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MINERAL INDUSTRY OF ALASKA IN 1937

BY

PHILIP S. SMITH

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CONTENTS

ILLUSTRATIONS

DEPARTMENT OF MINES
Territory of Alaska

MINERAL INDUSTRY OF ALASKA IN 1937

By PHILIP S. SMITH [1]

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 1937, is the thirty-fourth 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 basis and to give only those that ap-

[1] The canvass of producers, the tabulation of their replies, and general assistance in all phases of the office work connected with the preparation of the statistics set forth in this report have been carried through effectively by Kathleen S. Waldron, of the Alaskan branch of the 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, and 897–A. The reports for 1902 and 1903 were included with other "contributions to economic geology" in Bulletins 213 and 225.

pear 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 of course constitute a most authoritative record. Unfortunately, however, not all of them are returned by the operators, and even some of the operators who return them have not all the specific data desired, misunderstand the inquiries, or reply in such a manner that the answers may not be correctly interpreted when the schedules are edited. It is gratifying evidence of the general appreciation of these annual summaries that so many of the operators cooperate fully and cordially with the Geological Survey by furnishing the information called for on the schedules as well as volunteering much other pertinent information.

It is apparent, however, that facts collected from one source, although of themselves strictly accurate, are likely to be computed or stated on a different basis from equally reliable reports received from another source, so that considerable editing and revision must be done to bring all to one standard. It is not possible to know exactly

all the corrections that should be applied in order to reduce the reports of production to a strictly uniform standard. However, though some uncertainties necessarily remain, it is believed that they do not have significant effect on the results expressed and that the report is consistent within itself and with the other reports of this series which record the statistics of mineral production.

The restriction of the statistics in this report to those relating to production should be stressed, so that the reader will realize that while the statistics are comparable among themselves, they necessarily differ from those published by some of the other Government bureaus, because these are primarily records of production, whereas those issued by the Bureau of the Mint, for instance, relate to receipts at the offices of that Bureau, those issued by the Customs Service relate to shipments recorded at its stations, and those issued by other organizations may be computed on still other bases. The term "production," however, is rather indefinite because it may refer to the raw ore as it is broken from the ledge, or the metal content of the placer gravel before it has been sluiced, or it may be applied 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 recoverable content of valuable minerals can be closely determined and the material is in shape to be disposed of on that basis. In other words, ore lost in the tailings would not be considered "produced," but 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.

Much difference between statements from different sources arises also through various methods of computing the value of the different 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 dis-

regards 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 for tax or similar purposes.

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 a way that will disclose the production of individual plants, nor allow access to its records in any way disadvantageous either to the individuals who furnish the information or those to whom it relates. So scrupulously is this policy followed that in this volume it has been necessary to combine or group together certain districts or products so that the production of an individual may not be disclosed.

ACKNOWLEDGMENTS

To all the mining operators and prospectors of the Territory who have so generously made available information regarding their recent activities special acknowledgments are made. Without their friendly cooperation this report could not have been prepared. Thanks are also expressed to the various Federal and Territorial officials who have generously made available to the Geological Survey many helpful facts from their special fields of investigation.

Among the private individuals and companies who have been especially courteous in supplying information of general significance outside that pertaining to their own operations may be mentioned the Alaska Weekly and Volney Richmond, of the Northern Commercial Co., of Seattle, Wash., and the agents of this company, especially C. B. Haraden at Eagle, J. W. Farrell at Hot Springs, and William J. Kokko at McGrath; Ralph and Carl Lomen, of Seattle and New York; the Alaska Juneau Gold Mining Co., the Daily Alaska Empire, and J. J. Connors, of Juneau; the Ketchikan Alaska Chronicle, of Ketchikan; Sidney Anderson, of Hyder; the Cordova Daily Times, of Cordova; the Valdez Miner and M. J. Knowles, of Valdez; the Kennecott Copper Corporation, of Kennecott and New York; Carl

Whitham, of Chitina; N. P. Nelson, of Chisana; W. J. Erskine, of Kodiak; Elwyn Swetmann and the Seward Weekly Gateway, of Seward; the Bank of Alaska, Walter G. Culver, and the Anchorage Weekly Times, of Anchorage; Ralph Tuck, formerly chief geologist of The Alaska Railroad at Anchorage and later of Fairbanks; W. E. Dunkle, of Luckyshot; H. W. Wilmoth, of Wasilla; B. H. Mayfield, of Talkeetna; Frank H. Waskey, of Dillingham; Charles Naughton, of Kodiak; A. W. Amero and W. Yanert, of Beaver; the First National Bank, R. B. Earling and other officers of the Fairbanks exploration department of the United States Smelting, Refining & Mining Co., the Fairbanks Daily News Miner, the Alaska Miner, and G. E. Jennings, of Fairbanks; Clifton W. Hudson, of Livengood; John B. Powers and J. J. Hillard, of Eagle; Thomas J. DeVane, of Ruby; George Jesse, of Poorman; the Miners & Merchants Bank, Alex Mathieson, and Harry Donnelley, of Flat; Jessie M. Howard and Frank Speljack, of Ophir; the Kusko Times, of Takotna; H. S. Wanamaker, of Wiseman; J. W. Wick, of Russian Mission; Fred King, of McGrath; J. L. Jean, of Goodnews Bay; Charles Johnston, of the Goodnews Bay Mining Co., and the Clara Creek Mining Co., of Platinum; J. K. Crowdy, of the New York-Alaska Gold Dredging Corporation; the Nome Nugget, the Nome department of the United States Smelting, Refining & Mining Co., G. R. Jackson, of the Miners & Merchants Bank, and C. W. Thornton, of Nome; John Gross, of Council; A. S. Tucker, of Bluff; Arthur W. Johnson, of Haycock; Ethel M. Marx, of Teller; and Lewis Lloyd and James Cross, of Shungnak.

MINERAL PRODUCTION

GENERAL FEATURES OF THE YEAR

The total value of the Alaska mineral production in 1937 was $26,989,000. This was furnished by a number of different mineral products, but gold accounts for about 75½ percent. Compared with the mineral production of 1936, the output in 1937 was $3,395,000 greater. This notable increase is, of course, a source of satisfaction to those concerned with the general development of the mining industry in the Territory, especially as in large part it does not seem to be attributable to temporary conditions that are not likely to be repeated in the near future. In other words, this large output appears to be fairly representative of at least a reasonable rate that may be expected to be maintained for some time by the mines of the Territory under the conditions now prevailing. That this production by no means approaches the limit of which the Territory is capable must be apparent to anyone who is even moderately familiar with the developments in progress or in contemplation. A number

of new enterprises were well under way that had not yet reached the stage of production, and none of the larger operations that were active, except certain of the copper mines, showed signs of nearing the point where they appeared likely soon to encounter difficulty in maintaining their present output.

The total production, as stated, was influenced by the composite interaction of many factors, some of which were favorable whereas others were not. Among the favorable factors may be mentioned the fact that during 1937 the selling prices [3] of all the mineral commodities produced in Alaska were the same as in the preceding year or were higher. Thus the price of newly mined gold and silver, as fixed by the Government, remained constant throughout the year at $35 and 77.57 cents, respectively. The price of Alaska coal also appears to have remained the same in the 2 years at $4.20 a ton. Copper, however, which in 1936 sold at an average price of 9.47 cents a pound, sold in 1937 at an average price of nearly 13.17 cents, about 3.7 cents higher, or about 40 percent more than in 1936. The price of copper, however, fluctuated greatly during the year, as in January the average price was about 12.4 cents; the price then rose rapidly until in March it was nearly 15.8 cents, and then gradually decreased, until at the close of the year copper was selling for about 10 cents a pound. In 1937 the average selling price of lead was approximately 6.01 cents or 1.3 cents, or more than 27 percent, higher than the selling price in 1936. The price of this metal, which in January was on the average about 5.8 cents, rapidly advanced to slightly more than 7 cents in March and then declined until in December the average selling price was about 4.7 cents a pound. Tin, too, showed a great advance in its selling price in 1937 over that which prevailed in 1936, amounting to more than 7.9 cents a pound, or about 17 percent. The price of the composite platinum metals produced from Alaska mines was also greater in 1937 than in 1936, though the prices used in this report were necessarily computed on a different basis than for commercial platinum, as is explained on page 88, and therefore differ from the records published by the Engineering and Mining Journal. The selling price of platinum metals adopted in these reports for the years 1937 and 1936 were $48.90 and $42.93 an ounce, respectively.

Then, too, the proved success of many of the enterprises that have been undertaken in the last few years has had a stimulating effect on others to enter the field. The low interest rates that money has commanded in ordinary commercial channels elsewhere, the permissible deductions that can be taken for unprofitable commitments, and

[3] All the prices quoted for the various mineral commodities in 1937, unless otherwise stated, are based on statistics published by the Engineering and Mining Journal.

the willingness of the Government to finance acceptable private mining undertakings have all had a share in at least arousing some persons with money to consider the opportunities of employing it in Alaska mining ventures. On the whole, however, there has been no widespread awakening to the chances of engaging successfully in pioneer mining ventures in Alaska, and general business conditions must improve greatly before there is much money available for such projects.

In opposition to these factors favorable to mining there were others that had a contrary effect. The shipping strike that commenced in October 1936 continued unbroken until February 1937, and even after it was settled unrest, inefficiency, and uncertainty hovered under thin cover during most of the year. The isolation of Alaska makes it absolutely dependent on shipping for its supplies and the removal of its products, so that interruption of boat service between it and the States affects every industry. Fortunately for the mining industry most of the placer mining for 1936 had been completed and that for 1937 had not begun during the period when the strike was in progress. The lode mines, especially the copper mines, were especially hard hit by the inability to move their product to the smelters in the States and get the metal it contained on the market. The less determinable effects of the interruption of shipping on the mining industry as a whole were also serious because the inability to obtain supplies and equipment necessarily led to hesitation or abandonment of plans looking to undertaking certain contemplated improvements at old plants or construction of new ones.

The action of the Territorial legislature in placing a license tax on all mining enterprises and one that bore especially heavily on mines of the precious metals—gold and the platinum group—raised considerable opposition, and some predicted that it would discourage production. This act, approved March 4, 1937, is entitled "To provide for a tax on mines and mining and to repeal subsection 14 of section 3138 of the compiled laws of Alaska, 1935." It provides that "Any person, firm, or corporation prosecuting or attempting to prosecute or engaging in the business of mining in the Territory of Alaska shall apply for and obtain a license and pay for such license for the said business of mining." The act then goes on to provide that for all mining except gold and platinum metals this tax shall be levied on the net income derived from mining and the stipulated amounts are specified, ranging from three-fourths of 1 percent on net incomes of less than $10,000, to 8 percent on those over $1,000,000. For gold and the platinum metals the license tax is "3 percent upon the cash value of the gross production in excess of $10,000." The term "gross production" is thus specifically defined in the act: "By 'gross production' is meant the total cash value of all of the products taken from any

mine or mines." The operation of this act and its effect on mining will be watched with interest.

Certain of the minerals that at least have been mined intermittently in the past were not mined at all in 1937. For example, there was no production of petroleum products from the oil wells near Katalla, 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. None of the deposits at the places specifically named have been exhausted, and the cessation of production from them is regarded as due solely to extraneous causes which doubtless will not long prevail. It is encouraging to note that antimony, one of the minerals that several years ago was produced in significant amounts but has not been extensively mined lately, again contributed to swell the total for 1937.

The foregoing outline of the general features of the year 1937 clearly shows that not only has the record for that year been good but it holds out encouraging prospects for the future. Although this optimism is probably thoroughly well justified, it seems desirable to interject a word of caution to those who might be carried away by the glamor 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 for new areas for prospecting. While large parts of Alaska remain almost unknown and unexplored, other parts, especially those along the main avenues of communication, have lost most of their frontier characteristics, and their facilities compare favorably with those of many parts of the States proper. In many of these areas large, stable mining enterprises have already been built up, and there is the constant tendency to undertake operations on a larger scale than formerly, so that the unit cost of the work may be kept at a low figure. That mining may be done in parts of Alaska at an extremely low cost has been demonstrated by the past performance of one of the mines in southeastern Alaska, where costs are below those of any comparable enterprise in

the world. This tendency to operate in larger units marks a distinct departure from the old days, when the search for mineral deposits was directed mainly toward the discovery of small rich deposits that could be worked by relatively crude methods and with little outlay of capital. Today, by far the larger part of all the mineral production of Alaska comes from mines utilizing extensive equipment to handle large volumes of relatively low-grade material. The modern prospector is therefore not limited in his search to small rich stringers or concentrations but may well direct his attention to finding deposits that appear to hold promise of yielding large quantities of average or even low-grade ore. Such a prospector, however, must realize that 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.

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

TOTAL MINERAL PRODUCTION

From the time of the earliest records of mining in Alaska to the end of 1937 minerals to the value of over $749,000,000, or much more than one hundred 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 annual production fluctuated somewhat but ranged around $20,000,000. Then it mounted by leaps until it reached a maximum of more than $48,000,000 in 1916. This rapid increase was due to the growth of copper production under the stimulus of the World War, when prices advanced to unprecedented heights. By 1919 the war stimulation was over, and the annual production from Alaska dropped again to about $20,000,000. During

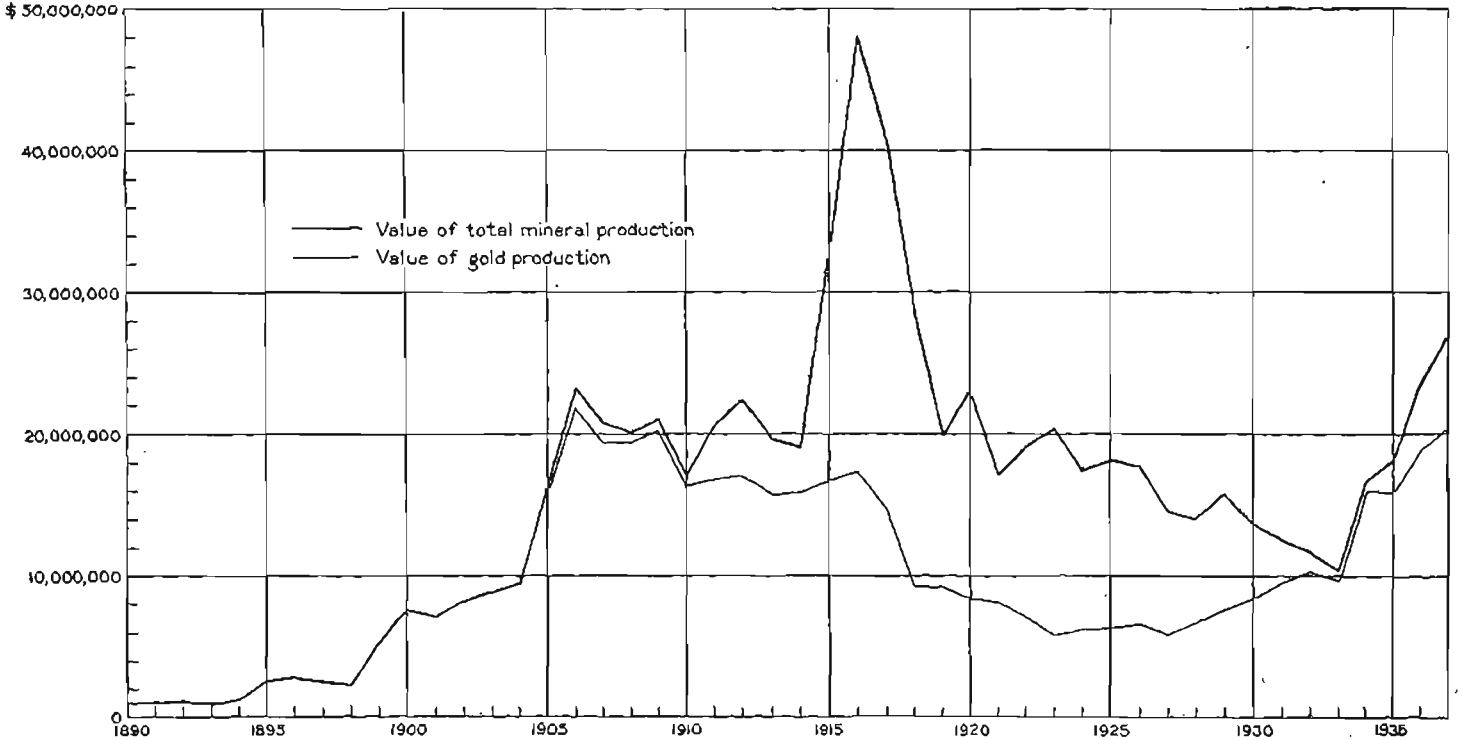

FIGURE 1.—Trends of mineral production of Alaska, 1890–1937.

the post-war period Alaska has suffered through the fact that in the States scales of wages and opportunities for the employment of capital have seemed to offer more advantages, and as a result there has been more or less fluctuation in the mineral output from Alaska, the production during the last few years ranging between $10,000,000 and $14,000,000, until in 1934, owing largely to the advance in the price of gold, it approached $17,000,000, and later, with the continued high price of gold and resumption of extensive production of copper, the value continued to increase until in 1937 it was almost $27,000,000.

Value of total mineral production of Alaska, by years, 1880–1937

1880	$6,826	1900	$7,995,209	1920	$23,330,586
1881	15,000	1901	7,306,381	1921	16,994,302
1882	23,000	1902	8,475,813	1922	19,420,121
1883	67,146	1903	9,088,564	1923	20,330,643
1884	72,000	1904	9,627,495	1924	17,457,333
1885	425,000	1905	16,490,720	1925	18,220,692
1886	540,000	1906	23,501,770	1926	17,664,800
1887	657,000	1907	20,840,571	1927	14,404,000
1888	667,181	1908	20,092,501	1928	14,061,000
1889	847,490	1909	21,140,810	1929	16,066,000
1890	873,276	1910	16,875,226	1930	13,812,000
1891	1,014,211	1911	20,720,480	1931	12,278,000
1892	1,019,493	1912	22,581,943	1932	11,638,000
1893	1,104,982	1913	19,547,292	1933	10,366,000
1894	1,339,332	1914	19,109,731	1934	16,721,000
1895	2,588,832	1915	32,790,344	1935	18,312,000
1896	2,885,029	1916	48,386,508	1936	23,594,000
1897	2,539,294	1917	40,694,804	1937	26,989,000
1898	2,329,016	1918	28,218,935		
1899	5,425,262	1919	19,626,824	Total	749,211,000

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 more than 65 percent of the total value of the mineral production and that gold and copper together accounted for more than 95 percent.

Total value of mineral production of Alaska, by substances, 1880–1937

Gold	$489,487,000
Copper	224,402,400
Silver	13,177,000
Coal	11,003,500
Lead	2,377,200
Tin	1,457,400
Other minerals products (including platinum metals)	7,306,500
Total	749,211,000

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 1937 and 1936, 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 the production of gold, silver, tin, platinum metals, and miscellaneous mineral products. But while there was an increase in the value of the production of copper and lead the quantity of these two metals that was produced in 1937 was somewhat less than in 1936. Coal was the only mineral commodity which both in value and quantity was produced in less amounts in 1937 than in 1936.

Mineral output of Alaska, 1937 and 1936

	1937		1936	
	Quantity	Value	Quantity	Value
Gold.....fine ounces..	582,085	$20,373,000	526,660	$18,433,000
Silver.....do....	495,000	384,000	475,700	369,000
Copper.....pounds..	36,007,000	4,741,000	39,267,000	3,720,000
Lead.....short tons..	1,002	120,400	1,058	99,500
Platinum metals.....ounces..	8,131	397,600	5,654	241,900
Tin, metallic.....short tons..	186	202,300	113	105,000
Coal.....do....	131,600	552,700	136,600	573,700
Miscellaneous mineral products.....	.....	218,000	.....	51,900
Total.....	.....	25,989,000	.....	23,594,000

GOLD

GENERAL FEATURES

Throughout 1937 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 given 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 1937 was $20,373,000, as against $18,433,000 in 1936, an increase of almost $2,000,000. The value of the gold output of Alaska in 1937 reached a high point in the record of gold mining in the Territory and one that has been exceeded only twice during the entire history of mining in Alaska. The banner year of Alaska gold production was 1906, with an output worth $22,036,794, and the next highest year was 1909, with $20,411,716. The record for the year 1937 was therefore less than $1,664,000 and $39,000, respectively, below those two outstanding rec-

ords. Although the quantity of gold recovered in 1937 was less than that for any year between 1905 and 1917, the value of the present output is much greater, owing to the difference between the price of gold that prevailed in some of the earlier years and now.

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 1899, 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 there was a still further decline in Alaska gold production, and it touched new lows in 1923 and 1927, when it was less than $6,000,000 a year. Since 1927 there has been in general a marked increase in the value and quantity of gold produced, until in 1934 the rise in the unit price of gold, coupled with the stimulation of gold mining that had been in progress, so increased the value of the production that in 1937 it nearly equaled 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 following table shows the amount and value of the gold produced annually for the last 38 years, the total amount that has been produced since gold mining began in the Territory in 1880, and the value of the gold that has been derived from each of the two principal types of gold mines. The annual production for each year from 1880 and the sources, from 1884, are also shown graphically in figure 2. Of the $489,487,000 in gold that has been produced from

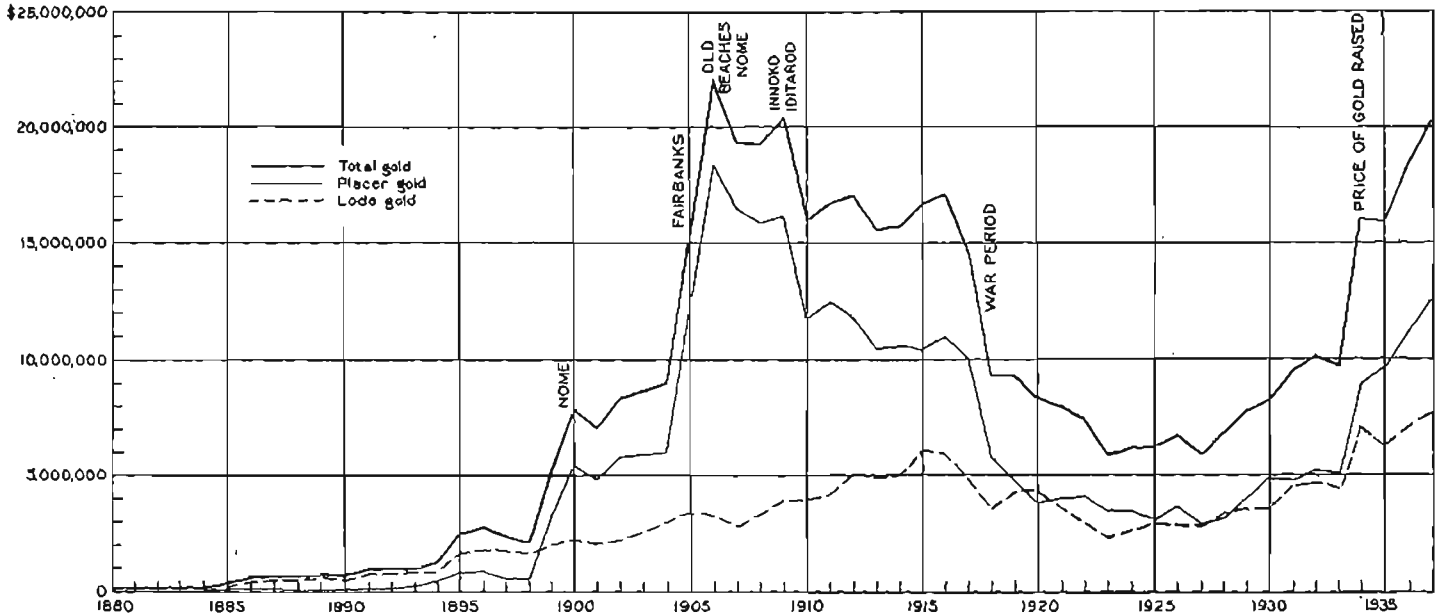

FIGURE 2.—Trend of value of gold production of Alaska, 1880–1937.

