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MR 65-1
1937

PRELIMINARY REPORT OF LODE MINING ACTIVITIES IN THE NIXON FORK DISTRICT, ALASKA

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Introduction:

Mining activities at the Nixon Fork Mine are being carried on at the same capacity as formerly. Renewed interest has been revived in the McGowan-Mespelt property and the Whalen mine. New workings on the Whalen near the old glory hole have produced 50 tons of ore this season. A new vertical shaft is under construction on the McGowan-Mespelt property which is under lease to McGowan and Lind. This spring Mospelt and Company milled 900 tons of ore that was mined last year from the Nixon Fork Mine. This summer a total of 400 tons has been mined and this was milled during September and October. This was followed by mining until winter conditions closed operations for the year. A recent report stated the ore milled gave returns double that which was expected.

The placer activities in this district were of a small nature and of a small production. Individual card reports were made of these operations. Fifteen men total the number of men working in the district and two were reported prospecting.

Mespelt and Company, Nixon Fork Mine:

The Nixon Fork Mine is located 12 miles via road north of Medfra on the upper Kuskokwim River in the Mt. McKinley precinct. Eight miles of this road, four miles on each end, is in fair condition, while the center four miles is poor with long stretches of broken corduroy. An airplane field in fair condition is maintained at the Medfra and pontoon ships land on the river. The airline distance to Medfra from Anchorage via Rainey Pass is 200 miles.

Mespelt and Company own eight unpatented claims at the head of Ruby Creek, a tributary of the Nixon Fork River. The company is owned and operated by the Mespelt Brothers and L. Rodrigue.

The Nixon Fork mine was discovered by Pearson & Strand in the spring of 1918. T. P. Eakin optioned the property this same year and sank the Crystal shaft. He continued working through the following year, during which time 400 tons of ore were shipped that averaged $90 in gold per ton. In 1919 the Whalen Lode was discovered and this and the Pearson and Strand property were optioned to the Treadwell-Yukon Company, Ltd. This company sank the Garnet No. 1 and No. 2 and the Recreation shafts. The following year a 10-stamp mill was erected, located midway between the Whalen-Griffen and Pearson & Strand properties. This mill was operated for two years by the Treadwell-Yukon Company and a total output of $235,000 is reported.* Of this amount Mr. C. Mespelt reports $28,000

*U. S. G. S. Bull. 783, "The Nixon Fork Country," by J. S. Brown, p. 127.

was milled from the Pearson and Strand property. Two hundred tons of ore and concentrates were shipped to the Tacoma Smelter. In the fall of 1923 these properties were dropped and reverted back to the original owners. In 1924 E. M. Whalen leased the mill and milled the remaining broken ore in the Whalen mine. Pearson and Strand continued prospecting in the workings on their property. In 1926 the Mespelt Brothers bought the Nixon Fork mill and the Pearson and Strand property. Since then they have been operating this property. The Whalen-Griffen property has been inactive until last year, when E. M. Whalen sank a new prospect shaft and hit ore and mined 50 tons this season. Since 1926 to this season nearly $400,000 has been the total production from the Pearson and Strand property by Mespelt and Company. Later reports were to the effect that more ore has been found on this latter property.

Development:*

On the Pearson and Strand property now owned by Mespelt and Company there has been continuous operations and development. This has proceeded in an intermittent manner. The mill has operated when a sufficient amount of ore was accumulated and sufficient water was available, mainly spring and fall. Development in the mine has been a program of drifting and cross-cutting until a small pocket of ore is found. This is mined and development continues in search of another. In the past considerable of the prospecting was done by surface pits and trenches. A total of seven shafts have been sunk on the property. Only the Garnet shaft No. 1 is used at the present time. This is a vertical shaft with a total depth of 300 feet. It is located 190 feet west of the incline shaft and 90 feet northwest of the Garnet No. 2 shaft. The workings of the Garnet No. 1 shaft connect with the workings of the Garnet No. 2 shaft. This shaft has four levels; namely, 77-foot level, 100-foot sub-level, 177-foot level and the 270-foot level. A 40-foot winze was sunk from the 270-foot level which is now filled. This shaft starts in altered limestone, cuts into monzonite porphyry between the 100-foot sub-level, and the 177-foot level. This last season a short drift off the 270-foot level hit two feet of ore on the limestone-monzonite porphyry contact which is the greatest depth ore has been found in the mine. Most of the ore mined from this shaft has come from stopes on the 77-foot level and the 100-foot sub-level. A total of 1200 feet represents the total of drifts and crosscuts from this shaft. Several raises and stopes comprise the total workings. The accompanying plan of the workings shows all but the 270-foot level where only a few feet of drifting and a short incline winze shows the lowest discovery of ore.

