HYDRO-THERMAL ACTIVITY IN THE VEINS AT WEDEKIND, NEVADA.

By Henry C. Morris.

The first mining location was made in 1896 upon the Reno Star, by George H. Wedekind, and this property and the adjoining Desert King are, as yet, the only producing claims in the district. Although the well-traveled Spanish Springs road and the big Orr ditch parallel each other not 100 ft. from the discovery shaft, and cross the rich float scattered by the lode, so that every traveler must have kicked it aside or ground it underfoot, they failed to recognize the fact that it was rich ore; similarly the laborers upon the Orr ditch, which has been in use for 20 years or more, must have shoveled aside hundreds of dollars' worth of this rich rock without suspecting its value. That this happened in a perfectly open country, and where every man considers himself a prospector, is explained by the appearance of the ore, which hardly differs at all from the ordinary detritus of the region.

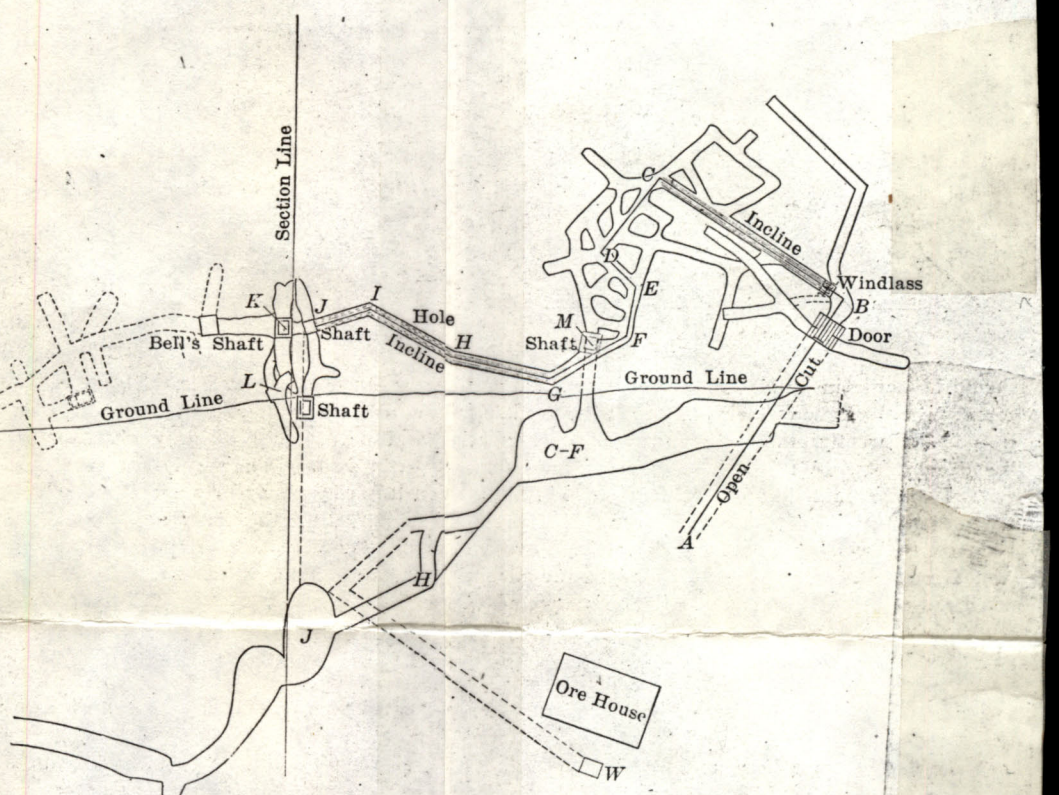
The general topography of the district is more rolling than rugged, the country having been so heavily eroded that few outcrops remain. All of these are very siliceous, and will be referred to as silicified zones, in default of an exact determination of the rock. The hill, upon the side of which the mines are located, is part of a range which skirts the northern side of the valley.

The prevailing rock of the region is a light gray, fine-grained andesite which has been so altered that it is exceedingly soft to a considerable depth. This soft material, although completely broken up by joint-cracks, stands so well that some of the shafts are sunk in it deeper than a hundred feet without any timbering. The colors of the rock vary from a pure white, when it has the appearance of infusorial earth, through the yellows and reds, to a deep purple. The comparatively unaltered gray andesite is heavily impregnated with sulphates and sulphides, and the cracks are filled with gypsum and pyrite.

The map of the mine workings shows the drifts on the general plan of the zone of impregnation, as indicated by the average dip of the ore-bodies. The elevation is simply a rough sketch on the survey line B C D E, etc.

