Denver, Colorado,
October 30, 1917.

Bluster Consolidated,
Mines Company,
Jarbidge, Nevada.

Gentlemen:

In compliance with instructions conveyed to me on behalf of your company by Mr. T. B. Beadle, I have completed an examination of your property at Jarbidge, and present for your consideration the following report:

Area involved and title thereto, being fully known to you, are not touched upon, attention being confined to geological and structural evidences afforded, the present physical condition of the property and promise of commercial importance for mining purposes. In this work I was ably assisted by Mr. F. W. Crosley, at present engineer for the noted Cresson mine at Cripple Creek, Colo., whose qualifications as an engineer and personal integrity are too well and widely known to require further reference at my hands. Mr. Crosley concerned himself particularly with measurements of ore-bodies, their metal value per ton, and estimates of ore-tonnage positive, reasonably assured and probable.

Location: The "Bluster Mine," the property of your company, is situated in the Jarbidge mining district, Elko county, Nevada. The Idaho state line lies five or six miles to the north. The nearest railroads are the Central Pacific, about seventy-five miles to the south by wagon road, and the Oregon Short Line, some sixty-five miles, more or less, to the north. At present Elko, Nev., distant about 108 miles in a southerly direction, and Twin Falls, Idaho, at a somewhat less distance to the north, are the nearest general supply points. From both directions supplies are brought in in freight wagons, the outlet to the south being wholly or partially closed during the winter months by snow. That from the north is open throughout the year. A new road is now building to connect with the Oregon Short Line, which, when completed, will materially shorten the wagon haul and greatly facilitate the delivery of supplies to the camp. Passenger travel is by auto-stage, the service in this respect being fairly satisfactory.

Topography: Jarbidge lies on the stream of that name, which flows at the foot of the westerly slope of what is called the "Crater Range" of mountains, a rugged succession of peaks trending in a northwest by southeast course. This range has an elevation of somewhere around ten to twelve thousand feet at the highest points, and breaks off sharply or precipitously from the crest to the east, but with gentler, though, in places, steep slope, to the west. The range is dissected transversely by several small living streams, flowing in deep, V-shaped canyons or gulches. It is thus separated into four distinct units, or mountains, the highest be-Bonanza Peak, whereon is situated the property belonging to your company. The upper reaches of the range support a good growth of pine and fir, or spruce timber, easily available for mining purposes. The lower portions are generally bare or sparsely covered with mountain mahogany, aspen, and kindred growths, some of which is suitable for fuel.

The Bluster Mine lies well up on the west slope of Bonanza mountain, at an elevation of about 8,600 feet above sea level. The Jarbidge river or creek, flows below at about 6,800 feet elevation. It is fringed with aspen and willow trees very generally.

The summer months are cool and pleasant, the winters not excessively cold, though the locality is frequented by heavy snowfalls and experiences freezing weather. The climatic conditions are not unfavorable to carrying on mining operations throughout the year.

The westerly facing slopes of the Crater Range are comparatively smooth and rounded, broken only here and there by the often bold and conspicuous outcrops of mineral veins, and occasional porphyry dykes. In this respect there is a marked contrast between the east and west sides of the range, that on the east being, as previously noted, abrupt and precipitous.

Good trails and a few wagon roads traverse the west slopes, connecting the various mining properties with the the town.

Geology: The formation is chiefly volcanic, the Crater Range being composed almost wholly, though not entirely, of a coarse to medium granular Rhyolite, assigned by the engineers of the U. S. Geological Survey to probably late Tertiary age. This Rhyolite attains in places a total vertical thickness of 5,000 feet, more or less, and covers a very large area. It is the oldest and most important extrusive lava-flow in the locality, from the mining standpoint, and in it are found the veins of gold and silver ores. It has suffered some further intrusion in the form of acidic porphyry dykes, which undoubtedly are merely later manifestations of the local volcanism, and may have had some direct bearing on the genesis of the ores of the district.

