

MINING IN THE FORTY MILE DISTRICT

By J. B. MERTIE, Jr.

INTRODUCTION

The Fortymile district is the oldest mining district in interior Alaska. Gold was discovered in 1886 on the bars of the Fortymile River by Howard Franklin and shortly thereafter on numerous streams tributary to the Fortymile. Franklin Creek, named after Howard Franklin, was struck in the fall of 1886, and the Fortymile district has produced steadily from that date to the present time.

This district had not been visited by members of the Geological Survey for a number of years until 1928, when a field party in charge of the writer passed through it on the way to the country that lies to the south. The primary object of this expedition was to visit and map the area lying between the Fortymile mining district and the Tanana River, and the results of this work will be published in a separate report. At the end of the field season the writer visited the mining plants in the Fortymile district, and this paper, resulting from these examinations, is intended mainly to sketch the present progress of mining development in the district.

Mining in the Fortymile district centers about six more or less separated areas—namely, Dome Creek, Steel Creek, Wade Creek, Franklin Creek, Chicken Creek, and the headwaters of Walker Fork of the Fortymile River. Post offices are maintained at Steel Creek, Jack Wade, Franklin, and Chicken, and the mail is carried three times a month. The Walker Fork area lies near the international boundary, east of the main mail route, and receives its mail by private carrier from Steel Creek.

The Fortymile district is approached from Eagle, to the north; from Fortymile, to the northeast; or from Dawson, to the east. The Eagle route is the main line of approach, Eagle being the distributing point for summer and winter mail and one of the sources of supplies for the district. In winter, however, much freight is brought up the Fortymile River from Fortymile, Yukon Territory; and Dawson is depended upon for medical supplies and services and is also a partial source of supplies for the Walker Fork area. An airplane landing field has been built at Chicken, and in emergencies passengers are carried thence to Fairbanks or elsewhere in the Territory. One of

the handicaps to communication in the district is the complete absence of telegraphic facilities, the nearest wireless stations being at Eagle and Dawson.

Supplies for the Fortymile district are carried by pack horses in summer and by horse sleds in winter from Eagle to Chicken, a distance of 90 miles. The summer freighting rates from Eagle to Steel Creek, Jack Wade, and Chicken are, respectively, 15, 20, and 25 cents a pound. The corresponding winter rates are 5, 6, and 7 cents. From Fortymile, Yukon Territory, winter freight is delivered at Jack Wade and Chicken, respectively, at 4½ and 5 cents a pound. The commercial winter freight rate from Fortymile to the Walker Fork area is 3½ cents a pound, but the Walker Fork Gold Corporation hopes to cut this rate in half by the use of caterpillar tractors. An interesting possibility for Chicken Creek and vicinity is the use of airplanes for commercial freighting from Fairbanks. The air-line distance is about 200 miles, and even at present commercial rates for airplane freight it should be possible to deliver supplies at Chicken at a rate as low as the present summer rate for land freight, if not lower. The use of airplanes for mail delivery in the Fortymile district, by providing regular business, should stabilize and materially cheapen air freight rates.

GEOGRAPHY AND GEOLOGY

The geography and geology of the Fortymile quadrangle, which includes the Fortymile mining district, has been described by Prindle¹ in earlier publications; and as no additional geologic work was done in this area in 1928 only a very brief statement regarding the geography and geology seems warranted.

The Fortymile mining district may be said to constitute the southern half of the Fortymile quadrangle and is drained entirely by the Fortymile River and its tributaries. (See fig. 4.) The Fortymile River has two main forks, the North Fork and the South Fork. O'Brien Creek, of which Dome Creek is a tributary, drains to the main Fortymile River. There are no mining operations on the North Fork of the Fortymile. The South Fork, as will be seen from Figure 5, is made up of three branches, which named in order upstream are Walker Fork, Dennison Fork, and Mosquito Fork. Wade Creek, one of the producing creeks, heads against Steel Creek and drains southward into Walker Fork. Other mining operations are being carried on at the head of Walker Fork. Franklin Gulch drains eastward into the South Fork, and Chicken Creek flows southward into Mosquito Fork. No mining operations are now in progress on Dennison Fork.

¹ Prindle, L. M., The gold placers of the Fortymile, Birch Creek, and Fairbanks regions, Alaska: U. S. Geol. Survey Bull. 251, 1905; The Fortymile quadrangle, Alaska: U. S. Geol. Survey Bull. 375, 1909.

