

MINERAL INDUSTRY OF ALASKA IN 1924

By PHILIP S. SMITH

INTRODUCTION

This volume is the twenty-first of a series of annual bulletins¹ summarizing the results achieved during the year in the investigation of the mineral resources of Alaska and treating of the mineral deposits and of the statistics of mineral production of the Territory.² This volume, like those previously issued, has for its chief purpose the prompt publication of the more significant economic results of the year. The articles included are mainly statements of preliminary results and may be modified when the field material is more fully studied. Those who are interested in any particular problem or district are therefore urged to procure a copy of the complete report on it as soon as it is available.

The information included in this volume could not have been prepared without the data furnished by many residents of the Territory, some of whom have rendered this assistance for many years. However, many still fail to report their mining operations. To those who fail to report because of fear that their confidential data may be disclosed to competitors or others who might use the information to the sender's disadvantage the Survey would say that all schedules of production are regarded as confidential, are not open to inspection, and are not used in any form that would disclose the production of individuals. Even members of the Survey who are working in other parts of Alaska than those to which the specific reports relate do not have access to them. To those who refrain from reporting because of the small size of their production the Survey would say that the accuracy of its results depends upon having reliable data from every operator, even from those who have produced nothing during the current year. As the final figures are based in part on estimated production of all claims, if a claim produced nothing definite information of that fact may prevent an erroneous estimate.

The Survey appreciates the efforts made by prospectors and miners throughout the Territory in filling in and transmitting its schedules and would gladly avoid asking for unnecessary information or simplify its inquiries. It therefore welcomes constructive criticism as to how these desirable objects may be effected. In return, it aims to give the best statistical information that it can

¹ The preceding volumes in this series are U. S. Geol. Survey Bulls. 259, 284, 314, 345, 379, 442, 480, 520, 542, 592, 622, 642, 662, 692, 712, 714, 722, 739, 755, and 773.

² The statistics in this report have been compiled principally by Miss Erma C. Nichols.

regarding the developments during the year in the mineral industry of Alaska. In the interest of increasing its value to the Alaska mining industry as a whole and to each operator individually the Geological Survey requests more complete and prompter return of its schedules by the Alaska mining operators. To be of service the Survey reports should be in the hands of the users at the earliest possible moment. Delays in returning the schedules mean delay in publication of the results, so that anyone who delays sending in his report not only causes additional expense but also decreases the value of the result.

It is impossible to record here the names of all who have rendered aid to the Geological Survey during the past year, as the list would include more than a thousand names.

Special acknowledgment should be made to the Territorial mine inspector and resident engineer of the Bureau of Mines, who furnished the data on coal production, as well as other valuable information; to N. L. Wimmeler, also of the Bureau of Mines, for information about gold placers; to George Parks, now Governor of Alaska, and H. K. Carlisle, of the General Land Office; to the directors and other officers of the Bureau of Mines and Bureau of the Mint; to the collector and other officers of the Alaska customs service; to the officers of the Alaska Railroad; to Charles H. Flory, forest supervisor for Alaska; to John C. McBride and the Alaska Juneau Gold Mining Co., of Juneau; Thomas Vogel, of Haines; J. H. Cann, of Chichagof; Thomas G. White, of Katalla; the Kennecott Copper Corporation, of Kennicott; Thomas Larson, of Chitina; J. M. Elmer, of Dempsey; S. W. Jensen and H. W. Nagley, of Talkeetna; Alex Liska and Sumner Smith, of Anchorage; Louis Huber, of Seldovia; Arthur Moose Johnson, of Chulitna; J. H. Lander, of Wasilla; Charles Zielke, of Nenana; Carl F. Whitham, of Chisana; A. W. Amero, of Beaver; J. J. Hillard, of Eagle; Alfred Johnson, of Deadwood; John C. Boyle and Frank Slaven, of Circle; the First National Bank, George Hutchinson, and G. E. Jennings, of Fairbanks; Charles E. M. Cole, of Jack Wade; J. H. Elden, of Steel Creek; the Miners & Merchants Bank, of Iditarod; E. J. Stier, of Flat; Frank Speljack, of Ophir; George W. Huey, of Wiseman; Tom Plunkett, of Fortuna Ledge; J. W. Wick, of Russian Mission; B. J. Bower, of Long; Lynn Smith, of Ruby; A. Stecker and John Haroldsen, of Kwinak; the Miners & Merchants Bank, A. W. Kah, and R. W. J. Reed, of Nome; E. M. Marx, of Teller; T. P. Roust, of Candle; A. S. Tucker, of Bluff; James C. Cross and Lewis Lloyd, of Shungnak; and J. J. Elliot, of Haycock.

GENERAL FEATURES

In presenting this annual inventory of the progress of mining in Alaska many facts are set forth which show that the Territory is really a treasure box and not the liability which some people, who do

not know the country, suppose it to be. For instance, the accompanying table, which gives the value of the mineral production of Alaska, shows a total of more than \$535,000,000 from this source alone, and minerals form less than half of the total wealth, which includes fish, lumber, furs, and other products that the Territory has furnished. However, the mineral production for 1924, as compared with that for 1923, decreased about \$2,900,000. This is a cause for regret, especially as more than \$1,500,000 of this decrease is due merely to the fact that the market price of copper was 1.6 cents a pound lower in 1924 than in 1923—really not a matter that reflects in any manner on the productivity of the Territory.

Value of total mineral production of Alaska, 1880-1924

By years				By substances	
1880-1890....	\$4, 193, 919	1909.....	\$21, 140, 810	Gold.....	\$347, 240, 798
1891.....	1, 014, 211	1910.....	16, 875, 226	Copper.....	167, 812, 879
1892.....	1, 019, 493	1911.....	20, 720, 480	Silver.....	9, 950, 593
1893.....	1, 104, 982	1912.....	22, 581, 943	Coal.....	4, 140, 480
1894.....	1, 339, 332	1913.....	19, 547, 292	Tin.....	946, 227
1895.....	2, 588, 832	1914.....	19, 109, 731	Lead.....	930, 313
1896.....	2, 885, 029	1915.....	32, 790, 344	Platinum (placer).....	111, 773
1897.....	2, 539, 294	1916.....	48, 386, 508	Antimony.....	237, 500
1898.....	2, 329, 016	1917.....	40, 694, 804	Marble and other products (including lode platinum metals).....	3, 713, 713
1899.....	5, 425, 262	1918.....	28, 218, 935		
1900.....	7, 995, 209	1919.....	19, 626, 824		
1901.....	7, 306, 381	1920.....	23, 330, 586		535, 084, 276
1902.....	8, 475, 813	1921.....	16, 994, 302		
1903.....	9, 088, 564	1922.....	19, 420, 121		
1904.....	9, 627, 495	1923.....	20, 330, 643		
1905.....	16, 490, 720	1924.....	17, 457, 333		
1906.....	23, 501, 770				
1907.....	20, 840, 571		535, 084, 276		
1908.....	20, 092, 501				

A clearer picture of the state of the mining industry in 1924 is afforded by the following table, in which the total mineral output is distributed among the various metals and mineral products. According to this table the production of gold, lead, tin, and miscellaneous mineral products increased, while copper, silver, and coal decreased. The platinum metals derived from placers decreased about \$400, but the production of platinum metals really increased greatly, for, as explained more fully on pages 24-25, the platinum metals derived from lodes are included in the miscellaneous mineral products.

Mineral output of Alaska, 1923 and 1924

	1923		1924		Decrease or increase in 1924	
	Quantity	Value	Quantity	Value	Quantity	Value
Gold..... fine ounces.....	289, 539	\$5, 985, 314	304, 072	\$6, 285, 724	+14, 533	+\$+300, 410
Copper..... pounds.....	85, 920, 645	12, 630, 335	74, 074, 207	9, 703, 721	-11,846,438	-2, 926, 614
Silver..... fine ounces.....	814, 649	668, 012	669, 641	448, 659	-145, 008	-219, 353
Coal..... short tons.....	119, 826	755, 469	99, 663	559, 980	-20, 163	-195, 489
Tin, metallic..... do.....	1. 90	1, 623	7. 00	7, 028	+5. 10	+5, 405
Lead..... do.....	410	57, 400	631	100, 899	+221	+43, 499
Placer platinum metals..... fine ounces.....	25. 90	3, 004	21. 98	2, 594	-3. 92	-410
Miscellaneous mineral products, including petroleum, marble, gypsum, and lode platinum metals.....		220, 486		348, 728		+119, 242
		20, 330, 643		17, 457, 333		-2, 873, 310

The decrease in silver is mainly a natural consequence of the decreased production of copper. The decrease in production of coal, about 20,000 tons, was due in large part to a serious fire in one of the largest mines. The decrease in both coal and silver is nearly offset by the increase in gold. On the whole, therefore, the decrease in 1924 may be considered as resulting from decreased production of copper. Further discussion of the details regarding the different metals and mineral products is given under each metal or material in later pages of this report.

The earlier volumes of this series contain complete tables of the production of all valuable metals for each year since they were first mined. With a view to reducing the size and cost of this volume many of these tables have been condensed, so that only the annual statistics for the last nine years are given and the production for the earlier years is grouped as one item. The reader interested in obtaining the more complete record should consult Bulletin 773.

Although complete tables have now been worked up for the annual production of gold, silver, copper, coal, tin, lead, placer platinum metals, and antimony, there are a number of mineral products, such as petroleum, gypsum, marble, and lode platinum metals that have not been so tabulated and either have not been determined or have been reported in the table on page 3 as miscellaneous mineral products. The following table has therefore been prepared, so that information as to the value of these miscellaneous mineral products should be readily available in one place.

Value of output of miscellaneous mineral products of Alaska, including petroleum, gypsum, marble, and other products, 1901-1924

Year	Value	Year	Value	Year	Value
1901.....	\$500	1910.....	\$96,408	1919.....	\$214,040
1902.....	255	1911.....	145,739	1920.....	372,599
1903.....	389	1912.....	165,342	1921.....	235,438
1904.....	2,710	1913.....	286,277	1922.....	266,296
1905.....	710	1914.....	199,767	1923.....	229,486
1906.....	19,965	1915.....	205,061	1924.....	348,728
1907.....	54,512	1916.....	326,737		
1908.....	81,305	1917.....	203,971		
1909.....	86,027	1918.....	171,452		
					3,713,713

GOLD

TOTAL PRODUCTION

For many years gold was practically the only metal that was produced in any quantity in Alaska, and even now the value of the total production of gold far exceeds that of any other mineral. The following table gives the total annual production of gold for the last nine years and the gross output from 1880 to 1915. This table

shows that altogether nearly \$350,000,000 worth of gold has been recovered since gold mining first began in the Territory in 1880. As indicated in this table, the amount of gold produced in 1924 was about \$300,000 greater than in 1923, and furthermore most of the increase came from the lode mines rather than from the placers. Additional information is given regarding the different types of deposits from which gold was produced and the different areas from which it came.