The Garnet No. 2 shaft located 90 feet southeast of the Garnet No. 1 has a depth of 60 feet. This 60-foot level has a length of 160 feet and connects with a raise from the 77-foot level of the Garnet No. 1 shaft. Ore has been stoped over a distance of 100 feet along the drift. A crosscut to the south across to monzonite porphyry intersected another orebody in the limestone-porphyry contact. Stoping was in progress here on

* Refer to map of Underground Workings in file. (Too Large for Report)

the date of visit. This orebody had a length of 30 feet and averages 3 to 4 feet in width. It extends into the limestone. Considerable work has been done by the present company in past years in the High Grade shaft. It is not in use at the present time and the workings were not visited. This shaft is located 340 feet west of the Garnet No. 1 shaft, and has a drift of 150 feet. Two levels, the 70-foot and the 150-foot, were reported with a total of 1200 feet of drifts and crosscuts. Two orebodies were found on the 70-foot level. They are described by J. B. Mertie, Jr. in U. S. G. S. bulletin 864-C, "Mineral Deposits of the Ruby-Kuskokwim Region, Alaska," p. 238, as follows:

> "There are two orebodies striking about N. 25° E., one of which has an average dip of 65° SE. and the other an average of 40° NW. These orebodies meet and coalesce at or near the surface, but diverge downward. The southeastward-dipping orebody, however, cuts off the other one, suggesting a difference in their age. Both these orebodies are irregular in strike and more so in dip. They are also variable in thickness, which in the southeastward-dipping orebody ranges from 2 to 11 feet, and in the northwestward-dipping orebody from 2 to 9 feet. Both these orebodies are developed in the limestone, and, as elsewhere, the footwall and hanging wall are indefinite. A short distance below the 70-foot level these orebodies end abruptly against an altered dike rock, and their continuation was not found in the 150-foot level below."

This description of the orebodies is similar to those found in the other shafts. They appear of the pocket lense type with very irregular boundaries.

The Recreation shaft is located north of the incline shaft along the wagon road to the McGowan-Mespelt property. No work has been done in this shaft for several years. It was reported to have a depth of 50 feet with a 35-foot drift exposing a 6-foot vein. This shaft is in limestone.

The Crystal shaft located 200 feet northeast of the incline shaft is in the main body of monzonite. This shaft was sunk to a reported depth of 65 feet. It was inacessible, as nothing further has been done in this shaft since 1920. An orebody 10'x20'x65' was mined from the shaft and 6 feet of solid sulphides were encountered in the bottom. The ore from this shaft was reported shipped to the Tacoma Smelter.

The Keen shaft is also abandoned, and it is located in monzonite 1000 feet east of the western border of the quartz monzonite. Four feet of sulphide ore was reported in this shaft.

The Incline shaft was sunk by the Mespelt Brothers to a depth of 100 feet on a 50° incline. The first level is vertically 25 feet below the surface and the second level is at the bottom of the shaft or vertically 75 feet down. The total workings consist of nearly 550 feet of drifts and crosscuts with 100 feet of raises. This shaft is not in use and contained so much ice it was not accessible on date of visit. Two orebodies were reported encountered and mined. The largest orebody was nearly 60 feet in length and extended northeast of the shaft from the surface to below the first level. The other consisted of small orebodies or small bunches of ore, approximately 100 feet west of the shaft on the second level. These were small and of apparent low grade. As a result these workings were abandoned for the time being.