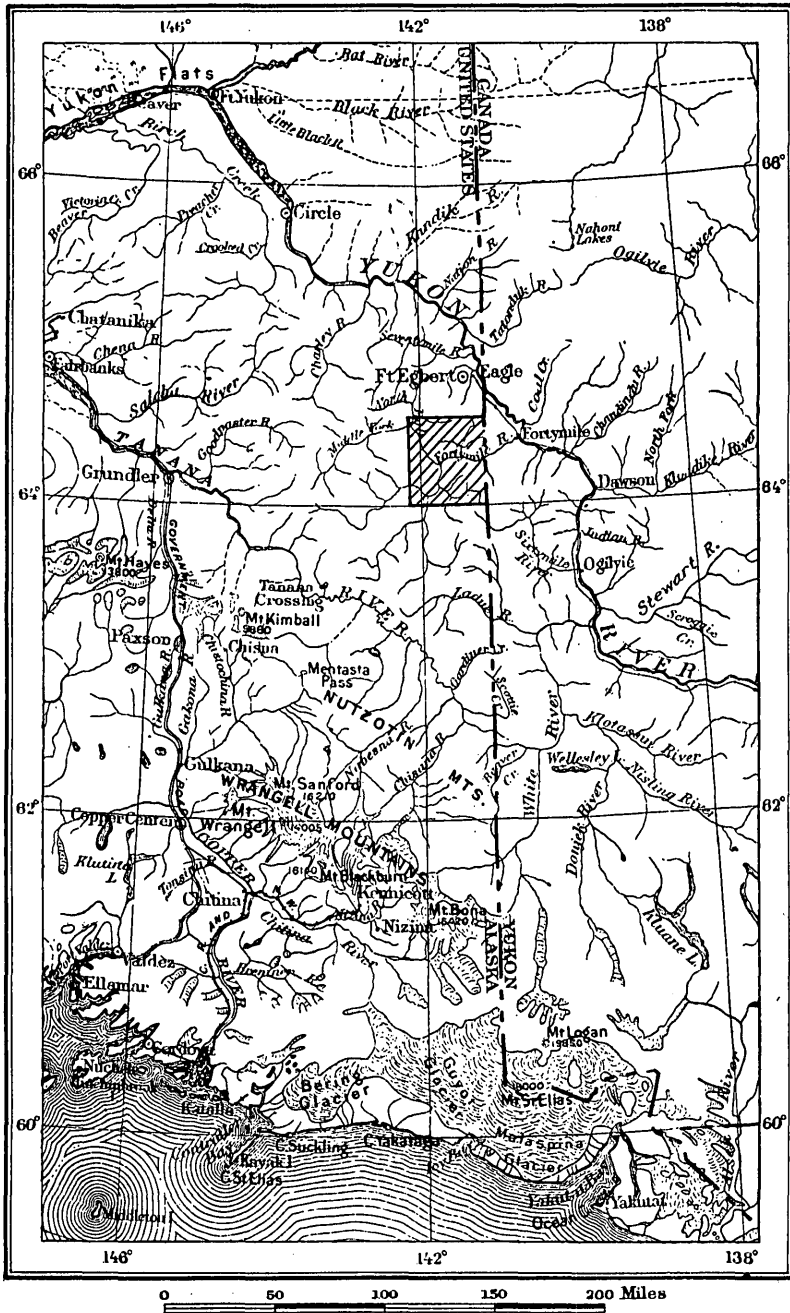


FIGURE 4.—Index map showing location of Fortymile mining district
3200°—31—9

The main Fortymile River in this area flows at an altitude of about 1,000 feet above sea level, and the ridge tops rise to 3,000 feet or more, making an average regional relief of a little more than 2,000 feet. At numerous places isolated prominences; known locally as domes, rise

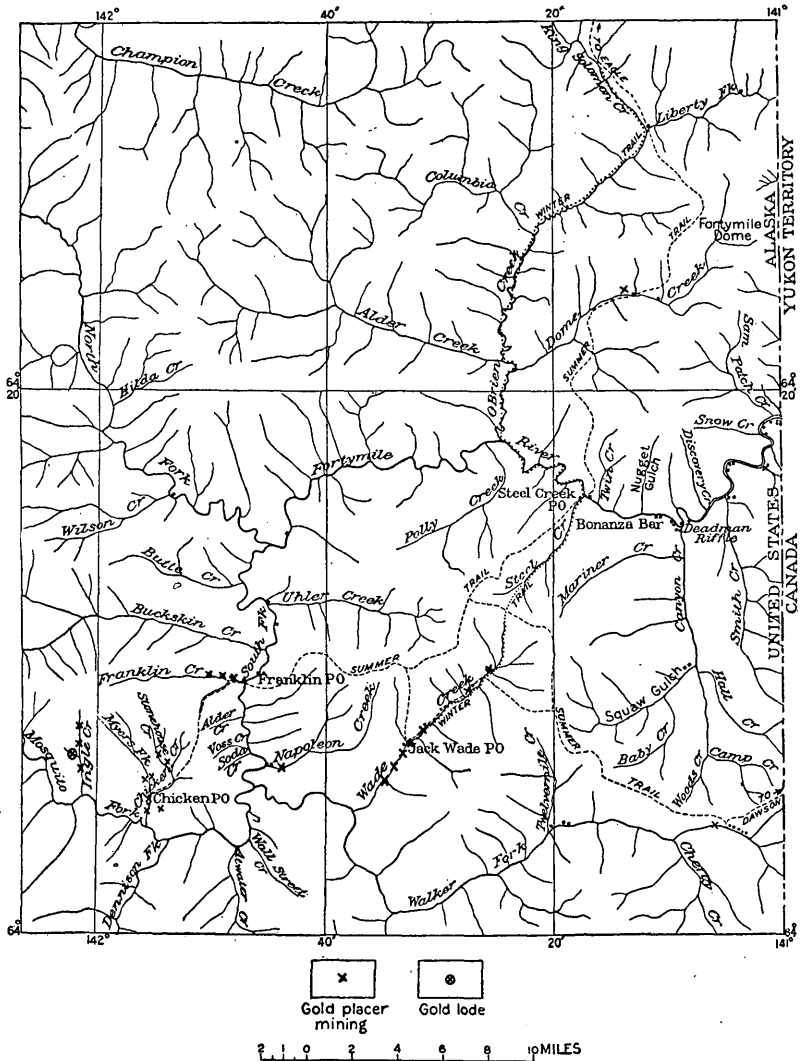


FIGURE 5.—Sketch map of Fortymile mining district showing location of gold placer mining operations

several hundred to a thousand feet above the average ridge level. The upland areas constitute in reality a maturely dissected land surface, of late Tertiary origin. By a lowering of the regional base-level, probably in late Pleistocene time, the Fortymile River was rejuvenated, and since that time it has incised itself into a deep, narrow

valley, characterized by a well-developed system of benches, which occur at various levels from a few feet to 600 feet above the main valley. Some of these benches, particularly the lower ones, have yielded commercial gold placers.

