

ADMINISTRATIVE REPORT.

By G. C. MARTIN.

INTRODUCTION.

Eleven parties were engaged during 1917 in Alaska surveys and investigations. The length of the field season ranged from $2\frac{1}{2}$ to 12 months, being determined by the character of the work and by the climatic conditions prevailing in different parts of the Territory. The parties included 9 geologists, 1 topographer, 1 engineer, and 18 packers, cooks, and other auxiliaries. Nine of the parties were engaged in geologic surveys, one in topographic surveys, and one in stream gaging. The areas covered by reconnaissance geologic surveys on a scale of 1:250,000 (4 miles to an inch) amount to 1,750 square miles; by detailed geologic surveys on a scale of 1:62,500 (1 mile to an inch), 275 square miles. Much of the time of the geologists was devoted to the investigation of special problems relating to the occurrence of minerals, the results of which can not be expressed in terms of area. About 1,050 square miles was covered by reconnaissance topographic surveys on a scale of 1:250,000 (4 miles to an inch). In cooperation with the Forest Service, stream gaging was continued in southeastern Alaska.

In 1917 the entrance of the United States into the war and the beginning of the construction of the Government railroad in Alaska gave more than ordinary importance to the collection of reliable statistics of mineral occurrence and production. Many governmental agencies connected more or less directly with the prosecution of the war were seeking information concerning available supplies and reserves of raw material. Therefore, the greater number of the geologists assigned to Alaskan work were charged with investigations of the occurrence and production of minerals of economic value, among which were tin, tungsten, platinum, copper, chrome iron ore, nickel, and sulphur.

Of the five parties whose work may be classified geographically, two parties worked in southeastern Alaska, two on Prince William Sound, and one in the region tributary to the Government railroad.

The following tables show the allotments, including both field and office work, of the total appropriation of \$100,000 for the fiscal year 1917, classified by regions, by kinds of surveys, and by kinds of expenditures. In addition to these funds a balance of about \$6,000 from last year's appropriation was expended in equipping parties for the season's field work. In the first table, the general office expenses are apportioned to the several allotments, account being taken of variations in character of work. The results are expressed in round numbers. Salaries of the permanent staff are included up to the end of the fiscal year 1918, but expenses other than these include only the cost of field and office work during 1917. The "general investigations" include, among other things, the cost of collecting mineral statistics, of office work relating to the field investigations of previous seasons, and of investigations under the direct administration of the geologic branch. A balance of about \$37,300 is available for equipping the field parties in 1918.

Approximate general distribution of appropriations for Alaska investigations, 1917.

Southeastern Alaska	\$20,300
Prince William Sound, Copper River, and Controller Bay ..	10,300
Cook Inlet and Susitna Basin	7,600
Southwestern Alaska	3,900
Yukon Basin	5,500
Seward Peninsula	1,900
General investigations	13,200
To be allotted to field work, 1918	37,300
	<hr/> 100,000

Approximate allotments to different kinds of surveys and investigations, 1917.

Reconnaissance geologic surveys	\$9,100
Detailed geologic surveys	3,400
Special geologic investigations	17,500
Reconnaissance topographic surveys	4,000
Investigations of water resources	5,400
Collection of mineral statistics	1,600
Miscellaneous, including administration, inspection, clerical salaries, office supplies and equipment, and map compilation	21,700
To be allotted to field work, 1918	37,300
	<hr/> 100,000

Allotments for salaries and field expenses, 1917.

Scientific and technical salaries	\$24,964
Field expenses	18,536
Clerical and administrative salaries and miscellaneous expenses	19,200
To be allotted to field work, 1918	37,300
	<hr/> 100,000

The following table exhibits the progress of investigations in Alaska and the annual grant of funds since systematic surveys were begun in 1898. 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.

Progress of surveys in Alaska, 1898-1917.

Year.	Appropriation.	Areas covered by geologic surveys.			Areas covered by topographic surveys,a				Water resources investigations.		
		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).	Lines 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	
	1,561,189	73,200	101,285	5,507	51,680	148,030	3,731	453	74		
Percentage of total area of Alaska.....		12.48	1.727	0.94	8.81	25.24	0.64				

^a The Coast and Geodetic and International Boundary surveys and the General Land Office have also made topographic surveys in Alaska. The areas covered by these surveys are, of course, not included in these totals.

GEOGRAPHIC DISTRIBUTION OF INVESTIGATIONS.

GENERAL WORK.

Alfred H. Brooks, geologist in charge of the division of Alaskan mineral resources, was engaged in office and administrative work until May 17, when he entered the military service as captain of the Corps of Engineers, United States Army, and was assigned to active duty in France, where he is now serving as lieutenant colonel. His time in office in the early part of 1917 was divided as follows: Fifty

days to routine and administrative work, $23\frac{1}{2}$ days to the preparation of the progress report, $3\frac{1}{2}$ days to writing a pamphlet on mineral supplies of Alaska, $6\frac{1}{2}$ days to a memorial of Dr. C. Willard Hayes, 5 days to compilation of mineral statistics of Alaska, $2\frac{1}{2}$ days to the critical reading of manuscript, $5\frac{1}{2}$ days to field plans, 2 days to scientific meetings, $2\frac{1}{2}$ days to study of the physiography of Alaska, and 11 days to matters connected with military service.

The writer has been acting geologist in charge of the Alaska division since May 17. He was engaged in office work till August 1, when he started for Alaska. Two days were spent in Juneau, collecting data on mining developments. The time from August 15 to 21 was spent in the Katalla oil field. The time from August 26 to September 6 was devoted to a field conference with the engineer in charge of the Government coal mines in the Matanuska Valley. A brief visit was then made to the Nenana coal field. He returned to Washington on October 11.

In the office the writer devoted his time to the following work: Forty-seven days to study of notes and preparation of report on the Nenana coal field, 22 days to report on upper Matanuska region, 43 days to compilation of data for use in establishing leasing units in the Nenana coal field, 5 days to preparation of memorandum for the Secretary of the Interior on the Nenana coal field, 13 days to preparation of memorandum for the Secretary of the Interior on the Matanuska coal field, 5 days to proof reading, 2 days to study of Alaska stratigraphy, and 9 days to the Alaska press bulletin.

During the writer's absence in Alaska F. H. Moffit was acting geologist in charge and devoted considerable time to executive work. Since June 11, 1917, most of Mr. Moffit's time has been given to assisting Maj. Bagley in his investigations of airplane mapping, and since November he has devoted himself exclusively to that work.

R. H. Sargent continued the general supervision of the Alaska topographic surveys and map compilation until May 26, when he was furloughed to accept a scientific position abroad. He has since returned to the Survey and is doing topographic work in the Northwestern States.

E. M. Aten continued as office assistant to the acting geologist in charge and assisted in the collection of statistics of production of precious metals in Alaska until July 13, when he went into the military service as captain in the Quartermaster Corps, United States Army. After that date Miss L. M. Graves took up Mr. Aten's administrative duties and T. R. Burch assisted in the collection and compilation of the mineral statistics.

J. W. Bagley's investigations of photo-topographic methods were early recognized as of potential military value. Both he and F. H. Moffit devoted considerable time to this work early in the year and on

June 22 Mr. Bagley received a commission as captain (now major) of engineers. Since that date he has devoted all his time to airplane mapping work. He has been assisted by Mr. Moffit, Capt. C. E. Giffin, and J. B. Mertie.

A systematic investigation of the heavy placer minerals of Alaska was begun by G. L. Harrington and J. B. Mertie, jr., during the year. This work has already yielded results of considerable value. Platinum was found in concentrate from Aloric River in the Kuskokwim Delta and also from Marshall. Tin ore (cassiterite) was found in concentrates from Yentna River in such amount as to indicate that it possibly occurs in commercial quantities. Cassiterite was also found in small quantities in concentrates from Boob Creek in the Tolstoi district, from Willow Creek near Nome, and from Riglagalik River in the Kuskokwim Delta. Scheelite was determined in a number of concentrates from the vicinity of Nome and from Bonanza Creek at the base of Seward Peninsula. These localities are not new but are important as indicating that the mineral may occur in sufficient amount to be a valuable by-product of placer mining. Scheelite was also found at a new locality on Jack Wade Creek.

SOUTHEASTERN ALASKA.

Field work in southeastern Alaska included special investigations of Paleozoic stratigraphy and paleontology by Edwin Kirk, a continuation of the geologic reconnaissance of the Ketchikan district by Theodore Chapin, a reconnaissance of parts of Chichagof Island with special investigations of the nickel deposits by R. M. Overbeck, a reconnaissance of Lituya Bay and special investigations of the iron ores of the Ketchikan district and of mining conditions in the Juneau district by J. B. Mertie, jr., and a continuation of the investigation of water resources by G. H. Canfield.

Studies of the ore deposits and mining developments in the Ketchikan district were continued by Theodore Chapin, who devoted the time from July 10 to 20 and from September 25 to November 4 to this work. Especial attention was given to the copper deposits.

An investigation of the reported occurrence of platinum at Lituya Bay was made by J. B. Mertie, jr., in July. Mr. Mertie also investigated the iron ores of southeastern Alaska in October.

A reconnaissance of the geology and mineral deposits of the Sitka district, with especial reference to the nickel-bearing copper ore on the west side of Chichagof Island, was made by R. M. Overbeck.

The investigation of the water resources of southeastern Alaska, begun in 1915 under a cooperative agreement with the Forest Service, was continued throughout 1917. G. H. Canfield, who had charge of

this work, maintained 17 automatic gages throughout the year. In addition to these gages 3 others were installed in cooperation with individuals and corporations. The results are briefly summarized in another section of this report. This work could not have been carried on without the cordial cooperation of the Forest Service, many members of which have given substantial aid; particular acknowledgment should be made to W. G. Weigle, special agent at Ketchikan, and to Leonard Lundgren, district engineer at Portland, Oreg.

A study of the Paleozoic rocks of southeastern Alaska was assigned to Edwin Kirk in the summer of 1917. He left Washington July 1 and remained in the field until the later part of September studying the stratigraphy and making large collections of fossils from localities in southeastern Alaska.

PRINCE WILLIAM SOUND AND COPPER RIVER REGION.

Mr. B. L. Johnson in 1917 continued his investigations of mining developments in the Prince William Sound region and the eastern part of Kenai Peninsula. He also made a detailed survey of part of the Jack Bay district. Mr. Johnson devoted the time from July 14 to October 19 to this work.

The reconnaissance topographic survey of the Prince William Sound region, which was begun several years ago, was extended eastward by D. C. Witherspoon in 1917. The season's work comprised 1,000 square miles, including the eastern shore line of Prince William Sound from Fidalgo Bay to the entrance of Orca Inlet, which was mapped on a scale of 1:250,000. In addition, Mr. Witherspoon surveyed the eastern end of Hawkins Island.