A recent opencut, located midway between the Garnet No. 1 and High Grade shafts, shows about 18 inches of ore. A few tons have been mined from this cut, a portion of which was loose surface pieces highly oxidized.

Geology:

Considerable has been written regarding the geology of this section. It is best described in Bull. 783, "Mineral Resources of Alaska, 1924, 'The Nixon Fork Country'" by J. S. Brown, pp. 97 to 151. A short report on the region is contained in Bull. 722 on the mineral resources of Alaska in 1920, "Gold Lodes in the Upper Kuskokwim Region" by Geo. C. Martin, pp. 149-161. Further descriptions of the region with a detail description of the property is contained in Bull. 864 on the mineral resources of Alaska in 1933, "Mineral Deposits of the Ruby-Kuskokwim Region" by J. B. Mertie, Jr., pp. 229-242. In this latter report the geology is described as follows:

> "In the vicinity of the lodes the country rock consists of early Paleozoic limestone and Cretaceous sandstone and shale. Both the Paleozoic and Cretaceous rocks have been invaded by a mass of quartz monzonite and related rocks, along the borders of which mineralization has taken place. The intrusive mass occurs as a plug, which crops out in a roughly elliptical area with major and minor axes about 5 and 2 miles in length. The trend of the major axis is about N. 35° E. The intrusive rocks consist dominantly of quartz monzonite, but include porphyritic variants of similar composition, which occur as marginal faces and as dikes. These monzonitic rocks are considered to be of Tertiary age. * * * * *
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> "The principal gold lodes lie at or near the contact of this intrusive mass with the Paleozoic limestone, and most of those so far discovered occur in the limestone, though few of them are more than 100 feet from the contact. * * * * *
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> "It is also apparent that this irregular contact line has been further modified by cross faulting, some of which occurred prior to the deposition of the ores. In fact, it seems probable that the ore-bearing solutions followed fault planes as well as contact planes in their upward migration."

The following sketch, a reduced print of a sketch made by the Alaska Treadwell G. M. Co., shows the surface geology of the south end of this monzonite stock. This sketch shows the quartz monzonite with the porphyritic phase in contact with the blue Paleozoic limestone and Cretaceous slates. The limestone area, which contains the site of the Whalen mine, shows clearly an isolated block of limestone enclosed in the monzonite. In a small scale this represents a small roof pendent with a contained orebody. Small quartz porphyry stocks are shown away from the main mass intruded through both the limestone and the overlying slate. Thus a cross-section would show a structure of an arched anticline formed by the intrusion of the monzonite stock. Thus the upthrust force accounts for the apparent thrust faulting which formed the openings for the associated dikes. The cooling of the upper portion of this stock which was during a period of active flow of mineralizing solution caused another process of faulting and formed openings both in the surrounding sediments and within the upper portion of the stock itself. Following this intrusion an apparent rapid erosion wore away the overlying sediments and exposed the intrusion. Since the intrusive was more resistant, it remained as an elongated ridge with surrounding hardened metamorphic sediments.

Ore Bodies and Mineralization:

Three types of mineralization found in this area formed three kinds of orebodies. The latest type of mineralization formed orebodies which are the richest and the only kind mined at the present time. If this region had cheaper transportation, or was located nearer salt water and smelter facilities, it is possible the other kind of orebodies could be mined at a profit. The kinds of orebodies and types of mineralization are here discussed as to sequence in origin, mode of occurrence, associated minerals, etc.

The first kind of orebody or deposit is classified as a contact-metamorphic type. This is found along the contact in the altered phase of the quartz monzonite and the hardened metamorphosed sediments. The ore is low grade and these bodies have not been mined. The mineralization is disseminated chalcopyrite and pyrite in the contact porphyritic phase of the monzonite and in the garnetite the contact phase of the limestone. Three zones of this type of mineralization were noted. On the accompanying geological sketch a zone 500 feet in length is shown extending northeast from the Whalen glory hole. The Whalen orebody was originally a contact metamorphic deposit. This is evident from the description by Brown, J. S. at p. 129 of Bull. 733 of the Whalen orebody as follows:

"Much of the altered limestone is a white or gray rock, recrystallized, but not otherwise greatly modified. Mixed through this rock as irregular streaks or bands are masses of darker rock that is much more severely altered. This darker rock consists of typical contact-metamorphic silicates, such as zoisite, pyroxenes, garnet, and similar minerals, together with a great deal of fine-grained quartz, which replaces the original limestone. These masses in many places are closely associated with irregular knots and blebs of much modified intrusive matter, doubtless originally monzonitic.

