D E F E N S E M I N E R A L S A D M I N I S T A T I O N

R E P O R T

DMA DOCKET No. 331

STAR MINE AND MILL

Neihart, Cascade County, Montana

DMA FIELD TEAM, REGION II

W. A. Mapell

For

U. S. BUREAU OF MINES

And

Allan F. Griggs
Thor L. Kiilsgaard

For

U. S. GEOLOGICAL SURVEY

March 7, 1951

CONTENTS

	Page
Recommendations	[illegible]
Purchase contract	1
"Y" Loan	1
Repayment	1
Applicant	1
Location of deposit	1
Ownership	2
History and past production	2
Description of proposal	[illegible]
Technical feasibility	3
Geological setting of the deposit	3
Mine workings	4
Reserves	5
Measured	5
Indicated	6
Inferred	6
Mining methods	7
Milling methods - Costs	7
Operating profit	8
Costs of production	8
Mine schedule	8
Marketing	9
Equipment and facilities	9
Labor supply	9
Power	10
Transportation	10
Adequacy of requested funds	10
Capacities of applicant	11
Conclusion of proposal and suggested alternatives	11
Appendix	

[illegible], [illegible], Ontario
([illegible] 301)

[illegible] and [illegible] Mill, [illegible]
[illegible] Mills, [illegible]

[illegible]

It is recommended that [illegible] be granted a [illegible] contract for zinc, and also a "A" loan on the Salt Mine, Delhart, [illegible]. However, it is not recommended that [illegible] a loan for drivi[illegible] [illegible] as originally proposed. Instead, it is proposed that Alternative Proposal No. 1, (to rehabilitate the Queen shaft and [illegible] level) be given first consideration. In the event that a working [illegible] cannot be reached with Mr. Caswell, principal owner of the Queen Mine, it is recommended that Alternative No. 2 be considered.

[illegible] Contract

It is recommended that Mr. [illegible] be [illegible] a purchase [illegible] for [illegible] tons of zinc, the contract to extend over a period of three years.

"A" Loan

It is recommended that Mr. [illegible] be loaned $85,000, if plan [illegible] Alternative No. 1 is adopted.

It is recommended that Mr. [illegible] be loaned $115,000, if plan [illegible] Alternative No. 2 is adopted.

Repayment

It is proposed to repay the loan by a payment of [illegible] percent of the [illegible] smaller returns from Mill Concentrate.

[illegible]

[illegible] Mr. [illegible] of Delhart, Ontario, has submitted a [illegible] for a production loan, which, under the present setup, should [illegible] viewed as an application for a purchase contract and "A" loan for the [illegible] Mill property, Cascade County, Delhart, Ontario. Mr. [illegible] is the owner of the property.

[illegible] OF PROPERTY

The mine is in the Delhart Mining District, Cascade County, Ontario, [illegible] 29 and 32, T. 14 N., R. [illegible] E., Ontario principal meridian. The present work is being carried out on two claims, the Equator and the [illegible], with the Mill being located on the [illegible] claim (see attached map).

[illegible]

Mr. L. [illegible] Stark owns a total of [illegible] patented and 5 unpatented claims in the district. He apparently is the sole owner of the property and equipment. However, there is a loan of $30,000 outstanding against the property.

History and Production

The Salt claim first was located on January 1, 1866. The mine was operated intermittently for many years by the Salt Mining Co. In 1[illegible] an agreement was made with the Queen Mining & Milling Company, which gave the Salt Mining Company the right to extend the main Queen adit for a distance of 400 feet and to use this adit for development of the Salt veins. A charge of $0.50 per ton was made for all ore or waste moved through the Queen adit.

The mine was idle from 1897 to 1899. It was operated during 1900 and 1901, but was again idle in 1902-05. Considerable ore was mined from 1906 to 1908. The mine was closed from 1908 to 1916. From 1916 until 1920, it was again in continuous operation. It was worked intermittently by various operators from 1920 until 1945, when it was purchased by Stark and Olives, who have operated it steadily since that date. Since 1963, Mr. Olives, Stark's partner, has died, and Stark is now sole owner of the property.

