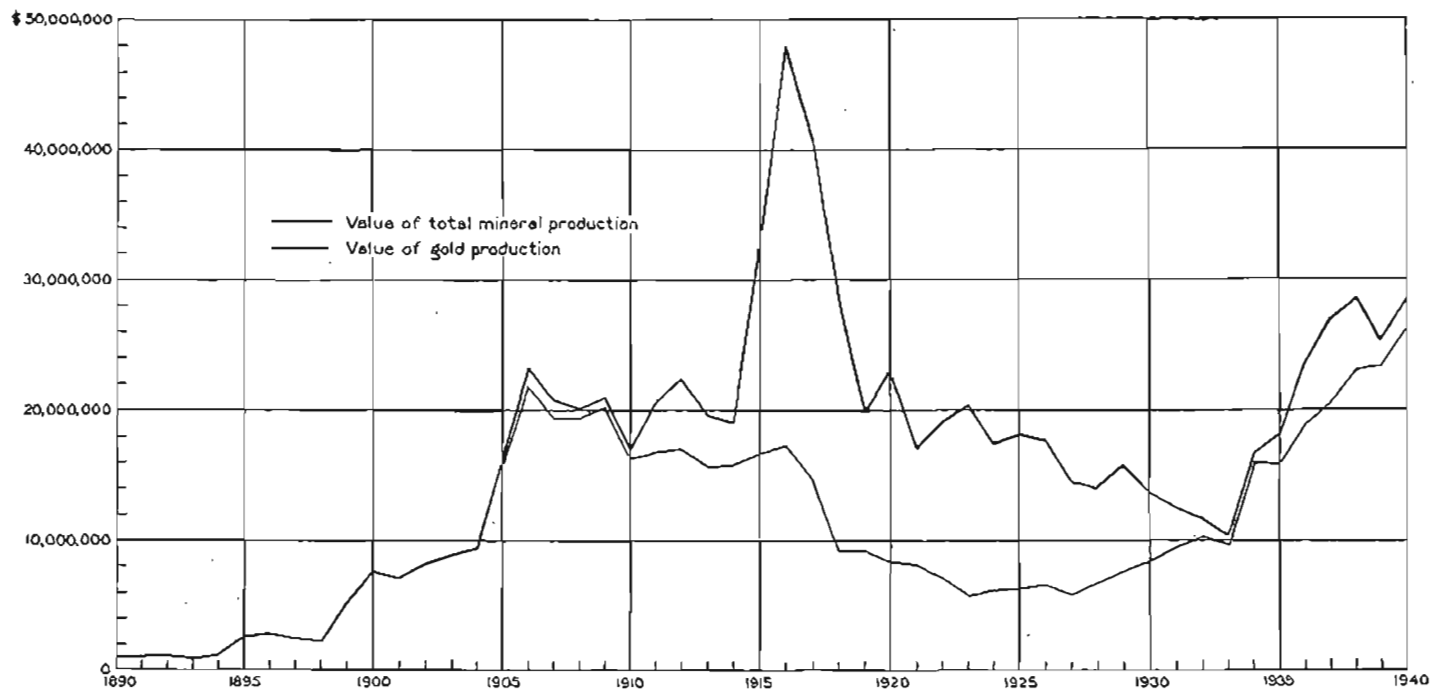


FIGURE 1.—Trends of mineral production of Alaska, 1890-1940.

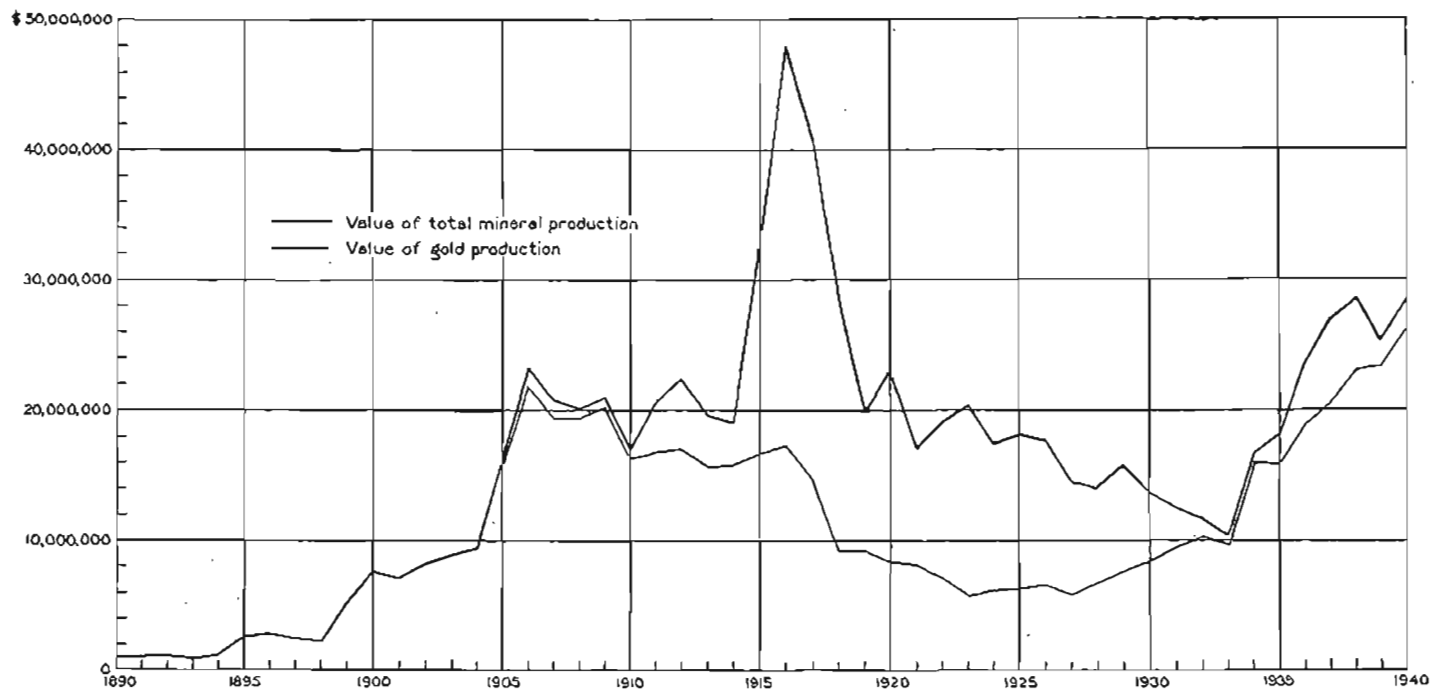


FIGURE 1.—Trends of mineral production of Alaska, 1890-1940.

a year. 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 suffered through the fact that in the States, scales of wages and opportunities for the employment of capital seemed to offer more advantages, and as a result there was more or less fluctuation in the mineral output. Between 1929 and 1933, production dropped from \$16,000,000 to slightly more than \$10,000,000. In 1934, owing largely to advance in the price of gold, it approached \$17,000,000 and later, with the continued high price of gold and general stimulation of mining, it swiftly mounted to the high point in 1938 of over \$28,600,000, and in 1940 was \$28,470,000.

Value of total mineral production of Alaska, by years, 1880-1940

1880.....	\$6,826	1901.....	\$7,306,381	1922.....	\$19,420,121
1891.....	15,000	1902.....	8,475,813	1923.....	20,330,643
1892.....	23,000	1903.....	9,089,564	1924.....	17,457,333
1893.....	67,146	1904.....	9,627,495	1925.....	18,220,692
1894.....	72,000	1905.....	16,490,720	1926.....	17,664,800
1895.....	425,000	1906.....	21,501,770	1927.....	14,404,000
1896.....	540,000	1907.....	20,840,571	1928.....	14,061,000
1897.....	657,000	1908.....	20,092,501	1929.....	16,066,000
1898.....	667,181	1909.....	21,140,810	1930.....	13,812,000
1899.....	847,490	1910.....	16,875,226	1931.....	12,278,000
1890.....	873,276	1911.....	20,720,480	1932.....	11,638,000
1891.....	1,014,211	1912.....	22,581,943	1933.....	10,366,000
1892.....	1,019,493	1913.....	19,547,292	1934.....	16,721,000
1893.....	1,104,982	1914.....	19,109,731	1935.....	18,312,000
1894.....	1,339,332	1915.....	32,790,344	1936.....	23,594,000
1895.....	2,638,832	1916.....	48,396,508	1937.....	26,989,000
1896.....	2,835,029	1917.....	40,694,804	1938.....	28,607,000
1897.....	2,839,294	1918.....	28,218,935	1939.....	25,296,000
1898.....	2,329,016	1919.....	19,626,824	1940.....	28,470,000
1899.....	5,425,262	1920.....	23,330,586		
1900.....	7,995,209	1921.....	16,994,302		
				Total.....	831,584,000

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 nearly 67.6 percent of the total value of the mineral production and that gold and copper together accounted for nearly 95 percent.

Total value of mineral production of Alaska, by substances, 1880-1940

Gold.....	\$562,114,000
Copper.....	227,422,200
Silver.....	13,765,000
Coal.....	12,904,400
Lead.....	2,872,600
Tin.....	1,635,800
Other mineral products (including platinum minerals).....	11,070,000
Total.....	831,584,000

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 1940 and 1939, distributed by quantity and value among the main kinds of substances, so that a comparison between the 2 years may be readily made. From this table it is apparent that there was an increase in the quantity and value of gold, platinum metals, tin, coal, and miscellaneous mineral products and a slight increase in the value of the silver produced in 1940 but a decrease in both the quantity and value of the output of copper and lead in 1940.

Mineral output of Alaska, 1940 and 1939

	1940		1939	
	Quantity	Value	Quantity	Value
Gold.....fine ounces.....	747,943	\$26,178,000	665,114	\$23,279,000
Silver.....do.....	201,150	143,000	203,500	138,000
Platinum.....ounces.....	28,886	1,093,000	27,230	997,000
Copper.....pounds.....	122,369	13,800	278,500	30,000
Lead.....do.....	1,680,000	84,000	2,120,000	106,000
Tin, metallic.....do.....	104,000	52,000	74,080	37,300
Coal.....short tons.....	173,970	695,000	146,250	585,000
Miscellaneous mineral products.....		211,200		123,700
Total.....		28,470,000		25,296,000

GOLD

GENERAL FEATURES

Throughout 1940 the price of gold remained fixed officially at \$35 an ounce, the same as it has been since 1933. It should be borne in mind, however, in all comparisons made with the records of the earlier years that the value of gold produced prior to 1934 has been computed on the then prevailing price of approximately \$20.67 an ounce, or only about 60 percent of the present price. The value of the gold production of Alaska in 1940 was \$26,178,000, as against \$23,279,000 in 1939, an increase of \$2,899,000. This marks an all-time high, the nearest approach to it having been the 1939 record. Although in value the gold produced in 1939 exceeded that of any other year, in quantity the production did not come up to that of any of the years between 1905 and 1916, inclusive, when the price of gold was lower.

Gold produced in Alaska, 1880-1940

Year	Fine ounces	Value		
		Total	Placer mines	Lode mines
1880-99.....	1,153,889	\$23,853,000	\$8,692,000	\$15,161,000
1900.....	381,921	7,895,000	5,623,000	2,272,000
1901.....	348,300	7,200,000	4,980,000	2,220,000
1902.....	408,206	8,335,000	5,887,000	2,448,000
1903.....	423,185	8,748,000	6,010,000	2,738,000
1904.....	440,938	9,115,000	6,025,000	3,090,000
1905.....	766,550	15,846,000	12,340,000	3,506,000
1906.....	1,066,030	22,036,794	18,607,000	3,429,794
1907.....	936,043	19,349,743	16,491,000	2,858,743
1908.....	933,290	19,292,818	15,888,000	3,404,818
1909.....	987,417	20,411,716	16,252,638	4,159,078
1910.....	780,131	16,126,749	11,984,806	4,141,943
1911.....	815,276	16,853,256	12,540,000	4,313,256
1912.....	829,436	17,145,951	11,990,000	5,155,951
1913.....	755,947	15,626,813	10,680,000	4,946,813
1914.....	762,596	15,764,259	10,730,000	5,034,259
1915.....	807,966	16,702,144	10,480,000	6,222,144
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	9,426,029	4,970,000	4,456,029
1920.....	404,683	8,365,590	3,873,000	4,492,590
1921.....	390,558	8,073,540	4,226,000	3,847,540
1922.....	359,057	7,422,235	4,395,000	3,027,235
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	3,789,000	2,918,000
1927.....	286,720	5,927,000	2,982,000	2,945,000
1928.....	331,140	6,845,000	3,347,000	3,498,000
1929.....	375,438	7,761,000	4,117,000	3,644,000
1930.....	410,020	8,476,000	4,837,000	3,639,000
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
1936.....	526,660	18,433,000	11,328,000	7,105,000
1937.....	582,085	20,373,000	12,655,000	7,718,000
1938.....	662,000	23,170,000	14,897,000	8,273,000
1939.....	665,114	23,279,000	16,058,000	7,221,000
1940.....	747,943	26,178,000	18,852,000	7,326,000
Total.....	24,342,839	562,114,000	366,926,000	195,188,000

The general trend of gold mining in Alaska since 1880 is graphically represented by one of the curves in figure 2. From 1880 to 1884 only negligible amounts of gold were produced. Then the curve of production gradually steepened, until in 1895 the former production nearly doubled, and this remained fairly constant until 1900, when the great increase marking the discovery of the rich deposits near Nome carried the value of the annual output of gold to about \$8,000,000, near which it remained until 1904. From 1880 to 1904 the curve of gold produced practically coincides with the curve for the value of the total mineral production of Alaska. 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 the Alaska gold production declined still further, and

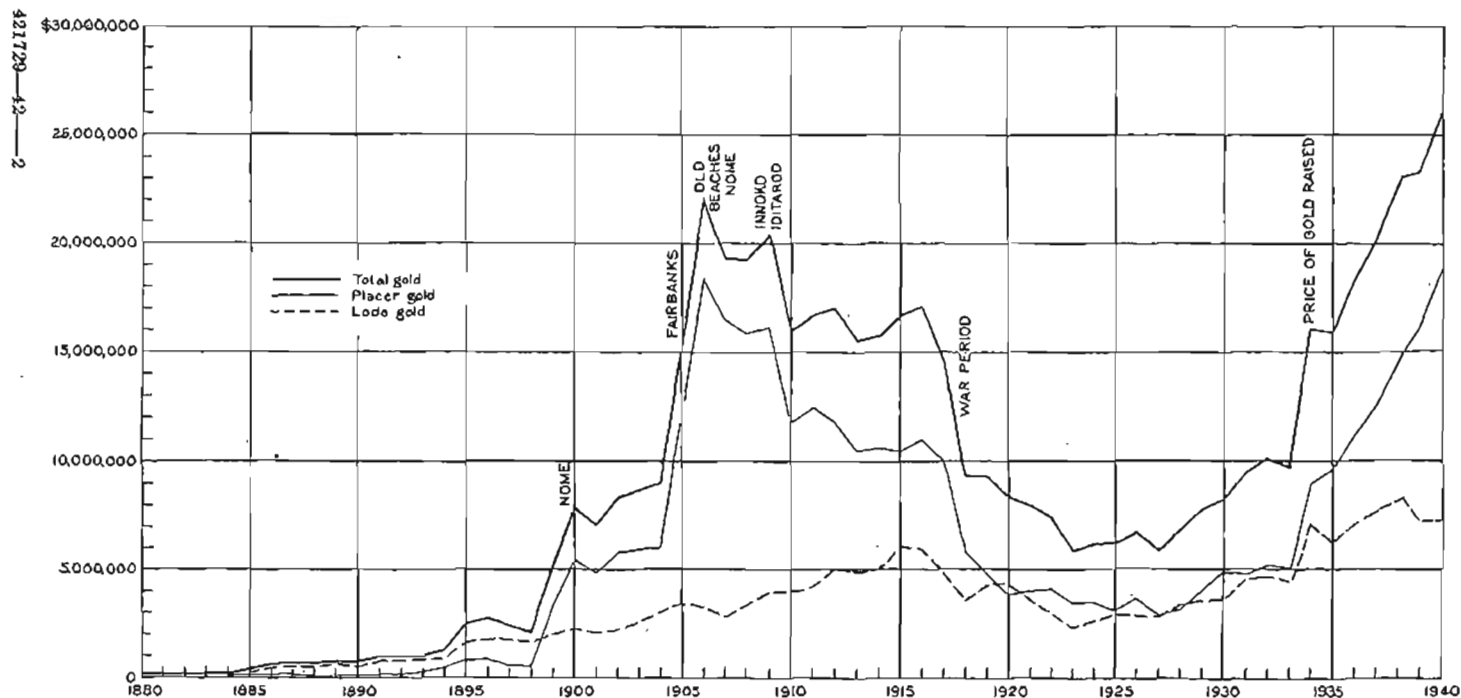


FIGURE 2.—Trend of value of gold production of Alaska, 1880-1940.

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. The rise in the unit price of gold in 1934, coupled with the stimulation of gold mining that had been in progress, so increased the value of the production that in 1940 it exceeded that of the boom days of gold production in the Territory.

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 table on page 12 shows the amount and value of the gold produced annually for the last 40 years, the total amount produced since gold mining began in the Territory in 1880, and the value of the gold derived from each of the two principal types of gold mines. The annual production for each year since 1880 and the sources, since 1884, are also shown graphically in figure 2. Of the \$562,114,000 in gold that has been produced from Alaska mines, \$366,926,000 or somewhat more than 65 percent has come from placers and \$195,188,000 or slightly less than 35 percent from lodes. In the past the relation between the outputs from these two sources has varied widely. Thus, up to 1898 the production from lodes was greater than that from placers. Then ensued a period of more than 20 years when the annual production from placers far exceeded that from lodes. From 1919 to 1933 the production was about evenly distributed between the two sources. Since then, with the growth in the mining of extensive low-tenor placer deposits by highly mechanized plants, the production of gold from the placers has exceeded that from the lodes; so that for a number of years the spread between the production from these two sources has been wider, and in 1940 the ratio was almost 3 to 1. There is reason to believe that the current rates of production are by no means rates that may not be maintained or exceeded in succeeding years. Although the output of placer gold may be expected to lessen eventually, the time is apparently not near at hand; and increasing production from the lode mines may be predicted with all confidence.

GOLD LODES

Alaska lode mines in 1940 yielded \$7,326,000 in gold, or \$105,000 more than in 1939, when the production was \$7,221,000. The gold derived from lodes was about 28 percent of the entire gold production of the Territory, or somewhat less than the proportion in 1939. The lode gold was recovered from widely distributed mines, but approximately 65 percent came from mines in southeastern Alaska, as shown in the following table:

Gold produced from gold-lode mines in Alaska in 1940, by districts

	Fine ounces	Value
Southeastern Alaska.....	135,886	\$4,756,000
Willow Creek.....	53,086	1,858,000
Fairbanks.....	15,914	557,000
Nabesna.....	986	34,500
Other districts.....	3,443	120,500
Total.....	209,315	7,326,000

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 nearly three-fifths of the total lode-gold output of the Territory in 1940. The magnitude of the company's mining operations is set forth in its published report to its stockholders,³ from which the following statements are abstracted: The total rock mined and trammed to the mill in 1940 was 4,739,790 tons. Of this amount 2,431,393 tons of coarse tailings were rejected, and 2,308,397 tons were fine-milled. The average gold content of all the material mined during 1940 was 0.0331 ounce to the ton. The amount of gold in that part of the rock that was rejected was about 0.0065 ounce to the ton, and the gold content of the rock that was further treated was about 0.0612 ounce to the ton. Of this content 0.0081 ounce to the ton was lost during the treatment, 0.0442 ounce was recovered as bullion, and 0.0089 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.

³ Alaska Juneau Gold Mining Co., 26th Ann. Rept., for the year ended December 31, 1940.

Production of Alaska Juneau mine, 1893-1940

Year	Ore (tons)			Metals recovered			
	Total	Fine milled	Coarse tailings rejected	Gold (ounces)	Silver (ounces)	Lead (pounds)	Total value ¹
1893-1913.....	507,254	330,278	176,976	34,240	(²)	(²)	\$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	273,207	459,445
1919.....	692,896	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	781,390
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	2,268,998	1,893,352	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	4,582,559
1935.....	3,729,660	2,091,475	1,638,185	118,998	77,787	1,455,167	4,281,110
1936.....	4,366,800	2,462,046	1,904,754	149,235	101,591	2,192,594	5,400,621
1937.....	4,442,760	2,251,079	2,191,681	151,671	120,691	1,980,405	5,516,414
1938.....	4,663,880	2,478,928	2,184,952	148,103	121,473	2,152,714	5,364,488
1939.....	4,648,060	2,377,718	2,270,342	129,012	111,494	2,040,280	4,695,537
1940.....	4,739,790	2,308,397	2,431,393	122,470	100,633	1,666,016	4,447,171
Total.....	79,505,488	42,217,033	37,288,455	2,638,320	1,745,989	37,308,168	71,913,924

¹ Based on company's valuation.² Lost in tailings.

The cost of mining in 1940, as stated by the company, was 36.8 cents for each ton of ore trammed to the mill, the cost of milling was 22.6 cents, and all other marketing costs and expenses amounted to 10.8 cents, making the entire operating cost for each ton of ore trammed only 70.2 cents. This indicates the exceedingly efficient operation in handling a deposit of this low-grade type, which could have been brought about only through capable management and the adoption of every technical means for maintaining and stimulating production in all stages of the enterprise.

