THE ALASKAN MINING INDUSTRY IN 1922.

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GENERAL SITUATION.

The value of the total annual mineral production of Alaska increased from $17,004,124 in 1921 to $19,506,365 in 1922.[1] Though this increase was due almost entirely to the larger copper output from a few mines, the prosperity of the mining industry as a whole was very evident.

The rather widespread pessimism in regard to the present and future prosperity of the Alaska mining industry is not hard to understand. Dazzled by the quick fortunes made during the prosperous days of bonanza placer mining, the public has failed to mark the steady advance of other and more permanent phases of mining that not only continued during the war but has been greatly accelerated in the last two years. The great publicity given to the failure of some of the large auriferous quartz mines near Juneau, for reasons later to be discussed, has entirely obscured the slow but steady development of other Alaska lode properties. The marked decline in the annual copper output since 1917, the result of low prices for the metal, has been erroneously interpreted as marking the decline of the Alaska copper-mining industry. The public, misled by widely circulated and grossly exaggerated statements of the value of Alaska coal lands, is puzzled by the apparent lack of progress in their exploitation. Thus far, indeed, discouraging results have met the rather meager underground exploration of the best Alaska coal. On the other hand, the furnishing of local coal to the region tributary to the Alaska Railroad is a very important advance, even though a reserve of export coal has not yet been developed. In like manner many who have long heard of the promising occurrences of petroleum in Alaska have wondered at the delay in its development. The explanation lies in the fact that oil drilling was prohibited from 1910 until 1920, when a leasing law was enacted. Since 1920 surface exploration of the oil fields has been very active, but it takes considerable time to start actual drilling in these distant fields. At the end of 1922 preparations for drilling in the Cold Bay district were well under way, and since then drilling has been started.

[1] The statistics in this report have been compiled by T. R. Burch.

Even Alaskans, many of whom are survivors of the days of bonanza mining, are by no means hopeful of the future. Those who have seen miners without capital grow suddenly wealthy from placer gold dug out with their own hands and who have beheld prosperous communities spring up almost over night are often impatient with mining projects that can succeed only by large investments and after years of preparation.

Some erroneously assume that the revival of mining in Alaska can be assured only by the discovery of a great mineral deposit, such as a large oil pool or a rich placer field, and no doubt only such a discovery could revive quickly the former prosperity of the Territory. Alaska mines have produced nearly half a billion dollars' worth of minerals, and 98 per cent of this amount has come from her deposits of gold, silver, and copper. The estimated known reserves of these metals alone, without regard to future discoveries or other minerals, such as oil and coal, are sufficient to assure a prosperous future for the mining industry.

Many appear to believe that the building of the Alaska Railroad should have immediately produced a marked boom. Now that a year has passed since the railroad began to furnish transportation and cheaper fuel and there has been no immediate increase of mineral output, they are loud in condemning the entire project. The Government railroad, as well as the greater activity in the building of wagon roads, has already stimulated mining, but it will be some time before the results of this work can be expressed in a notable increase in mineral production.

In spite of all despair or doubt the Alaskan mining industry is advancing, not retrograding. In fact, though the value of its present product is small compared with that of the past, the industry is now on a more substantial basis than ever before. In 1922 preparations for drilling were sufficiently advanced to assure the beginning of underground testing in 1923 of at least one of the Alaska petroleum fields; the installation of large placer-mining plants continued, and the work on some was so well advanced as to assure their operation in 1923; the activity in gold-lode development already noted for 1921 was continued; the copper production was about 43 per cent larger than in 1921, and there was a revival in the prospecting of copper deposits. Alaska's mining industry needs capital for its further development, and during the year there were many encouraging signs that large mining companies were turning their attention to Alaska as a prospective field for investment.

Estimates of number of men employed at productive mines of Alaska, 1911–1922.

Year.	Placer mines.		Lode mines and reduction plants.	All other mining and quarrying.	Total, not including winter placer mines.
	Summer.	Winter (omitted from total).			
1911	4,900	670	2,360	150	7,410
1912	4,500	900	2,500	150	7,210
1913	4,500	800	3,450	140	8,090
1914	4,400	800	3,500	140	8,040
1915	4,400	700	3,850	160	8,410
1916	4,050	880	4,570	340	8,960
1917	3,550	950	3,220	270	7,040
1918	3,000	610	2,000	400	5,400
1919	2,180	320	1,900	310	4,390
1920	1,990	340	1,880	360	4,230
1921	2,150	460	1,450	400	4,000
1922	2,198	402	1,200	410	3,808

In considering the above table it should be remembered that the summer placer mines are operated for an average period of less than 100 days in a year. A comparison of the first two columns shows that only a small percentage of the men engaged in summer placer mining can find similar employment in the winter. As the winter placer mining is all done through shafts and drifts it is closely related to lode mining. Some of the deep placer mines are operated for nearly the entire year and hence are included in the total summer mines also. The lode mines include copper and gold and a few other metal mines, and the figures for these include only the average number employed during the year. The fourth column shows the number of men engaged in all other forms of mining and quarrying, including the exploitation of coal, petroleum, marble, tin, gypsum, and other products.

Mineral output of Alaska, 1921 and 1922.

	1921		1922		Decrease or increase in 1922.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	390,558	$8,073,540	359,057	$7,422,367	−31,501	−$651,173
Copper.....pounds..	57,011,597	7,354,496	77,967,819	10,525,655	+20,956,222	+3,171,159
Silver.....fine ounces..	761,085	761,085	729,945	729,945	−31,140	−31,140
Coal.....short tons..	76,817	496,394	79,275	430,639	+2,458	−65,755
Tin, metallic.....do....	4	2,400	1.40	912	−2.6	−1,488
Lead.....do....	759	68,279	377	41,477	−382	−26,802
Platinum metals, fine ounces	40	2,670	28.30	2,830	−11.70	+160
Miscellaneous nonmetallic products, including petroleum, marble, and gypsum	.....	245,260	.....	352,540	.....	+107,280
Total	.....	17,004,124	.....	19,506,365	.....	+2,502,241

Value of total mineral production of Alaska, 1880–1922.

By years.				By substances.	
1880–1890	$4,686,714	1908	$20,145,632	Gold	$335,526,460
1891	916,920	1909	21,146,953	Copper	145,478,823
1892	1,098,400	1910	16,887,244	Silver	8,833,922
1893	1,051,610	1911	20,691,241	Coal	2,723,161
1894	1,312,567	1912	22,536,849	Tin	937,576
1895	2,388,042	1913	19,476,356	Lead	772,014
1896	2,981,877	1914	19,065,666	Antimony	237,500
1897	2,540,401	1915	32,854,229	Marble, gypsum, petroleum, platinum, etc	3,475,822
1898	2,587,815	1916	48,632,212		497,985,278
1899	5,706,226	1917	40,710,205		
1900	8,241,734	1918	28,253,961		
1901	7,010,838	1919	19,620,913		
1902	8,403,153	1920	23,303,757		
1903	8,944,134	1921	17,004,124		
1904	9,569,715	1922	19,506,365		
1905	16,480,762		497,985,278		
1906	23,378,428				
1907	20,850,235				

GOLD AND SILVER.

TOTAL PRODUCTION.

In 1850 and 1851 a Russian mining engineer, P. P. Doroshin, with a large force of men, did some placer mining in the Kenai River Basin, about 140 miles west of the present location of Seward. This project was soon abandoned and, except for the exploitation of some lignitic coal near Port Graham, was the only mining attempted by the Russians in their American colony during the 80 years of its occupation.

In 1861 some gold was found in the bars of Stikine River, but by subsequent surveys this locality proved to be on the Canadian side of the boundary. No important mining was done here, but the discovery resulted in the first gold stampede to Alaska. The Stikine Valley was soon abandoned by the prospectors, however, and did not again attract attention until it was much used as a highway into the Cassiar gold district, discovered in 1871. Wrangell, in southeastern Alaska, then became the coastal port for the new placer camps, and prospectors began to turn their attention to the adjacent region. It is reported that about this time many thousand dollars' worth of gold was mined on Shuck River, emptying into Windham Bay, about 70 miles south of the present site of Juneau. This report is unverified and probably has little foundation; in fact, some of the Wrangell prospectors extended their search for gold to Sitka and in 1872 found auriferous quartz in that region. The first mining was done by Michael Haley, who had come north as a soldier but was an experienced miner. In 1879 George F. Pilz, a German mining engineer, opened up the Stewart mine, near Sitka. Pilz was the first educated mining engineer, opened the first quartz mine, and built the first mill in Alaska. In 1880 Richard T. Harris and Joseph Juneau found auriferous quartz and placer gold near the present site of Juneau. The great Alaskan mining industry, the total product of

which is valued at nearly half a billion dollars, began with gold-placer mining at Juneau 42 years ago.

Gold and silver produced in Alaska, 1880–1922.

Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Commercial value.
1880	967	$20,000		
1881	1,935	40,000		
1882	7,256	150,000		
1883	14,561	301,000		
1884	9,724	201,000	10,320	$11,146
1885	14,512	300,000		
1886	21,575	446,000		
1887	32,653	675,000		
1888	41,119	850,000	2,320	2,181
1889	43,538	900,000	8,000	7,490
1890	36,862	762,000	7,500	6,071
1891	43,538	900,000	8,000	7,920
1892	52,245	1,080,000	8,000	7,000
1893	50,213	1,038,000	8,400	6,570
1894	62,017	1,282,000	22,261	14,257
1895	112,642	2,328,500	67,200	44,222
1896	138,401	2,861,000	145,300	99,087
1897	118,011	2,439,500	116,400	70,741
1898	121,760	2,517,000	92,400	54,575
1899	270,997	5,602,000	140,100	84,276
1900	395,030	8,166,000	73,300	45,494
1901	335,369	6,932,700	47,900	28,598
1902	400,709	8,283,400	92,000	48,590
1903	420,069	8,683,600	143,600	77,843
1904	443,115	9,160,000	198,700	114,934
1905	756,101	15,630,000	132,174	80,165
1906	1,066,030	22,036,794	203,500	136,345
1907	936,043	19,349,743	149,784	98,857
1908	933,290	19,292,818	135,672	71,906
1909	987,417	20,411,716	147,950	76,934
1910	780,131	16,126,749	157,850	85,239
1911	815,276	16,853,256	460,231	243,923
1912	829,436	17,145,951	515,186	316,839
1913	755,947	15,626,813	362,563	218,988
1914	762,596	15,764,259	394,805	218,327
1915	807,966	16,702,144	1,071,782	543,393
1916	834,068	17,241,713	1,379,171	907,495
1917	709,049	14,657,353	1,239,150	1,021,060
1918	458,641	9,480,952	847,789	847,789
1919	455,984	9,426,032	629,708	705,273
1920	404,683	8,365,560	953,546	1,039,364
1921	390,558	8,073,540	761,085	761,085
1922	359,057	7,422,367	729,945	729,945
	16,231,091	335,526,460	11,463,592	8,833,922

Gold and silver produced in Alaska, 1922, by sources.

	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.
Siliceous ores (2,513,455 short tons)	145,883	$3,015,669	71,886	$71,886
Copper ores (581,384 short tons)	561	11,596	622,978	622,978
Lead ores (79 short tons)	5	102	8,712	8,712
Placers (5,225,274 cubic yards of gravel)	212,608	4,395,000	26,369	26,369
	359,057	7,422,367	729,945	729,945

Gold and silver produced in Alaska from different sources, 1880–1922.

	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.
Siliceous ores [a]	4,993,626	$103,227,434	1,948,761	$1,595,477
Copper ores	86,689	1,792,034	7,666,126	6,125,041
Placers	11,150,776	230,506,992	1,848,705	1,113,404
	16,231,091	335,526,460	11,463,592	8,833,922

[a] Including small amounts of galena ore.

GOLD LODES.

For many years the Alaskan gold-lode mining industry was almost entirely based on the Treadwell property, in the Juneau district. The profitable exploitation of this enormous ore body, containing not more than $2.50 worth of gold to the ton, long ago brought proof that the cost of mining in tidewater Alaska was not necessarily excessive. This very profitable venture led to the development of two other large ore bodies in the same district, the Alaska-Juneau and Perseverance. The metallic content of these ores is much lower than that of the Treadwell ore, but it was believed that this handicap could be offset by the use of cheaper mining and milling methods. The Perseverance (Alaska Gastineau) plant was completed in 1916 and the Alaska-Juneau in 1917, and therefore at the very outset these plants met the adverse industrial conditions imposed by the World War. In addition, other difficulties arose relating to irregularity in the distribution of gold as well as to mining and milling. As a consequence, the Perseverance mine finally closed in 1921; the Alaska-Juneau, however, by improving its practice, increased its output in 1922 over that of 1921.

In 1917 came the Treadwell disaster—the caving and flooding of two of the three large mines. As a result of the abandonment of three of the five large mines of the Juneau district the value of the annual gold output decreased from $4,570,000 in 1916 to $1,573,000 in 1922. The most encouraging fact about the Alaskan lode-mining industry is that the loss of output from these large gold mines has already in part been made up by the output of the smaller mines of other districts. The total gold-lode output of Alaska in 1916 had a value of $5,900,000 and in 1922 about $3,015,771. The reduction is therefore only 47 per cent for all Alaska, while that of the Juneau district has been 65 per cent.

The facts above set forth are cited because many believe that the closing of some of the Juneau mines means the end of any considerable quartz mining in Alaska. This is not true even at Juneau, and in all

other Alaska lode districts that are accessible by railroad or tidewater the development and prospecting of hard-rock gold deposits are actively going on.

Though the gold-silver deposits of the Salmon River district are not yet productive, the outlook for profitable mining is good. The development of mines in the Juneau district is more active than for several years. On Chichagof Island, in the Sitka district, one additional mine, the Hirst-Chichagof, began producing in 1922, and several other properties are being developed. The small gold mines on Prince William Sound will probably soon react to the cheapening of fuel by coal furnished from the Matanuska field. The Willow Creek district, now accessible by railroad and good roads, is making excellent progress in lode mining. In 1922 the value of the output from the seven small mines of the district was $238,000, as against $118,000 in 1921; but more important than this gain of more than 100 per cent is the fact that at last systematic underground exploration has begun. In the Fairbanks district the completion of the Alaska Railroad and the assurance of comparatively cheap fuel from the Nenana coal field have stimulated lode development. Five mines and prospects produced gold to the value of $54,000 in 1922, as compared with $38,000 in 1921. There are in the Fairbanks district at least a score of lode properties which under present conditions are worthy of further exploration. In addition to the productive districts, there are many other regions in Alaska where auriferous lodes have been found.

Twenty-five gold and silver lode mines and six prospects [2] were operated in 1922 and produced gold, silver, and some lead and copper to a total value of $3,138,585; in 1921 19 gold and silver lode mines and 13 prospects were operated and produced metals to a total value of $4,082,741. These values do not include the gold and silver recovered from the copper lode mines. In general, the lode-mining industry in 1922 showed progress during the year, but developments of ore bodies are not yet sufficient to give any assurance that the output of gold from this source will increase in the immediate future. At the same time the outlook for an early increase in lode-gold production from the Sitka, Willow Creek, and Fairbanks districts is exceedingly good.

[2] Lode properties the value of whose total metallic output is less than $1,000 are here classed as prospects. These include some mines on which considerable development work has been done but which have not yet been put on a regular productive basis.

Gold and silver produced from gold-lode mines in Alaska in 1922, by districts.