It is known that a large amount of work was made before 1901, but no [illegible] of ore are available. Production from 1901 to 1960, inclusive, is reported to have been 31,4[illegible] tons of ore, from which was recovered 2[illegible] ounces of gold, 825,712 ounces of silver, 5,[illegible] pounds copper, [illegible],292 pounds lead, and 1,[illegible],574 pounds zinc.

[illegible]

Mr. Lewis L. Stark is applying for a loan of $150,000.00, the money to be spent in approximately the following manner:

Additional milling equipment	17,500
" mining equipment	7,500
Payment of loan	30,000
Driving 1,500 ft. drainage adit	46,[illegible]
Sinking 300-foot winze	37,000
Working capital	[illegible],000

The $30,000 loan was incurred when Mr. Stark had to purchase the interest of his deceased partner. This loan is due in October of this year.

[illegible]

[illegible]

Geological [illegible] on the property (Cont'd)

The ore consists principally of galena, sphalerite, pyrite, and subordinate chalcopyrite in a gangue of quartz, iron carbonate—possibly siderite, and barite. In the [illegible] No. 1 and No. 2 tunnel levels, where the ore was oxidized, a number of silver minerals, including wire silver, are reported to have been found. Quartz stringers were common in the vein.

The limited field examination by the [illegible] A field party did not [illegible] for a study of the possible structural control of the ore bodies. There is evidence that the veins widen in those areas of steeper dip, and at the intersection of the main vein and the footwall splits. There is no indication that the ore has been terminated, but rather it is believed that ore will continue well below the lowest mine level, the 300-foot level.

The consistent character of the main vein on the equator and queen levels suggests that it will continue well to the northeast into the Lovelia claim. Continued drifting to the northeast may open up appreciable ore bodies. In addition, other exploration that might yield favorable results would be to crosscut to the equator vein from the queen level east of the queen level winze, and to crosscut the various footwall splits from the queen and 300-foot levels.

Mine workings

The main [illegible] was driven through the main No. 1 and No. 2 tunnels (see accompanying longitudinal section). These tunnels have been worked in recent years and are now largely inaccessible, although certain parts of the No. 2 tunnel [illegible] are open.

[illegible] a lower [illegible], the lower [illegible] main report [illegible] the queen level, and also [illegible] the queen 300-foot [illegible] queen shaft. [illegible] arrangement [illegible] the owners of the queen [illegible] called for a [illegible] cents per ton for all ores treated [illegible] [illegible]. This arrangement [illegible] interfering with the main [illegible] development and [illegible] of the main vein.

[illegible] main tunnel [illegible] through the equator main, [illegible] portals 130 feet [illegible] east of the queen portal, [illegible] the equator vein. [illegible] from the portal, the [illegible] main crosses the main [illegible] vein. [illegible] crosscut northeast [illegible] main vein [illegible] footwall splits on the vein. [illegible] have been put in from the equator level on the main vein and the footwall splits, and most of the [illegible] above that level has now been [illegible]. [illegible] crosscuts were driven from the main-vein footwall and some [illegible] fractures were found and drifted [illegible] but did not reveal any [illegible] reliable [illegible] of ore.

Mine workings (cont'd)

In 1900, Mr. Stark sunk a winze from the Equator adit level to the Queen level. It was Stark's intention to open the Queen level north of the winze and mine the block of ore between the Queen and Equator levels. Upon reaching the Queen level, Stark found the north Queen drift caved and had to turn to the south where the Queen level was open for about [illegible] feet. At the present time, Stark is mining from two stopes in that vicinity (see longitudinal section).