Gold and silver produced in Alaska, 1880-1924

Year	Gold		Silver		Value of gold by sources	
	Fine ounces	Value	Fine ounces	Commercial value	Placer mines	Lode mines
1880-1915.....	12,592,121	\$260,302,243	4,923,198	\$2,821,911	185,200,444	\$75,101,799
1916.....	834,068	17,241,713	1,379,171	907,495	11,140,000	6,101,713
1917.....	709,049	14,657,353	1,239,150	1,021,060	9,810,000	4,847,353
1918.....	458,641	9,480,952	847,789	847,789	5,900,000	3,580,952
1919.....	455,984	9,426,032	629,708	705,273	4,970,000	4,456,032
1920.....	404,683	8,365,560	953,546	1,039,364	3,873,000	4,492,560
1921.....	390,558	8,073,540	761,085	761,085	4,226,000	3,847,540
1922.....	359,057	7,422,367	729,945	729,945	4,395,000	3,027,367
1923.....	289,539	5,985,314	814,649	668,012	3,608,500	2,376,814
1924.....	304,072	6,285,724	669,641	448,659	3,564,000	2,721,724
	16,797,772	347,240,798	12,947,882	9,950,593	236,686,944	110,553,854

Gold and silver produced in Alaska, 1924, by sources

Source	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
Gold ores (3,127,905 short tons).....	131,018.01	\$2,708,383	75,284	\$50,440
Copper ores (761,779 short tons).....	645.37	13,341	572,078	383,292
Placers.....	172,408.50	3,564,000	22,279	14,927
	304,071.88	6,285,724	669,641	448,659

GOLD LODES

The production from the gold lodes amounted in 1924 to more than 17,500 ounces of fine gold, having a value of about \$360,000 above that in 1923. No new mines became notable producers during the year, and only a few mines that were producers in 1923 discontinued production in 1924. Nineteen mines which are here classed as gold mines because gold is the dominant metal in their ores and whose production was valued at more than \$1,000 during the year, reported production in 1924, the same number that reported in 1923. All lode properties that produced less than \$1,000 during the year are regarded as prospects.

The accompanying table gives information regarding the gold and silver produced from the gold mines in Alaska in 1924, by districts.

Gold and silver produced from gold-lode mines in Alaska in 1924, by districts

District	Number of mines	Ore mined (short tons)	Gold		Silver	
			Fine ounces	Value	Fine ounces	Value
Southeastern Alaska	6	3, 112, 507	111, 035. 43	\$2, 295, 306	68, 911	\$46, 170
Willow Creek	4	8, 075	9, 765. 83	201, 878	754	505
Fairbanks district	5	4, 528	4, 870. 05	100, 673	1, 295	868
Other districts	4	2, 795	5, 346. 70	110, 526	4, 324	2, 897
	19	3, 127, 905	131, 018. 01	2, 708, 383	75, 284	50, 440

^a Including small amounts of galena ore.

The mines of southeastern Alaska continued to yield the greatest amount of gold, and of these the mine of the Alaska Juneau Gold Mining Co. was by far the largest producer. The record of this company is shown by the report of its operations which it publishes each year. The following table, taken from that report, shows the recovery of gold as well as the other metals from this mine:³

Production of Alaska Juneau mine, 1893-1924^a

Year	Ore (tons)			Metals recovered			
	Total	Fine milled	Coarse tailings rejected	Gold	Silver (ounces)	Lead (pounds)	Total value
1893-1913	507, 254	330, 278	176, 976	\$707, 730	Lost in tailings		\$707, 730
1914-1915	242, 328	239, 918	2, 410	251, 655	6, 192	117, 031	261, 326
1916	180, 113	180, 113		115, 022	2, 844	61, 068	121, 379
1917	677, 410	677, 410		429, 262	12, 248	296, 179	460, 666
1918	592, 218	574, 285	17, 933	430, 124	11, 828	273, 297	459, 445
1919	692, 895	616, 302	76, 593	499, 002	16, 431	359, 762	542, 714
1920	942, 870	637, 321	305, 549	732, 870	23, 348	487, 574	791, 390
1921	1, 613, 600	904, 323	709, 277	969, 703	40, 619	550, 913	1, 035, 251
1922	2, 310, 550	1, 108, 559	1, 201, 991	1, 296, 157	49, 404	687, 315	1, 388, 679
1923	2, 476, 240	1, 134, 759	1, 341, 481	1, 427, 199	41, 876	755, 423	1, 514, 774
1924	3, 068, 190	1, 367, 528	1, 700, 662	1, 907, 374	63, 191	1, 256, 857	2, 055, 782
	13, 303, 668	7, 770, 796	5, 532, 872	8, 766, 098	267, 981	4, 845, 419	9, 339, 136

^a Compiled from published reports of mining company.

Some slight discrepancies between the figures in this table and those used by the Geological Survey are due principally to the fact that the price of some of the metals used by the Geological Survey in preparing its estimates is based on the average price for the year rather than on the actual price received by the producers. For instance, the price of lead, as computed from the figures given in the company's report, was 8.42 cents, whereas the price used by the Survey is 8 cents a pound. These differences are usually small, but in the example just cited the value of the lead given in the company's report is greater than the value of the whole production of lead in Alaska as given in the table on page 22, which was computed by the Survey. The report of this company further shows

³ Alaska Juneau Gold Mining Co., Tenth Ann. Rept., for 1924, published Mar. 3, 1925.

that operations were carried on for 362 days during the year, that its mining and milling plants, which had an average capacity of 7,430 tons a day at the beginning of the year, had been increased at the end of the year to 9,520 tons a day, and that the average number of tons mined per day for the entire year was 8,476.

The Alaska Juneau Gold Mining Co. also continued throughout the year its development of the Ebner mine, which lies adjacent to its property. In the report of the company for 1923 Bradley said:⁴

Litigation over the boundary line between the Alaska Juneau property and the westerly adjoining Ebner property has been settled by an agreement that resulted in our taking possession of the entire Ebner property, which possession is to continue after November 2, 1925, either as long as we mill an average of a thousand tons per day from the westerly side of an agreed-upon line between the Alaska Juneau and Ebner properties and equally divide the net profits, or as long as we employ a minimum of five men preparing the Ebner mine for profitably producing a thousand tons per day.

Good headway is being made on the preparatory work, and the management expected that by November, 1925, a thousand tons of ore a day would be coming from the Ebner mine.

Prospecting and development work on gold lodes was carried on in many of the other parts of the Juneau district. On Admiralty Island, in this district, a belt of metamorphic rocks, which extends from Funter Bay to Hawk Inlet, contains a great number of large well-defined quartz fissure veins with shoots carrying gold values. Several of these veins are being prospected on the properties of the Admiralty-Alaska Gold Mining Co. and the Alaska Dano Co. on Funter Bay and by Charles Williams and others on Hawk Inlet. A description of these properties by Buddington is given in another paper in this bulletin.

Work at the mines of the Chichagof Development Co., the Hirst-Chichagof Mining Co., and the Apex El Nido Mining Co., all on Chichagof Island in the Sitka district, was continued actively throughout the year, and the mines report a considerable production of gold. A new mill was put in operation during the year at the Apex-El Nido property. The success of these mines has stimulated interest in prospecting for gold lodes in this region, and doubtless this search for new ore bodies will be in some places successful.

The only other mine in southeastern Alaska in which a gold lode was productively mined during 1924 was in the Ketchikan district, where the Kassan Gold Mining Co. reports renewed mining at the Julia mine, near Hollis, throughout part of the year.

In the Copper River district the only mine which has been classed with the gold-lode mines was that of the North Midas Copper Co.,

⁴Bradley, F. W., Alaska Juneau Gold Mining Co. Ninth Ann. Rept., for 1923, published Mar. 11, 1924.

in the Chitina region near Strelna. This mine, although placing emphasis on copper in its name, has been considered a gold lode because the most valuable part of its production is gold.

Very little gold-lode mining was carried on in the Prince William Sound region. The largest production came from the old Ramsey-Rutherford mine, on the east side of Valdez Glacier, but some production was reported from the Tuscarora mine near Shoup Bay. Toward the end of the summer preparations were under way for further prospecting on the Little Giant claim on Mineral Creek, in the Valdez district. A number of men were engaged and a compressor installed to reopen the Cliff mine, near Shoup Bay.

Mining in the Kenai district was continued at the Lucky Strike mine of the Alaska Minerals Co., formerly the Hirshey mine, at the head of Palmer Creek near Hope. Further discoveries of gold-quartz lodes at Nuka Bay, on the south shore of Kenai Peninsula, indicate that this may be the center of a large area of mineralization. According to report, a mill was to be installed there during 1924, and several of the veins are said to show promising indications. The Alaska Hills Mines Corporation, near Seward, also reported the recovery of some gold from its lode claim known as the Paystreak.

No important new developments are reported from the Willow Creek region during the year. The largest gold-lode production came from the War Baby claim of the Willow Creek mines, on Craigie Creek. None of the other mines of this company were in operation. The Fern Gold Mining Co.'s property, near the head of Archangel Creek, showed a considerable increase in production owing to the discovery of a rich shoot of ore. The Mabel, on the ridge west of the lower part of Archangel Creek, was operated for part of the season. The only other mine in the district that reported having recovered any lode gold during the year is that of Elder & Thorpe, in the schist area near the mouth of Grubstake Gulch.

The Fairbanks district showed probably the greatest rate of increase in 1924 over 1923 of all Alaskan camps in its production of lode gold, for its output of gold in 1924 was more than \$100,000, as compared with an output of less than \$25,000 in 1923. The largest amount of work was in the general neighborhood of Ester Dome, especially near the head of St. Patrick Creek. Here Tyndall, Henderson, and McLoughlin, on the Mohawk claim, have taken out a considerable quantity of excellent ore. They have the only mill that is operating in the region. Most of the metal that is recovered is in the form of free gold. Sulphides, especially stibnite, and some galena and blende are fairly abundant in the ore, but no attempt is made to recover the gold intimately associated with them. The only other claim on Ester Dome which is reported to have milled any

gold ore is the First Chance, operated by Sam Stay & Co. Some development work was done on other claims in the neighborhood, but many of the owners have been "marking time," as negotiations are reported to have been in progress for a large consolidation of properties and their operation by companies not now active in the district. Lode prospecting in the vicinity of Fairbanks Creek has received a new impetus, and the Crites & Feldman Hi Yu mine still continues to be a consistent producer. The old Rhoads-Hall mine, on Bedrock Creek, a tributary of Cleary Creek, operated by Gustafson Bros., and the Wyoming claim, on the same stream, both produced some gold. Much of the work done at the Gustafson mine, however, was "dead" work required in reopening the mine, which had stood idle for several years, and in developing an adequate new systematic plan for mining the deposit.