The Rhyolite of Bonanza Mountain has overflowed and completely buried a small mountain range of rocks geologically much older, the axis of which trends nearly with the present Crater Range. Subaerial erosion has exposed this buried range crossing Bonanza Gulch, which forms the north boundary of Bonanza Mountain, separating it from Buckeye Mountain, next to the north. (The writer has appended a sketch showing the relation in cross-section of this buried range to the present mountain mass.) What bearing this older, buried formation has on such of the veins as will be found to pass into it from the Old Ryholite, has not as yet been proved, but there is reason to believe that it may be effective in determining the downward limit of the ore-bodies, which, it is probable, are largely confined to the overlying Rhyolite.

After the extrusion and complete or partial consolidation of the Old Rhyolite, faulting occurred principally along lines parallel to the present axis of the mountain. These displacements on the west side of the range are roughly parallel and occur separated at intervals of from less than 100 to several hundred feet between. The planes of movement dip to the east, and the down-throw is in that direction, the faults being normal in type. They form a series of so-called "stepped faults," and subsequent circulation of hydrothermal waters arising along these fault fissures from the still highly heated depths converted some of them into gold and silver-bearing veins. This is entirely characteristic of the gold and silver veins in the various productive localities throughout the entire Cordilleran Mountain System, both in respect to the nature of the rocks involved and the manner of the ore occurrence. Some allowance must, however, be made for local minor variations between one locality and the others.

On the east side of the range, these same fault movements occur, but with dip to the west and down-throw in the same direction. That is to say, the veins found on both sides of the range are of the same general character, owe their origin to the same genetic causes, but dip toward each other under the apex of the range. From this it is legitimate to infer what is most likely the case, that the eruptive center of the locality lies under the Crater Range of which Bonanza Mountain is the highest, and that the veins of both the east and west sides unite along some common central fissure at depth.

The significance of the above, in its relation to the Bluster Vein, is that it, being an important member of the vein system, is likely to go very deep, and is connected with the principal seat of volcanic activity of the region. This further implies a maximum intensity of mineralizing circulation and accompanying ore deposition. This will be again referred to in discussing the Bluster Vein.

On the whole, the rocks of the Jarbidge locality in general, and of the Crater Range in particular, are those in which it is usual to find productive gold and silver mines wherever mining is carried on; the veins appear to be deep-seated, and, in some of them at least, opportunity has been afforded for a long-continued, unusually active circulation of underground waters, greatly favoring extensive deposits of gold and silver ores.

Bluster Vein: The Bluster Vein outcrops between eight and nine thousand feet above sea-level on the westerly side of Bonanza Mountain. It strikes north, 22 to 28 degrees west, although the outcrop, owing to difference in elevation from point to point, appears to be somewhat sinuous. The dip, as nearly as now known, is about 58 degrees to the east, with a tendency to straighten up somewhat in the lower levels, being as much as 70 degrees in places. The figure 58, however, is believed to more nearly represent a true average. It shows two well-defined walls, separated by generally barren, seamed and sheeted Rhyolite, or by Rhyolite more or less brecciated, crushed and softened with occasional patches or stringers of ore. In the vicinity of and south of the Bluster Shaft, these walls are from twenty to twenty-five feet apart, but farther north this distance becomes narrowed down to three feet or less. The walls referred to are clear cut, show movement along nearly vertical lines, and are accompanied generally by a well-defined sheet of soft, kaolinized gouge or selvage. There are, however, many smooth slip-faces both between these and also lying outside of them parallel to and in every way similar, so that it is not always easy to determine with exactness which one truly defines the limit of the vein. This is undoubtedly due to the structure produced at the time of the faulting which made the vein. This movement was in the nature of a shearing of the Rhyolite along several parallel planes more or less closely spaced, the total displacement being in this way distributed over a considerable width of the Rhyolite. This has given the jointed or sheeted structure so characteristic of the veins of this locality. From the main line of displacement fissures and stringers, many of them of importance in size, branch out into the country rock on both sides. These have been frequently mistaken by the miners for changes in the direction of the main vein. Some fissuring and faulting has occurred in places striking across the main vein. At the points of intersection of such cross faults or fissures, as well as in the sharp tongues of Rhyolite enclosed between the main vein and its numerous branching spurs just described, the rock has been much shattered, crushed and brecciated. These crushed and brecciated localities have been generally well mineralized and form the present ore-shoots. Indeed, it is quickly apparent to a competent observer that the ore is confined mostly, if not entirely, to such crushed and brecciated portions of the vein, and that little or no ore appears in the less disturbed segments.

