

MINING IN CHITINA VALLEY.

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INTRODUCTION.

All the mining districts in Chitina River valley were visited by the writer in 1916 and were described in an account published as part of the report on the progress of investigations in Alaska for that year.¹ Since then no description of individual mining properties in the region has appeared in publications of the United States Geological Survey, although G. C. Martin visited some of the properties in 1918 during a rapid journey through parts of Alaska and incorporated the results of his observations in the report on the investigation of Alaskan mineral resources for 1918. Material for the present account was collected by the writer during the early part of September, 1919, and the paper is presented as a report on progress in mining development rather than as a detailed description of ore deposits.

Mining in this region, as in all other parts of Alaska, was greatly affected by conditions that arose from the war. Prospecting practically ceased during war time, and even the assessment work on many claims was omitted under exemption allowed by laws passed for the relief of owners during the war. The scarcity of labor and the high cost of mining equipment and supplies made it unprofitable or at times impossible to carry on development work at some properties, which were allowed to lie idle.

The principal mining activity in the region in 1919 was on Kuskulana River, at Kennicott, and on Dan and Chititu creeks, in the Nizina district. No assessment work had been done on Elliott Creek and on Kotsina River up to the later part of September, but preparations were being made to do such work before January, 1920, for the new regulation regarding assessment work for 1919, as it was passed late in the summer, exempted no more than five claims in one holding and thus made it necessary for some claim owners to do assessment work who had not planned to do it in 1919.

¹ Moffit, F. H., Mining in the lower Copper River basin: U. S. Geol. Survey Bull. 662, pp. 155-182, 1918.

KUSKULANA RIVER.

Development work in the Kuskulana River valley in 1919 was done principally on three properties—the Alaska Copper Co.'s property on Nugget Creek, the North Midas Copper Co.'s property on Berg Creek, and the Chitina-Kuskulana Copper Co.'s property on Bigfoot Creek. The North Midas Co., which produced a small quantity of silver and gold, was the only company to do more than exploratory work. Some prospecting was done on Slatka Creek, where a little placer gold is contained in the gravels and where the presence of float gold has been known for some time.

The Alaska Copper Co., which owns the claims staked on Nugget Creek by James McCarthy in the early days of exploration in this district, after making a careful mine test of the copper-bearing vein which originally cropped out on the Valdez claim, decided to stop all development work and removed the machinery and equipment from the ground to Strelna. The developments on this property include about 4,000 feet of drifts, crosscuts, and shafts. The work disclosed a well-defined copper-bearing fault zone, which contained principally bornite and chalcopyrite. The vein near the surface consisted largely of high-grade ore, all of which was removed and shipped to the smelter, but it did not maintain its high copper content in the lower levels, and for that reason the ground was abandoned. Gold and silver are constituents of the ore, and a little native copper accompanied the copper sulphides in parts of the vein. The greatest depth below the outcrop of the Valdez claim attained by the workings is 420 feet, and the writer was informed by the manager that the relative quantity of chalcopyrite as compared with bornite in the lower levels was less than in the upper levels. Since 1916 about 160 tons of concentrates and hand-sorted ore have been shipped to the smelter. Previous shipments consisted of about two carloads of hand-sorted ore.

The mine was equipped with a mill, a small hoist, power drills, a drill sharpener, and other machinery. Power for the drills and hoist was furnished by two semi-Diesel engines. The mill contained a coarse crusher, one fine crusher, two jigs, and two tables. All this equipment, together with all other movable property, was hauled to Strelna on automobile trucks during the later part of the summer. A good road suitable for automobile travel was constructed at considerable expense between the mine and Strelna, on the Copper River & Northwestern Railroad, in 1917 and 1918, and has been in use for the last two seasons. This road for part of its length is on the line of the horse trail from Strelna into Kuskulana Valley, and is available for use by all the people in the valley. It is now in poor

condition because of heavy traffic in wet weather and should be repaired if it is to be preserved for automobile travel.