The only productive lode-gold mining in the Kuskokwim basin was at the Whelan mine, in the Nixon Fork country. This general region was visited by a Survey party in 1924, and the geology and economic facts regarding it are described in considerable detail by J. S. Brown in another chapter of this bulletin. The gold recovered this year was mined during the winter of 1923-24 and was milled in the 20-stamp mill owned by the Alaska Treadwell Gold Mining Co., which had been leased to an association that included the owners of the Whelan mine. This mill was operated for 73 shifts, after which the mine and mill were practically closed down, though further prospecting in the neighborhood was undertaken.

In addition to the lode gold won from the lode mines discussed in the preceding pages, considerable gold was also recovered from the mines classed as copper lodes, which are described on pages 20-22. The gold recovered from the copper lodes amounts to 645.37 ounces of fine gold, valued at \$13,341.

GOLD PLACERS

GENERAL FEATURES

Gold placers are widely distributed through Alaska. Because in the early stages of their development many placers can be mined with relatively little heavy equipment and because the resulting product is small in bulk and high in value in comparison with its weight, they can be mined profitably in rather inaccessible regions where transportation facilities are poor. Even in the most remote parts of the Territory some gold still comes from placers. The cost of operating deposits by hand labor is, however, relatively high, and a decrease in cost can be effected only by the installation of

suitable machinery or the leading to the properties of large volumes of water under control. Most of the developed camps have reached the stage where the known rich bonanzas have been worked out and successful operation requires good mining practice and considerable labor-saving machinery. A person now undertaking placer mining must therefore either be prepared to go into the more inaccessible parts of the Territory or have sufficient capital to provide rather extensive equipment and to buy up claims staked by others. In other words, placer mining in Alaska is fast ceasing, if it has not already ceased, to be a business in which poor men inexperienced in mining can quickly become wealthy. It is still, however, a kind of work in which a person without much money can probably make as comfortable a living as can be made in the States with perhaps no more work and with the added attraction and disadvantage that the prospector is his own boss.

The total production of placer gold, distributed according to the districts in which it is produced, is shown in the following table:

Statistics of placer mining in Alaska in 1923 and 1924

Region	Number of mines		Value of gold produced		
	1923	1924	1923	1924	Decrease or increase, 1924
Southeastern Alaska.....	5	4	\$3, 500	\$7, 000	+\$3, 500
Copper River region.....	12	9	144, 000	130, 000	-14, 000
Cook Inlet and Susitna region.....	35	39	247, 000	168, 800	-78, 200
Yukon basin.....	365	374	1, 644, 000	1, 740, 500	+96, 500
Kuskokwim region.....	30	25	292, 000	268, 700	-23, 300
Seward Peninsula.....	66	84	1, 270, 000	1, 245, 000	-25, 000
Kobuk region.....	8	5	8, 000	4, 000	-4, 000
	521	540	3, 608, 500	3, 564, 000	-44, 500

In addition to the gold and silver some platinum and tin ore (cassiterite) are recovered in the course of placer mining.

The foregoing table shows that the production of gold from the placer mines in 1924 was almost identical with the amount produced from the same source in 1923. This correctly indicates the actual condition, that placer mining in the two years was done on practically the same scale and that there were no new strikes that affected the production to a marked degree, nor did any of the large formerly productive camps show decided increase in output. Although not yet reflected in their effect on production, several important events that took place during the year before long should stimulate placer mining, especially in the Fairbanks and Nome districts. One of

these events was the announcement, in August, that the Hammon Consolidated Gold Fields and the United States Smelting & Refining Co. had effected a consolidation of certain of their Alaskan holdings under the joint ownership of a company known as the Fairbanks Exploration Co. This consolidation had been in effect only a few months when, in the spring of 1925, the announcement was made that the United States Smelting & Refining Co. had taken over all the holdings of the Hammon corporation in Alaska, including the dredges at Nome as well as the many claims in the Fairbanks district. It is still too early to predict what developments will be undertaken in the near future, but the well-known success of the company in carrying through vigorously any work it undertakes gives every assurance that the properties will be brought to a producing stage as early as the most expert mining methods will permit. Not only will this enterprise have a direct effect on the mining industry of the Territory but it will be of indirect benefit in educating new miners in Alaskan methods and will afford work for many who will use some of the wages they earn as stakes to do some prospecting on their own account.

Another consolidation of claims, many of which have lain idle for several years, was effected by a company supposed to represent mainly English capital. The main area in which this company has acquired ground is in the vicinity of Engineer Creek, in the Fairbanks district. This arrangement was made late in the year, and the plan of development has not yet been announced. Carefully managed mining in this region on a large scale, backed by adequate funds, should give attractive returns on the investment and be of benefit not only to the producing company but also to the mining industry as a whole and to all the activities of the district tributary to the area in which the work is done.

An interesting experiment that is being tried in one of the drift mines on Little Eldorado Creek in the Fairbanks district is the mining of frozen ground by blasting rather than by thawing it with steam or water. According to J. S. Brown, this experiment was tried at the mine of the Idaho Mining & Leasing Co. At this property the shaft is about 175 feet deep and from it about 800 feet of drifts have been driven. The mining practice here is to use a general long-wall system of undercutting by blasting the frozen gravels, taking out 3 to 4 feet of the gravels and 2 to 3 feet of the upper bedrock. The frozen gravel is said to stand well without thawing, but the material broken by blasting that contains the gold thaws rapidly when exposed to the air for a short time, and its subsequent treatment for the recovery of the gold is the same as that for

other thawed material. If this system proves practicable it should have considerable application in many of the deep placers both of Seward Peninsula and of the interior of Alaska.

NOTES ON THE PLACERS BY REGIONS

Southeastern Alaska.—The only places in southeastern Alaska in which placer mines were worked in 1924 were the Juneau region, the Porcupine district, and the Yakataga district. In none of these places, however, were more than two claims worked and at none was more than a few thousand dollars in gold produced. All the gold came from stream placers except from two in the Yakataga district, where marine beach sands were mined. The total production for all of southeastern Alaska is shown in the table on page 10.

Copper River region.—Three districts in the Copper River region reported some production of placer gold. In the order of their output these were the Nizina, Chistochina, and Nelchina districts. A good-sized mine on Chititu Creek and another on Dan Creek and two small ones, one each on Rex and Dan creeks, were the only mines that were in operation in the Nizina district. With the exception of the Slate Creek Mining Co.'s work on Slate Creek, all the placer mines in the Chistochina and Nelchina districts were very small. There was only one other placer mine in the Slate Creek district and three in the Nelchina. The production of placer gold for all of the Copper River region is given in the table on page 10.

Cook Inlet-Susitna Basin.—The Yentna was by far the most productive district in the Cook Inlet-Susitna Basin region. Here 23 different mines, including one dredge, produced placer gold worth \$136,900. Most of the mines produced only a few thousand dollars in gold and only a few produced more than \$10,000.

In the Kenai district the placer production, which was \$27,900, came from 10 mines, most of them, except the claims on Crow Creek, producing less than \$5,000 each in gold and some of them only a few hundred dollars. These small producers were located on Canyon, Bear, Lynx, Mills, Resurrection, and Sixmile creeks, and on Resurrection River and Nuka Bay.

In the Valdez Creek district four claims, three of which were on Lucky Gulch and one on White Creek, mined a little placer gold.

Yukon basin.—The scope of placer mining in the Yukon basin is summarized briefly in the following table, which affords a ready comparison between the placer production in 1924 and in 1923. As shown in the table, there was an increase in 1924 over 1923 of about \$100,000, a large part of which might be attributed to the increased production in the Fairbanks district.

Placer gold produced in Yukon basin, 1923 and 1924, by districts

District	Value of gold		Number of mines	
	1923	1924	1923	1924
Fairbanks and Richardson.....	\$619, 000	\$680, 400	88	74
Iditarod.....	228, 000	207, 100	20	21
Tolovana.....	164, 000	189, 500	26	20
Innoko (including Tolstoi district).....	153, 000	161, 200	23	19
Circle.....	114, 000	90, 200	24	26
Ruby.....	72, 000	84, 600	32	32
Hot Springs.....	62, 000	83, 400	18	22
Fortymile.....	53, 000	31, 800	42	51
Chandalar.....	42, 000	17, 900	6	6
Koyukuk (including Indian River district).....	37, 000	54, 000	20	27
Chisana.....	23, 000	23, 400	9	8
Eagle.....	23, 000	49, 800	11	19
Rampart (including Gold Hill district).....	16, 000	16, 000	8	8
Bonnifield.....	13, 000	12, 500	13	13
Kantishna.....	13, 000	18, 800	13	18
Marshall.....	12, 000	19, 900	12	10
	1, 644, 000	1, 740, 500	365	374

It is rather surprising that most of the camps that made the greatest production showed so little change in the two years. In fact, the order of the first seven districts, based on production of placer gold, showed no change. A considerable amount of the placer gold from the Yukon region is recovered by dredges. A large amount of drift mining is done, especially in the Fairbanks, Tolovana, Fortymile, and Koyukuk districts. Many of the districts in the Yukon basin are now so close to relatively good transportation facilities that the more prosperous ones have rather extensive equipment. Some of the camps, however, are difficult of access, and further road building and trail making should unquestionably be undertaken, as this work would undoubtedly stimulate production and lead to the development of new deposits.

As already noted, the Fairbanks district, with which the Richardson district has been included in the table given below, produced the most placer gold. The table shows the amount of placer gold produced by camps on the different streams in the Fairbanks district for 1923 and 1924 and from the beginning of mining on the different streams, the first gold having been taken from the district in 1903.

Gold production by streams in Fairbanks district

	1923	1924	Approximate total to date
Cleary Creek and tributaries.....	\$54, 000	\$97, 600	\$23, 349, 900
Goldstream Creek and tributaries.....	201, 000	226, 000	15, 512, 000
Ester and adjacent creeks.....	54, 000	102, 600	11, 600, 000
Dome and Fairbanks creeks.....	225, 000	181, 500	16, 892, 100
Vault Creek and tributaries.....	32, 000	15, 900	2, 749, 000
Little Eldorado Creek.....	20, 000	33, 900	2, 414, 000
All other creeks.....	17, 000	22, 900	740, 000
	603, 000	680, 400	73, 257, 000

In the Iditarod district two dredges and the Chicken Creek Mining Co. on Chicken Creek and the Alpha Mining Co. on Flat Creek were the largest of the 21 mines that were operated in 1924. None of the others produced as much as \$10,000 in gold. Other creeks in this district that yielded placer gold were Granite, Happy, Cripple, and Willow creeks. Mining in the Tolovana district was reported by several mines on Livengood, Lillian, Amy, Ruth, and Willow creeks, named in the order of decreasing production of gold. Of the 20 producers in this district 6 produced at least \$10,000 in gold. Outside of three dredges—two on Ganes and one on Yankee Creek—the production of placer gold in the Innoko district came from 16 mines, the largest of which produced less than \$20,000. More than 26 placer mines were in operation in the Circle district, and all of them except the dredge on Mastodon Creek were relatively small operations, none of which produced as much as \$10,000 in gold.

