EXTRACTS from SPECIAL REPORT by PROFESSOR BENJAMIN SADTLER

On mineral property now belonging to the Blue Bird Mining and Milling Company Near Silverton, San Juan County, Colorado
While several previous reports had been made by Mining Engineers and Metallurgists on the property now belonging to the Blue Bird Mining and Milling Company, many stockholders were desirous of securing the services of the most able and experienced mining and metallurgical engineer obtainable to thoroughly examine the property and make a conservative report, irrespective of any and all former reports.

Acting upon these instructions, the representatives finally secured the services of Prof. Benjamin Sadtler, an engineer of recognized ability, who in point of education and extended practical experience, is probably second to no engineer in the west.

Prof. Sadtler was instructed to proceed to the property and make a thorough examination in their interests; ascertain the physical condition of the property; make all analytical and other tests; to measure up ore reserves blocked out, and ascertain their gross and net values, and then tender his findings together with his recommendations.

Professor Sadtler.

Professor Sadtler is an Arts graduate of Muhlenberg College, Allentown, Pa.

Then, after a post-graduate course, under the eminent Dr. Edgar F. Smith, later Professor of Chemistry at the University of Pennsylvania, he was honored with the degree of Master of Arts and Bachelor of Science, on account of his masterful theses on two highly interesting scientific subjects.

Professor Sadtler further continued his studies with enthusiastic ardor at Frei-
berg, Germany, and the degree of Mining and Metallurgical Engineer was conferred on him by that famed center of mining education.

He then returned to America, and, covered with honors, worthily bestowed, came West; was offered and accepted the charge of a copper mine and smelter in Wyoming, going from there to the American Smelting and Refining Company at Pueblo, Colorado—first in the laboratory and afterwards in charge of the silver refining.

On account of his extended practical experience and scholarly attainments, he was proferred and accepted the chair of Metallurgy and Mineralogy at the State School of Mines, at Golden, Colorado, which position he filled with increasing benefit to that college for six years, when the persistent demands for his services as consulting engineer, and in independent mine and mill examinations, became so urgent as to draw him away from his educational work and identify him more closely with the splendid mineral-producing properties of his adopted state.

Since the resignation of his professorship in the State School of Mines, he has been employed by the St. Louis Smelting and Refining Company; for various plants of the American Smelting and Refining Company; the Colorado Fuel and Iron Company, and in many of the largest mining, milling and smelting operations in the West.

He has reported upon and superintended the construction of concentrating, reduction and cyanide plants for treating ores, on plans originated and carried to successful termination under his direct personal supervision, after his careful expert examination of the properties and of extended ore tests, later being employed as consulting engineer for several of the most successful mining properties in the state.

The following is Professor Sadtler's report:

George Oliver, Esq., Cohoes, N. Y.:

Dear Sir—As per request, I visited and examined the properties of the "Henrietta" group, now the property of the Blue Bird Mining and Milling Company, with a special view to observing the quantity and value of the ores and determining the best method of treatment and would beg to report as follows:

Location, Supplies, Etc.

The properties are situated on a small stream running into Cement Creek from the west, at a point about six (6) miles from Silverton, on the Silverton, Gladstone & Northern railroad.

Water in abundance for milling purposes exists in the stream headed in the amphitheatre, which is largely occupied by the mining claims of the Henrietta group, known as Prospect Basin, and can be readily and cheaply put into the mill by gravity. Cement Creek also flows through the mill site, and in addition to a large supply of water for milling purposes, which would probably not be needed, affords—during portions of the year—sufficient water for power purposes.

All supplies for mine and mill are as cheap as can be gotten in any mining district directly reached by railroad, as this is.
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All supplies for mine and mill are as cheap as can be gotten in any mining district directly reached by railroad, as this is.
Labor is of a good, and in this section of the San Juan—very fortunately—of a peaceable class, Silverton having been exempt from the strikes and sometimes consequent violence, which at one time so severely damaged Cripple Creek, Telluride and some other camps. It is largely a city of homes, and from its nearness to the rich farming and coal-producing district around and near Durango, can obtain supplies which are denied to less favored camps.