Most of the bedrock in the Fortymile mining district is comprised in a group of metamorphosed sedimentary rocks, of pre-Cambrian age, known as the Birch Creek schist. These metamorphic rocks consist mainly of quartzite schist, quartz-mica schist, and mica schist. Associated with these are metamorphosed igneous rocks, of which the most abundant is a granitic gneiss, known as the Pelly gneiss, which may also be a part of the pre-Cambrian sequence. Other associated metamorphosed igneous rocks include amphibolite, hornblende schist, and greenstones of various types.

Infolded with the pre-Cambrian rocks are smaller areas of metamorphosed Paleozoic rocks, which are probably in large part of Silurian age. One area of such rocks forms the bedrock of the upper part of the South Fork of the Fortymile. These rocks consist of green and black phyllites, siliceous slate, chert, and quartzite, and associated igneous rocks, mainly greenstone and serpentine.

Economically the most important rocks of the area are granite and quartz diorite, which intrude the metamorphic rocks at a number of localities. Twenty such areas of granitic rocks have been mapped by Prindle,² of which the largest one occurs in the lower parts of Mosquito and Dennison Forks of the Fortymile and in the vicinity of Chicken Creek. These rocks are believed to have been the source of the gold in this region.

The youngest hard-rock formation in the area is composed of soft sandstone, conglomerate, and shale of Upper Cretaceous or Tertiary age, which crop out on Chicken and Napoleon Creeks. These rocks are of importance mainly because they carry beds of coal, which serves locally for blacksmithing and similar work.

The present streams and the bordering benches are characterized by fluvial deposits of gravel and sand. The older bench gravel is sharply delimited, but the latest bench gravel merges imperceptibly into the gravel of the present streams. All these deposits of gravel and sand are derived from the erosion of the neighboring country rock and are not particularly different from similar deposits elsewhere. Many of these fluvial gravel deposits in the Fortymile district, however, have proved to be auriferous, and such deposits constitute the Fortymile gold placers, which have been mined for more than 40 years.

² Prindle, L. M., The Fortymile quadrangle, Alaska: U. S. Geol. Survey Bull. 375, pl. 5, 1909.

GOLD PLACERS

DOME CREEK

Placer-mining operations are being conducted on Dome Creek by the Alaska Consolidated Gold Corporation. A small tributary of Dome Creek, which enters from the north about 6 miles in an air line from the mouth of the creek, is known as Little Miller Creek. Mining of the creek gravel of this stream was begun in 1893. Afterwards pay gravel was struck on the north bench of Dome Creek, from Little Miller Creek downstream; and the present operations are a continuation of the mining of this bench gravel. One cut has been taken from the bench gravel on the east side of Little Miller Creek, at its mouth. Another cut from the gravel on the west bench of Little Miller Creek yielded \$27,000 at an average value of 35 cents to the square foot of bedrock.

The present mining operations are being carried on about 1½ miles downstream from the mouth of Little Miller Creek, on the north bench of Dome Creek. A large open cut was begun at this locality in 1922 and is still being extended downstream. The gravel at the site of present operations ranges in thickness from a few feet at the south rim of the bench to 80 feet at the north end of the cut; it was 65 feet thick where the nozzle was in operation in June, 1928. As a rule there is little or no overburden, but at one place where a gulch has been cut down through the old gravel deposits a considerable deposit of muck was noted, which is said to contain remains of mammoth, bison, and other ancient vertebrates. It is evident that the gravel and muck deposits on this bench are of Pleistocene age. The bedrock consists of several varieties of schist and some thin seams of coarsely crystalline limestone. The schist is cut by numerous small seams of quartz, which carry pyrite and arsenopyrite.

Mining is being done by hydraulic methods. A ditch 8 miles long supplies water at a head of 150 feet at the workings, from a 2-foot intake reduced to 11 inches at the nozzle, which is of a 4-inch type. The capacity of the ditch is 1,000 miner's inches, but at the time of the writer's visit only a quarter of that amount was available. The bedrock in the cut is 140 feet above the present creek level, thus affording ample room for tailings, although a sluiceway usually has to be opened through the overburden to the bedrock level of the hill slope below the workings. The present ditch is being extended 6,000 feet downstream, 2,000 feet of which requires fluming, in order to work the bench gravel farther down the valley. The gravel at present being mined is said to average about 35 cents to the square foot of bedrock.

The placer gold is rather porous, especially in the larger pieces, and contains considerable quartz. It is of high grade, however, averaging \$18.50 to \$18.75 an ounce after melting.