Mining on the Queen level is hampered by an up-hill tram to the badly corroded winze and by the absence of a winze skip pocket on the Queen level. The Queen level is badly caved between the portal and the present working stopes, and it is believed that it would be impracticable to try and reopen it even though a working agreement might be reached with the Queen owners.

Any future mining below the Queen level will require either the costly sinking of the present winze or the rehabilitation of the Queen shaft and Queen 300-foot level, both of which are now flooded and inaccessible. From conversation with a miner, who worked in the 300-foot level in 1942, it is believed that it would not be too difficult to reopen that level. The first 5 sets of the Queen shaft are badly in need of replacement; however, it is not believed that the rest of the shaft would be too difficult to dewater and rehabilitate.

Reserves

In calculating ore reserves, primary consideration was given to the footwall vein. The only footwall-split vein considered was the footwall vein near the northern end of the Equator adit level, which has been stoped for 220 feet, and which continues downward to and possibly below the Queen level. Other footwall splits, such as the footwall vein near the top of the [illegible] to the Queen level, were not considered, inasmuch as they are discontinuous and unreliable.

In the area north of the winze between the Queen and Equator levels, and in the areas below the Queen level, the writers have leaned heavily on the longitudinal section and its accompanying assay data, which was kindly furnished by the Anaconda Copper Mining Company.

Measured

No ore reserve has been classified as measured, inasmuch as accessible mine workings do not disclose ore bodies that can be measured.

Indicated

By using a tonnage factor of 12 cubic feet per ton, and a mean width of the ore as reported in the assays and by measurement, the following tonnages were computed:

3,000	tons (approximate)	in the No. 2 Galt tunnel dump.
3,000	"	to be taken by open cut mining from the Galt outcrop above the No. 1 Galt tunnel.
4,300	"	from a block above the northern stopes above the Equator level. This tonnage will be difficult to mine and will have substantially higher mining costs.
6,700	"	from blocks between the Queen and Equator levels.
21,000	"	between the Queen and the underlying 300-foot level.
Total 38,000	tons	

A longitudinal section in U. S. Bureau of Mines Information Circular 7500: Lines and Mineral Deposits of Cascade County, Montana, by Alison F. Robertson, indicates that a block of ground has been mined in the area between the Queen and 300-foot level. Mr. Stark does not know of any mining that has been done in this area, and also stoped areas do not show on the U.S.B.M. longitudinal section. However, if mining has been done in this area there are probably about 15,000 tons remaining instead of 21,000 tons as was calculated.

By using a mean assay of 0.83 ozs. Ag., 2.43 percent Pb, and 3.90 percent Zn, and by assuming a 90 percent recovery for Ag, Pb, and Zn, under the present metal prices the total indicated ore reserve has a value of $620,000.00, after smelter and shipment charges.

The indicated ore below the Equator adit level, which totals 27,700 tons, has a value of $462,000.00. If the aforementioned stoping has been done between the Queen and 300-foot level, there will be approximately 15,000 tons of ore remaining instead of 21,000 which will have a value of 341,000.

Inferred

There is an inferred 20,000 tons existing below the 300-foot level and in the northern end of the block between the Queen and 300-foot levels.

This gives a total for indicated and inferred ore of 58,000 tons, which, with a grade of 0.79 ozs. Ag, 2.07 percent Pb, and 3.64 percent Zn, would

have a net value of $705,320 after smelter charges and metallurgical [illegible].

Mining Methods - Costs

The present mining method is overhand cut and fill. The vein first is shot out and slushed to the chutes, then the walls are slabbed.

Costs are variable, inasmuch as the vein pinches and swells both vertically and horizontally. The operator has kept no accurate records of mining costs; consequently, only an estimate may be made.

Under the present setup using the adjacent tunnel and hoisting through the present winze, the owner estimates his mining costs to be a little over $2.00 per ton. However, this figure undoubtedly is low and costs will more closely approach $3.50 per ton. To this figure would have to be added a cost of at least $3.00 for the development and exploration, and a 50 cent charge for overhead, making a total cost of around $7.00 per ton for ore delivered to the mill. A production increase to 75 tons per day may lower these costs 50 to 75 cents per ton.