A brief investigation of the reported nickel ore in the Copper River valley was made by R. M. Overbeck, who devoted a few days in August to this work.

COOK INLET, SUSITNA REGION, AND SOUTHWESTERN ALASKA.

The progress of construction of the Government railroad in Alaska created a demand for information on the geology and mineral resources of the region tributary thereto. S. R. Capps was charged with the investigation of an area tributary to the railroad in the upper Susitna Valley. Between July 1 and September 7 he made geologic reconnaissance surveys covering an area of more than 1,500 miles on a scale of 1:250,000, and also investigated the copper and gold lodes of the western Talkeetna Mountains and of the Willow Creek district.

Investigations of the platinum deposits of the Yentna district and of the chromite deposits of lower Cook Inlet were made by Mr. Mertie.

The sulphur deposits of Makushin and Akun islands and near Stepovak Bay were investigated by A. G. Maddren. Mr. Maddren also made a brief visit to the beach placers on the west side of Kodiak Island. His field work extended from July 21 to September 22.

YUKON REGION.

The work in the Yukon region included special investigations of the tungsten, tin, and platinum deposits of the Fairbanks, Hot Springs, and Ruby districts by Theodore Chapin; a special investigation of platinum deposits in the Tolstoi district by G. L. Harrington; and an examination of the coal along the main line of the railroad west of Nenana River by G. C. Martin. No areal surveys were undertaken.

SEWARD PENINSULA.

Work on the Seward Peninsula included investigations by G. L. Harrington of the gold and platinum placers of the Candle and Koyuk districts, of the placer and lode tin and the graphite of the York district and Imuruk basin, and of the general mining developments. No areal surveys were made.

COLLECTION OF STATISTICS.

The collection of statistics of production of metals in Alaska, begun by the Alaska division in 1905, was continued as usual. Preliminary estimates of mineral production for 1917 were published on January 1, 1918.

PUBLICATIONS.

During 1917 the Survey published 1 bulletin and 1 water-supply paper relating to Alaska. In addition, 2 professional papers and 5 bulletins were in press, and 21 reports, including this volume, were in preparation at the end of the year. Five topographic maps were in press at the end of the year.

REPORTS ISSUED.

BULLETIN 657. The use of the panoramic camera in topographic surveying, with notes on the application of photogrammetry to aerial surveys, by J. W. Bagley.

WATER-SUPPLY PAPER 418. Mineral springs of Alaska, by G. A. Waring.

REPORTS IN PRESS.

PROFESSIONAL PAPER 109. The Canning River region, northern Alaska, by E. DeK. Leffingwell.

PROFESSIONAL PAPER 120-D. The structure and stratigraphy of Gravina and Revillagigedo islands, Alaska, by Theodore Chapin. (Published Aug. 22, 1918.)

BULLETIN 655. The Lake Clark-Central Kuskokwim region, Alaska, by P. S. Smith. (Published Apr. 17, 1918.)

BULLETIN 662. Mineral resources of Alaska, 1916, by Alfred H. Brooks and others. (Published Aug. 1, 1918.)

BULLETIN 667. The Cosna-Nowitna region, Alaska, by H. M. Eakin. (Published Apr. 12, 1918.)

BULLETIN 668. The Nelchina-Susitna region, Alaska, by Theodore Chapin.

BULLETIN 675. The upper Chitina Valley, Alaska, by F. H. Moffit, with a description of the igneous rocks, by R. M. Overbeck. (Published June 26, 1918.)

REPORTS IN PREPARATION.

BULLETIN 664. The Nenana coal field, Alaska, by G. C. Martin.

BULLETIN 682. The marble resources of southeastern Alaska, by E. F. Bur-
chard.

BULLETIN 683. The Anvik-Andreafski region, Alaska, by G. L. Harrington.

BULLETIN 687. The Kantishna region, Alaska, by S. R. Capps.

The lower Kuskokwim region, by A. G. Maddren.

The Kotsina-Kuskulana district, by F. H. Moffit.

The upper Matanuska basin, by G. C. Martin.

Geology of the Glacier Bay and Lituya region, Alaska, by F. E. Wright and
C. W. Wright.

Geology of the region along the international boundary from Porcupine River
to the Arctic Ocean, by A. G. Maddren.

The Porcupine district, Alaska, by H. M. Eakin.

The Yakataga district, Alaska, by A. G. Maddren.

The Mesozoic stratigraphy of Alaska, by G. C. Martin.

The Port Valdez and Jack Bay district, Alaska, by B. L. Johnson.

The Ruby-Kuskokwim region, Alaska, by J. B. Mertie, jr., and G. L. Har-
rington.

The Cretaceous and Tertiary flora of Alaska, by Arthur Hollick.

The Ketchikan district, Alaska, by Theodore Chapin.

The geology and mineral resources of Latouche and Knight Island districts,
Alaska, by B. L. Johnson.

A geologic reconnaissance in the northern part of the Yukon-Tanana region,
Alaska, by Eliot Blackwelder.

The western Talkeetna Mountains, Alaska, by S. R. Capps.

The Juneau district, Alaska, by A. C. Spencer and H. M. Eakin.

TOPOGRAPHIC MAPS IN PRESS.

Lower Matanuska Valley, by R. H. Sargent; scale, 1:62,500; contour inter-
val, 50 feet. Sale edition. (Issued Feb. 28, 1918.)

Reconnaissance map of Cosna-Nowitna region, Alaska, by H. M. Eakin, C. E.
Giffin, and R. B. Oliver; Yukon River from Fort Gibbon to Nowitna River from
Alaska Road Commission; scale, 1:250,000; contour interval, 200 feet. (Issued
April 12, 1918, as Plate I, Bulletin 667.)

Reconnaissance map of Lake Clark-Central Kuskokwim region, Alaska, by R.
H. Sargent, D. C. Witherspoon, and C. E. Giffin; scale, 1:250,000; contour in-
terval, 200 feet. (Published Apr. 17, 1918, as Plate I, Bulletin 655.)

Reconnaissance map of Upper Chitina Valley, Alaska, by International
Boundary Commission, F. H. Moffit, D. C. Witherspoon, and T. G. Gerdine;
scale, 1:250,000; contour interval, 200 feet. (Issued June 26, 1918, as Plate
I, Bulletin 675.)

Juneau and vicinity Alaska, by D. C. Witherspoon, control by U. S. Coast and
Geodetic Survey, D. C. Witherspoon, and Alaska Gastineau Mining Co.; scale,
1:24,000; contour interval, 50 feet. Sale edition. Issued July 27, 1918.)

THE ALASKAN MINING INDUSTRY IN 1917.

By G. C. MARTIN.

GENERAL FEATURES.

The mineral production of Alaska in 1917 is valued at \$40,700,212. This output is less than that for 1916, which was \$48,632,138, but is greater than that of any other year. The decrease is chiefly in copper, production of which fell from 119,602,028 pounds, valued at \$29,484,291, in 1916, to 88,783,400 pounds, valued at \$24,240,598, in 1917. The reduction in the output of copper was due largely to labor troubles, which included a strike at the Kennecott mine and shortage of labor at other mines. The production of gold fell off about \$2,500,000 and is the smallest since 1904. The reduction in the output of gold is due chiefly to curtailment of operations because of the scarcity of labor and the high cost of materials but is also due in part to the disaster at the Treadwell mine and the depletion of some of the richer placers. There was a reduction in the output of silver, which was due to the decrease in production of gold and copper. The value of silver produced in Alaska in 1917 was, however, the greatest in the history of mining in the Territory. The production of lead increased somewhat. The production of tin showed a considerable decrease, although the value of tin produced was greater than ever before. The production of antimony fell to very small proportions, owing to the inability of the producers in the interior of Alaska to compete with the cheaper foreign product. The production of coal was the largest in the history of mining in Alaska, owing to the beginning of commercial mining in the Matanuska field. Tungsten mining continued in the Fairbanks district and the Seward Peninsula on about the same scale as in the preceding year. Petroleum continued to be produced from the single patented claim near Katalla, and the local refinery was operated on about the customary scale. The production of marble and gypsum in southeastern Alaska was somewhat less than in 1916. The year 1917 marks the beginning of the production of chromite in Alaska. The production of platinum, which was begun in 1916, continued on an increased scale. The production of platinum was chiefly from the Chistochina district and from Seward Peninsula, but small amounts

were also produced at other localities, and discoveries of platinum were recorded at many localities in different parts of Alaska. It is believed that these discoveries forecast the beginning of regular platinum production in Alaska, at least on a small scale.

The statistics for the mineral production of Alaska for the last three years are given in the following table. The output of marble, gypsum, petroleum, and certain other substances is given as a single item, because a separate listing might reveal the production of individual properties.

Mineral output of Alaska, 1915, 1916, and 1917.

	1915		1916		1917	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold.....fine ounces..	807,966	\$16,702,144	834,068	\$17,241,713	709,050	\$14,657,353
Silver.....do.....	1,071,782	543,393	1,379,171	907,554	1,239,150	1,021,060
Copper.....pounds..	86,509,312	15,139,129	119,602,028	29,484,291	88,793,400	24,240,598
Tin, metallic.....tons..	102	78,846	139	121,000	100	123,300
Antimony, crude ore.....do..	833	74,000	1,458	134,000	165	28,000
Lead.....short tons..	437	41,118	820	109,120	852	116,584
Coal.....do.....	1,400	3,300	12,200	55,000	53,955	265,317
Marble, gypsum, petroleum, platinum, tungsten, chromi- um, and graphite.....		^a 272,299		^b 579,500		218,000
		32,854,229		48,632,178		40,700,212

^a No platinum, chromium, or tungsten included.

^b No chromium included.

Regular mining may be said to have begun in Alaska in 1880, when the Juneau gold placers were first exploited. It is estimated that since that time mineral wealth has been produced to the value of more than \$390,000,000. This output, by years and substances, is summarized in the following table:

Value of total mineral production of Alaska, 1880-1917.

By years.			By substances.		
1880-1890.....	\$4,686,714	1904.....	\$9,569,715	Gold.....	\$292,758,009
1891.....	916,920	1905.....	16,480,762	Silver.....	4,750,525
1892.....	1,098,400	1906.....	23,378,428	Copper.....	88,644,470
1893.....	1,051,610	1907.....	20,850,235	Tin.....	703,152
1894.....	1,312,567	1908.....	20,145,632	Antimony.....	236,000
1895.....	2,388,042	1909.....	21,146,953	Lead.....	363,964
1896.....	2,981,877	1910.....	16,887,244	Coal.....	686,150
1897.....	2,540,401	1911.....	20,691,241	Marble, gypsum, pe- troleum, etc.....	2,143,861
1898.....	2,587,815	1912.....	22,536,849		
1899.....	5,706,226	1913.....	19,476,356		
1900.....	8,241,734	1914.....	19,065,666		
1901.....	7,010,898	1915.....	32,854,229		
1902.....	8,403,153	1916.....	48,632,212		
1903.....	8,944,134	1917.....	40,700,205		
			390,286,131		

GOLD AND SILVER.