FORTY MILE RIVER

The Fortymile River throughout much of its course in this district flows on bedrock, owing to the fact that the river has been rejuvenated and is still in process of adjustment to a lower base-level. The old meanders of the stream are now entrenched, and hence the river follows a meandering course through a steep-walled valley. As a result of lateral erosion the bedrock has been planated at places, especially at the bends of the river, and upon such surfaces a thin veneer of gravel has been deposited by the river. The bedrock along most of the river is schist, which has been mineralized to a greater or less extent. Alluvial deposits from tributary gold-bearing streams are being moved downward into the main river. Hence, many of the gravel bars along the Fortymile are in fact gold placers and have been worked intermittently since the district was discovered. All such mining has been done by shoveling the gravel into sluice boxes or other washing devices and by hand cleaning of the bedrock. Water is obtained by short ditches from near-by creeks or even from the river itself. Some of these bar operations yielded large profits in the early days, but the richer deposits were long ago worked out. Nevertheless, a number of men still work the bars of the Fortymile River every season, and during the season of 1928 six or seven men were reported to be engaged in such work.

WALKER FORK

Placer mining is being done in Walker Fork by the Walker Fork Gold Corporation. The camp is near the southeastern part of the Fortymile quadrangle, about 2 miles west of the international boundary, and is reached from Steel Creek by a good ridge trail 25 miles in length. Another trail from Walker Fork leads 12 miles eastward to Glacier Creek, on the Canadian side, from which a wagon road leads into Dawson.

Walker Fork, about 1½ miles above the camp, divides into three smaller streams, which constitute its headwaters. The north fork is called Davis Creek, the middle fork Poker Creek, and the south fork is Walker Fork. Cherry Creek, another tributary from the south, enters Walker Fork about 4 miles below the junction of the three forks above noted. Walker Fork flows about west and from the forks to Cherry Creek has a grade of about 100 feet to the mile and an altitude above sea level of about 2,200 feet. This part of the valley of Walker Fork is open, with a wide alluvial bottom, and gentle spurs lead to the ridges on both sides. Farther downstream the valley becomes constricted.

At the site of present mining operations the stream gravel is about 10 feet thick near the valley slopes, but only 5 to 6 feet thick in the

center of the valley, with only about 1 to 2 feet of muck overburden. The general run of the stream gravel is small, but some boulders as large as 4 feet in diameter are uncovered, particularly where quartz ledges cut the bedrock. Most of the gravel consists of quartzite schist. The gold occurs both in the gravel and in bedrock, and even though 2 feet of bedrock is removed not all the gold is recovered. The bedrock consists of several varieties of blocky quartzite schist, the cleavage of which strikes about northeast and dips about 20° NW., or downstream, so that the gold sinks deeply into the cleavage cracks. The bedrock is cut by many thin seams and stringers of quartz, and at places thick veins of quartz have been uncovered.

Three cuts in the gold-bearing gravel were excavated and cleaned up in 1928. The lower cut was 300 feet long and 247 feet wide. Upstream the pay streak widened to 600 feet, so that two parallel cuts were taken, one on the south side 300 feet long and 160 feet wide, and one on the north side 300 by 300 feet. The extreme limit of pay gravel was not exploited in the south cut, owing to increasing depth of the overburden. The ground runs from 18 to 36 cents to the square foot of bedrock.

Placer mining is here accomplished by a combination of hydraulic and steam-shovel methods. Elevated sluice boxes are placed at one side of the cut, and a Bucyrus steam shovel with a 50-foot boom lifts the gravel and bedrock into the sluice boxes. The hydraulic nozzle is used to move the gravel from the far edge of the cut inward to a point where it can be reached and handled by the steam shovel. The steam shovel has a bucket with a maximum capacity of 1½ cubic yards and can move 1 cubic yard of gravel a minute into the sluice boxes. Nine sluice boxes are used, of which the first four have cross riffles overlain by grizzlies and the last five have Hungarian riffles. Most of the gold is recovered in the first four boxes.

Water for the hydraulic operations and sluicing is obtained from two ditches on the north side of the valley. The upper ditch is 2 miles long and supplies water at a head of 175 feet to the nozzle used for hydraulic operations. A lower ditch, 1 mile long, is used for sluice water and incidentally picks up the seepage from the upper ditch. For hydraulic purposes the water is taken from the ditch in a 28-inch pipe, which is reduced to 12 inches at the giant. Wood is used as fuel for the steam shovel. The company owns 14 miles of claims on Walker Fork and employs 20 men in these placer-mining operations.

The gold ranges in size from small flat pieces down to very fine gold, though pieces as large as an ounce have been found. It is said to be worth \$18.50 an ounce before and \$18.67 an ounce after melting. The concentrates recovered with the gold consist mainly of magnetite, limonite, ilmenite, psilomelane, pyrite, and garnet.

WADE CREEK

Wade Creek heads against Steel Creek Dome and flows due southwest for 11 miles to join Walker Fork. The valley is exceptionally straight and at its lower end lies 1,400 feet above sea level and from 1,500 to 1,800 feet below the ridge tops on each side. According to Prindle,³ the stream gradient in the lower 8 miles of the creek is about 75 feet to the mile. The valley is asymmetric, the walls being considerably steeper on the southeast than on the northwest side. The valley floor is rather narrow from one end of the creek to the other, and near Jack Wade post office it is only a few hundred feet wide.

Wade Creek was struck in 1895 and has therefore been mined for over 30 years. Two Discovery claims are said by Prindle to be recognized in the creek, but present reckoning is done from a Discovery claim on the lower part of the creek. All the claims from No. 15 below to No. 23 above Discovery are held, and many of them are operated in winter by drifting, the gravel dumps being sluiced in the spring. At the time of the writer's visit, in late August, summer mining was in progress on only two claims. No well-defined low bedrock bench is present in this valley, for the bedrock appears for the most part to slope gradually upward from the creek to higher ground. At claim 5 above Discovery and on downstream, however, higher benches appear, but these have not so far proved to be good placer ground.

