REPORT

on the

LITTLE ANNIE GROUP OF MINES,

Property of

THE CONSOL GOLD MINING COMPANY,

Summit Mining District,

Rio Grande County,

Colorado.

The ground in which the development of these ore bodies is confined at present, and on which the mill, shaft, and tunnel houses, and other company property is situated, consists of the following patented property:-

THE LITTLE ANNIE LODE CLAIM,	-----	U.S.L.	63.
" Del Norte " "	-----	" " "	64.
" Golden Queen " "	-----	" " "	61.
" Highland Mary " "	-----	" " "	606.
" Chas. Brastow " "	-----	" " "	715.
" Little Ida " "	-----	" " "	67.
" Margaretta " "	-----	" " "	65.
" Oding " "	-----	" " "	475.
" Peterson Placer Claim	-----	U.S.L.	74
" Brandt " "	-----	" " "	75
" San Juan " "	-----	" " "	68.

All of which are located in Summit Mining District, Rio Grande County, Colorado.

This property is located 28 miles South West from Del Norte, the nearest railroad station, and is reached by a fairly good wagon road, with daily mail and passenger service.

The district is located on the Continental Divide at the

heads of the Alamosa, East Fork of San Juan, and the South Fork of the Rio Grande rivers, with an elevation of from 10000 to 14000 feet.

The elevation of the mines is 11050 feet above sea level and 3200 feet above the railroad station at Del Norte.

This camp was, like many others, first the seat of placer mining which afforded only fair wages, and an occasional nugget.

In the summer of 1871, a number of prospectors went into the camp looking for placer ground. Among these men were Major J.C.French, James Phillips, Thomas Bowen, Theodore Goupil, B.F.Lovett, P.J.Peterson and Charles Johnson.

French, Phillips and Bowen staked some lode claims but did not complete their locations. The others worked in the gulch, taking out some placer gold.

Sometime in September, 1872, the first lode claim was located by Theodore Goupil , and known as the Summit Lode, being now known as the Aztec, owned by Schieffer Brothers.

In September of the next year, P.J.Peterson and F.H. Brandt discovered the Little Annie which they located together with the Del Norte, Margaretta and other claims. Some rich

specimens were taken from the surface of the Annie, the reports of which brought a rush to camp, during which most of the present patented properties were located.

The early methods of working, were open cut mining and amalgamation, after crushing in 5 and 10 stamp mills.

The first mill taken into the camp was a 5 - stamp mill which a Dr. Adams took in to work the ore from the Aztec. This mill was put in operation in the fall of 1874. In 1876, the Annie and Golden Queen mills of 10 stamps each, and San Juan Consolidated and the Iowa Consolidated mills, of 20 stamps each, were put in commission. In 1882, the Iowa mill of 40 stamps was built and put in operation. In 1884, the Little Annie, Odin, and San Juan were consolidated and the Annie 60 stamp mill was put in commission by that company. From this time until the rich oxidized ores were worked out in the summer of 1886, the camp was prosperous and a heavy gold producer. The last month's run of the Annie mine and mill produced a gold brick worth $32,000.00 . Since then, only one or two small producers have been worked; work on the principal properties being largely of an experimental character for the determination of a process for the treatment of the low grade sulphide ores, which up to date have not been treated success-

fully. We are indebted for most of the above history of the camp, to John B.Haffy of Del Notte, Colorado.

The ore deposits are of a somewhat novel nature, not conforming strictly to any typical ore deposit. The position of the deposits seems to be an important feature necessary to the explanation of their formation.

They are situated on the east face of the main range of the Continental Divide. The country rocks in which the deposits lie are all acid lava of the same general character, being rhyolites and trachites. Present development does not show the depth of these beds.

The formation of these deposits seems to be logically and simply explained by the occurence of a series of parallel anticlinal cracks in the igneous flows at the time of the general upheaval of the range, which were subsequently filled by ascending mineral bearing waters.

These deposits are true veins, the formation of which is due to the filling of fracture planes and subsequent enlargement by replacement. These fractures were probably the result of a gentle local upheaval during which South Mountain (in which the veins lie) was formed. The anticlinal fold was not sharp, and no large open fissures were formed, which is

proven by the following observed facts:-

(1) The veins have no definite walls, the siliceous gangue gradually fading into the rhyolite on both sides.

(2) Metamorphic casts of the feldspar crystals are found in the siliceous gangue of the most heavily mineralized part of the vein.