There is an ample amount of timber on the company's own property, which is largely below timber line, for all possible mining purposes. I have inspected some of this timber, and have observed it to be of very excellent quality, both what I saw standing and what I saw in the mine. As the mill site is right on the railroad, machinery and all materials for such mill can be unloaded direct from the cars onto the building site. The timber on the property supplies ample fuel for heating purposes, but owing to the nearness to Durango, coal is used. No coal need be used for power as power lines of the Animas River Power Company and the Telluride Power Company, both generated by large water power, run directly across the property, and power from them can be cheaply obtained at all seasons of the year.

Geology.

The Henrietta group is located on Red Mountain, which is mainly composed of andesite porphyry, which, near the surface, is generally considered brecciated. The veins in some of the other larger mines existing around this mountain, or group of mountains, do not always show well defined walls, having very frequently—according to the statements of the U. S. Geological Survey—but one defined wall, with an impregnation of a greater or less extent of this andesitic breccia, with mineral forming the large bodies of mill ore, without the treatment of which in concentration mills most of the large mines of the San Juan can not be worked at a profit. According to the same authority, as well as my own observation, the Henrietta vein, while having large bodies of both smelting and milling ore, still is a well defined fissure.

The Surprise—a diagonal vein on the same property—which intersects the Henrietta, shows, where cut by tunnel No. 7, more of this impregnation—although the continuity of the ore body justifies its being classed as a vein—and less of the defined fissure than the Henrietta.

Surface Improvements.

The property is substantially equipped at the mines with boarding and bunk houses, stables, etc., as well as tunnel houses, blacksmith shops, etc., all connected with the railroad by a good and substantial wagon road about one and one-half (1½) miles in length, well surveyed and of easy grade. Its present importance, however, is simply to haul machinery and supplies to the mines, although this function is now largely superseded by the tram. The most important improvement is a substantial wire cable tram of the Bleichert system—which is probably the best and safest known—reaching from the mouth of Tunnel No. 7, a distance of fifty-three hundred (5,300) feet, to the lower terminal on the railroad. This tram is equipped with a head house into the
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bins of which the ore is dumped directly from the tunnel. These bins have a capacity of four hundred (400) tons and discharge by gravity into the buckets of the tram, which has a capacity of five hundred (500) tons daily. They are substantially housed so as to be comfortable and amply protected against storms. All this construction is most solid and permanent. The towers of the tram are built double instead of single, making them very much stronger and more permanent. At the lower end of the tram, the terminal bins have a capacity of five hundred (500) tons and discharge by gravity directly into railroad cars on the company's switch. This terminal, which is one thousand (1,000) feet lower than the upper one, has also substantial housing. An admirable mill site exists adjoining this. The ore from the tram which was (after the construction of a mill) designed to come into the mill, could then be conveyed from this lower terminal directly into the mill by belt conveyor using the present bins and loading equipment for smelting ore; as, even after the erection of a mill, a considerable amount of ore will be found in the mine which would be too high grade to pay to put through the mill, direct shipment of this ore to the smelters being more profitable. The same switch which now serves the lower terminal would also serve to receive the concentrates from the mill.

Development.

The total development on the Henrietta group is somewhat over six thousand (6,000) feet. By far the larger proportion of this, however, is on the Henrietta vein proper, including, of course, the short cross cuts necessary to reach the vein at some levels.