The output of gold from this company's property in 1940 was approximately \$229,000 less than in 1939, owing mainly to the somewhat lower tenor of the ore mined and the lesser amount that was milled. Operating costs and expenses were reduced 3.4 cents a ton below the charges for similar outlays in 1939. Although the supply of unskilled labor was adequate throughout the year, the many emergency defense enterprises calling for skilled labor and paying abnormally high wages depleted the supply of artisans at the mine, so that for most of the year the supply was inadequate and the turn-over was heavy. The death of L. H. Metzgar, superintendent of its Juneau operations, was a serious loss to the company. Much of the splendid engineering and operating efficiency that has marked the development of the property during the past 18 years is at-

tributable to the personal skill and ability of Mr. Metzgar. The company reports that during 1940 more than 34,000 linear feet of underground openings were made, and nearly 79,000 square feet of stope area was cut out. The main shaft was sunk from the 1,000- to the 1,300-foot level, the drainage tunnel started in 1936 was completed, and a long drift to the east was started on the 1,000-foot level to explore the deeper parts of the so-called South Orebody. During 1940 the ore was mined from the various parts of the property as follows: North Orebody, 16 percent; South Orebody, 43 percent; Perseverance section, 41 percent. No notable changes were made during the year in the milling practice except to complete the regrinding installation that was started in the preceding year. Progress was made on relocating the Annex Creek electric transmission line, which will probably be finished in 1941.

In the more remote areas of the northern part of southeastern Alaska, which for convenience are here considered as included within the broad limits of the Juneau district, some lode mining and prospecting was in progress in 1940. Among the areas of this sort may be mentioned Admiralty Island, Eagle River, Berners Bay, and Glacier Bay. On Admiralty Island, some 20 miles southwest of Juneau, the Alaska Empire Gold Mining Co. was mining on its property near Hawk Inlet, where work has been in progress on a small scale for a number of years. So far as reported to the Geological Survey, no productive mining was done at the property of the Admiralty-Alaska Gold Mining Co. on Funter Bay, a few miles north of Helm Bay, on the west coast of Admiralty Island. In the Eagle River district north of Juneau, activity was reported to have been revived in reopening the deposits on several of the old lode claims that have been taken over by the Echo Cove Mining Co. Work there consisted mainly in preliminary surface developments. Still farther north, in the Berners Bay district, local reports indicated that arrangements had been made for reopening the old Kensington and Comet mines near Jualin, under Canadian management, and that Belgian interests were negotiating for other properties in the same general district. In the Glacier Bay district, which lies some 80 to 100 miles northwest of Juneau, small shipments of ore were made from deposits near Reid and Lamplugh Glaciers. Work at both these localities was mainly prospecting—that near Reid Glacier by J. P. Ibach and associates on the Rainbow claims, and that near Lamplugh Glacier by A. L. Parker on the LeRoy claim. Doubtless at many other places throughout the northern part of southeastern Alaska lode prospecting on a small scale was in progress, though details regarding such prospecting has not been specifically brought to the attention of the Geological Survey.

The second most productive lode-gold district in southeastern Alaska is on the west coast of Chichagof Island, some 75 miles southwest of Juneau. In this district the two principal mines are the properties of the Hirst-Chichagof Mining Co., at the head of Kimshan Cove, some 65 miles northwest of Sitka, and of the Chichagoff Mining Co., near Klag Bay, a few miles to the southeast. The season's work at the Hirst-Chichagof mine proceeded at essentially the same rate as in recent years and with equally satisfactory results. The mill was in constant operation at approximately capacity load. In the mine, besides getting out the necessary flow of ore, the passages were searched for extensions of the known ore bodies or for new ones. At the Chichagoff mine practically no underground mining was carried on during 1940, but the work that year consisted in re-treating some of the old tailings that had accumulated during earlier years. A number of other lode properties are situated at intervals all along the western coast of Chichagof Island. Few of them are being energetically prospected and at most of them the only work that has been done recently is the minimum required by law to protect the title to the claims. The extensive mineralization that has already been recognized in this part of Chichagof Island encouraged the Geological Survey to make an especially intensive study of the area near the two larger mines and of some of the nearby prospects. This study was made with the expectation that the results would assist prospectors and others in interpreting the geology of the deposits with which they were concerned and thus would lead to better-directed effort through an understanding of the features to be sought or avoided. A report setting forth the results of this study is now in the course of publication by the Geological Survey.⁴ This report describes in considerable detail not only the principal mines but also many of the smaller prospects.

The Ketchikan district of southeastern Alaska, as the term is here used, embraces the entire southern part of the region. In the past it contained scores of lode-mining properties that have yielded gold to the value of more than a million and a quarter dollars. Lately, however the annual gold output of the district has been but a small fraction of that sum, and at present only a few producing mines are in the entire district. The two tracts in which most mining was in progress in 1940 were on Prince of Wales Island, some 40 miles west of Ketchikan, and on Cleveland Peninsula, some 25 miles north of Ketchikan. Much of the mining on Prince of Wales Island centers around Kasaan Bay. Near the head of this bay and its extension, Twelvemile Arm, are the properties of the Alaska Gold

⁴ Reed, J. C., and Coats, R. R., *Geology and ore deposits of the Chichagof mining district, Alaska*: U. S. Geol. Survey Bull. 929 (in press).

& Metals Co., of the Flagstaff Mining Co., and of Wendell Dawson. The Salt Chuck mine of the Alaska Gold & Metals Co. is especially interesting because its ore, in addition to carrying gold and copper, contains recoverable amounts of palladium, one of the members of the platinum metals group. Its occurrence will be mentioned later under the subject "Platinum metals," on page 72. The Flagstaff property was visited by a Geological Survey party consisting of J. C. Reed and J. Van N. Dorr early in 1940. At the time of their visit the mine was developed by means of a main level 1,120 feet long, a 55-foot winze, and five small stopes. The surface plant and equipment, in addition to the necessary camp buildings, consists of a 20-ton mill and a 1,800-foot aerial tram from the mine to the mill. The satisfactory milling of the ore was said to have been somewhat difficult, as only a little of the gold appears to amalgamate.

In the Cleveland Peninsula area of the Ketchikan district the small lode-gold mines that were operating were in the neighborhood of Helm Bay. Of these, the two principal producing mines were the old Gold Standard and the Blue Jay mines, but some development or prospecting work was in progress at several other properties.

The Geological Survey has received no report of any productive mining during 1940 at any of the old mines on Revillagigedo Island in the immediate vicinity of Ketchikan, though several of the mines, especially those on Thorne Arm, have been at times noteworthy producers.

In the Hyder district, which includes a considerable tract of country at the head of Portland Canal, in southeastern Alaska, practically no gold-lode development was in progress, and even the sudden increase of interest in prospecting that was awakened earlier by the great increase in the price of gold seems to have practically died out. So far as the Geological Survey is informed, only desultory prospecting was in progress at a few of the properties that a few years before had been active, and no significant amounts of ore or concentrates were shipped from any of them during 1940.

The Willow Creek district, at the head of Cook Inlet, has long been the second most productive lode-gold district in the Territory and has produced gold worth more than \$12,140,000 since lode mining started there in 1909. Mining was in progress in 1940 at several camps scattered through the district, but the three largest producing mines were the Independence mine of the Alaska-Pacific Consolidated Mining Co., near the head of Fishhook Creek; the Lucky Shot and War Baby mines of the Willow Creek Mines, on Craigie Creek; and the Fern mine, operated by the Fern Gold Leasing Co., near Archangel Creek. In addition, lode-gold production was reported from the Gold Cord, the Gold Bullion, and the Mabel mines, as

well as from a number of smaller properties where the season's work was little more than prospecting and the carrying on of preparatory examinations.

The Alaska Pacific Consolidated Mining Co.'s property embraces most of the former holdings of several independent mining companies that covered the country west of Fishhook Creek, the ridge between that stream and the head of Willow Creek, and considerable tracts in the valley of the latter stream. A number of separate veins have been found, and on several of them extensive underground openings have been made. For a while each of these veins was developed independently, but as the various holdings have become better coordinated the mining and milling have been carried on through more unified plans. The process of unification is still going on, and in 1940 a considerable step in furthering that process was brought about through the driving of a long, low-level tunnel to crosscut several of the veins and thus afford an economical line of communication for handling the ores from the higher levels. This crosscut tunnel has not yet been extended far enough to intercept the Independence vein, and it will probably be a year or more before that connection is made. The new surface plants that have been erected have been especially well designed to afford maximum convenience and efficiency, as well as comfortable quarters for the personnel.

At the Willow Creek Mines the principal new development during 1940 was the installation of a 20-ton ball mill, which brings the capacity of the plant up to about 60 tons a day. The former practice of cyanidation and flotation of the concentrates was discontinued, and instead the table concentrates are shipped to a smelter in the States for treatment. New developments underground consisted in the extending of drifts some 1,000 feet and the driving of a new crosscut adit, which ultimately will intercept the vein at a distance of about 1,400 feet and thus greatly reduce the amount of tramming hitherto required along the old adit. At the end of the year the new adit was reported to have reached a point about 500 feet from the portal. About 65 men were employed on the property.

Work at the Fern mine was accelerated during 1940, owing to the increased transportation facilities afforded by the completion of the new low-level tunnel, the installation of additional milling equipment, and the modification of earlier milling practice. Alterations and additions to the surface plant have greatly improved the living quarters and conditions. The concentrates from the property are trucked to a specially constructed wharf on Goose Bay, a reentrant on the west side of Knik Arm some 40 miles southwest of the mine, whence they are shipped by local carrier to a smelter in the States.

Considerable activity was shown during 1940 at the Gold Cord mine, which is near the head of Fishhook Creek a short distance north of the Independence mine. At this place a new management had taken over the property and spent most of the open season in rehabilitating the camp buildings and enlarging and renovating the mill. At the time of the writer's visit in August 1940 these surface improvements were occupying practically the entire attention of the management, so that much of the underground development was put off until later in the season when the weather would be unsuitable for extensive surface work. It is understood, however, that the preliminary investigations of the ore deposits were adequate to convince the management that sufficient ore could be readily developed when needed to justify the expenses that were being incurred and that the mine probably would become one of the large producers of the district.

One of the properties in the Willow Creek district that reported a considerable output is that of Rapp and Till, near the central part of the Craigie Creek Valley. It is perhaps a nice question for academic discussion as to just what classification—lode or placer—this mine should be placed in. This enterprise is based on the reworking of the tailings from the old mill of the Gold Bullion mine that of course were originally gold-bearing lode material. The extraction of the gold is effected by means of a 35-ton cyanide plant utilizing the principles of agitation, counter-current decantation, and precipitation. The handling of the material on its way to the cyanide tanks has many features in common with certain stages in ordinary placer mining.

One of the new developments in the Willow Creek district during 1940, according to local reports, was the taking over of the old Thorpe claims on Grubstake Creek by a company that is said to have installed a tram and mill on this property, and also to have developed it considerably underground. This work is of special interest to geologists because the bedrock of the claims is dominantly schist instead of the granitic rock, which everywhere else in the district is the wall rock of the productive veins. Whether or not the difference in environment has had significant effect on the mineralization, or whether the two types have any close geologic relation to each other, are matters that cannot be determined without more extensive knowledge of the habits and characteristics of the veins in the schist area.

The third most productive of the Alaska lode-gold districts that are listed separately in this report was that in the vicinity of Fairbanks. The production of lode gold from this district in 1940 was \$557,000, which, although only a few thousand dollars more than in 1939, marks an all-time high that has not been exceeded in any other

of the nearly 30 years during which lode mining has been in progress in that camp.

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 larger producing mines lie outside the borders of the quartz diorite mass that forms the higher parts of Pedro Dome, in the old metamorphic schists that have been intruded by that mass and affected by it. The three largest producing mines in this area are those of the Cleary Hill Mines Co., the McCarty mine, and the Hi Yu Mining Co., but at a dozen smaller properties in the same general area some mining or prospecting was actively in progress.

The McCarty property, which is near the divide at the head of Fairbanks Creek, was leased by the Fairbanks Department of the United States Smelting, Refining & Mining Co. Exploration of the deposits and milling of the resulting ore were carried on uninterruptedly throughout 1940. During that time some 639 feet of drifts and crosscuts were driven and 545 feet of raises made. In the mine, which is opened up by means of a shaft 250 feet deep, altogether nearly a mile of underground passageways and 1,750 feet of raises have been made, and considerable ground has been stoped. The ore is milled on the property at a small plant equipped with a two-stamp Nissen mill with plates and crusher. The vein is rather narrow, somewhat irregular, and difficult to follow, but the ore is high grade and readily gives up its gold to simple milling treatment. The success of this project, while attributable in good part to skillful management and adequate funds, appears a clear demonstration of the fact, sometimes questioned, that some of the small gold veins in the Fairbanks district are capable of being worked profitably for considerable periods.

The property of the Cleary Hill Mines includes much of the tract of country between Bedrock and Chatham Creeks. The underground developments are mostly extensions of the work originally started at the Rhoads-Hall mine. The structural problems connected with the search for ore are extremely complex, as the faulting, which has been considerable, has greatly disturbed extensive tracts of the country; yet there is a woeful lack of recognizable geologic markers by which the movements may be deciphered. Most of these problems have now been adequately worked out. The output of ore necessary to supply the mill currently has been blocked out so that no longer is extensive underground exploration so urgent. As a result, the company has done considerable surface prospecting in the

eastern part of its property near Chatham Creek. The surface plant at the property has been constantly improved and is in effective condition. The mill is equipped with a battery of gravity stamps and the necessary gold-saving devices, including small flotation cells. Power for the mine mill and for miscellaneous camp uses is supplied by a modern Diesel engine.

The other principal mine in the eastern area of the Fairbanks district is the Hi Yu mine on Too Much Gold Creek, a tributary of Fairbanks Creek. No specific report has been received by the Geological Survey as to new developments at this mine in 1940, but it is believed that work was carried on at approximately the same rate as it has been in recent years. This property has a well-equipped camp with the necessary bunk and mess houses, other accessory buildings, and a powerhouse and mill. The mill has two batteries of five stamps each with the usual plates and gold-saving devices. The sulfides in the ore are concentrated by means of small flotation cells and the resulting concentrates are shipped for treatment to smelters in the States.

In the Ester Dome area of the Fairbanks district the production of lode gold in 1940 was at a somewhat lower rate than in the preceding year, but development was active at several properties that, although not producing, were being put into shape to become so in the near future. Among the properties in this area that reported greatest activity were those of the Mohawk Mining Co. on St. Patrick Creek, the Happy Creek mine near Happy Creek, and the Ryan lode on the ridge between St. Patrick and Eva Creeks. In addition, there were half a dozen or more smaller mines and prospects at widely scattered places on Ester Dome that individually yielded only small amounts of gold but collectively contributed considerable gold to swell the total of the district. It should perhaps be noted that the inclusion of the Ryan lode in the foregoing list of properties is due to the large amount of development work that was in progress there as it was not a significant producer in 1940. The Bartholomae Oil Corporation of California has acquired this property and under the direction of B. W. Vallat, has made an extensive series of trenches and surface cuts to trace its mineralized zones. The tests have been supplemented by geophysical investigations and by an analysis of the factors incident to opening up the deposit on a large scale. As a result, a mill site has been laid out in the valley of St. Patrick Creek, and from near that point it is proposed that the main working crosscut will be driven in to intersect the vein in depth.

The fourth most productive of the Alaska lode-gold districts shown separately in the table on page 15 is in the Nabesna River Valley.

This district, at the present time, has only one producing mine, that of the Nabesna Mining Corporation. The Survey under its regular practice would not be permitted to disclose the production of a single mine, but, as this company itself publishes for its stockholders statements of its operations, that restriction is removed. The most significant information regarding the season's work at the property is that, while mining was much less active during 1940, prospecting was continued at a high rate. Unfortunately, although the search for new ore bodies in the Nabesna mine proper was not successful, the findings on the Golden Eagle are reported to have been encouraging. Milling was carried on at a reduced rate during most of the year and was discontinued entirely by September 11, after which the equipment was overhauled so as to be in condition for resuming operations in 1941. All work was suspended for the winter about October 1, and only a watchman will remain on the property until spring. During the field season a Geological Survey party carried on extensive examinations in the immediate vicinity of the mine, as well as in the more distant parts of the area. The results of that work are published as a separate chapter⁸ of this volume and furnish a comprehensive account of the geology and mineral resources of the district.

Among the lode-gold districts that are grouped together in the table on page 15 under the heading "Other districts," the most productive, named in the order of output, are the Kantishna district, on the northern slopes of the Alaska Range; the Kenai Peninsula district, including the Nuka Bay area, the area south of Hope, and the hills north of Girdwood; the Nixon Fork district, in the Kuskokwim region; the vicinity of Valdez and other parts of the Prince William Sound region; and a few districts widely scattered through other parts of central and western Alaska, the gross output of which totaled only a few thousand dollars in gold. In practically every one of these districts the production in 1940 came from a single mine, so that to avoid disclosing the individual output it has been necessary to combine the statistics.

The only producing lode-gold mine in the Kantishna district is that of the Red Top Mining Co. This property includes a large number of claims on Friday Creek and on the ridge between that stream and Eureka Creek and in the valley of Eureka Creek. The principal camp of the company is on the Banjo claim near the head of Lucky Gulch, a small tributary to Eureka Creek from the north. Near this camp are the main mine openings and the mill. Extensive developments at this mine were commenced late in the season of

⁸ Moffit, F. H., and Wayland, R. G., *Geology of the Nutzotin Mountains, Alaska; Gold deposits near Nabesna*: U. S. Geol. Survey Bull. 933 (In preparation).

1939, so that much preparatory work remained to be done in 1940. Much of the early part of 1940 was therefore lost in getting into running order, so that only a part of the year was spent in production work. It is understood, however, that much of the necessary dead work has now been accomplished so that the mine should be in good shape for an early start and full season in 1941.

The principal districts in the Kenai Peninsula district in which some lode gold is known to have been mined in 1940 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 been intruded locally 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 sulfides are by no means uncommon. Little information is available on new lode-gold developments in any of these areas in the Kenai district, and it seems likely that no new developments of other than local significance occurred in any of them. In all the areas the mines are small, only a few men being employed in each, and most of the equipment is of a simple type.

In the Copper River region the only producing lode-gold mine is the Sheriff mine of the Yellow Band Gold Mines, Inc., in the Bremner district. No important changes were made in the general equipment or method of operating. Much of the early part of the season of 1940 was spent in repairing damage done during the preceding winter by snowslides. By July 5 the mill was started and until October 10 was run intermittently. A crew of about 10 men was employed on the property throughout the open season, but with the coming of winter all work was discontinued and only a small watch force retained. The mill is equipped with a 50-ton Marcy ball mill, an amalgamator, a classifier, and a Wilfley table. Most of the ore treated was produced incidentally to the development and exploration work rather than as a result of direct attempts at productive mining. In the course of this work approximately 200 feet of drifts and crosscuts were driven and somewhat more than 100 feet of raises cut. The average weighted value of the ore along a stretch of about 200 feet and for a width of 30 inches is said to be in

excess of \$20 a ton. The management apparently is wisely extending its efforts in thoroughly proving up the property rather than showing undue haste in forcing production in advance of such tests.

In the Kuskokwim Valley the only producing lode-mining area is in the vicinity of Nixon Fork, north of Berry Landing. The principal producing mines in this area are the Nixon Fork mine, operated by Mespelt & Co., and the Southern Cross mine, of McGowan & Lind. Work at the Nixon Fork mine was continued throughout the year at about the same rate as heretofore, and the value of the output of gold recovered seems to have been approximately the same as in 1939. 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 a normal season. The Southern Cross mine is about a mile from the Mespelt property, in the same general geologic setting with relation to the contact of the quartz monzonite intrusive and the limestone country rock. Only a small amount of ore was produced from this property during the year, and so far as reported to the Geological Survey none was milled.

Few details regarding the lode-gold mining in progress in the Prince William Sound region in 1940 have been received by the Geological Survey direct from the operators there. From general sources it is apparent that the lode-gold production of the district was very much less than it has been in recent years. The principal mine in the district is the old Cliff mine, a short distance west of Valdez. Here much of the season of 1940 was spent in development work in driving a crosscut from the bottom of the 500-foot shaft. In the course of this work a new vein was discovered that is intermediate between the main and the footwall vein. The ore in this vein tested well and showed that the amount of free gold in the vein at 500 feet deep compared favorably with the amount in the other veins on the property at higher levels. As a result of this find, the mill was started on October 28 and continued until mid-December with very satisfactory showings. The mill is equipped with six Nissen stamps with inside and outside amalgamation, and the concentrates in the pulp are saved on corduroy tables. The concentrates are shipped to a smelter in the States for treatment. A small amount of lode gold was produced by the Portage Gold Mines on Portage Bay. No noteworthy changes were made in the developments at this place.

The ore is treated in a 15-ton Marcy ball mill, and the pulp passes over amalgamating plates and a Wilfley table. The concentrates are shipped to the States for smelting.

Although not in operation during 1940, the lode-gold mine of the Golden Zone Mine, Inc., in the valley of the West Fork of the Chulitna River, deserves special mention. This property, which is being opened up under the management and direction of W. E. Dunkle, was formerly known as the Wells Bros. prospect. Development at the mine has been in progress during the past 2 years, during which many new schemes were initiated for acquiring the necessary supplies of water throughout the year and for effectively handling the ore and treating it economically. The present plant is designed to have a capacity of 120 to 150 tons a day, but possibly that quantity may be exceeded if the results of certain tests in disposing of some of the waste in the ore proves as effective in actual practice as they seem to be on smaller-scale demonstrations. The ore is a complex mixture of sulfides carrying some copper, silver, and lead, in addition to the gold, which is the principal valuable constituent. Apparently the general method of treatment of the ore will be a coarse screening and crushing plant ahead of the mill, with rejection of the coarse oversize, followed by fine grinding in a ball mill and then flotation, with possibly further treatment of the tails by cyanidation. By the close of 1940 the mill had only been run on a part-time or experimental basis so that many details still remain to be worked out before full-time operation is undertaken. The manager, however, estimates that by mid-1941 the entire plant should be running on a full-time, three-shift basis.

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 McKinley Lake district of the Copper River region, the Yentna district of the Cook Inlet-Susitna region, the Goodpaster district of the Yukon-Tanana region, and a few widely scattered points in Seward Peninsula.