District.	Ore mined (short tons).	Gold.		Silver.		Average value per ton of ore in gold and silver.
		Fine ounces.	Value.	Fine ounces.	Value.	
Southeastern Alaska	[a] 2,501,542	124,796.11	$2,579,764	67,590	$67,590	$1.06
Willow Creek	7,242	11,513.25	238,000	1,500	1,500	33.07
Fairbanks district	1,724	2,612.25	54,000	490	490	31.60
Other districts	3,026	6,965.82	144,007	11,018	11,018	51.23
	2,513,534	145,887.43	3,015,771	80,598	80,598	1.23

[a] Including small amounts of galena ore.

In the above table are included silver-lead ores as well as auriferous quartz. The ore hoisted from auriferous quartz mines yielded an average of $1.23 worth of gold and silver to the ton. In 1921 the average recovery was $1.39. The low recovery in 1922 was caused by the large percentage of the total tonnage furnished by the Juneau mines. If these mines, which handle ore of very low grade, are eliminated, the average recovery from the other mines included in the table is $29.27 to the ton.

GOLD PLACERS.

Placer mining has been done in Alaska since 1880 and has yielded gold having a total value of $230,000,000. Of this total more than $200,000,000 has been mined since 1900, when the industry received its first great stimulus by the gold output of the Nome district. Other bonanza deposits were soon discovered, and by 1906 the value of the annual output of placer gold had reached $18,600,000 and the industry employed about 8,000 men. From 1906 the annual output declined, and by 1913 its value was reduced to $10,680,000 and the number of miners to 4,700. It should be noted that this reduction (45 per cent) in the value of the placer output took place before the war and that it indicated the rapid exhaustion of the bonanza deposits. From 1914 to 1917 the average value of annual output of placer gold was about $10,000,000, and if the general industrial conditions had remained the same and railroad and road building and the development of coal and petroleum had been accelerated, the annual placer output would probably not have declined below this amount. But after 1917 the war began to affect Alaska industries seriously, and placer mining rapidly declined, reaching its minimum in 1920, when the value of the output was only $3,873,000. Since then, however, it has somewhat increased.

During the period of bonanza placer mining the cost of operation was gradually but constantly lowered by improved methods of mining, especially in gold dredging, the output of which increased in value from $20,000 in 1903 to $2,200,000 in 1913. Dredges had been built so actively before the war that, in spite of adverse conditions,

they continued to increase their output, which did not reach its maximum until 1916, when its value was $2,679,000. The hard times that followed led not only to the shutting down of dredges already built but to the abandonment of some new projects. The dredges reached their minimum output of gold in 1920, when its value was $1,130,000. This rise and decline of gold dredging before 1920 was paralleled by a similar though smaller fluctuation in hydraulic and other mechanical mining.

The passage from almost strictly manual to mechanical methods of placer mining was well under way when it was checked by the war. Had it not been thus interrupted the transition would have been more gradual, and it would not have dealt so severe a blow to the communities supported by the returns from placer mining.

Everyone who is interested in the prosperity of Alaska, which in the past has been so largely built upon the returns from placer mining, will naturally ask the question whether the gold placer reserves are sufficient to support again a large industry. In 1919 [3] an attempt was made to estimate the value of the placer gold still unmined. Such an estimate could not of course take account of possible new discoveries; it must include only those areas of auriferous gravel that have been more or less prospected. Fine colors of gold are likely to be found in most Alaska streams, but only a few of these streams contain workable placers. A rough estimate, which includes only the auriferous gravel whose gold content is large enough to be profitably exploited by methods now used, shows that there is still about $350,000,000 worth of placer gold in the ground in Alaska. This estimate is based on very incomplete data, and its value should therefore not be overrated, but it at least indicates the magnitude of the true figures, and it certainly shows that the Alaska placers are by no means approaching exhaustion.

In this connection an instructive comparison may be made between the placer mining in Alaska and that in the Klondike district, in the Canadian Yukon. During the eight years of bonanza placer mining ending about 1905 this district produced $107,000,000 in gold. It was then generally believed that the days of placer mining there were about over, but by use of hydraulic and dredging plants the district has since produced gold worth more than $70,000,000. Yet compared with placer mining in the Klondike, placer mining in Alaska is but in its infancy.

Though the outlook for large-scale placer mining in Alaska is very encouraging, yet it can not be denied that in many districts the day of profitable small operations is rapidly passing.[4] Where the rich placers have been mined out, as they have been in many camps, the individual operator who has little or no capital can not

[3] Brooks, A. H., The future of Alaska mining: U. S. Geol. Survey Bull. 714, pp. 7–11, 1921.
[4] Brooks, A. H., The Alaskan mining industry in 1920: U. S. Geol. Survey Bull. 722, pp. 14–17, 1922.

profitably exploit the deposits of lower grade. If such deposits are large enough they will be worked by more economical methods, but if not the work on them must be abandoned. It is also clear that the operations of large companies will not support settlements that have been built up on the returns from bonanza mining. A dredge employing say 15 men may do the work of several hundred with consequent loss to the local community. In many districts this loss will be more than offset by the business developed through lode mining or other new industries. Some settlements, however, are bound to decline, and some will be entirely abandoned.

The interests of placer mining can be best served by affording cheaper transportation and fuel, a fact shown by the stimulating effect on placer mining of only one year's operation of the Alaska Railroad. The life of many of the districts in which the operations are small can be much prolonged by the building of wagon roads, which at the same time attract enterprises requiring large capital.

About 507 Alaska placer mines, employing 2,198 men, were operated during the summer of 1922, and 120, employing 402 men, during the preceding winter. These mines produced gold to the value of $4,395,000. In 1922 many more men than for several years in the past were employed in installing large mining plants that are as yet unproductive. It is certain that when the plants now being installed are operated the output of placer gold will be increased; it will be larger in 1923 than it was in 1922.

Statistics of placer mining in Alaska in 1921 and 1922.

Region.	Number of mines.				Number of miners.				Value of gold produced.		
	Summer.		Winter.		Summer.		Winter.		1921	1922	Decrease or increase, 1922.
	1921	1922	1921	1922	1921	1922	1921	1922			
Southeastern and southwestern Alaska	7	2	3	1	11	3	3	2	$4,000	$3,000	−$1,000
Copper River region	7	8	2	5	130	91	14	18	220,000	165,000	−55,000
Cook Inlet and Susitna region	34	36	2	1	144	174	29	2	165,000	293,000	+128,000
Yukon basin	334	321	79	99	1,131	1,254	335	321	1,860,000	2,119,000	+259,000
Kuskokwim region	28	30	3	.....	98	137	8	.....	520,000	542,000	+22,000
Seward Peninsula	126	104	13	11	622	528	61	51	1,450,000	1,265,000	−185,000
Kobuk region	9	6	4	3	15	11	10	8	7,000	8,000	+1,000
	545	507	106	120	2,151	2,198	460	402	4,226,000	4,395,000	+169,000

Gold and silver produced from placer mines in Alaska in 1922, by regions.

Region.	Gold.		Silver.		Gravel mined.	
	Fine ounces.	Value.	Fine ounces.	Value.	Cubic yards.	Recovery per cubic yard.
Southeastern Alaska	145.13	$3,000	23	$23	1,800	$1.67
Copper River region	7,981.88	165,000	851	851	305,747	.54
Cook Inlet and Susitna region	14,173.88	293,000	2,095	2,095	593,788	.49
Yukon basin	102,506.61	2,119,000	13,751	13,751	1,999,167	1.01
Kuskokwim region	26,219.25	542,000	2,815	2,815	215,950	2.50
Seward Peninsula	61,194.37	1,265,000	6,790	6,790	2,103,691	.60
Kobuk region	387.00	8,000	44	44	5,857	1.37
	212,608.12	4,395,000	26,369	26,369	5,226,000	.84

In the early days of mining on the Yukon it was generally considered that a placer miner must recover at least $20 a day during the short working season if he was to be profitably employed. Indeed, fortunes were believed to come only to those who were gaining each day a still larger quantity of gold from the gravels. Experience has shown that in most Alaska districts a wage of $10 a day from a mine operated only by manual methods is considered to be a good venture. These figures expressed in value per cubic yard of gravel sluiced would be about $4 for the old days and $2 for the present. In the first two years of mining on Seward Peninsula the minimum profitable return was about $5 to the cubic yard; now, with the large use of dredges, it averages less than 70 cents. In spite of the fact that much the larger part of the present-day placer mining in Alaska is done on gravel carrying a lower percentage of gold than that of the gravel that has already been mined, the average profit is much larger. This gain is of course due to the decreased cost of mining, which has resulted both from improvements in the methods employed and from the lowering of cost of transportation. This gradual lowering of cost is demonstrated by the following tables, which are based in part on returns made by operators of placer mines and in part on known facts or assumptions concerning the richness of the gravel in the several districts. Although the tables are thus in part estimates, they are probably nearly correct. The decline in the average gold content of the gravel mined from 1908 to 1914 reflects the gradual exhaustion of bonanza placers, the improvement in methods of placer mining, and especially the increased use of dredges.

Gravel sluiced in Alaskan placer mines and value of gold recovered, 1908–1922.

Year.	Total quantity of gravel (cubic yards).	Value of gold recovered per cubic yard.	Year.	Total quantity of gravel (cubic yards).	Value of gold recovered per cubic yard.
1908	4,275,000	$3.74	1916	7,100,000	$1.57
1909	4,418,000	3.66	1917	7,000,000	1.40
1910	4,036,000	2.97	1918	4,931,000	1.20
1911	5,790,000	2.17	1919	4,548,000	1.10
1912	7,050,000	1.70	1920	3,439,900	1.13
1913	6,800,000	1.57	1921	4,812,700	.88
1914	8,500,000	1.26	1922	5,226,000	.84
1915	8,100,000	1.29			

Relation of recovery of placer gold per cubic yard to proportion produced by dredges.

Year	Percentage of placer gold produced by dredges.	Recovery per cubic yard.			Year.	Percentage of placer gold produced by dredges.	Recovery per cubic yard.		
		Dredges.	Mines.	All placers.			Dredges.	Mines.	All placers.
1911	12	$0.60	$3.36	$2.17	1917	26	$0.68	$2.21	$1.40
1912	18	.65	2.68	1.70	1918	24	.57	1.84	1.20
1913	21	.54	3.11	1.57	1919	27	.77	1.31	1.10
1914	22	.53	2.07	1.26	1920	29	.69	1.53	1.13
1915	22	.51	2.33	1.29	1921	37	.57	1.31	.88
1916	24	.69	2.64	1.57	1922	40	.55	1.29	.84

Now that the means of transportation are improving and it is becoming recognized that there are large areas of dredging ground in Alaska, this form of mining is being more widely extended. In the summer of 1922, after two years of systematic prospecting, two dredges, the largest in Alaska, were built at Nome, with buckets holding 9 cubic feet and 40 and 60 foot ladders. A strong company was also engaged in extensive prospecting of dredging ground in the Fairbanks district. During the summer a dredge was being taken to Gaines Creek, in the Innoko district, and another to Minook Creek, in the Rampart district, so that four new gold dredges will be installed in Alaska in 1923. In 1922, 23 dredges produced gold worth $1,767,753; in 1921, 24 dredges produced gold worth $1,582,520. Of the 23 dredges operated in 1922, 15 were in Seward Peninsula, 2 each in the Iditarod and Fairbanks districts, and 1 each in the Innoko, Mount McKinley (Upper Kuskokwim), Circle, and Yentna (Susitna) districts. The dredges in Seward Peninsula produced about $609,859 worth of gold in 1922.

Gold dredges operated in Alaska in 1922.

Seward Peninsula:
- Council district:
  - Crooked Creek Dredge Co., Crooked Creek.
  - Garrod & Overbaugh, Warm Creek.
  - Northern Light Mining Co., Ophir Creek.
  - Wild Goose Mining & Trading Co. (2 dredges), Ophir Creek.
- Kougarok district, Behring Dredging Corporation, Kougarok River.
- Nome district:
  - Ames & Guinan, Glacier Creek.
  - Bangor Dredging Co., Anvil Creek.
  - Center Creek Dredging Co., Snake River.
  - Dexter Creek Dredging Co., Dexter Creek.
  - Frank Hall, Arctic Creek.
  - Julien Dredging Co., Osborn Creek.
- Solomon district:
  - Eskimo Gold Dredging Co., Solomon River.
  - Iverson & Johnson, Big Hurrah Creek.
  - 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. (2 dredges), Fairbanks Creek.
- Iditarod district:
  - Beaton & Donnelly, Otter Creek.
  - J. E. Riley Investment Co., Otter Creek.
- Innoko district, Flume Dredge Co., Yankee Creek.

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

Cook Inlet and Susitna region:
- Yentna district, Cache Creek Dredging Co., Cache Creek.

Gold produced by dredge mining in Alaska, 1903–1922.

Year.	Number of dredges operated.	Value of gold output.	Gravel handled (cubic yards).	Value of gold recovered per cubic yard.
1903	2	$20,000	.....	.....
1904	3	25,000	.....	.....
1905	3	40,000	.....	.....
1906	3	120,000	.....	.....
1907	4	250,000	.....	.....
1908	4	171,000	.....	.....
1909	14	425,000	.....	.....
1910	18	800,000	.....	.....
1911	27	1,500,000	2,500,000	$0.60
1912	38	2,200,000	3,400,000	.65
1913	35	2,200,000	4,100,000	.54
1914	42	2,350,000	4,450,000	.53
1915	35	2,330,000	4,600,000	.51
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
	.....	24,875,205	.....	.....

COPPER MINING.

A little copper mining was done at Kasaan Bay, in the Ketchikan district, as early as 1880, but this project was soon abandoned. About 1899 the copper deposits of Ketchikan and Prince William Sound began to receive attention, and in 1900 small shipments began.

The production of a large output of copper in Alaska began with the opening of the Kennecott mines after the completion of the Copper River & Northwestern Railway in 1911. In the next four years the annual output averaged 25,000,000 pounds. By 1916, under the stimulus of war prices, the output had been increased to 119,654,000 pounds. Since then, in consequence of the slump in the copper market, the annual output of the metal in Alaska has in general gradually decreased, reaching its lowest point in 1919, when it was 47,000,000 pounds. In spite of the continued low price of copper, the output in 1922 was 77,967,819 pounds. Alaska has now produced a total of 751,086,642 pounds of copper.

Most of the copper mined in 1922 was obtained from the three large mines of the Kennecott group in the Chitina Valley, and from the Beatson-Bonanza mine, on Prince William Sound. In 1922, as in many other years, copper was produced also at the Rush & Brown mine, in the Ketchikan district. A small output of copper was also made from mines in the upper Kuskokwim Valley and in some other districts. The low price of the metal has prevented the owners of many small mines from renewing operations, but there was some revival of interest in prospecting copper lodes in 1922, notably in the Chitina Valley. The advance in the price of copper will undoubtedly reanimate copper-mining activities in Alaska.

The average copper content of the ore mined in 1922 was 6.7 per cent. The ores yielded an average of $0.020 in gold and $1.07 in silver to the ton. The average yield in 1921 was 5.8 per cent of copper and $0.024 in gold and $1.14 in silver.

Of the total copper ore mined in Alaska in 1922, 94 per cent, or 544,212 tons, was concentrated and yielded 53,572 tons of concentrates, which averaged 45 per cent of copper. Most of the copper ore mined in 1922 was shipped to the Tacoma smelter, but a part of that mined in southeastern Alaska was treated elsewhere.

Copper produced in Alaska, 1880–1922.

