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Item 23

REPORT ON THE GEOLOGY

of the property of

the

NEVADA WONDER MINING COMPANY

at

WONDER, NEVADA.

by

J.A.BURGESS.

Wonder, Nevada.

June , 1911.

Letter of Transmittal.

Nevada Wonder Mining Co.

Gentlemen;

The attached report summarizes the results of my investigation of the geology of your property at Wonder, Nevada.

In order to arrive at a confident determination of the age-relations of the various rocks of a volcanic complex such as is found at Wonder, it would be necessary to carry the field work over an area large enough to embrace the entire limits of most of the formations under consideration; but in this examination the work was necessarily limited to a comparatively small area. I have not, however, avoided the question of the interrelation of the rocks, but have given in a tentative way what seems the most probable explanation in the light of the data secured.

The delay in submitting the report was due to the necessity of doing all the work connected with it in the way of mapping, lettering, copying, type-writing, etc., myself, and that in time that could be spared from the supervision of the mine work; and to the slow communication by mail with outside firms who made a few rock determinations and printed the maps.

Very respectfully yours,

L. A. Burgess

Wonder, Nevada.

June, ,1911.

The Wonder Mining District, in Churchill County, Nevada is built up of Tertiary rhyolites, dacite and andesite. Of these the Wonder rhyolite is the oldest, and it was followed by the Alpine dacite, the Extension rhyolite, and the Blue Jay rhyolite, and a small amount of andesite.

Rock Formations.

Wonder Rhyolite. The Wonder rhyolite forms the main body of Wonder Mountain, and is found over a large area to the north , south, and west. This body of r ock is bounded on the east by its contact with the Alpine dacite, which appears to form a dike half a mile wide in the rhyolite. East of the dike the Wonder rhyolite again appears and extends to near t he top of the range where an intrusive andesite forms the ridge.

The rock is a typical rhyolite. It has a porphyritic structure, and shows numerous phenocrysts of quartz, orthoclase, and a few remnants of biotite, with a groundmass of devitrified glass. The rock varies in the relative amounts of its mineral constituents in different parts of the area mapped; and particularly in the western part, the relative amount of quartz decreases while the orthoclase increases, and the rock more nearly approaches the character of a trachyte. Locally the quartz greatly predominates over the orthoclase.

The rhyolite is always found much altered. On the west the alteration is principally oxidation. On the east the rock is highly silicified especially in the neighborhood of the vein system, and the higher parts of Wonder Mountain owe their relief to the intense silicification that has affected the rhyolite in this place.

The Wonder rhyolite forms the walls of the Wonder vein system, including the Wonder vein, the Badger vein, and the Ruby vein, and it outcrops on all the surface of the Nevada Wonder property except the extreme eastern part. The Wonder vein system and the Wonder fault are both parallel to the contact between the western edge of the Alpine dacite and the Wonder rhyolite. This contact forms an almost straight line and is strongly

suggestive of a fault line. I have found no positive evidence bearing on this point but if the contact prove to be a large fault, it would make the Alpine dacite seem to be in part a flow and would admit the possibility of the Wonder rhyolite existing under the dacite. The mapping of a larger area than has been gone over would throw light on some of these doubtful points, but the purpose of this examination did not call for such an extensive research, and the necessity of getting quickly at the mine work prevented it.

Alpine Dacite. The Alpine Dacite seems to form a large dike through the Wonder Valley about parallel to the Wonder Vein System and east of it. It extends in a longitudinal direction north and south beyond the company's property lines, farther than this investigation was pursued. To the east it forms the first hills east of the ice-plant, but is limited on that side by a steep contact with the Wonder rhyolite, which appears again in that place.

On the company's property it outcrops from a point on the Ruby No. 1 Claim just south of the mill to the north boundary of the Wonder No.2. The contact crosses the hill about a hundred yards from the Wonder Shaft, and strikes down along the bottom of the canon toward the Hidden Treasure Mine.

