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Report on the

ANTELOPE MINING DISTRICT

PERSHING COUNTY, NEVADA

by

Edward P. Jucevic, E.M.

Mining and Metallurgical Engineer

P.O. Box 8077 University Station

Reno, Nevada 89507

Phone 702-322-7765

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284

TABLE OF CONTENTS

Edward P. Jucetic, E.M.

SUMMARY

At the request of Sterling Mines, Inc., an investigation of the Antelope Mining District, Pershing County, Nevada, was conducted in order to evaluate the area. The area of the mines is gently mountainous and semi arid. It has a history of production beginning in 1906 and extending to the 1940's. During this time, two mills were built to handle the oxidized ore, which milled fairly well. However, the sulfide ore was not amenable to these gravity mills and very little sulfide ore was mined. The mines were allowed to fill with water to the top of the sulfide zone. All production from the area has been fairly high grade, averaging about:

Au	0.01 oz/T
Ag	23.0 oz/T
Pb	15%
Zn	6 %
Cu.	1.2%

An estimate of the total production of the area is about 80,000 tons.

The mines are situated along two parallel shear zones, striking about N 45° W, the longest being over 12,000 feet long. The wallrocks are Triasssic or Jurassic dark slates and shales with occasional sandstone or quartzite interbeds. The ore shoots are located within this shear zone in veins that usually average about four to five feet wide and usually split into a hanging wall vein and a foot wall vein separated by from two to twenty feet of waste. Where these veins part and recombine, the ore is wider, occasionally up to 18 feet wide. In the Antelope mine, the ore has been shown to be continuous for over 500 feet of vertical depth. In the Superior Mine, all indications are that the sulfide ore between the 200 foot level and 300 foot level is still almost all in place.

Copy No. 1

Edward P. Jucevic, E.M.

The Iron Mast Mine on the second shear zone is characterized by higher grade ore in smaller ore bodies. Production from this zone was probably fairly small.

Due to the high grade nature of the ore, the depth to which the ore shoots will probably go, the very strong nature and long length of the shear zone that contains the veins, and the prospects for a continued raise in the price of silver, this area presents a very attractive exploration opportunity.

It is recommended that mining rights to the entire area be secured, and that an exploration program be commenced.

Edward P. Jugovic, E.M.

I N T R O D U C T I O N

At the request of the officers of Sterling Mines Inc., an investigation of the Superior Mine, Iron Mast Mine, Antelope Mine, Noble Mine and the Smith Canyon property was conducted. All are non-producing silver-lead properties located in the Antelope Mining District, Pershing County, Nevada.

The purpose of this investigation was to evaluate the property, determine if further exploration was warranted, and if so, to suggest a program of exploration.

At the present time, Sterline Mines Inc. is in the process of acquiring mining rights to all the properties discussed in this report. Some of the ground is already held by Sterling Mines under location according to federal laws. All of the other ground is privately owned, and I am informed that this is being acquired under lease and option.

The Superior Mine, Antelope Mine, and Noble Mine are all located on the same shear zone trending about N 45° W. They are developed with numerous shafts and adits. The Iron Mask Mine and Smith Canyon property are located on a parallel shear zone about 1500 ft. N.E. of the Superior shear zone. These also are developed by numerous shafts and drifts.

The geography, geology and history of the specific area and the surrounding region, the past and possible future mining methods, and the availability of water, power labor and transportation, were all examined and evaluated before any conclusions were drawn.

The information used in writing this report was obtained from three days spent on the properties, from publications by the Nevada and Federal Bureau of Mines, material supplied by various companies and papers and reports in the possession of the Sterling Mines Corporation.

Edward P. Jucovic, E.M.

September 2 and 3, 1967, and October 14, 1967 were the days spent on the property. The author was accompanied on all three days by either Mr. Davis or Mr. Watson, both of whom were very helpful in pointing out features of the property and acting as guides.

Previous work on the area is very sparse. Jones (1931) has some general geology for the area about three miles N.W., referred to as the Scossa District. Lawrence (1963) refers briefly to some of the mines in the district. An old engineering report by Hanselman (1941). though not complete, was very helpful.