Alaska mines $317,119,000, or about 65 percent, has come from placers and $172,368,000, or about 35 percent, from lodes. The relation between the outputs from these two sources has varied widely. Thus up to 1898 the lode production was greater than that from the placers. Then ensued a period of more than 20 years when the annual placer production far exceeded that from the lodes. 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 ratio of production from these two sources has been about 3 to 2. There is reason to believe that the current rates of production by no means mark rates that may not be maintained or exceeded in succeeding years. Although obviously the output of placer gold may be expected to lessen as time goes on, there is no evidence yet that such a point is near at hand, and increasing production from the lode mines may be predicted with all confidence.

Gold produced in Alaska, 1880–1937

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	403,206	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	8,365,560	3,873,000	4,492,560
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	3,769,000	2,938,000
1927	286,720	5,927,000	2,982,000	2,945,000
1928	331,140	6,845,000	3,347,000	3,498,000
1929	375,438	7,761,000	4,117,000	3,644,000
1930	410,020	8,476,000	4,837,000	3,639,000
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
Total	22,267,782	489,487,000	317,119,000	172,368,000

GOLD LODES

Alaska lode mines in 1937 yielded $7,718,000 in gold, or $613,000 more than in 1936, when the production was $7,105,000. The gold derived from the lodes was about 38 percent of the entire gold production of the Territory, or practically the same proportion in 1936. The lode gold was recovered from widely distributed mines, but slightly over 77 percent came from mines in southeastern Alaska, as shown in the following table:

Gold produced from gold-lode mines in Alaska in 1937, by districts

	Fine ounces	Value
Southeastern Alaska	170,171	$5,956,000
Willow Creek	25,371	888,000
Fairbanks district	12,086	423,000
Other districts	12,886	451,000
Total	220,514	7,718,000

Of the Alaska lode-gold mines, the properties of the Alaska Juneau Gold Mining Co. in southeastern Alaska are by far the largest, and that company alone produced about three-quarters of the total lode-gold output of the Territory in 1937. The magnitude of the company's mining operations is set forth in its published report to its stockholders,[4] from which the following statements are abstracted: The total rock mined and trammed to the mill in 1937 was 4,442,760 tons. Of this amount 2,191,681 tons of coarse tailings were rejected and 2,251,079 tons were fine-milled. The average gold content of all the material mined was 0.0453 ounce to the ton. The amount of gold in that part of the rock which was rejected was about 0.0082 ounce to the ton, and the gold content of the rock that was further treated was about 0.079 ounce to the ton. Of this content 0.0116 ounce to the ton was lost during the treatment, 0.0594 ounce was recovered as bullion, and 0.0080 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.

[4] Alaska Juneau Gold Mining Co. 23d Ann. Rept., for the year ended Dec. 31, 1937.

Production of Alaska Juneau mine, 1893–1937

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	273,297	459,445
1919	692,895	616,302	76,593	24,141	16,431	359,762	542,714
1920	942,870	637,321	305,549	35,456	23,348	487,574	791,390
1921	1,613,600	904,323	709,277	46,914	40,619	550,913	1,035,251
1922	2,310,550	1,108,559	1,201,991	62,707	49,405	687,315	1,388,679
1923	2,476,240	1,134,759	1,341,481	69,047	41,876	755,423	1,514,774
1924	3,068,190	1,367,528	1,700,662	92,277	63,191	1,256,857	2,055,782
1925	3,481,780	1,537,884	1,943,896	98,213	55,971	1,288,974	2,184,384
1926	3,829,700	1,649,678	2,180,022	93,423	52,333	1,300,915	2,067,837
1927	4,267,810	1,839,695	2,428,115	112,653	61,232	1,513,306	2,463,262
1928	3,718,140	1,795,191	1,922,949	152,047	77,591	2,038,655	3,316,019
1929	3,836,440	2,020,470	1,815,970	164,993	90,635	2,501,832	3,627,247
1930	3,924,460	2,066,239	1,858,221	163,312	97,607	2,640,771	3,551,950
1931	4,162,350	2,298,998	1,863,352	179,532	118,508	3,309,176	3,879,839
1932	4,001,630	2,414,469	1,587,161	151,578	94,519	2,509,263	3,236,183
1933	4,085,960	2,466,832	1,619,128	150,967	109,483	2,299,777	3,960,166
1934	4,302,600	2,387,138	1,915,462	128,015	86,458	1,662,894	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	2,102,594	5,400,621
1937	4,442,760	2,251,079	2,191,681	151,671	120,691	1,980,405	5,516,414
Total	65,453,758	35,051,990	30,401,768	2,238,735	1,412,388	31,449,148	57,406,727

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

The cost of mining in 1937 was stated by the company to have been 34.7 cents for each ton of ore trammed to the mill, the cost of milling was 24.5 cents, and all other marketing costs and expenses amounted to 11.6 cents, making the entire operating cost for each ton of ore trammed only 70.8 cents. This indicates the exceedingly efficient operation of a deposit of this low-grade type, which could have been brought about only through capable management and the adoption of all technical means for maintaining and stimulating production in all stages of the enterprise.

The output of gold from this company's mine in 1937 was slightly larger, as compared with that of 1936, but this was partly offset by the great increase in operating and maintenance charges. The average value of the ore appears to have been practically identical for the 2 years. No interruptions due to labor conditions occurred during the year, and the company report states that there was a very low turn-over of labor and that at all times there was an abundant supply available for necessary replacements. The superintendent reported that during 1937 more than 31,000 linear feet of underground openings were made and more than 82,000 square feet of stope area was cut out. The development and preparatory work in opening up the extension of the property in the old Perseverance ground was continued with such good effect that before the end of the year con-

siderable ore was being drawn from this area. The earlier experiments that had indicated the desirability of some modification in the former milling practice led to the installation of new milling equipment, including a flotation machine with accessory classifying cones, thickeners, and other apparatus. A description of some of the problems connected with the milling of this ore has recently been published.[5] At the various power plants of the company new installations were made to take care of the increased demands for power and additional cables were strung to bring the power to points where it was needed. The disposal of the fine tailings from the mill, which had become a serious problem, was taken care of by installing pumps to elevate the tailings and discharge them farther down the channel.

The next most productive lode-gold mines in southeastern Alaska are situated on the west coast of Chichagof Island. At this place are the properties of the Hirst-Chichagof Mining Co., near Kimshan Cove, some 65 miles northwest of Sitka, and the Chichagoff Mining Co., near Klag Bay, a few miles to the southeast. At the Hirst-Chichagof mine the accomplishments of the year consisted of sinking the shaft about 125 feet, driving 585 feet of drift and 670 feet of crosscut, and mining and milling considerable ore. The property was in constant operation throughout the year, except for minor shut-downs. The general milling practice consists of crushing the ore in a 10-stamp mill and recovering the free gold by amalgamation. The pulp then passes through a tube mill and classifier in a regrind circuit, the overflow being again treated by amalgamation and the tailings going through a flotation machine. The concentrates are shipped to a smelter in the States. Details as to the year's progress at the property of the Chichagoff Mining Co. have not been learned by the Geological Survey, but from the amount of gold recovered it appears that mining and milling were carried on at approximately the same rate as in recent years. The long successful record of accomplishment of these two mines has amply demonstrated the significance of this area of mineralization. In order that more may be learned as to the conditions under which the mineralization occurred and to try to determine other localities which appear to hold promise of containing deposits that may warrant development, the Geological Survey will make an intensive study of parts of the district during the field season of 1938, under the personal leadership of John C. Reed, geologist.

Already the successful development of these two larger properties on Chichagof Island has led to considerable prospecting in their immediate neighborhood, as well as farther afield, and rumors of

[5] Hall, R. G., Importance of flotation at the Alaska Juneau mine: Eng. and Min. Jour., vol. 139, pp. 39–41, Jan. 1938.

promising finds are of frequent occurrence. Among the more persistent rumors of new finds is that of the discovery of good showings of veins on Krestof Island, some 12 miles north of Sitka, where some actual development work is said to be in progress. These activities, however, are not limited only to search for new deposits, for reports indicate that active work has been in progress at several of the old properties, which lately have been dormant or worked only on a small scale. Among the older properties, the Apex-El Nido, on Chichagof Island, some 25 miles northwest of Chichagof, was reported to have been partly reopened during the season and a crew of about 18 men engaged for some time in sampling and testing the property, evidently for the purpose of considering plans for resuming operations if the results were satisfactory. Some mining is also reported to have been in progress at Slocum Arm, where for a number of years gold-bearing lodes have been known and mined and milled on a small scale.

On Admiralty Island productive lode-gold mining was carried on at the properties of the Alaska Empire Gold Mining Co., a short distance north of Helm Bay. It was expected that this mine would be able to step up its production materially in 1937, through the use of the additional equipment that had been installed in 1936. Unfortunately, however, during the height of the season the main shaft became damaged and much time was lost before it was replaced, so that production was much less than the capacity of the plant. So far as reported, no productive lode mining was in progress on the property of the Admiralty Alaska Gold Mining Co., a few miles to the north, on Funter Bay.

Throughout the Juneau-Chichagof district, or the northern part of southeastern Alaska, in addition to these producing mines there were many other lode-mine developments in progress, which, although the respective properties are not yet producers of notable amounts of gold, indicate the revival of interest in searching for and attempting to develop some of the more promising areas. Unfortunately, however, some of the enterprises of which much had been expected failed to materialize. The most notable of these disappointments was the discontinuance of work on the old Kensington and Comet properties in the Berners Bay area, north of Juneau. This work had been undertaken on a large scale to establish a really important business at that locality. The preparatory work had been in progress for more than a year, but as soon as the owners learned of the passage of the tax that had been levied by the Territorial legislature on the gross production of precious metals they suspended further work on the project to await a more favorable time for carrying out their plans for rehabilitating the mine, stating that they based their decision on that act.

The flurry of excitement that prevailed immediately prior to the opening to prospecting of Glacier Bay National Monument died down soon after prospecting was permitted, and no finds of moment were immediately forthcoming. Signs of mineralization have long been known but no extensive deposits have yet been discovered. The facts regarding this area can perhaps be best summed up by quoting from the report issued by the Geological Survey, resulting from examinations made in the area during 1936 by a party in charge of J. C. Reed, geologist, as follows:[6]

> Prospecting has thus far failed to disclose any large deposits of ore minerals. None of the deposits examined can make large mines, and it has not yet been demonstrated that any of them can be successfully mined on a small scale. Even tentative predictions of the economic value of these small numerous and diversified deposits must await the receipt of assay results.

Some further preparatory work is reported to have been done by the Alaska-Windham Gold Mining Co., in the Windham Bay area south of Juneau. A crew of from 8 to 10 men at times was employed at the property, but so far as learned had not advanced the preparatory work to the productive stage. The rumor that the old Treadwell mine on Douglas Island, west of Juneau, was to be reopened seems to have been unfounded, and it is now authoritatively denied that any move of the sort is likely to be undertaken in the near future. No reports have been received as to any productive lode mining having been in progress in 1937 in either the Skagway or Porcupine districts in the extreme northern parts of southeastern Alaska.

In the Ketchikan district, in the southern part of southeastern Alaska, mining seems to have been carried on in 1937 at about the same rate and in the same places as in recent years. The mine in this district that reported the greatest production of gold in 1937 was that of the Alaska Gold & Metals Co., which is situated near the head of Kasaan Bay, a deep indentation on the east coast of Prince of Wales Island, some 40 miles west of Ketchikan. Work at this mine is reported to have been in progress throughout the year, though, for part of the time at least, at much below the rated capacity of the plant. The ore consists of sulphides and occurs in shoots in gabbro and pyroxenite. In addition to the gold, considerable copper and a little silver are recovered from the concentrates, but the most distinctive feature of the ore is that it contains considerable recoverable palladium, one of the group of platinum metals. All the metallic contents that are saved are recovered by crushing and concentrating the ore by flotation and shipping the concentrates thus

[6] Mineral deposits of the Glacier Bay region, Alaska: U. S. Dept. Interior Press. Memo. 130584, 1937.

obtained to the States for smelting. The discovery in 1936 of rich gold-quartz stringers in the vicinity of McLean Arm, near the southern tip of Prince of Wales Island, led to considerable activity there during 1937 by a crew operating under the direction of the Anaconda Copper Co., which was said to have obtained an option on the property. Although considerable gold ore was taken out in the course of the tests and preliminary work, terms for continuing work there apparently could not be satisfactorily arranged, and the option was finally given up and the work stopped.

The number of indications of mineralization throughout almost all parts of the Ketchikan district has given the people there an especially keen interest in mining, and they have displayed considerable community interest in encouraging many moves looking toward further stimulating the search for and development of potential mining properties. Among the definite plans of this sort that have been carried through are classes for the training of prospectors, as an extension service of the University of Alaska, and the establishment of an assaying laboratory under the Territorial Bureau of Mines, for which authorization and funds were provided by the Territorial legislature in 1937.

In the Hyder district, which includes a considerable tract of country at the head of Portland Canal, in southeastern Alaska, no extensive lode development was in progress, and even the sudden increase of interest in prospecting that was earlier awakened 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 1937. It is true that many physical difficulties confront the prospector who tries to develop a mine in this area, for the country is notable for tumultuous streams and snarled forests in its lowlands, with rocky precipitous slopes above, and snow fields and glaciers in all of its uplands, reaching down in places to only a few hundred feet above sea level, and a phenomenally heavy fall of snow covers everything from early fall to late spring. In spite of these handicaps the known geologic setting of this district, which lies along the eastern margin of the great Coast Range intrusive mass, seems favorable for the occurrence of mineralization that might have given rise to commercial ore bodies. The proved occurrence of bodies of this sort in comparable environment in contiguous parts of British Columbia seems to confirm this view. It is inconceivable that the international boundary line serves to mark also the line of separation between good and poor prospective mining territory. The conclusion seems almost inescapable, therefore, that

intelligent and thorough search for and following up of indications of mineralization might well lead to the establishment of a significant mining industry in the Alaska part of the district.

The Willow Creek district, at the head of Cook Inlet, has long been the second most productive lode-gold district in the Territory and has produced gold worth about $9,200,000 since lode mining started there in 1909. The principal producing property in the district is that of the Willow Creek Mines, Inc., which holds claims on Craigie Creek and gets its ore mainly from the Lucky Shot and War Baby mines, on the northern slopes of the valley of this stream. This company employs about 100 men in the various phases of mining and milling, and the property is in continuous operation throughout the year. No important changes are reported to have been made during the year, and work continued at about the same scale as formerly. The ore is highly siliceous and occurs in veins and shear zones near the margin of a large body of quartz diorite. The ore is partly oxidized to the depth that has been reached by mining, but in spite of that fact unweathered sulphides are found in places practically at the surface. The ore is conveyed from the mines to the mill by gravity trams. The mill at the Lucky Shot is capable of handling some 40 tons of ore a day, and the treatment of the crushed ore consists of amalgamation of the table and flotation concentrates and cyanidation of the amalgamation tailings. The entire layout has been carefully planned and well carried out. In addition to milling the current output of ore from its mines, the cyanide plant that was erected a few years ago was also actively employed during 1937 in re-treating some of the tailings that had been impounded from earlier milling of the ore from this property. It is probable that as soon as these old accumulations are cleaned up some of the tailings from other properties farther up the creek will also be cyanided in this mill.

Some 2½ miles northeast of the group of mines at the head of Fishhook Creek is the property of the Fern Gold Leasing Co. near the head of Archangel Creek in the Willow Creek district. The reports from this mine indicate that it had an especially successful season in 1937 and increased its output considerably over that of the immediately preceding years. The ore is of high grade, comparable in its general character to that of the better producing mines in the district. During the year a new 20-ton ball mill was installed in place of the old mill that had previously been in use. After the crushing in the mill the pulp passes into a pulsator jig, and next the fine ore is treated in a flotation machine. About one-quarter of the gold in the ore is recovered in the concentrates, and the other three-quarters in the mill bullion and precipitates. The concentrates are

shipped to a smelter in the States for treatment. The main new development in the mine was the driving of a new adit about 200 feet below the old level. This will not only open up a considerable block of ore but will greatly reduce the cost of mining and transportation.

In addition to these larger operating properties in the Willow Creek district there were a number of other places where some gold was produced or where prospecting was earnestly in progress. In fact, all the news received from the district seemed to indicate especial activity, and several of the prospects seemed to be worthy of considerable additional work.

The third most productive lode-gold district in the Territory is that in the vicinity of Fairbanks. Its output of lode gold in 1937 was $423,000. This was somewhat more than in the season of 1936 and is exactly the same as in 1935, which marked the highest lode production in the entire history of the camp. It is believed, however, that this output by no means marks the maximum limit of production, for steps are already in progress that give promise of soon increasing the output materially.

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 larger producing mines in this area are those of the Cleary Hill Mines Co., the McCarty Mining Co., 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.

At the Cleary Hill mine the work proceeded along the same general lines in 1937 as in recent years but at a somewhat accelerated rate, owing to the modernization effected by the company when it rebuilt after the disastrous fire that occurred at the property in 1936. The mine is situated on Bedrock Creek, a short distance upstream from the point where that stream joins Cleary Creek.

The McCarty property is situated near the divide at the head of Fairbanks Creek, which also serves to separate the tributaries of that stream from those that flow northerly into Cleary Creek. A number of veins have long been known to occur on this property, and some of them have afforded considerable ore, though of late years they have not been mined actively. During most of 1937 this property was being actively mined by E. F. Schreiber, but late in the fall negotiations had been carried through for the United States

Smelting Co. to take it over and carry on the work. A crew of a dozen or more men was employed by this new management in drifting along the vein on the 135-foot level on the Henry Ford claim. This is a new departure for the United States Smelting Co. to undertake the opening up of lode prospects in Alaska and will be watched with special interest, as success in this venture would doubtless encourage the company to expand its activities in undertakings of this sort.

Another of the principal producing gold-lode mines in the vicinity of Pedro Dome is the Hi Yu mine, on Too Much Gold Creek, a tributary of Fairbanks Creek. At this mine not only were the underground developments continued successfully and the milling plant operated efficiently during the year, but many general improvements were made. The general practice here consists of bringing the ore to the surface through an adit and transporting it to the mill by tractors. At the mill the ore is passed through batteries of gravity stamps, and most of the free gold is collected on plates or in the mortars. The fine tailings are then run through flotation units. A crew of 20 to 25 men was employed. The customary high tenor of the ore milled was maintained; a large part of the free gold was recovered in the milling operations, and the part that is intimately associated with sulphides is contained in the concentrates, which are shipped to a smelter in the States for treatment.

In the Ester Dome area of the Fairbanks district the development of gold lodes continued at essentially the same places as heretofore, but the scale of operation at several of the mines underwent a marked increase. For instance, part of the old holdings of Borovich & Stevens, of Sam Stay, and of others, were acquired early in the year by the Bartholomae Oil Corporation, of Los Angeles, and a crew of 20 or more men was put to work at once rushing improvements and construction that would renovate all departments of the enterprise. This work entailed driving a new adit at a lower level and opening up the veins underground, reconstructing the mill and equipping it with the machinery required to give it the capacity to handle 50 tons or more of ore a day, and erecting buildings to take care of the increased force that would be employed as well as provide facilities for workshops, assay office, and the countless other activities that must be carried out if the property is to be run effectively. These many details occupied the company during the entire period so that it did not report any production of gold for that year. The thoroughness and vision with which the preliminary work is being done give ample assurance that the enterprise is being undertaken as a long-time permanent investment, which should do much to build new confidence in the stability of lode mining in this district. In the same general area there were a number of small

producing lode mines which in the aggregate contributed considerable gold to the district's total. Among the larger of these properties was that of the Blue Bird Mining Co., whose ore is treated in a custom mill some 2 miles distant. In the vicinity of Happy Creek the greatest production of lode gold in 1937 came from the following mines and prospects: Mohawk, Royal Flush, Nickaloff, and Irishman. During the year considerable custom milling was done for the small operators at the Smith mill near the head of St. Patrick Creek and that of Nickaloff on Happy Creek.

The undertaking of prospecting by a large company in part of the Goodpaster area late in 1936 was one of the main matters of interest in the Fairbanks district, although it concerns a tract lying more than 100 miles to the east of Fairbanks and therefore but remotely connected with that district. The plans for prospecting the claims that had been acquired called for having a small crew spend the winter of 1936–37 driving openings along several of the more promising veins so as to test them at some distance from the outcrop. Details of the precise findings of this work are not available to the Geological Survey, but apparently they were not such as to induce the company to go far with the work, and by spring it was announced that the company had discontinued the work and given up its options. This decision was a great disappointment to many, as the opening of a permanent lode camp in that area would have been helpful not only through its local effects but also in its aid to the general development of lode mining throughout interior Alaska.

Among the districts producing lode gold that are grouped together in the table on page 16 under the heading "Other districts", the most productive, named in the order of output, are the Nabesna district, which lies north of the Wrangell Mountains of the Copper River region; the vicinity of Valdez and other parts of the Prince William Sound region; the Nixon Fork district, in the Kuskokwim region; Kenai Peninsula, including the Nuka Bay area, the area south of Hope, and the hills north of Girdwood; and a few districts widely scattered through other parts of central and western Alaska whose gross output totaled only a few thousand dollars in gold. In practically each of these districts the production in 1937 came from a single mine, so that to avoid disclosing the individual output it has been necessary to combine the statistics.

In the Nabesna district the only producing gold-lode mine is that of the Nabesna Mining Corporation, which is sometimes referred to as the Carl Whitham mine, from the name of its principal owner and manager. This mine is on White Mountain, west of the Nabesna River, between its tributaries Jack and Jacksina Creeks. A good road to the mine from the Richardson Highway at Gulkana has now been

completed and is available for trucking in supplies and equipment, thus greatly facilitating operations, though for speedy or emergency service the airplane is still extensively utilized. According to the published report of this company the principal results of the year were the mining of nearly 8,800 tons of ore and the treatment of this and more than 7,300 tons of tailings that had previously accumulated. In the course of this work nearly 2,000 feet of underground openings were driven and 700 feet of diamond-drill holes bored. New construction and equipment put into the mill permitted cheaper handling of the material and a higher rate of recovery. Some time was lost during the early part of the year, owing to inability to get adequate supplies of Diesel oil, which had been cut off by the shipping strike and later by a strike that closed the railroad between Cordova and Chitina. Tests to demonstrate the continuation and tenor of the ore bodies that will subsequently be mined seem to prove satisfactory reserves ahead. These tests seem to show that the ore body lies somewhat farther north than had been expected. The width of the vein is reported to average about 4 feet. Some exceptionally high-grade ore was found in the course of the development work, and the average value is expected to be more than $30 a ton. Plans for 1938 at this property provide for continuous operation of the mine and mill along the same general lines as at present but with additions and changes in the mill that will permit handling a greater quantity of ore more efficiently.

At several places within the Prince William Sound region there are gold-lode mines which in the aggregate afford a significant contribution to the yearly output of gold from the Territory. Unfortunately, the Geological Survey has received only meager first-hand information regarding the new activities at any of these properties in 1937. From such information as has been received it appears that the greatest production came from the properties of the El Primero Mining & Milling Co., on the west side of Port Wells, north of Bettles Bay; the prospect near the head of Bettles Bay, formerly known as the Herman-Eaton prospect and now operated by Ralph Merrill; and the Cliff mine, a few miles west of Valdez. The following notes regarding these properties as well as some of the smaller properties in the Prince William Sound region were prepared by F. H. Moffit, of the Geological Survey.