Milling Methods - Costs

The Star Mill (see Description No. 4476) is a selective flotation plant. It produces a zinc concentrate and lead concentrate. During 1960, it was capable of producing at a rate of approximately 40 tons per day (on a three-shift basis).

With the aid of an additional crusher, vibrating screen, several additional flotation cells and doubling the filter capacity, it is estimated that the capacity of the mill could be increased to 75 tons per day.

No accurate records are kept on milling costs. Present costs are estimated at (40 tons per day) at $2.75 per ton. By increasing the output to 75 tons per day, mill costs should be lowered to about $2.25 per ton.

Operating Profit

The tabulation below gives a cost breakdown and the operating profit.

[illegible] per ton after:

Smelter Charges and metallurgical losses	17.4

[illegible] per ton:

Direct mining costs	13.00
Exploration development	3.00
Overhead	.50
Milling costs	2.75
15% [illegible]	[illegible]
[illegible]	[illegible]

[illegible] PAYMENT OF LOAN: [illegible]

Rate of Production

The zinc [illegible]wood lead and zinc concentrates during 1950 from 11,[illegible] tons of ore at a rate of 299,202 pounds of zinc, 203,686 pounds of lead, and 34,411 ounces of silver per year. By increasing mill heads as indicated by ore reserves, and by increasing the mill capacity to 75 tons per day, approximately 1,000,000 pounds of zinc, 700,000 pounds of lead, and 120,[illegible] ounces of silver should be produced per year.

Time Schedule

The proposed increase of production to 75 tons per day can be reached within 3 months from the time of receiving the loan, by use of present workings.

Marketing

The zinc concentrate is shipped to the smelter of the Anaconda Copper Mining Company at Great Falls, Montana.

The lead concentrate is shipped to the American Smelting and Refining Company at East Helena, Montana.

EQUIPMENT AND FACILITIES

At present there is a 40-ton selective flotation mill (Star Mill) in operation. This mill is located about one-half mile from the Salt Mine. The mine is equipped with all necessary mining tools to produce up to 40 tons per day.

To increase the production to 75 tons a day as proposed, the following additional equipment is necessary:

For mill--

	Pounds net	Cost
Secondary crusher 22" Symons cone,	7,160	[illegible]
25-hp. motor for crusher	1,110	[illegible]
Vibrating screen 5' by 6' Denver with 5-hp. motor	1,540	1,[illegible]
2 each Flotation cells, used	3,000	1,[illegible]
Filter 4' diameter by 4 discs, Denver	1,500	1,[illegible]

For mine--

Air tramer	3,500	1,[illegible]
1500 feet-4 inch pipe	16,000	2,[illegible]
10 20-cu. ft. mine cars	10,000	2,[illegible]
75-ton ore bin		1,[illegible]
Compressor shed		[illegible]
Shop		[illegible]
Dry and change room		1,[illegible]
200 gpm pump with electric motor 450' head, including wiring and discharge line	6,000	2,[illegible]

This would give a cost of approximately $12,000 for additional mill equipment and approximately $13,000 for additional mine equipment. This cost may be reduced up to as much as 50 percent by the purchase of used equipment. Installation and transportation costs are considered above in the above figures.

LABOR SUPPLY

Local manpower is ample at present for the size operation (75 tons per day) which is contemplated. This is assuming that the armed forces will not take any of the miners which already are employed. Currently, there are 12 men employed, including 8 miners, 3 millmen, and a truck driver. At present the wage scale is $10.04 per 8-hour shift for all employees; they are working 6 days a week with time and one-half for Saturdays. This wage

scale undoubtedly will have to be raised to about $12.00 per shift to correspond with the prevailing wage scale in other Montana mining districts.

