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THE VALDEZ CREEK MINING DISTRICT ALASKA, IN 1936

BY

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THE VALDEZ CREEK MINING DISTRICT IN 1936

By Ralph Tuck

ABSTRACT

The Valdez Creek district is on the south flank of the Alaska Range, about 50 miles east of the line of the Government-owned and -operated Alaska Railroad. This report is a result of a short investigation of the current mining activities in the district in 1936, as a part of the cooperative program of the Alaska Railroad and the Geological Survey in furthering the mineral industry in the area tributary to the railroad.

The district is underlain by metamorphosed sedimentary rocks, principally argillite, slate, schist, tuff, and greenstone, which have been intruded by small stocks of diorite and quartz diorite. Stream and glacial deposits of clay, sand, gravel, and boulders are present in all the valleys.

Placer mining has been carried on in this district since the first discovery of gold here in 1903. Placer-gold deposits of two types have been worked—a buried-channel type, formed before the last period of glaciation; and a type in which the gold has been concentrated since the glacial epoch by the present streams. Deposits of both types have produced a considerable amount of gold. Placer gold will continue to be produced for many years, and probably at an increased rate, as many of the creeks have not yet been thoroughly prospected, and some of the producing properties are capable of a greater production. A number of gold-quartz prospects have been located and are being prospected, particularly in recent years. The gold lodes have a wide variety of occurrence and are found in both the metamorphosed sediments and in the intrusive rocks. None of these prospects have as yet produced gold in important amounts, but conditions are considered favorable for their doing so, and further prospecting and exploitation is well justified.

INTRODUCTION

The Valdez Creek mining district is in south-central Alaska, on the southern flank of the Alaska Range, at approximately latitude 63°12′ and longitude 147°20′. (See fig. 5.) In local usage the term "Valdez Creek district" includes Clearwater Creek and its tributaries which lie to the east. However, during the season of 1936 no operations were carried on in the Clearwater area and the field work was entirely within the drainage basin of Valdez Creek, so that the investigation covered a relatively small area. All the mines and prospects here described lie within an area of 25 square miles.

In an air line the Valdez Creek district is about 60 miles west of the Richardson Highway, which runs from Valdez to Fairbanks, and

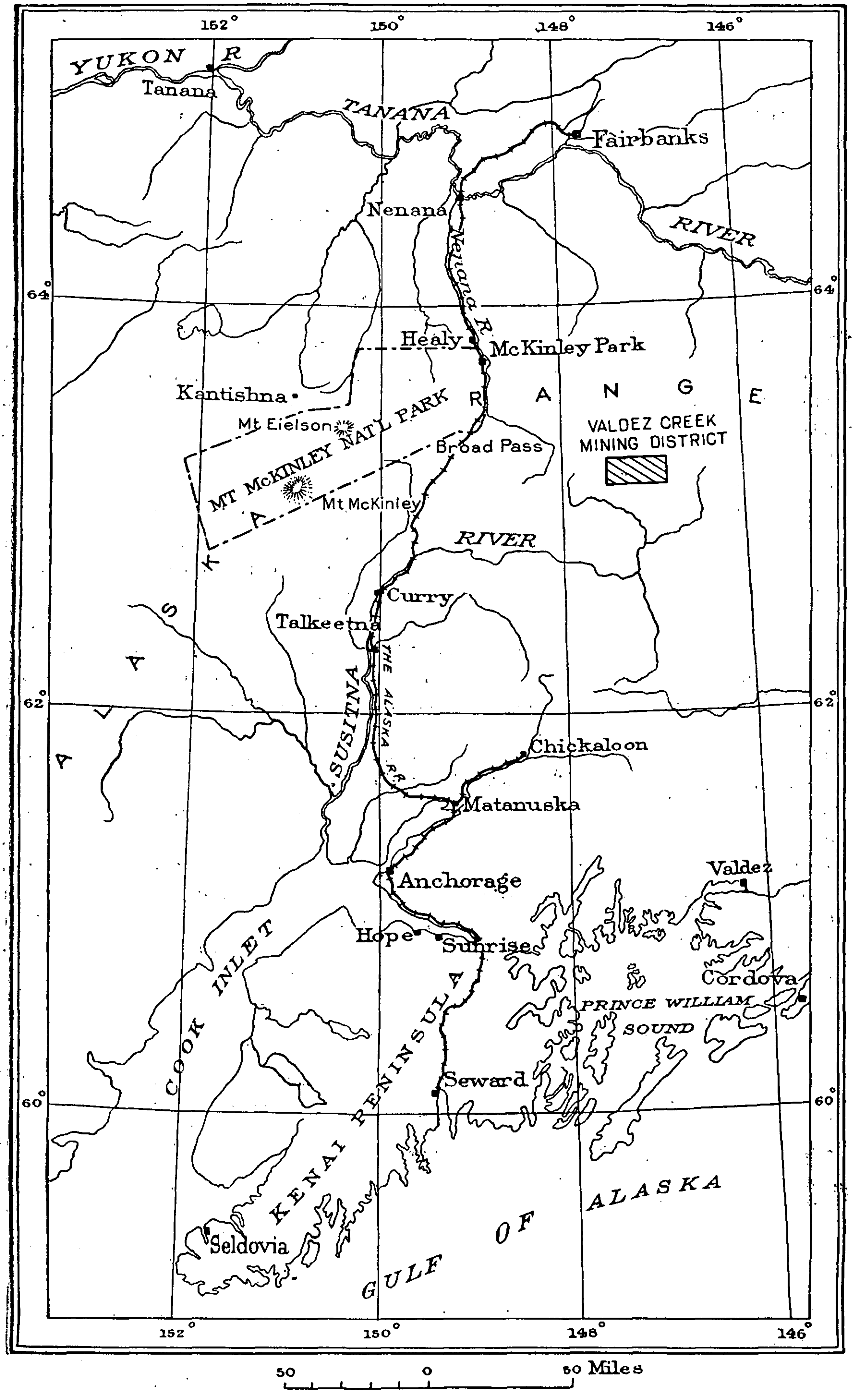

FIGURE 5.—Index map showing location of the Valdez Creek mining district, Alaska.

about 50 miles east of the Alaska Railroad, which runs from Seward to Fairbanks. At the present time the district has communication and transportation solely with the town of Cantwell, which is at mile 319 on the Alaska Railroad. Cantwell is a section point on the railroad, and a few men are stationed here for railroad maintenance. A roadhouse and trading post are operated for prospectors, miners, and trappers who make Cantwell their summer and winter headquarters. Within the last 3 years 30 miles of ordinary dirt road and two bridges across the Jack and Brushkana Rivers have been constructed; ultimately, this road will be extended to Valdez Creek. Three airplane landing fields have been constructed, one at Cantwell, one on lower Valdez Creek near Denali post office, and a third near the Brushkana River, half way between Cantwell and Valdez Creek. A plane is usually stationed at Cantwell in the summer, and freight and passengers are transported to Valdez Creek at reasonable rates. Most of the heavy freighting is done by tractor in the late winter, when there is sufficient snow and the streams can be safely crossed on the ice; the chief obstacle to this type of freighting is the uncertainty and lateness of the freezing of the Susitna River.