The Granite mine (El Primero Mining & Milling Co.) is the largest and most widely known of the gold-producing properties of the Port Wells district. The mine has been in operation for many years, although not continuously. The ore body is irregular in form and has been faulted so that it has been difficult at times to keep in pay ore. The operations of 1937 where late in starting but were carried on in good ground and resulted in a favorable season's production. About a dozen men were employed. Mining at the Granite

mine has usually been carried on only in the summer season, and no production is made in winter.

The Merrill property was in operation only in the earlier part of the season, and the mine on Culross Island, south of the entrance to Port Wells, which at one time shipped a small quantity of ore, was not in operation at all.

The Cliff mine, after lying inactive for many years following a period of profitable operation that began when the mines were opened in 1909, is again on a productive basis under the management of the Cliff Gold Mines, Inc. This company took charge of the property and started the work of reopening it in March 1935. Since then extensive exploration and development work has been done. The lower workings of the mine are below sea level and filled with water after mining stopped. At present no attention is being given to the recovery of ore that lies below sea level, and the new work is in the higher levels above the mill. The mill was started in the spring of 1937, which event appears to mark the beginning of continuous production and a renewal of the life of this important property that bids fair to last for many years.

The Mayfield claims are west of Shoup Glacier and north of the pass between Anderson and Columbia Glaciers, on the steep south slope of the mountain ridge projecting westward into Columbia Glacier. They are 7½ miles west of the bay and about 3,000 feet above sea level. Gold-bearing quartz veins that cut the slate and graywacke beds which make up practically all of the Chugach Mountains in the area north of Prince William Sound are being prospected. Emil Helekal, who has charge of the operation, employed three or four men and devoted the season to development work. He proposes to install a 25-ton mill and plans to transport his freight over Columbia Glacier from Columbia Bay. In previous years supplies have been brought to the mine over Anderson Glacier from Shoup Bay or by airplane from Valdez.

The Ruff and Tuff mine is on the south side of a nunatak, rising out of Columbia Glacier. It is 7½ miles nearly northwest of the head of Shoup Bay and is reached by airplane, using two landing fields on the smooth glacier ice, one field half a mile south of the mine, and the other 1 mile to the northeast on the north side of the nunatak. At the place where the work is in progress the slate and graywacke country rock is intruded by a body of diorite that is exposed on the surface and, as measured by the owners, has a length of 465 feet and a width of 56 feet. Fractures in the country rock and intrusive are filled with quartz that contains gold and silver associated with sulphide minerals, mostly iron. The development work on the property in 1937 included an open cut and 90 feet of tunnel. During 1937 several new buildings were built, employing materials that were brought from Valdez by airplane. No milling was done.

The Portage Bay Mining Co. has been engaged for three seasons in opening up and equipping a mining property that lies about 2 miles north of the bay and is reported to have yielded some excellent prospects in gold. Part of the work of equipping the mine was the construction of a road to it, which required first attention. In 1937 a 16-ton ball mill was finished and put into operation; thus a part of the season was productive. About eight men were employed.

The principal activity on Mineral Creek for several years has been in connection with the Big Four mine on the ridge between Mineral Creek and Shoup Glacier basin and the Little Giant and associated claims east of the mouth of Brevier Creek. Both of these properties have been equipped for production. No work was in progress on the Big Four in the later part of the summer, but the stopes were filled with ore ready for milling, and some ore

made at the property appears to have been the installation of a new gravity tram by which the ore from the Jewel mine is transported to the mill. The distance between supports is approximately 2,500 feet, and the difference in elevation between its two ends is about 600 feet.

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 the more significant were the Chulitna, Valdez Creek, Kantishna, and McKinley districts and the Copper River region.

The principal lode-mining project was that undertaken to prospect the extensive mineralization on the West Fork of the Chulitna River nearly due west of the station of Broad Pass on The Alaska Railroad. Numerous attempts have been made in the past to explore this tract, but inadequate funds, or some other equally cogent reasons prevented accomplishing much. In 1936, however, W. E. Dunkle and associates undertook a well-planned intensive exploration of the area with a view to establishing a large low-grade mine if conditions proved favorable. After this work had been under way several months an option was given on the property to the Anaconda Copper Co. and an extensive campaign was started to test the mineralization in depth with diamond-drill holes. After considerable drilling had been done the company gave up its option early in 1937, and the property reverted to Dunkle and associates. According to the present plans they will resume their original scheme of developing the property, and they state that the showings so far obtained demonstrate that the ore continues good to a depth of at least 500 feet below the lower tunnel, which is the limit to which they have drilled. It is expected that the property will begin active production not later than 1940. The general plan of treating the ore after crushing will be to subject it to differential flotation, which will yield a concentrate for shipment containing about 15 percent copper, 40 ounces of silver, and 6 ounces of gold to the ton of concentrates. The gold in this concentrate will account for about 65 percent of the gold in the original ore. The rest of the gold will be recovered through cyanidation of the remaining iron concentrates.

In the Valdez Creek district there were several lode developments in progress, the largest of which was that of the Alaska Exploration & Mining Co. Some work was in progress on the Yellow Horn claims of Boedeker & McGahan, who are reported to have set up a small Straub mill to test some of the ore found in the course of their underground developments. No significant amounts of gold

are reported to have been produced at any of these properties during the year, and the work was carried on only during the open season.

In the Kantishna district the principal item of interest regarding lode developments, outside of the work on the antimony deposits on Stampede Creek, which is referred to on page 102, was the acquisition of the Quigley properties near Eureka and Friday Creeks by Fransen and Hawkins, two experienced hard-rock mining men who have long been identified with the successful management of lode-gold mines in the Fairbanks district. The new owners plan to put the property into production as rapidly as possible, but it will be necessary first to do considerable work in constructing a surface plant and to bring in equipment for economically carrying on the underground work and later for furnishing a suitable mill. Much of the preliminary underground work will be carried on during the winter of 1937–38, so that the mine will be ready to supply sufficient ore to the mill to make a significant production in 1938.

No recent information is available as to the progress in 1937 of the work that was started in 1936 looking to the development of low-grade gold ores in the vicinity of Slippery Creek, which rises in the northern foothills of the Alaska Range almost due north of Mount McKinley. This work was being carried on under the direction of W. E. Dunkle, who had several assays from the district that seemed to indicate a very extensive deposit of quartz-bearing gold veins. In so remote a district as the Slippery Creek area it seems likely that small lode deposits, even though of high grade, would be extremely expensive to develop on a commercial scale, so that only a large deposit that would justify the installation of the required facilities would probably prove attractive at this time. The adequate proving up of a large body of low-grade ore necessarily requires thorough preliminary testing, and this may account for the fact that no information has as yet been given out regarding the progress of the prospecting that was understood to be under way.

In the Bremner district of the Copper River region the search for lodes has been in progress for a number of years in the vicinity of Golconda Creek. The following notes on this district have been prepared by F. H. Moffit, who, while he did not personally visit the district, obtained considerable information at first hand from some of the operators regarding the recent developments.

The Bremner Mining Co., which is the only organization now prepared to mine and treat ore, did not operate its mill in 1937 but devoted the season to development work. This consisted chiefly of opening another adit to the ore body, at a lower level than the existing tunnels. Clarence Poy, of Valdez, was employed to supervise the driving of the new tunnel and gave part of his time to that project. The tunnel was not completed at the end of the

summer season, so that its importance to the operation of the mine is yet to be determined.

The claims of the Bremner Mining Co. are at the head of Golconda Creek and west of the pass from Golconda Creek to Monahan Creek and the Chitina Valley. They cover part of a mineralized area that extends to the mountains east of the creek and doubtless supplied the placer gold contained in the gravels of the creek. During the summer exploration work was carried on by the company on some of its other claims, as well as on the new adit, and altogether about 14 men were employed.

Other prospecting in progress in the Bremner district was that on the Yellow Band group, which lies high on the mountain east of Golconda Creek and 1¼ miles south of the pass leading to Monahan Creek. These claims are the property of John Letendre, Joe Meloy, and Carl Killian. They are under lease to A. C. Baldwin, of Seattle, and have been under development for several years.

The country rock in this vicinity is a succession of alternating beds of slate and graywacke intruded by numerous light-colored, porphyritic dikes. The beds are strongly folded and are cut by many faults and shear zones. Slate is the dominant rock in the part of the mountain where the Yellow Band claims are located. The dikes that intrude the slate appear to belong to at least two distinct groups. One that appears to be the older trends eastward or a little north of east. Dikes of this group are offset in some places where they are crossed by dikes of the second group. The second group includes a larger number of dikes. They commonly strike somewhat west of north and indicate the trend of the principal faults and shear zones so far encountered, although there is some deviation from this strike among the smaller dikes.

The exploratory work to date includes a drift over 50 feet long on the Killian vein and a crosscutting tunnel 60 feet long and several open cuts on the Meloy vein, which is 240 feet east of the Killian vein and 110 feet higher at the tunnel. The tunnel on the Meloy vein penetrates a dike nearly 10 feet wide which either branches or is cut by narrower dikes, striking more to the west, in the vicinity of the tunnel. The main dike appears to have resulted from two intrusions, for the east and west sides differ in appearance. Possibly, however, the difference may be due to faulting and shearing, which is pronounced. Mineralization took place along the sheared zone of crushed rock and quartz which is now stained with iron oxide. Panning shows that free gold is present in sufficient quantity to encourage further exploration. One of the difficulties of mining in the Bremner district is the transportation of equipment, supplies, and men. The chief obstacle is the Chitina River, which is a swift stream subject to wide fluctuations in volume and requiring boats for crossing in summer. Heavy and bulky freight is taken in over the ice in winter, but nearly all the things that have to be gotten in summer, as well as men, are carried by airplane. Two landing fields are available. One is on the Golconda-Monahan Creek summit and is small and at times treacherous. The other is on the gravel bench west of Golconda Creek and south of the mining area. This field is larger and better situated in many respects but was not yet completed in 1937. Elsewhere in the Copper River region practically no new development work was in progress, though in the McKinley Lake and Kotsina districts and near Tiekel there has been lode-mining activity in the past, and many claims are still held there, some of which may justify further exploration.

In the Iditarod district some work was in progress by Johnson & Martin and a crew of five or six men at the Golden Horn lode prop-

erty on Granite Creek near Flat. This work was in the main directed toward exploration and testing of the mineral showings, but as it progressed some ore is reported to have been taken out.

At several points in Seward Peninsula some development of the known gold lodes was undertaken. In the hills north of Nome search for workable deposits was carried on especially in the area near the head of Snake River. To the east of Nome in the Bluff region extensive prospecting and development work is reported to have been in progress on a number of the lode showings that have long been known in the district. This preliminary work is said to have been so encouraging that plans for bringing the property into production in 1938 had reached an advanced state. The litigation that had long been pending, and which was one of the causes that had kept the Big Hurrah lode gold mine near Solomon closed down, was settled during the season of 1937 in favor of the Lane Investment Co. This action should enable mining interests to consider seriously taking steps that may lead to the reopening of the well-known property, which 25 years ago was the most productive lode-gold mine in the entire Seward Peninsula region.

GOLD PLACERS

GENERAL CONDITIONS

Placer mining in Alaska in 1937 yielded gold worth $12,655,000. This amount marks a considerable increase in value as well as in quantity over the output of the preceding year. In fact, the value of the placer production was larger than for any other year since 1909 and has only been exceeded in 4 years 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. 14). 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 great increase in the

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 1937 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 that 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 allurement of possibly discovering a real prize as a result of his efforts. Such a career obviously should be undertaken only by the physically fit and those reasonably skilled in understanding nature's secrets and the ways of acquiring what she has to offer. 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 desire 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 were on the whole normal throughout 1937. The tie-up of shipping because of the strike that prevailed throughout the early months of the year had little direct effect on the placer-mining industry. It did, however, have indirect effect, because the uncertainty it created doubtless dissuaded some operators from placing their orders for replacements and additional equipment early and handicapped them later in getting material onto the ground and set up in time to utilize fully the open season. Labor conditions were on the whole satisfactory, so that there was usually an adequate supply available and except at individual properties no controversies arose that materially handicapped productive activity. Weather conditions which effect mining, such as quantity of rainfall and temperature, were in general normal. Throughout most of the placer-mining areas there was, if anything, rather more than the usual rainfall, so that water supplies were kept at a normal stage. This, of course, does not mean that many of the miners were satisfied with the supplies available at their individual properties, for always there is the tendency of the operator

to plan to use the entire available supply, and in order that he should not underestimate that limit he usually allows a lavish factor of safety or rather of hope. The time of starting mining in the spring and closing it in the fall necessarily varied widely according to temperature, but showed no abnormal change from the average dates of similar events in like areas in other years. The apparent normalcy of most of the extraneous conditions in the placer areas during 1937, a year of especially large placer production, serves as a basis for believing that the industry should have little difficulty in maintaining or bettering that record in the succeeding years, when normal conditions prevail.

PRODUCTION BY DISTRICTS

The description given on pages 3–4 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 and many of whom are in the most remote parts of the Territory. The gold they produce frequently passes through many hands before it finally reaches a mint or assay office, so that a single lot is difficult to trace, for it may appear in the reports of the individual and then lose its identity by being lumped with other gold by the storekeeper, who took it in exchange for supplies, and still further consolidated by the bank, perhaps in some distant district, to which it was sent by the merchant, and its course perhaps still further obscured by being shipped to another bank before being turned in to the mint, 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 fully 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 discrepancies so far as possible. As a result it is believed that the figures given for the total placer production are in accord with the actual facts. The distribution of this total among the different districts, however, is open to more serious errors, as gold produced in one district, unless reported to the Geological Survey by the original producer, may be credited to some other district through which it passed in the course of trade. In spite of the possibility of some error in the distribution of placer gold among the different regions, the following table has been prepared to show the comparative standing of the different regions as accurately as possible. It should be remembered that in this table, unlike other tables in this volume that relate to production of gold in periods prior to 1934, all statements

relating to the value of the gold are based on the present standard price of $35 an ounce.

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

Value of placer gold produced in Alaska in 1937 and 1936

Region	1937	1936	Increase, 1937
Southeastern Alaska	$6,000	$5,000	$1,000
Copper River region	117,000	109,000	8,000
Cook Inlet-Susitna region and southwestern Alaska	459,000	265,000	194,000
Yukon Basin	8,201,000	7,689,000	512,000
Kuskokwim region	478,000	152,000	326,000
Seward Peninsula and northwestern Alaska	3,394,000	3,108,000	286,000
Total	12,655,000	11,328,000	1,327,000

SOUTHEASTERN ALASKA

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

The entire placer production from southeastern Alaska in 1937 is estimated to have been worth only $6,000, so that even the largest operations were small camps of two or three men each, who took out only enough gold to make a very modest grubstake. There are three areas in southeastern Alaska in which, in the past, placer min-

ing has been active—near Juneau, in the valley of the Porcupine River, and on the beaches between Lituya Bay and Yakataga. No placer mining is reported to have been in progress in the Juneau district in 1937, though a small amount of gold is said to have been recovered in the course of casual one-man operations. None of the placer claims in the Porcupine district afforded a production worthy of note. The principal company that has long held claims in the district has not done any development work on its properties owing to litigation and internal dissension. These difficulties are in course of being cleared up, and the company expects that it may resume its development of the claims in 1938. In the Lituya-Yakataga district placer mining was continued on about the same scale as for several years. The placers there are all of the beach type, exposed to the waves of the Pacific Ocean. This position, though in a measure favorable for concentration of the beach material, is disadvantageous, because except under suitable weather conditions the placers cannot be mined, and even then the use of extensive mechanical appliances is precluded by the necessity of removing them during times of storm.

COPPER RIVER REGION

In the Copper River Valley there are two principal areas and one minor area that have yielded placer gold, though a few small camps are widely scattered elsewhere throughout the river basin. The principal areas, named in order of their production, are the Nizina and Chistochina districts, and the minor area is the Nelchina district. The value of the placer gold produced from the Copper River region in 1937 was $117,000, an increase of about $8,000 over that from the same region in 1936. The greater part of the gold from placers in the Nizina district came from the properties of the Nicolai Placer Mines on Dan Creek and of the Andrus estate on Chititu Creek and Rex Gulch.

A summary of the recent developments in this area is afforded by the following notes of F. H. Moffit:

> Most of the placer mining for gold on Dan Creek is done by the Nicolai Placer Mines which owns many claims on the creek channel as well as adjacent bench claims. Its equipment includes pipe lines, which bring water from a recently built reservoir above the canyon, giants, power plant, and the other machinery required in hydraulic-mining operations.
>
> From 7 to 14 men were employed during the season of 1937. An abundance of water made favorable conditions for mining, yet considerable time was lost in the best part of the season through trouble with the pipe line. This came about because of washouts resulting from the abundant rain and the fact that the pipe line, which was installed the previous season to replace an older one in use for many years, had its foundation undermined by the floodwater in places. In spite of this the results of the summer's work were exceptionally favorable.

Practically all the stream gravels of lower Dan Creek have been mined out, and the bench claims have furnished most of the gold mined for several years. In 1937 mining operations were directed to the high bench gravel on the north side of Dan Creek just above Boulder Creek. The work of the last few years has shown that a well-defined bedrock channel lies north of the present channel of Dan Creek, runs parallel with this channel, and is from 30 to 50 feet above it in the placers where it has been exposed. Between the old and the present channels is a rim of the slate bedrock which ranges from 25 to 50 feet higher than the old channel. More than a quarter of a mile of the old channel has been uncovered, but it is not yet fully evident where it joins the present channel above Boulder Creek nor whether it comes back into the present channel below Boulder Creek or continues west under the point of the high gravel bench to the Nizina River. This development presents an interesting question concerning the old drainage system, which has decidedly important economic aspects.

The work of the 1937 season was begun by driving a tunnel through the slate rim of the old channel, through which the channel and overlying gravel was then sluiced. About 40,000 square yards of bedrock were uncovered, bounded on the north by a vertical gravel face nearly 100 feet high. The lower half of this gravel bank is horizontally bedded stream gravel, which becomes somewhat coarser toward the west than it is on the upstream or east side. The upper half is dark fine-grained gravel or sand with false bedding, yet in the main it, like the lower gravel, is horizontally bedded. At the base of the deposit, resting on bedrock, lies rusty-weathering, poorly assorted wash, which carries most of the gold, although gold is distributed through the upper gravel also. The sand and fine gravel are closely packed and stand without slumping. Even the water from the giant, when directed against one point, does little but bore a round hole. The bedded gravel of the high face is overlain by till left by the glaciers, consisting of silt and angular material ranging in size from small fragments to large blocks. Whether or not the glacial material carries gold was not learned.

Other placer-mining operations on Dan Creek were on a much smaller scale than those of the Nicolai Placer Mines and contributed only a small amount of gold to the total production of the district.

Mining in the Chititu Valley gave employment to about the usual number of men, something less than 20. The principal operation was on Rex Gulch, in ground that was less productive than adjacent parts of the creek had been, in consequence of which the yield was somewhat reduced. At this point the old drainage lines differ from those of the present creek and made it necessary to handle an unusual quantity of gravel. Apparently this is a temporary condition. Fourteen men were employed in this operation.

Other placer mining on Rex Gulch gave employment to a few additional men and added a relatively small amount to the production of the district.

The Chistochina district embraces a rather indefinite area on the southern flanks of the Alaska Range at the head of the Copper River, extending for some 50 miles eastward from the Richardson Highway. The following notes on mining in this district in 1937 have been furnished by F. H. Moffit:

The principal gold placer mining in the Chistochina district was on Slate Creek, although there were other small operations in the vicinity and the prospecting of ground on the Middle Fork of the Chistochina, which has been

in progress for several years, was continued. The lease on ground on Slate Creek, which was held by Arne Sundt, expired with the season of 1937, and the property was taken over by Gen. J. G. Steese, who has brought in a large quantity of supplies and equipment and expects to begin mining on a large scale when the season of 1938 opens. The equipment which General Steese is installing was landed at Valdez in September, so that it could be hauled over the summit of Thompson Pass before the Richardson Highway at that point was closed by the winter snows, and was later freighted to Slate Creek. During the summer, in recent years, nearly all transportation of men and supplies to the upper Chistochina Valley has been by airplane and will probably continue to be so for another year or two, although a road to connect Slate Creek with the highway is under consideration and some preliminary work has been done. Such a road would be of great benefit to those mining in the district, for the season of placer mining is naturally short, owing to the high altitude, water for sluicing is scarce, and the present means of transportation is either slow and difficult or relatively expensive when compared with automobile transportation. A means by which the effective length of the working season could be increased and the cost of transportation reduced would be of great advantage in decreasing the cost of production, and especially a means by which heavy and bulky equipment could be transported in summer is needed.

Placer mining has been carried on in the Ahtell Creek Valley since 1934 on a small eastern tributary called Grubstake Creek. This creek is 6½ miles, airline, northwest of Slana and about 30 miles southeast of Chisna. The operation is a small one, using simple equipment, and has employed from four to six men. In 1937 the force was reduced and only the two original locators of the property, Messrs. Swanson and Olson, were at work. They are reported to have recovered sufficient gold to pay for operation and expect to continue mining in 1938.

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. The mining centered mainly around Albert Creek, and the total production amounted to only a few thousand dollars.

COOK INLET-SUSITNA REGION

In the Cook Inlet-Susitna region, as the term is used in this report, are included the placer camps in Kenai Peninsula and adjacent country, the Yentna-Cache Creek district, and the Valdez Creek district, near the head of the Susitna River. For convenience, the small placer production from southwestern Alaska has also 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. Of late years, however, there has been a marked increase in the placer gold production of some of the districts, and in 1937 the value of the gold pro-

duced from the Yentna-Cache Creek district appears to have exceeded that of any other year since mining began in the district in 1905, and the production from the Valdez Creek district seems almost to have equaled that of the year of greatest production from that area. The combined placer gold production from all these districts in 1937 was valued at $459,000, or about $194,000 more than the production from the same area in 1936. In the relative order of their placer production in 1937 these districts ranked as follows: Yentna-Cache Creek, Valdez Creek, Kenai Peninsula and vicinity, and other miscellaneous scattered small placer camps, including southwestern Alaska.

In the Yentna-Cache Creek district at least 100 men were engaged in productive mining and about 20 more were doing casual prospecting and development work, which in some localities amounted to little more than that required by law to hold the claims. By far the largest producing mine in the district was that of the Peters Creek Mining Co., under lease to Pat McDonald, Inc. This mine was equipped with a Bucyrus-Erie dragline scraper, having a 1½-cubic-yard bucket and 60-foot boom, operated by a 200-horsepower caterpillar Diesel engine. The material being dug is about 6 to 12 feet thick and rests on a bedrock of the Tertiary coal-bearing series. The operators report an especially large output due to the fact that mining commenced nearly a month earlier than usual and sluicing was under way by May 5. It is understood that the current lease expired at the close of the season of 1937 and that a new organization, called the Spokane Peters Creek Mining Co., was awarded the lease for the next season. Half a dozen other mining camps were established on Peters Creek or its tributaries north of the McDonald ground. Most of these were small one- or two-man outfits that employed only the modest pick-and-shovel method. Reports were current that negotiations had been completed whereby an extensive group of claims on Bird Creek, one of the headwater tributaries of Peters Creek, had been acquired by a syndicate that proposed to work the ground in 1938 by hydraulic methods.

The other main center of placer-mining activity in the Yentna district embraces Cache Creek and its numerous tributaries from the north that rise in the Dutch Hills. A number of other streams on which placer deposits have been found also rise in the Dutch Hills but flow northward to join Dutch Creek, which in turn flows into Granite Creek, which after a circuitous course joins the Kahiltna River 3 or 4 miles northwest of the mouth of Cache Creek. The principal placer production from this area has come from several camps on Cache Creek itself and its tributaries, Nugget and Thunder Creeks, and from Dutch Creek. Most of the mining on the larger

properties is done by hydraulicking, but there are several small camps that employ only simple hand methods. It is understood that arrangements were concluded late in the season for taking over the extensive holdings formerly belonging to the Murray interests by a new group styled the Cache Creek Mining Co. It is reported that this company will probably undertake the drilling of the tract downstream from the former site of the Murray dredge to determine whether or not it can be advantageously mined by a dragline scraper.