"The ore occurred in irregular masses and ore shoots not confined to any definite vein or structure. It has been almost wholly oxidized to the bottom of the workings, but enough of primary ore remains to indicate that it consisted mainly of pyritic sulphides, especially pyrite and chalcopyrite, with free gold, the gold being the chief portion of value."

This type of ore deposit and mineralization of hypogene origin has been the source from which the later or supergene type has been formed. The processes concerned in this transposition have been mainly chemical in nature. The erosional process has worn away the surrounding sediments exposing these earlier types of orebodies to the action of ground circulating waters. Oxidation and the action of sulphuric acid on the sulphides and the metals have been the important reactions which have set free the gold contained in the sulphides. The action of the ground water with low contents of manganese and magnesium have been the agency that transported the metals into the limestone along faults, shear zones, etc., formed by the cooling of the stock prior to the erosion. Another process that has accompanied this later ore deposition has been a replacement of the limestone. This latter process accounts for the irregularity of the orebodies.

The second locality, which shows another ore deposit of the contact-metamorphic type, is the first level in the Incline shaft. Here again is another band of garnetite and contact metamorphic rocks formed on the marginal phase of the monzonite. Here the same processes were in action and formed the later supergene type of orebody which was mined from this shaft.

The third locality containing this type of orebody is located on the contact of monzonite and limestone near the line of the McGowan-Mespelt property to the north along the old road. Here approximately disseminated chalcopyrite and pyrite is contained in a 10-foot width of garnetite containing a high silica content. This rock has been considerably hardened metamorphically to the extent that it is mined and used for pebbles in the tube mill. This mineralization also occurs disseminated into the monzonite. While the extent of the mineralization is not great enough to form ore, this locality does afford proof of

definite contact-metamorphic origin. Therefore, this type of deposit was the first to form caused by the cooling of the marginal phase of the monzonite with the sediments. The primary minerals formed as disseminations in the monzonite and in the limestone. The portion formed in the limestone was probably formed as a replacement. Thus the solutions forming the garnetite contained the metallic solutions which segregated as disseminations during the cooling and metamorphic process. Thus the type of mineralization that identifies this type of deposit is the presence of pyrite, chalcopyrite and associated gold values, with associated gangue minerals of garnet, quartz, andalusite, mica, altered monzonite minerals, epidote, and other contact minerals.

The second type of mineralization occurs within the monzonite mass itself at variable distances from the contact. These are found on definite vein structures within the cupola monzonite mass. The structures appear as faults, but are believed to have been originally cooling cracks formed from the cooling contractional forces of the roof of the cupola. These were reopened by pressure from below and the contained ore was deposited in them from solutions from the parent hot magma below. These deposits represent a more defined orebody, greater concentration and contain higher gold values. Since the trend of solutions in them was mainly upward caused by pressure, tabular small ore shoots were formed. This type of deposit is shown at the old crystal shaft, located near the top of the ridge at the head of Crystal Gulch and a few hundred feet from the contact in quartz monzonite. Here the ore was found unoxidized and containing sufficient gold values to mine and ship. At the bottom of the shaft 6 feet of solid sulphide was found. Quartz appears from samples in the dump to have been the most abundant gangue mineral. The mineralization was mainly chalcopyrite, and pyrite with a small amount of bornite.