The following table gives an estimate of the total production of gold and silver since the beginning of mining in 1880. For the earlier years, the figures, especially for the silver, are probably far from being correct, but they are based on the best information now available.

Gold and silver produced in Alaska, 1880-1917.

Year.	Gold.		Silver.	
	Quantity (fine ounces).	Value.	Quantity (fine ounces).	Commer- cial value.
1880.....	967	\$20,000		
1881.....	1,935	40,000		
1882.....	7,256	150,000		
1883.....	14,561	301,000	10,320	\$11,146
1884.....	9,724	201,000		
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	22,281	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	907,554
1917.....	709,050	14,657,353	1,239,150	1,021,060
	14,162,169	292,758,009	7,541,519	4,750,525

The subjoined table gives an estimate, based on the best available data, of the source of the gold and silver produced in Alaska since mining began in 1880. About \$65,100,000 worth of gold, or nearly one-third of the total estimated output, was produced before 1905, and there is but scant information about its source. For the period since that time fairly complete statistical returns are available, and it is probable that the figures presented in the following table are sufficiently accurate to be valuable. The figures given for the silver recovered from placer gold and from siliceous ores are probably less accurate than those for the gold. Copper mining did not begin in Alaska until 1901, and the figures for gold and silver derived from

this industry, as now presented, are therefore a close approximation to the actual output.

Estimated sources of gold and silver produced in Alaska, 1880-1917.

	Gold.		Silver.	
	Quantity.	Value.	Quantity.	Value
	<i>Fine ounces.</i>		<i>Fine ounces.</i>	
Siliceous ores ^a	4,066,033	\$84,052,353	1,229,825	\$841,332
Copper ores.....	75,593	1,562,664	4,608,461	2,947,429
Placers.....	10,020,543	207,142,992	1,703,323	961,764
	14,162,169	292,758,009	7,541,609	4,750,525

^a Including small amounts of lead ore.

The above table shows that about 28½ per cent of the total gold production of Alaska has been obtained from the auriferous lode mines (siliceous ores). In 1917 the lode-gold production was 31 per cent; in 1916, 38 per cent; in 1915, 37 per cent; in 1914, 32 per cent; in 1913, 31.6 per cent; and in 1912, 29 per cent. In the following table the production of precious metals in 1917 has been distributed as to sources:

Sources of gold and silver produced in Alaska, 1917.

	Total quantity.	Gold.		Silver.	
		Quantity.	Value.	Quantity.	Value
	<i>Tons.</i>	<i>Fine ounces.</i>		<i>Fine ounces.</i>	
Siliceous ores.....	3,414,660	221,507	\$4,578,930	131,503	\$108,358
Copper ores.....	659,951	12,829	265,223	1,040,185	857,113
Placers.....		474,559	9,810,000	64,410	53,074
Lead and lead-copper ores.....	46	155	3,200	3,052	2,515
	4,074,657	709,050	14,657,353	1,239,150	1,021,060

Thirty-one gold-lode mines were operated in 1917. There was also a production from nine prospects or small mines that were not in regular operation. Twenty-nine mines were operated in 1916. The value of the lode gold output decreased from \$5,912,736 in 1916 to \$4,581,453 in 1917. Southeastern Alaska, especially the Juneau district, is still the only center of large quartz-mining developments in the Territory. Next in importance is the Willow Creek lode district. There was also considerable gold lode mining on Prince William Sound. The production in the Fairbanks district increased slightly, but lode mine owners of Fairbanks are still awaiting the cheapening of operating costs, especially of fuel, which will be brought about by the Government railroad. Of the producing mines 10 were in southeastern Alaska, 3 on Prince William Sound, 4 on Kenai Peninsula, 5 in the Willow Creek district, and 9 in the Fairbanks district. In 1917 the average value of the gold and silver con-

tents for all siliceous ores mined was \$1.37 a ton; the average for 1916 was \$1.70 a ton. These averages reflect the dominance in the total lode production of the large tonnage produced from the low-grade ores of the Juneau district.

The production by districts of gold and silver in 1917 from gold lode mines, including small amounts from lead-silver mines which can not be given separately without disclosing individual productions, is given in the following table:

Production of gold and silver from gold lode mines by districts, 1917.

District.	Mines operated.	Ore mined (short tons).	Gold.		Silver.		Average value of ore in gold and silver.
			Fine ounces.	Value.	Fine ounces.	Value.	
Southeastern Alaska.....	10	3,400,120	205,107	\$4,239,914	129,691	\$106,865	\$1.28
Prince William Sound.....	a 3	5,350	4,509	93,208	697	575	17.53
Kenai Peninsula.....	4	140	223	4,614	124	102	33.68
Willow Creek.....	5	7,885	9,466	195,662	713	588	24.89
Fairbanks district b.....	c 9	1,200	2,311	47,781	2,217	1,827	41.34
Seward Peninsula d.....	(e)	5	13	274	145	119	78.60
	13	3,414,700	221,629	4,581,453	133,587	110,076	1.37

a Also 5 prospects.

b Includes some lead ore.

c Also 2 prospects.

d Lead ore.

e One prospect on Seward Peninsula; also 1 shipment from an unknown locality.

The value of the output of placer gold in Alaska in 1917 was about \$9,810,000; in 1916 it was \$11,140,000. The decrease was due chiefly to restriction of operations because of the high cost of supplies and the scarcity of labor. These adverse conditions were felt in all parts of Alaska and everywhere tended to reduce the output of gold. Production was increased only where local conditions permitted an expansion of the industry in spite of increased costs. Such conditions existed in some of the newly discovered camps, and consequently there was an increase in the output of placer gold in the Tolovana, Marshall, Tolstoi, and Koyuk or Dime Creek districts. The production of the Ruby district increased slightly, owing to the very successful operation of the Greenstone dredge. There was also an apparent increase in the output of the Kuskokwim region, but this may be due to underestimates of the production of the previous year.

It is estimated that about 610 placer mines were operated in the summer of 1917 and 200 during the previous winter, but many for only a part of the season. About 3,550 men were engaged in productive placer mining in the summer and 950 in the winter. In addition, several hundred men were engaged in prospecting or other nonproductive work relating to placer mining. The only new placer-bearing areas discovered during 1917 were in the Kuskokwim region, and these have not as yet made any large production.

The following table shows approximately the total bulk of gravel mined annually and the value of the gold recovered per cubic yard. The table is based in part on returns made by placer mine operators and in part on certain other information which is not available this year. The figures for 1917 are based on an assumption that the ratio of the recovery per cubic yard for the mines which supplied complete information to the recovery per cubic yard for all mines is the same as in 1916. Although the table is thus only approximately correct, the amounts given are probably near the true figures.

Estimated amount of gravel sluiced in Alaskan placer mines and value of gold recovered, 1908-1917.

Year.	Total quantity of gravel.	Value of gold recovered per cubic yard.	Year.	Total quantity of gravel.	Value of gold recovered per cubic yard.
	<i>Cubic yards.</i>			<i>Cubic yards.</i>	
1908.....	4,275,000	\$3.74	1913.....	6,800,000	\$1.57
1909.....	4,418,000	3.66	1914.....	8,500,000	1.26
1910.....	4,036,000	2.97	1915.....	8,100,000	1.29
1911.....	5,790,000	2.17	1916.....	7,100,000	1.57
1912.....	7,050,000	1.70	1917.....	5,900,000	1.68

The above table shows that from 1908 to 1914 there was a decline in the average gold content of the gravels mined. This decline reflects the improved methods of placer mining that have been introduced, especially in the use of dredges. If data were available on the average recovery of gold previous to 1908 a far greater decline would be noted. The rise of the average recovery from 1914 to 1917 is due largely to the fact that the Alaskan dredges were for the most part working on far richer placers. This change is also influenced by the fact that in 1916 and 1917 a larger percentage of the placer gold came from the rich deposits of the newer districts, where recoveries of \$7 to \$20 a cubic yard are not uncommon. In the final analysis the movement of the miners away from the lower-grade placers, made evident by the average recoveries for 1915 to 1917, is the result of the present economic conditions, which affect gold mining more adversely than most other industries.

Thirty-six gold dredges were operated in Alaska in 1917, two more than in 1916. Twenty-eight dredges were in Seward Peninsula, three in the Iditarod, and one each in the Ruby, Fairbanks, Circle, Forty-mile, and Yentna districts. These dredges produced about \$2,500,000 worth of gold and handled about 3,700,000 cubic yards of gravel. In 1916 the 34 dredges handled about 3,900,000 cubic yards of gravel and recovered gold worth \$2,679,000. The average recovery of gold per cubic yard was about 67½ cents in 1917 and 69 cents in 1916. The gold dredges of Seward Peninsula made an average recovery of 49 cents a cubic yard in 1917 and 53 cents in 1916. The dredges of the Alaska Yukon districts are working on placers of relatively high

gold tenor. The value of gold recovered per cubic yard in 1917 was about 94 cents; in 1916, about 85 cents.

Though dredges were built for use in the Alaska Yukon as early as 1898 and at Nome in 1900, this method of placer mining did not reach a profitable stage until 1903, when two small dredges were successfully operated in Seward Peninsula. Dredging began in the Fortymile district in 1907; in the Iditarod, Birch Creek, and Fairbanks districts in 1912; and in the Yentna district in 1916. Up to the end of 1917 gold to the value of \$17,610,000 has been mined by dredges. The distribution of this output by years is shown in the following table:

Estimate of gold produced from dredge mining in Alaska, 1903-1917.

Year.	Number of dredges operated.	Value of gold output.	Year.	Number of dredges operated.	Value of gold output.
1903	2	\$20,000	1912	38	\$2,200,000
1904	3	25,000	1913	36	2,200,000
1905	3	40,000	1914	42	2,350,000
1906	3	120,000	1915	35	2,330,000
1907	4	250,000	1916	34	2,679,000
1908	4	171,000	1917	36	2,500,000
1909	14	425,000			
1910	18	800,000			17,610,000
1911	27	1,500,000			

COPPER.

The copper production of Alaska in 1917 was about 88,793,400 pounds, valued at about \$24,240,598. This is less than the production in 1916, which was 119,854,839 pounds, valued at \$29,484,291, but is greater than the production of any other year. The reduction in total output for the year was due largely to scarcity of labor and to a strike at the Kennecott-Bonanza mine. During the year 17 copper mines were operated, compared with 18 in 1916. Of these mines seven are in Ketchikan district, seven in the Prince William Sound district, and three in the Chitina district. Small shipments of copper were also made from nine prospects or mines not in regular operation. The output of the Alaska copper mines by districts is shown in the following table:

Output of Alaska copper mines by districts in 1917.