GOLD PLACERS

GENERAL CONDITIONS

Placer mining in Alaska in 1940 yielded gold worth \$18,852,000. This amount marks an increase in value of more than \$2,794,000 and in quantity of nearly 79,830 ounces over the output of the preceding year. In fact, the value of the placer production in 1940 was greater than for any other year in the entire time that placer mining has been in progress in the Territory.

The annual production of placer gold and certain other data relating to Alaska's gold production are represented graphically in figure 2 (p. 13). 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 1899 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 approximately \$18,600,000. In 1918, after the entry of the United States into the World War, placer production dropped to about \$6,000,000, and in the 15 years from that time to 1933 it fluctuated between that amount and \$3,000,000. Since 1934, owing in part to the increase in the mint price of gold and in part to the revived interest in placer mining, the value of the output has rapidly climbed each year until in 1940 it reached the high figure stated above.

The trend of placer mining in Alaska for the last few years has been toward the development of larger enterprises requiring the installation of expensive equipment, such as dredges, draglines, 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. As a consequence, while many small placer-gold operations sprang up almost at once after the announcement of the rise in the price of gold, only recently have any large undertakings that resulted from the stimulation become productive, and some of the larger ones have not yet come into full production. Conversely, when adverse factors arise they usually result first in shutting down the small operators, who can more readily curtail work at their properties because the unavoidable charges on their investment are less. It is too soon, therefore, to gage accurately the results that some of the recent acts relating to taxation, social security, and other matters will have on the placer-mining industry of the Territory, but already some of the small operators have reported that they found the additional expenses so burdensome that they were curtailing their activities. Obviously, before new enterprises are undertaken these additional items of expense will have to be figured in any estimates of the probable returns from the projects.

The stimulus of the high price of gold and unemployment in many businesses in the States have led many to think about turning to prospecting in Alaska as a means of improving their condition. To such it may not be amiss to offer the following comments. The life of the prospector has much that is attractive 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 allurements 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 by those reasonably skilled in understanding Nature's secrets and the ways of acquiring what she has to offer. Prospecting is just as much a specialized business as farming or storekeeping, and outstanding success comes to few in any line of endeavor. Inevitably the life of the prospector is full of physical hardships and should not lightly be undertaken by the ordinary city dweller. It is believed, however, that Alaska still holds opportunities for the capable placer prospector to find tracts that, while not bonanzas, will well repay his best endeavors. It is still true that there are large tracts of Alaska that have not yet been thoroughly prospected or adequately examined, but it should not be forgotten that all the readily accessible parts of Alaska have been at least traversed by prospectors and hunters in the past, so that the newcomer, unless he possesses keener insight or some other qualities that these earlier searchers lacked, is not likely to have his quest for fortune rewarded by stumbling on rich deposits they missed. None of the open unworked areas appear to give promise of holding bonanza deposits that can be won easily and cheaply. Necessarily, the individual's experience, enterprise, and financial resources will determine the sort of search he can undertake most successfully, but it must not be forgotten that it is of prime importance that the newcomer should at least be provided with sufficient funds to defray his living expenses during the time required to obtain employment or find a deposit that will afford some income. It must be remembered, too, that all costs in most parts of Alaska are higher than they are in communities of similar size in the States proper; that the season when there is need for the employment of many persons in most places does not last more than 3 or 4 months; that for one dependent on his current earnings sufficient income must be procured during the short working season to tide over the 8 months or so when jobs are extremely scarce; and finally, should the venture not turn out as well as hoped, that return to the States necessitates a considerable outlay of money for transportation.

General conditions affecting placer mining appear to have been essentially normal, though obviously this does not mean that conditions were uniform throughout the wide extent of territory in which

placer mining is done. Indeed the reports from different camps show wide diversity in climatic conditions even in the same camp. For instance, throughout much of central Alaska the early part of the open season was marked by a deficiency of rain, with a resulting marked shortage of water, and the air was filled with the smoke of many fires that had started in the tundras or woods. Later in the season heavy rains swept over the same area. It is perhaps unnecessary to point out here that the availability of adequate supplies of water for many of the processes involved in placer mining is a matter of first importance to many of the operators of small mines, as it furnishes the needed power for transportation or separation of the gold from the worthless material with which it is associated. At the larger placer mines or those using extensive mechanical equipment less dependence is now placed on the normal gravity supply of water and more and more reliance on the use of pumps to augment or even to replace that supply. Consequently, unless extremely adverse conditions arise, the total production of gold from the placers is increasingly less directly affected by shortage of precipitation than heretofore. This lessening dependence on climatic conditions holds true also for the so-called freeze-up and break-up, because with increased transportation facilities many of the miners can get to their properties earlier and remain on them later and thus make a longer working season. Then, too, the extensive use of thawing equipment at all of the larger properties makes it possible to lengthen the working season by starting earlier in the spring and closing later in the fall.

Labor conditions on the whole were reasonably satisfactory, and most of the time there was a fair supply of unskilled labor available. However, many of the workers, though perhaps having adequate training in a certain trade, were unused to working under Alaska conditions and were not therefore well fitted to meet quickly the unfamiliar requirements. There was considerable unrest because of the drain put on the usual supply of labor through the many emergency enterprises that were trying to buy time by the lavish expenditure of funds. For a while efforts were made toward introducing closed-shop methods into some of the larger placer mines, and some controversies arose as to the selection of the accredited bargaining agencies. These questions, however, were allowed to stand without settlement until they could be gone into more fully at some future date.

PRODUCTION BY DISTRICTS

The description given on pages 1-4 of 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 mineral commodities. This is due to the great number of small producers, who are widely scattered, many being in the most remote parts of the Territory. Frequently the gold they produce passes through many hands before it finally reaches a mint or assay office, so that a single lot is difficult to trace. It may appear in the reports of the individual and then lose its identity by being lumped with other gold by the storekeeper, who took it in exchange for supplies; it may be still further consolidated by the bank, perhaps in some distant district, to which it was sent by the merchant; and perhaps its course may be still further obscured by being shipped to another bank before being turned in to the mint; or the gold may be carried personally by the producer or sent by mail or express to its ultimate destination. Thus records from one source may entirely or partly duplicate those from other sources, whereas for other lots there may not be any definite records at all. Every reasonable effort has been made to check the information from different sources and to adjust recognized 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. In this table the different regions are arranged in geographic order from southeast to northwest. As has so long been the case, 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 1940 and 1939

	1940	1939
Southeastern Alaska.....	\$13,000	\$5,000
Copper River region.....	115,000	146,000
Cook Inlet-Susitna region and southwestern Alaska.....	223,000	214,000
Yukon Basin.....	12,727,000	10,810,000
Kuskokwim region.....	1,299,000	1,283,000
Seward Peninsula and northwestern Alaska.....	4,475,000	3,600,000
Total.....	18,852,000	16,058,000

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, thus 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 geological 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 holds much promise as a placer region, though in a few places where special geologic conditions prevail there is a chance of finding in restricted tracts placers of value.

The entire placer production from southeastern Alaska in 1940 is estimated to have been worth only \$13,000, 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. Placer mining has been active in three areas in southeastern Alaska in the past—near Juneau, in the Porcupine River Valley, and on the beaches between Lituya Bay and Yakataga. No significant amount of productive placer mining is reported to have been in progress in either the Juneau or the Porcupine district in 1940. Near Juneau a small amount of hand mining was done at a few points in the basin of Gold Creek. Current reports indicate that a new attempt was made to mine the placer deposits on Montana Creek north of Juneau and that some equipment was installed on the property, though most of the season was spent in building a road and in surface improvements. Near Windham Bay attempts to develop the detrital material that had been deposited in some of the high-level glacial lakes by draining the lakes through a tunnel at a lower level appear not to have been successful, though no first-hand report of the operations there has been received by the Geological Survey. 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 in general disadvantageous, because only under suitable weather conditions can the placers 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

The Copper River Valley has two principal areas and one minor area that have yielded placer gold, though a few small camps are widely scattered elsewhere throughout the valley of this river. 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 1940 was \$115,000, a decrease of \$31,000 below the production from the same region in 1939. The decrease is attributable to several local causes, none of which, as will be explained later, seem to be due to the exhaustion of the deposits. The greater part of the gold from placers in the Nizina district came from properties on Dan and Rex Creeks. The mine on Dan Creek, formerly the Nicolai Placer Mines, was operated under lease by Joshua Green Associates. Although the ground contains considerable amounts of gold, it was impossible to recover much of the gold because throughout large tracts the placer gravels were so firmly cemented that they could not be disintegrated sufficiently to allow separation of the gold from the worthless material. Efforts to break up the cemented gravel by blasting failed to shatter it sufficiently, and as a result the operators were forced to leave uncleared considerable areas that had been prepared for mining or to put blocks of the cemented material through the boxes and recover only a part of the gold they contained. Necessarily this greatly curtailed the amount of material handled and also reduced the amount of gold that was recovered. At the Rex Creek property, locally known as the Chititu mines, the returns were somewhat less than would be expected from the amount of placer gravel handled. This property is accounted for by the fact that in part of the area mined in 1940 the operators encountered old workings from which much of the gold-bearing gravel had already been taken out. At these two mines a total of 35 men are employed, and in addition perhaps 4 or 5 prospectors were active during the open season on their own claims.

The Chistochina district embraces a rather large indefinite area on the southern flanks of the Alaska Range at the head of the Copper River and extends for some 50 miles eastward from the Richardson Highway. The principal placer mining activity in this district was at the property formerly mined by the Slate Creek Placers, Inc., which in 1940 had been taken over by the Goldfield Consolidated

Mining Co. Although this company did some productive mining, its main activities are reported to have been directed toward carrying out an intensive campaign of testing the ground by drilling and other means. No public statement has been made as to the outcome of the tests, but according to local reports the new company discontinued its operations before the close of the open season and presumably has given up its lease or option. On Grubstake Gulch, which is a tributary of Ahtell Creek, which in turn is a tributary of Slana River, the Ahtell Mining Co. did some hydraulicking, starting May 15 and closing September 15. Five or six small one- or two-man outfits were also prospecting in the Chistochina district and recovered small amounts of placer gold.

In the Nelchina district, which is in the extreme western part of the Copper River region and is most conveniently approached by way of the Matanuska Valley, tributary to Cook Inlet, all the placer mining was done by a few small camps, consisting of only two or three men each. At one of the properties in or near the valley of Albert Creek considerably more than the usual amount of gravel was handled through the recent acquisition of a bulldozer, and more than the usual amount of water was made available by using a small gasoline pump. As a result of these mechanical aids, the placer gold output of the district in 1940 was considerably more than it has been during most of the recent years, though it still amounted to a total of only a few thousand dollars.

COOK INLET-SUSITNA REGION

The Cook Inlet-Susitna region, as the term is used in this report, includes 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. For convenience, the small placer production from southwestern Alaska has been included with that of the Cook Inlet-Susitna region. In parts of this region were some of the earliest and most productive of the gold-placer camps of this Territory. Many of these old camps have gradually played out and been superseded by camps that have sprung up in new areas, and many of these too have now waxed and waned. The placer-gold production from the region in 1940 is estimated to have been \$223,000, or about \$10,000 more than the value of the production from the same area in 1939. In making this estimate the writer feels that it is more likely to be an undervaluation for this than perhaps for any other Alaska placer region. The reason is that many small producers are widely scattered throughout a vast tract of country that is known to be mineralized, many of whom do not supply the Geological Survey with first-hand information as to their season's work. As a result,

the records obtained from other sources, such as banks, assay office, and express shipments, may be interpreted incorrectly, so that due credit is not given to some of the gold that passes through their offices as really having come from this region.

In the relative order of their placer production in 1940 the districts in the Cook Inlet-Susitna region ranked as follows: Yentna-Cache Creek, Valdez Creek, Kenai Peninsula and vicinity, and other miscellaneous scattered small placer camps, including southwestern Alaska.

The most productive part of the Yentna-Cache Creek placer district centers around the Dutch and Peters Hills, which form part of the southern foothills of the Alaska Range and lie some 25 to 35 miles west of the stretch of the Alaska Railroad between Talkeetna and Curry. In general, the productive placer creeks flowing from these hills are tributaries of Peters, Cache, or Granite Creeks, all of which ultimately join Kahiltna River. Peters Creek and its tributaries drain most of the eastern part of the area, and the main stream follows a circuitous course, first southeastward and then southward to its junction with Kahiltna River. Its principal tributaries on which placers were mined are Bird and Willow Creeks. The principal tributaries of Cache Creek on which placer mining was done in 1940 are Nugget, Thunder, Falls, and Windy Creek. Westward across Kahiltna River, on the eastern slopes of the mountain area in which Mount Fairview is one of the dominating peaks, are several streams on which placer deposits occur. This tract, which is locally known as the Fairview area, is here considered part of the Yentna-Cache Creek district. The principal streams in the Fairview district on which placer mining was in progress in 1940 were Pass, Mills, and Twin Creeks. No mining is reported to have been in progress in 1940 on the main Tokichitna River or on any of its tributaries that lie to the north of Peters Creek and in part traverse or rise in the same group of hills that form the highlands in which that stream also rises. In this large district there are between 25 and 35 properties at which 75 to 100 men were employed and some mining was done in 1940. Of these, the largest producer in the valley of Peters Creek and its tributaries was the Alaska Exploration & Mining Co. on Bird Creek; in the Cache Creek area, the Cache Creek Mining Co. on Nugget Creek; in the Granite Creek area, the Dutch Creek Mining Co. on Dutch Creek; and in the Fairview area, the mine of Devault, Devault & Leitz on Pass Creek.

In the Valdez Creek district, which lies some 125 miles north of Anchorage, near the head of the Susitna River, and about 50 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.

The output of placer gold from the district in 1940 appears to have been somewhat less than in 1939. The decrease is at least partly attributable to the shortage of water for mining purposes during most of the early months of the open season. The two principal outfits mining on the main Valdez Creek Valley are Carlson & Associates on the Folk bench claim, and Fairfield & Associates on Joplin bench claim. Some mining was also done on claim No. 4 above, on White Creek. At the Folk claim the owner reports that the gold recovered in 1940 was in unusually coarse pieces. Toward the end of the season it was announced that arrangements had been made to lease an extensive tract on White Creek to one of the successful miners in the Fairview area of the Yentna district, who planned to mine it intensively during 1941.

The producing camps in the Kenai Peninsula district are scattered rather widely in the northern part of the peninsula, which extends from near the Moose Pass station on the Alaska Railroad to the little settlements of Hope and Sunrise on the southern shores of Turnagain Arm. For convenience, the small amount of placer mining in the vicinity of Girdwood on the northern shore of Turnagain Arm is also included in this district. Unfortunately, the Geological Survey has received only a few specific reports as to recent placer mining in this district. From such general information as is available it seems evident that somewhat less than the usual amount of placer mining was in progress in the district in 1940, and such as was done yielded somewhat less gold than in the immediately preceding years. The absence of much local news regarding placer mining in the district indicates that no noteworthy new developments took place during the year. Such mining as was done seems to have been carried on at essentially the same places as heretofore and at extensions of that earlier work.

A small production of placer gold is also reported to have come from a little desultory mining at a few points on Kodiak Island. This mining was confined almost exclusively to the beach and coastal-plain deposits near Red River, on the southwestern coast of the island. Here, at times, as many as five to seven men are said to have employed their leisure in simple hand methods of washing the gold from the sands. For all practical purposes it may be considered that no serious attempts to develop any of the potential placers of the region have been made, but that the amount of gold recovered by the desultory work indicates that placer gold occurs there in quantities that would warrant a more thorough search for profitable deposits.

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 streams 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 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 to any of the legal subdivisions, such as 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 1940 had a gross value of \$12,727,000 which is \$1,917,000 more than in 1939, when the value was \$10,810,000. This large increase is not to be attributed to any specially favorable condition but is largely due to the coming into full production of several new enterprises that have been in the course of development during preceding years and to the more extensive utilization at many of the older properties of modernized mechanical equipment capable of handling larger volumes of placer material more effectively. It cannot be viewed as a mere temporary spurt resulting from some spectacularly rich finds but marks rather a rate that, under reasonably expectable conditions, will be maintained, if not bettered, in the next several years.

In the following table the districts are arranged in order of their placer production in 1940, and for comparison the production from the same districts in 1939 are 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 many 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, 1940 and 1939, by districts

District	1940	1939	District	1940	1939
Fairbanks.....	\$7,315,000	\$5,041,000	Bonnifield.....	\$167,000	\$188,000
Circle.....	1,462,000	1,398,000	Kantishna.....	139,000	
Innoko.....	935,000	638,000	Rampart.....	63,000	31,000
Iditarod.....	803,000	776,000	Eagle.....	19,000	18,000
Hot Springs.....	518,000	396,000	Chisana.....	14,000	20,000
Marshall.....	344,000	421,000	Chandalar.....	3,000	8,000
Fortymile.....	276,000	341,000	Miscellaneous ¹	34,000
Tolovana.....	253,000	226,000	Total.....	12,727,000	10,810,000
Ruby.....	215,000	216,000			
Koyukuk.....	167,000	92,000			

¹ Includes Big Delta, Richardson, Fort Gibbon, Morelock, and Tozi areas.

The foregoing table presents in condensed form a comprehensive summary of the general placer-mining situation in the Yukon region in 1940 as contrasted with that in 1939. From this table it will be evident that the value of the output in 1940 was \$1,917,000 more than in 1939. The individual districts differed greatly in their contribution to the total for the region and also in the amount that each produced in the different years. On the whole, however, the increase was distributed among all the large producing districts, and the only decreases recorded were relatively small or occurred in the smaller producing districts. Only 5 districts showed a falling off in their placer-gold production, and the total amount of their decrease was less than \$160,000, whereas 11 of the main districts, exclusive of the scattered producers included in the table under "Miscellaneous," produced over \$2,000,000 more placer gold in 1940 than in 1939. Information as to the principal happenings of the year in each district is given in more detail in the following pages. The order in which the districts are taken up corresponds to the order given in the above table, namely, in the order of the value of the placer-gold production in 1940.

The indefinite tract of country adjacent to Fairbanks, here called the Fairbanks district, has long been and still is the main placer district in Alaska. In 1940 it furnished over 57 percent of the placer gold produced from the entire Yukon region and approximately three-eighths of the entire placer gold produced from Alaska placer mines in that year. This is an especially good showing, because in that district during most of the early part of the season the supply of water available for mining was less than normal.

The greatest amount of gold from the district was produced by the Fairbanks Department of the United States Smelting, Refining & Mining Co. with its eight dredges on Goldstream, Pedro, Cleary, Fish, Cripple, and Ester Creeks, and its scattered small hydraulic plants. One other company, the Nome Creek Mining Co., was engaged in dredging in the district. Its dredge is on Nome Creek, which, although considered by some as being in the Tolovana district, is treated in the Survey reports as part of the Fairbanks district. Considerable placer-

gold was also recovered by several other companies using hydraulic, open-cut, and drift mining methods. Placer gold recovered by the smaller operators, using other methods than dredging, came principally from Goldstream and its tributaries, Gilmore, First Chance, Nugget, Eldorado, and Happy Creeks; from Chatanika River and its side streams or their tributaries, Dome, Vault, Cleary, Wolf, Kokomo, Faith, and Sourdough Creeks; from Chena River and its side streams or their tributaries, Fairbanks, Alder, Pearl, and Fish Creeks; from No Grub Creek, a tributary of Salcha River, and from Nome Creek. Several other streams also had some placer mining. Although the production from some of these other placer camps individually was worth only a few hundred or a few thousand dollars, in the aggregate they helped considerably to swell the total production of the district.

The principal operator in the Fairbanks district was the Fairbanks Department of the United States Smelting, Refining & Mining Co. The main new item of interest regarding the work of this company in the district was the completion of its No. 10 dredge in the Cripple Creek area and the beginning of productive mining on the project there, which has been in course of preparation for the past 3 or 4 years. The dredge, with its line of buckets of 10 cubic feet each, has a rated capacity of about 10,000 cubic yards a day. Many new features have been included in the design of the dredge so as to adapt it to the rather unusual condition it must overcome in mining the area successfully. In addition to the productive work that the company is carrying on with its dredges, it is also doing much preliminary work in preparing areas for mining and in testing areas that may prove to contain placer deposits of value. In addition to the preparatory work required in advance of each of the working dredges to remove the overburden and thaw the gold-bearing gravels, similar work was done during 1940 in the areas on which dredges have not yet been placed. Among the larger tracts of the latter class are areas on Little Eldorado and Dome Creeks, which are tributaries of Chatanika River, and on parts of Fairbanks and Fish Creeks, which are in the drainage basin tributary to Little Chena River. Drilling and development work by the company to test some of the areas that are not yet developed was especially active in parts of the lower Goldstream Valley and adjacent country. To one familiar with the great and costly efforts that have been made in many of the placer camps of interior Alaska to get rid of the frost, which renders much of the gravel and overburden a firm unyielding mass, it is somewhat startling to learn that artificial freezing of certain of the deposits has been resorted to. This process is, however, actually in operation in the vicinity of part of the area to be dredged in the Cripple Creek field. There the bulk of material is unfrozen and so thick and so unstable that fears were entertained that slumping of the banks might

endanger lives and property. Consequently, the company set up a number of refrigerating plants by which a substance retaining its liquidity at low temperatures was circulated through pipes set in the ground, and the surrounding material was thus frozen to form a series of "dowelpins" to prevent serious movement or collapse of the walls near the dredging pits. The experiment was entirely successful.

In referring at some length to the operations of this principal producing company the fact should not be overlooked that many of the so-called smaller operations here would be considered good-sized mines in other districts. Many of these camps are well equipped with suitable mechanical appliances, mainly draglines and bulldozers, so that they are handling large yardages economically. In fact, it is rather rare nowadays to run across plants using only the simple hand methods that at one time were the principal ones used in the district.