Fairly complete reconnaissance investigations and reports on the district have previously been made by two Geological Survey parties—one by F. H. Moffit [1] in 1910, and the other by C. P. Ross [2] in 1931. Those interested in general and detailed information on the district are referred to these reports, as the present report is intended only to describe the current mining and prospecting activities and to record the salient facts regarding the nature of the lode and placer deposits that have been disclosed in the course of recent development work.

The information in this report was obtained during an examination of the principal mines and prospects from August 24 to 31, 1936, and is a part of the cooperative work of the Alaska Railroad and Geological Survey in aiding and stimulating the development of the mining industry in the vicinity of the railroad. The writer is greatly indebted to the miners and prospectors of the district, not only for their hospitality but also for the information and field assistance that they provided.

GEOGRAPHY AND GEOLOGY

The geography and geology have been described in the previous reports, and only a summary will be presented here. Most of the

[1] Moffit, F. H., Headwater regions of the Gulkana and Susitna Rivers, Alaska, with accounts of the Valdez Creek and Chistochina placer districts: U. S. Geol. Survey Bull. 498, 1912.

[2] Ross, C. P., The Valdez Creek mining district, Alaska: U. S. Geol. Survey Bull. 849, pp. 425–468, 1933.

regional information on the geology has been taken from the earlier Geological Survey reports that have been cited.

Valdez Creek is about 15 miles long and flows westward into the Susitna River. The Susitna at this point flows in a broad, open valley and, like other large glacial streams in this part of Alaska, has a broad flood plain upon which it is constantly changing its channel. The headmost part of Valdez Creek flows in a broad glaciated valley; farther down, about 4 miles from its mouth, it enters a narrow canyon from 30 to 150 feet deep; half a mile from the Susitna River it emerges onto the broad flats of that river. The larger tributaries of Valdez Creek—namely, Timberline, White, Roosevelt, and Eldorado Creeks—all join it from the south, and none of them are more than 6 miles in length. (See fig. 6.) The valleys of all these tributary streams have been glaciated, and most of them head in small basins. Roosevelt Creek, the largest of the tributary streams, has its source in two glacial lakes, Tenas and Roosevelt Lakes.

The elevation of the district above sea level ranges from 2,500 feet at the mouth of Valdez Creek to over 6,000 feet at the summits of the divides on the north and south sides of Valdez Creek. The lower slopes are usually smooth and rolling, and only the highest summits are steep and precipitous. The entire district lies above timber line with the exception of a small area near the mouth of Valdez Creek. This lack of timber is a severe handicap to prospecting, as in some localities even firewood has to be hauled 8 to 10 miles.

The geologic formations that crop out in the Valdez Creek drainage basin are of three general types—metamorphosed sedimentary rocks, intrusive igneous rocks, and unconsolidated glacial and stream deposits.

Most of the outcrops are metamorphosed sedimentary rocks, and they are exposed on both north and south valley walls and in the canyon of Valdez Creek. Moffit and Ross distinguish the rocks on the north side from those on the south side and tentatively map them as separate formations. The rocks on the south side are chiefly argillite and slate, with minor amounts of impure sandstone, limestone, tuff, and schist, whereas on the north side the sedimentary beds have been more highly metamorphosed into sericite and chlorite schists, which are characterized by the presence of such typical metamorphic minerals as garnet, staurolite, sillimanite, and cyanite. Ross stated that the rocks of the two sides are probably assignable to the same formation and explained the greater metamorphism of the rocks on the north side as due to the proximity of the large intrusive mass of quartz diorite that forms the backbone of the northern ridge. The general strike of the metamorphosed sedimentary rocks is slightly north of east, and the prevailing dip is north. The schist and slate exhibit minor folds and crenulations with the same general trend as the major structure.

In addition to the batholithic mass of quartz diorite in the northern part of the district, several stocks and smaller masses of diorite intrude the metamorphosed sedimentary rocks. The three largest of these intrusive bodies are on Timberline Creek, on the north face of Gold Hill, and directly across the valley from Gold Hill. Many small quartz diorite and basic dikes occur throughout the metamorphosed rocks.

The entire region has been glaciated with the exception of the higher peaks and ridges, which protruded through the ice. Glacial moraines and glacial outwash deposits of clay, sand, gravel, and boulders cover the floors of all the valleys. Recent stream deposits of clay, sand, and gravel occur in only very small amounts along the present streams. The higher rock ridges are continually breaking down under the mechanical influence of weathering, forming accumulations of rock waste that cover large parts of the valley walls.

ECONOMIC GEOLOGY

HISTORY

Gold was first discovered in this region early in the fall of 1903, on the gravel bars of Valdez Creek a short distance above its mouth. The next spring a small stampede into the district took place, and practically all the streams were staked for placer-gold claims. In the fall of 1904 the so-called "Tammany Channel", an old buried channel that is cut across by the present Valdez Creek, was located. This old channel has contributed the major part of the gold production of the region. Prior to 1912 it was worked principally by underground methods; from 1913 to 1924 it was mined by hydraulicking; in 1924 hydraulic operations ceased, and shortly afterward underground mining was resumed. In 1928 hydraulic mining was started on some rich gravel on what may be the lower part of the Tammany Channel. Hydraulic operations on this new find and underground mining of the Tammany Channel have continued to this time. Mining of the recent gravel of Valdez, White, and Timberline Creeks, and Lucky Gulch has continued intermittently since the discovery of the camp.

Prospecting for gold lodes has been carried on at intervals since about 1908, on Valdez, Fourth of July, Timberline, White, Eldorado, and Surprise Creeks and Lucky Gulch, and several veins have been found. Systematic prospecting, however, has been carried on only during the last few years.

