Dep

MINING INVESTIGATIONS
AND
MINE INSPECTION
IN
ALASKA

Including Assistance to Prospectors

BIENNIUM ENDING MARCH 31, 1933

Juneau, Alaska,
February 28, 1933.

Sir:

I have the honor to submit herewith a report on the results of mining investigations and the inspection of mines in the Territory during the biennium ending March 31, 1933, the work in connection with which was carried on in accordance with the terms of Chapter 122, Session Laws of 1931.

There is also included therewith a report on assistance given to prospectors under the terms of Chapter 66, Session Laws of 1931.

Respectfully yours,

B. D. STEWART,

Supervising Mining Engineer.

Honorable Geo. A. Parks,
Governor of Alaska,
Juneau, Alaska.

INTRODUCTION

The following report outlines the work accomplished during the biennium 1931-1932 in conducting investigations of the progress of mining development, and in the inspection of mines in the Territory. It also includes information as to assistance given to prospectors.

This work has been carired on in accordance with a cooperative arrangement between the Territory and the U. S. Interior Department that has been in effect since 1922.

Owing to the condition of the Territorial treasury, the funds available for conducting the work of making mining investigations and for mine inspection, as well as the fund for assistance to prospectors, were withdrawn from use by the Governor in the month of May, 1932. Subsequent to that date, therefore, field investigations and mine inspection activities ceased and assistance to prospectors was withdrawn. As a result of this situation the report herewith presented is fragmentary. Details of mining development are given only for those areas where it was possible to conduct field investigations with the very limited funds and personnel available. No field examinations were made in Southeastern Alaska during the biennium and those made in the Second and Fourth Judicial divisions were incomplete. This report deals largely, therefore, with the progress of mining in the Third Division. It is believed the quite complete report covering the Nuka Bay, Goodnews Bay, Nabesna River, White River, and Bremner River districts will be of particular value at this time, for the reason that new developments that have attracted attention have taken place in each of those districts within the biennium and no other report covering any of them adequately is now available.

In addition to the material published herein much valuable information has been received, from the associate Territorial mining engineers and from prospectors who were given assistance by the Territory, concerning many districts. This material could not be prepared for publication on account of lack of time and personnel. These data, which include many valuabel maps, are in the files of the office of the Supervising Mining Engineer at Juneau, and constitute an important source of authentic information for use in answering inquiries concerning opportunities and conditions affecting mining and prospecting in Alaska.

GENERAL STATEMENT OF MINING CONDITIONS IN ALASKA

In spite of the near collapse of its copper-mining branch during 1932, the mining industry of Alaska, as a whole, enjoyed greater stability than that of any of the metal-mining states, with the possible exception of Colorado and South Dakota. The total value of the mineral output of the Territory during 1932, compared with that of 1931, shows a decline of only 11 per cent. Corresponding declines in value of output for some of the principal metal-mining States were as follows: Colorado, 3 per cent; Idaho, 35 per cent; Nevada, 44 per cent; Washington, 47 per cent; Utah, 51 per cent; and Arizona, 67 per cent.

The price of copper during 1932 was the lowest average annual price for any year on record since 1850. In addition to the inevitable effect of this market situation, not only in lowering the value of the output per unit, but also in forcing curtailment of production, the copper output of Alaska was materially reduced on account of disastrous floods that caused suspension of traffic on the Copper River and Northwestern Railway in the fall of 1932, which, in turn, forced the complete shut-down of the mines of the Kennecott Copper Corporation.

The copper output of the Territory for the biennium just ended was valued at $2,408,000* as compared with a value of $11,374,000 for the biennium next preceding; a reduction in value of 79 per cent. The value of the output for 1932 fell to $531,000, which is the lowest of that for any year since 1904.

Fortunately, the condition of the gold-mining industry of the Territory affords a much more encouraging subject for contemplation. The value of the output of gold during the biennium just ended was 17 per cent greater than that for the next preceding biennium. Within the span of the last two biennia the value of gold produced in Alaska has increased from $7,761,000 in 1929 to $9,539,000 in 1932, which is greater than that for any year since 1917. The production for 1932 represented an increase of $32,000 over that for 1931. The value of the gold produced in

* All figures relating to production in this report are quoted from statements published by the U. S. Geological Survey.

1932 was greater by 27 per cent than that of the average value for the preceding ten years.

The largest increase in production of gold was made by lode mines, the total recovery from this source having been 24 per cent greater in value than that for the next preceding biennium. The increase in the value of the output from placer mines for the same period was 12 per cent. A gratifying feature of the increase in output from lode mines is that it resulted from enlarged operations at several mines, resumption of operations at mines previously idle, and also from entirely new mines in districts hitherto unproductive. Production from the Alaska Juneau mine, which mine occupies a commanding position in the lode-mining field, was substantially the same during each of the last two biennia. Features of progress in lode mining during the biennium that are particularly worthy of note were: Extensive deep-level development at the Alaska Juneau mine, which is reported to have resulted in revealing large reserves of ore below the present tramming level that are materially higher in tenor than that mined hitherto; resumption of productive operations at the Chichagoff Mine on Chichagof Island; inception of year-round operation of the two principal productive lode mines in the Willow Creek district, and extensive development work on at least one new property; commencement of productive lode-mining operations that have resulted in an important yield of gold in the Nabesna River district; successful mining and treatment of the complex gold ore at the Ferry Mine in the Bonnifield district; and expansion of operations and reopening of old properties in the Fairbanks district.

In the placer-mining field production continued to be derived principally from the operation of dredges, particularly those of the Fairbanks Exploration Company and its affiliate, the Hammon Consolidated Gold Fields. The number of dredges in successful operation in all fields was maintained, however, and the outlook is favorable for an increase, rather than a decrease in this number.

Prospecting for placer deposits received a stimulus by reason of its attractiveness as a means of securing a livelihood when remunerative employment is difficult to procure. The number of inquiries that have been received from many parts of the States as to the opportunities in Alaska for successful individual placer operations indicates the probability that the number of persons engaged in efforts to provide living expenses for themselves by

this means will increase during the coming year. Another interesting and significant innovation in connection with individual operations during the biennium is the number of resident Alaskans of the younger generation who have successfully undertaken the re-sluicing of old placer dumps, the retreatment of lode-mine dumps, and kindred activities.

Small-scale operation of platinum-placers in the Goodnews Bay district continued to be carried on with a resulting output slightly greater than during the preceding biennium.

Production of non-metallic minerals other than coal in Alaska is confined to limestone, which is utilized at Seattle in the manufacture of cement, and marble, which is produced from quarries located at Tokeen, on Prince of Wales Island. During the early part of the biennium interest developed in the discovery of witherite, the carbonate of barium, which was found associated with barite lode deposits on the northeast coast of Kuiu Island in Southeastern Alaska. Some prospecting work was carried on in an effort to uncover a deposit of witherite of commercial extent, but so far without success. Further prospecting for this mineral is justified, however, as the current market price for it is in excess of $40 per ton. The principal use for witherite is in connection with the refining of sugar. Another discovery during the biennium of a new non-metallic mineral was made on Dahl Creek, a tributary of Kobuk River, where chrysotile asbestos deposits were located which give promise of being of importance. Samples of this asbestos, which is of the slip-fiber type and which have a length of 12 inches or more, were submitted to the U. S. Bureau of Mines for determination. The sample was pronounced to be among the finest specimens of chrysotile that have been submitted from an undeveloped property.

The production of coal during the biennium was on substantially the same scale as during the preceding biennium, and the output was derived from the same mines, except for a small tonnage that resulted from the reopening of the old Rawson mine on Moose Creek during 1932.

Productive operation of the oil wells of the Chilkat Oil Company at Katalla continued during the biennium on about the usual scale and one new prospect well was drilled by that company at a point east of the producing section of the field. Work on this

well was still in progress when the latest reports were received. Drilling of the Peterson well in the Chickaloon section of the Matanuska coal field was suspended during 1932, but the property and equipment are being maintained in shape to resume drilling when financial conditions are more favorable.

FIRST DIVISION

As stated in the introduction to this report, no field investigations of mining development were carried on during the biennium in the First Judicial Division, owing to lack of the necessary funds and personnel. It is not possible, therefore, to give in this report authentic information as to the details of the progress of mining development in this division.

Market conditions affecting the price paid for lead and silver inevitably caused stagnation in the development of the lode deposits of the Hyder district, where the mineral deposits are prevailingly of the lead-silver type.

The market price of copper likewise discouraged the development of the known copper deposits in the Ketchikan precinct and the search for new deposits of that type. Many areas in the Ketchikan precinct are known to carry deposits of gold-bearing ores, however, and prospecting was active in several of those districts.

View Cove Limestone Quarry

The limestone quarry at View Cove on Dall Island was operated continuously for the first nine months of 1931 by the Pacific Coast Cement Company, with an average crew of 20 men engaged.

A crew of the same size was engaged in productive operation of the quarry during the months from April to August, inclusive, 1932. These operations were conducted by the Superior Portland Cement Company of Seattle, successors in interest to the Pacific Coast Cement Company.

Vermont Marble Works

After a protracted idleness, productive operations were resumed at the quarries of the Vermont Marble Company at Tokeen in March, 1932, when work was started with a crew of 46 men. The number of men employed was increased to 73 in April and the crew was maintained at that number until the end of September, when operations ceased for the year.

One small gold mine is known to have been operated on Woewodski Island, near the south end of Wrangell Narrows in the Petersburg precinct, but no information is available as to the extent of the work done or the results.

Alaska Juneau Mine

The value of the gold recovered in the operation of the Alaska Juneau mine at Juneau during the biennium represents about 36 per cent of that of the total gold, both lode and placer, mined in the Territory.

Reports made public by the company indicate that the gross production for the biennium was valued at approximately $7,004,000, which is about $175,000 less than for the next preceding biennium. The net profit realized, before deductions were made for depreciation, taxes and depletion, amounted to about $2,528,000, during the biennium just closed, which is greater by approximately $170,000 than the corresponding figure for the preceding biennium.

The local expenditures of the company, made in connection with their operations during the biennium, amounted to over 3½ million dollars, of which about $2,600,000 represents the pay-roll. The average number of men employed at the mine, mill, and surface works was 664, which is an increase of 40, as compared with the number employed during the preceding biennium.

The total amount of development and preparatory mining work accomplished underground is expressed in terms of the number of feet of advance made in various types of openings, such as drifts, cross-cuts, raises, winzes, etc. During the past biennium the total number feet of such work recorded was 31,705 as compared with 25,712 for the next preceding biennium, which is the largest amount of work done in any year since 1917. The total amount of underground development and preparatory work done since the present mining program was commenced in 1911 amounts to 239,152 feet, or 45.3 miles.

The most significant underground exploratory work done during the biennium was the deep-level development of the north orebody beneath the present main haulage-level. Two winzes, des-

ignated No. 53 and No. 91, respectively, were sunk to the depth of the No. 10 level, which is 1,000 feet vertically below the present main haulage-level, otherwise known as the Gold Creek Tunnel. A haulage drift connecting these two winzes on the No. 10 level has been completed. The winzes are 1,150 feet apart. Development and exploratory work in the deep-level program accomplished during the biennium, expressed in feet of advance of openings of various types, totalled 13,562 feet. As to the tenor of the ore disclosed by the deep-level development work that had been accomplished at the end of 1931, the published report of the company states:

> "The weighted average gold assay value of all the above work done to date is $3.30. In addition, five diamond drill holes on No. 6 Level average $1.69 gold, over a width of 169 feet; and on No. 8 Level five diamond drill holes gave an average assay value of $1.80 over an average width of 296 feet."

The most important outside mining venture undertaken by the Alaska Juneau Company during the biennium was an extensive surface and underground exploratory program on the optioned Hallum and Dora groups of claims, which contain 7,200 feet of the outcrop of the Juneau Gold Belt west of the Alaska Juneau and Ebner groups. Details as to the extent of this work for 1932 are not yet available.

The company has announced that the lease under which productive operations have been carried on in the Ebner property, which adjoins their own on the west, has been cancelled and all work discontinued.

Chichagoff Mining Company

After a period of several years, during which mining operations were suspended at the Chichagof mine on Chichagof Island, the property was acquired in 1930 by the newly organized Chichagoff Mining Company and exploratory work was resumed on the 1,300-foot level of the mine. This work resulted in the discovery of a new ore-shoot upon which development work has progressed steadily during the biennium. Resumption of underground work was started on February 23, 1931, and since that time there has been driven 396 feet of shaft, 2,468 feet of drifts, 161 feet of crosscuts, and 511 feet of raises.

Owing to the long period during which the mine remained

idle, extensive repair work was necessary, both underground and on the surface, before productive operations could be undertaken. On November 13, 1931, the milling plant was put in operation and has continued active since that date, with the result that a substantial output of gold has been made. The crew employed at this mine numbers about 60 men.

Alaska Chichagoff Mining Company

The property of the Alaska Chichagoff Mining Company embraces a group of claims that is situated a short distance west of the Chichagof mine on the north shore of Klag Bay, Chichagof Island. It is frequently referred to as the "Nick Bez" property, and was formerly known as the "McKallick prospect."

During the biennium development has progressed on a vein on this property that includes a shaft, which has been sunk to a depth of 250 feet; drifts, which aggregate 550 feet in length; and a raise 45 feet in length. This property is now idle.

Hirst-Chichagof Mining Company

The Hirst-Chichagof mine at Kimshan Cove on Chichagof Island was operated continuously during the biennium with an average total crew of 34 men. The mill was run almost continuously throughout 1931 and for a period of 11 months in 1932. In 1931 the tonnage of ore milled amounted to 12,862 tons, which was derived from a stope that extends from the 700-foot level to the 500-foot level. During 1932 a total of 2,553 tons of ore was milled that was taken from pillars around the old No. 1 and No. 2 shafts, which have been abandoned. In addition to this ore there was milled 6,731 tons of tailing that had resulted from previous milling operations.

Underground development work included the following items: Drifts that were driven on the main haulage-level and on the 700-foot level in 1931 aggregated 599 feet in length; in 1932 development drifts that were driven on the main haulage-level, the 700-foot level and the 500-foot level had an aggregate length of 1,034 feet; during the biennium the new No. 3 shaft was extended a total distance of 425 feet, which completed the shaft between the bottom level, the 700-foot level, and the main haulage-level; crosscuts were driven from each of the existing mine-levels

to connect with this new shaft, the aggregate length of the crosscuts being 395 feet; and prospect raises that total 85 feet in length were driven.

Up until March, 1932, the milling plant consisted of: A 10-stamp battery, with amalgamating plates; a tube mill, used in regrinding battery-plate tailing; a Dorr duplex classifier; 3 slime amalgamation plates; and 4 concentrating tables. With this equipment the recovery of gold from the ore was usually about 80 per cent of the whole content.

During 1932 there was added to the mill equipment a 6-cell Denver Sub.-A (Fahrenwald) flotation machine, in which tailing from the slime plates is treated. The tailing from the flotation machine is passed to 3 concentrating tables. There was also added a single-leaf, 4-foot American filter which is used to dry the flotation concentrate. By these improvements the percentage of gold recovered has been increased to an amount representing from 95 to 98 per cent of the total content, as compared with the former percentage of 80 per cent. It is believed that a little more experience with the present equipment will enable a recovery of 99 per cent to be attained.

The retreatment of the tailing pile at the Hirst-Chichagof mine has presented some interesting and difficult problems. The tailing pile is situated on the beach where it has been subjected for many years to alternate wetting by sea-water and drying, as the tide fluctuated. The valuable content of the tailing occurs predominantly as gold-bearing pyrite, which has become oxidized, and with which is associated some fine, free gold. Furthermore, an oil tank is now located just above the tailing pile, and formerly a diesel-driven power plant was also so located. Spillage and run-off from this tank and plant have been draining into the tailing pile for many years. A further complication is introduced by the necessity for utilizing sea-water in all milling operations. In other words, there is being treated a highly oxidized gold-bearing pyrite ore, which is well soaked with fuel oil and diesel oil, in a flotation circuit using sea-water. The value of the tailing that is fed to this circuit averages from $5.50 to $6 per ton. The concentrate now being obtained from this tailing has a value ranging from $500 to $1,000 per ton, depending on the oil content of the feed. The value of the gold that remains in the tailing is from $0.80 to $1.20 per ton.

Apex-El Nido Mine

Following a period of several years during which it was idle, the Apex-El Nido property, otherwise known as the Cann property, was again active during a part of 1932. The property is situated on the west side of Lisianski Inlet, Chichagof Island. A syndicate that holds an option on the property employed a crew of 15 men who were engaged in development work during the period from June 1 to November 16, 1932. New drifts and raises were driven on the Apex vein that total 350 feet in length. On the El Nido vein exploratory drifts and raises were also driven that have an aggregate length of 240 feet. This work is reported to have exposed ore in the El Nido vein at a locality which, hitherto, had been regarded as being barren. The milling plant and water-power equipment were rehabilitated and the mill was operated for a short period. The ore that was milled was derived from the exploratory workings and the results obtained are reported to have been satisfactory. Operations were suspended in November on account of excessive snow-fall and other adverse conditions.

Admiralty-Alaska Gold Mining Co.

In addition to the very large group of claims owned by the Admiralty-Alaska Gold Mining Company at Funter Bay on Admiralty Island, the company also now holds, under an option taken early in the biennium, the extensive adjoining group owned by Chas. Williams and associates. The entire property now controlled by the company reaches from tidewater at Funter Bay upward across the top of Mt. Robert Barron and down to tidewater on Hawk Inlet, and embraces about 200 mining claims. Development work during the biennium was concentrated largely on the Williams property, where diamond drilling was carried on for the purpose of exploring at depth the large auriferous quartz bodies that occur on the property. During 1932 some ore, which was mined from a vein on which extensive development work had previously been done, was milled in the Lane mill that was placed on the property several years ago. No information as to the nature and extent of the work done on the Funter Bay property is available.

Clark Prospect

The Clark prospect, which is located on a branch of Carlson Creek and about 6½ miles northeast of Juneau, was held under option during 1932 by the Premier Southern, Inc.,

the Alaskan subsidiary of the Premier Mining Company of British Columbia. This company employed a crew of 8 men who for two months during the summer and fall were engaged in stripping and blasting the outcrops of the veins exposed on the property, as a means of securing samples. This work extended over a distance of several hundred feet along the outcrops. The Clark property is described by the U. S. Geological Survey in bulletin No. 783 at pages 50-52.

SECOND DIVISION

Field investigations of mining development in the Second Division during the biennium were confined to the Kobuk River district, a small portion of the Fairhaven precinct in the vicinity of Candle, and part of the Nome precinct in the vicinity of Bluff, which were visited during the summer of 1931 by Irving Reed, associate Territorial mining engineer.

The yield of placer gold from the Second Division during the bieninum is estimated to have had a value of approximately $2,750,000, which represents about 27 per cent of the total placer gold produced in the Territory. The value of the output in 1932, which is estimated to have been $1,500,000, exceeded that for 1931 by about $250,000.

As has been the case for a number of years, most of the gold mined was recovered by dredges, of which 14 were in operation during the biennium. About 250 men were employed in dredging operations, many of whom were Eskimos, who are reported to be efficient workmen. The distribution of the dredges was as follows: In the Nome precinct were the 3 large electrically-operated dredges of the Hammon Consolidated Gold Fields, one small dredge that has been recently constructed and which was operated in the immediate outskirts of Nome by Panos, Haughey and Neily, and the Dry Creek Dredging Company's plant which was operated by Belleview Bros. on Dry Creek; in the Council district the dredge of the Ophir Gold Dredging Company and that of the North Star Dredging Company were operated on different sections of Ophir Creek; in the Solomon district one dredge was operated on Spruce Creek by Scott and Jones Bros., and another was operated on Ruby Creek by J. J. Connors; dredging in the Candle district was carried on by the Keewalik Mining Company; and Volmer and Forsgen operated their dredge on Inmachuk River.

There were in operation on the Peninsula 38 hydraulic plants in 9 separate districts as follows: Nome, 7; Inmachuk, 2; Council, 1; Solomon, 5; Teller, 1; Koyuk, 6; Candle, 5; Iron Creek, 4; and Kougarok, 7. The total number of men reported employed at these plants was 174.

Scraper operations were conducted at one plant in the Nome area, where 3 men were employed; and at another plant in the Bluff district, where 16 men were employed.

Drift-mining operations were conducted in the Koyuk, Council, and Inmachuk districts, in each of which was one plant employing from 2 to 5 men; and in the Nome district were 2 plants, which, together, employed 5 men.

A total of 31 shoveling-in operations, each of which employed from 1 to 3 men, were distributed in 9 separate districts, as follows: Nome, 5; Council, 4; Solomon, 3; Teller, 5; Bluff, 4; Candle, 1; and Kougarok, 9. The total number of men thus employed was 49.

It is estimated that there was an average of about 20 men engaged in beach-washing, using rockers and surf-washers, on the stretch of beach about 4 miles in length in the immediate vicinity of Nome. Most of them were experienced men, who, it is reported, recovered gold to the value of from $4 to $10 per day.

It is encouraging to note a revival of interest in the development of lode properties in various localities during the biennium. The occurrence on Seward Peninsula of many lode deposits of substantial merit has already been demonstrated, but interest in their development has languished on account of the remoteness of the region. The rapid development of dependable airplane service to and within the Peninsula, which renders hitherto inaccessible areas easy of access, and the nation-wide search for properties capable of producing gold, will probably stimulate exploration for and development of lode properties on an increasing scale. Detailed descriptions of most of the known lode deposits are to be found in an article entitled "Metalliferous Lodes in Seward Peninsula, Alaska," which has been published by the U. S. Geological Survey in bulletin No. 722, "Mineral Resources of Alaska, 1920." Mineral deposits other than gold that are described include those of copper, tungsten, lead, zinc, iron, platinum, antimony, tin, bismuth, graphite, mercury and coal.

Lode-mining development that has been reported during the biennium includes the following operations: Development work is being carried on at the Sliscovich antimony mine on Manila Creek, by a crew of men employed by A. C. Stewart, of Nome; on a gold-silver ledge at the head of Tripple Creek, which is near the Sliscovich property, a shaft is being sunk by Charles Berg; work is being continued by C. J. Jannsen on the development of a gold-bearing quartz vein on Goldbottom Creek; similar work is being done by C. Z. Shallet and son on a gold-quartz vein on Glacier Creek, a tributary of Snake River, and by August Homburger, whose property is on Newton Gulch, a tributary of Anvil Creek; Edward Fox with a crew of two men is developing a quartz property in the Kougarok district; and steps are being taken to reopen the Meegan and Olson mine on Daniels Creek in the Bluff district, upon which a considerable amount of shallow development work has already been done that is reported to have proven the existence of extensive schist bands well mineralized with gold.

No development work has been reported done on the Big Hurrah gold-quartz veins in the Solomon district, which are the largest known on Seward Peninsula. These three parallel veins, which have been followed by underground workings for several hundred feet, are 4 to 8 feet wide and very uniform in width. The gold ores of these veins are of the free-milling type.

NOATAK-KOBUK PRECINCT

SHUNGNAK DISTRICT

Shungnak River

Kobuk-Alaska Mines

Gold placer operations were continued during the biennium by the Kobuk-Alaska Mines organization, whose property is in reconcentrated glacial outwash material below the canyon of Shungnak River

The following description of current operations conducted by this company is taken from an extensive report on the district submitted by Irving Reed, associate Territorial mining engineer, who examined the property in 1931.

The deposit mined in 1931 lies on the left limit of Bismark Creek. The depth to bedrock is not known and only about 8 feet of the upper portion of the deposit, which is the gold-bearing stratum, is removed in mining. The sequence of material in a section of this 8-foot stratum is as follows: Half a foot of moss and soil; 4 feet of sandy silt; 4 feet of gravel; from 2 to 6 inches of black, finely-broken, slaty material and sand, which is taken as bedrock. The gravel is coarse and sub-angular and boulders, which are very numerous, occur up to 3 feet in diameter. The gold is fine and platy. It occurs all through the gravel, but is especially concentrated on top of the lower, black stratum. It is valued at $16.70 per ounce. The pit that had been excavated by September, 1931 was approximately 100 by 100 feet in dimension, from which about 3,000 cubic yards of material was removed. The recovery of gold from this pit is reported to have been about 90 cents per cubic yard. A cut that was made in 1929 at a point about 300 feet downstream from that above described, and which had dimensions of about 150 feet by 100 feet, is reported to have yielded about 55 cents per cubic yard. The black stratum, or false bedrock, was there found to be about 6 feet above water-level.

Additional exploratory work is reported to have yielded the following results: On the Gold Bank Association claim, which is on Bismark Creek, two small pits are said to have yielded $1.55 and 93 cents per cubic yard, respectively; on the Clark Association claim, at a point on the outwash apron about 100 feet above the level of the river, a small test pit is said to have returned 7 cents per cubic yard; on the "313" Association claim a small test pit sunk to water-level in a bar near the river bank is said to have yielded $2.43 per cubic yard; on the Jim Association claim, which is slightly downstream from the "313" claim, a test pit sunk on the right limit and on a bench about 10 feet above the river, is said to have returned 57 cents per cubic yard; on the Wien claim, on the left limit river bench, also about 10 feet above the level of the river, a test pit is said to have yielded more than 50 cents per cubic yard; near the south corner of the Twins Association claim a test pit is said to have yielded more than 50 cents per cubic yard; and on the Joe Association claim, in several cuts at the present river-level and on the right limit, an average recovery of $2.43 per cubic yard is reported to have been obtained.

In 1931 the company put in use at the camp at Bismark Creek a Crescent (Sauerman) bottomless 1½-cubic-yard scraper. There has also been put in use a 46-H. P. boiler and hoist, which was landed at the mouth of Shungnak River in 1931 and which was

hauled by its own power to Bismark Creek in the spring of 1932. The boiler is said to require the use of 3 cords of wood per 24 hours. Water is supplied by a rope-driven, centrifigal pump, which has a capacity of 2,000 gallons per minute against a 40-foot head. For night work a flood-lighting system has been provided that is driven by a steam turbo-generator.

The cost of the entire operating equipment above described, which was shipped from the States, is said to have been about $40,000 when landed at Bismark Creek ready for operation. During the summer of 1932 the plant was set up on the Joe Association claim, where excellent results are said to have been obtained.

In 1931 the crew employed consisted of 6 men besides the manager. Wages for common labor were $5 per day and board, which latter item costs the company about $2 per day. Eskimos were employed for all unskilled labor.

As a means of testing the ground as a feasible location for the operation of a small dredge, a number of drill holes were sunk in the spring of 1931 in a tract on the downstream end of the property of the Kobuk-Alaska Mines. This work was done by H. R. Norsworthy and Geo. C. Crangle, who represented investors from the eastern States. Bedrock was not reached in any of the holes, the deepest of which was 42 feet below the surface. The best results are said to have been obtained from a hole sunk on a bar near the river. The holes that were sunk appear to have been too irregularly spaced and to have been confined within too restricted an area to provide a fair test of the tract. Though the ground is all unfrozen, great difficulty would probably be experienced in attempting to operate a small dredge on the ground tested because of the presence of many boulders of quite large size. Erection and operation of a large dredge, capable of handling the boulders, would probably not be justified owing to the limited extent and shallowness of the gold-bearing stratum.

On Axels Gulch, at a point about half a mile above its junction with Bismark Creek, a shaft was sunk to a depth of 80 feet by Axel Hanson in 1929. Throughout its depth this shaft is in rather fine glacial outwash material and bedrock was not reached. Hanson died before the shaft was completed.

Jay Creek

During 1930 and 1931 Paul Primer prospected on Jay

Creek, which is a comparatively large left-limit tributary of Cosmos Creek. It is reported that "pay" was struck in the fall of 1931 and that preparations were being made to place a crew of 5 men on the ground to work at shoveling-in operations during 1932.

Dahl Creek

Since early days Dahl Creek has been the principal producer of the upper Kobuk River region. Current operations on the creek include that of Lewis Lloyd, who is mining on Association claims Nos. 1 and 2 Below Discovery; that of Michael J. Touhy, whose ground is located about a fourth of a mile above Lloyd's; and that of Fred Johnson, whose former partner was Axel M. Hanson, now deceased. Johnson's operation is on claim No. 2 Above Discovery, which is about three-eighths of a mile above the mouth of Harry Creek.

Dahl Creek has been worked continuously from below Johnson's pit to a point about half a mile below Harry Creek. The width of the workings averaged 20 feet. The depth to bedrock ranged from 6 feet, at the uper end, to 4 feet at the lower end of the ground that has been worked. The gold is said to have been coarse, one nugget worth $620 having been found just below the mouth of Harry Creek. A few silver nuggets have also been found with the gold.

Riley Creek

During the summer of 1931 Wm. D. Dugan was running a bedrock drain and ground-sluicing on the right fork of Riley Creek. His workings are on the left limit and opposite the lower end of old workings, now abandoned. He was also "splashing" and shoveling-in a small cut in the stream-bed about 500 feet further upstream. It was estimated about 1,000 square feet of bedrock would be cleaned at the end of the season.

California Creek

California Creek is a large left-limit tributary of Kogoluktuk River which it enters about 5 miles above its confluence with Kobuk River. Mining operations have been conducted by F. R. Ferguson on California Creek since he discovered gold in the canyon on the creek in 1918. He now holds 8 claims that extend from the canyon upstream. Commencing at the head of the canyon Ferguson has mined out by the use of a hydraulic lift, a pit 50

feet in width that extends 1,000 feet upstream. He then moved upstream a distance of 800 feet and started a second pit, which has been mined out for a width of 60 feet and for a distance of 1,000 feet upstream. Work on this pit was stopped in August, 1931 and, skipping another strip of ground, the plant was moved 1,200 feet upstream where a third pit was started.

In working this ground all but from 6 to 10 feet of the lower gravels are hydraulicked to one side of the creek-bed, after which the lower gravels are hydraulicked to the elevator, which is a No. 1, 14-inch elevator of the Campbell type and which lifts the material to a height of 14 feet. Water is supplied by a ditch, which is 12 feet wide at the top, 6 feet wide at the bottom and 5 feet in depth, and which is 2½ miles long. About 3,000 feet of 24-inch pipeline is in use. Three No. 1 giants, equipped with 2-inch and 3¼-inch nozzles, are operated under a head that varies from 160 feet to 225 feet, according to the location of the elevator.

Up to and including 1930 the ground is said to have averaged approximately $0.49 per bedrock-foot, or about 81 cents per cubic yard. The ground worked in 1931 is said to have averaged approximately $0.29 per bedrock-foot, or about 38.5 cents per cubic yard.

The crew consists of from 3 to 4 Eskimos, who receive wages of $5 per day and board, which costs about $2 per day. The working season is about 100 days.

Lynx Creek

Lynx Creek is a small left-limit tributary of Kogoluktuk River about one mile upstream from California Creek. Since 1912 the gravels of this creek have been worked by Herman Pohl, who had mined up to 1931 about 65,000 square feet of bedrock in a cut 3,500 feet long that ranges in width from 25 feet at the lower end to 10 feet at the upper end. Overburden and gravel to the depth of about 7 feet is removed by ground-sluicing, and the remaining gravel, together with one or two feet of bedrock, is shoveled-in to sluice boxes. The average yield of the ground mined up to and including 1930 is said to have been about 9.1 cents per bedrock-foot, or about 27.3 cents per cubic yard. During 1931 the ground yielded about 12.5 cents per bedrock foot, or about 37.5 cents per cubic yard. It is estimated that in about one more year the creek will have been worked out, unless improved methods are applied.

Lode Deposits

Gold and Copper: The lode deposits of the Shungnak district were described by the U. S. Geological Survey following an examination of the region in 1910.* Since that date no further work has been done on any of the deposits. It is believed the gold-bearing veins of the district deserve more attention from prospectors than they have received.

Asbestos: The occurrence of asbestos in the region adjacent to Dahl Creek has been known for many years, but the quality of the material was poor, according to a description given by the U. S. Geological Survey*

During the biennium additional discoveries have been made of deposits of chrysotile asbestos that give promise of being of importance. These discoveries were made by Michael Garland by whom a large group of claims has been staked covering the deposits. A sample of the material found at the surface by Mr. Garland was furnished by him to the office of the Territorial mining department that was forwarded to the U. S. Bureau of Mines at Washington, D. C. It was identified as chrysotile asbestos and pronounced the finest grade material of its type yet submitted from an undeveloped prospect.

The following description of the occurrence of the asbestos deposits on the Garland property was prepared by Irving Reed, associate Territorial engineer, who visited the ground in 1931:

About three-eighths of a mile north of and about 250 feet in elevation above the mouth of Stockley Creek, and on the left limit of Dahl Creek, is a prominent outcropping of greenstone and serpentine. This rock weathers out along both vertical and horizontal joint planes into rectangular blocks. Parallel to the horizontal joint planes are three thin parallel seams of asbestos. The largest was about 3 inches wide and was uncovered for about 2 feet. The dip was about 25½° to the east. The asbestos fibers lie longitudinally in the direction of the dip and parallel to the walls of the seam. Fibers over a foot long could be pulled from the seam.

* Mineral Resources of Alaska, 1910; U. S. Geol. Survey Bull. 480, pp. 298-305.

* Op cit., p. 304.

On the Dahl Creek slope near the top of Asbestos Mountain, and about one mile east of and at least 1,000 feet in elevation above the first mentioned outcrop, is another large outcrop of serpentine and nephrite. Here, also, three thin seams of asbestos were seen, the largest 3 or 4 inches in width. These seams were traced for approximately one-fourth of a mile, and may be longer. The dip is about 25° to the east. The asbestos lies longitudinally with the dip as in the seams first described. Fibers at least 18 inches long could be pulled from these seams.

About one-half of a mile east of the last described outcrop, and near the "monument" on the highest peak of Asbestos Mountain, is a surface deposit of short-fibered asbestos. Weathered fibers, observed lying on the ground, had a length of about 1 inch. This deposit is undoubtedly weathered from the serpentine and may consist of chrysotile. Its value is very problematical.

Similar deposits of low-grade asbestos occur associated with greenstone and serpentine above the canyon on Cosmos Creek and about half way up the canyon near the base of Shungnak Mountain on Shungnak River.

About one mile west from the lower outcrop or first discovery made by Garland, and across Dahl Creek, near the contact of the serpentine and limestone, Garland claims to have found in 1932 another much larger outcropping of asbestos. He took some old powder that was 20 years old and tried to blast out the face of the outcrop. He says that apparently the asbestos is in vertical columns with plates of serpentine between the columns. This would make known exposures two miles apart in the greenstone, and the greenstone extends at least a mile farther to the west from the exposure on top of Asbestos Mountain, with a probable extent of three miles of asbestos-bearing rock.

SQUIRREL RIVER DISTRICT

The gold placers of the Squirrel River district were described by the U. S. Geological Survey following an examination of the region in 1910.* This report is accompanied by a sketch map of the area.

* The Noatak-Kobuk Region, Alaska; U. S. Geol. Survey Bull. 536, pp. 133-139.

The district was again visited in 1931 by Irving Reed, associate Territorial engineer, and the following notes on current mining operations are based on his report. The only mining now in progress is being done on a small scale and is confined to Klery Creek and Central Creek.

On Klery Creek the following operations are being conducted: Leopold Geffe, assisted by one Eskimo, is shoveling-in on claim No. 4 Below Discovery. The depth of ground mined is about 4 feet, where a false bedrock occurs. The gold, which occurs entirely in the gravel, is fine and flaky. It is claimed that the ground runs $1.10 per cubic yard.

On the Star Association claim, at a point on the left-limit bench a short distance below the mouth of Jack Creek, Manuel Lavendero commenced in 1931 the operation of a small hydraulic plant. The ground ranges from 14 to 30 feet in depth, of which the upper 5 feet is sandy silt and loam and the rest is coarse gravel wash, which contains boulders up to 18 inches in diameter. Bedrock is limestone, which is also mined to a depth of from 1 to 4 feet. Coarse and fine gold occur mixed in the deposit, and its value is about $18.50 per ounce. The ground is said to run about 40 cents per cubic yard. Two natives are employed in this operation.

Andrew Garbine also worked on the Star Association claim during the summer of 1931. He was shoveling-in a small pit on the left-limit bench just above Lavendero's ground and below Jack Creek.

On the downstream part of the eastern side of the "Gopher Bench" claim Theodore Westlake, assisted by one man, is shoveling-in. The gold at this locality is coarse and is frequently in the form of nuggets. Its value is about $18.50 per ounce. The value of the ground is said to average about 65 cents per cubic yard.

On claim No. 23 Above Discovery E. G. Wood was shoveling-in during 1931. At this locality the depth to bedrock is about 2 feet. The gravel is very coarse, sub-angular wash and contains boulders that are as much as 3 feet in diameter.

Owing to the fact that the part of Klery Creek that contains the paystreaks that have been and are being mined is in a narrow gorge, above which is an extensive drainage basin, the stream is

subject to prolonged and severe freshets, which usually occur within the period extending from late in June to September first. The paystreak on Klery Creek appears to occupy the whole width of the floor of the gorge. The workable deposits seem to have been formed at those places where the existing stream has cut an old channel, remnants of which probably still remain.

Central Creek is a left-limit tributary of Squirrel River, which it joins at a point about 5 miles below the mouth of Klery Creek. The flow of water in Central Creek in August, 1931 was estimated to amount to about 1,000 miners' inches, or 25 second-feet. The stream is about 13 miles long and the direction of flow is substantially the same as that of Klery Creek. Much of the ground on the upper reaches of the creek is unfrozen.

During the winter of 1930-1931 a line of drill-holes, which were spaced 50 feet apart, was being drilled across the valley of Central Creek by Arthur M. Hansen, who controls nearly seven miles of the creek. This line of holes is situated about a quarter of a mile below the cabin that occupies a position about midway between the upper and lower limits of the Hansen property. A "Star" type gasoline-driven drilling rig was being used and two native helpers were employed. It was planned to continue the drilling program during the winter of 1931-1932. It is claimed that the value of the ground drilled averages 65 cents per cubic yard.

It was also announced that W. K. Suksdorf planned to thoroughly drill the creek with a "Keystone" drilling rig during the summer of 1932.

From local records obtained by Mr. Reed, the total production of gold in the Squirrel River district up to and including the year 1930 is estimated to have been approximately $657,000, distributed as follows:

Klery Creek	$647,000.00
Bear Creek	2,000.00
Caribou Creek	1,000.00
Central Creek	3,000.00
Homestake Creek	4,000.00

The production for the season of 1931 is estimated to have been $1,000, all of which came from Klery Creek.

THIRD DIVISION

While the Third Judicial Division suffered a very material reduction during the biennium in the output of copper ore, which for many years has held first rank among the mineral products not only of the Third Division, but of the Territory, there was a very gratifying compensatory increase in production of gold from lode mines in the division.

Noteworthy features of progress in the several mining districts during the biennium were: Enlargement of the scale of mining, plant improvements, bettered transportation facilities, and development of new properties in the Willow Creek and Nabesna River districts; continued productive lode-gold mining in the Nuka Bay and Hope districts, and of productive placer-mining in the Cache Creek, Turnagain Arm, Nizina, and Valdez Creek districts; and normal production of bituminous coal from the Matanuska field, and of petroleum from the Katalla field.

In addition to these productive operations there was a marked impetus in prospecting for new ore deposits, especially for those of gold, in many districts.

KENAI PRECINCT

Kenai precinct embraces roughly that portion of Kenai Peninsula that lies south of Turnagain Arm and east of the latitude of Tustumena Lake. The principal mining districts of the precinct are the Nuka Bay, Seward, and Moose Pass-Hope districts.

Descriptions of the mineral resources of Kenai Precinct were contained in U. S. Geological Survey bulletin No. 587, "Kenai Peninsula, Alaska," which included excellent topographic and geologic maps of the peninsula. Unfortunately, this bulletin is now out of print and no longer available. Reports on the results of examinations of mineral resources and mining development in the Seward and Moose Pass-Hope districts, made by the U. S. Geological Survey on behalf of the Alaska Railroad in 1931, are not yet available. The only productive lode-mining operation conducted in these districts during the biennium was that of R. B. Heastan and associates at the Lucky Strike mine, better known as the Hirshey mine, situated at the head of Palmer Creek in the Hope district. Several placer mining operations were also being carried on in both the Hope and Sunrise placer-mining districts, but details concerning them are lacking.

NUKA BAY DISTRICT

Introduction

The major features of the geology of the southern portion of Kenai Peninsula, including Nuka Bay, were studied and mapped during the year 1909 by U. S. Grant and D. F. Higgins for the U. S. Geological Survey, and in 1915 a report based on their observations was published.* The supply of the bulletin that contains this report has become exhausted and copies are no longer available for distribution. Furthermore, at the time their report was prepared, the occurrence of auriferous quartz veins in the section of the Nuka Bay region described in the following report had not been recognized.

In 1924 the district was visited by Harry H. Townsend, associate Territorial engineer. At that time initial development work had been carried on at about half a dozen prospects, all of which were examined by Townsend, who secured numerous samples of the various exposed ores. During that season the first mill to be erected in the district was under construction at the property of the Alaska Hills Mines Corporation on Nuka River.

During the season of 1925 a visit to the district was made by J. G. Shepard, associate Territorial mining engineer, who examined and rendered brief reports on 10 prospects then under development, and who also secured numerous samples from the various vein exposures visited.

The following report is based largely on a report of examinations made in the district during the summer of 1931 by Earl R. Pilgrim, associate Territorial engineer, supplemented by material from the unpublished reports by Townsend and Shepard.

Geography

Nuka Bay lies on the south front of Kenai Peninsula about midway between Resurrection Bay and Cook Inlet, between which points it is the largest embayment on the coast of the Peninsula. The bay as a whole has roughly the form of the letter "Y", with the arms extending inland and the stem, which is the main body of the bay, extending seaward. The general trend of the bay is east of north. For a distance of approximately nine miles from

* Geology and Mineral Resources of Kenai Peninsula, Alaska, 1915; U. S. Geol. Survey Bull. 587, pp. 209-238.

the ocean entrance the bay maintains a width of about six miles between the east shore, which is formed by Pye Islands, and the west shore, which is formed by Nuka Island as far north as Nuka Island Pasage, beyond which it is formed by the mainland of Kenai Peninsula. The easterly branch of the northern section of the bay is designated East Arm. It is about two and one-half miles wide and extends for a distance of about seven miles to McCarty Glacier, the front of which has a width of three miles and which forms the inner shore of the arm. The western branch of the bay, which is designated West Arm, extends northwesterly from the main bay a distance of approximately six miles, where it, in turn, branches into Beauty Bay, which extends northwesterly for about two miles, and North Arm, which extends northeasterly for about six miles. On the westerly side of West Arm near its entrance is Yalik Bay; and on the easterly side at about three miles from its entrance is Surprise Bay, and at about five miles from the entrance is Quartz Bay. The inner branches of the bay, above described, are in the nature of fiords, from the shores of which the mountains rise abruptly to altitudes of from 2,000 feet to 3,500 feet. Storm Mountain, the southerly slopes of which form the peninsula that separates Nuka River valley and Beauty Bay from North Arm, is the highest peak in the region, its elevation being 3,775 feet. Mt. Diablo, whose slopes rise from the west shore of Beauty Bay, is next in height with an elevation of 3,550 feet. The shores of Nuka Bay and its branches are prevailingly rough, although there are a few scattered beaches upon which boats may be drawn between tides. In numerous coves good anchorage is found for small power boats. In many parts of the bay the water is of sufficient depth to permit large steamers to approach within a few yards of shore. Excellent charts of the bay have been published by the U. S. Coast and Geodetic Survey.