The author wishes to express his gratitude to Mr. P. van Löben Sels of the Southern Pacific Company for providing the use of their topgraphic and geologic maps of the area. Mr. Edgar Noble of Imaly, Nevada was also very helpful in providing first hand information about the property. The American Smelting and Refining Company, International Smelting and Refining Co., and the United States Smelting, Mining and Refining Co. all cooperated in supplying any information they had on past production. Unfortunately, most of their old records have been destroyed, but some useful information was obtained.

Edward P. Jucevic, E.M.

G E O G R A P H Y

The mines investigated in the report are located in the Antelope or Cedar Mining District, in the Antelope Mountains, Pershing County, Nevada. More specifically they are situated in Sec. 25, 26 & 36, T. 33 N., R. 30 E. and in Sec. 30, [redacted] & 32, T. 33 N.R. 31E., M.D.M. about 110 airline miles northeast of Reno, Nevada. (See Fig. 1).

The area is accessible by automobile, although some of the roads on the property require a pickup truck for easy travel. The mines can be reached from Lovelock, Nevada by 38.5 miles of Interstate 80, a four lane divided highway, 18 miles of graded county road and about four miles of dirt road. Other than days immediately following heavy snows, the property is accessible the year round.

Topography in the region is characterized by gentle canyon walls and moderately steep peaks. Elevations range from 5500 to [illegible] ft. with relief averaging about 600 ft. per half mile.

The climate of the region is typically arid. Some snow is encountered during winter months, but most snows do not remain on the ground long. During a regular mining operation not more than one or two working days per year would be lost due to snow conditions. Winters are moderately cold, but the summers are never really hot.

Vegetation consists of typical Nevada sagebrush on the lower elevations and piñon pine on the upper elevations and on the northern slopes.

Edward P. Jucevic, E.M.

HISTORY

Unfortunately a precise history of this area, including accurate tonnage figures, is not possible to obtain. From the limited amount of published information available, from talking to old-timers in the area and from the little production information the smelters were able to furnish, a general picture can, nevertheless, be constructed.

It is not known when the area was first prospected, but Lincoln (1923, pg. 201) states that the Nevada Superior Mining Company began shipping ore from the Superior Mine in 1906. In 1910, 72 tons of ore were shipped netting about $49.00 per ton. At today's metal prices this would be about $147.00 per ton. In 1911 Lincoln reports that construction was begun on a seventy five ton gravity concentration mill for the Superior Mine. Development work at that time consisted of a 330' shaft and about 4500' or workings. Mr. Noble of Imlay, Nevada (Personal Communication) states that the mill worked well on the oxide ore but was ineffectual on the sulfides due to excess pyrite. Pyrite is heavy and difficult to separate from galena, the ore mineral, in a gravity concentration mill. According to Lincoln, the mill operated until 1913. No production information is available. Sometime around this date, Mr. Noble, as a boy, reports being underground in the Superior Mine with Mr. Tomkin Sr., who was then Superintendent. A steam line to the pumps ruptured, almost scalding Mr. Noble and Mr. Tomkin. The boilers were turned off and the shaft was allowed to flood to the drainage tunnel. The reason for this probably was not the rupturing of the steam line but the refactory nature of the sulfide ore. Mr. Noble further reports that the ore was wide and continuous on the three hundred foot level but fairly high grade. Noble reports that only about 50 or 60 tons of ore were mined from the three hundred foot level before the shaft flooded and the shaft has never been dewatered.

Edward P. Jacevic, E.M.

In 1915, according to Lincoln, the Antelope Springs Mining Co. built a 25 ton per day mill at the Antelope Mine. It must have been fairly successful because it was enlarged to 50 tpd in 1917. No records are available on the early production from the Antelope.

In about 1917 or 1918, Mr. Noble reported that he shipped about 50 tons of ore from the Noble Mine, netting $99.60 per ton. This ore was reportedly high in silver and contained almost 40% lead.

Mr. Noble further reports that sometime during the twenties two Italians mined the ore between the 100 and 200 foot levels of the Superior Mine. The evidence indicates that a substantial amount of material was removed between these two levels. A large amount of the floor on the 100 foot level sounds hollow. On the 200 foot level stoping is evident for 200 feet on either side of the shaft. These stopes have been filled with wallrock, probably from hanging wall raises. They appear fairly narrow, two to three feet wide, but this could be due to squeezing of the fill.