(3) There is a thin central core, which is nearly pure mineral.

So we conclude that these fractures were not large, open water courses, but simply porous fracture planes which offered less resistance to upward circulating solutions. The fact that mineral is found in the casts of feldspar crystals proves that deposition by replacement, as well as by filling of open places, has taken place.

It is a well known fact stated by eminent authorities such as Kemp, Le Coute and others, that solutions of hot alkaline carbonates will carry in solution metallic sulphides and silica, and will also attack silicates. With these facts as a foundation, we conclude that the solutions, having gathered metallic sulphides and silica from below, worked upward through the fracture planes, depositing silica and metallic

sulphides as conditions would permit, and attacking the adjacent silicates along its path. In time this replacement formed the large quartz veins closely resembling true fissure veins.

The main veins have a general strike of about S 50° E and a dip S 40°W of from 85°to 90°. The width varies from four to forty feet.

There are a number of small cross veins of the same character and apparently of the same age as the main veins, intersecting the latter almost at right angles. They are practically vertical veins, varying in width from four feet to an undetermined width.

The vein filling in the sulphide zone consists of a quartz gangue carrying enargyte, pyrite, and tetrahedrite. In the oxidized zone the gold and silver values are carried in limonite, most of the copper and arsenic and antimony having been leached out. The rich orewhich has been almost entirely worked out, and which was very rich, was found on and near the surface. This richness in the upper part of the oxidized zone was due to concentration by the leaching of the values from the portions of the veins, which have been eroded, [redacted]

and redeposition at a slightly lower level. As iron sulphate is an excellent solvent for gold, this concentration is easily explained, as the iron sulphate would naturally be formed by the oxidation of the pyrites. This concentration and lowering of the enriched zone probably was a continuous operation which kept the concentration some distance below the surface of erosion so that the latter was always a zone of impoverishment, thus furnishing but a small per cent for the placers.

This creation of bonanzas at the surface, which contained their gold in the free state, and which could be taken out by open cut mining, and treated with high extraction in an ordinary stamp mill, presented large dividends which gave impetus to the development of the properties.

The development has been confined almost entirely to two main veins, viz., the Annie and Tewkesbury. The Winchester tunnel shows three other parallel veins, none of which, excepting the McDonald about 120 feet west of the Annie, have been developed at all. The latter has a large cavity stoped out above the Winchester level.

The method of sampling, as carried on throughout our examination of the property, was the picking of a groove, either around the entire perimeter of the cross section of the drift

or tunnel, when the latter was entirely surrounded by vein matter, or by cutting a groove across the face when the limits of the vein were exposed. In the sulphide zone large samples were broken down on to a canvas blanket, and the sack sample, which in all cases was about two pounds, was taken from it. In the oxidized zone a much smaller sample was picked from the groove and caught in a box, from which the sack sample was taken.

In the following tables of assays from the different veins, the numbers in the column headed "No." will be the sample numbers as recorded for convenience in assaying; the column headed "Location" gives the nearest survey station, plus or minus its distance from the latter in feet, plus meaning in the direction to the next higher numbered station; the column headed "Width" refers to the width and position of vein at point of sampling; when width is unknown and vein lies on east of the drift, the symbol "V.E." will indicate the condition; when width is unknown and vein is on the west "V.W." will be used; when width is unknown and vein is on all sides of working, the symbol "W V E" will be used; the other columns give the values in dollars of the gold, silver and

copper per ton, gold at $20.00 per oz., silver at $.60 per oz. and copper at $.16 per lb.

McDONALD VEIN.

No.	Location	Width	Gold	Silver	Copper	Total
123	88 - 20	V E	$1.60	$.15	----	$1.75
124	88 + 25	V E	1.90	.24	----	2.14
125	89	6 ft.	3.20	.42	----	3.62
126	90	30 ft.	1.20	.75	----	1.95
127	R - 20	30 ft.	9.60	.45	----	10.05
128	R + 30	V W	1.00	.20	----	1.20

TEWKESBURY VEIN.

