MR 66-0

THE KANTISHNA REGION

ALASKA

By

JOHN A. DAVIS, SUPERINTENDENT,

Alaska Experiment Station, U. S. Bureau of Mines.

1922

CONTENTS

Contents - Continued.

THE KANTISHNA REGION

ALASKA

By

JOHN A. DAVIS, SUPERINTENDENT,

Alaska Experiment Station, U. S. Bureau of Mines.

INTRODUCTION.

Location.

The Kantishna Region, in the broader sense, includes that portion of interior Alaska lying between the Tanana River on the north, the crest of the Alaska Range on the south, and the 149th and 152d meridians on the east and west respectively, and embodies an area of approximately 10,000 square miles.

Drainage.

The main stream within this area is Kantishna River. It is one of the chief tributaries of the Tanana and empties into that stream about 90 miles above the junction with the Yukon. Two of its principal tribu-

taries, Toklat and McKinley Fork, have their headwaters in the Alaska Range and are supplied from the melting ice fields and glaciers on the northern slopes of these mountains. A third tributary, the Bearpaw, does not reach the high mountains but has its headwaters in the Kantishna hills which lie 15 or 20 miles north of the main range. The eastern portion of the region is drained by Nenana River and its principal tributary from the west, the Teklanika.

Topography.

The northern part of the region contains the broad, flat lowland of the Tanana River, which is about 25 miles wide along the Nenana R iver and increases to 60 miles in width in the western part of the region. In this lowland the surface rises gently from the river to the base of the foothills. It is dotted with lakes and marshes and for the most part is so swampy that travel across it is impossible during the summer months. Flanking the lowlands from the Nenana to the Toklat is a range of foothills. Beyond the Toklat these widen and include the Kantishna hills. A second range of foothills lies south of the first and extends from the Nenana River at the

mouth of Healy Fork to the east fork of the Toklat, where it merges with the main Alaska Range. Between the foothill ranges are broad, open valleys having little relation to the present drainage which crosses them at right angles and pierces the foothills in deep, rock-walled canons.

The Alaska Range between Nenana River and Muldrow Glacier is about 20 miles in width and many of the peaks rise to elevations of 7000 or 8000 feet. Beyond Muldrow Glacier to the west the peaks become higher, culminating in Mount McKinley whose summit rises 20,300 feet above sea level.

Geology.

The Tanana lowlands are covered with Quaternary terrace and stream gravels. The eastern portion of the first range of foothills is composed chiefly of Silurian or Devonian sediments, but the Kantishna hills are carved from the Pre-Ordivician Birch Creek schist. The second range of foothills is flanked on the north by Tertiary coal-bearing sediments which contain the lignite of the Nenana field. The foothills themselves are composed of Birch Creek schists and Paleozoic sediments extensively dis-

[redacted] by considerable masses of intrusive and extrusive igneous rocks. The Alaska Range is composed principally of sedimentary rocks, although west of Muldrow Glacier large areas of granitic rocks are found.

The geology of the region has been covered at length by Capps [a] in Bulletin 687 of the U. S. Geological Survey, to which the reader is

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U. S. Geol. Surv., 687, Washington, 1919.

---

referred for a more detailed description.

MINING DISTRICTS

From the view-point of mining development the most important localities in this region are the Kantishna and Copper Mountain districts. The Kantishna district is situated in the southern part of the Kantishna hills and comprises the area drained by Eldorado, Friday, Eureka and Glen Creeks, which flow into Moose Creek, the principal tributary of the Bearpaw River, and by Glacier and Caribou Creeks which are also tributaries of the Bearpaw. The Copper Mountain district is located on the north slope of the main range near the northern terminus of Muldrow Glacier. In addition some placer mining is carried on at Little Moose Creek, a tributary of Clearwater Fork of the Toklat.

THE KANTISHNA DISTRICT.

Placer Mining.

Placer gold was first discovered in the Kantishna district in 1905. The diggings were shallow and rich and the news of their discovery caused a stampede of several thousand people, chiefly from the Fairbanks district.

But by midwinter it was generally known that bonanza ground was restricted to a few short creeks and by the fall of the following year the population had dwindled to 50 or 60 of the more fortunate who had staked paying claims. The value of placer gold won from this district during the period from 1905 to 1921 is estimated by the U. S. Geological Survey [a] at $480,000.

---

a. Alaska Mining Industry in 1921, Alfred H. Brooks, Bull. U. S. Geol. Surv. 739, page 58.

With the exception of two large-scale hydraulic operations, the Kantishna Hydraulic Co. and the Mt. McKinley Gold Placers, Inc., placer mining in the Kantishna district is conducted at present by individuals, or by partnerships having not more than two or three members, usually without the employment of any additional labor. Mining is carried on in the narrow V-shaped bottoms of the present creeks, the paystreak being narrow and the depth to bedrock rarely more than 10 or 15 feet. The upper portion of the gravel deposits together with any surface muck is customarily removed by "ground sluicing" from an automatic dam, and the

lower 2 or 3 feet of gravel containing the concentrated gold from the entire deposit is shoveled by hand into sluice boxes mounted on low trestles and containing riffles for saving the gold. Where the bedrock is "loose" or shattered and broken one or two feet of the top portion is also shoveled in with the gravel.

Various types of riffles are used, depending upon individual preference of the miner, the pole and the Hungarian types being the favorites. The gold is usually coarse and the recovery is therefore relatively high.

The automatic dams are provided with a spillway and a flexible gate. Attached to the gate is a lever having a counterweight and a wooden box which becomes filled with water when the level behind the dam reaches a predetermined height. The weight of this water opens the gate abruptly, loosing a flood through the spillway. When the pond above the dam is emptied, the gate closes and the operation is repeated automatically at intervals, depending upon the amount of water flowing down the creek.

During the season of 1922 there were 12 individuals or partnerships engaged in placer mining in the Kantishna district. They were: Peter Liesh

on Friday Creek; Weisel and Ferraris at claim 10 above, and Peter Nelson at claim 13 above discovery on Eureka Creek; Faulkner and Appelle on Rainy Creek; Dan Badavinac at claim 6 above, and Dan Keeler at claim 13 above discovery on Glen Creek; Standall and Lillidale on the right fork of Glen Creek; Chas. Trundy on the left fork of Glen Creek; Sutherland and Le Claire on Spruce Creek; John Lee at claim 14 above and William Sborgia at claim 22 above discovery on Glacier Creek; and Andrew Ness on 22-pup of Glacier Creek.

The largest area of bedrock cleaned at any of these operations was 20,000 square feet, from which approximately $5000 was recovered. The other operations were much smaller than this, ranging from 1500 to 4000 square feet with recoveries of $300 to $1000.

Kantishna Hydraulic Mining Co. K+66-13

T he Kantishna Hydraulic Mining Co. owns approximately 890 acres of placer ground on Moose Creek, embraced in 45 claims, extending from a short distance above Eureka Creek to 1½ miles below Friday Creek. The claims were located at various times from 1905 to 1920 and none are patented.

Moose Creek is one of the larger tributaries of Bearpaw River and has a gradient of 227 feet in three miles at the property. Its valley is 2000 to 2500 feet in width and the sides are abrupt. The creek flows through a narrow canon about two miles above Eureka Creek and there is a second canon at the lower end of the property. Water for hydraulic operations can be had from Moose Creek which carries from 1500 to 3000 miners' inches, and from Wonder Lake, the outlet of which joins Moose Creek 1½ miles above the property. This lake is about 3½ square miles in area, and the water is impounded by a dam five feet high. It is believed that the lake derives its water chiefly from underground seepage. An additional 5000 or 6000 miners' inches could be brought to Wonder Lake from McKinley Fork at an estimated cost of $125,000, ~~but since~~ It would have to be taken from within the boundaries of Mt. McKinley National Park, ~~such a course would not be permitted except by special enactment of Congress.~~

The property is underlain by a false bedrock at a depth of eight feet below the bottom of the creek. The distance to true bedrock is not known, although a shaft which was drowned out at a depth of 50 feet is thought to

have been very close to it. The paystreak is from 400 to 600 feet in width/ which preliminary estimates placed at fifty cents per square foot. Gravels of lower value which, it is estimated, carry from eight cents to ten cents per square foot extend beyond this on either side. Some gold is found distributed all through the gravel, although the richer ~~values are~~ ground is found near the false bedrock. Large boulders are rare, the maximum being 400 or 500 pounds.

Preparatory work at this project included the construction of a dam at the outlet of Wonder Lake, a ditch 12,000 feet long, two to six feet deep, five and a half to six feet wide at the bottom and six to eight feet wide at the top, and an inverted siphon across Willow Creek 268 feet long, 41 feet high on the intake and 31 feet high on the discharge end.

The pipe line consists of 4000 feet of riveted steel pipe tapering from 26 inches to 18 inches in diameter, together with 1300 feet of side lines and feeders tapering from 14 inches to 9 inches in diameter. There are 5 giants, using 3, 3½ and 4 inch nozzles interchangeably. The effective head is 259 feet.

The cost of the claims is reported at $33,000; the dam $300; the ditch, including the trestle for the siphon, $9,700; and the pipe lines, including the siphon, $19,500.

Approximately 50,000 square feet of bedrock were cleaned during 1922, which was the first season of operation at this property. The gravel was piped over the side of the sluice boxes which were 30 inches wide, 20 inches deep and had a slope of 9 inches in 12 feet. The upper boxes of the string were fitted with riffles made of iron boiler tubes and the lower boxes had iron plates perforated with ¾-inch holes. The gold recovery was disappointing as it fell considerably below the estimated value of the ground. The mining methods employed at this property is described by Norman L. Wimmler as follows:—

(Quote pp 19 & 20 Wimmler report)

Mount McKinley Gold Placers, Inc.

KX 66-14

The Mount McKinley Gold Placers, Inc., owns all the claims on Caribou Creek from the mouth to one mile above Crevice Creek; all the first tier, left limit, bench claims on Glacier Creek from discovery to 14 above; and approximately 400 acres on the divide between Glacier and Caribou Creeks. The claims were located at various times from 1905 to 1920 and none are patented.

Caribou Creek has its headwaters on the north and west slopes of Kankone Peak in the Kantishna hills and flows west for approximately ten miles, then north for seven or eight miles, emptying into the Bearpaw near the town of Glacier. On its westerly course it is joined at intervals of one to two miles by Crevice, Last Chance, Snowshoe and Rex Creeks in the order named, all of them flowing into the main creek from the south. After Caribou Creek turns to the north it has no important tributaries from either side.

Glacier Creek has its headwaters on the north and west slopes of Glacier Peak, which is situated about five miles southwest of Kankone Peak, flowing west for two or three miles and then north for ten miles, emptying into the Bearpaw near the mouth of Caribou Creek. The distance between Glacier and Caribou Creeks varies from two to three miles.

The gradient of Caribou Creek at the upper end of the property is approximately 150 feet per mile, but after it turns to the north the gradient is about 75 feet to the mile. The valley floor averages 1500 feet in width and in the upper portion of the creek the valley walls are steep and

abrupt, somewhat more so on the right limit than on the left, but where the stream flows on a northerly course the sides are low and equally gently sloping. There are three canons or constrictions in the valley of the creek, one near the center of the property, one at Rex Creek and one at Last Chance Creek.

Water for hydraulic operations is taken from Caribou Creek, which has a flow of perhaps 100 cubic feet per second in wet seasons and 25 cubic feet per second in dry seasons, the average being 50 cubic feet per second.

The depth to bedrock in Caribou Creek varies from two feet at the head to twelve or fourteen feet near the mouth. On the benches the depth is unknown; two holes on the Glacier Creek side failed to reach bedrock at 46 and 52 feet respectively. The paystreak is not well defined and the deposit is spotty. The value of gold near the mouth of Snowshoe Creek is estimated at seventy-five cents per cubic yard in the center of the deposit, with some 20¢ and 25¢ ground on either side. Seventy-five percent of the values are found at or near the surface of bedrock. Boulders as large

as one cubic yard are frequently met with and are a serious handicap to mining operations.

The hydraulic plant includes 450 feet of ditch, 460 feet of flume which is 4 feet wide and 2 feet deep, and 4000 feet of riveted steel pipe tapering from 36 inches to 9 inches in diameter. The dam at the intake near Crevice Creek is 200 feet long and 8 feet high. Three nozzles are used, two being 4 inches and the other 5 inches in diameter. The smaller ones are used for driving and the larger for stacking tailing. The effective head at Rex Creek is 150 feet.

The cost of the claims is reported to average $500 per 20-acre claim. The pipe line and nozzles cost $22,000 in Seattle and weighed 77 tons. Figures for the cost of the dams and flume were not available.

During 1922, which was the first season of operation, approximately 70,000 square feet of bedrock were uncovered. The gravel was piped into the end of the boxes, which were 4 feet wide and 2 feet deep and had a slope of 4 inches in 12 feet. Cottonwood block riffles were used. The low gradient of the boxes, although it was the maximum obtainable, caused

great difficulty in mining. As a result preparations were being made at the end of the season to pipe the gravel over the side of the boxes during the coming year and obviate this trouble. No data could be obtained as to the amount of gold recovered except that it was somewhat disappointing.

Lode Mining.

Lode mining development in the Kantishna district centers in Quigley Hill, as the main ridge between Friday and Eureka Creeks has been named in honor of Joseph B. Quigley, the pioneer "quarts" prospector of the district. The mineralized zone found in this hill has been traced beyond Glacier Peak to the east, a distance of 8 or 10 miles, and for about 5 miles to the southwest across Moose Creek along the divide between Eldorado Creek and Bear Creek.

Quigley Hill.

Red Top Claim. 1766-15

One of the most important claims on Quigley Hill is the Red Top, which lies across a spur that slopes toward the mouth of Friday Creek from the western end of the hill. The claim trends N. 70° E., and its center

lies along the crest of the spur; the western half extends down a steep slope toward Moose Creek and the eastern half extends along the more gentle slope of Friday Creek valley.

The vein on the Red Top claim occupies a fault fissure in a country rock of Birch Creek schist. It ranges from 4 to 10 feet in width, the vein matter being chiefly quartz with shoots containing galena, zinc blende, arsenopyrite and occasionally tetrahedrite, together with the oxidation products of these minerals. The ~~clean-cut~~ hanging wall is quite distinct and both slickensides and gouge are present. ~~While~~ the reverse is usually true in regard to the foot wall ~~and~~ which shows replacement of the schist by vein matter. The sulphides ~~carry high values in silver and some gold,~~ particularly those of lead and copper, carry a high silver content and some gold, ~~particularly the sulphides of lead and copper.~~ They are usually segregated in a band or seam varying in width from 5 or 6 inches to as much as 3 feet, and at some places are found near the hanging wall and at others near the foot wall of the vein. Where weathered the quartz is stained with oxides of iron and often contains free gold which may be detected by panning.