Although by far the greater part of the placer gold attributed to the Fairbanks district is mined within a radius of 25 miles of the town of Fairbanks, there are camps near the head of the Chatanika, Chena, and Salcha Rivers that are more than 60 miles from that center. In certain of the earlier reports, some still more remote placer mines were included, such as those near the old settlement of Richardson, or at Tenderfoot, or on Jarvis Creek, a tributary of Delta River. In this volume, however, the production of these and a few other scattered districts in interior Alaska have been grouped together in the table on page 38 under the term "Miscellaneous" and will be noted in later pages.

The placer gold production from the Circle district in 1940 showed an increase of \$64,000 over the production in 1939. This gain, while extremely gratifying as indicating the excellent condition of the placer industry, can hardly be considered to mark a definite trend, but seems rather to represent a fluctuation such as naturally may be expected from season to season. Considerably more than half the output of placer gold from the Circle district in 1940, as in the preceding year, came from three dredges. Two of these dredges were in the extreme northeastern part of the district, on Coal and Wood-chopper Creeks respectively, and the third was on Mammoth Creek, in the western part of the district near Mastodon Dome. Operators mining with other equipment than dredges were working on almost every creek in the district, and although some of them, as for instance those on Deadwood Creek, reported shortages in the supplies of water, most of them seem to have had normal amounts most of the season. Perhaps some of the increased output of placer gold is to be attributed to the early opening of mining in the spring of 1940. For instance, it is reported that dredging on Mammoth Creek was started nearly 3 weeks earlier than had been done in any preceding year. Most of even the smaller mines in the district are equipped with some mechanical devices for handling more gravel expeditiously and cheaply.

However, there are indications that some of the less experienced operators are being tempted to place too much reliance on the utilization of extensive mechanical equipment as an infallible means of working placer ground that is of too low tenor to be mined under existing conditions. Obviously, such temptations are to be avoided, as they are sure to lead to unwise commitments and ultimate losses.

It is impracticable at this place to record all the creeks in the Circle district on which placer mining was in progress or to record the names of the various operators. A rough estimate of the number of men employed in the mines of the district indicates that upward of 300 were thus employed. The greatest production, other than that of the dredges, came from mines in the eastern part of the district on Portage, Deadwood, and Ketchum Creeks; in the west-central part, on Mastodon, Mammoth, Miller, Independence, and Eagle Creeks; and in the southern part, on North Fork of Harrison Creek and on Half Dollar Creek. The extensive drilling campaign that had been in progress by the Fairbanks Department during 1939 and the early part of 1940 on Harrison Creek apparently did not disclose placer deposits that encouraged continuation of the work, so that further search was given up.

In 1940 the third place in point of placer production among the districts in the Yukon region went to the Innoko district, which increased its production to \$935,000, or \$297,000 more than its output in 1939. The Innoko district, as referred to in these reports, embraces a very wide expanse of territory, including practically all that part of the valley of Innoko River that lies east of its junction with its tributary, Dishna River. In this great district are three more or less distinct centers around which mining has developed. These are the country adjacent to the settlement of Ophir, near the head of Innoko River; an area near Tolstoi, some 25 miles northwest of Ophir; and an area in the extreme eastern part of the district, in the vicinity of the Cripple Creek Mountains. In this district, as in most of the large producing districts of the Yukon region, a considerable part of the placer gold reported was recovered by dredges. Two of the dredges were mining on Ganes Creek, and one each on Yankee and Little Creeks. The dredge on Little Creek was mining only part of the season, as it was closed down early. Ownership of the dredge on Ganes Creek, formerly known as the Holky dredge, was transferred during 1940 to Mr. A. A. Shonbeck of Anchorage and in the list on page 68 is designated as the Shonbeck dredge. In addition to these dredges, there were one or more draglines on Ganes, Little, and Yankee Creeks. Draglines were also reported to have been mining in the same general areas on Ophir and Spruce Creeks. In spite of the extremely low water, which seriously interfered with the freighting of supplies and equipment into the district, the mining operators do

not seem to have been greatly hampered by shortages of water for their work.

In the Tolstoi area the principal production was from the Three Miners' properties on Esperanto Creek and other creeks nearby. Mining at this place is done with a dragline and bulldozer equipment. Although reports indicate a serious shortage of water during most of the season, the output of gold from the area does not appear to have been greatly curtailed.

In the Cripple Creek area of the Innoko district, by far the greater part of the placer gold recovered was mined by draglines and bulldozers, though some of the small mines used only simple hand methods of mining. The principal producing mines are those of the Cripple Creek Mining Co., Hard, Uotila & Hansen, and Sidney Paulson. The Paulson property is on Colorado Creek near the northern flanks of the Cripple Creek Mountains. Most of the mining of the Cripple Creek Mining Co. was on Cripple Creek some 12 miles east of Cripple, on Innoko River, but local reports indicate that the company was also doing some prospecting and development work on Colorado Creek. The principal productive property, that of Hard, Uotila & Hanson, was on Bear Creek; but the group was reported to be doing prospecting and development work on Beaver Creek, a tributary of Bear Creek, and on Graham Creek, as well as on Colorado Creek in the same general area. A little drift mining is also carried on in the area, but during 1940 apparently only a little placer gold was recovered from mines of this type. Prospecting an area of deep ground on Dominion Creek, which is a tributary of Folger Creek, by means of shafts, was said to have been in progress.

Although in 1940 the Iditarod district dropped from its usual place as the third largest placer-gold producer in the Yukon region to fourth place, it bettered its 1939 production by some \$27,000. The total for the district in 1940 was \$803,000. A considerable part of this total came from the dredges of the North American Dredging Co. and the J. E. Riley Investment Co., both of which were mining on Otter Creek, not far from the town of Flat. During the early spring and part of the open season the boat of the North American Dredging Co. received a considerable overhaul, during which new pontoons were installed and much additional machinery substituted for outmoded or outworn parts. All reports indicate that the natural supplies of water were considerably less than normal in 1940. As a result, many of the smaller mines experienced considerable difficulty in their operations and some of them actually found it desirable to close down before they were forced to do so by the freeze-up. The large companies, however, with their mechanical plants, apparently were able to offset some of the shortage by recirculating the supplies available to them. Detailed reports from the individual operators in the dis-

trict have not been numerous or complete enough to allow the writer to enumerate here all of the places where placer mining was in progress in 1940. However, from such general information as has been obtained regarding the district, it is evident that mining was done mainly at approximately the same places and by much the same operators as have been active in the district during the past few years. All the larger camps are within a radius of about 10 miles of Flat, but many of the smaller one- or two-man camps are widely scattered at more remote points throughout this district. The largest producing camps in the district, exclusive of those of the two dredges already mentioned, were on Otter, Flat, Slate, Black, Granite, Happy, Willow, and Chicken Creeks.

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; the other, including the eastern part, with its center at Eureka Creek. The large production of placer gold from the Hot Springs district in 1940, which was \$518,000 as compared with the output of \$396,000 from the district in 1939, is attributable largely to the greatly increased recovery of gold by dredging. The dredge is that of the American Creek Operating Co. on American Creek, in the extreme western part of the district. According to local reports, the dredge completed mining of all the placer ground that was available to the company during 1940, so that there seems to be no intention of using it in this area another season. In the western area, in addition to the dredge, the most productive placer mining appears to have been that of the Cleary Hill Mines Co. on Sullivan Creek, and of the Deep Creek Mining Co. on Deep Creek and adjacent areas. Smaller amounts of placer gold were recovered by other operators in this area on Woodchopper Creek, and on its tributaries, Deep Creek, Miller Gulch, and Cache Creek. In the Eureka area the largest placer production came from deposits on or near Omega, Pioneer, Rhode Island, and Eureka Creeks and the principal mines on each of these creeks were respectively, the Montana Mining Co., J. R. Frank & Co., A. W. Pringle, and Brock & Johnson. Altogether, some 25 separate properties seem to have been active during 1940 in the Hot Springs district and they gave employment to between 115 and 125 persons. It is perhaps significant to note here that while the mining season of 1940 is reported to have been marked by a lack of normal rainfall in the Hot Springs district, many of the mines have been equipped with pumps by which sufficient supplies of water are circulated, so that few of the mines had to suspend operations on account of shortage of water.

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 Hamp-

ton recording precinct. In this large area placer mining or even prospecting is being carried on extensively at only a few places. The three sites showing the greatest amount of mining in 1940 were near Marshall, in the vicinity of Kako Creek, which is a short distance north of Russian Mission, and in the Stuyahok or Bonasila Valley. The placer gold output of this district in 1940 fell considerably below that of 1939. The decrease is to be explained in part by the fact that the principal operator in the Stuyahok Valley, after mining the ground he controlled, moved off his equipment to a new site in the Ruby district, where it will be reassembled and used next season. As a result productive mining was in progress in this valley during only part of the open season of 1940. The largest amount of placer gold mined in 1940 in the Marshall district came from two properties a short distance east of the town of Marshall. One of these was that of Johnson & Ostnes on Willow Creek and the other that of the Wilson Creek Mining Co. on Elephant Creek, a tributary of Wilson Creek. At both these properties near Marshall, mining is effectively done with draglines and tractors, and the gravels are washed in elevated movable units carrying sluice boxes. In the Kako area, so named from Kako Creek, the principal stream in it, the only placer mining reported was on Bobtail Creek, a tributary that joins Kako Creek about 4 miles north of the Yukon. Mining at this place was done by the Yukon Mining Co., using a dragline that dumped into a string of elevated sluice boxes. It is estimated that approximately 50 persons were employed at the four main properties in the district.

The Fortymile district, which includes that part of the Yukon-Tanana region lying adjacent to the Canada-Alaska boundary, was one of the few districts in the Yukon Valley whose placer production in 1940 was considerably less than in 1939. Part or all of the decrease appears to be directly attributable to the scarcity of water for a considerable time in the early part of the open season, as a consequence of which some of the hydraulic mines were unable to operate at full time. The comparison noted above between the output of the district in the 2 years is in a measure misleading because the output in 1939 was abnormally great. Therefore, had the comparison been made between the output of 1940 and 1938, it would have been shown that the production of 1940 exceeded that of the earlier year by \$42,000. By far the greater part of the placer production from the Fortymile district in 1940 came from two dredges—the dredge of the Wade Creek Dredging Co. on Jack Wade Creek and that of the Boundary Dredging Co. on Canyon Creek. The company dredging on Jack Wade Creek was operating under a lease from the North American Mines, Inc., which had mined there in 1939. An item of considerable significance as forecasting enlarged mining activity in the district in the future was

the purchase of the holdings formerly belonging to the Alaska Gold Dredging Co., near the junction of Chicken Creek and North Fork, by the Fairbanks Department of the United States Smelting, Refining & Mining Co. After this purchase, which took place late in the season, was concluded, the new owners immediately began to prepare the property so that it could be mined promptly with the opening of the 1941 season. In addition to the production from the dredge on Jack Wade Creek, three or four other placer mines were in operation on that creek. Of these, the Central Development Syndicate reported the largest production. Other creeks on which gold was recovered by hydraulicking or open-cut methods were Lost Chicken, Chicken, Myers Fork, and Dome Creeks, as well as a score of other creeks where one- and two-man camps made little more than modest grubstakes. The usual number of old-timers searched for gold at favorable localities along the bars of the Fortymile River, especially during periods of low water.

The Tolovana district, as that name is used in this report, embraces a considerable tract of country lying north and northwest of Fairbanks. In it the greatest placer mining activity centers around the settlement of Livengood, which is about 80 miles by automobile road from Fairbanks. The main item of interest relating to the Tolovana district was the progress that was made in developing the placers on Livengood Creek and in its vicinity. This work involved not only the bringing in and constructing of a modern dredge equipped with 6-foot buckets but also the beginning of a project for impounding water in the headwater basin on Mike Hess Creek and conducting it into the Livengood Creek area, where it will be used. Remarkably rapid progress was made in erecting the dredge, and early in September it was in active operation, digging a short distance downstream from the settlement of Livengood. Marked progress was also made in the preparatory work necessary for the new water-supply system. Clearings had been made for the foundation of the dam that was to be built on Mike Hess Creek, a long tunnel had been driven to serve as the flumeway by which the water would be led across the divide between the Mike Hess and Livengood Valleys, and a good start had been made in constructing part of the ditches by which the water would be distributed along the western slopes of the Livengood Creek Valley. The construction of the dam and the completion of the other items of the water-distributing system will not be finished for another year. In the meantime, however, the dredge can be kept in productive operation. The carrying out of this larger project was made possible by grants of funds from the Reconstruction Finance Corporation to the Livengood Placers, Inc. In addition to the placer deposits in and adjacent to the valley of the main stream, workable placers occur in many of

the valleys of the side streams. All the important placer deposits on the side streams seem to occur in those valleys that radiate from a more or less common center near Amy Dome. These include Lillian, Gertrude, Ruth, and Amy Creeks, which flow into Livengood Creek, and Olive Creek, which flows directly into the Tolovana River. A considerable amount of placer gold was recovered in 1940 from deposits in the valley of Wilbur Creek, a stream that is tributary to the Tolovana River from the south, not far from Livengood Creek. Producing placer camps were active on all these side streams during 1940. In the main these camps used hydraulic methods of mining, but several of them had added tractors and other mechanical devices to aid in the work, either for handling tailings or other transportation work or for pumping, and at one property a dragline plant was in use.

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 and including the settlement of Poorman and the various camps adjacent thereto. 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. Few detailed reports as to their season's work have been received from the operators in the district, so that for the following notes the writer has had to rely on more general and perhaps less accurate sources of information. Apparently the camps were handicapped greatly by a shortage of water during much of the early part of the season, but in spite of that shortage the amount of placer gold recovered in 1940 was essentially identical with that in 1939. The reason that the district was able to maintain its position as the ninth most productive district in the Yukon region is probably attributable to the fact that several new camps using modern mechanized equipment are reported to have gone into the district during the year or late in the preceding season. The principal producing creeks in the area near Long are Long Creek and its tributaries, Flat and Greenstone Creeks. On tributaries of the Sulatna River, downstream from its junction with Long Creek but within what may be considered the Long area, there has been placer mining on Spruce and Trail Creeks. The largest producing company in the entire Ruby district is the Long Creek Mining Co., on Long Creek, some 20 miles south of the settlement of Ruby. This company has extensive equipment on the property and is operating with a dragline and two bulldozers. Of four other smaller outfits that were mining by hydraulic methods or shoveling into the sluice boxes, three were on Long Creek proper and one was on Flat Creek. The Trail Creek Mining Co., which late in 1939 had equipped its property on Trail Creek with a modern dragline and accessories, reported that its work had been much handicapped through lack of water, as up to September 7 practically no rain had fallen. In the

area adjacent to Poorman the amount of productive mining was rather less than usual because of the preparatory work in progress at many of the properties on Poorman Creek that originally were mined separately but in 1939 were acquired by Vance Hitt and were to be developed as a group. At this place much of 1940 was spent in getting the available equipment set up and in waiting for the arrival of the dragline, which Mr. Hitt was having transferred from his ground in the Stuyahok area of the Marshall district.

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 areas are the Indian River-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. The supplies of water available for mining seem to have varied greatly in different parts of the district because, while certain of the camps in its more southern part reported that they were handicapped by shortage of water, others a few miles north of Wiseman stated that they were flooded out of their diggings by an excess. Much of the larger part of the present placer production from the Koyukuk district now comes from the upper Koyukuk and Hughes areas. The largest placer production from the entire district came from deposits on Myrtle Creek that were mined by Repo & Schwaesdall with modern mechanized equipment. It is reported that a nugget worth about \$800 was recovered in the course of the work at this property. Altogether, there were some 25 camps in the upper Koyukuk area at which some placer gold was recovered in 1940. In addition to the large mine on Myrtle Creek, camps employing several men each were on Nolan Creek, Tramway Bar, Hammond, Bettles, and Wild Rivers, and some one- or two-man camps at a score of other sites. Most of the mines are being developed by surface methods, but at a few places deep ground is being drifted.

In the Hughes-Indian River area of the Koyukuk Valley, the principal producing camp was that of L. McGee, on Utopia Creek, one of the headwater tributaries of Indian River. This company is opening up two more or less separate tracts of ground at this place. The main camp, near the mouth of the creek, is equipped with a $1\frac{1}{2}$ -yard dragline and the necessary accessories for carrying on the work. Some of the ground handled is said to be as much as 25 feet deep. About 4 miles upstream from this lower camp are the upper claims, which are being mined by hydraulicking. Work at these upper claims was discontinued toward the end of August because of the shortage of water. Altogether, 15 to 20 men are employed by this company.

Although, so far as the Geological Survey is informed, no placer gold was mined in the Hogatza area during 1940, the project that was started in 1939 to prospect part of the area adjacent to the Zane Hills was continued. This work was being undertaken by the Fairbanks Department, which had drill crews in the area during most of the open season and which proposed to continue its examinations until it was satisfied as to the resources. No announcement has yet been made as to the results of the work, but it has already attracted much attention to this area, which has long been untouched.

In the table on page 38, the values of the placer production of the Bonnifield and Kantishna districts in 1939 have been combined and stated as a single amount. This seemed to be necessary if, as promised by the Geological Survey, the records of individual producers were not to be disclosed, because in that year the greater part of the placer production of each district came from a single mine. In 1940, however, as there were a sufficient number of producers in each district, it no longer was necessary to combine the records of the two districts; and therefore the value of the placer production of each has been entered separately in the table and notes on the principal items of significance in each have been stated separately in the following paragraphs.

The term "Bonnified district" is applied in this report to a rather indefinite tract on the northern flanks of the Alaska Range lying between the Nenana River on the west and the Delta River on the east. Throughout much of the mining area the bedrock consists of highly metamorphosed schists cut by granitic intrusives. The camps in the district are widely scattered. The production in 1939 from this district showed an increase over that of the preceding year. The only large mine in the district is that of the Triple X Placers on Moose Creek, a tributary of Nenana River, about 7 miles from the station of Ferry, on the Alaska Railroad. This property, under the management of E. W. Pringle, is being mined by a unique device patented by Messrs. Becker and Hopkins. As this device is often referred to as a "one-bucket dredge," it might have been included in this report among the dredges. However, it has not seemed desirable to so consider it, and it has not been included among the dredges that are listed on pages 67-68. In addition to this mine on Moose Creek, Mr. Pringle and associates are reported to have acquired an extensive tract of placer ground on Eva Creek, some 10 miles from Moose Creek, and under the designation of Standard Mines, Inc., have placed a "one-bucket dredge" on the property, which showed good returns in 1940. The Standard Mines, Inc., also operated a hydraulic mine on Eureka Creek. In addition to the above-mentioned camps, the other producing placer camps in the district were on Totatlanika River and its tributaries, Marguerite and Platte Creeks; on Grubstake Creek, a

tributary of Tatlanika River; on Gold King Creek, a tributary of Wood River; and on Portage Creek, a tributary of the West Fork of Little Delta River.

In the Kantishna district the principal producing placer mine is that of the Caribou Mines on Caribou Creek, a tributary of Bearpaw River, some 10 miles north of the old Kantishna post office. Mining by this company is being done with a dragline, which dumps into a sluicing unit mounted on tractor treads, by which it can be moved into convenient position for operations. The camp is well equipped with all necessary facilities to expedite the work, such as a landing field for small planes, tractors, and bulldozers. Another dragline plant, that of Mehling & Maurer, was also mining on Caribou Creek in 1940. Smaller camps were also reported to have been mining by either simple hydraulic or hand methods on Eureka Creek; on 22 Pup, a small tributary of Glacier Creek; on Caribou Creek; and on Crooked Creek, a tributary to the Toklat River. A group of claims in the Clearwater Valley is said to have been drilled by the Kantishna Mining Co. to test the suitability of the deposits for development by the use of dragline equipment.

Reports from the Rampart district indicate that the revival of mining activity that was indicated by the records of its production of placer gold in 1939 continued during 1940, so that during the latter year it showed an increase of \$32,000 over the value of its production in 1939. This was brought about by an unusually large amount of prospecting and development of some of the old properties through the use of effective mechanical equipment. The largest amount of gold was recovered by Minook, Ltd., which is mining on Little Minook Creek and using a power shovel, bulldozer, and trucks. In addition to this large producer, one other camp was on Little Minook Creek and other productive camps were on Minook Creek, Hunter Creek, and Florida Creek in the areas south of Rampart, and on Quail Creek in the Troublesome Creek area of the same district, but some distance east of Rampart. In addition to the mines and prospects noted above, doubtless a few others at widely scattered points in the district did not report their season's activities to the Geological Survey.

The placer-gold production in the Eagle district for 1940 came from essentially the same general area as in 1939 and is estimated to have been almost identical in value to the production for the preceding year, as the increase in 1940 was only \$1,000. No notable new events were reported. About a dozen small camps were mining on different creeks in the district, but none of them employed more than five men, and many of them consisted of a single operator. The largest enterprise was under the management of Casper Ellinger, on Fourth of July Creek, which joins the Yukon some 30 miles northwest of Eagle.

The second most productive area in the Eagle district was the valley of the Seventymile River, where there were a number of camps not only along the main river but also in the valleys of its tributary streams, in Crooked, Broken Neck, Falls, Barney, and Alder Creeks. Small amounts of gold were recovered from placers in the valley of American Creek.

The few reports of the season's activities in the Chisana district that have been received by the Geological Survey direct from the operators indicate that mining there was carried on during 1940 at very nearly the same places but at a somewhat lower rate than in the preceding year. The decrease was undoubtedly due in large part to the extremely dry season, which limited the amount of water that was available for mining. As in the recent past, the principal camp in the district is that of the Nelson Mining Co., on Bonanza Creek, but there were smaller camps on that stream as well as on Little Eldorado Creek and Glacier Creek and on Gold Run, a tributary of Glacier Creek. Probably not more than 20 men were mining in the district, and all of them used simple hydraulic or hand methods. As the district is one of the less accessible Alaska placer areas, it attracts the casual seeker for gold less than many parts of the Territory that are more easily reached.