Southwest of the Kahiltna River, in the area usually referred to as the Fairview district but included in this report as part of the Yentna-Cache Creek district there were several small camps doing prospecting or development work. The largest of these appears to have been that of Hamberg & Gliska on Pass Creek, where a hydraulic plant had been put into commission that was being operated by a crew of three men. It is also reported that Wagner & Co. are proposing to develop prospects on Mills and Cottonwood Creeks, with hydraulic plants and bulldozers.

In the Valdez Creek region, which lies some 125 miles north of Anchorage, near the head of the Susitna River and about 40 miles in an air line east of the main line of the Alaska Railroad, prospecting for both lodes and placers has been going on for many years. Altogether about five separate placer camps were producing in the district, and individuals were prospecting at other points. In addition to those engaged in work on lodes, there were about 30 miners in the district. Both hydraulic and drift placer mining was carried on at the different camps, and the output of gold from the camp in 1937 was considerably more than it has been in any of the recent preceding years; in fact, the value of the placer production in 1937 appears to have been greater than in any other year since the camp was discovered in 1908 and was only a few thousand dollars less than that of that boom year. The principal producing camps were those of Carlson, Fairfield & Ohman, and of Fred Bucke. The first-named of these outfits was mining ground south of Valdez Creek on the bench back of Discovery Claim, where the miners have found what they consider to be the downstream continuation of the Tammany Bench channel. The Bucke work involved drifting on the Tammany channel about half a mile upstream from Valdez Creek. The ground here averages about 145 feet deep. Some placer gold was also recovered in the course of mining on White Creek by the Alaska Central Mining & Exploration Co., and Babel and two associates recovered some gold from the deposits of Lucky Gulch. In addition there were several small one- and two-man camps not only on Valdez Creek proper but also on some of the other streams in the neighborhood which, while individually recovering only modest grubstakes, helped swell the total output of the district.

The producing placer camps in the Kenai Peninsula region are mainly in the vicinity of Hope, Sunrise, and Girdwood. In the area near Hope and Sunrise mining was in progress at several of the old properties that have been consistent though small producers for many years. These mines are situated principally in the valleys of Resurrection Creek and its tributaries near Hope and Sixmile, Canyon, Mills, and other creeks south of Sunrise. No notable discoveries of new placer areas are reported to have been made during 1937. So far as shown by the records of the Geological Survey, a considerable part of the production from this district came from properties of Edwards & Plowman on Mills Creek, of the Canyon Creek Placers on Canyon Creek, and of Shell & Richards on Bear Creek. It had been expected that considerable mining would be in progress on Lynx Creek, but unfortunately a heavy snowslide in May killed six men working on the property, damaged much of the equipment, and disorganized the plans for the work. So far most of the placer mines in the vicinity of Hope and Sunrise have been developed mainly by hand methods or by simple hydraulic plants. The dredge which operators had proposed to erect on Sixmile Creek in 1936 was still awaiting installation in 1937. A small dragline was in operation part of the season on Sixmile Creek, and plans for installation of this sort of equipment at one or more other properties next season were said to be under consideration.

In the Girdwood district, which lies north of Turnagain Arm and includes the valleys of Glacier Creek and its tributary, Crow Creek, the only placer property that reported any notable production of gold was that managed by A. S. Erickson, about 4 miles north of Girdwood. The placer that is being mined is a thick deposit of bench gravel on the north side of Crow Creek. A well-planned and efficiently managed hydraulic plant has been in operation here for several years and was thought to have about cleaned up the parts of the deposit that could be worked profitably. In 1937 prospecting of the bench ground on the left limit of the stream disclosed an additional area that proved rich enough to mine. A little mining activity was in progress on Rainbow Creek, where a new outfit spent part of the season in transporting hydraulic pipe which it expects to use another season. No productive placer mining was in progress on Bird Creek nor on any of the other nearby streams which may be considered as within the Girdwood district.

A few small placer camps also occur at widely separated points in the Cook Inlet-Susitna region that at present have little effect on the output of gold from the region as a whole. Among the places of this sort may be mentioned the small placer operations on the outskirts of the Willow Creek lode district. For a number of years a

small and irregular production of placer gold has been recovered from that area. These deposits occur principally in the valley of Little Willow and Grubstake Creeks, especially in those parts where the bedrock is schist, and south of and outside the area occupied by the main granitic intrusive mass that forms the bedrock throughout most of the Willow Creek lode district.

YUKON REGION

The Yukon Valley embraces a tremendous extent of territory, and scattered through it from one end to the other are placer-gold camps. In the past gold has been reported from almost every stream in the entire basin, though the quantities in some have been so small as to be of no commercial significance. For convenience of description in this report, all the producing placer camps in this vast area have been grouped into 17 more or less distinct tracts that are here called "districts." It should be noted that the boundaries of these districts are by no means well defined and do not necessarily correspond with any of the legal subdivisions, such as 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 1937 had a gross value of $8,201,000, which was $512,000 more than in 1936, when the value was $7,689,000. This very large increase is attributable to the especially favorable supplies of water that were available at most of the camps and to the coming into production of a number of new enterprises that had been in course of development in preceding years. 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, can 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 1937, and for comparison the production from the same districts in 1936 is given. The total is believed to be correct as stated, but the distribution of this total among the districts is open to some uncertainty, owing to the great number of small producers, their wide distribution, and the failure of some of them to supply the essential information. However, every reasonable pre-

caution 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, 1937 and 1936, by districts

District	1937	1936	District	1937	1936
Fairbanks and Richardson	$4,891,000	$5,642,000	Koyukuk	$39,000	$38,000
Circle	937,000	346,000	Chisana	30,000	37,500
Iditarod	694,000	546,300	Eagle	20,000	17,000
Innoko	565,000	293,200	Rampart	12,000	11,200
Ruby	259,000	83,000	Fort Gibbon	9,500	(1)
Hot Springs	205,000	277,000	Kantishna	8,000	3,000
Tolovana	184,000	136,300	Chandalar	5,500	16,000
Fortymile	166,000	158,500			
Marshall	132,000	72,000	Total	8,201,000	7,689,000
Bonnifield	44,000	12,000			

[1] Combined with Rampart in 1936.

The foregoing table presents in condensed form a comprehensive summary of the general placer-mining situation in the Yukon region in 1937 as contrasted with that in 1936. From this table it will be readily evident that the value of the output in 1937 was more than $500,000 larger than in the earlier year. The contribution of the individual districts to the total for the region varied greatly between one and another and also in the amount that the same district produced in the different years. Thus, while some of the districts showed increases of more than 2.7 times their output in 1936, others showed decreases, whereby in 1937 they produced only about three-quarters of the amount they had produced in 1936. Information as to the principal happenings for the year in each of the districts is given in more detail in the following pages. The order in which the districts are taken up corresponds with the order given in the above table—namely in the order of the value of the placer-gold production in 1937.

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. The production from this district in 1937 showed a drop of about 13½ percent from that in 1936. This decrease is largely attributable to the fact that none of the dredges heretofore active in the district, with the exception of those of the Fairbanks Exploration Department of the United States Smelting, Refining & Mining Co., were active during the season, and one of the dredges of that company, which was reconstructed at a new locality during the winter of 1936–37, did not get started as early as usual and also lost time in getting under full swing at its new site. Another cause of the lessened production from this district was that the opening of the mining season was somewhat later than usual, owing to a cold

period during the spring, which retarded starting work at some of the camps for two to three weeks. This decrease in production was not accompanied by any decrease in mining activity in the district. On the contrary, on all sides there was evidence of work being in progress that was only preliminary to increasing the production another year.

The greatest amount of gold from the district was produced by the Fairbanks Exploration Department with its five dredges on Goldstream, Cleary, and Ester Creeks, its scattered small hydraulic plants, and its drift placer mine on the Chatanika River. Considerable placer gold was also recovered by a number of smaller companies using hydraulic, open cut, and drift mining methods. Placer gold recovered by the smaller operators, using other methods than dredging, came principally from Wolf, Gilmore, Pedro, Dome, Fairbanks, Vault, Fish, and Cleary Creeks. There were also smaller camps in the valleys of several of the other streams, whose production, though individually only a few hundred or a few thousand dollars, in the aggregate swelled considerably the total production for the district.

The extensive mining project being carried on by the Fairbanks Exploration Department, embracing large tracts on Goldstream, Cleary, and Ester Creeks, continued to be the outstanding placer-mining enterprise not only in the Fairbanks district but throughout the Territory. The placer work of this company in 1937 is divisible into eight more or less separate enterprises that are closely knit together in their broader aspects. Two of these parts embrace the dredge mining in progress on Goldstream and on Cleary Creeks, and the third is the dredging in progress in the headward part of Ester Creek. The work on Goldstream and Cleary Creeks was essentially a continuation of the dredging that had been in progress on these streams for several years. Two modern dredges were engaged in this work on Goldstream and two in the Cleary Creek area, and both projects were supplied mainly by a long ditch line that picked up its water far up the Chatanika River and led it by ditches, flumes, and gigantic siphons to the areas where it was put to work. The dredging on Ester Creek was done by one of the company's dredges that had formerly been used in the valley of Goldstream, near Fox, but which during the fall and winter of 1936–37 had been dismantled and moved to its new site near the head of Ester Creek, where it was reassembled. A fourth enterprise of major significance, though not yet yielding gold, was the continuation of the preparatory work that has been in progress for 3 years in removing the overburden and thawing the underlying gold-bearing gravels of an enormous tract on Cripple Creek near its junction with Ester Creek. This project has

required the removal of several million cubic yards of non-gold-bearing material and the installation of the devices requisite for supplying and distributing an adequate supply of water for the various hydraulic processes and the disposal of the waste products thereby created. Water for most of this development work is pumped from Chena Slough to a nearby high ditch line by which and through accessory siphons the water is distributed to the different parts of the area as needed. The stripping part of this program has already been well advanced and the thawing of part of the area to be mined is well under way. At first it was proposed to mine the area, when ready, by a large dredge, but analysis of many of the technical problems as well as the cost have led to a reconsideration of that plan, and it is now expected that a specially designed scraping device will be substituted. It will still be a year or so before this plant is in productive operation.

In emphasizing the preparatory work that is in progress by the Fairbanks Exploration Department in the Cripple Creek area it should not be overlooked that a similar type of preparatory work, though by no means on as gigantic a scale, is also in progress in the so-called producing areas on Goldstream and Cleary and upper Ester Creeks. It takes the company at least 3 years to prepare a tract for dredging, as the surface vegetation must be taken off, the overburden thawed and disposed of, and the frost in the gold-bearing gravel thoroughly removed before it can be excavated. All these processes are going on simultaneously in different parts of these so-called producing areas, as an integral part of the dredging project, and therefore they have not been counted separately in listing the major undertakings of the year by this company.

At several points in the Fairbanks district the company's holdings, either because of the isolation of the tracts or because they could not be reached handily by the dredges in their regular course, have been mined by small hydraulic plants. An interesting combination of hydraulic and drift mining was undertaken by the company at its property in the valley of the Chatanika River several miles west of the mouth of Cleary Creek. The overburden there is about 200 feet deep, and practically all the gold has been concentrated at the base of the section on bedrock. The experiment of sinking a shaft to bedrock and then doing the sluicing underground was attempted. This general scheme has been tried before in places in the district but usually unsuccessfully because of the heaving of the clay bedrock. At the Chatanika property the bedrock is firm schist, and many special adaptations have been introduced to correct certain of the defects of other systems. Although the system enabled the company to work a block of ground that otherwise could not have been handled

by ordinary methods, not enough details have been made public to demonstrate whether or not it could be applied generally and what it would cost.

The two other items regarding recent events affecting the Fairbanks Exploration Department concern the addition of several tracts of placer ground to its already large holdings in the district. After considerable negotiation the company acquired sufficient contiguous claims on Pedro Creek which its tests showed could be profitably dredged, so that the company has ordered a small dredge with 3-foot buckets to be ready for operation in 1938. The area to be mined by this dredge connects with the ground in the lower part of Pedro Creek that was worked by the company's dredge on upper Goldstream and will continue from there up Pedro Creek for several miles. The other property acquired by the company late in the fall embraced the former holdings of the Tanana Valley Gold Dredging Co. By this transaction the company obtained ownership of the old Fish Creek dredge and considerable placer ground on Fish Creek. A good deal of work will be required to put this property into operating condition, but this work will be pressed, so that it should begin to make some return in 1938.

Although all the camps so far referred to in the Fairbanks district lie within a radius of 10 to 20 miles of the town of Fairbanks, there are a number of others situated at more remote points that are considered parts of the Fairbanks district, and some of them contributed considerable gold to swell the total for the district. For instance, farther up the Chatanika River there was the plant of A. A. Zimmerman on Kokomo Creek, about 25 miles in an air line from Fairbanks, and two other outfits managed by the same operator on Sourdough Creek, some 50 miles in an air line northeast of Fairbanks, all of which experienced a successful season. Still nearer the head of the Chatanika River, in the vicinity of Faith Creek, Peterson & Co. maintained a camp of 12 men. East of Fairbanks in the valley of the Chena River at least two camps were established, and on Palmer Creek, a tributary of the Chena from the south, that joins that river about 65 miles slightly north of east of Fairbanks, extensive drilling was in progress that was expected to lead to considerable development another year. On Caribou Creek, a tributary of Salcha River from the north about 55 miles east of Fairbanks, Stevens & Johnson are reported to have acquired the former holdings of the Salcha Mining Co. and to have carried on sufficient drilling tests to convince them that they were justified in putting a dredge on the property; it is rumored that a new dredge having buckets of 6-cubic-foot capacity will be built at this place during 1938. Still farther east and somewhat south of Fairbanks is the old camp of

Richardson or Tenderfoot. At one time this was an exceedingly active mining area, but of late years it has quieted down until at present there are probably not over half a dozen prospectors or miners in the district, and they eke out at best only a modest grubstake as a reward for their mining work in the area.

Of all the districts in the Yukon region the Circle district showed the greatest quantity as well as percentage increase in placer-gold output in 1937 over that in 1936, comparative figures for the 2 years being, respectively, $937,000 and $346,000. This puts the Circle district in second place in the list of large producing districts in the Yukon region, with a production that exceeds that in any other year of the camp's existence. This great increase was not brought about through any one single cause but was due to the large number of well-equipped mechanized plants that have been established in the district lately and that have been efficiently handled to utilize the power thus made available. Much the greater part of the output of placer gold was recovered by dredges, but draglines, bulldozers, and hydraulic plants—all were effective in swelling the total. Two new dredges were built during the season—one, that of the Alluvial Placers, Inc., on Woodchopper Creek, and the other, that of the Deadwood Mining Co., on Deadwood Creek. In addition, the dredge of the Gold Placers, Inc., on Coal Creek, which had been put into commission in 1936, and the dredge which had also been built in 1936 and was operating on Mammoth Creek under the direction of the C. J. Berry Dredging Co., were both active again in 1937. To list all the mining operations in the Circle district would unduly overload these notes. Suffice it, therefore, to record the facts that between 300 and 400 men were engaged in mining in the district in 1937, and that camps were in active operation on practically every one of the streams that have been known to contain workable placers. The water supply was especially good throughout the working season, so that at no time was there a serious shortage and at no time were there freshets to interfere with the work, as has unfortunately happened several times in the past. The greatest production from camps other than the dredges came from mines on Mastodon, Deadwood, Independence, Eagle, Ketchem, Butte, and Porcupine Creeks, with smaller amounts from Bonanza, Miller, Harrison, Switch, and Portage Creeks. Excellent as was the record of the Circle district in 1937 it does not seem to have set a figure that will not be equaled or even surpassed in succeeding years. In fact, with the new equipment already ordered or on the ground the operators should be capable of handling much more material than heretofore.

In spite of a large increase in production over the preceding year the Iditarod district lost its usual position as the second largest

placer-mining district in the Yukon region, and in 1937 dropped to third place, with a placer-gold output valued at $694,000, as compared with $546,300 in 1936. This large increase was due to the general activity throughout the camp and the constantly growing number of operations that have installed extensive mechanized equipment which is being used effectively. It is estimated that three new dragline outfits were brought into the district in 1937, making a total of seven that were running within a short distance of Flat. The two dredges that had been in operation for many years in the district were also actively mining throughout the season. According to current reports, during the early part of the season the supplies of water for mining were rather short, but later this condition improved, and from early August to the end of the season there was a good amount of water available at almost all the plants. A large share of the gold from the Iditarod district comes from mines in the valley of Otter Creek and its tributaries, Flat, Granite, and Slate Creeks. On the main stream, in addition to the dredges of the Riley Investment Co. and of the North American Dredging Co., the new dragline plant of Peter Miscovich was in operation. On Flat Creek the larger producers were the new dragline plant of Awe & Durant and the hydraulic plants of Stuver Bros., Walter Sakow, and Pat Savage. On Granite Creek Frank Salen and associates were hydraulicking. On Slate Creek Gus Uotila had replaced his old dragline plant with a new one, which seems to have made an especially good record. To the south of the valley of Otter Creek, but rising in the highland at the head of Flat Creek, is Willow Creek, a tributary of the Iditarod River, which joins that river some 8 miles upstream from the mouth of Otter Creek. In the main valley of Willow Creek the Northland Development Co. and the Iditarod Mining Co. were the principal operating placer companies, and both were mining with draglines. On Happy Creek, a small tributary of Willow Creek from the east, Olson & Co. was mining with a dragline. In the valley of Bonanza Creek, which lies immediately south of Willow Creek, the only extensive mining in progress was on a small tributary, Chicken Creek, which comes in from the north about 7 miles east of the junction of Bonanza Creek and the Iditarod River. Near the head of Chicken Creek Duffy & Co. was using a bulldozer for getting the placer material to the boxes, and farther downstream Captain Becker and associates were hydraulicking. A small hydraulic plant was also being operated at the head of Prince Creek, a tributary of Bonanza Creek, lying 1 or 2 miles east of Chicken Creek. In addition to these larger plants there were a number of small one- and two-man camps at various points throughout the district.

Reports from the Innoko district indicate that the output of placer gold from there was about twice as much in 1937 as in 1936. This increase is accounted for largely by the successful operation of the four dredges and the installation of additional mechanical equipment at several of the plants. The dredges are those of Felder & Gale on Yankee Creek, of the Ganes Creek Dredging Co. on Ganes Creek, and of Puntila and associates which has dredges both on Ganes and Little Creeks. Ownership of the Ganes Creek Dredging Co.'s dredge changed hands late in the season, and after that time the dredge was under the management of Holky & Shonbeck. At the Puntila dredge on Ganes Creek the early part of the season was spent in overhauling and making repairs and in midseason the dredge was taken over by Savage & Matheson. A new dragline equipment was brought in by Schwaesdall & Vibe on Spaulding Creek and made an excellent showing after it was in running order. This is the fourth power scraper in the district, the three others being that of Uotila & Hard on Ophir Creek, the Cripple Creek Mining Co. on Cripple Creek, and the slackline scraper of Hard & Johnson operating near the head of Ophir Creek. In addition to these larger camps there were several hydraulic plants in operation and a larger amount of prospecting in progress than usual. As a result of the prospecting and exploratory work several new projects that will require the use of extensive mechanical equipment had reached advanced stages. Of the latter type of project, that of Eric Hard and associates in the Cripple Creek area of the district seems to have gone farthest, for after having stripped some 4 miles for ditching and having drilled 200 test holes, they have ordered a Northwestern dragline, bulldozers, pipe boxes, and all other necessary equipment, which were to be hauled in during the fall and winter and set up so as to be available for operating as soon as possible in 1938. The first work of this outfit will be done on Bear Creek, but the property embraces claims on Cripple, Beaver, and Graham Creeks, as well. Renewed activity is also reported to have been shown in the Tolstoi area, which lies in the northern part of the Innoko district. A small amount of gold was mined on Esperanto and Madison Creeks, and it is rumored that a dragline will be installed in the area in 1938.

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. The principal producing creek in the area near Long is Long Creek and its tributaries, Flat and Greenstone Creeks. On tributaries to the

Sulatna River, downstream from its junction with Long Creek but within what may be considered the Long area, are placer camps on Spruce and Trail Creeks. The largest producing company in this area is the Long Creek Mining Co. which is using a dragline scraper, but at least four other camps were active on Long Creek proper during 1937, two others on Flat Creek, and one on Greenstone Creek. There was one producing camp on Spruce Creek and two on Trail Creek. In the area adjacent to Poorman the principal producing creeks are the main Poorman Creek and its tributaries, Duncan, Tenderfoot, and Timber Creeks, and somewhat farther downstream and to the west, Moose Creek, on which is the small settlement of Placerville. Many of the properties in the vicinity of Poorman are worked by drift methods during the winter, and the resulting dumps sluiced during the succeeding summer. There appear to have been five separate camps engaged in productive mining on Poorman Creek proper and two each on Solomon, Timber, and Moose Creeks. In addition several smaller camps were engaged mainly in prospecting but recovered some gold in the course of their tests. As in most of the Alaska placer districts, rumors were current of anticipated new developments that were to be undertaken shortly. Doubtless many of these will not materialize, but a healthy undercurrent of optimism as to the camp maintaining its present high rate of output at least for several years was manifest.

The Hot Springs district, as the term is here used, consists of two rather widely separated tracts—one including the western part of the district from Tofty to Woodchopper Creek and extending as far west as American Creek, the other including the eastern part, which centers around Eureka Creek and is locally referred to as the Eureka Creek district. The district was one of the few in the entire Yukon region that did not show as large a production in 1937 as in the preceding year, the decrease being estimated as about $70,000. This falling off in production is regarded as of only temporary significance, because the comparison with 1936 is with a year of especially high output. Furthermore, several of the larger companies suspended or decreased their regular productive work in order to do the preparatory work necessary for undertaking even more extensive work next season. For instance, the dredge of the American Creek Operating Co. was idle throughout the season, though the company was busy stripping and thawing some of its ground, so that next season the dredge might have plenty of ground prepared ahead of it and not be held up during the short mining season. Then, too, at the Bock & Hanson property on Deep Creek much time was spent in preparatory work for mining on a much larger scale next year. In the Tofty area the largest production came from the properties of the Cleary Hill

Mines Co. in the Sullivan Creek Valley, where the company is mining with dragline and bulldozers. In addition there were two other camps mining on Sullivan Creek, two on Deep Creek, and three on Boulder, and one-man camps on Colorado, New York, Miller, and Cache Creeks. In the Eureka area the greatest production is reported to have come from Glen Gulch, Eureka Creek, McCaskey Bar, and Pioneer and Rhode Island Creeks, with lesser amounts from Chicago Creek, Gold Run, and Shirley Bar. The item that seems to have caused the most newspaper comment was the fact that a new company, the Montana Mining Co., was preparing ground on Omega Creek for the installation of a dragline, bulldozer, and hydraulic outfit, which would be in active operation in 1938.