Year.	Mines operated.	Ore mined (tons).	Copper produced.	
			Pounds.	Value.
1880	1	20	3,933	$826
1900	1	500	100,000	16,000
1901	2	1,350	270,000	44,000
1902	3	2,750	510,000	59,000
1903	4	9,000	1,730,000	224,510
1904	4	15,000	2,843,586	376,076
1905	8	52,199	3,481,771	542,155
1906	15	105,739	6,459,803	1,246,682
1907	13	98,927	6,308,786	1,261,757
1908	9	51,509	4,585,362	605,267
1909	7	34,669	4,124,705	536,211
1910	7	39,365	4,241,689	538,695
1911	8	68,975	27,267,878	3,408,485
1912	7	93,452	29,230,491	4,823,031
1913	6	135,756	21,659,958	3,357,293
1914	6	153,605	21,450,628	2,852,934
1915	14	369,600	86,509,312	15,139,129
1916	18	617,264	119,654,839	29,484,291
1917	17	659,957	88,793,400	24,240,598
1918	17	722,047	69,224,951	17,098,563
1919	8	492,644	47,220,771	8,783,063
1920	8	766,095	70,435,363	12,960,106
1921	6	477,121	57,011,597	7,354,496
1922	5	581,384	77,967,819	10,525,655
	.....	5,548,928	751,086,642	145,478,823

SILVER-LEAD DEPOSITS.

No marked advances were made in 1922 in the development of deposits of galena. The Moonshine property, in the Ketchikan district, long idle, was reopened. Work was continued on the lodes of the Salmon River district (Portland Canal), which carry a high content of silver. In the Kantishna district the prospecting of galena ores continued with encouraging results, but systematic and large underground exploration must await the construction, already begun, of wagon roads to the Alaska Railroad. So far as now known, the Perseverance claim, in the Ruby district, and the Quigley mine, in the Kantishna district, were the only galena deposits mined in 1922. The output from these properties and the by-product from the Alaska-Juneau mine appear to have been the source of all the lead produced in Alaska in 1922. The Alaska lead output is as yet but small and in the past has fluctuated with the mining of gold and

copper. The silver produced in 1922, estimated at 729,945 ounces, was only in small part derived from these galena deposits, for most of it was a by-product of gold and copper mining.

Lead produced in Alaska, 1892–1922.

Year.	Tons.	Value.	Year.	Tons.	Value.
1892	30	$2,400	1908	40	$3,360
1893	40	3,040	1909	69	5,934
1894	35	2,310	1910	75	6,600
1895	20	1,320	1911	51	4,590
1896	30	1,800	1912	45	4,050
1897	30	2,160	1913	6	528
1898	30	2,240	1914	28	1,344
1899	35	3,150	1915	437	41,118
1900	40	3,440	1916	820	113,160
1901	40	3,440	1917	852	146,584
1902	30	2,460	1918	564	80,088
1903	30	2,520	1919	687	72,822
1904	30	2,580	1920	875	140,000
1905	30	2,620	1921	759	68,279
1906	30	3,420	1922	377	41,477
1907	30	3,180		6,195	772,014

TIN.

The price of tin has been too low to encourage the further operation of Alaska tin mines. In 1922 the only tin produced was that taken from the gold placer mines of the Hot Springs district. About 700 pounds of stream tin was shipped from Nome, however, but so far as known this was all mined before 1922 and has therefore been previously included in the statistics of Alaska tin production.

Tin produced in Alaska, 1902–1922.

Year.	Ore (tons).	Metal (tons).	Value.	Year.	Ore (tons).	Metal (tons).	Value.
1902	25	15	$8,000	1914	157.5	104	$66,560
1903	41	25	14,000	1915	167	102	78,846
1904	23	14	8,000	1916	232	139	121,000
1905	10	6	4,000	1917	171	100	123,300
1906	57	34	38,640	1918	104.5	68	118,000
1907	37.5	22	16,752	1919	86	56	73,400
1908	42.5	25	15,180	1920	26	16	16,112
1909	19	11	7,638	1921	7	4	2,400
1910	16.5	10	8,335	1922	2.3	1.4	912
1911	92.5	61	52,798				
1912	194	130	119,600		1,609.3	993.4	937,576
1913	98	50	44,103				

PLATINUM METALS.

There were no developments during 1922 in mining the platinum minerals in Alaska. The Salt Chuck copper-palladium mine, in the Ketchikan district, was closed throughout the year. The only platinum produced was that recovered incidentally to gold placer mining by about five operators, mostly in Seward Peninsula and the Chisana district.

Platinum metals produced in Alaska, 1916–1922.

Year.	Crude ounces.	Fine ounces.	Value.	Year.	Crude ounces.	Fine ounces.	Value.
1916	12.0	8.33	$700	1920	1,493.4	1,478.97	$160,117
1917	81.2	53.40	5,500	1921	57.0	40.00	2,670
1918	301.0	284.00	36,600	1922	39.0	28.30	2,830
1919	579.3	569.52	73,663		2,562.9	2,462.52	282,080

MISCELLANEOUS METALS.

Deposits of quicksilver, antimony, chromite, tungsten, and molybdenite occur in Alaska and have been mined in the past. In 1922 the output of these metals was confined to a small amount of scheelite (tungsten ore) recovered from gold placer mining near Nome. Some development work was continued on the nickel deposits of Chichagof Island and on the quicksilver-bearing lodes in the lower Kuskokwim River. Work was also done on a bismuth-bearing lode in the Bonnifield (Nenana) district of the Tanana Valley.

COAL.

In 1922 a total of 79,275 tons of coal was produced in Alaska, of which over 90 per cent was the output of private mines, and the rest came from the Government mines. In 1921 only 30 per cent of the coal output was produced from private mines. Evidently, therefore, the development of the mining of coal for local use is well under way. It is certain that Alaska's coal consumption will expand with the demands of mining and other industries, and much of this increased use will be met by the product of Alaskan mines. It is not likely that the subbituminous and lignitic coal now locally mined can compete with the imported fuel now used in southeastern Alaska. On the other hand, central Alaska, including the region along the Alaska Railroad, Kenai Peninsula, Prince William Sound, Alaska Peninsula, and probably the region along the Copper River & Northwestern Railway, form an industrial province which should draw its fuel from Alaskan sources. The industrial developments under way in this province should soon double the demand for coal, but even then the market will not exceed 200,000 tons. Interesting possibilities for the use of Matanuska coal for bunkering were opened in 1922 by the supplying of the U. S. collier *Jason* with 5,000 tons of coal from the Chickaloon mine. Fuel for Seward Peninsula is now all imported and is predominantly petroleum. Plans have been considered for utilizing the enormous deposits of coal near Cape Lisburne to supply the Bering Sea region. The Cape Lisburne region includes very high-grade bituminous coal as well as enormous bodies of subbituminous coal, and these form the largest coal reserve of northwestern Alaska and probably a larger reserve than any in northeastern Siberia. The shipping season from Cape Lisburne is only two months long, which

is a serious handicap to the project, but in spite of the difficulties in exploitation, these coals will in time be drawn upon to supply the country around Bering Sea.

The high-grade coals of the Bering River and Matanuska field are not yet sufficiently developed to give assurance that they can find a market in competition with fuels from other fields, which can be mined much more cheaply. As they are the best coals on the Pacific seaboard of North America, however, it is only a question of time when they must be utilized.

To summarize the Alaska coal situation: The mining of the lower-grade coals for local use will increase considerably, though no large market for these coals can be expected in the immediate future. Underground exploration of the higher-grade coals of Bering River and Matanuska will be continued. The mining of these coals will depend on the discovery of beds that will be cheaper to mine because they are less disturbed than those at present known, or on an increase in the demand for coal on the Pacific, which would force the mining of expensive fuels. Evidently such an increase in demand is involved with the future of petroleum production. If petroleum can not be drawn upon to supply the constantly increasing demand for fuel, the Alaska coal will have to be utilized. In this connection the possibility that Alaska may furnish a large petroleum supply should be considered.

Coal produced and consumed in Alaska, 1888–1922, in short tons.

Year.	Produced in Alaska, chiefly subbituminous and lignite.		Imported from States, chiefly bituminous from Washington.[a]	Total foreign coal, chiefly bituminous from British Columbia.[a]	Total coal consumed.
	Short tons.	Value.			
1888–1896	6,000	$84,000	.....	.....	.....
1897	2,000	28,000	.....	.....	.....
1898	1,000	14,000	.....	.....	.....
1899	1,200	16,800	10,000	[b] 50,120	61,320
1900	1,200	16,800	15,048	[b] 56,623	72,871
1901	1,300	15,600	24,000	[b] 77,674	102,974
1902	2,212	19,048	40,000	[b] 68,363	110,575
1903	1,447	9,782	64,626	[b] 60,605	126,678
1904	1,694	7,225	36,689	[b] 76,815	115,198
1905	3,774	13,250	67,713	[b] 72,612	144,099
1906	5,541	17,974	69,493	[b] 47,590	122,624
1907	10,139	53,600	46,246	[b] 93,262	149,647
1908	3,107	14,810	23,893	[b] 86,404	113,404
1909	2,800	12,300	33,112	69,046	104,958
1910	1,000	15,000	32,098	58,420	91,518
1911	900	9,300	32,255	61,845	95,000
1912	355	2,840	27,767	68,316	96,438
1913	2,300	13,800	69,066	56,430	127,796
1914	.....	.....	41,509	46,153	87,662
1915	1,400	3,300	46,329	29,457	77,186
1916	13,073	52,317	44,934	53,672	111,679
1917	53,955	265,317	58,116	56,589	168,660
1918	75,606	411,850	51,520	37,986	165,112
1919	60,674	343,547	57,166	48,708	166,548
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	27,021	134,753
Total	469,880	2,723,161	982,443	1,382,751	2,826,074

[a] No figures on imports before 1899 are available. [b] By fiscal year ending June 30.

In 1922 coal was mined at about 12 localities. Some of the operations were small, there being only 7 that produced more than 1,000 tons each. Coal-land exploration was continued in the Matanuska field throughout most of the year by either the Alaska Naval Coal Commission or the Alaskan Engineering Commission. Incidentally to this work 5,297 tons of coal was produced. The Jones mine was worked until the later part of November, when operation was temporarily suspended on account of a fire. Because of this suspension, the Eska mine of the Alaskan Engineering Commission was reopened and produced 2,611 tons of coal before the end of the year. Some coal was also produced at the Baxter mine, and there were small operations at other localities in the field. A large sample of Government coal from the Matanuska field was washed and shipped out for a naval test in 1922.

The only coal mined during the year in the Bering River field was a sample sent out from the Carbon Creek mine for naval tests and some mined on the Alaska Petroleum Co.'s property incidentally to development work. Some progress was made on the project for a railroad from Katalla to the heart of the field.

Of the coal mined during 1922, 23,636 tons was lignite, most of which came from the Nenana field, where two mines were operated. The Broad Pass Coal & Development Co. worked a mine from July to December. The Healy River Corporation continued operating its mine on the west bank of Nenana River until July. It then turned its main efforts to another property on the east side of the Nenana, to which a spur from the railroad was completed in October, when coal production began.

A few coal banks were worked for local use in the Broad Pass region. As in the past, the Bluff mine, on Cook Inlet, was operated. In northern Alaska lignitic coal was mined at three localities—at the Kugruk mine, on Seward Peninsula; on Kobuk River; and at Wainwright Inlet for use of natives. The total output from these operations was about 500 tons.

PETROLEUM.

Plans are under way for testing by drilling in nearly all the Alaska oil fields, but one well put down by the St. Elias Oil Co. in the Katalla field is all that was actually accomplished in 1922. Meanwhile the project for work in the Cold Bay field, on Alaska Peninsula, was actively pushed, and drilling began in the winter of 1922–23.

In August, 1922, two steamers landed equipment for drilling at Portage Bay, in the Cold Bay field. The town of Kanatak, at the head of Portage Bay, was changed within a short time from a settlement of 10 or 15 whites to a boom town with tents, cabins, and frame buildings numbering a hundred or more and with a population of

150 to 200, which has been augmented by still others arriving on every boat. Several months before the oil rigs were landed all the ground for several miles from the town had been staked. Drilling is to be done on the Pearl Creek dome, 17½ miles northeast of Kanatak, by the Associated Oil Co. and the Standard Oil Co. of California. The Associated Oil Co. has two portable Star rigs and intends to use local petroleum residue as fuel. The Standard Oil Co. has a standard rig and the equipment needed for drilling to a depth of 4,000 feet. Power is to be furnished by a 75-horse power gasoline engine. Immediately after the arrival of the steamers work was started on a wagon road that must cross two 1,000-foot divides, and by the middle of October this road was a little more than half completed. All hauling is being done by tractors. It is reported that the Associated Oil Co. had reached a depth of 200 feet in March, 1923, and that the Standard Oil Co. had started drilling about March 1.

The work in the Cold Bay oil field is by far the most important event in the history of the Alaska petroleum lands since they were thrown open to leasing in 1921. Though it was the only definite action taken in 1922 for drilling in the prospected though undeveloped Alaska oil lands, plans for such development in other parts of the Territory are under way, and applications for oil permits are still being filed. Test drilling in other regions will quickly follow the discovery of an oil pool in the Cold Bay field or may even precede it. The only oil produced in Alaska in 1922 was that obtained from the 11 small wells on the single patented tract in the Katalla field. These wells are owned by the Chilkat Oil Co., which finds a ready local market for its product in the form of gasoline produced at its own refinery.

It is known that there are good possibilities for the occurrence of a large oil field in the extreme northern part of Alaska. Some indications of oil have been found or reported in the Arctic coastal-plain region, in a belt some 400 miles in width, and what is known of the geology suggests that the geologic conditions may be favorable for petroleum. It will, however, take many years of surveys and investigations before any part of this vast and inaccessible region can be classed as probable oil land. If there is a large oil field in this region means will be found to develop it, but this will not be done under the restrictions imposed by the present petroleum-land leasing law. No such large investment as would be required by such a project will be made unless the conditions are so changed as to be very attractive to the investor.

In February, 1923, about 35,000 square miles of the western part of this possible oil-bearing region was withdrawn from entry as naval petroleum reserve No. 4. Alaskans, from bitter experience in the past, have a well-grounded prejudice against withdrawals. In this

case, however, the withdrawn area is of no value for development under the present land laws. The Executive order indicates the purpose of the reservation by the following clause: "Said lands to be so reserved for six years for classification, examination, and the preparation of plans for development," and until otherwise ordered by Congress or the President private interests in this region are safeguarded by the following clause: "The reservation hereby established shall be for oil and gas only and shall not interfere with the use of the lands or waters within the area indicated for any legal purpose in connection therewith." In April, 1923, the Navy Department made a grant to the Geological Survey to meet the cost of an investigation of a part of this reserve.

Petroleum products shipped to Alaska from other parts of the United States, 1905–1922, in gallons.[a]

Year.	Heavy oils, including crude oil, gas oil, residuum, etc.	Gasoline, including all lighter products of distillation.	Illuminating oil.	Lubricating oil.
1905	2,715,974	713,496	627,391	83,319
1906	2,688,940	580,978	568,033	83,992
1907	9,104,300	636,881	510,145	100,145
1908	11,891,375	939,424	566,598	94,542
1909	14,119,102	746,930	531,727	85,687
1910	19,143,091	788,154	620,972	104,512
1911	20,878,843	1,238,865	423,750	100,141
1912	15,523,555	2,736,739	672,176	154,565
1913	15,682,412	1,735,658	661,656	150,918
1914	18,601,384	2,878,723	731,146	191,876
1915	16,910,012	2,413,962	513,075	271,981
1916	23,555,811	2,844,801	732,369	373,046
1917	23,971,114	3,256,870	750,238	465,693
1918	24,379,566	1,086,852	382,186	362,413
1919	18,784,013	1,007,073	3,515,746	977,703
1920	21,981,569	1,764,302	887,942	412,107
1921	9,209,102	1,403,683	2,021,033	232,784
1922	15,441,542	1,436,050	2,095,675	345,400
Total	284,581,705	28,209,441	16,811,858	4,590,824

[a] Compiled from Monthly Summary of Foreign Commerce of the United States, 1905 to 1922, Bureau of Foreign and Domestic Commerce.