POWER

All surface equipment at the mine and mill is driven by electric power. Underground equipment is driven by compressed air excepting the battery trammer. Three trucks, used for transporting ore and men, are gasoline driven.

Electric power is furnished at both the mine and mill at 23,000 volts by the Montana Power and Light Co. Apparently, there is ample electrical power to meet any present or any future demand.

At present there is 150 hp. connected at the mine and 250 hp. at the mill. The electric power bills in 1960 varied between $453 and $586 per month.

TRANSPORTATION

Present transportation facilities are adequate for all phases of the operation. The lead concentrate is trucked to the American Smelting and Refining Company smelter at East Helena, Montana, a distance of 118 miles, at a cost of $6.00 per ton. The zinc concentrate is trucked to the Great Northern Railroad Company, railhead at Armington, Montana, and there loaded into gondolas for shipment by rail to the Anaconda smelter at Great Falls, Montana. The trucking charges to Armington are $2.50 per ton and rail charges from Armington to Great Falls are $4.50 per ton.

No additional road construction is necessary.

ADEQUACY OF REQUESTED FUNDS

The requested funds are adequate for proposal.

COMPETENCE OF APPLICANT

Mr. Lewis E. Stark has profitably operated mining properties in the Weihart district for the past 13 years. He is not a technically trained man, but is locally considered a very competent operator. The DMA field team was impressed with Stark's sincerity and ability, and believe that he is capable of carrying out any proposed program.

DISCUSSION OF PROPOSAL AND SUGGESTED ALTERNATIVES

The DMA field team believes that the ore reserves do not warrant driving the proposed 1,800 foot haulage adit, inasmuch as there is only 6,700 tons of indicated ore which could be mined from above the proposed new adit level. The total ore reserves are not great enough to warrant such an expenditure.

The proposed Alternatives are:

1. To formulate a working agreement with Mr. George Campbell, principal owner of the Queen claims, whereby Mr. Stark could rehabilitate the Queen shaft and the Queen 300 haulage level. This would immediately make available 87,700 tons of indicated ore above the 300-foot level. Such a working agreement could also make available an unknown tonnage of stope fill in the old Queen workings, as well as possible additional ore bodies on Queen ground. It is estimated that this proposal, including rehabilitation of Queen shaft and 300 level, installations in the Star Mill, and repayment of $30,000 loan would be approximately $86,000.

2. To enlarge and straighten out certain sections of the Equator adit in order to facilitate haulage, and to sink the present winze to the 300 level. This Alternative could cost an estimated $116,000.

APPENDIX

APPRAISAL OF STAR MINING CO., NEIHART, MONT., MILLING PLANT
RELATIVE TO GOVERNMENT LOAN - DMA DOCKET 31

By John D. Bardill 1/

On February 24, 1951, I visited the flotation mill of the Star Mining Co. at Neihart, Mont., accompanied by Mr. Lewis B. Stark, owner and operator of the plant, to appraise it and its operation in connection with a proposed DMA loan of $150,000. An estimated $7,500 of this amount was proposed to be expended to increase the present mill capacity from 45 tons to 75 tons per 24 hours by expanding the crushing, zinc flotation, and filter departments.

Past production from the Galt mine indicated crude ore mill heads averaging about 6.6 percent zinc, 4.0 percent lead, and 10 to 20 ounces silver per ton. Zinc flotation concentrates averaged about 50 percent zinc, 2.5 percent lead, and about 20 ounces of silver per ton, and the lead flotation concentrates assayed approximately plus 50 percent lead, 9 percent zinc, and 80 ounces silver. A small amount of scavenger table concentrate from the flotation tailings contain about 1 percent zinc, 24 percent lead, and 16 ounces silver. The lead was probably badly oxidized and was lost during flotation but recovered on the scavenger shaking table. Crude ore weights to the mill are estimated and, since the final mill tailings are not sampled and assayed, an accurate determination of mineral recovery cannot be made. Operation control of the mill is based on frequent panning of the tailings. Several years ago the Bureau made beneficiation tests on a sample of their lead concentrate to decrease the zinc content. No appreciable improvement in grade was accomplished so I am inclined to think their metallurgy is satisfactory.