No.	Location	Width	Gold	Silver	Copper	Total
11.	10 to shaft	22ft.	$2.00	$.45	$6.40	$8.85
46.	Shaft at Ida level.	W V E	.60	.15	----	.75
52.	35	V W	4.00	.39	----	4.39
53.	35 + 25	V W	1.40	.18	----	1.58
54.	35 + 50	V W	.40	1.38	----	1.78
106.	70	20 ft.	2.40	1.02	----	3.42
107.	72	20 ft.	.90	.15	----	1.05
108.	M	20 ft.	2.40	.36	----	2.76
109.	L - 30	20 ft.	3.20	.45	----	3.65
110.	L - 10	20 ft.	6.40	.96	----	7.36
111.	above 83	W V E	20.00	1.20	----	21.20
112.	above 83+10	W V E	20.00	1.20	----	21.20
113.	83 + 40	V E	22.00	1.26	----	23.26
114.	83 + 40	V E	4.00	.33	----	4.33
115.	83 + 60	V W	1.60	.36	----	1.96
116.	83 + 80	V W	2.60	.33	----	2.93
117.	83 + 90	V W	1.60	.21	----	1.81
118.	Q	V W	2.60	.42	----	3.02

ANNIE VEIN.

No.	Location	Width	Gold	Silver	Copper	Total
1.	7	W V E	$6.40	$.98	$7.68	$15.06
2	7 + 10	W V E	1.00	.30	6.07	7.37
3.	7 + 20	W V E	1.00	.15	trace	1.15
4.	7 + 30	W V E	17.20	1.44	13.20	31.84
5.	7 + 40	W V E	2.00	.33	1.94	4.27
6.	7 + 50	W V E	2.00	1.20	18.55	21.75
7.	7 + 60	W V E	1.60	.48	7.04	9.12
8.	7 + 70	V E	2.40	1.02	8.95	12.37
9.	8 + 10	V E	2.00	.90	11.20	14.10
10.	8 + 20	V E	1.40	.24	trace	1.64
12.	11	V E	1.60	.24	10.25	12.09
13.	11 + 10	W V E	8.80	.72	3.84	13.36
14.	11 + 20	W V E	2.60	.75	17.35	20.70
15.	12	W V E	4.00	.30	2.88	7.18
16.	12 + 10	W V E	5.20	2.85	12.15	20.20
17.	12 + 20	W V E	1.60	.54	1.60	3.74
18.	12 + 30	W V E	1.80	.54	2.88	5.22
19.	15	W V E	.80	.15	9.60	10.55
20.	14	Porphyry	2.60	.18	trace	2.78
21.	14 + 10	V E	2.80	.24	.96	4.00

ANNIE VEIN. (Continued).

No.	Location	Width	Gold	Silver	Copper	Total
22.	14 + 20	V E	$3.00	$ .21	$1.60	$4.81
23.	14 + 30	V E	1.80	.12	trace	1.92
24.	14 + 40	V E	16.00	1.35	.64	17.99
25.	14 + 50	V E	1.40	.15	trace	1.55
26.	C	V E	1.60	.27	trace	1.87
27.	13	W V E	2.20	.43	23.70	25.33
28.	16 - 10	W V E	1.60	.30	trace	1.90
29.	16.	W V E	1.60	.36	14.70	16.36
30.	17 - 10	W V E	4.80	.66	3.20	8.66
31.	17	W V E	6.00	.72	1.60	8.32
32.	18	W V E	2.00	.54	3.20	5.74
33.	18 + 10	W V E	2.00	.54	1.60	4.14
34.	18 + 20	W V E	4.00	.42	3.20	7.62
36.	19	W V E	6.00	1.14	trace	7.14
37.	19 + 10	W V E	3.20	.45	6.40	10.05
38.	20 + 20	W V E	6.20	.90	trace	7.10
39.	20 + 30	W V E	2.00	.48	trace	2.48
40.	20 + 40	W V E	14.00	3.06	trace	17.06
56.	39	W V E	4.80	.30	----	5.10
57.	39 +45	W V E	.40	.30	----	.70

ANNIE VEIN. (Continued).

