

PORTO RICO MINE, YMIR CAMP, B.C.

Location.

The Porto Rico mine is situated at the headwaters of Barrett Creek on the divide between the creek and the East Fork of the North Fork of Salmon River. The property which included five full mineral claims falls within the Nelson Mining Division of West Kootenay District, B.C.

Transportation

A well graded wagon road, 7 miles long down Barrett Creek Valley, connects the mine and mill with Porto Rico Siding on the Nelson and Fort Sheppard railway. This railway which belongs to the Great Northern System, follows the west bank of the Salmon river as far south as Salmo, B.C. The road from Porto Rico Siding to the mine, is at present in much need of repair.

Topography

The topography of the surrounding country is rough and rugged and typical of the Selkirk Mountain system to which it belongs. The mountain summits and valley slopes bear evidence, in the presence of serrated ridges, cols, horns, cirques, U-shaped valleys, truncated spurs, hanging valleys and terraces, of intense alpine and valley glaciation.

The Porto Rico mine and mill lies within the most south-westerly one of many rock-bound glacial basins or "cirques" which are the sources of glacially smoothed tributary valleys to that of the main Barrett creek. The mine workings are confined to the steep northwestern bounding wall of the cirque and extend up its rocky face to the low divide or "col" (elevation 6,400 feet above sea-level) which separates the Barrett creek from the North Fork of Salmon River drainage Basins. The vein which trends in a general northeast by north direction with low dip to the west outcrops or "spexes" in the "col" itself. The mill is situated several hundred feet further down in the basin near the lip of the cirque.

Timber

The upper stretches of Barrett Creek Valley with its tributaries supports a heavy growth of timber suitable for mining purposes. Cedar is very plentiful in the valley bottoms and white fir or balsam on the higher mountain slopes and bench lands, Spruce, hemlock, tamarack, white pine, Douglas fir, jack pine, poplar, cottonwood, birch, willow, alder and yew are also common through-out the valleys. Red pine is rather rare. Mountain laurel of "buck brush" and rhododendron renders travel on the upper slopes of the valleys difficult. The lower stretches of the valley of Barrett creek is largely brush country supporting a thick growth of fireweed.

The Nankin Pole and Post Company are the largest lumber operators in the Ymir district having leased 5,300 ^{acres} areas of timberlands which include areas up Barrett Creek Valley.

Water Supply.

The water supply right at the mine and mill is not sufficient for power purposes or extensive milling operations and could hardly be depended upon for service throughout the entire year. Abundant supply for mining and milling purposes, however, might be obtained from the main Barrett creek to the northeast (see Map). The precipitation in the region would probably average 30 inches per annum, a large part of which falls as snow in the winter months. Ice remains in certain parts of the mine workings all the year round.

History and Production.

The Porto Rico property was first discovered and located by two prospectors named Maxwell and Day, in the autumn of 1896. Assays of some of the ore samples obtained by them from surface outcroppings are said to have run as high as \$2600 to the ton. Within two months of their staking, the two prospectors had leased the property upon very favourable terms to the Canadian Pacific Exploration Company, Limited, an English company capitalized at \$500,000 in 1 shares. Having required the property,

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Mr. W. H. Corbould, managing director for the Company, at once commenced to thoroughly exploit the ground, Mr. J. J. McMullen was engaged as superintendent and under his management, operations were commenced and development work actively carried on by means of adit tunnels driven on the Porto Rico vein. Forty miners were employed. In 1899, a trail shipment of ore was sent to San Francisco which resulted in 90 percent of the gold values being saved on the amalgamating plates. A ten-stamp mill and 2500-foot-wire rope tramway connecting it with the mine was completed in December, 1898. The aerial tramway was installed by Mr. B.C. Riblet, then of Sandon, Slocan district, B.C. The following is an extract from a report of the directors for the year ending the 30th of September 1898: "Crushing commenced on the 8th of December, on the 20th of that month the result of the first clean-up was as follows:- Crushing 142 tons which gave a return of 295 ounces of retorted gold, also 20 tons of concentrates. The approximate value of clean-up was \$5,500.00; an average sample of the tailings assayed 3 dwts. per ton". In the Company report for the year ending the 30th of September 1899 the following: "Crushing during the year ending September 30th, there were as near as could be estimated 3,280 tons of ore crushed yielding in bullion 3178.06 ounces, value as per bullion certificates \$53,227.91 and 140.69 tons of concentrates, value \$3,285.59 making a total of \$56,511.50 or an average of \$17.21 per ton of ore crushed. Of the above, 1317 tons of ore yielding \$20,757.36 were taken altogether from the stopes above No. 2 level and the balance 1963 tons yielding \$35,754.14 was taken from the stopes between No. 2 and No. 3 levels so that the grade of that ore in sight improved with depth. On September 30th, there existed ore in sight in the stopes sufficient for five months mill run."