The Tolovana district, as the name is used in this report, embraces a considerable tract of country lying north and northwest of Fairbanks. It has long been difficult to reach, except by airplane or by a circuitous, time-consuming journey, but the completion of the long-awaited road connecting it with Fairbanks should be of material aid not only in its own development but also in opening some of the intervening tracts. The output of placer gold in 1937 was somewhat larger than in 1936—the increase being estimated as about $47,700. Much of the current production of placer gold from the Tolovana district is obtained by drift mining, though there are shallow diggings, especially adjacent to the Tolovana River. The occurrence of deep placers that give employment throughout the year has a very stabilizing effect on the camp as a whole, though the difficulty of getting sufficient water often necessitates leaving the gold-bearing dumps unsluiced for more than a year. According to reports received by the Geological Survey, the largest amounts of placer gold recovered in 1937 were mined from deposits on Livengood Creek, where 6 camps, employing a total of about 40 men, were active throughout the season. The tributaries of Livengood Creek also afforded notable amounts of gold and, arranged in order of their production, seem to have stood as follows: Lillian, Gertrude, Ruth, and Amy Creeks. On these side streams were 6 camps, employing about 25 men. Olive Creek, which was one of the large producers of the district, heads in the same highland as that in which many of these streams rise but flows directly into the Tolovana River, a short distance above Livengood Creek. Wilbur Creek, on which were two camps that produced some gold, joins the Tolovana River from the south, not far from Livengood Creek. Interest in the district still continues to be centered around the drilling in progress on Livengood Creek, which is being done to test the feasibility of mining it with a dredge. This work has been in progress for more than a year, and the fact that successive payments have been made on the options as they fell due indi-

cates that the results have been encouraging. It is reported that extensive dragline equipment, as well as bulldozers, pumps, and other necessary gear for enlarging the operations on Olive Creek next year has been arranged for, so that even greater mining activity in that area is expected soon.

In the Fortymile district the exceedingly good showing made in 1936 was somewhat bettered by the output of gold in 1937, when $166,000 was produced, as against $158,500 in the earlier year. By far the greater part of this production comes from the three dredges—those of the Alaska Gold Dredging Co. on Mosquito Fork, the Walker Fork Gold Corporation on Walker Fork, and the North American Mines, Inc., on Wade Creek. An interesting item in connection with the operation of the first two dredges named above is that they proposed to test the practicability of generating their power by the use of coal mined from a small deposit on Chicken Creek. In addition to the dredge production from Wade Creek, there were two other placer mines in operation on that creek. Other creeks on which considerable gold was recovered by hydraulicking or open-cut methods were Lost Chicken, Chicken, Myers Fork, and Dome Creek, as well as a score of other creeks where one- and two-man camps made little more than modest grubstakes. There was the usual number of old-timers searching for gold at favorable localities along the bars of the Fortymile River, especially during periods of low water. The extensive use of airplanes in the transportation of persons and supplies to this rather remote area is doing much to aid in its being opened up more adequately.

The production of placer gold from the Marshall district in 1937 is estimated to have been nearly double the value of the production in the preceding year, or $132,000 in 1937 as against $72,000 in 1936. The Marshall district, as the name is used in this report, includes practically all of the western part of the Yukon Valley below Holy Cross, and is somewhat more inclusive than the so-called Wade Hampton recording precinct. In this large area there is relatively little placer mining or prospecting, and this was more or less localized at two points—one near Marshall and the other in the Stuyahok or Bonasila Valley. The greatest production in the immediate vicinity of the settlement of Marshall came from Willow Creek, about 15 miles southeast of Marshall, and the largest camp on this stream was that of Johnston & Ostnes, as laymen, using a dragline and bulldozer. Ten men were employed on this property during the summer. Two other smaller outfits were mining on Disappointment and Elephant Creeks. No mining was in progress on Kako Creek, a small stream that joins the Yukon some 50 miles due east of Marshall. About 50 miles northeast of Marshall, but still in what is considered the Mar-

shall district, in the valley of Flat Creek, a tributary of the Stuyahok River, itself a tributary of the Bonasila River, Vance Hitt and associates continued work on the property they had started to develop late in 1936. The mining is done with a dragline, and the enterprise has been so successful that it is understood the owners expect to add another dragline unit to the equipment for the next season. Some 18 men were employed on the property, and work did not close down until October 11.

The term "Bonnifield 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 1937 from this district showed remarkable increase over that of 1936. This increase was brought about largely by the introduction of the first fully mechanized plant. This outfit was installed on Moose Creek. It is called the Triple X Placers and is in charge of E. W. Pringle as resident manager. Eight to ten men were employed on the property and made a good record for a new enterprise, in view of the fact that the new management did not put in the dragline until late in August, and before that time the ground was mined by ordinary small-scale, open-cut methods. In addition to this large camp, there was a smaller one on Moose Creek under the management of E. M. Keys. Other producing camps in the district were situated on Trixey, Marguerite, Little Moose, Eva, and Portage Creeks. Portage Creek is a tributary of the West Fork of the Little Delta River.

The Koyukuk district, as the term is here used, embraces a very large tract of country and consists of at least three rather widely separated areas in which placer gold has been mined. These subordinate areas are the Indian Creek-Hughes area, in the central part of the Koyukuk Valley; the Hogatza River area, somewhat north of Hughes and embracing country north of the Koyukuk River; and the upper Koyukuk area, which includes that part of the Koyukuk Valley lying north and northeast of Bettles and the country near Wiseman. Much the larger part of the present placer production from the Koyukuk district now comes from the northern area. According to the United States Commissioner there were in this area more than 50 small camps working for at least part of the season. The largest of these camps employed only four men and many of them were merely lone operators who spent only part of their time mining. According to current reports during the early part of the season the supply of water for mining was deficient, and it was the middle of August before some of the camps were able to do much sluicing.

This left but a short season for productive mining, as winter begins to close down before the end of September. Among the outfits that have reported directly to the Geological Survey regarding their season's work the principal ones were working on streams tributary to the Middle Fork, including Slate Creek and its tributary, Myrtle Creek; Wiseman Creek and its tributaries Archibald and Nolan Creeks and Linda and Gold Creeks, as well as on several of the tributaries of the Dietrich River. A report was also received regarding mining on Spring Creek, a tributary of the Wild River, some 40 miles west of Wiseman, and a number of reports came from other small producers at points as far remote as the Alatna River.

So far as the Geological Survey is informed no productive mining was in progress during 1937 in the Hogatza River area. In the area, including Hughes and the Indian River, considerable prospecting and development work was under way, but little productive work was accomplished. This work was mainly done on claims on Utopia Creek, a small tributary of the Indian River about 15 miles east of Hughes. At this property about 20 men were employed most of the season digging a bedrock drain and stripping the ground to be mined. A dragline has been installed, and it is expected that the preliminary work will have been sufficiently advanced for productive mining to commence in 1938.

Only a few reports of the season's activities in the Chisana district have been received by the Geological Survey direct from the operators. 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 Little and Big Eldorado and Gold Run, a tributary of Glacier Creek. The following notes have been furnished by F. H. Moffit, of the Geological Survey, who, although he did not visit the Chisana district in 1937, was able to get some information at first hand from some of the operators who had been working there.

The placer mines of the Chisana (Shushanna) district became important contributors to the gold production of Alaska in 1914 and since then have continued to contribute their quota each year. The present production, however, is on a much reduced scale as compared with the earlier days and was even smaller in 1937 than in the year before. The reduced output apparently results from the lower gold content of the gravel that was mined in 1937, for conditions were much the same as in 1936. About the same number of men were employed in mining, the season was of the usual length, and the water supply, so far as rainfall was concerned, was favorable. Yet the problem of obtaining water for use at a particular point where it is needed for mining naturally involves other considerations than rainfall alone, and the difficulties from such sources have to be overcome by some of the operators.

The exact number of men mining in the Chisana district was not learned, but it is about 20, a number that has varied little for several years. Interest in quartz veins carrying gold, which was lively some years ago, is less so now and

is partly replaced by interest in some large veins of iron sulphides uncovered in placer mining, which are reported to carry low values in gold.

The Chisana district, notwithstanding the extension of the highway to the Nabesna River, is still somewhat remote and not easily reached. After the breakup in the spring, mail, supplies, and men are transported chiefly by airplane, as this means of reaching the district is much easier and quicker than the long journey by trail. One hindrance to travel by trail has been removed by the construction of a bridge over Jack Creek by the Alaska Road Commission, but there still remains the fording of the Nabesna and Chisana Rivers and the high climb over Cooper Pass, where the snow comes early and stays late.

The placer gold production in the Eagle district in 1937 was some $3,000 more in value than for the preceding year, but it came from essentially the same general areas, and 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 four men and many of them consisted of a single operator. The largest enterprise was that of R. A. Bauer 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—Lucky Gulch, Crooked, Broken Neck, Falls, Barney, and Alder Creeks. Smaller amounts of placer gold were recovered from placers in the valleys of American and Dome Creeks and Discovery Fork.

Reports from the Rampart district indicate that placer mining there was continued at about the same rate and at the same places as in the immediately preceding years and that at most of the camps the returns had amounted to little more than exceedingly modest grubstakes. The largest amount of gold appears to have come from Minook Creek and its tributaries—Hunter, Little Minook, Hoosier, and Slate Creek. Only about 30 persons are known to have been mining in the district, and even the largest camps employed only a few men in addition to their owners. All the mines are being worked by simple hydraulicking or hand methods, and as yet no modern mechanized equipment has been introduced. Apparently the supply of water available for mining was somewhat more abundant than usual.

North of the Yukon River, in a rather indefinite tract that extends some 30 miles both to the east and to the west of the settlement of Tanana, at the junction of the Tanana and Yukon Rivers, is a large area in which placer mining has been in progress from time to time at scattered camps. To avoid disclosing information regarding the individual producers in this area the entire tract is referred to here as the Fort Gibbon district, the name being taken from the old Army post that was long a familiar landmark near Tanana. Mining in this district in 1937 centered more or less closely around Grant Creek for that part of the district which lies west of Tanana and around More-

lock Creek for that part of the district lying east of that settlement. The western area is often referred to as the Gold Hill area. In that area in 1937 the greatest productive work was that from claims of Fisher & Fisher that were being mined by hydraulic methods, supplemented by a Diesel-powered dragline. The latter equipment was not received in time to be used to full effect in 1937, but should enable the miners to increase greatly the amount of ground handled by the company in 1938. In the area east of Tanana, four outfits using simple open-cut methods of mining, were active during 1937 on Morelock Creek and its tributaries.

In the Kantishna district there was considerably more placer mining work in progress in 1937 than in the immediately preceding years, and there were indications that even more activity was likely to be shown as developments already in progress came to a producing stage. Among the places where placer mining was in progress in 1937 may be mentioned camps on Moose Creek and its tributaries, Eureka and Glen Creeks; in the valley of the Bearpaw River, on its tributary, Caribou Creek, where three camps were located; and on Glacier Creek and its tributary, Twenty-two Gulch. On streams tributary to the Toklat River two small camps were mining on Crooked and Martin Creeks. Reports were current that plans were under consideration for the installation of dragline equipment on claims on Eureka Creek next season.

In the past it has been the practice in these reports on the mineral industry of Alaska to include the production of the Chandalar district with that from the Koyukuk, because of the few operators in the Chandalar district. Although there are still only a few miners in that district the need for this consolidation no longer obtains, and it is now desirable to list the district separately. The death of one of the former principal operators in the district was partly the cause of the slight decrease in production in 1937 as compared with that of 1936, but the general remoteness of the district has discouraged development or even adequate prospecting of more than a small part of the valley of the Chandalar River and its tributaries. In 1937 only three placer outfits are reported to have been active—the drift mine of Manuel Mello on Little Squaw Creek, the drift mine of Ellis Anderson, and the hydraulic mine of Carlson & Freshman on Tobin Creek. The property of A. L. Newton on Big Creek was idle and will doubtless remain so until arrangements can be effected for the administration of Mr. Newton's estate.

KUSKOKWIM REGION

Included in the Kuskokwim region are four principal districts where gold placers were mined in 1937. For convenience of description they

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

The production of placer gold in the Kuskokwim region in 1937 is estimated at $478,000. This is a little more than three times as much placer gold as was produced from its deposits in 1936. In view of the enormous area of the Kuskokwim region, the amount of the present production is extremely small, but when it is remembered that there are probably less than 100 white miners in the whole region, that their activities are much handicapped by their remoteness from supplies, and that their expenses are consequently large and their funds small, the wonder is that the production is 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 in 1937, as in the past, there were three main areas in which placer mining was in progress. One of these is the Moore Creek area, which lies about 50 miles southwest of McGrath and is near the head of the Takotna River Valley. On Moore Creek is the largest producing camp in the district—that of the Moore Creek Mining Co. It is equipped with the dragline formerly used at a property on Slate Creek in the Iditarod district, and to judge from the amount of gold produced the mine had an especially successful season. It is understood that the Fairbanks Exploration Department did extensive drilling on the creek during the year, but the results of those tests have not yet been made public. This same company is also reported to have moved over to Fourth of July Creek and drilled an extensive tract there.

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 1937 the largest of these camps in the neighborhood of Marvel Dome were those of Kvamme & Co. under the management of Alfred Anderson on Canyon Creek, and of Wilson and associates on Marvel Creek. Canyon Creek is a small tributary of the Kwethluk River that joins the Kuskokwim a short distance west of the settlement of Akiak. Marvel is a tributary of Salmon River, which flows northward and eastward into the Aniak River and that stream in turn joins the Kuskokwim about 75 miles in an air line northeast of Akiak. Several other small outfits of a few men each are reported to have been carrying on some mining in this same general area, but details regarding their work have not been furnished the Geological Survey, and apparently the total amount of gold they recovered was small.

Lately the interest of prospectors and miners in the Goodnews Bay district of the Kuskokwim region has been centered so closely on the search for and development of the platinum resources of the district that relatively little activity has been shown in hunting for or mining the gold deposits. The platinum deposits are described on pages 87–90 of this report. It will be noted in those descriptions that some gold is recovered in the course of the platinum mining, but it has in the past rarely formed as much as 1 percent of the noble metals recovered in the clean-up from these platinum placers, so that it has been worth not more than one or two thousand dollars, even during the years of greatest platinum production. This condition will doubtless change as mining of the deposits of the Salmon River increases, for in these deposits the ratio of gold to platinum appears to be considerably higher. Of the properties mining placers solely for their gold content the greatest production is reported to have come from those on Kow Kow and Butte Creeks, which are small tributaries of the Arolic River lying some 30 miles in an air line north of Goodnews Bay. While productive mining was at a rather low ebb during 1937, prospecting and acquiring prospective placer ground seems to have been especially active. Throughout the field numerous drilling tests and negotiations were in progress, some of which seemed likely to be consummated by actual development work. Among enterprises of this sort may be mentioned the extensive drilling and exploration on Wattamuse and Slate Creeks, which had reached such a stage that it was currently rumored a dredge would be put on the ground in the near future, and the work of the Goodnews Bay Mining Co., which was said to have staked all of the lowland adjacent to the Arolic River for a distance of 6 to 8 miles westward from the mouth of Keno Creek. Felder & Gale, long experienced in placer mining in the

Innoko district of the Yukon region, are said to have taken up extensive tracts in the Goodnews district and will henceforth devote their time entirely to its development.

Somewhat remote from the Goodnews Bay district but closer to it than to any other mining area and served mainly from that district is the stretch of coast from the Togiak River to Cape Newenham. In 1937 reports of the finding of gold in workable amounts in some of the beach deposits northwest of Hagemeister Island and in the valley of the Slug River nearly started a mild stampede from Goodnews Bay into that area. The reports turned out to have been much more optimistic than the facts warranted, and although several hundred dollars were recovered in the course of the flurry the general results were not such as to indicate that rich deposits occurred there and merely awaited taking by the first comer.

SEWARD PENINSULA

The production of placer gold from Seward Peninsula in 1937, including the production from northwestern Alaska, is estimated at $3,394,000, or nearly $300,000 more than in 1936, itself a year of especially large production. This increase of nearly 9 percent was especially unlooked for in view of the fact that much of the early part of the season was unusually dry, so that it was the middle of August before many of the properties had enough water for normal mining needs. The increase was therefore made in spite of drawbacks rather than through especially 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 Seward Peninsula placers is mined by dredges. In 1937 gold worth $2,775,000, or slightly more than 81 percent of the placer output of the peninsula and northwestern Alaska was mined by 21 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 73–79.

In the relative order of their output of placer gold in 1937 the mining districts of Seward Peninsula stood as follows: Nome, Kougarok, Fairhaven (including Candle, Inmachuk, and Bear Creek areas), Bluff, Council, Solomon (including the Casadepaga River area), the Koyuk River district (including the areas adjacent to and east of the head of Norton Sound), and Port Clarence. So much of the placer

gold from some of these districts came from only one or two mines that it has not seemed advisable to publish 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 large company that is operating three dredges in the valley of the Snake River and tributaries near Nome and that has extensive ditches, some of which are more than 20 miles long, and other equipment for properly conducting its work. For many years this company operated under the name of the Hammon Consolidated Gold Fields, but in June 1937 all the operations were formally taken over completely by the United States Smelting, Refining & Mining Co. and designated the Nome department of that organization, and that name will be used in this report to cover the entire operations of this enterprise whether they occurred before or after this change. Some notes on the operation of these dredges are given on page 75. 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 rocky 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. The various steps must therefore all 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 amounts of water used in the thawing operations as well as for other purposes are mainly supplied by 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. The high engineering efficiency and smooth running of this complex undertaking give abundant proof of the efficiency of the staff who outlined the plans and of the personnel who are so ably carrying them out. Approximately 250 men were employed in various phases of the company's work.

Three other dredging companies were operating in the Nome district in the season of 1937—the Alaska Sunset Mines Co., on Sunset Creek; the Dry Creek Dredging Co., on Dry Creek; and the Greenstone Mines, Inc., near the junction of St. Michael and Osborne Creeks. The Sunset dredge was mining in the coastal plain area some 7 miles

west of Nome. It is reported to have had an especially good season, and the company is making plans for even more extensive work next season. The Dry Creek dredge was mining on its property in the coastal plain area slightly northeast of Nome, continuing on about the same scale as the one at which it has been working during recent years. No details have been furnished the Geological Survey regarding the season's developments at the Greenstone dredge, but it apparently was carrying on at about the same general site and rate as in 1936.

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 there were at least a score that 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. Although the lack of water during the early part of the season caused some curtailment in the usual amount of employment offered in the Nome district, it does not seem to have worked serious hardship, because many of those who were physically fit to work utilized the enforced lay-off to undertake some prospecting of their own, and as a result there was more work of that sort done during 1937 than in any other recent year.

From being one of the smaller producing placer districts in Seward Peninsula the Kougarok has recently been increasing its output until in 1937 it ranked second only to Nome in the value of gold recovered from its mines. A large part of this growth must be attributed to the excellent showing of the two dredges that have recently started mining in the district. One of these dredges belongs to the Fox Bar Dredging Co. and the other to the Kougarok Consolidated Placers, Inc. The Fox Bar dredge is situated in the southern part of the valley of the Kougarok, whereas the other one is near Taylor at the head of that stream. The Fox Bar dredge, under the management of Graham D. Lammers, was somewhat hampered because the small size of much of the gold in its ground required more riffle area if a high percentage of loss was to be prevented through the small particles of gold being carried off with the tailings. This defect was satisfactorily remedied by simple reconstruction of the sluices, but production was somewhat retarded while the changes were being made. The dredge of the Kougarok Consolidated Placers had been completed only late in September of the year before, so that in 1937 it had to overcome some of the difficulties that always arise in getting a new enterprise under way.

These preliminaries, under the able management of C. A. Hallberg, were effectively taken care of, and in point of production the dredge made a highly satisfactory showing. It would be incorrect, however, to attribute the great increase in production of the Kougarok district to the dredges alone, because there was a very great increase in the amount of gold produced by camps using other mining methods. These other camps were widely scattered throughout the district from the southern part near Coffee Dome to Macklin Creek, near the head of the Kougarok River, or even beyond the valley of the Kougarok River, on Dick Creek, a headwater tributary of the Serpentine River. The mining methods employed at many of the smaller properties are still simple forms of hydraulicking or open cuts, but an increasing amount of mining machinery is being installed, and draglines or similar mechanical devices for supplementing hand labor were in operation at properties on Coffee, Henry, and Macklin Creeks, as well as on the Kougarok River, and bulldozers were becoming almost essential accessories at many of the other properties. Somewhat remote from the more intensively developed part of the Kougarok district but constituting what may be one of the most significant new developments in the district was the finding of placers that yielded considerable gold in the valley of Black and Buzzard Gulches, small tributaries of the Noxapaga River that join that stream from the west near Goose Creek, some 25 miles northeast of the Bunker Hill Landing.

South of what is locally known as the Kougarok district, but included in that district for statistical purposes in this report, in the vicinity of Iron Creek, some hydraulic mining is reported to have been done during the year. According to the reports furnished the Geological Survey, the largest productive work was done by small camps on Benson Creek and on Iron Creek proper. The entire production of gold from the Iron Creek area, however, so far as known, was so small that it amounted to little more than wages for the few men concerned. Some testing of ground near the junction of Iron Creek and its tributary, Dome Creek, was reported to have been started in midseason with the intention of undertaking a considerable project if the preliminary results should warrant that action.

The placer gold mined in the Fairhaven district comes from three main tracts—Candle Creek, the Inmachuk River, and Bear Creek. Altogether between 150 and 200 men were employed on different mining properties in this district in 1937. 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 acquired 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. One was built during 1937 and was not completed until so late in the season that it was in operation less than a month. In that short season, however, it proved highly successful, and the management proposes to add another dredge to its fleet in 1938. The company was severely handicapped in its other mining work by the shortage of water that continued throughout the early part of the season up to the middle of August and thus greatly curtailed its usual output of gold from the bench placers. In addition to its hydraulic giants the company uses a dragline and tractors in mining some of its bench ground. The recent death of the president of this company came as sad news to those who recognized his constructive ability in the affairs of the enterprise, as well as in the mining industry in general.

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. According to reports, the miners on Quartz Creek had an especially good season in spite of deficient supplies of water during the early part of the season. A little mining was also reported to have been done on the Kugruk River, southwest of Candle.

In the Inmachuk Valley, which lies some 30 to 40 miles west of Candle, one of the principal producers was the Forsgren Dredging Co., which is mining with a small dredge a short distance south of the settlement of Deering. The company reports an especially good season and plans continued operation of its properties. The amount of ground handled by the dredge was greatly increased by the installation of a small dragline outfit, which removed much of the overburden and thus greatly reduced the amount of material that had to be passed through the dredge. Farther upstream in the Inmachuk Valley, near the mouth of the Pinnell River, the ground that had been tied up through litigation for several years was finally cleared of certain of the outstanding mortgage claims, and work was resumed on a larger scale than when it was being mined under direction of the court. In this same area and including some of this property considerable drilling was done during 1937 by representatives of the North American Mines, Inc., evidently with the aim of determining whether or not the installation of a dredge would be justified. Several small hydraulic or open-cut plants were established at other points in the valley of the

Inmachuk River and nearby streams. Of these the largest and most productive appears to have been that of Dick Hoogendorn on Discovery Gulch, which employed four men. It was currently reported that arrangements were consummated late in the season for a company to take over an extensive tract on Humboldt Creek, a tributary of the Goodhope River, which is the next large river flowing into Kotzebue Sound west of the Inmachuk River. It was also reported that a syndicate had acquired options on the claims that had been staked near the margin of the lava field adjacent to Imuruk Lake in the hopes of finding old stream courses preserved under the lava. No new finds are reported to have been made as a result of the tests conducted in the course of this search.

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. No reports as to recent mining developments in this area have been received by the Geological Survey, and it seems probable from their absence that the activity in the area was less than in 1936 and that presumably the production from it was also less. 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.

Almost the entire production of placer gold from the Bluff district in 1937 was afforded by the novel scraper plant installed by J. J. Sullivan, near the mouth of Daniels Creek. This plant is described as operating during the early part of the season through a trench cut in the ice off the coast with the outboard end of the scraper line held by a heavily weighted deadman sunk in the sea. The scraper is then hauled inshore over the sea floor and thus loads itself and brings its load ashore, where it is dumped and the process repeated. That the device works is attested by the large amount of gold that came from the property in 1937. The success of the device must be attributed not only to the skill of the manager in its construction and operation but also to the fact that the sands off the coast in the area selected had a high content of gold. In this connection it may be remembered that the placers on Daniels Creek were among the richest so far found anywhere in Alaska. As a consequence, the sands on the sea floor off the mouth of that stream probably received much gold that was not trapped in those placers.