Sometime during the 1930's Mr. Tomkin Jr., son of the Mr. Tomkin Sr., who ran the Superior Mine during its development era, drove a drift on the Iron Mast property. He encountered two pods of very high grade ore that, according to Mr. Noble, netted $14,000.00 for about 100 tons. At today's prices, that would amount to over $400.00 per ton.

It has not been possible to obtain any production records for the time previous to the 1930's. The smelters periodically destroy old records to make room for new ones. U. S. Smelting and Refining Co. was not able to supply any information on production. American Smelting and Refining Co. was able to show one shipment in 1947, and International Smelting and Refining Co. was able to show about 1000 tons of production during the 1930's.

Between 1935 and 1938, the International Smelting and Refining Co. shows more than 600 tons of ore shipped from the Superior Mine by E. J. Baker. It is possible that this ore might have come from the stopes between the 100 and 200 foot level of the Superior shaft. This

ore averaged about 23 oz. silver- 15% lead and 2.5% zinc.

International also shows about 300 tons of ore shipped to them, during the 1937 thru 1939 period, from the Antelope Mine. There were ten shipments averaging about 30 tons each. A mining engineer's report by Hansleman (1941), in the possession of Sterline Mines, Inc., shows about 30 analysis of shipments from the Antelope during the 1930's, ten of which were confirmed by International. If we probject the average of thirty tons per shipment as indicated by International to the thirty shipments indicated by Hanselman we have about 900 tons of ore shipped during this period. The map by Rogers (1941 ?) drawn from a report by Parrington M. McCree shows the No. 1 ore shoot in the Antelope Mine averaging about 150 feet long and being continuous for at least 500 feet in depth, with no indication of diminishing. The map shows the ore shoot completely removed. Hansleman (1941) reports the ore to average about 4 feet thick. This would indicate about 25,000 tons of ore removed. The No. 2 ore shoot would probably have contained as much ore, indicating that the Anteleope probably produced about 50,000 tons total.

The only other production from this area was reported by American Smelting and Refining Co. In 1947, Mr. Jess T. Simmons shipped 42 tons of ore, probably from the upper levels of the Superior shaft, that analyzed only 3.7 oz. silver, 5.2% lead and 0.2% copper.

It is not possible to say with much accuracy exactly what the production of this area was. However, a guess might be in the range of 80,000 tons.

GEOLOGY

GENERAL GEOLOGY OF THE AREA

Most of the district is underlain by dark colored slates and soft mica schists, which have a general strike of N 40° E and dip 40 to 60 degrees to the northwest. Interbedded with the slates and shists are sandstone and limestone strata. In general, the sandstones are indurated, and verge on quartzites in some areas. There is a question as to whether these beds are upper Triassic or Lower Jurassic. No intrusives were noted in the area studies, but Jones (1931) reports small quartzdorite dikes in the Scossa Mining District three miles northwest of the Superior area. Spruck (1938) shows a large granodiorite intrusive six miles to the northeast, and intrusive rhyolites four miles east at Majube Mill.

The only structures evident in the area are the two shear zones related to the ore deposits (see fig. no. 2). These zones trend about N 45° W and cut the slates and schists at almost right angles. The more southerly sheer zone, hereafter referred to as the Superior shear, appears to be the strongest and has undoubtedly produced the most ore. Its strike is N 45° W and its dip is generally almost vertical. This zone can definitely be traced over 12,000 feet on the surface. The second shear zone, hereafter

Edward P. Jacovic, E...

referred to as the Iron Mast Shear, is located about 1500 feet northeast of the first and parallels it in strike. The dip of the Iron Mast Shear, however, is about 40° to 60° to the Southwest, toward the Superior Zone, indicating a possible intersection at somewhat less than 2000 feet. The Iron Mast shear is not nearly as strong as the Superior, but may be as long, possibly extending into Smith Canyon. There is some question as to whether the Smith Canyon area is a continuation of the Iron Mast shear or and offset of the Superior shear.

The veins are true fissure veins that probably filled voids in the shear zone and replaced some of the crushed wallrock. At various intervals the main vein splits, forming two veins separated by a few feet of wall rock in places, but sometimes separated up to twenty feet. Where the veins split and rejoin together, the ore is often wider than ten feet.

SPECIFIC GEOLOGY

The geology of the mines on the Superior shear zone will be discussed first and the mines on the Iron Mast shear zone second.