The largest stream of the region is Nuka River, whose length is five and one-half miles. It receives its waters from five small glaciers and discharges into the head of Beauty Bay at its northeast corner.

Climate

Considering the latitude, which is approximately 59° 30' North, the climate is quite mild. The prevailing temperatures, which are influenced by warm ocean currents off-shore, are moderate and uniform, ranging from a monthly mean of approximate-

ly 20° above zero in January to about 55° above zero in July and August.

The mean annual precipitation is probably about 50 inches, being somewhat less than that which characterizes the southern coast of Alaska farther to the eastward. While the snowfall is moderate as compared with other sections of the southern Alaska coastal region, care must be exercised in the choice of location for camp-sites, mine workings, and roads and trails, in order to avoid the menace of snowslides, and the structure of buildings should be so designed as to care for heavy loads of moist snow.

Timber and Vegetation

Spruce forests cover the mountains from sea-level to a maximum elevation of 1,000 feet. The best stands of timber are in the valleys at the heads of Beauty Bay, Surprise Bay, Quartz Bay, Yalik Bay and North Arm. Trees standing 100 feet in height and with a diameter of three feet at the base are of common occurrence. While grasses are plentiful in certain localities, the use of horses for transportation purposes is impractical.

Animal Life

Black bears and squirrels were the only land animals observed. Fish are plentiful in season and clams are to be found on a few beaches.

Transportation

Local transportation to all points along the shores of Nuka Bay where miners or prospectors are living is supplied by Peter Sather, fox farmer of Nuka Island, who maintains a monthly gasboat service, and whose boat is also available for special charter. The steamer "Starr" maintains a monthly schedule between Seward and Kodiak and will make trips into Nuka Bay by special arrangement. Passenger fare from Seward to Nuka Bay is $15 on regular scheduled trips. Seward is the commercial supply center for the region.

Power

Many streams of the region are capable of affording sufficient power for small mining operations during about nine months of the year, and in some cases twelve months. Water power is available within two miles of almost any point of moderate elevation in the region. A stream of large volume on which occurs a 900-foot cataract is reported at the head of North Arm. This stream was not seen by the writer.

General Geologic Features

The predominating rocks of the region are slates and graywackes, considerably folded, tilted and faulted and, in places, highly silicified. They vary in hardness from soft, easily carved slates to hard, highly siliceous quartzites that show little indication of their sedimentary nature and which have, therefore, been frequently mistaken for intrusives. Microscopic analysis has determined their sedimentary origin. Unconformable contacts between the sedimentary beds were observed in several localities, in places being marked by the occurrence of conglomerates of varying degrees of coarseness. The sediments are generally steeply pitching. It is in these tilted sediments that the principal mineralization of the region occurs.

Intrusive Rocks: No large intrusive masses have been observed within the mineralized region. However, the large granite mass that includes Pye Islands and the peninsula immediately north of them borders the mineralized area on the south. From this mass numerous granitoid dikes extend northward, penetrating and cutting the sedimentary series of rocks, especially in the southerly portion of the peninsula.

Numerous light colored dikes, for the most part highly siliceous, were noted in various sections of the Nuka Bay region. These range from a few inches to 20 feet in thickness and the larger ones are very persistent. The distribution of these dikes is shown on the general map of the region. A specimen of one of the large dikes examined microscopically was determined to be an igneous rock consisting of quartz, feldspar and amphibole. It contained somewhat less than one per cent of pyrite. An assay of the sample yielded gold, 0.02 oz. and silver, 0.10 oz., total value $0.43 per ton. All the dikes that were observed have a general north-south trend and lie parallel to the principal axis of folding in the sedimentary rocks. The sediments exhibit little or no effect of alteration along the contacts with these dikes.

Veins and Minerals: From an examination of nearly all the veins now held by location and a number that have not been located, the following general observations were made: Veins are generously distributed throughout the Nuka Bay area. They occur both in the slates and in the graywackes, and both close to and at considerable distances from exposed intrusive dikes. They are found at and below sea-level and at elevations greater than 1,200

feet. The following types of veins were noted: Lenticular veins lying in the slaty cleavage of the country rock; gash veins cutting the cleavage; and fissure veins of indefinite length cutting across the cleavage of the slates and into the graywacke. One vein was noted in contact with an acidic dike and another following approximately the contact between hard massive graywacke and dark slate. In at least two localities veins were seen intersecting or crossing. The veins range in width from less than an inch to over ten feet.

Types of vein filling observed include crystalline quartz with metallic sulphides; massive, vitreous, hard quartz with no sulphides; milky white quartz containing considerable slate and graywacke breccia; sheared zones in the sediments with a little quartz in the form of stringers filling the crevices. Some veins are frozen to the wall rocks, while others have a distinct parting, with gouge on one or both walls.

Listed in the order of their abundance the associated minerals include quartz, calcite, arsenopyrite, sphalerite, pyrite, galena, pyrrhotite, chalcopyrite, gold and silver. A trace of nickel was detected in one vein. A portion of the gold occurs free, but the larger percentage is contained in the metallic sulphides.

Surprise Bay

Frank Skinner Property

The vein that is exposed on this property outcrops on a rocky slope at sea-level in a small cove which is situated on the east side of Surprise Bay about one mile south of the narrows at the entrance to Palisade Lagoon. Where exposed at the surface the vein appears strong and regular and is made up of fractured graywacke and quartz accompanied by considerable gouge. At an elevation of a few feet above high-tide level a tunnel has been driven on the vein for a distance of 42 feet. In the face of this tunnel there is about 12 inches of vein filling. At this point the vein is made up of the principal gouge-filled fissures and brecciated wall-rock accompanied by very little quartz. The walls are composed of massive graywacke. Near the face of the tunnel numerous quartz stringers extend southeasterly into the walls. The bedding of the graywacke strikes N. 3° E. Prominent cleavage is developed in the graywacke the planes of which strike N. 57° W. and dip 80° S.

No samples of the vein were taken by the examining engineer,

but he was informed that assays of two samples of the vein taken by others showed values in gold of $38.90 and $18 per ton, respectively.

Sonny Fox Mining Company

The property of the Sonny Fox Mining Company, which is usually referred to as the Babcock and Downey property, is situated in the amphitheater-shaped valley at the head of Surprise Bay, approximately one mile beyond the upper end of Palisade Lagoon. The group embraces six claims designated Sonny Fox and Sonny Fox Nos. 1 to 5, inclusive. The principal production of gold from the Nuka Bay district has been derived from operations on this property, which have been carried on since the year 1926.

The original discovery of gold-bearing ore on the property was made at the outcrop of a small vein on the Sonny Fox claim. This exposure was examined in 1925 by J. G. Shepard, associate Territorial mining engineer, who described it as a small quartz-filled fissure that is traceable for some distance on the surface and that varies in width from 6 inches to 18 inches. A sample taken by Shepard across the vein at the discovery outcrop assayed $7.60 in gold and silver. Subsequent to Shepard's examination, this small vein was developed by means of two tunnels, the lower of which was 60 feet and the upper one was 40 feet in length. A raise on the vein was also driven between these two tunnels, the vertical interval between which is 40 feet. A tramway was erected that delivered ore from these workings to an Ellis ball-mill, and a small production of gold from the Sonny Fox vein resulted.

On the Sonny Fox No. 3 claim and at a distance of about 1,200 feet south of the Sonny Fox workings a second vein outcrops on the hillside, that has been traced for a distance of several hundred feet by means of one short tunnel and several open cuts. This vein strikes N. 10° E. and dips 65° W. The full width of the vein is 11 feet where it is exposed in the short tunnel at an elevation of 206 feet. The hanging-wall section of the vein consists of 6 feet of solid, white, crystalline quartz. The foot-wall section, 5 feet in width, is made up of parallel stringers of white quartz in slate bedrock. The hanging-wall is sharply defined and carries a small amount of gouge. The foot-wall is not clearly defined and is distinguished only by the gradual disappearance of the quartz stringers. Both walls are of dark slate. No samples of this vein were

taken by the examining engineer, but he was informed that assays running from $8.60 per ton to $40 per ton resulted from samples of it that had been taken by others.

At a distance of about 20 feet south of the short tunnel referred to in the last paragraph above, a third vein is exposed that has been developed by a tunnel 60 feet in length, which is also at an elevation of 206 feet. Where exposed in this tunnel this vein consists of iron-stained quartz and has a width varying from 2 feet to 4 feet. In the face of the tunnel a fault striking N. 30° W. and dipping 75° E. has cut off the vein. The vein itself strikes S. 75° E. and dips 73° N. and undoubtedly intersects the other vein on Sonny Fox No. 3 claim, above described, although the intersection is not exposed. No definite information was obtained as to the gold content of this vein.

The Lady Luck vein lies a short distance south of the above described tunnels and traverses the Sonny Fox No. 4 claim. Current mining operations are being conducted on this vein, which is the most extensively developed and, thus far, the most productive vein on the property. Initial mining operations on the Lady Luck vein were conducted on the outcrop at the discovery point in an open-cut 65 feet in length from which several hundred tons of high-grade ore was extracted. Subsequently, a tunnel 100 feet in length was driven on the vein below the outcrop exposure and at an elevation of 190 feet. At at point in this tunnel 40 feet from the portal a split in the vein occurs beyond which one branch of the vein strikes east and the other N. 45° E. At an elevation 40 feet below this tunnel is the present main working tunnel. On July 25, 1931, it had been driven a distance of 230 feet on the vein and stoping operations were being conducted on the northeast branch of the vein between the working tunnel level and the upper tunnel. A cross-cut was also being driven from the working tunnel so directed as to intercept the other branch of the vein, to accomplish which, however, some distance still remained to be driven.

In the open-cut at the discovery outcrop the Lady Luck vein has a width of from 3 feet to 4 feet. It consists of white crystalline quartz that contains considerable aresenopyrite, with which is associated small amounts of galena and sphalerite and some free coarse gold. In specimens of the vein material examined under the microscope calcite and amphiboles or other silicates related to them are found to be present in small amounts.

In the lower tunnel the vein has a width varying from a few inches to 4 feet. In this tunnel several minor faults appear, all of which trend in a southeasterly direction and by each of which, as encountered in the driving of the tunnel, the vein was offset to the south.

About 800 feet southeast of the present Babcock and Downey camp the outcrop of a large vein is exposed on the hillside at an elevation of about 100 feet. The quartz of this vein appears to lie in a number of parallel bands separated from one another by cleavage planes. The vein also contains some graywacke breccia and also a considerable amount of pyrite and arsenopyrite. A sample taken across 22 feet of the outcrop, which probably represents its full width, returned an assay of only a trace of gold and silver.

An 800-foot surface tram, partly graded and partly on trestle work, connects the working tunnel on the Lady Luck vein with an ore-bin at the head of a gravity-type aerial tram equipped with two bottom-dump buckets, which have a capacity of 500 pounds each. This short aerial tram delivers ore to the mill bin.

The milling plant includes a No. 1 Denver quartz mill, which is operated at a speed of 35 R. P. M. and which has a capacity of 7 tons per 22 hours. The pulp from this mill passes over two amalgamating plates, the dimensions of which are 3 feet by 6 feet and 4 feet by 8 feet, respectively. Tailing from the mill is treated on a Gibson concentrating table, which is driven by a small gasoline engine. The table tailing is impounded. The crusher and mill are operated by a 45-inch water-wheel under a head of about 40 feet. A 25-H. P. gasoline engine is available for emergency power. The mill is at an elevation of about 35 feet above sea-level.

The concentrate recovered in the mill is shipped to the smelter at Tacoma, Washington. The average value of the concentrate is said to be about $128 per ton. The following analysis of the concentrate was furnished the examining engineer:

	Per Cent		Per Cent
Al^2O^3	5.9	Lead	0.2
Insoluble	1.3	Zinc	1.3
SiO^2	55.8	Arsenic	6.11
Sulphur	4.9	Iron	11.3

The camp buildings include a log mess-house, a log bunk-

house, two tent-frame residences, and a log compressor-house and blacksmith-shop. The compressor is an Ingersoll-Rand, portable, gasoline-driven type.

The Sonny Fox Mining Company is owned by Thomas Babcock, D. W. Downey and Charles Tecklenberg, of Seward, Alaska. Up to August 1, 1931, the property had produced about 1,000 tons of ore, which was said to have averaged about $25 per ton.

Johnston and Degan Property

The mining claims that comprise this property are situated on either side of the top of the ridge that separates Quartz Bay from Surprise Bay. The claims of the group that lie on the Quartz Bay side of the ridge are the Grubstake Nos. 1 and 2 and the Lost Boy. These claims were not visited by the examining engineer on account of the unusual amount of snow that remained on the ground at that locality. Where it is exposed at the head of Quartz Bay the Lost Boy vein is reported to have an average width of 4 feet. The strike of this vein is said to be northerly and southerly.

The Grubstake Extension Nos. 1 and 2 claims are situated on the ridge directly above the narrows that connect the head of Surprise Bay with Palisade Lagoon. At this point a small gulch extends in a northwesterly direction from the west shore of Surprise Bay, in which gulch and its branches are exposed the veins that occur on the Grubstake Extension Nos. 1 and 2 claims.

As this gulch is ascended the first exposures are found at an elevation of 370 feet where two small veins outcrop 36 inches apart. The veins are filled with white quartz which contains no visible sulphides. The exposed width of the northerly one of these veins is 2 inches and that of the southerly one is 8 inches. Both veins strike N. 54° W. and dip 86° N. and their walls are of graywacke. Conglomerate boulders containing graywacke pebbles that are found distributed in the gulch for some distance above these outcrops indicate that these small veins occur in the vicinity of a contact between graywacke and conglomerate.

The next exposure occurs at an elevation of 810 feet where a vein of white quartz 3 feet in width outcrops above a slide in the gulch. As nearly as could be determined from the small extent of the outcrop that was visible through a snow drift, the strike

of this vein is N. 82° W. No sulphides were visible in the quartz of this outcrop.

On the ridge above this exposure is disclosed by outcrops a group of four veins that include a through-vein and three cross-veins, all of which meet the through-vein at approximately right angles, but which do not cross it. The through vein has a general trend of northeasterly and southwesterly, the strike being N. 25° E. at the lower exposure, which is at an elevation of approximately 900 feet, and N. 62° E. at the upper outcrop, which is at an elevation of 1,000 feet. Its width at the lower exposure is 12 inches and at the upper exposure 40 inches. At the upper outcrop the through-vein is composed of crystalline quartz which contains plentiful sulphides. A sample taken across 28 inches of this material returned an assay of gold 0.98 oz. and silver 1.0 oz. The lowermost cross-vein intercepts the hanging-wall side of the through-vein at an elevation of about 910 feet. It strikes S. 36° E. and dips 85° SW. The cross-vein has a width of 4 feet at the outcrop where it is composed of white quartz and graywacke breccia. No sulphide mineralization was visible in the quartz, but the surface outcrop is considerably oxidized.

At a distance of 35 feet from the first cross-vein the through-vein is intercepted on its foot-wall side by the second cross-vein, which strikes N. 35° W. and dips 80° NE. This second cross-vein has a width of 36 inches. It is composed of quartz that contains some galena, arsenopyrite and pyrite. The third cross-vein, which is parallel to the second and which also intercepts the through-vein on its foot-wall side, outcrops at an elevation of 1,000 feet. It has a width of 2 feet and contains considerable sulphides. This vein is made up of parallel stringers of quartz, alternating with bands of graywacke.

Each of the above described veins is in graywacke at the outcrop exposures. However, at an elevation of about 70 feet higher than the upper exposure on the through-vein and to the north of it slate bedrock was observed, which indicates that the vein system is close to the contact between graywacke and slate.

Development work on the Johnston and Degan property includes a number of surface trenches and also trails that lead to the several veins. A cabin has been built near the head of Quartz Bay at its northeast corner. Near this cabin is a cataract upon

a stream that would provide an excellent source of power for mining. From this power site a transmission line to mining claims on the Surprise Bay slope would be feasible. The elevation of the intervening ridge at the point of crossing is 1,220 feet.

Charles Goyne Property

This property is situated on the west side of Surprise Bay a short distance south of the Johnston and Degan claims. The two claims of the group which are designated the Surprise and the Bear, respectively, extend from the shore of Surprise Bay up the mountain-side to an elevation of approximately 1,000 feet. The principal vein exposures are on the Surprise claim. At an elevation of 150 feet on this claim a tunnel has been driven that was 51 feet in length at the time of visit. This tunnel penetrates hard, fine-grained graywacke for a distance of 41 feet, at which point a vein is intercepted that strikes S. 80° W. and dips 83° S. At the face of the tunnel the vein has a width of 57 inches. The hanging-wall section of the vein for a width of 9 inches is composed of fractured, white crystalline quartz that is separated from the hard graywacke of the hanging-wall by a thin seam of gouge. The remainder of the vein is made up of parallel banded quartz stringers cutting hard slate, of which the foot-wall is composed. A sample taken across the 9-inch hanging-wall section assayed: Gold 3.68 oz., silver 0.20 oz. per ton.

Above the tunnel the vein is exposed at the surface for a distance of several hundred feet up the mountainside. Throughout much of this distance it follows the contact between slate and graywacke. At an elevation of 280 feet the vein has a width of 17 inches and is composed entirely of quartz. A sample across the vein at this point, taken by Mr. Goyne is said to have shown an assay value of $11 per ton. Beyond a point at an elevation of 330 feet the vein is found to lie wholly within graywacke, but parallel to the slate-graywacke contact and at a distance of about 4 feet therefrom. This section of the vein is formed of a number of parallel bands of quartz alternating with bands of graywacke, one of which is 30 inches in width. At the 330-foot elevation a parallel quartz vein is exposed that lies wholly within graywacke and at an average distance of 24 feet south from the contact vein. This southerly vein has a width of 48 inches and may be traced for some distance up the mountainside. It is composed of massive quartz and graywacke breccia. No sulphide mineralization is visible in the lower outcrop of this vein, but at a higher elevation it contains some galena.

At an elevation of 550 feet the contact vein is exposed where it has a width of 2 feet and is composed of quartz that is strongly mineralized with arsenopyrite, galena, and visible free gold. In order to determine with which sulphide the gold was most directly associated in this material a specimen was picked that showed only quartz and galena. This specimen assayed: Gold 5.29 oz., and silver 5.20 oz. per ton. A second specimen that showed only quartz and arsenopyrite assayed: Gold 0.11 oz., and silver 0.30 oz. per ton. At the 550-foot elevation the southerly vein has a width of 26 inches and is said to return assay values of from $3 to $5 per ton. The general strike of the two parallel veins and of the slate-graywacke contact is N. 85° W. The cleavage of the slate bedrock varies in direction from N. 5° E. to N. 34° E. and its dip is 80° W.

From a shipment of several tons of sorted ore obtained from the contact vein that was made to the Tacoma Smelter in September, 1931, the following returns are reported to have been received:

Gold, 4.10 oz. at $19.50	$79.95
Silver, 1.72 oz. at 0.27¾	.34
Arsenic, 5.6 units	
Sulphur, 0.24 per cent	
Total payment per ton	$80.92

Quartz Bay

Along the shores of Quartz Bay there were observed outcrops of a number of veins that carry a small amount of pyrite. A sample that was taken from the outcrop of one of these veins, 6 inches in width, that is exposed on the south side of the bay about 50 feet west of a large, light-colored dike, returned an assay of gold 0.02 oz. and silver 0.10 oz. per ton. A sample taken from another vein or series of stringers at an outcropping on a bluff on the south shore of the bay about one-half mile west of the head returned an assay of gold 0.01 oz. and silver 0.30 oz. per ton. The full width of mineralization at this locality is 12 feet, of which the sample taken represented a width of 5 feet.

Yalik Bay

Peter Sather Property

The Sather property comprises a group of seven claims designated Rolph Nos. 1 to 7, inclusive, that are situated just east of a stream that enters Yalik Bay on the south shore about 2 miles from the mouth. This property was formerly referred to as the Al. Blair prospect.

The Rolph No. 1 vein outcrops on the beach, from which point it extends northwesterly under the waters of the bay and southeasterly into the rock bluff that forms the shore. It is exposed above the shore-line for a distance of about 50 feet where it varies in thickness from a few inches to 42 inches. It is composed of white, crystalline quartz that contains pyrite, sphalerite, chalcopyrite and galena. A sample taken across 42 inches at the outcrop assayed: Gold 0.80 oz. and silver 1.40 oz. per ton. The strike of the vein is S. 57° E. and the dip 85° E. The walls are of slate, the cleavage of which strikes N. 7° E. and dips 66° W. A tunnel driven from a point 20 feet east of the outcrop on the beach in a direction of S. 17° W. intersects the vein 24 feet in from the portal. At that point the vein is 6 inches wide and is composed of quartz that contains some sulphide mineralization. The tunnel has been driven beyond this vein for a distance of 27 feet where it intersects a second vein, but does not pass through it. In a surface exposure of this vein, not seen by the examining engineer, the width of this vein is said to be 6 feet. The quartz of this vein, where exposed at the face of the tunnel, is dull white in color and contains little visible metallic mineralization. A sample taken at the tunnel face across a width of 24 inches returned an assay of a trace of gold and silver.

About 700 feet west of the tunnel described above a second tunnel has been driven on the Rolph No. 3 claim. This tunnel, which is at an elevation of 20 feet above sea-level, is directed southwesterly from the portal near the shoreline and is 60 feet in length. At its face the tunnel penetrates, but does not cross a vein which outcrops at the surface above, the full width of which is not disclosed. The foot-wall of the vein strikes N. 21° W. and dips 73° W. At the face of the tunnel 30 inches of dull white quartz is exposed that contains much slate breccia, but no sulphide materials. Some calcite stringers occur among the brecciated material. The foot-wall rock is a light-gray intrusive that is exposed on the

east wall of the tunnel for a distance of 15 feet back from the vein. A band of slate 9 feet in width intervenes between this intrusive mass and a narrow tongue of similar intrusive material that crosses the tunnel in a direction of N. 58° W. and dips 80° SW. This tongue of intrusive varies in width from 4 inches at the east wall of the tunnel to 18 inches at the west wall, and carries on its foot-wall side a band of quartz about 2 inches in thickness. The cleavage of the slates through which the tunnel passes for a distance of 35 feet from the portal strikes N. 10° E. and dips 52° W. A sample of the portion of the vein that is exposed at the face of the tunnel assayed a trace of gold and silver.

The report of an examination of this property, then known as the Al. Blair prospect, made by J. G. Shepard, associate Territorial engineer, in 1925, indicates that a dike and accompanying quartz vein extend along the hillside between the two exposures above described roughly parallel with the beach line, but in places as much as 300 feet distant therefrom. Shepard states that the vein, which is of white quartz, had been stripped at intervals for a distance of about 1,500 feet and that the widths of solid vein matter exposed varied from 1 foot to 4 feet. In places where the vein is composed of a stockwork of stringers interspersed with dike material the width of the vein was from 6 to 7 feet. He states that throughout its entire length the vein is associated with a granite dike of the type prevalent in the region. Ore minerals observed by him in the vein include free gold, sphalerite, galena and pyrite. The country rock is black slate. Assays of surface samples of the vein matter taken by Shepard at intervals of from 50 feet to 200 feet along the strike of the vein were as follows:

Sample No. 1, width 3 ft.—gold, trace
Sample No. 2, width 15 in.—gold, $6 50 per ton.
Sample No. 3, width 42 in.—gold, $1.20 per ton.
Sample No. 4, width 12 in.—gold, $8.75 per ton.
Sample No. 5, width 29 in.—gold, $2.50 per ton.
Sample No. 6, width 36 in.—gold, $6.50 per ton.
Sample No. 7, width 36 in.—gold, $3.25 per ton.

A frame house is located on the property at a point in the heavy timber about 450 feet westerly from the most westerly of the two tunnels above described. A small cove with a slate bottom affords a fair anchorage for small power boats.

Veins on North Side of Yalik Bay

Near the entrance to Yalik Bay on its north shore is a small rocky tributary bay on the west shore of which a number of quartz veins and stringers outcrop in a rock bluff. These veins strike N. 30° W. and dip steeply to the west. They vary in width from a fraction of an inch to 4 feet. Considerable pyrite mineralization was observed in them. The predominant rocks are black slates. A grab sample taken from several of the veins assayed a trace of gold and silver.

North Arm

Charles Frank Property

This property is situated on the west side of North Arm about one and three-quarters miles northeast of Moss Point. The principal mineralization exposed on the property occurs on the steep hillside about 50 feet above tide level where a body of quartz that contains arsenopyrite and pyrite, and the trend of which is N. 60° E., outcrops. A few feet from its southwesterly end this quartz body bends to the westward, expands to a width of 5 feet and terminates. The wall rock on the north side of this exposure is slate and that on the south side is dense siliceous graywacke. About 4 feet north of this quartz body another one, 20 inches in width, outcrops that trends N. 60° W. Both walls are of slate. The extent of this quartz occurrence is not revealed at the surface owing to the fact that its strike carries it directly into the mountainside and its surface apex is covered by vegetation. At a point about 40 feet lower in elevation than the above-described surface exposures a crosscut tunnel has been driven in a direction of N. 50° W. for a distance of 60 feet. From the end of this tunnel one drift has been driven for a distance of 8 feet to the southwest and another 43 feet to the northeast. These drifts follow a quartz vein that strikes about N. 52° E. and dips 79° N. The width of the vein varies from 8 inches in the southwest drift to 14 inches in the northeast drift. Throughout these workings the bedrock exposed is slate. In the southwesterly drift the strike of the slaty cleavage is N. 7° W. In the northeasterly drift the strike is N. 20° E. The dip in both drifts is 70° W.

At a point about 100 yards southwest of the tunnel is a cabin that is situated on a bluff about 100 feet above tide level.

Rossness and Larson Property

About 1,400 feet northeast of the Charles Frank tunnel, at a small sheltered cove with a gravel beach, is situated the camp of the Rossness and Larson property. At this locality a group of claims covering several veins is held by Albert Rossness, Frank Larson and Josie Ehmswiler. The first output of gold from North Arm was produced by a small mill that was erected on this property in 1931.

At the southwest corner of the cove a vein outcrops on the beach just above tide level. In order to prevent waves from entering the workings on this vein during stormy weather it has been necessary to erect a bulkhead. At the time of visit the decomposed surface material at the outcrop of this vein was being mined and hoisted to the mill ore-bin by means of a trolley and windlass. Only that portion of the outcrop that was being mined was visible, the remainder being covered by beach gravel. So far as observed, the outcrop consisted of several feet of crumbly, iron-stained decomposed quartz, the trend of which is northwesterly and the dip probably steep. A sample that was taken across 45 inches at this outcrop assayed: Gold 0.64 oz., and silver 0.40 oz. per ton.

In a bluff of slaty graywacke about 30 feet south of the above-described beach exposure the outcrops of a large number of quartz stringers are exposed. Into this bluff a tunnel has been driven for a distance of 28 feet in a direction of S. 13° E., near the end of which a winze has been sunk to a depth of 27 feet. When visited, this winze was filled with water. The tunnel cuts diagonally across the cleavage of the slaty bedrock, the strike of which is S. 34° E., and which dips from 70° to 80° W. The quartz stringers are lenticular in shape and vary in width from one-half inch to six inches. A sample taken across a width of 8 feet 8 inches at the face of the tunnel assayed gold 0.08 oz., and silver 0.30 oz. per ton.

On the main shore of North Arm at a distance of about 350 feet southeasterly from this tunnel and across an intervening low ridge therefrom several quartz stringers outcrop that strike N. 45° W. and dip 63° S. About 50 feet farther south the outcrops of several other small veinlets, which vary in width from one-half inch to six inches, are exposed in slaty graywacke to the cleavage of which they lie parallel. Part of this exposure was covered from view. Its total width is at least 8 feet. These quartz stringers

and veinlets are reported to carry some gold content. They probably represent the extension of the similar zone that is exposed in the tunnel and winze above described.

About 250 feet northwesterly from the beach workings and tunnel above described, and at an elevation of 110 feet, a tunnel has been driven for a distance of 20 feet on a vein of white, crystalline quartz that strikes westerly and dips 80° S. At the portal of the tunnel the width of the vein is 30 inches and at the face the width is 6 inches. The quartz of the vein contains some metallic sulphides and is reported to carry some gold. About 70 feet north of this tunnel and at an elevation of 120 feet is an open-cut in which is exposed 10 feet of brecciated graywacke that contains many parallel stringers of quartz, which strike N. 58° W. and dip 80° S. Below this open-cut and at an elevation of a few feet above tide level is a tunnel 105 feet in length, the course of which is N. 61° W. This tunnel has not reached the mineralization exposed in the open-cut above, toward which it is directed. The bedrock exposed on the walls of this tunnel is dark, slaty graywacke, the structural planes of which strike N. 48° E. and dip 60° W.

About 100 yards northeast of the camp a number of small veins of white, crystalline quartz, in which no sulphides were noted, outcrop at the shore in a bluff of graywacke.

A short distance beyond this bluff is exposed at the shore one of the largest acidic dikes observed in the region. It has a width of 39 feet, strikes N. 30° W. and dips 68° W. The dike is highly siliceous, hard and massive, and contains a small amount of pyrite distributed throughout its entire width. The assay of a sample of the dike material that was impregnated with pyrite indicated a value of 43 cents per ton in gold.

The surface plant at the Rossness and Larson property includes an Ellis mill that has a capacity of about 4 tons per 24 hours and which is driven by a gasoline engine. In addition there is a small frame residence and at the time of visit two tents were in use. In July, 1931, two men were working at the property.

Robert Hatcher Properties

Along the east side of North Arm and south of Pilot Bay several groups of claims are held under location by Robert Hatcher.

The Utopia group includes the Utopia Nos. 1 and 2 claims and the North Gold, which are situated about one mile south of Pilot Harbor. On these claims the Utopia vein outcrops about 800 feet east of the shore of North Arm whence it has been traced for several hundred feet up the mountainside and into the North Gold claim, which extends across the summit of the ridge and onto the Quartz Bay slope. When the property was visited on July 18, 1931, a tunnel that was being driven on this vein at an elevation of 64 feet above tide level, had attained a length of 20 feet. In the tunnel the vein, which strikes S. 75° E. and dips 85° S., has a width of 5 inches and is composed of porous, white, crystalline quartz which contains no visible sulphides. Where the vein outcrops at the surface, about 25 feet above the tunnel, the width is 30 inches. At the points examined both walls of this vein are of hard, massive graywacke.

On the rocky shore of North Arm about 4,000 feet north of the Utopia vein a large vein outcrops upon which a tunnel has been driven for a distance of 30 feet. This vein strikes N. 77° E. and dips 70° N. Where the surface outcrop is exposed at the roof of the tunnel entrance there is 4 feet of massive quartz in the hanging-wall section, 3 feet of graywacke in the middle and 4 feet of fractured graywacke cemented with quartz stringers in the footwall section. Arsenopyrite and pyrite are plentiful in the quartz of the hanging-wall section. At a point in the tunnel about 15 feet from the portal slate bedrock appears against which the vein terminates. It is possible that the vein has been displaced by movement along the contact between the slate and graywacke, but there is little evidence present of a fault plane or gouge. A selected piece of quartz taken from the outcrop of this vein just above the tunnel contained pyrite, arsenopyrite, traces of galena, sphalerite and chalcopyrite. An assay of this specimen yielded gold 0.01 oz., and silver 0.20 oz. per ton.

At a point on the rocky shore about 1,300 feet north of the vein above described, and on the Sea Level No. 1 claim, a third vein outcrops which strikes S. 85° E. and dips 85° S. It is composed of massive white quartz and has a width of 6 feet. The walls are of hard, massive graywacke. At an elevation of 10 feet above tide water a tunnel has been driven for a few feet on this vein, and at an elevation 85 feet higher a second tunnel has been driven upon it for a distance of 60 feet. In this upper tunnel the vein has a width of two feet and is composed of quartz similar in appearance to that of the lower exposures. The vein has been traced up the mountain-

side for a distance of 600 feet. In an exposure at an elevation of 170 feet above tide level the width is 4 feet and the vein quartz contains some visible free gold. It was reported to the examining engineer that a sample of the vein taken at this locality returned an assay of $20 per ton in gold.

Mr. Hatcher's cabin is situated at the mouth of a stream that enters North Arm about 3,200 feet north of the Utopia vein.

Kesnoff and Smith Vein

At a point about one mile south of the Utopia vein Alec Kesnoff and Jack Smith have driven a tunnel 26 feet in length on a vein that is 5 feet in width and which is composed of hard, white quartz that contains scattered specks of pyrite. The vein strikes N. 85° E. and has a vertical dip. The property has been abandoned.

Other Veins on North Arm

A number of other veins were noted outcropping along the shores of North Arm. A brown-stained outcrop in slate situated about 3,000 feet northwest of the Kesnoff and Smith tunnel, was examined. This mineralized zone, which has a width of over 10 feet, is exposed on the face of a rocky bluff above the water's edge. A grab sample of broken material from the quartz stringers of this exposure assayed gold 0.08 oz., and silver 0.30 oz.

Beauty Bay and Nuka River

Little Creek Property

This property was originally located by Eric Burman and H. Carlson who discovered several veins and conducted preliminary development work on them during 1924 and 1925, in which years the property was examined by H. H. Townsend and J. G. Shepard, respectively, associate Territorial engineers. As early as 1924 a large number of open-cuts had been excavated on at least 4 quartz veins, and one 20-foot tunnel had been driven on a 14-inch vein, now designated the "A" vein. The property is now known as the Little Creek group and is held by Mr. Earl Mount of Seward, Alaska. It is reached by a trail one mile in length that starts at the northwest corner of Beauty Bay on the west side of the mouth of Ferrum Creek, otherwise known as Iron Creek. The trail extends up the west side of this stream

for one-half mile, thence westerly up a small tributary gulch and over a pass, the elevation of which is 220 feet, to the mine camp on Little Creek, which is an easterly tributary of Ferrum Creek. The property includes two claims: Little Creek Nos. 1 and 2, respectively. The vein outcrops lie a short distance southeast of the mine camp.

The "A" vein, which is the most northerly of the group, strikes N. 87° E. and dips 52° N. The tunnel on this vein above referred to, the elevation of which is 230 feet, now has a length of 50 feet. The vein as exposed in the tunnel is described by Pilgrim as being from 10 inches to 24 inches in width and as consisting of solid, white crystalline quartz, which contains considerable arsenopyrite, some sphalerite and a trace of copper and lead. A grab sample taken by him from various points along the vein in the tunnel assayed gold 0.01 oz., and silver 0.10 oz. per ton. A sample described as oxidized material taken by Townsend at the face of the tunnel when it was 20 feet from the portal, at a point one foot above the floor and across a width of 14 inches, assayed gold 0.32 oz., and silver 0.15 oz. Another sample of unoxidized vein material taken by Townsend across 14 inches in the back of the tunnel 8 feet from the portal assayed gold 0.14 oz., and silver 0.20 oz. A number of open-cuts expose the outcrop of this vein at the surface over a length of several hundred feet.

The "B" vein lies south of and parallel to the "A" vein, to which it is similar in type. Its outcrop is exposed in three open-cuts along the hillside above the easterly exposed section of the "A" vein.

The "C" vein lies about 200 feet south of the "A" vein and has a similar strike. The dip, however, is nearly vertical. A series of open-cuts reveals the width of this vein to be from 4 feet to 6 feet at the westerly exposure and varying from 6 inches to 18 inches for a distance of about 200 feet easterly therefrom. The vein is composed principally of white crystalline quartz, which in the widest portions contains some graywacke breccia. The vein material contains metallic sulphides in considerable quantity that include galena, with which gold appears to be associated. At one of the open-cuts on this vein a shaft has been sunk to a depth of 15 feet. Pilgrim states that near the west end of this open-cut free gold is visible in the quartz along the south wall.

The "D" vein, which is parallel to the three others above described, lies about 50 feet south of the "C" vein. The dip is 75° N. Its outcrop has been exposed by a series of 4 open-cuts and trenches over a distance of about 150 feet, in which the widths of the vein vary from 6 inches to 4 feet. A sample taken by Townsend across a width of 1 foot in the most westerly cut, just north of a small stream, assayed gold 0.02 oz., and silver 0.10 oz. per ton. In a cut 50 feet east of this point a sample taken by him across a width of 30 inches of quartz assayed gold 0.20 oz., and silver 0.25 oz. Where exposed in the open-cuts the hanging-wall of this vein is slate and the foot-wall is graywacke. In the most easterly trench the vein narrows to a width of 6 inches where it passes from slate into graywacke.

Alaska Hills Property

The camp of the Alaska Hills Mines Corporation is situated on the east side of Nuka River valley about two miles north of the head of Beauty Bay and at an elevation of about 40 feet above tide level. It is reached by a narrow roadway which extends from the beach at the mouth of Nuka River along the mountain-base east of the river to the mine camp. This road was built from Territorial funds by the Alaska Road Commission. The camp includes two log bunk-houses and a mill building.

The mine workings are situated about 1,000 feet from the mill and at an elevation of 500 feet. The principal mining operations have been conducted on a vein that was originally discovered in 1918 by Frank Case and Otis Harrington. This vein was relocated in 1923 by Frank Skeen, who later transferred the property to the Alaska Hills Mines Corporation. The property now includes Pay Streak Nos. 1 and 2 claims and Pay Streak Extension, Pay Streak Fraction, and Fairweather claims. Development work has been carried on in four separate tunnels. The uppermost tunnel, which is at an elevation of 570 feet above tide level, has a length of 125 feet. Above this tunnel the vein has been mined to the surface and is not accessible for examination. The present operating tunnel, which is at an elevation of 495 feet, has a total length of about 550 feet. This tunnel intercepts the vein at a point 118 feet from the portal, at which point the vein is 6 inches in width, strikes easterly and dips 55° N. From this point the tunnel follows the vein for a distance of 50 feet to a fault, the strike of which is N. 5° E. and which cuts off the vein. At its

intersection with the fault the vein is 30 inches in width. The vein quartz is white and crystalline and contains metallic sulphides in considerable quantity. At a point in the tunnel about 35 feet west of the fault a winze has been sunk on the vein to a depth of 40 feet. This winze was filled with water and inaccessible for examination. From the point at which the vein is cut off by the fault the tunnel has been driven southerly along the fault plane for a distance of 55 feet and thence easterly, approximately normal to the fault plane, for a distance of about 100 feet where the faulted segment of the vein was intercepted. From this point a drift has been extended on the vein westerly for a distance of 50 feet, where the vein is cut off by a fault plane, and easterly about 40 feet, where the vein separates into scattered stringers and apparently terminates. The ore between the operating tunnel and the upper tunnel level has been stoped. The wall rock exposed in the operating tunnel is graywacke with the exception of that penetrated by the last 60 feet of the tunnel which is slate. Where the vein enters the slate it becomes narrower and, as stated above, gradually becomes dissipated into scattered stringers. The mine workings develop a large amount of water.

From a point about 280 feet northwesterly from the portal of the operating tunnel and at an elevation of 370 feet a crosscut tunnel has been driven a distance of 165 feet that is so directed as to intercept the vein at the lower horizon. This objective has not yet been reached, but the fact that several gold-bearing stringers have been cut by the last few feet of the tunnel indicates that the face of the tunnel may be near the vein.

About 350 feet northerly from the Alaska Hills vein, above described, is the Ehmswiler vein, upon which has been driven a tunnel 75 feet in length. This vein is said to have a width of from 6 inches to 20 inches and to be parallel to the Alaska Hills vein. Two additional veins are said to occur between the Alaska Hills and Ehmswiler veins and another one at a distance of 75 feet northerly from the latter.

Operations at the Alaska Hills property during the summer of 1931 were being conducted by a crew of three men, who were mining the decomposed slide rock below the outcrop of the Alaska Hills vein. During the season 267½ tons of this material were milled and the operation is reported to have been profitable. In the course of the surface stripping above noted the outcrop of the

Alaska Hills vein, hitherto covered, was exposed at the elevation of the portal of the operating tunnel and 25 feet southerly therefrom and from that point a tunnel was driven on the vein a distance of 35 feet.

The surface mine plant at the Alaska Hills property includes an Ingersoll-Rand portable, gasoline-driven compressor; a 25-ton ore bin; and a 2-bucket, gravity aerial tram, 1,000 feet in length, that delivers ore from the mine workings to the mill. The milling plant includes a 35-ton ore bin at the tram terminal; a 7-inch by 10-inch jaw-crusher; a fine-ore bin of 10 tons capacity; and a 4-foot by 4-foot Worthington ball-mill; with an amalgamator in closed circuit with a drag classifier and a Diester sand table. Power for the milling plant is provided by a 66-inch Pelton wheel, the water to drive which is delivered under a head of 94 feet through a 16-inch wooden pipe-line 1,000 feet in length that is equipped with a duplex nozzle. It is reported that when the mill-feed is being supplied from the underground workings the value of the table concentrates ranges from $107 to $112 per ton, and that of the tailings averages about $2.85 per ton. It is also reported that the value of the total production from the property to the end of the year 1931 amounted to more than $40,000.

Officers of the Alaska Hills Mines Corporation are J. H. Rice, president, and E. W. Barnett, secretary-treasurer, both of Anchorage, Alaska.

Nuka Bay Mines Company

The property of the Nuka Bay Mines Company, which includes the Nooka, the Nooka Extension and the Nooka No. 1 lode claims, is situated on the mountainside east of Nuka River at a point about a mile northeast of the head of Beauty Bay. It is reached by following the road that leads to the Alaska Hills property for a distance of about three-quarter mile to a log cabin owned by the Nuka Bay Mines Company, whence a trail about 3,400 linear feet in length leads to the upper camp, which is at an elevation of 1,200 feet above tide level.

This property was originally known as the Harrington prospect. The discovery was made and the first work was done on a vein that outcrops above the camp at an elevation of 1,470 feet and that was not accessible for examination by Pilgrim in 1931, owing to heavy snow drifts which still remained at the site.

It was visited, however, by H. H. Townsend, associate Territorial engineer, in 1924, whose description is as follows:

> "There are a number of cuts and one timbered shaft on the quartz vein, which is from one to three feet wide. The country rock is graywacke and slate striking N. 8° W. and dipping about 25° easterly. The strike of the quartz vein is nearly east and west and the dip 65° to 75° southerly."

Assay results from three samples taken by Townsend from the outcrop of this vein at intervals over a length of 60 feet were as follows:

> Sample H2, width 2 ft., gold 0.16 oz., silver 0.20 oz.
> Sample H3, width 3 ft., gold 4.54 oz., silver 0.20 oz.
> Sample H4, width 2 ft., gold 0.24 oz., silver 0.25 oz.