The rock is dacite of porphyritic structure, and is composed of phenocrysts of sanadine, andesine, occasional quartz, and an altered ferro magnesian mineral, probably hypersthene. The base of the rock is a brownish ~~an altered glass~~, partly devitrified and showing some flow lines. The rock can be found fairly fresh at the surface. It contains numerous inclusions of various rock fragments.

The dacite can be found in the lower part of the mill excavation; and at the portal of the lower Last Chance tunnel there is a fault-zone of crushed and highly kaolinized rock which, judging from the few solid

pieces that can be found, seems to be referable to the dacite. I seems then that the dacite forms a tongue intrusive into the Wonder fault at this place.

On the 300 ft. level of the Wonder shaft, east of the Wonder fault the east crosscut encountered a crushed, leached and pyritized rock which seems to be another intrusive part of the Alpine dacite, but the rock is so altered that the identification is not certain. It was not found on the 500 ft. level though the crosscut went farther than the 300. So far as I know no ore has been found in this rock.

<u>Extension Rhyolite.</u> The Extension rhyolite is a surface flow of white silicious rhyolite containing numerous quartz phenocrysts and many inclusions of foreign rocks such as granite, andesite, and sedimentary rocks. In some places it becomes porous and ~~silicious~~ pumiceous. It outcrops in the south eastern part of the property in the neighborhood of the office buildings, and the Extension shaft which was sunk in this rock is probably in an intrusive neck. It seems to be a surface flow in a pre-existing valley of erosion. It is not known to contain ore.

<u>Small Intrusive Bodies.</u> A thirty five foot wide dike of typical hornblende andesite, is found lying a short distance south of the southwestern side lines of the property and parallel to them. It is intrusive into the Wonder rhyolite and dips 80 degrees to the north east. It seems to have caused no vein formation and is of little importance.

The summit of the hill a short distance north of the office buildings and outside the Nevada Wonder property lines, is formed of a quartz and biotite bearing rhyolite, here called the Blue Jay rhyolite which is part of an intrusive neck later than the Extension rhyolite ~~neck~~. It has no special significance excepting that together with the extrusion of the Extension rhyolite and the intrusion of the Alpine dacite, it shows that the middle part of the Wonder valley was once the scene of considerable volcanic activity.

Rock Debris and Soil. Much of the surface is so mantled with soil and rock debris that the tracing of the exact lines of contact is difficult and sometimes impossible.

Formations found Underground. The mine workings are all in Wonder rhyolite except the east crosscut on the 300 ft. level of the Wonder shaft, which is thought to be in Alpine dacite. Owing to the unsafe condition of the ladders in the Extension shaft I did not go down it, but the rock on the dump is all of one character and is referred to an intrusive part of the Extension rhyolite.

Veins.

Location of Veins. The chief veins on the property are the Wonder and the Badger veins. Across the Nevada Wonder and the Nevada Wonder No. 2 claims these veins are parallel and separated by a distance of about 40 to 50 feet. Owing to the covering of soil they cannot be traced continuously acrossthe Ruby No. 1 claim, but near the southern corner of this claim the out crop of a single vein is found, and it seems that the two veins have joined before reaching this point. From this point the united vein can be traced through the Last Chance tunnels, and from there southward only barren float and some stringers mark its probable course along the side of Last Chance Hill. The course of the vein on the hill would take it under the soil and the Extension rhyolite on the flat, but near the southern corner of the Last Chance Claim at the side of a small gully the outcrop of a barren vein several feet wide appears, which has all the characteristics of the vein on the hill, except that it seems to be barren, and it seems that the main vein system extends throughout the entire length of the property.

The Ruby vein is found lying just within the Ruby claim parallel to its eastern side line. To the north it is weak and composed of barren quartz stringers. To the south its outcrop shows several feet of

solid quartz at a point a short distance from the large water supply tank, but it appears to be barren there also. Its strike as indicated at this point would make it meet the united Wonder and Badger veins near the eastern corner of the Ruby claim, but the junction is covered by wash.

Strike and Dip. The main veins strike about N 30 W and dip to the east at a speep angle, usually 75 to 85 degrees. The Ruby vein strikes N 45 W and also dips steeply to the east.