The records received by the Geological Survey from the Council district in 1937 indicate that it maintained the position it held in 1936 as making the fifth largest placer-gold production of the Seward Peninsula districts and considerably 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 dredges that were active in the district. These were the property of the Council Dredging Co. and the Northern Star Dredging Co., both of which were mining in the flood-plain deposits of the Niukluk River at and above the valley of Ophir Creek; the Ophir Gold Dredging Co., on Ophir Creek; and the Kimball dredge, on Melsing Creek, recently acquired by the Glass Dredging Co. These dredges have all been active for a number of years at essentially the same general localities as those in which they were mining in 1937 and no notable new developments were recorded as having occurred at any of them, with the exception of the Northern Star boat. At that dredge a new hull was built, and the delay caused by this work and reinstalling the machinery resulted in productive mining being started late and the operating season consequently curtailed. There were a number of small open-cut and hydraulic camps scattered through the district, but no direct reports have been received from them, and nothing specific is known about the progress of their work, although to judge from the total amount of gold received from this district by the banks and other purchasers or the shippers of gold from the region, most of them made at best only modest grubstakes. During the season considerable prospecting work and drilling was done in the valley of the Fish River near its junction with Aggie Creek, as well as in the valley of the latter creek. The results of these tests must have shown workable placer ground, because late in the fall it was announced and confirmed that the Council Dredging Co. had purchased the dredge that formerly had been mining on Spruce Creek in the Solomon district and was proposing to move it to Aggie Creek and erect it in time to put in a full season mining in 1938. This should do much to attract attention to a part of the Council district that has received little notice in the past and will be of general importance in extending the known placer-bearing areas of the peninsula. Rumors were also current that negotiations had been entered into for extensive drilling and tests of prospective placer ground west of Council in that part of the flood plain and bench deposits of the Niukluk River near the mouth of the Casadepaga River. These arrangements were not perfected until so late in the season that it will be at least another year before any noteworthy results in the way of production may be expected from them.

In the Solomon district by far the larger part of the placer gold produced was obtained by three dredges situated on Spruce Creek and the Solomon and Casadepaga Rivers. The dredge of the Spruce Creek Dredging Co. mined on Spruce Creek about 6 miles east of the settlement of Solomon. It worked upstream until the amount of gold recovered failed to pay for the cost of mining and no more

promising areas seemed to be at hand. In this predicament the owners accepted an offer for the sale of the dredge to the Council Dredging Co., and until the close of the season the former owners were engaged in dismantling the dredge and transporting the parts to the beach awaiting shipment to the new site. The dredge on the Solomon River was under the management of the Lee Bros. Dredging Co. The dredge made an extremely good showing, although it was late in starting, for it did not begin mining until July 19. About 11 men were employed at this dredge. The dredge on the Casadepaga River was operated under lease by the Casa De Paga Gold Co., and the work was directed by Donald Stewart. This dredge was mining the placer deposits on the main river about 2 miles from Ruby. Many difficulties were encountered and the results of the season's work were not as good as had been expected. It is therefore planned to move the dredge to Monument Creek, in the Nome district. Some open-cut mining by small outfits was also in progress in various parts of the valleys of these two main streams. None of them, however, employed more than two or three men, and many of them were mere 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 Koyuk district, as the term is used in this report, includes most of southeastern Seward Peninsula and is so named from the principal stream that traverses it. Most of the placer deposits that are mined are on Dime Creek and a few other streams in the vicinity of Haycock. The largest amount of placer gold mined in this district was recovered by the dredge of the Dime Creek Dredging Co. on Dime Creek. Altogether in this part of the district there were, in addition to the dredge, four drift mines operated during the winter and nine open-cut mines that have been worked during the summer. The total number of men employed in productive mining was between 30 and 35. All of the drift mines and seven of the open-cut mines were on Dime Creek, and the other two open-cut mines were on Sweepstake Creek, a few miles to the west.

East of Seward Peninsula but more or less closely related to it and along the eastern border of Norton Sound lies the Bonanza area, so named from a small stream, tributary to the Ungalik River, which has long been known to carry some placer gold. For convenience, this general area has here been treated as part of the Koyuk district, though the productive parts of the two areas are widely separated. Prospecting has been carried on at several places in this general area in the past, and for the last few years has been localized in the narrow coastal plain that lies between the waters of Norton Bay and the hills to the east. The bedrock in this part of the area consists mostly of

dark slate and sandstone and thus differs markedly from the schist bedrock that occurs in most of the other placer camps in Seward Peninsula. The history of the coastal plain at this place, in the main, however, seems to have been comparable to that of the coastal plain at Nome and elsewhere in Seward Peninsula, so that prospecting for ancient beaches in this district is well justified. Recent unconfirmed statements indicate that the construction of one or two dredges in this area is likely to be undertaken in the near future.

The production of gold from the placer mines in the Port Clarence district of Seward Peninsula was much less in 1937 than in the preceding year. This decrease was largely attributable to the much reduced scale of operations at the principal mine in the district. This was the property on Gold Run, a tributary of the Bluestone River, which is being dredged by the Bartholomae Oil Corporation. The decreased activity at this property resulted from pending litigation rather than from either the desires of the management or conditions enforced by the character of the deposits to be mined. It is therefore expected that this situation will be cleared up soon and normal operations resumed. It should be remembered, however, that the production of the Port Clarence district in 1936 was unusually high, so that some decrease in 1937 would not have been at all unexpected. During 1937 the Bartholomae dredge was in operation only from the middle of July to the middle of September and even during that period was on a one-shift basis only. The operators noted that the quality of the gold dust recovered during 1937 showed marked difference from that recovered in the preceding years.

In the Port Clarence district a second dredge, that of N. B. Tweet & Sons, was mining on Dese Creek, 6 to 7 miles east of Teller. No specific report of its operations has been received from the company, but from general sources it appears that it enjoyed an especially good season. A few small open-cut and hydraulic mines were also in operation in the district for part of the season. The largest of these appear to have been that of Martinson and associates near the head of Gold Run and camps on Offield and Sunset Creeks.

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 1937. In this valley there are two principal areas where placer mining is being done. The western area is near Kiana, and the principal placer tract is in the valley of the Squirrel River and especially in the valley of its tributary, Klery Creek. The eastern area is in the vicinity of Shungnak, a small settlement about midway between the head and mouth of the Kobuk River. Kiana is about 50 miles in an air line

above the mouth of the Kobuk, and Shungnak is about 90 to 100 miles in an air line east of Kiana. Both of these tracts are so remote and so poorly served by any means of regular transportation or communication that their development is much retarded and hampered by high costs, unavoidable delays, and short working season.

So large a part of the production of placer gold from northwestern Alaska came from one mine that it has not been considered desirable to list the report from the region separately, as to do so would divulge the individual output. As a consequence, the production of placer gold for northwestern Alaska has been consolidated with that from Seward Peninsula in the table on page 37.

In the Kiana area is the principal mining activity in progress in any part of northwestern Alaska. This work is situated in the valley of Klery Creek, one of the tributaries of the Squirrel River from the north. The mine is that of the Klery Placers, Inc., which has installed a modern mechanized plant and done the countless other jobs incident to the establishment of a new camp in what was at the start a remote district. Now, with the completion of some 5 miles of hard surfaced road and an arrangement for barges from Kotzebue to the company's landing on the Squirrel River and the use of tractors and trailers and of air transportation, much of the former isolation of the district is disappearing. In fact, it is reported that the landed cost of freight from Seattle to the company's tractor road is only $27 a ton on general merchandise and supplies and $20 a ton on oil and fuel. The present mining plant of the company consists of a mechanical sluicing unit in combination with power shovels and bulldozer. The ground mined in 1937 was on Klery Creek, a short distance upstream from Bear Creek. A second unit, consisting of a hydraulic plant with water supply from Jack Creek, was in process of being installed during 1937 and should be in running order in 1938. This hydraulic plant is on Klery Creek some 3 miles above the unit near Bear Creek, and its water supply will be delivered with a head of approximately 190 feet.

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 1937 eight small camps, some of which accomplished little more than assessment work, employed a total of about

15 men, some of whom were natives, on streams in the vicinity of Shungnak—3 on Dahl Creek, 2 on the Shungnak River, and 1 each on Boulder, Riley, and Lynx Creeks. Lynx, Riley, and Boulder Creeks are tributaries of the Kogoluktuk River, which joins the Kobuk some 3 or 4 miles east of Shungnak, and the Shungnak River enters the Kobuk about 15 miles west of Shungnak. According to local reports the season of 1937 was very late in opening, and there was so much rain during the mining season that in places it interfered with the work. One man was prospecting on Agnes Creek, a tributary of the Ambler River northwest of Shungnak, but no news as to the results of that work has been received. Late in the season a party of five prospectors and trappers are reported to have landed from a plane on Walker Lake, near the head of the Kobuk River, with the intention of spending the winter prospecting that area. The results of that work will not become known until 1938.

DREDGING

About 69 percent of all the placer gold produced in Alaska in 1937 was mined by dredges. The total value of the gold thus recovered was $8,743,000, of which the greater part came from 18 dredges in the Yukon region and the rest from 21 dredges in Seward Peninsula and 2 in the Kuskokwim region.[7] This total is about 2 percent less than the value of the gold recovered by dredges in 1936 and was a decrease of about $162,000 in value and about 4,600 fine ounces less 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 close of 1937.

The total value of the gold produced by dredges since 1903 is more than 27 percent of the total value of gold produced from all kinds of placer mining since 1880, and of recent years the value of the gold recovered by dredging has been as high as 80 percent of the total placer production. In 1937 the percentage of gold recovered by dredging, as already stated, was only 69 percent in comparison with 79 percent for 1936. This by no means indicates that dredging is on the wane, because the value of the gold recovered by this type of mining in 1937 was less than 2 percent below that in 1936. The explanation lies in the fact that other types of mining are greatly on the increase. The extensive use of relatively 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

[7] Records regarding the dredge installed in 1937 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.

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.

Gold produced by dredge mining in Alaska, 1903–37

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
Total		87,176,000	[1] 152,507,000	[1] 49

[1] Since 1915.

In the foregoing table the figures given for yardage mined and value of the gold recovered per cubic yard are subject to some inaccuracy, because several of the dredge operators have not furnished specific information on those subjects for their individual properties, and the figures for these properties have therefore had to be estimated. In making these estimates the following procedure has been adopted to determine the unknown factors: Operators of dredges that produced approximately $7,710,700 in gold, or somewhat more than 88 percent of the total mined by dredges, report that that amount came from 14,714,290 yards of gravel. The average yield thus shown is about 52.4 cents in gold to the cubic yard. By applying this average to determine the unreported yardage a total of 16,684,000 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 13 years, so that the quantities and values given for 1937 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 after 1933 a price of $35 an ounce has been adopted. If the production of gold from dredges in 1937 had been computed at the old standard price the average value per cubic yard would have been slightly less than 31 cents a yard or lower than for any other year recorded except 1927.

The length of time that the different dredge companies were operating varied widely. The longest season reported for 1937 was 266 days for dredges of the United States Smelting, Refining & Mining Co., Fairbanks Exploration Department, operating in the Fairbanks district of the Yukon-Tanana region. This was only slightly less than the working season for dredges in 1934, which marked an all-time record for Alaska of 275 days and was also set by the Fairbanks Exploration Department. The longest season reported for any of the Seward Peninsula dredge companies in 1937 was 185 days for the Nome Department at Nome. The earliest date for beginning work in the spring of 1937 and the latest date for ending work in the fall were reported by the Fairbanks Exploration Department, which began mining March 17 and did not stop its last dredge until December 7. The earliest and latest dates in 1937 on Seward Peninsula were May 28 and November 28, both reported by the Nome Department. The average length of the working season in 1937 of the 20 companies for which information is available, exclusive of those that were completed only in time to make the test run of a few days, as determined from the beginning and ending dates reported by each company, irrespective of how many dredges it operated, was 133 days. Obviously, the shortness of this average season as compared with the record of 266 days for the longest working season was due not to climatic conditions, but to breakage or some other purely local cause at the different dredges. The fact that is 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 unfavor-

able 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 1937.

Yukon region:	
Circle district:	
Gold Placers, Inc	Coal Creek.
Alluvial Golds, Inc	Woodchopper Creek.
C. J. Berry Dredging Co	Mammoth Creek.
Deadwood Mining Co	Deadwood Creek.
Fairbanks district:	
United States Smelting, Refining & Mining Co., Fairbanks Exploration Department (5).	Goldstream, Cleary, and Ester Creeks.
Fortymile district:	
Walker's Fork Gold Co., Inc	Walker Fork.
North American Mines, Inc	Wade Creek.
Alaska Gold Dredging Corporation	Mosquito Fork.
Iditarod district:	
North American Dredging Co	Otter Creek.
J. E. Riley Investment Co	Do.
Innoko district:	
Waino F. Puntila	Little Creek.
Savage & Matheson	Ganes Creek.
Felder & Gale	Yankee Creek.
Ganes Creek Dredging Co.	Ganes Creek.
The Holky Dredging Co.[1]	
Kuskokwim region:	
Tuluksak-Aniak district:	
New York-Alaska Gold Dredging Corporation (2).	Bear Creek.
Seward Peninsula region:	
Casadepaga district:	
Casa De Paga Gold Co	Casadepaga River.
Council district:	
Northern Star Dredging Co	Ophir Creek.
Ophir Gold Dredging Co	Do.
Council Dredging Co	Niukluk River.
Charles E. Kimball	Melsing Creek.
Glass Dredging Co.[2]	
Fairhaven district:	
Forsgren Dredging Co	Inmachuk River.
Arctic Circle Exploration Co. (2)	Candle Creek.
Kougarok district:	
Fox Bar Dredging Co	Kougarok River.
Kougarok Consolidated Placers Co	Do.
Koyuk district:	
Dime Creek Dredging Co	Dime Creek.

[1] Purchased dredge from Ganes Creek Dredging Co. and operated part of 1937 season.
[2] Purchased dredge from Charles E. Kimball and operated part of 1937 season.

Seward Peninsula region—Continued.

Nome district:	
United States Smelting, Refining & Mining Co., Nome Department (3).	Snake River area.
Dry Creek Dredging Co	Dry Creek.
Alaska Sunset Mines Co	Sunset Creek.
Greenstone Mines, Inc	Osborne Creek.
Port Clarence district:	
N. B. Tweet & Sons	Dese Creek.
Bartholomae Oil Corporation	Gold Run.
Solomon district:	
Spruce Creek Dredging Co	Spruce Creek.
Lee Bros. Dredging Co	Solomon River.

The dredges that were active in 1936 but not in 1937 were those of J. R. Murphy, lessee from Fairbanks Gold Dredging Co., on Fairbanks Creek, in the Fairbanks district; and the American Creek Operating Co., on American Creek, in the Hot Springs district, Yukon region. Four dredges that were not in operation in 1936 were mining in 1937 in the Yukon region—the Deadwood Mining Co., on Deadwood Creek, and Alluvial Golds, Inc., on Woodchopper Creek, in the Circle district; in the Kuskokwim region, one dredge of the New York-Alaska Gold Dredging Corporation, on Bear Creek, in the Tuluksak-Aniak district; and in Seward Peninsula, one dredge of the Arctic Circle Exploration Co. on Candle Creek, in the Fairhaven district, Alaska.

Practically all the dredges mentioned above as in operation in 1937 but not in 1936 were newly built and were not merely ones that had been idle recently. They therefore represented modern, well-constructed machines designed to accomplish their particular tasks effectively rather than old dredges that perhaps had outlived part of their usefulness on other jobs. Several of the dredges that are not here listed as "new" were completed so late in 1936 that they actually contributed little to the output of that year and for practical purposes might be regarded as starting their work in 1937.

So far as the Geological Survey is informed, no new dredges were in actual process of construction on the ground that were not completed and in operation before the close of the year. Many projects involving the construction of new dredges or the removal of old dredges to new sites were in contemplation, and doubtless some of them may have reached the "blueprint" or "shop construction" stage; but as they did not affect the mineral output of the Territory in 1937, they may be dismissed without further mention here.

Much of the placer ground at practically all the places where gold dredges are now working in Alaska is frozen, so that extensive plants for thawing it must be available. This adds heavily to the

cost of the work, and unless the thawing has been done adequately it slows up or actually stops mining. Most of the dredge camps are now using cold water for thawing, though in the past steam or hot water was thought to be necessary. At any large dredging operations, such as at Nome or Fairbanks, miles of pipe are used for the thawing process, and a larger force of workmen is required in the various tasks connected with the thawing than in actual mining. In addition to the labor costs for thawing operations, there is need for large quantities of water, both for thawing and for sluicing. Adequate supplies of water for most of the dredging camps in interior Alaska and Seward Peninsula are difficult to find and costly to develop. In places it has been necessary to go scores of miles to get water under sufficient head and then lead it by means of long ditches and siphons to the mining ground. The regulation of this water and the maintenance of the ditches require the constant attention of a considerable force of men throughout the working season, especially if the construction is new and the ground has not settled. As a result of this continuing high cost of maintenance, many of the camps where transportation is not too difficult are turning to or considering the practicability of obtaining the necessary water by means of pumps. Supplying large quantities of water by pumping is already in successful operation in the Fairbanks district, and the procedure is by no means uncommon at small mines in many other parts in the Territory.

The success of most of the good dredges already built has induced many individuals and companies to reexamine formerly known extensive deposits that were too low in tenor to be worked by any of the methods that require less capital. As a result, rumors are heard regarding dredging projects to be undertaken on placer ground almost from one end of interior Alaska to the other. Unquestionably these projects deserve most careful consideration, and some of them will doubtless be successfully carried through, but there is a tendency to regard the dredge as a magic method by which even worthless deposits may be mined at a profit, so that a word of caution may not be amiss to those who are considering undertaking some of the projects or investing in them. The amount of money needed to finance the building of even a small dredge and furnish the necessary equipment is so great that the cost of a thorough report by a competent engineer is relatively insignificant, and such a report should be obtained as almost the first step in any well-advised project. Obviously, for the preparation of a reliable report, considerable prospecting and testing of the ground must be done to determine the quantity and tenor of the materials to be handled. Necessarily, these examinations

are costly, and the penny-wise or get-rich-quick investor may regard them as items on which to economize. Adoption of such a policy almost inevitably in the long run leads to unnecessary loss, and adequate prospecting in advance well repays the outlay; because, in addition to preventing unwise commitments, it enables the competent manager to effect savings throughout the life of the project by wise planning in advance.

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 is rarely as much as 1½ ounces to the ton. For 1937 it is estimated that 285,000 ounces of silver was derived from the copper ores and was recovered in the course of treatment at smelters in the States.

All the gold-lode mines yield some silver in addition to their gold. Thus the mine of the Alaska Juneau Gold Mining Co., though worked principally for gold, yielded 120,691 fine ounces of silver in 1937, 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 2,251,079 tons of rock that was fine-milled—in other words, the quantity of silver recovered was only little more than 0.053 ounce to the ton. The silver from all the gold-lode mines amounted to 156,000 ounces and was worth $121,000. 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 54,000 ounces, worth $42,000.

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 1937 as well as for the earlier years are set forth in the following table:

Silver produced in Alaska, 1880–1937, by sources

Year	Total		Copper lodes		Gold lodes		Gold placers	
	Ounces	Value	Ounces	Value	Ounces	Value	Ounces	Value
1880–1918	8,389,398	$5,598,314	5,327,852	$3,666,820	1,319,889	$931,396	1,741,657	$1,000,098
1919	629,708	705,273	488,034	546,598	108,691	121,734	32,983	36,941
1920	953,546	1,039,364	682,033	743,416	246,292	268,458	25,221	27,490
1921	761,075	761,075	545,229	545,229	193,281	193,281	22,565	22,565
1922	729,945	729,945	622,978	622,978	80,598	80,598	26,369	26,369
1923	814,649	668,012	715,040	586,333	77,237	63,334	22,372	18,345
1924	669,641	448,659	572,078	383,292	75,284	50,440	22,279	14,927
1925	698,259	482,495	606,929	419,294	67,186	46,445	24,144	16,756
1926	690,000	430,500	605,190	377,600	59,940	37,400	24,870	15,500
1927	627,800	356,000	525,100	297,800	79,400	45,000	23,300	13,200
1928	454,700	266,000	350,430	205,000	80,340	47,000	23,930	14,000
1929	472,900	252,000	351,730	187,400	94,370	50,300	26,800	14,300
1930	408,570	157,300	279,990	107,800	102,080	39,300	26,500	10,200
1931	352,000	102,000	193,850	56,200	129,800	37,600	28,350	8,200
1932	234,050	66,000	81,150	22,900	115,300	32,500	37,600	10,600
1933	157,150	55,000	----------	----------	128,150	44,850	29,000	10,150
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	54,000	42,000
Total	18,455,391	13,176,937	12,671,613	9,322,260	3,458,488	2,456,676	2,325,290	1,398,000

From the foregoing table it is readily apparent that since about 1923 there was a gradual diminution in the output of silver until in 1934 the low point of 154,700 ounces was reached. Since that time there has been a marked increase until in 1937 the output was more than three times that for 1934. The reason for these marked changes is not hard to discover for, as has been stated, by far the larger part of the Alaska silver comes from the copper ores, so that the two fluctuate more or less together. As will be seen from the table the copper mines yielded no silver in 1933 and 1934, and it might be added parenthetically that this was because the larger mines had suspended operations. As these variations are so closely tied to the rise and fall in the activity of copper mining it is perhaps significant to point out here what is discussed more fully on pages 84–85, namely that production from the group of large copper mines is doomed to be cut off in the near future, so that a marked downward trend in the output of silver will inevitably take place before long.

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 has 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 1937 the price, set by the Government in 1936

for silver that qualified under the law, was 77.57 cents an ounce. According to the Engineering and Mining Journal, the average price during this period for silver that did not so qualify was approximately 44.9 cents an ounce. On the assumption that all the silver produced from Alaska mines in 1937 qualified as eligible for purchase at the Government price, its value, as stated in this report, has been calculated at that price.

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

Average selling price of silver, 1880–1937

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

The development in Alaska of ores that are valuable principally for their silver content is necessarily attended by many more difficulties and expenses than are likely to be met in developing gold mines. Among the most obvious reasons for this difference are the much lower value per unit of weight of the silver and the fact that more elaborate and expensive processes are usually required to recover silver in a readily salable metallic state than to recover gold. As a result, it is more or less unwarranted at this time to attempt to develop or even to search for silver lodes in remote parts of Alaska unless the ore has an especially high tenor. Therefore, although silver-lead lodes have been reported at many places in Alaska, few of them have appeared sufficiently attractive to induce persons with money to have the necessary examinations made and to undertake exploitation. Practically the only mining enterprise in progress in 1937 looking to the development of an Alaska deposit whose ore was mainly valuable for its silver content was the resumption of prospecting on the property formerly known as the Mint mine on Portage Creek, a small tributary of the Susitna River about 9 miles east of Chulitna Station on The Alaska Railroad.[8] Arrangements for the new work on this property were not concluded until fairly late in the open season of 1937, so that the work accomplished amounted to little more than examining the old workings and surface exploration.

[8] Capps, S. R., and Short, M. N., A ruby silver prospect in Alaska: U. S. Geol. Survey Bull. 783, pp. 89–95, 1926.

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 of these districts would repay further exploration for workable silver ores, but while 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 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 sulphides is already making handsome returns in many places and 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.