None of the mines in the Ruby district produced more than a few thousand dollars in gold in 1924. In the Tolstoi district, which has been tabulated with the Innoko district, the production was almost negligible. An increase in production was reported by the Hot Springs district, especially from American Creek and Sullivan Creek and its tributaries in the western part of the district, and Omega and Eureka creeks and tributaries in the eastern part of the district. More than 50 placer mines were active in the Fortymile district. The greatest production came from Jack Wade Creek and its tributaries, Chicken Creek, and Fortymile River proper, but with few exceptions most of the claims individually produced only a few hundred dollars worth of gold.

In the Chandalar district the placer gold came mainly from Big Creek and from Big Squaw and Little Squaw creeks. The placer mines on the Koyukuk report an increased production over 1923. Most of the 27 properties that were mined, however, produced only a few thousand dollars worth of gold each. The most productive placer mining in the Chisana district was on Bonanza and Little Eldorado creeks, and about the same amount of gold was produced as in 1923. In the Eagle district the production of placer gold came from Seventymile River and its tributaries, especially Alder, Crooked, and Fox creeks, from Fourth-of-July Creek, and from American Creek and its tributaries, especially Discovery Fork. On Hunter Creek and Little Minook Creek were the most productive placer camps in the Rampart district. Most of the mines were small, and each produced only a few thousand dollars worth of gold. The report of the Richardson district has been tabulated with that of the Fairbanks district, as there are only two operating

mines in it. The largest of these mines is that of the Salcha Mining Co. on Caribou Creek, a tributary of Salcha River, and the other is on Democrat Creek.

In the Bonfield district placer gold was produced by 13 small mines, none of which recovered more than a few thousand dollars worth of gold. In the Kantishna district also the placer gold was mined by a number of small plants, many of which recovered only a few hundred dollars worth of gold and the largest only a few thousand dollars.

Information from different sources regarding mining in the Marshall district is not in entire accord. Apparently in 1924 the greatest production came from Flat, Willow, Buster, Disappointment, and Montezuma creeks.

Kuskokwim basin.—The placer gold produced in the Kuskokwim basin came from the Mount McKinley, Georgetown, Tuluksak-Aniak, and Goodnews districts. The greatest production in the Mount McKinley district, in fact in the entire Kuskokwim basin, was made by the Kuskokwim Dredging Co.'s dredge on Candle Creek. The largest of the other placer camps in this district were on Moore, Hidden, and Holmes creeks, with several small producers on other creeks near McGrath. Notes on the economic geology of the Nixon Fork country, including a description of some of the areas that have been prospected or worked for gold placers, are given in a report by J. S. Brown that forms another chapter of this bulletin.

In the Georgetown district some placer mining was done at two properties on Donlin Creek. In the Tuluksak-Aniak district, 10 placer mines produced some gold. The largest amount of mining was done on Canyon and Bear creeks, but even the largest producers recovered only a few thousand dollars in gold. Four small mines were worked in the Goodnews district. With the exception of the property on Watermuse Creek only a little gold was produced by each of the other operators.

Seward Peninsula.—Placer mining in Seward Peninsula was done on essentially the same scale as that maintained during the past two or three years, and about the same production was made. As heretofore, the dredges contributed the most gold, but the amount was somewhat less than that produced in the preceding year. The decrease was due in part to the discontinuance of some of the older dredges and to the fact that some of the newer ones were in operation only a part of the season. The following table gives a comparison between the amounts of gold won by different methods of mining in Seward Peninsula in 1923 and in 1924.

Placer gold produced in Seward Peninsula in 1923 and 1924, by methods of mining

Method	Number of mines		Value of gold	
	1923	1924	1923	1924
Dredging.....	16	16	\$1,017,620	\$896,210
Drifting.....	10	7	51,290	38,700
Other methods of mining.....	40	61	201,090	310,090
	66	84	1,270,000	1,245,000

The great increase in the number of mines worked by methods other than drifting and dredging is in part real but in part due to the inclusion of a number of prospects, some of which produced at most only a few hundred dollars' worth of gold and were not included in the records for 1923, though the gold they produced was included in the total production of that year. Practically all the increase in production by methods of mining other than dredging and drifting came from the Nome region. In the following table the placer gold produced in Seward Peninsula in 1923 and 1924 is distributed by districts, so far as possible without disclosing the production of individual mines. This table indicates that the Nome district made a very large increase in production, whereas the Solomon, Casadepaga, and Council districts, which have been grouped together, showed the greatest decrease.

Placer gold produced in Seward Peninsula, 1923 and 1924, by districts

District	Number of mines		Value of gold	
	1923	1924	1923	1924
Nome.....	18	20	\$598,000	\$848,500
Solomon, Casadepaga, and Council.....	11	21	449,000	217,600
Koyuk.....	11	11	59,000	51,700
Kougarok.....	9	14	50,000	31,600
Fairhaven.....	10	13	107,000	82,600
Port Clarence.....	7	5	7,000	13,000
	66	84	1,270,000	1,245,000

In the Nome district, in addition to the production from seven dredges, the greatest amount of gold came from ground on Little Creek that was hydraulicked by the Hammon Consolidated Gold Fields. Other creeks from which a considerable amount of gold in the aggregate was taken were Anvil, Boulder, and Last Chance, Osborn, Rock, and Sunset creeks, and from the old second beach line. The greatest production from the districts here grouped as the Solomon, Casadepaga, and Council districts came from six

dredges. Five mines in the Solomon district, one in the Casadepaga, and nine in the Council district are the only other mines where productive work was in progress. In the Koyuk the greatest mining activity was on Dime and Sweepstakes creeks. Drift methods for underground mining of deposits are extensively used at several claims, especially on the lower part of Dime Creek and on some of the bench claims. The aggregate production from these drift mines is considerably greater than that from the properties in this district that are using other methods of mining. One dredge was operated during part of the season on Dime Creek. The placer deposits on Dime Creek are of special interest because some of them carry platinum metals.

Mining in the Kougarok district was carried on at 14 properties, two of which were mined by dredges. Even the largest of the mines operated by other mining methods than dredging produced only a few thousand dollars worth of gold. In the Fairhaven district the greatest amount of gold was mined by three camps on Inmachuk River. Considerable gold was recovered by two mines on Patterson Creek, two on Candle Creek, and one on Bear Creek. Some production was also reported from the new camp on Koopuk Creek, a tributary of the Buckland, but the general reports from that region are not so favorable for extensive developments as some had been led to expect from the earlier rumors.

Most of the placer gold mined in the Port Clarence district in 1924 came from mines of Dick, Coyote, and Gold Run creeks, although a very small amount was also obtained from placers on Windy Creek and Bluestone River.

Kobuk region.—In the Kobuk region three properties in the vicinity of Shungnak and one on Klery Creek produced a small amount of gold. Mining in the region as a whole appears to have been little more than prospecting. The records regarding the region, however, are far from complete, and most of the data used in preparing the foregoing estimates are based on information obtained from different sources, some of which do not appear to be fully reliable.

DREDGING

The use of dredges for winning gold from placers continued to be a highly successful method of mining. Although the general facts regarding the production by dredges have already been given in the general tables of placer production, it has been desirable to make special mention here of the work done during the year by the dredges. The amount of gold produced by this form of min-

ing, in spite of the fact that two more dredges were in operation, decreased somewhat from the amount produced in 1923. The large new dredge of the Hammon Consolidated Gold Fields at Nome was not completed and in running order until October 7, so that it had a rather short season. The following list of the dredges and the different districts in which they were operated during the season of 1924 shows that there were 27 dredges operated in Alaska during that year, of which 16 were in Seward Peninsula, 9 in the Yukon basin, and one each in the Kuskokwim and Susitna basins:

Seward Peninsula:

Council district:

Northern Light Mining Co., Ophir Creek.
Wild Goose Mining & Trading Co., Ophir Creek.
Mebes & Hansen, Albion Creek.

Kougarok district:

Alaska Kougarok Co., Kougarok River.
Behring Dredging Corporation, Kougarok River.

Koyuk district: Dime Creek Dredging Co., Dime Creek.

Nome district:

Bangor Dredge Co., Anvil Creek.
Alaska Mines Corporation, Snake River.
Dexter Creek Dredging Co., Dexter Creek.
Hammon Consolidated Gold Fields (three dredges), on or near Little Creek.
A. H. Moore, Osborn Creek.

Solomon district:

Iversen & Johnson, Big Hurrah Creek.
Lomen Reindeer & Trading Corporation, Solomon River.
Shovel Creek Dredging Co. (Nylen, Hultberg, and others), Shovel Creek.

Yukon Basin:

Circle district: Berry Dredging Co., Mastodon Creek.

Fairbanks district:

Fairbanks Gold Dredging Co. (two dredges), Fairbanks Creek.
Chatham Gold Dredging Co., Cleary Creek.

Iditarod district:

North American Dredge Co., Otter Creek.
J. E. Riley Investment Co., Otter Creek.

Innoko district:

Flume Dredge Co., Yankee Creek.
Guinan & Ames Dredging Corporation, Ganes Creek.
Innoko Dredging Co., Ganes Creek.

Kuskokwim region:

Mount McKinley district: Kuskokwim Dredging Co., Candle Creek.

Cook Inlet and Susitna region:

Yentna district: Cache Creek Dredging Co., Cache Creek.

About 45 per cent of Alaska's total production of gold from placers in 1924 was won by dredges. The following table shows

the value of the gold recovered by dredges since this type of mining began in 1903:

Gold produced by dredge mining in Alaska, 1903-1924

Year	Number of dredges operated	Value of gold output	Gravel handled (cubic yards)	Value of gold recovered per cubic yard
1903-1915.....		\$12,431,000		
1916.....	34	2,679,000	3,900,000	.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
		28,287,162		

* See text (pp. 19-20) for basis of estimate.

The average length of the operating season for the dredges that furnished reports of their work was approximately 100 days, but there was wide variation in the extremes. So far as can be told from the incomplete records in hand, the Hammon Consolidated Gold Fields operated two of its dredges in the vicinity of Little Creek in the Nome district from May 1 to December 6, an operating season of 220 days. The two dredges that were operated the next longest period were both in the Iditarod region. One of these dredges reported operating from June 12 to November 17, and the other from June 1 to November 1, or 158 and 153 days, respectively. May 1 was the earliest date on which any dredges started work, and most of them did not begin until July and closed down in October.

Mining by dredges is less affected by variations in rainfall than almost any other type of mining, but this year several of the dredges reported considerable difficulty owing to rather sudden rises and falls in near-by streams which destroyed dams or made it necessary to dig an unusual depth in bedrock to keep the boats afloat.