This, in detail, is as follows:

Two thousand (2,000) feet on the tunnel at the head of the tram or No. 7, most of this on the vein; about four hundred (400) feet on Tunnel No. 10, three hundred (300) feet lower than Tunnel No. 7, and not yet quite into the vein; eight hundred and one (801) feet on Tunnel No. 3; five hundred and sixty (560) feet on Tunnel No. 2; three hundred (300) feet on Tunnel No. 1; and about one hundred (100) feet on levels just started at 5 and 6; five hundred and seventy-two (572) feet of a raise from Tunnel No. 7 to the level of Tunnel No. 1, with, in smaller raises and winzes, an aggregate of several hundred feet more. This, with the surface and comparatively shallow workings on the large number of other claims, comprising the group, gives the aggregate above mentioned of over six thousand (6,000) feet on the group.

Ore Reserves.

In figuring the ore reserves, I have taken the ground blocked out between No. 7 Tunnel and No. 3 Tunnel, between No. 3 Tunnel and No. 2 Tunnel, and between No. 2 Tunnel and No. 1 Tunnel, taking the proportions of these tunnels which actual measurements showed to be in ore. As the breasts of all these tunnels were in ore there is, of course, an unknown extension of the ore shoot further into the mountain. We had, in figuring the length of these tunnels, actually in one, four hundred and eighty-five (485) feet above which more or less smelting ore had actually been extracted in No. 2 Tunnel, five hundred and forty (540) feet in No. 3 Tunnel, and six hundred and twenty-five
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(625) feet in No. 7 Tunnel, being an average length of ore shoot exposed in these workings of five hundred and fifty (550) feet. The height of this block of ground from Tunnel No. 7 to Tunnel No. 1, by the surveys, is five hundred and seventy-two (572) feet. In computing the thickness of this block of ground, I was met with a difficulty which I fear has forced me to do an injustice to the property in making my computations. In Tunnel No. 1 and Tunnel No. 2, the smelting ore streak had been partly extracted, as per map herewith, but the milling ore streak, where crosscut, showed an average in excess of fifteen (15) feet. In Tunnel No. 3, some crosscuts showed ore from seventeen (17) to twenty-eight (28) feet in width in places; also milling ore, exclusive of the smelting ore, which had been partly extracted, so that we are very safe in computing to this ground fifteen (15) feet average thickness of milling ore, as all measurements exceed this. In Tunnel No. 7, on account of the property not being equipped with a mill, and the milling ore not being high enough grade to yield a profit by smelting, especially considering the refractory nature of its gangue rock, no attempt has been made to crosscut the milling ore, work being confined to the smelting ore streak, and that portion of the milling ore more immediately adjacent to it.

In sampling this ore body at various places along No. 7 level, and up in No. 6 level, I sampled both smelting ore and adjacent milling ore. The places sampled ran from three (3) to eight and one-half (8 ½) feet in thickness, averaging five and sixteen hundredths (5.16) feet. While there is no doubt in my mind that the milling ore body in this level is just as wide as in the upper levels, still, I was unable to measure it and sample it, and will, therefore, take for an average thickness of the ore body, an average between the width sampled in Tunnel No. 7 and the width of the milling ore exposed in the upper levels, although this does the property the serious injustice of making no account of a large proportion of the ore between Tunnels No. 7 and No. 3, or the largest block of ore in the property so far exposed. Taking then this average of the fifteen (15) feet above and five and sixteen hundredths (5.16) feet in Tunnel No. 7, gives us as average thickness of ten and eight hundredths (10.08) feet, which, multiplied through by the previous length and height of ore shoot between Tunnels No. 7 and No. 1, of five hundred and fifty (550) and five hundred and seventy-two (572) feet gives us in toto three million, one hundred and seventy-one thousand, one hundred and sixty-eight (3,171,168) cubic feet, or, at the rate of ten (10) cubic feet of ore per ton of ore in place, which, for an ore carrying this amount of sulphide is conservative, would give us three hundred and seventeen thousand, one hundred and sixteen (317,116) tons of ore opened up and immediately available for the concentration mill.

Simply cross cutting of the milling ore body at Tunnel No. 7, would, in a very short time largely increase this tonnage, in which I am also taking no account of the large amount of ore existing above Tunnel No. 1 to the apex of the mountain, which is known to exist and in which the smelting ore has been more or less stoped. The driving of Tunnel No. 10 a few hundred feet further to catch the vein three hundred (300) feet below Tunnel No. 7 will, of course, also enormously increase the above reserves.