The total gold production of the district since its discovery up to and including 1936 is about $720,000, practically all of which has come from placers.

LODE DEPOSITS

ALASKA EXPLORATION & MINING CO.

A group of claims on the right limit of Timberline Creek about a mile above its mouth (see fig. 6) is held by the Alaska Explora-

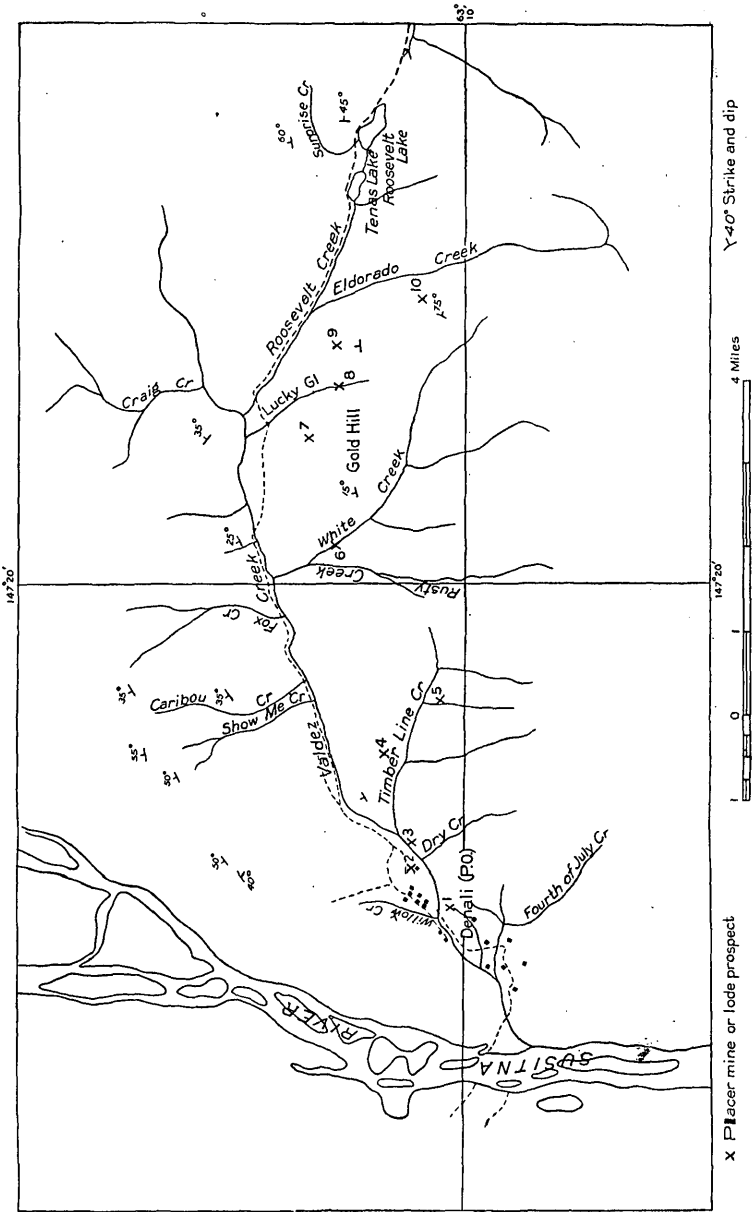

FIGURE 6.—Sketch map showing location of mines and prospects in the Valdez Creek district in 1936. Placer mines: 1, Carlson and associates; 2, Fred Bucke; 3, Loren Campbell; 6, Wickersham Bros.; 8, Babel & McDonald. Lode prospects: 4, Alaska Exploration & Mining Co.; 5, Campbell & Boedeker; 7, Yellowhorn; 9, Lucky Top; 10, Wagner and associates.

tion & Mining Co., which is incorporated under the laws of Alaska and composed largely of Washington and Idaho stockholders. Up to the present time more work, both surface and underground, has been done on this prospect than on any other in the district. The prospect was formerly known as the Powless claims, after the original locator, and in 1926 and 1927 some surface work was done on the Big and Little Caribou veins. Shortly afterward the claims were abandoned, but several years later they were restaked by Lawrence Coffield and associates, who spent the years from 1931 to 1933 in surface exploration of the Caribou veins. During the course of that work several small new gold-quartz veins were also discovered in the same locality, several hundred feet above the previously known

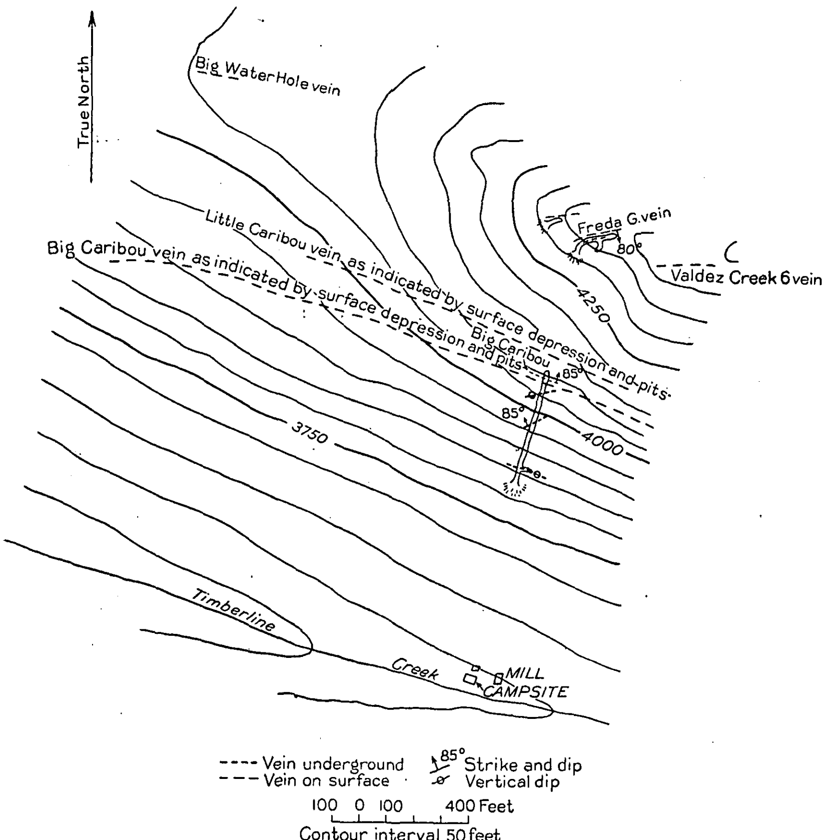

FIGURE 7.—Sketch map of the Timberline prospects of the Alaska Exploration & Mining Co.

veins. In the fall of 1933 Coffield's interest was acquired by the present company. In 1934 a small mill was installed on Timberline Creek, underground and surface work was undertaken on the Freda G., Valdez Creek No. 6, and Big Water Hole veins (fig. 7), and a few tons of ore was milled. The work was continued in 1935, and in 1936 a new lower tunnel was started at an elevation of 3,825 feet to intersect the Caribou veins about 200 feet below their outcrops.