At the time the claim was visited by the writer in September, 1922, the development work consisted of a series of open cuts and a tunnel 300 feet long. The open cuts extend southwesterly along the outcrop of the vein from the discovery stake which is situated about half way up the steep slope mentioned above. The tunnel near the bottom of the slope starts at a point about 150 feet from the west end line of the claim.

The discovery cut disclosed something over nine feet of vein matter, although the full width may not have been exposed. The vein consisted of two bands of mineralized quartz each about three feet in width, separated by a band of practically solid galena and oxidized products of galena also about three feet in thickness. A sample taken by the writer across the galena bearing portion assayed 0.28 ounces of gold, 57.6 ounces of silver and 12.8 percent lead. The quartz portion also carries some [redacted] gold and silver.

A second open cut, 50 feet southwesterly from discovery, shows four feet of galena or its oxidization products. An interesting feature of this

open cut is the occurrence of a considerable amount of what is apparently free sulphur, which will ignite with a match and burn with a characteristic blue flame and odor.

A third cut, 80 feet southwesterly from discovery, shows vein matter in place, but at the time of the visit it had caved in so that it was inaccessible.

A fourth cut, about 150 feet from discovery, was also inaccessible but a fifth cut, at 220 feet, showed 15 inches of galena which is said to have assayed $275 per ton in combined gold and silver. The full width of the vein could not be determined at this point.

The tunnel, which starts at a point 255 feet S. 75° W. from the discovery stake, follows a course of N. 80° E. for 18 feet, thence N. 88° E. for 27 feet. The vein in this portion of the tunnel dips 65° S. and is 6 or 7 feet wide although the footwall is not well defined. It contains a band of galena, or the oxidation products of galena, about 3 feet wide, lying near the hanging wall. The remainder of the vein consists of iron stained quartz containing some galena and carbonates of lead.

The vein divides at a point 45 feet from the portal, one branch swinging to the south, the other slightly to the north along a course of N. 77° E., which the tunnel follows for 22 feet. This branch of the vein is about 3 feet wide at the beginning and contains a considerable amount of galena and carbonates, but it soon narrows to 18 inches or less and the lead ores disappear, leaving only iron stained quartz. For this reason the tunnel turns through the schist country rock on a course of S. 45° E. to meet the other branch of the vein, which it intersects at a distance of 16 feet.

It then follows this branch, which contains a band of galena 5 or 6 inches wide occurring near the foot wall and dipping 75° S., for a distance of 28 feet along a course of N. 83° E., after which it turns on a course of S. 82° E. for a distance of 28 feet in an effort to find the hanging wall of the vein. A crosscut has been driven 5 feet due south at a point 9 feet from the beginning of this course and a well defined wall having a vertical dip was found. Two small stringers, having a strike of N. 55° E. with a vertical dip and consisting mainly of quartz but containing some

arsenopyrite, melanterite and free sulphur are exposed in the crosscut. They intercept the main vein but do not cross it.

From the end of the course the tunnel runs N. 59° E. for 21 feet, being driven partly through quartz vein matter which dips 65° N. and partly through schist country rock. At the end of the course the vein dips 80° S. At this point a crosscut has been driven 26 feet in a northwesterly direction. The vein matter in the crosscut is mainly quartz with arsenopyrite, some galena and a small amount of zinc blende. A short crosscut was also driven 5 feet in a southeasterly direction.

The tunnel then follows a narrow seam of gouge 1½ to 2 inches in width along a course of N. 84° E. for 35 feet, and at the end of the course a crosscut has been driven 6 feet in a southeasterly direction disclosing 30 inches of white quartz containing bunches of schist the size of a football. A flat fault, the plane of which strikes N. 50° W. and dips 10° S.W., first appears in the floor of the tunnel at this point, the vein above the fault apparently having been displaced a short distance to the north.

The tunnel continues N. 48° E. for 11 feet where another crosscut has been driven to the south for 7 feet and at the end a winze started which was 12 feet deep at the time of examination (Sept. 1922).

From the winze crosscut the tunnel runs N. 41° E. for 18 feet, keeping the gouge marker on the north wall, and then N. 67° E. for 26 feet. At the end of the course the roof of the tunnel consists of vein matter lying below the fault plane; and a gouge marker, which is believed to be the same one previously followed, appears on the south wall of the tunnel. The dip at this point is 83° S.

The tunnel continues for 26 feet on a course of N. 53° E., with the gouge marker forming the south wall. At a distance of 14 feet on this course a crosscut has been driven to the north across 8 feet of mineralized white quartz and 4 feet of crushed black schist containing quartz stringers.

At the end of the course the tunnel divides, one branch continuing N. 43° E. for 7 feet where a fault plane was encountered which strikes N. 89° W. and dips 55° N. This branch of the tunnel continues through the

crushed schist for 20 feet beyond the fault. The other branch runs S. 75° W. for 13 feet and N. 58° E. for 14 feet until it also encounters the fault plane.

Thirty seven samples were taken by the writer from the untimbered portion of the Red Top tunnel. Eight samples from the timbered portion, which includes the first 67 feet of the tunnel, were taken by Mr. Quigley at the time the timbering was placed. The assay returns of these samples which are lettered A to H inclusive, to distinguish them from the numbered samples taken by the writer, are given here because they indicate the values in a portion of the tunnel that could not be sampled at the time the mine was examined. All assays were made at the Alaska station of the U. S. Bureau of Mines.

Sample A was taken across 5 feet of vein matter in the top of the tunnel at a point 10 feet from the portal.

Sample B was taken across 5 feet of vein matter in the top of the tunnel at a point 15 feet from the portal.

Sample C was taken across 5 feet of vein matter in the top of the

23

tunnel at a point about 20 feet from the portal.

Sample D was taken across 3 feet of vein matter in the top of the tunnel at a point about 25 feet from the portal.

Sample E was taken across 3 feet of vein matter in the top of the tunnel at a point about 30 feet from the portal.

Sample F was taken across 3 feet of vein matter in the top of the tunnel about 35 feet from the portal.

Sample G was taken across 3 feet of vein matter in the top of the tunnel at a point about 45 feet from the portal.

Sample H was taken across 18 inches of vein matter at a point about 55 feet from the portal.

Sample No. 1 was taken across 24 inches of quartz vein matter in the roof of the tunnel at the end of the timbering 65 feet from the portal.

Sample 2 was taken across 8 inches of gouge containing galena and lead carbonates lying on the hanging wall of the southern branch of the vein where it is first intersected by the tunnel at a point approximately 80 feet from the portal.

Sample 3 was taken across 24 inches of quartz immediately adjacent to sample 2.

Sample 4 was taken across 22 inches of white quartz ledge matter with gouge on both sides in the roof of the tunnel at a point 90 feet from the portal.

Sample 5 was taken across the width of the vein, which consisted of 30 inches of shattered white quartz, in the roof of the tunnel at a point 100 feet from the portal.

Sample 6 was taken across 20 inches of pulverized quartz in the roof of the tunnel at a point 110 feet from the portal.

Sample 7 was taken across 10 inches of gouge immediately adjacent to sample 6.

Sample 8 was taken across 22 inches of ground quartz in the main vein, near the intersection of two small quartz stringers exposed in a crosscut on the south side of the tunnel, at a point 120 feet from the portal of the tunnel.

Sample 9 was taken across 18 inches of heavy dark sulphides and quartz lying immediately north of sample 8.

Sample 10 was taken across 24 inches of quartz vein matter in the roof near the north wall of the tunnel at a point 130 feet from the portal.

Sample 11 was taken across 24 inches of quartz containing pyrite in the roof of the tunnel at a point 140 feet from the portal.

Sample 12 was taken across 12 inches of gouge containing melanterite in the roof of the tunnel at a point 150 feet from the portal.

Sample 13 was taken across 30 inches of quartz vein matter in the roof of the south crosscut at a point 160 feet from the portal.

Sample 14 was taken across 48 inches of quartz vein matter containing some pyrite in the roof of the main tunnel between the two crosscuts at a point 160 feet from the portal.

Sample 15 was taken across 5 feet of country rock impregnated with quartz and some pyrite on the west wall of the north crosscut immediately adjacent to sample 14.

Sample 16 was taken across 5 feet of impregnated country rock on the west wall of the crosscut starting at the north end of sample 15.

Sample 17 was taken across 5 feet of schist on the west wall of the crosscut starting at the north end of sample 16. The schistose character of the rock is very pronounced and numerous small stringers of quartz one-half to three inches thick cutting across the schistosity are very noticeable.

Sample 18 was taken across 5 feet of schist on the west wall of the crosscut starting at the north end of sample 17. Two stringers of quartz 4 and 6 inches wide are included in the sample.

Sample 19 was taken across 39 inches of white and slightly iron stained quartz containing some pyrite adjacent to the north end of sample 18; a well defined wall having a strike of N. 80° E. and a dip of 40° S. was observed at the north end of the sample.

Sample 20 was taken across 36 inches of quart z vein matter containing some sulphides in the roof of the tunnel at a point 170 feet from the portal. A 2-inch gouge marker occurs 12 inches from the north end of the sample.

Sample 21 was taken across 44 inches of white quartz south of the gouge marker which forms the north wall of the tunnel at a point 180 feet from the portal.

Sample 22 was taken across 12 inches of white quartz vein matter south of the gouge marker which forms the north wall of the tunnel at a point 190 feet from the portal. Two feet of schist lying south of the quartz vein were not sampled.

Sample 23 was taken across 30 inches of white quartz containing bunches of schist the size of a football on the east wall of a south cross cut at a point 195 feet from the portal of the tunnel.

Sample 24 was taken across 8 inches of gouge and 16 inches of heavily iron stained quartz in the roof of the tunnel, at a point 200 feet from the portal of the tunnel. The gouge contains free sulphur.

Sample 25 was taken across 8 inches of black gouge on the west wall of the winze 8 feet below track level.

Sample 26 was taken across 36 inches of quartz vein matter on the west wall of the winze adjacent to sample 25. A thin gouge seam defined

the southern limit of the sample.

Sample 27 was taken across 44 inches of shattered quartz and gouge in the roof of the tunnel at a point 210 feet from the portal.

Sample 28 was taken across 36 inches of crushed quartz and gouge in the roof of the tunnel at a point 220 feet from the portal.

Sample 29 was taken across 40 inches of crushed vein matter in the roof of the tunnel above the flat fault plane at a point 230 feet from the portal.

Sample 30 was taken across 35 inches of ground up vein matter in the roof of the tunnel just above the fault plane at a point 240 feet from the portal.

Sample 31 was taken across 34 inches of hard white quartz containing a streak of gray sulphides in the roof of the tunnel below the horizontal fault at a point 250 feet from the portal. A gouge marker one-half inch thick forms the south wall of the tunnel.

Sample 32 was taken across 30 inches of quartz vein material in the roof of the tunnel beginning with the gouge marker which forms the south

wall at a point 260 feet from the portal.

Sample 33 was taken across 4 feet of iron-stained quartz on the west wall of the crosscut beginning at the north end of sample 32.

Sample 34 was taken across 4 feet of iron-stained quartz on the west wall of the crosscut beginning at the end of sample 33. The north end of the sample terminates in a well defined fissure showing gouge and lying roughly parallel to the main vein.

Sample 35 was taken across 4 feet of schist along the west wall of the crosscut immediately adjacent to sample 34.

Sample 36 was taken across 36 inches of vein matter in the roof of the tunnel at a point 270 feet from the portal. The 16 inches of the sample adjacent to the gouge marker which forms the south wall of the tunnel contained a large amount of pyrite. The remainder was iron-stained white quartz.

Sample 37 was taken across 5 feet of vein matter in the roof of the tunnel at a point 280 feet from the portal. The 12 inches of the sample adjacent to the gouge marker on the south wall of the tunnel contained a large amount of pyrite. The remainder of the portion sampled was white quartz.

The following table shows the results of the assay of these samples:

ASSAYS OF SAMPLES FROM RED TOP TUNNEL

Sample	Width Sample	Distance from Portal of Tunnel	Ounces per ton Gold	Ounces per ton Silver	Total Value (See note below)
A	3.0 feet	10 feet	1.66	1717.10	$ 1755.55
B	3.0 "	15 "	1.94	828.60	868.70
C	3.0 "	20 "	1.72	632.30	667.85
D	3.0 "	25 "	1.28	661.20	687.66
E	3.0 "	30 "	0.58	689.00	699.99
F	3.0 "	35 "	1.96	735.70	776.21
G	3.0 "	45 "	0.80	237.70	254.24
H	3.0 "	55 "	0.14	0.10	2.99
1	2.0 "	65 "	0.06	0.20	1.44
2	2.0 "	80 "	trace	0.60	0.60
3	0.7 "	80 "	0.20	80.60	84.73
4	1.8 "	90 "	0.08	1.20	2.85
5	2.5 "	100 "	0.06	0.40	1.64
6	1.7 "	110 "	0.10	0.20	2.27
7	0.8 "	110 "	0.04	0.20	1.03
8	1.5 "	120 "	0.24	0.80	5.76
9	1.8 "	120 "	trace	0.10	0.10
10	2.0 "	130 "	0.08	0.40	2.05
11	2.0 "	140 "	0.15	0.60	3.70
12	1.0 "	150 "	0.09	0.60	2.46
13	2.5 "	In c.c.at 160	0.12	44.60	47.08
14	4.0 "	160 feet	trace	0.20	0.20
15	5.0 "	In c.c.at 160	0.20	0.40	4.53
16	5.0 "	"	0.18	0.30	4.02
17	5.0 "	"	0.06	0.20	1.44
18	5.0 "	"	0.04	0.20	1.03
19	3.5 "	"	0.04	0.20	1.03
20	3.0 "	170 feet	0.36	1.20	8.64
21	3.7 "	180 "	0.28	11.30	17.09
22	1.0 "	190 "	0.14	5.20	9.09
23	2.5 "	In c.c.at 195	1.74	6.40	42.37
24	2.0 "	200 feet	0.08	1.20	2.85
25	0.7 "	In winze at 205	0.04	0.10	0.93
26	3.0 "	"	0.12	10.50	12.98
27	3.7 "	210 feet	0.06	1.60	2.84
28	3.0 "	220 "	0.14	2.40	5.29
29	3.3 "	230 "	0.16	13.50	16.81
30	2.9 "	240 "	0.44	6.00	15.10
31	2.8 "	250 "	0.14	1.40	4.29
32	2.6 "	260 "	0.24	3.50	8.46

Note: Calculated on the basis of gold at $20.67 per ounce and silver at $1 per ounce.