No.	Location	Width	Gold	Silver	Copper	Total
58.	39 + 65	W V E	$ .20	$ .36	----	$ .56
59.	39 + 85	W V E	1.20	.36	----	1.56
60.	40 + 10	W V E	37.20	1.44	----	38.64
61.	41 + 5	W V E	.40	.60	----	1.00
62.	41 + 25	W V E	.40	.24	----	.64
63.	41 + 45	W V E	.40	.66	----	1.06
64.	41 + 55	W V E	39.20	2.16	----	41.36
65.	41 + 65	W V E	2.00	.36	----	2.36
67.	56 + 30	W V E	1.60	.36	----	1.96
68.	56 + 51	W V E	2.00	.48	----	2.48
69.	56 + 60	W V E	2.40	.36	----	2.76
70.	60	W V E	1.60	.36	----	1.96
71.	60 + 20	W V E	1.60	.36	----	1.96
72.	61	W V E	1.60	.36	----	1.96
73.	61 + 20	W V E	.80	.36	----	1.16
74.	61 + 40	W V E	3.40	.45	----	3.85
75.	61 + 60	W V E	.50	4.60	----	5.10
76.	61 + 80	W V E	3.20	.42	----	3.62
77.	63 - 10	W V E	3.20	.42	----	3.62
78.	H - 10	W V E	2.80	.36	----	3.16
79.	H	W V E	3.40	.24	----	3.64
80.	64 - 10	W V E	.50	.36	----	.86

ANNIE VEIN. (Continued)

No.	Location	Width	Gold	Silver	Copper	Total
81.	64 + 10	W V E	$2.80	$ .36	----	$3.16
82.	64 + 30	W V E	2.60	.36	----	2.96
83.	67 + 15	W V E	3.00	.24	----	3.24
84.	67 + 30	W V E	.50	.30	----	.84
85.	67 + 45	W V E	2.40	.30	----	2.70
86.	67 + 65	W V E	2.40	.30	----	2.70
87.	67 + 77	W V E	2.40	.30	----	2.70
88.	I - 12	W V E	2.40	.30	----	2.70
89.	I	W V E	.40	.60	----	1.00
90.	20/61 #	W V E	.80	.96	----	1.76
91.	28/61	W V E	10.40	.90	----	11.30
92.	38/61	W V E	4.00	.54	----	4.54
93.	48/61	W V E	2.40	.54	----	2.94
94.	58/61	W V E	8.00	1.80	----	9.80
95.	68/61	W V E	1.60	.36	----	1.96
96.	74 + 60	W V E	1.60	.36	----	1.96
103.	69	W V E	.60	.15	----	.75
104.	70 - 35	W V E	44.00	.30	----	44.30
105.	70 - 15	W V E	10.40	2.40	----	12.80
120.	15/80	Pay streak	155.00	6.90	----	161.90

ANNIE VEIN. (Continued).

No.	Location	Width	Gold	Silver	Copper	Total
120.	15/80	W V E	$13.00	$ .60	----	$13.60
122.	10/81	W V E	4.00	.36	----	4.36

\# 20/61 indicates sample taken 20 feet directly above station 61.

CROSS VEIN AT STATION 25. (Probably the Oding).

47.	W - 40	4 feet	$ 1.60	$ .37	----	$ 1.97
48.	W - 20	4 "	.80	.18	----	0.98
49.	W	4 "	.40	.18	----	.58

ODING VEIN.

41.	31	W V E	1.00	.24	----	1.24
42.	33 - 40	W V E	1.40	.36	----	1.76
43.	33 - 30	W V E	1.40	.24	----	1.64
44.	33	20 ft.	1.40	.36	----	1.76
45.	32	W V E	12.80	1.68	----	14.48

CROSS VEIN AT STATIONS 55, 71 and 77.

No.	Location	Width	Gold	Silver	Copper	Total
35.	55-20rt.	W V E	$3.20	$ .96	----	$ 4.16
66.	55-20lft.	W V E	1.60	.36	----	1.96
97.	J	W V E	1.60	.36	----	1.96
98.	J - 10	W V E	.40	.36	----	.76
99.	J - 20	W V E	trace	trace	----	----
100.	J - 35	W V E	1.60	.36	----	1.96
101.	J - 45	W V E	1.60	.48	----	2.08
102.	J - 58	W V E	6.40	.48	----	6.88
109.	X	W V E	12.00	.72	----	12.72

UNEXPLORED VEINS IN EAST DRIFT OF IDA.

50.	34 + 21	5 ft.	1.20	.24	----	1.44
55.	36 + 30	16 ft.	2.00	.30	----	2.30
51.	37	6 ft.	1.60	.36	----	1.96

UNEXPLORED VEINS IN WINCHESTER TUNNEL.

129.	92 + 10	6 ft.	4.40	.27	----	4.67
130.	92 + 30	6 ft.	.80	.12	----	.92
131.	93 - 30	unknown.	1.00	.18	----	1.18
132.	93 - 20	" "	1.40	.36	----	1.76
133	93	" "	.70	.18	----	.88
134.	90 + 65	6 ft.	1.00	.12	----	1.12

McDONALD VEIN.