For several years the Survey has prepared a statement regarding the amount of ground handled by the dredges during the year. This information has considerable interest and value, but in 1924 only 18 of the 27 reports of dredges that have come to the Survey have given data from which this information could be computed. Therefore, rather than to make estimates of the amount of yardage handled by the companies that did not report, it has seemed best to give only the amount actually stated by the 18 companies that reported. These companies dredged 3,476,656 cubic yards of gravel and from that material obtained the equivalent of fine gold valued at \$1,257,565. The average recovery was therefore 36 cents a cubic yard. This is somewhat lower than the value of gold recovered by the dredges in 1923, when the average was 40 cents. If this factor

of 36 cents applies to the ground of those companies that did not report, the total volume of the gravel dredged in 1924 was 4,342,667 cubic yards, as compared with 4,645,053 cubic yards handled by the dredges in 1923. On the whole, however, the dredges that reported the volume of gravel they had mined were those of the larger companies, and therefore they could handle profitably ground of lower tenor than the smaller dredges could. It therefore seems probable that the average fine gold recovered per cubic yard by the dredges that did not report and that is not included in the foregoing table probably was higher and might bring up the average per cubic yard. The total cubic yardage mined would then be less than the estimate given above, for that was computed by dividing the total gold output of the dredges by the average fine gold content.

A healthy sign in the undertaking of many of the newer dredging projects has been the more thorough examination of the ground in advance of any extensive outlay of money. Although mining enterprises necessarily face many uncertainties in actual operations, there are many factors which can be determined in advance, and neglect to determine them is bound to be detrimental. Among the most obvious, but in the past one of the most frequently disregarded factors, is the tenor and character of the ground to be dredged. Adequate sampling and testing by drilling well repay their cost and are now generally carried on extensively before any large new project is undertaken. Many of the smaller operators, however, who especially need this sort of information, still do not make adequate outlays for getting it.

COPPER

Copper ores are widely distributed in Alaska, but only in regions readily accessible to transportation have productive mines been developed. Even in those parts of Alaska near the coast many known prospects are still lying idle because of the lack of capital or because, at the present price of copper, the ore will not repay the high cost of necessary supplies and equipment. Copper was produced in 1924 mainly in the Chitina region of the Copper River basin by the Kennecott Copper Corporation, the Mother Lode Coalition Mines Co., and the Green Butte Copper Co.; on Latouche Island in Prince William Sound by the Kennecott Copper Corporation; and in the Ketchikan district of southeastern Alaska by the Alaska Palladium Co. The relative order of their production is the order in which the districts are named. Altogether more than 74,000,000 pounds of copper was produced from the different mines, and at the average price of copper that prevailed in 1924 the output was worth over \$9,700,000. This output came from lode mines whose dominant valuable mineral was copper and from a lode project

near Seldovia, though a few thousand pounds of copper were also recovered from placer operations in the Copper River basin. In addition a little copper was recovered from lodes of the Strelna district, in which gold predominates, and from the silver-lead lode of the Kantishna district.

Copper, silver, and gold produced at Alaska copper mines, 1900-1924

Year	Mines operated *	Ore mined (tons)	Copper		Silver		Gold	Total value of metals
			Pounds	Value	Fine ounces	Value		
1900-1915.....		1, 232, 396	220, 773, 969	\$35, 031, 225	2, 351, 726	\$1, 297, 756	\$1, 059, 357	\$37, 388, 338
1916.....	18	617, 264	119, 654, 839	29, 484, 291	1, 207, 121	794, 286	188, 977	30, 467, 554
1917.....	17	659, 957	88, 793, 400	24, 240, 598	1, 041, 153	857, 911	265, 900	25, 364, 409
1918.....	17	722, 047	69, 224, 951	17, 098, 563	719, 391	719, 391	107, 635	17, 925, 589
1919.....	8	492, 644	47, 220, 771	8, 783, 063	488, 034	546, 598	63, 795	9, 393, 456
1920.....	8	766, 095	70, 435, 363	12, 960, 106	682, 033	743, 416	18, 868	13, 722, 390
1921.....	6	477, 121	57, 011, 597	7, 354, 496	544, 311	544, 311	11, 689	7, 910, 496
1922.....	5	581, 384	77, 967, 819	10, 525, 655	623, 518	623, 518	15, 069	11, 164, 242
1923.....	6	731, 168	85, 920, 645	12, 630, 335	715, 040	586, 333	33, 633	13, 250, 301
1924.....	5	761, 779	74, 074, 207	9, 703, 721	572, 078	383, 292	13, 341	10, 100, 354
		7, 041, 855	911, 077, 561	167, 812, 053	8, 944, 405	7, 096, 812	1, 778, 264	176, 687, 129

* Properties producing less than \$1,000 are not counted as mines but are considered prospects.

There was a decrease of more than 11,000,000 pounds in the amount of copper produced in 1924 from the amount produced in 1923, and as the average price of copper was 1.6 cents less in 1924 than in 1923 the value showed an even greater decrease. It should be remembered, however, that 1923 was marked by a rather unusually large production of copper in Alaska and that the production for 1924 was more than 5,000,000 pounds greater than the average production for the preceding six years. A large part of the decrease was due to lessened production by the Kennecott Copper Corporation, for, according to the statements in its published annual reports, the copper sold was 50,945,719 pounds in 1923 and 42,985,532 pounds in 1924. At the Kennecott mine of this company a serious fire early in August, 1924, destroyed part of the power plant, but by great efforts and marked engineering ingenuity the mine and mill were kept in almost continuous operation. A temporary power installation was practically completed before the end of September, so that there was only slight interruption. Two mines in southeastern Alaska that produced several hundred thousand pounds of copper in 1923—in part from old dumps and material that had been mined several years before—were not in operation in 1924.

Prospecting and development work, according to Moffit, was continued at Rua Cove on Knight Island, at the Hemple property in Landlocked Bay, at one or two neighboring prospects on Landlocked and Fidalgo bays, and on Hogg Bay at the southwest end of Bainbridge Island. Except for annual assessment work on the claims of the Hubbard-Elliott Copper Co. on Elliott Creek and on claims on

Kotsina River there was no prospecting for copper in the western part of the Chitina Valley.

Buddington reports that work on the copper claims near Lake Bay in the Ketchikan region was continued.

In addition to copper the mines classed as copper mines produced some gold and a good deal of silver and palladium. The gold and silver from this source are included in the tables on pages 3 and 5. The palladium is included under miscellaneous mineral products in the table on page 4.

SILVER AND LEAD

Practically all the silver produced in Alaska in 1924 was a by-product from the gold lodes and placers and from the copper lodes. Nearly all the lead came from deposits classified as gold lodes. One mine, however, was operated primarily for the silver and lead contained in its ore. This mine was the Alpha mine in the Kantishna district, but as its output was small and could not be listed separately without disclosing confidential information, it has been tabulated as one of the gold mines and is so treated in the following statements.

The following records show the amount of silver and lead recovered from the various types of mines classified according to the dominant valuable mineral they contain.

Silver and lead obtained from gold lodes, gold placers, and copper lodes in 1924

	Silver		Lead	
	Ounces	Value	Pounds	Value
Gold lodes.....	75, 284	\$50, 440	1, 261, 239	\$100, 899
Gold placers:				
Dredges.....	9, 272	6, 212	-----	-----
Others.....	13, 007	8, 715	-----	-----
Copper lodes.....	572, 078	383, 292	-----	-----
	669, 641	448, 659	1, 261, 239	100, 899

The silver obtained from the gold lodes came from 19 mines and a few prospects; that from the gold placers from 540 mines; and that from the copper lodes from 5 mines. The lead was obtained from 6 lode mines or prospects. According to the table on page 6, which was compiled from the published annual reports of the Alaska Juneau Gold Mining Co., that company's mine at Juneau alone produced 1,256,857 pounds of lead.

Although, as noted above, only one small silver-lead mine reported production in 1924, at several mines the development work that was being done should soon result in adding new names to the list of producers and materially swell the yield of these metals. According to A. F. Buddington, prospecting in the vicinity of Hyder has dis-

closed ore that is sufficiently rich to lead the owners of one property, the Riverside, to feel justified in going ahead with the construction of a mill, and promising ore has been found at several other prospects in the district. Additional notes on this district are contained in a paper by Mr. Buddington that forms a later part of this report. A detailed survey of the region was undertaken near the close of the fiscal year 1925 by Mr. Buddington, and a summary statement of the results will probably be available for inclusion in the next progress report.

Prospecting for silver-lead lodes was also in progress in the Wrangell district on the Lake claims.

Further development work on certain of the silver-lead claims in the Kantishna district has uncovered ore that will probably reach the market in 1925.

An examination of an interesting ruby silver lode in the upper Susitna basin about 9 miles east of Chulitna station on the Alaska Railroad was made by S. R. Capps. He states that too little development work to permit an estimate of the size and value of the ore body has yet been done. A picked sample of the ore, however, tested by the Bureau of Mines, showed a silver content of nearly 120 ounces of silver to the ton, although selected samples, cut continuously across the vein, according to the best mining practice, showed less than 33 ounces of silver to the ton. A complete statement of Mr. Capps's observations, together with notes on the laboratory examination of the material by M. N. Short, is given in another chapter of this bulletin.

A silver-lead prospect situated about 14 miles south of Ruby was visited by J. S. Brown, who believes that the amount of ore so far discovered is too small to justify the risk of further expenditure in that place under present conditions. However, he says that similar surface outcroppings in that region justify at least sufficient prospecting to determine their size and richness. The full statement of Mr. Brown's observations regarding this prospect form a later chapter in this bulletin.

Lead produced in Alaska, 1892-1924

Year	Tons	Value	Year	Tons	Value	Year	Tons	Value
1892.....	30	\$2,400	1904.....	30	\$2,580	1916.....	820	\$113,160
1893.....	40	3,040	1905.....	30	2,620	1917.....	852	146,584
1894.....	35	2,310	1906.....	30	3,420	1918.....	564	80,088
1895.....	20	1,320	1907.....	30	3,180	1919.....	687	72,822
1896.....	30	1,800	1908.....	40	3,360	1920.....	875	140,000
1897.....	30	2,160	1909.....	69	5,934	1921.....	759	68,279
1898.....	30	2,240	1910.....	75	6,600	1922.....	377	41,477
1899.....	35	3,150	1911.....	51	4,560	1923.....	410	57,400
1900.....	40	3,440	1912.....	45	4,050	1924.....	631	100,899
1901.....	40	3,440	1913.....	6	528			
1902.....	30	2,460	1914.....	28	1,344		7,236	930,313
1903.....	30	2,520	1915.....	437	41,118			

TIN

Eleven tons of tin ore, equivalent to 7 tons of metallic tin, was obtained from placers in the Port Clarence district, Seward Peninsula, and in the vicinity of Tofty in the Hot Springs district, Yukon-Tanana region. Although small in amount, the production in 1924 was considerably larger than it has been for the preceding three years and may be taken as a sign of revival of interest in the mining of this metal. No direct information regarding the renewal of tin operation in Seward Peninsula has been received, and little is definitely known about the mining there except that the tin ore came from Goodwin Gulch. The tin ore from the vicinity of Tofty was a by-product recovered in the course of the placer gold mining. The bedrock source of the tin ore in the Tofty region has not been discovered, and the heavy overburden makes the tracing of the placer tin to its source difficult.