Assays of samples from Red Top tunnel - Continued.

Sample	Width Sample	Distance from Portal of tunnel	Ounces per ton Gold	Silver	Total value.
33	4.0 feet	In cs. at 260	0.10	0.20	$ 2.27
34	4.0 "	"	0.04	0.10	0.93
35	4.0 "	"	trace	0.10	0.10
36	3.0 "	270 feet	0.44	1.30	10.40
37	5.0 "	280 "	0.52	1.60	12.35

Approximately five tons of high grade ore, secured while driving the first 50 feet of the tunnel, had been sorted and sacked for shipment and the dump contains approximately 600 tons which it is estimated has a value of $15 to $20 per ton. A grab sample of the sacked ore, taken by Mr. Livingstone Wernecke, and assayed at Juneau, showed 1.24 oz. of gold and 243.1 oz. of silver per ton.

In September, 1922, Mr. Hawley Sterling of Fairbanks obtained a lease to mine the high grade ore shoot near the portal of the tunnel and on January 1, 1923, had taken out approximately 50 tons of ore delivered to Kobe averaging over $200 per ton. The ore mined under the lease will be hauled to the Alaska Railroad at Kobe (Mile 387) and shipped to the smelter by way of Seward.

Hillside or Silver King Claim.

An extension of the Red Top claim has been located to the west along the bench above Moose Creek. The Red Top vein was exposed in the bottom of a 40-ft. shaft ~~which~~ that was sunk just beyond the west endline of the Red Top claim. The vein at this point was from 5 to 6 feet wide and carries sulphides of lead and copper in a quartz gangue.

The ownership of this ground is at present in litigation, one of the claimants calling it the Hillside and the other claimant the Silver King.

What is thought to be a further extension of the Red Top ledge was exposed in 1921 in an open cut made by ground sluicing on the steep hillside above Moose Creek on the opposite side from the Red Top claim. At the time the district was visited by the writer a slide of debris, loosened by the water used in ground sluicing, had completely refilled the cut making it impossible to secure any detailed data as to this exposure.

Galena Claim. #166-16

The Galena claim lies along the western end of Quigley Hill about 2000 feet south of the Red Top and adjoins the Frances claim on the east. The principal developments on this claim are a tunnel near the discovery stake and an open cut about 300 feet to the northeast.

The tunnel is driven through schist country rock for a distance of 30 feet until it intersects a vein which it follows for 30 feet. The vein is 8 or 9 feet wide, consisting chiefly of highly iron-stained quartz which contains galena, arsenopyrite, zinc blende, and some tetrahedrite. These sulphides occur in a band about 12 inches thick near the hanging wall, which is well defined. The foot wall, however, gradually merges into the schist country rock. The strike of the vein is approximately N. 45° E., the dip 65°-70° S.E. A shallow winze a few feet from the breast was inaccessible at the time this claim was visited.

The open cut lying northeast of the tunnel shows a quartz vein about a foot in width containing tetrahedrite and chalcopyrite. The strike of this

vein is N. 45° E. with a nearly vertical dip. Between 50 and 100 tons of ore ~~have been mined~~ driven have been mined partly from the tunnel and partly from the open cut, and shipped to the smelter at Selby, California.

Lucky Strike Claim. RT 66-15

The Lucky Strike claim lies about 1500 feet southeast of the Galena claim along a bench in the angle between Moose and Eureka Creeks. The claim trends northeast.

Two veins have been discovered on the Lucky Strike claim in the bluff overlooking Moose Creek. A tunnel has been driven along the strike of one of these veins which is N. 59° E. The vein, which dips 84° S, is exposed for 20 feet above the tunnel and shows at least 6 feet of quartz between schist walls. The hanging wall is highly silicified. A sample of this vein next the foot wall, consisting of highly mineralized quartz and thought to be the richest portion, shows .04 ounces of gold and 6.40 ounces of silver per ton. A sample of the next 3 feet of the vein shows .05 ounces of gold and 10.00 ounces of silver per ton. The vein is reported to carry ~~values~~ valuable minerals beyond this width but a sample could not be obtained.

The second vein has been exposed in two open cuts about 40 feet apart and lying 125 feet north of the tunnel just mentioned. They show a strong quartz vein, well mineralized, and probably about 8 feet wide, although the cuts were so badly caved that the width could not be accurately determined, nor could a representative sample be secured. A number of pieces of vein matter that were broken off at random ~~and showed~~ averaged .04 ounces of gold and 1.40 ounces per ton in silver. The samples were taken by Mr. John Gross, metallurgist of the Bureau of Mines.

Silver Pick No. 2 Claim. K-66-15

The Silver Pick No. 2 claim lies northeast of the Lucky Strike and several hundred feet higher on Quigley Hill. ~~Its side line is nearly parallel with the side line of the Frances which it overlaps. It has a common end line with the Silver Pick claim on the east.~~

At discovery, which is 400 feet from the east end of the claim, a shaft 12 feet deep showed 6 or 7 feet of iron stained quartz and calcite. The shaft was caved at the time of the visit and no samples were taken for assay.

An open cut near the northeast corner of the claim showed 3 feet of iron stained quartz. A sample taken by Mr. Gross at this point assayed .14 oz. of gold and .10 oz. of silver per ton. The strike of the vein is N. 88° E. and the dip 63° N.

Frances Claim. K46-15

The Frances claim lies between the Galena on the west, the Little Maud on the east, the Martha Q. on the north and the Silver Pick No.2 on the south.

Development on the Frances claim consists of a tunnel 75 feet in length, the first 40 feet of which is timbered, and a series of open cuts on the surface extending along the strike of the vein which is N. 55° E. As exposed in the tunnel the vein varies from 12 to 40 inches in width. It dips to the south at an angle of 65°. The vein matter in the tunnel is chiefly white quartz carrying gold and silver, but at discovery cut, near the east end line of the claim, some copper sulphide was observed. The open cuts were filled with material which had caved from the sides, hence no information could be obtained about the vein other than that indicated by the small dumps

produced when the cuts were excavated. A series of samples taken by Mr. Gross across the total width of the vein at five-foot intervals in the tunnel gave the following assays:

Sample number	Ounces per ton Gold	Silver
1	.02	.50
2	.01	.10
3	trace	.20
4	.06	1.00

Sample No. 1 includes 24 inches across the floor of the tunnel at the end of the timbering, 40 feet from the portal, and 12 inches across the roof at the 45-ft. station.

Sample No. 2 includes 18 inches across the roof at the 50-ft. point and 12 inches across the roof at the 55-ft. point.

Sample No. 3 includes 22 inches across the roof at the 60-ft. point and 30 inches across the roof at the 65-ft. point.

Sample No. 4 includes 38 inches across the roof at the 70-ft. point and 40 inches across the face at the 75-ft. point.

The ore in the Frances tunnel appears to be very spotted to very greatly from place to place, however, and samples taken by the lessee of this property in 1919-20 gave much better returns than this, some of them running as high as $35 per ton in gold and silver.

Martha Q. Claim. K 66-15

The Martha Q. claim lies between the Frances and the North Star.

A shallow shaft near the northwest corner of the claim has exposed a narrow vein, consisting chiefly of galena, having a strike of N. 16° W. and a dip of 56° E. A sample taken by Mr. Gross across 6 inches of this vein assayed .08 oz. in gold and 284.20 oz. in silver per ton. Several tons of ore were shipped from this claim in 1920-21, being added to the ore from the Gold Dollar claim which is described below.

North Star Claim. K 66-18

The North Star claim adjoins the Martha Q. and overlaps a small part of the Red Top.

An open cut in the southwestern part of the claim disclosed a 6-inch stringer containing galena and zinc blende from which a sample is reported to have assayed 60 ounces per ton in silver.

Friday Claim. K66-15

The Friday claim lies north of the Martha Q. and Polly Wonder claims. It has a common end line with the North Star claim on the west.

Development work consists of a number of open cuts ~~which~~ that were excavated in ~~the~~ an effort to discover an extension of the Red Top vein. Although encouragement has been received from the finding of rich float in the debris of the hill, solid bed-rock was not reached in any of these cuts.

Polly Wonder Claim. K66-19

The Polly Wonder claim adjoins the Martha Q. on the east, with a common end line, and lies between the Friday and Little Maud claims. An open cut 100 feet southwest of discovery exposed 8 feet of iron stained quartz in which free gold can be detected by panning. The ore also contains a small amount of galena. The strike is approximately due east with a dip of 65° or 70° to the south.

Little Maud Claim. KKbb-15

The Little Maud claim lies between the Polly Wonder on the north, the Silver Pick on the south, and has a common end line with the Frances on the west, with the Little Annie on the east.

At discovery, which is near the west end line and but a few feet from the discovery on the Frances, the open cut showed a quartz vein 18 inches wide carrying some tetrahedrite. The strike of the vein is approximately N. 55° E. with a dip to the south of 60° or 70°.

Silver Pick Claim. KKbb-15

The Silver Pick claim adjoins the Little Maud on the south and has a common end line with the Silver Pick No. 2 on the west.

The Silver Pick claim is developed by a number of open cuts and by a cross-cut tunnel 190 feet long which starts on the Little Maud claim. The first 25 feet of the tunnel is timbered and its course is S. 30° E. It intersects three veins, the first directly at the portal, the second at a distance of 55 feet and the third at a distance of 165 feet.

The first vein, which is composed chiefly of quartz carrying free gold and some galena, is also exposed in an open cut 100 feet southwest of the tunnel. It is 3 feet in width. The strike is N. 50° E. and the dip 70° S. A sample taken in the tunnel by Mr. Gross showed .03 oz. of gold and 5.70 oz. of silver per ton.

The second vein shows 6 feet in thickness where it crossed the tunnel on a strike of N. 30° E. with a dip of 65° N.W. The vein matter consists of rusty quartz containing numerous bunches of galena, some pyrite and a considerable amount of zinc blende. According to Capps[a] a picked

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S.Geol.Surv. 687, Washington, 1919, page 102.

---

sample of the galena assayed 100 oz. of silver per ton. A sample taken by Mr. Gross across 6 feet of the vein along the north wall of the tunnel showed .06 oz. of gold and 10.00 of silver per ton. This vein is also exposed in an open cut 125 feet south of the tunnel portal.

The third vein, as described by Capps[a] "consists of one foot of

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S.Geol.Surv.687,page 105. Washington,1919.

---

calcite on the footwall and 12 feet of quartz and schist, more or less sheeted, the quartz predominating in bulk over the country rock. Little galena is seen in the tunnel, but it is abundant along the surface crop of the vein. The whole zone is brecciated and leached, and large open cracks extend from the tunnel to the surface. Pyrite, arsenopyrite, and small amounts of galena and sphalerite were observed, and along some of the cracks deposits of a soluble salt, which on analysis proved to be the iron sulphate melanterite, were found". A sample taken by Mr. Gross across 12 feet of the vein along the south wall assayed .05 oz. of gold and .10 oz. of silver per ton. It is quite likely, however, that this sample is not representative, because there are unquestionable evidences of leaching at the point where the sample was taken. The strike of the vein as determined by survey between its exposure in the tunnel and in an open cut on the top of the hill 200 feet distant is N. 65° E. The dip, measured in the tunnel, is S. 67° E.

Darling Claim. K+66-15

The Darling claim adjoins the Silver Pick on the east, having a common end line, and is south of the Little Annie claim.

The discovery cut, near the center of the claim, disclosed a ledge of iron stained quartz one foot wide, in which a small amount of pyrite was observed. It is quite probable that the large vein exposed in the Silver Pick tunnel crosses the Darling claim but the work on this claim has as yet failed to expose it.

Little Annie Claim. K+66-15

The Little Annie claim is located on the north side of Quigley Hill. It lies between the Little Maud claim on the southwest and the Little Annie No. 2 on the northeast, having common end lines with both these claims. It is partially overlapped by the Gold Dollar claim on the north.

An open cut on the crest of a spur jutting out from the main hill towards Friday Creek discloses a vein of quartz 13 feet wide, having a strike of N. 58° E. and a steep dip to the SE. The ore for the most part is free milling and strongly oxidized, although some galena was noted near the hanging

wall of the vein. Slickensides indicating a horizontal movement along the strike were observed. A sample taken by Mr. Gross across the full width of the vein assayed 0.28 oz. of gold and 4.90 oz. of silver per ton.

The same vein is also exposed in a second cut 60 feet southwest of ~~discovery~~ and a sample taken by the writer across 10 feet of ledge matter at this point assayed 0.24 oz. of gold per ton and 7.00 of silver per ton.

The principal development work on this claim centers around the Little Annie tunnel which was driven through schist country rock along a course of S. 40° W. to intersect this vein, starting from the west side of a small gulch in the northeast corner of the claim. It is timbered for the first 35 feet. In the tunnel the large vein just described is apparently split into two fairly well defined smaller ones which stand roughly parallel at a distance of 30 feet from center to center. The first of these, which was encountered at a point 60 feet from the portal of the tunnel, is 8 feet 2 inches thick and has a strike of N. 55° E. and a dip of 62° SE. The vein material is iron stained quartz. A drift extends along the strike of this vein to the southwest for 10 feet and a sample taken by Mr. Gross across the

vein at the end of this drift assayed 0.07 oz. of gold and 0.10 oz. of silver per ton. The second vein, which is cut by the tunnel at a point 90 feet from the portal, is 4 feet, 6 inches thick and has a strike of N. 59° E. and a dip of 66° SE. A sample taken on the left wall of the tunnel yielded 0.20 oz. of gold and 0.60 oz. of silver per ton. A drift has been driven along this vein for 75 feet to the southwest. The combined material from cuts taken in the roof of the drift at points 10, 20, 30 and 40 feet from the tunnel and across the full width of the vein in each case assayed 0.08 oz. of gold and 0.50 oz. of silver per ton. The material between these veins is highly silicified schist, intricately dissected by small quartz veinlets, carrying a small amount of gold.

From the point of its intersection with this second vein the main tunnel was extended for 170 feet in a southeasterly direction and it was used during 1919 in mining the high grade ore from a small vein which it intersected at this point.