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In sampling this ore body at various places along No. 7 level, and up in No. 6 level, I sampled both smelting ore and adjacent milling ore. The places sampled ran from three (3) to eight and one-half (8 1/2) feet in thickness, averaging five and sixteen hundredths (5.16) feet. While there is no doubt in my mind that the milling ore body in this level is just as wide as in the upper levels, still, I was unable to measure it and sample it, and will, therefore, take for an average thickness of the ore body, an average between the width sampled in Tunnel No. 7 and the width of the milling ore exposed in the upper levels, although this does the property the serious injustice of making no account of a large proportion of the ore between Tunnels No. 7 and No. 3, or the largest block of ore in the property so far exposed. Taking then this average of the fifteen (15) feet above and five and sixteen hundredths (5.16) feet in Tunnel No. 7, gives us as average thickness of ten and eight hundredths (10.08) feet, which, multiplied through by the previous length and height of ore shoot between Tunnels No. 7 and No. 1, of five hundred and fifty (550) and five hundred and seventy-two (572) feet gives us in toto three million, one hundred and seventy-one thousand, one hundred and sixty-eight (3,171,168) cubic feet, or, at the rate of ten (10) cubic feet of ore per ton of ore in place, which, for an ore carrying this amount of sulphide is conservative, would give us three hundred and seventeen thousand, one hundred and sixty (317,160) tons of ore opened up and immediately available for the concentration mill.

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In making this tonnage estimate, I have
taken no account of the large Surprise vein which was cross cut by the tunnel in reaching the Henrietta vein. I will deal with the value of these ores later on, but it has not been drifted on sufficiently to enable me to make any estimate of tonnage. That its probable tonnage is enormous is evidenced by the fact that where slightly diagonally cross cut, it was one hundred and ten (110) feet in thickness, and that where drifted on for a few feet, on one streak of ore, it showed a streak of good milling ore with values principally in lead, zinc and silver of eight and one-half (8 1/2) feet thick. Other streaks of similar ore showed in this vein, but were not drifted on.

The Value of Ore Reserves.

In arriving at the value of the ore reserves, I took two different data. First, the average of my samples on the sixth level where the ore body was exposed for eight and one-half (8 1/2) feet wide, and at various points along, or slightly above, Tunnel No. 7. These gave an average of one dollar and twenty-six cents ($1.26) in gold; seven and four-tenths (7.4) ounces silver; four and two-tenths (4.2) per cent copper. That my sampling is conservative is best shown by the fact that the smelter returns from the large number of car-loads, which I personally inspected, and taken from the same ore body, and only slightly sorted, ran on an average of about ten (10) ounces in silver; eighty cents (80c) in gold and between eight (8) and nine (9) per cent in copper.