Your mine samples should indicate the approximate tenor of ore being currently milled which I understand is being mined from another ore-shoot where the minerals are entirely sulfides compared to the other ore shoot which is a mixture of sulfides and oxides. The present mill plant equipment consists of a 200-ton coarse ore bin, a 9-inch by 16-inch Blake type crusher, 200-ton fine ore bin, feeder, 4-1/2 feet by 40-inch Union Iron Works ball mill, 1 UIW 15-1/2 foot by 32-inch Simplex classifier, six 24-inch by 24-inch UIW and two 36-inch by 36-inch Special Denver Sub A lead cells, conditioner, five 32-inch by 32-inch Denver Sub A lead cells and a No. 5 Wilfley scavenger table treating flotation tailings. A 5-foot American type 2-leaf filter, one leaf for lead and the other for zinc, dewaters the concentrates. The present jaw crusher discharge product has rock as large as 3 inches which is fed directly to the ball mill, thereby greatly reducing the capacity of the mill.

1/ Metallurgist, Bureau of Mines, Region II, Albany, Oreg.

Mr. Stark proposes replacing the present jaw crusher with a 7-inch by 10-inch Smith jaw crusher which he states will produce a discharge of about one-half inch. This statement is based on actual experience at the adjoining Florence mill where such a crusher is installed. Reportedly, the crusher easily crushes in excess of 100 tons per 24-hour day at minus 1/2-inch. He also proposes installing a vibrating screen between the coarse ore bin and crusher to remove fines. Another vibrating screen on the crusher discharge may be necessary with oversize return to the crusher. Two more 36-inch by 36-inch Denver Sub A flotation cells are planned to be added to the zinc circuit or as an alternate one bank of 36-inch by 36-inch cells to replace the present bank of five 32-inch by 32-inch cells. A 4-leaf American type filter is planned to replace the present 2-leaf filter to increase capacity. The classifier will be rebuilt and widened 1 foot. These equipment additions should increase the mill capacity to about 75 tons per 24 hours.

Mr. Stark, as you have probably observed, is a thrifty operator and quite likely a good trader, so that if he shops around and purchases good used equipment, the $7,500 should suffice. I understand he has a $20,000 item for miscellaneous plant equipment, part of which could be used if new equipment must be purchased.

xxxxxxxxxxxxxxxx
So. 157 Howard Street
Spokane 4, Washington

February 2, 1962

Mr. Roger V. Pierce
808 Newhouse Building
Salt Lake City 11, Utah

Dear Roger:

I am sorry that I have very little information on the Star mine in Wickart, Montana. DMEA had a contract with your Mr. Stark to explore the neighboring Queen-Galt vein, but we were not concerned with the Star mine at that time. Incidentally, the caving of a winze station forced Mr. Stark to abandon the project before much work was done on the contract.

As part of the wartime Strategic Minerals Program, the Bureau of Mines drove a short crosscut from the Star adit and extended a diamond drill hole from the end of the crosscut.* All this happened before I came to the Northwest. I know nothing of any plans made at that time for joint participation in sinking a shaft. This might well have been something which Bureau of Mines engineers discussed informally with Mr. Stark. The work was done under the direction of the Bureau's Helena office, now closed. Thomas Oster, whom you ask about, was attached to the Helena office. He was employed by the Bureau of Mines as a mining engineer from August, 1942, until he resigned in August, 1945. The local office of the Bureau does not know his present whereabouts.

I hope that the above will be of some use to you.

