UNITED STATES
DEPARTMENT OF INTERIOR
OSCAR L. CHAPMAN-SECRETARY

DEFENSE MINERALS ADMINISTRATION

Report by Examination Team
Region II

DMA-418--Silver Butte mine

Lincoln County, Montana

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U. S. Geological Survey

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DMA Examining Team Report on Silver Butte Mine, Lincoln County, Montana

DMA Docket No. 418

By: Constantine C. Popoff and E. G. Erickson, U. S. Bureau of Mines
Bradley Myers and Henry Rainey, U. S. Geological Survey

RECOMMENDATIONS

The examining team recommends that Mr. F. R. Middaugh, the applicant, and the lessee of the Silver Butte mine, be denied any DMA assistance.

APPLICANT

The application for loan is filed by Mr. F. R. Middaugh in behalf of himself and his father, J. E. Middaugh. Both have a five year production lease from the Silver Butte Zinc-Lead Company. According to the application, J. E. Middaugh has 35 years mining and milling experience in Nevada, California, and Montana. F. R. Middaugh is at present employed by Riegel Brothers Dodge Dealers as truck salesman. He has experience in organization and maintenance of repair shops for the aircraft industry, but no experience in mining and milling.

LOCATION

The Silver Butte mine is mostly in sec. 7, T. 28 N., R. 30 W., Lincoln County, Montana. The property lies in an area of high relief between the altitude of 4,000 and 5,400 feet. The mine is reached from Libby, the county seat and a station of the Great Northern Railway, by driving 28 miles the Forest Service road along the Fisher River to the Silver Butte divide, a distance of about 15 miles.

OWNERSHIP

The property consists of 10 patented claims, two patented millsites, and 18 unpatented claims, with a total area of about 630 acres.

It is owned by the Silver Butte Zinc and Lead Company, Libby, Montana. The company was organized in 1943 with capital of $100,000. At present it owes a $25,000 mortgage on the property, and has outstanding debts in the amount of $800,00. The officers of the company are Wm. Curts, President and

Director, and Andrew Prader, Secretary and Treasurer. The former is a cattle man from Malta, Montana, and the latter a retired mining engineer.

The property is leased by J. E. and F. R. Middaugh. The original lease was for five years on a royalty basis of 25 percent of net smelter returns. At present, negotiations are in progress for a new lease with a 15 year term on a royalty basis of 12½ percent of net smelter returns.

HISTORY AND PRODUCTION

The deposit was discovered in 1883. It was purchased in 1905 and was operated as a gold-silver mine until 1910. Extensive development workings included four adits on the vein, and a crosscut adit. A gravity mill was installed to treat the lead-silver ores. It is reported that the lead recovery was low, and separation of lead and zinc was not achieved. In 1910, a forest fire destroyed the mill and surface building, and the mining operations stopped. Little mining was done by lessee until 1944, when the property was acquired by the present company. Further development of the mine included two raises from adit No. 1, one driven to the surface and other to adit No. 2, and a raise to adit No. 1 from the crosscut adit. A pilot mill was installed near the portal of the crosscut adit that was later increased to 50-ton capacity. Up to the present time the mill has failed to produce marketable zinc and lead concentrates.

The total metal output from the Silver Butte mine is small, and is limited to gold and silver produced by the Kentucky-Vermillion Mining Company before 1910. The Silver Butte Zinc and Lead Company has shipped 11 tons of lead concentrates to Bunker Hill Smelter at Bradley, Idaho in 1945. The assays reported for this lot are as follows:

Au - 0.025 oz/ton	S - 18.3%
Ag - 21.4 oz/ton	Sb - tr.
Cu - 0.33%	As - 0.34%
Pb - 40.9%	Bi - 0.114%
Zn - 22.5%	Ins. 9.9
Fe - 3.9	

Twenty tons of zinc concentrates were shipped to Sullivan Mining Company electrolytic zinc plant, Silver King, Idaho, at the same time. The assays of this lot were:

Zn	42.7%
Pb	6.8%
Ag	4.3 oz/ton
Fe	8.0%
Insol	15.2%

DESCRIPTION OF PROPOSAL

The applicant requests DMA assistance in form of a direct loan in the amount of $52,500. The nature of the proposed use is as follows:

Purchase of equipment (bulldozer)	$ 6,000.00
" of supplies	6,900.00
Payroll two months	11,900.00
Contract price for raising 230 feet to connect adit No. 1 with crosscut adit for handling ore	5,000.00
Debts and Insurance	1,400.00
Transportation (concentrates)	1,000.00
Repairs	300.00
	$52,500.00

According to application the loan will put the Silver Butte Zinc and Lead Company on a production basis in a period of 60 days. The expected output of the mill is 120 tons of lead and zinc concentrates per week. Average grade of milling ore is assumed to be 4.7 percent lead and 19.2 percent zinc, or a total of 23.9 percent of combined metals. Repayment of loan is offered at 5 percent net smelter returns.

GEOLOGIC SETTING OF DEPOSIT

The Silver Butte mine explores a quartz replacement of a shear zone in argillite and fine-grained quartzite of the Pritchard formation. The shear zone has an average strike of N. 55 W., in the main level of the mine. (See fig. 1). The shear dips southwestward at angles which vary from 45° in the northwestern part of the mine to as low as 30° in the southeast part for the interval between the surface and the main adit level. The dip flattens slightly with depth, averaging about 35° between the main adit level and the lower crosscut. Although the beds locally parallel the shear zone in the main workings, observations on the surface and in the southeastern workings indicate that the shear zone strongly truncates the bedding at these points.

The central part of the shear zone is fairly well defined and averages about three feet thick. Where partially replaced by quartz and sulphide, it constitutes the vein zone. On the main adit level the black argillite and minor fine-grained quartzite which forms both the foot and hanging wall of the zone is more or less sheared. This less intensely sheared zone is commonly but a few feet thick in the footwall of the vein zone, but may be as much as 30 feet wide in the hanging wall where it is overlain by quartzite, separated from the argillite by a prominent bedding plane shear.

In the lower crosscut level the vein zone is represented by a sharp fault plane with spotty mineralization both in the quartzite footwall and the sheared black argillite hanging wall.

On the main adit (No. 1 tunnel) level the shear zone is more or less completely replaced by quartz beyond a point about 150 feet in from the portal. The quartz occurs as tabular or lenticular bodies arranged parallel to the attitude of the shear zone and set in a matrix of soft sheared black argillite. Individual bodies range up to several feet in thickness and scores of feet in length, but most are only a few inches or less in thickness and a few feet in length. The percentage of quartz varies widely within a few feet but averages 60 percent over an 800 foot length.

The ore minerals are dark brown massive sphalerite and galena which locally replace the quartz bodies forming distinct streaks or bands of massive sulphide in the sheared argillite. The distribution of the ore minerals is shown by the assays plotted on fig. 2, and diagrammatically by the vertical longitudinal projection on fig. 1. The ore minerals are locally accompanied by a very minor amount of pyrite, estimated to be not more than two percent of the total of sphalerite and galena. Traces of chalcopyrite locally cause a little copper staining.

Zinc-lead mineralization is exposed for more than 800 feet in the main adit. At a point about 960 feet in from the portal the workings turn into the hanging wall of the vein. The vein assays 7.7 percent combined Pb and Zn at its last complete exposure. A few feet beyond the hanging wall portion of the vein zone, exposed in the floor, is barren pyritic quartz, which can be traced to a point about 30 feet southeast of the last sample. Now, a crosscut towards the footwall exposes 30 inches barren massive pyritic quartz, without doubt the same vein. Similar mineralization is exposed continuously to the raise at the face of the adit level, a distance of more than 800 feet. A crosscut to the raise cuts 6½ feet of massive pyritic quartz with traces of sphalerite and galena. The raise to tunnel No. 2 indicates that the mineralization on that level is in a different vein zone which lies in the hanging wall of the vein zone on the main adit level. This higher vein is essentially barren where it leaves the raise midway between levels and would probably be barren on the main level below.

An examination was made of the surface, tunnel No. 3 and the lower crosscut and raise to the main adit. The major structure and notes on lithology and mineralization are plotted on the composite plan on fig. 1.

Mine Workings

The mine workings are illustrated on fig. 1. All but tunnel No. 4 are accessible.