This small vein consisted principally of silver bearing galena and was traced for nearly 100 feet along the surface by four open cuts. A series of samples taken by Mr. Gross across the full width of the vein in each instance gave the following assay returns:

Assays from the outcrop of the "Galena vein".

Location of Sample	Width of vein sampled	Ounces per ton Gold	Silver	Percent Lead
Uppermost cut.....	24 in.	0.26	286.20	46.70
Second cut.....	8 in.	0.22	224.00	26.10
Third cut	12 in.	0.54	243.60	46.70
Lowermost cut	26 in.	0.14	218.90	53.40

During 1919 this claim was operated by a lessee and approximately 500 tons of high grade ore, which averaged over $200 per ton were mined and shipped to the smelter at Selby, California. In this work it was discovered that the high grade values rarely continued to a depth of more than 60 feet from the surface. All the ore in this particular shoot having a value greater than $150 per ton was removed, and the workings were then abandoned. By 1921, when they were first visited by the writer, they had become inaccessible.

The strike of this vein is approximately N. 20° E. with a dip of 65° or 70° SE. The ore is described as being almost solid galena, although some zinc blende and a little gray copper are were associated with it. The gangue matter when present was either iron carbonate or calcite. Several small faults in a practically vertical plane having a throw of perhaps 5 or 6 feet were encountered during the mining operations.

Little Annie No. 2 Claim. #46-15

The Little Annie No. 2 claim, which is located near the head of Friday Creek, is the eastern extension of the Little Annie and is partly overlapped both by the Gold Dollar and the Gold Eagle.

The development on this claim consists of three open cuts. One of them, lying about 100 feet east of discovery, which is situated near the west end line of the claim, disclosed a vein of quartz about 9 feet wide which is highly iron stained and contains some partly oxidized galena. Free gold can be detected by panning. The strike of this vein is approximately N. 65° E., with a dip of 70° S., and it is believed to be a continuation of the second branch of the Little Annie vein encountered in the Little Annie

tunnel. A second open cut, 135 feet south of discovery, disclosed a 12-inch vein containing 5 or 6 inches of practically solid galena having a strike of N. 50° E. with a dip of 65° SE. The galena carries high values in silver and a sample taken by Mr. Gross across 12 inches of the vein assayed .08 oz. in gold and 136.50 oz. in silver per ton. The lessee mined approximately 10 tons of high grade ore from this vein in 1920 having a value of $200 per ton.

A third cut 800 feet northeast of discovery disclosed a vein of quartz 10 to 12 feet wide which is highly iron stained and contains a considerable amount of oxidized galena. The cut was partly caved and the strike of the vein difficult to determine, but it is approximately N. 60° E. dipping steeply to the southeast. The vein might well be a continuation of the first branch of the Little Annie vein encountered in the Little Annie tunnel. A sample taken by the writer across 10 feet of vein matter assayed 0.10 oz. in gold and 1.00 oz. in silver.

Gold Dollar Claim. K466-15

The Gold Dollar claim lies north of the Little Annie and Little Annie No. 2, partly overlapping them.

A rich shoot of ore was discovered in an open cut near the east end line of the claim. The vein averages 3 or 4 feet in width and contains galena, sphalerite, tetrahedrite and some stromerite. The strike of the vein is N. 65° E., dipping 75° to the south. It was developed by a shaft 38 feet deep and a short tunnel driven from the side of a small draw to intersect the foot wall of the shaft. During 1920 the lessee mined between 500 and 600 tons of ore from this shoot having a minimum value of $170 per ton. At the time it was visited by the writer, however, the workings were so badly caved that they were inaccessible.

Gold Eagle Claim. K+66.15

The Gold Eagle claim is the eastern extension of the Gold Dollar, the two claims having a common end line.

At discovery cut, near the west end line of the claim, a vein approximately 3 feet wide was disclosed containing galena, pyrite, sphalerite and the oxidation products of these minerals. The sulphides carry high values in silver. A tunnel was started on the east side of the small draw previously

mentioned to intersect this vein and follows a crushed and slicken sided zone for 60 feet along a course N. 70° E. It then swings to the north for an additional 60 feet where it intersects the vein and follows it for 30 or 40 feet along a course N. 65° E. The vein dips 75° SE. The vein in the tunnel, which is chiefly quartz, does not contain as many sulphides as are found in the surface cut. In the tunnel these are confined to a band 8 or 10 inches wide near the foot wall. Three or four tons of high grade ore, valued at $170 per ton, were mined from the surface cut by the lessee in 1920.

Gold King Claim. K 166-17

The Gold King claim is located near the head of Iron Gulch, a small stream flowing into Eureka Creek at the eastern end of Quigley Hill.

The claim is developed by two tunnels which were inaccessible. As described by Capps,[a] the vein has a width of from 4 to 6 feet and strikes N. 80° E. It consists chiefly of quartz containing arsenopyrite, sphalerite and galena.

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S. Geol. Surv. 687, page 103. Washington, 1919.

Gold King East Claim. KX 66-17

This claim is the eastern extension of the Gold King, having a common end line with it, and extends across Iron Gulch practically at right angles to that stream.

The vein has been traced across the entire length of the claim by a series of open cuts which, however, were so badly caved that no accurate determinations of the width of the vein could be made.

Pittsburgh Claim. KX 66-15

The Pittsburgh claim is located on the east side of Iron Gulch and is partly overlapped by the Pennsylvania claim. The trend of the claim is N. 75° E. At discovery near the west end line of the claim an open cut disclosed a vein consisting of 6 or 7 feet of quartz containing some sulphides and calcite. The hole was inaccessible, however, and no samples were secured.

Pennsylvania Claim. KX 66-15

The Pennsylvania claim lies west of the Pittsburgh and south of the Gold King East and is adjoined by the Keystone claim on the west. There are

two principal veins on this claim which have been named Pennsylvania and Keystone by the owner.

The Pennsylvania vein crosses the west end line of the claim, (which lies at the bottom of Iron Gulch) about 100 feet north of the center and extends up the east slope towards the Pittsburgh claim. The strike of the vein is N. 65° E. with a dip of 85° S. and it has been traced for over 500 feet by a series of open cuts spaced at approximately 100 feet intervals. Although there is a gap of about 1000 feet which has not been prospected as yet, hence the continuity is not absolutely established, it is quite likely that this vein is the same one that is exposed in the discovery cut on the Pittsburgh claim. The vein matter is quartz containing some pyrite and calcite, and free gold can be panned from samples taken along the outcrop.

The Keystone vein crosses the west end line of the claim at a point 100 feet south of the Pennsylvania vein. It has a strike of N. 50° E. with a dip of 60° S. and extends up the hill towards the NE corner of claim, intersecting the Pennsylvania vein about 400 feet from the west end line. It has been traced along the surface for more than 1200 feet by 20 open cuts on the

outcrop. The vein matter is chiefly quartz containing a considerable quantity of pyrite and arsenopyrite and some sphalerite and galena. It varies from 4 to 6 feet in width. A tunnel starting near the western end line of the claim has been driven for 50 feet along the hanging wall of the vein, and a shaft was sunk to a depth of 30 feet at a point near the intersection with the Pennsylvania vein. A sample taken by Mr. Gross across 14 inches of vein matter in the face of the tunnel assayed 1.6 oz. of gold and 1.60 oz. of silver per ton. Several ounces of finely crystallized gold were obtained by panning in a small open cut 60 feet east of the portal of the tunnel. A sample taken in the shaft by the writer gave the following assay: Gold, 0.96 oz. per ton and silver, 0.20 oz. per ton.

Keystone Claim. K46-15

The Keystone claim adjoins the Pennsylvania on the west with a common end line.

Both the Keystone and Pennsylvania veins have been traced by open cuts for 300 or 400 feet on this claim. There is a third vein which outcrops near the east end line of the claim between the other two veins and intersects both of them. The strike of this vein is N. 30° E. and it has a steep dip. It is developed by a tunnel which is 50 feet long and by several open cuts on the surface. The vein matter is quartz carrying galena and some pyrite. The vein is 3 feet wide at the portal of the tunnel bur narrows to 12 inches at the face. Some of the assays of weathered quartz taken from the surface cuts show high values in gold while others show but a trace, indicating that the deposit is extremely "spotty".

Sulphide Claim. 12466-15

The Sulphide claim is situated in the valley of Eureka Creek about 1500 feet south of the Keystone.

The discovery cut, near the center of the claim, disclosed an 8-ft. quartz vein carrying pyrite. It shows free gold on panning.

Water Level Claim. KX66-15

The Water Level claim lies west and a little north of the Sulphide claim along the south slope of Quigley Hill. A cut at the eastern end of the claim disclosed a vein 3 feet in width carrying galena. Samples from this cut are reported to have assayed from 30 to 40 oz. of silver per ton.

White Hawk Claim. KX66-15

The White Hawk claim lies west of the Water Level and somewhat higher on the slope of Quigley Hill.

A 3-ft. vein carrying some tetrahedrite but no galena was exposed in the discovery cut. This vein has been traced 500 feet to the southwest where a 12-ft. shaft disclosed a 3-ft. vein, which was followed by a drift 15 feet long. The ore is similar to that found at discovery. No assays have been made of samples from this claim.

Other Claims.

In addition to these claims there are a number of others, including the Jumbo, Caribou, Meadowbrook, Bluebell, Iron Gulch, etc., which have been KX66-20 KX66-15

staked on Quigley Hill. At the time this district was visited by the writer the excavations on these claims were so badly filled by caving that no data could be obtained regarding the veins exposed in them.

Eldorado Creek.

A number of claims have been staked on the hill north of El dorado Creek and west of Moose Creek, and in line with the trend of mineralization on Quigley Hill. On the majority of these claims the development work is limited to open cuts on the surface which were inaccessible through caving at the time the district was visited. On the Alpha claim, however, a considerable amount of development work has been done.

Alpha Claim. KK 66-12

The Alpha claim lies near the top of the hill on the Eldorado Creek side about a mile from Moose Creek. The development work consists of a tunnel 120 feet long, the first 100 feet of which is timbered, and a shaft 20 feet deep situated 60 feet S. 25° W. from the end of the timbering. The vein matter is highly iron stained quartz and contains sulphides and oxides of lead and copper. The bottom of the shaft exposed a mineralized zone 8 or 9

feet wide containing three bands of highly mineralized iron stained quartz, each about one foot in width. Something over a ton of ore was sorted and sacked from the material excavated in sinking this shaft. A grab sample of this ore assayed by the Bureau of Mines showed 266.30 oz. of silver per ton.

Glacier Creek.

McGonagall Claims. Lt 66-21

The McGonagall claims are located near the head of Glacier Creek.

The upper claim lies at an elevation of about 3500 feet. The vein is exposed at the surface and is developed by a tunnel 30 feet long at the face of which 8 feet of mineralized quartz was exposed which carried some galena and a small amount of stibnite. Samples taken by the owners across the entire width of the face are reported to have yielded .60 oz. of gold and 63.00 oz. of silver per ton.

The lower claim is also situated on the right limit of the creek but approximately one-half mile to the west and several hundred feet lower in elevation. The vein is exposed at the surface and consists of 18 inches

of quartz which is free milling. One ton of ore from this outcrop was sent to a testing plant in Seattle and milled, yielding $30 in gold. A cross cut tunnel was started from the bank of the creek and driven to intersect this vein. At a distance of 30 feet from the portal it encountered a 3-ft. shear zone impregnated with gray copper, stibnite and chalcopyrite, from which assays containing as high as 52 oz. of silver per ton were secured. The tunnel was extended 15 feet beyond this shear zone without encountering the free milling quartz vein which it was being driven to intersect. A cross cut was then driven 12 feet to the right of the tunnel along the shear zone at the end of which the quartz vein was encountered. It was discovered that the vein had been faulted and displaced to the left and that the tunnel had been driven through the fault. The tunnel is 4 feet by 6 feet in the clear and is timbered for the first 25 feet.

Glen Creek.

Two prospects were discovered during the summer of 1921 near the head of the west fork of Glen Creek.

Arkansas Claim. K+66-22

T he first of these is known as the Arkansas claim, and the open cut at discovery exposed a mineralized zone about 14 feet wide consisting of three bands of quartz separated by two bands of schist from right to left as follows: 5 feet of quartz, 2⅓ feet of schist, 1⅓ feet of quartz, 2⅓ feet of schist, 1½ feet of quartz. A grab sample taken by the writer across the 5-ft. quartz band showed 90 oz. of silver per ton. The ore is chiefly sulphides of lead and antimony with some sphalerite.

Pension Claim. K+66-22

The Pension claim lies about 1500 feet farther up the creek. The open cut at discovery exposed a vein 5 feet wide of which 2⅓ feet was nearly solid galena, the remainder being quartz. A grab sample, taken by the writer, of the 2⅓ feet of galena assayed 150 oz. of silver per ton. The owner was starting a tunnel about 25 feet below the outcrop at the time the claim was visited.

Spruce Creek.

Five claims have been located at the head of Spruce Creek, as follows:

Lucky Jim Claim. Kt 66-23

The discovery cut on the Lucky Jim claim exposed a ledge of rusty quartz one foot in width which pans free gold and carries some galena and chalcopyrite.

Lena Claim. Kt 66-~~23~~ 18

The vein on the Lena claim is two feet wide and also consists of rusty quartz. It carries galena, some copper oxides or carbonates and some native silver. In an open cut 75 feet below discovery the vein is 3 feet in width.

Silver Wire Claim. Kt 66-~~23~~ 18

The discovery cut on the Silver Wire claim showed a quartz vein two feet in width, carrying galena and some copper oxides.

Mystery Claim. K46-23

At the Mystery claim the quartz vein is 2½ feet wide as exposed in the discovery cut, carrying galena, stibnite and copper oxides. No free silver was observed on this claim.

Ridgetop Claim. K46-23

The Ridgetop claim is located on the divide between Spruce and Crevice creeks. The vein is 12 feet in width consisting chiefly of iron stained quartz and carrying a very little galena and some copper oxides.

Transportation.