Pilgrim's description continues: About 320 feet down hill from the shaft at the upper vein exposure and at an elevation of 1,240 feet a second vein is exposed in an open-cut. This vein, which has a width of 12 inches, strikes N. 83° W. and dips 85° N. It is composed of the white crystalline quartz that is characteristic of the district and contains some graywacke breccia and small amounts of pyrite. A sample of a small pile of quartz from this vein that was alongside the open-cut returned an assay of gold 0.02 oz., and silver 0.10 oz. per ton. At the east end of the open-cut the vein is cut off by a fault, which strikes N. 13° E. and dips 75° W. The vein is exposed for a distance of 180 feet down hill and westerly from the fault. The section of the vein east of the fault is believed to have been shifted to the southeast. The wall-rock of the exposed section of the vein is graywacke. East of the fault, however, the bedrock is slate.

About 260 feet west of the open-cut noted above, and at an elevation of 1,180 feet, is the outcrop of a third vein, the strike of which is N. 61° E. and the dip 85° S. Where exposed this vein has a width varying from a few inches to over three feet. Much graywacke breccia is interspersed throughout the white, crystalline quartz of the vein. No work has been done at this outcrop, nor have any samples of it been taken.

At a point about 100 feet southwesterly from the outcrop of the vein last described above, and at an elevation of 1,140 feet, is the portal of a tunnel that has been driven easterly on a course that is directed in a general way toward the outcrops of the two

veins first described above. This tunnel is nearly 400 feet in length. The innermost 100-foot section of the tunnel curves gradually toward the south and near the face its course is S. 5° W. At a short distance from its portal the tunnel intercepts quartz that is also exposed at the surface above the portal. Throughout the remainder of its length the tunnel is wholly in graywacke, neither of the veins toward which it was driven having been reached by it.

The property is equipped with a small gasoline-driven Gibson mill that is situated near the portal of the tunnel.

The principal owners of the property are Mrs. E. B. Weybrecht and Cal. M. Brosius, of Seward, Alaska.

Other Prospects in Beauty Bay

It is reported that late in the season of 1931 two veins were discovered in Shelter Cove by Frank Skinner. These veins are said to lie 20 feet apart and to have widths of 12 inches and 4 feet, respectively. An assay of $51 per ton is reported to have been returned from a sample of the smaller vein.

West Arm

Frank Lang Property

The Frank Lang property is situated on the west shore of West Arm, directly across the Arm from Beautiful Island, which is at the mouth of Quartz Bay. At the location where the veins on this property outcrop near tide level the shores are rocky and there is no beach suitable for landing a boat.

The property was visited in 1924 by H. H. Townsend, and in 1925 by J. G. Shepard, each of whom, at the time, was serving as associate Territorial mining engineer.

Townsend's description of the prospect, upon which no work had been done when he visited it, is as follows:

> "The bedding of the graywacke and slate country rock is obscure, but probably nearly flat. The vein is 6 to 14 inches wide, striking S. 35° W. and dipping 60° northwesterly. A sample, which I moiled across 14 inches, assayed $18.80 in gold, and 0.25 oz. in silver."

Shepard's report reads as follows:

> "Two quartz veins, which have a northeasterly strike and which are separated from one another by 14 feet of country rock, are exposed on the hillside above the shore. On each vein a tunnel 10 feet in length has been driven. The lower vein is 2 feet wide at the breast of the tunnel. A sample across the vein at this point assayed $9.20 in gold and silver. At the face of the second tunnel the upper vein has a width of 2½ feet. A sample across the vein at that point assayed $11.20 in gold and silver."

A description by Pilgrim, based on his examination of the property in 1931 is as follows:

About 10 feet above high tide a tunnel has been driven on a vein that outcrops in a small gulch. The direction of the tunnel, which is also the strike of the vein, is S. 45° W. The vein is a well-defined fissure filled with white quartz containing considerable graywacke breccia. Arsenopyrite is the only sulphide observed in the quartz. The vein varies from 6 to 24 inches in width along the full length of the tunnel, which is 88 feet. The walls are slaty graywacke with a cleavage striking S. 30° E. A cross-cut in the graywacke has been driven for 39 feet in a direction of N. 33° W. from a point 27 feet in the tunnel. A sample taken from a pile containing about 8 tons of vein quartz, at the mouth of the tunnel, assayed gold 0.38 oz., silver 0.30 oz. per ton. A log cabin is situated on the hillside above the tunnel. There is also a frame house on a leveled dump at the portal of the tunnel.

KNIK PRECINCT

The Knik precinct includes the Willow Creek and Girdwood gold-mining districts and the Matanuska coal field.

Extensive examinations of mining development in the Willow Creek and Girdwood districts were made by the U. S. Geological Survey on behalf of the Alaska Railroad during 1931, but the reports covering them are not yet available. In order to avoid duplicating the work of the Survey, these areas were not visited by representatives of the Territorial mining department during the biennium. Authentic information is available, however, concerning the principal productive mining operations in the two districts.

Willow Creek District

The biennium just closed has been marked by particularly active mining development in the Willow Creek region that augurs

well for the future of the district. Important phases of this development have been the inception of year-round productive operations with increased crews at the Lucky Shot and Gold Cord mines; commencement of active underground exploratory work by the Gold Top Syndicate on a property adjacent to the Lucky Shot mine; and resumption of mining and milling operations at the Fern mine.

Transportation facilities in and to the district have been improved by the construction of a tractor road 26 miles in length that leads from Willow Station on the Alaska Railroad to the Craigie Creek section of the mining district. This road, which follows practically a water-grade throughout, has been constructed by the Alaska Road Commission, with substantial assistance from the Willow Creek Mines Company. During this biennium also an airplane landing field has been prepared in the vicinity of the Lucky Shot mine and regular air service is now available between Anchorage and the mine.

Willow Creek Mines

Productive mining operations continued throughout the biennium at the Lucky Shot mine of the Willow Creek Mines Company, where a crew that has been increased to an average of 100 in number has been employed the year round.

Milling operations were resumed early in 1931, upon the completion of the erection of a new milling plant that replaced the stamp-mill formerly used, which was destroyed by fire. The new plant is equipped with a Marcy-type mill, which has a capacity of 50 tons per day, and which is driven by diesel-electric power. Other recent improvements at the mine include a 3-story bunk-house, a 2-story mess-house, and an office building, all of substantial frame construction, electrically lighted, and steam heated.

Gold Cord Mine

The Gold Cord mine and mill have been operated during the biennium by Messrs. Bartholf, Horning and Black. It is reported that a new orebody of encouraging proportions has been developed and that the camp has been prepared so that operations may be conducted throughout the winter months, which, heretofore, has not been attempted at this property. A crew of 12 men is engaged.

Fern Mine

The Fern mine was operated during the biennium by T. S. McDougall and associates. Development work that was carried on during the summer of 1931 is reported to have made available additional reserves of milling ore. Work was suspended in the fall of the year owing to very adverse snow conditions and during the winter much damage to the mill and camp was caused by snowslides. During 1932 a crew of 12 men was employed. The damaged mill was rebuilt and underground development work proceeded throughout the open season with results that are reported as being very satisfactory.

High-Grade Mine

Operations were continued on a small scale by Dodson and Snider at their High-Grade mine, which is situated near the Gold Cord property at the head of Fishhook Creek. The discovery on this property is reported of a new vein of ore 3 feet in width that is regarded as the possible extension of the formerly productive Independence vein. The ore from this property was formerly shipped to the States for treatment, but a small milling plant has been erected at the property which has been in operation during the biennium.

Gold Top Syndicate

For a number of years surface prospecting work has been carried on at a group of claims known as the Kempf property, or Gold Top group, which is situated on Craigie Creek east of and adjacent to the Lucky Shot-War Baby property of the Willow Creek Mines Company. In 1931 this property was acquired by the Gold Top Syndicate, a Canadian mining organization. During the summer of 1932 a shipment of 290 tons of mining equipment, lumber, and supplies was transported by the syndicate to the property and on August 15 work was commenced on the construction of a camp on Craigie Creek. This camp includes a mess and bunk-house; a blacksmith shop; a power-house, which houses the compressor and diesel engine; the lower tram terminal; and diesel-oil storage tanks, which have a capacity of 15,000 gallons. An aerial tram, 3,000 feet in length, the upper terminal of which is 1,200 feet in elevation above the lower camp, was also erected, and at the upper terminal a camp was established that accommodates 15 men.

Underground work that had been accomplished at the end

1932 includes a cross-cut adit 300 feet in length, at the face of ıich the vein was intersected, and drifts on the vein, both easterly ıd westerly from the intersection point, each of which drifts is)0 feet in length. The average number of men employed in the ew is 12. Development work on the vein is progressing through-ıt the present winter.

Marion-Twin Gold Mining Company

This company is the owner of two separate properties in the Willow Creek district. One property, which is equipped with a 5-stamp mill and which was formerly productive, is situated on Little Susitna River about 4 miles above Fishhook Inn. This property is now idle. The other property is at the head of Craigie Creek and east of the old Bullion property of the Willow Creek Mines Company. Durg the past two seasons the company has had a small crew of men ıgaged in exploratory work on the Craigie Creek property.

Miscellaneous Work

In addition to the activities above recorded, prospecting work was being carried on at numerous localities in the district, and examinations of the district were made by several engineers representing important mining organizations, both the States and Canada.

Girdwood District

Successful productive placer-mining operations were contin-d throughout the biennium by John Holmgren and associates their property on Crow Creek, which has continued to yield an ıportant output of gold for a period of many years.

Lode-mining development was continued on a small scale at ıe property of the Monarch Mining Company, which is situated ar the head of Crow Creek. Information concerning exploratory ork at other lode properties in the district is lacking.

Matanuska Coal Field

The production of bituminous coal from the Matanuska field ntinued at the normal rate throughout the biennium. This field pplies locomotive and coking fuel to the Alaska Railroad, and so domestic fuel to the towns of Anchorage and Seward, as well s many outlying smaller communities, canneries, mines, etc. The incipal production was derived from the mines of the Evan Jones

Coal Company at Jonesville, and the Alaska Premier mine on Moose Creek.

During 1932 the workings of the old Rawson mine on Moose Creek were reopened by the Wishbone Hill Coal Company and a small production was made therefrom. A small tonnage was also produced from new workings that were commenced by this company at a point about 800 feet south of the Rawson workings, where a gangway has been driven on an 8-foot coal seam.

The Ross Heckey mine at Coal Creek in the Chickaloon area, which, heretofore, has produced a small tonnage of semi-bituminous coking coal for use by the Alaska Railroad, was closed and dismantled in the fall of 1932, owing to the shutting off of the market for the product.

TALKEETNA PRECINCT

The Talkeetna precinct embraces the lower half of the drainage basin of the Susitna River and all of the drainage basins of its principal tributaries, the Skwentna, Yentna, Chulitna, and Talkeetna Rivers. It includes that portion of the Talkeetna Range of mountains that lies north of the Willow Creek mining district and all of the south front of the Alaska Range between Broad Pass on the north and Mt. Redoubt on the south. The principal mining district in the precinct, and thus far the only productive one, is the Cache Creek placer district, which includes the tributaries of the Yentna River and the foothills of the Alaska Range west of the town of Talkeetna. Development of lode properties has been confined largely to the region occupied by the tributaries of the Chulitna River in the general vicinity of Broad Pass. The portion of the Talkeetna Mountains that lies north of the Willow Creek district offers a favorable field for prospecting, however, as geologic conditions favorable for the occurrence of both gold and copper ores are known to exist there.

Cache Creek District

While information is lacking as to details of mining operations in the Cache Creek district during the biennium, it is reported that productive activities were on about the usual scale that has been maintained over a period of years and that the yield of gold was normal in amount.

It is reported that the Peters Creek Placer Company, a new

organization whose principal office is at Lewiston, Idaho, has acquired extensive holdings on upper Peters Creek and its tributary, Bird Creek. Early in 1931 a large shipment of equipment was transported to the property that included a caterpillar steam-shovel. It is reported by the press that 3 miles of ditch line was completed by this company during 1932 and that its productive operations yielded gold to the value of $30,000.

CHULITNA DISTRICT

Colorado Creek

Wells Property

Several groups of claims that are usually referred to as the Wells Brothers property were held under option during the biennium by C. I. Paulson and associates of Spokane, Washington.

On the Golden Zone group, where an extensive outcrop of gold-bearing arsenopyrite ore in altered quartz-diorite bedrock had been partly developed by trenching and by one cross-cut adit 150 feet in length, further development work was done during the biennium. The tunnel was extended a distance of 125 feet, which sufficed to undercut the principal surface outcrop, and additional open-cuts were made on the outcrop of a second ore zone that lies across Bryn Mawr Creek from that above described.

Some open-cuts were also made on a property, formerly called the Hector group, but now referred to as the Copper King group, which lies across a low divide from the Golden Zone group and about one mile distant. Two veins are known to occur on this property, each of which has a width of from 7 feet to 8 feet. They are mineralized with pyrrhotite, chalcopyrite and bornite, with which is associated some gold. Samples taken by J. G. Shepard across the full widths of these veins in open-cuts returned assays as follows:

Copper—3.43 to 7.07 per cent.
Gold—$2.00 to $2.40 per ton.
Silver—3 oz. to 4.5 oz. per ton.

Hidden Creek

Boedeker Bros. Prospect

During the summer of 1929 quartz veins carrying free gold were discovered by Roy and Elmer Boedeker adjacent to Hidden Creek, which is a tributary of Chulitna River and which lies south of Eldridge Glacier. Development work has been carried on by Boedeker Brothers and associates each year since the discovery was made. Although very fine samples of gold-bearing quartz are reported to have been found, ore in comercial quantity has not yet been developed.

VALDEZ PRECINCT

Although no extensive mining development was under way in the Valdez precinct during the biennium, small-scale operations were conducted at a number of properties and a small production of gold was made.

PRINCE WILLIAM SOUND DISTRICT

Port Wells Area

Hamilton-Irving Prospect

On the west shore of Port Wells, directly west of the locally well-known Granite Mine, and about one mile from the beach, is located the property of A. J. Hamilton and Jack Irving. It includes three claims that are designated Snowball No. 1, Snowball No. 2 and Mountain View, respectively. These claims are directly in line with the Granite vein and undoubtedly cover its extension.

At an elevation of 860 feet a tunnel 20 feet in length has been driven on a vein, the outcrop of which shows it to lie at the contact of granite on the east and graywacke on the west. The tunnel is now caved and inaccessible. At the mouth of the tunnel a shaft 27 feet in depth was sunk that now is also caved. Where exposed by these workings the vein is reported to have a width of about 12 inches and to have a quite high gold content. The granite wall of the vein is also reported to be auriferous.

On the hillside below the tunnel and shaft the outcrop of the vein is exposed over a length of more than 100 feet. Here the vein strikes N. 50° W. and dips 85° E. and its width varies from 3 inches to over 12 inches. It is composed of white crystalline

quartz containing many angular fragments of graywacke and slate, small amounts of pyrite and some visible free gold.

When the property was visited in 1931 a lower cross-cut tunnel was being driven through the granite diagonally toward the vein. The elevation of the tunnel is 720 feet, and at that time its length was 220 feet. For a distance of 164 feet from the portal the course of the tunnel is S. 61° E., beyond which it is S. 88°E. to the face. The distance necessary to be driven in order to reach the vein with this tunnel would be less if the tunnel line were more nearly at right angles to the course of the vein.

At a point 160 feet from its portal the tunnel intersects a zone of fracturing in the granite that strikes N. 10° E. and dips 65° W. and that has a width of about 3 feet. With the crushed granite of this zone is associated some quartz. A sample was taken of this material the assay returns of which were gold, 0.02 oz.; silver, 0.10 oz. per ton.

The assay returns from a sample that was taken by Pilgrim across about 10 inches of the vein at the outcrop below the upper tunnel were gold, 2.54 oz.; silver, 0.80 oz. per ton.

John Keller Prospect

A property held by John Keller consists of two claims that are situated about one mile west of the beach on the west side of Port Wells and about five miles north of the Granite Mine. The property lies at an elevation of somewhat more than 1,000 feet above sea-level.

A vein on the property has been developed by a tunnel 75 feet in length, a shaft 10 feet in depth, and several open-cuts. The vein is reported to be in the form of a series of parallel stringers, and to vary in thickness up to 14 inches. It strikes northwesterly and dips 80° S.

During the season of 1930 a 2-stamp mill was erected and a small production of gold was made, but in 1931 the property was idle.

Bettles Bay

Merrill Mining Company

A full description of the property of the Merrill Mining Company was contained in the mining report to the Legislature for the biennium ending March 31, 1931. Following the date of the examination on which that report was based,

several hundred tons of ore was mined by the company in the fall of 1930, and was milled, with results that were reported to have been very satisfactory. The ore was extracted from the second stope north of the shaft and above the 100-foot level.

Work at the mine was resumed in the spring of 1931 and was still in progress when the property was again visited by Mr. Pilgrim in August, at which time a crew of 8 men was employed. Ore was being mined from the same stope from which production was made in 1930.

On the 100-foot level north of this stope the vein appears to decrease in width and separate into a number of parallel stringers, which have only a small gold content. Beyond this pinched zone in the vein a fault crosses the tunnel in a direction of N. 61° E. Although the vein may be offset by this fault, it appears more probable that it has terminated at the pinched zone. A crosscut that was driven along the fault and into the hanging wall failed to disclose a continuation of the vein. A similar splitting up and pinching out of other veins in the Prince William Sound region has been observed, especially where the veins pass into slate bedrock.

At the time of visit in 1931 work was also in progress on the driving of an intermediate drift beyond the raise and below the 100-foot level. This drift is designed to intersect the ore that shows in the floor of the 100-foot level, where it appears to rake northerly. The new drift had not yet reached the ore.

During the season of 1931 a frame blacksmith shop was erected near the portal of the mine-adit and a pneumatic drill-sharpener was put into service.

Unakwik Inlet Area

Norris Lead & Zinc Mines Corporation

This property is more frequently referred to as the A. D. Thompson property, under which heading it was described in the mining report for the preceding biennium. It is situated on Miners River, above the head of Miners Lake. During the season of 1931 two men cleared a tractor road, two miles in length, that leads from the head of Miners Lake to the property. A skiff propelled by an outboard motor is used for transportation on the lake. During that season a cabin was also erected and a small amount of additional development work was done on two veins that were partly developed in 1929. The plan was an-

nounced of driving during the winter of 1931-1932 a tunnel on the No. 1 vein, commencing at a point near the easterly end line of the Eureka No. 5 claim.

Port Valdez Area

Devinney and Dolan Prospect

This prospect, which is situated on the north shore of Port Valdez about one mile west of Mineral Creek and which was discovered in 1929, was described in the mining report for the preceding biennium. A small amount of additional exploratory work was done on the property during 1931. Work was confined to the lower, or main tunnel, which was advanced a distance of about 100 feet, at the face of which section the vein has pinched in size. At that point a raise was being driven up on the vein at an angle of about 45°. In the lower tunnel the vein splits into two branches, of which the easterly branch strikes N. 12° W., and the westerly branch strikes N. 60° W. The upper tunnel, which is at an elevation of 1,160 feet and which is 38 feet in length, is on the easterly branch. In the upper tunnel this branch has a width of from 4 to 24 inches and is composed of shattered quartz accompanied by much brecciated country rock, a considerable amount of pyrite, and some galena and visible free gold. Some of this ore appears to be of very high grade. The west branch of the vein is visible at the surface over a distance of more than 100 feet along the bluff west of the upper tunnel, where its width varies from 2 to 8 inches.

Both branches of the vein cut across the cleavage of the slaty, graywacke country rock, which strikes N. 65°-80° E. and dips from 45° to 60° N.

Mineral Creek Area

Nick Mischko Prospect

The group of claims held by Nick Mischko lies east of Mineral Creek valley at a point about 5½ miles from the north shore of Valdez Bay. It is reached by following the road up Mineral Creek for a distance of about 4½ miles, at which point that stream is crossed, either by wading or by use of a cable tram, which is rather insecure. From this crossing, which is at an elevation of 250 feet, a switchback trail leads up the steep mountainside to an elevation of 1,500 feet and thence along the ridge a distance of half a mile to the property.

For convenience of description, the several veins observed on the property will be referred to by number.

Vein No. 1. This vein has been opened to a depth of 10 feet by an open-cut, which is at an elevation of 2,140 feet and at a point about 600 feet south of Wood Creek. It consists of a quartz stringer, from half an inch to 3 inches in thickness, that strikes S. 25° E. and dips 78° N. The walls of slaty graywacke strike N. 67° E. and dip 67° S.

Vein No. 2. On a smooth-surfaced bench and at a point about 860 feet north of the cut on vein No. 1 is the outcrop of vein No. 2, which has a width of about 6 feet. This outcrop is exposed above the moss for a distance of more than 100 feet. The quartz is white and crystalline, and contains no visible sulphides.

Vein No. 3. At a distance of about 700 feet southeast of the cut on vein No. 1, and at an elevation of 2,430 feet, is the outcrop of vein No. 3. This vein is in the form of a zone about 20 feet in width that is made up of quartz stringers, which lie in the cleavage planes of the schistose graywacke bedrock. The stringers, which are from half an inch to 2 inches in thickness, strike N. 68° E. and stand vertical.

Vein No. 4. The outcrop of vein No. 4 is exposed on a bluff about 300 feet southeast of the outcrop of vein No. 3, and at an elevation of 2,480 feet. It is visible at the surface over a length of several hundred feet. The vein, which is about 30 inches in width, strikes N. 43° W. and dips 45° E. It is composed of coarsely crystalline quartz, which is considerably iron-stained.

At a point about 125 feet southeast of the above described outcrop, and at an elevation of 2,430 feet, a shaft has been sunk on the vein to a depth of about 60 feet. The quartz of a large pile of vein material that surrounds the collar of the shaft was observed to contain pyrite, but its average gold content is said to be low. The assay of a sample that was taken by Mischko at the bottom of the shaft is reported to have been, gold 1.60 oz.; silver, 0.70 oz. per ton.

Vein No. 5. This vein outcrops at the edge of a rocky bluff about 270 feet southeast of the shaft on vein No. 4, and at an elevation of 2,430 feet. Although it is offset about 50 feet from vein No. 4, it is probably an extension of that vein. Its width is

about 5 feet. A pit 5 feet in depth has been sunk on the vein. The vein-quartz is iron-stained and also contains much pyrite, but the gold content is said to be low.

Vein No. 6. The outcrop of vein No. 6 is about 100 feet south of that of vein No. 5, and is at an elevation of 2,550 feet. The vein, which is composed of white, crystalline quartz, has a width of 24 inches. It strikes N. 55° W. and dips 85° N. Outcrops of the vein at the surface are observable at several points over a distance of about 800 feet northwest of the above described outcrop, and the strike of the vein appears to be regular in that direction. The walls of schistose graywacke contain numerous quartz stringers, which strike N. 60° E. and dip steeply to the southeast. The cleavage of the graywacke strikes N. 68° E.

At a point about 50 feet southeast of the above described outcrop of vein No. 6 the strike of the vein changes to N. 48° W. and the dip to 70° N. Here the width is 30 inches and the vein quartz contains fragments of graywacke. The hanging-wall is well defined, but the foot-wall is irregular.

Although these veins have been held by location for a number of years, the amount of development work done on them is insufficient to determine their value.

A small frame residence is located upon the property and a larger frame house is situated on Mineral Creek, directly below the property.

An adequate supply of water for use in developing power is available during summer months in Wood Creek, which crosses the north side of the property.

Charles Wetzler Prospect

This prospect is on Mineral Creek a short distance above a narrow canyon that is about 5 miles from the north shore of Valdez Bay.

The east wall of the canyon is composed of dark-gray, slaty graywacke, the cleavage planes of which are filled with a multitude of quartz stringers, which range in thickness up to 1½ inches. This type of mineralization is exposed on the canyon walls for a considerable distance and also appears in tributary gulches that cut through the canyon walls.

A short distance above the mouth of the canyon a tunnel

has been driven into the east wall for a distance of 45 feet and at an elevation slightly above the water surface of the creek. The course of the tunnel is from S. 58° E. to S. 24°E. The slaty cleavage of the graywacke strikes N. 83°-87° E. and dips about 70° N. A sample was taken by Pilgrim across the full section represented by the tunnel. Assay returns from this sample were, gold, trace; silver, trace.

Little Giant Group

The mining report for the preceding biennium contained a description of this property, which is operated by Wm. Quitsch and associates of Valdez. During the current biennium Mr. Quitsch, assisted by one man, continued development work and milled a small tonnage of ore. The ore that was milled in 1930 included 20 tons that was mined from the Little Giant vein and 10 tons from the Rose vein. Up to August, 1931, the additional production amounted to 40 tons, which was obtained from the Rose vein just below the outcrop above the upper tunnel. This ore is said to have yielded about $30 per ton. Up to the same date the tunnel on the Little Giant vein had advanced a distance of 20 feet during the year.

Valdez Glacier Area

Valdez Mining Company

The property of the Valdez Mining Company was described by Brooks in 1911.* The following description is based on a report of the reexamination of the property by E. R. Pilgrim, associate Territorial mining engineer, in 1931, supplemented by data from Brooks' report.

The camp at the property is situated on a steep ridge west of Valdez Glacier and at an elevation of about 2,440 feet, which is about 870 feet above the surface of the glacier at that locality. In reaching the property an automobile road is followed from the town of Valdez to the foot of Valdez Glacier, a distance of 5 miles. Thence the glacier is ascended for a distance of 4½ miles to a point at the west rim whence a switchback trail ascends the ridge to the camp.

The principal surface exposure of the vein that has been de-

* Gold Deposits Near Valdez, by A. H. Brooks; U. S. Geol. Survey Bull. 520, pp. 127-128.

veloped is a large outcrop of quartz that stands out boldly on the steep mountainside. and which has a width of 20 feet at the top and 6 feet at the bottom. At the outcrop the vein strikes N. 74° W. and dips 75° S. At an altitude of 2,720 feet is an adit, which undercuts this outcrop and which now has a total length of about 185 feet. The length is, therefore, 75 feet greater than it was when visited by Brooks in 1911. The adit crosscuts the interbedded schistose graywacke and slate bedrock for a distance of 60 feet, at which point it intersects the vein, which at that point has a width of 5 feet. The remainder of the adit follows the foot-wall of the vein. From three points in this drift-portion of the adit short crosscuts have been driven through the vein that show the vein to have widths varying from 5 feet to 15 feet, and possibly greater. Pilgrim states that in portions of this section of the vein the quartz is soft, crushed and stained, but in other portions it is hard and massive. He observed small amounts of galena and pyrite in the quartz.

At the point where the adit intersects the vein, at 60 feet from the portal, a winze was sunk on the vein to a depth of 50 feet and from the bottom of the winze a drift was driven on the vein a distance of 40 feet. The following description of the vein in these workings below the adit is taken from Brooks' report, as the winze was filled with water and inaccessible when visited by Pilgrim.

> 'A winze has been sunk 50 feet below this level, at which depth a drift has been run on the vein for some 40 feet. The vein at this depth is well defined, having good walls and a gouge on the hanging-wall. The vein is from 3 to 8 feet wide in the underground workings. It is made up of ribbon quartz, which carries the gold in high values and measures from 2 to 4 feet in thickness, and of massive white quartz. On the lower level the ribbon quartz is from 24 to 50 inches wide. The white quartz also carries some gold. The ribbon quartz includes coarse pyrite masses and crystals. The vein includes druses containing well-developed quartz crystals."

According to Brooks, the course of the vein in the workings above described is N. 60° W. and the dip is 70° S.

A sketch of the workings that was prepared by Pilgrim indicates that in that portion of the adit which has been driven since Brooks' visit the strike of the vein trends more northerly in the form of a flat crescent.

A second adit, which is referred to as the lower tunnel, has been driven at an altitude of 2,430 feet, or approximately 300 feet lower than the workings described above. At the time of Brooks' visit this adit had a length of 115 feet, and he states that it was intended to crosscut the vein at the lower level. This adit now has a total length of 528 feet, and at a point 53 feet from the face a crosscut from it has been driven westerly for a distance of 100 feet. Pilgrim states that the portal of the lower adit is in a rocky bluff at the edge of a steep gulch which extends down to the glacier. The adit starts in blocky graywacke and follows a vein of white quartz, the outcrop of which is exposed on the bluff above. At this outcrop the vein has a width of 10 inches, but it pinches to a narrow seam both upwards and at the adit level. At the outcrop the vein strikes N. 45° W. and dips 68° NE. The quartz is vitreous and white and contains much graywacke breccia. The adit follows the fissure in a westerly direction for a distance of 420 feet and then turns in a gradual curve toward the north, and the inner 50-foot section trends slightly east of north. The fracture that is followed by the adit contains some discontinuous lenses of quartz, but for most of the distance it is only a gouge-filled seam.

According to a sketch map of the workings prepared by Pilgrim, the lower adit, throughout its length is more nearly parallel than transverse to the course of the vein developed in the upper workings, which it was designed to crosscut. Its position is also too far south of the upper workings to intersect the upper vein on its dip at the level of the lower adit, unless the dip of the upper vein has changed, or unless the downward course of the vein has been interrupted by faulting in the interval between the two adits. It is also noted that the dip of the gouge-seam followed by the lower adit is opposite in direction to that of the upper vein. Consideration of these conditions makes it seem doubtful whether the veins developed by the two adits are identical and sugegsts the advisability of further crosscutting to the north from the lower adit as a means of finding the downward extension of the upper vein.

Miscellaneous Development Work

In addition to the development work above described on mining properties in the Prince William Sound district, assessment work is reported to have been done in 1931 on the following list of properties: Ramsey Rutherford mine, in the

Valdez Glacier area; Ethel mine, the Home group, and the Venus claim, in the Mineral Creek area; Three-in-One group and the Cliff mine, in the Port Valdez area; the Mayfield property and the Cameron and Johnson mine in the Shoup Glacier area; the Gold King group in the Columbia Glacier area; the Beauty Bird group on Avery River; and the Granite mine in the Port Wells area.

It is probable that additional development work, at least sufficient in amount to cover annual labor requirements, was done on a number of copper properties in the southern half of the Prince William Sound district, concerning which definite information is lacking.

TIEKEL DISTRICT

The Tiekel mining district embraces a high mountainous area at the headwaters of Tonsina and Tiekel rivers that is approximately 35 miles in an airline northeast of the town of Valdez. The district lies immediately west of the Valdez branch of the Richardson Highway and is easily reached by trails that leave the highway at points in the near vicinity of Tiekel Roadhouse, which is at Mile 52 out from Valdez. The district may also be reached by automobile or airplane from Copper Center, which is 50 miles north of Tiekel Roadhouse.

The types of bedrock found in the district include schistose slates and graywackes that are cut by numerous light-colored dikes of diorite porphyry. These rocks have been described by Fred H. Moffit of the U. S. Geological Survey, who visited the district in 1916.* The mineralization of the rocks includes stringers, lenses and veins of quartz, some of which carry arsenopyrite, galena and free gold.

Mining development that had taken place in the district up to 1916 is described by Moffit.* The mining properties of the district were again visited in 1926 by J. G. Shepard, and in 1931 by Earl R. Pilgrim, each of whom was serving as associate mining engineer for the Territorial Mining Department. The following descriptions of veins and development work were prepared prin-

* Mineral Resources of Alaska, 1916; U. S. Geol. Survey Bull. 662, pp. 177-182.

* Op. Cit., pp. 178-182.

cipally from Pilgrim's report, supplemented by data from that of Shepard:

Up to date the value of gold produced from the district has been limited to a few thousand dollars, won mostly from auriferous quartz veins by means of locally constructed arrastres operated by water power, but partly from small placer deposits on Quartz Creek and Fall Creek.

Hurtle Creek

Hurtle Creek Gold Mining Company

The group of 11 lode claims that are now held by the Hurtle Creek Mining Company of Valdez embraces portions of two groups formerly known as the Quail group and Telluride group, respectively, that were being developed in 1916 by Messrs. Peter Layton and Chas. Nelson and associates. The present group includes the following contiguous lode claims: Quail Discovery; Quail Nos. 1 and 2; Gem Nos. 1 to 3, inclusive; White Metal Nos. 1 to 3, inclusive; and Jim Nos. 1 and 2.

The property is situated on the east side of the valley of the West Fork of Hurtle Creek at a point about 2 miles above its junction with the East Fork and about 3½ miles southeast of the upper end of Tonsina Lake, to which Hurtle Creek is tributary. It is reached by a pack trail that leaves the Richardson Highway at Mile 55¼, where the elevation is about 1,400 feet. Thence the trail follows a westerly course, up the mountainside for a distance of approximately 7 miles to a pass, which separates the East Fork of Hurtle Creek from Quartz Creek, and whose elevation is 4,450 feet. From the pass the trail follows the East Fork of Hurtle Creek downstream for about 2 miles, whence it crosses the intervening ridge to the West Fork, which it follows upstream about 1½ miles to the camp, at an elevation of 3,650 feet. Although the expense would be considerable and some steep grades would be involved, a road might be constructed following the same general route. An alternative route that is considerably lower in maximum elevation leaves the above-described route about 4 miles from the highway and, following a more westerly course, passes through Black Canyon to the valley of the East Fork of Hurtle Creek where it rejoins the route first described. This trail might be

converted into one on which tractors or horse-drawn sleds might be used, but the expense would be considerable. A third possible route, on which the grades would be very favorable, but which would be 20½ miles in length, is up Tonsina River from its junction with Mosquito Creek at Mile 75 on the Richardson Highway, around Tonsina Lake and thence up Hurtle Creek.

On the Hurtle Creek group numerous veins have been found, descriptions of some of which are as follows:

On the hillside south of the mine camp and at an elevation of 3,780 feet two veins occur which are parallel and whose strike is N. 4°W. One open-cut exposes the outcrop of Vein No. 1, which is the more westerly vein, over a length of 80 feet, and a second cut, to the south of the first, discloses an additional length of 30 feet. The dip of the vein is 52° E. and its width varies from 1 inch or less to 18 inches. It is composed of white, crystalline quartz, which, at several places contains considerable free gold. While no sulphides were observed in the vein or in the ore from the surface cuts, cavities that remain in the oxidized quartz indicate their former presence.

Assays of samples taken by Pilgrim from piles of ore alongside the surface cuts on Vein No. 1 are as follows:

	Gold, oz.	Silver, oz.
Sample No. 1: From ½-ton pile—	0.54	2.00
Sample No. 2: From 1-ton pile —	0.08	0.50
Sample No. 3: From 1¼-ton pile—	0.34	0.20
Sample No. 4: From 4-ton ore pile alongside shallow shaft—	2.76	0.20

The outcrop of Vein No. 2, which lies about 20 feet east of Vein No. 1, is exposed over a length of 175 feet by several open-cuts. The width of the vein varies from a narrow seam in the cuts at either end of the series to 18 inches in those of the central portion. While the dip of the second vein was difficult to observe, it appeared to be about the same as that of the first vein. The vein-quartz is white, crystalline, crumbly, and considerably oxidized.

The assay of a composite grab sample that was taken by Pilgrim from two piles of ore alongside open-cuts, one of which piles contained 5 tons and the other 1 ton, was as follows: Gold, 1.60 oz.; silver 1.30 oz. per ton.

At an elevation of 3,740 feet a crosscut adit has been driven below the outcrop of the two veins above described. At a distance of 90 feet from the portal this tunnel intersected the first vein, which at that point strikes N. 15° W. and stands vertical. The width varies from 8 to 16 inches. The vein is free on both walls, each of which carries a small amount of gouge. The filling is white quartz, which contains a considerable amount of arsenopyrite, galena, and pyrite. The wall rock is greenish-gray, somewhat schistose graywacke, the cleavage planes of which strike N. 74° W. and dip 47° S. The assay of a sample that was taken by Pilgrim across the vein where the width was 12 inches was as follows: Gold, 1.96 oz.; silver, 0.70 oz. per ton.

A sample across vein No. 1 where the width is 12 inches that was taken by Shepard in a surface cut about 20 feet north of the line of the adit yielded an assay of gold, 2.06 oz.; silver 13.40 oz. per ton. A second sample of vein No. 1 taken by Shepard underground at the face of a short drift at the south side of the adit gave an assay of gold, 0.18 oz., and silver 0.60 oz. per ton.

At a point in the adit 121 feet from the portal a small, well-defined fissure was intersected that strikes N. 4° W. and dips 65° E. The fissure is from 1 inch to 2 inches in width and is filled with white quartz in which no sulphides were observed. The fissure has been followed by a tunnel that extends 38 feet southerly from the crosscut adit. No appreciable change occurs in the general appearance of the fissure throughout the length of this drift. It is uncertain whether this small vein is identical with the No. 2 vein that is exposed on the surface. The adit has been driven 10 feet beyond the intersection without displaying evidence of the presence of another vein.

A sample of vein No. 2 that was taken by Shepard over a width of 12 inches where the vein is exposed in a surface open-cut, which is vertically above the 38-foot drift that extends south from the adit, yielded an assay of gold, 0.96 oz., and silver 0.20 oz. per ton.

At a point 280 feet north of the portal of the adit a light-colored dike of hornblende-syenite outcrops that is several feet in width. The dike trends S. 80° E., which direction is parallel with the cleavage planes of the enclosing schistose graywacke.

At a point about 3,000 feet south of the portal of the above

described adit, and on the White Metal claim, a vein that has a width of 22 inches is exposed in an opencut, the elevation of which is 4,150 feet. The trend of the vein is north and south. The vein-quartz exposed in the cut is white and crumbly and assays of it are reported to indicate a value of $12 per ton in gold.

A few hundred feet south of the above-mentioned cut there is exposed on the bare hillside for a length of over 100 feet, and trending east and west, a granodiorite dike 35 feet in width. About 300 feet southwest of this dike, and trending southeasterly, is another light-colored dike, of similar composition, but evidently older. It is extensively fractured and somewhat schistose. The exposure is at an elevation of 4,030 feet. Lying along the upper wall of this older dike is a quartz vein over 12 inches in width. The quartz is white and crystalline, and shows no evidence of sulphide mineralization. In a small gulch and directly below the same dike there is exposed at an elevation of 3,950 feet another quartz vein over 24 inches in width that strikes N. 35° W. and dips steeply northeast. A few specks of pyrite were observed in the white quartz of the vein, both walls of which are of dark, schistose graywacke. The vein is reported to carry some gold.

About 175 feet west of the outcrop of this vein and at an elevation of 3,940 feet the outcrop of a third vein is exposed. This exposure is on the Quail No. 3 claim where the outcrop is uncovered for a length of about 75 feet by a shallow trench. The vein strikes N. 18° W. and dips 70° NE. It is from 12 to 18 inches in width and is composed of white, crystalline quartz, which contains a slight amount of sulphides. It is reported that a small amount of free gold may be obtained from this vein by panning.

At a point about 375 feet northwest of the above described trench and at an elevation of 3,775 feet a fourth vein is exposed in a small watercourse. It strikes N. 10° W. and dips steeply eastward. It has a width of from 6 to 12 inches and is similar in composition to the vein last described above.

It is reported that yet higher on the mountain above the veins already described thece additional veins outcrop, from each of which some gold may be panned.

Several years ago preliminary steps were taken to erect a mill on the Hurtle Creek property and part of the necessary machinery was transported as far as Tiekel Roadhouse, but the enterprise was not carried to completion. A house has been constructed on the property.

Boulder Creek

Just north of Tiekel Roadhouse, Boulder Creek flows into Kanata River, which forms the north branch of Tiekel River. A trail that starts at Tiekel Roadhouse extends westerly up the mountainside along the south side of the valley of Boulder Creek for about 3½ miles to a point about half a mile above the forks of the creek, where the trail splits. One section of the trail crosses the south fork at this point, the elevation of which is 2,920 feet, and proceeds up the west fork, which is the larger of the two, to its head and thence across a pass at an elevation of 4,200 feet into the head of Mill Creek. The other section follows the south fork for a distance of 1¼ miles to a point that is within one-half mile of the head.

Ross Property

This property is described by Moffit as follows:*

> "The Ross property is near the top of the ridge that stands between the south fork of Boulder Creek and Tiekel River. It is at an elevation of about 4,500 feet and is reached by a steep trail. The gold-bearing vein is in black siliceous slate, very much crumpled and sheared. A tunnel about 200 feet long has been driven on the vein, but was closed at the time the property was visited. The vein is made up of quartz, arsenopyrite, and galena, and yielded very high assays in gold, but is reported to be decidedly bunchy."

The property was visited in 1931 by Pilgrim, who states that no work had been done on the ground for several years and that the workings are caved and inaccessible. A grab sample of quartz float taken by Pilgrim from below the old tunnel assayed: Gold, 1.06 oz.; silver, 0.60 oz. per ton.

Ellis Property

This property, which was once known as the Meckem property, is now held by H. E. Ellis of Valdez, who located it as the Eagle Rock lode in 1911. It is situated on the south slope of the west fork of Boulder Creek about 2½ miles above the forks.

On the mountain slope above the camp at an elevation of 3,960

* Op. Cit., p. 178.

feet a crosscut-adit has been driven in a direction of S. 13° W. for a distance of 93 feet. At a point 45 feet in from the portal the adit intersects a fault that trends north of east. Beyond this fault the adit follows a quartz vein 8 inches in width, which strikes S. 9° W. and dips 45° E., to a point 69 feet from the portal where it intersects a cross vein that strikes S. 85° E. and dips 85° S. The cross vein has been developed by a drift that has been driven a distance of 48 feet easterly from the intersection. In this drift the vein has a width of from 12 to 24 inches. It is composed of iron-stained crystalline quartz that contains considerable graywacke breccia. A sample taken by Pilgrim at the face of the drift across a width of 24 inches assayed: Gold, 0.66 oz. and silver, 0.40 oz. per ton. A second sample taken by him across a width of 24 inches at a point 25 feet from the face assayed: Gold, 0.24 oz. and silver, 0.10 oz. per ton.

For a distance of 10½ feet back from the face of the adit is a series of quartz veinlets that cross the tunnel in an east-west direction. No sulphides were observed in the quartz of the veinlets. A sample taken by Pilgrim across the full width of this 10½ foot section assayed: Gold, 0.08 oz.; silver, 0.10 oz. per ton.

At a point 150 feet east of the tunnel the outcrop of another vein, which averages 8 feet in width, is exposed over a length of more than 200 feet along the steep mountainside. This vein strikes N. 7° W. and dips 79° E. The walls are platy graywacke and the quartz is iron-stained.

A dike of quartz-diorite porphyry that varies in width from 10 feet to over 50 feet crosses the valley about 150 feet south of the small frame house that stands below the tunnel. This dike may be discerned on both sides of the valley for a length of over a mile. Its trend is slightly east of south and the dip is 60° E.

In an open-cut at an elevation of 4,050 feet, on the ridge above the tunnel, a vein is exposed that strikes N. 76° E. It is about 24 inches in width and is composed of iron-stained quartz, which contains some pyrite and galena. A grab sample taken across the vein in the cut assayed: Gold, 0.14 oz.; silver, 0.10 oz. per ton.

In the discovery cut of the Eagle Rock lode, which is directly above the tunnel and at an elevation of 4,030 feet, a vein over 36 inches in width is exposed. The vein strikes N. 41 ° E. and stands

vertical. The quartz is iron-stained and contains some pyrite and galena. A sample taken by Pilgrim across 28 inches of the vein assayed: Gold, 2.86 oz.; silver, 1.70 oz. per ton.