This vein is first exposed at the main bend in the Winchester tunnel, at station 90, the tunnel following it northward about 80 feet, and a drift southward 120 feet. Beginning at station 90 and extending southward about 50 feet, there is a large stoped out cavity, which it was impossible, on account of lack of timbering, for us to explore. However this shows an immense chute, which probably contained high grade ore. The chute was 30 feet wide, and 50 feet long. At station 87 it appeared to have a dip of about 45° East. The ore extraction with this small amount of development would warrant prospecting in the lower levels for this vein.

VEINS IN THE WINCHESTER TUNNEL.

Vein matter of mineralized gray quartz appears on the north side of the tunnel 65 feet east of station 90; this does not appear on the south side of tunnel. Sample 134 is from this material. There has been no development to prove this a separate vein.

Just east of station 92 there is a north and south vein, about 6 feet wide, which is located almost in the direct line of the Annie vein, and is from all appearances a part of the

same. This vein has been exposed by drifting 10 feet to the north and 30 feet to the south. Samples 129 and 130 are from these drifts.

For 30 feet along the tunnel west from station 93 the characteristic vein matter of gray quartz appears; judging from the relative position and size of the vein, it is a part of the Tewkesbury vein. Samples 131, 132, and 133 are from this vein.

UNEXPLORED VEINS IN EAST DRIFT OF IDA TUNNEL.

In addition to cutting the Tewkesbury and Annie this drift cuts three other veins. Sample 50, near station 34, shows a quartz vein, but being totally undeveloped, its identity cannot be determined. It is very probable that this is only a spur from one of the main veins as it lies between the Annie and Tewkesbury.

Sample 55 near station 36, shows another vein, which, being undeveloped, aannot be identified. It lies parallel to and is probably another spur of the main veins.

In the end of the drift another quartz vein about 6 feet wide, apparently striking away from the main veins at a large angle, has been developed by a stope three sets high and 30 feet long. Sampke 51 was taken across this vein. Such meager

developmentmakes the identity of this vein also indistinguishable.

CROSS VEIN AT STATIONS 55, 71, and 77.

Drifts on a cross vein in the French, Montroy, and Winchester levels, which from the survey have the same general strike and lie nearly in the same vertical plane, indicate conclusively to extension of the same cross vein through the three levels. The workings on the vein were entirely in ore and were 15 to 20 feet wide in places, which shows this to be a vein worthy of further exploration in the lower levels. By drifting south about 60 feet from the breast of the Chandler tunnel, this vein could be tapped. (See tabulated matter for assays).

ODING VEIN.

This vein is exposed in the breast of the west drift of the Ida, at stations 31, 32, and 33. This vein has an easterly and westerly strike, and in the vicinity of the breast of this drift, there is a large chute, the dimensions of which have not been entirely exposed, but the drift has cut through 50 feet of ore with some stoping. A drift southwest from station 25 discloses a 4 foot vein which strikes almost directly

toward this chute in the Oding and it seems very probable that it is part of the Oding.

TEWKESBURY AND ANNIE VEINS.

At all points in which the Tewkesbury is open for examination, it is in such close proximity to the Annie vein, it seems very appropriate to discuss the two under the same general head. The two are nearly in contact near the Ida shaft at both the Chandler and Ida tunnel levels, and also near the Crawford raise in the Monteroy, French and Winchester levels. Tunneling and drifting on the Tewkesbury proper has been carried on to the extent of 500 feet, together with the Ida shaft, which was sunk about 350 feet entirely in the vein. All other tunnelling, drifting and sinking has been done in connection with the development of the Annie vein; but the close proximity of the two veins throughout, means that the development of the Annie can be used practically, by the addition of a system of cross cuts, to prospect, and if it proves worthy, to develop the Tewkesbury.

On the Annie Vein proper there are 5731 lineal feet of development. Our survey shows the following :-

Tunnels and drifts 5' x 7'				Chandler level		- - -		-1126ft.
"	"	"	"	Ida	"	- - -		-1227
"	"	"	"	French	"	- - -		-1471
"								
"	"	"	"	Montroy	"	- - - -		479
"	"	"	"	Winchester	"	- - - -		798
Crawford Raise 4' x 8'						- - - - - - - - - - - - - - -		187
Raise No.1. 10' x 10'						- - - - - - - - - - - - - - -		75
Raise No.2. 10' x 10'						- - - - - - - - - - - - - - -		68
								5431
From Company's maps, Caved Montroy tunnel,						- - - -		300
								5731

In addition to workings on Annie, the drifts

to Oding, cross veins, etc. - - - - - - - - - - - - - 1394

Shaft in Tewkesbury, - - - - - - - - - - - - - - - - - 350

Drifts on Tewkesbury, - - - - - - - - - - - - - - - - 500

Total workings accessible to survey, - - - - - - 7975 ft.