The Canadian Pacific Exploration Company expended over \$150,000 in the development of the Porto Rico property and of that amount \$8,000 was used for the construction of the wagon road. In April 1899, the mine closed down owing to the difficulty of getting wood cut for fuel. Seven cords of wood were required per day at the

mill and mine and the wood-cutters demanded \$8.00 per cord for the cutting and delivering of same.

The Port Rico mine was opened up again in 1903 after three years idleness, under lease to G.H. Barnhart, formerly Superintendent of the Ymir mine. During the first mill-run, six hundred tons was crushed having gross value of over \$16,000. the returns from which yielded considerable profit to the lessee after paying a heavy royalty. In July 1904, Mr. Barnhart signed another lease for a period of three years, on a royalty basis, the royalty under this, lease however, being lower. The mine was closed down the following spring. During the summer of 1914, M. W. B. De Witt, formerly of the Queen mine in Sheep Creek camp, took a short lease on the Porto Rico mine and along with three partners did a few months work making a trial run of ore through the mill.

Mine Development.

The mine is developed by means of four adit tunnels driven in on the vein as well as by open cuts. The tunnels are numbered from the above downwards. No. 1 tunnel is 250 feet long: No. 2 tunnel 90 feet lower down is about 380 feet long: and No. 3 tunnel 87 feet lower than No. 2 is about 600 feet long: and No. 4 tunnel 85 feet lower than No. 3 is about 300 feet long. Two hundred feet below No. 4 tunnel but off the vein is No. 6 tunnel only 90 feet long. In No. 3 tunnel is an up-raise 7 feet wide extending up to No. 2 tunnel, a distance of 130 feet, the working being all in ore. Much of the stoping and development work was done by five machine drills run by air compressed at the mill.

Geological Structure.

The vein which belongs to the true fissure-vein type, has a filling of quartz scattered through with iron pyrites. The values in the ore are carried in gold and silver, the former chiefly in the free state. Native gold may be seen in hand specimens from the vein. The values vary from \$3.00 up to \$146 per ton. The ore that Mr. Barnhart put through the mill in 1903 ran about \$17 to \$18 per ton. The width of the vein ranges from 2 to 5 feet

with an average width of 3 feet. It widens, however, in a few places to 8 feet but the values in such cases are not so high at the widening. The vein is very regular and continuous striking north 49 degrees east and dipping to the west at an angle of 45 degrees. The ore shoots are tabular in shape and in the vein appear to have a vertical pitch. The largest shoot has a stope length of 450 feet at the No. 3 tunnel level. The vein has been opened up at intervals for about half a mile along its outcrop from No. 4 tunnel up to its apex on the divide and is found invariably in contact with a narrow, fine grained charity lamprophyre (altered augite kersantite) about 2 feet in width and having the same strike and dip as the vein. The dyke generally forms the hanging wall but in some places ore occurs on both sides of the dyke and both vein matter and dyke have been stoped out and put through the mill.

The country rock of the ore producing portion of the vein is a somewhat granular, dark porphyrite containing prominent white feldspar phenocrysts. This augite feldspar porphyrite (Triassic?) occurs as an intrusive sill striking north and south and dipping steeply to the west. The east boundary of the sill passes close to the mouth of No. 4 tunnel whereas the west boundary falls outside the map-area. Another sill of an augite porphyrite of contemporaneous age to the augite feldspar porphyrite is about three-quarters of a mile thick and outcrops to the east. This sill has a similar strike and dip to the ore-bearing one. No. 6 tunnel is entirely in the augite porphyrite and as the vein has not been traced from the augite feldspar porphyrite eastward into this sill any variations that may be present in vein character and ore value with change of country rock cannot as yet be determined.

The accompanying longitudinal section indicates that probable structural relations of the two sills and the position of the adit tunnels and stopes.

Geology of Mine Workings.