	Mines.	Ore (tons).	Copper.		Gold.		Silver.	
			Pounds.	Value.	Fine ounces.	Value.	Fine ounces.	Value.
Ketchikan district.....	a 7	41,060	2,646,553	\$722,509	2,338	\$48,337	20,500	\$18,891
Chitina district.....	b 3	287,541	70,587,110	19,270,281	.....	6	887,880	731,614
Prince William Sound c....	d 7	351,356	15,559,737	4,247,808	10,524	217,557	132,773	109,405
.....	.....	659,957	88,793,400	24,240,598	12,862	265,900	1,041,153	857,910

a Also small shipments from two prospects.

b Also a small amount of placer copper and small shipments from four prospects.

c Including a small amount from Cook Inlet.

d Also small shipments from three prospects.

The average copper content of the ores mined in 1917 was 6.4 per cent. The ores also yielded an average of \$0.382 in gold and \$1.233 in silver. The average yield for 1916 was 9.7 per cent of copper and \$1.60 to the ton in gold and silver. The decrease in the content of copper for 1917 was due to the smaller proportion of high-grade Kennecott ores in the total production. The following table shows the total production of copper in Alaska by years:

Copper produced in Alaska, 1880-1917.

Year.	Ore mined.	Copper produced.	
		Quantity.	Value.
	<i>Tons.</i>	<i>Pounds.</i>	
1880.....		3,933	\$826
1881-1900.....			
1901.....		250,000	40,000
1902.....		360,000	41,400
1903.....		1,200,000	156,000
1904.....		2,043,586	275,678
1905.....	52,199	4,805,236	749,617
1906.....	105,729	5,871,811	1,133,260
1907.....	98,927	6,308,786	1,261,757
1908.....	51,509	4,585,362	605,267
1909.....	34,669	4,124,705	536,211
1910.....	39,365	4,241,689	538,695
1911.....	68,975	27,267,878	3,408,485
1912.....	93,452	29,230,491	4,823,031
1913.....	135,756	21,659,958	3,357,293
1914.....	153,605	21,450,628	2,852,934
1915.....	369,600	86,509,312	15,139,129
1916.....	617,264	119,654,839	29,484,291
1917.....	659,957	88,793,400	24,240,598
	2,521,007	428,561,614	88,644,470

^a Estimated.

Among the noteworthy features of copper mining in Alaska in 1917 was the continued enormous output of the Kennecott-Bonanza mine in the Chitina district, which, as in previous years, overshadowed all other operations. The total output of the coastal mines increased in 1917, largely owing to the increased production of the Beatson mine, but the aggregate production of the so-called independent mines was also larger than in 1916 in spite of the shortage of labor and ships. The heavy production from the smaller low-grade mines is, of course, due to the high price of copper and will not be maintained by all of them. However, some of the mines which are now being placed on a productive basis or on an enlarged capacity under the stimulus of high prices will probably be able to maintain their output with copper at a lower price, and the copper industry of Alaska will in general continue to advance, although there will doubtless be temporary setbacks. Work preparatory to the production of copper was continued energetically on several of

the nonproducing mines and prospects in all three of the Alaska copper districts. No important new discoveries were reported.

LEAD.

The production of lead in Alaska in 1917 is estimated at 852 tons, valued at \$146,584. This is the largest production in the history of mining in Alaska. The production of 1916, which was larger than that of any previous year, was 820 tons, valued at \$113,160. Lead in Alaska is still, as in past years, derived chiefly from the concentrates of the gold mines at Juneau. The production of lead in 1917 includes small amounts derived from the galena ores of the Fairbanks district and Seward Peninsula and from copper-lead ores of southeastern Alaska. Though silver-lead ores are found in many parts of Alaska, most of the deposits have not yet been opened on a commercial basis. The following table shows the production of lead in Alaska, so far as it can be determined from available data:

Estimate of lead produced in Alaska, 1892-1917.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Tons.</i>			<i>Tons.</i>	
1892	30	\$2,400	1906	30	\$3,420
1893	40	3,040	1907	30	3,180
1894	35	2,310	1908	40	3,360
1895	20	1,320	1909	69	5,934
1896	30	1,800	1910	75	6,600
1897	30	2,160	1911	51	4,590
1898	30	2,240	1912	45	4,050
1899	35	3,150	1913	6	588
1900	40	3,440	1914	28	1,344
1901	40	3,440	1915	437	41,118
1902	30	2,460	1916	820	113,160
1903	30	2,520	1917	852	146,584
1904	30	2,580			
1905	30	2,620		2,933	369,348

TIN.

The Alaskan mines produced about 100 tons of metallic tin, valued at \$123,300, in 1917, compared with 139 tons, valued at \$121,000, in 1916. The decrease was due in part to unusually heavy rains, which interfered with the work of the Seward Peninsula dredges, and in part to the cessation of large gold-mining operations in the Hot Springs district on account of the high cost and scarcity of supplies and labor. Not all of the tin ore mined in 1917 was shipped, for Knopf¹ estimates that the ore mined and shipped in 1917 yielded about 80 tons of metallic tin. This amount is considerably smaller than that given by the collector of customs, who states that 219 long tons of tin ore, containing 219,894 pounds (about 110 short tons) of

¹ Knopf, Adolph, U. S. Geol. Survey Mineral Resources, 1917, pt. 1, p. 63, 1919.

metallic tin, was shipped during 1917. The difference is probably due to the fact that a large amount of ore mined in 1916 was not shipped till 1917. The following table shows the production of tin in Alaska since 1902:

Tin produced in Alaska, 1902-1917.

Year	Quantity.	Value	Year.	Quantity.	Value.
	<i>Tons.</i>			<i>Tons.</i>	
1902.....	15	\$8,000	1911.....	61	\$52,798
1903.....	25	14,000	1912.....	130	96,000
1904.....	14	8,000	1913.....	69	44,103
1905.....	6	4,000	1914.....	104	60,560
1906.....	34	38,640	1915.....	102	78,846
1907.....	22	10,752	1916.....	139	121,000
1908.....	25	15,180	1917.....	100	123,300
1909.....	11	7,638			
1910.....	10	8,335		867	703,152

Most of the tin ore mined in 1917 came from the placers of the York district, Seward Peninsula, where two dredges and some sluicing yielded about 146 tons of tin ore. The gold placer mines of the Hot Springs district yielded about 25 tons of stream tin.

Some development work was done on the tin lode claims of the York district, but no ore was milled or shipped. In the Hot Springs district there appears to be a considerable amount of stream tin in the old tailings and in the unworked ground. Prospecting in 1917 showed that both gold and stream tin occur in the basin of Sullivan Creek, considerably below the area which has been mined. Prospecting on Midnight Creek in the Ruby district has shown the presence of tin at several places.

The systematic examination of placer concentrates by the United States Geological Survey has shown that tin ore (cassiterite) exists in considerable amounts and possibly in commercial quantities in the placers of the Yentna district. This locality is a new one for tin ore and is the first at which tin ore has been authentically reported south of the Alaska Range. Cassiterite was also found in concentrates from Boob Creek in the Tolstoi district, from Willow Creek near Nome, and from Riglagalik River in the Kuskokwim Delta. The occurrence on Boob Creek possibly indicates an extension of the previously known area that contains tin in the Ruby-Poorman district.

TUNGSTEN.

The production of tungsten in Alaska in 1917 is estimated at about 28 tons of scheelite concentrates valued at about \$45,000. The Fairbanks district and Seward Peninsula were the principal producers of tungsten in Alaska in 1917. In the Fairbanks district two tungsten mines are in course of development. At one of these mines one

unit of a 75-ton mill is in operation and late in the summer was turning out several hundred pounds of scheelite concentrates daily. At the other mine a similar mill was in course of construction. Underground work was in progress at both mines. The present indications give promise of a large increase in the production of tungsten in the Fairbanks district. In Seward Peninsula tungsten was produced principally by sluicing the residual scheelite-bearing lode material in Sophie Gulch. Smaller quantities were recovered as the result of placer mining at other localities.

As a result of the examination of placer concentrates by the United States Geological Survey, scheelite was determined in a number of concentrates from the vicinity of Nome and from Bonanza Creek at the base of Seward Peninsula. These localities are not new but are nevertheless of importance, as there appears to be a possibility of the production of scheelite as a valuable by-product of placer gold mining. A new locality, on Jack Wade Creek, in the Fortymile district, was found for this mineral.

ANTIMONY.

The Alaska output of antimony in 1917 was about 165 tons of crude ore worth about \$28,000. The entire output came from the Fairbanks district and part of it was derived from reworking of old tailings.

Production of antimony in Alaska, 1915-1917.

Year.	Quantity of crude ore.	Value.
	<i>Tons.</i>	
1915.....	833	\$74,000
1916.....	1,458	134,000
1917.....	165	28,000
	2,456	236,000

PLATINUM.

It is estimated that the output of platinum in Alaska in 1917 was about 81 ounces of crude platinum valued at about \$5,500. The largest productions were from Dime Creek on Seward Peninsula, from Boob Creek in the Tolstoi district, and from Slate Creek in the Chistochina district. Small amounts were produced from Sweepstakes Creek in Seward Peninsula and from the beach placers of Kodiak Island.

Platinum is proving to be very widely distributed in Alaska. In addition to the localities at which it has been previously recorded,¹ it has been found as a result of the systematic investigation of placer concentrates by the Geological Survey in concentrates from Aloric

¹ U. S. Geol. Survey Bull. 662, pp. 21-25, 1918; U. S. Geol. Survey Bull. 666-P, p. 8, 1917.

River in the Kuskokwim Delta and from the Marshall district. It has also been reported from the placers of Anvik River and of Valdez Creek, but these reports have not been confirmed.

CHROMITE.

The first production of chromite in Alaska was in 1917, when shipments were made from Port Chatham near the lower end of Cook Inlet. The Cook Inlet deposits have been known¹ for a number of years, but were reexamined in 1917 by J. B. Mertie, jr.,² who has written a paper on the subject which appears elsewhere in this volume.

NICKEL.

Nickel ore has been reported at three localities in Alaska—on the west coast of Chichagof Island, near Copper River, and on Knight Island, Prince William Sound. The deposits on Chichagof Island and near Copper River were examined in the summer of 1917 by R. M. Overbeck,³ who has written an account which appears elsewhere in this volume. A brief statement of the results of that examination follows:

The nickel deposits of Chichagof Island are situated on the west coast of the island about 3 miles northwest of Pinta Bay, or about 65 miles northwest of Sitka. The developments consisted in 1917 of a 180-foot shaft, with 155 feet of drifts at the 80 and 180 foot levels, and of several prospect holes.