STRUCTURAL MATERIALS, ETC.

The mining of gypsum in the Sitka precinct continued on about the same scale as in previous years. In 1922 the output of the marble quarries of Prince of Wales Island, in the Ketchikan precinct, was larger than that of 1921. The sulphur mining and refining plant on Akun Island made no production during the year, and no graphite, barite, or garnet was produced.

REVIEW BY DISTRICTS.

The enormous extent of Alaska and its greatly diversified mining industry make it difficult to obtain complete records of important events in every one of the fifty-odd districts where productive mining is being carried on. The small technical staff assigned to the

Alaskan work of the Geological Survey under the present reduced appropriation can not reexamine these districts except at long intervals. Therefore, many of the data contained in the following review were of necessity gained by correspondence. If every miner in Alaska would report the results of his work, this summary could be made complete. Unfortunately this ideal has not been attained, and therefore the following statement is necessarily incomplete. As most of the mine operators can be reached by mail only once during the year, prompt publication demands that this report be prepared by the spring following the year which it covers. As a rule data received after that can not be included. The space here devoted to any one district may indicate the amount of information on hand relating to its mining developments rather than its relative importance.

SOUTHEASTERN ALASKA.

The mineral output of southeastern Alaska in 1922 was derived from seven gold and silver lode mines, one copper mine, a few small placer operations, a gypsum mine, and a group of large marble quarries. The value of the total mineral output decreased from $3,865,150 in 1921 to $3,084,389 in 1922. This decrease is largely due to the smaller production of the Ready Bullion mine, which was closed in December. During the year there were marked advances in gold-lode development in southeastern Alaska, especially in the Portland Canal region.

KETCHIKAN DISTRICT.

The Rush & Brown mine was the only producing copper mine in southeastern Alaska in 1922. Some work was done at the Jumbo copper mine, preparatory to reopening it, and some development work was done at the Lake Bay property. The Salt Chuck copper-palladium mine is in the hands of a receiver and made no production in 1922. No report was received from Julia gold mine, which was apparently closed. Developments were continued at the Fortuna mine, and some test shipments of gold ore were made. Some work was also done on the Alaska and Free Gold properties, at Helm Bay.

The large marble quarries near the north end of Prince of Wales Island were worked on a somewhat larger scale in 1922 than in previous years.

Mining near Hyder, in the Portland Canal region, consisted in the development of at least a dozen properties carrying chiefly gold, silver, and lead ores, with some other valuable minerals. No ore was produced, but some test shipments have been made. The aggregate amount of open cuts and drifts is large, and the results of

this work are reported to be exceedingly favorable. The development of shipping mines is soon to be expected. Information about the developments on individual properties of the district is not complete enough to justify a summary.

WRANGELL DISTRICT.

No productive mining was carried on during 1922 in the Wrangell district. The silver-lead ores are still being developed, it is said, with encouraging results. Application has been made for patent to the barite deposits on Castle Island, in Duncan Canal. There was no production and but little development of copper ore.

JUNEAU DISTRICT.

At Juneau mining interest centered on the remarkable results achieved in the milling of the ore of the Alaska Juneau mine. The mine is developed by a 7,000-foot adit and equipped with a concentrating mill having a daily capacity of 8,000 tons. Up to the end of 1922 the total underground developments, exclusive of stopes, aggregated 111,273 feet. The work done in 1922 comprised drifts and crosscuts, 1,071 feet; raises, 2,291 feet; interdrifts, 172 feet; powder drifts, 1,907 feet; bulldozing chambers, 60 feet; stations, 52 feet—a total of 5,553 feet.

Production of Alaska Juneau mine, 1921–22 and 1893–1922.

	Ore (tons).			Metals recovered.			
	Total.	Fine or milled.	Coarse tailings rejected.	Gold.	Silver (ounces).	Lead (pounds).	Total value.
1921	1,613,600	904,323	709,277	$969,703	40,619	550,913	$1,035,251
1922	2,310,550	1,108,559	1,201,991	1,296,157	49,405	687,314	1,388,679
1893–1922	7,752,549	5,263,523	2,489,026	5,431,526	162,914	2,833,139	5,768,580

The Ready Bullion mine and 100-stamp mill were operated throughout the year until December 20, when both were permanently closed. During the summer a little groundsluicing was done at a placer mine in Silver Bow Basin.

The Peterson gold mine, north of Juneau, which has been worked in a small way for many years, was closed during 1922. The Daisy Bell, a small mine south of Juneau, was also closed.

The Jualin mine, at Berners Bay, north of Juneau, which was closed in 1917 because of war conditions, is now under lease to the Jualin Berners Mining Co. This company in 1922 continued the old drainage tunnel and employed some 45 men. During the last years of operations, 1915 and 1917, the mine milled 25,691 tons of ore with

an average recovery of $10.81 a ton, giving an extraction of 91 per cent of the assay value.

No report has been received from the Endicott Mining & Milling Co., which is opening a lode property on William Henry Bay, on the west side of Lynn Canal. According to newspaper statements, the 15-stamp mill was completed in November and started operations before the end of the year.

SITKA DISTRICT.

Productive mining in the Sitka district includes the work done at Chichagof and Hirst-Chichagof gold mines, in the northern part of Chichagof Island, and the gypsum mine at Iyoukeen Cove, on the east shore of the island. In 1922, as in the past, the Chichagof was the only large producing mine. Here the underground work during the year consisted of 320 feet of shafts and 2,060 feet of drifts. The total developments to date are reported to comprise 1,570 feet of shafts, 18,680 feet of drifts, and 10,000 feet of adits (six).

No report has been received from the Hirst-Chichagof mine. It is known, however, that the erection of a 10-stamp mill was completed, and the mill started operations during the summer. The prospecting of nickel-bearing copper ores in the northwestern part of Chichagof Island is reported as being continued. The Pinta Bay Mining Co. continued the development of its gold property on Chichagof Island, and toward the end of the year was preparing to install a mill. In the same district the Falcon Bay Co. also continued work on a gold property and completed 640 feet of adit. At the Brown Bear group 140 feet of underground work has been completed, chiefly in 1922. At the Golden Copper group development work was continued during the year, and a small mill has been installed. At the El Nido property, on Lisianski Inlet, the ore lode is reported to have been found in the lowest crosscut, 475 feet below the outcrop of the vein.

OTHER DISTRICTS.

The development of gold placer mines on Porcupine, McKinley, and Cahoon creeks, in the Porcupine district of southeastern Alaska, continued in 1922. It is planned to exploit the placers on these three creeks by two large hydraulic elevator plants. The most important developments of the year were the building of a bridge across Porcupine Creek and the extension of a road up the same creek. Some work was also done on the Porcupine property, an auriferous lode. About 30 men are reported to have been employed in this development work.

No reports have been received from the Lituya Bay region, but it is believed that a little placer mining was done there.

Five men were engaged in mining the beach placers of Yakataga during the season of 1922, which extended from about May to December. The actual working time of these mines was between 60 and 150 days, and the work was done by groundsluicing. It is reported that good placer prospects have been found away from the beach in spruce timber. The geologic information at hand indicates a recent elevation of the shore line. If this is true, the discovery of ancient beach deposits is not improbable.

COPPER RIVER BASIN.

The continuous operation of the three large copper mines of the Kennecott group and the summer placer mining in the Nizina and Chistochina districts constitute nearly all the productive work done in the Copper River basin in 1922.

In the west end of Chitina Valley [5] some mining operations were conducted on Elliott Creek and on Berg Creek, tributary to Kuskulana River. The work at the North Midas mine, on Berg Creek, was done by an association called the "Engineer syndicate." The small cyanide plant installed near the mouth of Berg Creek was replaced by a flotation plant, and the gold and silver bearing pyrite of the ore was concentrated to a shipping product for smelter treatment. The concentrates were hauled by a tractor nearly 12 miles from the mill to Strelna and shipped on the Copper River & Northwestern Railway. A semi-Diesel engine was installed in the summer of 1922 as a source of auxiliary power to that obtained from Berg Creek.

Development work on the copper prospects of Elliott Creek was directed principally toward the exploration of the Goodyear and Henry Prather claims, on Rainbow Creek, and the "Kings claims," near the head of Elliott Creek. The principal camp is now at the mouth of Rainbow Creek, but a new camp was established at the head of the Elliott Creek valley, and from these two camps as bases exploratory tunnels were driven on the claims mentioned. Power for the compressors was furnished by two semi-Diesel engines, and supplies were freighted by pack train from Strelna.

The mines at Kennicott, including the Bonanza, Jumbo, and Mother Lode, were steady producers of copper throughout the year. Although the Mother Lode mine is operated by the Kennecott Corporation as a separate project, its ore is now brought to the surface through the Bonanza mine and is sent to the mill over the Bonanza tram. These mines are remarkable because of the high grade of the ore, which consists principally of chalcocite and carbonates, and the low cost of producing copper. Development has now been carried down to the 1,500-foot level, and nothing has been found to indicate how much deeper the ore bodies may be expected to extend.

[5] Notes by F. H. Moffit.

During the summer the steam turbines that have heretofore furnished power for all mine operations were supplemented by two new Diesel engines capable of bearing all the load. This improvement will result in a very material saving in the cost of fuel oil and should lead to a further decrease in the cost of producing copper.

The following statements on mining and milling at the Kennecott group of mines during 1922 are taken from the annual report of the company:[6]

Kennecott ores milled totaled 182,726 tons, assaying 6.47 per cent. From this tonnage there was produced 18,277 tons of concentrates of an average assay of 49.63 per cent copper. * * * The leading plant treated 217,395 tons of mill tailings assaying 90 per cent carbonate copper, producing 1,976.78 tons of precipitates, containing, 2,970,400 pounds of copper. The development work done at Kennecott during the year totaled 7,893 feet, as well as 6,637 feet of diamond drilling. At the Erie mines work was started on a crosscut 12,000 feet long, which will connect with the Jumbo mine.

The Mother Lode mine, adjacent to the Kennecott-Bonanza, is worked by the same company. Its ore is treated in the Kennecott mill. The Mother Lode is developed by an 850-foot adit and a 700-foot shaft.

Possibly the most important new development of the year in the Nizina district viewed from the standpoint of its potential benefit to the district generally, is the work at the Green group, on McCarthy Creek, about 11 miles from the town of McCarthy. A promising body of chalcocite was discovered in the limestone at the limestone-greenstone contact on the east side of McCarthy Creek, at a point on the hill slope where the contact was covered by slide rock. A tunnel was started at this point and extended into the limestone. Another tunnel was driven through the greenstone to the limestone 100 feet lower than the first tunnel, and a raise was made to connect the two. Copper deposits were found in the greenstone, but the principal ore body was encountered in the limestone of the upper tunnel and in the raise. Exploration had not advanced sufficiently at the time this property was visited to determine whether the ore body is large enough to yield a mine.

In the Nizina placer district two large hydraulic plants were operated in both Dan and Chititu creeks, and there were some smaller summer operations on Rex and Young creeks. A little winter mining was also done on Rex and Dan creeks, and some prospecting on Copper Creek. A total of eight mines, employing 98 men, were operated in the Nizina district in the summer of 1922, and three mines, employing 5 men, during the preceding winter.

Hydraulic mining in the bench gravel on the north side of Dan Creek resulted in the discovery that the creek, at some earlier time in its history, had cut one or more terraces in the shale bedrock, so that the overburden has proved to be less than the topography seemed to indicate, and the work of removing it will therefore be less than was expected. Mining on Dan Creek has been carried on chiefly in the stream gravel, and comparatively little attention has been given to the bench gravel, although it is known to be gold bearing. Placer mining on Chititu Creek in 1922 was done under

[6] Kennecott Copper Corporation Eighth Ann. Rept., for 1922, pp. 5–6, New York, 1923.

difficulties because of differences between the operators and laborers and because of unseasonable weather, so that probably a diminished output was made. At the time when the first snow came, late in August, work on the cuts laid out for the season was much less advanced than is ordinarily expected at that time of the year. On Young Creek considerable prospecting and some mining was done in the summer, with results sufficiently good to encourage the miners to continue their work another season.

In the Chistochina district the hydraulic plant on Slate Creek, employing 25 men, was much the largest in operation. One plant employing 10 men was also operated on the Middle Fork of the Chistochina, and there were probably other small mining activities that were not reported.

The unusually dry season in the Nelchina district, in the western part of the Copper River basin, seriously interfered with placer mining and almost no gold was produced there. The Alaska Placer Gold Mining Co., on Alfred Creek, made the largest developments. It built a mile of ditch and a 400-foot flume and installed a hydraulic plant. One other small mine was worked on Alfred Creek and three others on Albert Creek. The value of the placer gold mined in the Copper River basin during 1922 was about $165,000.

PRINCE WILLIAM SOUND.

In 1922 the only output of minerals on Prince William Sound was that made at the Beatson copper mine and at the Big Four, Gold King, and Ramsay-Rutherford gold mines, near Valdez. There was, however, in the aggregate considerable prospecting of lode deposits. According to the Kennecott Copper Corporation,[7] the Latouche property (Beatson-Bonanza) was operated at approximately 50 per cent capacity throughout the year. The mill treated 274,863 tons of ore assaying 1.88 per cent copper, producing 23,147 tons of concentrates assaying 18.99 per cent copper.

A total of 7,155 feet of development work was done at Latouche during the year.

No report has been received from the Girdwood mine, adjacent to the Beatson-Bonanza, which appears to have been idle. Statements have been published in the press that this property was purchased in 1923 by the Kennecott Corporation.

Outside of the work at the Beatson-Bonanza mine, the most important developments on the sound have been made at the Rua copper property, on Knight Island. This mine is now developed by a drift 900 feet long and a total of 750 feet of crosscuts. The crosscuts are spaced at 100-foot intervals. In 1922 244 feet of underground work

[7] Kennecott Copper Corporation Eighth Ann. Rept., 1922, p. 6, New York, 1923.

was done. Drifts and crosscuts are about 1,500 feet below the highest outcrop of the ore body.

In the description of this ore body published by the Geological Survey it is stated [8] that at an altitude of 750 feet the ore body "pinches out beneath overlying greenstone flows," but this statement has been found to be erroneous. In fact, some evidence of the fissure and of copper mineralization is traceable to the top of the cliff, 1,500 feet above the mine workings.

The continued low price of copper has discouraged the development of copper lodes on the sound, and little was done except assessment work. At the Fidalgo mine a 30-foot adit was driven, and there were minor operations on other properties.

The Big Four gold mine, near Valdez, was operated for a part of the summer. It is developed by drifts and crosscuts and equipped with a small prospecting mill, and an aerial tram is to be built. The Gold King, also in the Valdez district, developed by adits and shafts and equipped with a prospecting mill, was further developed during the summer. No report was received from the Ramsay & Rutherford mine, in the same district. It appears, however, that some gold was produced in this mine in the early part of 1922, though this may have resulted from work done in the preceding year. The Culross mine, in the western part of Prince William Sound, was reopened about midsummer of 1922. An air compressor and drills were installed, and the old 400-foot adit was enlarged and regraded, and the face advanced 160 feet. Plans for a new mill were made, with the expectation of operations in 1923. Only assessment work is reported on the other gold lodes of Prince William Sound.

KENAI PENINSULA.

Only five placer mines were reported to have been operated on Kenai Peninsula and in the adjacent region during 1922, but there is some evidence that about 12 mines made more or less gold output. The apparent failure of more than half the mine operators to furnish reports makes it impossible to give anything but estimates of output, but it is believed that about $40,000 worth of gold was produced.