In the fall of 1936 the Big Caribou vein was intersected, but because of winter conditions the underground work was stopped before encountering the Little Caribou vein.

Both the Big Caribou and Little Caribou veins show on the surface as shallow depressions over 1,000 feet long. In 1936 surface exposures of these veins were not visible, as rock slides on the steep slopes of the hillside had filled in all surface pits. Ross in 1931 described the surface exposures of the Big Caribou vein as having 8 feet of sheared and chloritized diorite, with quartz lenses containing arsenopyrite, pyrite, pyrrhotite, and a little chalcopyrite. The exposure of the Big Caribou vein in the new lower tunnel, 360 feet from the portal and about 200 feet below the surface, is much the same, showing 2 feet of quartz and 5 feet of gouge and sheared diorite with small quartz lenses. The quartz is glassy and in places has small grains of calcite associated with it. Pyrrhotite is the chief sulphide, with lesser amounts of pyrite, chalcopyrite, and a very small amount of ilmenite. Free gold has not been found in the vein material underground, and assays show only traces of gold and silver. The pyrrhotite is not nickel-bearing. The country rock is diorite and close to the veins is altered to chlorite that contains some pyrite. Although only a few feet of drifting on the vein has been done, it is apparent that the quartz is in lenses in the sheared diorite. Underground the Big Caribou vein strikes N. 85° W. and dips 85° N., its altitude being similar to that shown at the surface.

The crosscut tunnel to the Caribou veins also strikes three small veins. One about 60 feet from the portal, which has been drifted on for a distance of about 50 feet to the east, has 3 feet of quartz and sheared diorite, stands vertical, and strikes S. 70° E. At 200 feet from the portal is a vein with 1 foot of quartz and sheared diorite that strikes N. 65° E. and dips 85° NW. At 310 feet from the portal is a vein with 2 feet of quartz and sheared diorite that strikes east and is vertical. All these veins are similar in character to the Big Caribou except that sulphides are not as numerous, although assays seem to indicate that the gold content is slightly higher, though not of commercial grade.

The two upper tunnels are partly caved. One intersected the Freda G. vein at 60 feet from the portal, and there the vein is similar to its occurrence on the surface, with a few inches to 2 feet of massive glassy quartz that contains some free gold. The vein continues for 50 feet and then pinches down to a thin seam of gouge in the country rock of diorite. The other tunnel was intended to intersect a vein west of the Freda G. vein, but either the vein pinched out downward or else its inclination changed so that the tunnel was not driven far enough, as only massive barren diorite is exposed underground. At the surface this vein has about 1 foot of massive white quartz that contains some free gold. A few tons of ore from these veins has been milled.

The Big Water Hole vein consists of quartz lenses in sheared and altered diorite that are exposed by a few surface pits. About 30 feet from the vein is a zone of sheared and highly altered diorite that has locally been called schist. The altered diorite contains some gold, and a few tons of it has been milled. On both sides of the sheared zone the diorite is massive.

The only permanent building on the property is that enclosing the small mill consisting of a jaw crusher, ball mill, classifier, and amalgamating plates. It is reported that the percentage of gold recovered from the small tonnage that was milled was satisfactory. The present management has expressed the intention of continuing the lower crosscut tunnel to the Little Caribou vein and then of drifting on both Caribou veins in an attempt to discover an ore shoot.

The following table gives the results of assays of samples taken from the veins intersected by the lower tunnel. The gold and silver contents are similar to those obtained by Ross on the surface showing of the Big Caribou vein.

Assays from veins on Timberline Creek

Source and character	Gold (ounce to the ton)	Silver (ounce to the ton)
3-foot channel sample of quartz vein 60 feet from portal of lower tunnel	0.02	0.2
1-foot channel sample of quartz vein 200 feet from portal of lower tunnel	.01	.1
2-foot channel sample of quartz and gouge from vein 310 feet from portal of lower tunnel	.06	Trace
7-foot channel sample of Big Caribou vein in lower tunnel; 2 feet of quartz and 5 feet of gouge and sheared diorite	Trace	Trace
1-foot channel sample of quartz on north wall of Big Caribou vein in lower tunnel	Trace	Trace

CAMPBELL & BOEDEKER

Campbell & Boedeker have discovered a vein at the level of and about a quarter of a mile above the mouth of a small tributary of Timberline Creek from the south. (See fig. 6.) A 20-foot tunnel on the vein has not yet penetrated the weathered zone, because of the thickness of overlying slide rock. In the face of the tunnel is exposed 2 feet of quartz and sheared diorite. The quartz contains a large amount of pyrite, in some places as much as 50 percent, and both the sheared diorite and the massive diorite wall rock are in places impregnated with pyrite. The vein material shows some free gold, but because of its weathered condition whether the gold is primary or has been released by oxidation of the sulphides is uncertain. The vein strikes N. 85° E., dips 68° N., and has well-defined walls. The owners report that a sample of the sulphide concentrates assayed 1.9 ounces of gold and 1.5 ounces of silver to the ton and that a sample of the sheared diorite vein material assayed 0.18 ounce of gold.

YELLOWHORN

The Yellowhorn prospect was examined by Moffit[3] in 1910. Discovered in 1906 by a Mr. Frates, it is one of the oldest discoveries in the district. From 1908 to 1920 some surface work was done by Bill Smith and L. S. Wickersham. From 1921 to 1923 it was held by Steve O'Neil, and a few feet of tunnel was driven. In 1930 and 1931 it was restaked by Lawrence Coffield. In 1932 it was relocated by C. A. MacGahn and Elmer Boedeker, who are the present owners.