Tin produced in Alaska, 1902-1924

Year	Ore (tons)	Metal (tons)	Value	Year	Ore (tons)	Metal (tons)	Value
1902.....	25	15	\$8,000	1915.....	167	102	\$78,846
1903.....	41	25	14,000	1916.....	232	139	121,000
1904.....	23	14	8,000	1917.....	171	100	123,300
1905.....	10	6	4,000	1918.....	104.5	68	118,000
1906.....	57	34	38,640	1919.....	86	56	73,400
1907.....	37.5	22	16,752	1920.....	26	16	16,112
1908.....	42.5	25	15,180	1921.....	7	4	2,400
1909.....	19	11	7,638	1922.....	2.3	1.4	912
1910.....	16.5	10	8,335	1923.....	3	1.9	1,623
1911.....	92.5	61	52,798	1924.....	11	7	7,028
1912.....	194	130	119,600				
1913.....	98	50	44,103		1,623.3	1,002.3	946,227
1914.....	157.5	104	66,560				

PLATINUM METALS

Platinum metals were produced both from lodes and from placers in Alaska in 1924. The only lode from which platinum metals were recovered is the one at the Salt Chuck mine of the Alaska Palladium Co. on Kasaan Peninsula, in the Ketchikan district, southeastern Alaska. This mine, formerly called the Goodro mine, was originally started as a copper mine and is still so considered in the statement regarding copper production on page 20, but its most valuable metallic product now is palladium, one of the platinum group of metals. The output of this mine so far exceeds that of all the other producers of platinum metals in Alaska that the Survey is not able to state the amount without disclosing confidential information, which is precluded by its obligation to all producers. Consequently the value of the production of lode palladium has been lumped with other ores and minerals under the general heading "Miscellaneous minerals," in the table on page 4. The copper ore from this property, as well as the gold and silver, are included in the appropriate

places in the tables on pages 3, 5, and 21. The general geology and mineral composition of this lode has been described by Mertie,⁵ who states that the country rock is a basic intrusive igneous rock (pyroxenite), in which the ore minerals are distributed in grains and small patches as ore shoots, but that the ore deposit was formed later than the inclosing rock.

Nowhere in Alaska have the platinum metals been found in placers in sufficient quantities to make their recovery for themselves alone profitable. Platinum metals, however, were obtained from concentrates that were recovered from gold placer mining operations on Dime Creek in the Koyuk district of Seward Peninsula; on Slate Creek in the Chistochina district, Copper River basin; on Granite Creek in the Ruby district; and on Metal Creek in the Kenai Peninsula. Altogether 28 ounces of crude platinum metals, equivalent to 21.98 ounces of fine platinum metals, was recovered from these placer deposits. The value of these metals, computed as worth \$118 for each fine ounce, is \$2,594. This production is somewhat less than that in the last few years, for in 1921, 1922, and 1923 the production of fine platinum metals from these placers was 40, 28.3, and 25.9 ounces, respectively.

The bedrock source of the platinum metals found in the placers is not definitely known, though it was probably in the basic igneous rocks, usually of dark-green color and of high specific gravity. The discovery of the bedrock source is not likely unless search is specially directed toward this object. When it is remembered that in the Dime Creek region only about 1 ounce of platinum is found to 125 to 300 ounces of gold, the carefulness with which the search must be conducted will be apparent. This same general relation between the platinum metals and gold prevails in the other placer platinum deposits of Alaska.

MISCELLANEOUS METALS

The demand that arose during the war for many of the less common ores has subsided to such an extent that practically none of the Alaskan deposits of such minerals as those containing antimony, tungsten, chromium, and molybdenum shipped any ore during 1924. A small production of quicksilver from the Thrift mine, in the Iditarod-Kuskokwim region, was reported. This mine is about 23 miles north of the Crooked Creek landing on Kuskokwim River. The old furnace, which had four tubes, broke down soon after it was started late in 1924, but all the equipment necessary for the construc-

⁵ Mertie, J. B., jr., Lode mining in the Juneau and Ketchikan districts: U. S. Geol. Survey Bull. 714, pp. 121-127, 1921.

tion of a new 12-tube mill, with a rated capacity of 5 tons a day, has been delivered and will be installed as soon as possible next season. Developments at the mine are reported to be progressing satisfactorily, and the ore at the depth reached by the shaft that is being sunk is said to be fully as good as that found near the surface.

Buddington reports that some prospecting was done on several molybdenite claims at various places on Lemesurier Island in Cross Sound, southeastern Alaska, especially near Willoughby Cove. Fuller notes on the geology of these deposits is given in the report by Buddington in a later chapter of this bulletin. Interest has continued in the prospecting and development of some nickel-bearing deposits on Chichagof, Baranof, and Yakobi Islands. These deposits were recently described by Buddington,⁹ who states that most of the deposits are associated with basic intrusive igneous rocks (norite, gabbro) and that the geology of the region adjacent to some of the deposits bears a close similarity to that of the great nickel deposits at Sudbury, Ontario. No nickel ore from these mines, however, was reported to have been smelted in 1924.

Development work is reported to have been continued on a bismuth-bearing lode in the hills on Eva Creek, Nenana district, a few miles east of the railroad.

COAL

The most extensive coal mining in Alaska was in the Matanuska and Healy River fields, adjacent to the Alaska Railroad. The coals that are being mined in the Matanuska field are high-grade bituminous coals, whereas those mined in the Healy River field are lignites. Four mines in the Matanuska field and two in the Healy River field reported some production of coal during the year. In addition, a small amount of subbituminous coal was mined by Eskimos from outcrops along the shores of Wainwright Inlet in northern Alaska, and a little lignite was mined for local use on Kugruk River in Seward Peninsula. The total coal produced from all these sources was 99,663 tons, valued at approximately \$600,000. Too great reliance should not be placed on the statement of the value, for the prices used in the computations were based in part on the contracts placed by the Alaska Railroad for relatively large orders. For the fiscal year 1924 the railroad bought over 60,000 tons of coal of all grades, from all fields, at an average price of \$5.63 a ton, and the contract prices for coal from the Matanuska field for the fiscal year 1925 were \$7.50, \$5.80, and \$5.25 a ton, respectively, for lump, fine,

⁹ Buddington, A. F., Mineral investigations in southeastern Alaska: U. S. Geol. Survey Bull. 773, pp. 95-113, 1925.

and steam sizes, and for coal from the Healy River field \$4.25, \$3.50, and \$2.50, respectively, for similar sizes.

In spite of the fact that Alaska contains vast stores of coal and in spite of the fact that many of the coal mines could produce each year more coal than they now do, a great deal of the local market is still supplied by coals imported mainly from British Columbia and from the State of Washington. In 1924 nearly 45 per cent of the coal used in Alaska was imported. If the amount of coal used in the maintenance of the Alaska Railroad is deducted from the total amount used in the Territory it will be seen that the present Alaskan production is practically the same as it was six or eight years ago, before the railroad was built, and that about the same amount of coal was imported then as now.

Coal produced and consumed in Alaska, 1880-1924

Year	Produced in Alaska, chiefly subbituminous and lignite		Imported from States, chiefly bituminous coal from Wash- ington ^a (short tons)	Imported from foreign countries, chiefly bituminous coal from British Columbia ^a (short tons)	Total coal consumed (short tons)
	Short tons	Value			
1880-1915.....	71,633	\$456,993	679,844	1,079,735	1,814,047
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
	711,986	4,140,480	1,056,686	1,475,166	3,226,673

^a Compiled from Monthly Summary of Foreign Commerce of the United States, 1905-1924, Bureau of Foreign and Domestic Commerce. No figures on imports before 1899 are available.

Some exploratory work was done during the year on the high-grade coal of the Matanuska and Bering River fields, though none of this coal was marketed. S. R. Capps, of the Geological Survey, who studied the coal fields of the upper Matanuska Valley, reports that the coal-bearing area on the south flank of Anthracite Ridge contains beds carrying excellent anthracite coal, which is exposed at many places. At a place on the head of West Fork of Purinton Creek a bed of anthracite nearly 40 feet thick crops out. In this area, however, the coal-bearing formation is highly disturbed by folding, crumpling, and faulting, as well as intruded by bodies of igneous rock, such as dikes and sills. The coal beds appear to lie in synclinal basins, most of the upper part of the folds having been removed by erosion. These beds no doubt contain considerable an-

thracite coal of high grade, but whether the beds are sufficiently large and continuous to justify the expense of mining is uncertain in view of the cost of building a railroad to the area. Very little prospecting has been done on the anthracite beds, and whether they include workable bodies of coal can be proved only by extensive exploration, both on the surface and underground. The complete report by Mr. Capps is now awaiting publication by the Survey, but no definite date for its issue can yet be set.

The parties engaged in exploring Naval Petroleum Reserve No. 4 in northern Alaska in 1924 report a great extension of the coal fields previously known in the coastal region near Cape Lisburne. The coal-bearing rocks extend eastward through the central part of the reserve and evidently carry an enormous quantity of bituminous or subbituminous coal.

Some idea of the amount of coal available may be obtained from the measurements on Kukpowruk and Utukok rivers, where of 69 coal outcrops 30 contained minable beds of coal 3 feet or more thick and aggregating 187 feet of coal. This region is so remote that there is little likelihood of any of its coal being used in the near future except locally. However, in a region where trees are entirely absent this fuel has a special value, and the coal will doubtless play an important part in making possible the development of any oil resources that may be discovered in the region. A comprehensive report on the coals, as well as the other geologic information on this northern country, is in preparation, but it will probably be a year or more before it is published. A statement regarding the results of the work done in the region in 1923, however, has been printed,⁷ and a summary statement which deals mainly with the possibilities of the presence of oil forms another chapter of this bulletin.

PETROLEUM

The Katalla field, situated near the south-central coast of Alaska, still continues to be the only producing oil field of the Territory. The oil produced here in 1924 came from 16 small wells, all on patented claims owned by the Chilkat Oil Co. The oil is refined at the company's own plant and is marketed in the form of gasoline and distillate, which has a ready sale and is said to be of especially high grade. No new wells were completed and no old wells were abandoned during the year. The quantity and value of the petroleum produced has been included in the table on pages 3-4, under the heading "Miscellaneous mineral products."

⁷ Paige, Sidney, Foran, W. T., and Gilluly, James, A reconnaissance of the Point Barrow region, Alaska: U. S. Geol. Survey Bull. 772, v, 33 pp., 9 pls., 1925.