Production of placer gold from the Chandalar district in 1940 is estimated to have been only \$3,000, or \$5,000 less than was recovered from its mines in 1939. It is therefore evident that at best only a small amount of productive work was in progress, although according to current reports several prospectors searched for placers or engaged in dead work that has not yet yielded gold. So far as the Geological Survey is informed, three outfits produced some placer gold in the Chandalar district in 1940. These camps were in the valleys of the Big, Tobin, and Little Squaw Creeks. At two of these properties the placers are worked by simple surface methods, but at the mine on Little Squaw Creek drifting methods were employed. On another property on Little Squaw Creek, which was nonproductive in 1940, considerable development work, including the sinking of a shaft, was done in the expectation that it would be in shape to be actively mined in 1941.

The last item under the column for districts in the table on page 38 has been carried as "Miscellaneous." This has been done to bring together reports from a few widely scattered camps that did not fall naturally into any of the other districts. Furthermore, it was a necessary device adopted to avoid disclosing the production of individual operators, as in these scattered areas there was usually but a single mine. Included under the heading "Miscellaneous" are camps in the Big Delta-Jarvis Creek-Richardson area east of Fairbanks and in

the Morelock Creek-Moran-Grant Creek area, which lies within a radius of 25 miles or so of the town of Tanana at the junction of the Yukon and Tanana Rivers.

KUSKOKWIM REGION

Included in the Kuskokwim region are four principal districts where gold placers were mined in 1940. For convenience of description they are here called the Mount McKinley, Georgetown, Tuluksak-Aniak, and Goodnews 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 south border of the district. Although lying in the Kuskokwim drainage basin, the district actually has closer affiliation with the Iditarod district, to which it has better transportation facilities than to many 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. The Goodnews district takes its name from Goodnews Bay, a small indentation of the coast on the east side of Kuskokwim Bay, about 125 miles in an air line south of Bethel.

The production of placer gold in the Kuskokwim region in 1940 is estimated at \$1,299,000. This, although \$16,000 more than in 1939, is practically the same as the value of the placer gold produced from the region in that earlier year. In view of the enormous area included in the Kuskokwim region, the amount of the present production is extremely small, but when it is remembered that there are probably less than 150 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 so much. 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. These are the Moore Creek area, the Candle Creek area, and the Medfra area. The

Moore Creek area lies some 50 miles southwest of McGrath and is near the head of Takotna River. At this place the largest placer camp is that of the Moore Creek Mining Co. This company is mining with a dragline and bulldozers, and, though details are lacking in the Geological Survey as to the results of the year's work, general information indicates that the company had an especially good season and, besides the productive mining noted above, did considerable preparatory work on the additional claims it acquired late in the season of 1939.

The second area in the Mount McKinley district includes Candle Creek, which is a tributary of the Takotna River, lying just west of McGrath. There has long been a small amount of placer mining in the valley of Candle Creek, and at one time a small dredge was used for mining the deposits in the eastern part of this valley. The principal mining work in the area is that done by Strandberg & Sons, Inc., who are using a dragline with the necessary subsidiary equipment. During 1940, when mining was in progress from May 21 to October 24, an average of 22 men were employed on the property. During the early part of the season the company was much handicapped by a shortage of water, but later the supplies of water were rather better than normal.

The third area in the Mount McKinley district lies some 30 miles northeast of McGrath. The placer areas seem to center more or less around the flanks of the Nixon Fork Mountains, in which workable gold lodes have been discovered. No extensive placer deposits have been opened up in the area, and such placer mining as has been done has been carried on by one- or two-man camps. No specific reports from any of the operators in this area have been received by the Geological Survey concerning their work in 1940; but from such general reports as have been received it is evident that the placer production was even smaller than normal.

So far as the Geological Survey is informed, the only placer production in the Georgetown district, in the central part of the Kuskokwim Valley, was from deposits on Crooked Creek and some of its tributaries. Crooked Creek joins the Kuskokwim a few miles west of Georgetown. It has long been the site of a small amount of mining. No information has been received by the Geological Survey as to whether or not the deposits in the valley of George River were mined during 1940. In order that a start might be made in exploring the potential placer and other mineral resources of the Holitna Valley, which includes much of that part of the Kuskokwim Valley south of Georgetown, the Geological Survey sent a surveying party in charge of T. W. Ranta to commence the reconnaissance mapping of as much of that area as conditions permitted. The topography of the country

near the main stream was mapped on the scale of approximately 3 miles to 1 inch. The surveys were continued to a point about 75 miles in an air line south of the junction of the Holitna and Kuskokwim Rivers and covered some 2,000 square miles of the basin.

In the Tuluksak-Aniak district the bulk of the placer-gold production came from the property of the New York-Alaska Gold Dredging Co., in the vicinity of Bear Creek. This company operates two dredges—one dredge with 6-foot buckets and the other with 2½-foot buckets—and a dragline, together with the various accessories needed in the successful carrying out of its extensive plans. The company has installed its own power plant, which utilizes water conveyed by a 4-mile ditch from Bear Creek, and thus is able to produce the power needed at a much lower cost than formerly, when power was generated by Diesel motors using fuel oil that was transported from Bethel to the company's property by plane. The demonstrated success of the work already accomplished and the large holdings that the company has acquired in the district have encouraged the management to formulate plans for enlarging its operations perhaps 50 percent over its present capacity. If these plans are consummated, another and perhaps larger dredge will be added to the company's present equipment.

In addition to the dredging operations on Bear Creek, there were several smaller mines in the general neighborhood. The largest of these seems to have been that of the Garrison Co., on Granite Creek, a tributary of Tuluksak River from the north. Mining by this company was done by means of a small dragline and tractors. Some 10 miles or so south of Bear Creek is Marvel Dome, a prominent landmark on the highland that forms the divide between the eastward-flowing streams that ultimately join the Aniak River and the westward-flowing streams that, like the Tuluksak, join the Kuskokwim not far from Akiak or Bethel. A number of the streams that flow outward from Marvel Dome have placer deposits in their valleys, and several small mining camps are busy on them each year. In 1940, the largest of these, in point of placer-gold production, was the Marvel Creek Mining Co., which consists of Henry DuRand, Fritz Awe, and Luther Hess. This company mined with a dragline, tractors, and bulldozers. Practically all of the placer gravel on Marvel Creek is naturally thawed, so that it can be readily dug. An adequate supply of water flowing on a good gradient is reported to have been available at all times during the open season. Marvel Creek is a tributary of Salmon River, which flows northward and eastward to join Aniak River, which in turn joins the Kuskokwim at a point about 75 miles in an air line northeast of the small settlement of Akiak. On Cripple Creek, which is a tributary of Aniak River,

Peck & Rice were mining under a lease from J. A. Davidson; and, if we may judge from the amount of gold recovered, they had an especially successful season. In fact, it is currently reported that the owner expects the ground to be mined on a much larger scale in 1941 with a complete dragline outfit. Another of the streams in the vicinity of Marvel Dome on which considerable placer mining has been done in the past is Canyon Creek, a tributary of Kwethluk River, which joins the Kuskokwim a short distance west of Akiak. As no report has been received by the Geological Survey concerning mining operations on this stream in 1940, it seems doubtful whether any mining was in progress. Several other small outfits of a few men each are reported to have been carrying on some mining in this same general district, but details regarding their work have not been furnished the Geological Survey, and apparently the total amount of gold recovered was small.

For some time after the discovery of the platinum-bearing placer deposits in the Goodnews district, interest in the gold-bearing placers waned and almost ceased. Within the last few years search for and development of the gold placers has taken an enormous spurt, so that recently the Goodnews area has become one of the large placer-gold districts not only of the Kuskokwim region but of Alaska. The largest single production of placer gold in the district was that of the Bristol Bay Mining Co., which is mining on Wattamuse Creek, a tributary of Goodnews River, about 18 to 20 miles in an air line northeast of the head of Goodnews Bay. The method of mining used involves several unique features, but dominantly it consists in excavating by means of a dredge equipped with buckets that have a cubic capacity of 3 feet each, the dredge being aided in reaching otherwise inaccessible parts of the deposit by the use of an auxiliary dragline. A rather complete description of the equipment and the manner in which it is used is published in one of the recent mining journals.⁶ The second largest amount of placer-gold mining in the district in 1940 appears to have been done by the Goodnews Bay Mining Co. at its property on Snow Gulch, a small tributary of the East Fork of Arolic River. The mining of this placer is being done by a combination of hydraulic and dragline methods. On Kowkow Creek, which is also a tributary to Arolic River, the Kow Kow Mining Co. is mining with a dragline. Another stream in this same watershed on which mining was done is Butte Creek. Mining here is under the management of John Huff, who with a crew of 6 men is using a bulldozer in connection with hydraulicking. Still farther north in the valley of Rainey Creek, a tributary of Eek River, the Eek River Mining Co., under the management of Al Jones, was opening up a new prop-

⁶ Bristol Bay mining: *Min. World*, vol. 3, pp. 20-22, May 1941.

erty by using two Diesel tractors with bulldozer blades and pumping the water needed for sluicing. The results, if we may judge from the quantity of gold recovered, must have been highly satisfactory to the owner, and they are of general significance as demonstrating the presence of workable placer ground in an area that heretofore has not been known to contain such deposits. -

SEWARD PENINSULA

The production of placer gold from Seward Peninsula in 1940, including the production from northwestern Alaska, is estimated at \$4,475,000, or about \$875,000 more than in 1939, itself a year of especially large production. The great increase does not appear to have been made as a result of unusually favorable conditions, and this portends well for the maintenance of the present rate of production for some time. In fact, to judge from the increased mining activity throughout the peninsula and the additional equipment being installed at many of the properties to replace the less effective and more costly manual labor that had hitherto been employed, it would seem entirely reasonable to expect that further increase in production is inevitable.

A large part of the gold recovered from the placers in Seward Peninsula is mined by dredges. In 1940 gold worth \$3,497,000, or slightly more than 78 percent of the placer output of the peninsula and northwestern Alaska, was mined by 23 dredges, one or more of which was 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 64-69.

In the relative order of their output of placer gold in 1940 the mining districts of Seward Peninsula stood as follows: Nome, Kougatok, Fairhaven (including Candle, Inmachuk, and Bear Creek areas), Council, Koyuk (including the areas adjacent to and east of the head of Norton Sound), Bluff, Solomon (including the Casadepaga River area), and Port Clarence. The first five districts stood in the same order as in 1939. 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 estimates of 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 United States Smelting, Refining & Mining Co., Nome Department. This company is operating three dredges in the valley of the Snake River and its tributaries, near Nome, and has extensive ditches, some of which are more than 20 miles long, and other equipment for properly conducting its work. Some notes on the operation of these dredges are given on page 67. The work of this company involves the

dredging of extensive tracts of the coastal plain adjacent to Nome, in which ancient beaches occur at intervals inland from the present beach to the foot of the rock hills that rise steeply some 3 miles or more from the shores of Norton Sound. Much of the area to be mined is permanently frozen, so that considerable preparatory work has to be done in stripping and thawing it before it can be successfully mined by the company's dredges. All the various steps must therefore be carefully planned and coordinated, so that they progress in orderly fashion without interference and at all times provide sufficient ground ahead of the dredges for uninterrupted work. Power for the operation of the dredges, as well as for the many other purposes for which it is needed, is provided by the generation of electricity at a central plant through the use of fuel oil that is shipped in by tankers from the States. The large supplies of water used in the thawing operations, as well as for other purposes, come mainly through long ditches, some of which have their intake far up in the hills to the north of Nome. These supplies, however, are supplemented by power pumps utilizing nearer sources of water. Approximately 250 men were employed in various phases of the company's work. During 1940 one of the main new items of interest was the preparation that was in progress for the erection of a new dredge in the coastal plain area not far from Bourbon Creek, south of the area that earlier had been mined by the other dredges. Parts of the new dredge had already been received at Nome before the close of navigation in 1940, so that an early start on assembling them could be made in 1941 to enable the company to have the dredge in operation before the end of that year.

Two other dredges were also mining in the Nome district in 1940, namely, that of the Osborne Creek Dredging Co. on Osborne Creek and the Casa De Paga Gold Co. on Beaver Creek. The dredge on Osborne Creek was mining in the same general locality as it has been for the past several years. The dredge on Beaver Creek was formerly mining in the valley of Casadepaga River near Monument Creek but had subsequently been moved to Monument Creek, a tributary of Snake River, a short distance west of Nome. During the winter of 1939-40 it was again moved and reassembled at its present site on Beaver Creek, which is a tributary of Eldorado River that enters Safety Lagoon about 15 miles east of Nome. This is an area that heretofore has not been mined, probably because it is wet ground that could not be adequately prospected or mined by the methods available to the small operator. The discovery of workable placers in this area is of great significance not only to the company that is now mining there but also to others, for it indicates that this new area merits further consideration and that possibly workable placers

may extend into the hitherto blank areas between the productive camps in the southern part of the Nome district and those in the Solomon district.

In addition to the dredges, there were a number of open-cut and hydraulic mines on many of the creeks in the Nome district. No exact count was obtained as to the number of these properties, but apparently within a radius of 20 miles or so of Nome at least a score were active during the season. Some of these, it is true, consisted of only a single miner or a miner and his partner, and many of them were mining during only part of the season and their output was but a modest grubstake. In the aggregate, however, these smaller mines produced more gold than some of the dredges. Among the larger of the mines using other methods of mining than dredging may be mentioned the Gold Beach Placers, Inc., which was mining with a dragline and bulldozers a tract near Peluk Creek, practically within the town limits of Nome. On the eastern slopes of Anvil Creek Valley B. F. Gillette and several camps of one or two miners each were mining near Specimen Gulch. The ground is mined by hydraulicking and seems to represent one of the old high-level channels of Anvil Creek. Search for the other channels of this sort was in progress at several other claims in the same general neighborhood. Near the junction of Dorothy Creek and Nome River a company using an ingenious washing device and power scraper was mining. West of Nome in the valley of Oregon Creek, Gustafson & Swedman, with a crew of several men, were mining with a bulldozer. As the site of their work was near a tract of which part had been mined before by hand methods, they had to rehandle considerable quantities of old tailings.

The Kougarak district, as the term is used in this report, includes much of the central part of Seward Peninsula, and is very vaguely delimited on the south by the Nome district, on the west by the Port Clarence district, on the north by the Innachuk area of the Fairhaven district, and on the east by the Casadepaga area of the Solomon district. Recently, with the improved methods of mining by mechanized equipment, mining in the district has shown a great increase and does not yet appear to have reached the expansion of which it is capable. There are two principal centers around which the most active work has been in progress. These are a northern area lying near the head of the Kougarak River and embracing not only the main stream and its tributaries but even Dick Creek, which lies north of the Kougarak, and a southern area, which includes the country near Coffee Dome and areas in the southern part of the Kougarak Valley. In addition, a number of widely scattered camps throughout the district in the aggregate yield considerable placer gold. Among these outlying areas may be included the Iron Creek area, which might perhaps be considered as an outlier of the Nome district, and

the scattered camps on streams tributary to Noxapaga River, such as Buzzard, Goose, and Black Gulches. A large amount of gold that came from the Kougarok district was mined by the dredges of the Fox Bar Dredging Co., in the southern part of the Kougarok Valley, and of the Kougarok Consolidated Placers, Inc., near the head of that valley. The season's work at both these dredges seems to have resulted in a larger output of gold than heretofore. In the Iron Creek area the new dredge erected by Tolbert Scott during 1939 on claim No. 10 below, on Iron Creek, appears to have had a satisfactory season in 1940, though no details as to the accomplishments are available. No specific information has been received by the Geological Survey regarding the season's work of the dredge of the American Creek Dredging Co., near Game Creek and Auburn River in the valley of American Creek, though it is understood that as the company experienced considerable difficulties it was mining for only a short part of the open season.

It is, however, unwarranted to stress the activity in dredging as the principal reason for the increase in mining activity in the Kougarok district. In fact, fully as much gold came from camps using other mining methods. These camps ranged from those with elaborate mechanical equipment and yielding tens of thousands of dollars worth of gold to camps in which a lone worker employed only crude hand methods. Among some of the larger producers using other than dredging methods may be mentioned the Kougarok Consolidated Placers, Inc. (dragline and hydraulic plants), and the Alaska Taylor Mining Co., near the head of Kougarok River; Laurin Bros. and Carl Anderson, on Macklin Creek; the Grant Mining Co., on Coffee Creek; George Waldhelm, on Dahl Creek; Louis Nashenweng, on Quartz Creek; George Bodis, on Dick Creek; Lammers & Fitzpatrick, on Buzzard Gulch; the Midnight Sun Mining Co., on Boulder Creek; and Barney Rolando, on Game Creek.

The placer gold mined in the Fairhaven district comes from three main tracts—near Candle, the Inmachuk River, and Bear Creek. Altogether more than 200 men were employed on different mining properties in this district in 1940. 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. This company has control of extensive tracts along Candle Creek, which include not only the lowlands along the creek but also bench gravel high on the valley slopes. The different types of deposits necessarily must be mined by different methods, so that both dredging and hydraulicking are resorted to, and an extensive mechanical equipment is utilized. For the part that can be dredged, two dredges were used. The older of these was mining on claims Nos. 2 and 3 below, on Candle Creek, not far from the

settlement of Candle, and the newer dredge was on claims Nos. 14 and 16, farther upstream. In addition to production from its dredges, the company derives nearly a quarter of its output of placer gold from ground that is mined by hydraulicking and by the use of a dragline and tractors. Most of the placer that is mined by the company by methods other than dredging is bench ground on claims Nos. 13-15, 3d tier, on the western slopes of Candle Creek. The company reports that its work was much handicapped because of shortage of water due to the exceedingly dry season.

A few small one- and two-man camps were also established on creeks adjacent to Candle. Of these may be mentioned those on Jump and Patterson Creeks. Farther south of Candle, on Quartz Creek, which joins the Kiwalik River from the east, 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. As no details have been furnished the Geological Survey concerning new developments in these smaller camps during the year, it is assumed that such work as was done disclosed no noteworthy new conditions. West of Candle a new company, Kugruk Mines, Inc., was mining with a small Diesel unit on the main stream of Kugruk River a short distance west of Chicago Creek.

In the Inmachuk Valley, which lies some 30 to 40 miles west of Candle, the two principal operators were the Dry Creek Dredging Co. and the Forsgren Dredging Co. As their names imply, both these companies were mining with dredges, but the Forsgren Co. was also using a small dragline. The Dry Creek dredge was formerly mining on Dry Creek in the Nome district but had been removed to its new site on Inmachuk River. Owing to the time spent in reerecting the dredge at this new site and getting the necessary thawing done, considerable time was lost in the early part of the season, so that it was after the middle of July before things were in running order. Several small hydraulic or open-cut mines were established at other points in the valleys of the main stream or of its tributaries. No detailed records as to the results of the season's work at these smaller properties has been furnished the Geological Survey by the owners, and such information as is available regarding them pertains only to general conditions. Apparently, most of the smaller camps had difficulty during the early part of the open season in obtaining even meager supplies of water, owing to the dry season; but late summer rains somewhat remedied that condition. Mining by these smaller outfits seems to have been done at approximately the same places and same rate as in the preceding year.

The third tract in which placers were mined in the Fairhaven district includes Bear Creek and adjacent areas on the eastern flank of hills that form the divide between the Buckland and Kiwalik

Rivers. As no reports concerning recent mining developments in this area have been received by the Geological Survey, the activity in the area was probably small and the placer-gold production from it was presumably about the same as or less than in 1939. Even during the periods when the area is fairly active there are rarely more than three or four camps mining in it, and their gross production is usually valued at only a few thousand dollars.

The records received by the Geological Survey from the Council district in 1940 indicate that it was fourth among the districts of Seward Peninsula in point of its placer production and that it had somewhat increased the amount of placer gold that came from its mines. As usual, by far the greater part of the production came from the four active dredges in the district. The dredge of the Alaska Placer Co., which formerly was the property of the Northern Light Mining Co. and later of the North Star Dredging Co., was mining in the flood plain of Niukluk River, a short distance north of Council. Still farther upstream in the Niukluk Valley was the dredge of the Council Dredging Co. The operators had intended to have the dredge dig its way downstream to some of the company's other property, but as legal action was taken to stop this project the dredge was kept near its former site and mined mainly to the west of the Niukluk River. Still farther upstream, near the mouth of Camp Creek, was the dredge of the Camp Creek Dredging Co. Aggie Creek, which is a tributary of Fish River and joins that stream about 12 miles east of Council, has placers that are being mined by the dredge of the Inland Dredging Co. It was currently reported that steps were being taken to recondition the old Ophir Creek dredge, but so far as the Geological Survey is informed the project was not carried through to the point of placing the dredge in operation during 1940. Prospecting and development work by hydraulic or simple manual methods seems to have been almost at a standstill in the Council district during 1940, and the amount of placer gold recovered by the few outfits using those methods appears to have been worth at most only a few thousand dollars.

The Koyuk district, as that term is used in this report, embraces all of southeastern Seward Peninsula as well as the adjacent region immediately east of Norton Bay. In this large tract are two more or less definite centers around which the present placer mines are situated. The northern center has for its focus the settlement of Haycock, on Dime Creek. The southern may be briefly referred to as the Ungalik area. The placer production from the Koyuk district in 1940 appears to have been at essentially the same rate and from about the same places as in 1939, and no noteworthy new developments appear to have occurred. The greatest amount of placer gold

that was recovered from the Koyuk district in 1940 came from the property of the Ungalik Syndicate. This company is mining with a dredge in the valley of Ungalik River, near the junction of that stream and its small tributary from the west, Bonanza Creek. Mining at this place was started for the season on June 5 and was closed down October 20. The Shaw dredge that at times in the past mined some distance farther downstream in the Ungalik Valley appears to have been out of operation throughout 1940. In the northern part of the Koyuk district there was another dredge, that of the Dime Creek Dredging Co., on Dime Creek. This is a small dredge that has long been operating in this neighborhood, and it has produced a small but consistent amount of placer gold. Dredging by the Dime Creek Dredging Co. was at about the same place in the area north of Haycock as for several years past. Almost all of the placer mining in the Koyuk district that was done by methods other than dredging was in the Haycock area. Altogether in this part of the district there were, in addition to the dredge, two or three drift mines that were operated during the winter and several open-cut mines that were worked during the summer. The total number of men employed in productive mining is estimated to have been between 30 and 35. All the drift mines and most of the open-cut mines were on Dime Creek, but two open-cut mines were on Sweepstake Creek, a few miles to the west.