The prospect is on the north slope of Gold Hill, about midway between White Creek and Lucky Gulch, at an elevation of about 3,950 feet. (See fig. 6.) The country rock is micaceous schist, striking S. 75° E. and dipping 18° N. The short tunnel driven by O'Neil has been cleaned out, and a 4-foot mineralized zone has been uncovered; 1 foot of quartz is exposed at the top, underneath which is 3 feet of schist with small quartz seams and lenses. The quartz veins and lenses parallel the schistosity of the country rock, and the whole mineralized zone appears to have the same strike and dip as is regionally shown by the metamorphosed sediments. All of the exposed rock and mineralized material is highly weathered. Most of the quartz is sugary and microscopically shows small crystal terminations in small vugs. Small amounts of pyrite and galena and some gold occur in the quartz, the gold being usually in very small particles and visible only with a hand lens. The weathered material from the mineralized zone pans well; 10- to 20-cent pans of very small-sized rough gold are not uncommon. A 1-foot channel sample of the quartz at the top of the mineralized zone assayed 0.01 ounce of gold and 0.1 ounce of silver to the ton. A 4-foot channel sample of the schist with small quartz lenses assayed 0.04 ounce of gold and 0.1 ounce of silver to the ton.

About 12 feet below and a few feet to the west of the old tunnel a new tunnel 60 feet long has been driven by Boedeker & MacGahn in micaceous schist that has the same strike and dip as the mineralized zone. Because of this dip, the tunnel at its present level will not intersect the mineralized zone, as the farther it penetrates the hill the higher the lode is above it.

About 140 feet west of the old tunnel, the probable continuation of the zone has been found (see fig. 8), but here the mineralized schist is only 12 inches thick, and numerous pannings of the vein material indicate that the gold content is lower.

[3] Moffit, F. H., op. cit., p. 56.

Prospecting the lode is difficult, not only because of slide rock and the weathered condition of the bedrock but also because of the inclination of the mineralized zone and the configuration of the hill. The slope of the hill is only slightly greater than the dip of the mineralized zone, and both are in the same direction; furthermore, the hill here is not cut by any large gullies, which might give easy access to the lode. Considerable underground work will be necessary in order to expose enough unweathered material to determine the average gold content of the zone, and much more to block out an appreciable tonnage, even if the mineralized zone is persistent.

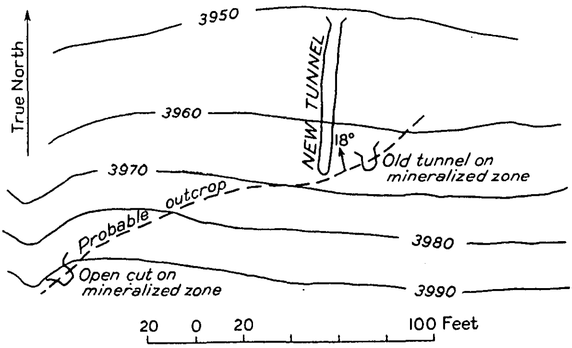

FIGURE 8.—Sketch map of the Yellowhorn prospect, Gold Hill.

If it can be definitely established by surface work that the two openings are on the same zone, the most logical point of access would be a tunnel on and along the strike of the lead to the southwest, from the small gully at the western exposure.

The weathered condition of the mineralized material, the small size and roughness of the particles of gold, and the presence of some sulphides suggest the possibility that in the unweathered portion of the lode the gold may be combined with the sulphides, and therefore the ore would not be free-milling.

At several other places on Gold Hill fine gold can be panned from the soil and weathered rock, indicating that other such mineralized zones are present. So far as is known, no work has been done on the old Accident claim, a few hundred yards east of the Yellowhorn, which was reported by Moffit[4] to have some fine gold.

LUCKY TOP

The Lucky Top prospect was located in the early part of August 1936 by John Babel, William McDonald, Fred Johnson, and Casper Johnson. Rich gold-quartz float was found on the east side of Lucky

[4] Moffit, F. H., op. cit., p. 57.

Gulch and was finally traced to the top of the ridge, which lies between Lucky Gulch and Valdez and Eldorado Creeks and is known locally as Lucky Hill. (See fig. 6.) The only exposure of the vein at the time of this investigation was the discovery pit at the top of the ridge, at an elevation of about 5,000 feet. The vein is from a few inches to a foot wide and is composed of banded comb quartz with well-defined slate walls. Gouge and slickensided quartz indicate that there has been postmineral movement, chiefly in the plane of the vein. Associated with the quartz are arsenopyrite and flakes of galena. Free gold is common, and some very spectacular specimens have been taken from the vein at the surface. One, a piece of quartz about the size of a teacup, contained almost 2 ounces of free gold.

The locators report that the vein has been traced several hundred feet down the side of the mountain toward Lucky Gulch, and this is indicated by the caved pits and small piles of gold-bearing quartz that is identical with that from the discovery at the top of the ridge. A small tunnel has been started on the east side of Lucky Gulch about 300 feet below the outcrop, and it is expected that the vein will be encountered within 70 feet of the portal if it persists to the tunnel level. With this type of vein, it would be advisable to drive the adit at only a short distance below the outcrop, as many such veins pinch out within short distances.

Because of the coarseness and roughness of the gold in the gravel of Lucky Gulch, that basin has long been believed to be a favorable location for lode prospecting, and the discovery of 1936 substantiates this belief. The Lucky Top prospect had long been overlooked, in spite of the rich float on the hillside, because of the presence of barren quartz veins on each side of it. Whether or not this prospect will develop into a profitable mine can be proved only by underground work, but it is evident, from the high grade of ore at the discovery pit, that even if the vein proves to be small it may be capable of being worked commercially. The probability is that a vein of this type will be narrow and will pinch and swell because of the minor faulting in the plane of the vein. However, it is probable that, if the vein persists in its normal course down the slope of Lucky Hill, free-milling ore will continue to depth.

Float from the Lucky Top vein would probably join the channel of Lucky Gulch halfway down its course, and since coarse, rough gold is found in the gravel above that point and as this gulch is of postglacial origin it seems likely that other gold-bearing lodes are present higher up the gulch.

ELDORADO CREEK

F. L. Wagner and associates hold several lode claims on the west side of Eldorado Creek, 1½ miles above its mouth. (See fig. 6.)

These claims were staked in 1934 by Lawrence Coffield, who later in the same year disposed of his interests to the present owners. The location of these claims was due to the discovery of large quartz boulders, some several feet in diameter and carrying considerable free gold, on a small knoll on the mountain side. It has not yet been determined whether this gold-bearing float came from that knoll or from some point higher on the side of the mountain. The configuration of the mountain side suggests a rather extensive slide, although small gold-bearing veinlets in tuff were found in place on the knoll. Detailed surface prospecting will be necessary to locate the source of the large gold-bearing quartz boulders.