Other workings on the property which were inaccessible on account of caving or filling would greatly increase the above figures for the work that has been done. These however have been totally abandoned and are now practically useless in the further development of the property.

These workings have blocked out an area of stoping ground of 250,000 sq.ft., all of which is above the drainage

level of the Chandler tunnel. Of this, 90,000 sq.ft. in the oxidized zone have been stpped out, leaving practically everything in the sulphide zone untouched, a total area of ore in place of 160,000 sq.ft. This latter area can be increased 50 % by driving the Chandler tunnel 600 feet and the Ida tunnel 300 feet further along the vein, giving an area above tunnel drainage of 250,000 sq.ft.

Reference to the longitudinal section will show that the rich oxidized ores have been totally extracted; there is simply left the possibility of encountering more of these bonanzas in the upper levels further to the south. It is evident from this that the future of the property lies in the large bodies of untouched sulphide ores whose main value is their copper contents.

Careful assays of 26 samples (11 to 37 inclusive) of this sulphide ore, as exposed in the Chandler tunnel and small stopes, gives an average value in gold, silver and copper of $8.88. Many of these samples were taken on the edge of the vein and were half wall rock, and this value is certainly a minimum to place upon ore which would be properly extracted from the vein. However, all future profits from these proper-

tiesmust be looked for from the treatment of ore of this approximate value.

A general sample of the sulphides in the Chandler level containing a considerable amount of wall rock showed an analysis as follows, from which the character of the ore necessary to be treated can be observed.

COPPER	2.70
IRON	4.50
SULPHUR	4.30
ARSENIC	2.45
ANTIMONY	trace
INSOLUBLE	81.60
MOISTURE	3.00
	98.55

A qualitative analysis of this sample showed the presence of a very small amount of aluminum and magnesium.

While this ore is not especially refractory to treat, its low value necessitates the evolution of a cheap process, and even then, the treatment of large quantities to produce a profit over cost of mining and reduction.

Treatment of the sulphides by stamp amalgamation has been tested by the company. Mr. Kirby, who is the company's superintendent, reports this method to be a failure. This is easily accounted for by the low gold and silver values and

the presence of arsenic and sulphur to sicken the mercury.

People in the district report the trial of chlorination and cyanide processes with total failure, but no reason is available to show the result of these tests.

A Denver man by the name of Best succeeded in convincing the management of the company of his ability to treat these ores profitably by means of his secret process, which he called "Best's Hydrazene Process". In the summer of 1899 the company spent several thousand dollars in the erection of a "Best Roaster", and in fitting the mill as advised by Mr. Best for the treatment by his process.

The general outline of the treatment was;- crushing; preliminary roasting with his patent salt in his muffle furnace; subsequent extraction of the gold by stamp amalgamation, and the leaching of the copper from the pulp, and its precipitation from solution on scrap iron.

In more detail, the ore was put through a Blake crusher, then rolled and screened to about 5 mesh. The ore was then piled on a floor and sprinkled with a solution of the salts, after which it was roasted in the muffle furnace to nearly a dead roast, drawn, allowed to cool, and treated in the stamp battery. The overflow from the plates, which it

was supposed contained the copper in solution, was run into large vats, where the copper was to have been precipitated.

A few days' trial run demonstrated the absolute inadaptability of the process as engineered by Mr. Best. Several barrels of the salt, upon which he hinged the success of the process, were left in the mill, and Mr. Kirby gave us the privilege of analyzing it, being interested to know what such a wonderful salt might be. An approximate analysis, which we undertook, showed the salt to consist of chlorates, and chlorides, and the elements, potassium, sodium, and chlorine, and the radical ammonium in such proportions as warranted us in stating the following composition:-

NH_4Cl	1 part by weight.
NaCl	1 " " "
$KClO_3$	2 parts " "

This mixture then gives 39% chlorine, and on account of the presence of the high oxidizer, $KClO_3$, would give an excellent chloridizing roast and a consequent large loss of copper and gold by vola-til-i-zation as chlorides during the roast.