Much of the best pay gravel has been taken from a pay streak called bench gravel, which follows down the valley first on one side of the creek and then on the other. The best ground on the creek was found on claims 6, 7, and 8 above Discovery, but the most gold from any one claim was recovered on No. 6 above. At claim 7 above Discovery this "bench" or rim pay streak was 100 to 120 feet wide and 12 feet deep. Such ground yielded from \$1 to \$1.50 to the square foot of bedrock. The valley floor itself, which is from 200 to 300 feet wide, has not been worked, except farther upstream, where open-cut methods are employed, because it is too wet for drifting. The creek ground at claims 7 or 8 above Discovery is only 8 to 10 feet deep and may run 25 cents or more to the square foot of bedrock for a considerable distance both upstream and downstream. Such ground, including also the "bench" ground, is suitable for hydraulic operations, but scarcity of water will always be a handicap to such development. In time, however, all this ground should be worked by dredging or by scraper plants. The spotted character of the pay streak also makes it desirable to work large blocks of ground.

The bedrock on Wade Creek includes several varieties of schist and also, according to Prindle, some thin-bedded ferruginous lime-

³ Prindle, L. M., The Fortymile quadrangle, Alaska: U. S. Geol. Survey Bull. 375, pp. 39-42, 1905.

stone, all part of the Birch Creek schist. Quartzite, mica schist, and hornblende schist are the most common of the schistose rocks. The general strike of the cleavage is about northeast, thus paralleling the course of the creek; and the dip of the cleavage is variable in degree, but mainly southeastward. Several small bodies of granitic rocks have been mapped by Prindle within the basin of Wade Creek, and cobbles of these rocks are found on the gravel. Quartz veins, in part pyritiferous, derived from such granitic rocks are common in the schistose rocks.

The principal summer mining on Wade Creek is done at a hydraulic plant on claim No. 14 above Discovery, which is operated by Charles Martin. The gravel here is between 10 and 12 feet thick, with little or no overlying muck, although in places farther downstream 4 or 5 feet of muck overlies the gravel. The gravel is mined in cuts 96 feet long and 175 feet wide, and three such cuts were made during the summer of 1928. The bedrock is a blocky quartzite, in the cracks and joints of which the gold works downward to a depth of 2 or 3 feet, making it necessary to take up this much bedrock in places and to clean the bedrock by hand. This is a slow and laborious process. The strike of bedrock cleavage in these cuts is about N. 15° E. and the dip 5° E. The rock is also jointed and thus breaks into rhomboidal slabs several inches to a foot thick. The gravel ranges from small cobbles to boulders 2 feet in diameter, but no boulders large enough to require blasting are present. As mined, this ground yields about 20 cents to the square foot of bedrock.

Three nozzles are used, a 3-inch one for moving the overburden, a 3½-inch one for piping in, and another 3½-inch one for stacking tailings. The sluice boxes are set on bedrock in the middle of the cut, and when the material is being piped from one side of the cut wooden shear boards are placed on the opposite side of the sluice boxes so that the gravel will fall into the boxes. This necessitates moving the shear boards when piping is done from the other side of the cut. Water is taken from Wade Creek about a mile upstream, just below the mouth of a small tributary from the north called Gilliland Creek, and is delivered to the cut at a head of 80 feet. As work progresses upstream, this head will be reduced, and a new ditch will need to be built. The water is taken from the ditch in a 30-inch pipe, which is reduced to 10 inches at the nozzles.

The gold is fairly coarse, and some of it contains much quartz. The value is irregular, ranging commercially from \$15.90 to \$18 an ounce and passing on the average at \$16.50. Three assays of this gold, representing material produced in 1926 and 1927, are given herewith:

Assays of gold from Wade Creek

Fineness after melting		Total value per ounce
Gold	Silver	
0.8185	0.177, at 62 cents an ounce.....	\$17.02
.82975	.164, at 65 cents an ounce.....	17.25
.8075	.189, at 55 cents an ounce.....	16.79

The concentrates taken with the gold are nearly half barite and comprise also magnetite, ilmenite, hematite, and garnet, with smaller amounts of cinnabar, pyrite, and cassiterite. The cassiterite is found both in crystalline form and as wood tin.

This plant has been in operation eight years. The early work was done with a scraper plant, but this was not successful. The present methods are the most economical possible. Three men are required to operate the plant, which works both day and night shifts.

On claim 23 above Discovery, at the confluence of Gilliland Creek with Wade Creek, two men were engaged in groundsluicing preparatory to the operation in 1929 of a small hydraulic plant. Two automatic dams, one on Wade Creek and one on Gilliland Creek, were being used for this work. The bedrock is a quartzite schist, cut by numerous quartz stringers, some of which carry gold. About 3 to 4 feet of gravel is present, overlain by 4 to 8 feet of muck. Coarse gold has been found here in a pay streak estimated to be 80 feet wide.

FRANKLIN CREEK

Franklin Creek is the oldest producing creek in the Fortymile district, having now produced gold for 43 years. This creek is about 6 miles in length, flows almost due east, and enters the South Fork of the Fortymile River about 10 miles in an air line above the main forks. The upper valley is fairly open, but the lower valley, where placer mining has been carried on, is very narrow, with steep walls. The stream gradient in the lower 2½ miles of the creek is 170 feet to the mile. The rejuvenation of the Fortymile River is here admirably reflected in a tributary stream, which evidently is still in process of adjustment to the new and lower regional base-level.