Previous USBM Examination

The mine was examined by George H. Bennett, USBM engineer, on September 4, 1943. The results of this examination were submitted for publication as a War Mineral Report in 1944 under the title "Silver Butte Mine, Lincoln County, Montana."

The results of sampling by Bennett are as follows:

Sample No.	Location	Width feet	Percent Lead	Percent Zinc	Oz/tn Ag	Oz/tn Au
Bennett 202	adit No. 1 150 ft. from face	1.0	4.7	18.4	2.15	0.010
Bennett 204	same center big stope floor	4.0	3.3	1.2	3.75	0.005
Bennett 205	lower adit (crosscut) at vein intersection	4.0	7.6	0.4	16.80	0.025
Average			5.2	6.6	7.6	0.013

Indicated ore reserves were estimated by Bennett to be equal 45,000 tons of grade similar to the ore sampled. 30,000 tons of ore outlined by surface trenching and underground workings were considered to be reasonably assured.

It should be noted that Bennett's average approximates an arithmetic average. A weighted average sharply reduces the computed grade for zinc.

Thickness weighted average of Bennett's samples

Width in feet	Pb Percent	Zn Percent	Ag oz/tn	Au oz/tn
3	5.4	2.8	9.4	0.014

Sampling

In the limited time available for examination, no attempt was made to completely sample the mine. It is apparent that a large number of samples would be required to determine the distribution of ore minerals and the average grade with accuracy. The mineralization varies greatly, and individual samples cannot be projected safely for more than a few feet at most.

Check samples have been taken to determine the degree of accuracy of several previous samplings. The work was limited to adit No. 1. During the original examination samples of the mineralized zone were taken at every other chute, or approximately at 70-foot intervals. The rest of the zone was sampled at irregular intervals.

The location and results of this sampling are shown on table 1 and fig. 2. The results of this sampling were not encouraging, but with the more favorable economic picture occasioned by the prospect of a long-term lease at a lower royalty, it was felt that the deposit merited more sampling. During the second visit, samples were taken midway between the original sample locations in the southeast part of the main adit level and along the back of the stope in the northwest part. The results of this later sampling are shown on Table 2 and the location and computed values on fig. 2.

The DMA sampling between chutes 4 and 6 compares favorably with that of professor D. A. Diagnan of the Montana School of Mines who sampled the mine in 1948 for metallurgical testing. His results follow:

Sample No.	Location	Percent Pb	Percent Zn	Percent Fe	Percent Ins.	Oz/ton Ag
8	adit No. 1 along the hanging wall lead-100'	1.3	4.4	-	-	0.4
7		3.0	1.4	-	-	0.8
6	between chutes 5 & 6	3.9	1.7	2.0	86.8	2.7
5	between 4 and 5	4.7	0.4	2.0	87.3	2.6
4		6.0	1.5	-	-	3.8
Composite (used as heads for metallurgical tests)		3.7	2.0	1.8	86.1	2.3

Results of previous sampling by the Silver Butte Zinc and Lead Company are summarized in table 3 and recorded on figure 2. The spotty distribution of ore in the mineralized zone and the necessity of methodical sampling is apparent.

RESERVES

Although the Silver Butte mine has rather large reserves of rock containing sub-marginal amounts of zinc and lead, the reserves on which mining might be contemplated are not extensive.

The DMA samples indicate (figure 2) that on No. 1 tunnel level only two short segments of the vein zone can be safely considered to contain more than 6 percent combined lead and zinc. In addition, a third segment, inadequately sampled, may possibly contain more than 6 percent combined Pb + Zn above the level.

If it is assumed that the quantity and grade of ore exposed on the No. 1 tunnel level extends directly up and down the dip

to the top and bottom respectively of the ore body as inferred on the longitudinal projection, a total of 6,600 tons of ore averaging 9.45 percent combined Pb + Zn may be computed. An additional 2,500 tons of ore of uncertain grade but probably greater than 6 percent combined Pb + Zn may be inferred above the stope back in the northwest part of the stope. From examination of all the accessible workings and the dumps of those inaccessible, it is believed that no other ore reserves are exposed on the Silver Butte property. Therefore, the estimated reserves total only 9,100 tons with a grade of 9 percent combined Pb + Zn.