COPPER

The production of copper from Alaska mines in 1937 is estimated as 36,007,000 pounds, valued at $4,741,000. This is a decrease in quantity of more than 3,000,000 pounds from the production in 1936 but an increase in value of more than $1,000,000. The value of the copper produced from Alaska ores in 1937 has been computed on the basis of the average selling price for the year as computed by the Engineering and Mining Journal. This price for domestic copper was 13.16⅔ cents a pound, or about 3⅔ cents higher than in 1936. The price of copper fluctuated considerably during the year. The price stood at an average of about 12.4 cents in January, rose to more than 15¾ cents in March, but by May had dropped to about 13¾ cents, at which figure it remained almost stationary until September. During the later months of the year the price of copper decreased still further, until in December the average selling price was about 10 cents a pound. On the basis of the average price of copper for the year of 13.16⅔ cents, the total value of the Alaska production in 1937 is estimated to have been $4,741,000.

It is realized that this method of calculating the value does not take into account the fact that an efficient and fortunate selling agent would take advantage of fluctuations in the price of copper and thus dispose of as much as possible during periods of high prices and hold as much as possible during periods of low prices. The figures given for the value of the Alaska output of copper cannot therefore be regarded as representing the amounts received by the different companies for their copper. They do, however, serve to indicate within close limits the

magnitude of the industry and are comparable with the figures for earlier years as stated in these reports.

In the following table are shown the amount and value of the copper produced in Alaska since the earliest recorded mining of copper:

Copper produced by Alaska mines, 1880, 1900–1937

Year	Ore mined (tons)	Copper		Year	Ore mined (tons)	Copper	
		Pounds	Value			Pounds	Value
1880		3,933	$826	1927	645,000	55,343,000	$7,250,000
1900–1915	1,232,396	220,773,969	35,031,225	1928	579,500	41,421,000	5,965,000
1916	617,264	119,654,839	29,484,291	1929	590,400	40,510,000	7,130,000
1917	659,957	88,793,400	24,240,598	1930	531,000	32,651,000	4,244,600
1918	722,047	69,224,951	17,099,563	1931	88,000	22,614,000	1,877,000
1919	492,644	47,220,771	8,783,063	1932	56,900	8,738,500	550,500
1920	766,095	70,435,363	12,960,106	1933		29,000	1,900
1921	477,121	57,011,597	7,354,496	1934		121,000	9,700
1922	581,384	77,967,819	10,525,655	1935		15,056,000	1,249,700
1923	731,168	85,920,645	12,630,335	1936		39,267,000	3,720,000
1924	761,779	74,074,207	9,703,721	1937		36,007,000	4,741,000
1925	860,023	73,855,298	10,361,336				
1926	670,000	67,778,000	9,489,000	Total		1,344,472,500	224,402,400

In the foregoing table no quantity of ore mined is shown in the appropriate column for the years subsequent to 1932. This has been omitted for the years 1933 and 1934 because the copper produced in those years was but a minor byproduct from the gold ores mined, which are not at all comparable with the ores reported for the preceding years, mined primarily for their copper content, and for the years since 1934 the amounts were omitted because the large copper-producing companies no longer publish that information.

The general trend of the copper-mining industry in Alaska is graphically indicated by one of the curves in figure 3, which shows the output of copper for each year from 1900 to 1937. 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.

Practically all of the Alaska copper comes from mines that have been developed primarily for the copper content of their ores, but there is a small amount of copper that is recovered as a byproduct through the treatment of ores principally valuable for their content of gold or of some other metal. The ore mined primarily for its copper content came from mines in the Copper River region near Kennecott,

owned by the Kennecott Copper Corporation and the Mother Lode Coalition Mines Co. and operated as a more or less single unit, except for accounting purposes. The ore at these mines consists mainly of high-grade copper sulphide and carbonate containing considerable silver but no gold. The ore deposits lie near the contact of a thick limestone formation and an effusive greenstone. The deposits are of a unique type and have yielded hundreds of millions of pounds of copper in the 25 years that they have been actively mined. Obviously, all mineral deposits are exhaustible, so that it is not strange that after these years of heavy output the further life of these deposits appears

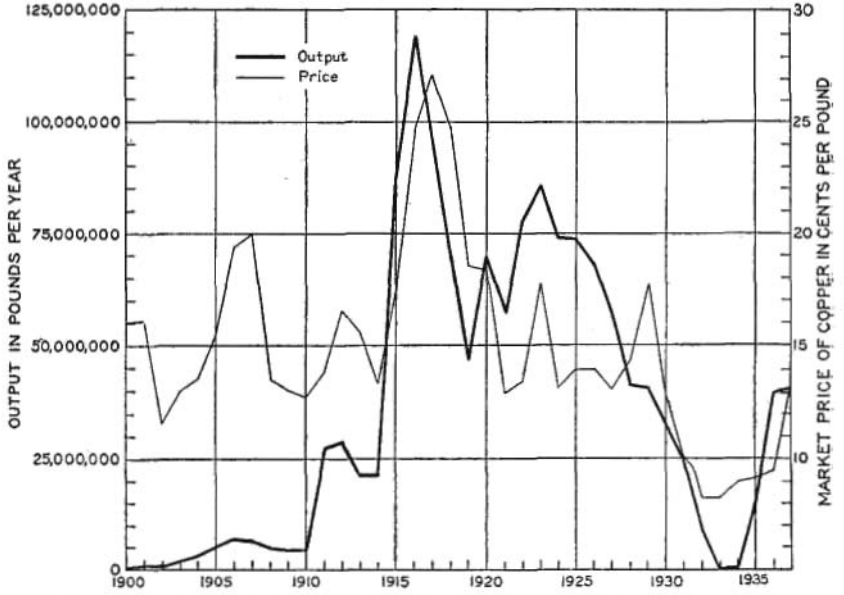

FIGURE 3.—Copper produced from Alaska mines, 1900–1937, and fluctuations in the price of copper during that period.

to be short. That this is recognized by both these companies is clear from statements in their recently published annual reports. According to the annual report of the Kennecott Copper Corporation [9] regarding its Alaskan property, which forms but a minor part of that company's copper mining operations:

> Development work failed to disclose any new ore possibilities, and therefore it is now expected to discontinue all operations at Kennecott in the latter part of 1938 upon completion of the mining of the remaining tonnage of ore. With only a small copper production and mounting costs, cessation of these operations will not be a serious matter to your Corporation.

The situation at the copper mines of the Mother Lode Coalition Mines Co. near Kennecott was essentially similarly described by its

[9] Kennecott Copper Corporation 23d Ann. Rept., for the year ended December 31, 1937, p. 6, New York, 1938.

management in the company's annual report.[10] After reciting the fact that the extremely limited future life of the mine had been forecast in the preceding report, the report states:

> Nothing has occurred since then to alter the situation or change this conclusion. * * * Therefore the total quantity of copper still to be sold after January 1, 1938, should amount to about 5,900 tons. Barring unforeseen interruptions in operations, all the remaining tonnage of ore in the mine should be extracted by the early summer of this year, after which the mine will have to be abandoned.

Considerable difficulty was experienced by both these large copper mines as well as by other Alaska enterprises owing to the shipping strike, which started in October 1936 and was not settled until February 1937. During that time the usual operation of the railroad and the shipping of the copper ore to smelters in the States was entirely disrupted. Even after the settlement of the main controversies the decreased labor efficiency and undercurrents of unrest seriously impaired the normal operations of getting the copper ore to the States.

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 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 operations.

That there are other places in Alaska where copper minerals occur is well known. That some of these deposits contained enough copper to enable them to be worked at a profit under past conditions is a matter of history. It is extremely doubtful, 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 en-

[10] Mother Lode Coalition Mines Co. 19th Ann. Rept., for the year ended December 31, 1937, pp. 1 and 2, New York, 1938.

courage the copper-mining industry, but it seems doubtful whether much improvement through such measures can be looked for in the near future. Indeed, the early cessation of copper mining at the large mines, as now so definitely forecast, points inexorably to the conclusion that within a year or so the output of copper from Alaska mines will come only from the small mines in which it is recovered as a by-product 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 1937 is estimated to have been 2,004,200 pounds, or about 112,000 pounds less than in 1936. This decrease is attributable mainly to the lesser 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 1937, according to the Engineering and Mining Journal, was 6.009 cents a pound, which was about 1.3 cents higher than the price that prevailed in 1936. At this price, the value of the Alaska lead production was $120,400, which, while greater than for any other year since 1931, was much less than for some of the preceding years when the quantity produced was very much less.

Lead produced in Alaska, 1892–1937

Year	Tons	Value	Year	Tons	Value	Year	Tons	Value
1892	30	$2,400	1908	40	$3,360	1924	631	$100,899
1893	40	3,040	1909	69	5,934	1925	789	140,571
1894	35	2,310	1910	75	6,600	1926	778	124,400
1895	20	1,320	1911	51	4,590	1927	1,008	127,000
1896	30	1,800	1912	45	4,050	1928	1,019	118,000
1897	30	2,160	1913	6	528	1929	1,315	166,000
1898	30	2,240	1914	28	1,344	1930	1,365	136,500
1899	35	3,150	1915	437	41,118	1931	1,660	126,000
1900	40	3,440	1916	820	113,160	1932	1,261	75,600
1901	40	3,440	1917	852	146,584	1933	1,157	85,600
1902	30	2,460	1918	564	80,088	1934	840	62,100
1903	30	2,520	1919	687	72,822	1935	815	65,200
1904	30	2,580	1920	875	140,000	1936	1,058	99,500
1905	30	2,620	1921	759	68,279	1937	1,002	120,400
1906	30	3,420	1922	377	41,477			
1907	30	3,180	1923	410	57,400	Total	21,303	2,377,200

Practically all of the lead that is reported in the foregoing table as produced in 1937 was recovered in the course of treatment of the gold ores of the Alaska Juneau Co.'s mines in southeastern Alaska. According to the published reports of this company, it recovered less than half a pound of lead from each ton of ore that it mined and trammed to the mill, or about 0.88 pound of lead from each ton of ore that is fine-milled. From the table on page 17, showing the recovery

of metals at the Alaska Juneau mine, it is evident that the total quantity of lead recovered from the total quantity of ore that was fine-milled has remained practically constant for the entire period of the mine's operation since 1914.

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

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 total quantity of platinum metals produced in Alaska in 1937 is estimated to have been a little more than 8,131 ounces, which had an estimated value of $397,600.

These bald statements as to quantity and value of the output from Alaska of the platinum metals from certain viewpoints group together so many dissimilar items that they fail to afford a clue to many of the facts that one may wish to learn regarding the industry. They are, however, as far as the available facts permit the writer to go at this time. The difficulty lies in the fact that the members of the platinum group of metals have a wide range in price, and each

clean-up from different claims shows a different proportion of the individual members of the group. Thus the composite statistics given above include indefinite amounts of palladium, whose price has been around $20 an ounce, together with amounts of platinum, whose price in 1937 averaged more than $50 an ounce, and iridium, which at times sold for more than three times the price of platinum. Obviously any statement as to quantity, to be satisfactory, should include information as to the precise amounts of the different platinum metals present. In this report, however, it is not possible to give this information, because for certain areas the information is not available to the Geological Survey and for others such separation would disclose confidential records.

Likewise, in determining the value of the output of platinum metals from Alaska for 1937 it has been necessary not only to make certain assumptions but also to combine the records of various dissimilar products. Furthermore, because of the wide fluctuations in the prices that prevailed for some of the rarer members of the group, it has been necessary to adopt the gross price for entire shipments as reported by the producers rather than to attempt to utilize average prices for the year. As an outcome of this procedure the total value of the Alaska output of platinum metals in 1937 has been set at $397,600. From this figure for the value of the total output, it follows that the average price of the total 8,131 ounces of platinum metals recovered was $48.90 an ounce. Strangely enough this average, derived from such composite material, does not differ greatly from the average price of platinum in 1937, which was $51.77 an ounce as determined by the Engineering and Mining Journal.

The outstanding development in the platinum-mining industry in Alaska, as well as in the United States proper, continued to be the placer-mining operations in the vicinity of Goodnews Bay in the extreme western part of the Kuskokwim region in southwestern Alaska. The importance of that area as a domestic source of platinum metals led the Geological Survey to undertake examination of the field in the open season of 1937. A geologic survey in charge of J. B. Mertie, Jr., supplemented by topographic surveys by Gerald FitzGerald, covered all the known producing area in the district. A summary of the results of that work has been prepared by Mr. Mertie and forms a separate chapter in this volume.[11] A more comprehensive report covering all phases of the geology and geography of the districts is being completed by Mr. Mertie and will be issued as soon as practicable.[12] For adequate descriptions of the district these reports should

[11] Mertie, J. B., Jr., Platinum deposits of the Goodnews Bay district, Alaska: U. S. Geol. Survey Bull. 910–B (in press).

[12] Mertie, J. B., Jr., Geology and mineral resources of the Goodnews Bay district, Alaska: U. S. Geol. Survey Bull.—(in preparation).

be consulted, and it seems desirable here to mention only the actual mining enterprises in progress. The principal productive area lies immediately south of Goodnews Bay and seems to be closely localized in the vicinity of masses of intrusions of ultrabasic igneous rocks. The principal mining operations are being carried on by two companies, each equipped with adequate modern mechanized plants. Both these companies in the past have mined mainly with draglines and bulldozers comparable with those used in several of the placer-gold camps. During 1937, however, one of the companies, the Goodnews Bay Mining Co., brought in and erected on Salmon River a dredge with 8-cubic-foot buckets. Although it was late in the season before the dredge was completed it was immediately put into operation and had a successful season of about 6 weeks before it closed down for the winter on December 20. The area to be dredged had been carefully tested in advance, so that the physical condition and tenor were well known. Frozen ground, the mining of which in more northern parts of Alaska causes so much additional difficulty and expense, is absent from the area to be dredged in the Goodnews Bay region. The size and distribution of the deposits containing platinum metals of value, the competent handling of the enterprises undertaking the recovery of these metals, and the excellent equipment already installed for the mining—all assure continued activity in the region and promise continued or even higher output of platinum metals from this field for many years.

Another large contributor to the output of platinum metals from Alaska in 1937 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 1937 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 sulphide, 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 in operation continuously during the year, though during the winter it is run on a reduced schedule.

The only other region in Alaska where some platinum metals are reported to have been recovered in 1937 is Seward Peninsula. In that region small amounts of platinum metals were recovered from gold placers on Dime Creek, a tributary of the Koyuk River, and on

Quartz Creek, a tributary of the Kiwalik River, in the 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 byproduct. The streams derive their gravel in large part from the hills formed of Mesozoic basic effusive rocks which have been cut by granite intrusives and in part from lower country in which Paleozoic schists and limestones predominate. 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.

Although no other operators in Alaska are known to have produced and sold platinum metals in 1937, it is not at all unlikely that small amounts may have been produced elsewhere and held by their producers. Places where platinum has been recognized are widespread through other parts of Alaska, and some of them in other years have produced platinum that has been sold. Among these places may be mentioned the Chistochina district of the Copper River region; Metal Creek, in the Kenai district; some of the beach placers of Kodiak Island, in southwestern Alaska; the Kahiltna River and nearby streams, in the Yentna district of the Susitna region; Boob Creek, in the Tolstoi area of the Innoko district; Granite Creek, in the Ruby district of the Yukon region; and some streams in the Marshall district, in the western part of the Yukon region.

TIN

For many years Alaska has been a small but regular producer of tin, and in the course of the more than a third of a century since tin minerals were discovered in Seward Peninsula and later elsewhere in the Territory, it has shipped tin worth nearly $1,460,000. During 1937 the production of tin from Alaska mines is estimated to have been 372,400 pounds of metallic tin valued at $202,300, an increase in quantity of about 145,000 pounds and in value of nearly $100,000 over the output of the preceding year. This indeed marks a greater amount both in quantity and value over the tin production in any preceding year during which tin mining has been in progress in the Territory. The cause of this increase is not to be attributed to a sudden unexpected spurt in production brought about by temporary activity, but rather marks the still further advance that has been made in carrying out the program of development of the placers in western Seward Peninsula that was begun in 1935. As such it may well be looked upon as indicating a progressive growth that has not yet attained its maximum.

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 number of 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 occur around the eastern border of Cape Mountain, a granite mass that forms the westernmost limit of the North American Continent and has been intruded into a country rock consisting of limestones and slates that had been much metamorphosed even before the intrusion of the granite. The tin minerals have been found in place in the contact zone of the granite, and in the past attempts have been made to develop some of the richer areas as lode mines. At the main operating property a highly effective plant has been constructed both to excavate the placer material and to wash it and separate the tin minerals from the waste. A high-grade concentrate is prepared by sluices, jigs, and tables, which is shipped to Singapore for smelting. The property is favorably located for transportation, as ocean-going vessels can bring freight practically to the door of the mill, and an abundant supply of water for milling is always available during the operating season because the company pumps water from Bering Sea for that purpose.

In addition to the granitic intrusion at Cape Mountain there are several other places in western Seward Peninsula within 50 miles or so of Tin City, where other intrusives of the same sort occur. In the past, in the vicinity of several of these other intrusives tin minerals have been found in the stream gravels, and during 1937 some work was in progress by small camps at a number of these places which, while their individual output was small, added materially to the output of the district. In fact the demonstrated occurrence of widely disseminated deposits of tin minerals in this part of Alaska has revived considerable activity in tin prospecting and mining in the area.

Although they contributed only a small amount of tin to the total output from Alaska mines in 1937, mention should be made of the placer deposits in the Hot Springs and Circle districts of the Yukon-Tanana region, which, while mined mainly for their gold content, afford a small but rather constant amount of tin minerals each year. None of the tin minerals now mined from either of these smaller deposits or from those of Seward Peninsula are now 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, 1902–37

Year	Ore (tons)	Metal (tons)	Value	Year	Ore (tons)	Metal (tons)	Value
1902	25	15	$8,000	1921	7	4	$2,400
1903	42	25	14,000	1922	2.3	1.4	912
1904	23	14	8,000	1923	3	1.9	1,623
1905	10	6	4,000	1924	11	7	7,028
1906	57	34	38,640	1925	22.2	13.8	15,980
1907	37.5	22	16,752	1926	12.85	8	10,400
1908	42.5	25	15,180	1927	37.5	26.7	34,000
1909	19	11	7,638	1928	58.6	41	41,000
1910	16.5	10	8,336	1929	51.6	38.6	35,000
1911	92.5	61	52,798	1930	21	14.7	9,300
1912	194	130	119,600	1931	5.6	4.1	2,000
1913	98	50	44,103	1932			
1914	157.5	104	66,560	1933		2.9	2,300
1915	167	102	78,846	1934		4.14	4,300
1916	232	139	121,000	1935		49.4	49,800
1917	171	100	123,300	1936		113	105,000
1918	104.5	68	118,000	1937		186	202,300
1919	86	56	73,400				
1920	26	16	16,112	Total		1,504.44	1,457,400

The importance of tin in our national economy and the dearth of workable tin deposits throughout most of the States makes the future of the Alaska deposits a matter of special significance. The facts are not yet in hand to warrant expressing any fixed conclusion as to the quantity of tin these deposits may supply under hypothetical conditions. The showings already made do, however, justify certain tentative opinions. Some of these facts may be summarized as follows: (1) Tin minerals in considerable quantities have already been recovered from certain areas in Seward Peninsula; (2) other nearby areas as yet not equally developed appear to have similar geologic setting and presumably may contain deposits of equal value; (3) certain areas adjacent to those containing workable placers or that are likely to contain such placers have been subjected to geologic processes that are capable of producing placers of other types than those now receiving attention—for instance, old beach concentrations; (4) the angularity of much of the tin ore in the placers and the size of many of the fragments showing the short distance which the material has probably been transported—all point to a rather local source for the mineralization and suggest the possibility of discovering lode deposits of commercial value. None of these opinions is of moment until it is confirmed or disproved. This can be done only by means of critical investigation and analysis. To be most successful this work would require examination of an area of several thousand square miles by the usual surficial methods of study, as well as by excavations and drilling at critical sites. The various records thus obtained should be correlated and interpreted by skilled specialists, alert to make the most use of the information disclosed in arriving at correct deductions. Such an investigation would take a number of years and would cost considerable money, and while it is by

no means certain that it would disclose workable deposits of tin it appears not excessive in view of the ends sought. Certain it is that if extensive tracts of workable tin deposits should be disclosed by such an investigation there would be no serious difficulty in developing them. True, the conditions for mining offer some drawbacks: there are no trees in the region, so that it is extremely difficult in most places to get even enough wood to maintain a campfire; much of the bedrock is limestone, and in few places is there enough fresh water to maintain even a meager sluicing operation; the climate is bad and the season short. On the other hand, few parts of the prospective tin area are far from the sea, so that transportation charges are moderate and sea water might be advantageously used for many of the mechanical operations at the plant; the limestone bedrock offers good footing over much of the country and allows the construction of adequate inexpensive roads; and the use of airplanes makes the district by no means inaccessible, the flying time from Nome being only about an hour. Many of the difficulties that confront the successful operation of placers would disappear if such investigation disclosed workable tin veins that could be mined under cover throughout the year and thus support a mining industry far more stabilized than that dependent on seasonal operation.

In thus focusing the foregoing discussion of 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 1937 is estimated to have been 131,600 tons, an amount that has been exceeded in only one year since coal mining began in the Territory. Even for the highest year, 1936, the output was less than 5,000 tons in excess of the amount produced in 1937. This is an astonishing record when the fact is taken into consideration that one of the principal producing mines was completely closed down for more than two months as a result of a serious explosion. In addition to the coal mined in Alaska, 31,556 tons of coal were imported from fields outside Alaska, and no Alaska coal was exported. The consumption of coal in Alaska in 1937 was thus 163,156 tons, or about 13,000 tons less than in 1936. The local consumption of coal is being supplied more and more by increased output of the domestic mines, as is shown by the dwindling amounts

of coal that are being imported. A comparison of coal production and consumption in Alaska for the entire period for which records are available is afforded by the table following.

In this table the total value of the coal produced in Alaska in 1937 is stated to have been $552,700. 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, or produced by that organization for its own use, 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 1937 may be taken as $4.20 a ton. This is the same as the estimated price since 1934, but is 80 cents a ton less than the price that was considered to be the average for 1933 and for the immediately preceding years and is about $1.25 less than the average price that prevailed during the period from 1880 to 1933.

Coal produced and consumed in Alaska, 1880–1937

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bituminous coal from Washington [1] (short tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia [1] (short tons)	Total coal consumed (short tons)
	Short tons	Value			
1880–1915	71,633	$456,993	679,844	1,079,735	1,831,212
1916	12,676	57,412	44,934	53,672	111,282
1917	54,275	268,438	58,116	56,589	168,980
1918	75,816	413,870	51,520	37,986	165,322
1919	60,894	345,617	57,166	48,708	166,768
1920	61,111	355,668	38,128	45,264	144,503
1921	76,817	496,394	24,278	33,776	134,871
1922	79,275	430,639	28,457	34,251	141,983
1923	119,826	755,469	34,082	43,205	197,113
1924	99,663	559,980	40,161	41,980	181,804
1925	82,868	404,617	37,324	57,230	177,422
1926	87,300	459,000	35,620	34,254	157,174
1927	104,300	548,000	35,212	27,225	166,737
1928	126,100	662,000	39,184	32,521	197,805
1929	100,600	528,000	34,762	24,172	157,534
1930	120,100	631,000	37,128	23,892	181,120
1931	105,900	556,000	30,772	17,796	154,468
1932	102,700	513,500	28,422	13,959	145,081
1933	96,200	481,000	21,524	14,009	131,733
1934	107,500	451,500	28,317	14,675	150,492
1935	119,425	501,600	26,554	15,707	161,686
1936	136,600	573,700	27,643	11,806	176,049
1937	131,600	552,700	21,930	9,626	163,156
Total	2,133,179	11,003,500	1,459,078	1,772,038	5,364,295

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

Practically all the Alaska coal mined in 1937 came from three mines—two in the Matanuska field and one in the Nenana or Healy

River field. The principal mine in the Matanuska field was that of the Evan Jones Coal Co., at Jonesville, but a smaller amount of coal was produced from the Government's own mine at Eska and a still smaller amount from the Wishbone Hill coal mine, operated by the New Black Diamond Coal Co., in the valley of Moose Creek. The mine in the Healy River field is owned and operated by the Healy River Coal Corporation.