The bedrock is made up of a number of varieties of schistose rocks of the Birch Creek schist, including mainly mica and quartz-mica schist, in part garnetiferous, hornblende schist, and some crystalline limestone. The head of the creek and some of its south tributaries also cut a body of granitic rocks, and locally the schist is cut by dikes of such material. The creek gravel consists of several varieties of schist, basalt, granite, quartz, and other types of rock and ranges in thickness from 8 to 10 feet. The gold occurs in the lower part of the gravel and the upper 2 feet of bedrock.

Franklin Creek, in the early days of its mining history, yielded good pay, some of the gravel, according to Prindle, going as high as \$5 to the cubic yard. The best ground, however, has now been mined out over a width of 50 feet or more, and present operations are confined to the leaner and deeper gravel along the edges of the old pay streak. As in Wade Creek, two Discovery claims were made, but present reckoning is done from upper Discovery. Three men are still at work on Franklin Creek, one on claim 2 below, one on claims 4 and 5 below, and one on claims 6 and 7 below upper Discovery. These operations are of the shoveling-in type.

The concentrates taken with the gold on Franklin Creek are 50 per cent magnetite and include many garnets, considerable ilmenite, some limonite, and small amounts of barite and cinnabar. One piece of galena and pyrite was also observed in the concentrates. The cinnabar is not found throughout the concentrates but occurs in scattered pieces a quarter of an inch in diameter or larger. It is probably original vein material and is believed to indicate a stage of mineralization later than the main mineralization which accompanied the intrusion of the larger granitic masses in this region.

CHICKEN CREEK AND TRIBUTARIES

Chicken Creek is about $4\frac{1}{2}$ miles long, runs somewhat west of south, and enters Mosquito Fork of the Fortymile River about a mile above the confluence of Mosquito and Dennison Forks. It has two good-sized tributaries from the northwest, Stonehouse Creek and Myers Fork, which make the upper valley exceptionally wide and open. The lower part of the valley is rather flat and merges gradually into the wider valley floor of Mosquito Fork. Discovery claim is just below the mouth of Stonehouse Creek. It is on this lower valley floor that the airplane landing field is built. The town of Chicken is about a mile above the mouth of Chicken Creek.

The pay streak on Chicken Creek was discovered in 1901, and mining has continued since that time, but little mining is in progress at the present time, and the writer is dependent in considerable measure on the descriptions given by Prindle some 20 years ago when active mining was in progress. A number of different kinds of bedrock are found in the basin of Chicken Creek. These include Paleozoic schists of several varieties, basalt, and little-indurated rocks of Upper Cretaceous or Tertiary age. The stream gravel is therefore of very diverse character. The schistose rocks it contains include hornblende schist, in part tuffaceous, phyllite, quartzite, mica schist, and crystalline limestone; the granitic rocks are represented by quartz diorite, granite, and vein quartz; and the Upper Cretaceous or Tertiary rocks have contributed sandstone, shale, conglomerate, and ironstone. Most of the gravel is fairly well

rounded and ranges in size from small pebbles to good-sized cobbles, but a few large boulders are present. In the main valley the ground is in places as deep as 40 to 50 feet, but little of this ground has been mined because it is too wet for drifting, and insufficient water is available for hydraulicking. The low gradient of the creek would make it necessary to stack tailings, thus further increasing the amount of water that would be required for hydraulic operations.

Most of the mining has been done on the west bench of Chicken Creek from 500 to 1,000 feet from the creek, where the ground is frozen or where it is shallow enough to be worked by open cuts. The best pay gravel on Chicken Creek was found in claim 9 below Discovery, although the richest spots occurred on claim 7 below. The creek has been worked from claim 1 above to claim 11 below Discovery, as single creek claims, but at the lower end the pay streak was so much wider that claims were staked in pairs. Much of the bedrock on this west side of the creek, particularly at the upper end of the pay streak, is little if any higher than in the center of the valley. A company has recently taken options on the producing ground of Chicken Creek, and a dredge may be installed in the near future.

Drift mining was done in the winter of 1927-28 on claim 5½ below Discovery, and prospecting was in progress at the same place during the summer of 1928. The ground was mined from a shaft 34 feet deep about 175 feet from the main creek. The gravel is 12 feet thick, overlain by 22 feet of muck. The bedrock is shale, with coal beds, of Upper Cretaceous or Tertiary age. The trend of the pay streak was given as about N. 10° E. Open-cut mining was also in progress on claim 10 below Discovery. The bedrock here is also sandstone and shale, and the gravel is from 14 to 16 feet thick at the head of the cut. With a good supply of water about 24 box lengths per season can be shoveled in at this property. The gold occurs mainly on or near bedrock, and the pay occurs in narrow streaks quartering downstream and is rather spotted.

Two hydraulic plants were in operation on Myers Fork. Years ago the creek gravel of Myers Fork was worked for 1,000 feet or more upstream from the mouth, but the present operations are on benches. On the northeast side of Myers Fork the bench gravel is being mined by a combination of hydraulicking and groundsluicing. The gravel here is 4 feet thick and is overlain by about 11 feet of muck. The bedrock is partly sandstone and shale and partly basalt. The ground is mined in cuts 20 feet wide and 100 feet long, and four such cuts were expected to be made during the summer of 1928. The ground probably averages about 30 cents to the square foot of bedrock. Water is obtained from a ditch 2 miles long, with an intake on Chicken Creek above the mouth of Stonehouse Creek, and is supplied to a 2-inch giant at a head of 70 feet. The gold is not very coarse, although

one piece worth \$25 has been found on this property. It assays \$16.40 a crude ounce and passes commercially at \$16 an ounce. The concentrates taken with the gold are largely magnetite and ilmenite but include also garnet, barite, and zircon.