The largest placer mine in this region is on Crow Creek, where a hydraulic plant was operated from June 5 to October 4, employing 16 men. This is the only large operation in the region, but some others are being prepared. The largest number of producers was on Resurrection Creek, but productive mining was also done on Mills, Lynx, Canyon, and Bear creeks.

The Lucky Strike gold quartz mine and mill were operated from the end of May to October. Underground developments consist of a

[8] Johnson, B. L., Copper deposits of the Latouche and Knight Island districts, Prince William Sound: U. S. Geol. Survey Bull. 662, p. 214, 1918.

300-foot adit, of which 165 feet was driven in 1922. A 5-stamp mill was installed on Kenai Star late in the summer and is believed to have been operated for a part of the season. Work was continued at the Jewel mine, north of Turnagain Arm, and some ore was crushed in the 10-stamp mill. Work was also continued at the Strong gold quartz property, in the same general region. Some underground development work was done during the year at the Grant Lake mine, but there was no production. So far as known, the only other mining on the peninsula was the operation during the summer of the McNally & Maitland lignitic coal mine, on Kachemak Bay (p. 20).

SUSITNA-MATANUSKA REGION.

Productive mining in the Susitna-Matanuska region included gold-lode mining in the Willow Creek district, gold-placer mining in the Yentna district and at a few scattered localities, bituminous-coal mining in the Matanuska field, and a little lignite mining at a number of scattered localities in the Susitna basin. (See p. 20.) The value of the total mineral production from this region was $677,025 in 1921 and $803,685 in 1922.

WILLOW CREEK DISTRICT.[9]

Productive gold mining was done on seven lode mines in the Willow Creek district. The largest output came from the Gold Bullion and Lucky Shot mines, controlled by the Willow Creek Mining Co. The Lucky Shot mine and mill were operated throughout the year. About 450 feet of drifts and 225 feet of adits have been driven. The mine is equipped with an 8-stamp mill. A 930-foot adit has been started which crosscuts the ore body 450 feet below the highest level, and a 50-ton cyanide plant is to be installed.

The same company is developing the adjacent War Baby mine, where a crosscut tunnel has been driven and some drifting done along the vein. An aerial tram has been built.

In 1922, as for many years, the Gold Bullion mine and mill, using water power, were operated during the open season. The mine is developed by 500 feet of adits and equipped with a 12-stamp mill, a classifying and amalgamation plant, and a 50-ton cyaniding plant.

The Kelly Mines Co. controls a group of auriferous properties lying in the basins of Fishhook and Willow creeks. These properties include the Brooklyn, Independent, Free Gold, and others. Among them are some gold mines that have been productively worked in the past in a small way. In 1922 the company undertook a much deeper testing of the veins, which had been developed only to a shallow depth. After a careful survey it was decided to drive a crosscut tunnel beneath the veins developed on the Willow-Fishhook divide. This long crosscut is now under way.

[9] In part based on information from Philip S. Smith.

A long crosscut was being driven at the Rae-Wallace property during the summer of 1922. The small mill was operated only intermittently.

Work was continued at the Gold Mint (Hatcher) mine, and the mill was run 22 days. Here a 20-foot shaft, a 300-foot adit, a 58-foot crosscut, and a 58-foot raise have been completed.

The Fern mine, on Archangel Creek, was operated throughout the year. A 520-foot drift that had been driven prior to 1922 was repaired during the year and extended 178 feet. A Dease mill, having a capacity of 30 tons, was installed November 15 and operated the rest of the year.

At the Consolidated (Talkeetna) property, on Fairangel Creek, development work was continued. During the year the mill on this property was used only for testing the ore derived from the development work.

Some developments were continued at the Mabel mine, and the mill was used in test runs on the ore recovered incidentally to this mining.

Development work was continued during the year at the Opal (Skarstad), Home Builder (Richter), Webfoot (Conroy), Homesteader-Martha, and many other properties from which there was no production, and assessment work was done on many claims. The success of several mines in the district and the projects for systematic work under way give great hopes for the future.

Gold and silver produced at lode mines in the Willow Creek district, 1908–1922.

Year.	Mines operated.	Ore mined (short tons).	Gold.		Silver.	
			Ounces.	Value.	Ounces.	Value.
1908	1	12	87.08	$1,800	6.88	$3.64
1909	1	140	1,015.87	21,000	80.25	41.73
1910	1	144	1,320.15	21,290	104.29	56.31
1911	2	812	2,505.82	51,800	197.95	109.91
1912	3	3,000	4,673.02	96,600	369.07	226.97
1913	3	3,028	4,883.94	100,960	385.83	233.42
1914	3	10,110	14,376.28	297,184	1,330.00	735.00
1915	3	6,117	11,961.55	247,267	811.00	421.00
1916	3	12,182	14,473.46	299,193	1,468.00	967.00
1917	5	7,885	9,466.17	195,662	713.00	586.00
1918	5	13,043	13,043.05	269,624	724.00	724.00
1919	5	6,730	7,882.00	162,944	508.00	509.00
1920	3	2,850	3,067.00	63,400	148.00	158.00
1921	7	3,591	5,721.50	118,273	1,029.00	1,029.00
1922	7	7,242	11,513.25	238,000	1,500.00	1,500.00
	.....	76,886	105,990.14	2,184,997	9,375.27	7,300.98

YENTNA DISTRICT.

Mining was very successful in the Yentna district in 1922. Most of the gold produced came from the dredge on Cache Creek, which was operated on a larger scale than ever before, and from hydraulic

plants; some was obtained from pick and shovel mines. Altogether there were productive placers in the district employing about 96 men. This district contains no deep placers suitable for winter exploitation. In all, 471,986 cubic yards of gravel was mined and sluiced during the year, with an average gold recovery of 44 cents to the cubic yard. In 1921 a total of $120,000 worth of gold was mined and in 1922 $223,000 worth. No platinum was reported by any of the placer miners of the district.

The occurrence of gold-bearing quartz veins in the Yentna district has long been known, but so far no auriferous lodes of commercial value have been developed. Mertie [10] described some apparently detrital deposits of auriferous quartz on Thunder Creek. Miners report that what may be an extension of the same zone of metallization has been traced through Dollar, Falls, and Thunder creeks.

OTHER DISTRICTS.

Some placer gold has been found on Metal Creek, a tributary of Knik River, southeast of the town of Anchorage. The development of a group of claims was under way during 1922, and a little gold was recovered incidentally. There was in the aggregate much prospecting of gold and copper lode claims in the region tributary to the railroad above Willow Creek. This region includes what are generally called the Talkeetna or Iron Creek, the Chulitna, and the Broad Pass districts. There has also been a little placer mining in this region, though no reports from miners have been received. A little lignitic coal was mined in this region for local use.

Only one placer mine in the Valdez Creek district reported in 1922, though it is believed that three or four were operated. One large hydraulic plant on Valdez Creek is known to have been operated, but the company made no report.

The Nelchina district is tributary to the Alaska Railroad but lies on Copper River and is described on page 28.

SOUTHWESTERN ALASKA.

The outstanding event of the year in southwestern Alaska was the continued activity in staking oil claims and preparations for drilling, as already noted (pp. 20–21). The importance of the outcome of this drilling can scarcely be overestimated, for the bringing in of a productive oil field would immediately insure a thorough investigation of all possible oil-bearing territory and would stimulate drilling in many places. In the Lake Iliamna region placer mining was practically discontinued and lode prospecting was prosecuted on only a small scale. There was no production reported. Underground

[10] Mertie, J. B., jr., Platinum-bearing gold placers of the Kahiltna Valley: U. S. Geol. Survey Bull. 692, pp. 250–251, 1919.

development work was continued on the Duryea copper claim and some work on trails was done in order to make it possible to ship out some ore.

A few men were engaged in beach placer mining at the south end of Kodiak Island and on the adjacent Trinity Islands, but conditions were unfavorable for beach mining in this vicinity in 1922 and the production was small. A little prospecting was done on quartz veins on Kodiak Island.

At the Apollo mine, on Unga Island, some experimental work was done, and a small quantity of ore was mined and concentrated; the concentrates were shipped to the smelter, and a small amount of gold and copper was recovered.

No sulphur was produced at the plant on Akun Island during the year.

YUKON BASIN.

GENERAL FEATURES.

The value of the total mineral output of the Alaska Yukon region in 1922 was $2,303,755, as compared with $2,093,088 in 1921. This brings the total value of the mineral products of the Alaska Yukon during 37 years of mining to $137,580,598.

Mineral production of the Yukon basin, Alaska, in 1922.

	Placer mines.		Lode mines.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	102,507	$2,119,000	2,874	$59,415	105,381	$2,178,415
Silver.....do....	13,751	13,751	9,070	9,070	22,821	22,821
Coal.....tons..	.....	.....	.....	.....	23,636	97,292
Lead, copper, and tin.....	.....	.....	.....	.....	.....	5,227
	.....	2,132,751	.....	68,485	.....	2,303,755

Mineral production of the Yukon basin, Alaska, 1886–1922.

	Placer mines.		Lode mines.		Total.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	6,498,342	$134,331,000	65,673	$1,357,090	6,564,015	$135,688,090
Silver.....do....	1,109,150	682,093	246,861	248,787	1,356,011	930,880
Coal.....tons..	.....	.....	.....	.....	81,071	416,845
Lead, copper, tin, antimony, tungsten, and platinum.....	.....	.....	.....	.....	.....	544,783
	.....	135,013,093	.....	1,605,877	.....	137,580,598

In the summer of 1922 about 321 placer mines, employing 1,254 men, were operated in the Alaska Yukon, and during the preceding winter about 99 mines, employing 321 men. The only other productive mining in this region in 1922 was done at 8 lode mines,

employing about 50 men, and 2 coal mines, employing about 38 men. None of these mines were operated throughout the year.

Estimated value of gold produced from principal placers of Yukon basin in 1922.

Fairbanks	$693,000	Chandalar	$83,000
Iditarod	280,000	Hot Springs	55,000
Innoko and Tolstoi	224,000	Fortymile	50,000
Tolovana	221,000	All others	137,000
Koyukuk	132,000		
Ruby	123,000		2,119,000
Circle	121,000		

FAIRBANKS DISTRICT.

In the Fairbanks district placer and lode mining was continued on a somewhat larger scale than in 1921. The value of the total mineral output of the district during 20 years of mining is $74,015,674. Some antimony, tungsten, and lead have been produced in this district, but, as shown in the following table, the mineral output has come briefly from the placer mines.

Placer gold and silver produced in the Fairbanks district, 1903–1922.

Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.
1903	1,935.00	$40,000	348	$188
1904	29,025.00	600,000	5,225	2,821
1905	290,250.00	6,000,000	52,245	28,212
1906	435,375.00	9,000,000	78,367	42,318
1907	387,000.00	8,000,000	69,660	37,616
1908	445,050.00	9,200,000	79,909	43,151
1909	466,818.75	9,650,000	84,027	45,375
1910	295,087.50	6,100,000	53,116	28,683
1911	217,687.50	4,500,000	52,245	27,690
1912	200,756.25	4,150,000	48,182	29,632
1913	159,637.50	3,300,000	20,274	12,245
1914	120,937.50	2,500,000	29,024	16,050
1915	118,518.75	2,450,000	28,444	14,421
1916	87,075.00	1,800,000	11,058	7,276
1917	63,371.25	1,310,000	8,379	6,904
1918	38,700.00	800,000	5,708	5,708
1919	35,313.75	730,000	5,197	5,820
1920	28,057.50	580,000	3,870	4,218
1921	27,573.75	570,000	3,941	3,941
1922	33,523.87	693,000	4,783	4,783
Total	3,481,693.87	71,973,000	644,002	367,053

The placer output of 1922 came from 62 placer mines, employing 392 men, in the summer and 27 mines, employing 108 men, during the preceding winter. In 1921 work was done at 48 summer mines, employing 340 men, and 14 winter mines, employing 107 men. A total of 516,422 cubic yards of gravel was sluiced in 1922, having an average gold content of about $1.34 to the cubic yard. The placer mines comprised 45 drift mines, of which 25 were operated in the winter as well as in summer and 10 only in winter, 2 dredges, 10

open-cut mines using steam scrapers, 5 hydraulic mines, and 11 small open-cut mines without any special mechanical equipment. The drift mines sluiced about 56,000 cubic yards of gravel carrying $4.55 worth of gold to the cubic yard. Some 460,000 cubic yards of gravel was sluiced from the open-cut mines and dredges. The gold recovery from this gravel was about 95 cents to the cubic yard. The sluicing season averaged about 126 days.

The largest single drift-mining operation was on Little Eldorado Creek, and the two dredges on Fairbanks Creek were the largest open-cut plants. On Cleary Creek, formerly the largest producer of placer gold in the district, only eight mines, most of them small, were in operation in 1922. A dredging company, however, has obtained options on a large number of claims on Cleary Creek and in Chatanika Valley near the mouth of Cleary Creek and during 1922 employed three Keystone drills, working two shifts, for about six months in prospecting the ground preliminary to dredging. In the Goldstream Creek basin 23 placer mines, large and small, were operated in 1922. One operator in the district reports that the cost of provisions has dropped 30 per cent since 1918, and the opening of the Alaska Railroad should still further reduce working costs. This will stimulate mining on many properties that have been operating on a narrow margin of profit.

Approximate distribution of placer gold produced in Fairbanks district, 1903–1922, by sources.

Cleary Creek and tributaries	$23,198,000
Goldstream Creek and tributaries	15,085,000
Ester and adjacent creeks	11,443,000
Dome and Fairbanks creeks	16,486,000
Vault Creek and tributaries	2,701,000
Little Eldorado Creek	2,360,000
All other creeks	700,000
	71,973,000

The production of the lode mines in the Fairbanks district in 1922 showed a gratifying increase over that in 1921, being in fact larger than in any other year since 1915. Active mining was conducted on five properties, and prospecting and development work on a number of others. At the Mohawk mine, on Ester Creek, a tunnel 150 feet long was driven from the creek level to tap the ore body at depth. The ore mined was milled at the custom mill on Eva Creek. At the Hi Yu mine work was continued and the ore treated at the 5-stamp mill on the property. The Smith Bros., at their mine on the St. Patrick's Creek divide, are reported to have struck the ledge toward which they had been sinking at the 200-foot level. The ore is said to have yielded satisfactory returns, and a pump was to be installed in the spring of 1923 to handle the water in the main shaft. No tungsten was mined in the Fairbanks district in 1922.

Lode gold and silver produced in the Fairbanks district, 1910–1922.

Year.	Crude ore (short tons).	Gold.		Silver.	
		Fine ounces.	Value.	Fine ounces.	Value.
1910	148	841.19	$17,389	106	$57
1911	875	3,103.02	64,145	582	308
1912	4,708	9,416.54	394,657	1,578	971
1913	12,237	16,904.98	349,457	4,124	2,491
1914	6,526	10,904.75	225,421	2,209	1,222
1915	5,845	10,534.91	217,776	1,796	910
1916	1,111	1,904.81	39,376	140	92
1917	1,200	2,311.38	47,781	2,217	1,826
1918	1,035	1,294.04	26,750	616	656
1919	1,384	2,026.57	41,893	378	424
1920	504	967.48	20,000	164	178
1921	944	1,858.27	38,414	279	279
1922	1,724	2,612.25	54,000	490	490
	38,241	64,680.19	1,337,059	14,679	9,864

HOT SPRINGS DISTRICT.

Placer mining has been on the decline in the Hot Springs district for several years, the annual production having shrunk from $800,000 in 1916 to $35,000 in 1921. In 1922 production increased somewhat, and this may be the beginning of more prosperous times in the district, for freight costs have been reduced since the building of the Alaska Railroad, and it should now be possible to exploit many properties at a profit that have not been rich enough to be workable under the existing heavy overhead charges. In all, 25 mines were operated in 1922, of which 18 produced more than $1,000 worth of gold each. About 60 men were employed in summer and about 10 in winter mining. Considerably more gold was produced by open-cut mining than by drift mining, and with the increase of hydraulic operations the proportion of gold recovered in this way is likely to show a still further increase.