The other known occurrence of this type of ore deposit was at the Keen shaft, located 1,000 feet from the contact in monzonite and north of the Crystal shaft. Here the dump shows massive sulphide ore and considerable iron stained quartz. The vein is reported as 4 feet in width. Other than chalcop yrite and pyrite, arsenopyrite is reported as probably contained in this ore. This ore did not contain sufficient gold values to ship as an ore. However, in appearance, it compares with the ore of the crystal shaft. Thus this type of deposit is identified by the chalcopyrite-pyrite mineralization and associated gangue of quartz. It no doubt formed immediately after the contact-metamorphic deposits at a comparatively high temperature, but less than the former.

The third and minable type of orebody is of the secondary type formed at the expense of the former two by action of underground waters. These orebodies are located in the limestone in close proximity to the contact. They occur as bunches, small lenses and irregular tabular masses. They were formed along planes of weakness such as faults, fractures, and crushed zones in the limestone. The cooling of the monzonite mass itself accounts for some of the faulting and fracturing with the force of the stoping action of the mass bowing the sediments up into a folded and faulted anticlinal structure originally. These openings were penetrated by ground waters following the process of erosion as it gradually approached this level from above. The chemical action involved was generally a breaking down of the sulphides, forming a weak solution of sulphuric acid which intensified action, the metals being taken into solution and migrating into the planes of weakness in the limestone, partially replacing and filling open spaces. The ore changed from a primary sulphide ore to a secondery ore consisting of iron hydroxides and copper carbonates. One of the important chemical changes from the present economic point of view is that in the decomposition of the sulphides, the gold was set free, migrated with the solutions and was precipitated as free gold in the secondary ore. Gold is found free and very evident to the eye in massive copper carbonates and the iron hydroxides. The chemical reaction that accounts for the migration of the gold is not known. However, since manganese minerals were found in several localities surrounding the orebodies and traces in the ore itself, it is believed that this accounts for the gold after having been set free by the reaction of sulphuric acid, being taken into solution by the ground water, containing slight amounts of manganese. Thus it traveled along with the iron and copper minerals and was precipitated along with them by carbonaceous matter derived from the limestone.

The ore minerals contained in this later ore are malachite, azurite, chalcocite, chrysocolla, cuprite, black earthy oxides of copper, free gold and silver. The gangue minerals consist mainly of calcite, sericite, chlorite, garnet, dolomite, etc. Gold is the only metal recovered by the milling process at the present time. Values in gold of the average ore milled varies from $50 to $100 per ton.

A shipment of two lots by the Alaska-Treadwell in 1921 of hand sorted ore gave the following return assay:

First lot	Second lot
Gold 5.38 oz.	Gold 4.98 oz.
Silver 7.01 oz.	Silver 5.35 oz.
Copper 11.40%	Copper 9.64%

These shipments being of hand sorted and from near the surface orebodies, show higher values than found on lower levels. Therefore, these cannot be taken as average values. Nevertheless, they give a fair average of copper for the highest grade ores.

The ore as taken from the mine is hauled by truck and dumped along the road into a chute that leads to a short tunnel on a level with the top of the mill. The ore is trammed to the mill in ton cars and dumped over grizzly bars of one-inch mesh. The fine drops to the ore bin below and the coarse is fed through a Blake crusher 8"x10" jaws. From the bin the ore is fed to ten 1250-pound stamps. These stamps were made at the Treadwell foundry at Douglas, Alaska. Mercury is fed into the battery. Two sets of 5'x6' plates are used. The pulp is fed to a classifier with the fine material passing off as tailings and the coarse material is reground in a tube mill. Garnetite pebbles are used in the mill. The flow from the tube mill is run through an amalgamator and thence over slime plates. The slime plates consist of two sets of two 5'x6' plates. The tailings are ponded below the mill. Power for the mill is furnished by two 60 H. P. steam boilers which furnish steam for a 125 H. P. single Ames steam engine. Four-foot cord wood is used for fuel. Water for the mill is furnished from a spring above. The mill capacity is 50 tons in 24 hours.