What is called the "main vein" strikes northwest into the south face of the hill, the outcrop being altogether blind. Indeed, one can hardly say that there is any outcrop, since it only comes to the grass-roots and does not project above the surface nor show any evidence of its existence except by the float. For a distance of 60 ft. between B and shaft M on an approximate east and west line the ore comes to the grass-roots; while 150 ft. to the north (not mapped) the first evidence of ore is 60 ft. deep. The covering is the ordinary altered country rock. Crossing the "main vein" with a north and south strike is a zone of, what is locally called, conglomerate. It is one of the striking features of the mine. Both of these zones or lodes dip to the west, and are approximately paralleled, both in dip and strike, by a silicified zone, which is about 500 ft. to the east.

On entering the open cut the ore appears in small yellowish streaks on the west side. Directly ahead is an arch supported by a pillar of ore to the west and of barren material to the east. Almost in the center of this arch the ore-body extends from the surface in an abrupt curve, concave to the west. All the ground immediately to the west is ore, the iron-silver showing in blotches in many of the joint cracks. The great amount of gypsum is very noticeable; the whole mass of soft rock is heavily impregnated with it. Another peculiar feature of the upper workings is the occurrence of fairly continuous streaks of sand, some times six inches wide, distinct from the attrition material of the lode. This sand is found to a depth of 40 ft. The crevices and joint-cracks often contain a network of roots which are found 50 ft. below the surface, and, I am told, are characteristic of this region, showing at what extreme depths plants will seek for moisture. The iron stain along the levels segregates in bands, leaving the rest of the rock with a distinctly chalky appearance. Cracks a foot wide are only half-filled with breccia, and the whole ground is very open. The so-called "conglomerate" makes its first appearance in the uppermost of the large chambers C-F, shown on the profile map of the mine, and is traversed in the direction of its strike by a large sand crack. The general appearance of the ore here is that of a ferruginous-cement conglomerate, the pebbles being imperfectly rounded. From this large chamber shipments were made of ore of the same general appearance, but cemented with lead sulphides and carbonates carrying gold, with silver sulphide and chloride. Sulphides of this character now appear in thin seams, 2 or 3 ins. in thickness, which show characteristic stains of bromine.



PROFILE MAP OF DESERT KING MINE.

As depth is gained to the west, the conglomerate appears to develop a more distinct hanging wall, showing gradation, from comparatively solid wall matter through breccia to the pebble vein, within a distance of 2 ft. from wall to vein. On the same level, in a branch to the north from the incline at H, the wall fades out; the conglomerate is perfectly white, and the cement resembles the pebbles so closely that the mass looks solid at first sight. Entirely surrounded by this formation is a small pocket of little pebbles very firmly cemented with iron. On the level of chamber J the conglomerate is made up of larger pieces, often 2 or 3 ft. across, with small pebbles filling the interstices. Small nodules or irregular masses of a very dark compact quartz occur in the ore here, and the individual pebbles are coated and cemented with a thin layer of silica. This grows more noticeable as the depth increases until at the lowest levels of the Desert King, near the Bell shaft, there are continuous bands of dark quartz, which is, however, more porous than the inclusions above mentioned. Quartz bands seem to be a general accompaniment of the ore in the Desert King at this level, either underlying or blanketing the streaks of rich sands. The conglomerate is visible only at the extreme north of chamber K, and the character of the ore-body changes very rapidly, as one observes it in going by way of the steep incline, down to the bottom of the Bell shaft, which is about 85 ft. deep, as shown on the map. The shoots there are from [illegible] real [illegible]

width with occasional swells of several feet, and most of the seams are approximately horizontal. A few feet to the south, however, on this level, at L, the shoots curve over sharply and pitch abruptly to the southwest. Here a large swell occurred which yielded handsome profits. The ore is very soft and of a sandy character, with just enough clay to give it some consistency and showing heavy oxidation. The gold values in this ore are higher than in any part of the mine. Occasionally, small masses of soft bluish-gray porphyrite are encountered, which are easily recognizable as intermediate between the unaltered andesite and the decomposed material of the lode.