We judge from the name given to the process that Mr. Best intended hydrazene to be generated in the muffle during

the roast, by the reaction of the mixture giving the free radical N_2H_4 (hydrazene) which is known to be the basis of a fine solvent for the precious metals. This solution and subsequent breaking down would agglomerate the gold and silver so that they could be easily amalgamated. But we have been unable to find any chemical authority which gives a method for the generation of hydrazene, except from very complicated methods, none of which simulate the above in the least. This may account for the failure of the test. Unless Mr.Best's knowledge of the chemical reactions far surpasses that of any accessible authorities, the presence of his salt in the roast would simply make an efficient but very expensive chloridizing roast, which in this case would do more harm than good, because of the large loss of copper chloride and gold chloride by volitilization during the roasting.

This was the last effort made to treat these ores, and the field is still open for a suitable process.

PRESENT EQUIPMENT OF PROPERTY.

The Ida shaft is a single compartment, supplied with a 100 H.P. hoist, having cylindrical drum and round rope and ordinary cage. There are two 60 H.P.and one 80 H.P. boilers at Ida shaft house in fairly good condition.

At the Ida tunnel house there is a saw mill fairly equipped for timber framing. The upper terminus of the tram is near the Ida tunnel house, and has ample bin capacity and good arrangements for loading. This tram is of the Bleichert Aerial type having a traction and a carrying cable with a capacity of 100 tons per 10 hours. Its discharging terminus is at the Annie Mill.

The French tunnel has a tunnel house and blacksmith shop. The Chandler tunnel has only a tunnel house.

All the tunnels have narrow gauge car tracks for their entire length with car equipment. Heretofore most of the tramming has been done by mules.

The mill has a 9"x15" Blake jaw crusher, a set of slow speed rolls, a 60 stamp battery with automatic feeders, a 175 H.P. Corliss, single expansion engine, and a dynamo for lighting all company buildings, together with a setting of three 80 H.P. boilers. In a building east of the mill there are ten "Frue" vanners in fairly good condition.

There is an assay office, fully equipped for retorting and melting down the amalgam, also for fire assaying and ordinary analytical work. In addition, the Company has a suitable office and residence, and a boarding house capable of

feeding two hundred men.

The water supply for the stamp mill is uncertain and liable to fall short at any time. For steam purposes there is always plenty within a short distance of boilers. For domestic purposes there is plenty of good spring water.

Hardware and other supplies can be had at the mine for Denver prices with freight of 1-1/2 ¢ per lb.added.

The following is a list of prices on labor and material at the mine, as furnished by Supt. Kirby.

Wood per cord	$3.50
Coal per ton	15.00
Charcoal per bu.	.20
Mining timber 6"to4" diam.per running foot	.20
Lagging poles 16' long per foot	.20
Lumber per M.	14.00
Miners'wages for 8 hrs.	3.00
Trammers " " "	3.00
Engineers" " "	4.00
Firemen's" " "	3.50
Battery men " 12 "	3.50
Roustabouts (in mill) per 10 hrs.	2.50
Table & Vanner men, " 12 "	3.50
Teamsters per month	60.00
Outside labor per day	2.50
Four horse team " "	8.00
Freight from Mine to R.R. per T.	8.00
" " R.R. " Mine " T.	20.00
" Del Norte to Denver ($65.ore) per T.	5.50
" " " " " (less than $65.)per T.	5.00
Smelting charges in 1899 per T.	9.00

It is simply necessary for us to present a few rough calculations to demonstrate the necessity of extracting the values from the ore at the mine. Concentration and shipping to smelter are shown by the following figures to be out of the question. Assuming the best possible concentration, which is five to one with this ore, and an unavoidable loss of 30% due to the sliming of the enargite in the ore, the shipping product would be worthabout $30.00: with a smelter charge of $9.00, freight to railroad $8.00 and freight to smelter $5.00, this leaves $8.00 clear per ton, assuming that the smelters pay for all the copper.

This $8.00 is equivalent to $1.60 per ton of ore extracted which must pay costs of mining, concentration, superintendence, interest and depreciation on plant, and any possible dividends.

The results of several attempts of extraction on the ground have been cited previously.

As the copper must be saved in order to render the ore treatable, and as smelting is impossible, the process, whatever its details, must be a leaching process. Even though the water supply is insufficient to run the stamp mill at times,

it would always serve the purposes of a leaching mill, because less is needed and provision could be made so that the water could be used again and again.