About a mile north of the Wagner claims on the west side of Eldorado Creek, C. P. Lampert has found some lenses of glassy quartz which have a maximum width of several feet. They are most abundant in basic dikes but also occur in the country rock of slate. The quartz is rusty in places, but no sulphides are visible. The locator reports that free gold can occasionally be panned from the quartz.

PRINCIPAL FEATURES OF THE LODE PROSPECTS

The prospecting already done indicates that gold is the only metal that might occur in economic quantities in the Valdez Creek district. Although several lode-gold prospects have been located, none of them have reached a commercially productive stage; whether commercial deposits exist can be demonstrated only by further prospecting for new lodes and continued development of the known ones. The search for lode-gold deposits is fully justified by the geologic conditions, particularly by the presence of small dioritic stocks, many of which are hydrothermally altered, as well as by the occurrence of shear zones, which might control the location of gold deposition. The placer-gold concentrations in the gravel of most all the creeks and the gold-quartz float found in many parts of the district are clearly of local origin and further suggest the likelihood of lode deposits in the immediate vicinity. However, the original material from which the placers or the float was derived may be of too low tenor to work as a lode deposit. The vicinity of Lucky Gulch seems to be a particularly encouraging place for prospecting for lodes as the gulch is small and the gravel has been rich and contains coarse gold, much of it with is found in the gravel above that point and as this gulch is of post-glacial origin, it seems likely that other gold-bearing lodes are present a few hundred feet from its bedrock source.

The gold lodes thus far found show a wide variety of characteristics, and scarcely any two of the prospects are alike. They occur in both the metamorphosed sedimentary rocks and the intrusive diorite, and as fissure veins, sheared zones, mineralized zones paralleling the structure of the metamorphosed sedimentary rocks, small irregular veins, and disseminated deposits. Division of the occurrences into types is not practicable with the present small number of discoveries, but some belong to types that under favorable conditions might carry gold in sufficient quantities to be worked commercially.

The minerals associated with the gold are not diverse but in a few deposits give some indication of the conditions under which the lode was formed and of the future possibilities. Glassy quartz, pyrrhotite, and ilmenite in a few of the deposits suggest formation under conditions of high temperature and at considerable depth, or else at an early stage of mineral deposition, prior to the gold. Such an association of minerals is not usually favorable to the occurrence of gold. In many of the veins glassy quartz is associated with mica and calcite—an association that likewise is not usually regarded as favorable in this area. The presence of pyrite is not diagnostic, as it may or may not be accompanied by gold. Veins that carry some galena and sphalerite, even if in small quantities, are encouraging, as in this part of Alaska many such veins contain gold in valuable amounts.

PLACER DEPOSITS

GEOLOGIC HISTORY AND ORIGIN

In the valleys of a mountainous country that has been glaciated the glaciers have usually removed or disturbed most of the loose, unconsolidated deposits of silt, sand, and gravel that may have previously been formed. As the Valdez Creek region has been severely glaciated, it would normally be expected that all preglacial concentrations of gold in the gravel would have been destroyed and that the only placer gold would be found in gravel that has been deposited since the glaciation. However, this region contains not only postglacial gold-bearing gravel, but in at least one place a preglacial gold concentration has survived through a part of the glacial epoch.

PREGLACIAL DEPOSITS

The Tammany Channel is a narrow, sharply V-shaped canyon containing a rich concentration of gold, which lies principally on bedrock. The bottom of the channel is cut 60 to 80 feet below the surrounding bedrock. Rough, poorly sorted stream-deposited gravel containing some gold completely fills this narrow canyon and is overlain by rounded, well-sorted gravel containing very little gold. Mantling this later gravel and distributed over the surface throughout the valley in this area are very large, angular glacial boulders. The present topography of the valley in the vicinity of Denali gives no evidence of the presence of this buried channel, and it was discovered only because it was later cut across by the present Valdez Creek.

The Tammany Channel probably represents the course of an ancestral Valdez Creek, which had approximately the same general drainage basin as the present creek. This ancestral stream was eroding vigorously, as is shown by the narrow, V-shaped canyon and the large boulders and rich accumulation of gold on bedrock. Any stream that has a rich bedrock gold deposit must have been cutting downward vigorously prior to the deposition of the gold. For some unknown reason, directly after the deposition of the bedrock gold, the base level of the old Valdez Creek was raised, so that it changed from a vigorously eroding stream to one that was depositing more material than it was removing. At times, perhaps during flood periods, it even cut downward again, as is indicated by the coarse wash in the channel and the scattered small runs of gold above bedrock. Another rise in base level followed, so that the stream became more placid and deposited the well-rounded and sorted gravel that overlies the channel. The rise in base level may have been either a contributory cause or an effect of glaciation, as glacial boulders were deposited on the upper gravel. Little silt occurs with the boulders, so it seems improbable that they were rafted in on floating ice but more likely that the ice upon melting left them in their present position. The movement of ice could not have been great, as if so it would have removed the gravel, although the concentration of gold might have been preserved because of the narrow and steep walls of the Tammany Channel. The Valdez Creek Valley has been severely glaciated, and any movement of ice down the valley would probably have removed the gravel, as at least a part of the channel lies parallel to the ice movement. It is therefore probable that the glacial boulders overlying the Tammany Channel in the vicinity of Denali were deposited by a sluggish lobe of the Susitna Valley glacier at a time when the Valdez Valley glacier had already retreated.

Little is known of the advances and retreats of the valley glaciers in this region, and the concentration of gold in the Tammany Channel may have been formed during one of the periods between advances of ice. In a few localities in the immediate vicinity the bedrock underlying the sorted gravel is glacially striated, and this, together with the moraine overlying the same gravel, indicates at least two ice advances, although, as previously suggested, the last of these may have only been a minor advance of a lobe of the Susitna Glacier into the valley of Valdez Creek.

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After the final retreat of the glaciers, Valdez Creek began to flow anew over the moraine-covered surface. It did not reassume the course of the ancestral stream, because of the irregularities of the moraine and gravel surface, and so far as is known, it has cut the old channel only in one place. Today the base level has been lowered even below that of preglacial time, and Valdez Creek has entrenched itself in bedrock 40 feet below the bottom of the Tammany Channel.