The vein has been trenched and developed on the surface by means of open cuts and prospect pits above the tunnel levels

No. 1 tunnel :- The No. 1 tunnel is about 300 feet from the apex of the vein on the divide and 142 feet vertically. The tunnel was driven in on the vein which has since been stoped from below. The tunnel was inaccessible at time of visit but appeared to branch beyond a winze full of water which ^{was} covered by rotten boards. The tunnel is reported to be 250 feet long. The vein near the portal of the tunnel has been stoped above the sill floor for a distance of 15 feet which brings it close to the surface. The hanging wall of the portion of vein observed is the same cherty eruptive as elsewhere through out the mine and is here 2 feet wide. A hanging wall stringer of the vein was found in one place to follow the other border as the dyke.

No. 2 tunnel:- No. 2 tunnel is about 380 feet long and is 90 feet vertically below the level of No. 1 tunnel. This also follows the vein for a distance of about 300 feet when the working becomes deflected from the main vein and dyke and appears to follow a stringer of ore with a steeper dip to the west in the footwall country, (figure). A few inches of calcite and red iron oxide is present in this stringer and iron-stained quartz impregnated with pyrites appears in another vertical stringer which intersects the first one. The country rock is augite feldspar porphyrite through-out. The altered augite kersentite dyke from the hanging wall to the vein which has been extensively stoped above this level. Both dyke rock and ore has been stoped out in many places and run through the mill.

No. 3 tunnel:- No. 3 tunnel is the main adit tunnel of the mine being nearly 600 feet long. It is 87 feet vertically below the No. 2 tunnel level. The ore in the vein may be well seen at the portal of the tunnel near the door on the east side of the sill floor.

The main ore shoot on this level is 450 feet in stope length and the dip of the stope from this level up to the surface is 45 degrees. The quartz vein contains a little calcite in some places. At 500 feet, a lamprophyre dyke was encountered striking north and south at an angle of 55 degrees to the trend of the vein and between well defined walls which dipped to the east at an angle of 50 degrees. The hanging wall to the vein on this level for long productive stretches is a cherty augite Mersantite dyke which is intrusive into the augite feldspar porphyrite sill. About 40 feet from the face of the tunnel, the vein was lost in a brownish fine grained schist formation containing lime films. The east boundary of this schistose zone strikes north and south and varies from vertical to steeply dipping to the east. The working was deflected from the course it should have taken by this schistose band and is too far in the footwall country. This schist formation is in all probability a metamorphosed phase of the porphyrite caused by regional mashing. It may be expected to occur as a comparatively narrow, tabular zone trending with the formation. Beyond it, the vein should be found enclosed in the normal porphyrite. A grab sample of milling ore taken from one of the stopes assayed in gold and silver.

No. 4 tunnel:- No. 4 tunnel is 85 feet lower in elevation than No. 3 and is driven about 300 feet in on the footwall side of a curving quartz vein which contains scattered sulphides. The vein here dips to the northwest at any angle of 57 degrees. A dense cherty eruptive probably the altered augite kerstentite, forms its hanging wall where its footwall is the augite feldspar porphyrite.

No. 6 tunnel:- There is no No. 5 tunnel and the lowest working is No. 6 tunnel which is at an elevation nearly 200 feet below the level of No. 4 tunnel. This tunnel is only 90 feet long and was driven with the intention of croscutting the vein and then raising some 310 feet to the No. 3 level for ventilation purposes. Such a project would involve over 900 feet of work at a considerable cost. The tunnel is driven in the western portion of the augite porphyrite sill which lies between the augite feldspar porphyrite sill of the

mine and the Summit Ridge volcanics to the east. The augite porphyrite is cut by two dykes of augite minette, one 6 feet and the other 4 feet in width both striking north 34 degrees east and making an angle of 15 degrees with the strike of Porto Rico vein.

Mining and Milling.

The ore was mined by the overhand stoping method and air for five machine drills was supplied by a Rand Air Compressor placed in the mill. The ore consisting chiefly of a mixture of clean ore and low grade wall rock, was dumped into ore bin^s situated near the mouth of No. 3 tunnel. It was then conveyed from the bins to the mill by means of a wire rope tramway 2,500 feet long and with a vertical drop of 600 feet. The tramway was two 1-inch cables, supported upon five towers, the buckets each having a carrying capacity of 1,000 pounds. To each bucket is attached a 1/8 inch cable which passes over a drum with a lever and brake attachment located at the mine station. By this method 50 tons of ore were tramed from mine to mill in 10 hours or at the rate of 5 tons per hour. At the mill the buckets dumped automatically and dropped their contents into ore bins of which there are two having a holding capacity of 200 tons. From the bins the ore was fed over a grizzly, the fine ore passing into the No. 2 bin whereas the coarse ore was run through a Blake crusher which reduced it into cubes of about 1 1/2 inch in size. The crushed ore from No. 2 bin fell into the self feeders, then into the mortars and under the stamps. The pulp from the stamps passed through a 40 mesh screen, directly to the amalgam^{1/2} plates, which are 12 feet in length. From the amalgam plates, it was carried through the classifiers of which there are three, to the Frue Vanners. The mill is well equipped with 10-stamps each weighing 1,000 pounds and two 6-foot and one 4-foot Frue Vanners. The power plant consists of two boilers, a five drill air compressor, and a 40 horse power high speed engine, the latter employed in the operation of the mill. The building was illuminated by acetyline gas and the Company had telephonic communication between mill and mine. The capacity of the