The Ellis property is above timberline and all lumber, mine timbers. and supplies must be packed from the Richardson Highway, a distance of about 5½ miles.

A series of four small lakes, the lower of which is about 900 feet southwest of the tunnel and at an elevation of 4,020 feet, are capable of supplying an assured water supply for a small plant. The outlet stream was discharging about 2 second-feet of water in August, 1931. The upper three lakes are within the span of a mile from the lower one and lie, respectively, at elevations of 4,050, 4,160 and 4,430 feet.

Gold to the value of several thousand dollars has been produced from the Ellis property by means of a water-driven arrastre, which has since been demolished by snow-slides and freshets. In 1926 lumber was transported to the property and a dwelling was erected.

Stewart Creek

The north fork of Stewart Creek, sometime referred to as Mill Creek, has its source in a string of small lakes that lie southwest of and immediately across a flat divide from the head of the west fork of Boulder Creek. The main stream of Stewart Creek flows easterly and enters Tsina River a short distance south of the point where it joins Kanata River to form Tickel River.

Bedrock is exposed for a distance of over a mile from its head on the valley floor and also on the steep walls that flank the valley of Mill Creek. The bedrock is dark-gray, slightly schistose graywacke that strikes N. 70°-80° E. and dips 50°-75° N. Numerous nearly vertical light-colored dikes cut the graywacke and, in a general way, trend northerly. They vary in width from 16 inches or less to more than 50 feet. The occurrence was observed of two systems of quartz mineralization in the valley: A vein and stringer system that follows the direction of the cleavage of the graywacke, and another that crosses the graywacke and trends northerly, parallel to the system of dikes. The quartz veins are numerous and vary in width from a few inches to several feet. Some of them are closely associated with small dikes. Most of them are composed

of white crystalline quartz with only slight evidence of sulphide mineralization.

Mike Knowles Property

This property is situated on Mill Creek, a fork of Stewart Creek, about 2 miles by trail from the Ellis property on the west fork of Boulder Creek, above described, and about three-fourths of a mile southwest of the pass that separates Mill Creek from Boulder Creek. A two-story frame dwelling has been erected in the valley near the vein outcrops on the property.

A few hundred feet north of the frame house and at an elevation of 4,120 feet is the outcrop of a group of quartz stringers that has a width of over 8 feet. The strike of the stringers is N. 70° E. and the dip is 75° N. A section across the outcrop from northwest to southeast is as follows: Quartz, 5 inches; graywacke, 16 inches; quartz, 4 inches; graywacke with a few cross stringers of quartz, 24 inches; quartz, 10 inches; graywacke, 10 inches; quartz, 2 inches; graywacke, 18 inches; quartz, 12 inches.

About 150 feet west of the house and at an elevation of 4,060 feet, is the outcrop of a vein, from 6 to 14 inches in width that strikes N. 17° E. and dips 62° E. Another, somewhat narrower, parallel vein outcrops 40 feet east of it.

About 800 feet northeast of the camp, and at an elevation of 4,700 feet is the outcrop of a vein that strikes N. 68° E. and dips 59° N., which is made up of quartz stringers alternating with bands of graywacke. A section of this vein from south to north is as follows: Quartz, 3 inches; graywacke, 18 inches; quartz, 12 inches; graywacke, 6 inches; quartz, 60 inches. The quartz is white and crystalline and shows slight evidence of metallization. An open-cut about 6 feet in depth has been made on this outcrop.

About 350 feet southwest of the open-cut and at an elevation of 4,620 feet, a vein, 9 inches in width, has been exposed in an open-cut, which is about 8 feet in length. The vein strikes N. 18° E. and dips 82° E. The walls are not "frozen" to the graywacke. A sample taken by Pilgrim across 9 inches of this vein assayed: Gold, 0.06 oz. and silver 0.30 oz. per ton.

Shepard observed free gold in two separate vein exposures on the Knowles property. He also secured eight samples from surface exposures, assays of six of which were gold, trace and silver, trace. Descriptions and assays of the other two were as follows:

No. 1. Across width of 6 inches; gold, 0.36 oz.; silver, 0.10 oz. per ton.

No. 2. Across width of 12 inches; gold, 0.54 oz.; silver, 0.60 oz. per ton.

Tsina River

Tsina River is followed by the Richardson Highway from Thompson Pass to its junction with Tiekel River, of which it constitutes the south fork.

Holland-Townsend Property

At Mile 39½ out of Valdez on the Richardson Highway two claims are held by Messrs. William Holland and Louis E. Townsend. They are designated Tsina No. 1 and Tsina No. 2, respectively. Two veins were discovered on the property several years ago and considerable development work was done on them, but they were later abandoned. The property lies on the north side of Tsina River and crosses the Richardson Highway. At an elevation of 1,560 feet, which is 50 feet lower than the highway at that point, is the portal of a tunnel, which has been driven in a northeasterly direction. It passes underneath the highway and is said to be about 500 feet in length. For a distance of about 60 feet from the portal the tunnel penetrates gravel before bedrock is reached. Caving in this section prevented access to the tunnel when the property was visited by Pilgrim in 1931. At a point 220 feet from the portal is a raise that extends from the tunnel level to the surface. The outcrop of the vein developed by the tunnel is exposed at the surface from the top of this raise for a distance of 60 feet. The strike of the vein is N. 64° E. and the vein stands vertical. The vein is composed of white, crystalline quartz and has a width of from 12 to 18 inches. The wall rock is gray, schistose graywacke, the cleavage planes of which strike N. 80° E. and dip 70° N. A sample taken by L. E. Townsend, owner, across the vein at the collar of the raise is reported to have assayed gold, 0.36 oz.; silver, 0.20 oz. per ton.

Below the road, and about 185 feet west of the above mentioned tunnel, is the outcrop of a second vein, which strikes N. 39° E., and which has been developed by a tunnel 157 feet in length. For a distance of 75 feet from the portal the walls are schistose

graywacke and the vein is well defined, varies in width from 6 to 18 inches, and dips 80° E. Beyond this section the tunnel turns easterly and cuts diagonally across the cleavage of the bedrock, which becomes more slaty. As the slaty bedrock is penetrated the vein breaks up into a number of stringers and disappears. A composite grab sample taken by Pilgrim across the vein at several places assayed: Gold, 0.01 oz.; silver, 0.02 oz. per ton.

Timbers suitable for fuel and mining are available along Tsina River in the vicinity of the property and the water of the river could be utilized for developing power.

CHITINA PRECINCT

As was the case during the previous biennium, the outstanding features in connection with mining development in the Chitina precinct have been the continued expansion of operations by the Nabesna Mining Corporation, in the Nabesna district, and the extension by the Alaska Road Commission of the automobile highway that leads from Gulkana toward the Chistochina and Nabesna mining districts. This branch of the Richardson Highway has now been completed from Gulkana up the right limit of the Copper River a distance of 73 miles, over which section auto trucks may be operated in hauling heavy equipment. From the present terminus a tractor-road has been prepared that is suitable for winter hauling to the property of the Nabesna Mining Corporation on Jacksina Creek. The present road program of the Commission contemplates the completion of this 32-mile section as a low-standard truck road during the 1933 season.

This road that has been provided by the Government now makes reasonably accessible the entire south front of the Nutzotin Mountains of the Alaska Range from Slate Creek eastward to points within the Nabesna River drainage, as well as the north front of the Wrangell Mountains. The establishment of airplane service in the Chitina precinct by the Gillam Airways, whose base of operations is at Copper Center, has also been an important factor in facilitating and encouraging mining development in the Nabesna region as well as elsewhere throughout the Copper River basin. There is thus rendered available for prospecting and mining development a very large area of favorable territory that heretofore has remained unexplored owing to its remoteness from transportation routes. The marked success that has attended the

recent development of the gold mine of the Nabesna Mining Corporation, following the improvement in transportation facilities to the district, should bring about extensive exploration and prospecting throughout this region. Geologic conditions are favorable for the occurrence of valuable ore deposits and the field is undoubtedly one that is worthy of much more attention by prospectors than it has received in the past.

NABESNA DISTRICT

Descriptions of the mineral deposits of the Nabesna district and current mining development in the area were included in the report of the Mining Department for the biennium 1930-1931, that were based on an examination of the district in 1930 by Earl R. Pilgrim, associate Territorial mining engineer. That report contained a geologic sketch showing the relationship of the gold ore deposits on the property of the Nabesna Mining Corporation to the associated bedrock types. The principal geological features of th dstrict have also been described by Moffit and Knopf of the U. S. Geological Survey,* whose report is also accompanied by topographic and geologic maps. The district was again visited by Mr. Pilgrim in 1931 and the following notes on additional mining development and prospecting during the current biennium are taken from a report prepared by him for the mining department, and from other reliable sources.

Nabesna Mining Corporation

At the time the property of the Nabesna Mining Corporation was examined in the summer of 1930, development work included numerous open cuts that had exposed ore at ten separate outcrops along contact-boundaries of narrow, sinuous bodies of quartz-diorite, which have intruded carboniferous limestones. On the principal exposure, which is designated the "Bear Vein," a shaft had been sunk to a depth of 30 feet and a tunnel had been started that was designed to develop the Bear vein at a depth of 80 feet vertically below the summit outcrop. At the close of the year 1930 this tunnel, which follows the Bear vein, had a total length of 170 feet. A 2-bucket aerial tram had also

* Mineral Resources of the Nabesna-White River District, Alaska; U. S. Geol. Survey Bull. 417.

(Available from the Superintendent of Documents, Washington, D. C. at a price of 25 cents).

been completed, the upper terminal of which was at the elevation of the above-described tunnel or approximately 4,200 feet, and the lower terminal was at the site chosen for the milling plant, which is at an elevation of about 3,150 feet. Early in the spring of 1931 a large consignment of equipment and supplies was freighted in to the property from Chitina, on the Copper River Railroad. This consignment included mining and milling machinery and saw-mill equipment, in addition to supplies of gasoline, oil, explosives, and food.

Much of the season of 1931 was devoted to the construction of a mill building, the lumber for which was sawed at the camp, and to the installation of the milling and mining machinery.

A new tunnel, which is 160 feet lower in elevation than the tunnel above described, and now referred to as the intermediate tunnel, was driven a distance of over 450 feet.

Productive mining and milling operations were commenced in mid-summer and about 1,300 tons of ore was mined and milled before the property was closed down on account of shortage of water for use in the mill, late in September. The ore that was milled during 1931 was derived from a stope that was opened on the Bear vein above the upper tunnel. At the time the property was visited on September 6 the width of ore exposed in this stope was about 15 feet, and its assay value was reported to be over $100 per ton. The mine was equipped with pneumatic drills for which the compressed air was furnished by a portable 3-cylinder Worthington compressor, which is driven by a 60-H. P. Continental motor, and which has a capacity of 280 cubic feet per minute. The ore is delivered from the mine to the lower-terminal bin in tram buckets which have a capacity of 750 pounds each. The primary crusher is a 7-inch by 10-inch Blake-type crusher, from which the crushed ore passes to the mill ore-bin, where it is delivered by an automatic-weighing belt-feeder to a 54-inch by 24-inch Hardinge ball-mill. The material discharged from the ball-mill passes to a chain-drag classifier, the overflow from which goes to a distributor box from which it is delivered to three Plat-O slime-tables, each of which produces high-grade concentrate, low-grade concentrate and tailing. The material that is discharged from the classifier is treated on a Deister Plat-O sand table that makes a high-grade concentrate, which is shipped, and middling, which is returned to the Hardinge ball-mill for regrinding. The overflow water from the sand table is treated on the No. 1 Plat-O slime table. Power for the operation of the mill was being supplied by a Novo gasoline engine. The capacity of the mill was about 1½ tons per hour.

During the summer of 1931 the supply of gasoline that had been transportated to the camp by truck and tractor became depleted with the result that during the latter part of the season gasoline for use in the power plants was transported to the mine by airplane from Copper Center. On the return trips the airplane carried concentrate to Copper Center, whence it was hauled by truck over the Richardson Highway to tidewater at Valdez. Similar use of airplane service was continued throughout the 1932 season when the weight of supplies carried by that means from Copper Center to Nabesna amounted to 11,747 pounds and the weight of concentrate carried on the return trips totaled 12,571 pounds.

The following statements with reference to operations during the season of 1932 have been furnished by the Nabesna Mining Corporation, or are quoted from press interviews that have been given by the manager of the company, Mr. Whitham:

Milling operations were commenced May 19, 1932 and ceased on account of cold weather September 20, 1932. The tonnage of ore milled amounted to 2,127 tons. The average crew numbered 24 men. Underground development work included the driving of new drifts and raises that aggregate in length 415 feet. Surface improvements include the erection of a mess-house, a bunk-house, a store-house, a garage, and an assay office. The size of the mill was also increased by 50 per cent. The location of the upper tram-terminal has been shifted from the level of the upper tunnel down to the level of the present operating tunnel, which corresponds to the 250-foot level in the mine.

A new power plant has been shipped to the mine that includes a 135-H. P. Washington-Estep diesel engine and a 75-K. W. Westinghouse generator, which will be direct-connected to the diesel engine. The gasoline engine heretofore used will be kept in reserve as an auxiliary power unit. There has also been shipped to the mine a Kraut flotation machine, which will be used in the retreatment of tailing and in the direct treatment of all mill products except high-grade concentrate. Following the installation of

the flotation unit it is anticipated that a recovery will be made of between 90 and 95 per cent of the valuable contents of the ore. It is estimated there is available for retreatment about 4,000 tons of tailing.

According to interviews given the press by Mr. Whitham, the total value of the production of the mine to the end of the 1932 season has amounted to approximately $170,000, exclusive of the value represented in stored tailing. It is stated that at the depth to which underground development work has been carried the width of the ore-bodies varies from 4 feet to 10 feet and that the gold content of the ore exposed at that horizon is valued at from $40 to $100 per ton.

Tom Jackson Claims on Canyon Creek

In August, 1931, two lode claims were located on Canyon Creek by Tom Jackson, a local native. Canyon Creek, which is about 5 miles in length, empties into Jacksina Creek about 3½ miles south of the camp of the Nabesna Mining Corporation. It has cut a deep canyon through beds of Tertiary lava, which form the main mass of the isolated mountain that is enclosed between Pass Creek, Wait Creek, Tanada Lake and Jack Creek.

The Jackson claims are about 1⅞ miles above the mouth of Canyon Creek. They are located on a mineralized belt, which is heavily iron-stained, and which accompanies a bed of soft, light-colored andesite, that overlies one of darker color. The irregularity of the contact between the two beds gives the impression that the light-colored bed has been intruded by the darker-colored mass. It is probable, however, that the two beds constitute separate lava flows and that the irregular contact is an erosion surface developed on the older bed during the interval between flows. The light-colored bed is overlain by a bed of conglomerate composed of similar andesitic material and about 160 feet in thickness. The conglomerate is overlain by a series of bedded, gray sandstones several hundred feet in thickness, overlying which are additional beds of lava.

Two grab samples were taken at points on the iron-stained out-crop 200 feet apart and at elevations of 3,740 feet and 3,750 feet, respectively. Returns from assays of these samples gave for each a trace of gold and a trace of silver.

Jackson is reported to have discovered, early in the fall of 1931, another vein 3 feet in thickness with quartz filling, which is said to contain free gold and some pyrite. The location of the vein is said to be on the east side of the long ridge that lies between Jacksina Creek and Monte Cristo Creek.

Eagles Nest Group

The Eagles Nest group, which includes claims designated Eagles Nest No. 1 to No. 10, inclusive, was located during the summer of 1931 by Ernest D. Gercken, James Brown and Charles Anderson. The property is situated on the easterly side of Nabesna River valley and extends from the valley floor, which is at an elevation of 2,500 feet, up the mountainside to an elevation of over 4,500 feet. From Brown's camp near the Nabesna airplane landing field, which is in the area between Jack Creek and Nabesna River, the property may be reached by saddle horse. The route follows the west side of the valley floor until a crossing is made of Jacksina Creek. Nabesna River is then crossed to Gercken's camp, the distance of which from the landing field is 6 miles.

From the edge of the valley a large belt of crystalline limestone, which has a width of over one-half mile, extends in an easterly direction upward over the mountainside for a distance of more than 3 miles and down into the valley of the first north fork of Bond Creek. This limestone belt is intruded by a number of diorite dikes in a manner similar to that which obtains on the property of the Nabesna Mining Corporation on White Mountain and also on the mountain that lies behind Orange Hill. On the southeasterly side of the limestone belt is a large mass of intrusive rock that extends southerly across Bond Creek to Orange Hill.

On a limestone bluff about 100 yards north of Gercken's camp a number of veins of calcite are exposed that cut the limestone. The rock of the lower portion of the bluff is conglomerate, which contains angular fragments of gray limestone and some fragments of dark-colored diorite. The cementing matrix is white lime. Upward the conglomerate grades conformably into massive limestone. The calcite veins exhibit a small amount of copper stains, but contain no quartz or other visible minerals. An old location notice that is still legible indicates that a mining claim covering these vein exposures was held by one H. J. Field in 1903. At an elevation of 4,120 feet there occurs a contact between a

small diorite dike and overlying limestone. The bedding of the limestone strikes N. 20° E. and dips 49° E. The limestone above this contact is mineralized for a width of 24 inches and the diorite below is considerably mineralized for a width of several feet with copper carbonate, which is probably derived from the contact above. Along the contact itself is a fissure about 4 inches in width that is filled with brown-stained calcite accompanied by small amounts of quartz. A sample 12 inches in length was taken across this fissure vein that included also several inches each of the mineralized limestone above and of the diorite below. An assay of this sample returned gold 0.02 oz., and silver, 2.60 oz. per ton. The sample contained some visible chalcopyrite and oxidized copper minerals.

At a point about 80 feet northeast of the above described exposure, and at an elevation of 4,240 feet, another contact of the same dike with the overlying limestone is exposed. At this point a vein occurs that lies partly in the contact and partly in the diorite dike. It has a strike of N. 85° E. and dips 70° N. The outcrop is uncovered for a distance of about 30 feet beyond which limits it passes beneath slide material above and below. The width of the vein is from 2 inches to 12 inches and so far as exposed both walls are of diorite. The filling is mainly of calcite with which are associated some basic silicates, considerable chalcopyrite, which probably constitutes about 5 per cent of the whole, pyrite, and some magnetite. A grab sample that was taken across the vein at intervals over a length of about 10 feet assayed gold, 0.01 oz. and silver 0.50 oz. per ton.

Bond Creek: The country rock along the first fork that enters Bond Creek from the north is composed of intrusives of granitic type. At this locality several quartz veins were observed that are mineralized with quartz, pyrite, calcite and small amounts of chalcopyrite. From two of these veins grab samples were taken, descriptions and results of assays of which were as follows: Sample "A." From fissure exposed at creek level in west bluff on the north fork of Bond Creek about half a mile from mouth. Assay return: Gold, trace; silver, 0.50 oz. per ton. Sample "B." Picked pieces from fissure vein exposed in west bluff on the north fork of Bond Creek about three-fourths of a mile above the mouth. Assay return: Gold, trace; silver, trace.

During the season of 1931 a small-scale placer-mining operation was being carried on by N. P. Nelson on the north Middle Fork of Jack Creek, a tributary of the Nabesna River.

CHISTOCHINA AND SLANA RIVER DISTRICTS

The Chistochina district is in the same geographic and also in the same geologic province as the Nabesna district, above reviewed. Mining and prospecting activities in the Chistochina district, heretofore, has been confined, however, almost wholly to the placer deposits of the headwater tributaries of the Chistochina River, of which Slate Creek and Miller Gulch have been the most productive of placer gold. Up to the year 1910 gold to the value of $1,500,000 had been won from the gravels of the Chistochina district, and since that year the value of the additional yield exceeds $500,000. Now that this region has been rendered much more accessible by the construction of the Gulkana-Nabesna auto road, intensive search for gold lodes, as well as for additional placer deposits, is undoubtedly justified. The probable source of the extremely rich placer deposits of Miller Gulch and Slate Creek was announced by W. C. Mendenhall of the U. S. Geological Survey to be the upper beds of a group of rocks designated by him the "Mankomen formation."* This formation is made up of sandstones, shales and limestones, with intrusive sheets, and has a total thickness of between 6,000 and 7,000 feet. With reference to the beds of the formation that are of particular importance as probable sources of gold mineralization, Mendenhall says:*

> "Northwest of the main body of the Mankomen sediments a narrow belt of shales and limestones, regarded as representing the upper beds of the group, extends from the head of the Middle Fork of the Chistochina to West Fork Glacier. This belt is only about 3 miles wide, although nearly 12 miles long. A heavy limestone, believed to be the upper part of the Eagle Creek bed, is partly exposed north of the upper Chisna, but generally the sediments of this section are shales. They are somewhat metamorphosed in the vicinity of Slate Creek, where they are regarded as the source of the gold of the Chistochina district."

* Central Copper River Region, Alaska, by W. C. Mendenhall; U. S. Geol. Survey Prof. Paper 41, p. 41.
(Available from the Superintendent of Documents, Washington, D. C. at a price of 50 cents).

* Op. cit., p. 41.

The beds of the Mankomen series are correlated with similar beds at Jack Creek in the Nabesna River district in which the orebodies being mined by the Nabesna Mining Corporation occur. The series is also found in the drainage basin of the Slana River, which lies between Chistochina River and Nabesna River.

Mining operations in the Chistochina district during 1932 were confined to Slate Creek where a crew of 10 men was employed by Arne Sundt in placer mining on property heretofore operated by the Slate Creek Mining Company.

During the season of 1931 K. D. Peterson and V. E. Peterson were prospecting for placer deposits on Granite Creek, a headwater tributary of Slana River.

KOTSINA-STRELNA DISTRICT

No reports have been received as to any prospecting or development work having been done during the biennium on the copper deposits of the Kotsina-Strelna district, which lies on the westerly slopes of the Wrangell Range west of Kennecott.

BREMNER DISTRICT

There was a marked increase in activity in prospecting and development work, both on lodes and placers, in the Bremner-Hanagita district, which occupies the extreme southerly portion of the Chitina precinct. This district is usually approached from McCarthy on the Copper River and Northwestern Railroad. The trail route heretofore in use leaves the railroad at Long Lake and crosses the Chitina River at the mouth of the Nizina River, where fording of the two rivers is necessary. The route then follows up the Chakina River to the mouth of Monahan Creek, thence up the valley of that stream to the mining district. Recent work accomplished by the Alaska Road Commission now enables the district to be reached much more readily and safely, especially with heavy loads, by a new route. This new route leaves the McCarthy-Dan Creek road at the south end of the Nizina River bridge. From that point a new trail has been extended for a distance of 18 miles that enables the old trail at the mouth of Monahan Creek to be reached more readily and with a much more favorable crossing of the Chitina River than was afforded by the old route. During the past season about 150 tons of fuel wood and mine timbers was transported to the Bremner district over the new route after the

freeze-up. The district may now also be reached by airplane from Copper Center.

The geology of the Bremner-Hanagita district is described by the U. S. Geological Survey in a report that is accompanied by excellent geologic and topographic maps of the region.*

Golconda Creek

Bremner Gold Mining Company

The property of the Bremner Gold Mining Company, otherwise referred to as the Ramer Bros. property, is situated near the head of Golconda Creek, which is a tributary of the north fork of Bremner River. The property is on the mountainside above the pass that separates Golconda Creek from the west fork of Monahan Creek, a tributary of Chakina River. The route by which the property is reached is described above. During the summer of 1931 an airplane landing field was prepared near the mine by the company crew that enables a plane to land within a very short distance of the camp.

During the year 1932 a crew of about 10 men was engaged in development work on the property that included the driving of a crosscut adit 204 feet in length that intersects a vein 2 feet in width, upon which a drift was driven a distance of 44 feet. The tunnel cuts the vein at a depth of 150 feet below the surface outcrop and work has been started on a raise that follows the vein. The vein has also been uncovered at the surface for a distance of over 200 feet by a shallow shaft and a series of trenches. An aerial tramway has been erected that leads from the camp on Golconda Creek to the mine portal, a distance of 3,600 feet.

The Bremner Gold Mining Company has its principal place of business at McCarthy.

Lode Prospecting: East of the placer claim of Fred Tagstadt on Golconda Creek, described below, Clyde Brown and Dieterlie were prospecting for quartz lodes in a locality where it is reported numerous small dikes cut the slate country rock.

* Geology of the Hanagita-Bremner Region, Alaska; U. S. Geol. Survey Bull. 576.
(Available from the Superintendent of Documents, Washington, D. C. at a price of 30 cents).

Placer Development: On the Black Bear and Black Dog placer claims, which are the property of Fred Tagstadt, and which are located on Golconda Creek about 1½ miles below the mouth of Standard Creek, Hans Tjielle and E. C. Koivula were shoveling-in on the left limit of Seller's Bar. They sank 4 pits that averaged 15 feet in depth to bedrock, which is said to be flat-lying slate above which is a layer of glacial clay that forms a false bedrock. The gravel is unstratified glacial material that contains some boulders as large as 6 feet in diameter and but a small amount of sediment. Gold is found scattered throughout the full depth of gravel and over a width of about 150 feet across the stream bed. The largest nugget found during the prospecting work on this ground was worth $1.

At the mouth of Standard Creek John Lucky and Olaf Soostadt were prospecting in 1931. At this locality the gravel has a depth of 3½ feet and bedrock is soft slate, of which 1½ feet is removed in mining. The gravel contains many boulders and much sediment, but no glacial clay is present. Although one nugget was found that was valued at $6, most of the gold is fine and flaky. It is found distributed over a width of 100 feet. The prospecting work included digging a bedrock drain several hundred feet in length. One ounce of gold, valued at $17.60, was recovered on the Standard No. 1 claim.

Prospecting work was being carried on in 1931 by Fred Tagstadt on Golconda Creek at a point about 3½ miles below its head and 1 mile above the mouth of Standard Creek. The gravel at that locality has a depth of 6 feet and the gold is found concentrated close to bedrock. It is coarse and angular and frequently has quartz adhering to it. The largest nugget found was valued at about $6. More than 20 ounces of gold were recovered in 1931. A sod wing-dam equipped with gates was used for storage and diversion of water.

Monahan Creek

On Monahan Creek prospecting work was being carried on in 1931 by Nickolai Jensen, who was working on Discovery claim.

On claim No. 1 Above Discovery, Jack Young and Robert Clark drove two bedrock drains 200 feet and 400 feet in length, respectively, neither of which reached bedrock, although one had a depth of 9 feet. Many large boulders are present in the gravel

and no gold was recovered. The same men worked also at the mouth of Monahan Creek where they drove a drain 600 feet in length and 9 feet in depth that also failed to reach bedrock. The material excavated at this locality was rounded wash-gravel that contains many large boulders.

Hanagita River

The only prospecting reported done in the Hanagita valley has been the development during 1931 of a group of claims by Jack O'Hara that are situated about 6 miles above the mouth of Hanagita River. The type of mineralization on the property is said to be lead-zinc.

M'CARTHY PRECINCT

The McCarthy precinct embraces the upper, or easterly, section of the drainage basin of the Chitina River and all of the basin of its principal tributary, the Nizina River. The principal mining districts in the precinct are the Kennecott district, wherein are located the famed copper mines of the Kennecott Copper Corporation, and the Nizina district, which for many years has been an important source of placer gold.

Kennecott Copper Corporation

During the past biennium the operations of the Kennecott Copper Corporation have been sharply curtailed. According to statistics issued by the U. S. Customs Service, the tonnage of ore produced in 1932 was less than half the amount produced in 1931 and, owing to the extremely low price of copper, the value of the product was but little more than one-third of that of the output in 1931.

During 1932 the average number of men employed in the crew was 40 per cent less than it was in 1931, and in the latter part of October, 1932 all productive operations ceased for the year. Only a "skeleton" crew, sufficient for maintenance of the property, remained at the plant. This situation developed partly as a result of serious difficulty that was experienced in the winter operation of the Copper River and Northwestern Railway, which serves the mine, to overcome which would have entailed large expenditures. It is believed that productive operations at the mine will be resumed

when traffic on the railway is again established in the spring of 1933.

Chas A. Nelson Prospect

This property is situated on the south side of the valley of Chitistone River, about a mile west of Glacier Creek, and at an elevation of a few hundred feet above the valley floor. It is reached by a trail 12 miles in length that leaves the McCarthy-Dan Creek road at Dan Creek, traverses the flat on the east side of the valley of Nizina River to the valley of Chitistone River, and leads thence up the south side of that valley to the property.

A brief description of the development work that has been done on the property was included in the mining report to the Legislature for the biennium ending March 31, 1931.*

The following additional information has been prepared from a report submitted by Earl R. Pilgrim, associate Territorial engineer, following an examination of the property in 1931:

The original discovery of the property was made by Chas. A. Nelson, in 1928, at which time the claims of the group were located by him. The property was later taken under option by the Kennecott Copper Corporation, by which company the development work described below was done. Not having discovered ore-bodies of sufficient extent to meet the requirements of a plant of the size contemplated, the company suspended work in 1930 and returned the property to the owners. A careful study of the property has demonstrated that it is situated in an isolated block of Chitistone limestone that is separated from the main mass of that formation by an extensive fault. The size of the block is estimated to be about two miles in length, from northeast to southwest, and about half a mile in maximum thickness. The exploratory work thus far done on the property has developed small tonnage of both high-grade and milling ore.

The highest tunnel is at an elevation of 3,180 feet, which is approximately 1,200 feet above the valley floor. It has been driven for a distance of 85 feet on a fissure that was uncovered

* Report on Cooperation between the Territory of Alaska and the United States in Making Mining Investigations and in the Inspection of Mines for the Biennium ending March 31, 1931, p. 59.

at the original discovery point, and which strikes south and dips 60° E. The most favorable discovery in this tunnel is a short distance from the portal, where both high-grade and milling ore are exposed. Beyond this point the fissure separates into three branches, one of which continues straight ahead and the other two bend toward the east. These fissures, which attain widths of several inches, are filled with azurite and chalcocite. Numerous slips, or joint planes, that cross the fissures show no mineralization. At a point 30 feet from the portal a drift about 10 feet in length was run on one of them, but failed to disclose ore. At 70 feet from the portal the main fissure is cut off by a fault which strikes N. 77° W.

At a point almost directly beneath the above described tunnel, and 10 feet lower in elevation, a second tunnel 33 feet in length has been driven to undercut the ore exposed near the portal of th upper tunnel. A little ore shows at the face of the lower tunnel.

At a point 100 feet east of the upper tunnel is the portal of a third tunnel, which is at an elevation of 3,130 feet and alongside which is a fan house. For a distance of 120 feet from the portal this tunnel has a direction of S. 76° W. and it was designed to undercut at a depth of 50 feet the ore-body that outcrops at the portal of the upper tunnel. From a point 85 feet from the portal a branch tunnel extends S. 22° W. for a distance of 132 feet. The bedrock penetrated by these workings is dark-colored limestone which is badly crushed and is intersected by numerous slips on joint planes. The bedding of the limestone strikes N. 25° W. and dips from 12° to 16° S. The copper mineralization exposed at the surface and in the upper tunnels does not appear in this tunnel.

The portal of the fourth tunnel is a little over 200 feet southeast of that of the third tunnel and at the same elevation, 3,130 feet. The initial section of this tunnel has a direction of S. 57° W. for a distance of 123 feet, and is so placed as to undercut a number of well-mineralized fissures that appear on the surface above and that are part of the original discoveries on the property. Near the portal and at a point 85 feet therefrom joint planes in the bedrock of this section of the tunnel are slightly mineralized with azurite and chalcocite. From a point 43 feet from the portal a branch tunnel extends southerly for a distance of 210 feet, and from a point 75 feet back from the face of this branch a second branch extends westerly a distance of 180 feet. From the point

where it starts, the southerly-trending branch of the tunnel follows a fissure which varies in width from half an inch to several inches and which is filled with chalcocite. At 42 feet from the starting point of this branch the fissure expands into a small ore-body from which several tons of high-grade ore was obtained. Beyond this point the fissure pinches out, and the tunnel follows a strong fault, which carries a gouge-seam from 12 to 20 inches in width, but which is not mineralized. Only barren, gray dolomite is exposed by the 180-foot westerly branch of the tunnel.

At a point about 110 feet east of the fourth tunnel, above described, and at an elevation of 3,080 feet, is the portal of a fifth tunnel. This tunnel, which has a direction of S. 68° W. and which is 200 feet in length, is so placed as to undercut at a depth of 47 feet the ore-body above described that was disclosed in the southerly branch of the fourth tunnel. It penetrates greenstone for a distance of 83 feet from the portal, at which point it intersects the contact with the overlying limestone. The strike of the contact is about N. 15° W. and the limestone beds trend N. 25° W. and dip 13° W. Throughout its length the tunnel disclosed only slight copper mineralization in the bedrock. At a point 20 feet from the face, however, a drift 15 feet in length that extends south from the tunnel exposes some stringers of chalcocite that expand into a body of milling ore several feet in width, of which several tons was removed. At the face of the drift this ore appears to pinch out.

The only buildings on the property are a log blacksmith shop and a fan house, which are situated near the above described tunnels. On an adjoining property, however, and directly downhill from the mine workings, are five substantial log buildings, which are slightly above the valley floor and at an elevation of 2,700 feet.

An adequate supply of timber suitable for mining purposes is to be had on the mountainsides in the immediate vicinity of the property and also on the Nizina River flats at the mouth of Chitistone River valley.

Martin Radovan Prospect

Glacier Creek is a northwesterly-flowing stream that empties into Chitistone River about two miles east of the junction of the Chitistone and Nizina River valleys. The Radovan property is situated on the steep mountain southwest of Glacier

Creek valley and near the head of the first glacier that enters that valley from the southwest. It is reached by the same trail that leads to the Chas. A. Nelson prospect, which route has been described above. Radovan's camp is on the southwest side of Glacier Creek valley about one mile above its mouth, and is at an elevation of 2,800 feet. From the camp a steep, switchback trail leads up the mountain and into a hanging valley at the head of which is a small glacier. South of this glacier and at an elevation of 6,480 feet the trail reaches the contact of Nickolai greenstone with Chitistone limestone. Thence, for a distance of about 5,000 feet, the trail follows a narrow shelf, which marks the contact at the top of the greenstone, to a point just below the outcrop of the ore exposure on the Radovan property. From this point the outcrop is reached by a short climb, which is effected by the aid of ropes tied to drill-steel that is anchored in the steep face of the cliff. It is feasible to use horses on the trail from Dan Creek to Radovan's camp, and with very little work they could be taken to within a few hundred yards of the contact at the head of the hanging valley. From this point to the outcrop, however, supplies must be carried by man-pack.

For a number of years the existence of the surface ore exposures on the property now held by Radovan has been known, as they were visible from a distance with the aid of binoculars, for which reason the outcrops were referred to as the "binocular prospect." The surface outcrops were considered inacessible, however, until Mr. Radovan's resourcefulness solved the problem of constructing a trail to the locality.

The claims that now comprise the group held by Radovan are 30 in number and are designated Triassic Nos. 1 to 30, inclusive.

The discovery outcrop is exposed on the nearly vertical face of a cliff of much-fractured Chitistone limestone at a point about 230 feet vertically above the greenstone contact. To the north of this outcrop is a fault that strikes N. 30° W. and dips 80° W., by which the body of limestone that contains the outcrop has been dropped a distance of about 150 feet vertically, relative to the adjacent mass of limestone. A number of small vertical fractures cut the mineralized mass at the outcrop, one of the more prominent of which strikes N. 63° W. and dips 87° N. This fracture is a few inches in width and is filled with brecciated limestone that contains

a considerable quantity of oxidized iron and coper minerals. The main ore exposure consists of a mineralized bed of limestone about 20 feet in thickness, the rusty-colored, oxidized outcrop of which is exposed for a distance of about 170 feet along the bed. At the outcrop this bed strikes N. 20° E. and dips 30° S. North of the fault, above mentioned, the limestone beds strike N. 62° W. and dip 13° S. The overlying beds are more massive than the mineralized bed and have been much less fractured.

When the property was visited in September, 1931, but little development work had been done at the outcrop, other than rendering it accessible over about 70 feet of its length. For that distance a cut or trench in the bedrock exposes fractured limestone that contains considerable chalcocite and azurite, together with lesser amounts of covellite and some pyrite. Though the major portion of the mineralized bed was inaccessible for close examination, when viewed from below, the portion that had been stripped appeared to be the most highly mineralized.

Upper Chitina River Valley

Development work that has been in progress for a number of years was continued during 1931 by Martin Harrais, assisted by one man, on a group of claims in upper Chitina River valley between the mouth of Canyon Creek and Hawkins Glacier. Minerals found on the Harrais property include ores of copper, zinc, silver and lead.

On an adjoining group of claims prospecting work was being carried on in 1931 by Wm. Slempert.

Tana River

During the season of 1931 and 1932 prospecting for both lode deposits and placers was being done by A. G. Grate in the drainage basin of Tana River, from the "Canyon", which is 10 miles above the mouth, to the "West Fork", which is 16 miles upstream from the "Canyon". A section of the rock formations observed by Mr. Grate west of Tana River from the "West Fork" northerly to the "Canyon" is as follows: "Slate, 6 miles; diorite, 2 miles; slate belt, half a mile; old, basic lava, 2 miles. Diorite-gneiss and other basic igneous rocks continue from the lava to the canyon."

A number of holes were sunk to bedrock, and, although some

placer gold was found, it was not present in paying quantities. The basic lavas were found to contain iron ores (possibly hematite), and some copper mineralization was observed, although not in sufficient quantity to justify development.

NIZINA RIVER DISTRICT

Dan Creek and Chititu Creek Placers

The gold-placer deposits of Dan Creek and Chititu Creek have been continuously productive each year since their discovery in 1902.

During the past biennium operations continued at the property of the Nicolai Placer Mines on Dan Creek, where a crew of 14 men was engaged in hydraulic operations. The discovery is reported of additional bench deposits on this property that are said to justify the belief that profitable placer operations will continue on Dan Creek for many years.

Prospecting with a small hydraulic plant was also carried on by James Lyons on Copper Creek, the principal tributary of Dan Creek. On the left-limit bench of Copper Creek Gustav Langland, Jex Larson and two partners worked on an association claim.

A crew of 30 men, under the direction of Chas. Cramer, was engaged in operating on the John E. Andrus property on Chititu Creek two hydraulic plants, one of which was placed on claim No. 4 Above Discovery and the other on claim No. 8 Above Discovery.

Williams Peak Lode Prospect

It is reported that a tunnel, which is to be 200 feet in length, is being driven on a property, formerly held by Wm. Krom and later by John Barrett, that is situated on Williams Peak opposite the mouth of Dan Creek. Williams Peak is the mountain mass that separates Dan Creek from Chititu Creek. The lode deposit that is being developed by the tunnel is said to carry gold associated with antimony.

WHITE RIVER PRECINCT

CHISANA DISTRICT

Placer mining has been conducted on a small scale in the Chisana district each year since the discovery there of placer deposits in 1913.

A report on the geological features of the district, including

a discussion of the source of the placer gold, and accompanied by a sketch map, has been published by the U. S. Geological Survey.* Capps' report also describes seven routes by which the district may be reached from various starting points. Although supplies are still freighted by the Nizina-Chisana route over Skolai Pass from McCarthy on the Copper River and Northwestern Railway, by means of dog teams in winter, it is probable the Copper River-Nabesna route will increase in favor. The completion of the automobile and tractor road from Gulkana to Nabesna River, which is contemplated within the next year, will enable supplies to be transported from Valdez to Nabesna River at minimum cost. The route from Nabesna River to Chisana is by way of Cooper Creek, Cooper Pass and Notch Creek. It has the advantage of being ice-free and that of traversing a well-timbered country. Furthermore, the area between Nabesna River and Chisana, through which the trail passes, contains the belt of Carboniferous rocks that are regarded as the source of the gold of the Chistochina and Chisana placers and in which also occurs the gold-lode deposits that are being mined by the Nabesna Gold Mining Corporation. The area is, therefore, a favorable one for prospecting. Airplane service is also now available to Chisana and during 1932 several loads of passengers, equipment and supplies were transported to the district by that means.

The following placer mining activities were in progress in the Chisana district during 1931:

On Bonanza Creek individual operations were being conducted by W. E. James on Discovery claim; by A. S. Johnson on claim No. 8 Above Discovery; and on claim No. 11 Above Discovery by Anthony McGettigan, who installed a new splash-dam.

On Little Eldorado Creek individual operations were being conducted under lease on claim No. 2 Above Discovery by B. L. Davis; and on claim No. 1 Above Discovery by John Carrol.

Reports have been received that lode prospecting has been actively engaged in during 1932 on upper White River and within a radius of 50 miles from Chisana. The most encouraging discovery appears to have been made on the right limit of Alder Gulch, about 4 miles from the Chisana airplane field, where Louis McCallum reports having found three parallel veins that carry free gold. Mr. McCallum states that these veins occur in an ore zone 100 feet in width that traverses granitic rocks, in which are porphyry dikes and veins of honey-combed quartz. The widths of the three veins are given as follows: No. 1 vein, 4½ feet; No. 2 vein, 7 feet; No. 3 vein, 7 feet. Mr. McCallum also reports that the assay of one sample taken by him at his discovery ran gold, 4.60 oz. per ton, and that from other samples, taken since the veins were stripped by open-cuts, but which have not been assayed, free gold has been panned.

* Mineral Resources of the Chisana-White River District, by S. R. Capps; U. S. Geol. Survey Bull. 622, pp. 189-228.

KODIAK PRECINCT

Kodiak precinct embraces Kodiak, Afognak, and adjacent islands, as well as that portion of the Alaska Peninsula that lies south of the crest of the Aleutian Range of mountains between Cape Douglas and Chignik Bay.

A revival of interest in prospecting within this precinct has taken place within the past two years, and a number of prospectors have been active in the search for both lode and placer deposits. There has also been a resumption of individual operations on the beach placers in the vicinity of Red River at the westerly end of Kodiak Island, and elsewhere. The total recovery of gold from the beach placers during the biennium is not known. One prospector reports that he recovered with a rocker fine gold to the value of $300 in 1931 from the beach at Red River.

During 1931 Z. T. Halferty of Kodiak carried on prospecting operations on a northerly-flowing stream, which he named Montana Creek, that enters a bight on the west shore of Uganik Bay a short distance inside the entrance. He reports having found "heavy colors" of gold in a somewhat "spotty" pay-streak on this stream and "fine colors" on California Creek, of which Montana Creek is a right-limit tributary.

W. E. Baumann of Afognak carried on prospecting operations in a search for placer gold on the mainland of Alaska Peninsula in the vicinity of Amalik Bay and Takli Island. He reports that "gold was found on bedrock on the beach and was of a very heavy character." Regarding the formations examined, he states: "Large bodies of porphyry at the head of the bay and inland are rusty. The igneous dikes west of the bay at the outer point were the only ones seen, and the greatest mineralization is not far from

the coast line." A heavy covering of volcanic ash and pumice makes it difficult to prospect the creeks in this area.