The development to date has disclosed the ore almost exclusively in the foot-wall side of the vein as replacements, metasomatically, of the Rhyolite, its component Feldspars being chiefly affected. A little ore makes now and then in and along the hanging wall, but such occurrences have been thus far small and of little commercial value.

The Bluster Vein makes a little water in the workings, but this is entirely seepage from the surface. It was also noticed that wherever ore occurs, the ground is quite wet and the gangue rather soft and more or less completely decomposed. This can be made a valuable index in the further development of the vein, the presence of a high degree of saturation of the rocks with water; their altered and decomposed character indicating the approach to an ore-shoot with what amounts almost to a certainty.

The level of the permanent ground-water is thought to lie somewhere around five to seven hundred feet in depth below the outcrop.

Alteration of the original or primary minerals contained within the Bluster Vein, together with evidences indicating the leaching out of some of these minerals by infiltrating surface waters clearly appears. Among these iron and silver seem to have been especially affected. Concentrations of Limonite and Hemitite at and close to the surface are succeeded by a zone below, which is comparatively free from these minerals. Then below this zone iron oxides again come in more uniformly distributed and in a more concentrated form in the ore-bodies

Silver appears also, as stated above, to have suffered some leaching from the higher portions of the vein, with the very probable relative concentration of this metal below in the vicinity of the permanent water level. With the possible exception of the gold, the primary mineralization was in the form of the sulphides of iron and silver. This is proved by the presence in the ore now and then of pseudomorphs of Limonite after Pyrite, and of Argentite, or Silver sulphite. That leaching has been effective in transfering a part, at least, of the silver from the higher to the deeper vein levels is made clear, as follows:

The harder, denser, less permeable portions of the ore-bodies carry a proportionately greater amount of silver than the soft, decomposed and water-soaked portions. Residual small bunches of extremely rich silver ores, the remains of former enrichments when the level of the permanent ground-water was higher than at present, have been encountered. These were so situated as to largely escape the influence of descending, oxygenated surface waters. In short, the leaching action of percolating surface waters within the vein has been irregular, resulting in some parts being thoroughly leached, and others escaping this action wholly or in part. The silver quite commonly appears in the form of the black, sooty sulphide, in patches and cloudy threads along minute fractures in the quartz of the Gangue. This is the form characteristic of Argentite deposited from leaching waters. Its presence may be taken as conclusive evidence that this process has been active.

The foregoing considerations warrant the belief that at or near the level of the standing ground-water, the character of the ore may be expected to change from an oxidized to a sulphide condition. The writer further firmly believes that the sulphides at this zone of change will be found to contain enrichments of Argentite, and that such enriched portions of the vein will prove to be, economically, much the more important both in value and extent. The gold, since it is little, if at all, affected by leaching agencies, will probably maintain its present average per ton value in this lower, enriched portion of the vein. The enrichment will be confined to the silver. As the level of the permanent standing ground-water has not yet been reached, this enrichment zone has not been encountered and awaits the further development of the property.

The Gangue consists mainly of the kaolinized and altered Rhyolite, together with much quartz, some Pyrolusite—(the Di-oxide-of Manganese)—secondary Feldspar of the variety known as Adularia, some Chlorite and the hydrous and anhydrous oxides of iron.

The quartz frequently occurs as pseudomorphic replacements of Calcite, indicating here as quite commonly in other important mining localities in Tertiary Volcanics, that the original filling of the fissures was Calcite, and that this was followed by the period of ore-deposition. A marked analogy is afforded in the case of the now famous United Eastern and other large producers in the Oatman District, Arizona, where a similar history and Petrology is recorded. Little or no Calcite now remains in the veins of Bonanza Mountain so far as the writer has observed.

Silicification of the vein filling and the Rhyolite adjacent is extensive and thorough, and testifies to the intensity of the action of the hydrothermal waters to which the genesis of the ores is directly traceable.

All this is extremely favorable to the commercial importance of the Bluster Vein, proving it to belong to a type which has proved productive of many important producers.