The North Midas Copper Co.'s property includes 18 lode claims, 4 placer claims, and a mill site on the east side of Kuskulana River 12 miles from Strelna. The first claims staked in this vicinity were located as copper claims and for several years were prospected in the hope of developing a copper mine. The ore body now being exploited, however, contains silver and gold as well as copper and is mined for those metals rather than for copper. The mine is on the south side of Berg Creek about $1\frac{1}{4}$ miles from Kuskulana River, at an elevation of 850 feet above the river bars. The ore body consists of quartz and a minor quantity of calcite containing arsenopyrite, pyrite, and chalcopyrite. It was deposited along a fault plane, cutting rocks which are prevailingly light-gray diorite, locally porphyritic, and dark-green fine-grained diorite. These rocks are in one of the major zones of faulting of the region and are cut by many other faults besides that containing the ore body. In places the tunnels also show white silicified limestone. The strike of the ore body is N. 70° E., and the dip is about 45° SE. but shows some variation. The thickness of the vein ranges from less than a foot to 7 feet.

Mining has been conducted on two levels 100 feet apart and reached by different adits. A short intermediate level has also been driven from the upper level. The main upper and lower levels have been connected, however, and the ore from the upper level is drawn off through the lower level. More than 1,600 feet of levels and adits have been driven.

The gold and silver content is variable in different parts of the ore body and ranges from a few dollars to several hundred dollars to the ton. The silver is present in greater quantity than the gold and in some places has a ratio to gold as great as 4 to 1. The most valuable ore is the oxidized part of the vein near the surface.

A cable tram equipped with buckets having a capacity of $3\frac{1}{2}$ cubic feet conveys the ore from the mine to the mill, which is built on a terrace near Kuskulana River. This mill has a capacity of 20 tons in 24 hours and is driven by water power furnished by Berg Creek. A wood pipe line 2,200 feet long carries water from the intake to the mill, where it supplies both power and water for milling. The tramway was constructed in the spring of 1919 and was not completed till the greatest flow of water in Berg Creek was over, and consequently the mill was operated for only a few days at the end of the season.

Communication with Strelna has been greatly simplified by the construction of the road from Strelna to Nugget Creek and of the Government bridge over Kuskulana River $1\frac{1}{4}$ miles below the mouth

of Trail Creek. The mill is only $1\frac{1}{2}$ miles from the bridge and has been connected with the Nugget Creek road by a branch road $2\frac{1}{2}$ miles long, which leaves the main road near the crossing of Squaw Creek. This road is available for automobile travel and has been used for two summers, but like the main road will require further expenditure of work and money before it is in first-class condition.

The Chitina-Kuskulana Copper Co. owns 21 claims, 5 of which are mill sites, on Bigfoot Creek, between Berg and Trail creeks, on the southeast side of Kuskulana River, about 13 miles from Strelna. Bigfoot Creek is nearly 4 miles long, and most of its course is through an area of light-colored porphyritic diorite. Its upper part cuts Triassic shales and limestone and Jurassic limestone, sandstone, and shale. The mountain northeast of the creek is all diorite except near the head of the stream, where Jurassic sediments overlie the igneous rocks. Most of the claims are on the southeast side of the creek, where the rocks below the Jurassic sediments are heavily mineralized in many places, principally with magnetite.

Most of the development work has been done on two claims known as the War Eagle and Calcite claims. The War Eagle claim and tunnel are on the mountain slope southwest of the creek, 200 feet above the "middle camp," or 1,300 feet above the "lower camp," which is on the bars of Kuskulana River. The tunnel is 200 or 300 feet above timber line, about 3,400 feet above sea level. It is 100 feet under cover and cuts a silicified limestone containing dark bands, possibly intrusive dikes, mineralized with pyrite and chalcopyrite and showing green copper stains. Between the tunnel and the base of the Jurassic sandstone beds, about 200 feet higher on the mountain slope, are large exposures of magnetite, which is older than the sandstone, for the conglomeratic beds near the base contain rounded pebbles of the magnetite.

The Calcite claim and tunnel are high on a sharp, narrow ridge separating Bigfoot Creek from a southern branch of Trail Creek. The tunnel, 600 feet long, is at an elevation of about 4,800 feet above sea level and lies in or near the contact of a diorite mass on the north and silicified limestone on the south. These rocks have been greatly disturbed through faulting, by which the underlying Triassic limestone and shale have been thrust in a northerly direction over the younger Jurassic sediments. The fault doubtless played a large part in the deposition of the metallic minerals of this creek and of Berg Creek. It strikes north-northwest and dips 25° N. to 30° S. It extends at least as far as from Chokosna River to the west side of Kuskulana River, and probably farther. Both the white altered limestone, of undetermined age, in the tunnel and the rocks adjoining the tunnel are much fractured and sheared along the fracture planes,

where there is rusty iron-stained gouge and more or less laminated rock containing pyrite and copper-bearing pyrite or chalcopyrite. Copper staining is abundant.