In the Bluff district more mining camps were active than in any of the immediately preceding years, and a great variety of mining methods were employed at the various camps. One of the most unique mining projects in this district, or perhaps in the whole of Alaska, is that of the J. T. Sullivan Mining Co., near the mouth of Daniels Creek. The notable feature of this plant is that it is essentially a scraper outfit set up on the sea ice off the coast in winter. The scraper operates through a trench kept open in the ice to excavate the placer material on the sea floor and bring it inland, where it is heaped into a stock pile that is sluiced up during the summer, after the offshore work has had to be discontinued because the sea ice has moved away. It is understood that the pay streak is rather closely confined to a narrow trenchlike depression offshore, and the gold is not broadly spread out throughout the sands on the sea floor. The gravels in the trench are now said to have been mined out as far as is practicable by the methods and equipment in use, so that it now seems unlikely that work will be resumed there during the spring of 1941. This company, in association with J. M. Crabtree and others, also has claims inland on Daniels Creek, which it mines during the open season with a slack-line scraper. During 1939 one of the old dredges that had lain idle for some time in the Nome

district was acquired and moved to California Creek, in the Bluff district. This dredge, under the management of Mahan & Slack, was in operation part of the season of 1940. There were also a few small one- or two-man camps using simple hydraulic or hand methods of mining on several of the creeks in the Bluff district, but apparently the result of their work was the production of only a small amount of placer gold.

In the Solomon district by far the greater part of the placer gold produced in 1940 came from the dredges of the Lee Bros., on the Solomon River, some 6 to 8 miles above the mouth of that stream. At this place a well-equipped surface plant, with all modern conveniences, including an air field, has been established. For several years this company had been mining at this place with a single dredge, but the success of that work and the acquisition of additional tracts of placer ground in the vicinity made it practicable and desirable to add another dredge to its equipment. The additional dredge was one that long ago had been mining on the headward part of the Solomon River Valley but had been rebuilt and reconditioned. It is equipped with buckets having a capacity of $3\frac{1}{2}$ cubic feet each. The actual recoveries of placer gold made by the dredges were considerably higher than the owners had been led to expect from the showing of the samples from the test holes that had been made to prospect the ground. Some open-cut mining by small outfits was also in progress in various parts of the valleys of the main streams, but so far as reported to the Geological Survey the most productive of the camps using methods of mining other than dredging was that of Margraf & Kowalski, on Big Hurrah Creek. None of these camps, however, consisted of more than two or three men, and many of them had merely individual workers. The aggregate production from all this simpler type of mining probably did not exceed a few thousand dollars, and few of the miners made more than a modest grubstake.

The production of gold from placer mines in the Port Clarence district in 1940 was considerably less than in 1939. This was due mainly to the decrease in activity at the property of the Bartholomae Oil Corporation, which is being mined by a dredge equipped with buckets having a capacity of $2\frac{3}{4}$ cubic feet each. The lessening of production at this property was by no means unexpected, as the owners had announced their intention to restrict active dredging so that a much-needed reconditioning of the plant and equipment could be made. In the Port Clarence district the largest amount of placer gold recovered by operators other than the dredging company appears to have been recovered by Frank Rice from deposits on Sunset Creek north of Teller. Mr. Rice was mining with a bulldozer and

getting most of the water he needed for sluicing with a gasoline pump. On Coyote Creek, N. B. Tweet & Sons were mining with a bulldozer and pumping the water used in sluicing with a Diesel engine. On Gold Run, a short distance upstream from the dredge, Martinsen and associates spent part of the open season of 1940 mining by simple hydraulic methods some of the bench deposits that lie along the left limit, or western slopes, of the valley. The enterprise, which was planned to exploit the placer deposits in the Agiapuk Valley, apparently was not successful in finding tracts of placer ground that proved sufficiently remunerative to induce the company to continue the work for more than a short time. Probably a few other small open-cut, or hydraulic mines, were in operation in other parts of the district during the open season but, if so, they have not reported their activities to the Geological Survey and probably at best produced no more than a few score ounces of placer gold.

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 1940. In this valley there are two principal areas where placer mining is being done. The western area is near Kiana, and the principal placer tract is in the valley of the Squirrel River and especially in the valley of its tributary, Klery Creek. The eastern area is in the vicinity of Shungnak, a small settlement about midway between the head and mouth of the Kobuk River. Kiana is about 50 miles in an air line above the mouth of the Kobuk, and Shungnak is about 90 to 100 miles in an air line east of Kiana. Both these tracts are so remote and so poorly served by any regular means of transportation or communication that their development is much retarded and hampered by high costs, unavoidable delays, and a short working season.

In 1939 so much of the placer-gold production of northwestern Alaska came from a single property that it was not considered advisable to show the total production of the region separately, but instead it was included with that of the Seward Peninsula. In 1940 no similar reason obtains because the placer production came from a number of small properties, and the total may be stated as \$5,000. However, in order that the comparisons that may be drawn regarding the output of placer gold in these 2 years may be on the same basis in the table on page 31, the placer production for 1940 and 1939 for northwestern Alaska and Seward Peninsula have been expressed as a single value for each year.

In the Kiana district little placer mining was in progress in 1940 except for a few small camps consisting of only one or two men each and usually yielding only a few hundred dollars in gold. The large

company, the Klery Placers, Inc., which had been mining near Klery Creek in the preceding years with a well-equipped modern plant, was apparently inactive throughout 1940. The reason for the suspension of operations is understood to have been due to litigation and financial difficulties rather than to nonproductiveness of the placers. If that is so, it seems reasonable to expect that these difficulties will be adjusted before long and that the area may resume an important place in the mining economics of the region.

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 the gold 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 1940 several small camps, some of which accomplished little more than panning tests, employed a total of about 12 to 15 men, some of whom were natives, on streams in the vicinity of Shungnak. Of these camps, two were on Dahl Creek, and one each was on Shungnak River, California, Riley, and Lynx Creeks. California, Lynx, and Riley 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 principal new item of mining significance concerning the Shungnak district was the taking over of a considerable group of claims on California Creek by Graham Lammers and associates, who shipped in considerable mining machinery and did a large amount of preparatory work on the placers, as well as making a start on mining part of the tract that had been stripped. In addition to other facilities, the company built a small airplane landing close to its property, so that instead of being exceedingly difficult to reach, the area can now be quickly and conveniently served by plane. No public announcement as to the company's plans for its future operations in the district have been made, but everything indicates that work will be resumed there as early as practicable in 1941 and continued as long as the deposits yield profitable returns.

DREDGING *

About 64 $\frac{2}{3}$ percent of all the placer gold produced in Alaska in 1940 was mined by dredges. The total value of the gold thus recov-

* Records regarding the dredge operating in 1940 in the Kuskokwim region to mine principally the placer platinum deposits are not included in any of the statements given in this section of the report.

ered was \$12,186,000, of which the greater part came from 22 dredges in the Yukon region and the rest from 23 dredges in Seward Peninsula and 3 in the Kuskokwim region. This total, which is more than 14 percent greater than the value of the gold recovered by dredges in 1939, represents increases of about \$1,509,000 in value and 43,114 fine ounces in quantity. The accompanying table gives the value of the gold output and the yardage handled by Alaska dredges from the earliest year for which records are available to the end of 1940.

Gold produced by dredge mining in Alaska, 1903-40

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
1936.....	39	8,905,000	14,632,000	60.9
1937.....	41	8,743,000	16,684,000	52.4
1938.....	44	9,845,400	20,052,000	49.1
1939.....	43	10,677,000	19,860,000	53.8
1940.....	48	12,186,000	21,820,000	55.8
Total.....		119,884,000	214,239,000	50.1

The total value of the gold produced by dredges since 1903 is nearly 32 $\frac{2}{3}$ percent of the total value of gold produced from all kinds of placer mining since 1880, and in some of the recent years the value of the gold recovered by dredging has been as high as 80 percent of the total placer production. In 1940 the percentage of gold recovered by dredging, as already stated, was 64 $\frac{2}{3}$ percent, or slightly less than in 1939.

The fact that for the past 2 or 3 years the proportion of gold recovered by the dredges has tended to decrease with respect to the amount recovered by other placer mining methods is due not to an actual decrease in dredging but to the great growth in mining by other methods. This is clearly shown by the foregoing statements and the accompanying table, from which it will be seen that although the percentage of gold recovered by dredging in 1939 and 1940 was about identical, the actual value of the gold from this source in 1940 was approximately \$1,400,000 more than in 1939. The extensive use of rela-

tively mobile lower-priced mechanized equipment, such as dragline scrapers and bulldozers, is obviously far more expedient at many of the placer properties suitable for such kinds of equipment than the installation of dredges, which cost more initially and therefore require a longer assured life of the property on which they are to be used, especially if the physical characters of the deposits do not lend themselves well to dredge mining. It seems certain, however, that whether or not the percentage of gold recovered by dredges increases or decreases with respect to the total output of placer gold, there will be in the near future little diminution in the quantity of gold that annually comes from this type of mining. Indeed, all signs seem to indicate that for a number of years an increase in the quantity of gold recovered by dredging is to be expected.

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 \$10,575,908 in gold, or slightly less than 87 percent of the total mined by dredges, report that that amount came from 18,935,730 cubic yards of gravel. By applying this average to determine the unreported yardage, a total of approximately 21,820,000 cubic yards is obtained, 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 16 years, so that the quantities and values given for 1940 were computed on the same basis as those reported for the recent preceding years. In comparing the actual values, however, attention should be called to the fact that, as in all the tables in this volume, the price of gold prior to 1934 has been computed at the recognized official figure of \$20.67 an ounce, whereas since 1933 a price of \$35 an ounce has been adopted. If the production of gold from dredges in 1940 had been computed at the old standard price the average value per cubic yard would have been practically 33 cents a yard.

The length of time that the different dredging companies operated varied widely. The longest season reported for 1940 was 269 days for dredges of the United States Smelting, Refining & Mining Co., Fairbanks Department, operating in the Fairbanks district of the

Yukon-Tanana region. The longest season reported for any of the Seward Peninsula dredging companies in 1940 was 193 days for the United States Smelting, Refining & Mining Co., Nome Department, operating in the Nome district. The earliest date for beginning work in the spring of 1940 and the latest date for ending work in the fall were reported by the Fairbanks Department, which began mining March 13 and did not stop its last dredge until December 6. The earliest and latest dates in 1940 on Seward Peninsula were May 12 and November 20, both reported by the Nome Department. The average length of the season in 1940 of the 18 companies who reported dates of beginning and ending work, irrespective of how many dredges they operated, was 138 days. Obviously, the shortness of this average season was due not to climatic conditions but to the late time in getting started or some other purely local cause at the different dredges. The fact demonstrated by these dredging records is that at practically any of the productive placer camps throughout Alaska a moderate-sized dredge, reasonably well handled, may be expected to have an average working season of at least 4½ months and that, with skill and special provisions against unfavorable climatic conditions, the season may be considerably extended 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 1940:

Yukon region:

Circle district:

Gold Placers, Inc.....	Coal Creek.
Alluvial Golds, Inc.....	Woodchopper Creek.
C. J. Berry Dredging Co.....	Mammoth Creek.

Fairbanks district:

United States Smelting, Refining & Mining Co., Fairbanks Department (8)....	Cleary Creek.
	Cripple Creek.
	Ester Creek.
	Fish Creek.
	Goldstream Creek.
	Pedro Creek.

Nome Creek Mining Co. (formerly Deadwood Mining Co.).....	Nome Creek.
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Fortymile district:

Wade Creek Dredging Co. (lessee from North American Mines, Inc.).....	Wade Creek.
Boundary Dredging Co.....	Canyon Creek.

Hot Springs district:

American Creek Operating Co.....	American Creek.
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Iditarod district:

North American Dredging Co.....	Otter Creek.
	Flat Creek.
J. E. Riley Investment Co.....	Otter Creek.

Innoko district:		
W. F. Puntilla.....	Little Creek.	
Moss & Larson Mining Co.....	Ganes Creek.	
A. A. Shonbeck (formerly Holky Dredging Co.).....	Ganes Creek.	
N. J. Vibe.....	Yankee Creek.	
Tolovana district:		
Livengood Placers, Inc.....	Livengood Creek.	
Kuskokwim region:		
Goodnews district:		
Bristol Bay Mining Co.....	Wattamuse Creek.	
Tuluksak-Aniak district:		
New York-Alaska Gold Dredging Corporation (2).....	Bear Creek.	
Seward Peninsula region:		
Bluff district:		
Mahan & Slack.....	California Creek.	
Council district:		
Alaska Placers Co.....	Niukluk River.	
Council Dredging Co.....	Do.	
Camp Creek Dredging Co.....	Camp Creek.	
Inland Dredging Co.....	Aggie Creek.	
Fairhaven district:		
Arctic Circle Exploration Co. (2).....	Candle Creek.	
Forsgren Dredging Co.....	Inmachuk River.	
Dry Creek Dredging Co.....	Do.	
Kougarok district:		
American Creek Dredging Co., Inc.....	American Creek.	
Fox Bar Dredging Co.....	Kougarok River.	
Kougarok Consolidated Placers, Inc.....	Do.	
Tolbert Scott.....	Iron Creek.	
Koyuk district:		
Dime Creek Dredging Co.....	Dime Creek.	
Ungalik Syndicate.....	{ Ungalik River.	
	{ Bonanza Creek.	
Nome district:		
Casa De Paga Gold Co.....	Beaver Creek.	
Osborne Creek Dredging Co.....	Osborne Creek.	
United States Smelting, Refining & Mining Co. (3).....	Snake River area.	
Port Clarence district:		
Bartholomae Oil Corporation.....	Gold Run Creek.	
Solomon district:		
Lee Bros. Dredging Co. (2).....	Solomon River.	

The only dredge that was active in 1939 but not in 1940 was that of the Alaska Sunset Mines Co. in the Nome district. Six dredges that were not in operation in 1939 were mining in 1940. These were as follows: Two dredges of the Fairbanks Department, in the Fairbanks district, one of which was the large new dredge on Cripple Creek and the other was the reconstructed and built-over dredge on Fish Creek; the new dredge of the Livengood Placers, Inc., on Livengood Creek

in the Tolovana district; the reconstructed dredge of Lee Bros., on Solomon River; the reconstructed dredge of the Bellevue Bros., operating as the Dry Creek Dredging Co., on Innachuk River in the Fairhaven district; and the dredge of the American Creek Dredging Co. on American Creek in the Kougarek district, which was mining for a short time during 1940. Rumors are rife of the intention to build additional dredges to mine placers in almost every one of the various Alaska placer camps. Most of these are obviously mere wishful thinking and are hardly worth mention. A few of them, however, record carefully considered plans that are likely to be carried out in the near future. Among new dredging projects that seem most likely to materialize soon may be mentioned the following: Rehabilitation of the dredge of the Fairbanks Department in the Fortymile district; construction of new dredges or the removal of old ones in the Fairbanks district to mine areas now held by the Fairbanks Department at Gold Hill and on the Fairbanks, Little Eldorado, and Dome Creeks; a new dredge in the vicinity of Livengood to develop ground of the Livengood Placers, Inc.; a dredge on the Salcha River, east of Fairbanks, for the Caribou Gold Mining Co.; one or more new dredges in the Nome district to aid in mining some of the claims in the coastal plain area now owned by the Nome Department.

SILVER

None of the materials that are now being 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 or byproduct in ores whose principal value lies in some other metal. As is evident from the following table, nearly 70 percent of the silver that has been produced from Alaska in the past has been derived from 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 it is seldom as much as 2 ounces to the ton of ore, and the average amount recovered has rarely been as much as $1\frac{1}{2}$ ounces to the ton. For 1940 no Alaska ores were mined primarily for their copper content; consequently no Alaska silver was derived from distinct copper ores.

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 100,633 fine ounces of silver in 1940, 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 2,308,397 tons of rock that was fine-milled; in other words, the quantity of silver recovered was less than 0.044 ounce to the ton. The silver from all the gold-lode

mines amounted to 119,550 ounces and was worth \$85,000. Some silver is also contained in all the gold that is recovered from Alaska placer mines. This silver is not recognizable in the crude gold dust or nuggets received from these mines, 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 81,600 ounces, worth \$58,000.

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 1940, as well as for the earlier years, are set forth in the following table:

Silver produced in Alaska, 1880-1940, 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	1,039,344	682,033	743,416	246,292	268,458	25,221	27,490
1921.....	761,075	761,075	545,229	545,229	193,281	193,281	22,565	22,565
1922.....	729,945	729,945	622,978	622,978	80,598	80,598	26,369	26,369
1923.....	814,649	668,012	715,040	586,333	77,237	63,334	22,372	18,345
1924.....	669,641	448,659	572,078	383,292	75,284	50,440	22,279	14,927
1925.....	698,259	482,495	606,929	419,294	67,186	46,445	24,144	16,756
1926.....	690,000	430,500	605,190	377,600	59,940	37,400	24,870	15,500
1927.....	627,800	356,000	525,100	297,800	79,400	45,000	23,300	13,200
1928.....	454,700	266,000	350,430	205,000	80,340	47,000	23,930	14,000
1929.....	472,900	252,000	351,730	187,400	94,370	50,300	26,800	14,300
1930.....	408,570	157,300	279,990	107,800	102,080	39,300	26,500	10,200
1931.....	352,000	102,000	193,850	56,200	129,800	37,600	28,350	8,200
1932.....	234,050	66,000	81,150	22,900	115,300	32,500	37,600	10,600
1933.....	157,150	55,000	-----	-----	128,150	44,850	29,000	10,150
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
1936.....	475,700	369,000	304,600	236,000	119,800	93,000	51,300	40,000
1937.....	495,000	384,000	285,000	221,000	156,000	121,000	64,000	42,000
1938.....	474,940	307,000	245,000	158,400	156,300	101,000	73,640	47,600
1939.....	203,500	138,000	-----	-----	128,500	87,000	75,000	51,000
1940.....	201,150	143,000	-----	-----	119,550	85,000	81,600	58,000
Total.....	19,334,981	13,764,937	12,916,613	9,480,660	3,862,638	2,729,676	2,555,530	1,554,600

From the foregoing table it is readily apparent that there had been a steadily waning production of silver from 1920 to 1934, when the low point of 154,700 ounces was reached. There was then a brief upward spurt, and for 3 years, 1936-38, the production of silver was about 475,000 ounces or more a year, but this was followed by a more or less uninterrupted tapering down until in 1940 the production had dropped to 201,150 ounces. It is probable that for several years this will continue to be about the average annual output. The cause for these fluctuations is not hard to discover when one remembers the close interrelation that has existed between the content of silver in the copper ores and the production of those ores. Thus the low points in silver production in 1933 and 1934 coincide with the cessation of copper production in those years. So, too, the lack of

production of copper ores in 1939 and 1940 resulted in the great decrease in the output of silver in those years. As is stated more fully on p. 75, all the large copper mines have definitely announced that their ore bodies have been worked out and that they have therefore discontinued operations. There is, therefore, no reason to expect that in the near future any considerable amount of silver will be produced from this type of ore.

In thus attributing much of the variation in the quantity of silver produced to the rise and decline of copper mining, it must not be overlooked that the fluctuations in the price for which silver sold have played a large part in determining the value of the Alaska silver output. Thus in the period 1919-22 the average selling price of silver was \$1 or more an ounce, whereas in 1931-32 it was less than 30 cents. Since 1933 the selling price has advanced considerably, partly through natural causes and partly through the action of the Government in setting the price it would pay for newly mined silver from American sources. Throughout 1938 and up to July 1, 1939, the price, set by the President by Executive order on December 30, 1937, was \$1.2929 a fine ounce subject to a deduction of 50 percent for seigniorage and services by the Government. On July 6, 1939, this order was modified, so that the seigniorage and charges became only 45 percent of the set price and the producer received 71.11 cents a fine ounce. On the assumption that all the silver produced from Alaska mines in 1940 qualified as eligible for purchase at the Government price, its value, as stated in this report, has been calculated at that price. According to the *Engineering and Mining Journal*, the average price during this period for silver that did not so qualify was approximately 34.8 cents an ounce.

The striking fluctuation in the average selling price of silver is clearly shown by the following table:

Average selling price of silver, 1880-1940

Year	Cents an ounce	Year	Cents an ounce	Year	Cents an ounce
1880-1918.....	66.7	1927.....	56.7	1936.....	77.57
1919.....	112.0	1928.....	58.5	1937.....	77.57
1920.....	108.0	1929.....	53.2	1938.....	64.64
1921.....	100.0	1930.....	38.5	1939.....	67.88
1922.....	100.0	1931.....	29.0	1940.....	71.1
1923.....	82.0	1932.....	28.2		
1924.....	67.0	1933.....	35.0		
1925.....	69.1	1934.....	64.6		
1926.....	62.4	1935.....	71.9	Average for period since 1918.....	67.9

In Alaska the development 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 Alaska, few of them have appeared sufficiently attractive to induce persons with money to have the necessary examinations made and to undertake exploitation.

The Alaska districts that in the past have received most attention as possible sources of commercial silver mineralization were the Kantishna district, north of the Alaska Range in central Alaska, and the Hyder district, at the head of Portland Canal, in southeastern Alaska, and shipments of ore from both these places have been made to smelters in the States. It is believed that both these districts would repay further search for workable silver ores, but although that search might be rewarded by success it is believed that any notable increase in production of silver in the near future is most likely to come from stimulation of mining of some of the lodes carrying silver mixed with other metals, such as gold, copper, and lead. This belief arises not through any skepticism that deposits of silver minerals occur in the Territory but rather through the knowledge that the mining of lodes of mixed sulfides is already making handsome returns in many places and the confidence that some of the deposits of this kind that are not now being mined might also, under capable handling, be brought into profitable condition.