Placer gold and silver produced in the Hot Springs district, 1902–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1902-3	12,717.79	$262,900	1,818	$964	1914	36,281.25	$750,000	6,125	$3,387
1904	7,038.56	145,500	1,007	584	1915	29,508.75	610,000	4,982	2,526
1905	5,805.00	120,000	831	507	1916	38,700.00	800,000	6,534	4,299
1906	8,707.50	180,000	1,245	843	1917	21,768.75	450,000	3,675	3,028
1907	8,465.63	175,000	1,210	798	1918	7,256.25	150,000	1,225	1,225
1908	7,256.25	150,000	1,038	550	1919	4,837.50	100,000	817	915
1909	15,721.88	325,000	2,248	1,169	1920	2,418.75	50,000	567	618
1910	15,721.88	325,000	2,248	1,169	1921	1,693.12	35,000	438	438
1911	37,974.37	785,000	5,430	2,932	1922	2,660.62	55,000	631	631
1912	19,350.00	400,000	3,267	2,009					
1913	19,350.00	400,000	3,267	1,973		303,233.85	6,268,400	48,603	30,565

TOLOVANA DISTRICT.

In the Tolovana district about 25 mines in all were operated in 1922, employing approximately 132 men in open-cut mining and 60 in drift mining. The gold production, as shown in the subjoined table, was somewhat less than in 1921. An unusually heavy rainfall during the summer of 1922 favored placer mining, yet because of the gradual depletion of the ground fewer mines were operated and the production consequently decreased. Livengood Creek, as usual, produced a large part of the total production for the district; Amy and Olive creeks followed in the order named. The discovery on Wilbur Creek, made in 1921, proved to be somewhat disappointing, as the gold content was low and the pay streak narrow. This creek will be mined by open-cut methods in 1923. Prospecting in this district has been continued and some ground found that will be mined in 1923.

Placer gold and silver produced in the Tolovana district, 1915–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1915.....	3,870.00	$80,000	321	$163	1920.....	9,675.00	$200,000	819	$893
1916.....	33,862.50	700,000	2,813	1,851	1921.....	13,786.88	285,000	1,189	1,189
1917.....	55,631.25	1,150,000	8,430	6,946	1922.....	10,690.88	221,000	913	913
1918.....	42,328.12	875,000	4,060	4,060					
1919.....	25,396.88	525,000	2,141	2,454		195,241.51	4,036,000	20,686	18,469

RAMPART DISTRICT.

The production of gold from the Rampart district in 1922 was slightly less than in 1921. About 14 properties were operated, employing about 25 men in summer and 4 in winter. As usual, the largest production came from Little Minook Creek. The chief event of interest in this district in 1922 was the preparation by the Rampart Gold Mining Co. to install a dredge on Minook Creek. The dredge was in transit during the summer and was expected to arrive before the freeze-up. It was planned to erect the dredge and have it ready for operation in the summer of 1923.

Placer gold and silver produced in the Rampart district, 1896–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1896–1903...	[a]29,799.00	$616,000	4,440	$2,664	1914.....	1,451.25	$30,000	257	$142
1904.....	4,353.75	90,000	649	376	1915.....	1,693.13	35,000	300	152
1905.....	3,870.00	80,000	576	351	1916.....	1,935.00	40,000	343	226
1906.....	5,805.00	120,000	865	588	1917.....	1,644.74	34,000	283	233
1907.....	6,046.87	125,000	901	595	1918.....	1,209.37	25,000	215	215
1908.....	3,628.12	75,000	540	286	1919.....	1,596.37	33,000	115	129
1909.....	4,837.50	100,000	721	375	1920.....	1,015.88	21,000	80	87
1910.....	2,080.12	43,000	310	167	1921.....	1,064.25	22,000	95	95
1911.....	1,548.00	32,000	231	125	1922.....	870.75	18,000	62	62
1912.....	1,548.00	32,000	274	169					
1913.....	1,548.00	32,000	274	165		[a]77,545.10	1,603,000	11,531	7,202

[a] Includes small production from Gold Hill district.

CIRCLE DISTRICT.

During 1922 mining was continued in the Circle district on a somewhat larger scale than in the preceding two years. The largest output of any single plant was made by the dredge on Mastodon Creek. Fifteen summer mines, employing 42 men, and 8 winter mines, employing 16 men, were operated, handling over 260,000 yards of ground, with an average gold content of 46 cents to the yard. This low average gold content for all mines is of course due to the low grade of the ground worked by the dredge. Two promising new discoveries of placer ground in this district are reported, one by Lee and McGregor on Dome Creek and another in the Crazy Mountains.

Placer gold and silver produced in the Circle district, 1894–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1894	483.75	$10,000	123	$77	1910	10,884.37	$225,000	2,830	$1,528
1895	7,256.25	150,000	1,886	1,226	1911	16,931.25	350,000	4,402	2,333
1896	33,862.50	700,000	8,794	6,080	1912	15,721.87	325,000	2,439	1,500
1897	24,187.50	500,000	6,289	3,773	1913	8,465.63	175,000	1,314	794
1898	19,350.00	400,000	5,031	2,968	1914	10,884.37	225,000	1,689	934
1899	12,093.75	250,000	3,144	1,886	1915	11,126.25	230,000	1,727	875
1900	12,093.75	250,000	1,886	3,144	1916	14,512.50	300,000	2,252	1,482
1901	9,675.00	200,000	2,512	1,507	1917	9,675.00	200,000	1,561	1,285
1902	9,675.00	200,000	2,512	1,331	1918	8,465.63	175,000	1,798	1,798
1903	9,675.00	200,000	3,144	1,698	1919	6,530.63	135,000	1,260	1,411
1904	9,675.00	200,000	3,144	1,823	1920	2,660.62	55,000	464	506
1905	9,675.00	200,000	3,144	1,918	1921	2,902.50	60,000	571	571
1906	14,512.50	300,000	3,773	2,565	1922	5,853.37	121,000	1,037	1,037
1907	9,675.00	200,000	3,144	2,075					
1908	8,465.63	175,000	2,212	1,166		325,853.99	6,736,000	78,170	49,505
1909	10,884.37	225,000	2,830	1,472					

RICHARDSON DISTRICT.

Prospecting was continued in 1922 in the Richardson district, and a small amount of gold was produced, though no mines were regularly operated. Many streams in this district yield coarse gold to the prospector's pan, and persistent and intelligent search may at any time prove the presence of workable ground. Indications were found in 1922 on Savage Gulch and Mineral Creek that were sufficiently favorable to warrant further investigation.

Placer gold and silver produced in the Richardson district, 1905–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1905	(a)	(a)	(a)	(a)	1915	4,595.62	$95,000	939	$476
1906	4,837.50	$100,000	989	$673	1916	3,870.00	80,000	790	520
1907	18,140.62	375,000	3,707	2,447	1917	1,289.37	25,000	245	202
1908	18,140.62	375,000	3,707	1,965	1918	290.25	6,000	59	59
1909	7,256.25	150,000	1,483	771	1919	483.75	10,000	99	111
1910	4,837.50	100,000	989	534	1920	338.62	7,000	69	75
1911	4,837.50	100,000	989	524	1921	145.13	3,000	26	26
1912	4,837.50	100,000	989	608	1922	96.75	2,000	21	21
1913	4,837.50	100,000	989	597					
1914	4,837.50	100,000	989	547		83,971.98	1,728,000	17,079	10,156

a Prospects.

EAGLE AND SEVENTYMILE DISTRICTS.

In the Eagle district 14 summer mines were operated in 1922, employing 28 men and yielding a somewhat larger output of gold than in the preceding three years. As usual, the largest producing mines were the hydraulic mines on Crooked and Alder creeks. The upper basin of Seventymile River experienced an unusually dry season, which affected the gold production unfavorably.

Placer gold and silver produced in the Eagle and Seventymile districts, 1908–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1908.....	483.75	$10,000	76	$40	1917.....	628.88	$13,000	96	$75
1909.....	1,209.37	25,000	191	99	1918.....	1,209.37	25,000	191	191
1910.....	483.75	10,000	76	41	1919.....	969.50	20,000	152	170
1911.....	580.50	12,000	92	49	1920.....	725.62	15,000	99	108
1912.....	967.50	20,000	164	100	1921.....	774.00	16,000	93	93
1913.....	2,418.75	50,000	382	231	1922.....	1,161.00	24,000	159	159
1914.....	2,418.75	50,000	382	211					
1915.....	1,935.00	40,000	305	155		16,788.11	347,000	2,588	1,808
1916.....	822.37	17,000	130	86					

FORTYMILE DISTRICT.

During 1922 mining was continued in the Fortymile district on about the same scale as in the past, 24 summer mines, employing 52 men, and 18 winter mines, employing 33 men, being operated. Most of these mines are small, as the average number of miners employed was about 2 to the mine. About 35,927 cubic yards of gravel was handled, carrying an average gold content of $1.39 to the yard. The greater part of the production was made by a few outfits, most of which employed scrapers. An attempt at hydraulic mining on Wade Creek was abandoned on account of lack of water, and scrapers were resorted to. As usual, a small amount of gold was recovered by individuals working the bars of Fortymile River.

Placer gold and silver produced in the Fortymile district, 1886–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1886–1903..	193,500.00	$4,000,000	30,553	$22,915	1914.....	2,418.75	$50,000	382	$211
1904.....	14,851.12	307,000	2,345	1,360	1915.....	2,418.75	50,000	382	194
1905.....	12,384.00	256,000	1,955	1,193	1916.....	2,418.75	50,000	382	251
1906.....	9,868.50	204,000	1,558	1,059	1917.....	3,870.00	80,000	624	513
1907.....	6,772.50	140,000	1,069	706	1918.....	3,628.12	75,000	573	573
1908.....	6,772.50	140,000	1,069	567	1919.....	1,983.37	41,000	313	350
1909.....	10,884.37	225,000	1,719	894	1920.....	1,935.00	40,000	348	380
1910.....	9,675.00	200,000	1,528	825	1921.....	2,418.75	50,000	448	448
1911.....	9,675.00	200,000	1,528	810	1922.....	2,418.75	50,000	423	423
1912.....	10,303.87	213,000	1,627	1,000					
1913.....	4,837.50	100,000	764	461		313,034.60	6,471,000	49,590	35,133

CHISANA DISTRICT.

In 1922 mining was carried on in the Chisana district about as usual, though operations were somewhat curtailed as the result of an unusually dry summer. Nine mines, employing 25 men, were operated in the summer and moved 10,600 cubic yards of ground that yielded an average of $2.73 to the cubic yard. Practically all mining in this camp is now done by the use of automatic dams, with the aid of which the overburden is washed away, the bedrock being cleaned by pick and shovel methods.

Placer gold and silver produced in the Chisana district, 1913–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1913.....	1,935.00	$40,000	465	$280	1919.....	1,306.12	$27,000	314	$352
1914.....	12,093.75	250,000	2,910	1,609	1920.....	967.50	20,000	137	150
1915.....	7,740.00	160,000	1,862	944	1921.....	1,112.62	23,000	164	164
1916.....	1,935.00	40,000	465	306	1922.....	1,402.87	29,000	200	200
1917.....	1,935.00	40,000	420	346					
1918.....	725.63	15,000	160	160		31,153.49	644,000	7,097	4,511

BONNIFIELD DISTRICT.

The Bonnifield placer district extends from Nenana River eastward to and including the Wood River basin and is in general coextensive with the Nenana coal field. Placer mining has been carried on in this district for 20 years, and the production, though small, has been steady. In 1922 two hydraulic plants were installed, one on Totatlanika River near the mouth of Iron Creek and the other on Platte Creek. The district contains extensive gravel deposits that carry gold, and careful prospecting may reveal localities where it will pay to mine these deposits on a large scale. The coal-mining operations in the region have been described on page 20. Further development work was done on a gold-bismuth quartz prospect [11] on Eva Creek, a headward tributary of Moose Creek about 10 miles east of the railroad. No ore was shipped, but assay returns are reported to show a large body of ore carrying a promising content of gold. In 1922 seven placer mines, employing 24 men, were operated and handled 3,500 cubic yards of gravel carrying $2.86 in gold to the cubic yard.

[11] Overbeck, R. M., Lode deposits near the Nenana coal field: U. S. Geol. Survey Bull. 662, pp. 351–362 1918.

Placer gold and silver produced in the Bonnifield district, 1903–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1903–1906..	1,451.25	$30,000	227	$136	1916.....	483.75	$10,000	76	$50
1907.....	241.87	5,000	38	25	1917.....	580.50	12,000	98	81
1908.....	241.87	5,000	38	20	1918.....	580.50	12,000	91	91
1909.....	2,418.75	50,000	379	197	1919.....	483.75	10,000	75	84
1910.....	483.75	10,000	76	41	1920.....	241.87	5,000	38	41
1911.....	967.50	20,000	152	81	1921.....	774.00	16,000	114	114
1912.....	967.50	20,000	152	93	1922.....	483.75	10,000	73	73
1913.....	967.50	20,000	152	92					
1914.....	1,451.25	30,000	227	126		13,786.86	285,000	2,158	1,422
1915.....	967.50	20,000	152	77					

KANTISHNA DISTRICT.

The following notes on mining in the Kantishna district in 1922 are based on observations by Philip S. Smith, of the Geological Survey, who visited the district in July, 1922.

Gold placers.—Gold placer mining was continued in a small way, mainly by pick and shovel methods, on the streams that have been worked for many years. The principal operations of this type were on Eureka Creek, where four men were employed; in the Glen Creek basin, where five men were mining; in the Spruce Creek basin, where four men did a little mining; and on Glacier Creek, where there were a few small operations. Little was accomplished on Little Moose Creek in 1922. The outstanding developments in the district were the initial mining operations of two large hydraulic plants, one on Moose Creek and one on Caribou Creek.

The Kantishna Hydraulic Mining Co. was mining gravels in the valley of Moose Creek near the mouth of Eldorado Creek. This company owns claims extending for about 3 miles downstream below Eldorado Creek. Water for mining is brought by a ditch from the stream draining from Wonder Lake, but in 1922 considerable difficulty was experienced in keeping the ditch in repair, and breaks, with consequent interruption to mining, were frequent. Sufficient water was available to operate two giants most of the season, and three were operated part of the time. The ground mined is relatively shallow and full of large boulders, and the gold occurs on a false bedrock of sticky blue clay. Many of the boulders are too large to be rolled aside and must be broken by explosives before they can be moved. This delays operations and adds considerably to the cost of mining. The gold is somewhat rusty red, moderately angular, and not very coarse. The largest pieces do not exceed a few dollars in value, and pieces worth 5 cents are larger than the average. A large amount of gravel was sluiced at this plant during the season, but the recovery is said to have been less than prospecting had indicated.

The Mount McKinley Gold Placers (Inc.), after several years of preparatory work, began mining in 1922 on a large holding of placer ground on Caribou Creek, some 40 men being employed. Water was obtained from Caribou Creek for hydraulic operations, but construction was under way on a higher ditch, to take water from the same stream near the mouth of Last Chance Creek. In 1922 there was an unusually heavy rainfall, as a consequence of which mining was at times hampered by the high water and dams were washed out. Supplies were brought to this property from the head of launch navigation on Bearpaw River, at Diamond, by caterpillar tractor, but the bad trail made its operation slow and expensive. It is reported that this trail is now being improved. At the workings the gold was recovered from a false bedrock of yellowish muddy clay, though true bedrock is found at other places on Caribou Creek. The gravel mined contained many large boulders that greatly increased the cost of mining. The gold, which is rough and rather fine, occurs in association with black sand and considerable garnet. It is said that the large cut mined in 1922 gave a disappointingly low yield of gold.