SUPERIOR SHEAR ZONE MINES

The mines along the Superior shear zone from northwest to southwest are the Noble, the Superior, the Antelope and the Queen. The mines will not be discussed in that order, however, but in order of their importance as follows:

The Superior Mine
The Antelope Mine
The Noble Mine
The Queen Mine

THE SUPERIOR MINE. The Superior Mine on the west side of the mountain (see fig. 1) is developed by a 320 foot shaft with levels at 100 foot, 200 foot and 300 foot depths and a 2,500 foot drainage tunnel. There is evidence of caving in the shaft at the water level and probably some caving below. The shaft has probably been lagged over at the drainage tunnel level. The 100 foot and 200 foot levels are accessible, though badly caved in part. Parts of the drainage tunnel are accessible, though most of it is not. About 400 feet up the hill from the Superior shaft is an adit that contains about 400 feet of workings.

The vein is a fissure vein in the Superior shear zone. The shear zone at the Superior shaft strikes N 50°W and dips about 70° to the N.E. at the surface. This dip may be due to rock creep near the surface since the vein steepens to almost vertical dip between the 100 foot and 200 foot levels.

On the 100 foot level of the Superior, drifting has exposed the shear zone for about three hundred feet on either side of the shaft. Cross cuts show the shear zone to be at least 45 feet wide. A few raises have been driven but there is evidence of only small amounts of ore having been removed. No ore remains on this level, however, in many places the floor sounds hollow, indicating the possibility of stoping from below.

The 200 foot level also extends for several hundred feet on either side of the shaft. To the southeast, stoping is evident for at least two hundred feet of the drift. The stopes have all been filled with waste rock and most of the timbers have rotted,

Edward P. Jarvis, E.M.

giving way to much caving. The stopes here appear to average only about two feet wide, but this may be due to squeesing of the stope fill. Hanselman (1941) stated that at that time the ore was three to four feet wide on the two hundred foot level. It is probable that the 600 tons shipped by E.J. Baker in the late 30's, which averaged about 2.3 oz. silver. 15% lead 2.5 zinc, came from this level. North west of the shaft stopin and caving is also evidenced. There was no ore left on the 200 foot level.

The author was not able to gain access to the drainage tunnel from the shaft, due to deep water. Hanselman (1941) reports that the tunnel is in and out of the vein and exposes ore bodies for many hundreds of feet. He further states that considerable low grade ore of carbonate form was encountered toward the west end of the tunnel.

The report by Hanselman contains a fair discussion of the 300 foot level. He states; " The three hundred foot level, I am told is run on the vein both ways from the main shaft for 300 feet northwest and 250 feet southeast, exposing several fine shoots of ore. The estimated tonnage exposed from this development is reputed to be 50,000 tons, and is fairly high grade ore.

Mr. Hanselman's informer in the above statement was Mr. Tonkin Jr. who was the son the the mine superintendent and who worked in the Superior Mine as a boy.

Hanselman further states that "I am told that in the bottom of the shaft (Superior) the

Edward P. Jucevic, E. M..

vein is from 10 to 18 feet wide, and 3 to 4 feet or ore occurs on both walls. " All indications are that the ore between the 200 foot level and 300 foot level is still in place.

The fact that there was little ore on the 100 foot level, ore on the 200 foot level and a fair tonnage of ore on the 300 foot level, tends to indicate that this is the top of an ore shoot and that ore can be expected to continue with depth and probably increase in width and length.

Mr. Noble (1967) stated that the ore on the 300 foot level was all sulfide, being in the main pyrite. The mineralization on the upper levels indicates that the ore probably contained a large amount of pyrite before it was oxidized. Based on all available information, the vein in the sulfide zone will probably be made up of quartz and pyrite gangue and argentiferous galena, sphalerite and chalco-pyrite ore minerals. Some silver values may be in the form of tetrahedrite since Lawrence (1963, p. 156) reports finding this mineral in the ores of the area. The average of all the ore we have been able to find that has been shipped from the Superior Mine is about.

Au 0.01 oz/T
Ag 25.0 oz/T
PB 15.0 %
ZN 2.5 %
CU 0.35%

This shows ratios of silver to lead of about 2 to 1, silver to zinc of about 10 to 1 and lead to zinc of 6 to 1.