The ore occurs in and near the margin of a mass of hornblende gabbro or norite which is intrusive into quartz-mica schist. This contact is parallel to the shore. The ore is exposed in two outcrops about half a mile apart. A shaft was sunk at the more northerly of these outcrops. There is a third outcrop about half a mile farther north, where a mass of limonite is believed to be the weathered capping of the ore. These outcrops form irregular areas, about 70 feet in maximum diameter, projecting somewhat above the surrounding surface. At several other places the ore minerals were seen to be disseminated in small amounts through the country rock.

The ore contains copper and nickel, the most abundant sulphide minerals being pyrrhotite, chalcopyrite, and pentlandite. Pentlandite is an iron-nickel sulphide, (FeNi)S, containing 22 per cent of nickel. The minerals in the ore include also a small amount of niccolite, which is an arsenide of nickel containing about 43.9 per cent of nickel. Two selected samples of ore from the 80-foot level contain 4.68 and 3.93 per cent of nickel and a trace of cobalt.

The number, size, and shape of the ore bodies have not been determined. The only opportunity for underground observation in 1917 was in the 80-foot level at the center outcrop. The shaft is in igneous rock that is free from ore

¹ Grant, U. S., The southeastern coast of Kenai Peninsula: U. S. Geol. Survey Bull. 587, pp. 237-238, 1915.

² Mertie, J. B., jr., Chromite deposits in Alaska: U. S. Geol. Survey Press Bull. 361, p. 1, April, 1918.

³ Overbeck, R. M., Nickel in Alaska: U. S. Geol. Survey Press Bull. 376, p. 2, August, 1918.

minerals. The drift for about 30 feet from the shaft is also in barren hornblende gabbro, but the last 30 feet of the drift is in massive ore. At the face of the drift there are some masses of barren rock, but the drill holes in the face are apparently in sulphides. There has been some faulting at this level, but its extent is not known. The drift at the 180-foot level could not be reached, but it is said to be about 80 feet long and to reveal ore which has apparently been somewhat broken up by faulting.

The three outcrops described above apparently have no surface connection and may have no connection underground. They may possibly be the exposures of a single continuous ore body, but they are more likely to be outcrops of separate ore bodies that lie in a mineralized zone along the intrusive contact. This zone probably contains other ore bodies that do not show at the surface.

Neither the outcrops nor the underground workings are of sufficient extent to permit any reliable estimate of the amount of ore that may be present at this locality. Ore bodies of this kind are generally very irregular. The amount of ore shown in the present workings therefore does not justify large investments in facilities for mining, ore treatment, or shipping. The amount of ore in sight and the geologic conditions at the locality do, however, encourage the hope that workable ore bodies will be developed, and justify the expenditure of a moderate amount of money in blocking out the known ore body and in the search for other ore bodies. This search should include the thorough prospecting of the entire area along the contact of the intrusive rock with the schist. It is believed that diamond drilling near the known outcrops, and at the localities where disseminated ore is seen, may reveal additional ore bodies that do not reach the surface.

The Copper River nickel locality is situated near the headwaters of Canyon Creek about 13 miles east of Copper River opposite Mile 121 on the Copper River & Northwestern Railroad at an altitude of more than 4,000 feet. Mining claims have been located on the outcrops of basic dikes which cut the schists, but only a little underground work has been done. Pyrrhotite and chalcopyrite are localized at a few places, but there is no evidence of extensive mineralization. The amount of ore can not be estimated on account of the small amount of underground work and the fact that at one locality, at least, the ore body has been faulted. A selected specimen of ore contains 7.23 per cent nickel and a trace of cobalt, but most of the known ore is believed to be of much lower grade.

A nickel deposit is said to have been discovered on Knight Island, Prince William Sound. It is reported that this deposit was being prospected with a diamond drill in the summer of 1917, but the locality has not been visited by any member of the Geological Survey and no authentic information is available.

MOLYBDENUM.

No molybdenum has yet been produced from Alaska, but operations preparatory to mining were undertaken in 1917 at a molybdenite-bearing lode near Shakan on the west coast of Prince of Wales Island, at the molybdenite prospect 9 miles north of Skagway, and at a molybdenite deposit on Reid Creek, a tributary to Little Susitna River in the Willow Creek district. A molybdenite deposit is reported on Ptarmigan Creek, a tributary to the Dry Delta about 50 miles above the Tanana. An occurrence of molybdenite on Healy River is described by Theodore Chapin elsewhere in this volume.

COAL MINING.

The production of coal in Alaska in 1917 was 53,955 tons, valued at about \$265,317. This production was by far the largest in the history of coal mining in Alaska, and it probably marks the beginning of coal mining on a moderate but permanent commercial scale. The major part of the production was derived from the Matanuska coal field, especially from the Eska Creek mines, which were opened under private auspices in 1916 but were taken over and operated by the Alaskan Engineering Commission in 1917. The Matanuska branch of the Government railroad was completed late in the fall of 1917, which rendered the coal on Chickaloon River available for exploitation. The coal on Chickaloon River is being opened by the Alaskan Engineering Commission. A large amount of underground work must be done before mining can be attempted on a large scale, but small shipments of coal obtained in the course of development of the mines were made late in 1917. A small mine on Moose Creek was operated under a mining permit throughout the year, and work preparatory to mining was undertaken by private lessees on Moose Creek and near Chickaloon River. A more extended account of mining in the Matanuska field is given elsewhere in this volume.

The lignite fields on Cook Inlet rank next to the Matanuska coal fields in point of production for 1917. A considerable quantity of lignite that was mined near Bluff Point was shipped to towns on Cook Inlet for local consumption. A lignite mine on Cache Creek in the Yentna district was operated during part of the year in order to supply fuel for a gold dredge.

Steps preparatory to opening the Nenana coal field were in progress throughout the year. The Government railroad was being extended south toward this field from Nenana on Tanana River. The more accessible coal lands in the Nenana field were offered for leasing early in 1918.

There was apparently no coal mining in the Bering River field during 1917. A railroad under construction from the east shore of Controller Bay to a patented coal claim in the eastern part of Bering River field is reported to be nearing completion. No leases had been granted in the Bering River field up to the close of 1917, but two claims have been patented, and it is said that one application for patent is still pending.

The following table gives the estimated production of coal in Alaska since 1888. The production for 1888 to 1896 is estimated from the best data available but is only approximate. The figures for 1897 to 1917 are based for the most part on data supplied by operators. Most of the coal mined before 1916 was lignite. There was a small production of bituminous coal from the west end of the

Bering River field in 1906. The table does not include 855 tons of coal mined in the Bering River field in 1912 and 1,100 tons mined in the Matanuska field in 1913 for test by the United States Navy.

Production of coal in Alaska, 1888 to 1917.

Year.	Quantity.	Value.	Year.	Quantity.	Value.
	<i>Short tons.</i>			<i>Short tons.</i>	
1888-1896.....	6,000	\$84,000	1908.....	3,107	\$14,810
1897.....	2,000	28,000	1909.....	2,800	12,300
1898.....	1,000	14,000	1910.....	1,000	15,000
1899.....	1,200	16,800	1911.....	900	9,300
1900.....	1,200	16,800	1912.....	355	2,840
1901.....	1,300	15,600	1913.....	2,300	13,800
1902.....	2,212	19,048	1914.....		
1903.....	1,447	9,782	1915.....	1,400	3,300
1904.....	1,694	7,225	1916.....	13,073	52,317
1905.....	3,774	13,250	1917.....	53,955	265,317
1906.....	5,541	17,974			
1907.....	10,139	53,600		116,397	685,063

The following table shows the coal consumption of Alaska, including both local production and imports since 1899. Most of the coal shipped to Alaska was bituminous, but a little was anthracite:

Coal consumed in Alaska, 1899-1917, in short tons.

Year.	Produced in Alaska, chiefly sub-bituminous and lignite.	Imported from States, chiefly bituminous from Washington.	Total foreign coal, chiefly bituminous from British Columbia.	Total coal consumed.
1899.....	1,200	10,000	a 50,120	61,320
1900.....	1,200	15,048	a 56,623	72,871
1901.....	1,300	24,000	a 77,674	102,974
1902.....	2,212	40,000	a 68,363	110,575
1903.....	1,447	64,626	a 60,605	126,678
1904.....	1,694	36,689	a 76,815	115,198
1905.....	3,774	67,713	a 72,567	144,054
1906.....	5,541	69,493	a 47,590	122,624
1907.....	10,139	46,246	a 88,596	144,981
1908.....	3,107	23,893	a 72,831	99,831
1909.....	2,800	33,112	a 74,316	110,228
1910.....	1,000	32,138	a 73,904	107,042
1911.....	900	32,255	a 88,573	121,728
1912.....	355	27,767	a 56,804	87,926
1913.....	2,300	61,666	a 60,600	124,566
1914.....		41,509	46,153	87,662
1915.....	1,400	46,329	29,457	77,186
1916.....	13,073	44,934	53,672	111,679
1917.....	53,955	58,116	56,589	168,660
	107,397	775,534	1,214,852	2,097,783

a By fiscal years ending June 30.

It is too early to forecast the future of coal mining in Alaska, especially in the Bering River and Matanuska fields. If future discoveries in the Matanuska field reveal any considerable extension of the known coal lands, especially the lands containing high-grade coal, the areas of which as now known are very small; if it be found that the greatly disturbed bituminous coals of the Bering River and Matanuska fields can be mined at a moderate cost; if the Matanuska or Bering River coal proves to be suitable for the manufacture of coke; or if it is found that there is a supply of coal suitable for the

Navy in the Matanuska or Bering River fields and if the Navy requires coal rather than oil—then there will probably be a rapid expansion of coal mining in one or both of these fields. The facts now known indicate, however, that there may be considerable difficulty in producing and in selling any large amount of coal at a profit, and that mining in both these fields will probably proceed at a moderate rate. If the general public still retains the extravagant and entirely false impression that was created by sensational magazines a few years ago as to the amount and value of Alaska coal it should be prepared for disappointment.

The future of the Nenana coal field is more definite. This field contains a large amount of lignite of fair grade that can be mined at a moderate cost. The market is reasonably certain. Although this coal is not suitable for export, it will furnish a valuable and much-needed fuel in portions of interior Alaska that are now dependent on a scanty and expensive supply of wood. The coal of the Nenana field will probably be used as locomotive fuel on the Government railroad, for power and thawing at the mines in the Tanana Valley, as domestic fuel in the Tanana Valley, and as fuel on local Tanana River boats and possibly on some of the Yukon steamers. The coal of the Nenana field should, if possible, be used on the greater part of the railroad, rather than the higher-grade Matanuska coal, because the heavy freight traffic will be northbound, leaving southbound empties available for hauling coal. The Nenana coal field is nearer the summit of the Alaska Range than any known coal south of the divide. It seems reasonable to expect that a coal-mining industry of moderate size will begin in this field in the near future. The growth of coal mining in this field will be dependent on the growth of other industries. Gold mining, coal mining, and agriculture in the Tanana Valley should be mutually interdependent, and each industry, through the stimulating effect of the others, should expand at a gradually accelerating rate.