Petroleum products shipped to Alaska from other parts of the United States, 1905-1924, in gallons^a

Year	Heavy oils, including crude oil, gas oil, residuum, etc.	Gasoline, including all lighter products of distillation	Illuminating oil	Lubricating oil
1905.....	2,715,974	713,496	627,391	83,319
1906.....	2,688,940	580,978	568,033	83,992
1907.....	9,104,300	636,881	510,145	100,145
1908.....	11,891,375	939,424	566,598	94,542
1909.....	14,119,102	746,930	531,727	85,687
1910.....	19,143,091	788,154	620,972	104,512
1911.....	20,878,843	1,238,865	423,750	100,141
1912.....	15,523,555	2,736,739	672,178	154,505
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.....	23,555,311	2,844,801	732,369	373,046
1917.....	23,971,114	3,256,870	750,238	465,693
1918.....	24,379,566	1,086,852	382,186	362,413
1919.....	18,784,013	1,007,073	3,515,746	977,703
1920.....	21,981,569	1,764,302	887,942	412,107
1921.....	9,209,102	1,403,683	2,021,033	232,784
1922.....	15,441,542	1,436,050	2,095,675	345,400
1923.....	12,285,808	4,882,015	473,826	454,090
1924.....	14,412,120	5,554,859	566,431	506,364
	311,279,633	38,646,315	17,852,115	5,551,278

^a Compiled from Monthly Summary of Foreign Commerce of the United States, 1905 to 1924, Bureau of Foreign and Domestic Commerce.

The search for oil in the Alaska Peninsula still continues. W. R. Smith, of the Geological Survey, who visited this region during the field season of 1924, reports that drilling in the Cold Bay district was continued on the Pearl Creek dome by the Standard Oil Co. of California, whose Lee No. 1 well had been drilled to a depth of 3,017 feet, where it struck a rather strong flow of water and some gas. The Associated Oil Co. suspended drilling at a depth of 950 feet in June, 1923, but renewed operations in June, 1924, and continued drilling during the remainder of the year. The latest reported depth of the Associated well is 2,170 feet. Although drilling has been carried on with difficulty at considerable expense, and to a greater depth than was at first considered necessary, both wells have given showings of oil, and the companies expect to test the dome thoroughly. The Government road from Kanatak to Becharof Lake was completed late in the fall of 1923 and was used during the summer of 1924 by the operating companies. The new road does not shorten the distance to the wells, but it avoids a hard climb over the mountains. A few claims were surveyed during the summer. A more complete statement by W. R. Smith regarding the geology and oil developments in this region, accompanied by a structure contour map of the Salmon Creek-Bear Creek anticline, forms a later chapter of this bulletin.

The search for oil in Naval Petroleum Reserve No. 4, in the extreme northern part of Alaska, is still being continued by the Gov-

ernment through parties sent out by the Geological Survey. A report⁸ covering the work of the Survey parties in 1923 in the region has already been printed, but the results obtained in 1924 will be included with the work of parties now in the field and will not be published in separate form. The interest in this northern field, however, has led to the preparation of a summary statement of the present knowledge regarding the possibilities of the presence of petroleum in the region, and this statement forms a separate chapter of this volume.

STRUCTURAL MATERIALS

Shipments of marble from southeastern Alaska began in 1902, and since 1904 quarrying has been an important industry. Most of the marble produced has come from the north end of Prince of Wales Island, where the only large quarries (those of the Vermont Marble Co.) are located. There are, however, many other places in southeastern Alaska where marble has been found. The broad geologic relations of some of these other localities for marble and limestone are discussed in a paper by A. F. Buddington, which forms a chapter of this bulletin. The value of the marble produced in 1924 was somewhat greater than in 1923.

The only commercial deposit of gypsum which has been found in Alaska is on the eastern shore of Chichagof Island, in the Sitka district. Gypsum has been quarried at this place every year since 1906, but the mine then operated by the Pacific Coast Gypsum Co. was closed down in December, 1923, and remained idle until August, 1924, when it was taken over by the Standard Gypsum Co. Since that time the main activity has consisted in prospecting the ground and laying out plans for a new mill and the development of the mine. For these reasons the production in 1924 was very much less than in the preceding year.

⁸ Palge, Sidney, Foran, W. T., and Gilluly, James, *op. cit.*

ADMINISTRATIVE REPORT

By PHILIP S. SMITH

REVIEW OF THE WORK OF THE YEAR

Systematic investigations and surveys of Alaskan mineral resources have been carried on uninterruptedly by the Geological Survey since 1898, and even before that year some of the geologists and engineers of the Survey had been assigned to special investigations within the Territory. During this period of more than a quarter of a century about two-fifths of Alaska has been mapped and all the larger known mineral deposits have been studied to some extent. Practically all of this work was organized, administered, and largely participated in by Alfred H. Brooks, chief Alaskan geologist, who died suddenly November 22, 1924. Mr. Brooks, through his long experience, sympathetic understanding of the problems of the mineral industry in a frontier country, and broad technical knowledge, was in large measure personally responsible for the application of sound scientific principles to the search for and development of the Territory's mineral resources. S. R. Capps served as acting chief Alaskan geologist after the death of Mr. Brooks until March 31, 1925, and on April 1, 1925, Philip S. Smith was designated to take charge of the branch.

The following table indicates the areas that have been geologically and topographically mapped by the Geological Survey. The figures, of course, do not include any surveys in Alaska conducted by other Government organizations.

Areas surveyed by Geological Survey in Alaska, 1898-1925, in square miles

Fiscal year	Areas covered by geologic surveys			Areas covered by topographic surveys		
	Exploratory (scale 1:625,000 or 1:1,000,000)	Recon- naissance (scale 1:250,000)	Detailed (scale 1:62,500)	Exploratory (scale 1:625,000 or 1:1,000,000)	Recon- naissance (scale 1:250,000; 200-foot contours)	Detailed (scale 1:62,500; 25, 50, or 100 foot contours)
1898-1924.....	73, 200	123, 665	5, 657	51, 680	163, 430	3, 936
1925.....	4, 300	18, 590	190	4, 300	17, 470	130
	77, 500	142, 255	5, 847	55, 980	180, 900	4, 066
Percentage of total area of Alaska.....	39			41		

In this summary table only the net areas surveyed in earlier years are given. Furthermore, an area that has been surveyed on more than one scale is tabulated only in the column for the largest scale on which it has been mapped. For instance, the region adjacent to Nome, which in the early days was surveyed on an exploratory scale, later mapped on a reconnaissance scale, and still later on a detailed scale, is reported only as covered by detailed mapping. Therefore there is no duplication of areas reported under the different kinds of geologic or topographic surveys. On the whole, the areas covered by geologic surveys are coincident with those covered by topographic surveys, so that nearly two-thirds of the Territory has not yet been mapped by the Geological Survey.

Many of the surveys and investigations of Alaskan mineral resources, however, do not readily lend themselves to tabulation in terms of area or other intercomparable units of measurement. Among such studies may be mentioned the collection of statistics regarding the annual production of the different ores and minerals or the bringing together in one report all available data regarding the known oil or coal resources of the Territory. Furthermore, for several years the Geological Survey conducted investigations relating to the water resources of the Territory, maintaining at times as many as 80 gaging stations and making each year several hundred stream measurements.

The funds directly appropriated for the Survey's Alaskan work that were available for the fiscal year 1925 comprised \$75,000 carried in the Interior Department bill for 1925, which became immediately available on the signing of the act, June 5, 1924, and \$72,000 carried in the Interior Department appropriation act for the fiscal year 1926, which became available March 3, 1925. In addition a transfer of funds amounting to \$75,000 was made available to the Survey by the Navy Department for the continuation of the investigation of Naval Petroleum Reserve No. 4, in northern Alaska. Two of these appropriations were legally available for expenditure and some money was expended from both during the fiscal year 1924; all three of them were available and used to pay for expenses during the fiscal year 1925; and the balance of the Navy funds and the regular 1926 appropriation are available for expenditures during the fiscal year 1926. The expenditures from all these funds have been accounted for under the methods and procedure laid down by law or by the regulations of the Treasury Department, but these methods do not lend themselves to showing the costs during a field season or concerning individual projects. The labor and expense of determining the precise expenditures for the different jobs by years would far exceed the value of the resulting analysis, and therefore these expenditures have not been accurately computed. The follow-

ing statements give only in round figures the principal uses to which the funds were put during the fiscal year 1925. The amount expended in starting off the parties in advance of the beginning of the fiscal year in the field season of 1924 practically offset the amount used to start the parties at the end of the fiscal year 1925 to begin the work of the field season of 1925. Thus, except for the work financed by the Navy Department, which will be analyzed separately, the funds used for the fiscal year 1925 were \$75,000.

The following table shows the approximate allotment for salaries and field and office expenses for the fiscal year 1925:

Expenditures from funds directly appropriated for Survey's work in Alaska

Branch administration.....	\$3, 850
Other technical salaries.....	21, 750
Branch clerical and drafting salaries.....	5, 400
Services rendered by other Survey units, including editing, duplicating-machine service, accounting, and other services.....	7, 000
Office expenses, stationery, telegrams, photography, and other expenses.....	2, 000
Field expenses.....	28, 000
Airplane mapping by Navy Department.....	7, 000
	75, 000

An analysis of the allotment of the \$75,000 transferred to the Geological Survey by the Department of the Navy is as follows:

Allocation of funds for surveys in Naval Petroleum Reserve No. 4, northern Alaska

Administration.....	\$2, 500
Other technical salaries.....	17, 100
Clerical and drafting salaries.....	3, 300
Services rendered by other Survey units, including editing, accounting, instruments, and other services.....	2, 900
Office expenses, including stationery, photography, telegrams, and other expenses.....	900
Field expenses.....	36, 000
Allotted to work in progress for fiscal year 1926.....	11, 000
Balance for contingencies.....	1, 300
	75, 000

The items in the table regarding Alaskan branch expenditures for "other technical salaries, field expenses, airplane mapping," and \$1,500 of the item for clerical salaries, amounting in all to \$58,250, have been allotted for the different kinds of surveys and investigations in progress during the fiscal year 1925, as follows:

General investigations.....	\$3, 750
Geologic surveys.....	33, 400
Topographic surveys.....	19, 150
Statistics of mineral production.....	1, 950
	58, 250

It has been impossible to show accurately in the foregoing table the expense that should appropriately be distributed to topographic and geologic surveys, for two parties were engaged in work of both kinds. Each of these parties cost between \$6,000 and \$7,000, and their principal work was topographic mapping, so that, except for the geologists' salaries and a few hundred dollars spent for their traveling and subsistence, the whole amount might properly be included in the item for topographic surveys. On the other hand, the parties obtained many geologic data that could not have been obtained by separate geologic parties except at an additional expense of at least \$3,000 a party. In spite of the uncertainty, it has seemed best to divide the field expenses of both parties equally between topographic and geologic surveys, though by so doing geologic surveys bear perhaps an unduly heavy charge; or, to state the matter in another way, the economy of \$6,000 to \$7,000 effected by attaching geologists to the topographic parties is not adequately reflected by the table.