THE ANTELOPE MINE. The author was not able to make an on the spot investigation of the Antelope Mine due to a lack of time. However, the report of Hanselman, the map of Rogers, and

Edward P. Lucevic, E.M.

the information supplied by the smelters give sufficient information for evaluation.

The Antelope Mine is developed through four adits at various elevations on the hill. The No. 1 adit is on the vein, while the No. 2, No. 3 and No. 4 were driven to cross cut the vein. There are also numerous raises and winzes connecting the various levels. When Hanselman was in the area in 1941, many of the drifts along the vein were caved and Mr. Bill Davis of Sterling Mines tells me that except for the work he did last year, most of the drifting along the vein is caved.

The Antelope Mine is located in the N W ¼ of Sec. 31, immediately southeast and adjacent to the Superior Mine. The mine is on the Superior shear zone and the veins strike N 50° W. Two ore shoots were encountered in the drifting along the vein. One of the ore shoots rakes at 5[illegible]° following the dip of the bedding and possibly following one of the sandstone beds. The other is almost vertical. Both are continuous for the 500 vertical feet they have been explored and both improve with depth. The raking shoot begins only about 1.5 feet to 2.0 feet wide at the surface, but increases to double this amount with depth. It's length also increases from about 100 feet to several hundreds of feet in length. The vertical ore shoot is fairly consistent in length with depth but is reported to widen. It will average about 100 feet long. Although Rogers shows only one of the shoots having a split into a hanging wall vein and foot wall vein, Hanselman contends that both do. This is consistent with the split Hanselman refers to in the Superior ore shoot, at the

Edward P. Jugovic, E.M.

bottom of the shaft. Where the veins split and recombine, the ore is usually from 8 to 18 feet wide.

Indications are that most of the ore mined in the Antelope was oxidized in part. The No. 4 level was probably just about at the top of the sulfide zone. Reports of ores shipped indicate two general types; high zinc and low zinc ore. They average about the following analyses:

High Zinc Ore:

Au	0.01	oz/T
Ag	18.0	oz/T
Pb	6.0	%
Zn	17.0	%
Cu	1.9	%

Silver to lead	3 to 1
Silver to zinc	1 to 1
Lead to zinc	1 to 3

Low Zinc Ore:

Au	0.01	oz/T
Ag	22.0	oz/T
PB	12.0	%
Zn	6.0	%
Cu	2.1	%

Silver to lead	2 to 1
Silver to zinc	4 to 1
Lead to zinc	2 to 1

The ore shoots as they extend below the No. 4 level are excellent exploration targets and should produce a large amount of ore.

THE NOBLE MINE. The Noble Mine lies on the northwestern end of the Superior shear zone in the NW ¼ of Sec. 26. The author has never been on the ground but the map by Spurk (1958) and information obtained from Mr. Noble indicate that the mine is developed by two shafts, numerous adits and test pits. The only production information obtained was reported by Mr. Noble. He states that in

Edward F. Jycevic, E.M.

about 1917-1918 he shipped 50 tons of ore that, at that time, netted about $100.00 per ton. At today's metal prices, the same ore would net approximately $200.00 per ton. The area between the Superior Mine and Noble Mine holds excellent promise for new mineral production.

THE QUEEN MINE. The Queen Mine lies about 1500 feet southeast of the main Antelope workings (fig. No. 1) on the same shear zone and vein structure. Just recently a large bulldozer cut was put in at this property, covering the old shaft and tunnels. The shear zone and veins are, however, exposed by this work. The veins strike about N 50°E and dip almost vertically. The shear zone is not nearly as strong here as it is in the Antelope and Superior Areas and probably dies off southeast of the mine. Hanselman reports that the vein at the bottom of the shaft was four or five feet wide, but the ore only averaged from 8 to 18 inches wide. The Queen Mine should not be an area of immediate interest. However, if the major part of the Superior zone becomes productive, the Queen Mine would warrant further exploration.

IRON MASK SHEAR ZONE MINES

The Iron Mask Shear Zone lies parallel to and about 1500 feet north of the Superior shear zone. The mines from northwest to southeast are the Iron Mask and the Smith Canyon Property.