During 1932 the Chirikof Island Gold Platinum Company, which was organized in that year, transported from Seattle to Chirikof Island equipment and supplies for use in an effort to mine and treat the beach sands of that island, which are reported to contain both gold and platinum in moderate amounts. The equipment is reported to include an amalgamating machine of the centrifugal type, a Fordson tractor, a hoist, concentrating tables and a slack-line scraper outfit.* Chirikof Island is an isolated island that lies about 100 miles southwest of the nearest point of Kodiak Island and about an equal distance offshore from Aniakchak Bay on the Alaska Peninsula. It is about 12 miles in length and the maximum width is about 7 miles.

FOURTH DIVISION

The report of the Collector of Customs shows that the value of the gold and silver shipped from the Fourth Division during the biennium amounts to $6,761,000, and that the value of the shipments made in 1932 exceeded that of the shipments made during 1931 by about $190,000. The increase in the value of output during the biennium just closed over that of the next preceding biennium amounts to $1,616,000, which represents a percentage increase of 31½ per cent.

Data on production of gold, published by the U. S. Geological Survey, show that in 1930 about 81 per cent of the output of the Fourth Division was mined in the Fairbanks district. This percentage was probably maintained, at least approximately, during the period since 1930.

PLACERS

In view of the fact that field investigations were not made during the biennium in most of the placer-mining districts of the Fourth Division, no attempt will be made to set forth in this report detailed data with regard to the progress of that branch of the industry.

* The Alaska Weekly, October 28, 1932.

FAIRBANKS PRECINCT

The major part of the output of gold from the Fairbanks district was derived from the operation of the five large dredges of the Fairbanks Exploration Company, all of which were active throughout the biennium in the Goldstream, Cleary and Chatanika sections of the district. Fine progress was made by the company in its thawing and stripping operations, by which large areas of ground have been prepared for dredging. Each of the dredges was operated throughout the season that has been found feasible within the area where the dredge is located. The earliest date on which dredging operations were commenced during the biennium was April 2. The latest date on which operations ceased was December 7. In 1932 thawing operations were commenced on various dates within the period from May 8 to May 12 and were all discontinued by September 22. Stripping operations were commenced on May 3 and ceased on September 27. The average force of men employed in 1932 numbered 528 men.

Other dredging operations in the Fairbanks district included the following: During 1931 two dredges were operated on Fairbanks Creek with a total crew of 60 men employed. Dredge No. 1 started work on June 6 and ceased on October 15; dredge No. 2 commenced operating May 7 and closed down on October 29.

The Nome Creek dredge commenced operations on June 5, 1931 and closed down for the season on November 11, 1931. A shut-down during June caused a loss of time amounting to 15 days. The crew consisted of 13 men.

Operations of the Chatham Creek dredge started on June 4, 1931 and ceased for the season on October 15, 1931. A crew of 10 men was employed.

During 1931 there was no productive operation of the Fish Creek dredge. Stripping operations were carried on, however, for a period of one month, in which work a crew of 8 men was engaged.

Details are lacking as to the operations of individual dredges in the Fairbanks district during 1932. It is known, however, that a total of nine dredges were active and that the total number of men employed was about 620.

In addition to dredging in the Fairbanks district, placer min-

ing operations of several different types were actively carried on during the biennium. It is also to be noted that the number of such enterprises and the size of the crews engaged both increased materially in 1932 as compared with 1931.

Hydraulic-mining plants that were active in 1931 furnished employment to 33 men, whereas in 1932 a total of 64 men were engaged in 8 separate operations.

In 1931 a total of 23 men were engaged in drift-mining; similar activities during 1932 furnished employment to a total of 61 men at 19 separate plants in the several districts.

The number of men engaged in shoveling-in operations during 1931 was 7; in 1932 there were active 13 such operations with a total of 22 men employed.

Three drilling rigs, other than those used by the larger companies, were in active operation during each year of the biennium, in which work a total of 7 men were engaged.

It is estimated that about 25 men were engaged in prospecting for new placer deposits and that these men were divided among 11 separate outfits.

Information concerning the distribution of placer mining activities in other precincts of the Fourth Division during 1931 is incomplete. Fairly accurate estimates based on information available as to such activities during the year 1932 may be summarized as follows:

EAGLE PRECINCT

In the Eagle precinct there were reported active during 1932, 7 hydraulic-mining plants, with 23 men employed; 13 shoveling-in operations, with 17 men employed; and 6 individual prospectors.

FORTYMILE PRECINCT

In the Fortymile precinct during 1932 the following activities were reported: Hydraulic mining was conducted at 9 plants, at which a total of 40 men were employed; shoveling-in operations were carried on at 18 places, with a total of 27 men engaged; and 9 prospecting enterprises gave employment to a total of 26 men.

CIRCLE PRECINCT

The following activities in the several types of placer mining

in the Circle precinct are reported for the year 1932: Twelve hydraulic plants were in operation with a total of 69 men engaged; 10 drifting operations were conducted with a total of 23 men engaged; shoveling-in operations were 11 in number, with 16 men employed; and 30 prospecting outfits were in the field with 38 men engaged.

TOLOVANA PRECINCT

The following types of operation are reported to have been carried on in the Tolovana precinct during 1932: Seven hydraulic plants engaged the activities of a total of 32 men; 5 drift-mining operations were conducted with crews whose number totaled 22; and 2 men were engaged in individual prospecting work.

HOT SPRINGS PRECINCT

A very encouraging development in the Hot Springs precinct has been the resumption of active operations by the American Creek dredge under very competent management. Most of the work done in connection with the revival of this enterprise during the biennium is in the nature of preparatory activities and repair work. Nevertheless, a short productive run was made with the dredge, with results that are reliably reported to have been very satisfactory. A material expansion of operations in this enterprise during the coming biennium is confidently anticipated. In the operations conducted during 1932 the dredge crew consisted of 18 men.

Other types of activity reported from the Hot Springs district during 1932 included 5 hydraulic-mining plants with a total of 27 men employed; 6 drift-mining operations with a total of 28 men employed; 4 shoveling-in operations with 5 men employed; 1 drilling-rig active, with 2 men employed; and 17 prospecting outfits conducting exploration work with a total of 19 men employed.

TANANA PRECINCT

Only 5 men were reported to have been engaged in mining activity during 1932 in the Tanana precinct. Two of these men conducted a hydraulic-mining operation, and the other 3 were engaged in individual drift-mining, shoveling-in, and prospecting activities, respectively.

CHANDALAR PRECINCT

In the Chandalar precinct a total of 10 men were reported to

have been engaged in mining operations during 1932. Seven of these men were employed at 5 separate drift-mining operations, 1 was shoveling-in, and 2 were engaged in prospecting.

KOYUKUK PRECINCT

In the Koyukuk district proper, the following activities are reported to have been carried on: Two hydraulic plants were operated, in connection with which a total of 4 men were employed; in drift-mining work 8 separate enterprises engaged a total of 22 men; shoveling-in occupied 9 men at 6 separate localities; and 3 men were prospecting.

In the lower Koyukuk and Indian River district 2 men operated an hydraulic plant and 2 others were prospecting together.

In the Wild River district shoveling-in operations were carried on at 4 localities, with a total of 7 men employed, and 1 man was engaged in prospecting.

NULATO PRECINCT

In the Poorman-Ruby district reports indicate there were the following types of mining activity in progress during 1932: Drift-mining was being carried on in 9 separate operations, with a total of 32 men engaged; 4 shoveling-in operations were in operation with a total of 5 men employed; and 5 prospecting outfits were in the field with 8 men engaged.

MT. M'KINLEY PRECINCT

The Mt. McKinley precinct embraces the Tolstoi, Ophir, Cripple, Takotna and Nixon Fork districts. Reports have been received which indicate that a total of 78 men were engaged in the several types of mining activity carried on within the precinct during 1932. These activities were distributed as follows: Three dredges were in operation, which, together, employed 20 men; 7 hydraulic-mining plants were operated that gave employment to a total of 33 men; 2 scraper operations were active with a total of 7 men engaged; and 16 prospecting outfits were active with 18 men engaged in the work.

OTTER PRECINCT

The principal mining district in the Otter precinct is the Flat placer-mining district.

The following notes as to mining activities in the Flat district during 1932 were furnished by Mr. Geo. H. Miller, safety instructor for the U. S. Bureau of Mines, who conducted safety training there in August, 1932.

Two dredges were in operation in the district during 1932, both of which are reported to have had successful seasons. The North American Dredging Company operated on Flat Creek with a crew of 18 men, and the dredge of the Riley Investment Company was active at its location on Otter Creek with a crew of 17 men employed.

A dragline-scraper outfit was being operated on Happy Creek by Olson and Company, by whom a crew of 11 men was employed.

The Northland Development Company, which is a recently formed company, operated a dragline outfit on a tract of ground on Flat Creek that was leased by them from Dave Strandberg.

Strandberg and Sons continued the operation of their hydraulic plant on upper Flat Creek with a crew of 5 men employed.

Pete Miscovich also continued operating on Discovery Claim on Otter Creek, where mining has been carried on by him for several years. He uses an hydraulic lift and employs a crew of about 4 men.

Gus Uotilla, assisted by a crew of from 3 to 4 men, took advantage of the abundance of water available during the season and sluiced the overburden from a tract of ground on Slate Creek, which he has leased and on which a dragline outfit is to be placed next season.

The Chicken Mining Company employed from 6 to 8 men at their hydraulic plant on Chicken Creek.

The only operation reported to have been active on Willow Creek was that of Jules Loranger, who, assisted by 3 men, was hydraulicking bench ground on lower Willow Creek.

In addition to the activities enumerated above, there were reported to have been three other outfits working in unidentified localities, by which a total of about 12 men were employed. About 8 men were also carrying on individual activities in several separate localities.

At Moore Creek, which is a tributary of the upper Takotna River and about 40 miles east of Flat, Olson and Palmgren are reported to have conducted preparatory work with a view to commencing dragline operations on ground leased from Cecil Barlow. Formerly Moore Creek has been worked by hydraulic methods.

KUSKOKWIM PRECINCT

The only mining activities reported from the Kuskokwim precinct include two hydraulic-mining operations with a total of 10 men employed; one drilling operation with 4 men employed; and two prospecting outfits with 4 men employed. All of these activities were in the vicinity of Georgetown.

BETHEL PRECINCT

Akiak District

New York-Alaska Gold Dredging Company

The largest single mining enterprise conducted during the biennium in the Bethel precinct was that of the New York-Alaska Gold Dredging Company at their plant at Nyac on Bear Creek, a tributary of upper Tuluksak River. A crew of about 25 men has been employed throughout each dredging season during the biennium.

An interesting and significant feature of the results of the dredging done by this company during the past two years has been the large excess of gold recovered by the dredge over the content of the ground as indicated by prior extensive drilling tests. The manager states that the recovery realized has been from 40 per cent to 100 per cent greater than that anticipated from estimates made on the basis of drilling done over a period of two years prior to actual dredging operations. The explanation for this condition is that the occurrence of the gold in the ground is very erratic and "spotty," as a result of which numerous "bonanza" spots are recovered by the dredge which were missed by the drill. From the time dredging was commenced by this company on Bear Creek in 1926, up to the beginning of the 1931 season, the dredge has advanced upstream from claim No. 7 Below Discovery to a point about one mile above the mouth of Fox Creek. Up to 1929 the method of operation had been to follow a channel of limited width that drilling results indicated contained the greatest gold content. During 1929 and 1930, however, far better results were obtained by dredging the full width of the stream channel, which is about

700 feet in the upper section of the dredgable area. Operations during the biennium have been downstream, during the course of which, not only have streambed areas that were missed on the upstream operations been dredged, but adjacent bench ground lying as much as 19 feet above creek level has also been dredged successfully.

It has been found that the gold becomes progressively coarser in Bear Creek as progress is made upstream. For this reason it is believed the bedrock source of the gold may possibly be found in lodes above the area dredged. The greatest production is reported to have come from an area near the mouth of Bonanza Creek, which stream is said to "throw" a paystreak of gold. Although Fox Creek does not appear to be a source of gold enrichment, much cinnabar appears in the gravels that lie downstream from its mouth. The bedrock source of this cinnabar will also be sought.

The bedrock of Bear Creek is granitic in type and is disintegrated so that the dredge removes it to a depth of about 2 feet.

At the site occupied by the dredge at the beginning of 1931 the gravel being dug was from 7 to 9 feet in depth.

Miscellaneous Operations

In addition to the dredging operations above described, there were active in the Akiak district during the biennium one hydraulic-mining plant, where 6 men were employed, and one shoveling-in operation, also with 6 men employed. Three prospecting outfits are also reported to have been in the field with 5 men employed.

There was thus a total of about 42 men actively engaged in mining in the Akiak district.

Goodnews Bay District

Introduction

The mineral resources of the Goodnews Bay region were investigated during the year 1919 by members of the U. S. Geological Survey, following whose examinations a report that is accompanied by a topographic and geologic map of the area covered was published by the Survey.* At the time that report was prepared,

* Mineral Resources of the Goodnews Bay Region, by George L. Harrington; U. S. Geol. Survey Bull. 714, pp. 207-228.

however, the known mineral resources of the region were confined to gold placers that had been worked on a small scale on the headwater tributaries of Arolic River and on the few streams that head opposite them and flow into Goodnews River from the north. At that time it was not known that placer deposits of the platinum minerals existed in the drainage basin of Salmon River, which lies immediately south of Goodnews Bay. During the past few years increasing interest has been shown in these deposits, which have yielded a small but steady production of platinum minerals. In order to secure authentic information as to the occurrence of the platinum deposits and their probable extent and importance, arrangements were made by the Territorial mining department for the district to be examined during the summer of 1931. The task of making this examination was assigned to Irving Reed, associate Territorial mining engineer, who reached Mumtrak at the head of Goodnews Bay by plane from Anchorage on June 21. Mr. Reed spent the following week conducting investigations in the platinum-bearing district and the following data are based on his observations:

Geography

Drainage: The principal streams of the district are Salmon River and Smalls River, both of which are shown on the accompanying map, Plate II.

The placer-bearing area, so far as its limits have been determined, is drained almost wholly by Salmon River and the creeks tributary to it.

Relief: The relief of the area is dominated by Red Mountain and Susie Mountain, each of which rises to an elevation of about 2,000 feet above sea level. The western or seaward face of Red Mountain is a steep talus-covered slope that descends abruptly from the summit to a flat, marshy coastal plain about three-quarter mile wide, which is continuous with the lowland plain that surrounds Goodnews Bay. All other mountains and hills in the district, as well as the landward side of Red Mountain, have well-worn and rounded outlines. The principal streams of the district flow in rather wide, mature valleys which have very low gradients.

Glaciation: So far as is known there are at present no glaciers in the Goodnews Bay region. There are evidences, however, that portions of the region were at one time occupied by glaciers.

These evidences include high banks of outwash gravel that lie all along the left limit of Smalls River below McCann Creek and many small lakes and pot-holes high up on the hill that extends upstream on the right limit from a point opposite McCann Creek. These features indicate that the upper valley of Smalls River was formerly occupied by a glacier. While no evidences were observed that the basin of Salmon River has ever been glaciated, old high channels that lead southward from Smalls River indicate that at least a part of the waters that were discharged by the Smalls River glacier once flowed down the valley of Salmon River.

Inhabitants

In 1931 the population of the entire Goodnews Bay region south of Arolic River and north of Chagvan Bay consisted of 17 white persons and approximately 50 natives. Of the white residents, 13 were working in connection with the platinum placers in the Red Mountain area.

Travel and Transportation

The Goodnews Bay district may now be reached most readily by means of the airplane. A weekly air-mail and passenger service is now maintained throughout the year from Anchorage to Bethel, on the lower Kuskokwim River. These trips are made alternately by way of Nushagak, on Bristol Bay, and by way of Takotna, on the upper Kuskokwim River. By special arrangement with the airplane company a stop may be made at the native village of Mumtrak, which is at the head of Goodnews Bay and in the near vicinity of the platinum-bearing area. There are two stores at Mumtrak, but there are no accommodations for travelers, who must make arrangements with either miners or natives to care for them in private homes.

Steamer freight and passenger service is limited to two round trips during the summer between Seattle and Bethel.

Bethel may also be reached by the traveler in summer from Nenana on the Alaska Railroad. This route is by river-steamer to Russian Mission on the Yukon River, thence by mail launch and tram across the portage to the Kuskokwim River and down that river by launch to Bethel.

The diesel-motored schooner "Moravian," operated by the Moravian Mission at Bethel, generally makes one trip from Bethel

to Goodnews Bay each summer, which at that time of year is the only available service by water route, unless the traveler is able to arrange for passage on some privately owned sailing boat of the natives. During the winter means of travel is confined to the dog-team and the airplane. During the winter season the airplanes are equipped with skis, and during other seasons they are equipped with pontoons.

Most of the freight for the district is brought to Mumtrak from Bethel by the MS. "Moravian." Many of the miners and natives also transport during periods of good weather small amounts of freight from Bethel by means of fishing boats of the Columbia River type, and in the winter by dogteams. With the exception of perishables in summer, all freight is transported from Mumtrak to the various platinumm placer camps by means of dog-teams.

Climate

While the annual precipitation in the Red Mountain area is not large, the weather during the summer is prevailingly raw and foggy. Driving mists and light showers are of frequent occurrence. Even when weather conditions at Mumtrak are excellent, mist and fog envelop Red Mountain. Compared with interior Alaska the winters are quite mild, being characterized by periods of cold weather with snow alternating with warm spells when the snow partly or wholly disappears.

The stability of the ice in Goodnews Bay during the winter is extremely unreliable. At any time it is apt to be broken up by the tide and to move either back and forth in the bay or out to sea. The sea-ice rarely freezes solid, but moves up and down the coast with the tide. Continuous high winds prevail at all seasons of the year. All the above conditions make dogteaming very hazardous and add greatly to the difficulties experienced by the miners and prospectors.

Vegetation

The country south of Goodnews Bay is covered by a thin blanket of grass and moss, but the typical tundra, composed of deep layers of moss and decayed vegetation, that prevails further north is absent. Much bare rock and slide material are exposed on the mountains, but good footing for man and horses prevails everywhere. There is no forest timber in the district. On Smalls River above Tundra Creek and also on Salmon River below Clara Creek there occurs a narrow strip of stunted willows, which, after being dried, serves as fuel of very poor quality.

Animal Life

Ptarmigan, which are present in considerable numbers, and a few hares are the only resident edible wild life in the region. Innumerable ducks, geese, gulls and shore-birds nest in the summer around Goodnews Bay or pass through the district on their annual migrations. A constant supply of fresh meat is available that may be bought from the Eskimos who own the many herds of reindeer that roam all over the region. Salmon, smelt or herring may be taken at almost any time or season in Goodnews Bay. In winter the Eskimos secure both seal and walrus on Kuskokwim Bay where they usually hunt from the South Spit.

Of the fur bearers red foxes are the most numerous. White foxes, also, are caught occasionally, and during each season a few mink and otter are taken. Parka squirrels are relatively scarce.

Owing to the high winds that prevail, mosquitoes and flies are almost non-existent in the district.

Geology

Types of Rocks: The rocks of the platinum-bearing district are prevailingly igneous rocks that range in type from basic to ultra-basic. Only one small area was observed wherein the igneous rocks are of the acidic type. So far as observed the only sedimentary rocks of the district are confined to one small area near the head of Salmon River, and appear to be remnant of the pre-existing rocks that were invaded by the intrusive igneous mass that occupies most of the district. A roughly zonal arrangement of the various types of basic igneous rocks in this mass was noted at Red Mountain. This arrangement appears to be due to the segregation within the same mass of rocks of different composition rather than to separate intrusions of different types. The rock type of one zone merges by gradation into the rock type of the adjacent zone with no distinctive boundary separating the two. So much of the surface is covered by soil that it is very difficult to trace contacts between rocks of various types. This difficulty is increased by reason of the weathering of the rocks at the surface. Unconsolidated deposits of gravels are of quite widespread occurrence in the valley and lowland sections of the district.

The general distribution of the various rock types and of the unconsolidated deposits is shown on the accompanying sketch map, Plate II.

Structure: The prevailing trend of the dominant features of the rock structure is northeasterly in the platinum-bearing area. This trend is parallel to that noted by Harrington* as characterizing the rock structure north of Goodnews Bay and in the Arolic River region. It was noted that faulting is of common occurrence and it is considered probable that major drainage lines may have been determined by zones of movement in the bedrock of the region.

Sedimentary Rocks: Outcrops of sedimentary rocks in place were observed in the platinum-bearing area at only two localities. One of these outcrops is on the left limit of Clara Creek near the top of the McCann Creek divide and at an elevation of 540 feet. The rock at this outcrop is quartzite of light gray to bluish green color and in the hand specimen is easily mistaken for fine-grained igneous rock. The other outcrop was observed in the bed of Clara Creek where the bedrock has been exposed by mining operations on Discovery Claim. The exposed rock is slate or argillite that has been altered to light gray schist. While no outcrops or rock in place were seen on top of the hill on the left limit of Clara Creek, on account of the presence of overburden, float was found which could have traveled only a few feet, and that indicated the bedrock is of sedimentary type.

Igneous Rocks: For the most part the igneous rocks of Red Mountain and Susie Mountain are ultra-basic in character. They include varieties of dunite, pyroxenite, hornblendite and peridotite, which in places are altered to serpentine.

On the right limit of Boulder Creek the rock of the north slope of Boulder Hill is of medium-basic type, probably a variety of diorite. Rock of similar kind outcrops on the left limit of Clara Creek near its head. A narrow strip of diorite of similar character occurs on the left limit of Platinum Creek and extends from near the head of the stream to a point below Fox Creek. Apparently the diorite zone is not continuous between Platinum Creek and Boulder Creek as no diorite is found in the bedrock of the intervening valleys of Dry Creek and Squirrel Creek.

* Op. cit., p. 216.

Dark basic rocks that appear to be a variety of gabbro were observed to occur at the heads of Clara Creek and Boulder Creek, in the bed of Squirrel Creek above the bend in that stream, above the head of Dry Creek and at the bend on Fox Creek.

Peridotite, gabbro and diorite all occur in an area that lies north of Contact Creek and of the belt of sedimentary rocks above described. Their true relationships to one another in this area are difficult to determine on account of the amount of overburden that covers the bedrock.

On the divide between McCann Creek and Clara Creek there was observed a small area of acidic intrusive rocks which are either a variety of granite or quartz diorite. Whether this occurrence is in the form of a dike, or as a separate intrusive mass, or as a salic border zone could not be determined from the available exposures.

Evidence that the basic rocks of the district all represent separate phases of a single intrusive mass was observed at several localities. At a contact which is exposed on the steep seaward slope of the pass at the head of Platinum Creek, where the bedrock is denuded, diorite on one side merges gradually into a much darker, more basic rock on the other side with no sharp boundary between the two types. A similar merging of types may be seen on the right limit of Boulder Creek where there is a transition from diorite to peridotite on the south and to gabbro on the west. Still further to the west there is a transition from the gabbro to peridotite.

Attention has already been called above to the probability that there is a zonal arrangement of the igneous rocks of the district. It is thought that zones of rocks of the more acidic phases lie nearest to the preexisting contact with the overlying rocks of sedimentary origin and that the zones of rock become more basic as the central portion of the igneous intrusive mass is approached.

The relationship of the igneous rocks of Red Mountain and Susie Mountain to the "mesozoic basaltic intrusions, flows and tuffs" further to the north that have been described by Harrington* is not clear. The basic rocks north of Goodnews Bay that were examined in the field appear to weather darker in color and to be finer grained than those in the platinum-bearing area.

Unconsolidated Deposits: On Smalls River below the mouth

* Op. cit., p. 218.

of McCann Creek banks of glacial outwash material as much as 75 feet in height are exposed. This material appears to be well water-worn and fairly well sorted.

Most of the gravel in Salmon River seems to be ordinary river wash, although some of it may be glacial outwash. It is all rather fine in size and few boulders occur. The gravel in the tributary creeks, even near their heads, is surprisingly fine in size. The explanation of this may be that the basic igneous rocks of the district, on weathering, tend to disintegrate into small particles rather than to break up into large slabs or boulders. Only toward the heads of Squirrel Creek and Boulder Creek were many large boulders observed.

The entire Goodnews Bay region is south of the line of permanent frost and all unconsolidated deposits of the district are unfrozen.

Relationship of Platinum Mineralization to Bedrock

The types of bedrock that are found in the areas drained by the streams on which placer-platinum is found in the Goodnews Bay district, the character and condition of the individual particles and nuggets of platinum minerals in the deposits, and the character of the bedrock particles that are observed clinging to the nuggets and grains of platinum, all afford convincing evidence that the platinum placers have been derived from the immediate areas within which the deposits occur. The dark-colored, basic igneous bedrock of the district is similar in kind to that which has been recognized as being the source of the principal platinum placer deposits of the world, notably those of the Ural Mountains of Russia.

That the platinum nuggets and grains found in the placer deposits at Goodnews Bay have not been transported far from their bedrock source is shown by the fact that they are characterized by slender, branching forms and many sharp unworn edges. Further evidence of the residual nature of the deposits is the occurrence in the minute hollows and cavities on the surface of the platinum grains of particles of bedrock apparently identical in type with that found in the immediate vicinity of the deposit.

The probability that the platinum minerals will be found in bedrock in place is difficult to appraise. Some efforts by prospectors to effect such a discovery have been made, but so far,

without success. At only a few localities in the world have platinum minerals been recovered from bedrock sources. In that connection the following is quoted from Dana:*

> "Platinum is a rare metal which occurs almost exclusively native (only one rare compound, sperrylite, $PtAs^2$, being known). It is found in quantity in only a few localities, and then only in stream sands, as placer deposits, where it has been preserved on account of its great weight and hardness. * * * * * Its original source is probably usually in peridotite rocks or the serpentine rocks resulting from their metamorphism. It occurs so sparingly disseminated through such rocks, however, that it is only after their disintegration and the subsequent concentration of the platinum in the resulting sands that workable deposits of the metal are formed."

One of the notable exceptions to the above statement is the recovery that has been made from the copper ores of the Salt Chuck mine on Prince of Wales Island, Alaska, of platinum metals, chiefly palladium, to the total value of approximately one-half million dollars. So far as is known no platinum metals have been observed to occur in the full state in the Salt Chuck ores. These ores and their associated bedrock and metallic gangue-minerals have been described by Mertie* who notes a probable close association of the platinum metals with the chalcopyrite and bornite of the ore.

A small particle of chalcopyrite has been noted among those of platinum in the material recovered on Clara Creek in the Goodnews Bay district.

Lindgren* lists the following types of occurrence of platinum:

> "The modes of occurrence of platinum are as follows: (1) in placers; (2) disseminated in peridotite and olivine gabbro, associated with chromite; (3) in magmatic deposits in basic rocks, associated with chalcopyrite and pyrrhotite (with palladium); (4) in small quantities in quartz veins (with palladium); (5) in contact metamorphic deposits; (6) in traces in copper deposits of many kinds (with palladium); (7) concentrated by processes of oxidation in replacement ores of copper and gold in limestone (with palladium)."

* Dana's Manual of Mineralogy, Fourteenth Edition, pp. 142-143.

* U. S. Geol. Survey Bull. 714, pp. 121-125.

* Mineral Deposits, by Waldemar Lindgren, Third Edition, p. 870.

Lindgren also notes the recent discovery of the extensive occurrence of platinum in basic igneous rocks of the Transvaal South Africa* and the probable commercial importance of the deposits.

Further search for platinum mineralization in bedrock in the vicinity of the placer deposits of Goodnews Bay is undoubtedly justified.

Discovery of Platinum South of Goodnews Bay

Platinum was first discovered in the region south of Goodnews Bay in the year 1926. In the fall of that year an Eskimo named Walter Smith told another native named Henry Whuya that he had found "white gold" at the mouth of the gulch on the south end of Red Mountain now known as Fox Gulch. Whuya repeated this information to Charles Thorsen, a local white resident who was an old-time miner. Thorsen, being curious to learn what the so-called "white gold" might be, went to the scene of the reported discovery and panned the gravel of the creek bed. Although familiar with the appearance of the platinum that was obtained in small amounts in connection with the gold-placer operations on Arolic River, further to the north, Thorsen did not at first identify as platinum the grayish metal which he recovered by panning at Fox Gulch, probably because it was rough and in the form of branching crystals instead of the usual rounded, shotlike particles. However, by biting a small nugget he determined that the material was metallic and malleable. He thereupon sent his pannings to the office of the U. S. Bureau of Mines at College, Alaska, where they were analyzed and pronounced to be high-grade platinum.

The first discovery of platinum on Squirrel Creek was made by Edward St. Clair in the spring of 1928. During the same year Charles Thorsen discovered platinum in the gravels of Clara Creek, which stream he named after his adopted daughter.

The first recorded production of platinum from the Goodnews Bay district was made in 1927 and consisted of 10 ounces that was recovered from Fox Gulch and 7½ ounces that was mined on Platinum Creek.

* Op. cit., p. 873.

Description of Individual Creeks and of Mining Development

McCann Creek: McCann Creek is a short, northerly-flowing tributary of Smalls River. It is located on the northeasterly slope of Red Mountain and is the most northerly of the known platinum-bearing streams of the district. Its head is opposite that of Clara Creek. Four claims on this creek are owned by Edward McCann, who was unable to carry on his prospecting work during 1931 owing to illness. Very good platinum prospects have been found on McCann Creek, but it has not yet been determined whether deposits of commercial value are present. As the creek is a small one of steep gradient whose valley is not over 50 feet wide between rims, the yardage of workable placer ground upon it is limited.

Contact Creek: A short distance below its head Salmon River is joined by its most northerly right-limit tributary, which is Contact Creek, a short stream that has its source on the lower slopes of the northeast section of Red Mountain whence it flows southeasterly. Owing to the fact that this stream lies near the contact of the igneous and sedimentary rocks of the region, it is probable that it carries some platinum. At the time the district was examined no claims had been located on the creek, however, nor had it been prospected. The yardage of gravel that would be available for mining is small.

Susie Creek: Susie Creek is a left-limit tributary of Salmon River, which it enters from the east at a point between the mouth of Contact Creek and Clara Creek. It has its source on the west slope of Susie Mountain, which occupies the opposite side of Salmon River valley from Red Mountain. It is reported that fair platinum prospects have been found by panning the rims near the head of this creek, which is the only type of prospecting that has yet been done on the creek. So far as is known no mining claims have been located on this stream.

Clara Creek: Clara Creek is one of the principal producing creeks of the district. It is also one of the largest tributaries of Salmon River, which it enters on the right limit at a point about one mile below the head. It has its source on the northeast slope of Red Mountain at an elevation of about 800 feet, whence it flows southeasterly to Salmon River. From the forks of the valley, which is at an elevation of between 500 and 600 feet, the distance to the mouth of the stream is about 1¾ miles.

Platinum in paying quantities is found from the mouth of Clara Creek to within about 600 feet of the forks.

From the mouth to No. 2 Above Discovery claim, a distance of about 1¼ miles, the valley has an average width of about 300 feet between rims.

The depth to bedrock ranges from 5 feet on Discovery claim, one-half mile from the mouth of the creek, to 9 feet on No. 2 Above Discovery claim. Upstream from the latter claim the creek hugs the left-limit rim and the right-limit rim becomes poorly defined.

On No. 3 Above Discovery claim the depth to bedrock increases to 10 feet, and on No. 4 Above Discovery claim it is 13 feet.

The only method of mining used on the creek is ground-sluicing and shoveling-in.

The seven sluice boxes that are being used on Discovery claim are of the usual type and their dimensions are 10 by 10 inches and 12 by 10 inches. They are set on a grade of 7 inches to 12 feet and are equipped with steel-shod wooden riffles. On this claim almost all the platinum occurs in the decomposed schistose bedrock which, in being mined, is removed to a depth of about 1½ feet. The gravel is coarse and angular, but contains no boulders.

Since commencing work in the summer of 1928, Charles Thorsen and Andrew Olson have cleaned on Discovery claim about 19,000 square feet of bedrock.

Up to 1931 Martin Garthe had cleaned on No. 1 Above Discovery claim about 2,000 square feet of bedrock. On this claim depths to bedrock range from 6 feet at the lower end of the claim to 7 feet at the upper end. The material penetrated consists of from 4 feet to 5 feet of sod and soil and about 2 feet of gravel. The sod and soil are removed by ground sluicing and the gravel is shoveled into boxes. The method of mining employed and the equipment used is similar to that on Discovery claim, above described. The grade of the surface of the ground from Garthe's open-cut to that of Thorsen and Olson is 1.82 per cent.

Up to the summer of 1931 bedrock had been cleaned to the extent of 11,000 square feet in a cut on No. 2 Above Discovery claim. This work had been done by O. J. Sampson, who, during

most of the years 1929 and 1930 was in partnership with Martin Garthe. Depths to bedrock range from 7 feet at the lower end of this claim to 9 feet at the upper end. The depth of gravel that overlies the bedrock on this claim is practically the same as that on Claim No. 1 Above Discovery and the material mined is similarly handled.

The grade of the ground surface from Sampson's cut to that of Garthe is 1.94 per cent.

At the time No. 3 Above Discovery claim was visited in 1931 the amount of bedrock that had been cleaned by John Haralsen and August Wicklund, the operators, totalled 14,240 square feet. At the lower end of this claim the depth from the surface to bedrock is 9 feet, and at the upper end it is 11 feet. At the place where mining was in progress in 1931 the average depth of ground was 10 feet, of which 1½ feet was sod, below which was 7 feet of gravel that was underlain by 1½ feet of mixed gravel and heavy sediment, by which the platinum was carried.

On No. 4 Above Discovery claim the depth to bedrock increases to 13 feet at the center of the claim from which point it decreases rapidly upstream. The operators, Haralsen and Wicklund, have determined by drilling with a pipe that ground carrying sufficient platinum to be profitably mined extends for about one-third the length of the claim above its lower boundary. Boulders on the surface and in the creek bed become very numerous on the upper half of the claim.

The full width of the pay-streak on Clara Creek has never been definitely determined. Mining, so far, has been confined to the creek bed where water for ground-sluicing may be most easily obtained. The volume of water in Clara Creek varies from 10 to 40 miners' inches and averages about 20.

The platinum minerals recovered from Clara Creek include about 7 per cent, by weight, of osmiridium. About 1 per cent, by weight, of the cleaned product is gold, for which the miners receive no payment from the smelter. The concentrate consists of about 75 per cent magnetite and 25 per cent chromite. Much fine platinum is left in the concentrate and much is also lost as a result of the crude methods of mining being employed. It is estimated that from 25 per cent to 50 per cent of the platinum content is lost in handling the clean-up and in mining. A charge of five dollars

per ounce is made by the smelters for handling the material produced by the miners.

The ownership of the several mining claims on Clara Creek, as reported in 1931, was as follows:

No. 2 Below Discovery claim—Charles Thorsen.
No. 1 Below Discovery claim—O. J. Sampson.
Discovery claim—Charles Thorsen.
No. 1 Above Discovery claim—Martin Garthe.
No. 2 Above Discovery claim—Wm. B. Moeck and Fred Wolters.
No. 3 Above Discovery claim—Wm. B. Moeck and Fred Wolters.
No. 4 Above Discovery claim—Oddie Halson.

Dowry Creek: Dowry Creek is a small stream on the east slope of Red Mountain that flows parallel to Clara Creek and enters Salmon River on the right limit about three-quarters of a mile below the mouth of Clara Creek. The width of its valley between rims near the mouth of the stream is about 200 feet. The width rapidly diminishes, however, upstream. At the upper end of the creek the surface grade is very steep, but it diminishes to a grade of about 2 per cent near the mouth.

Although platinum in workable quantities has been found on Dowry Creek, no mining had been done on the creek up to the summer of 1931. The reason for this is said to be lack of available men in the district.

The amount of water in this stream available for mining is small. The supply probably does not exceed 30 miners' inches.

Two claims have been located on Dowry Creek that were held in 1931 by Fred Wolters and Neil Corrigal.

Boulder Creek: Boulder Creek, which is also on the easterly slope of Red Mountain, is another small right-limit tributary of Salmon River, which it enters at a point about 1¼ miles below the mouth of Dowry Creek. At the mouth of Boulder Creek its valley is about 75 feet wide between rims. The grade of the stream is very steep, the fall from the head of the creek to the mouth, a distance of about 1 mile, being 360 feet. There are many boulders on the creek that are derived from the diorite outcrops on its right limit.

It is reported that platinum in workable quantities has been found on Boulder Creek. In the summer of 1931 two claims on this creek were held by George Wickert, that were designated Discovery and No. 1 Above Discovery, respectively.

On the easterly slope of Red Mountain between Boulder Creek and Clara Creek there are three unnamed creeks or gulches, which, although small, are very favorably situated for platinum mineralization. So far as is known, no work has been done on any of them up to the summer of 1931, nor had any claims been located upon them.

The southerly slope of Red Mountain is deeply dissected by the valleys of Squirrel Creek and Platinum Creek and their minor tributaries, which streams join to form the largest right-limit tributary of Salmon River. The confluence of the two streams is about three-fifths of a mile above the mouth of Platinum Creek, which enters Salmon River about 1½ miles below the mouth of Boulder Creek.

Squirrel Creek: From its junction with Platinum Creek to its forks at an elevation of about 750 feet on the south slope of Red Mountain, Squirrel Creek is approximately 1½ miles in length.

The occurrence of platinum in workable quantities on Squirrel Creek for a distance of nine-tenths of a mile above its mouth has been demonstrated, and indications of its similar occurrence for an additional quarter of a mile upstream have been fairly well established.

From its fork the course of Squirrel Creek is southeasterly for six-tenths of a mile. From that point downstream its valley swings to the south and the stream runs roughly parallel to Salmon River, until it joins the easterly-flowing Platinum Creek. At the upper end of claim No. 3 Below Discovery the valley of Squirrel Creek has a width of about 600 feet between rims. On Claim No. 1 Below Discovery, which is at the bend of the stream nine-tenths of a mile above its mouth, the valley narrows abruptly to a width of 300 feet. The flow of water in Squirrel Creek varies from 40 to 200 miners' inches and averages about 80 miners' inches.

On claim No. 3 Below Discovery, near the mouth of Squirrel Creek, Wm. B. Moeck and Fred Wolters had cleaned about 2,200 square feet of bedrock up to the summer of 1931. The depth from surface to bedrock on this claim is 9 feet. The sequence of mater-

ial in the section is as follows: 2 feet of sod; 2½ feet of gravel; ½-foot of gravel carrying concentrated platinum; 3½ feet of gravel; ½-foot of gravel carrying concentrated platinum; and bedrock.

The distribution and extent of platinum mineralization in the gravels has been determined by drilling with pipe. It has been found that platinum occurs throughout the depth of the gravels, but that it is concentrated in a 6-inch stratum lying at a depth of about 5 feet below the surface and in another 6-inch layer immediately above bedrock. The gravel is quite fine and contains no boulders. The largest pebbles are not over 4 inches in diameter.

When the claim was visited in 1931 the sod overburden was being boomed off and the underlying gravels, as deep as water-level would permit, were being shoveled into sluice-boxes. The position of water-level is such that only the upper layer of concentration could be reached by the operators with the equipment available. It was believed, however, that bedrock and the lower stratum of concentration can be reached by utilizing a drain that was being constructed on Platinum Creek a short distance below the claim. The mining equipment in use included six 10-inch by 12-inch sluice boxes of the usual type, provided with wooden riffles and set on a grade of 7 inches to 12 feet.

On the lower end of claim No. 2 Below Discovery Edward (Gaston) St. Clair, had cleaned about 12,000 square feet of bedrock by ground-sluicing and shoveling-in. The section from surface to bedrock at his cut includes 2 feet of moss, grass and sod underlain by 5 feet of small boulders and gravel. The boulders are small and easily handled, none being over 1½ feet in diameter. The bedrock is pyroxenite. The platinum lies immediately on or in the upper part of bedrock, a 2-foot section of which is mined.

The grade of the surface from St. Clair's cut to the workings of Moeck and Wolters is 2.23 per cent. St. Clair was using 7 sluice boxes set on a grade of 8 inches to 12 feet.

On claim No. 1 Below Discovery Tupper Thompson had cleaned about 8,000 square feet of bedrock by shoveling-in. At his cut the depth to bedrock is 6 feet and the material is practically all gravel and boulders. Bedrock consists of peridotite, pyroxenite, a transition phase between pyroxenite and gabbro, and gabbro. The platinum lies directly on the bedrock. To a depth of about

1 foot the bedrock, which is much decomposed in places, is mined with the gravel. Upstream from the lower boundary of this claim boulders become increasingly large and numerous, and at the upper end of the claim they range in size from 1 foot to 4 feet in diameter.

The grade of the surface from Thompson's cut to that of St. Clair is 5.66 per cent. Thompson was using 7 sluice boxes set on a grade of 9 inches to 12 feet.

While no mining had been done on Discovery claim or on claim No. 1 Above Discovery, it is reported that results of drilling that has been done with a pipe indicate the occurrence on these claims of platinum in sufficient quantities to justify shoveling-in operations. Although the boulders decrease in size on claim No. 1 Above Discovery, the size and angularity of the pebbles in the gravel show a marked increase, slabs and pieces of slide material up to a foot in length being of common occurrence.

The surface grade from Thompson's open-cut to the bend on Squirrel Creek at the lower end of Discovery claim is 6.64 per cent. From that point to the forks of the creek the grade is 6.96 per cent.

Most of the platinum recovered on Squirrel Creek is caught in the first two boxes of the string of sluices. Ten per cent, by weight, of the material recovered is osmiridium. The product that is shipped to the smelters contains gold in the ratio of about one-half ounce to each 100 ounces of platinum metals. It is said the miners receive no payment from the smelters for this contained gold.

The full width of the pay-streak on Squirrel Creek is not known. Such drilling as has been done indicates that the main paystreak follows the center of the valley, especially above St. Clair's open-cut. Most of the mining operations have been carried on at localities where water is most easily obtained in the bed of the stream, which hugs the left limit of the valley. As is the case on Clara Creek, the platinum that is lost by the miners on account of crude methods of mining and cleaning-up probably amounts to from 25 per cent to 50 per cent of that present in the material that is mined and sluiced.

The several mining claims on Squirrel Creek were held in 1931 by individuals as follows:

No. 1 Above Discovery—Gil. McIntyre.
Discovery—Gil. McIntyre.
No. 1 Below Discovery—Gil. McIntyre.
No. 2 Below Discovery—Joseph Jean and Ed. Smith.
Fraction of 220 feet between claims Nos. 2 and 3 Below Discovery—Edward St. Clair.
No. 3 Below Discovery—Fred Wolters.

Platinum Creek: Platinum Creek has its source on the easterly side of the divide that separates Red Mountain and Thorsen Mountain. This divide lies within 1½ miles east of the shore of Kuskokwim Bay and has an elevation of about 600 feet above sea-level. From its source to the mouth of its left-limit tributary, Squirrel Creek, a distance of 1½ miles, the stream has a course slightly north of east. From the mouth of Squirrel Creek to its confluence with Salmon River, a distance of six-tenths of a mile, the course is southeasterly. The valley of Platinum Creek is of fairly uniform width, being about 2,000 feet wide in the section below the mouth of Squirrel Creek, and about 1,500 feet wide near the pass at its head that leads to Kuskokwim Bay. While the true width of the valley between rims has never been ascertained, it is probable that it does not exceed 800 feet in the section below Squirrel Creek, and that it is not greater than 500 feet in the section between Squirrel Creek and Fox Creek.