On the opposite or southwest side of Myers Fork, on a still higher bench, about 100 feet above the creek level, another hydraulic plant was operated in 1928 but was not in operation at the time of the writer's visit. The gravel is here about 8 to 10 feet thick, with little or no overburden, and the bedrock is the same as across the creek.

Two men were also doing open-cut placer mining on Stonehouse Creek. One was engaged in shoveling in creek gravel. Farther upstream another man was mining bench gravel on the east side of the valley, about 400 feet above the creek level. The gravel here is 3 feet thick, and the bedrock is a blocky rock resembling phyllite but possibly of tuffaceous origin, cut by stringers of quartz and calcite. Two cuts of 6 box lengths each, or about 1,728 square feet of bedrock in all, were expected to be cleaned and shoveled in at this property during the season of 1928. The ground was said to yield about \$60 to the box length, or about 40 cents to the square foot of bedrock. The concentrates taken with the gold are mainly magnetite, oxidized on the surface, ilmenite, and pyrite but include also some specular hematite and numerous small grains of cinnabar.

LOST CHICKEN CREEK

On the east side of Chicken Creek almost opposite the town of Chicken is a bench about 275 feet above the creek. A small creek, known as Lost Chicken Creek, heads just east of this bench and flows southeast to the South Fork of the Fortymile River, so that this east bench of Chicken Creek is in reality also a west bench of Lost Chicken Creek. Gold placers were discovered on the west bench in 1901 and have been mined intermittently since that time. Some of this ground carried as much as \$1 to the square foot of bedrock.

During the summer of 1928 three men operated a hydraulic plant on this west bench of Lost Chicken Creek, almost 75 feet above the creek level and 500 feet distant from the creek. This old bench channel had previously been worked for 1,000 feet or more, and the present operations consist of cuts 150 feet wide at the lower end of these old workings. The gravel at this place consists of 3 to 5 feet of sub-angular to rounded wash, mixed with hillside rubble and sand. The largest cobbles are about 8 inches in diameter. The bedrock is quartz diorite, cut at one place by a dike of basalt, and the bedrock surface is very irregular and therefore difficult to clean. Two cuts aggregating 5,000 square feet had been mined at the time of the writer's visit, in late July, and the work was still in progress. Water for

hydraulicking is obtained from Chicken Creek through a ditch 3 miles long and is delivered under a head of 50 feet to a 1½-inch nozzle. The gold is in small flattened pieces but is not flaky. The largest piece recovered was worth \$3. The concentrates consist mainly of magnetite, ilmenite, garnet, and zircon.

INGLE CREEK

Ingle Creek is a small stream, about 4 miles long, which lies west of Chicken Creek and flows into Mosquito Fork about 4 miles above the confluence of Mosquito and Dennison Forks. The valley of Ingle Creek is very narrow, and the walls are steep. A number of claims are held on Ingle Creek, but only two plants were in operation in late July. On claim 5 above Discovery shoveling-in operations were in progress. At this place the present creek gravel constitutes the pay streak, which is from 40 to 50 feet wide. About 2 feet of overburden is present, and the gravel consists of angular to subangular cobbles of granitic rocks, with considerable green schist and quartzite. Some large boulders, as much as 30 inches in diameter, occur in the gravel. The bedrock is green schist and quartzite cut by numerous veinlets of quartz, and about 12 inches of it has to be removed to recover the gold, which lies mainly on bedrock. The gold is rather coarse, the largest piece so far found being worth \$60. Numerous pieces worth as much as \$5 have been found. The gold assays \$17.40 an ounce and passes commercially at \$17 an ounce.

Water for sluicing is taken from three small dams upstream. The gravel is shoveled into elevated sluice boxes, and three or more box lengths are cleaned up at a time. It was estimated that 10 box lengths would be shoveled in at this property during the summer of 1928. The ground is believed to average about \$75 to the box length.

Farther down on Ingle Creek, on claim 2 above Discovery, much the same type of mining is in progress. Here about 3 feet of gravel is present, and the bedrock is the same as farther upstream. Ten box lengths is also the estimated capacity at this plant for the season.

PRODUCTION

The following table gives the production of the Fortymile district for 1928 and previous years. Annual data are not available for the earlier years of this camp. The total production of placer gold and silver for the Fortymile district is to date about \$6,809,000.

Gold and silver produced in Fortymile district, 1886-1928

	Gold		Silver	
	Fine ounces	Value	Fine ounces	Value
1886-1903 (estimated).....	193, 500. 00	\$4, 000, 000	30, 553	\$22, 915
1904.....	14, 851. 12	307, 000	2, 345	1, 360
1905.....	12, 384. 00	256, 000	1, 955	1, 193
1906.....	9, 868. 50	204, 000	1, 558	1, 059
1907.....	6, 772. 50	140, 000	1, 069	706
1908.....	6, 772. 50	140, 000	1, 069	567
1909.....	10, 884. 37	225, 000	1, 719	894
1910.....	9, 675. 00	200, 000	1, 528	825
1911.....	9, 675. 00	200, 000	1, 528	810
1912.....	10, 303. 87	213, 000	1, 627	1, 000
1913.....	4, 837. 50	100, 000	764	461
1914.....	2, 418. 75	50, 000	382	211
1915.....	2, 418. 75	50, 000	382	194
1916.....	2, 418. 75	50, 000	382	251
1917.....	3, 870. 00	80, 000	624	513
1918.....	3, 628. 12	75, 000	573	573
1919.....	1, 983. 37	41, 000	313	350
1920.....	1, 935. 00	40, 000	348	380
1921.....	2, 418. 75	50, 000	448	448
1922.....	2, 418. 75	50, 000	423	423
1923.....	2, 588. 32	53, 500	466	382
1924.....	1, 538. 46	31, 800	265	177
1925.....	1, 924. 19	39, 800	303	210
1926.....	2, 902. 50	60, 000	454	284
1927.....	1, 790. 00	37, 000	479	272
1928.....	3, 827. 00	79, 100	609	356