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, iridium, osmium, ruthenium, and rhodium—all members of this group—have been recognized in the product from some of the lodes and placers in Alaska.

The spectacular increase in production of platinum metals from Alaska mines in 1938 marked one of the outstanding features of the mineral industry of that year, and the continuance of production in 1940 at a very high rate is of significance in the economics of the whole Nation. According to records of the Geological Survey, the production of platinum metals in Alaska in 1940 was equivalent to 28,886 fine ounces, valued at \$1,093,000. This indicates an increase in quantity of nearly 1,660 ounces and in value of about \$96,000 from

the production in 1939. The foregoing statistics, as far as they relate to quantity, are believed to have a high degree of accuracy, but the values stated are to be given much less dependence. The lesser claims for accuracy of the value of the product are due to several causes mainly arising through a rather unstable market for platinum metals and the wide fluctuations that are shown in the sales of each individual shipment. The shipments of placer platinum metals from Alaska show a constantly varying relation among the half dozen specific platinum metals they contain and in the impurities and dross associated with them. The records collected by the Survey are not sufficiently detailed to show the exact composition of each lot of metal produced. This being the case, it is evident that to try to arrive at an average price per ounce for material composed of widely variable elements that range as greatly in selling price as do the several members of the platinum group leads to confusion that obscures rather than clarifies the main objective. The main part of the platinum metals derived from Alaska lodes is palladium, and a fairly well-established record of the price of that metal is quoted at frequent intervals by the *Engineering and Mining Journal*. Utilizing this record of the price of palladium and the average price of the group of platinum metals, as derived from that source, a composite figure, \$37.83 a fine ounce, has been arrived at for the average value of the Alaska production of composite platinum metals in 1940. This compares with the average price of platinum for the year as given by the *Engineering and Mining Journal*, which was approximately \$37.92 a fine ounce. Even if the unit price that has been adopted should not prove to be strictly correct, it is probably sufficiently close to the fact to serve the useful purpose of correctly reflecting the magnitude of the industry in the Territory.

The outstanding development in the platinum-mining industry in Alaska, as well as in the United States proper, during recent years has been the placer-mining operations in the vicinity of Goodnews Bay, in the extreme western part of the Kuskokwim region, in southwestern Alaska. In this field the three principal mines are those of the Goodnews Bay Mining Co., the Clara Creek Mining Co., and Strandberg & Sons. These properties, as well as the adjoining country, have been examined in considerable detail by a Geological Survey party in charge of J. B. Mertie, Jr. The report of the work of that party, which has recently been published,⁸ furnished much factual as well as theoretical information regarding the area and its mineral deposits. At the property of the Goodnews Bay Mining Co., which embraces many claims in and adjacent to the main valley floor of

⁸ Mertie, J. B., Jr., *The Goodnews platinum deposits, Alaska*: U. S. Geol. Survey Bull. 918, 97 pp., 1940.

Salmon River, and on Squirrel and Platinum Creeks, mining is done with both a dredge and a dragline. The claims of the Clara Creek Mining Co. were mined with a dragline. The claims on which Strandberg & Sons were mining in 1940 were on Dry Gulch, and the method used was hydraulicking. The Strandbergs have an interest in many of the other claims in the area, so that in addition to the platinum metals that they mine themselves they receive as royalty considerable platinum metals from claims on Squirrel, Platinum, and Dowry Creeks, and Salmon River. Unlike many of the Alaska placer deposits, those in the Goodnews district are not permanently frozen and therefore can be excavated without long and expensive thawing operations, such as are required in the Nome and Fairbanks districts. The distribution of the platinum-bearing placer deposits appears to be quite strictly localized to the streams deriving their detritus from and around the flanks of Red Mountain, an intrusive mass of basic composition. As most of that area has now been covered by claims of the larger companies, very few small camps or individual prospectors are mining or seeking this type of deposit in the area, though before the consolidations took place there were many such small outfits. During the season of 1940 between 65 and 70 men were engaged in platinum mining in the Goodnews area.

Another significant contributor to the output of platinum metals from Alaska in 1940 was one of the lode mines on Kasaan Peninsula, in the Ketchikan district of southeastern Alaska. The principal platinum metal recovered at this mine is palladium, which, as already noted, sells for a much lower price than most of the other platinum metals, and which in 1940 rarely sold for more than \$24 an ounce. The development at this mine was being carried on by the Alaska Gold & Metals Co., which has successfully operated the property since 1935. The ore is a basic sulfide, carrying in addition to the palladium considerable amounts of gold, copper, and silver, all of which are recovered from the concentrates shipped to the Tacoma Smelter for treatment. From the mine the crude ore is delivered to the mill, where it is passed through various crushers and subjected to concentration processes, including flotation. The property is reported to be in operation continuously during the year, though during the winter it is run on a reduced schedule.

The only other regions in Alaska where some platinum metals are reported to have been recovered in 1940 are Seward Peninsula and Copper River. In the Seward Peninsula region small amounts of platinum metals were recovered from gold placers on Dime Creek, a tributary of the Koyuk River, Quartz Creek, a tributary of the Kiwalik River, in the Fairhaven 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 by-product. 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. The bedrock source of the platinum metals has not yet been determined, though some ultrabasic igneous rocks have been recognized in proximity to the placers. The locality in the Copper River region from which some platinum metals were recovered in 1940 was Treasure Gulch, a tributary from the north of Chistochina River. The platinum metals were recovered as a byproduct in the course of prospecting the placer-gold deposits that occur in the valley of this gulch.

Although no other operators in Alaska are known to have produced and sold platinum metals in 1940, 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 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.

COPPER

For many years the copper production of Alaska miners has been second in value only to the gold production of the Territory and during the past span of years has accounted for more than \$227,000,000 of the mineral wealth that has come from Alaska. Obviously, all mineral deposits have a limited extent, and as their mining is continued there necessarily comes a time when they become depleted and finally exhausted. The great copper mines of the Territory reached that state in 1938 and late in that year were definitely closed down by their managements. This of course does not mean that no other copper ores are known to occur in Alaska or that subsequently new deposits may not be discovered and developed. It simply means the closing of the great epoch of copper mining that began with the opening of the unique and phenomenally rich deposits near Kennicott in 1911 and ended with their final cessation in 1938. Henceforth, for at least some years, the only copper that is likely to come from the mines of the Territory is that recovered as an accessory or byproduct from ores that are valuable mainly for their content of

some other metal. This was the source of the small amount of copper credited to 1940.

Copper produced by Alaska mines, 1880, 1900-1940

Year	Ore mined (tons)	Copper		Year	Ore mined (tons)	Copper	
		Pounds	Value			Pounds	Value
1880.....		3,933	\$826	1929.....	500,400	40,510,000	\$7,130,000
1900-1915.....	1,232,396	220,773,969	35,031,225	1930.....	531,000	32,651,000	4,244,600
1916.....	617,264	119,654,839	29,484,291	1931.....	88,000	22,614,000	1,877,000
1917.....	659,957	88,793,400	24,240,598	1932.....	56,900	8,738,500	550,500
1918.....	722,047	69,224,951	17,098,563	1933.....		29,000	1,900
1919.....	492,644	47,220,771	8,783,063	1934.....		121,000	9,700
1920.....	766,095	70,435,363	12,960,106	1935.....		15,056,000	1,249,700
1921.....	477,121	57,011,597	7,354,496	1936.....		39,267,000	3,720,000
1922.....	581,384	77,967,819	10,525,655	1937.....		36,007,000	4,741,000
1923.....	731,168	85,920,645	12,630,335	1938.....		29,760,000	2,976,000
1924.....	761,779	74,074,207	9,703,721	1939.....		278,500	30,000
1925.....	860,023	73,855,298	10,361,336	1940.....		122,369	13,800
1926.....	670,000	67,778,000	9,489,000				
1927.....	645,000	55,343,000	7,250,000	Total.....		1,374,633,369	227,422,200
1928.....	579,500	41,421,000	5,965,000				

In the foregoing table no quantity of ore mined is shown for the years since 1932. This has been omitted partly because the large copper producers no longer made that information available but largely because much of the copper was derived as a minor by-product of gold ores, so that the quantity of ore ceased to give a proper basis of comparison with the production of earlier years. Thus, in 1940, as stated, no ores were mined primarily for their copper content; and it would be manifestly misleading to tabulate the gold ores from which only small amounts of copper were obtained as though they really were copper ores.

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 1940. 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 meager 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 upward as the operators attempted to salvage the remnants of such ore as could be cleaned out before finally closing the mines down in 1938.

Among the mines whose principal mineral content of value was some metal other than copper, but which furnished concentrates from which 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, and those of the Alaska Gold & Metals Co. on Prince of Wales Island, in the Ketchikan district of southeastern Alaska. 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 and milling operations.

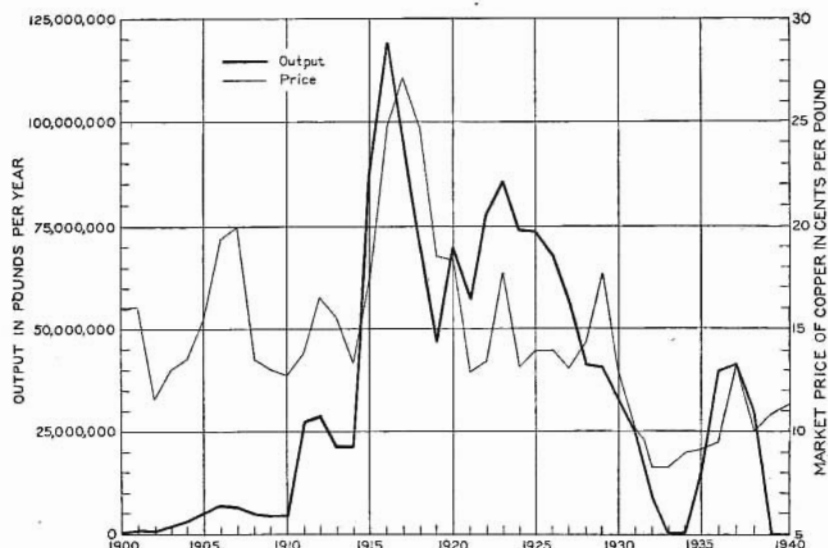


FIGURE 3.—Copper produced from Alaska mines, 1900–1940, and fluctuations in the price of copper during that period.

That there are other places in Alaska where copper minerals occur is well known. That some of these deposits contained enough copper to enable them to be worked at a profit under past conditions is a matter of history. It is extremely doubtful, however, 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-mining industry, but it seems doubtful whether much improvement through such measures can be looked for in the near

future. Indeed, the cessation of copper mining at the large mines points inexorably to the conclusion that hereafter the output of copper from Alaska mines will come only from the mines in which it is recovered as a byproduct of ores of gold or some other metal more sought as the principal object of mining. Some increase from this source is expected with considerable confidence.

LEAD

The lead produced from Alaska ores in 1940 is estimated to have been 1,680,000 pounds, or about 440,000 pounds less than in 1939. This decrease is attributable to less production of ore from certain of the lode mines that are principally valuable for their gold, because all the lead is recovered as a byproduct from the concentrates of the gold ores. These concentrates are shipped to smelters in the States for treatment to recover all the valuable metals they contain. The average market price of lead in 1940, according to the Bureau of Mines, was 5 cents a pound, which was identical with the price that was used in computing the value of the lead produced from Alaska ores in 1939. At this price, the value of the Alaska lead production was \$84,000, which was \$22,000 less than for 1939.

Lead produced in Alaska, 1892-1940

Year	Pounds	Value	Year	Pounds	Value	Year	Pounds	Value
1892.....	60,000	\$2,400	1909.....	138,000	\$5,934	1926.....	1,556,000	\$124,400
1893.....	80,000	3,040	1910.....	150,000	6,000	1927.....	2,016,000	127,000
1894.....	70,000	2,810	1911.....	102,000	4,090	1928.....	2,038,000	118,000
1895.....	40,000	1,320	1912.....	90,000	4,050	1929.....	2,630,000	166,000
1896.....	60,000	1,800	1913.....	12,000	528	1930.....	2,730,000	136,500
1897.....	60,000	2,160	1914.....	56,000	1,344	1931.....	3,320,000	128,000
1898.....	60,000	2,240	1915.....	874,000	41,118	1932.....	2,522,000	75,600
1899.....	70,000	3,150	1916.....	1,640,000	113,160	1933.....	2,314,000	85,600
1900.....	80,000	3,440	1917.....	1,704,000	146,584	1934.....	1,680,000	62,100
1901.....	80,000	3,440	1918.....	1,128,000	80,088	1935.....	1,630,000	65,200
1902.....	60,000	2,460	1919.....	1,374,000	72,822	1936.....	2,116,000	99,500
1903.....	60,000	2,520	1920.....	1,750,000	140,000	1937.....	2,004,000	120,400
1904.....	60,000	2,580	1921.....	1,518,000	68,279	1938.....	2,224,000	105,400
1905.....	60,000	2,620	1922.....	754,000	41,477	1939.....	2,120,000	106,000
1906.....	60,000	3,420	1923.....	820,000	57,400	1940.....	1,680,000	84,000
1907.....	60,000	3,180	1924.....	1,262,000	100,899			
1908.....	80,000	3,360	1925.....	1,578,000	140,571	Total..	48,630,000	2,672,600

Practically all of the lead that is reported in the foregoing table as produced in 1940 was recovered in the course of treatment of the gold ores of the Alaska Juneau Gold Mining Co.'s mines, in southeastern Alaska. According to the published reports of this company, it recovered less than one-third of a pound of lead from each ton of ore that was mined and trammed to the mill, or less than 0.72 pound of lead from each ton of ore that was fine-milled. From the table on page 16, which shows the recovery of metals at the Alaska Juneau mine, it is evident that the quantity of lead recovered from the fine-milled ore in 1940 was somewhat below the average for the entire period of the

mine's operation since 1914, which is 0.89 pound of lead to the ton of fine-milled ore.

Ores containing greater or lesser quantities of lead minerals are widely known throughout the Territory. 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 Omilak mine; and from the Kobuk district in the vicinity of Shungnak. Lead is, however, a heavy, low-priced commodity that requires rather elaborate treatment to produce in readily salable metallic form, and these draw-backs, 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 by-product. That the mining of lodes of mixed metallic content is likely to increase is regarded as a certainty, and that some of the silver-lead deposits now lying idle will be opened up again seems almost equally certain. As general business conditions throughout the world improve and as development and transportation facilities in Alaska improve, an increase in the output of lead from Alaska ores is looked for with considerable assurance.

TIN

For many years Alaska has been a small but regular producer of tin, and in the course of the more than a third of a century since tin minerals were discovered in Seward Peninsula and later elsewhere in the Territory it has shipped tin worth more than \$1,600,000. During 1940 the production of tin from Alaska mines is estimated to have been equivalent to 104,000 pounds of metallic tin valued at \$52,000. This marks an increase in both quantity and value as compared with the preceding year, although it falls far short of the record set in 1937 of 372,000 pounds of metallic tin having a value of more than \$200,000. It may be significant to point out that even at the rate maintained during 1940 Alaskan deposits furnish by far the largest amount of tin that is produced anywhere within the limits of the United States or its possessions. All the Alaska tin was derived from the mineral cassiterite (SnO_2 ; tin 78.6 percent, oxygen 21.4 percent), which occurs in placers mixed with gravel and rock detritus and is recovered by processes that are essentially the same as those used in placer-gold mining. The tin is then obtained in metallic form from the cassiterite by smelting, which is done outside Alaska.

The principal producing tin properties in Alaska lie in the extreme

western part of Alaska, near the western tip of Seward Peninsula. In addition to a few small one- and two-man camps that are fairly widely distributed in this general region, the main tin-mining activity is on the property of the American Tinfields, Inc., near Tin City. The tin-bearing placers that are now being mined are near the eastern border of Cape Mountain, a granite mass that forms the westernmost limit of the North American continent and that has been intruded into a country rock consisting of limestones and slates, which had been much metamorphosed even before the intrusion of the granite. As the tin minerals have been found in place in the contact zone of the granite, attempts have been made in the past to develop some of the richer areas as lode mines. Somewhat similar conditions prevail at other points in western Seward Peninsula, where in the past both tin lodes and placers have been found and a number of the placers mined extensively.

Although they contributed only a small amount of tin to the total output from Alaska mines in 1940, mention should be made of the placer deposits in the Hot Springs and Ruby districts of the Yukon-Tanana region, which, though mined mainly for their gold content, afford a small but rather constant amount of tin minerals each year. In order to avoid misunderstandings that may arise later as to the amount of tin recovered in these districts in 1940, it seems desirable to state here that the amount credited to them in that year is only approximately half the amount that certain records indicate was shipped in 1940. This is due to the fact that the boats on which the 1939 production was being shipped were caught en route by ice, so that the tin ore they were carrying was held up and was not shipped from Hot Springs, nor carried over the railroad, nor taken to smelters in the States until 1940, and it thus appeared in those records as though mined in that year. None of the tin minerals now mined from either of these smaller deposits or from those of Seward Peninsula are at the present time reduced in smelters in the United States. The metallurgy of their reduction, however, involves no great difficulty, so that if a sufficient and constant supply were available it would be entirely practicable to smelt it in the States.

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

Tin produced in Alaska, 1902-40

Year	Ore (tons)	Metal (pounds)	Value	Year	Ore (tons)	Metal (pounds)	Value
1902	25	30,000	\$8,000	1923	3	3,800	\$1,623
1903	42	50,000	14,000	1924	11	14,000	7,028
1904	23	28,000	8,000	1925	22.2	27,600	15,980
1905	10	12,000	4,000	1926	12.85	16,000	10,400
1906	57	68,000	38,640	1927	37.5	53,400	34,000
1907	37.5	44,000	16,752	1928	58.6	82,000	41,000
1908	42.5	50,000	15,180	1929	51.6	77,200	35,000
1909	19	22,000	7,638	1930	21	29,400	9,300
1910	16.5	20,000	8,335	1931	5.6	8,200	2,000
1911	92.5	122,000	52,798	1932			
1912	194	260,000	119,600	1933		5,800	2,300
1913	98	100,000	44,103	1934		8,280	4,300
1914	157.5	208,000	66,560	1935		98,800	49,800
1915	167	204,000	78,846	1936		226,000	105,000
1916	232	278,000	121,000	1937		372,000	202,300
1917	171	200,000	123,300	1938		210,640	89,100
1918	104.5	136,000	118,000	1939		74,080	37,300
1919	86	112,000	73,400	1940		104,000	52,000
1920	26	32,000	16,112				
1921	7	8,000	2,400				
1922	2.3	2,800	912				
				Total		3,398,000	1,635,800

The importance of tin in our national economy and the dearth of workable tin deposits throughout most of the States make the future of Alaska deposits a matter of special national significance. As a start toward finding out in terms of quantity the tin available in these deposits and to answer the practical questions involved in their development, the Geological Survey in 1939 sent a party in charge of J. B. Mertie, Jr., to begin an intensive field investigation of the tin deposits of Seward Peninsula. As the work in that year was rather closely restricted to the area immediately adjacent to Cape and Potato Mountains, maps were made and samples taken to afford specific information as to all the occurrences of tin in the area. This work was followed during 1940 by another Geological Survey party, also in charge of Mr. Mertie, whose principal field of operations was in the vicinity of Lost River, where both lode and placer tin occur. Further field work will be done at all the other Alaska localities where significant amounts of tin have been reported. In this way it is expected to obtain as reliable an inventory of the Territory's tin resources as possible in advance of detailed tests, such as can only be obtained by expensive and time-consuming drilling campaigns. Obviously, the collection of data and material in the field forms but one stage in answering the questions raised. The observations and materials must be carefully studied and rechecked in the laboratory; the samples must be assayed; the rocks must be examined microscopically; workers in other fields must be consulted to see if their experiences will throw light on the proper interpretation of the subjects in hand. All these researches take time if erroneous judgments are to be avoided and if the conclusions reached are to be valuable to those who may risk their time, efforts, and money on following up the geologic work by the actual development of those deposits that appear to have commer-

cial value. The findings of the Survey parties will be published as promptly as practicable because their value to the public depends in large measure on their availability to warn against unwise undertakings or encourage those who may make the Nation less dependent on foreign sources for a part at least of its supply of this useful metal.

In focusing so sharply the activities of the Survey's search for tin in Alaska on the possibilities of the development of tin on the area in western Seward Peninsula, it should not be forgotten that the occurrence of tin minerals in other parts of Alaska has been amply demonstrated. That further intensive examination of some of these other deposits is highly desirable is obvious, but their geologic settings are more obscure and their physical surroundings are such that determination of their real merits is likely to present difficulties that cannot easily be solved.

COAL

The coal produced from Alaska mines in 1940 is estimated to have been 173,970 tons, an amount that has not been exceeded or equalled in any other year since coal mining began in the Territory. In addition to the coal mined in Alaska, 22,407 tons were imported from fields outside Alaska, and no Alaska coal was exported. The consumption of coal in Alaska in 1940 was thus 196,377 tons, or about 23,780 tons more than in 1939. Coal for local consumption is being supplied more and more by increased output of the domestic mines. 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 83.

In this table the total value of the coal produced in Alaska in 1940 is stated to have been \$695,000. The 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 or charged on its books is not a suitable index of the price paid for the lots sold to the smaller consumers, who in the aggregate buy a rather 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 1940 may be taken as \$4 a ton. This is the same as the estimated price in 1939 and is about \$1.07 a ton less than the average price that prevailed during the period 1880 to 1939.

Practically all the Alaska coal mined in 1940 came from two mines—one in the Matanuska field and one in the Nenana, or Healy River, field. The principal mine in the Healy River field was that of the

Healy River Coal Corporation and in the Matanuska field that of the Evan Jones Coal Co., at Jonesville.