With best regards,

A. E. Weissenborn

Reading copies:
Director
Hobbs
Olsen

*In 1944

ROGER V. PIERCE
CONSULTING ENGINEER
808 NEWHOUSE BUILDING
SALT LAKE CITY 11, UTAH

January 29, 1962

Mr. Al Weisenborn
U. S. Geological Survey
Spokane, Washington

Dear Al:

I've had the Star Mine at Niehart, Montana called to my attention and the story that has been passed along to me is that the present owner, a Mr. Stark, was told by the Bureau of Mines engineer that they would welcome joint participation in sinking a 100' shaft on this property. The name of the Bureau engineer is Thomas Oster and I cannot find him listed in AIME so I am not able to contact him to see what his story might be.

If you can give me any information at all on this I will be most appreciative. The owner said that the Bureau proposed doing this sinking way back in 1944.

With kindest regards.

Yours very truly,

Roger

Roger V. Pierce

RVP/dma

RECEIVED
JAN 31 1962
U. S. G. S.
SPOKANE, WASH.

W.M.R._____ February 1945

WAR MINERALS REPORT*

Report of the Bureau of Mines to Secretary of the Interior, Harold L. Ickes

STAR MINE
Project 15-146

Cascade County, Montana

Lead - Zinc - Silver

0

SUMMARY

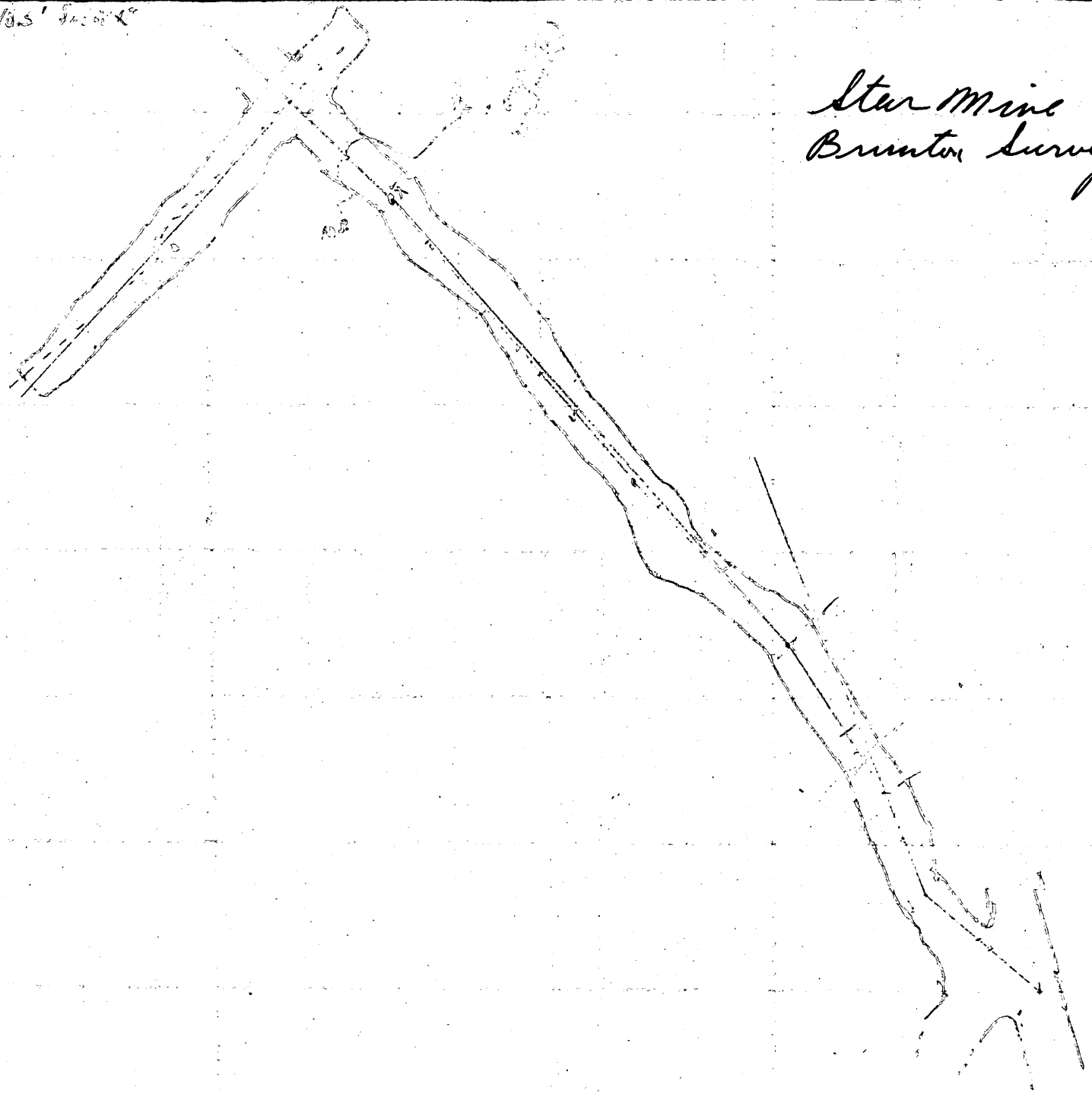
The Star mine is located in Cascade County, Montana, in the Neihart mining district. This property has produced intermittently since the Neihart district was first discovered. During periods of high metal prices, the camp produces substantial tonnages of silver-lead-zinc ore. During the current war, production from Neihart has not been at full capacity because of the acute labor shortage.