Although the Tammany Channel gold came from the Valdez Creek Basin, the immediate source is a matter of speculation. The gold is flat and worn smooth, and no large nuggets have been found, although in general it would be termed coarse. It may have been derived from some of the known mineralized areas, such as Timberline Creek and the Gold Hill and Lucky Gulch areas, or it may have come from unknown lode deposits in Valdez Creek Valley that are now covered with overburden. Another possibility is that it may be a reconcentration from gravel or moraine of the old preglacial or interglacial Valdez Valley. This possibility seems the more plausible, because the location of the concentration is at the mouth of the valley, which at this point is wide and suggests the existence here of such deposits at one time.

POSTGLACIAL DEPOSITS

The remainder of the known placer gold deposits in the region are concentrations that have been formed since glaciation ceased. Although all of the same general type, they vary within themselves in the distribution, quantity, and source of gold.

The gold in the present stream gravel on the lower part of Valdez Creek, below the Tammany Channel, is a postglacial deposit. The greater part of this gold is reconcentrated from the Tammany Channel where it has been dissected by Valdez Creek. In Valdez Creek Canyon upstream from the Tammany Channel there are many small bars containing gold, but the concentration is not as rich as that below. The principal source of the gold in the lower part of Valdez Creek was the rich Tammany Channel, whereas in the upper part of the canyon the gold probably came from the comparatively lean gravel that mantles the whole region in this vicinity.

The gold-bearing gravel of Lucky Gulch and White Creek has been deposited since the glaciation. The gold on White Creek has probably been concentrated from glacial gravel and moraine as well as from the bedrock source on Gold Hill. The deposit in Lucky Gulch came entirely from the bedrock source on Gold and Lucky Hills. On both of these creeks the concentration on bedrock is not as marked as in the Tammany Channel, for the time since the glaciers retreated has been short, and the streams are not cutting down vigorously. In both of these valleys, particularly Lucky Gulch, the streams have sufficient grade to be eroding vigorously, but they have more rock debris than they can handle, and their channels are choked. Only occasionally, at times of very high water, can they cut down to bedrock. The supply of rock debris to both of these streams is large because of the rock slides on the steep slopes of the adjacent valley walls.

PLACER MINING

VALDEZ CREEK

In 1936 there were no large placer operations on the recent gravel bars of Valdez Creek. The first discovery of gold in this district, as well as the first mining, was in the recent gravel in the lower part of the canyon, and it is reported that this ground has been worked out up to the point where the Tammany Channel crosses the creek. Above the Tammany Channel the canyon is narrow and deep for several miles, with here and there small benches of gravel that are 20 to 100 feet wide and several hundred feet long. In places these small benches have a good gold content. During the greater part of the summer of 1936 Loren Campbell sluiced the creek gravel at a locality a few hundred feet below the mouth of Timberline Creek, and he reports that he made good wages but that the gold concentration is erratic. Between Campbell's ground and the old Tammany Channel several Indians worked by hand at intervals through the summer and took out a small amount of gold. The creek gravel is from 4 to 10 feet deep and lies on slate bedrock. Diorite boulders as much as 4 feet in diameter are plentiful, and their removal is the principal mining difficulty. If systematic prospecting should show that these gravel deposits contained a satisfactory amount of gold along the entire canyon, it seems probable that they could be worked mechanically, but an extremely mobile type of outfit would be necessary, as frequent moves would have to be made.

In recent years practically all of the gold produced in the district has come from the buried Tammany Channel in the vicinity of Denali and from ground a little to the southwest, which may be the western extension of that channel.

The Tammany Channel was first mined by underground methods, later by hydraulicking, and again during the last few years by underground methods. The property is owned by John Carlson, of Cantwell, but is leased to and being mined by Fred Bucke, who during the season of 1936 employed six men in operating it. A vertical shaft 145 feet deep reaches the face of the old underground workings at the bottom of the channel. From the bottom of this shaft a drift has been driven as near as possible to and along the middle of the channel. Short crosscuts are made at right angles to the drift, for the channel has an average width of only about 25 feet. All the ground to a height of 6 feet above the slate bedrock is mined and is carefully timbered with square sets. Small areas of low-grade gravel are sometimes encountered, and they are left in place and serve as supporting pillars. Some of the gravel is slightly consolidated, so that it will stand for a short time, but in the unconsolidated ground that is likely to cave the top laggings are driven ahead of the mining. Diorite boulders, as large as 5 feet in diameter, are numerous; the boulders are washed, scrubbed, and carefully stacked in the mined-out areas as supporting pillars so as to relieve the timber of the pressure of the overlying gravel. Bedrock is especially carefully cleaned, as most of the gold lies directly on it.

The mined gravel is trammed to the shaft and hoisted to the surface, where it is dumped directly into sluice boxes, which are built at a considerable elevation above the surface so as to provide room for the discharge of the tailings. Hoisting is done by means of a water wheel, and water for both hoisting and sluicing is obtained by a pipe line and ditch which has its intake in Valdez Creek above the canyon. The old drift down the channel from the bottom of the shaft to the face of the open cut is kept open for drainage, ventilation, and as a safety exit. Ventilation from the shaft up the channel to the underground working face is maintained by a water-driven blower fan.

Gold from the Tammany Channel is flat and worn, and the average value of the ground is reported to be around $2 a square foot of bedrock. Experience has shown that the richest concentrations of gold are found at places where the bedrock is rough and the gravel is angular and compacted. Loose gravel on smooth bedrock yields only small amounts of gold.

The only other work on the Tammany Channel, on the north side of Valdez Creek, was being done by a few individuals in the area that has been exposed by hydraulicking. At various times during the season of 1936 these persons were engaged in cleaning the gravel-filled fractures in the bedrock of the old channel, principally with spoons and knives. They report that this work was yielding an average return of $3 to $6 a day.

The Tammany Channel has not been definitely identified on the south side of Valdez Creek, although some prospecting has been done on the south wall opposite the channel. At the present time bedrock on this canyon wall is concealed by debris from the overlying gravel. As work progresses in the hydraulic pit about 3,000 feet downstream and on the south side of the creek, it becomes increasingly apparent that the lower part of the Tammany Channel is present there. That ground is owned by John Carlson, and the pay streak now being worked was discovered in 1927 by natives who had leased the claims. The pay channel where first discovered, on the south side of Valdez Creek, was believed to be bench gravel, as bedrock is about 15 feet above the creek. The pay streak leaves Valdez Creek and trends up the dry bed of a gully in the general direction of the Tammany Channel. The channel is wider and shallower, and the gravel differs from that of the known part of the Tammany Channel, but the character of the gold and the average tenor of the ground are similar. The bedrock at the face of the hydraulic pit is 30 to 40 feet below the lowest elevation of bedrock on the known part of the Tammany Channel, which further indicates the possibility of the two localities being on the same channel.