The property of the Chitina-Kuskulana Copper Co. is equipped with a power plant situated on the low, timber-covered gravel bars within a short distance of Kuskulana River. This plant includes an 80-horsepower engine, a 125-horsepower wood-burning boiler, a 62½-kilowatt 3-phase alternating-current generator, and a 7½-kilowatt exciter. Current is carried to the War Eagle claim, where the company has installed a 50-horsepower 3-phase motor, an air compressor, air receivers, two piston drills, jack hammers, and other necessary equipment, including a drill sharpener. Power drills have not yet been used in the Calcite tunnel, but a 6-horsepower gasoline engine, a blower, and 600 feet of air tubing are used to provide ventilation at the tunnel face.

The bars of Kuskulana River furnish easy communication with the bridge over the river and thus with the road to Strelna, making it much easier than formerly to get supplies in summer. The Government bridge recently constructed by the Alaska Road Commission is undoubtedly of great benefit to all the property owners on the east side of Kuskulana River, for it obviates the difficulty and danger of fording that stream, which at times is practically impassable.

A separate company, named the Mount Wrangell Copper Co. but under the same management as the Chitina-Kuskulana Copper Co., controls the Copper Queen, formerly the Rarus group of claims, adjoining the War Eagle group, and also two groups of claims called the Broken Leg and the Mineral King groups on Chokosna River. It is expected that work will be done on the Broken Leg group in 1920.

Benito Creek is a small stream flowing into Kotsina River from the mountains south of Elliott Creek. It is about 9 miles north-northwest of Strelna but is reached from that place by trails considerably longer. Interest in Benito Creek lies in a gold-bearing quartz vein commonly known in the district as the Canning property, from the name of one of the owners who discovered the vein in 1913. The property consists of five recorded claims situated a short distance below timber line on Benito Creek and is owned by Jack Canning and Benito Contino.

The vein consists of quartz and calcite, with quartz predominating, and ranges from 2 to 3 feet in thickness but averages about 30 inches. It dips steeply to the east and strikes N. 70°-75°W., cutting a succession of dark-colored igneous rocks that include both dense basaltic members and coarser granular phases, with abundant horn-

blende. These rocks grade into each other without sharp boundaries. They are considerably altered and are sheared, particularly near the vein.

The vein originally appeared in the creek as a mass of pure white quartz but has now been proved by a succession of five shallow holes to extend for at least 500 feet. The deepest of these holes penetrated the vein 15 feet. Much difficulty was experienced from water, which flowed along the rock surface beneath the gravel covering, and to obviate this trouble an automatic dam was constructed on the creek and two channels ranging in depth from 2 to 20 feet were sluiced across the claims. Owing to irregularities in the bedrock surface these cuts do not expose the bedrock in many places.

The vein is mineralized with iron and copper sulphides, principally arsenopyrite, which near the surface are much oxidized and have colored the shattered quartz with rusty iron stains. In places the oxidized vein has furnished some handsome specimens of free gold. Small particles of free gold are rather common in much of the oxidized vein and contain or are accompanied by silver, as is shown by the assays.

On the left-hand side of the creek about 100 feet downstream from the vein is another quartz vein carrying arsenopyrite and a black metallic mineral, probably hematite. This vein strikes N. 10° W.

About one claim length still farther downstream is a vein of rusty shattered quartz 8 to 9 feet wide, containing pyrite and arsenopyrite. Several open cuts have been made on this vein, but no particularly encouraging results have been gained.

Benito Creek at present has no adequate means of communication with Strelna. It lies on the direct route to Elliott Creek and may be reached by any one of several trails that have been made since the railroad was constructed. The chief difficulty with all these trails, which are pack trails only, is that parts of them are wet and soft except in the driest weather or in winter, when they are not used.

KENNICOTT.