The only route available in the past for the transportation of any quantity of supplies to the Kantishna district is the water route down the Tanana River and up the Kantishna River to Roosevelt, and thence overland to the mines. The distance from Fairbanks to the mouth of the Kantishna is 155 miles, from the mouth of the Kantishna to Roosevelt is 156 miles, and from Roosevelt to Kantishna Post Office is 35 miles, a total of 341 miles to cover an "air line" distance of 135 miles. The rivers are of course navigable only during the summer months, but during that season of the year the first six miles of the overland portion of the route from Roosevelt to Kantishna are almost impassible for teams because of swamps. The usual procedure therefore involves the storage of the supplies at Roosevelt until the swamps are frozen when they can be crossed by horses and sleds. The cost of transportation over this route is $80 per ton,- $40 by water to Roosevelt and $40 by sleds from Roosevelt to Kantishna. During the years 1919 and 1920 a special rate of $32.50 per ton was made by the Alaska-Yukon

Navigation Company for ore shipments from Roosevelt down the Kantishna River to St. Michael and thence by sea to Tacoma. This company has abandoned transportation on the Tanana River owing to the completion of the Alaska Railroad, and this rate will probably not be duplicated.

Another route starts at McKinley Park station on the Alaska Railroad, which is 348 miles from Seward, and follows up Morris Creek, thence along the northern slope of the second foothill range (described on page 2) across Savage, Sanctuary and Teklanika Rivers, thence up Igloo Creek and around the southern end of Sable Mountain, thence through Polychrome and Highway Passes, past the northern end of Muldrow Glacier, down McKinley Fork and along the shores of Wonder Lake to Moose Creek in the Kantishna district. This route is used chiefly during the summer months when it is easily passible for pack-horses but not for wagons, and saves several days' travel compared with the river route. It is of course impossible to transport any quantity of supplies economically by these means. During the winter months deep snow and the absence of standing timber to prevent its drifting divert travel to other more favorable routes.

The favorite winter route has always been up Moose and Myrtle creeks and over a low divide into Clearwater Creek, thence down that stream and Toklat River to the Mouth of the Shushana and Across the Tanana lowland to the railroad. The cost of transportation by dog teams, which are used exclusively on this route, is $240 to $300 per ton. In the future, however, this trail will undoubtedly be abandoned in favor of a new one which the Alaska Raod Commission is now building from Kobe, a station on the Alaska Railroad 387 miles from Seward, to the Kuskokwim mining region.

The Kuskokwim trail, which follows the southern edge of the Tanana lowland across Teklanika and Toklat rivers, has been completed as far as Diamond on the Bearpaw River. From here it will run by way of Lake Minchumina to McGrath and Iditarod. It is being cut wide enough and the bridges are strong enough to accommodate heavy traffic. From Diamond a branch trail follows Bearpaw River, Glacier and Moose Creeks to K antishna. The distance from Kobe to Diamond is 55 miles; from Diamond to Kantishna the distance is 25 miles. The cost of transportation over this route has not been definitely established. With horse-drawn sleds, which will probably

be used to haul ore from the Kantishna district during the present winter although caterpillar tractors are being considered, it is estimated at $80 per ton from Kantishna to the railroad. Although this is no cheaper than the cost of water transportation, this route has a great advantage in the fact that the delay at Roosevelt is eliminated. Supplies will no longer have to be stored there until the swamps are frozen, and ore mined during the winter can be delivered at the smelter by way of the railroad several months earlier than when it is necessary to wait for river navigation to open in the summer. The one disadvantage of this route is due to the fact that the swampy ground over which it passes is absolutely impassible in the summer, nor could a summer wagon road that would suffice even for light equipment be constructed except at a prohibitive expense.

Recommendations.

Transportation.

The construction of an all-year wagon road from Kantishna to the Alaska Railroad is urgently recommended to provide better transportation facilities which are the most imperative present need of the district. The grades on this road and the character of the road bed should be such that freight can be hauled across it with automobile trucks. It is understood that the Alaska Road Commission is at present considering such a road with two routes in mind. The first follows west from the railroad at Lignite Creek (Mile 363) along the broad valley between the first and second ranges of foothills to the Toklat, thence up the Clearwater and down Moose Creek. The second starts from McKinley Park Station on the railroad (Mile 347) and follows the Polychrome-Highway Pass route described above. Without going into the merits of either of these routes it is strongly recommended that a road be built along one of them at an early date.

The possibility of a branch of the Alaska Railroad should also be kept in mind and in this connection the extension to the Kuskokwim region beyond the Kantishna district and the possible needs of the Copper Mountain district, which will be discussed later, should be taken into account. From an engineering point of view either the Kuskokwim winter trail or the Polychrome Highway-Pass trail, which are described above, present no serious obstacles. The lower route has the advantage of better gradients and the minimum of heavy construction work, to compensate for the fact that it would have to cross Teklanika and Toklat Rivers after they have been joined by their various tributaries, thus requiring larger and more costly bridges, and for the fact that it would not serve the Copper Mountain district. With the Polychrome-Highway route these advantages and disadvantages are exactly reversed.

Fuel.

The majority of the mines in the Kantishna district are situated at a considerable distance from timber and the cost of fuel for domestic as well as mining purposes is extremely high. It is therefore recommended that the coal deposits near the head of Moose Creek be investigated and that a mine sufficient for local needs be opened there.

Further development work.

It is obvious from the description given above that further development work is essentially necessary. Such work is highly recommended, in spite of the great handicap of high transportation costs, for it is only by proving that the Kantishna is in reality the important mining district which the preliminary prospecting seems to indicate that any material reduction in transportation costs can be hoped for.

COPPER MOUNTAIN DISTRICT

The Copper Mountain district is situated near the northern terminus of Muldrow Glacier, which is the main source of water supply for the McKinley Fork of the Kantishna River. The district lies near Lat. 64° 20' N. and Long. 150° 20' W., about five miles south of the southern boundary of the map[a] accompanying U. S. Geological Survey bulletin 687.

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull.U.S.Geol.Surv.687, Washington 1919. Plate I in pocket.

Lode Mining.

The Copper Mountain district was discovered early in the spring of 1921. It was visited by the writer in September, 1921, and September, 1922, on the return from trips to the Kantishna district, but owing to inclement weather in both cases time was available for only a brief reconnaissance of a portion of the district, and such examination as could be made was rendered extremely difficult by snow which masked much of the

ground. The examinations were confined chiefly to the neighborhood of Grant Creek, a small stream rising in the heart of Copper Mountain and flowing north into McKinley Fork. The upper part of this stream flows through a steep, rock-walled canon and debouches across a terrace one-half to three-quarters of a mile wide before emptying into the gravel basin above the canon at the end of Muldrow Glacier.

Owen Claim. 1366-24

The Owen claim is located across Grant Creek near the middle of this terrace. No well defined vein was observed, the deposit occurring in a zone of quartzite about 100 feet wide lying between two areas of granite. Portions of the quartzite are impregnated with galena, copper sulphides, and some native copper.

Virginia Claim. 1366-2

The Virginia claim is situated at the mouth of the rocky canon of Grant Creek about one-quarter of a mile above the Owen claim. At the discovery stake on this claim a ledge 30 feet wide was observed, having a

strike of N. 75° E. and a dip of 75° S. The hanging wall is limestone and the foot wall porphyry. The vein matter is chiefly quartz containing banded streaks highly impregnated with galena. The proportion of galena bearing ore to the more barren quartz is perhaps that of 1 to 8. A sample of the galena bearing material from this vein taken at random by the writer assayed a trace of gold, 1.10 oz. of silver per ton and 4.18 percent lead.

About 75 feet to the south is a second vein 12 feet thick having a limestone foot wall and a granite hanging wall. The strike is S. 85° W. with a dip of 40° S. and the vein carries galena and sphalerite interbanded with quartz. At a distance of 25 or 30 feet south of this is a third vein 8 feet in thickness having a strike due east and west and a dip of 70° S. The foot wall is granite and the hanging wall limestone. This vein also carries sulphides of lead and zinc. All three of these veins are exposed in the rocky walls of the canon and required practically no excavation to discover them.

74

Denver Claim. KX66-2

On the Denver claim, 150 feet south of the third vein on the Virginia, is a 12-ft. ledge having a strike of N. 60° E. and a dip of 70° S. The vein matter is quartz containing some galena. At a point 100 feet east of the creek and 100 feet higher up on the hill the ledge carries a considerable amount of copper stain, and the assay of a picked sample taken by the owners from this place showed 270 oz. of silver per ton.

A second ledge 50 feet to the south is 6 feet in width and has a strike of N. 70° E. and a dip of 70° S. The foot wall is granite but the hanging wall was concealed. A third vein on the Denver claim 75 feet further south is 7 feet in width and consists chiefly of quartz carrying lead sulphide. The strike and dip of this vein could not be determined. A sample broken at random from the ledge by the writer assayed .40 oz. of silver per ton and 5.87 percent lead.

Caribou Claim. K46-25

The main vein of the Caribou claim lies 200 feet south of the third vein on the Denver. Its strike is N. 75° W. and it has a dip of 50° N. The foot wall is granite. The lode, which appears to be a zone of quartzite of more than 100 feet in thickness, contains a band of galena-bearing material along the foot wall 12 to 18 inches thick. At a distance of 12 feet from the foot wall is a zone of copper stained rock about 1 foot in thickness, with bands containing galena, sphalerite and pyrite 2 feet wide on either side. At a distance of 25 feet from the foot wall a similar band of copper stained rock with galena, sphalerite and pyrite on either side was also observed. Except for the band along the foot wall the ore in this lode appears to be "pockety".

Two other veins about 800 feet south of the Caribou are reported by the owners, one of which is 12 feet and the other 14 feet in width. The character of the ore is said to be similar to that on the Virginia.

Arizona Claim. Kt 66-26

The Arizona claim is situated one-half mile west of the Virginia in a small gully which flows into Grant Creek. The deposit occurs in a band of quartzite 125 feet thick occurring between the masses of granite. Portions of this quartzite show considerable mineralization, galena and sphalerite being the chief constituents, with some pyrite and copper stain. A random sample of the mineralized quartzite taken by the writer showed .50 oz. of silver per ton and 3.98 percent lead. The strike of a porphyry dike 12 feet wide occurring in the granite 15 feet from the lower contact with the quartzite is N. 70° E. The dip is 40° S.

Montana Claim. Kt 66-26

The Montana claim lies just above the Arizona and contains two ledges about 50 feet apart, each of which is two feet in thickness. The vein matter of both ledges is quartz and both carry galena and sphalerite. In the upper ledge, however, galena is predominating, while the lower ledge is chiefly sphalerite. A selected sample from the lower ledge taken by the writer assayed .40 oz. of silver per ton and 37.36 percent zinc.

177

Giles Claim. 4x66-2

The Giles claim lies east of the Virginia and Denver claims, along the face of the bluff east of Grant Creek and south of the terrace of McKinley Fork.

At discovery an open cut 30 feet long and from 5 to 15 feet wide was excavated during the summer of 1922. An extensive body of ore, which appears to be an impregnation in the limestone, has been exposed across the entire face of this cut. Several tons of the ore were piled at the edge of the cut and more than 100 tons were mixed with the waste scattered down the slope of the hill below the cut. The ore consists chiefly of galena and sphalerite in a limestone gangue, but a small amount of chalcopyrite, which occurs as a filling in incipient cracks of the ore, was also observed. A sample of the ore was taken and assayed at the Alaska Station of the Bureau of Mines with the following results: Gold, trace; silver, 2.20 oz. per ton; lead, 6.35 percent; zinc, 9.05 percent; and copper 0.38 percent.

The ore shows also on the point of the ridge 300 feet west of discovery in an open cut which was partly caved. This cut is on the east bank of a small gully and the ore is also exposed in an open cut on the west bank of the gully. This cut was filled by a deep snow drift. The course between the two cuts is N. 80° E. A big deposit of light colored porphyritic rock, belonging to the granite or the diorite group, occurs about 20 feet north of the west cut.

Other Claims.

Approximately fifty other claims have been located, for the examination of which time was not available. Those described above, however, are fairly typical of the district and serve to indicate the abundance of lead and zinc ores found there.

Fuel. K+66-27

There is no standing timber within 20 miles of the property and hence the question of fuel, both for domestic needs and for possible future mining operations, is important. Fortunately an outcrop of sub-bituminous

coal has been discovered on the west fork of Stony Creek, one of the tributaries of the Toklat River, at Lat. 65° 30' N. and Long. 154° 15' W., at a distance of 8 or 9 miles from the property. The exact thickness of this bed is unknown, but more than 30 feet are exposed at a point where several tons were mined and transported to the property by pack horses. The resulting pile of coal was sampled by the writer and analyzed by the Pittsburgh station of the Bureau of Mines with the following results:

	Moisture	Ash	Volatile matter	Fixed carbon	B.t.u.
As received, ...	21.2	9.0	36.6	33.2	8530
Moisture free, ...		11.4	46.4	42.2	10830
Moisture and ash free,			52.4	47.6	12220

Transportation.

From the viewpoint of transportation the Copper Mountain district is in even more dire straits than the Kantishna district. The only method available at present for getting supplies to the district in any quantity is by dog team from Kantishna during the winter months. The distance from Kantishna Post Office to the Copper Mountain district by way of Wonder Lake

and McKinley Fork is about 25 miles. It would be possible, although difficult, to haul supplies from there by horse sleds in winter. The Polychrome-Highway Pass trail described on page 68 passes through the edge of the Copper Mountain district but as has been already stated this is passible during the summer months only for pack trains or men on foot, while during the winter months deep snows make travel very difficult. It would b possible, however, to make a fairly good wagon road for the 65 miles along this route which would also give access to the scenic beauties of Mt.Mckinle National Park through which it passes.

Recommendations.

Even the brief reconnaissance here described indicates that the Copper Mountain district contains a large reserve of lead and zinc ores; but whether it will fulfill the promise of the remarkable showing made by superficial prospecting depends entirely upon the results obtained by further development work. That this is clearly recognized by the owners is evidenced by the fact that they are planning to install a diamond drill

during the coming summer with which they hope to determine the extent and depth of the ore bodies. Such a course is highly recommended, because it is important to know as soon as possible whether the property will warrant the investment necessary for mining operations on a large scale or whether, failing in this respect, it is valueless.

It is, of course, too early at this time to recommend a branch line from the Alaska Railroad, because such an investment could only be justified by the actual blocking out of a huge tonnage; but when this is accomplished such a branch will follow as a matter of course. Nor can a smelter be recommended at present, although coal for smelting purposes is available within a few miles of the mine.

LITTLE MOOSE CREEK. XX66-28

Little Moose Creek is one of the tributaries of Clearwater Fork, joining that stream about 5 miles above its confluence with Toklat River.

The principal activity in this district is placer mining, the methods employed being similar to those in the Kantishna district. The placers are distinguished by the occurrence of native silver, small nuggets of which are found in practically every clean-up.