Coal produced and consumed in Alaska, 1880-1940

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bi- tuminous coal from Washing- ton ¹ (short tons)	Imported from foreign countries, chiefly bi- tuminous 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	496,594	24,278	33,776	134,871
1922.....	79,278	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.....	105,000	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
1936.....	136,600	573,700	27,643	11,806	176,049
1937.....	131,600	552,700	24,561	10,781	166,942
1938.....	159,230	620,900	23,465	11,633	194,328
1939.....	146,250	585,000	18,173	8,174	172,597
1940.....	173,970	695,000	16,068	6,339	196,377
Total.....	2,612,629	12,904,400	1,519,415	1,799,339	5,931,383

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

The largest coal mine in the Territory is that of the Healy River Coal Corporation, in the Nenana field. The mine is situated in the valley of 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 between 300 and 400 tons a day. The coal beds that are being mined are of Tertiary age, comparable with those in the Matanuska field, but the individual beds are much thicker and the measures have suffered much less deformation through mountain building than those in the southern area. Probably because the beds of the Nenana field have undergone less folding, the coal there is a high-grade lignite, which has a somewhat lower heating value than that from the Matanuska and nearby fields; as a consequence, it 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 1940 and yielded considerably more than half the coal mined in Alaska during that year. The largest single user of

coal from this property is the United States Smelting, Refining & Mining Co., Fairbanks Department, which utilizes it for furnishing power to its dredges and in its large placer-mining operations in the vicinity of Fairbanks. The constantly growing demands by that company for more power, as well as the extensive developments adjacent to Fairbanks that have taken place in connection with the various defense measures, require an increasing quantity of coal, which is now supplied mainly by coal from the Healy River mine. The Healy River coal is also extensively used for power and domestic fuel at other points in Alaska, even as far distant from the mine as Cordova and the Alaska Peninsula.

The mine of the Evan Jones Coal Co., in the Matanuska field, is situated on a spur of the former Chickaloon Branch of The Alaska Railroad, about 16 miles in an air line northeast of the settlement of Matanuska. Its coal is of bituminous rank and in steam sizes has been practically the only fuel used in locomotives or for power purposes by The Alaska Railroad. The larger sizes are extensively used for domestic purposes, and much of the product finds a ready market throughout the western and central coastal portions of Alaska, especially in the schools under the direction of the Office of Indian Affairs and in some of the canneries.

In addition to these larger mines, small amounts of coal were obtained from a few other places and were used locally. For instance, The Alaska Railroad has long maintained a mine at Eska, a short distance east of Jonesville, as a means of insuring itself a supply of railroad fuel should an emergency arise. Although this mine is kept merely in a stand-by condition most of the time, the heavy calls that have arisen in the Anchorage and nearby areas through the extensive Government construction that has been under way, as well as the railroad's own needs, indicate that this mine should be reopened. As a result, late in 1940 a crew was sent to the mine to do the necessary preparatory work to put the mine into production. One of the early steps to be taken will be the driving of a crosscut to intersect the known coal beds beyond the old workings and thus tap new supplies of coal, as well as affording a short haulage route for getting it out. In the course of the work, some coal that had been left standing in the earlier work will be taken out; but the quantity that was recovered during 1940 was small.

It is interesting to note that certain of the mines in some of the more remote parts of the Territory are showing an interest in some of the small deposits of coal that have long occurred in their neighborhood. Most of these coals are of relatively low rank and probably could not supply an extensive market, but their nearness to some of the gold mines furnishes a great incentive to use them rather than

to incur the heavy charges for transportation that would have to be borne by coals from other sources. Among places where a start has already been made in utilizing some of these small local coal deposits may be mentioned deposits on Coal Creek near the gold-lode mine of the Golden Zone Mines, on West Fork of Chulitna River; deposits near Chicken Creek, which is near the property being developed in the Fortymile district by the Fairbanks Department; and deposits near Chicago Creek, Seward Peninsula, near placer deposits on Kugruk River.

A small amount of coal is reported to have been mined by Eskimos from coal outcroppings that appear at intervals along Kuk Lagoon, south of Wainwright. This coal is used locally by both Eskimos and whites in Wainwright.

The whole problem of the development of Alaska's coal resources is exceedingly complex, for although there are in the Territory large areas occupied by coal-bearing rocks, the present local demands are fairly well supplied by existing mines, and to attempt to enter a larger field would require not only large outlays for developing mines but also perhaps even greater difficulties in establishing profitable markets. 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. Many of the steps that must be taken, if any more 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 certain great competitive advantages over those from outside sources. That growth, however, probably will be relatively slow though none the less sure.

PETROLEUM

No petroleum was produced from any Alaska deposits in 1940, although for a number of years prior to 1934 a small but significant production of petroleum had come from wells of the Chilkat Oil Co., in the Katalla district, east of the mouth of the Copper River.

Even during the period that this company was active the supply of petroleum products from that source was by no means adequate to meet the constantly increasing demand for fuel and lubricants created by the increasing use of machinery. This lack of a local supply was met in 1940, as it had been in earlier years, by imports from the States. The total value of the various petroleum products imported into Alaska in 1940, according to the records of the Bureau of Foreign and Domestic Commerce, was nearly \$4,028,000. The accompanying table shows the amount of petroleum products that were imported into Alaska during 1940, as well as during the preceding years.

Petroleum products shipped to Alaska from other parts of the United States, 1905-40, in gallons¹

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	84,542
1909.....	14,119,102	746,580	531,727	165,687
1910.....	19,142,091	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	731,148	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.....	15,441,642	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	460,870
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
1936.....	43,846,082	7,786,548	297,444	731,419
1937.....	43,656,900	9,179,557	383,586	677,223
1938.....	45,785,418	9,441,726	326,970	667,620
1939.....	52,869,012	9,808,050	394,296	800,898
1940.....	52,026,828	12,246,906	627,396	777,126
Total.....	728,726,489	159,152,404	24,589,046	15,654,571

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

From the foregoing table the great change in the types of different petroleum products imported and the amounts of each type during the period of record are readily apparent. Thus the illuminating oils, which in the period from 1919 to 1922 formed a considerable part of the imports, have dropped to less significant amounts since 1922. Im-

portations of heavy oils, which have always formed the bulk of the petroleum imports to Alaska, increased in the last few years, until in 1940 they amounted to about three and a half times the average for the period from 1921 to 1932. This great increase undoubtedly reflects the growing use of Diesel-equipped apparatus at many of the mines, on tractors, and on vessels of the fishing fleet. It should also be noted that, whereas in 1920 the importation of gasoline was about 1,764,000 gallons, in 1940 it was practically 12,250,000 gallons, or nearly seven times that of the earlier year. This increase is, in considerable measure, in direct response to the increasing mileage of available roads and the attendant increase in the number of motor vehicles that use them, as well as the increased mechanization of mining equipment in general.

Search for new oil fields in Alaska was practically at a standstill in 1940 and, although title to many tracts in prospective oil areas are still held by private individuals and companies, no drilling tests were in progress to determine whether or not they actually contained oil deposits of value or to bring the fields into production. This condition, however, should not be interpreted as indicating that the earlier tests have demonstrated the futility of developing a domestic source of petroleum in Alaska. Such an interpretation is definitely not in accord with the facts. Many of the operators who previously have failed to find commercial oil in Alaska are most sanguine about discovering oil if the search is continued. The main deterrent to further exploration is the present high cost of operations under Alaska conditions. Many of these conditions are not closely determinable in advance and therefore must be guarded against by the insertion of exceedingly liberal factors of safety. As none of even the most general features of the prospective pools, such as depth or geologic relationships, are known, special precautions must be taken at every step of the exploration to keep especially full records and to do many things that could be dispensed with in a better-known area with its attendant more complete facilities. All these supplemental items take time for their accomplishment and thus directly and indirectly add greatly to the expense of operations. Furthermore, many of the prospective Alaska fields require deep drilling rather than shallow exploration if their secrets are to be disclosed. Tests in one of the Alaska Peninsula fields west of Cook Inlet penetrated nearly 8,800 feet of sediments that apparently were but part of the sequence laid down during a single geologic period, and the bottom of the hole was still above the horizon in which accumulations of oil are likely to occur. The search for oil in Alaska is therefore not to be undertaken lightly by those with only meager capital, training, or experience, and determinative conclusions are

not likely to be reachable quickly. The rewards of the successful prosecution of such search, however, are an attractive incentive to the individual not only financially but as a service to the Nation and, in the writer's opinion, are likely to be achieved without undue risks. In other words, the writer believes that there are several areas in Alaska where skilled exploration backed by adequate funds is likely to disclose commercial deposits of petroleum.

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 at one time or another have 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, mercury or quicksilver, molybdenum, nickel, tungsten, and zinc; and among nonmetallic products, asbestos, barite, building stone, clay, garnet, graphite, gypsum, jade, limestone, marble, and sulfur. Without doubt small quantities of practically all these materials may have been "produced" in 1940 in the broadest sense of that word, but none of them, with the exception of antimony, limestone, and quicksilver, are known to have been produced and sold in quantities valued at as much as a few hundred dollars.

In the following table, as well as in some of the other tables in this report, all of these minerals that were produced by a single operator only 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." Included in this table among the miscellaneous mineral products are the platinum metals, although they have also been described elsewhere in this report. The inclusion of the value of the 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 several producers of platinum metals, inclusion of that group among the miscellaneous mineral products is no longer necessary or desirable from certain points of view, 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 1940, it has been considered desirable still to include the value of the platinum metals in this table. In other words, for 1940 the item shown in this table as \$1,304,200 may be broken down into miscellaneous mineral products other than platinum, \$211,200, and platinum metals, \$1,093,000.

Value of output of miscellaneous mineral products of Alaska, including platinum, petroleum, quicksilver, stone, antimony, gypsum, marble, and other products; 1901-40¹

Year	Value	Year	Value	Year	Value
1901.....	\$500	1915.....	\$205,061	1929.....	\$194,000
1902.....	255	1916.....	326,737	1930.....	157,300
1903.....	389	1917.....	203,971	1931.....	108,000
1904.....	2,710	1918.....	171,452	1932.....	223,400
1905.....	710	1919.....	214,040	1933.....	39,200
1906.....	19,965	1920.....	372,599	1934.....	86,400
1907.....	54,512	1921.....	235,438	1935.....	299,700
1908.....	81,305	1922.....	266,296	1936.....	293,800
1909.....	86,027	1923.....	229,486	1937.....	615,600
1910.....	96,408	1924.....	348,728	1938.....	1,338,600
1911.....	141,739	1925.....	454,207	1939.....	1,120,700
1912.....	165,342	1926.....	444,500	1940.....	1,304,200
1913.....	286,277	1927.....	162,000		
1914.....	199,767	1928.....	164,000		
				Total.....	11,070,000

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.

The only significant production of antimony ore from Alaska mines in 1940 came from the property of Morris P. Kirk & Sons, Inc., on Stampede Creek in the Kantishna district, in the northern foothills of the Alaska Range. Antimony ore has long been known to occur at that locality, but prior to 1936 no systematic mining of the deposit had been attempted. Since 1936 the present company has been active in developing its property and has shipped out considerable ore. The mine is developed by a vertical shaft and adit from which openings have been made into the ore body. A mill for concentrating the lower-grade material has been built and was in operation during 1940. Both high-grade crude ore and concentrates, both of which run 55 percent or better in metallic antimony, are produced. The antimony bearing material is hauled by tractors and sleds, principally during the wintertime when the trails are good, to Lignite, one of the stations on The Alaska Railroad, and thence transported to the States for further treatment and use. Some attempts were made during 1940 to open up an antimony deposit in the valley of Tok River, a tributary of Tanana River that joins that stream about 16 miles in an air line east of Tanana Crossing. The antimony deposit lies near the head of Tok River a little southeast of the pass leading to the Robertson River. Unfortunate delays upset the owner's plans for shipping the ore in 1940. However, he is reported to have considerable ore piled up at the mine ready to be hauled out by tractor to the Nabesna-Gulkana Highway next season. As is well known, antimony is one of the metals that is much in demand for war purposes, and the United States does not have within its own borders a supply adequate for its national needs. The importance therefore of developing and utilizing to their full extent all deposits that can supply the national deficiency is especially pressing at this time. The average price of antimony, according to the quotations given by both the

Bureau of Mines and the Engineering and Mining Journal averaged 14 cents a pound during 1940, which was 1.64 cents a pound more than the average price paid for the metal in 1939.

The quarrying of limestone as an ingredient of cement afforded a considerable part of the amount credited here to miscellaneous minerals in 1940. This enterprise is conducted by 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 ordinarily it is possible to supply all the limerock needed by the company by keeping the quarries in operation only part of the year. In accordance with this practice, the quarries were in operation in 1940 only from March 1 to August 10. The records showed a somewhat smaller quantity of limestone quarried from the property than was shipped during the year. The quantity mined in 1940 was considerably less than in 1939.

Cinnabar, the principal ore of quicksilver or mercury, has been recognized in the concentrates from the placer deposits in many parts of the Territory, but in most of these places the lodes from which the cinnabar originally came were apparently small stringers that appear unlikely to afford ore that can be mined under present conditions. In the central and western parts of the Kuskokwim Valley, however, extensive areas of cinnabar in bedrock, which have long been known to occur, 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. One of the better known of these areas is in the vicinity of the settlement of Sleitmut, on the Kuskokwim, near the mouth of the Holitna River. In 1940 Mellick & Halverson did considerable development at their mine known as the Red Devil, south of the Kuskokwim, and in the course of that work took out sufficient ore to keep their two retorts, each of which had a capacity of about 1 ton of ore a day, busy for nearly 3 months. The region is so difficult to reach quickly by ordinary means of transportation that a large part of the mercury that was recovered was shipped several hundred miles by airplane to a point where other less expensive methods of transportation could be utilized. Retorting of the ore was discontinued November 18, but work will be continued underground in the mine all winter and both the rate of mining and retorting will be accelerated in 1941. In addition to the productive work in progress at this property, there was considerable activity in prospecting and acquiring claims in the district. Attempts to negotiate for the Parks

quicksilver properties have been made, but so far they have been unsuccessful because of legal complications that have arisen as a result of Mr. Parks' death. W. G. Culver and associates are understood to have leased the Willis quicksilver properties, which are about a mile west of the Parks property and about a mile north of Kuskokwim River. Other prospectors are reported to have done some work under option at the old quicksilver prospect near the head of Crooked Creek, a tributary of the Kuskokwim, and not far from the divide between that stream and Iditarod River.

Some steps were taken late in 1940 toward the possible opening of the quicksilver deposits at the head of Olive Creek in the Tolovana district. The mineralization at that place appears to be localized near the margin of a granite dike and in the fractures and sheltered parts of the mass. A tunnel had been driven for some distance close to the margin of the dike and some of the ore treated in a home-made retort. Only a small quantity of *mercury minerals* were seen in the material inspected, and careful sampling would be required to determine whether or not the deposits could be developed profitably. It was understood that the owners proposed to do such testing in the near future, but as yet no public announcement has been made as to the results of any such work that may have been done. Local reports from Seward Peninsula indicate that renewed efforts were being made to develop the quicksilver deposits in the vicinity of Bluff, but so far as known no shipments were made from the property during 1940. A new rotary furnace and other equipment is said to have been acquired for the property but evidently did not arrive in time to be set up and be put into productive operation. On the schedule reporting the placer-gold mining done by the Eek River Mining Co., on its property on Rainey Creek, a tributary of Eek River, the recovery of several hundred pounds of cinnabar ore is mentioned. As no details are given concerning the quality or mode of occurrence of the material, it is assumed that it was picked up in the course of cleaning the sluice boxes used in the placer-gold mining done there. The recovery of such a large amount of mercury ore under those conditions suggests that a careful search for its bedrock source might result in disclosing a deposit that would have commercial value.

Although the foregoing notes cover all the mineral products that contributed to swell the total output from Alaska during the year, they by no means have given account of all the significant prospecting that has been in progress or of the deposits that are temporarily lying dormant. As an example of the dormant deposits may be mentioned the temporary cessation of production at the well-known quarries of the Vermont Marble Co., in southeastern Alaska. These quarries are on the west coast of Prince of Wales Island not far from the small

settlements of Tokeen and Calder. No productive mining was done there during 1940, 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 needed for the ensuing years, during which time the quarries are kept only in a stand-by condition. These quarries have lain dormant since 1932. The stone is used in many of the larger and better buildings throughout the Pacific coast region and is especially in demand for interior trim and decoration. Ordinarily the company ships its rough stone from Alaska to finishing plants that 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 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 throughout southeastern Alaska, and, according to Burchard,⁹ are of many different grades, some even approaching statuary quality. 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 sometime be developed profitably.

The revival of activity at the gypsum deposits that have long been known to occur in the vicinity of Iyoukeen Cove, on the east coast of Chichagof Island—a revival that was reported in the 1939 volume of this series—is said to have been continued during 1940, though no report has been furnished the Geological Survey as to the work accomplished during that year. Mining at this place was being done by the Camel Gypsum Co. and apparently consisted only of development work as there is no record of any shipments having been made.

Chromium is another of the metals that occur in Alaska deposits, and lately considerable interest has been displayed in the reexamination of some of the deposits that might furnish commercial amounts. Chromium enters into many phases of modern life and at present is one of the metallic elements that the United States must import to meet its domestic needs. It is therefore one of the so-called "strategic" materials, which the Government is eagerly trying to obtain from domestic sources in case of a national emergency. Of the known Alaska deposits of chromium ore, those near Seldovia have been regarded as the most likely to supply readily significant quantities.

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

Indeed, during a part of 1940 a contract was in force whereby the Government was to purchase 25,000 tons of ore from these deposits. Unfortunately, no ore was delivered under the agreement, which was later canceled. In the meantime, however, considerable prospecting and development work was done by private individuals, and a Geological Survey party under the leadership of P. W. Guild made extensive examinations of the prospective chrome-bearing area. The report¹⁰ of Mr. Guild's examination is now in course of publication, and a brief abstract¹¹ of his conclusions has already been issued. From this abstract the following statement is quoted:

The total chromite reserves of Kenai Peninsula are thus estimated to be 150,000 tons. Of this about 70,000 tons is of shipping-grade, and the remainder is contained in some 170,000 tons of lower-grade ore, which will require concentration to produce a marketable product.

Nickel is another of the metals that are necessary in military and industrial operations of national importance. It is also one of the materials with which the United States is not at present adequately supplied to meet its domestic needs. Consequently, at this time it is especially urgent to seek out and determine whether or not there are domestic deposits that might relieve this national shortage. Although for a long time nickel ores have been known to occur in Alaska, their real worth was not known with the degree of exactness that was required if a national policy was to be framed on the basis of their supposed availability or unavailability. To obtain quantitative information that would aid in settling the question, the Geological Survey in 1940 sent a special party in charge of J. C. Reed to make an intensive investigation of one of the deposits on which considerable prospecting had been done by private parties. The specific deposits examined are on Yakobi Island, a small island near the extreme northwestern tip of Chichagof Island, about 80 miles west of Juneau. The results of the work of this investigation are set forth in a report,¹² now in course of publication by the Geological Survey. As considerable time would elapse before that report was printed, a short summary¹³ of the principal conclusions has been circulated. From this summary the following statements are quoted:

Calculations based on the investigations made by the Geological Survey in 1940 indicate that about 6,000,000 tons of rock, containing about 0.36 percent of nickel and 0.27 percent of copper, is present and available for mining in the

¹⁰ Guild, P. W., Chromite deposits of Kenai Peninsula, Alaska: U. S. Geol. Survey Bull. 931-G (in preparation).

¹¹ U. S. Dept. Interior, Information Service, Chromite deposits of Kenai Peninsula, Alaska: Release of May 1941, 2 pp. and 2 sketch maps.

¹² Reed, J. C., and Dorr, J. Van N., Nickel deposits of Bohemia Basin and vicinity, Yakobi Island, Alaska: U. S. Geol. Survey Bull. 931-F (in preparation).

¹³ Nickel deposits of Bohemia Basin and vicinity, Yakobi Island, Alaska: U. S. Dept. Interior, Information Service, Press release, 2 pp., May 1941.

eight bodies that have been partly prospected. The estimate of the number of tons is based on the very conservative assumption that each of the bodies extends to a depth equal to half its length.

Further prospecting will probably greatly increase the estimate of the tonnage available in the bodies, but it probably will not greatly change the estimate of the grade. Rough calculations indicate that the material can be mined and the nickel and copper extracted from it at a cost roughly equal to the value of the metals that would be produced.

A new project of considerable significance that was undertaken during 1940 was the reopening of the old Riverside property in the Hyder district as a source of tungsten. Tungsten is one of the metals used extensively in certain classes of special steels and one that is not known to be available in sufficient quantities in domestic deposits to meet the normal needs of the United States. It is therefore one of the group of so-called "strategic" materials and one that the United States is now particularly anxious to have developed within its own borders. This property has been acquired by the J. H. Scott Co. of San Francisco, which spent the greater part of 1940 in sampling the deposits and preparing plans for its development. The results of the preliminary tests appear to have been satisfactory, for a modern camp has been built and considerable underground mining done, in the course of which a stock pile of ore was accumulated. According to the present plans, the plant should be in operation early in 1941, at which time it will be capable of treating each day about 50 tons of ore, averaging about 2 percent metallic tungsten. The concentrates will be shipped to the States for treatment. Because of the remoteness of the mine from routes of transportation by United States vessels and the readiness with which the shipments might be made through Canada if customs and other formalities of transit through a foreign country did not present obstacles, the company has not yet settled the question as to the manner in which the concentrates will be shipped.

Little new development is reported to have taken place in 1940 in mining many of the common nonmetallic mineral products at various places in Alaska. The widespread gravel and rock deposits were used extensively for railroad ballast and road construction. Such materials and sand entered largely into the concrete mixture required in the more permanent structures that are beginning to be built in many parts of the Territory. In estimating the value of Alaska's mineral output in 1940 no value has been set on these materials, though if a price of only a few cents a ton had been placed on them, the output of mineral products would have been worth many thousand dollars more than the value stated. Alaska is fortunate in having widely scattered through its extent deposits of these common materials, which can fill many of its needs as they arise and which are becoming increasingly important as the Territory develops.

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