The mining machinery, located at the Garnet No. 1 shaft, consists of an Ingersoll-Rand two-stage air-cooled compressor. This is run by a Caterpillar 15 H. P. gasoline tractor with belt drive. A 15-H. P. Fairbanks-Morse gasoline engine is geared to a friction drum hoist. The latter holds 1,000 feet of 1/2" cable. Ore is hauled from the shaft to the mill in a Ford V-8 truck. Assays are made by crushing samples on a bucking board and panning. Special 60% gelatin powder is used with No. 6 blasting caps and triple water-proof fuse. Seven men are employed as an average crew.

Tailing Problem:

The present ponded tailing pile was reported as containing 10,000 tons of tailings. The average values were reported as nearly $20 per ton in gold with unknown copper values. The problem is a metallurgical one of reworking the tailings and obtaining both the copper and gold. The owners desire to rework for the gold content only, since the cost of transporting concentrates is nearly prohibitive. Again to make a high grade concentrate for shipment involves a high cost of machinery installation and operation.

As a suggestion toward a solution the writer offered the following: A diamond drill program to locate orebodies and the blocking out of sufficient ore ahead to warrant the installation of a flotation process to handle a definite tonnage of the tailings and ore as mined. The objective to obtain as much free gold as possible by amalgamation, and then produce a high grade copper-gold concentrate that would warrant shipment.

Operations at the Whalen Mine:

The Whalen mine is located at the head of Holmes Gulch three-fourths of a mile south of the Nixon Fork mine. This property was discovered and staked by Messrs. Griffen and Whalen in 1919. The Treadwell-Yukon Company, Ltd. optioned the property in 1920 and also the Pearson-Strand property. Several hundred tons of ore was shipped from the Whalen lode to the Tacoma Smelter. In 1923 the company dropped their option and the mine was operated for two years following by E. M. Whalen and associates. The ownership of the property has remained in the hands of the original discoverers. No mining has been done since until last year when E. M. Whalen began sinking a prospect shaft. This new shaft is located 300 feet northeast of the old glory hole. This shaft is on the contact of limestone and monzonite. The ore consists of both copper carbonates and sulphides and iron hydroxides and sulphides, with gold values. The minerals present are malachite, chrysocolla, azurite, pyrite, chalcopyrite. The gangue minerals consist of quartz, calcite, dolomite, biotite, manganese oxides and numerous lime silicates.

This shaft was reported down 35 feet, but was inaccessible on date of visit due to ice. The orebody was reported as only a small pocket. Fifty tons was mined and hauled to the Nixon Fork mill. This ore was reported as averaging $50 in gold per ton. From the old dumps and in the glory hole a hundred tons of ore was picked and hauled for milling.

The geology of this section is well shown on the accompanying geological map and corresponds to that described under the Nixon Fork mine. The aforementioned geological publications describe both geology and mine developments.

Production of Whalen Mine:

Production given by E. M. Whalen, present operator of the mine, was as follows:

1921-1923 - Yukon-Treadwell Co., Ltd. 6,000 tons - recovered $70 gold.

1923-1924 - C. Weinen, Whalen, Walden & Possich - 1,800 tons averaged $56 recovery.

1925 - E. M. Whalen - 600 tons averaged $30 recovery.

1937 - E. M. Whalen - 150 tons, $50 expected recovery.

McGowan-Mespelt Property:

The McGowan-Mespelt property, which consists of two claims, the Southern Cross and Texas, is located near the head of Mystery Creek, and northeast of and adjoining the Pearson and Strand property. This property is under lease to W. D. McGowan and K. Lind. They were engaged on date of visit in sinking a new vertical shaft from which they intend during the winter months to prospect for ore. The claims represent

the northeasterly extension of the contact zone of the Pearson and Strand. There are several shafts on the property and from which a few small ore pockets have been mined. Due to a heavy overburden and disintegrated bedrock prospecting has to be done by short shafts. For a complete description of the workings and geology U. S. G. S. Bull. 864-C gives a detailed account. Due to ice conditions in the shaft the workings were not visited.

New machinery on the property used for shaft sinking consists of a 620-foot drum capacity friction hoist run by a 4-cylinder Hercules gas engine. This is used in connection with a highline lift with bucket. Two new cabins have been built. It was reported that a total of 200 tons has been milled from this property in the past and an average of $30 per ton in gold was recovered.