The Wedekind shaft W is not in ore at all, but yielded a very interesting observation in regard to the chemical agents instrumental in the general rock alteration. In sinking the shaft, hard gray or unaltered andesite was encountered at a depth of 113 ft., and continued for 100 ft. deeper. This rock, as mentioned before, is heavily impregnated [illegible]tional gypsum and metallic sulphides. Thus far [illegible]ferent. development work no great amount [illegible]ght be some been encountered. The ore-body in th[illegible]red brick. was absolutely dry, and there was very litt[illegible]night in either the Wedekind or Bell shafts. How[illegible] a when the Wedekind broke through the hard [illegible]ick into "gray mud," at a depth of 213 ft., there w[illegible]he heavy flow of water. This flow came in between [illegible]n-mud and the hard wall, causing the sump to [illegible]e-constantly with slime. The water was warm a[illegible]s heavily charged with sulphuretted hydrogen, an corroded the pumps to such an extent that many of the parts had to be replaced with bronze. The heat and offensive odor were so oppressive that many of the men working in the bottom of the shaft were overcome, and it was found so difficult to keep the ordinary plunger pump in repair that it was abandoned. A Byron-Jackson, three-series, centrifugal sinking pump, with a capacity of 150 gals. per min. to 150 ft., is now used to keep the water at the 100-ft. level. The water still gives off a strong odor of sulphuretted hydrogen when agitated.

In the Desert King the Bell shaft has been sunk 140 ft., some small but rich pockets of oxidized ore having been found. A drift run about 20 ft. to the northeast shows in areas of 2 to 3 square yards, the soft clayey, decomposed andesite, to which there occur segregations of very heavy antimony and lead sulphides, carrying good values in silver and some [illegible] mistaken b[illegible]

gold. The pockets are connected by small stringers of the same material, and the surrounding clay is so impregnated with minute sulphide crystals that ore-sorting is difficult. In such ground prospecting is blind, the extremely small seams and stringers affording the only clue to possible pockets.

After such a general description of the mines we can form some idea as to the causes which formed the ore. In this discussion of the ore occurrence it

CONGLOMERATE ON DUMP.

should be borne in mind, as a general fact, that the country rock, gangue material, and even the ore itself are of apparently the same general character; the chief difference is in the degree of alteration, and, of course, mineralization, that is to say, all of it represents an impregnation of brecciated material and country rock traversed by an intricate system of fractures. Probably the best clue to the origin of the so-called conglomerate is Becker's statement* that "A dense irregular body is acted upon (by solutions) at its salient points, and hence tends to become round, etc." This alternative action is very easily seen in many specimens in which the gradation from the soft, chalky, but still rough-cornered exterior, to the round, hard kernel of unaltered andesite is unmistakable. In such specimens, if broken across the middle, the solvent action upon the "salient points" is clearly illustrated. This action in conjunction with a primal brecciation would suffice, with the aid of very little, if any, attrition, to form

Mon[illegible]nglomerate. At all events, it is improbable
ton water exerted any physical effect beyond the
smelter [illegible]e altered portions of the rock, thus
[illegible] fresh surfaces for the disintegrating action.
Total[illegible]
[illegible]ems most probable that the Wedekind ground
[illegible]ceil subjected to the action of two solutions,
tl alterative and the other mineralizing. The
[illegible]igest reasons for supposing this is the fact that,
[illegible]e the whole district has been deeply and very
[illegible]ormly altered by hydro-thermal action, this is
only known ore deposit. Other shafts, from
[illegible]alf a mile to a mile distant, have tapped ground similar in appearance to that of the conglomerate and carrying traces of gold and silver, but there the similarity ends. A second argument for this distinction between the solutions is that practically all the conglomerate pebbles, when broken, show the identical soft, chalky-white character of the wall-rock, thus indicating that the alterative action in time and character, was the same for both. Now, if the alterative and mineralizing solutions were one and the same we should expect to find these pebbles carrying some values themselves, especially when imbedded in a cement running up into the hundreds of ounces in silver. This, however, is not the case, for the pebbles when cleaned of all cementing material show hardly a trace of metal.