During 1922 the principal operators were Pederson and Christianson, Fred Hauselman, and Mike Lody. Approximately 30,000 square feet of bedrock, valued at twenty-two cents per square foot, were cleaned during the season.

The following is taken from a report entitled KANTISHNA REGION by John A. Davis, U.S.B.M. - 1922 Division of Mines and Minerals Report MR 66-0

LODE MINING

Lode mining development in the Kantishna district centers in Quigley Hill, as the main ridge between Friday and Eureka Creeks has been named in honor of Joseph B. Quigley, the pioneer "quartz" prospector of the district. The mineralized zone found in this hill has been traced beyond Glacier Peak to the east, a distance of 8 or 10 miles, and for about 5 miles to the southwest across Moose Creek along the divide between Eldorado Creek and Bear Creek.

QUIGLEY HILL

Red Top Claim

One of the most important claims on Quigley Hill is the Red Top, which lies across a spur that slopes toward the mouth of Friday Creek from the western end of the hill. The claim trends N 70° E, and its center lies along the crest of the spur; the western half extends down a steep slope toward Moose Creek and the eastern half extends along the more gentle slope of Friday Creek valley.

The vein on the Red Top claim occupies a fault fissure in a country rock of Birch Creek schist. It ranges from 4 to 10 feet in width, the vein matter being chiefly quartz with shoots containing galena, zinc blende, arsenopyrite and occasionally tetrahedrite, together with the oxidation products of these minerals. The hanging wall is quite distinct and both slickensides and gouge are present. The reverse is usually true in regard to the foot wall which shows replacement of the schist by vein matter. The sulphides, particularly those of lead and copper, carry a high silver content and some gold. They are usually segregated in a band or seam varying in width from 5 or 6 inches to as much as 3 feet, and at some places are found near the hanging wall and at others near the foot wall of the vein. Where weathered the quartz is stained with oxides of iron and often contains free gold which may be detected by panning.

At the time the claim was visited by the writer in September, 1922, the development work consisted of a series of open cuts and a tunnel 300 feet long. The open cuts extend southwesterly along the outcrop of the vein from the discovery stake which is situated about half way up the steep slope mentioned above. The tunnel near the bottom of the slope starts at a point about 150 feet from the west end line of the claim.

The discovery cut disclosed something over nine feet of vein matter, although the full width may not have been exposed. The vein consisted of two bands of mineralized quartz each about three feet in width, separated by a band of practically solid galena and oxidized products of galena also about three feet in thickness. A sample taken by the writer across the galena bearing portion assayed 0.28 ounces of gold, 57.6 ounces of silver and 12.8 percent lead. The quartz portion also carries some gold and silver.

A second open cut, 50 feet southwesterly from discovery, shows four feet of galena or its oxidization products. An interesting feature of this open cut is the occurrence of a considerable amount of what is apparently free sulphur, which will ignite with a match and burn with a characteristic blue flame and odor.

A third cut, 80 feet southwesterly from discovery, shows vein matter in place, but at the time of the visit it had caved in so that it was inaccessible.

A fourth cut, about 150 feet from discovery, was also inaccessible but a fifth cut, at 220 feet, showed 15 inches of galena which is said to have assayed $275 per ton in combined gold and silver. The full width of the vein could not be determined at this point.

The tunnel, which starts at a point 255 feet S 75° W from the discovery stake, follows a course of N 80° E for 18 feet, thence N 88° E for 27 feet. The

vein in this portion of the tunnel dips 65° S and is 6 or 7 feet wide although the foot wall is not well defined. It contains a band of galena, or the oxidation products of galena, about 3 feet wide, lying near the hanging wall. The remainder of the vein consists of iron stained quartz containing some galena and carbonates of lead.

The vein divides at a point 45 feet from the portal, one branch swinging to the south, the other slightly to the north along a course of N 77° E, which the tunnel follows for 22 feet. This branch of the vein is about 3 feet wide at the beginning and contains a considerable amount of galena and carbonates, but it narrows to 18 inches or less and the lead ores disappear, leaving only iron stained quartz. For this reason the tunnel turns through the schist country rock on a course of S 45° E to meet the other branch of the vein, which it intersects at a distance of 16 feet.

It then follows this branch, which contains a band of galena 5 or 6 inches wide occurring near the foot wall and dipping 75° S, for a distance of 28 feet along a course of N 83° E, after which it turns on a course of S 82° E for a distance of 28 feet in an effort to find the hanging wall of the vein. A crosscut has been driven 5 feet due south at a point 9 feet from the beginning of this course and a well defined wall having a vertical dip was found. Two small stringers, having a strike of N 55° E with a vertical dip and consisting mainly of quartz but containing some arsenopyrite, melanterite and free sulphur are exposed in the crosscut. They intercept the main vein but do not cross it.

From the end of the course the tunnel runs N 59° E for 21 feet, being driven partly through quartz vein matter which dips 65° N and partly through schist country rock. At the end of the course the vein dips 80° S. At this point a crosscut has been driven 26 feet in a northwesterly direction. The

vein matter in the crosscut is mainly quartz with arsenopyrite, some galena and a small amount of zinc blende. A short crosscut was also driven 5 feet in a southeasterly direction.

The tunnel then follows a narrow seam of gouge 1½ to 2 inches in width along a course of N 84° E for 35 feet, and at the end of the course a crosscut has been driven 6 feet in a southeasterly direction disclosing 30 inches of white quartz containing bunches of schist the size of a football. A flat fault, the plane of which strikes N 60° W and dips 10° SW, first appears in the floor of the tunnel at this point, the vein above the fault apparently having been displaced a short distance to the north.'

The tunnel continues N 48° E for 11 feet where another crosscut has been driven to the south for 7 feet and at the end a winze started which was 12 feet deep at the time of examination (Sept. 1922).

From the winze crosscut the tunnel runs N 41° E for 18 feet, keeping the gouge marker on the north wall, and then N 67° E for 25 feet. At the end of the course the roof of the tunnel consists of vein matter lying below the fault plane; and a gouge marker, which is believed to be the same one previously followed, appears on the south wall of the tunnel. The dip at this point is 83° S.

The tunnel continues for 26 feet on a course of N 53° E, with the gouge marker forming the south wall. At a distance of 14 feet on this course a crosscut has been driven to the north across 8 feet of mineralized white quartz and 4 feet of crushed black schist containing quartz stringers.

At the end of the course the tunnel divides, one branch continuing N 43° E for 7 feet where a fault plane was encountered which strikes N 88° W and dips 55° N. This branch of the tunnel continues through the crushed schist for 20 feet beyond the fault. The other branch runs S 75° W for 13 feet and N 58° E for 14 feet until it also encounters the fault plane.

Thirty seven samples were taken by the writer from the untimbered portion of the Red Top tunnel. Eight samples from the timbered portion, which includes the first 67 feet of the tunnel, were taken by Mr. Quigley at the time the timbering was placed. The assay returns of these samples which are lettered A to H inclusive, to distinguish them from the numbered samples taken by the writer, are given here because they indicate the value of the ore in a portion of the tunnel that could not be sampled at the time the mine was examined. All assays were made at the Alaska station of the U.S. Bureau of Mines.

Sample A was taken across 3 feet of vein matter in the top of the tunnel at a point 10 feet from the portal.

Sample B was taken across 3 feet of vein matter in the top of the tunnel at a point 15 feet from the portal.

Sample C was taken across 3 feet of vein matter in the top of the tunnel at a point about 20 feet from the portal.

Sample D was taken across 3 feet of vein matter in the top of the tunnel at a point about 25 feet from the portal.

Sample E was taken across 3 feet of vein matter in the top of the tunnel at a point about 30 feet from the portal.

Sample F was taken across 3 feet of vein matter in the top of the tunnel about 35 feet from the portal.

Sample G was taken across 3 feet of vein matter in the top of the tunnel at a point about 45 feet from the portal.

Sample H was taken across 18 inches of vein matter at a point about 55 feet from the portal.

Sample No. 1 was taken across 24 inches of quartz vein matter in the roof of the tunnel at the end of the timbering 65 feet from the portal.

Sample 2 was taken across 8 inches of gouge containing galena and lead carbonates lying on the hanging wall of the southern branch of the vein

where it is first intersected by the tunnel at a point approximately 80 feet from the portal.

Sample 3 was taken across 24 inches of quartz immediately adjacent to sample 2.

Sample 4 was taken across 22 inches of white quartz ledge matter with gouge on both sides in the roof of the tunnel at a point 90 feet from the portal.

Sample 5 was taken across the width of the vein, which consisted of 30 inches of shattered white quartz, in the roof of the tunnel at a point 100 feet from the portal.

Sample 6 was taken across 20 inches of pulverized quartz in the roof of the tunnel at a point 110 feet from the portal.

Sample 7 was taken across 10 inches of gouge immediately adjacent to sample 6.

Sample 8 was taken across 22 inches of ground quartz in the main vein, near the intersection of two small quartz stringers exposed in a crosscut on the south side of the tunnel, at a point 120 feet from the portal of the tunnel.

Sample 9 was taken across 18 inches of heavy dark sulphides and quartz lying immediately north of sample 8.

Sample 10 was taken across 24 inches of quartz vein matter in the roof near the north wall of the tunnel at a point 130 feet from the portal.

Sample 11 was taken across 24 inches of quartz containing pyrite in the roof of the tunnel at a point 140 feet from the portal.

Sample 12 was taken across 12 inches of gouge containing melanterite in the roof of the tunnel at a point 150 feet from the portal.

Sample 13 was taken across 30 inches of quartz vein matter in the roof of the south crosscut at a point 160 feet from the portal.

Sample 14 was taken across 48 inches of quartz vein matter containing some pyrite in the roof of the main tunnel between the two crosscuts at a point 160 feet from the portal.

Sample 15 was taken across 5 feet of country rock impregnated with quartz and some pyrite on the west wall of the north crosscut immediately adjacent to sample 14.

Sample 16 was taken across 5 feet of impregnated country rock on the west wall of the crosscut starting at the north end of sample 15.

Sample 17 was taken across 5 feet of schist on the west wall of the crosscut starting at the north end of sample 16. The schistose character of the rock is very pronounced and numerous small stringers of quartz one-half to three inches thick cutting across the schistosity are very noticeable.

Sample 18 was taken across 5 feet of schist on the west wall of the crosscut starting at the north end of sample 17. Two stringers of quartz 4 and 6 inches wide are included in the sample.

Sample 19 was taken across 39 inches of white and slightly iron stained quartz containing some pyrite adjacent to the north end of sample 18; a well defined wall having a strike of N 80° E and a dip of 40° S was observed at the north end of the sample.

Sample 20 was taken across 36 inches of quartz vein matter containing some sulphides in the roof of the tunnel at a point 170 feet from the portal. A 2-inch gouge marker occurs 12 inches from the north end of the sample.

Sample 21 was taken across 44 inches of white quartz south of the gouge marker which forms the north wall of the tunnel at a point 180 feet from the portal.

Sample 22 was taken across 12 inches of white quartz vein matter south of the gouge marker which forms the north wall of the tunnel at a point 190 feet from the portal. Two feet of schist lying south of the quartz vein were not sampled.

Sample 23 was taken across 30 inches of white quartz containing bunches of schist the size of a football on the east wall of a south crosscut at a point 195 feet from the portal of the tunnel.

Sample 24 was taken across 8 inches of gouge and 16 inches of heavily iron stained quartz in the roof of the tunnel, at a point 200 feet from the portal of the tunnel. The gouge contains free sulphur.

Sample 25 was taken across 8 inches of black gouge on the west wall of the winze 8 feet below track level.

Sample 26 was taken across 36 inches of quartz vein matter on the west wall of the winze adjacent to sample 25. A thin gouge seam defined the southern limit of the sample.

Sample 27 was taken across 44 inches of shattered quartz and gouge in the roof of the tunnel at a point 210 feet from the portal.

Sample 28 was taken across 36 inches of crushed quartz and gouge in the roof of the tunnel at a point 220 feet from the portal.

Sample 29 was taken across 40 inches of crushed vein matter in the roof of the tunnel above the flat fault plane at a point 230 feet from the portal.

Sample 30 was taken across 35 inches of ground up vein matter in the roof of the tunnel just above the fault plane at a point 240 feet from the portal.

Sample 31 was taken across 34 inches of hard white quartz containing a streak of gray sulphides in the roof of the tunnel below the horizontal fault at a point 250 feet from the portal. A gouge marker one-half inch thick forms the south wall of the tunnel.

Sample 32 was taken across 30 inches of quartz vein material in the roof of the tunnel beginning with the gouge marker which forms the south wall at a point 260 feet from the portal.

Sample 33 was taken across 4 feet of iron-stained quartz on the west wall of the crosscut beginning at the north end of sample 32.

Sample 34 was taken across 4 feet of iron-stained quartz on the west wall of the crosscut beginning at the end of sample 33. The north end of the sample terminates in a well defined fissure showing gouge and lying roughly parallel to the main vein.

Sample 35 was taken across 4 feet of schist along the west wall of the crosscut immediately adjacent to sample 34.

Sample 36 was taken across 36 inches of vein matter in the roof of the tunnel at a point 270 feet from the portal. The 16 inches of the sample adjacent to the gouge marker which forms the south wall of the tunnel contained a large amount of pyrite. The remainder was iron-stained white quartz.

Sample 37 was taken across 5 feet of vein matter in the roof of the tunnel at a point 280 feet from the portal. The 12 inches of the sample adjacent to the gouge marker on the south wall of the tunnel contained a large amount of pyrite. The remainder of the portion samples was white quartz.