Two hydraulic outfits have been mining on this pay streak; one, consisting of three Indians, has been working on the south side, and the other, on the north side, consists of a partnership composed of John Carlson, Wallace Fairfield, and Dan Ohman. From six to eight men are usually employed by the partnership, which has a completely equipped plant. Water is obtained from a ditch line on the north side of Valdez Creek and is carried across the stream by means of an inverted siphon. Large boulders, which are numerous, are either hoisted out of the way or drilled with compressed-air drills and blasted. The greatest difficulty in the operation is the necessity of placing the boxes deep enough into bedrock to provide sufficient grade for future work. As the pay channel is narrow, with high barren gravel banks on each side, the gravel must be carried to Valdez Creek through the sluice line for disposal. The face of the hydraulic pit is now about 400 feet from Valdez Creek, and in places the boxes are 20 feet into bedrock.

Gravel of two types and of different ages is exposed in the cut. The lower gravel is partly oxidized, poorly sorted, and angular, has numerous boulders, and is overlain by 2 feet of soil and peat. The upper gravel is well sorted, has but few boulders, and carries little gold.

Two prospect holes were drilled in the gravel benches near the Susitna Flats during the summer of 1936 by a group of men from Palmer, Alaska. Both of these holes are said to have failed to reach bedrock. The one on the south side of the creek, a short distance southwest of the hydraulic pit, penetrated through the bench gravel into fine silts that are apparently part of an ancient flood plain of the Susitna River.

The valley of Valdez Creek above the canyon is broad, unchanneled by streams, and the grade of the creek is low, so that prospecting is difficult, and no paying gold placers have been found there. The possibility that preglacial placers have survived there through the glacial period is slight, for the valley has been intensely glaciated. Concentrations from tributary streams that occupied canyons in the broad valley of upper Valdez Creek and yet lay athwart its trend may have survived if the bedrock was not too greatly eroded. Since the close of glaciation there has been little erosion in the upper basin of Valdez Creek, and therefore little opportunity for the concentration of gold.

TIMBERLINE CREEK

No placer mining has been done on Timberline Creek during the last few seasons, and much of the ground remains untested. There are several sources from which gold might have been concentrated, but the highly glaciated condition of the valley precludes the likelihood of the survival of any extensive preglacial auriferous deposits. Any concentrations that may occur are likely to be in the lower part of the valley, formed since the retreat of the valley glacier.

WHITE CREEK

L. S. and H. M. Wickersham have for many years mined the gravel of White Creek at a point about 1½ miles above its mouth. On the right limit of the creek they have several hydraulic cuts in bench gravel that slopes away from Gold Hill. In these cuts the gravel is more than 15 feet deep and is composed chiefly of poorly sorted and but little worn slate fragments. Slide rock from the slope of Gold Hill is mixed with the gravel and in part overlies it. Small boulders are abundant, but few exceed 2 feet in diameter, and those are easily broken or disposed of. Most of the mining has been done by hand and with a small and inadequate hydraulic plant. Gold is disseminated throughout the gravel and the slide rock, and even though their workings seldom reach bedrock the Wickershams estimate that much of the ground they have worked has averaged 30 cents a cubic yard. Most of the gold is rough, many pieces still having quartz adhering to them. Hessite, the silver telluride, is fairly common in the concentrates.

In 1936 the Alaska Central Mining & Exploration Co. acquired an option on the Wickershams' ground on White Creek and spent the entire summer drilling both above and below the hydraulic pits. It is reported that much of the ground drilled is similar to that mined and that the depth to bedrock averages around 20 feet.

The valleys of White Creek and its tributaries have been severely glaciated, so that any workable placers there are likely to be of postglacial age. The character of the gold, its presence in the slide rock, and the occurrence of a pay streak on the right limit show that much of the gold has come from Gold Hill. The Wickersham pits show that the gold is disseminated throughout the gravel, and it is doubtful if a heavy concentration on bedrock will be found, for the rock debris on White Creek has not been sufficiently reworked. Rusty Creek, the largest tributary of White Creek, has not been mined for several years.

LUCKY GULCH

Lucky Gulch is a steep, short, northward-flowing tributary of Valdez Creek that heads on the ridge between White Creek and Roosevelt Creek between Gold and Lucky Hills. The gulch is only about 1 mile long and has a steep gradient, and the gravel, composed principally of slate, is subangular and little sorted. The slopes of Gold and Lucky Hills rise steeply from the creek, and slide rock from them is intermingled with the stream gravel. Slate boulders are numerous but are easily broken. The coarsest and roughest gold in the district has been obtained from this gulch, and it is apparent from the nature of the drainage basin that the gold is of local origin. Most of the creek is held by the Wickersham brothers, but for the last few years it has been leased and worked by John Babel and William McDonald. Booming with an automatic dam has been the chief means of mining, for the supply of water is small and furnished almost entirely by melting snowdrifts, which in late summer are often entirely gone. A small amount of drift mining is sometimes done in the winter, as the gravel is then frozen down to bedrock. Only the gravel in the present bed of the creek has been mined, and most of it has been worked out. However, the following quotation from Ross' report [5] is pertinent:

> In such a gulch snowslides and the movement of the talus have probably caused numerous shifts in the course of the stream, with resultant wide distribution of the gold content. Hence the entire fan-shaped mass of detritus and not merely a narrow channel in it is potential placer ground. A relatively small amount of this fan has yet been trenched by booming.

ROOSEVELT AND ELDORADO CREEKS

Both Roosevelt and Eldorado Creeks are potentially sources of placer gold, although they have been but little prospected. As in most of the creeks in this district, only postglacial concentrations

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[5] Ross, C. P., op. cit., p. 454.

of gold are likely to be found, for both valleys have been highly glaciated. Roosevelt Creek is similar to upper Valdez Creek, and the same general conditions prevail there. Eldorado Creek has a steeper grade and a more confined stream channel, so that prospecting there would be less difficult than on upper Valdez and Roosevelt Creeks. A few placer claims have been staked on Eldorado Creek near the Wagner lode deposit.

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