In 1931 no mining operations were being conducted on Platinum Creek as the miners who had formerly worked there had gone to Clara Creek, the placers of which are more easily worked.

During the years 1929 and 1930 Geo. Wickert cleaned 9,000 square feet of bedrock on the lower end of Discovery claim. In 1927 Charles Thorsen had cleaned 2,000 square feet of bedrock on the central section of the same claim.

On Discovery claim just below the mouth of Fox Creek the depth from surface to bedrock on Platinum Creek is 5 feet. Below the mouth of Squirrel Creek the depth to bedrock is 10 feet, which is too deep to work by the mining methods now in use.

The surface grade from the mouth of Platinum Creek to the mouth of Squirrel Creek is 1.39 per cent. Thence to the mouth of Dry Creek the grade is 2.16 per cent. From the mouth of Dry Creek to that of Fox Creek it is 1.55 per cent, from which point to the head of Platinum Creek it is 6.96 per cent.

The gravel of Platinum Creek from the mouth upstream as far as Squirrel Creek is medium-coarse, the largest pebbles in it probably being not over 3 inches in diameter. Above the mouth of Squirrel Creek both the size and angularity of the coarse material in the gravel increase, and at the mouth of Fox Creek many of the contained stones and slabs have dimensions ranging from 6 inches to 18 inches.

Above the mouth of Squirrel Creek the flow of water in Platinum Creek varies from 40 to 300 miners' inches, and probably averages about 100 miners' inches.

In 1931 the several mining claims on Platinum Creek were held by individuals as follows:

No. 1 Above Discovery—Gil. McIntyre.
Discovery—Chas. Thorsen.
No. 1 Below Discovery—Chas. Thorsen.
No. 2 Below Discovery—Chas. Thorsen.
No. 3 Below Discovery—Wm. B. Moeck and Fred Wolters.
No. 4 Below Discovery—Walter Smith.
No. 5 Below Discovery—Henry Samuelson.

Dry Creek: Dry Creek is a small left-limit tributary of Platinum Creek, which it joins a short distance above the mouth of Squirrel Creek. The creek is hardly more than a run-off swale or gulch, the full length of which lies almost wholly within the limits of the main valley of Platinum Creek. Because of the small amount of work that has been done on the creek the width of the pay-streak is unknown. Judging from surface indications, its width is probably not over 150 feet.

On the lower end of Discovery claim on Dry Creek Joe Chanie and Edward McCann cleaned, during the summer of 1930, about 1,200 square feet of bedrock by shoveling-in. On claim No. 2 Below Bench, left limit of Platinum Creek, Charles Tonietzko and John Bennett were building in the summer of 1931 a ditch from Platinum Creek. They worked a cut in 1930 and planned to have cleaned by the end of 1931 bedrock to the extent of 8,000 square feet.

The depth to bedrock on Dry Creek is 5 feet. The gravel is angular and medium coarse, the largest stone seen being not over 10 inches in diameter. Although platinum occurs throughout the depth of the gravel, it lies mostly just above bedrock. About 1 per cent of the platinum metals recovered on Dry Creek is os-

miridium. It is reported that clean-ups from this creek contain no gold.

Discovery claim on Dry Creek was held in 1931 by Joe Chanie, and claim No. 2 Below Bench, left limit of Platinum Creek was held by Chas. Thorsen.

Fox Creek: Fox Creek is a small left-limit tributary of Platinum Creek, which it joins about one-half mile above Dry Creek. It is a steep narrow gulch in which the pay-streak is only from 6 to 10 feet wide. The grade from the mouth of the stream to the bend is 5.22 per cent and from thence to the head it is about 19 per cent. The depth to bedrock below the bend is 5 feet. In placer operations on this creek gravel to the depth of from 3 feet to 3½ feet is ground-sluiced off and the remainder is shoveled into sluice boxes. The stream gravels are very coarse and angular. Many boulders occur that are as much as 3 feet in diameter and much bedrock is exposed. The flow of water in Fox Creek probably averages 40 miners' inches.

On claim No. 2 Above Discovery some natives mined in 1927 during which year they cleaned a total of 500 square feet of bedrock. The depth of material above bedrock at this cut was about 4 feet, all of which was shoveled-in.

On Discovery claim, 3,500 square feet of bedrock was cleaned by Neil H. Corrigal by whom operations were conducted in 1929 and 1930. In this work seven 10 by 12-inch sluice boxes were used that were set on grades of 8 inches and 10 inches to 12 feet. About 33 1-3 per cent of the cleaned product recovered was osmiridium. It is reported that no gold is recovered on Fox Creek.

In 1931 Discovery claim at the mouth of Fox Creek was held by Andrew Olson, and claims Nos. 1 and 2 Above Discovery were held by Gil. McIntyre.

Salmon River: Salmon River is the principal stream of the Goodnews Bay platinum-bearing area, as its basin receives most of the drainage from the entire district. At the mouth of Platinum Creek the valley of Salmon River has a width of about 1,000 feet between rims. The stream itself at that point was about 30 feet in width and 6 inches deep in June, 1931. At Salmon Bluffs, below the mouth of Boulder Creek, the valley narrows to a width of about 600 feet between rims, and the stream has a width of 15

feet. At the mouth of Dowry Creek the width of the valley increases again to about 1,000 feet between rims. This width is maintained up to the mouth of Clara Creek, above which point the valley narrows rapidly again to a width of about 500 feet, which width is maintained to the head. The grades of the various sections of the valley floor are as follows: From the mouth of Platinum Creek to the mouth of Boulder Creek, 0.5 per cent; thence to the mouth of Clara Creek, 0.62 per cent; thence to the head of Salmon River, 0.93 per cent.

No attempt has yet been made to conduct mining operations on Salmon River as the depth to bedrock is too great even to prospect successfully with the crude equipment available. Nevertheless, the river valley has been staked from claim No. 16 Above Discovery to claim No. 17 Below Discovery, and numerous prospect holes have been drilled by the use of pipe. Almost all the claim owners on the various other creeks of the district held claims on Salmon River in 1931, the principal owner being Gil. McIntyre.

Up to 1931 the development work done on Salmon River and the results reported were as follows:

On claim No. 16 Above Discovery, which is opposite Susie Mountain, Haralsen and Wicklund drilled a hole with a pipe in the middle of the valley, where the depth to bedrock was found to be 17 feet. No platinum was found.

On claim No. 7 Above Bench on the left limit the same men drilled to a depth of 17 feet without reaching bedrock. It is reported this hole revealed prospects of platinum throughout its depth.

On the line between claims No. 3 Above Discovery and No. 4 Above Discovery 6 holes were drilled with a pipe by Moeck and Wolters. In the first 3 holes on the left limit bedrock was reached at a depth of 6 feet. In the fourth hole, which was near the creek, bedrock was not reached at a depth of 22 feet. In the fifth hole, which was toward the right limit, bedrock was not reached at a depth of 33 feet. In the last hole, which was also toward the right limit, drilling was carried to a depth of 18 feet without reaching bedrock. At the location of this line of holes the gravel penetrated was found to be very fine, but also very compact to a depth of 10 feet. It was reported that in this upper 10-foot stratum very good prospects of platinum, some of the particles of which weighed as

much as 1½ grains, were found, together with a little gold. So far as drilled the gravel below a depth of 10 feet was found to be very loose and consequently failed to hold the valuable metals. Nevertheless, light prospects of platinum are reported to have been found in the lower horizon.

So far as could be ascertained, no prospecting has been done on Discovery claim, which is at the mouth of Platinum Creek.

On claim No. 1 Below Bench on the left limit Moeck and Wolters drilled one hole 11 feet deep that did not reach bedrock. It is reported that from a depth of 3 feet below the surface to the bottom fine platinum prospects together with a little gold were found in this hole.

On claim No. 4 Below Discovery Moeck and Wolters drilled a hole to a depth of 10 feet without reaching bedrock. It is reported that coarse prospects of platinum were found in this hole.

Medicine Creek: Medicine Creek is the largest left-limit tributary of Salmon River. It has its source on the easterly slope of Susie Mountain opposite the head of an easterly-flowing stream known locally as Kinikunok River, which is possibly identical with Bales Creek, as shown on the reconnaissance map of the U. S. Geological Survey. Medicine Creek flows in a deeply-incised valley, which trends southwesterly, and joins Salmon River a short distance above the mouth of Platinum Creek. No prospecting has been done on Medicine Creek, so far as could be ascertained.

Platinum Production

Since productive mining operations were commenced in 1927 approximately 3,000 ounces of platinum has been recovered and marketed from the placer deposits of the Red Mountain area. Details as to the production from individual creeks for the year 1932 are lacking, but from a reliable source it has been learned that the total production for that year amounted to approximately 833 ounces. Production up to and including the year 1931 is reported to have been as follows:

Production of Platinum Metals in Ounces from Red Mountain Area, Goodnews Bay District

Creek	Year					Totals
	1927	1928	1929	1930	1931	
Clara Creek	.....	71	224	385	410	1,090
Squirrel Creek	.....	60	141	245	245	691
Platinum Creek	7½	.....	36	22	.....	65½
Dry Creek	.....	.....	.....	44	100	144
Fox Creek	10	13	20	80	25	148
Totals	17½	144	421	776	780	2,138½

Note: Figures for production in 1931 estimated.

The average amount of the platinum metals recovered per yard of material mined on the several streams of the district up to and including the year 1931 is as follows:

Clara Creek	0.082 ounces
Squirrel Creek	0.104 ounces
Platinum Creek	0.032 ounces
Dry Creek	0.085 ounces
Fox Creek	0.075 ounces

Prospecting and Development Opportunities

Platinum Metals: If water could be pumped from either Salmon River or Kuskokwim Bay, the gravels of all the shallow creeks in the platinum-bearing area tributary to Salmon River on its right limit, as well as McCann Creek, could be mined by the hydraulic method. It is possible that by careful drilling it may be demonstrated that the gravels of Salmon River itself could be profitably mined by dredging.

Much additional prospecting in the area is justified. None of the streams entering Salmon River on its left limit has been prospected, so far as could be ascertained. There appears to be no reason why these streams, which drain the slopes of Susie Mountain, might not be platinum-bearing, as that mountain apparently is composed of rock formations similar to those found on Red Mountain. If these streams should be found to be platinum-bearing the area of potentially productive ground in the district would be increased manyfold.

So far as is known no prospecting has been done on the seaward slopes of Red Mountain that face Kuskokwim Bay. On these slopes are a number of small gulches that may be worthy of investigation.

Other areas that lie northeast of Susie Mountain and wherein basic intrusive rocks such as compose Red Mountain predominate, should also be investigated for platinum minerals.

Some of the platinum that is found on Clara Creek and Squirrel Creek still has clinging to it pieces of the bedrock matrix in which it originally occurred. This bedrock material consists of serpentine that has been derived from the dunite and peridotite rocks, probably of the immediate vicinity. The basic igneous rocks of Red Mountain appear to have a zonal arrangement and it is possible that one or more distinct zones may be recognized within which platinum minerals occur sufficiently concentrated to justify lode-mining development.

Gold: It has been reported that an area of granitic rock lies east of the head of Medicine Creek and in the drainage basin of Kinikunok River and that gold has been found on that river. It is also reported that two miners found placer gold on Sphinx Creek just north of Goodnews Bay and that, until their death in 1925, they recovered enough gold from their operations to support them. Investigation of this creek appears to be justified to determine whether reconcentration of extensive glacial outwash material may have resulted in the accumulation of gravels suitable for gold dredging.

Gold Placers of Arolic River-Goodnews River District

Following his examination of the platinum placers of the region south of Goodnews Bay in 1931, Irving Reed, associate Territorial mining engineer, visited many of the creeks in the Arolic River-Goodnews River area where small-scale gold-placer operations have been conducted for many years.

This district, which lies to the northeast of Goodnews Bay, was visited by George L. Harrington for the U. S. Geological Survey in 1919, and quite complete descriptions of most of the creeks, as well as a topographic and geologic map of the region, have been published by the Survey.*

The district was also visited in 1926 and current mining operations were described in an unpublished report by F. W. Holzheimer, who at that time represented the Territorial mining department.

The following notes have been prepared from the reports submitted by Reed and Holzheimer:

* U. S. Geol. Survey Bull. 714, pp. 207-228.

In 1926 there were in the area 12 placer miners, of whom 8 were ground-sluicing and shoveling-in on Kow Kow Creek and Butte Creek in the Arolic River drainage and on Olympic Creek, Wattamus Creek and Bear Creek, tributaries of Goodnews River. The other 4 persons were engaged in prospecting. One was working independently, and the other 3 were sinking by means of a hand-drill several lines of holes to determine the feasibility of dredging operations on Arolic River, and on Kow Kow, Butte, Trail and Faro creeks. The drilling program was in charge of H. C. Fohn-Hansen. At the time of Holzheimer's visit in 1926 the amount of drilling completed was not sufficient to afford a basis for conclusions as to the extent of dredgable ground in the field, although the results obtained were reported to be encouraging. Reed reports that Mr. Fohn-Hansen continued drilling in 1928 on Kow Kow and Trail creeks and on Arolic River. In 1929 Howard Kappler, representing the Clarence Berry estate, drilled with a 4-inch Empire hand-drill 3 lines of 7 holes each on Butte Creek, and 4 lines of from 5 to 8 holes each on Kow Kow Creek. In 1930 Frank V. Smith, representing the Hammon interests of California, drilled with a 4-inch Empire hand-drill 4 lines of holes crosscutting Arolic River at points one mile below the mouth of Keno Creek, half a mile below the mouth of Snow Gulch, just above the mouth of Faro Creek and 600 feet downstream from the mouth of Faro Creek.

In 1931 nearly all mining activity in the district had ceased and there were only 3 men working, each of whom was engaged in individual shoveling-in and prospecting operations. The reason for the cessation of mining activity was partly due to an exodus of men from the district to the more attractive platinum-placer field of the Red Mountain area. It is conceded, however, that the creeks of the district that have been productive are now practically worked out, so far as small-scale, individual operations are concerned. Reed states that prospecting on other streams not heretofore productive that head in the Island Mountains may reveal deposits that will prove productive. Some of the streams that have yielded the most gold in the past, including Kow Kow Creek and Butte Creek, have their sources in the Island Mountains. Additional productive deposits may also be found on streams which head in the mountains that lie to the southeast of the Arolic River basin.

Other areas of the district that have not been prospected in-

clude the headwater tributaries of Goodnews River and the region that lies east and northeast of the Arolic River basin.

The future of the Goodnews-Arolic region as a producer of placer gold appears to depend, however, on the feasibility of dredging, for which type of operation several areas appear to be promising. In addition to encouraging results that have been obtained from drilling that has already been done with hand operated equipment, the region has favorable features for dredging operations. These include moderate depths of gravel and overburden, adequate water supply, and absence of permanent frost. In addition to the areas that have already been partly drilled on Arolic River and its principal tributaries, possible opportunities for successful dredging appear to be offered by the lower reaches of Slate Creek, the largest productive tributary of Goodnews River, and a portion of the lowland area that lies south of Goodnews Bay.

LODE MINING

FAIRBANKS PRECINCT

The following data on lode mining in the Fairbanks precinct have been prepared from reports submitted by Earl R. Pilgrim, associate Territorial mining engineer. The production of gold by lode mines in the Fairbanks precinct during 1932 was substantially the same as that made during 1931. The production made during the biennium, however, was greater than that of the preceding biennium by about $90,000, or approximately 40 per cent, and during each of the two years was larger than that made during any year since 1915.

All mines that were operated during 1931 were active also during 1932, and, in addition, several mines that had been closed down, some of them for many years, were reopened. Some development was also done on each of several newly discovered veins.

The number of men engaged in lode mining in the precinct showed an increase of 60 per cent over the number so engaged during the preceding biennium. Further impetus will undoubtedly be given to the expansion of lode mining activities in the precinct by the lowering of freight rates on the Alaska Railroad, recently authorized by the Secretary of the Interior. Labor was plentiful during the biennium and wages remained at the level established for the district, or $6 and board per 8-hour shift.

The following table exhibits the growth of the lode-mining industry in the Fairbanks precinct during the past four years:

	1929	1930	1931	1932
Number of mines operated	10	9	13	17
Number of mills operated	9	7	7	9
Tons of ore milled	6,181	5,033	5,948	....
Production value	$83,500	124,000	144,900	....
Number of men employed underground	41	32	43	79
Number of men employed in mills	10	9	13	13
Number employed surface	7	7	11	18
Total number of men employed	58	48	67	101

Individual Mines

Pedro Dome District

Chatham Mine

After having been idle for many years the Chatham mine was reopened late in 1932 by Herb Miller and associates, to whom the property has been leased. The mine is situated near the head of Chatham Creek and about 3 miles from Cleary post office.

It was formerly operated through a crosscut adit that intersected the main vein at a depth of 180 feet below the surface outcrop and at 200 feet from the portal of the adit. At a point 850 feet from its portal the adit, which has a total length of 1,300 feet, intersects a second vein, from which a considerable tonnage of antimony ore was mined during 1916. The main vein was opened by drifts extending each way from the adit and aggregating nearly 1,000 feet in length. Above the drifts quite extensive workings were opened from which a considerable tonnage of gold ore was mined that is reported to have run from $25 to $40 per ton. The width of the vein ranges from 6 to 18 inches. The strike is N. 60° W. and the dip varies from 65° to 80° SW.

Under the new lease work has been started on a second crosscut adit, which, it is anticipated, will intersect the vein at a distance of 550 feet from the portal and at a depth of 120 feet below the original adit above described.

The property is equipped with a 4-stamp mill, which is situated lower on Chatham Creek and about a mile distant from the mine.

Colbert and Warmbold Prospect

Late in 1932 Capt. A. E. Lathrop and associates of Fairbanks took a lease and option on a group of claims owned by Lew Colbert and George Warmbold that are situated on Tamarack Creek, a tributary of Chatham Creek.

In October, 1932, a crosscut adit was commenced by the lessees that was designed to intersect three veins that outcrop on the surface. The altitude of the adit is 1,300 feet and it is being driven in a direction of N. 37° E. On February 8, 1933 the adit had been driven a distance of 550 feet. At a point 380 feet from the portal a vein was intersected which strikes NW., or about at right angles to the line of the adit, and which dips 28° SW. It is reported that at its surface outcrop this vein dips 45° SW. Where it is intersected by the adit the vein has a width of 5 inches and is composed of crumbly, ground-up quartz, from which, it is said, considerable amounts of free gold may be panned. Although the quartz is brown-stained, it contains no visible sulphides.

At a point 175 feet from the portal the adit intersects a quartz stringer one inch in thickness that strikes N. 48° W. and dips 53° SW., which is reported to "pan" a little gold.

At a point 240 feet from its portal the adit intersects a fissure, which is filled with gouge and brecciated schist, but which is reported not to carry gold.

It is believed the adit has been driven considerably beyond the point where the first of the three veins should be found at that altitude. It is presumed, therefore, that the dip of the veins has flattened greatly between the surface and the adit-level, or that between those limits the veins have been intercepted by a fault.

For use in driving the adit the lessees have provided a Gardner-Denver compressor, which has a capacity of 119 cubic feet per minute, and which is driven by a "Buick" motor, to which it is direct connected. Recently they have placed on the property a 12 by 10-inch, E. R.-type Ingersoll-Rand compressor, which will be driven by a 75-H. P. Fairbanks-Morse, 2-cycle oil engine.

Cleary Hills Alaska Mines Company

The most productive lode mine in the Fairbanks precinct is that of the Cleary Hills Alaska Mines Company, formerly known as the Rhoads-Hall mine. It was operated continuously throughout the biennium. Prior to 1931 exploratory work

was being carried on in search for the easterly extension on the main tunnel level of the Free Gold vein, the continuity of which had been interrupted by a fault. The search was successful and subsequent development work resulted in outlining an orebody upon which very succesful stoping operations have since been in progress.

More recent underground work has included a small amount of mining on the 70-foot level, which is 70 feet lower in altitude than the Main Tunnel level. Plans are said to be under consideration for driving a yet lower adit at an altitude 70 feet less than the 70-foot level, or 140 feet lower than the present Main Tunnel. The new adit would be started at a point farther downstream on Bedrock Creek than the present mine-openings and would serve to drain the heavy flow of water that has developed in the lower existing workings.

A notable and very commendable improvement made by the company during the biennium is the installation of a new power plant, which is a model of its type and size. The plant includes a 100-H. P. diesel engine, which drives the mill machinery and also drives a 45-K. W., 60-cycle, 440-volt generator, which, in turn, supplies power for the compressor, pumps and lighting system.

Pioneer Mine

Late in 1932 work was started by Charles Holke on a group of claims that includes property formerly operated as the Pioneer mine, which is located on the east side of Chatham Creek about three-quarters of a mile above the mouth. The present lessees plan to reopen and develop the property, which was last productive in 1912, at which time it was equipped with a stamp mill that was moved in 1914 to the Crites and Feldman property on Fairbanks Creek.

Wyoming Mine

The only work done at the Wyoming mine, which is situated on Bedrock Creek a short distance above the property of the Cleary Hills Alaska Mines Company, consisted of driving, early in 1931, about 60 feet of tunnel. This tunnel, which is about 50 feet below the level of the main adit to the mine, is designed to develop a vein which lies parallel to and about 150 feet north of the Wyoming vein. Efforts are being made to refinance operations at this property.

Tolovana Mine

The Tolovana mine is situated near the mouth of Willow Creek, and is about 2½ miles southwest of Cleary post office.

Small-scale operations were carried on at this mine during the biennium and a few tons of ore was produced from an extension of the vein that was found on the west side of Willow Creek. At the end of 1932 plans were under way to ship to a smelter a few tons of high-grade ore, in which the gold is said to be closely associated with the sulphides present, which include arsenopyrite, stibnite, pyrite, galena, and tetrahedrite.

Newsboy Mine

Development work progressed throughout most of the biennium on the Newsboy mine, which has been reopened by the Newsboy Development Corporation of Fairbanks. This mine is situated at the head of Little Eldorado Creek and is adjacent to the Fairbanks-Chatanika highway.

Underground operations have consisted of unwatering the mine to such extent as available equipment would permit; reopening unwatered levels that had caved; and blocking out and extracting a small tonnage of ore in order to make possible a mill test. During 1931 the mill, which was situated near the mouth of Willow Creek, had been reconditioned and had been equipped with a diesel engine, but, unfortunately, it caught fire in October and was completely burned before milling operations had commenced.

During 1932 a lot of 150 tons of ore that had been mined was transported by truck to the Gilmore mill on Fairbanks Creek, 7 miles distant, which was also reconditioned for use. The milling of this lot resulted in a recovery of gold to the average value of slightly less than $20 per ton of ore.

Subsequent operations at the mine will be greatly facilitated by the installation of new power equipment which will replace the inadequate arrangement heretofore in use. A new 180-cubic foot compressor has already been placed in commission that is driven by a 25-H. P. diesel engine, and which furnishes air for drilling, hoisting and pumping. It is planned to install in the near future a new electric-driven triplex pump. The 215-foot level is now being reopened and exploratory work will be carried on at that level in the locality north of the faulted region where the continuity of the vein has been interrupted.

In addition to the work being done by the Newsboy Development Corporation, lessees are sinking a shaft on the Robinson vein, which outcrops on the Newsboy claim. In February, 1933, this shaft had reached a depth of 30 feet. It is planned to carry it to the 50-foot level, where drifts on the vein will be run. It is reported that a lot of 35 tons of ore secured from a surface cut on this vein was milled and yielded gold to the value of $35 per ton. Where the Robinson vein is exposed in the shaft above mentioned, which is about 800 feet northeast of the Newsboy shaft, the strike is N. 80° E. and the dip 70° S., whereas the Newsboy vein strikes N. 42° E. and dips 73° NW. The Newsboy Extension vein, which is exposed in a shaft 300 feet northeast of the Newsboy shaft, strikes N. 15° E. A projection of the line of strike of the Robinson vein would intersect the Newsboy and Newsboy Extension veins at points approximately 200 feet north of the Newsboy shaft. No such intersection has been revealed in the underground workings. It is therefore probable that the trend of the Robinson vein changes as it approaches the Newsboy vein and becomes paralliel to the trend of the latter. It is also probable that this change is related to the occurrence of a soft basic intrusive rock, which outcrops in the affected locality.

The Robinson vein has a width that varies from a few inches to more than 2 feet, and averages 10 inches. It consists of white crystalline quartz, which contains considerable amounts of the sulphides of arsenic and antimony. On each of the walls of the vein is a layer of gouge about half an inch in thickness.

Soo Claim

Two separate leasing operations were conducted during the biennium on the "Soo" claim, which forms part of the old Spalding mine group on Dome Creek.

Operations conducted by C. M. Hawkins were confined to the Heath and Kearns vein, which is one of three veins that have been developed on the property, the others being the Soo vein and the Wild Rose vein. During 1931 a new shaft was sunk on the vein to a depth of 85 feet at a point about 110 feet east of the old main shaft, and all ore mined was hoisted through the new shaft. Mining operations under this lease continued until September, 1932, when work ceased. The ore mined during 1932 was obtained from a block of ground above the 110-foot level, and extending 100 feet south of the Heath and Kearns main shaft and 200 feet north of

the same shaft. During 1931 the 2-stamp mill that formerly served the property was replaced by a 5-stamp Demarest mill equipped with 1,000-pound stamps and fed by a 9 by 8-inch Blake-type crusher. The new mill and compressor were driven by a 25-H. P. Fairbanks-Morse diesel engine. A 15-H. P. engine of the same type was installed that was used to drive a small direct-current generator, which, in turn, operated a two-stage, centrifigal pump that was set at the 110-foot level. In September, 1932, this mill and plant were dismantled and moved to the property of Andy Markich, which is situated on Ready Bullion Creek in the Ester Dome district and which was taken under lease by Mr. Hawkins.

The second leasing operation was conducted by Harry Wood, who, in the fall of 1931, acquired a lease on a group that includes the Franklin, Mary, Alpha, Omega and Soo claims.

At a point near the southeast corner of the Franklin claim an adit was started, the direction of which is N. 6° W., and which is designed to crosscut, within a distance of 1,200 feet, the system of three veins that already have been disclosed on the property, and it is also anticipated that several other veins will be intersected by it. The altitude at which the adit is being driven is 1,230 feet, which is at a vertical depth of 300 feet below the collar of the Heath and Kearns main shaft. During 1932 the Heath and Kearns vein was intersected by the adit at a distance of 850 feet from the portal, and by the end of the year a drift had been driven easterly on the vein a distance of 50 feet and two short raises had also been driven above the drift. In these raises the width of the vein is from 10 to 16 inches. It is composed of brown, oxidized quartz, and the gold content is said to be quite high.

It is planned to install, early in the spring of 1933, a 2-stamp Nisson mill, equipped with 1,350-pound stamps, which is to be placed near the portal of the adit.

Hi-Yu Mine

During 1931 the Hi-Yu mine, otherwise known as the Crites and Feldman property, which is situated on Moose Creek, a tributary of Fairbanks Creek, was operated under lease by Henry Feldman. A few tons of ore was milled in the new Gibson rod-mill that was erected at the portal of the main mine adit late in 1930, and which replaced the stamp-mill formerly in use on the property.

Late in 1932 a lease and option was taken on the property by

Gustafson Brothers, operators of the Cleary Hills Alaska Mines, with whom are associated Joe Crosson and Ed Young. Under this new lease two men have been engaged in development work, which includes driving a raise from the main adit level to the upper tunnel as a means of prospecting the intervening ground. It is anticipated that this raise will intersect the downward extension of an orebody that was mined above the upper-tunnel level and which is said to have produced about $100,000. It is believed this orebody rakes in such a way that it has passed beyond the limits of existing development workings on the lower levels. The vertical interval between the main tunnel and the upper tunnel is 200 feet, and that between the main tunnel and the mill tunnel is 250 feet. The length of the upper tunnel is about 1,200 feet, and that of the main tunnel is 1,525 feet.

Henry Ford Group

The Henry Ford group, which is usually referred to as the McCarty mine, and which is situated on the divide at the head of Fairbanks Creek, is under development by lessees. Preparations are being made to sink the main shaft on the McCarty vein to a depth of 150 feet, where drifts will be run on the vein. The depth of the shaft at the present time is 80 feet. The dip of the vein is 65°.

North Star Group

During 1931 development work was being carried on by Herbert Falkner and James Muir on the North Star claim, which is situated on the west side of Skoogy Gulch. Two veins have been developed on this claim that are designated North Star No. 1 and North Star No. 2, respectively.

The North Star No. 1 vein was first exposed in a shallow shaft where the vein is said to have a width of 10 inches and to carry considerable gold. Lower on the slope and at a point about 200 feet east of the shaft a tunnel, which is at an altitude of 1,550 feet and which was planned to develop the vein exposed in the shaft, has been driven a distance of 155 feet in a direction of N. 87° W. At a point a few feet in from the portal this adit disclosed a 2-inch vein, which dips 83° S. and which the adit follows throughout the remainder of its length. This vein is composed of white crystalline quartz that contains many drusy cavities and small amounts of sulphides, and is said to carry some gold. The initial 6 feet of the adit penetrates a mass of non-porphyritic granite, which has evi-

dently been brought into its present position by a fault. The wall rock in the remainder of the adit is blocky quartzite.

From a point about 125 feet south of the portal of the tunnel above described and at a slightly higher altitude, a second tunnel has been driven a distance of over 60 feet. This tunnel follows for a distance of about 30 feet a vein, which has a width of about 2 feet and which is composed of brown, crushed quartz that is said to assay about $5 per ton. The 30-foot section of this vein that is exposed by the adit crosses the adit diagonally, strikes S. 55° W., and dips 43° S. At about 30 feet from the portal the adit intersects a second vein, which strikes N. 83° W. and stands vertical. This vein is filled with white crystalline quartz that is somewhat crushed, banded, and contains considerable amounts of stibnite and arsenopyrite. The quartz is said to assay about $50 per ton. Several tons of ore from this vein has been mined and sacked. At the face of the tunnel a small tongue of granite is exposed, but it is not cut by the vein.

Annie, Mary, Elsie and Key Claims

Development work was carried on during the biennium by G. O. Warren on a group of four claims, which includes the Annie, Mary, Elsie and Key claims, that are situated on the ridge that lies between Chatham and Tamarack creeks and a short distance above their junction.

On the Elsie claim a shaft was sunk to a depth of 35 feet on a vein that is 12 inches in width and that is composed of dark-colored, sheared schist and quartz. This vein strikes N. 75° W. and dips 80° S. The collar of the shaft is at an altitude of 1,420 feet. A few tons of ore that was mined in this shaft has been sacked in preparation for hauling it to a mill. At a point on the Elsie claim below the shaft a tunnel has been driven for a distance of over 60 feet. This tunnel penetrates crushed and brecciated material and no definite vein has been disclosed by it.

On the Mary claim, and about 95 feet east of the shaft above described, another shaft has been sunk to a depth of 25 feet. This shaft was not accessible for examination at the time of visit. The vein material exposed by it is said, however, to be similar to that found at the Elsie shaft. The quartz contains considerable amounts of galena, stibnite and arsenopyrite and is said to carry moderate amounts of gold.

Rex Claim

The Rex claim, which is situated on the west side of Chatham Creek and about 2,000 feet above the mouth, has been held for many years by W. S. Reese and associates.

A tunnel has been driven on the property that has a southerly course and lies at an altitude about 100 feet higher than the adjacent creek bed and that is designed to crosscut the general trend of the vein system found in the locality. At a point about 72 feet in from the portal this adit intersects a vein, which, at the time of visit was not accessible for examination. It is said, however, that this vein, which strikes northeasterly, averages about 3 feet in width and that from a lot of ore secured from it and milled a number of years ago, gold to the value of about $8.50 per ton was recovered. At a point 258 feet in from the portal the adit intersects a fault, which strikes S. 60° W. A branch of the tunnel follows this fault for a distance of more than 45 feet. At a point a few feet from the face of this branch there is exposed a quartz stringer about 3 inches in thickness, from which free gold may be panned. This stringer strikes west and dips 45° S. The other branch of the tunnel has been driven south for a distance of nearly 100 feet through blocky, schist bedrock. At a point about 40 feet beyond the intersection of the two branches of the tunnel the southerly branch cuts another stringer of quartz about 3 inches in width that also pans some free gold. This stringer strikes N. 75° E. and dips 25° S.

Rainbow and David Mines

The Rainbow and David mines, which are situated on Skoogy Gulch, are adjoining properties on which considerable development work has been done and from which some production has been made. The David mine is equipped with a 2-stamp, Joshua Hendy-type mill.

During the latter part of 1932 Wm. Hightower and associates commenced work on the David claim. On February 1, 1933, a new shaft was started near the portal of the Rainbow tunnel for the purpose of developing the vein below the tunnel level.

The old shaft, through which mining operations were formerly conducted, has a depth of 130 feet and extends 40 feet below the level of the tunnel, but, owing to the accumulation of ice in the old workings, it is now inaccessible. Permanent water level is about 10 feet below the floor of the tunnel.

According to Davis,* "approximately 1,500 tons of ore, which is reported to have averaged $25 per ton, were mined before the property became involved in litigation which lasted from 1914 to 1920, during which the mine was idle."

Ester Dome District

Eva Creek and Little Eva Groups

During 1931 Roy Caldart and Andy Markich held a lease on the Eva Creek group of claims, and during the year produced over 300 tons of ore which was custom-milled. Most of this ore was recovered from a tunnel that was extended through the Little Eva claim and into the Blue Bird claim. In an endeavor to locate the southern extension of the vein, which was found to be faulted just south of the portal of the main tunnel, a crosscut tunnel was driven a distance of 40 feet in an easterly direction. A shaft was also sunk to a depth of 45 feet and from the bottom a crosscut was driven a distance of 20 feet. Another crosscut, 60 feet in length, was also driven from a point in the main tunnel, and two winzes were sunk from the main-tunnel level to depths of 30 feet and 40 feet, respectively.

During 1932 Caldart and Markich produced from the Little Eva group 56½ tons of ore, which was custom-milled and from which the recovery was $34 per ton. This ore was mined at the south end of the Little Eva claim at a point south of the Sam Stay tunnel.

Little Eva Extension

During 1931 Sam Stay milled a few tons of ore, which was taken from the 40-foot level of the old shaft. He also drove a few feet on the vein from the 80-foot shaft on the Little Eva claim and produced a few tons of ore that was not milled.

Blue Bird, Iving, and Marion Claims

About 85 tons of ore was mined from the Blue Bird claim during 1931 by John Y. Bigelow, and the lot was milled in a custom mill. The ore was taken from a 70-foot shaft situated near the south end of the claim.

On the Iving claim, which is situated just west of the Ryan No. 2 claim, Mr. Bigelow also sank a shaft to a depth of 55 feet, from the bottom of which a drift was being driven in 1931. These

* Report of Mine Inspector, 1922, p. 104.

workings are in a large granite porphyry dike which is said to carry some gold.

On the Marion claim, which lies east of the McDonald claim, a tunnel was driven in a northerly direction for a distance of 268 feet and from it crosscuts, 18 feet and 30 feet in length, respectively, were driven in search for a vein from which a large quartz boulder had come. This "float" boulder weighs more than a ton.

Combination Claim

During 1932 the Combination claim, which is part of the McDonald group, was under lease to John Y. Bigelow and H. T. Jeppeson. On this claim a new shaft was sunk that on February 4, 1933, had reached a depth of 60 feet, measured on the incline. This shaft is situated about 40 feet north of the old McDonald shaft which is now caved. To a depth of 22 feet the new shaft is vertical, and below that point it follows the dip of the vein, which was first penetrated at a depth of 15 feet in the vertical section of the shaft. The vein strikes N. 15° W., and the dip changes from 30° E. at the apex to 62° E. at the bottom of the shaft. The width of the vein varies from 6 to 24 inches, or more, and averages about 17 inches. The vein quartz occurs in one or more bands, which are separated from one another by gouge. There is also gouge an inch or more thick on each wall of the vein. The vein filling includes a considerable amount of metallic sulphides, principally arsenopyrite. The vein-quartz is dense and fine-grained and dull in appearance. The color varies from white to a dark green hue that is imparted by the oxidation of contained arsenic minerals. The rock of both walls of the vein is a soft, gray intrusive, probably decomposed granodiorite. Samples taken by Mr. Bigelow across the full width of the vein at three separate intervals are reported to have assayed $36.52, $37.44 and $43.50 per ton in gold, respectively. In a lot of ore, which contained several tons, that was mined from this vein and milled several years ago more than half the gold content was found to be so closely associated with the sulphide minerals that it could not be recovered by amalgamation. From a lot containing 54 tons of ore that was mined during 1932 and which was milled at the Eva Quartz mill the gold recovered by amalgamation amounted to only $11 per ton. Another lot containing 31½ tons of the ore was shipped to the Tacoma Smelter for treatment and from it a return of $40.47 per ton was received. After deducting freight charges, penalties applied on account of

arsenic and antimony content, and treatment charges, however, only a slight profit was realized from the shipment. At the time shipment was made of this lot freight charges from Fairbanks to Tacoma amounted to $12 per ton; treatment charges for ore valued at $40 per ton amounted to $6.50 per ton; and a penalty of 25 cents per unit was applied for contained arsenic and antimony. The smelter analysis of the lot of ore shipped was as follows:

	Per cent		Per cent
Al^2O^3	1.3	Antimony	0.46
Iron	8.9	SiO^2	60.00
Arsenic	10.59	CaO	trace
Sulphur	1.2		

Clipper Claim

The Clipper claim, which forms part of the St. Paul group, is situated on Eva Creek at a point about 2 miles above the mouth.

From a point near the creek and at an elevation of 1,120 feet an adit has been driven into the hillside for a distance of 245 feet, in a direction of S. 85° E., which is at right angles to the general trend of the veins. At a point 50 feet in from the portal the adit intersects a vein, which strikes N. 4° E. and dips 80° E. A drift has been driven on this vein that, on January 13, 1932, had reached a length of 85 feet. Where exposed in this drift the width of the vein varies from 4 to 12 inches and averages 8 inches. It is composed of gray crystalline quartz that has a slight content of sulphides and it is said to carry some gold. During 1932 John Mikely drove the drift ahead a distance of 25 feet, which work was applied as annual labor. He also commenced work on a lower crosscut tunnel designed to intercept the vein at a depth of 60 feet below the tunnel above described.

Killarney Claim

In the fall of 1931 work was started by D. L. Thomas and associates on the development of a vein said to have been discovered by J. G. McCann on the Killarney claim, which lies on top of the ridge between the head of St. Patrick Creek and Eva Creek, and which is one of the St. Paul group of claims.

In January, 1932, the sinking of a vertical shaft on the vein that is now 94 feet in depth was commenced. At the 90-foot level drifts have been extended both north and south along the vein. The north drift was driven a distance of about 60 feet from the shaft where a fault was encountered. Although this fault was not accessible for examination at the time the claim was visited, it is thought probable the extension of the vein will be found to the eastward of the intersection, which is known to be the direction of throw of other veins intersected by similar faults in the same locality. The south drift was extended a distance of about 165 feet from the shaft. An intermediate drift was also driven at the 30-foot level northward to the fault.

About 180 tons of ore was mined from the Killarney workings during 1932 and was milled at the St. Paul mill. The crew that was engaged at the mine during 1932 consisted of 4 men underground and one man on the surface. Power for hoisting was provided by a 22-H. P. vertical steam boiler.

The Killarney vein strikes N. 5° E. and dips 75° W. The walls are of light-colored micaceous schist that dips gently to the East. The vein has well-defined walls, which are intersected at intervals by faults that trend at a small angle to the strike and dip of the vein. The faults dip somewhat flatter than the vein and to the east. Two types of quartz were observed in the vein, one of which is of sugary texture and unfractured. This type is said to be of low grade. The second type is somewhat translucent, grayish quartz that has been fractured into segments from one-quarter inch to one-half an inch in diameter and subsequently recemented. In this type of quartz visible free gold in particles as large as a pinhead was observed to occur. At the depth to which the workings have been carried the vein quartz is much oxidized and stained.

Eva Quartz Mining Company

During 1931 Borovich and Stevens conducted on the property of the Eva Quartz Mining Company extensive exploratory work in the search for a vein from which about 2½ tons of very high-grade float was found. The work included the sinking of a large number of shafts and pits from which drifts were run. Although several veins were discovered, none of them was believed to be the one from which the rich float was derived.

The writer visited one of the shafts, which is situated about 300 feet east of the portal of the lower tunnel of the Eva Quartz Mining Company and at an elevation of about 1,180 feet. In this shaft, which is about 40 feet in depth, a vein is exposed that has a width of from 16 to 24 inches and that strikes N. 2° W. and dips

75° E. It is composed of brown-stained quartz which contains much schist breccia. The schistose wall-rock, which appears to be altered porphyry, stands almost vertical.

During 1932 exploratory surface and underground work was continued by the company in development of the mineralized area that lies south of the present underground workings. During the year 18 surface shafts were sunk from which drifts and crosscuts were run whose aggregate length was about 150 feet. Raises, the total length of which was 40 feet, were also driven above the lower tunnel. When the mine was visited on February 4, 1933 a crosscut was being driven from a point 120 feet in from the portal of the lower tunnel that was directed easterly, which, in conjunction with the series of holes that have been sunk on the surface, will serve to crosscut the mineralized zone for a width of over 400 feet. The work that has been done on this zone to date is said to indicate a gold content ranging from a few cents to over $30 per ton.

About 60 tons of medium-grade ore, derived from the property, was milled during the year. A total of about 110 tons of custom ore was also treated at the company's mill.

Markich, or Radovich Group

This group of claims, which is situated about 1½ miles above the mouth of Ready Bullion Creek, was leased in September, 1932, to C. M. Hawkins.

The property is developed by means of three tunnels, which are referred to as the upper, intermediate and lower tunnels, respectively.

The upper tunnel is at an elevation of about 1,300 feet and its portal lies about 470 feet south of that of the lower tunnel. From the upper-tunnel level a winze has been sunk on the vein. The length of the lower tunnel is about 545 feet, of which about 75 feet was driven during 1932. Two raises were also driven on the vein above the lower tunnel, and the intermediate drift, which is 75 feet in length, was driven southerly from a point beneath the winze above described.

During the year about 750 tons of ore was mined from a block of ground lying above the intermediate drift and extending each way from the winze. This ore was treated in the mill that was erected on the property during the fall, after having been moved from its former location at the Spalding mine on Dome Creek. The ore that was milled is said to have been of low grade. It is also stated that much difficulty was experienced in mining the ground above the intermediate level on account of swelling of the hanging wall. This condition is caused by the brecciated condition of the vein-filling, the presence of soft gouge and the occurrence of water in the ground. In future mining operations it is planned to keep the drifts well within the foot-wall.