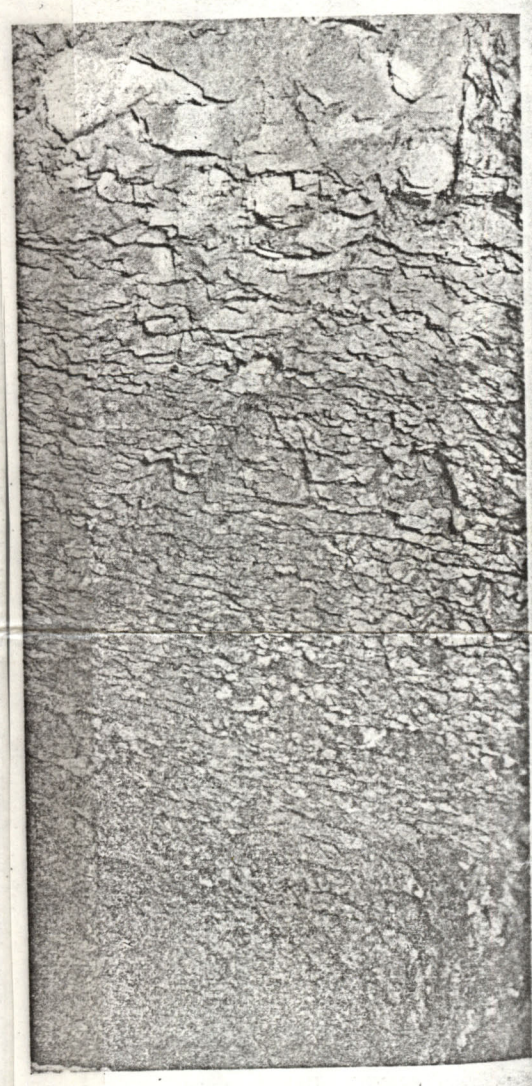
The successive events which formed the deposit [illegible]

*Monograph [illegible] of the Pacific [illegible]

must have been comparatively slow, very likely resulting at one stage in a product resembling the local occurrences of gray clay now found in the Desert King. The newly formed sulphides present in this clay result presumably from the presence of sulphur in the thermal waters and of its combination with the ferrous salts and other metals existing in the same state, when the original elements of the andesite were released by decomposition. Such a readjustment is illustrated in a neighboring tunnel at the northern base of Peavine mountain, and, I believe, was observed in the Comstock and commented upon by Becker. The next step in the process must have been a second fracturing, more general than the first and extending in a north and south direction. Whether or not this occurred before the first flow or seepage had ceased is immaterial. At all events the second disturbance was followed by a very much stronger flow, coming from sources generously supplied with both of the precious, and some of the base metals. The conditions and forces then at work were probably analogous to those now slowly subsiding at Steamboat Springs, about 11 miles south of Reno. There the solvent and disintegrating power of the hot water is largely augmented by alkaline-sulphides, chlorine, boric and sulphuric anhydrides, and similar natural reagents with which the water is heavily charged. Such conditions, in a broad, deep, detritus-choked conduit like that at Wedekind, would be amply responsible for the ore-deposition having the characteristics to be seen in this mine. We should expect the rounding off of the individual pieces of fractured material, and a simultaneous tendency to the formation of a deposit, on the surfaces so advantageously offered, when conditions became favorable either from loss of heat, or pressure, or the escape of gases. This being granted, we can easily conceive of the gradual building up of the deposit until the whole mass became cemented. The silica, as one of the most insoluble materials in solution, would be deposited first and at the greatest depths, thus causing the siliceous incrustations previously referred to as occurring in the lower levels.

In short, it seems that the facts, as found and stated, warrant the assertion that this ground has been the seat of hot spring activity similar to that [illegible] so common in Nevada to-day, and that it owes its right to distinction principally to its connection with sources unusually rich in precious metals. The analogy is not quite complete because the Wedekind has not the usual surface deposit of sinter, etc., but in considering such deficiencies we must not fail to credit the deposit with its comparative age and the erosion and weathering due to such seniority.

A few words in regard to other proofs of past and present hydro-thermal activity in the surrounding country may be of service. The significance of the silicified zones which give ruggedness to the Wedekind neighborhood is problematical. These zones, which somewhat resemble quartzite, do not have a universal trend or strike, but outcrop in every direction. Unfortunately none of the work in the district has uncovered a contact between this rock and the gray andesite. Three miles to the northwest is an iron mine which is worked intermittently, producing ore containing about 50 per cent available FeO, and from one to three dollars per ton in gold and silver. Unmistakable marks of hot water prove



INCLINE FROM B.

its origin. Several miles to the northeast, in Spanish Springs Valley, hot water is still flowing, and recent borings on a ranch 3 miles south of Reno have developed a strong flow of hot artesian water. Eight miles further south, on the same road, is Steamboat Springs, where the water still boils and roars, and emits clouds of steam. Becker's analysis shows that the materials held in solution by these waters and deposited at the vents carry arsenic, antimony, iron, lead, copper, gold and silver; 3.4 grams of the deposit containing 0.0034 gram gold and 0.0012 gram silver. The world-renowned Comstock is some 15 miles farther to the south and east, and with that as an incentive, and the Wedekind as an encouragement, it will be strange if we do not hear of further mineral discoveries in the near future.

A train moving at 60 miles an hour on a smooth level railway, only requires the engine to give out enough energy to overcome the resistance of the air and the rails.