The different kinds of work reported in the foregoing table were carried on in many parts of Alaska. The following table indicates the approximate distribution of the work by geographic divisions for the fiscal year:

General investigations.....	\$3,750
Southeastern Alaska.....	16,750
Prince William Sound.....	8,300
Matanuska region.....	5,150
Southwestern Alaska.....	9,775
Mount McKinley region.....	3,150
Nixon Fork region.....	6,800
Upper Yukon.....	2,625
Statistics of mineral production (including \$1,500 for clerical salaries).....	1,950
	58,250

The work that has been segregated in the two preceding tables under the heading "General investigations" comprises four separate studies. One was the study of the broader aspects of the general geologic history of Alaska as affording an insight into the origin and distribution of mineralization. This work was carried on by Alfred H. Brooks and is part of a comprehensive study to which all the detailed investigations have contributed. The field areas specially visited during the year were in southeastern Alaska, in the Prince William Sound region, and in the country adjacent to the Alaska Railroad. A little time was devoted by James McCormick to his revision of the "Geographic dictionary of Alaska," a valuable Survey publication issued in 1906, which has been out of stock for many years. The other two projects were paleontologic investigations required in correlating the fossils brought in by the different

geologists from their field investigations. The study of the fossil flora of the Tertiary rocks, to which Arthur Hollick devoted about three months, is of special importance in correctly interpreting certain of the coal formations. The other paleontologic studies related principally to the older rocks, mainly Paleozoic, and were of great value in furnishing data used by the geologists in investigating deposits of metalliferous minerals.

Five distinct projects were undertaken in southeastern Alaska, two of which were executed during the field season of 1924 and the others during the field season of 1925. In the field season of 1924 A. F. Buddington continued geologic studies in the Ketchikan and Wrangell regions, visiting many of the mines and prospects, including those in the Hyder district, at the head of Portland Canal. He collected many new data regarding the general geology of southeastern Alaska in relation to the ore deposits and did additional reconnaissance geologic mapping, especially on the southwest coast of Prince of Wales Island. A summary of the results of his work appears as a separate chapter in this volume.

In the same season R. M. Wilson continued the detailed topographic mapping of the Hyder district that had been started during the preceding fiscal year by E. S. Rickard, who was injured in the course of his duty in the field. The field surveys were completed, and after the office work, which required the computation of numerous topographic data from photographs, was finished, Mr. Wilson returned to his former duties with the topographic branch.

For the field season of 1925 Mr. Buddington has been detailed to map the geology of the hitherto unsurveyed areas in the extreme southwestern part of the Ketchikan region and then to do the detailed geologic surveying of the area topographically mapped by Mr. Wilson in the Hyder district. Only a portion of this work will be completed during the fiscal year, but it will be continued in the next fiscal year.¹

R. K. Lynt left late in May, 1925, to do some reconnaissance topographic mapping in the Ketchikan district and then to join a party of surveyors from the General Land Office who are carrying on subdivisional surveys in the vicinity of Wrangell Narrows, where Mr. Lynt will make a detailed topographic map.

Negotiations have been in progress for several months with the Air Service of the War Department and later with the Bureau of Aeronautics of the Navy Department for the airplane photographing of the islands of southeastern Alaska, in the belief that the resulting prints would greatly expedite the topographic mapping

¹ The reader's attention is called to the fact that this report was written and submitted as of June 30, 1925. Many of the projects which are mentioned as in progress will have been completed before this report is issued, since considerable delay in printing is unavoidable.

of the region and facilitate determination of the geology and mineral resources. The Navy Department agreed to do this work, and \$7,000 was turned over to it for that purpose under the fortifications act. The work will be done as soon as the necessary preparations can be completed. No field operations have been in progress this year under this grant, but ultimately it will furnish photographs of probably 18,000 square miles. It is hoped that this aerial survey may be the forerunner of surveys in some of the coastal tracts in other parts of Alaska that are traversable on foot with great difficulty and at a cost so high that their survey is not warranted under present conditions.

In the Prince William Sound region F. H. Moffit continued during the field season of 1924 the study of the ore deposits and related geology of the western part of the Sound and visited Valdez, Cordova, and the Kennicott region, in the Copper River basin, for the purpose of keeping in touch with recent developments bearing on mineral resources; he returned to Washington in the fall to work up his field notes. Mr. Moffit again left for the same general region in May, 1925, and will continue the reconnaissance geologic mapping not only to the end of this fiscal year but also into the next.

S. R. Capps spent the field season of 1924 in the upper Matanuska region, with K. K. Landes as geologic assistant, mapping in detail the extension of the coal-bearing rocks and determining the geologic history of the region as it bears on the other mineral resources of that area. Mr. Capps has completed a manuscript report on this work which is now in hand for critical examination with a view to its publication as a bulletin. Late in this fiscal year, in the field season of 1925, Mr. Landes was assigned to complete the reconnaissance geologic mapping of an unsurveyed area between Matanuska and Knik rivers that is known to hold promise of deposits of metallic minerals of value, and the results of his work will probably throw light on the general geology of a large tract of contiguous territory.

In southwestern Alaska during the field season of 1924 W. R. Smith carried on reconnaissance geologic mapping of an area previously topographically surveyed in the Cold Bay region. This region is a part of the Alaska Peninsula where geologic indications favorable for the accumulation of oil pools have been reported and considerable activity has been displayed in prospecting. A preliminary report on the geology and mineral resources of the region forms part of this bulletin. In February, 1925, Mr. Smith left Washington to serve as geologist in the explorations being conducted in northern Alaska in Naval Petroleum Reserve No. 4.

In the field season of 1925 R. H. Sargent, topographer, and R. S. Knappen, geologist, will continue previous surveys of Alaska Peninsula southwestward from a point near Cold Bay to Chignik. It is

expected that these surveys will practically complete the reconnaissance examination of the probable oil-bearing areas of the peninsula, as farther west igneous rocks probably form most of the country.

The surveys in the Nixon Fork region of the Kuskokwim were in charge of R. H. Sargent, with J. S. Brown, geologist. These surveys were made during the field season of 1924. A general description of the geology of the region has been prepared and transmitted for publication as part of this volume.

A geologic reconnaissance party in charge of S. R. Capps during the field season of 1925 examined the country adjacent to Mount McKinley, especially those parts which, from earlier exploratory surveys and reports of prospectors, are believed to contain metallic minerals of value. In addition to these surveys Mr. Capps will probably visit some of the mining camps in the Kantishna and Chulitna districts to obtain data on recent mining developments.

J. B. Mertie, jr., for all of the fiscal year until April, 1925, was engaged in naval petroleum work in northern Alaska. In May, 1925, he left Washington to carry on geologic investigations in the region lying on both sides of Yukon River westward from the international boundary as far as Circle. Although his party will study many places that have not been hitherto examined by Survey geologists, the main purpose of the work is to correlate all the observations that have been made in the region, some of which are not in accord and most of which have not been reviewed in the light of more complete and detailed geologic information that has been accumulated both from this region and from other parts of the Territory since the original observations were made.

All the projects above described that were started late in this fiscal year during the field season of 1925 will be continued into the fiscal year 1926. Most of the parties are out of reach of ordinary means of communication, so that it is not possible at this time to state just what part of the different projects each accomplished this fiscal year. On the whole, however, much of the time will have been spent in getting to the field and starting the work, so that at most each party has spent less than a month in actual surveys. In other words, as the usual field season is about a hundred days, the parties have probably completed approximately one-quarter of the field work of their respective projects during the fiscal year.

The geologic and topographic work done by the Survey for the Navy Department in Naval Petroleum Reserve No. 4 commenced with the dispatch of three parties to northern Alaska as early as possible in 1923. On the completion of the field work the scientific and technical personnel returned to Washington and spent the winter and spring in compiling their maps and reports. This report

has been printed and is now available for distribution. While the parties that worked in 1923 were still engaged in this office work two other parties, in charge of Philip S. Smith, with J. B. Mertie, jr., geologist, and Gerald FitzGerald and R. K. Lynt, topographers, left Washington in January, 1924, and carried on surveys from the areas hitherto mapped in the Koyukuk Basin into the unmapped region in the southern and eastern parts of the reserve. These parties completed their field work at Barrow late in August and returned to Washington to prepare their maps and reports.

During the open season of 1924 W. T. Foran, geologist, and O. L. Wix, topographer, went by sea to Wainwright and thence surveyed a strip of country in the western and southern parts of the reserve and tied with earlier surveys of Noatak River, returning to Washington at the end of the field work. On completion of Mr. Foran's work he left the Survey to accept employment with an oil company in South America, and Mr. Wix returned to the topographic branch.

In February, 1925, another party in charge of Gerald FitzGerald, topographer, with W. R. Smith as geologist, left Washington to carry on further surveys in the southern part of the reserve. This party has been entirely out of reach of mail or even telegraph since early in April, so that the precise areas covered during this fiscal year can not be learned until they return in the fall. It is expected, however, that they will have covered much of the mountain region lying between Noatak River and the streams flowing northward into the Arctic Ocean from a point near the Kugururok to the Aniuk. It is planned that they will return to Washington in October and will then complete their maps and reports.

FUTURE WORK

Although the Survey's work in Alaska has been largely instrumental in furnishing a basis on which not only the mineral industry but also other industries might proceed with assurance as to soundness of the information furnished, it has covered only a little more than a third of the Territory with maps and reports that are at least of exploratory standard. There remains over 350,000 square miles that ultimately should be surveyed, but of this area about one-half is of such character that its survey in the near future does not seem warranted if weighed against the probability of finding profitable mineral deposits in it. However, there are areas aggregating nearly 200,000 square miles of now unmapped territory that should be surveyed as soon as funds and personnel are available. Among these areas southeastern Alaska is probably the most important and should receive early attention. In addition to containing metallic and nonmetallic minerals of commercial value, it also contains

enormous water-power resources that will be of great value in the development of the mineral industry and in the utilization of the forest products. Next in order of importance is the completion of surveys in the broad arc of the Alaska Range and contiguous territory. This work would not only bear directly on the search for mineral deposits but also, because much of the area is in the general vicinity of the Alaska Railroad, it should indirectly contribute to the success of that Government enterprise. In northern Alaska the mountain and highland belt, which is from 100 to 300 miles wide and which stretches from the international boundary to the Arctic Ocean on the west, a distance of 500 miles, though it has only here and there been surveyed, shows indications that give foundation for the belief that valuable mineral deposits occur in it and that assistance in finding these deposits can be afforded by a thorough understanding of the geology of the region.

In addition to the distinctly areal surveys, there is also need for comprehensive studies and reports on the various larger problems relating to the different mineral resources, such as gold and copper. Already reports on the tin, coal, oil, and antimony deposits of Alaska have been published, and similar reports should be undertaken for many of the other metallic and nonmetallic minerals. The accumulation of data regarding much of the Territory has now reached a stage where the compilation of a general geologic map of the Territory is warranted. A start has been made in the correlation and compilation of all the available geologic information relating to the country adjacent to the Alaska Railroad, and a similar compilation of the data relating to southeastern Alaska is in progress. Enterprises of this sort not only focus attention on the areas in which mineral deposits of value may be sought with some probability of success but also serve to mark out those areas where the geologic conditions indicate that there is small likelihood of certain types of deposits and thus prevent the useless waste of further time and money.