It has been previously stated that the Rhyolite of Bonanza Mountain covers an older, buried mountain range composed of a very different and geologically much older class of rocks. These consist of an intruded series of Paleozoic sediments mainly composed of quartzite, shales and conglomerates. It was further stated that, where the veins of Bonanza Mountain pass into this older formation in depth, they may become non-commercial or relatively barren. This does not necessarily follow, but must be anticipated. However, by referring to the Cross-Section attached, it will be noticed that the Bluster Vein appears to lie well to the east of the apex of the buried range whose eastern flank dips rapidly back under the overlying Rhyolite; that the dip of the Bluster Vein is also in the same direction and it is the writer's belief that this older formation will not be encountered in the Bluster Vein under fifteen hundred feet below its outcrop measured on the dip, and possibly much more than this. This gives the assurance that the ores already proved to exist in the Rhyolite may be reasonably expected to persist to sufficient depth, in any event, to afford a large and permanent producer. The question of depth, therefore, may be regarded as established in favor of the property.

There are within the property lines of your company about two thousand feet longitudinally, of the Bluster Vein, together with several off-shoots which may be of economic importance. The vein has been opened and proved to a depth of approximately four hundred and thirty feet on the dip, three hundred and fifty of which lie within the property lines. and the remaining distance in the lower workings of the "Success" property, which owns the northerly extension of the Bluster Vein, and immediately adjoins the latter property. All this distance is in Rhyolite and ore occurs throughout this range.

The Bluster Vein is one of, if not the most important vein lying on the westerly slope of Bonanza Mountain. It is exceptionally well mineralized and contains large and important ore-shoots. It extends to great depth, and is closely connected with the eruptive center of the locality, and so has undoubtedly received its full share of the rising, metal-charged, heated waters sent up from below, with a corresponding development of important ore-shoots along the channel of flowage. Development has shown it to contain such ore-shoots in some of which it is possible to compute a very substantial blocked tonnage available for milling. Ore occurs in other places under such conditions as to warrant a reasonably assured tonnage, while many ore faces exist which point unmistakably to the probable existence of large and important bodies. The possibilities extend far beyond this, and are limited only to the depth to which the ore extends in the vein which can be made commercial and to the length of the vein within the property lines. (A sketch in Cross-Section of the vein showing its structure, form of the ore-bodies, and their position within the vein is appended, and may be referred to in this connection.)

Ore-Shoots: The Ore-shoots so far developed appear to stand nearly straight in the vein, with little, if any, rake. The ore thus far mined carries its values about equally in gold and silver. The gold occurs in two forms—one as a bright yellow, almost pure dissemination through the quartz, the other in the combined form alloyed with silver and much paler in color. From this it is inferred that there were two distinct periods of mineralization, the latter being comparatively free from silver.

The width of the Ore-shoots varies from a narrow, tabular sheet along the wall less than a foot across, to masses measuring fourteen feet through, or more. An average of three and one-half to five feet may be taken as a reasonable estimate. The wider portions are lens-like bodies, one of which measures two hundred feet in length along the vein, with depth still undetermined, but known to extend at least three hundred feet below its apex. The average width of this shoot throughout is around seven and one-half feet.

The ore is relatively soft and breaks easily and cheaply, the holes for shooting often being bored with an augur. As the vein stands at about 60 degrees' dip, the conditions in this respect are favorable for low-cost mining.

It has been necessary to do some timbering, though up to the present time the amount of timber used is not large. Greater depth will entail increased expense in this direction. Timbering this mine is not, however, a serious matter as regards expense. Good material for the purpose can be had on the slope above the mine, which can be cut and skidded down at a minimum cost.

The company also owns and operates a good sawmill near by, and owns timber concessions from the government of great value. In addition to supplying, cheaply, lumber for use at the mine and mill, it should derive a substantial profit on its investment through the sale of lumber to other going mines in the district. It is possible that this will overbalance the expense of timbering its own workings.

Collateral: The "Success Mining Company" is operating the northerly extension of the Bluster Vein, the two properties adjoining. In this ground the vein has been opened by tunnels much in the same way as in the Bluster ground and engineers estimate a total of twenty thousand tons of ore available for milling which will average around $14.90 per ton as it stands. Here, as in the case of the Bluster, development has only begun and the showing thus far made is most promising, and adds greatly to the evidence proving the commercial importance of this vein.