mill was 25 tons of ore every 24 hours provided the water supply did not fail. The recovery in the mill amounted to 94 per cent of assay values and the concentrates averaged between \$40 and \$50 per ton.

Origin.

The comparatively meagre underground data at present available in the Porto Rico mine is hardly sufficient to derive any safe inferences regarding the origin of the ore deposit. Until further development work is done on the property only mere suggestions can be attempted with the hope that further investigation into this important economic problem may be stimulated.

Comparing the trend of the Porto Rico fissure vein with other fissure veins in the Ymir Camp, it is noted that the Porto Rico vein lies intermediate in direction between the general east-west strike of the veins on the Ymir, Wilcox, Foghorn, Tamarac, Gold Cup, May Blossum and Free Silver properties, and the general north and south strike of the veins on the Fern, Lost Cabin, Jennie Belle, C. Pac., Golden Horn, Iowa and Nevada properties. The north and south trending veins appear to owe their direction to the influence of the country rock formations either striking with the formation or following along dykes. The east and west trending veins, on the other hand, cut the formations and as a rule bear evidence of being fault fissures. The fissures in the latter case, which resulted through accumulated regional stresses in this portion of the crust having reached their breaking point, have not been controlled in their direction by that of country rock formation nor dyke. Although the Porto Rico vein resembles in strike most closely the veins of the Dundee and Yankee Girl mines it does not belong to the same system for the latter veins cut the formation and are independent of dykes although the ore shoots are not. They are most closely related to the east and west trending veins. In the case of the Porto Rico

mine the fissure veins, as shown by conformity of strike and dip between vein and lamprophyre dyke, belongs more to the north and south system of fissure veins and has been controlled in its development by the dyke found invariably on the hanging wall of the ore body.

Recent fractures frequently follow ancient fracture planes so that in this case the accumulated stresses may have found the old dyke-filled fracture a favourable plane of breakage and thus permitted heated ascending alkaline solutions, carrying gold and some silver, to circulate and, under suitable conditions of temperature and pressure, to deposit their burden of precious metals along the underside of the lamprophyre dyke.

The source of the mineralizing solutions was probably the same magma reservoir that gave rise to the Nelson granodiorite batholith (late Jurassic in age); the solutions representing the "after effects: (solfaterism) of igneous intrusion.

Future Work.

Since the apex of the vein is well exposed on the divide and found to have the same structural relations as below in the mine with the same persistent lamprophyre dyke as hanging wall, it would seem advisable to explore the vein more extensively and systematically both laterally and in depth. The vein to the southwest could readily be explored for ore shoots by continuing the adit tunnels beyond the schistose zone which in No. 3 tunnel deflected the working to the footwall. No. 2 tunnel also left the main vein and dyke and is in the footwall country. The dyke ought to prove a good indicator of the position of the vein. Should the vein leave it, however, and the values in it cease, other dyke intersections with the same vein should be sought after. Before doing this underground development work in search for lateral extensions of ore, the vein and dykes should be carefully traced on the surface, and, if possible, the width of the schistose zone measured. Neither

the vein nor dyke have as yet been proved to extend to the north-east into the augite porphyrite sill. Although the augite porphyrite of the lower workings is not the ore-bearing country rock of the Porto Rico mine yet it is the country rock to high grade ore from prospects below the mine near the wagon road as well as from the Fern mine. In the case of the Fern mine, however the ore shoots are found in contact with a granite porphyry dyke. Dyke intersections with veins both lamprophyres and porphyry, particularly where, at acute angles, should be carefully prospected for. As several lamprophyre dykes have already been disclosed in the mine workings and found to strike at acute angles to the main vein fissure, the chances are fair for finding not only extensions of old ore shoots but also new shoots on the Porto Rico and adjoining properties.