The milling plant includes two batteries of stamps: One battery of 5 "Demarest," 1,000-pound stamps; and one battery of 3 "Joshua Hendy" stamps. A 25-H. P. Fairbanks-Morse semi-diesel engine drives both batteries. A 15-H. P. engine of the same type operates a direct-current generator, which furnishes power for lighting and for pumping water for use in the mill.

The compressor, which is of the "Rix", portable type and which has a capacity of 110 cubic feet per minute, is driven by a Fordson tractor.

Camp buildings include a log residence, a frame bunk-house, mess-house and mill.

Mohawk Mining Company

Small-scale operations were carried on throughout the year 1931 at the property of the Mohawk Mining Company, which is situated at the head of St. Patrick Creek, and which for many years has been an important producer. Ore was mined from above the level of the main adit on the Mohawk No. 1 vein, and also from the Bondholder vein. During the winter lessees were at work on both veins. A new shaft was sunk on the Bondholder vein that is situated several hundred feet south of the old shafts. Upon completion of the new shaft commencement of stoping operations is planned. The Bondholder vein has at this locality a width of from 6 to 10 feet. The vein strikes N. 28° E. and dips 40° W.

The lessees continued work during 1932 on the Bondholder vein with 2 men engaged. Two lessees also worked on the Little Mohawk vein, but no production was made from it. All ore produced during the biennium was mined from the Mohawk and Bondholder veins and was milled in the company's mill on the property. The company, itself, did not operate the mine.

Irishman Group

During 1931 O. M. Grant was operating during part of the year on the Irishman group, which is situated on the slopes between Happy Creek and St. Patrick Creek and about three quarters of a mile from the Alaska Railroad.

The shaft through which operations are carried on has been sunk to a depth of 180 feet, and from the bottom of the shaft a level has been driven on the vein southerly a total distance of 250 feet. For a depth of 94 feet below the collar the shaft penetrates overburden and the remaining 86 feet is through bedrock. During 1931 about 100 tons of ore was mined from above the 180-foot level and was custom-milled. The recovery is said to have been about $15 per ton. During 1932 Grant and Mutchler Brothers were engaged in sinking a new shaft which is situated about 500 feet south of the main shaft. A lot of about 75 tons of ore was mined during the year and was custom-milled. The grade of this ore was about $15 per ton.

American Claim

The American claim is situated on the divide between the heads of Pearl Creek, a tributary of Fish Creek, and Victoria Creek, a tributary of Smallwood Creek. There is on the claim, at an altitude of 1,730 feet a shaft, which was sunk several years ago and which is said to be 70 feet in depth. It was sunk on a vein that is reported to range in width from 18 inches to over 7 feet. The vein strikes about N. 56° E. and dips 62° NW.

At a point about 400 feet northeast of the shaft and at an altitude of 1,630 feet W. P. Borden and Ed. Quinn were driving during 1931 a tunnel in a southwesterly direction in an effort to intersect a vein, the float from which was found in considerable quantities along the course followed by the tunnel. On June 2, 1932 the tunnel was 160 feet in length. At that date it had not yet intersected the vein, which probably lies to the west of the tunnel line.

It seems apparent that the vein on which the shaft was sunk is either a different one from that which produced the float, or, if it is identical, it has been displaced quite a distance by a fault. A lot of about 75 tons of ore was piled on the dump of the tunnel. In the ore found on this property much scheelite is mixed with the vein quartz. The property lies in the scheelite belt of the district

and only about one mile from the Scheelite and Tungsten claims, which are at the head of Yellow Pup.

Sanford Property

This property is situated at the head of Little Dome Creek, which is a tributary of Sheep Creek. During the biennium Jess Sanford worked alone on the property. During 1931 a small tonnage of ore was produced, but was not milled. During 1932 work was in progress on the sinking of a new shaft.

Parker Vein

The Parker vein outcrops on the ridge that lies between the heads of Sheep Creek and Nugget Creek. It was discovered a number of years ago and was partly developed by means of a number of opencuts and by an inclined shaft 70 feet in depth, on the slope. Where exposed in the shaft the vein appears irregular and varies in width from one to 6 inches. The quartz is coarsely crystalline and contains small amounts of metallic sulphides. The vein strikes N. 15° E. and dips about 55° W. A lot that contained a few tons of ore, which was obtained from sinking the shaft and from surface pits, was milled in a test-mill at Fairbanks. It is reported that the recovery from this lot amounted to over $80 per ton.

The property has recently been leased by Warren and Parks, who, in February, 1933, were engaged in drifting on the vein, both northerly and southerly from the shaft, and at a level about 50 feet below the collar.

First Chance Vein

The First Chance vein is situated near the head of St. Patrick Creek. During each winter of the biennium work on this vein has been carried on by E. F. Wann, who has leased the claim. During the fall of 1931 the upper tunnel was being reopened, in which work Grant Augustine was associated with Mr. Wann.

NENANA PRECINCT

Eva Creek Mining Company

The Eva Creek Mining Company was incorporated during the spring of 1931 and at that time acquired a lease and option on the Liberty Bell mine, which is situated on Eva Creek, a tributary of California Creek in the Bonnifield district. An auto-truck road connects the mine with the Alaska Railroad at Ferry, which is at Mile 371.

Upon the completion of mill tests of the ore that were made at the Alaska College, milling equipment for a fine-grinding and flotation plant was shipped from Seattle to the property. The mill was placed in operation in February, 1932. The principal items of mill equipment employed in the plant include a 9 by 14-inch, Blake-type crusher; a belt feeder; a 5 by 5-foot "Emco" ball-mill; a "Dorr" Duplex classifier; a 6 by 5-foot conditioner tank; a 4-cell M. & S. flotation machine; an elevator, equipped with 8-inch buckets; 2 Wilfley tables; a 10 by 8-foot thickener; and two 4-leaf, "United" filters. The capacity of the mill was rated at about 20 tons per 12-hour shift.

Power is supplied by a 150-H. P. Atlas-Imperial, 3-cylinder diesel engine, which is belted to a 150-H. P., 60-cycle, 440-volt generator. All machines except the compressor are operated by individual motors. A 40-H. P. boiler furnishes steam for the mine hoist, for the mine pump and for heating the mill. A 10 by 10-inch Ingersoll-Rand compressor, which is belted to the diesel engine, supplies air for the mine.

The orebody at the Liberty Bell mine consists of a mineralized, flat-lying, somewhat silicified bed of schist, the structure of which is platy, and, in places, blocky. Locally this schist bed is considerably broken, and numerous faults of varying magnitude are present. The overlying and underlying beds are also of schist of various types. The mica-schist on the immediate hanging-wall of the mineralized bed is much oxidized and quite deeply stained in variegated colors. The principal metallic sulphide present is arsenopyrite, which occurs in masses, veinlets and, sparingly, disseminated. Bismuth is also present in the ore. The distribution of the gold is extremely erratic and does not appear to be dependent on the degree of sulphide mineralization. Schist that is not visibly mineralized may have a high gold content, whereas heavy, sulphide ore is frequently found to be almost barren of gold. This erratic and obscure distribution of the gold has made it extremely difficult to block out ore reserves of determinable grade.

Mining operations were commenced according to the following method: On the hillside above the orebody and near the mill-site a shaft was sunk to a depth of 90 feet. At the 63-foot level there was driven from the shaft a drift that undercuts the ore-bed, which had previously been outlined by means of prospecting operations that had been conducted through two adits and several connecting drifts. At various points along the 63-foot level raises were driven up through the ore-bed that serve as "mill-holes" through which the ore adjacent to them is passed to the level below. Owing to the broken condition of the ground and its flat-lying attitude, the exercise of skill and care is necessary in order to avoid caving and consequent loss of ore, and possible injury to workmen.

After being drawn from the raises the ore is trammed to the shaft, where it is hoisted by "carrier-bucket" and delivered to the mill bin.

A heavy flow of water in the workings adds greatly to the difficulty of carrying on the mining work.

The mine has been provided with excellent camp accommodations. The camp buildings include a superintendent's office, assay office, commodious mess-house, mill building, hoist-house, and blacksmith shop of frame construction; and 3 log bunk-houses and a log garage.

Early in 1932 the mine was placed in charge of Mr. E. A. Austin, an experienced operator, as manager, under whose skillful guidance the enterprise has become encouragingly stabilized, following a period of much uncertainty as to whether it could be successfully handled. Mr. Frank Erno, also an experienced operator, is superintendent.

Up to the time operations ceased in the fall of 1932 on account of cold weather shipments of concentrate from the mine to the Tacoma Smelter averaged 5 tons per day. A crew of 30 men was employed.

Contemplated reorganization and refinancing of the enterprise, which will enable enlarged and more economical operations to be undertaken, including all-year-round operation, give promise of establishing this mine, not only as a permanent and important producer of gold, but also as a desirable source of tonnage for the Alaska Railroad.

MT. M'KINLEY PRECINCT

Nixon Fork Mine

This mine, which is otherwise known as the Pearson and Strand mine, is situated on Ruby Creek, a tributary of the Nixon Fork of the Kuskokwim River, and about 12 miles north of Medfra post office, which is on the Kuskokwim River. A road

connects the mine with Medfra.

This property was developed and equipped with a 10-stamp mill by the Alaska-Treadwell Gold Mining Company in 1920. Subsequently it reverted to its original owners and during recent years it has been successfully operated by Mespelt Brothers, who have made a substantial production of gold each year.

Reports have been received that the mine has continued in operation as usual during the biennium, but details are not available as to the nature and extent of the work done.

ADMINISTRATIVE REPORT

THE COOPERATIVE ARRANGEMENT AND ITS PURPOSES

A brief history of the cooperative arrangement that has been in effect since 1922 between the Territory of Alaska and the U. S. Government for conducting mining investigations and for the protection of the lives and health of miners in the Territory, the details of its purposes, and a statement as to the organization of the personnel employed in the work are contained in the published report on operations under the agreement for the biennium ending March 31, 1929. Under authorization to the Governor contained in Chapter 122, Session Laws of 1931, this arrangement has continued in effect during the past biennium. By the provisions of this act the purposes to be accomplished through the cooperation authorized are the same as have been contemplated by each of the similar enactments made by the Legislature at its several sessions since that of 1921. These purposes include the investigation of productive mining operations, of the development of mining properties that have not yet reached the productive stage, and of the activities of prospectors engaged in the search for new mineral deposits; rendering assistance to prospectors and small operators who are financially unable to employ the services of private engineers; the dissemination of information as to the results of such investigations; the inspection of mines and safe-guarding the lives and health of miners in the Territory; and the performance of such other functions as may be proper and feasible in improving conditions in the mining, quarrying and metallurgical industries of the Territory. One such additional function that has been performed during the past biennium is the administration of the act commonly known as the prospectors' aid act by the Supervising Mining Engineer in his ex-officio capacity of mine inspector.

FUNDS AND PERSONNEL AVAILABLE FOR WORK PERFORMED UNDER THE COOPERATIVE ARRANGEMENT

Funds for conducting the cooperative work are derived from two sources: The annual appropriation provided by Congress for use by the Interior Department, Geological Survey, in the investigation of the mineral resources of Alaska, and the biennial appropriation made by the Alaska Legislature.

During the past two biennia the sum allotted annually by the Geological Survey to the office of Supervising Mining Engineer in Alaska for all work performed by that office in the Territory other than the supervision of operations on leased public lands, has amounted to the sum of $4,500. Only a part of this sum has been available for work contemplated by the cooperative arrangement, however, for the reason that a portion of the services paid for from the fund are devoted to geological investigations of the type conducted generally in the Territory by the geologic staff of the Survey. The personal services provided by the Government as its share in the cooperative work were limited during the biennium to those performed by the Supervising Mining Engineer in caring for the administration of the provisions of the Territorial act authorizing cooperation in mining investigations, etc., and those of the prospectors' aid act.

The fund provided by the Territorial Legislature for use in conducting the cooperative work during the biennium ending March 31, 1933 amounted to the sum of $25,000. Early in May, 1932, however, the authorization for continued use of this fund was withdrawn by the Governor, owing to the condition of the Territorial treasury. Subsequent to that date, therefore, no field examinations or inspection of mining properties have been undertaken.

EXPENDITURES FROM THE FUND PROVIDED BY THE TERRITORY IN THE ACT DESIGNATED AS CHAPTER 122, 1931

The following statement indicates the distribution of the expenditures made during the biennium, up to December 31, 1932 from the fund provided by the Territory for field and office expenses and for technical service in connection with the work of conducting mining investigations and the inspection of mines in cooperation with the United States:

Personal services	$10,040.00
Travel expenses	2,473.41
Office expenses, including printing	830.17
Field expenses (hire of packers, guides, etc.)	586.98
Total to December 31, 1932	$13,930.56

The total sum available for expenses of the above type during the biennium ending March 31, 1933 was $25,000. The balance available on December 31, 1932 is therefore $11,069.44. It is probable that approximately $2,500 will be required to defray the cost of printing this report and caring for other expenses of the office during the period from January 1, 1933 to March 31, 1933. This would leave a balance of approximately $8,500 of the amount appropriated by the 1931 Legislature which will revert to the Territorial treasury.

WORK PERFORMED IN COOPERATIVE MINING INVESTIGATIONS AND MINE INSPECTION

Field investigations of mining districts during the biennium were confined to the season of 1931, when they were carried on in several separate districts by two associate mining engineers. The results of these investigations are partly set forth in this report, but much additional valuable information was gathered that could not be prepared for publication. These data will be of use in preparing authentic replies to inquiries received as to mining and prospecting opportunities in the Territory.

Placer mining investigations were conducted by Irving Reed, associate engineer, throughout most of the mining season of 1931. The districts visited by him included the Goodnews Bay and Arolic River districts in the Bethel precinct; the Shungnak, Dahl Creek and Squirrel River districts in the Noatak-Kobuk precinct; the Kugruk River and Bluff districts on Seward Peninsula; the Tolovana district; and the Fairbanks district. Use of airplane transportation enabled Mr. Reed to cover in one season these remote and widely separated regions.

During the latter part of 1932 Mr. Reed has been completing the preparation of reports on field examinations already made. Numerous maps have also been prepared by him that accompany and illustrate the reports.

The services of Earl R. Pilgrim as associate engineer were

secured for the field season of 1931, during which time he examined several districts where lode mining development has been active. A complete survey was made by him of all lode-mining development in the Nuka Bay district on Kenai Peninsula, which had not been visited by representatives of the Federal or Territorial governments since 1926, and covering which no published report has been available. Examinations were also made by him in the Prince William Sound, Valdez and Tiekel River districts; in the Bremner River district; in the Nabesna River district; and in the Fairbanks district. Results obtained from these investigations appear in this report.

The Supervising Mining Engineer was able to devote to the cooperative work only so much time as was not occupied in the performance of other duties assigned him by the Geological Survey. These duties include the supervision of all operations in the mining of coal and other minerals on leased public lands and the direction of the work of the personnel assigned to duty in Alaska in that connection, and also supervision of the work of the field staff of the U. S. Bureau of Mines in the Territory. During the field seasons of 1931 and 1932 the duty was also assigned him of continuing geological examinations and mapping in the Taku River region of Southeastern Alaska that consumed much of both field seasons. Field examinations of limited extent were conducted by him in the Fairbanks district and in each of the coal fields. In addition to the performance of the above duties, the administration of the prospectors' aid act was cared for, which required much time and attention.

There was an appreciable increase in the number of inquiries concerning mining conditions, mining properties, opportunities of mining investments and prospecting that were handled by this office during the biennium as compared with previous years. Visitors seeking information at the office numbered several hundred and included, besides prospectors, tourists and others, many representatives of important mining companies in the States who desired authentic information on mining properties and mining districts. Assistance was given to a great many prospectors in identifying their mineral specimens, concerning the classification and value of which they were in doubt. The cabinets of specimens of Alaska rocks and ores that are available for use in the office of the Supervising Mining Engineer have been of much service in assisting pros-

pectors to familiarize themselves with the types of minerals that they may expect to find in various districts. This is likewise true of the library of books and technical journals on subjects related to mining, prospecting and geology that is maintained in the office for use of prospectors and others.

REPORT OF THE COMMISSIONER OF TRANSPORTATION FOR PROSPECTORS

The act passed by the Legislature in 1927, creating the office of Commisisoner of Transportation for Prospectors, and the act passed at the session of 1929 that continued the office, were repealed at the session of the Legislature held in 1931, and some changes were made in the provisions of the law. Among the most important changes was the provision for the payment of not to exceed $50 per annum to local agents of the commissioner for their services in connection with the administration of the Act. It was also provided that to be deemed a prospector within the meaning of the Act a person must be a citizen of the United States, and an inhabitant of the Territory of Alaska for at least one year immediately prior to the date of his application, or must have resided in Alaska for two years within the five-year period prior thereto. He must also be able to furnish proof that the property he intends to prospect is undeveloped and that he has not held possession of the same for a longer period than two years prior to the date of application for assistance under the Act. It is further provided that a prospector who has failed to make, within one year from the date on which he received aid, a report of the operations for conducting which he has received assistance, shall be entitled to no further assistance for a period of two years after the date on which such report should have been filed, unless he can satisfy the Commissioner of Transportation that failure to do so was unavoidable. Under the cooperative arrangement provided for in chapter 122, session laws of 1931, the supervising mining engineer, appointed by the Interior Department, Geological Survey, again administered the prospectors' aid act during the present biennium in his capacity as ex-officio mine inspector.

FUNDS AVAILABLE

At its session of 1931 the Legislature made available for the office of Commissioner of Transportation for Prospectors, for use during the biennium ending March 31, 1933, the sum of $20,000 to

be so distributed that, as nearly as practicable, one half of the appropriation should be expended during each year of the biennium. During the first year of the biennium vouchers were approved for the sum of $8,554.30. Early in May, 1932, the Commissioner of Transportation was requested by the Governor to accept no more applications for assistance under the prospectors' aid act owing to the depleted condition of the Territorial treasury. Upon receipt of the Governor's request the commissioner immediately notified the local agents to recommend for approval no further applications for assistance from their respective districts.

EXPENDITURES FROM THE PROSPECTORS' AID FUND AS OF DECEMBER 31, 1932

The total expenditures from the fund to December 31, 1932 were as follows:

Claims submitted for transportation of prospectors, their outfits and supplies	$10,759.86
Expenses of administration	179.00
Total expenditures as of Dec. 31, 1932	$10,938.86
Unexpended balance	$ 9,061.14

OUTSTANDING CLAIMS

There are three claims on file, each in the sum of $150, awaiting satisfactory explanation as to expenditures covered before they can be approved for payment. It is doubtful whether explanations can be furnished that will enable the Commissioner of Transportation to approve these claims, as they have been on file since the summer of 1931. However, it is possible that the claimants have been out of mail communication and will submit the necessary explanations before the end of the biennium.

OUTSTANDING APPLICATIONS

There are on file ten applications for assistance amounting to $1,445 that were recommended for approval by local agents prior to the withdrawal of the fund, but covering which no claims have been submitted. It seems evident that the majority of these applicants do not intend to submit claims covering the amounts applied for, as most of them have completed the trips for which assistance was requested, but have not submitted claims covering such trips.

DISTRIBUTION BY JUDICIAL DIVISIONS OF EXPENDITURES MADE ON ACCOUNT OF TRANSPORTATION OF PROSPECTORS AS OF DECEMBER 31, 1932

Division	Amount	Per cent of total
First	$ 3,052.89	28.4
Second	1,695.50	15.7
Third	2,827.48	26.3
Fourth	3,183.99	29.6
Totals	$10,759.86	100.0

Assistance was rendered to 105 prospectors in 31 of the 49 mining precincts in the Territory during the biennium. Precincts from which no requests for assistance were received are: Hyder and Wrangell in the first division; Council, Koyuk, St. Michael and Wade Hampton in the second division; Aleutian Islands, Bristol Bay, Cordova, Iliamna, Kvichak and White River in the third division; and Bethel, Innoko, Kantishna, Kuskokwim, Otter and Rampart in the fourth division.

DISTRIBUTION BY MINING PRECINCTS OF EXPENDITURES MADE ON ACCOUNT OF TRANSPORTATION OF PROSPECTORS AS OF DECEMBER 31, 1932

Mining Precinct	Number of Prospectors Receiving Assistance	Amount Expended
(First Division)		
Juneau	7	$ 622.78
Hyder	....	....
Ketchikan	8	697.02
Petersburg	2	118.34
Sitka	18	1,400.75
Skagway	3	214.00
Wrangell	....	....
Totals for first division	38	3,052.89
(Second Division)		
Cape Nome	5	700.00
Council	....	....
Fairhaven	1	150.00
Koyuk	....	....
Noatak-Kobuk	5	695.50
Port Clarence	1	150.00
St. Michael	....	....
Wade Hampton	....	....
Totals for second division	12	1,695.50

(Third Division)		
Aleutian Islands	....	....
Bristol Bay	....	....
Chitina	8	1,093.10
Cordova	....	....
Iliamna	....	....
Kayak	1	150.00
Kenai	1	23.90
Knik	1	35.85
Kodiak	5	539.50
Kvichak	....	....
McCarthy	1	123.60
Seldovia	1	55.00
Talkeetna	6	636.53
Valdez	2	170.00
White River	....	....
Totals for third division	26	2,827.48
(Fourth Division)		
Bethel	....	....
Chandalar	1	150.00
Circle	6	470.11
Eagle	3	288.10
Fairbanks	1	79.55
Ft. Gibbon	3	441.73
Fortymile	1	150.00
Hot Springs	2	156.75
Innoko	....	....
Kantishna	....	....
Koyukuk	5	750.00
Kuskokwim	....	....
Mt. McKinley	2	240.00
Nenana	2	169.80
Nulato	1	150.00
Otter	....	....
Rampart	....	....
Tanana	1	102.95
Tolovana	1	35.00
Totals for fourth division	29	3,183.99
Grand totals—all divisions	105	$10,759.86

COST OF TRANSPORTATION

The average amount of assistance received by each of the 105 prospectors who made the claims during the biennium was $104.20. The average cost of transportation per prospector varied in the several judicial divisions as follows:

First division	$ 80.35
Second division	141.30
Third division	108.75
Fourth Division	109.80

With the exception of one, all claims for assistance from the second division were for the full amount allowed by the act and in most instances it was indicated that expenditures for transportation had been more than the amount claimed. The majority of the transportation in the first division was by boat which accounts for the lower average cost per prospector than for the other divisions where transportation was by more expensive means.

EXPENSE OF ADMINISTRATION

The prospectors' aid act provides that not to exceed 15 per cent of the fund appropriated may be paid for clerk hire, salaries of agents or other office expenses necessary for the administration of the act. Up to December 31, 1932 the total sum disbursed for administrative expenses during the biennium amounted to $179. This sum represents an expense for the biennium of $1.70 per prospector assisted. The distribution of the administrative expense was as follows:

Cable and telegraph service	$ 23.25
Printing blank forms	60.75
Services of local agents	95.00
Total	$179.00

LOCAL AGENTS

The act authorizes the commissioner to "appoint agents for the purpose of carrying out the work of the office," etc. Under this provision agents served as representatives of the commissioner in 15 districts of the various judicial divisions. Most of these agents also served during the two previous biennia. Eleven of the 15 agents are U. S. Commissioners of the precincts in the districts served. All of the agents have a wide acquaintanceship among prospectors in their respective districts and occupy positions of responsibility. It is necessary for the commissioner to rely almost solely upon the recomendations of the local agents in passing on the merits of individual applications for assistance submitted by prospectors in outlying districts. In all cases the agents now serving throughout the Territory have been most cordial in their co-

operation with the office of the commisisoner, especially in cases where additional information was necessary in order to approve applications or claims. The amount of time devoted by some of them in the more populous sections in explaining to prospectors the provisions of the act and in assisting them to submit their applications and claims in proper form has been considerable. Although the Act provided for a small payment to local agents for their services, only a few of them made claims for such payment.

The Territory is indebted to the following persons who rendered during the current biennium services as local agents in the administration of the prospectors' aid act:

(First Division)

C. Clausen, U. S. Commissioner, Petersburg, Alaska.
W. C. Arnold, U. S. Commissioner, Ketchikan, Alaska.
R. W. DeArmond, U. S. Commissioner, Sitka, Alaska.

(Second Division)

R. N. Sundquist, Candle, Alaska.
C. W. Thornton, U. S. Commisisoner, Nome, Alaska.

(Third Division)

E. E. Chamberlin, U. S. Commissioner, McCarthy, Alaska.
O. A. Nelson, U. S. Commissioner, Chitina, Alaska.
George J. Love, U. S. Commissioner, Valdez, Alaska.
J. J. Corey, Geological Survey, Anchorage, Alaska.
K. G. Robinson, U. S. Commissioner, Cordova, Alaska.

(Fourth Division)

William N. Growden, U. S. Commissioner, Ruby, Alaska.
Irving McK. Reed, Fairbanks, Alaska.
E. J. Ulen, Postmaster, Wiseman, Alaska.
W. T. Vanderpool, U. S. Commissioner, McGrath, Alaska.
John B. Powers, U. S. Commissioner, Eagle, Alaska.

In addition to the above regularly appointed agents, postmasters and U. S. Commissioners at several remote localities have acted as certifying agents in the preparation of applications and claims submitted by prospectors in their districts.

REPORTS RENDERED BY PROSPECTORS

The act requires that every prospector who receives assistance from the fund shall within one year from the date of receiving such

assistance "file with the commissioner a written report of the result of the operations for which he receives the aid." In order to assist prospectors in rendering such reports a blank form is furnished each along with the application and voucher forms.

The number of reports received from prospectors who received the assistance during the biennium was again disappointing, only 44 per cent having submitted the required reports up to December 31, 1932, as shown by the following table. It is possible that a few reports will be received before the end of the biennium from prospectors who have recently returned from their season's prospecting. In a few cases it was necessary to refuse assistance to prospectors who had neglected to render reports in the required time for assistance previously granted. Most of the reports received were well prepared and contain valuable information which has been of much service in answering inquiries by prospectors and others concerning the mineral resources of regions about which little is known. Several well prepared reports were also received from prospectors who did not receive assistance from the Territory.

Record by Judicial Divisions of Reports Filed by Prospectors

Division	Deceased	Number of Prospectors Assisted	Number of Reports Filed	Reports Filed Per Cent
First	2	38	11	30
Second	....	12	5	42
Third	....	26	12	46
Fourth	....	29	18	62
	2	105	46	av. 44

Record by Mining Precincts of Reports Filed by Prospectors

(First Division)

Precinct	Number of Prospectors Assisted	Number of Reports Filed	Number of Prospectors Deceased	Per Cent
Juneau	7	1	1	14
Ketchikan	8	3	....	38
Petersburg	2	1	....	50
Sitka	18	4	1	22
Skagway	3	2	....	67
Totals	38	11	2	av. 30

(Second Division)

Cape Nome	5	....	....	....
Fairhaven	1	1	....	100
Noatak-Kobuk	5	3	....	60
Port Clarence	1	1	....	100
Totals	12	5	....	av. 42

(Third Division)

Chitina	8	5	....	62
Kayak	1	1	....	100
Kenai	1	....	....	....
Knik	1	....	....	....
Kodiak	5	3	....	60
McCarthy	1	1	....	100
Seldovia	1	....	....	....
Talkeetna	6	2	....	33
Valdez	2	....	....	....
Totals	26	12	....	av. 46

(Fourth Division)

Chandalar	1	1	....	100
Circle	5	2	....	40
Eagle	4	2	....	50
Fairbanks	1	1	....	100
Ft. Gibbon	3	2	....	67
Fortymile	1	....	....	....
Hot Springs	2	1	....	50
Koyukuk	5	3	....	60
Mt. McKinley	2	1	....	50
Nenana	2	2	....	100
Nulato	1	1	....	100
Tanana	1	1	....	100
Tolovana	1	1	....	100
Totals	29	18	....	av. 62

RESULTS OBTAINED FROM THE OPERATION OF THE PROSPECTORS' AID ACT

The field engineers of the Territory were not able to visit any of the prospectors who received the assistance while in the field during the season of 1931 and they were not in the field during the season of 1932, owing to lack of funds in the Territorial treasury, and the commissioner has no further information regarding the results obtained from the assistance other than the reports of prospectors themselves and of the local agents. However, the

fact that the Territory has furnished transportation assistance to prospectors has undoubtedly been a large factor in stimulating prospecting throughout the Territory and has made it possible for many prospectors to carry on their work who would have been unable to do so without assistance. It has also enabled a number of prospectors to examine remote localities that they would otherwise have been financially unable to visit.

Several discoveries have been reported by prospectors who received the assistance that give promise of adding to the mineral production of the Territory. Among these are discoveries in the Bremner River area of placer gold by two men who report that they were able to make wages by crude hand methods, with indications that the property will develop into something better. On Monahan Creek, in the Bremner River area, encouraging placer gold prospects were also reported. On Kodiak Island at the mouth of Red River several hundred dollars in fine placer gold was recovered by hand methods and encouraging placer gold prospects found on Montana Creek. At the mouth of Spring Creek in the Wild River area of the Kobuk district prospects of fine placer gold and quartz float carrying free gold were reported, and on Wild River in the same district several hundred dollars in placer gold was recovered and a piece of quartz float weighing about 14 pounds was picked up that was said to contain between $30 and $40 in gold. On Last Chance Creek, a tributary of the Big Delta River, placer gold prospects were found that seemed to warrant the installation of a drag-line scraper and plans to that end were being made. In an unexplored area on the Okpiluk River, about 60 miles inland from Barter Island on the Arctic slope, encouraging placer gold prospects were discovered.

In the Bremner River district a discovery of ore containing gold, lead and molybdenum is reported to have been located. On Alder Gulch in the Chisana district a discovery of three quartz veins of workable size is reported, assays from which indicate a satisfactory gold content.

On Kuiu Island in southeastern Alaska discoveries of the rare and valuable mineral witherite (barium-carbonate) were made, but the two prospectors who made the find were financially unable to undertake the development work necessary to determine the extent of the deposit. On Dahl Creek in the upper Kobuk River district what appears to be an extensive deposit of very high grade chrysotile asbestos was discovered that may prove to be the beginning of a new and important industry for Alaska.

In addition to the above, a number of discoveries of mineralized deposits of sufficient merit to induce prospectors to return to them for further examination in the future have been reported to the commissioner by prospectors who have received assistance from the Territorial fund.

MINE ACCIDENTS

FATALITY AND INJURY RATES DEFINED

The method of computing fatality and injury rates adopted by the U. S. Bureau of Mines has been used in considering statistics of mine accidents in Alaska. This procedure enables a true comparison to be made between the accident rates of mines in Alaska and those of the United States as a whole, and also those of the individual states. Up to the year 1930 accident rates were computed on the basis of the number of fatalities and injuries sustained per 1,000 "300-day" workers. This was the basis that was used in preparing the preceding Territorial reports on mine accidents. Commencing with the year 1930, the U. S. Bureau of Mines adopted a different method of computing accident rates. According to this new method the acident rate is determined by computing the number of fatalities and injuries sustained per million man-hours worked. This is the method that has been used in determining the accident rates stated in this report.

COMPARISON OF ACCIDENT RATES IN ALASKA WITH THOSE IN THE UNITED STATES

Recent reports issued by the U. S. Bureau of Mines show that as to mine accident rates Alaska occupies a superior position among the states and territories.

During 1931, which is the latest year for which statistics are available, there were fewer mine accidents in the metal-mining industry of Alaska, in proportion to the number of man-hours of exposure, than in any of the states, excepting Minnesota, Tennessee, Alabama, Florida and Michigan. The record of the coal-mining industry of Alaska is even more satisfactory. There have been fewer mine accidents in the coal-mining industry of Alaska, in proportion to the number of man-hours of exposure, than in any state of the United States. This record has been maintained for

a number of years. During 1930, which is the latest year for which statistics are available, only Alaska and Texas among the coal-mining states had no fatality to record. The fatality rates per million man-hours worked of the other states ranged from 0.52 for Michigan to 11.89 for Utah. The average rate for the United States was 2.16.

As to non-fatal injuries, Alaska's rate per million man-hours worked was 29.94, which compares with a rate of 94.94 for the United States; 45.22 for Arkansas, which ranked next to Alaska; and 189.15 for Utah, where the rate was the highest.

MINE ACCIDENT RATES DURING THE BIENNIUM 1931-1932

The following tables display the rates per million man-hours worked of fatalities and non-fatal injuries in the mines of Alaska during the biennium ending December 31, 1932:

Fatality Rates at Various Types of Mines, Including Milling Plants, During the Biennium 1931-32

	Rate per million man-hours worked			
			Comparison	
Type of Mine	1931	1932	Increase	Reduction
All mines	0.82	0.69	.....	0.13
Lode mines	1.76	1.45	.....	0.31
Gold-mining group	1.80	1.59	.....	0.21
Copper-mining group	0.17	0.00	.....	0.17
Non-metal group	0.00	0.00	.....	.....
Placer mines	0.00	0.00	.....	.....
Coal mines	0.00	0.00	.....	.....

Non-fatal Injury Rates at Various Types of Mines, Including Milling Plants, During the Biennium 1931-32

	Rate per million man-hours worked			
			Comparison	
Type of Mine	1931	1932	Increase	Reduction
All mines	37.29	33.52	.....	3.77
Lode mines	49.12	45.66	.....	3.46
Gold-mining group	47.24	43.63	.....	3.61
Copper-mining group	60.87	70.71	9.84	.....
Non-metal group	0.00	39.38	39.38	.....
Placer mines	26.28	18.70	.....	7.58
Coal mines	28.25	78.76	50.51	.....

Comparison of Fatality Rates for the Biennia 1929-30 and 1931-32

	Rate per million man-hours worked			
	Biennium		Comparison	
Type of Mine	1929-30	1931-32	Increase	Decrease
All mines	1.33	0.76	.....	0.57

Lode mines	2.14	1.58	.....	0.56
Gold mining	2.40	1.68	.....	0.72
Copper-mining	1.30	0.09	.....	1.21
Non-metal	0.00	0.00	.....	.....
Placer mines	0.69	0.00	.....	0.69
Coal mines	0.00	0.00	.....	.....

Comparison of Non-fatal Injury Rates for the Biennia 1929-30 and 1931-32

	Rate per million man-hours worked			
	Biennium		Comparison	
Type of Mine	1929-30	1931-32	Increase	Decrease
All mines	51.60	35.40	.....	16.20
Lode mines	60.71	47.39	.....	13.32
Gold-mining	47.44	45.35	.....	2.09
Copper-mining	91.56	65.79	.....	25.77
Non-metal	40.00	19.69	.....	20.31
Placer mines	36.60	22.49	.....	14.11
Coal mines	29.48	53.50	24.02	.....

Summary of Mine Accidents Occurring in Alaska During 1931

Number of Mines	Group	Number of men Employed	Number Shifts Worked	Results of Accidents fatal	serious	slight	Total Time Lost (days)
	PLACER MINES:						
31	Dredges	1,003	228,773	0	21	63	1,121
124	Hydraulic	522	93,960	0	2	6	130
294	Others	638	114,840	0	0	0	0
449	Sub-total	2,163	437,573	0	23	69	1,251
5	COAL MINES:						
	Underground	48	13,704	0	3	2	101
	Surface	30	8,425	0	0	0	0
5	Sub-total	78	22,129	0	3	2	101
	LODE MINES:						
38	Gold	870	272,748	4	31	82	1,881
1	Copper	102	36,121	1	15	19	534
1	Non-metal	20	4,866	0	0	0	0
40	Sub-total	992	313,735	5	46	101	2,415
	MILLS:						
20	Gold	225	75,731	1	7	12	249
1	Copper	106	35,735	0	0	1	4
21	Sub-total	331	111,466	1	7	13	253
515	GRAND TOTAL	3,564	884,903	6	79	185	4,020

Summary of Mine Accidents Occurring in Alaska During 1932

Number of Mines	Group	Number of men Employed	Number Shifts Worked	Results of Accidents fatal	serious	slight	Total Time Lost (days)
	PLACER MINES:						
28	Dredges	895	210,035	0	9	47	688
109	Hydraulic	532	95,760	0	2	9	77
338	Others	753	135,540	0	0	0	0
475	Sub-total	2,180	441,335	0	11	56	765
5	COAL MINES:						
	Underground	47	13,361	0	8	2	201
	Surface	31	8,906	0	1	3	49
5	Sub-total	78	22,267	0	9	5	250
	LODE MINES:						
40	Gold	1,009	312,582	5	29	98	2,124
1	Copper	55	13,381	0	8	12	385
2	Non-metal	99	15,887	0	0	5	19
43	Sub-total	1,163	341,850	5	37	115	2,528
	MILLS:						
24	Gold	245	80,300	0	3	7	100
1	Copper	88	23,726	0	0	1	2
25	Sub-total	333	104,026	0	3	8	102
548	GRAND TOTAL	3,754	909,478	5	60	184	3,645

Causes of Mine Fatalities During 1931

During the year 1931 a total of six fatalities occurred in and about the mines of Alaska.

Four fatalities occurred at gold lode mines, one at a gold mill, and one at a copper mine.

The causes that led to the fatalities reported for 1931 were as follows:

1. Run of muck from stope 2
2. Fell down chute 1
3. Falling power pole 1
4. Crushed between ore car and tipple 1
5. Falling slab of rock 1

6

Non-fatal Injuries During 1931

There were reported during the year 79 serious accidents and 185 slight accidents which caused a total loss of time amounting to 4,020 days.

The total number of men employed at mines in Alaska during 1931 is estimated to have been 3,564 and the number of shifts worked 884,903. There were probably about 400 prospectors engaged in the search for mineral deposits in Alaska during the year in addition to the men employed at operating mines mentioned above.

Causes of Mine Fatalities During 1932

During the year 1932 a total of five fatalities occurred in and about the mines of Alaska. All five of these fatalities occurred at gold lode mines.

The causes that led to the fatalities reported for 1932 were as follows:

1. Unguarded shot 1
2. Crushed between load of lagging and side of shaft 1
3. Fell into oreway 1
4. Fell into raise 1
5. Fell down winze 1

Non-fatal Injuries During 1932

There were reported during the year 60 serious accidents and 184 slight accidents which caused a total loss of time amounting to 3,645 days.

The total number of men employed at mines in Alaska during 1932 is estimated to have been 3,754 and the number of shifts worked 909,478. There were probably between 400 and 500 prospectors engaged in the search for mineral deposits in Alaska during the year in addition to the men employed at operating mines mentioned above.

Descriptions of Fatal Accidents Occurring at Mines in Alaska During 1931

April 20, Obrad S. Pavlovich, Jugoslav, bulldoze boss, age 29, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when a large slab of rock fell on him. Pavlovich dug a hole under a large slab of rock which had lodged about 10 feet above the grizzly, and placed a charge of powder in the hole.

Just as he was lighting the fuse a large rock came down from the stope striking the slab under which Pavlovich was working causing the slab to fall on him. He was removed after about 50 minutes, but his head and chest were badly cut and crushed and he was apparently dead when removed. He was rushed to the hospital, but could not be revived.

July 1, Zygmunt Gutkoski, Pole, bulldozer, age 37, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when he fell through the grizzly into the chute. Gutkoski was barring rocks on the grizzly and one of the rocks rolled over his bar causing him to lose his balance and fall through the grizzly into the chute a distance of about 300 feet. He was taken from the chute about 15 minutes after the accident happened and rushed to the hospital where it was found that his skull was crushed and that he had numerous severe bruises about the body and limbs. He died about 15 minutes after his arrival at the hospital.

July 22, H. L. Hablett, American, electrician, age 32, employed by the Kennecott Copper Corporation (copper lode), was killed when an old power pole which he had climbed fell on him. A three-pole tower was being renewed and Halbett climbed the old center pole to release the wire from it. He had attachd a tackle to the wire and when a slight strain was taken on this tackle to get enough slack so that the wire might be released from the pole, the pole which Halbett had climbed, as well as the one next to it, fell to the ground carrying him with them, and falling directly on him. He died about 10 minutes after the accident and upon examination by the company physician it was found that two cervical vertebrae had been fractured.

September 11, William Kidd, American, conductor on the ore train, age 31, employed by the Alaska Juneau Gold Mining Company (gold lode), was fatally injured when crushed between an ore car and the guard rail of the tipple. Kidd was at the front end of the tipple at the mill uncoupling cars before they were dumped into the ore bin and, while reaching for the coupling, was caught between an ore car and the guard rail of the tipple and crushed about the hips. He was immediately taken to the hospital where he died two days later.

October 25, Nick Mazoff, Russian, bulldozer, age 33, employed by the Alaska Gold Mining Company (gold lode), was killed when caught by a run of muck from the stope. Mazoff was drilling a hang-up about 35 feet up from the draw-hole of the stope and was about finished when the muck from above started to move. He jumped, but was caught and covered by the muck before he could get in the clear. He was removed from the muck about three hours after the accident and was found to be dead. His lower jaw was crushed, his head badly bruised and cut, and his body badly bruised at a number of places.

December 29, John W. Russell, Irish, bulldozer, age 29, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when a slab of rock fell on him. He was placing a charge of powder between two slabs of rock which had lodged in the collar of the stope when one of the slabs fell on him. He had been warned to watch out for the slab which was hanging, but instead of using a blasting stick he walked under the slab to place his charge with the result that he was pinned beneath the slab when it fell. He was immediately taken out and rushed to the hospital, but died on the way. His skull was fractured and he had numerous body bruises.

Descriptions of Fatal Accidents Occurring at Mines in Alaska During 1932

February 8, Frank Africh, Austrian, bulldozer, age 50, employed by the Alaska Juneau Gold Mining Company (gold lode), received injuries from which he died in July, 1932, when a rock fell on a charge of powder he was ready to set off, exploding it before he could get in the clear. Africh was working alone at the time the accident occurred and had two blasts ready to light, one near the back end of the grizzly and the other in the collar. As he was preparing to light the one in the collar a rock dropped on it setting it off. His right eye was destroyed, his skull fractured, and his right arm and hand punctured by numerous small rocks. The injured man was sent to Seattle to receive special medical attention but died there during July, 1932.

March 6, Esa Makela, shift boss, employed by the Chichagoff Mining Company (gold lode), was killed when squeezed between a bucket load of lagging and some pipes which cross the shaft. Makela was bringing a load of lagging from the 1500 level to the 1400 level and riding with the load. He loaded the lagging and signaled to be hoisted and at some distance below the 1400 level the friction on the hoist stopped. The hoistman waited for another

signal, but when none came he went down the shaft and discovered the body of Makela wedged between the load of lagging and some pipes which cross the shaft near the 1400 level.

May 23, Alex Brkovich, Servian, bulldoze boss, age 48, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when he fell through the grizzly and down the oreway. Brkovich went up toward the stope from the grizzly and dug a hole under a large rock which was lodged in the drawhole. When he started down after some powder rocks began to roll down from the stope and in dodging them he stepped on a slippery rock and slipped and fell backward between the grizzly bars into the oreway. After a search of several hours his body was found about 400 feet below the grizzly badly mangled.

October 31, Richard J. Casey, American, assistant surveyor, age 23, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when he fell into a raise. Casey had just finished some measurements and was looking in his notebook and at the same time walking toward the raise which he stepped into. His body was found about an hour later approximately 250 feet below the top of the raise. His skull was fractured, his body badly bruised and bones broken in various parts of the body.