Below the Bluster Vein some six hundred feet, or more, measured on the slope of the mountain, is what is known as the Pick and Shovel Vein. This vein closely parallels the Bluster Vein, has been partially developed and is understood to be in good ore of the same character as that in the latter. Milling facilities alone are lacking to make it productive. Another similar vein lying higher up, near the crest of the mountain, is being developed by a syndicate from Tacoma, Wash., and is considered very promising.

Much the most extensive and, to date, the most important undertaking in this district, is that of the "Elkoro Mining Co." This company is developing a group of claims containing the "Long Hike" and other properties a mile or so to the north of the Bluster. The veins are in the same Rhyolite as that which forms the main mass of Bonanza Mountain, and work has advanced to the point of building a new cyanide mill, reported capable of treating two hundred and fifty tons of ore daily. The Elkoro Company is spending a large amount of money monthly in the work of mine development and mill construction is in the hands of very large and highly successful mining men operating through a corps of experienced engineers, and evidently preparing for a large and extended production. The formation and character of the ore-occurrence in this property is identical with that in the Bluster ground; the source of the ore deposits is the same and the success of the one may be accepted as a measure of that to be expected in the other. Being well in advance of the rest of the district in both development and milling of these ores, the work of this company should prove of great value in planning for the operation of the other properties working in the same formation and having the same or similar ores.

Development and Improvements: From the maps accompanying this report, the present development of the Bluster Vein may be seen at a glance, and will not be taken up in detail here. Attached hereto will be found estimates covering ore, positive, reasonably assured and probable, together with net profit to be reasonably expected. Further development may be relied upon to greatly increase this showing. Indeed, it is in this direction that the great prospective value of your property lies, rather than in the development already accomplished, which is itself important, and constitutes a most favorable showing.

The property is equipped with a well-constructed mill of ten stamps, having a crushing capacity on this ore of seventy to eighty tons per day through ten or twenty-mesh screen. It is planned to follow this with a mill of the fine-grinding type, to reduce the ore for treatment in the cyanide section which is to be of the Dorr Continuous Counter Current System. This mill is located below the mine, close to the Jarbidge Creek, and is connected with the mine by a serviceable aerial tramway, some 3,400 feet in length, with capacity to handle one hundred and fifty tons per day. The company owns a water right in Bonanza Gulch, from which a wooden pipeline, four inches interior diameter, delivers an adequate supply for any reasonable requirements of the mill in the future. It is so delivered as to yield sufficient pressure-head for fire emergencies, and flows throughout the year.

Bunk houses, cook house and blacksmith shop are provided at the mine, with cars and tools sufficient for present needs, but not for extended development.

As access to the vein has been through tunnels up to the present time, no hoisting machinery, headframes or pumping machinery have been required, nor is the property equipped with an air compressor or machine drills.

Taken as a whole the present mine equipment, as far as it goes, is in good condition, and entirely suited to the purposes for which it has been used. Further operations, if at all adequate to the mine's needs, will require additional equipment both in machinery and tools, as well as housings for them.

The sole and only economic feature of an unfavorable nature affecting the carrying on of mining operations in the Jarbidge District is that of transportation. The present cost of bringing in supplies is high, amounting to around forty dollars per ton, or two cents per pound of freight. Owing to the character of the ores so far developed which permits of their being milled on the ground, this transportation item is not excessive except in the single matter of power. Heretofore, and at the present time, power in a small way has been derived through the use of internal combustion engines, using distillate, which must be shipped in. The cost of power, therefore, has been, and is at present, probably too high to be borne by the average grade of the ore produced. It is, in this connection, most gratifying and fortunate for the local mining companies that the Idaho Power Company is extending its transmission lines into the district, and proposes to furnish an abundance of hydro-electric power at the very moderate cost of one and one-half cents per kilowat hour. This will bring the cost of power down to a figure which compares favorably with that in the most favored camps in this particular, and is an item of saving over present methods of obtaining power of the greatest importance. It at once places the average grade of the ores which can be produced definitely in the commercial class, and assures a substantial working margin. With this question of cheap power settled, the camp at once takes its place among the low-cost producers, comparing favorably with any in the west. All other cost items closely approximate the level of other going camps generally.