The following table shows the results of the assay of these samples:

ASSAYS OF SAMPLES FROM RED TOP TUNNEL

Sample	Width Sample	Distance from Portal of Tunnel	Ounces per ton Gold	Ounces per ton Silver	Total Value (See note below)
A	3.0 feet	10 feet	1.66	1717.10	$ 1755.55
B	3.0 "	15 "	1.94	828.60	868.70
C	3.0 "	20 "	1.72	632.30	667.85
D	3.0 "	25 "	1.28	661.20	687.66
E	3.0 "	30 "	0.58	689.00	699.99
F	3.0 "	35 "	1.96	735.70	776.21
G	3.0 "	45 "	0.80	237.70	254.24
H	3.0 "	55 "	0.14	0.10	2.99
1	2.0 "	65 "	0.06	0.20	1.44
2	2.0 "	80 "	trace	0.60	0.60
3	0.7 "	80 "	0.20	80.60	84.73
4	1.8 "	90 "	0.08	1.20	2.85
5	2.5 "	100 "	0.06	0.40	1.64
6	1.7 "	110 "	0.10	0.20	2.27
7	0.8 "	110 "	0.04	0.20	1.03
8	1.5 "	120 "	0.24	0.80	5.76
9	1.8 "	120 "	trace	0.10	0.10
10	2.0 "	130 "	0.08	0.40	2.05
11	2.0 "	140 "	0.15	0.60	3.70
12	1.0 "	150	0.09	0.60	2.46
13	2.5 "	In c.c. at 160	0.12	44.60	47.08
14	4.0 "	160 feet	trace	0.20	0.20
15	5.0 "	In c.c. at 160	0.20	0.40	4.53
16	5.0 "	"	0.18	0.30	4.02
17	5.0 "	"	0.06	0.20	1.44
18	5.0 "	"	0.04	0.20	1.03
19	3.5 "	"	0.04	0.20	1.03
20	3.0 "	170 feet	0.36	1.20	8.64
21	3.7 "	180 "	0.28	11.30	17.09
22	1.0 "	190 "	0.14	6.20	9.09
23	2.5 "	In c.c. at 195	1.74	6.40	42.37
24	2.0 "	200 feet	0.08	1.20	2.85
25	0.7 "	In winze at 205	0.04	0.10	0.93
26	3.0 "	"	0.12	10.50	12.98
27	3.7 "	210 feet	0.06	1.60	2.84
28	3.0 "	220 "	0.14	2.40	5.29
29	3.3 "	230 "	0.16	13.50	16.81
30	2.9 "	240 "	0.44	6.00	15.10
31	2.8 "	250 "	0.14	1.40	4.29
32	2.5 "	260 "	0.24	3.50	8.46
33	4.0 "	In c.c. at 260	0.10	0.20	2.27
34	4.0 "	"	0.04	0.10	0.93
35	4.0 "	"	trace	0.10	0.10
36	3.0 "	270 feet	0.44	1.30	10.40
37	5.0 "	280 "	0.52	1.60	12.35

Note: Calculated on the basis of gold at $20.67 per ounce and silver at $1 per ounce.

Approximately five tons of high grade ore, secured while driving the first 50 feet of the tunnel, had been sorted and sacked for shipment and the dump contains approximately 600 tons which it is estimated has a value of $15 to $20 per ton. A grab sample of the sacked ore, taken by Mr. Livingstone Wernecke, and assayed at Juneau, showed 1.24 oz. of gold and 243.1 oz. of silver per ton.

In September, 1922, Mr. Hawley Sterlinf of Fairbanks obtained a lease to mine the high grade ore shoot near the portal of the tunnel and on January 1, 1923, had taken out approximately 50 tons of ore believed to average over $200 per ton. The ore mined under the lease will be hauled to the Alaska Railroad at Kobe (Mile 387) and shipped to the smelter by way of Seward.

Hillside or Silver King Claim

An extension of the Red Top claim has been located to the west along the bench above Moose Creek. The Red Top vein was exposed in the bottom of a 40-ft. shaft that was sunk just beyond the west endline of the Red Top claim. The vein at this point was from 5 to 6 feet wide and carries sulphides of lead and copper in a quartz gangue.

The ownership of this ground is at present in litigation, one of the claimants calling it the Hillside and the other claimant the Silver King.

What is thought to be further extension of the Red Top ledge was exposed in 1921 in an open cut made by ground sluicing on the steep hillside above Moose Creek on the opposite side from the Red Top claim. At the time the district was visited by the writer a slide of debris, loosened by the water used in ground sluicing, had completely refilled the cut making it impossible to secure any detailed data as to this exposure.

Galena Claim

The Galena claim lies along the western end of Quigley Hill about

2000 feet south of the Red Top and adjoins the Frances claim on the east. The principal developments on this claim are a tunnel near the discovery stake and an open cut about 300 feet to the northeast.

The tunnel is driven through schist country rock for a distance of 30 feet until it intersects a vein which it follows for 30 feet. The vein is 8 or 9 feet wide, consisting chiefly of highly iron-stained quartz which contains galena, arsenopyrite, zinc blende, and some tetrahedrite. These sulphides occur in a band about 12 inches thick near the hanging wall, which is well defined. The foot wall, however, gradually merges into the schist country rock. The strike of the vein is approximately N 45° E, the dip 65°-70° SE. A shallow winze a few feet from the breast was inaccessible at the time this claim was visited.

The open cut lying northeast of the tunnel shows a quartz vein about a foot in width containing tetrahedrite and chalcopyrite. The strike of this vein is N 45° E with a nearly vertical dip. Between 50 and 100 tons of ore derived partly from the tunnel and partly from the open cut have been mined and shipped to the smelter at Selby, California.

Lucky Strike Claim

The Lucky Strike claim lies about 1500 feet southeast of the Galena claim along a bench in the angle between Moose and Eureka Creeks. The claim trends northeast.

The veins have been discovered on the Lucky Strike claim in the bluff overlooking Moose Creek. A tunnel has been driven along the strike of one of these veins which is N 59° E. The vein, which dips 84° S, is exposed for 20 feet above the tunnel and shows at least 6 feet of quartz between schist walls. The hanging wall is highly silicified. A sample of this vein next the footwall,

consisting of highly mineralized quartz and thought to be the richest portion, shows .04 ounces of gold and 6.40 ounces of silver per ton. A sample of the next 3 feet of the vein shows .05 ounces of gold and 10.00 ounces of silver per ton. The vein is reported to carry valuable minerals beyond this width but a sample could not be obtained.

The second vein has been exposed in two open cuts about 40 feet apart and lying 125 feet north of the tunnel just mentioned. They show a strong quartz vein, well mineralized, and probably about 8 feet wide, although the cuts were so badly caved that the width could not be accurately determined, nor could a representative sample be secured. A number of pieces of vein matter that were broken off at random assayed .04 ounces of gold and 1.40 ounces per ton in silver. The samples were taken by Mr. John Gross, metallurgist of the Bureau of Mines.

Silver Pick No. 2 Claim

The Silver Pick No. 2 claim lies northeast of the Lucky Strike and several hundred feet higher on Quigley Hill. Its side line is nearly parallel with that of the Frances which it overlaps. It has a common end line with the Silver Pick claim on the east.

At discovery, which is 400 feet from the east end of the claim, a shaft 12 feet deep showed 6 or 7 feet of iron stained quartz and calcite. The shaft was caved at the time of the visit and no samples were taken for assay.

An open cut near the northeast corner of the claim showed 3 feet of iron stained quartz. A sample taken by Mr. Gross at this point assayed .14 oz. of gold and .10 oz. of silver per ton. The strike of the vein is N 88° E and the dip 63° N.

Frances Claim

The Frances claim lies between the Galena on the west, the Little Maud

Maud on the east, the Martha Q. on the north and the Silver Pick No. 2 on the south.

Development on the Frances claim consists of a tunnel 75 feet in length, the first 40 feet of which is timbered, and a series of open cuts on the surface extending along the strike of the vein which is N 55° E. As exposed in the tunnel the vein varies from 12 to 40 inches in width. It dips to the south at an angle of 65°. The vein matter in the tunnel is chiefly white quartz carrying gold and silver, but at discovery cut, near the east end line of the claim, some copper sulphide was observed. The open cuts were filled with material which had caved from the sides, hence no information could be obtained about the vein other than that indicated by the small dumps produced when the cuts were excavated. A series of samples taken by Mr. Gross across the total width of the vein at five-foot intervals in the tunnel gave the following assays:

Sample number	Ounces per ton Gold	Silver
1	.02	.50
2	.01	.10
3	trace	.20
4	.06	1.00

Sample No. 1 includes 24 inches across the floor of the tunnel at the end of the timbering, 40 feet from the portal, and 12 inches across the roof at the 45-ft. station.

Sample No. 2 includes 18 inches across the roof at the 50-ft. point and 12 inches across the roof at the 55-ft. point.

Sample No. 3 includes 22 inches across the roof at the 60-ft. point and 30 inches across the roof at the 65-ft. point.

Sample No. 4 includes 38 inches across the roof at the 70-ft. point and 40 inches across the face at the 75-ft. point.

Value of the ore of the Frances tunnel appears to vary greatly from place to place, however, and samples taken by the lessee of this property in

1919-20 gave much better returns than this, some of them running as high as $35 per ton in gold and silver.

Martha Q. Claim

The Martha Q. claim lies between the Frances and the North Star.

A shallow shaft near the northwest corner of the claim has exposed a narrow vein, consisting chiefly of galena, having a strike of N 15° W and a dip of 56° E. A sample taken by Mr. Gross across 6 inches of this vein assayed .08 oz. in gold and 284.20 oz. in silver per ton. Several tons of ore were shipped from this claim in 1920-21, being added to the ore from the Gold Dollar claim which is described below.

North Star Claim

The North Star claim adjoins the Martha Z. and overlaps a small part of the Red Top.

An open cut in the southwestern part of the claim disclosed a 6-inch stringer containing galena and zinc blende from which a sample is reported to have assayed 60 ounces per ton in silver.

Friday Claim

The Friday Claim lies north of the Martha Q. and Polly Wonder claims. It has a common end line with the North Star claim on the west.

Development work consists of a number of open cuts that were excavated in an effort to discover an extension of the Red Top vein. Although encouragement has been received from the finding of rich float in the debris of the hill, solid bed-rock was not reached in any of these cuts.

Polly Wonder Claim

The Polly Wonder claim adjoins the Martha Q. on the east, with a common end line, and lies between the Friday and Little Maud claims. An open cut 100 feet southwest of discovery exposed 8 feet of iron stained quartz in which free gold can be detected by panning. The ore also contains a small amount of galena. The strike is approximately due east with a dip of 65° or 70° to the south.

Little Maud Claim

The Little Maud claim lies between the Polly Wonder on the north, the Silver Pick on the south, and has a common end line with the Frances on the west, with the Little Annie on the east.

At discovery, which is near the west end line and but a few feet from the discovery on the Frances, the open cut showed a quartz vein 18 inches wide carrying some tetrahedrite. The strike of the vein is approximately N 55° E with a dip to the south of 60° or 70°.

Silver Pick Claim

The Silver Pick claim adjoins the Little Maud on the south and has a common end line with the Silver Pick No. 2 on the west.

The Silver Pick claim is developed by a number of open cuts and by a cross-cut tunnel 190 feet long which starts on the Little Maud claim. The first 25 feet of the tunnel is timbered and its course is S 30° E. It intersects three veins, the first directly at the portal, the second at a distance of 55 feet and the third at a distance of 165 feet.

The first vein, which is composed chiefly of quartz carrying free gold and some galena, is also exposed in an open cut 100 feet southwest of the tunnel. It is 3 feet in width. The strike is N 50° E and the dip 70° S. A sample taken in the tunnel by Mr. Gross showed .03 oz. of gold and 5.70 oz. of silver per ton.

The second vein shows 6 feet in thickness where it crossed the tunnel on a strike of N 30° E with a dip of 65° NW. The vein matter consists of rusty quartz containing numerous bunches of galena, some pyrite and a considerable amount of zinc blende. According to Capps[a] a picked sample of the galena assayed 100 oz. of silver per ton. A sample taken by Mr. Gross across 6 feet of the vein along the north wall of the tunnel showed .06 oz. of gold and 10.00 of silver per ton. This vein is also exposed in an open cut 125 feet south of the tunnel portal.

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S. Geol. Surv. 687, Washington, 1919, page 105.

The third vein, as described by Capps[a] "consists of one foot of calcite

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S. Geol. Surv. 687, page 105. Washington, 1919

---

on the footwall and 12 feet of quartz and schist, more or less sheeted, the quartz predominating in bulk over the country rock. Little galena is seen in the tunnel, but it is abundant along the surface crop of the vein. The whole zone is brecciated and leached, and large open cracks extend from the tunnel to the surface. Pyrite, arsenopyrite, and small amounts of galena and sphalerite were observed, and along some of the cracks deposits of a soluble salt, which on analysis proved to be the iron sulphate melanterite, were found." A sample taken by Mr.Gross across 12 feet of the vein along the south wall assayed .05 oz. of gold and .10 oz. of silver per ton. It is quite likely, however, that this sample is not representative, because there are unquestionable evidences of leaching at the point where the sample was taken. The strike of the vein as determined by survey between its exposure in the tunnel and in an open cut on the top of the hill 200 feet distant is N 65 E. The dip, measured in the tunnel, is S 67 E.

Darling Claim

The Darling claim adjoins the Silver Pick on the east, having a common end line, and is south of the Little Annie claim.

The discovery cut, near the center of the claim, disclosed a ledge of iron stained quartz one foot wide, in which a small amount ofpyrite was observed. It is quite probable that the large vein exposed in the Silver Pick tunnel crosses the Darling claim but the work on this claim has as yet failed to expose it.

Little Annie claim

The Little Annie claim is located on the north side of Quigley Hill. It lies between the Little Maud claim on the southwest and the Little Annie No. 2 on the northeast, having common end lines with both these claims. It is partially overlapped by the Gold Dollar claim on the north.

An open cut on the crest of a spur jutting out from the main hill towards Friday Creek discloses a vein of quartz 13 feet wide, having a strike of N 58° E and a steep dip to the SE. The ore for the most part is free milling and strongly oxidized, although some galena was noted near the hanging wall of the vein. Slickensides indicating a horizontal movement along the strike were observed. A sample taken by Mr. Gross across the full width of the vein assayed 0.28 oz. of gold and 4.90 oz. of silver per ton.

The same vein is also exposed in a second cut 60 feet southwest and a sample taken by the writer across 10 feet of ledge matter at this point assayed 0.24 oz. of gold per ton and 7.00 of silver per ton.

The principal development work on this claim centers around the Little Annie tunnel which was driven through schist country rock along a course of S 40° W to intersect this vein, starting from the west side of a small gulch in the northeast corner of the claim. It is timbered for the first 35 feet. In the tunnel the large vein just described is apparently split into two fairly well

defined smaller ones which stand roughly parallel at a distance of 30 feet from center to center. The first of these, which was encountered at a point 60 feet from the portal of the tunnel, is 3 feet 2 inches thick and has a strike of N 55° E and a dip of 62° SE. The vein material is iron stained quartz. A drift extends along the strike of this vein to the southwest for 10 feet and a sample taken by Mr. Gross across the vein at the end of this drift assayed 0.07 oz. of gold and 0.10 oz. of silver per ton. The second vein, which is cut by the tunnel at a point 90 feet from the portal, is 4 feet, 6 inches thick and has a strike of N 59° E and a dip of 66° SE. A sample taken on the left wall of the tunnel yielded 0.20 oz. of gold and 0.60 oz. of silver per ton. A drift has been driven along this vein for 75 feet to the southwest. The combined material from cuts taken in the roof of the drift at points 10, 20, 30 and 40 feet from the tunnel and across the full width of the vein in each case assayed 0.08 oz. of gold and 0.50 oz. of silver per ton. The material between these veins is highly silicified schist, intricately dissected by small quartz veinlets, carrying a small amount of gold.