Placer gold and silver produced in the Kantishna district, 1903–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1903–1906..	8,465.62	$175,000	1,325	$795	1916.....	1,451.25	$30,000	227	$149
1907.....	725.62	15,000	114	75	1917.....	725.63	15,000	120	99
1908.....	725.62	15,000	114	60	1918.....	1,451.25	30,000	227	227
1909.....	241.87	5,000	38	20	1919.....	725.63	15,000	114	128
1910.....	483.75	10,000	76	41	1920.....	1,209.37	25,000	320	349
1911.....	1,451 25	30,000	227	120	1921.....	580.50	12,000	156	156
1912.....	1,451.25	30,000	227	140	1922.....	1,548.00	32,000	403	403
1913.....	1,451.25	30,000	227	137					
1914.....	967.50	20,000	152	84		24,622.86	509,000	4,219	3,060
1915.....	967.50	20,000	152	77					

Gold and silver lode mining.—No productive lode mining was done in the Kantishna district in 1922. Underground and surface prospecting was continued on the Quigley claims, on lower Friday Creek, and some very promising ore was disclosed. No noteworthy work was done on the claims at the head of Friday Creek or on the divide between Friday and Eureka creeks. Several new lodes, the importance of which has not been determined, are reported on Glen and Eldorado creeks.

In the vicinity of Copper Mountain, near Muldrow Glacier, a large number of claims were staked in 1921 and 1922, but development work has so far been confined to a few shallow pits and open cuts. Considerable difficulty was encountered in starting underground prospecting tunnels on these claims, for in those places where the most promis-

ing mineralized rock was found the rock was badly broken, and as soon as an excavation was made the loose material on the hillside would begin to slide. This naturally interfered with the prospecting of the richer areas. The mineralization in the Copper Mountain district was extensive, and the geology is very complex. The ore occurs mainly as stringers in limestone near the contact of acidic or basic intrusive rocks, in quartzite beds, or in the igneous rocks themselves. There seem to have been two distinct types of mineralization—a copper mineralization that apparently was related to the basic intrusive rocks and a lead-zinc mineralization that was related to the granitic rocks. There are numerous faults and slips, both older and younger than the mineralization. The older ones were followed, to some extent, by the mineralizing solutions and the younger ones cut off and displaced the ore bodies. Further prospecting will be necessary to determine the size and value of these ore deposits.

RUBY DISTRICT.

There was a considerable falling off in the gold production of the Ruby district in 1922, although more mines were in operation and more miners were employed than in 1921. The decline was due in part to the exhaustion of some of the richer ground, the average gold recovery in 1922 being $3.50 to the cubic yard, as compared with $4.50 per yard in 1921. In 1922 there were operated 24 summer mines, employing 67 men, and 13 winter mines, employing 39 men The largest production was reported from Poorman, Solomon, Flat, Spruce, and Trail creeks. The Perseverance lead-silver lode mine produced 50 tons of very high grade ore.

Placer gold and silver produced in the Ruby district, 1907–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1907–8.....	48.38	$1,000	7	$4	1918.....	19,350.00	$400,000	3,000	$3,000
1912.....	8,465.63	175,000	1,157	712	1919.....	7,981.88	165,000	1,255	1,406
1913.....	37,974.37	785,000	5,188	3,134	1920.....	8,223.75	170,000	1,113	1,213
1914.....	48,375.00	1,000,000	6,609	3,655	1921.....	8,223.75	170,000	1,158	1,158
1915.....	33,862.50	700,000	4,626	2,345	1922.....	5,950.13	123,000	819	819
1916.....	41,118.75	850,000	5,618	3,697					
1917.....	42,811.88	885,000	6,073	5,046		262,386.02	5,424,000	36,643	26,189

INNOKO AND TOLSTOI DISTRICTS.

In the Innoko district 18 summer mines, employing 62 men, and 4 winter mines, employing 6 men, were operated in 1922. The chief production came from Little, Ophir, Yankee, Gaines, and Anvil creeks. Open-cut mining predominates, but with the continuous installation of dredges it is to be expected that this type of mining

will eventually surpass in production the open-cut methods. The Flume Dredge Co.'s dredge on Yankee Creek, first put into operation in 1921, mined continuously during the summer of 1922, and its success was sufficient to encourage the same company to start the installation of a similar dredge on Little Creek, which should be in operation in 1923. A 6-mile ditch was under construction along Innoko River to provide water for a hydroelectric plant to supply power for these dredges. The Innoko Dredging Co. landed the materials for a steam dredge at Tacotna in the fall of 1922 and sledded it to Gaines Creek during the winter. It was hoped to put this dredge to digging in 1923. In 1922 a total of 222,500 cubic yards of gravel was mined, carrying an average gold content of $1 to the yard.

In the Tolstoi district 4 mines were operated in summer and 4 in winter. Each mine was a one-man property, operated by the owner alone. Work was confined to Madison, Esperanto, and Bear creeks, but it was expected that Boob Creek would be opened up in 1923.

Placer gold and silver produced in the Innoko and Tolstoi districts, 1907–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1907	628.87	$13,000	67	$44	1916	10,642.50	$220,000	1,130	$744
1908	3,483.00	72,000	370	196	1917	8,465.63	175,000	1,113	917
1909	16,447.50	340,000	1,746	908	1918	5,805.00	120,000	608	608
1910	15,721.87	325,000	1,669	901	1919	6,772.50	140,000	717	803
1911	12,093.75	250,000	1,284	681	1920	4,982.62	103,000	529	577
1912	12,093.75	250,000	1,284	681	1921	5,321.25	110,000	569	569
1913	13,545.00	280,000	1,438	869	1922	10,836.00	224,000	1,264	1,264
1914	9,675.00	200,000	1,027	568					
1915	9,191.25	190,000	976	495		145,705.49	3,012,000	15,791	10,825

IDITAROD DISTRICT.

There were 13 productive mines, employing 136 men, in the Iditarod district in 1922. The two dredges on Otter Creek worked 163 and 167 days and produced a large part of the total gold output of the district. Otter, Happy, Flat, and Willow creeks were the chief producers The average gold recovery for the entire district was about 51 cents a yard, and 547,300 yards of gravel was moved. The large yardage and small average recovery are of course the result of dredge mining.

A promising discovery of gold quartz is reported to have been made by J. Warren at the head of Glen Gulch. It is said that a stamp mill has been installed and considerable ore mined. Plans were made to send a sample shipment to Tacoma to be smelted, but the high freight charges make it impossible to ship any but bonanza ore from this district. The quicksilver mine in the headwater region of Iditarod River was not operated in 1922.

Placer gold and silver produced in the Iditarod district, 1910–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1910.....	24,187.50	$500,000	4,254	$2,297	1918.....	59,985.00	$1,240,000	9,000	$9,000
1911.....	120,937.50	2,500,000	21,270	11,273	1919.....	35,071.88	725,000	5,300	5,937
1912.....	169,312.50	3,500,000	29,778	18,313	1920.....	24,429.37	505,000	3,628	3,954
1913.....	89,977.50	1,860,000	9,551	5,769	1921.....	16,931.25	350,000	2,482	2,482
1914.....	99,652.50	2,060,000	10,578	5,849	1922.....	13,545.00	280,000	2,041	2,041
1915.....	99,168.75	2,050,000	10,526	5,337					
1916.....	94,331.25	1,950,000	10,013	6,589		920,092.50	19,020,000	129,471	87,946
1917.....	72,562.50	1,500,000	11,050	9,105					

MARSHALL DISTRICT.

About 12 summer mines, employing 31 men, were operated in the Marshall district of the lower Yukon during 1922. This district is here made to include the Stuyahok region, about 40 miles northeast of Marshall. There was very little activity around Marshall in 1922, and reports from the Stuyahok were not very encouraging. Four men mined on Disappointment Creek, near the original Marshall discovery, operating a hydraulic plant and a scraper. One new encouraging prospect was said to have been found on claim No. 2. In this district about 17,000 cubic yards of ground was mined, from which an average of $1.29 in gold was recovered.

Placer gold and silver produced in the Marshall district, 1914–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1914.....	725.62	$15,000	94	$52	1920.....	4,353.75	$90,000	552	$602
1915.....	1,209.37	25,000	156	79	1921.....	1,451.25	30,000	192	192
1916.....	13,061.25	270,000	1,686	1,109	1922.....	1,064.25	22,000	134	134
1917.....	20,559.37	425,000	3,300	2,719					
1918.....	7,256.25	150,000	940	940		54,518.61	1,127,000	7,678	6,526
1919.....	4,837.50	100,000	624	699					

CHANDALAR DISTRICT.

According to reports received, 4 summer mines, employing 15 men, and 1 winter mine, employing 10 men, were operated in the Chandalar district in 1922. The greater part of the production from the district came from a single deep mine on Little Squaw Creek, operated by F. J. Smith, which was worked only in the winter. Plans were made to run a drainage tunnel to this ground, so that mining could be carried on in the summer of 1923. Big Creek was the second largest producer in the district. In the entire Chandalar district about 22,000 yards of ground was mined in 1922, having an average gold content of $3.73 to the cubic yard.

Prospecting continues on the gold lodes of this district. For many years promising gold quartz lodes have been held, but the remoteness of the region and the high cost of bringing mining machinery to it have retarded lode-mining developments. There are indications that eventually the Chandalar region will be included in the list of gold-lode camps.

Placer gold and silver produced in the Chandalar district, 1906–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1906–1912..	2,902.50	$60,000	416	$241	1919.....	483.75	$10,000	79	$88
1913.....	266.06	5,500	38	23	1920.....	870.75	18,000	125	136
1914.....	241.87	5,000	35	19	1921.....	1,451.25	30,000	197	197
1915.....	241.87	5,000	35	18	1922.....	4,015.12	83,000	574	574
1916.....	435.37	9,000	62	41					
1917.....	725.63	15,000	104	86		12,263.05	253,500	1,761	1,519
1918.....	628.88	13,000	96	96					

KOYUKUK DISTRICT.

In the Koyukuk district 36 summer placer mines, employing 106 men, and 10 winter mines, employing 25 men, were productively operated in 1922. An average of $3.44 in gold to the cubic yard was recovered from the 38,350 cubic yards of gravel mined. As in the past, the largest output came from Nolan Creek. A new piece of rich bench ground was opened up on Nolan Creek below the mouth of Smith Creek, but its extent is still unknown. Some recently discovered rich spots on Hammond River have stimulated prospecting there, and some coarse gold was mined on Sixtymile River, a tributary of John River.

Placer gold and silver produced in the Koyukuk district, 1900–1922.[a]

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1900–1909..	106,454.02	$2,200,600	15,242	$8,993	1917.....	12,287.26	$254,000	1,724	$1,421
1910.....	7,740.00	160,000	1,108	598	1918.....	7,401.38	153,000	880	880
1911.....	7,256.25	150,000	1,039	551	1919.....	5,514.75	114,000	787	881
1912.....	10,860.19	224,500	1,555	957	1920.....	4,402.12	91,000	148	161
1913.....	20,898.00	432,000	2,991	1,806	1921.....	3,773.25	78,000	119	119
1914.....	13,786.87	285,000	1,973	1,091	1922.....	6,385.50	132,000	214	214
1915.....	14,028.75	290,000	2,006	1,017					
1916.....	15,480.00	320,000	2,216	1,458		236,268.34	4,884,100	32,002	20,147

[a] Beginning with 1911 this table includes a small production from the Indian River district.

KUSKOKWIM REGION.

The returns from the placer operations in the Kuskokwim region are still incomplete, so a full statement of mining in 1922 is not possible. About 30 mines, employing about 137 men, were operated and produced about $542,000. Much the largest single operation was that of the dredge on Candle Creek near McGrath. This dredge operated during a period of 145½ days, digging in ground that averaged 14½ feet in depth. In addition to the dredging, about 7 mines were operated in the McKinley district, 7 in the Georgetown district, 11 in the Tuluksak-Aniak district, and 4 in the vicinity of Goodnews Bay.

Mining and development work was continued on the Nixon mines of the Treadwell Yukon Co. (Ltd.), at Nixon Fork, in the McKinley district. The company reports that 200 feet of inclined shaft and 1,690 feet of drifts and crosscuts were completed. The 10-stamp amalgamating and concentrating mill, erected in 1921, was operated from June to September, 1922, and the mine was operated continuously throughout the year. Some development work was done on the quicksilver deposits of the lower Kuskokwim and on one or two other lode deposits.

SEWARD PENINSULA.

SALIENT FEATURES.

The value of the total mineral production of Seward Peninsula in 1922 was $1,274,988, a falling off of $190,000 from the value in 1921. Of the total amount $1,265,000, as shown in the subjoined table, was in gold, and the rest in silver, platinum, coal, and lead. No tin was produced in Seward Peninsula in 1922. The platinum came chiefly from the Koyuk district and the lignitic coal from the Fairhaven district. At the Independence mine, in the Fairhaven district, no new ore was mined, but a small production was made by working over the dumps of the preceding year. This was the only producing lode mine on the peninsula in 1922. Some development work, mainly as assessment work, was done on other lodes of the district.

PLACER MINING.

A total of 104 placer mines, employing about 528 men, were operating on Seward Peninsula in the summer of 1922, and 11 mines, employing 51 men, the preceding winter. In 1921 there were about 126 summer mines, employing 622 men, and 14 winter mines, employing 64 men. These mines in 1922 moved an aggregate of about 2,103,691 yards of ground, which yielded about 60 cents in gold to the cubic yard.

Two interesting new discoveries of placer gold, the value of which has not yet been determined, are reported from the Buckland River basin, about 25 miles above the mouth of that stream.

Placer gold produced in Seward Peninsula in 1922, by districts.

District.	Value of gold.	Summer.		Winter.	
		Mines.	Miners.	Mines.	Miners.
Nome	$485,000	26	164	3	16
Solomon and Casadepaga	111,000	14	61	.....	.....
Koyuk	109,000	11	78	4	25
Council	375,000	11	89	1	3
Kougarok	32,000	11	35	.....	.....
Fairhaven	150,000	26	93	3	7
Port Clarence	3,000	5	8	.....	.....
	1,265,000	104	528	11	51

Placer gold produced in Seward Peninsula in 1922, by methods of mining.

Method.	Mines.	Men.	Value of gold.
Dredging	15	151	$609,859
Hydraulic mining (includes all operations where any water is used to move gravel to sluice box)	24	192	426,671
Open-cut mining (other than by hydraulicking)	59	136	117,736
Drifting	17	100	110,734

The 15 dredges operated on Seward Peninsula in 1921 dug about 1,574,500 cubic yards, as compared with 16 gold dredges and about 1,690,000 cubic yards in 1921. The gold recovery to the cubic yard was about 39 cents in 1922 and 41 cents in 1921. The dredges were operated from 13 to 114 days. Those that were fully prepared at the beginning of the operating season worked from 70 to 114 days. The most important event of mining interest in the Seward Peninsula region in 1922 was the acquiring of large dredging-ground holdings, including all the property of the old Pioneer Mining Co., by the Hammon Consolidated Goldfields Co. The property of the Pioneer Mining Co. has been worked mainly by hydraulic giants and elevators. The new company has let contracts for two new dredges, with buckets having a capacity of 9 cubic feet, to be erected and ready for operation on ground on the third beach by June, 1923. The cold-water thawing method will be used to keep the ground thawed in advance of dredging. The dredges will be electrically operated, the power being furnished by Diesel engines.