Of the total minable reserves, one-half is considered indicated and one-half inferred.

Mining Methods

On the level of adit No. 1 the mine has prepared for overhead open stoping along the strike of the vein for a distance of about 550 feet. Twenty-one chutes have been installed, and an attempt of actual stoping was made. Individual stopes have been advanced in some places for several score feet.

Although the accompanying sheared shale is soft, the ore is hard, and the walls in general stand well. Sloughing in old stopes is only found on a limited scale considering the 40-year interval some of them have remained open.

This method of mining is entirely feasible; ore could be followed and submarginal rock left as pillars. Stulls or other timbering would be necessary only locally.

Slushers could be used to deliver the ore to chutes. Direct tramming of ore to the portal of adit No. 1 would require truck hauling, or construction of an aerial tramway to the millsite. Instead the applicant proposes to drive a near-vertical raise, to be used as an ore-pass, from the crosscut level up to the adit level at No. 3 chute. The present raise on the ore zone between the adits is suitable only for ventilation.

Milling Methods

The problem of producing marketable lead and zinc concentrates with reasonably low lead tailings has not yet been solved. Disregarding the previous experience of the Kentucky-Vermilion Mining Company, who failed to produce satisfactory lead-silver concentrate, the Silver Butte Zinc and Lead Company installed a new flotation mill in 1940. Since then the mill flowsheet has been changed repeatedly. In 1948 rather extensive benefication tests were made

by the Montana School of Mines. It was found that a high percentage of oxidized lead ore from near-surface samples prevented the separation of lead and zinc sulphides and caused considerable loss of lead in the tailings. Although these were not completed, an experimental run of the new mill for two months followed. Mr. Moody, a student of the Montana School of Mines, states in his brief report that the mill tests were not completed but were considered satisfactory to warrant production without additional equipment, provided that only slightly oxidized ore is used. Moody recommends additional tests to increase the efficiency and capacity of the mill by upgrading heads, by sink-float treatment of the coarse and by Dutch State mines cyclone separation of the fines.

Per request of the DMA team, the mill plant was examined by John D. Bardill, Chief of Non-ferrous Branch, Region II, USBM. A copy of his report with a brief description and flowsheet and conclusions is enclosed. (Supplement 1.)

FACILITIES AND EQUIPMENT

The mine is adequately equipped for small scale mining operations. Bunkhouse accommodations are sufficient for a crew of 12 or 14 men. Mining equipment includes three jackhammers, four stoper, blacksmith shop, compressor, etc. The mine is equipped with ore bins, railways and airlines. For details on flotation mill see "Ore Milling Facilities at Silver Butte Mine", by John D. Bardill (Supplement No. 1).

DISCUSSION

The ore reserves and the average grade were assumed by lessee as follows:

Ore blocked out and probable	- 75,000 tons
Ore inferred	- 75,000 "
Average grade:	4.7 percent/19.2 percent Zn and 4.4 oz/tn Ag. Pb

The above data was not confirmed during the examination. It was found that reserves of high-grade ore that can be mined selectively are negligible. Reserves of milling ore (above 6 percent) are estimated to total 9,100 tons.

It is the opinion of the team that the isolated location with attendant high costs, coupled with the unsatisfactory condition of the mill render the estimated grade and tonnage of the reserves too low for consideration. The team further believes that the possibility of finding significant reserves of minable ore by further exploration is not sufficiently great to warrant an exploration program either by the present lessor or by the owner.

Table No. 1

Analyses of Original DMA Samples from Adit No. 1 Silver Butte Mine, Lincoln County, Montana. Taken by C.C. Popoff