Character of the Veins. The veins have a complex history and show several successive periods of formation. They are largely replacement veins formed in a shear zone of crushed rock parallel to, and west of, the Wonder fault, the shear zones being breaks of small movement induced by the larger movement of the Wonder fault. The earliest part of the vein was a barren white quartz replacing the rhyolite of the walls and filling the fissures that existed when it was introduced. It is seen in the barren outcrops of the Ruby vein, where it forms the entire body of the vein, and in the large body of quartz found on the footwall side of the Badger vein, as exposed in some of its outcrops and in the old winze level from the tunnel workings. This quartz is absent or less noticeable in the Wonder vein. It was followed by a light gray chalcydonic or chert-like quartz which is found in both the Badger and Wonder veins, and which may have brought with it a small amount of silver. Further movement of the walls crushed the chalcydonic quartz and permitted the entrance of later solutions which deposited the ore-bearing quartz. The ore is usually found in the hanging wall part of the vein, and encloses fragments of the chalcydonic quartz, and it may be seen cutting across the earliest white quartz at an open cut above the tunnel, on the Badger vein.

Of the two vein fissures the Wonder was the more open and allowed a freer movement of the vein-forming solutions, as shown by the better marked banding parallel to the w ~~of the~~ Banding parallel to the walls

can also be found in the Badger vein but is much less evident than in the Wonder vein, and the ore has a more irregular and blotched appearance, due to the slower movement of the solutions and to its being deposited almost entirely as a replacement of the rhyolite. As at Goldfield unaltered quartz phenocrysts of the enclosing wall rocks are found in the veins.

The gangue consists of quartz, pieces of partly replaced rhyolite, a feldspar resembling the adularia of the Tonopah veins, and decomposition products such as kaolin.

The valuable metals are in the form of argentite, embolite and gold. The argentite is usually finely divided and well disseminated, but occurs in spots and small bunches in the best ore, and sometimes in bands between quartz and adularia. Embolite occurs as an alteration product in cracks and porous quartz. Gold is found in visible specks in the Wonder vein, but not so in the Badger. The ratio of gold to silver is 1 oz. to 130 oz. in the Badger vein, and 1 oz. to 50 oz. in the Wonder vein; a circumstance that makes it appear that the solutions from which the veins were deposited carried different proportions of the metals and were of somewhat different age. An alternative hypothesis is that the difference in conditions of deposition in the two veins, a slow replacing deposition in the Badger vein and a more rapid one in the Wonder vein, threw down the gold and silver in different proportions from ~~the~~ similar solutions.

The base metals are almost absent in the parts of the vein now exposed. Pyrite is seldom noticeable and usually the only evidence of iron is a yellow-brown limonite stain in the fissures and in the kaolin. On the winze level a slight copper stain is found in one place on the Badger vein, and near the same place a small body of dark quartz is exposed which is heavily mineralized with pyrite and which is probably cupriferous. MnO_2 present.

No well defined oreshoots have yet been determined as hardly

enough work has been done to give any clew to the form and distribution of the ore-bodies. Ore is found where the vein outcrops for over a distance of 1500 feet as marked on the surface map by the letters D-D. I find ore of excellent value outcropping near the east side centre stake of the Nevada Wonder claim, and I think that an ore shoot whose size can only be guessed at exists to the north of the shaft. The outcrop mentioned comes through the wash for only a short distance.

The outcrops above the tunnel and the one near the south end of the Ruby No. 1 claim show ore and inlicate that the mineralized zone will extend to these limits. The distribution of the ore within these limits will only be known after a larger amount of mine work has been done In the present workings the drifts are sometimes in ore of good grade and sometimes in low grade material. As the sampling and calculation of value of the ore is not a part of this investigation nothing further will be said here on that subject.

The question as to the situation of the Badger vein on the lower levels from the Wonder shaft suggests several possibilities. It may change its dip below the 70ft. level and lie west of the shaft below that point, or as seems more probable, it weakens below the 70 ft. level and its downward continuation is the small amount of quartz found on the 200 ft. level near the shaft as shown on the map of the 200 ft. level. In the latter case, the Badger vein probably joins the Wonder vein near the 300 ft. level .In my recommendations for development I have planned work on the 200 ft. level which should give a clew to the situation. The Badger vein continues so persistently separate on its outcrop northward from the tunnel that it seems improbable that it will not be found separate , at least at moderate depth, north of the shaft.