The hydraulic mines of Seward Peninsula handled about 468,327 cubic yards of gravel and made an average gold recovery of 91.1 cents. About 21,118 cubic yards was mined by drifting and hoisting, with a gold recovery of about $5.24 to the cubic yard. Most of the deep mining was done in the Koyuk district. Open-cut mines other than

hydraulic mined 39,792 cubic yards of ground and recovered $3 to the yard in gold.

Gold and silver produced on Seward Peninsula, 1897–1922.

Year.	Gold.		Silver.		Year.	Gold.		Silver.	
	Fine ounces.	Value.	Fine ounces.	Value.		Fine ounces.	Value.	Fine ounces.	Value.
1897.....	725.63	$15,000	87	$52	1911.....	149,962.50	$3,100,000	17,996	$9,718
1898.....	3,628.12	75,000	435	256	1912.....	145,125.00	3,000,000	17,415	10,710
1899.....	135,450.00	2,800,000	16,254	9,752	1913.....	120,937.50	2,500,000	12,094	7,305
1900.....	229,781.25	4,750,000	27,574	17,097	1914.....	130,612.50	2,700,000	15,673	8,667
1901.....	199,822.61	4,130,700	24,579	14,747	1915.....	140,287.50	2,900,000	17,510	8,878
1902.....	220,677.07	4,561,800	26,481	14,035	1916.....	142,706.25	2,950,000	14,271	9,391
1903.....	215,994.38	4,465,000	24,171	13,052	1917.....	125,775.00	2,600,000	13,770	11,346
1904.....	201,462.52	4,164,600	24,175	14,021	1918.....	53,599.50	1,108,000	6,022	6,022
1905.....	232,200.00	4,800,000	27,864	16,997	1919.....	65,790.00	1,360,000	6,940	7,773
1906.....	352,812.50	7,500,000	43,537	29,605	1920.....	62,887.49	1,300,000	6,813	7,426
1907.....	338,625.00	7,000,000	25,497	16,828	1921.....	70,389.75	1,455,085	6,411	6,411
1908.....	247,680.00	5,120,000	20,577	10,905	1922.....	61,194.37	1,265,000	6,790	6,790
1909.....	207,077.50	4,260,000	20,871	10,853					
1910.....	169,312.50	3,500,000	20,317	10,971		4,024,516.44	83,380,185	444,124	279,608

KOBUK REGION.

Placer mining continued during 1921 in a small way in the Kobuk River basin, chiefly in the Shungnak district. About 6 summer mines, employing 11 men, and 3 winter mines, employing 8 men, were operated, most of them for only a part of the season. Klery and Dahl creeks were the largest producers, but the total output was only about $8,000 in gold. It is reported that two hydraulic plants are being installed in this region, one of them on California Creek.

ADMINISTRATIVE REPORT.

By ALFRED H. BROOKS and GEORGE C. MARTIN.

During 1922 seven parties were engaged in surveys and investigations in Alaska. These parties included 7 geologists, 2 topographers, 2 topographic assistants, and 12 packers, cooks, and other helpers. Five parties were engaged in geologic work, and two were combined geologic and topographic parties.

The funds available for field and office work for the season of 1922 included an appropriation of $75,000, an unexpended balance of $5,430 from the appropriation of 1921, and an allotment of $2,000 from the appropriation of 1921 for the classification of the public lands. The subjoined tables show the allotments of these funds geographically by types of work and by salaries and field expenses. A balance of $14,100 will be used for the field work of 1923. In these tables the money devoted purely to office work has not been allocated to the several projects, except as indicated.

Allotments for salaries and field expenses, field season of 1922.

	1921–22	1922–23
Scientists' salaries		$28,400
Field expenses	$7,430	17,000
Miscellaneous expenses, including clerical salaries, etc		9,500
Office of Director		6,000
To be allotted to field work, 1923		14,100
	7,430	75,000

The allotments shown in the subjoined tables as made to different kinds of work and to different regions are only approximations. To determine the precise figures would require an elaborate cost-keeping system too expensive to justify the results to be achieved. Many parties and individuals divide their time between two or more projects. The following table shows, in a general way, however, on what projects the funds have been spent. The geologic surveys include work that is used in the classification of public lands.

Approximate allotments to different kinds of surveys and investigations, field season of 1922.

	1921–22	1922–23
Special investigations of geology and mineral resources		$10,700
Reconnaissance geologic surveys	$3,130	20,500
Reconnaissance topographic surveys	4,300	9,700
Map compilation		4,100
Collecting mineral statistics		2,400
Administration, Alaska branch, including clerical salaries, miscellaneous expenses, etc		7,500
Office of Director		6,000
To be allotted to field work, 1923		14,100
	7,430	75,000

In the following table showing the distribution of allotment by regions, the overhead expenses, including administration, are distributed proportionately among the various projects:

Approximate distribution of allotments for investigations in Alaska, field season of 1922.

	1921–22	1922–23
General investigations, geology and mineral resources		$9,600
Southeastern Alaska		5,400
Copper River		8,400
Alaska Railroad		4,200
Alaska Peninsula	$6,450	18,400
Yukon basin	980	6,600
Map compilation		5,200
Collecting mineral statistics		3,100
To be allotted to field work, 1923		14,100
	7,430	75,000

The following table shows the progress of investigations in Alaska and the annual grants of funds since systematic surveys were begun, in 1898.[1] It should be noted that a varying amount is spent each year on special investigations that yield results which can not be expressed in terms of area. In 1917, when the United States entered the World War, nearly all the Alaska funds were allotted to the investigation of minerals such as platinum, sulphur, and antimony, which were then of special importance, and few areal surveys were made. Since 1918 the reduction of the annual appropriation and the increased cost of all field work has not permitted extensive geologic and topographic surveys. Little progress has therefore been made in extending the topographic and geologic mapping that is essential to obtain an adequate knowledge of the mineral resources of the Territory.

[1] The Geological Survey made some investigations of the gold and coal deposits of the Pacific seaboard region in 1895 and of the Yukon region in 1896.

Progress of surveys in Alaska, 1898–1922.

Year.	Appropriation.	Areas covered by geologic surveys.			Areas covered by topographic surveys.[a]					Investigations of water resources.	
		Exploratory (scale 1:625,000 or 1:1,000,000).	Reconnaissance (scale 1:250,000).	Detailed (scale 1:62,500).	Exploratory (scale 1:625,000 or 1:1,000,000).	Reconnaissance (scale 1:250,000; 200-foot contours).	Detailed (scale 1:62,500; 25, 50, or 100 foot contours).	Line of levels.	Bench marks set.	Gaging stations maintained part of year.	Stream-volume measurements.
		Sq. m.	*Sq. m.*	*Sq. m.*	*Sq. m.*	*Sq. m.*	*Sq. m.*	*Miles.*			
1898	$46,189	9,500	.....	.....	12,840	2,070	.....	.....	.....	.....	.....
1899	25,000	6,000	.....	.....	8,690	.....	.....	.....	.....	.....	.....
1900	60,000	3,300	6,700	.....	630	11,150	.....	.....	.....	.....	.....
1901	60,000	6,200	5,800	.....	10,200	5,450	.....	.....	.....	.....	.....
1902	60,000	6,950	10,050	.....	8,330	11,970	96	.....	.....	.....	.....
1903	60,000	5,000	8,000	96	.....	15,000	.....	.....	.....	.....	.....
1904	60,000	4,050	3,500	.....	800	6,480	480	86	19	.....	.....
1905	80,000	4,000	4,100	536	.....	4,880	787	202	28	.....	.....
1906	80,000	5,000	4,000	421	.....	13,500	40	.....	.....	14	286
1907	80,000	2,600	1,400	442	.....	6,120	501	95	16	48	457
1908	80,000	2,000	2,850	604	.....	3,980	427	76	9	53	556
1909	90,000	6,100	5,500	450	6,190	5,170	444	.....	.....	81	703
1910	90,000	.....	8,635	321	.....	13,815	36	.....	.....	69	429
1911	100,000	8,000	10,550	496	.....	14,460	246	.....	.....	68	309
1912	90,000	.....	2,000	525	.....	.....	298	.....	.....	69	381
1913	100,000	3,500	2,950	180	3,400	2,535	287	.....	.....	.....	.....
1914	100,000	1,000	7,700	325	600	10,300	10	.....	.....	.....	.....
1915	100,000	.....	10,700	200	.....	10,400	12	3	2	9	.....
1916	100,000	.....	5,100	636	.....	9,700	67	.....	.....	20	.....
1917	100,000	.....	1,750	275	.....	1,050	.....	.....	.....	19	.....
1918	77,000	.....	3,500	.....	.....	1,200	.....	.....	.....	.....	.....
1919	75,000	.....	2,700	.....	.....	2,300	.....	.....	.....	19	.....
1920	75,000	.....	1,480	.....	.....	770	.....	.....	.....	19	.....
1921	[b] 87,000	.....	2,130	150	.....	300	205	.....	.....	.....	.....
1922	[c] 77,000	.....	4,000	.....	.....	4,300	.....	.....	.....	.....	.....
	1,952,189	73,200	115,095	5,657	51,680	156,900	3,936	462	74	.....	.....
Percentage of total area of Alaska	.....	12.48	19.63	0.96	8.81	26.76	0.67	.....	.....	.....	.....

[a] The Coast and Geodetic Survey, International Boundary Commission, and General Land Office have also made topographic surveys in Alaska. The areas covered by these surveys are of course not included in these totals.
[b] Includes $12,000 for classification of public lands.
[c] Includes $2,000 for classification of public lands.

The chief Alaskan geologist was engaged in office work until June 12, 1922, when he left Washington for Seattle, where he joined Hon. C. H. Huston, Assistant Secretary of Commerce, and other members of an expedition sailing on the Coast Guard cutter *Mojave* to make investigations in the northern Pacific under the auspices of the Department of Commerce. With this party he visited and made some investigations of the geology and mineral resources in the coastal regions of Alaska and adjacent islands, as well as of the geology and geography of portions of the coast of Siberia. While in Alaska he visited Juneau, Seward, Anchorage, Fairbanks, Unalaska and Pribilof Islands, and Nome. His time in the office was divided as follows: Geologic studies, 14½ days; progress report, 15 days; press bulletin, 10 days; mineral statistics, 17 days; geology of Alaska, 24 days; geography and geology of eastern Siberia, 29 days; field plans and

orders, 14½ days; preparation of report on geology of Point Barrow region and plans for survey of naval petroleum reserve No. 4, 32 days; administrative and routine matters, the remainder. He left Washington June 21, 1923, to make certain inquiries in Seattle, and on June 29 sailed for Sydney, Australia, where he attended the Pan Pacific Conference as an official delegate.

George C. Martin did no field work in the summer of 1922 and was engaged throughout the year in geologic studies of the Alaska Mesozoic formations and in administrative duties as acting chief Alaskan geologist during the absence of Mr. Brooks. His time was divided as follows: Preparation of manuscript on Alaska Mesozoic formations, 121 days; revision of reports and preparation of original manuscript on Alaska oil fields, 32 days; revision of other referred manuscript and proof reading, 28 days; general administrative duties, including conferences, 49 days; preparation of manuscript of administrative reports, 6 days; preparation of manuscript and other data for Government officials outside of the Geological Survey, 14 days. The entire month of June, 1923, was spent in official travel on the way to the oil fields of Alaska Peninsula.

Philip S. Smith spent from June 14 to September 13 in making special investigations of the geology and mineral resources of areas adjacent to the Alaska Railroad.

Fred H. Moffit was engaged from June 14 to September 17 in a revision and extension of the reconnaissance geologic mapping of the Chitina Valley. The results of his investigations will appear in a summary report on the geology and mineral resources of the Chitina quadrangle.

J. B. Mertie, jr., continued the reconnaissance geologic mapping of parts of the Rampart and Fairbanks quadrangles. He spent from June 27 to September 3 in mapping, on the scale of 1 to 100,000, an area of about 1,000 square miles. Some time in September was spent in collecting statistics of mineral production in the vicinity of Fairbanks.

A. F. Buddington spent from June 13 to September 22 in continuing the geologic mapping and investigation of mineral resources of the Wrangell district.

R. H. Sargent was in charge of a double party engaged in reconnaissance topographic and geologic surveys of the oil fields of the Alaska Peninsula. Mr. Sargent spent from June 15 to September 22 in mapping on the scale of 1 to 180,000 an area of about 3,000 square miles lying along the axis of the Alaska Peninsula between Portage Bay and Chignik. He was accompanied by W. R. Smith, who made geologic surveys in the same district, and had general supervision of a party under the leadership of R. K. Lynt engaged in making surveys in an adjacent area. While in the office Mr. Sargent was

occupied largely in the administration of Alaska topographic surveys and map compilation, in addition to preparing his field maps for publication.

W. R. Smith, who accompanied R. H. Sargent from Portage Bay to Chignik, made reconnaissance geologic surveys of an area of about 2,000 square miles. A joint report on the results of his investigations and on those of Mr. Baker in an adjoining area appears elsewhere in this volume.

R. K. Lynt spent from June 15 to September 12 in making topographic surveys on the scale of 1 to 180,000 of an area of about 1,300 square miles in the vicinity of Becharof Lake. He was accompanied by A. A. Baker, who made geologic surveys of an area of 475 square miles in the same district. The results of Mr. Baker's investigations are published, jointly with those of W. R. Smith, elsewhere in this volume.

S. R. Capps, who had been on furlough since April 16, 1922, while engaged in commercial oil work for an American company in foreign countries, returned to the Geological Survey May 1, 1923, and resumed the preparation of his report on the geology and mineral resources of the region tributary to the Alaska Railroad. In June, 1923, in the absence of Mr. Brooks and Mr. Martin, he took over administrative charge of the Alaska branch as acting chief Alaskan geologist.

C. Arthur Hollick continued his studies of the Alaska Tertiary fossil plants, although he was not regularly employed by the survey.

James McCormick was employed for six months in the revision of the geographic dictionary of Alaska. John B. Torbert has been engaged in Alaska cartographic work throughout the year, about half of his time having been devoted to map compilation. E. B. Hill, assistant topographic engineer, was engaged in work upon Alaska topographic maps from November 15 to January 23.

Miss Lucy M. Graves, chief clerk, has continued to carry much of the clerical administration of the Alaska branch and has acted as chief during the absence of the chief Alaskan geologist and of the senior geologist, G. C. Martin. The details of collecting the statistics of the mineral production of Alaska have been in the hands of T. R. Burch.

During 1922 the survey issued three complete bulletins relating to Alaska—Bulletin 722, "Mineral resources of Alaska, 1920," by Alfred H. Brooks and others; Bulletin 733, "The geology of the York tin deposits, Alaska," by Edward Steidtmann and S. H. Cathcart; and Bulletin 742, "Chromite of Kenai Peninsula, Alaska," by A. C. Gill; also some of the separate chapters from Bulletin 739, "Mineral resources of Alaska, 1921," by Alfred H. Brooks and others. Bulletin 745, "The Kotsina-Kuskulana district, Alaska,"

including topographic maps, by F. H. Moffit and J. B. Mertie, jr., was issued in June, 1923. The manuscripts of three other reports—"The Ruby-Kuskokwim region, Alaska," by J. B. Mertie, jr., and G. L. Harrington (Bulletin 754), "The Juneau district, Alaska," by H. M. Eakin, and "The Ketchikan district," by Theodore Chapin, are nearly ready for the printer. The usual annual review of the mining industry of Alaska was issued on December 31, 1922.

A new map of Alaska on the scale of 1 to 2,500,000 was issued about March 1, 1923. A relief map on the same scale is almost completed. The compilation of the topographic map of the region tributary to the Alaska Railroad, on a scale of 1 to 250,000, is approaching completion. This will be published in three sheets, of which the southern sheet (Seward-Matanuska) was sent to the engraver in June, 1923.