THE IRON MASK MINE

The Iron Mask Mine is located in the center of the E½ of Sec. 25 T. 33N., R. 30 E., and the center of the W½ of Sec. 30, T. 33N., R. 31 E.,

Edward P. Jurcvic, E.M.

about 1500 feet northeast of the Superior shaft. The mine is developed by an incline shaft reported to be 280 feet deep, and numerous drifts and adits. The shaft has been lagged over at about 80 ft. and about 10 to 20 tons of waste has caved on this lagged area. All of the adits are caved at their portals, but it would take little work to reopen them.

Read

Surface mapping at the Iron Mast indicates the presence at least two northwest trending veins. The most northerly vein is exposed in the small shaft at the portal of the Tomkin tunnel, on the 35 foot level of the Iron Mast Shaft, and in an adit down the hill from the Iron Mast Shaft, and has a strike of N 55°W and dips about 60° to the southwest. The more southerly vein is about 300 feet south of the Iron Mast shaft and has a strike of about N 45° and dips about 60° to the southwest. In the vicinity of the Tomkin tunnel, it is probably only 200 ft. south of the north vein. There are a number of north-south veins extending between the two main veins and the intersections of these two systems were locals for ore shoots. The ore from this mine is of very good grade. A sample taken from the north vein in the vicinity of a north-south vein on a 35 foot level of the shaft showed 14 inches that assayed:

Au	T	Silver - Lead	2 to 1
Ag	48.5 oz./T	Silver - Zinc	10 to 1
Pb	27.2 %	Lead-zinc	5 to 1
Zn	6.1 %		
Cu	.04%		

Edward P. Jugovic, E.M.

The International Smelter shows 28 tons of this grade ore shipped in 1938-39. Mr. Noble reports that Mr. Tomkin, Jr., shipped two cars of ore (approximately 100 T) from the Tomkin tunnel in the 30's, netting $14,000.00. This ore was contained in a north-south vein just below where it flattened in dip. The ore bodies on this property, although higher grade than those of the Superior and Antelope, are much smaller.

SMITH CANYON PROPERTY - The Smith Canyon Property is located in the E½ of Sec. 32 (fig. 1), east of the Antelope and Queen Mine. It is developed by many adits driven into the hill. No evidence of production was found, although the amount of workings indicate some production. It is not evident at this time whether the Smith Canyon area shears are part of the Iron Mast shear or an offset of the Superior shear. There are two parallel quartz veins, striking N. 40° W, around which most of the development has centered.

Lead-silver mineralization is evident in spots and some siderite gangue was noted in association with the quartz vein. This area should not be considered for immediate exploration, but would be very valuable once the other areas are explored.

MISCELLANEOUS

In the past all mining has been by open stoping methods. The stopes were sometimes filled, probably from waste development rock or hanging-wall raises. This method, though not inexpensive, would probably be used in future mining.

At the present time, there are no facilities of appreciable value on the properties. Neither is there any timber that would be useful for mining. There is a small amount of water running out of the drainage tunnel of the Superior Mine and a small amount running from the No. 4 tunnel of the Antelope. There would probably be sufficient water from these sources, for mining, but the nearest water in sufficient quantities for milling would be either three miles west of the Superior shaft in the valley, or nine miles east of the Antelope Mine, in the Humboldt River valley. The nearest power would probably be Imlay, 20 miles to the east, or Sulfur, about twenty miles to the north. The Southern Pacific Railroad is available at Imlay and the Western Pacific is available at Sulfur. Interstate 80 also passes through Imlay. Labor is available in Lovelock and Winnemucca, each of which is about 55 miles from the mine. Housing and trailer space is available at Imlay.

Edward P. Jurcvic, E.I.

CONCLUSIONS

This area is, in the author's opinion, one of the best silver-lead exploration possibilities in the State of Nevada today. The potential for developing a successful mining operation is very good. These conclusions are based on the following:

1) The main shear zone is 2 ½ miles long, very strong and continuous. It has been well explored for only a small percentage of its length.

2) The known ore shoots are at least 500 ft. in vertical length. Mineralogically, there is no reason to believe that these ore shoots will not go to good depths.

3) The ores are of excellent grade, averaging for the entire district better than 20 oz. silver per ton, 15% lead, 6% zinc and 1.2% copper.