In taking the average value of the ore in No. 3 level and No. 2, as I was unable to get to the breast of No. 3 on account of a slight cave—which could, however, be picked up in a few days—I took an average trial shipment of eight hundred and eighty-seven (887) tons of the milling ore, which had been made at the smelter for the purpose of finding out what the average was, as being far more reliable than any possible hand sampling could be. This averaged fifty cents (50c) in gold; four (4) ounces in silver and three and three-tenths (3.3) per cent in copper. Averaging this with the ore from No. 7 level, gives us an average of eighty-eight cents (88c) in gold; five and seven-tenths (5.7) ounces in silver and three and seventy-five hundredths (3.75) per cent copper, which I used as a basis of our gross valuation. Cross cutting No. 7 would probably give us more ore of the class of this No. 3 lot, but would, at the same time, double the ore reserves in tonnage. In computing the net value of this ore I have taken the gold at eighty-eight cents (88c); silver at seventy cents (70c) an ounce; would equal three dollars and ninety-nine ($3.99). In estimating the copper, which is purchased by the smelters on fire assay, I have taken the value of a concentrate, which would be produced by concentrating three tons into one, which would mean eleven and twenty-five hundredths (11.25) per cent copper. Deducting from this one and one-half (1 1/2) per cent to allow for the trade rule of so-called fire assay values, which might be more truthfully, if not genteely styled, "a smelter steal," leaves us nine and three-fourths (9 3/4) per cent copper, or calculated back to the three (3) tons of ore, three and one-fourth (3 1/4) per cent copper per ton of ore, for which the smelter pays the mill. This would mean, at the present selling price of copper, of three dollars and twenty-five cents ($3.25) for each per cent present in the ore or concentrate, ten dollars and fifty-six cents ($10.56) worth of copper, which, added to the silver and gold values above,
taken no account of the large Surprise vein which was cross cut by the tunnel in reaching the Henrietta vein. I will deal with the value of these ores later on, but it has not been drifted on sufficiently to enable me to make any estimate of tonnage. That its probable tonnage is enormous is evidenced by the fact that where slightly diagonally cross cut, it was one hundred and ten (110) feet in thickness, and that where drifted on for a few feet, on one streak of ore, it showed a streak of good milling ore with values principally in lead, zinc and silver of eight and one-half (8½) feet thick. Other streaks of similar ore showed in this vein, but were not drifted on.

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would give us a gross valuation of fifteen dollars and forty-three cents ($15.43). Deducting from this, the cost would be about as follows: Mining the ore and tramming to the mill, seventy-five cents (75c) per ton; milling the ore and loading the concentrates on cars, seventy-five cents (75c) per ton; proportion of railroad freight and smelting charge, charged to each ton of ore, two dollars ($2.00); total expense per ton of ore, three dollars and fifty cents ($3.50). Deducting this from the fifteen dollars and forty-three cents ($15.43) leaves us eleven dollars and ninety-three cents ($11.93) per ton profit. The figure of two dollars ($2.00) is obtained by taking the railroad freight of one dollar ($1.00) and a smelting charge of five dollars ($5.00) or six dollars ($6.00) total, and dividing it by three (3) so as to charge it to the three (3) tons of ore needed to produce the one (1) ton of concentrates.

In making these concentrates, responsible milling men who have tested the ore, have assured me that they can guarantee a saving of from seventy-five (75) to eighty-five (85) per cent. Taking the lower of these figures, which I am very sure could be equalled or exceeded in practice, would give seventy-five (75) per cent of eleven dollars and ninety-three cents ($11.93), or eight dollars and ninety-five cents ($8.95) per ton, NET PROFIT in handling this ore, which will amount to, on the three hundred and seventeen thousand, one hundred and sixteen ($17,116) tons of ore in sight, TWO MILLION, EIGHT HUNDRED AND THIRTY-EIGHT THOUSAND, ONE HUNDRED AND EIGHTY-EIGHT DOLLARS AND TWENTY CENTS ($2,838,188.20), a small fraction of which would amply justify the erection of several mills such as proposed.

As stated above, I can make no estimate of the amount of ore reserves in the Surprise vein, but as my sample of eight and one-half (8 1/2) feet of ore, which was taken from a point two hundred and fifty (250) feet below the surface, ran forty cents (40c) in gold, eight (8) ounces in silver, fourteen and eight-tenths (14.8) per cent lead, and twelve and three-fourths (12 3/4) per cent zinc, we have here an admirable concentration product in this vein, as both the zinc concentrate and the lead concentrate, carrying a silver and gold value, are very much sought for and readily salable at good figures.

From my inspection of this ore, I do not hesitate to state that it would make a very high class product in both lead and zinc. A very limited amount of development would enable one to make estimates on this vein.

Advice as to Development.