The property of the Kennecott Corporation near Kennicott now includes three working mines, for in addition to the Bonanza and Jumbo mines the corporation has acquired the Mother Lode mine, formerly operated from the McCarthy Creek side of the ridge, between Kennicott Glacier and McCarthy Creek. Formal control of the Mother Lode began on May 1, 1919, and since that time ore from the Mother Lode has been delivered to the mill at Kennicott over the Bonanza tramway. The three mines are now connected underground, so that it is possible to pass from one mine to any other, a great advantage in operation and management. The connections

are made from the 600-foot level of the Bonanza to the 500-foot (?) level of the Jumbo and from the 800-foot level of the Bonanza to the Rhodes (700-foot?) level of the Mother Lode mine. On the connecting levels the slopes of the Bonanza and Jumbo mines are 4,370 feet apart. The shaft of the Mother Lode is 1,400 feet from the incline of the Bonanza.

Much work has been done in the three mines to facilitate mining and handling the ore. New slopes were driven in both the Bonanza and Jumbo mines, and new dumping pockets were provided underground. New hoisting machinery was also installed. In addition the loading station of the Jumbo tram is being moved underground. The new station will no longer be in danger from movements of the Jumbo Glacier and will add greatly to the comfort of the men who load the tram cars, for they will be well underground and no longer exposed to the winter storms. Development work has now been carried below the 1,000-foot level of both mines, although the new inclines had not fully reached that depth at the time of visit. There is stoping ore on all the levels of the Jumbo mine. Most of the ore of the Bonanza mine above the 300-foot level, however, has been mined out except in the pillars, which contain much ore and have not been touched. Exploratory work, both by drifts and crosscuts and by diamond drilling, has been pushed in all parts of the property. The Bonanza and Jumbo mines employ about 150 men each.

Work in the Mother Lode mine in 1919 was directed mostly toward exploration of the mine and toward removal of the ore already mined and piled on the dumps by the previous owners, for because of the cost of transportation by truck from the mine to McCarthy only the highest-grade ore was shipped and the ore of lower grade was left. Much of this lower-grade ore was scraped up in the summer of 1919 and hauled by electric engines from the Mother Lode dumps to the Bonanza incline on the 800-foot level and thence sent to the mill at Kennicott. Within the mine a prospecting shaft was sunk from the Pittsburg (600-foot) level to a point below the 1,100-foot level, and crosscuts were driven to the ore-bearing zone. Prospecting by drifts and with the diamond drill was carried on from the crosscuts at the same time.

An increase in the capacity of the Bonanza tram to about 1,000 tons a day makes possible the handling of ore from both the Bonanza and Mother Lode mines.

Part of the ore delivered to the mill over the Bonanza and Jumbo trams is sorted out and shipped as high-grade ore, but the greater part passes through the mill for concentration. The mill tailings all pass through the leaching plant, where they are deprived of the light-weight copper-carbonate minerals left in them on leaving the mill. The leaching plant treats 600 tons of ore a day.

DAN AND CHITITU CREEKS.

The gold placers of Dan and Chititu creeks were not visited by the writer in 1919, and the few statements made here are based on statements of the owners of the properties or on information from other sources. An estimate of the gold production of the two creeks is contained in the first part of this volume.

Little in the way of new installation or new discovery has taken place on Dan Creek, but the mining plants already installed have continued operation as in previous years. The largest operator is the Dan Creek Mining Co., whose plant was installed several years ago and has been in operation each year since. In addition work has been done on a smaller scale by other owners on the bench claims of Dan Creek and on claims on Copper Creek, the southern branch of Dan Creek.

The principal fact of note relating to Chititu Creek is the consolidation of the claims on lower Rex Creek and part of those on White Creek, the two branches of Chititu Creek, with the claims on Chititu Creek itself. This was brought about by the purchase of certain claims on Chititu Creek just below the junction of Rex and White creeks. Mining on these claims and on some of the claims on Chititu Creek has been hampered by a conflict of water rights. This difficulty is now obviated by the consolidation, and a proper exploitation of the gravels involved is possible. This property now includes not only the creek claims already mentioned but also certain bench claims on the east side of Rex Creek a short distance above Chititu Creek, which heretofore have been worked independently of the claims on Chititu Creek. The two hydraulic plants on the Rex and Chititu creek claims were in operation as formerly.

The work just mentioned as having been in progress on Rex and Chititu creeks was the principal mining done on those streams in 1919, but some further mining was done by other operators on upper Rex and White creeks which contributed a small amount to the gold production of the Nizina district.