The possibility of the growth of an important coal-mining industry on Cook Inlet should not be overlooked. There is a large amount of lignite on Cook Inlet, and it is of fair quality, being of about the same grade as the lignite of the Nenana field. Much of it is situated on waters that are navigable throughout the year, and it lies in beds that are but slightly folded. Its mining and shipment should, therefore, be relatively cheap. The possibility of coal mining on Cook Inlet on a large scale depends, however, on the success of experiments in the treatment of lignite in order to render it available for purposes for which the higher-grade coals are now required. If lignites can, at a moderate cost, be rendered suitable for such purposes the lignites of Cook Inlet must be regarded as one of the most important factors in the Alaska coal situation.

PETROLEUM.

The production of petroleum from the only oil claim patented in Alaska, in the Katalla district, was increased somewhat in 1917 by cleaning out the old wells. The Katalla refinery was operated as usual. Two new wells were drilled, and drilling was continued at a well started in a previous year, but no new productive wells were obtained. Some of the oil claims in the Katalla field were surveyed preparatory to application for patent.

The consumption of petroleum in Alaska is indicated approximately by the imports, which are shown in the following table:

Petroleum products shipped to Alaska from other parts of the United States, 1905-1917, in gallons.^a

Year.	Oil used for fuel, 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
	194,785,913	21,511,481	7,909,276	2,260,417

^a Compiled from Monthly Summary of Foreign Commerce of the United States, 1905 to 1917, Bureau of Foreign and Domestic Commerce.

STRUCTURAL MATERIAL, ETC.

One marble quarry and one gypsum mine were operated in southeastern Alaska in 1917. No barite was shipped. Work was continued on two graphite deposits in Seward Peninsula, and considerable graphite was mined and shipped. A brickyard was operated at Anchorage, and it is reported that one is being operated at Seward. A small limestone quarry and kiln and a deposit of marl near Anchorage were worked and made small productions of lime.

REVIEW BY DISTRICTS.

The following review summarizes briefly the principal developments in all the districts. Many of the districts were not visited by members of the Geological Survey in 1917 and some operators failed to make reports, so that the information at hand about mining in some of the districts is incomplete and scanty. The space here devoted to any district is therefore not necessarily an indication of its relative importance. The arrangement is geographic, from south to north.

SOUTHEASTERN ALASKA.

The mineral production of southeastern Alaska in 1917 was derived from 10 gold lode mines, 8 copper mines, 3 placer mines, 1 gypsum mine, and 1 marble quarry. The value of the mineral production fell from \$7,032,010 in 1916 to \$5,407,902 in 1917. The value of the different products is shown in the following table:

Mineral production of southeastern Alaska, 1917.

	Gold lode mines.		Copper mines.		Placer mines.		Value of products of all mines and quarries.
	Quantity (fine ounces).	Value.	Quantity (fine ounces).	Value.	Quantity (fine ounces).	Value.	
Gold.....	205, 107	\$4, 239, 914	2, 338	\$48, 337	1, 790	\$37, 000	\$4, 825, 251
Silver.....	129, 691	106, 825	20, 500	16, 891	133	109	123, 825
			<i>Pounds.</i>				
Copper.....			2, 646, 553	722, 509			721, 686
Lead, marble, gypsum, etc.....							236, 317
							5, 407, 902

The largest mining operations, as in previous years, were at the gold mines in the Juneau district. All the productive copper mining of southeastern Alaska was in the Ketchikan district. Placer mining was limited to the Porcupine district and to small beach operations at Yakataga and Lituya Bay.

The principal copper producers in the Ketchikan district were the Rush & Brown, It, Jumbo, and Mount Andrew mines. The Mamie mine was closed down in the spring, and an increased output was made at the It. The Rich Hill copper property, on Kasaan Peninsula, is being developed and made a small production. A 60-ton flotation mill was constructed on the Salt Chuck mine (formerly the Goodro mine). A molybdenite-bearing lode in the vicinity of Shakan, on the west coast of Prince of Wales Island, is being developed. Marble quarrying at Tokeen was continued about as usual. The Dunton mine was the only gold mine in operation. It is reported that a small plant for treating ore is under construction at the Complex mine on Moira Sound.

Development of the copper lodes of the Ketchikan district, particularly on Kasaan Peninsula, has led to the uncovering of large bodies of magnetic iron ore at a number of places. This magnetite, which contains in general about 0.5 per cent of copper, has hitherto been regarded only as a low-grade copper ore. Attention has recently been redirected to these ores as a source of iron. Magnetic separation should yield a high-grade iron ore and a valuable by-product of chalcopyrite to pay for the cost of separation. Plans for utilizing these iron ores are now being considered.

Gold lode mining continued on a large scale at the mines near Juneau.

As a result of a cave-in at the Treadwell, 700-foot, and Mexican mines, which occurred on April 21, these mines are now flooded with sea water and are not in operation. The surface equipment of these three mines is being dismantled and sold. The Ready Bullion mine, though connected at the 1,350-foot level with the Mexican mine, was saved by a concrete bulkhead, which after the cave-in was made permanent and greatly strengthened. At the end of June the drawing of all broken and caved ore above the 2,000-foot level was discontinued, in order to render the mine entirely safe, and all open stopes are now being filled with waste. Development of the mine continued in the lower levels. The 2,400-foot level is now completed, and rapid progress is being made in the 2,600-foot level. The present plans contemplate the ultimate extension of the new No. 2 shaft to the 3,000-foot level. If the ore is of satisfactory grade at that depth a prospect drift will be run along the ore body underneath the flooded workings of the other mines. The production of gold at the Ready Bullion mine was decreased to one-third the normal quantity when work above the 2,000-foot level was discontinued but will gradually be increased as the lower levels are opened up.

The Alaska-Gastineau (Perseverance) mine and mill operated throughout the year. Operations were restricted by the scarcity of labor; there were only 712 men employed in 1917 against 940 in 1916. The supply of broken ore in the stopes overcame the deficiency caused by the shortage of labor, and the mine and mill were operated on a somewhat larger scale than in 1916. Development and prospecting for ore bodies was prosecuted as energetically as conditions permitted. A total of 15,472 feet of drifts, crosscuts, and raises and 12,754 feet of diamond drilling was completed. The principal object of this work was to find new and richer ore bodies in order to maintain the average grade of the ore sent to the mill and, if possible, to increase the average value. The mine is said to be in condition to furnish a maximum tonnage of ore whenever the necessary labor is available. The milling plant has shown a capacity of not less than 10,000 tons a day, and the transportation system, both underground and from the mine to the mill, is in a position to supply this tonnage.

The Alaska Juneau mine was operated throughout the year. The new mill at this mine was started in April but has been running at less than half its capacity.

Development work was continued at the Alaska-Ebner mine. The Jualin mine, at Berners Bay, was operated during most of the year but shut down in October on account of the scarcity and high price of supplies and labor. Other properties in the Juneau gold belt were

also developed or operated in a small way, and prospecting for new lodes was continued.

Development work continued at the molybdenite prospect 9 miles north of Skagway.

On Chichagof Island both the Chichagoff gold mine and the gypsum mine of the Pacific Coast Gypsum Co. were operated on about the same scale as last year. The main tunnel of the Chichagoff mine is now over 4,400 feet long. At the gypsum mine work was started on the new 300-foot level. This mine has been a steady producer since 1906.

Development work was continued on the group of copper claims near the head of Pinta Bay, about 15 miles northwest of Chichagof. A little prospecting but no underground development work was done on the copper-nickel deposit at Nickel, about 22 miles northwest of Chichagof.

COPPER RIVER REGION.

The largest mining operations of the Copper River region in 1917, as in several years preceding, were at the Jumbo and Kennecott-Bonanza copper mines. Considerable copper was also shipped from the Mother Lode mine and small shipments were also made from several other properties. Other mineral production included placer gold mining in the Nizina and Chistochina districts.

The Jumbo and Kennecott-Bonanza mines and the mill at Kennecott were operated on a large scale throughout the year, although production was considerably smaller than in 1916. This reduction in the output was due to a strike in the middle of summer and to shortage of labor throughout much of the year. The mill was operated at practically its full capacity throughout the winter, and this was the first time that it had not been necessary to shut down during the winter on account of the shortage of water. The ammonia leaching plant continued in successful operation, and it is reported that its capacity will be increased.

Automobile roads for hauling ore from the Mother Lode and Nugget creek mines were constructed. Much development work was done at these mines and also at several other mines in the region.

Hydraulic placer mining continued on a large scale in the Nizina district, where 2 mines employing 4 miners were operated in the winter of 1916-17, and 6 mines employing 91 miners in the summer of 1917. These mines produced about \$120,000 in placer gold and also a little placer copper. No important developments or discoveries are reported.

Placer mining on Slate Creek in the Chistochina district was continued on a large scale. The production of this district is estimated at about \$100,000 worth of gold and 15 or 20 ounces of platinum.

Platinum is said to occur in about the proportion of one part by bulk of platinum to 100 parts of gold, but not all of the platinum is saved.

Some underground work was done on the American Eagle lode near Tiekel, and a small production of gold was made. It is said that a small mill will be installed in 1918.

PRINCE WILLIAM SOUND.

The value of mineral production on Prince William Sound was \$4,667,929 in 1917 compared with about \$3,000,000 in 1916. This amount is the value of the product at seven copper mines and three gold mines which can be classed as regular producers and of additional small shipments from eight other small mines or prospects.

Mineral production of Prince William Sound, 1917.

	Ore (tons).	Gold (fine ounces).	Value.	Silver (fine ounces).	Value.	Copper (pounds).	Value.
Copper mines a.....	351,356	10,524	\$217,557	132,773	\$109,406	15,559,737	\$4,247,808
Gold mines.....	5,350	4,509	93,208	697	575	.....	.....
	356,706	15,033	310,765	133,470	109,981	15,559,737	4,247,808

a Including one small shipment from Cook Inlet.

The productive copper mines in 1917 included the Beatson, Blackbird, Schlosser property, Midas, Mackintosh property, and Ellamar. The Blackbird group, on Latouche Island, began shipping after lying dormant for several years. At the Beatson-Bonanza large operations were continued, the capacity of the milling plant was increased, and 350 men were employed. On the Blackbird 25 men were employed and a new ore body was opened up. On the Schlosser property 27 men were employed and considerable underground work was done. The Mackintosh property employed 13 men stoping an old lead and extending the adit tunnels on it and crosscutting to a new lead. The Ellamar mine, which employed 100 men, continued operations throughout the year on about the usual scale. At the Midas 50 men were employed during the year, underground operations were continued, the tram was operated, and large shipments were made. On the Rua property 600 feet of tunnel and crosscuts were driven. A large low-grade copper property was discovered on Long Bay. Some diamond drilling on a nickeliferous deposit on Knight Island is reported.