	Sample Nos.	Location	Hanging Wall Section True Thickness Feet	Hanging Wall Section Percent Pb	Hanging Wall Section Percent Zn	Footwall Section True Thickness Feet	Footwall Section Percent Pb	Footwall Section Percent Zn	Mineralized Zone True Thickness Feet	Mineralized Zone Percent Pb	Mineralized Zone Percent Zn
Northwest Section	220 221	Chute 4	1.7	6.5	1.3	1.2	0.5	0.4	2.9	4.02*	0.93*
	CCP-214	" 6	-	-	-	-	-	-	2.9	0.09	1.0
	CCP-222 223	" 8	1.3	0.6	2.9	1.7	0.2	1.3	3.0	0.37*	1.99*
	CCP-215 216	" 10	1.8	2.3	3.8	1.7	0.2	0.4	3.5	1.28*	2.15*
	CCP-224	" 12	several thin sphalerite streaks						3.2	2.1	3.0
Southeast Section	CCP-217 218	" 14	2.6	0.4	0.7	3.4	0.6	1.2	6.0	0.50*	0.98*
	CCP-225	" 16	-	-	-	-	-	-	3.6	0.9	3.1
	CCP-219	between 19 & 20	sphalerite streak up to 0.5 ft. in thickness. (streak between chutes 20 & 21 up to 1.0 ft.)						5.0	0.4	2.3
	CCP-226	21	several sphalerite streaks less than 0.2 ft.						2.2	0.7	3.3
	CCP-228	51' SE chute 21	sphalerite streaks up to 0.2 '						2.4	0.3	2.4
	CCP-229	105' " " 21	sphalerite streaks 0.5 and 0.2 ft. in thickness.						3.1	2.1	7.0
	CCP-230	151' " " 21	sphalerite streaks 0.3 and 0.1 in thickness.						3.0	2.1	3.6
	CCP-231	173' " " 21	several sphalerite streaks from 0.5 to 0.1 in thickness.						3.3	2.3	5.4

* computed

Table No. 2

Analyses of DMA check samples from Adit 1
Taken by E. G. Erickson during re-examination of Silver Butte Mine, Lincoln County, Montana

Samples Nos.		Total High-Grade Streaks			Low-Grade Portion			Mineralized Zone		
		True Thickness Feet	Percent Pb	Percent Zn	True Thickness Feet	Percent Pb	Percent Zn	True Thickness Feet	Percent Pb	Percent Zn
Southeast Section	EGE 99	130' SE of Chute 21	0.55	3.4	11.6			2.85	0.7	2.7
	100	" " " " "				2.3	0.0	0.6		
								3.1	0.0	3.0
	EGE 101	78' SE of Chute 21								
	EGE 102	25' SE of Chute 21	1.5	7.0	7.9					
	103	" " " " "				1.5	0.4	1.5	3.0	3.7	4.7
	EGE 104	30' NW of Chute 21	1.5	1.5	10.8					
	105	" " " " "				1.5	0.0	1.9	3.0	0.8	6.3
	EGE 106	footwall sample below EGE 105				3.5	trace	2.6		
	EGE 107	65' NW of Chute 21	2.3	4.1	12.4				3.0	3.2	9.9
	108	" " " " "				0.7	trace	1.1		
Northwest and Central Sections	EGE 109	Stope back above Chute 18							4.7 (y)	0.4	4.8
	EGE 110	" " between Chutes 12 & 13							3.8	1.1	5.3
	EGE 111	" " above Chute 11							4.0	trace	0.0
	EGE 112	" " " " 9							2.5	trace	2.4
	EGE 113	" " " " 7							5.7 (y)	00	0.0
	EGE 114	" " between Chutes 4 & 5							3.0	5.5	2.7
	EGE 115	" " above Chute 19							5.0 (y)	trace	2.1

* Where indicated by (y) sample was taken across minimum mining thickness as estimated by Erickson and includes some waste.

Table No. 3

Analyses of Samples taken by Silver Butte Company from Adit No. 1

Sample Nos.	Location	Width ft.	Percent Pb	Percent Zn	Oz/tn Ag
12"	Stope between chutes 3 and 4	3.0	5.9	3.7	3.9
11	Stope chute 4	8.0	8.5	0.0	8.4
10	Stope chute 5 (footwall)	6.0	7.5	2.8	4.8
9	Stope between chutes 5 and 6	2.5	14.2	9.2	6.6
8	Stope chute 7	2.0	6.3	4.6	2.6
7	Stope chute 8	2.5	2.1	8.6	1.0
6	Stope chute 9	2.5	2.6	11.2	1.2
5	Stope between chutes 12 and 14	2.5	0.9	2.6	0.7
4	Stope chute 14	4.0	2.5	4.6	1.3
3	Stope chute 14 and 15 (hanging wall)	4.0	3.7	8.3	1.8
2	Stope chute 15	5.0	3.4	4.7	3.8
1 S	Between chutes 15 and 16	4.0	2.0	1.2	1.6
N	Between chutes 15 and 16	1.0	6.5	26.1	4.6
Weighted Average		3.9	5.3	4.7	3.8
Total combined metals			10.0 percent		