The mine of the Evan Jones Coal Co. 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 is practically the only fuel used in the 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 western and central coastal portions, especially in the schools under the direction of the Office of Indian Affairs and in some of the canneries. Work at the mine during 1937 had progressed along the same general lines as of late years, but at a slightly accelerated pace, and improvements were constantly being made in the equipment and organization to handle the company's growing business, when suddenly on October 26 a violent explosion occurred which took the lives of 14 miners, practically the entire shift that was underground. This catastrophe caused immediate cessation of productive mining, and though, fortunately, the mine itself had not been wrecked by the explosion, it was not reopened during the year, though it will be in operation again in 1938.

For many years The Alaska Railroad has maintained in a standby condition its own mine at Eska, a mile or so east of Jonesville, which had been opened on the same general series of coal beds as those mined by the Evan Jones Coal Co. Within the past 2 years a change in the plan for its underground development had led to the driving of a new crosscut to the coal beds and the necessary changes in the surface plant. This work had been undertaken only as a measure of protection to the railroad in assuring an adequate supply of coal for the operation of its equipment and it fulfilled that purpose admirably when the emergency arose through the explosion at Jonesville. Within a short time crews had been gotten together, and soon an adequate supply of coal to meet the needs of the railroad was being delivered. Doubtless when the commercial mines resume production the operations at the Eska mine will be discontinued, and the mine, having served its purpose, will be allowed to lapse into its former standby condition.

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

been of a prospecting or developing type, in the course of which a small amount of coal has been mined and delivered under contract to The Alaska Railroad. The coal beds belong to the same general series as those at Eska and Jonesville, though definite correlation between the individual beds has not yet been established. Only a small crew has been employed on this property, and some financial and operating difficulties have arisen. Most of the time that work was in progress at the property the greater number of the men were employed on surface work. The mine is connected with the standard-gage branch of The Alaska Railroad at Premier by a narrow-gage track, on which the coal cars are handled by a small engine leased to the operators of the mine. At the Premier terminus of this narrow-gage line an elevated siding has been constructed from which the cars can dump directly into the standard-gage cars without rehandling the coal, as had been necessary in the past.

In the Nenana coal field the only producing property was the Suntrana mine of the Healy River Coal Corporation, on the Healy River, about 4 miles east of the junction of that stream and the Nenana River. The plant of this mine has been well laid out and is now equipped with the necessary modern machinery to handle 300 or more tons a day. The coal beds which 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 owing to the lesser amount of folding that the beds have undergone, the coal of the Nenana field has a somewhat lower heating value than that from the Matanuska and nearby fields and as a consequence is not used in the railroad locomotives, but the shorter haul makes its use more economical in many parts of the interior. This mine was in continuous operation throughout 1937 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 Exploration Department, for furnishing power to its dredges and in its large placer-mining operations in the vicinity of Fairbanks, and constantly growing demands by that company for more power are calling for an increasing quantity of coal. The Healy River coal is also extensively used for power and domestic fuel at several other points in Alaska, even as far distant from the mine as Cordova. The general equipment and operation of the plant is thoroughly modern and well fitted for the work required. Indeed, every effort has been made to make the property in all ways a model of its kind, and these efforts have been extremely successful.

Small amounts of coal were reported to have been mined or prospecting for coal was in progress during the year near Houston, a station on The Alaska Railroad some 20 miles west of Matanuska; at the old Chicago Creek mine, in the valley of the Kugruk River, in northern Seward Peninsula; and at two or three points along Kuk Lagoon, south of Wainwright, in northern Alaska. The coal from these different properties was used only locally and had no significant effect on the general Alaska coal situation, except to confirm the statement, often made before, that throughout the Territory there are many areas containing coal adequate for local use. So far as the Geological Survey is informed, no production was made during the year from the known coal deposits on Admiralty Island, in the Juneau district, where some activity had lately been shown. In the Bering River field, where extensive deposits ranging in composition from bituminous coal to anthracite have long been known, prospecting or other development work relating to the coal resources continued apparently at a standstill in 1937. Rumors of renewed activity in this field were heard from time to time, and extensions of some of the Government permits for coal prospecting there have been asked for, as the old permits neared their expiration. It is evident that this field has much potential value, but it is also evident that the present coal consumption of Alaska is not such as to stimulate large companies to undertake extensive projects and that until there is a greater demand for their product or until they are prepared to invade a more distant market, where competition will be more severe, they will not enter this field. Furthermore, the development work already done in this field indicates that some complex geologic conditions will be encountered, so that desultory prospecting by small, poorly financed, or technically unskilled operators holds little promise of success, and full development must await a company that is able to go into the matter in a large way and to bear the necessarily uncertain expense of exploring a new field.

The whole problem of the development of Alaska's coal resources is exceedingly complex, for while there are in the Territory large areas occupied by coal-bearing rocks, the 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. Certainly many of the steps that must be taken, if any extensive use of Alaska coal is to be made, require that the enterprise be undertaken on such a scale as will justify the outlay for the essential facilities. This means that a considerable tonnage must be marketed, but the attempt to dispose of a large tonnage of Alaska coal will bring it into competition with coals from other areas and in places where the competitive conditions appear to be almost insuperable for the Alaska product. Many of the competitive conditions are changing, however, so that the situation must be subjected to constant review. Of course, as Alaska develops and becomes more settled, its people and industries will call for more and more coal, and in meeting this demand Alaska coals will have certain great competitive advantages over those from outside sources. That growth, however, probably will be relatively slow but none the less sure.

PETROLEUM

No petroleum was produced from any Alaska deposits in 1937, 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 1937, as it had been in earlier years, by imports from the States. The accompanying table shows the amount of petroleum products that were imported into Alaska during 1937 as well as during the preceding years.

Petroleum products shipped to Alaska from other parts of the United States, 1905–37, in gallons [1]

Year	Heavy oils, including crude oil, gas oil, etc.	Gasoline, including lighter products of distillation	Illuminating oil	Lubricating oil
1905	2,715,974	713,496	627,391	83,319
1906	2,688,940	580,978	568,033	83,992
1907	9,104,300	636,881	510,145	100,145
1908	11,891,375	939,424	566,598	94,542
1909	14,119,102	746,930	531,727	85,687
1910	19,143,091	788,154	620,972	104,512
1911	20,878,843	1,238,865	423,750	100,141
1912	15,523,555	2,736,739	672,176	154,565
1913	15,682,412	1,735,658	661,656	150,918
1914	18,601,384	2,878,723	731,146	191,876
1915	16,910,012	2,413,962	513,075	271,981
1916	23,555,811	2,844,801	732,369	373,046
1917	23,971,114	3,256,870	750,238	465,693
1918	24,379,566	1,086,852	382,186	362,413
1919	18,784,013	1,007,073	3,515,746	977,703

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

Petroleum products shipped to Alaska from other parts of the United States, 1905–37, in gallons—Continued

Year	Heavy oils, including crude oil, gas oil, etc.	Gasoline, including lighter products of distillation	Illuminating oil	Lubricating oil
1920	21, 981, 569	1, 764, 302	887, 942	412, 107
1921	9, 209, 102	1, 403, 683	2, 021, 033	232, 784
1922	15, 441, 542	1, 436, 050	2, 095, 675	345, 400
1923	12, 285, 808	4, 882, 015	473, 826	454, 090
1924	14, 412, 120	5, 554, 859	566, 431	506, 364
1925	16, 270, 746	6, 993, 560	562, 844	580, 321
1926	14, 000, 664	5, 069, 584	328, 615	730, 924
1927	17, 628, 744	8, 141, 574	516, 306	620, 450
1928	13, 000, 176	8, 025, 402	463, 134	715, 082
1929	17, 347, 344	6, 847, 050	589, 340	878, 094
1930	13, 801, 746	6, 317, 934	401, 646	701, 946
1931	12, 282, 480	5, 532, 912	338, 310	450, 870
1932	14, 167, 104	4, 755, 660	297, 780	338, 310
1933	15, 340, 962	5, 677, 644	412, 230	337, 806
1934	16, 174, 662	6, 791, 232	421, 218	515, 508
1935	29, 254, 008	7, 890, 750	375, 816	549, 696
1936	43, 840, 062	7, 786, 548	297, 444	731, 419
1937	43, 656, 900	9, 179, 557	383, 586	677, 223
Total	578, 045, 231	127, 655, 722	23, 240, 384	13, 378, 927

From the foregoing table the great change in the types of different petroleum products imported, as well as in the amounts of each type during the period, are readily apparent. Thus the illuminating oils, which in the period from 1919 to 1921 formed a considerable part of the imports, have dropped to less significant amounts from 1930 to the present. Importations of heavy oils, which have always formed the bulk of the petroleum imports to Alaska, increased in the last few years until in 1936 and 1937 they amounted to about three times the average for the period from 1921 to 1933. This great increase undoubtedly reflects the growing use of Diesel-equipped apparatus at many of the mines and on vessels of the fishing fleet. It should also be noted that, while in 1920 the importation of gasoline was about 1,764,000 gallons, in 1937 it was practically 9,180,000 gallons, or more than five times that of the earlier year. This increase is in considerable measure in direct response to the increasing mileage of roads available with the attendant increase in the number of motor vehicles that use them.

Search for new oil fields in Alaska, which after numerous hectic booms in the past had practically ceased, began to be revived in 1936 and in 1937 was attracting considerable attention, even though at only one place had the new search reached the stage of drilling test wells. This drilling work was carried on by the Iniskin Drilling Co., which had extensive holdings in the Iniskin-Chinitna district on the west coast of Cook Inlet, in the Alaska Peninsula region. Drilling at this place had been started in 1936, and when operations were suspended for that winter the hole had reached a depth of somewhat more than 2,500 feet. Further work was resumed at this property early in the

spring of 1937 and continued throughout the open season until a depth of more than 5,000 feet was reached, at which point work was again suspended for the winter. No details as to results of the season's work have been given out by the company, but apparently they were satisfactory, as the company proposes to continue the work another season and is locally reported to contemplate sinking to a depth of 10,000 feet if an adequate test of the geologic section is not obtained before that depth is reached. The work is being done by an adequately financed and competently conducted organization, so that the results should afford convincing information as to the possibilities of significant deposits of oil in that area. Discovery of commercial oil pools in this portion of Alaska would have an almost incalculable effect in accelerating the development of the whole Territory.

The revival of activity in the Cold Bay district was one of the noteworthy events, although the enterprise did not reach a more advanced stage in 1937 than critical field examination of its geology from surface observations. This examination, it is understood, was undertaken jointly by the Standard Oil Co. of California, the Associated Oil Co., and the Union Oil Co., and in its course several geologists, with necessary camp gear, made extensive reconnaissance surveys in much of the prospective oil areas of the south-central part of the Alaska Peninsula. The results of these studies apparently encouraged the three companies to plan in 1938 to send in crews and equipment to establish camp at Jute Bay and to start active drilling in the Salmon Creek area as rapidly as practicable. Sufficient funds are said to have been allotted for the work for the tests to be carried through to conclusive results.

Rumors have also reached the Geological Survey of revival of interest in the Yakataga field, east of the formerly productive Katalla field. In fact, some property surveys were reported to have been made during 1937, with the expectation that they would be followed up later by drilling tests. No definite information as to just what plans are in progress has been received by the Geological Survey. The fact that oil seepages have long been known at a number of points in this general area leads to the hope that before long adequate tests will be made to determine whether or not commercial deposits of oil do occur in their vicinity.

In connection with the general development of oil claims both in Alaska and the States there is a widespread misunderstanding as to the real significance of Government permits for exploration for oil. Hundreds of such permits have been issued by the Government and cover tracts in all parts of Alaska and are outstanding in the hands of individuals or companies, but most of them were evidently taken

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

MISCELLANEOUS MINERAL PRODUCTS

The list of minerals of value that have been found in Alaska is long. In addition to those described in the preceding sections of this report, others which have at one time or another been produced in quantities large enough to have more than local significance and some of which have been the basis of profitable mining industries include, among metallic products, antimony, arsenic, bismuth, chromium, iron, manganese, mercury or quicksilver, molybdenum, nickel, tungsten, and zinc; and among nonmetallic products, asbestos, barite, building stone, clay, garnet, graphite, gypsum, jade, limestone, marble, and sulphur. Without doubt small quantities of practically all these materials were "produced" in 1937 in the broadest sense of that word, but few of them were reported to have been produced and sold in quantities that represent a value of more than a few hundred dollars, and so far as could be determined the total value of the production in 1937 of all the mineral products not described in the earlier pages of this report was $218,000. This value was obtained principally from shipments of antimony ores and of limestone, but there was a small production of quicksilver ore. However, in the following table, as well as in some of the other tables in this report, all the 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." Among the mineral products included in this table that have also been described elsewhere in this report are the platinum metals. 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 a number of producers of platinum metals, it is appropriate to state their combined production, and this

has been done on page 87; 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 1937, it has been considered desirable to include the value of the platinum metals in this table.

Value of output of miscellaneous mineral products of Alaska, including platinum, petroleum, quicksilver, stone, antimony, gypsum, marble, and other products, 1901–37 [1]

Year	Value	Year	Value	Year	Value
1901	$500	1914	$199,767	1927	$162,000
1902	255	1915	205,061	1928	164,000
1903	389	1916	326,737	1929	194,000
1904	2,710	1917	203,971	1930	157,300
1905	710	1918	171,452	1931	108,000
1906	19,965	1919	214,040	1932	223,400
1907	54,512	1920	372,599	1933	39,200
1908	81,305	1921	235,438	1934	86,400
1909	86,027	1922	266,296	1935	299,700
1910	96,408	1923	229,486	1936	293,800
1911	141,739	1924	348,728	1937	615,600
1912	165,342	1925	454,207		
1913	286,277	1926	444,500	Total	7,306,500

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

Although antimony ores have long been known to occur in various parts of Alaska [13] and from time to time a few of the deposits have yielded some ore that has been shipped, there has generally been a lack of systematic development of even the more promising localities. It was therefore of special significance that in the fall of 1936 Morris P. Kirk & Son, Inc., took over the antimony properties on Stampede Creek in the Kantishna district [14] and under the capable direction of Earl R. Pilgrim soon had considerable quantities of ore coming out and being shipped. In general the plan of operation calls for moving the ore to the railroad only during the winter, when sledding conditions are favorable, so that the ore credited to the year 1937 was for the most part mined during the winter of 1936–37, and that part which will be mined during the winter of 1937–38 will be credited to the later year. The ore body has been developed by means of a 100-foot shaft on the vein from which crosscuts have been turned off. A crew of 20 or more men is employed during the period while mining and hauling are most active, but is cut down after the breakup, when freighting ceases for the summer. The ore is carefully hand-sorted and shipped to the States, where most of it is disposed of to various plants of the National Lead Co. The value of the ore as computed by the Geological Survey has been based on the average selling price of antimony for the year, a little more than 15⅓ cents

[13] Brooks, A. H., Antimony deposits of Alaska: U. S. Geol. Bull. 649, 67 pp., 1916.
[14] Moffit, F. H., The Kantishna district, Alaska: U. S. Geol. Survey Bull. 836–D, pp. 311–313, 1933.

a pound, as reported by the Engineering and Mining Journal. This was considerably in excess of the price at which the ore was valued by the operators at the mine.

It is reported that arrangements were made late in the season by M. P. Kirk & Sons for taking over under option a deposit of antimony ore on Cody Creek, near the head of the Wood River in the Bonnifield district. The plans called for the construction of a road to the property and the undertaking of underground development of the ore showings during the winter of 1937–38.

The quarrying of limestone as an ingredient of cement afforded a considerable part of the amount credited here to miscellaneous minerals in 1937. This enterprise is conducted by the Superior Portland Cement, Inc., of Seattle, operating under lease from the Pacific Coast Cement Co. The quarries at which this high-grade limestone is mined are on Dall Island, in the Ketchikan district of southeastern Alaska. From the quarries at this locality the rough stone is shipped in barges to Seattle, where it is treated and mixed with the other constituents of the cement. This property has been productive for several years, but ordinarily it is possible to supply all of the limerock needed by the company by keeping the quarries in operation only part of the year. In accordance with this practice, the quarries in 1937 were in operation from April to September, inclusive. The shipments from the property showed a somewhat larger quantity of limestone exported than was quarried during the year, because they included some rock that had been mined in an earlier year.

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 it came were apparently small stringers that appear little likely to afford ore that can be mined under present conditions. In the central and western parts of the Kuskokwim Valley there are, however, extensive areas of cinnabar mineralization which have long been known and which appear to hold promise of containing quicksilver deposits that may be profitably developed, though much further exploration will be required to determine their real value. Two small camps of two men each were established in the vicinity of the settlement of Sleitmut on the Kuskokwim near the mouth of the Holitna River. Reports from these camps indicated that during the year they had gotten out quite a quantity of ore but that, owing to the fact that neither of them had suitable furnaces for treating the ore, they had been unable to extract the mercury in a metallic state. The part of the Kuskokwim region where most of these showings of quicksilver ore occur is so remote that it is difficult and expensive to test out thoroughly the various places where mineralization has been recognized.

The exceedingly rich specimens of mercury ore that have been found occasionally in the course of such prospecting as has been done encourages further search for deposits of commercial value, but it has not yet been demonstrated whether these pieces come from small rich stringers, possibly too narrow and too scarce to mine, or from offshoots from a workable body of ore.

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 latter class 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 1937, though the property was kept in condition so that work could be resumed promptly when required. The general practice of this company has been to operate these quarries actively at intervals and supply all the stone it needed for the ensuing 2 or 3 years, during which time the quarries are kept only in a stand-by condition. The stone from these quarries is used in many of the larger and better buildings in the whole Pacific coast region, being especially in demand for interior trim and decoration. Ordinarily the company ships its rough stone from Alaska to finishing plants it maintains in Tacoma, Wash., and San Francisco, Calif. There is, of course, no basis for believing that the cessation of quarrying during the year means the permanent closing of the property. It only marks a halt in production until sales of the product now on hand deplete the stock so that replacements are needed, and there is every indication that this will occur shortly so that the quarries will again be running. Limestone and marble are widely distributed throughout southeastern Alaska, and, according to Burchard,[15] many different grades, some even approaching statuary quality, are found in the region. It therefore seems certain that some of these limestone and marble deposits, many of which are favorably situated with respect to deep-water transportation, will ultimately be profitably developed.

One of the significant new developments of the year in the way of searching for one of the less common metallic minerals was the testing of a deposit carrying molybdenite, a sulphide of molybdenum, in quantities that appeared attractive if sufficient tonnage could be demonstrated. The following notes regarding the work at this place have been prepared by F. H. Moffit, of the Geological Survey,

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

whose long familiarity with all parts of the Copper River region gives special weight to his statements.

Many samples of rock containing molybdenite have been found in the upper Copper River Valley, but only recently has any particular effort been made to determine their value and the extent of the deposits from which they came. In September 1937 a contract was let for driving a tunnel to prospect a deposit of molybdenite on the head of Rock Creek, near the highway leading to the Nabesna River. Rock Creek heads in a group of mountains between the main valley of the Copper River and the upper part of Suslota Creek. These mountains are made up chiefly of altered igneous rocks that include dark, fine-grained basalts and related rocks, tuffs, and locally a minor proportion of sedimentary beds of Permian age. The older rocks were intruded by light-colored, rather coarse-grained granitic bodies of diorite or quartz diorite, which are probably much younger than the host rocks. The contact zone of these older and younger rocks is mineralized in places and at the place under discussion contains molybdenite. The molybdenite prospect was not visited by the writer in 1937, but the following facts were obtained from reliable sources.

The deposit is near the head of Rock Creek, about 3.5 miles from the highway at mile 84, and between 2,000 and 3,000 feet above it. It occurs near the boundary between an area of the older rocks on the southwest and a body of diorite which is several square miles in extent and lies mostly on the Suslota Creek side of the ridge. The boundary is marked by a pegmatite dike or possibly a contact zone made up of coarsely granular feldspar, in a finely granular ground of hornblende, dark mica, and feldspar. Larger crystals of the mica are present, and a vein of mica forms the east wall of the mineralized zone at one of the exposures. Two open cuts uncovered a shear zone 3 feet wide, parallel to the contact of the diorite or trending about N. 30° W. Molybdenite occurs in the pegmatite as flakes and blebs, some of which are more than half an inch across. It is also present in the shear zone where it is exposed by the open cuts. Assays are reported to show molybdenum to be present up to 4.6 percent but to average about 3 percent.

The property consists of 6 claims, staked in 1936, and is known locally as the Todd claims or to its owners as "Discovery group." It is owned by George Todd, William Frame, Lawrence DeWitt (deceased), and Bern Horn. Development work in the fall of 1937 included a camp, trail, and two open cuts. A contract for 150 feet of tunnel was let in September by the Kennecott Copper Corporation, and it is expected that the work underground will give some better idea of the extent and value of the deposit than has been gained from the debris-covered surface and the small open cuts.

A little prospecting is said to have been continued and a revival of interest shown in the search for workable deposits of nickel-bearing ore in southeastern Alaska. The occurrence of nickel minerals in a belt that passes through Baranof and Chichagof Islands and in a more or less parallel belt farther east on Admiralty Island has long been known. The desirability, for purposes of both commercial utility and national defense, of developing a domestic source of nickel is obvious, and encouragement should be given to determine more fully the resources of any areas in Alaska that are known to contain nickel-bearing minerals. As one step in determining the extent that these deposits in southeastern Alaska could be relied on in case of national

need, the Geological Survey, through John C. Reed, one of its geologists, has begun making more detailed surveys of some of these deposits. One of the localities studied by Mr. Reed in 1937 was on the western coast of Admiralty Island. Certain of the conclusions reached by Mr. Reed are in course of publication by the Geological Survey.[16] The work of studying the nickel, as well as other metalliferous deposits, especially in parts of Chichagof Island, will be continued by Mr. Reed during the field season of 1938.

So far as the Geological Survey is informed, no noteworthy new developments took place during 1937 leading toward opening up any of the deposits of chromium ore that in the past have attracted attention. Chromium is one of the elements entering into many phases of modern commercial processes and at the present time is one of the metallic elements that the United States does not produce in sufficient quantities to meet its domestic needs. The possibility that this lack could be supplied from Alaska deposits is sufficiently attractive to make it desirable that all the potential sources should be thoroughly investigated. The principal known Alaska deposits are situated near the southern tip of Kenai Peninsula, and in the past shipments of ore have been made from some of them. These deposits, especially those in the vicinity of Red Mountain, were studied and reported on by the Geological Survey.[17] Other less well known deposits have been reported to occur in southeastern Alaska.

Little new development is reported to have taken place in 1937 in mining the many kinds of nonmetallic mineral products that occur at various places in Alaska. Extensive use was made of the widespread gravel and rock deposits for railroad ballast and road construction, and with sand they entered largely into the concrete mixtures 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 1937 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. Necessarily many of these common materials are becoming of increasing importance as the development of the Territory progresses, and Alaska is fortunate in having widely scattered through its extent deposits of materials that can fill most of these needs as they arise.

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[16] Reed, J. C., Nickel content of an Alaska basic rock: U. S. Geol. Survey Bull. 897–D (in press).

[17] Gill, A. C., Chromite of Kenai Peninsula, Alaska: U. S. Geol. Survey Bull. 742, 52 pp., 1922.

INDEX

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