The veins are much crushed and the fissures are usually filled with soft yellowish kaolin. They vary in width from 3 to 10 feet.

Origin of the Veins. The hypothesis that seems to best account for the

origin of these veins is that they have been formed in fissure lying parallel to a main plane of weakness through which the Alpine dacite was erupted; that the solutions that formed the veins followed the intrusion of this rock and owed their origin to it, either as a magmatic segregation from the rock near its source, or as waters set in circulation by the heat emanating from the intrusive. My adherence to either of these popular and conflicting theories of ore deposition is yet in abeyance, as I prefer to base my decision on the results of a wider observation than I have had as yet.

Faulting. The main fault system is parallel to the vein and is here named the Wonder fault system. It includes the heavy fault, 50 to 60 ft. wide, filled with crushed and kaolinized rock, lying a short distance east of the Wonder vein, and appearing in the main tunnel, in the lower Last Chance tunnel, and in the 300 ft. level of the Wonder shaft. It also includes a faulting some times found directly along the hanging wall of the Wonder vein, and all the faulting generally parallel to these. It seems probable that this system of faults is sympathetic with a larger fault lying farther to the east and not yet exposed, probably lying at the contact of the Wonder rhyolite and the later volcanics, and identical with the line of weakness through which they were erupted.

A minor secondary fault system of comparatively recent origin, known as the Cross Fissure System, cuts across the veins with a strike of about N 50 to 70 W, and dipping to the south west at an angle of about 60 degrees. It is a very persistent system, consisting of ~~about~~ an innumerable number of small breaks and fissures, and it nowhere shows movement of any considerable size, it seems to be the result of a general settling of the ground toward the southwest. It seldom causes a noticeable displacement of the vein though it has crushed it and sliced it in a diagonal direction throughout all the mine workings. It is difficult to believe that so much crushing of the vein could be caused by such a small move-

ment, movement which sometimes hardly shows on the hanging wall and only causes open fissures on the footwall. The explanation lies in the hard brittle characterof the vein material which shatters like glass under a sufficient strain, even with a slight actual movement.

This diagonal slicing of the vein has given rise to the notion that the mineral banding in the vein lies parallel to the cross fissures and was influenced by the cross fissuring; but this does not aggree with my observations; and the fact that the vein material does not extend into these fissures, that they are never cemented with quartz and are often open seems to be sufficient evidence that they were formed after the vein.

Comparison with the Sunny Side vein at Round Mountain, Nev. In its occurence in a large body of rhyolite, the Wonder vein system resembles the Sunny Side Vein of the Round Mountain Mining Co. at Round Mountain. Nev. As points of difference it should be noted that the Sunny Side vein has a low dip of 30 degrees, carries gold value almost exclusively, and contains but little quartz. There is however at Round Mountain a system of vertical stringers of auriferous quartz lying under the flat vein which seem to have acted as feeders to it, and these may be taken as analogous to the Wonder vein system.

Respectfully submitted,

J. A. Burgess.

DEVELOPMENT RECOMMENDED.

Tunnel level.

No work recommended.

70 ft. level.

Drift north and south on Wonder vein, and on Badger vein.

200 ft. level.

Drift ~~east~~ north and south on Wonder vein.

Crosscut west looking for downward continuation of Badger vein.

300 ft. level.

Try to follow Wonder vein into east wall of drift ~~about 30 ft.~~ about 30 feet south of main cross cut.

Drift north on Wonder vein.

Work on Badger vein depends on results of work done on the 200.

400 ft. level. Drift south on Wonder vein.

Drift north on both branches of Wonder vein as long as they continue separate.

500 ft. level.

Drift north on Wonder vein.

Cross cut east from Drift on Wonder vein at end of south drift for possible stronger branch of vein in hanging wall, and drift east on branch that looks best.