December 20, Mike Avoian, Russian, timberman helper, age 41, employed by the Alaska Juneau Gold Mining Company (gold lode), was killed when he fell down a winze. Avoian and three other men were taking fan pipe out of the winze. He was standing on the foot-wall plate about six feet below the skip on which they were loading the pipe. According to one of his fellow workmen, Avoian seemed to have a fainting spell, started to sit down and then fell forward into the winze. His body was picked up by the other members of his party some 300 feet below where it had lodged on the dividers.

List of All Accidents Reported from Coal Mines of Alaska for the Year 1931, Classified as to Causes and Results

	CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
					Time lost more than 14 days	Time lost less than 14 days	
	Underground						
	Number Killed or Injured by—						
1.	Falls of roof (coal, rock, etc.)	....	....	....	....	....	....
2.	Falls of face or pillar coal	....	....	....	....	....	....
3.	Mine cars and locomotives	....	....	....	1	....	1
4.	Gas explosions and burning gas	....	....	....	....	....	....
5.	Coal-dust explosions (including gas and dust combined)	....	....	....	....	....	....
6.	Explosives	....	....	....	....	....	....
7.	Suffocation from mine gases	....	....	....	....	....	....
8.	Electricity	....	....	....	....	....	....
9.	Animals	....	....	....	....	....	....
10.	Mining machines	....	....	....	....	....	....
11.	Mine fires (burned, suffocated, etc.)	....	....	....	....	....	....
12.	Other causes	....	....	....	2	2	4
	Total number killed or injured underground	....	....	....	3	2	5
	Shaft						
	Number Killed or Injured by—						
13.	Falling down shafts or slopes	....	....	....	....	....	....
14.	Objects falling down shafts or slopes	....	....	....	....	....	....
15.	Cage, skip, or bucket	....	....	....	....	....	....
16.	Other causes	....	....	....	....	....	....
	Total number killed or injured by shaft accidents	....	....	....	....	....	....
	Surface Shops and Plants						
	Number Killed or Injured by—						
17.	Mine cars and locomotives	....	....	....	....	....	....
18.	Electricity	....	....	....	....	....	....
19.	Machinery	....	....	....	....	....	....
20.	Boiler explosions or bursting steam pipes	....	....	....	....	....	....
21.	Railway cars and locomotives	....	....	....	....	....	....
22.	Other causes	....	....	....	....	....	....
	Total number killed or injured by surface accidents	....	....	....	....	....	....
	GRAND TOTAL	....	....	....	3	2	5

Average number of men employed underground	48
Average number of men employed on the surface	30
Total numbr of shifts underground	13,704
Total number of shifts on the surface	8,425
Total shifts lost on account of all accidents	101

List of All Accidents Reported from Placer Mines of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	....	....	....	....
2. Rock or ore while loading at working face or chute	....	....	....	....	....	....
3. Timber or hand tools	....	....	....	....	....	....
4. Explosives	....	....	....	....	....	....
5. Haulage (mine cars, locomotives, breakage of rope, etc.)	....	....	....	....	....	....
6. Persons falling down chute, winze, raise, or stope	....	....	....	....	....	....
7. Run of ore from chute or pocket	....	....	....	....	....	....
8. Drilling by machine or hand drills	....	....	....	....	....	....
9. Electricity	....	....	....	....	....	....
10. Machinery (other than locomotive or drills)	....	....	....	....	....	....
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	....	....
15. Other causes	....	....	....	....	....	....
Total number killed or injured underground	....	....	....	....	....	....
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	....	....	....
17. Objects falling down shaft	....	....	....	....	....	....
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip or bucket	....	....	....	....	....	....
21. Other causes	....	....	....	....	....	....
Total number killed or injured by shaft accidents	....	....	....	....	....	....

Surface Accidents						
(At surface yards and shops)						
Number Killed or Injured by—						
22. Mine cars or mine locomotives, gravity or aerial trams	....	....	....	1	....	1
23. Railway cars and locomotives..	....	....	....	....	....	....
24. Run or fall of ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	1	4	5
26. Nails and splinters	....	....	....	....	....	....
27. Hand tools, axes, bars, etc.	....	....	....	3	15	18
28. Electricity	....	....	....	....	....	....
29. Machinery	....	....	....	2	3	5
30. Other causes	....	....	....	6	15	21
Total number killed or injured by surface acicdents	....	....	....	13	37	50
Dredging						
Number Killed or Injured by—						
31. Machinery	....	....	....	4	1	5
32. Electricity	....	....	....	....	....	....
33. Boiler explosions or bursting steam pipes	....	....	....	1	....	1
34. Falls of persons	....	....	....	1	6	7
35. Tools	....	....	....	....	4	4
36. Other causes	....	....	....	2	15	17
Total number killed or injured by dredging accidents	....	....	....	8	26	34
Hydraulicking						
Number Killed or Injured by—						
37. Cave of bank	....	....	....	....	1	1
38. Explosives	....	....	....	....	....	....
39. Hydraulic giants	....	....	....	....	....	....
40. Falls of persons	....	....	....	....	1	1
41. Rock while handling	....	....	....	....	....	....
42. Tools	....	....	....	1	....	1
43. Machinery, derricks, etc.	....	....	....	....	....	....
44. Other causes	....	....	....	1	4	5
Total number killed or injured by hydraulic accidents	....	....	....	2	6	8
GRAND TOTAL	....	....	....	23	69	92

The following definitions apply to all accident tables:

(A)—Permanent total disability.—Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralysis or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B)—Permanent partial disability.—Loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed or any other injury known in surgery to be permanent partial disability.

(C)—Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.

Average number of men employed on dredges during 1931 1,003

Average number of men employed hydraulicking	522
Average number of men employed other placer methods	638
Total number of shifts, dredging	228,773
Total number of shifts, hydraulicking	93,960
Total number of shifts, other methods	114,840
Total shifts lost on acount of all accidents	1,251

List of All Accidents Reported from Gold Mines of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	1	8	20	29
2. Handling rock or ore:						
(a) Loading at face	....	....	....	....	....	....
(b) Loading at chute	....	....	....	1	6	7
(c) Sledging	....	....	....	....	....	....
3. Timber or hand tools	....	....	....	....	6	6
4. Explosives:						
(a) Transportation	....	....	....	....	....	....
(b) Charging	....	....	....	....	....	....
(c) Suffocation	....	....	....	....	....	....
(d) Drilling into old holes	....	....	....	....	....	....
(e) Striking into loose rock	....	....	....	....	....	....
(f) Thawing	....	....	....	....	....	....
(g) Caps, detonators, etc.	....	....	....	....	....	....
(h) Unguarded shots	....	....	....	....	1	1
(i) Returned too soon	....	....	....	....	....	....
(j) Premature shot	....	1	....	1	....	2
(k) Miscellaneous	....	....	....	....	....	....
5. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	2	1	3
6. Persons falling down chutes, winze, raise or stope	1	....	....	1	....	2
7. Run of ore from chute or pocket	2	....	....	4	....	6
8. Drilling (by machine or hand drills)	....	....	....	1	3	4
9. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	2	2
10. Machinery other than 5 and 8	....	....	....	....	....	....
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	1	1
15. Other causes:						
(a) Falling objects other than 1 and 2	1	....	....	3	4	8
(b) Flying objects other than 2c	....	....	....	....	4	4
(c) Burns	....	....	....	....	....	....
(d) Miscellaneous	....	....	....	2	7	9
Total number killed or injured underground	4	1	1	23	55	84
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	....	....	....
17. Objects falling down shaft	....	....	....	....	....	....
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip, or bucket:						
(a) Runaway	....	....	....	....	....	....
(b) Riding with rock or ore	....	....	....	....	....	....
(c) Riding with timber or tools	....	....	....	....	....	....
(d) Struck by	....	....	....	1	....	1
21. Other causes	....	....	....	....	....	....
Total number killed or injured by Shaft accidents	....	....	....	1	....	1
Surface Accidents						
(At surface plants and shops)						
Number Killed or Injured by—						
22. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	....	1	1
23. Railway cars and locomotives	....	....	....	....	....	....
24. Run or fall or ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	....	3	3
26. Nails and splinters	....	....	....	....	3	3
27. Hand tools, axes, bars, etc.	....	....	....	....	2	2
28. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	3	3
29. Machinery	....	....	....	1	2	3
30. Other causes:						
(a) Falling objects	....	....	....	1	9	10
(b) Flying objects	....	....	....	1	1	2
(c) Burns	....	....	....	....	....	....
(d) Miscellaneous	....	....	....	2	3	5

Total number killed or injured by surface accidents	....	....	....	5	27	32
GRAND TOTAL	4	1	1	29	82	117

Average number of men employed at gold mines during 1931.. 870
Total number of shifts underground 176,230
Total number of shifts on surface 96,518
Total shifts lost on account of all accidents at gold mines 1,881

List of All Accidents Reported from Copper Mines of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	....	....	....	....
2. Handling rock or ore:						
(a) Loading at face	....	....	....	....	....	....
(b) Loading at chute	....	....	....	4	1	5
(c) Sledging	....	....	....	1	1	2
3. Timber or hand tools	....	....	....	1	....	1
4. Explosives:						
(a) Transportation	....	....	....	....	....	....
(b) Charging	....	....	....	....	....	....
(c) Suffocation	....	....	....	....	....	....
(d) Drilling into old holes	....	....	....	....	....	....
(e) Striking in loose rock or ore	....	....	....	....	....	....
(f) Thawing	....	....	....	....	....	....
(g) Caps, detonators, etc.	....	....	....	....	....	....
(h) Unguarded shots	....	....	....	1	....	1
(i) Returned too soon	....	....	....	....	....	....
(j) Premature shot	....	....	....	....	....	....
(k) Miscellaneous	....	....	....	....	....	....
5. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	2	1	3
6. Persons falling down chutes, winze, raise or stope	....	....	....	....	1	1
7. Run of ore from chute or pocket	....	....	....	1	1	2
8. Drilling (by machine or hand drills)	....	....	....	....	1	1
9. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....

(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	....	....
10. Machinery other than 5 and 8	....	....	....	....	....	....
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	....	....
15. Other causes:						
(a) Falling objects, other than 1 and 2	....	....	1	....	2	3
(b) Flying objects, other than 2c	....	....	....	1	....	1
(c) Burns	....	....	....	....	....	....
(d) Miscellaneous	....	....	....	....	5	5
Total number killed or injured underground	....	....	1	11	13	25
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	....	....	....
17. Objects falling down shaft	....	....	....	....	....	....
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip or bucket:						
(a) Runaway	....	....	....	....	....	....
(b) Riding with rock or ore	....	....	....	....	....	....
(c) Riding with timber or tools	....	....	....	....	....	....
(d) Struck by	....	....	....	....	....	....
21. Other causes	....	....	....	....	....	....
Total killed or injured by shaft accidents	....	....	....	....	....	....
Surface Accidents						
(At surface plants and shops)						
Number Killed or Injured by—						
22. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	1	1	2	4
23. Railway cars and locomotives	....	....	....	....	....	....
24. Run or fall of ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	....	2	2
26. Nails and splinters	....	....	....	....	1	1
27. Hand tools, axes, bars, etc.	....	....	....	....	....	....
28. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	....	....
29. Machinery	....	....	....	....	....	....
30. Other causes:						
(a) Falling objects	1	....	....	....	....	1
(b) Flying objects	....	....	....	....	....	....
(c) Burns	....	....	....	....	1	1

(d) Miscellaneous	....	....	....	1	....	1
Total number killed or injured by surface accidents	1	....	1	2	6	10
GRAND TOTAL	1	....	2	13	19	35

Average number of men employed at copper mines during 1931.. 102
Total number of shifts underground 27,280
Total number of shifts on surface 8,841
Total shifts lost on account of all accidents at copper mines 534

List of All Acicdents Reported from Gold Milling Plants of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C): Time lost more than 14 days	Temporary Disability (C): Time lost less than 14 days	Total Injured
Ore-Dressing and Milling Accidents						
Number Killed or Injured by—						
1. Haulage system:						
(a) Cars and motors	1	....	....	1	....	2
(b) Mechanical conveyors	....	....	....	3	1	4
2. Railway cars and locomotives	....	....	....	....	....	....
3. Crushers, rolls, or stamps	....	....	....	....	....	....
4. Tables, jigs, etc.	....	....	....	1	....	1
5. Other machinery	....	....	....	....	1	1
6. Falls of persons	....	....	....	1	1	2
7. Suffocation in ore bins	....	....	....	....	....	....
8. Falling objects (rocks, timbers, etc.)	....	....	....	1	2	3
9. Cyanide or other poisoning	....	....	....	....	....	....
10. Scalding (steam or water)	....	....	....	....	....	....
11. Electricity	....	....	....	....	....	....
12. Hand tools, axes, bars, etc.	....	....	....	....	3	3
13. Nails, splinters, etc.	....	....	....	....	....	....
14. Flying pieces of rock from sledging or crushing	....	....	....	....	3	3
15. Other causes	....	....	....	....	1	1
Total number killed or injured at mills	1	....	....	7	12	20
Auxiliary Works Accidents (Yards, shops, construction, etc.)						
Number Killed or Injured by—						
16. Haulage systems, cars, motors, etc.	....	....	....	....	....	....
17. Railway cars and locomotives..	....	....	....	....	....	....
18. Falls of persons	....	....	....	....	....	....

19. Falling objects (rocks, timber, etc.)	....	....	....	....	....	....
20. Nails, splinters, etc.	....	....	....	....	....	....
21. Hand tools, axes, bars, etc.	....	....	....	....	....	....
22. Electricity	....	....	....	....	....	....
23. Machinery	....	....	....	....	....	....
24. Failure of ladder, scaffold, or other supoprt	....	....	....	....	....	....
25. Handling hot materials	....	....	....	....	....	....
26. Other causes	....	....	....	....	....	....
Total number killed or injured by shop and yard accidents	....	....	....	....	....	....
GRAND TOTAL	1	....	....	7	12	20

Average number of men employed at gold mills during 1931 225
Total number of shifts worked 75,731
Total shifts lost on account of all accidents at gold mills 249

List of All Accidents Reported from Copper Milling Plants of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C): Time lost more than 14 days	Temporary Disability (C): Time lost less than 14 days	Total Injured
Ore-Dressing and Milling Accidents						
Number Killed or Injured by—						
1. Haulage system:						
(a) Cars and motors	....	....	....	....	....	....
(b) Mechanical conveyors	....	....	....	....	....	....
2. Railway cars and locomotives..	....	....	....	....	....	....
3. Crushers, rolls, or stamps	....	....	....	....	....	....
4. Tables, jigs, etc.	....	....	....	....	....	....
5. Other machinery	....	....	....	....	....	....
6. Falls of persons	....	....	....	....	....	....
7. Suffocation in ore bins	....	....	....	....	....	....
8. Falling objects (rocks, timbers, etc.)	....	....	....	....	....	....
9. Cyanide or other poisoning	....	....	....	....	....	....
10. Scalding (steam or water)	....	....	....	....	1	1
11. Electricity	....	....	....	....	....	....
12. Hand tools, axes, bars, etc.	....	....	....	....	....	....
13. Nails, splinters, etc.	....	....	....	....	....	....
14. Flying pieces of rock	....	....	....	....	....	....
15. Other causes	....	....	....	....	....	....
Total number killed or injured at mills	....	....	....	....	1	1
Auxiliary Works Accidents						

(Yards, shops, construction, etc.)						
Number Killed or Injured by—						
16. Haulage systems, cars, motors, etc.	....	....	....	....	....	....
17. Railway cars and locomotives	....	....	....	....	....	....
18. Falls of persons	....	....	....	....	....	....
19. Falling objects (rocks, timber, etc.)	....	....	....	....	....	....
20. Nails, splinters, etc.	....	....	....	....	....	....
21. Hand tools, axes, bars, etc.	....	....	....	....	....	....
22. Electricity	....	....	....	....	....	....
23. Machinery	....	....	....	....	....	....
24. Failure of ladder, scaffold, or other support	....	....	....	....	....	....
25. Handling hot materials	....	....	....	....	....	....
26. Other causes	....	....	....	....	....	....
Total number killed or injured by shop and yard accidents	....	....	....	....	....	....
GRAND TOTAL	....	....	....	....	1	1

Average number of men employed at copper mills during 1931 106
Total number of shifts worked 35,735
Total shifts lost on account of all accidents at copper mills 4

List of Accidents Reported from Quarries of Alaska for the Year 1931, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Number Killed or Injured by—						
1. Falls or slides of rock	....	....	....	....	....	....
2. Explosives	....	....	....	....	....	....
3. Haulage	....	....	....	....	....	....
4. Steam shovels	....	....	....	....	....	....
5. Falls of persons	....	....	....	....	....	....
6. Falls of derricks, booms, etc.	....	....	....	....	....	....
7. Machinery (other than 3 and 4)	....	....	....	....	....	....
8. Electricity	....	....	....	....	....	....
9. Hand tools	....	....	....	....	....	....
10. Other causes	....	....	....	....	....	....
Total number killed or injured by quarry accidents	....	....	....	....	....	....

Average number of men employed at quarries during 1931 20
Total number of shifts worked 4,866
Total shifts lost on account of all accidents at quarries 0

List of All Accidents Reported from Coal Mines of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Falls of roof (coal, rock, etc.)	....	....	....	2	....	2
2. Falls of face or pillar coal	....	....	....	1	....	1
3. Mine cars and locomotives	....	....	....	1	....	1
4. Gas explosions and burning gas	....	....	....	....	....	....
5. Coal-dust explosions (including gas and dust combined)	....	....	....	....	....	....
6. Explosives	....	....	....	....	....	....
7. Suffocation from mine gases	....	....	....	....	....	....
8. Electricity	....	....	....	....	....	....
9. Animals	....	....	....	....	....	....
10. Mining machines	....	....	....	....	....	....
11. Mine fires (burned, suffocated etc.)	....	....	....	....	....	....
12. Other causes	....	....	....	4	2	6
Total number killed or injured underground	....	....	....	8	2	10
Shaft						
Number Killed or Injured by—						
13. Falling down shafts or slopes	....	....	....	....	....	....
14. Objects falling down shafts or slopes	....	....	....	....	....	....
15. Cage, skip, or bucket	....	....	....	....	....	....
16. Other causes	....	....	....	....	....	....
Total number killed or injured by shaft accidents	....	....	....	....	....	....
Surface Shops and Plants						
Number Killed or Injured by—						
17. Mine cars and locomotives	....	....	....	....	1	1
18. Electricity	....	....	....	....	....	....
19. Machinery	....	....	....	....	....	....
20. Boiler explosions or bursting steam pipes	....	....	....	....	....	....
21. Railway cars and locomotives	....	....	....	....	....	....
22. Other causes	....	....	....	1	2	3
Total number killed or injured by surface accidents	....	....	....	1	3	4
GRAND TOTAL	....	....	....	9	5	14

Average number of men employed underground	47
Average number of men employed on the surface	31
Total number of shifts underground	13,361
Total number of shifts on the surface	8,906
Total shifts lost on acount of all accidents	250

List of All Accidents Reported from Placer Mines of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	....	....	....	....
2. Rock or ore while loading at working face or chute	....	....	....	....	....	....
3. Timber or hand tools	....	....	....	....	....	....
4. Explosives	....	....	....	....	....	....
5. Haulage (mine cars, locomotives, breakage of rope, etc.)	....	....	....	....	....	....
6. Persons falling down chute, winze, raise, or stope	....	....	....	....	....	....
7. Run of ore from chute or pocket	....	....	....	....	....	....
8. Drilling by machine or hand drills	....	....	....	....	....	....
9. Electricity	....	....	....	....	....	....
10. Machinery (other than locomotive or drills)	....	....	....	....	....	....
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	....	....
15. Other causes	....	....	....	....	....	....
Total number killed or injured underground	....	....	....	....	....	....
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	....	..	....
17. Objects falling down shaft	....	....	....	....	....	....
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip or bucket	....	....	....	....	....	....
21. Other causes	....	....	....	....	....	....
Total number killed or injured by shaft acidents	....	....	....	....	..	....

Surface Accidents						
(At surface yards and shops)						
Number Killed or Injured by—						
22. Mine cars or mine locomotives, gravity or aerial trams	....	....	....	....	1	1
23. Railway cars and locomotives	....	....	....	....	....	....
24. Run or fall of ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	1	6	7
26. Nails and splinters	....	....	....	1	4	5
27. Hand tools, axes, bars, etc.	....	....	....	1	5	6
28. Electricity	....	....	....	....	....	....
29. Machinery	....	....	1	....	....	1
30. Other causes	....	....	....	....	14	14
Total number killed or injured by surface accidents	....	....	1	3	30	34
Dredging						
Number Killed or Injured by—						
31. Machinery	....	....	....	1	....	1
32. Electricity	....	....	....	....	....	....
33. Boiler explosions or bursting steam pipes	....	....	....	....	....	....
34. Falls of persons	....	....	....	1	6	7
35. Tools	....	....	....	....	4	4
36. Other causes	....	....	1	2	7	10
Total number killed or injured by dredging accidents	....	....	1	4	17	22
Hydraulicking						
Number Killed or Injured by—						
37. Cave of bank	....	....	....	....	....	....
38. Explosives	....	....	....	....	....	....
39. Hydralic giants	....	....	....	....	....	....
40. Falls of persons	....	....	....	....	2	2
41. Rock while handling	....	....	....	....	3	3
42. Tools	....	....	....	....	3	3
43. Machinery, derricks, etc.	....	....	....	....	....	....
44. Other causes	....	....	....	2	1	3
Total number killed or injured by hydraulic accidents	....	....	....	2	9	11
GRAND TOTAL	....	....	2	9	56	67

The following definitions apply to all accident tables:

(A)—Permanent total disability.—Loss of both legs, or arms, one leg and one arm, total loss of eyesight, paralysis or other condition permanently incapacitating workman from doing any work of a gainful occupation.

(B)—Permanent partial disability.—Loss of one foot, leg, hand, eye, one or more fingers, one or more toes, any dislocation where ligaments are severed or any other injury known in surgery to be permanent partial disability.

(C)—Under this head are included only those accidents which cause a loss of time more than the balance of the day or shift upon which the accident occurred.

Average number of men employed on dredges during 1932	877
Average number of men employed hydraulicking	505
Average number of men employed other placer methods	699
Total number of shifts, dredging	206,795
Total number of shifts, hydraulicking	90,900
Total number of shifts, other methods	125,820
Total shifts lost on account of all accidents	766

List of All Accidents Reported from Gold Mines of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	....	....	3	3
2. Handling rock or ore:						
(a) Loading at face	....	....	....	....	1	1
(b) Loading at chute	....	....	....	1	5	6
(c) Sledging	....	....	....	....	....	....
3. Timber or hand tools	....	....	....	1	5	6
4. Explosives:						
(a) Transportation	....	....	....	....	....	....
(b) Charging	....	....	....	....	....	....
(c) Suffocation	....	....	....	....	....	....
(d) Drilling into old holes	....	....	....	....	....	....
(e) Striking into loose rock	....	....	....	....	....	....
(f) Thawing	....	....	....	....	....	....
(g) Caps, detonators, etc	....	....	....	....	....	....
(h) Unguarded shots	1	....	1	....	....	2
(i) Returned too soon	....	....	....	....	....	....
(j) Premature shot	....	....	....	....	....	....
(k) Miscellaneous	....	....	....	....	....	....
5. Haulage:						
(a) Hand and animal	....	....	....	1	....	1
(b) Mechanical	....	....	....	1	2	3
6. Persons falling down chutes, winze, raise or stope	3	....	....	1	....	4
7. Run of ore from chute or pocket	....	....	....	11	30	41
8. Drilling (by machine or hand drills)	....	....	....	....	3	3
9. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	1	1
10. Machinery other than 5 and 8	....	....	....	....	1	1
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	2	2
15. Other causes:						
(a) Falling object, other than 1 and 2	....	....	1	2	3	6
(b) Flying objects other than 2c	....	....	....	....	6	6
(c) Burns	....	....	....	....	1	1
(d) Miscellaneous	....	....	....	2	15	17
Total number killed or injured underground	4	....	2	20	78	104
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	1	....	1
17. Objects falling down shaft	....	....	....	1	....	1
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip, or bucket:						
(a) Runaway	....	....	....	....	....	....
(b) Riding with rock or ore	....	....	....	....	....	....
(c) Riding with timber or tools	1	....	....	....	....	1
(d) Struck by	....	....	....	1	2	3
21. Other causes	....	....	....	....	....	....
Total number killed or injured by Shaft accidents	1	....	....	3	2	6
Surface Accidents						
(At surface plants and shops)						
Number Killed or Injured by—						
22. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	....	....	....
23. Railway cars and locomotives	....	....	....	....	1	1
24. Run or fall of ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	1	4	5
26. Nails and splinters	....	....	....	....	1	1
27. Hand tools, axes, bars, etc.	....	....	....	1	3	4
28. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	....	....
29. Machinery	....	....	1	....	....	1
30. Other causes:						
(a) Falling objects	....	....	....	1	3	4
(b) Flying objects	....	....	....	....	3	3
(c) Burns	....	....	....	....	1	1
(d) Miscellaneous	....	....	....	....	2	2

Total number killed or injured by surface accidents	....	....	1	3	18	22
GRAND TOTAL	5	....	3	26	98	132

Average number of men employed at gold mines during 1932.. 1,009
Total number of shifts underground 201,872
Total number of shifts on surface 110,710
Total shifts lost on account of all accidents at gold mines 2,124

List of All Accidents Reported from Copper Mines of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Underground						
Number Killed or Injured by—						
1. Fall of rock or ore from roof or wall	....	....	....	....	1	1
2. Handling rock or ore:						
(a) Loading at face	....	....	....	....	....	....
(b) Loading at chute	....	....	....	....	1	1
(c) Sledging	....	....	....	....	....	....
3. Timber or hand tools	....	....	....	....	....	....
4. Explosives:						
(a) Transportation	....	....	....	....	....	....
(b) Charging	....	....	....	....	....	....
(c) Suffocation	....	....	....	....	....	....
(d) Drilling into old holes	....	....	....	....	....	....
(e) Striking into loose rock or ore	....	....	....	....	....	....
(f) Thawing	....	....	....	....	....	....
(g) Caps, detonators, etc.	....	....	....	....	....	....
(h) Unguarded shots	....	....	....	....	....	....
(i) Returned too soon	....	....	....	....	....	....
(j) Premature shot	....	....	....	....	....	....
(k) Miscellaneous	....	....	....	....	....	....
5. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	....	1	1
6. Persons falling down chutes, winze, raise or stope	....	....	....	....	....	....
7. Run of ore from chute or pocket	....	....	....	1	....	1
8. Drilling (by machine or hand drills)	....	....	....	....	....	....
9. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	....	....
10. Machinery other than 5 and 8	....	....	....	....	....	....
11. Mine fires	....	....	....	....	....	....
12. Suffocation from natural gases	....	....	....	....	....	....
13. Inrush of water	....	....	....	....	....	....
14. Nails and splinters	....	....	....	....	....	....
15. Other causes:						
(a) Falling objects, other than 1 and 2	....	....	....	....	1	1
(b) Flying objects, other than 2c	....	....	....	....	1	1
(c) Burns	....	....	....	....	....	....
(d) Miscellaneous	....	....	....	2	1	3
Total number killed or injured underground	....	....	....	3	6	9
Shaft Accidents						
Number Killed or Injured by—						
16. Falling down shaft	....	....	....	....	....	....
17. Objects falling down shaft	....	....	....	....	....	....
18. Breaking of cables	....	....	....	....	....	....
19. Overwinding	....	....	....	....	....	....
20. Cage, skip or bucket:						
(a) Runaway	....	....	....	....	....	....
(b) Riding with rock or ore	....	....	....	....	....	....
(c) Riding with timber or tools	....	....	....	....	....	....
(d) Struck by	....	....	....	....	....	....
21. Other causes	....	....	....	....	....	....
Total killed or injured by shaft accidents	....	....	....	....	....	....
Surface Accidents						
(At surface plants and shops)						
Number Killed or Injured by—						
22. Haulage:						
(a) Hand and animal	....	....	....	....	....	....
(b) Mechanical	....	....	....	1	....	1
23. Railway cars and locomotives	....	....	....	....	....	....
24. Run or fall of ore in or from ore bins	....	....	....	....	....	....
25. Falls of persons	....	....	....	2	2	4
26. Nails and splinters	....	....	....	....	....	....
27. Hand tools, axes, bars, etc.	....	....	....	....	....	....
28. Electricity:						
(a) Direct contact with trolley wire	....	....	....	....	....	....
(b) Tool or bar striking trolley wire	....	....	....	....	....	....
(c) Contact with motor	....	....	....	....	....	....
(d) Others	....	....	....	....	....	....
29. Machinery	....	....	....	....	1	1
30. Other causes:						
(a) Falling objects	....	....	....	....	....	....
(b) Flying objects	....	....	....	1	1	2
(c) Burns	....	....	....	....	....	....

(d) Miscellaneous	....	....	....	1	2	3
Total number killed or injured by Surface accidents	....	....	....	5	6	11
GRAND TOTAL	....	....	....	8	12	20

Average number of men employed at copper mines during 1932 55
Total number of shifts underground 8,810
Total number of shifts on surface 4,571
Total shifts lost on account of all accidents at copper mines .. 385

List of All Accidents Reported from Gold Milling Plants of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Ore Dressing and Milling Accidents						
Number Killed or Injured by—						
1. Haulage system:						
(a) Cars and motors	....	....	....	....	....	....
(b) Mechanical conveyors	....	....	....	....	....	....
2. Railway cars and locomotives	....	....	....	....	....	....
3. Crushers, rolls, or stamps	....	....	....	....	....	....
4. Tables, jigs, etc.	....	....	....	....	....	....
5. Other machinery	....	....	....	2	1	3
6. Falls of persons	....	....	....	....	4	4
7. Suffocation in ore bins	....	....	....	....	....	....
8. Falling objects (rocks, timbers, etc.)	....	....	....	1	....	1
9. Cyanide or other poisoning	....	....	....	....	....	....
10. Scalding (steam or water)	....	....	....	....	....	....
11. Electricity	....	....	....	....	....	....
12. Hand tools, axes, bars, etc.	....	....	....	....	1	1
13. Nails, splinters, etc.	....	....	....	....	....	....
14. Flying pieces of rock from sledging or crushing	....	....	....	....	1	1
15. Other causes	....	....	....	....	....	....
Total number killed or injured at mills	....	....	....	3	7	10
Auxiliary Works Accidents						
Number Killed or Injured by—						
16. Haulage systems, cars, motors etc.	....	....	....	....	....	....
17. Railway cars and locomotives	....	....	....	....	....	....
18. Falls of persons	....	....	....	....	....	....
19. Falling objects (rocks, timber, etc.)	....	....	....	....	....	....
20. Nails, splinters, etc.	....	....	....	....	....	....
21. Hand tools, axes, bars, etc.	....	....	....	....	....	....
22. Electricity	....	....	....	....	....	....
23. Machinery	....	....	....	....	....	....
24. Failure of ladder, scaffold, or other support	....	....	....	....	....	....
25. Handling hot materials	....	....	....	....	....	....
26. Other causes	....	....	....	....	....	....
Total number killed or injured by shop and yard accidents	....	....	....	....	....	....
GRAND TOTAL	....	....	....	3	7	10

Average number of men employed at gold mills during 1932 245
Total number of shifts worked 80,300
Total shifts lost on account of all accidents at gold mills 100

List of All Accidents Reported from Copper Milling Plants of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
Ore Dressing and Milling Accidents						
Number Killed or Injured by—						
1. Haulage system:						
(a) Cars and motors	....	....	....	....	....	....
(b) Mechanical conveyors	....	....	....	....	....	....
2. Railway cars and locomotives	....	....	....	....	....	....
3. Crushers, rolls, or stamps	....	....	....	....	....	....
4. Tables, jigs, etc.	....	....	....	....	....	....
5. Other machinery	....	....	....	....	....	....
6. Falls of persons	....	....	....	....	....	....
7. Suffocation in ore bins	....	....	....	....	....	....
8. Falling objects (rocks, timbers, etc.)	....	....	....	....	....	....
9. Cyanide or other poisoning	....	....	....	....	....	....
10. Scalding (steam or water)	....	....	....	....	....	....
11. Electricity	....	....	....	....	....	....
12. Hand tools, axes, bars, etc.	....	....	....	....	....	....
13. Nails, splinters, etc.	....	....	....	....	1	1
14. Flying pieces of rock from sledging or crushing	....	....	....	....	....	....
15. Other causes	....	....	....	....	....	....
Total number killed or injured at mills	....	....	....	....	1	1
Auxiliary Works Accidents						
Number Killed or Injured by—						

16. Haulage systems, cars, motors etc.	....	....	....	....	....	....
17. Railway cars and locomotives	....	....	....	....	....	....
18. Falls of persons	....	....	....	....	....	....
19. Falling objects (rocks, timber, etc.)	....	....	....	....	....	....
20. Nails, splinters, etc.	....	....	....	....	....	....
21. Hand tools, axes, bars, etc.	....	....	....	....	....	....
22. Electricity	....	....	....	....	....	....
23. Machinery	....	....	....	....	....	....
24. Failure of ladder, scaffold, or other support	....	....	....	....	....	....
25. Handling hot materials	....	....	....	....	....	....
26. Other causes	....	....	....	....	....	....
Total number killed or injured by shop and yard accidents	....	....	...	....	....	....
GRAND TOTAL	....	....	....	....	1	1

Average number of men employed at copper mills during 1932 88
Total number of shifts worked 23,726
Total shifts lost on account of all accidents at copper mills 2

List of Accidents Reported from Quarries of Alaska for the Year 1932, Classified as to Causes and Results

CAUSES	Killed	Permanent total Disability—(A)	Permanent partial Disability—(B)	Temporary Disability (C)		Total Injured
				Time lost more than 14 days	Time lost less than 14 days	
In and About Quarry						
Number Killed or Injured by—						
1. Falls or slides of rock	....	....	....	....	....	....
2. Handling rock at face	....	....	....	....	1	1
3. Timber or hand tools	....	....	....	....	....	....
4. Explosives	....	....	....	....	....	....
5. Haulage	....	....	....	....	....	....
6. Falls of persons	....	....	....	....	....	....
7. Falling objects (other than 1 and 2)	....	....	....	....	....	....
8. Flying objects	....	....	....	....	....	....
9. Electricity	....	....	....	....	....	....
10. Drilling and channeling	....	....	....	....	....	....
11. Machinery	....	....	....	....	....	....
12. Nails, splinters, etc.	....	....	....	....	....	....
13. Boiler and air-tank explosions	....	....	....	....	....	....
14. Burns	....	....	....	....	....	....
15. Other causes	....	....	....	....	2	2
Total number killed or injured in and about quarry	....	....	....	....	3	3

Outside Works

Number Killed or Injured by—						
16. Haulage	....	....	....	....	....	....
17. Machinery	....	....	....	....	....	....
18. Hand tools	....	....	....	....	....	....
19. Nails, splinters, etc.	....	....	....	....	....	....
20. Electricity	....	....	....	....	....	....
21. Falls of persons	....	....	....	....	....	....
22. Falling objects (rocks, timbers, etc.)	....	....	....	....	....	....
23. Flying objects	....	....	....	....	1	1
24. Handling rock by hand	....	....	....	....	....	....
25. Burns	....	....	....	....	....	....
26. Other causes	....	....	....	....	1	1
Total number killed or injured at outside works	....	....	....	....	2	2
GRAND TOTAL	....	....	....	....	5	5

Average number of men employed at quarries during 1932 99
Total number of shifts worked 15,887
Total shifts lost on account of all accidents at quarries 19

LIST OF MINES IN ALASKA

The following list of mining operators in Alaska includes those whose activities have been reported to the office of the supervising mining engineer. The list of placer mining operators is based principally on field investigations carried on during 1929, supplemented by subsequent investigations that have been conducted each year since, with the exception of 1932, when no engineer was available for this work.

ACTIVE LODE MINES AND QUARRIES IN ALASKA

Admiralty Alaska Gold Mining Co., Funter Bay, Alaska.
Alaska Chichagof Mining Co., Chichagof, Alaska.
Alaska-Dano Mines Co., Funter, Alaska.
Alaska Hills Mining Co., Nuka Bay via. Seward, Alaska.
Alaska Juneau Gold Mining Co., Juneau, Alaska.
Alaska Mineral Development Co., Ketchikan, Alaska.
Alaska Windham Gold Mining Co., Windham, Alaska.
Apex-El Nido Mining Co., Juneau, Alaska.
Babcock & Downey, Seward, Alaska.
Bremner Gold Mining Co., McCarthy, Alaska.
Chichagoff Mining Co., Chichagof, Alaska.
Ethel Mining Co., Valdez, Alaska.
Eva Creek Mining Co., Fairbanks, Alaska.
Fern Mining Co., Wasilla, Alaska.
Henry Ford Mine, Fairbanks, Alaska.
Free Gold Mine, Fairbanks, Alaska.
Gold Cord Mining Co., Anchorage, Alaska.
Gold Top Syndicate, Wasilla, Alaska.
Hirst Chichagof Mining Co., Kimshan Cove, Alaska.
High Grade Mine, Wasilla, Alaska.
Hi Yu Mining Co., Fairbanks, Alaska.
Inspiration Point Mining Co., Skagway, Alaska.
Irishman Group, Fairbanks, Alaska.
Kennecott Copper Corporation, Kennecott, Alaska.
Lucky Strike Mine, Hope, Alaska.
Mabel Mine, Wasilla, Alaska.
Marion Twin Gold Mining Co., Wasilla, Alaska.
L. J. McCarty, Fairbanks, Alaska.
McDonald Mine, Fairbanks, Alaska.
Merrill Mining Co., Valdez, Alaska.
Mohawk Mining Co., Fairbanks, Alaska.
Monarch Mining Co., Anchorage, Alaska.
Nabesna Mining Corp., Chitina, Alaska.
Newsboy Development Corp., Fairbanks, Alaska.
Nixon Fork Mine, Medfra, Alaska (Chas. Mespelt).
Oracle Mining Co., Moose Pass, Alaska.
Quigley Mine, Kantishna, Alaska.
Ramsey-Rutherford Mine, Valdez, Alaska.
Rhoads-Hall Mine, Fairbanks, Alaska.
Riverside Mining Co., Hyder, Alaska.
Jess Sanford Mine, Fairbanks, Alaska.
Spaulding Mine, Fairbanks, Alaska.
Sam Stay Mine, Fairbanks, Alaska.

Superior Portland Cement Co., View Cove, Alaska.
Vermont Marble Co., Tokeen, Alaska.
Willow Creek Mines Co., Wasilla, Alaska.
Wyoming Mine, Fairbanks, Alaska.

ACTIVE COAL MINES IN ALASKA

Alaska Premier Coal Corp., Anchorage, Alaska.
Healy River Coal Co., Suntrana, Alaska.
Evan Jones Coal Co., Anchorage, Alaska.
Wishbone Hill Coal Co., Anchorage, Alaska.

PRODUCTIVE OIL WELLS IN ALASKA

Chilkat Oil Co., Katalla, Alaska.

PLACER MINES IN ALASKA EMPLOYING FIVE OR MORE MEN

Dredges

American Creek Dredging Co., Hot Springs, Alaska.
Casadepaga Mining Co., Nome, Alaska.
Chatham Gold Dredging Co., Cleary, Alaska.
Dime Creek Dredging Co., Haycock, Alaska.
Fairbanks Exploration Co., Fairbanks, Alaska.
Dry Creek Dredging Co., Nome, Alaska.
Fairbanks Gold Dredging Co., Meehan, Alaska.
Felder, Gale & Higgins, Takotna, Alaska.
Flume Dredge Co., Takotna, Alaska.
Gibbs & Elson, Takotna, Alaska.
Goldsmith Dredging Co., 824 Old National Bank Bldg., Spokane, Wash.
Hammon Consolidated Gold Fields, Nome, Alaska.
Hastings Creek Dredge Co., Nome, Alaska.
Inmachuk River Dredging Co., Deering, Alaska.
Innoko Development Co., Takotna, Alaska.
Keewalik Mining Co., E. J. Matthews, 1500 1st. Ave., Seattle, Wash.
New York Alaska Gold Dredging Co., 120 Broadway, New York City.
Nome Creek Dredging Co., Fairbanks, Alaska.
North American Dredging Co., Flat, Alaska.
North Star Dredging Co., Council, Alaska.
Northern Alaska Dredging Co., Flat, Alaska.
Ophir Gold Dredging Co., Nome, Alaska.
Osborn Mining Co., Nome, Alaska.
Riley Investment Co., Flat, Alaska.
Spruce Creek Dredging Co., Nome, Alaska.
Tanana Valley Gold Dredging Co., Ltd., Fairbanks, Alaska.

Hydraulic Mines

Alpha Mining Co., Flat, Alaska.
Alaska Kobuk Mines, Inc., Kobuk, Alaska.
American Creek Mining Co., Nome, Alaska.
John Anderson, Miller House via. Circle, Alaska.
John E. Andrus, 1180 N. Broadway, Yonkers, N. Y., or McCarthy, Alaska.
Dick Bauer, Eagle, Alaska.
C. J. Berry, Miller House, Alaska.
C. A. Bryant, Eagle, Alaska.
John E. Carlson, Cantwell, Alaska.
Joe Chesna, Fairbanks, Alaska.

Chicken Mining Co., Flat, Alaska.
Continental Gold Mining Co., Nome, Alaska.
A. V. Cordovado, Nome, Alaska.
J. Dawson, Girdwood, Alaska.
Eldorado Mining Co., Chatanika, Alaska.
F. R. Ferguson, Shungnak, Alaska.
J. R. Frank Co., Hot Springs, Alaska.
S. M. Gaylord, Nome, Alaska.
Chas. Harper, Moose Pass, Alaska.
John Holmgren, Girdwood, Alaska.
Wm. Kashinen, Flat, Alaska.
Frank Knowles, Chicken via. Eagle, Alaska.
Laurin Bros., Nome, Alaska.
Loranger & Co., Flat, Alaska.
Frank McCoy, Haycock, Alaska.
Meier Bros., Takotna, Alaska.
Pete Miscovich, Flat, Alaska.
J. Murray, Talkeetna, Alaska.
Nicolai Placer Mines, McCarthy, Alaska.
Peters Creek Placer Co., Talkeetna, Alaska.
Porter & Abraham, Haycock, Alaska.
Porcupine Mining Co., Haines, Alaska.
Quartz Creek Gold Dredging Co., Candle, Alaska.
E. W. Quigley, Solomon, Alaska.
Rylander & Jorgeson, Haycock, Alaska.
Harry Stevens, Flat, Alaska.
Stewart Bros., Nome, Alaska.
Arne Sundt, Paxson, Alaska.
Eugene Swanson, Rampart, Alaska.
Tillison & L'Heureaux, Hot Sjrings, Alaska.
Geo. J. Waldhelm, Nome, Alaska.
Walker Fork Corp., Jack Wade, Alaska.
A. Zimmerman & Co., Fairbanks, Alaska.

CONTENTS