A detailed statement regarding the mining on Prince William Sound is given in another chapter of this volume.

KENAI PENINSULA.

The mineral production of Kenai Peninsula includes about \$30,000 of placer gold, \$4,600 of lode gold, a small amount of silver obtained incidentally to the mining of the gold, a considerable amount of chromite, which was mined at Port Chatham on Cook Inlet, and some lignite mined at Bluff Point on Cook Inlet. There was very little activity in lode gold mining and no extensive developments are reported. A mill and tram are being installed at the Ronan & James mine in the Moose Pass district. The largest placer mining operations were on Resurrection and Crow creeks. Preliminary steps were taken toward the inauguration of large-scale operations at Canyon Creek. Very heavy rains in the fall caused serious damage at the placer mines throughout the district.

WILLOW CREEK DISTRICT.

The mineral production of the Willow Creek district in 1917 included \$195,662 worth of gold and \$586 worth of silver, all derived from quartz mines. The Alaska Free Gold, Gold Bullion, Gold Cord, Mabel, and Talkeetna (formerly Matanuska) mines were operated. The amount of ore milled was 7,883 tons. A promising new quartz vein which was opened at the Gold Cord mine at the head of Fishhook Creek has already been traced for several claim lengths.

YENTNA DISTRICT.

The Cache Creek district continues to be the principal source of placer gold in the Yentna basin. The inaccessibility of the placers on Cache Creek has made mining expensive, but a new wagon road, which is now under construction, from Talkeetna, on the Government railroad, to Cache Creek, will soon afford a quick and easy approach to the district. A dredge that burned local coal was operated on Cache Creek, and 15 hydraulic plants were working on Cache and Peters creeks during the summer. More than 100 men were employed, producing placer gold valued at \$125,000 to \$150,000. Operations at the end of the season were hampered by protracted rains and serious floods, which caused considerable damage to several mining plants. Late in the fall a Hudson dry dredge was installed on ground along the north side of Kichatna River, at the mouth of Nakochna River, to begin mining in the spring of 1918. Some prospecting and mining were done in the Camp Creek and Lake Creek basins.

Along the lower Kahiltna River prospecting for platinum was carried on by one company at two localities—one about 3 miles below the mouth of Peters Creek and the other a short distance upstream from the mouth of the river. A hand drill and two power drills

were used in prospecting the river bars, about 12 men having been employed in this work. The prospecting is to be continued next season. Platinum occurs at many other places in the Susitna basin, including Cache, Peters, Camp, and Lake creeks, as well as on Kichatna and Chulitna rivers, and placers that contain platinum in commercial quantities may ultimately be found.

An examination of placer concentrates from Yentna River by the United States Geological Survey has revealed the presence of tin ore (cassiterite) in considerable amount and possibly in commercial quantities.

UPPER SUSITNA REGION.

The mineral production of the upper Susitna valley is still restricted to the placer gold of the Valdez Creek district. The lodes of the Broad Pass and Talkeetna districts are being prospected.

In 1916 and 1917 about 20 groups of claims were staked on gold and copper bearing lodes in the basin of Iron Creek, a tributary of Talkeetna River from the southeast, but practically no underground work has yet been done. The discovery of a large dike that carries gold is reported from upper Talkeetna River. Some massive bornite that carried visible free gold and that was reported to have been found in the basin of Kashwitna River was brought in by a party of prospectors.

The prescribed amount of annual assessment work was performed on about a dozen groups of lode claims in the upper basin of Chulitna River, which is often referred to as the Broad Pass district. No mines in this district are yet productive, but more vigorous exploitation of the gold, copper, and antimony deposits awaits the better transportation that will be furnished by the Government railroad.

A new discovery of copper is said to have been made near the head of MacLaren River. The vein is reported to be chalcopyrite from 2 to 10 inches wide in amygdaloidal greenstone.

SOUTHWESTERN ALASKA.

The known mineral production in southwestern Alaska in 1917 comprised a test shipment of copper ore from a locality near Kami-shak Bay and some placer gold from the Kodiak beaches, from a creek near Katmai Bay, and from Portage Creek in the Clark Lake district.

YUKON BASIN.

GENERAL FEATURES.

The value of the gold produced by the placer mines of the Alaska Yukon districts in 1917 is estimated to have been \$6,583,000, com-

pared with \$7,550,000 in 1916. About 380 placer mines were operated in the summer of 1917, giving employment to about 2,550 men, and about 165 placer mines were operated in the winter, employing about 790 men. Nine small lode mines, all in the Fairbanks district, were productive in 1917. The following table gives the estimated gold output of the principal Yukon placer camps:

Estimated value of gold produced from placers of Yukon basin, 1917.

Iditarod-----	\$1, 500, 000	Koyukuk-----	\$250, 000
Fairbanks-----	1, 310, 000	Circle-----	200, 000
Tolovana-----	1, 150, 000	All others-----	413, 000
Ruby-----	885, 000		
Hot Springs-----	450, 000		6, 583, 000
Marshall-----	425, 000		

The Yukon placer mines also produced about \$39,000 worth of silver in 1917. The above figures do not include the output of the lode mines, which in 1917 produced gold and silver to the value of \$49,607. There was also a small output of tin from the Hot Springs district, and considerable tungsten and some antimony ore was mined in the Fairbanks district. (See pp. 20-21.) The total value of the entire mineral production from the Alaska Yukon in 1917 was \$6,747,835; that in 1916 was \$7,839,757. Since mining began in 1886 the Alaska Yukon has produced minerals to the value of \$123,180,000, of which \$121,625,000 has been derived from the gold placers.

The most noteworthy feature of the placer mining of the year was the increased output of the Tolovana placers. There was also an increased production in the Marshall, Tolstoi, and Ruby districts. The other districts show a decreased output, owing chiefly to a general retrenchment by operators because of the high cost of supplies and scarcity of labor.

FAIRBANKS DISTRICT.

The mineral production of the Fairbanks district in 1917 included placer gold worth \$1,310,000, lode gold worth \$47,781, placer silver worth \$6,904, lode silver worth \$1,826, and lead, tungsten, and antimony worth \$58,257. The total value of the mineral output for 1917 was \$1,424,768. The aggregate value of the entire mineral output of the district up to the close of 1917 is \$70,417,000. Much the larger part of this amount represents the value of the placer gold, the production of which is shown by years in the subjoined table. In addition to the actual production of the district about \$1,000,000 worth of gold mined in tributary areas passes through Fairbanks each year.

Placer gold and silver produced in the Fairbanks district, 1903-1917.

Year.	Gold.		Silver.	
	Quantity (fine ounces).	Value.	Quantity (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	79,900	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
	3,318,525.00	68,600,000	620,503	342,582

The available information as to the source of the gold by creeks is not very accurate. An attempt has been made in the following table, however, to distribute the total placer gold production of the Fairbanks district by the creeks on which the mines are located:

Approximate distribution of gold produced in Fairbanks district, 1903-1917.

Cleary Creek and tributaries.....	\$22,860,000
Goldstream Creek and tributaries.....	13,800,000
Ester Creek and tributaries.....	11,230,000
Dome Creek and tributaries.....	7,910,000
Fairbanks Creek and tributaries.....	7,400,000
Vault Creek and tributaries.....	2,640,000
Little Eldorado Creek.....	2,100,000
All other creeks.....	660,000
	68,600,000

No new discoveries or important developments in placer mining were made in 1917. A large dredge will be installed on upper Fairbanks Creek to begin operations in 1918.

Gold lode mining in the Fairbanks district declined from 1913 to 1916 but showed a slight increase in production in 1917. The cost of supplies and fuel has become so high that many operators will wait for more favorable conditions rather than work at a low profit and run the risk of actual loss. Eight gold lode mines were worked in a small way, and five of these operated their own mills. One silver-lead deposit is being worked and made an output. One anti-mony mine was in operation and some ore was hand-picked from old tailings and shipped. Two tungsten mines are in process of development. One is in operation and during the fall produced 500 pounds of scheelite concentrates a day. On the other the mill was in course of construction, and surface and underground development work was in progress.

Details regarding lode mining are presented by Mr. Chapin in another chapter of this report. The following table shows the production of gold and silver from the Fairbanks lode mines since this form of mining began in 1910:

Lode gold and silver produced in the Fairbanks district, 1910-1917.

Year.	Crude ore (tons).	Gold.		Silver.	
		Quantity (fine ounces).	Value.	Quantity (fine ounces).	Value.
1910.....	148	841.19	\$17,339	106	\$57
1911.....	875	3,103.02	64,145	582	308
1912.....	4,708	9,416.54	194,657	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	2,211.38	47,731	2,217	1,826
	32,650	55,921.58	1,155,952	12,752	7,877

CHISANA DISTRICT.

Placer mines were operated on Bonanza, Big Eldorado, Gold Run, and Little Eldorado creeks in the Chisana district. A total of 11 mines employed 44 men and produced gold to the value of about \$40,000. This camp is growing smaller year by year in spite of the fact that there is considerable prospecting on the neighboring creeks during winter. Only two mines were operated last winter. Prospecting is still going on in Notch Creek, but the ground is deep and thawed, and water consequently has to be pumped. Gold has been found in the gravel, but bedrock has not thus far been reached.

FORTY MILE DISTRICT.

The mineral production of the Fortymile district in 1917 consisted of placer gold worth about \$80,000 that was derived from 25 mines employing 68 miners, which operated in the winter of 1916-17, and 35 mines employing 93 miners, which operated in the summer of 1917. In addition to this mining a small dredge was operated at Franklin. It is reported that the benches on Fortymile River are proving very good. Preparations are being made for mining the bench claims at several localities additional to those at which mining has already been carried on. The discovery of stibnite is reported on the Middle Fork of Fortymile River, 12 miles south of Josephs village.

EAGLE DISTRICT.

Twelve placer mines employing 25 men were operated in the Eagle district in 1917 and yielded a gold production of about \$13,000. The largest number of mines and miners and the largest production

was on American Creek. Preparations were being made for the installation of a hydraulic outfit on Seventymile River in 1918. The hydraulic plant on Alder Creek tributary to Seventymile River had to close down early in the season for lack of water. A 6-mile ditch was being completed on Long Creek preparatory to hydraulic mining in 1918.

CIRCLE DISTRICT.