From the point of its intersection with this second vein the main tunnel was extended for 170 feet in a southeasterly direction and it was used during 1919 in mining the high grade ore from a small vein which it intersected at this point.

This small vein consisted principally of silver bearing galena and was traced for nearly 100 feet along the surface by four open cuts. A series of samples taken by Mr. Gross across the full width of the vein in each instance gave the following assay returns:

Assays from the outcrop of the "Galena vein."

Location of Sample	Width of vein sampled	Ounces per ton Gold	Ounces per ton Silver	Percent Lead
Uppermost cut.....	24 in.	0.26	286.20	48.70
Second cut.....	8 in.	0.22	224.00	26.10
Third cut.....	12 in.	0.54	243.80	46.70
Lowermost cut.....	26 in.	0.14	218.90	53.40

During 1919 this claim was operated by a lessee and approximately 500 tons of high grade ore, which averaged over $200 per ton were mined and shipped to the smelter at Selby, California. In this work it was discovered that the high grade values rarely continued to a depth of more than 60 feet from the surface. All the ore in this particular shoot having a value greater than $150 per ton was removed, and the workings were then abandoned. By 1921, when they were first visited by the writer, they had become inaccessible.

The strike of this vein is approximately N 20° E with a dip of 65° of 70° SE. The ore is described as being almost solid galena, although some zinc blende and a little gray copper ore were associated with it. The gangue matter when present was either iron carbonate or calcite. Several small faults in a practically vertical plane having a throw of perhaps 5 or 6 feet were encountered during the mining operations.

Little Annie No. 2 Claim

The Little Annie No. 2 claim, which is located near the head of Friday Creek, is the eastern extension of the Little Annie and is partly overlapped both by the Gold Dollar and the Gold Eagle.

The development on this claim consists of three open cuts. One of them, lying about 100 feet east of discovery, which is situated near the west end line

of the claim, disclosed a vein of quartz about 9 feet wide which is highly iron stained and contains some partly oxidized galena. Free gold can be detected by panning. The strike of the vein is approximately N 65° E, with a dip of 70° S, and it is believed to be a continuation of the second branch of the Little Annie vein encountered in the Little Annie tunnel. A second open cut, 135 feet south of discovery, disclosed a 12-inch vein containing 5 or 6 inches of practically solid galena having a strike of N 50° E with a dip of 65° SE. The galena carries high values in silver and a sample taken by Mr. Gross across 12 inches of the vein assayed .08 oz. in gold and 136.50 oz. in silver per ton. The lessee mined approximately 10 tons of high grade ore from this vein in 1920 having a value of $200 per ton.

A third cut 800 feet northeast of discovery disclosed a vein of quartz 10 to 12 feet wide which is highly iron stained and contains a considerable amount of oxidized galena. The cut was partly caved and the strike of the vein difficult to determine, but it is approximately N 60° E dipping steeply to the southeast. The vein might well be a continuation of the first branch of the Little Annie vein encountered in the Little Annie tunnel. A sample taken by the writer across 10 feet of vein matter assayed 0.10 oz. in gold and 1.00 oz. in silver.

Gold Dollar Claim

The Gold Dollar claim lies north of the Little Annie and Little Annie No. 2, partly overlapping them.

A rich shoot of ore was discovered in an open cut near the east end line of the claim. The vein averages 3 or 4 feet in width and contains galena, sphalerite, tetrahedrite and some stromerite. The strike of the vein is N 65° E, dipping 75° to the south. It was developed by a shaft 38 feet deep and a short

tunnel driven from the side of a small draw to intersect the foot wall of the shaft. During 1920 the lessee mined between 500 and 600 tons of ore from this shoot having a minimum value of $170 per ton. At the time it was visited by the writer, however, the workings were so badly caved that they were inaccessible.

Gold Eagle Claim

The Gold Eagle claim is the eastern extension of the Gold Dollar, the two claims have a common end line.

At discovery cut, near the west end line of the claim, a vein approximately 3 feet wide was disclosed containing galena, pyrite, sphalerite and the oxidation products of these minerals. The sulphides carry high values in silver. A tunnel was started on the east side of the small draw previously mentioned to intersect this vein and follows a crushed and slicken sided zone for 60 feet along a course N 70° E. It then swings to the north for an additional 60 feet where it intersects the vein and follows it for 30 or 40 feet along a course N 65° E. The vein dips 75° SE. The vein in the tunnal, which is chiefly quartz, does not contain as many sulphides as are found in the surface cut. In the tunnel these are confined to a band 8 or 10 inches wide near the foot wall. Three or four tons of high grade ore, valued at $170 per ton, were mined from the surface cut by the lessee in 1920.

Gold King Claim

The Gold King claim is located near the head of Iron Gulch, a small stream flowing into Eureka Creek at the eastern end of Quigley Hill.

The claim is developed by two tunnels which were inaccessible. As described by Capps,[a] the vein has a width of from 4 to 6 feet and strikes N 80° E. It consists chiefly of quartz containing arsenopyrite, sphalerite and galena.

---

a. The Kantishna Region, Alaska, Stephen R. Capps, Bull. U.S. Geol. Surv. 687, page 103. Washington 1919

Gold King East Claim

This claim is the eastern extension of the Gold King, having a common end line with it, and extends across Iron Gulch practically at right angles to that stream.

The vein has been traced across the entire length of the claim by a series of open cuts which, however, were so badly caved that no accurage determinations of the width of the vein could be made.

Pittsburgh Claim

The Pittsburgh claim is located on the east side of Iron Gulch and is partly overlapped by the Pennsylvania claim. The trend of the claim is N 75° E. At discovery near the west end line of the claim an open cut disclosed a vein consisting of 6 or 7 feet of quartz containing more sulphides and calcite. The hole was inaccessible, however, and no samples were secured.

Pennsylvania Claim

The Pennsylvania claim lies west of the Pittsburgh and south of the Gold King East and is adjoined by the Keystone claim on the west. There are two principal veins on this claim which have been named Pennsylvania and Keystone by the owner.

The Pennsylvania vein crosses the west end line of the claim, (which lies at the bottom of Iron Gulch) about 100 feet north of the center and extends up the east slope towards the Pittsburgh claim. The strike of the vein is N 65° E with a dip of 85° S and it has been traced for over 500 feet by a series of open cuts spaced at approximately 100 feet intervalls. Although there is a gap of about 1000 feet which has not been prospected as yet, hence the continuity is not absolutely established, it is quite likely that this vein is the same one that is exposed in the discovery cut on the Pittsburgh claim. The vein matter

is quartz containing some pyrite and calcite, and free gold can be panned from samples taken along the outcrop.

The Keystone vein crosses the west end line of the claim at a point 100 feet south of the Pennsylvania vein. It has a strike of N 50° E with a dip of 60° S and extends up the hill towards the NE corner of claim, intersecting the Pennsylvania vein about 400 feet from the west end line. It has been traced along the surface for more than 1200 feet by 20 open cuts on the outcrop. The vein matter is chiefly quartz containing a considerable quantity of pyrite and arsenopyrite and some sphalerite and galena. It varies from 4 to 6 feet in width. A tunnel starting near the western end line of the claim has been driven for 50 feet along the hanging wall of the vein, and a shaft was sunk to a depth of 30 feet at a point near the intersection with the Pennsylvania vein. A sample taken by Mr. Gross across 14 inches of vein matter in the face of the tunnel assayed 1.6 oz. of gold and 1.60 oz. of silver per ton. Several ounces of finely crystallized gold were obtained by panning in a small open cut 60 feet east of the portal of the tunnel. A sample taken in the shaft by the writer gave the following assay: Gold, 0.96 oz. per ton and silver, 0.20 per ton.

Keystone Claim

The Keystone claim adjoins the Pennsylvania on the west with a common end line.

Both the Keystone and Pennsylvania veins have been traced by open cuts for 300 or 400 feet on this claim. There is a third vein which outcrops near the east end line of the claim between the other two veins and intersects both of them. The strike of this vein is N 30° E and it has a steep dip. It is developed by a tunnel which is 50 feet long and by several open cuts on the surface. The vein matter is quartz carrying galena and some pyrite. The vein

is 3 feet wide at the portal of the tunnel but narrows to 12 inches at the face. Some of the assays of weathered quartz taken from the surface cuts show high values in gold while others show but a trace, indicating that the deposit is extremely "spotty".

Sulphide Claim

The Sulphide claim is situated in the valley of Eureka Creek about 1500 feet south of the Keystone.

The discovery cut, near the center of the claim, disclosed an 8-ft. quartz vein carrying pyrite. It shows free gold on panning.

Water Level Claim

The Water Level claim lies west and a little north of the Sulphide claim along the south slope of Quigley Hill. A cut at the eastern end of the claim disclosed a vein 3 feet in width carrying galena. Samples from this cut are reported to have assayed from 30 to 40 oz. of silver per ton.

White Hawk Claim

The White Hawk claim lies west of the Water Level and somewhat higher on the slope of Quigley Hill.

A 3-ft. vein carrying some tetrahedrite but no galena was exposed in the discovery cut. This vein has been traced 500 feet to the southwest where a 12-ft. shaft disclosed a 3-ft. vein, which was followed by a drift 15 feet long. The ore is similar to that found at discovery. No assays have been made of samples from this claim.

Other Claims

In addition to these claims there are a number of others, including

the Jumbo, Caribou, Meadowbrook, Bluebell, Iron Gulch, etc., which have been staked on Quigley Hill. At the time this district was visited by the writer the excavations on these claims were so badly filled by caving that no data could be obtained regarding the veins exposed in them.

ELDORADO CREEK

A number of claims have been staked on the hill north of Eldorado Creek and west of Moose Creek, and in line with the trend of mineralization on Quigley Hill. On the majority of these claims the development work is limited to open cuts on the surface which were inaccessible through caving at the time the district was visited. On the Alpha claim, however, a considerable amount of development work has been done.

Alpha Claim

The Alpha claim lies near the top of the hill on the Eldorado Creek side about a mile from Moose Creek. The development work consists of a tunnel 120 feet long, the first 100 feet of which is timbered, and a shaft 20 feet deep situated 60 feet S 25° W from the end of the timbering. The vein matter is highly iron stained quartz and contains sulphides and oxides of lead and copper. The bottom of the shaft exposed a mineralized zone 8 or 9 feet wide containing three bands of highly mineralized iron stained quartz, each about one foot in width. Something over a ton of ore was sorted and sacked from the material excavated in sinking this shaft. A grab sample of this ore assayed by the Bureau of Mines showed 266.30 oz. of silver per ton.

GLACIER CREEK

McGonagall Claims

The McGonagall claims are located near the head of Glacier Creek.

The upper claim lies at an elevation of about 3500 feet. The vein is exposed at the surface and is developed by a tunnel 30 feet long at the face of which 8 feet of mineralized quartz was exposed which carried some galena and a small amount of stibnite. Samples taken by the owners across the entire width of the face are reported to have yielded .60 oz. of gold and 63.00 oz. of silver per ton.

The lower claim is also situated on the right limit of the creek but approximately one-half mile to the west and several hundred feet lower in elevation. The vein is exposed at the surface and consists of 18 inches of quartz which is free milling. One ton of ore from this outcrop was sent to a testing plant in Seattle and milled, yielding $30 in gold. A cross cut tunnel was started from the bank of the creek and driven to intersect this vein. At a distance of 30 feet from the portal it encountered a 3-ft. shear zone impregnated with gray copper, stibnite and chalcopyrite, from which assays containing as high as 52 oz. of silver per ton were secured. The tunnel was extended 15 feet beyond this shear zone without encountering the free milling quartz vein which it was being driven to intersect. A cross cut was then driven 12 feet to the right of the tunnel along the shear zone at the end of which the quartz vein was encountered. It was discovered that the vein had been faulted and displaced to the left and that the tunnel had been driven through the fault. The tunnel is 4 feet by 6 feet in the clear and is timbered for the first 25 feet.

GLEN CREEK

Two prospects were discovered during the summer of 1921 near the head of the west fork of Glen Creek.

Arkansas Claim

The first of these is known as the Arkansas claim, and the open cut at discovery exposed a mineralized zone about 14 feet wide consisting of three bands

of quartz separated by two bands of schist from right to left as follows: 5 feet of quartz, 2½ feet of schist, 1½ feet of quartz, 2½ feet of schist, 1½ feet of quartz. A grab sample taken by the writer across the 5-ft. quartz band showed 90 oz. of silver per ton. The ore is chiefly sulphides of lead and antimony with some sphalerite.

Pension Claim

The Pension claim lies about 1500 feet farther up the creek. The open cut at discovery exposed a vein 5 feet wide of which 2½ feet was nearly solid galena, the remainder being quartz. A grab sample, taken by the writer, of the 2½ feet of galena assayed 150 oz. of silver per ton. The owner was starting a tunnel about 25 feet below the outcrop at the time the claim was visited.

SPRUCE CREEK

Five claims have been located at the head of Spruce Creek, as follows:

Lucky Jim Claim

The discovery cut on the Lucky Jim claim exposed a ledge of rusty quartz one foot in width which pans free gold and carries some galena and chalcopyrite.

Lena Claim

The vein on the Lena claim is two feet wide and also consists of rusty quartz. It carries galena, some copper oxides or carbonates and some native silver. It an open cut 75 feet below discovery the vein is 3 feet in width.

Silver Wire Claim

The discovery cut on the Silver Wire claim showed a quartz vein two feet in width, carrying galena and some copper oxides.

Mystery Claim

At the Mystery claim the quartz vein is 2½ feet wide as exposed in the discovery cut, carrying galena, stibnite and copper oxides. No free silver was observed on this claim.

Ridgetop Claim

The Ridgetop claim is located on the divide between Spruce and Crevice creeks. The vein is 12 feet in width consisting chiefly of iron stained quartz and carrying a very little galena and some copper oxides.