4) The prospects for continued increases in the price of silver, the main economic metal in the district are excellent. Prominent members of the U. S. Mining Industry have forecast that silver will eventually reach $3.00 per ounce.

The Superior shear zone offers the better possibility for large production of ore and it is felt that this area should receive the major exploration effort.

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Edward P. Jugevic, E.M.

RECOMMENDATIONS

It is recommended that the following procedures be followed in exploring the property. They represent the most efficient and economical method of proceeding and would give the property its best chance for success. They would also prepare the property for exploration assistance from the Federal Government, under the Office of Mineral Exploration. The Federal Government is willing to assist with up to 75% of the cost of exploration of silver properties of merit. This money is loaned, interest free, and is paid back as a royalty of 5 % of gross smelter returns. I believe this property would easily qualify. The recommendations are listed in the order of their importance.

1) Acquire mining rights to all of Superior and Iron Mast shear zones.

2) Proceed with exploration of the Superior shear zone in the following manner.

   A) Begin to dewater and retimber the Superior shaft to the 300 foot level. Open this level to its extremes.

   B) Begin a topographic and geologic survey of the shear zone from one end to the other on a scale of one inch to one hundred feet.

   C) Map all underground workings that are accessible.

   D) Conduct a geophysical survey of the entire zone using self-potential methods. This method is easy, inexpensive, and probably the best method of finding additional ore shoots.

Copy No. 1

Edward P. Jacevic, E.I.

E) Conduct a geochemical survey over the zone to confirm geophysical work.

F) On the basis of the results of the above, layout an extensive drifting and drilling program.

G) Apply for Federal assistance for the extensive exploration program.

3) Proceed with the exploration of the Iron Mast Shear Zone in the following manner:

A) Clean out the shaft to gain access to lower workings.

B) Clean out all other workings so that access is provided.

C) Map very thoroughly on a scale of one inch to forty feet, the surface and underground workings, including all geology.

D) Proceed with drifting or drilling along the lines suggested by the results of the geologic investigation.

The initial exploration suggested for the Superior Shear Zone and the Iron Mast could be accomplished at a reasonable expense. However, the extensive exploration of the Superior Shear Zone would mandate a large expenditure. Hence, the recommendation of obtaining financial assistance from the Federal Government.

Copy No. 1

Edward P. Jucevic, E.I.

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Edward P. Jugovic, E.M.

EDWARD P. JUCEVIC, E.M.
Consulting Mining and Metallurgical Engineer
P.O. BOX 8077
UNIVERSITY STATION
RENO, NEVADA 89507
702-322-7765

4500 W. Speedway
Tucson
85712

December 1969

RESUME

Education:

Master of Science, Metallurgical Engineering; Mackay School of Mines, University of Nevada, Reno, Nevada; January, 1970.

Engineer of Mines, Mining Engineering; Colorado School of Mines, Golden, Colorado; January 1961.

Professional:

1967 - Present: Consulting Engineer Reno, Nevada; Engaged in various facets of the minerals industry ranging from geochemical exploration projects to plant design and construction. Conducted property evaluations, exploration programs and economic feasibility studies in Nevada, Colorado, Utah, Arizona, Idaho and California. Commodities included mercury, gold, silver, copper, uranium, lead, zinc and sulfur. Work was conducted for both individual entrepreneurs and large mining companies.

1966: General Superintendent Bretz Mine, Malheur County, Oregon; In charge of 300 ton per day mercury open pit mine and flotation plant.

1965: Self- Employed Reno, Nevada; With a partner conducted exploration and mine evaluation in Nevada and Idaho.

1963 - 1965: Employed 1/2 time by the Nevada Mining Analytical Laboratory a division of the Nevada Bureau of Mines while attending graduate school. Work included testing of Nevada metallic and nonmetallic ores for susceptibility to metallurgical treatment and the design of flowsheets for those ores.

1962 - 1963: Self-Employed Ely, Nevada; With a partner operated a small mine in eastern Nevada. Conducted exploration programs on several properties. Performed contract engineering for various individuals and companies.

1960 - 1962: Mine Engineer and Chief Engineer Sabre-Pinon Corporation (now United Nuclear), Grants, New Mexico; All engineering facets associated with two underground uranium mines producing about 30,000 tons of ore per month.

Previous: Summer experience as a miner in Idaho, Colorado, and California.