As a matter of course, all important levels should be driven ahead to increase the already large ore reserves, and keep increasing them even after the erection of the mill. The milling ore body should be cross cut at the No. 7 level, to render it available for stoping and to determine its amount and quality. No. 10 level should be pushed to catch both the Henrietta and Surprise veins, and especially to catch the intersection of these large veins, at which point, according to all mining precedent, an enlargement and enrichment of the ore body can reasonably be expected. A level should be driven from No. 7 Tunnel on the Surprise vein to catch its intersection with the Henrietta and develop a portion of both of these veins not previously caught by this tunnel.
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As the AIR CONNECTIONS ARE ALREADY GOOD, and as the timbering is most substantial and excellently done, it is unnecessary for me to recommend anything beyond the usual mining rules in respect to these points. As ELECTRIC POWER is immediately available, additional drills should be installed as soon as possible to supplant the more costly hand work which is at present being used.

Ore Treatment.

This has proven to be the costly mistake in regard to the property. Mining engineers are very frequently not metallurgists and another smelter eccentricity in settlement for ores no doubt went very far in misleading the company. I can say from my own many years experience in smelting ores, that while smelters charge for all residue insoluble in acids, as silica, in figuring their treatment charges, they do not so figure it when they go to calculate the charge to put in the furnaces. The result of this has been that the insoluble constituents of an ore are generally classed as silica, and the chemist then employed by the company to make special analysis wrongly so reported them. The ore in this case contained a very large proportion of alumina combined in a form practically equivalent to fire clay, which it is needless to remark was too infusible to be smelted to a profit, when at all. The large smelting works get rid of it by mixing such ores with large amounts of other ores. In a smelter running on one ore, as was the case on this property, such a course was impossible, as was unfortunately proven by costly experience. This, of course, is now a thing of the past, but fortunately the remedy is both easy and well proven. The minerals containing alu-

minia, which made trouble in the smelter, are, fortunately, of very light specific gravity as compared with the sulphide ores, with which they are associated, their specific gravity being only two and seven-tenths (2.7) as compared with from four (4) to five (5) specific gravity of the sulphides. This makes simple, ordinary water concentration, such as is being pursued by all the large paying mines in the San Juan, and by multitudes of mines all over the country with similar conditions, easy and sure, thereby getting rid of the aluminous minerals, and giving about one-third ($\frac{1}{3}$) of the tonnage of the ore in the shape of a concentrate carrying the values. While it is sure that this can readily be done, to make assurance doubly sure, concentration tests have been actually made on considerable quantities of the ore with entirely favorable results, as per the samples herewith. While I have estimated that this concentration would only save seventy-five (75) per cent in computing my values, I am very confident that this can be exceeded. The machinery to be used in such a concentrator outside of the power, which here would be electric, would be—in my judgment—preferably; first, jigs, for the coarser sizes and then some of the standard makes of concentrating tables and slimes for the finer sizes, which, with proper classification of the ore and the re-crushing and treatment of the middling product from the first concentration, would give us a most thorough and efficient saving.

This property justifies the erection now of a mill of at least three hundred (300) tons daily capacity, as the ore reserves now available are sufficient for a three year supply for such a mill, and would repay its cost many times. This is without
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taking account of the very large increase in such reserves, which would be obtained by pursuing the development outlined and recommended above.

**Summary.**

The ore reserves on the Henrietta group are ample to continuously operate not only such a mill as described above, but, if development continued, a much larger one.

Transportation, supplies, etc., are entirely satisfactory.

A mill should be built during the summer months, when the property can be readily operated during the entire year. Machinery should be ordered at the earliest possible moment, as it is hard to get quick delivery on mining machinery at the present time.

With the property equipped and operated as above outlined, it cannot fail to be a large and continuous dividend payer.

Respectfully submitted,

(Signed) B. SADTLER.
Report by Professor Benjamin Sadler on property located six miles from Silverton, San Juan County, Colorado, on the east side of Red Mountain and now belonging to the

Blue Bird Mining and Milling Company

Main Office
707 COLORADO BUILDING
DENVER, COLO.