GOLD LODES

The gold placers of the Fortymile district and contiguous territory have been derived from lode deposits, and the wide distribution of these placers indicates the general nature of the gold mineralization. The character of the concentrates recovered with the placer gold, together with the results of more or less lode prospecting, shows that ores of other metals, such as silver, lead, zinc, copper, antimony, mercury, and tin, are also present in this district. Most of these metallic elements, as well as the gold, are considered to be related genetically to the granitic intrusions and are believed to have been introduced, together with vein quartz, at the time when such rocks were intruded or shortly thereafter. The details of the mineralization and the practical application of this theory to prospecting have been given in a previous publication.⁴

The remoteness of the Fortymile district renders it impossible at the present time to undertake lode mining of any base ores which may be present. Gold lodes might possibly be mined at a profit, but the cost of supplies and equipment and the difficulty and cost of transportation into this district would require deposits of bonanza type for exploitation. As no very rich quartz lodes have so far been discovered, no quartz mining has been undertaken, although considerable prospecting has been done.

⁴ Mertie, J. B., jr., The occurrence of metalliferous deposits in the Yukon and Kuskokwim regions, Alaska: U. S. Geol. Survey Bull. 739, pp. 149-165, 1923.

One gold quartz lode of considerable interest has been prospected on Lilliwig Creek, a small tributary of Ingle Creek from the west. The country rock has here been intruded by a small body of quartz diorite, and it is of interest in this connection to note that downstream from this intrusive body Lilliwig Creek has been mined for placer gold, whereas above the intrusive rock no commercial placers have been found. The relation between granitic intrusion and mineralization is thus more than ordinarily apparent. The lode consists of greatly sericitized quartz diorite, in which are numerous veinlets of quartz and calcite, together with gold-bearing sulphides. Pyrite is the principal sulphide mineral, but some chalcopyrite is also present. A shaft 55 feet deep was sunk at this place and, according to the owners, showed an ore body 42 feet wide at the surface of bedrock and 52 feet wide 14 feet deeper, at the bottom of the shaft. The lode material consists of many parallel stringers of vein quartz and calcite trending east and cut by another system of discontinuous stringers running north. The easterly stringers dip at a high angle northward. A sample of sulphides from the dump was taken by the writer and assayed by E. T. Erickson in the chemical laboratory of the United States Geological Survey. This assay shows 1.87 ounces of gold and 2.05 ounces of silver to the ton and 0.76 per cent of copper and therefore indicates a value of nearly \$40 a ton. A sample of the whole ore body, however, would show a much lower value. Undoubtedly other gold quartz lodes as good or perhaps even better are present in this district, and some of these may possibly be worked at a profit in the future when operating costs shall have been materially lowered.

COAL

The Upper Cretaceous or Tertiary formations that occur on Chicken Creek and elsewhere in this district contain beds of lignitic coal, which have been utilized locally for blacksmithing and similar work. One such bed of coal has been worked at Chicken. About a quarter of a mile west of Chicken a 35-foot shaft has been sunk to such a coal bed, and a tunnel has been driven 60 feet south from the bottom of the shaft. A room 14 feet high, 10 feet wide, and 60 feet long has been excavated and discloses 22 feet of coal which stands vertical and strikes N. 65° E. Neither the top nor the bottom of the coal bed is exposed. Two samples of this coal were taken for analysis, one an average of the bed and the other from a narrow seam of bright-looking coal, apparently of higher grade than the average. Proximate analyses of these samples were made by H. M. Cooper, of the Bureau of Mines, with the following results:

*Analyses of coal from Chicken Creek***Picked sample**

[Air-drying loss, 2.6]

	Air dried	As received	Moisture free	Moisture and ash free
Moisture.....	10.3	12.6	-----	-----
Volatile matter.....	36.4	35.4	40.6	42.6
Fixed carbon.....	49.0	47.8	54.6	57.4
Ash.....	4.3	4.2	4.8	-----
	100.0	100.0	100.0	100.0
Sulphur.....	0.5	0.5	0.6	0.6
Calorific value:				
Calories.....	5,906	5,750	6,583	6,911
British thermal units.....	10,630	10,350	11,850	12,440

Average of coal bed

[Air-drying loss, 8.9]

Moisture.....	15.1	23.1	-----	-----
Volatile matter.....	33.8	30.8	40.0	46.2
Fixed carbon.....	39.3	35.7	46.5	53.8
Ash.....	11.4	10.4	13.5	-----
	100.0	100.0	100.0	100.0
Sulphur.....	0.5	0.4	0.6	0.7
Calorific value:				
Calories.....	5,083	4,628	6,017	6,950
British thermal units.....	9,150	8,330	10,830	12,510