Owing to unfavorable conditions, chiefly lack of rain during the later part of August and during September, the gold production for nearly all creeks in the Circle district was greatly curtailed. The production was about \$200,000, which is about \$100,000 less than in 1916. About the same number of mines were operated and the same number of men employed as last year. The chief developments for 1917 included the installation of a hydraulic plant on Independence Creek, and the survey of placer mining ground for patent on Mammoth, Mastodon, Independence, and Miller creeks. Material for the construction of a hydraulic plant on Deadwood Creek has been landed at Circle.

RAMPART DISTRICT.

The value of the gold produced in the Rampart district in 1917 was about \$33,000. This gold was obtained from the operation of 2 mines employing 5 men in the winter of 1916-17 and 10 mines employing 26 men in the summer of 1917. The largest production was on Hunter and Little Minook creeks.

TOLOVANA DISTRICT.

The output of the placer mines of the Tolovana district for 1917 was about \$1,150,000, which is a 50 per cent increase over the production for 1916. About 50 mines were operated. Considerable prospecting has been reported, but authentic information as to the results is not at hand.

HOT SPRINGS DISTRICT.

The gold production of the Hot Springs district in 1917 is estimated to be \$450,000. Placer mines employing 190 men were operated on 30 claims situated on Eureka, Sullivan, American, and Boulder creeks. The tin production is estimated at 25 tons. The decrease in the production of both gold and tin is due in part to the cessation of large operations on Woodchopper Creek and in part to the high cost of food and of mining supplies, which has prevented the working of any except high-grade ground. Although the tin output was small, there appears to be a considerable amount of stream tin in the old tailings and in the unworked ground. Prospecting in 1917 showed that both gold and stream tin occur in the basin of Sullivan Creek,

considerably below the area which has been mined, and that large bodies of low-grade gravels occur on Boulder Creek. It is reported that several prospectors are at work in Gold Basin, where they are finding considerable tin but only little gold.

RUBY DISTRICT.

Mining operations in the Ruby district in 1917 were conducted on about the same scale as in 1916, and placer gold worth \$885,000 was produced, which is a little more than the production of 1916. It is reported that 19 mines, employing 310 men, were at work in the summer of 1917 and 19 mines, employing 520 men in the winter of 1917-18. The largest productions were on Greenstone, Poorman, Long, Spruce, and Tamarack creeks. The dredge on Greenstone Creek had a successful season, but the dredging ground has been worked out and the dredge will be moved. Good ground was discovered by winter prospecting on Ketchum Creek, but the ground is too deep for easy exploitation. Prospecting on Midnight Creek has shown the presence of placer tin at several places.

INNOKO DISTRICT.

The gold production of the Innoko district in 1917 is estimated at \$125,000. About 7 mines employing 46 men operated in the winter of 1916-17 and 20 mines employing 78 men in the summer of 1917. The chief activity was on Yankee, Gaines, Little Spruce, and Ophir creeks. There were no new developments during the year.

TOLSTOI DISTRICT.

In the winter of 1916-17 a stampede to Tolstoi occurred, and there were at times as many as 400 men at that camp. There was much prospecting during the winter and spring, but not over 50 men were there in July. About \$50,000 was taken out during the winter and summer in the Tolstoi district, the result of the operations of about 25 men on 5 plants, most of the production being made by one outfit on Boob Creek. Boob Creek is the only creek from which there was any production of platinum. It was not separated from the gold but was sold with it to a bank in Iditarod. The platinum in the gold was said to amount to about 1 per cent, which would make approximately 30 ounces of platinum produced.

IDITAROD DISTRICT.

The placer gold production of the Iditarod district in 1917 was about \$1,500,000, about \$450,000 less than the production of 1916. The decrease was due largely to continued breakdowns of the Otter Creek dredge. Detailed information concerning mining in this dis-

trict is not at hand, but it is believed that in addition to the 3 dredges there were about 15 mines employing nearly 400 men at work in the summer of 1917 and 2 mines employing about 10 men in the winter of 1916-17.

KOYUKUK DISTRICT.

Very little authentic information has been received concerning mining in the Koyukuk district except as a small proportion of the operators have supplied data on the output of their own properties. It is estimated that the total value of the gold produced in the Koyukuk district was about \$250,000, which is considerably less than the production for 1916. In the Indian River district 8 men were at work in the summer of 1917 on Indian Creek, Felix Fork, and Black Creek, and they produced about \$4,000 in placer gold.

MARSHALL DISTRICT.

The production at Marshall was about \$425,000, as compared with \$270,000 in 1916. Most of this gold was produced by 5 mines on Willow Creek, employing about 200 men, but some smaller plants were at work on Willow, Disappointment, and Elephant creeks. A small amount of platinum occurs with the gold on some of the creeks at Marshall, but none has yet been saved.

SMALLER YUKON DISTRICTS.

About 4 placer mines employing 9 men are known to have been operated in the Chandalar district. It is estimated that the total production of the district was about \$15,000. No information concerning lode mining has been received.

The Richardson district, in the Tanana region, apparently produced about \$25,000, which is considerably smaller than in 1916. The discovery of a promising gold lode on Democrat Creek has been reported. No production has been reported from the Goodpaster region, though it is known that considerable prospecting was done.

There were no large mining operations in either the Bonnifield or the Kantishna district during 1917. The value of the output of the Bonnifield district is estimated at \$12,000 and of the Kantishna district at \$15,000, both of which are somewhat less than in 1916. There was also some lode development in both districts.

There was no gold production in the Gold Mountain district, but considerable dead work is said to have been done preparatory to mining next year. Open cuts were made at Lancaster Creek, American Gulch, and Grant Creek, and a hydraulic plant was installed on Mason Creek. The ground is said to average 12 to 20 feet deep. The benches consist of wash gravel and are not frozen. Very little prospecting has been done on them.

A strike is said to have been made on Anvik River by two men. Platinum is reported in association with the gold.

KUSKOKWIM REGION.

The gold production of the Kuskokwim region in 1917, according to the best information at hand, was about \$135,000. The largest production was on Candle and Moore creeks. The dredge that was shipped in last year will be placed on the upper end of Candle Creek to work downstream. It is reported that a new strike was made on the left limit of Nixon Fork, between Nixon Fork and the North Fork of the Kuskokwim, a little below the mouth of South Fork.

Another new discovery of placer gold was said to have been made on Wahmus or Watermouse Creek, in the Goodnews Bay district, where it is said that 4 men took out between \$12,000 and \$20,000 in 3 weeks. The gravels are said to be about 4 feet thick and to yield from \$2 to \$4 to the square foot. It is also reported that prospecting on Holitna River is yielding encouraging results. The Kuskokwim region is still without adequate means of transportation, so both prospecting and mining are done under great difficulties.

SEWARD PENINSULA.

The mines of Seward Peninsula produced gold to the value of about \$2,600,000 in 1917 as against \$2,950,000 in 1916. The value of tin, tungsten, silver, and graphite produced in 1917 was about \$147,600; in 1916 it was \$170,000. The value of the total gold production since mining began in 1897 is about \$76,892,000. Nearly all this gold was taken from placers; up to the present time little has been produced from lodes. Silver, tin, and other substances have been produced to the value of about \$1,027,600. This amount makes the value of the total mineral output of Seward Peninsula to the end of 1917 about \$77,900,000.

Approximately 750 men were employed in placer mining in Seward Peninsula, exclusive of those employed on dredges. They worked with 170 plants. About half the men were employed in the Nome and Council precincts.

In 1917 twenty-eight gold dredges were operated on the peninsula—7 in the Nome district, 5 in the Solomon River district, 10 in the Council district, 2 in the Port Clarence district, 2 in the Fairhaven district, and 2 in the Kougarok district.

Gold production on Dime Creek was greater than in the preceding year, 6 plants making a very large part of the \$150,000 produced by deep mining during late winter and early spring. An additional \$20,000 will about cover the summer production, mostly from three open cuts. Platinum occurs with the gold in the ratio of about 1

ounce of platinum to \$5,000 worth of gold on the lower claims of the creek and on bench claims. The proportion of platinum is somewhat larger on claims near the head of the creek. The platinum production in 1917 amounted to about 35 ounces. In all 17 plants worked during the winter and summer, employing about 85 men. This mining was done on 4 claims, but on other claims there was prospecting or setting up of plants for winter work. A number of men were engaged in this work for short periods during the summer, as well as in constructing ditches and in sluicing winter dumps.

About \$10,000 was produced on Sweepstakes Creek, between Bear Creek and Dime Creek, by 4 plants employing 11 men. This gold also contains a small amount of platinum, about an ounce having been separated from the gold.

The gold production from Bear Creek is not known. Four outfits, employing 14 men, worked during the season. Some prospecting also was done on this creek. A few pennyweights of platinum were produced.

Exclusive of dredge production, the gold produced from the Port Clarence precinct is estimated at \$27,000. That from the Kougarok precinct, likewise exclusive of dredge production, is estimated at \$55,000.

Lode mining developments for the year consisted for the most part of little more than the necessary assessment work. The high prices of lead and silver gave an impetus to the search for those metals in the vicinity of Lost River and on the Kugruk, considerable work having been done on some properties in both localities. A mill was set up on a gold lode property near Bluff.

During the summer two tin dredges were in operation in the York region—one on Buck Creek, the other on Grouse Creek below the mouth of Buck. In addition to the tin won by the dredges, a small amount of placer tin was sluiced by two men working on Iron Creek, which flows into Sutter Creek, a tributary of Buck Creek. One of the dredges was prospecting for future dredging ground, as the next season will finish up their present ground. Unusually heavy rains during the last week in August delayed the work of both dredges. About 25 men were engaged in the placer mining of tin.

Some development work was done on tin lode claims at the head of Buck Creek, Tin City, Lost River, and Ear Mountain. No ore was milled or shipped from any of these properties.

Most of the tungsten ore (scheelite) produced in 1917, as in 1916, came from Sophie Gulch. A few pounds was saved as the result of smaller placer operations on one of the small tributaries of Snake River, below Glacier Creek, and a small production was made on Sunset Creek, in the Port Clarence district.

Work was done on two graphite properties during the summer of 1917. On one of these properties it consisted only of assessment work. On the other property about 4 miles of road were constructed from the property to Graphite Bay, an arm of Imuruk Basin. Some graphite was mined and was hauled to Graphite Bay by a gasoline tractor.

KOBUK RIVER.

During the year about 20 men were mining on Kobuk River, but they took out grubstakes only. The production of the district was probably about \$25,000. The ground is worked by open cut in summer, the deeper spots being worked in winter. Most of the mining is done on Klery Creek. One outfit was prospecting on Ambler River and another on the Noatak. It is reported that a strike was made at Walker Lake during the summer and that 4 or 5 men were rocking out \$10 to \$15 a day. About 9 mines employing 16 men were operated on Lynx, Riley, and Dahl creeks and Shungnak River making an estimated production of about \$5,000.