The cyanide process, with a preliminary leaching of the copper, made soluble by roasting, would undoubtedly give a high extraction, but whether or not it would be sufficiently economical, would have to be proven by careful tests.

It seems that the chlorination process, on account of its ability to treat large quantities of ore in a short time and with less apparatus, would be more applicable in this case. A preliminary roast, at a temperature not over 500°C, will oxidize the copper sulphide to copper sulphate, which is readily soluble in water, and could be leached out before the chlorination begins, thus reducing the amount of chlorine needed for extraction, and giving a less base bullion. After the extraction of the copper, this ore is a model for treatment by chlorination, as at the low temperature of roasting most of the arsenic and antimony will have been gotten rid of, and only a fractional per cent of unleached copper sulphate would remain, the balance being silica and iron oxide (Fe_2O_3).

As much more work can be done by bromine than by an equal weight of bleaching powder and sulphuric acid, a great saving in freight would be made by the use of bromine, which

fact should be taken into consideration in making tests and plans.

Therefore, we recommend extensive and careful tests along the lines indicated in the previous paragraph, and if these prove the process to be efficient, that a plant of the following general description be installed:-

A roaster plant of 500 tons capacity, or a concentration plant of 500 tons with a 100 ton raasting plant, a chlorination mill of 500 or 100 tons, and a water power plant with electric transmission of 700 H.P. net at the mines.

The low value of the ore necessitates the handling of large quantities at a minimum cost of mining and milling. As fuel is so expensive, power furnished by steam would be very uneconomical. Five hundred tons daily capacity should be the ultimate plant from which it may be expected to realize large dividends. For such a plant the power required in the mine and mill would be about 700 H.P. and economy would warrant the erection of a power plant of the full capacity on the first installation. This power might be obtained from the East Fork of the South Fork of the Rio Grande river, about six miles from the mine, or from the Alamosa river, about four miles from the mine; but, as both of these locations would incur

excessive first cost of installation and subsequent difficulty in the winter months, on account of snow, besides an uncertainty of water supply during the summer, it would be much better to place the power plant lower down. As the water supply in the Rio Grande river is certain and in excess of requirements, and the greater length of line would not decrease the efficiency of transmission and would greatly decrease the first cost of plant, we recommend the erection of this plant at some suitable point on the river above Del Norte.

A rough estimate on a plant thus situated, including line, dynamos and motors for mine and mill amounts to $150,000.00, and the cost per H.P. per hour for power, figuring interest and depreciation at 15%, and running expenses at $85.00 per day, is about one cent. On a 500 ton basis, each ton of ore would have to be charged with but $.32 for power in mine and mill.

The mill should be planned for 500 tons but might be equipped for only one fifth capacity to start with, and increased as development in the mine called for it.

If it should be decided to operate along the lines indicated above, work should be begun at once to enlarge and bring to proper grade, the Chandler tunnel, as per map furnished the company for this purpose, and the tramway now

now running from the Ida tunnel to the mill should be moved to connect the Chandler with the new mill, making the former the working level. Tunnelling and drifting should be commenced and stoping ground put in shape, so that mill capacity could be increased as rapidly as possible.

A rough estiamte of the costs and profits which could be gained from 100, 200, and 500 ton plants is shown by the following figures; assuming the mine to be good for twenty years, and paying 20% interest on the investment, and establishing a sinking fund for the investment:-

Present Plant	$250 000.00
Power "	150 000.00
Mill	150 000.00
Mine development	50 000.00
Total investment	$600 000.00
Interest and depreciation on above, at 23%	$138 000.00
With 300 working days, per day,---	460.00

Taking the value of the ore as given above as $8.88and a 100 ton capacity, $4.28 per ton is left for mining, milling and other running expenses; with a 200 ton plant $6.58 per ton is left for same expenses; with 500 ton plant $7.96 per ton is left for same items. We estimate that it will take $6.00 per ton to mine and mill the ore. On this basis a 100 ton

plant will not pay the interest and depreciation as allowed, but a 200 ton plant will a little more than meet requirements, while a 500 ton plant will make a gilt edged investment.

As 60,000,000 tons of ore are required to supply a 500 ton plant for twenty years, the mine should be developed along the vein 3000 feet, and 800 feet below the Chandler level to determine the ore contents , before the erection of the plant.