Recommendations: It is not within the scope of this report to outline the future development of the property, or to work out plans for the best methods of treating its ores. These questions can be safely left in the hands of your present manager. It is desired, however, to offer the suggestion that the Bluster Vein be opened as soon as possible down to water level, and to there determine the character of the ores which are almost certain to be encountered. This can probably best be done by sinking on the vein, leaving the matter of tunnel entry to be later determined and planned, according to the conditions determined in sinking the shaft. Ultimately, to comply with the law and to facilitate the draining of the mine, a tunnel will have to be driven at some suitable point lower down the mountain. This will not only then drain the workings above, but will afford two outlets from the workings and establish a satisfactory ventilation. In this way the mine can be made to justify and probably meet the additional expenditures made necessary in thorough development of the property.

A satisfactory plan for the treatment of the ores appears to have been worked out, and will not be discussed in this report. Much valuable aid may probably be derived from observing the experience of the Elkoro Company in the treatment of its ores, soon to be put in operation.

The following estimates covering tonnage and values have been worked out by Mr. Crosley in conjunction with the writer. The figures have been carefully computed on data believed to be entirely reliable, and are submitted for your consideration:

In connection with what follows you are referred to map accompanying this report, in which the several blocks are set off and lettered to conform with those given in the estimates.

Positive Ore.

Block.	Tons.	Value per Ton.	Total Gross.
A	9,200	$24.00	$220,800.00
B	6,771	25.10	169,952.00
C	2,952	13.84	48,855.00
A, B, C	18,923	Average $23.25 per ton	$439,607.00

Ore Reasonably Assured.

Block.	Tons.	Value per Ton.	Total Gross.
D	3,432	$30.34	$104,126.00
E	2,421	12.00	29,052.00
F	1,514	9.08	13,747.00
	6,277	(Not positive)	23.25	145,940.00

Probable Ore.

Block.	Tons.	(Values not estimated)
G	1,400	
H	3,424	
I	2,800	
J	2,240	
K	6,600	
L	1,640	
	18,104	

In Tailings Dump at Mill.
(Positive Ore.)

Tons.	Value per ton.	Gross
8,993	$6.00	Silver at 50c. $53,958.00
8,993	$9.00	Silver at $1.00 $80,937.00

It has been found that the silver values form about one-third of the total value per ton in the ore, and as the silver was almost entirely lost in milling under the plating system, the tailings average unusually and unnecessarily high. They form a part of the positive ore reserves immediately available under the new method of treatment which has been planned. The following costs are tentatively submitted, based upon the best available data at hand. They are believed to be fairly close, however.

	Per Ton.
Mining and delivery to mill	$3.00
Development	1.00
Milling and refining	2.00
Taxes and insurance	.25
Amortization of plant	.50
Incidental and unforeseen	.50
Office and administration	.25
Total cost per ton of ore milled	$7.50

Positive Ore—	
18,923 tons at $15.75 net per ton	$298,037.00
Less 10 per cent loss in milling	29,803.00
Total net	$268,234.00
Tailings Dumps (Positive)—	
8,993 tons at $4.00 net per ton recovery	$ 35,972.00
Total positive ore and dumps, net	$304,206.00
Reasonably Assured Ore—	
13,644 tons at $13.90 net, per ton	$189,651.00
Less 10 per cent loss in milling	18,965.00
Total net	$170,686.00

(N. B.: The average value for the 13,644 tons of Reasonably Assured Ore is $21.40 per ton. Deducting $7.50, cost of mining and milling, leaves $13.90 per ton net.)

No calculations on the Probable Ore are, of course, justifiable at this time, but every consideration makes it seem reasonable to expect results more or less closely corresponding to those shown above.

As stated before, the Possible Ore is limited only by the length of the Bluster Vein within the company's ground, and the depth at which commercial mining is practicable. In any event, this may be taken to be sufficient to sustain mining operations for many years to come.

The showing which has been made, considering the small amount of development that obtains on the Bluster Vein, is, as indicated in the figures given above, highly commendable, somewhat unusual and most encouraging for the future of the property.

Conclusion: The judgment of the writer may be briefly stated as follows: You have a strong, clearly defined vein, in a proved mineral district, and traversing the most favorable rock formation. You have a substantial profit in sight in the ore already opened and available for mining. Only a small part of the vein has been explored, and what remains gives assurance of becoming, when fully developed, a large and permanent producer, comparing favorably with any in the district.

EDWARD W. BROOKS,
Mining Geologist and Engineer.

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