Supplement No. 1

Memorandum

To: DMA Field Team, Region II

From: John D. Cardill

Subject: Ore Milling Facilities at Silver Butte Mine - F. R. Middaugh, lessee, Silver Butte Zinc Lead Mining Company, Lincoln County, Montana - DMA Docket No. 418

F. R. Middaugh and J. E. Middaugh, lessees from the Silver Butte Zinc Lead Mining Co., have filed application for a production loan in the amount of $32,500 under the Defense Production Act of 1950. The purpose of the loan is to furnish funds for a 230-foot raise, payroll for two months, repairs, supplies, trucking, and purchase of a bulldozer to maintain the road to the Silver Butte Zinc-Lead mine.

On May 19, 1951, accompanied by F. R. Middaugh, I visited the mining property and examined the ore milling facilities there to determine their adequacy for treating any zinc-lead ore that might be produced from the mine.

Initial construction of the mill plant reportedly commenced in 1944, with additions being made sporadically. Numerous attempts were made to operate the mill during August 1949, but because of the poor equipment and its faulty installation the mill never operated as a unit at one time. The mill would have to be almost rebuilt at considerable expense to be satisfactory.

The flowsheet was said to have been changed repeatedly. The probable flowsheet as indicated by the present arrangement of the equipment was as follows:

Mine run was trammed to the head of the mill and dumped through a grizzly into a 50-ton coarse ore bin. Coarse ore was crushed in an 8" x 10" Union Iron Works jaw crusher into an elevator and elevated and discharged into a 12" x 24" Union Iron Works rolls, then into a 50-ton fine ore bin. This fine ore was ground in a 4-1/2'x24" Hardinge ball mill which discharged into a 15' x 27' simplex drag classifier. The oversize from the classifier was to be transported by a screw conveyor to a 3'x4' U.I.W. ball mill in closed circuit with another simplex classifier. The overflow from both classifiers discharged into the second cell of a bank of six 24" x 24" cells (probably U.I.W.). A clean lead concentrate was recovered from the first cell, thickened and filtered on one leaf of a two-leaf American type filter. The rougher concentrate from the five cells was returned to the first cell for cleaning. The tailings from the lead cells overflowed to a conditioner, then, after being conditioned, was pumped to the third cell of another bank of six cells. The first three cells presumably yielded a clean zinc concentrate which was thickened and filtered on the second leaf of the American type filter. The last three cells, although not connected in the circuit, probably were intended to produce a rough concentrate to be returned to the cleaner circuit.

Sufficiency of water for milling during the dry summer months could not be estimated since the trip to the mine was made during a thaw when two mountain streams were flooded.

No analysis of the mill feed or concentrates was available, although Mr. Middaugh stated that because of a leaking filter each concentrate was contaminated with the other.

Samples of the ore taken underground by C. C. Popoff, Bureau of Mines engineer, indicated roughly 1 ounce of silver, 2 percent lead, and 4 percent zinc in the vein material having an average width of about 3 feet.

I understand that F. R. Middaugh and J. E. Middaugh, lessees, are obligated under the terms of their 5-year lease to pay a 25 percent royalty on net smelter returns to the lessor, the Silver Butte Zinc Lead Mining Co. This royalty is prohibitive.

Mr. J. E. Middaugh is, I believe, an old-time prospector, and his son, F. R. Middaugh is a truck salesman in Spokane. While they are both sincere in their efforts, I believe them both incompetent to property develop and operate the mine and mill.

The isolated location and difficult access to the mine and mill by mountain road will appreciably increase cost of transportation of supplies and make procurement of satisfactory labor difficult.

Recommendations

In view of the above adverse conditions and more particularly because of the low tonnage and tenor of the ore and the inadequate milling facilities, I recommend the loan be refused.

John D. Sardill