Until the present operators obtained possession of the Star mine, only high-grade ore, which could be shipped directly to the smelter, was mined. Since 1940, however, ore produced at the Star has been concentrated in the 50-ton flotation mill built on the property.

The Federal Bureau of Mines examined the property in 1942 and recommended a program of exploratory work designed to prospect a favorable area west of the Star vein. By developing new ore bodies on the property, it was believed that the Bureau could resuscitate a dying operation and insure production of lead, zinc, and silver for the war.

* The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon the field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purposes of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

Star Mine
Brunton Survey



Scale: 1" = 50'

Footage	Approx Recov.		Remarks				Mineralization
				P.D. ~ Granite Gneiss (Red Felds)			
	60%	Bl. + alt. w. little Pbs.	Diorite Gneiss. Fine text. Gneissic struct. only mod. developed.				
1,000		sl. blchd. / blchd. L. calc. + Fe staining. / very sl. blchd.					
		sl. blchd. L. calc. / sl. blchd.					
2,000		1" decomposed mat. / 4" Calc (Dolo?) blchd. both sides. / Not abund Red fields.	270 Change to more gyanular rock Prob. still diorite gneiss. More gneissic – biot? in fairly large flakes. Coarse gneiss –				
	80%	Blchd. Lgtz + dolo? + Pbs. / sl. blchd. + altd.					
4,000							
	75%	Blchd. altd. zone w. dolo, lgtz & Pbs. Contacts gradational. / L. qtz + altn. / 6" altd + blchd. mat. / L. py.					
5,000	35%	More red f'ffds. than usual. / Bleached + altered zone w. dolo, qtz, L. fine py. + Pbs. contacts gradational. / Fine text. gn. as usl start of hdo / Coarse gn. but folds. not red.					

Fine text. gneiss.

<6" blkd + decomp. mat.

50% { } Fe blkd + altd. some blocks gongy.

← ~~Blkd + altd.~~

90% { } Fe std. Decomposed mat. w. calc + ob?

1" calc.

} coarse gn. Possi. pinkd. but not charistically greenish folds, + not much red.

} Not typical gran. gn. but abund. red folds. in the dark fine text. gn.

← contact. grad.

Fine text. gn.

Arlington ~~Course, Dip,~~ Difficulty, ~~Crosscuts~~, Home of mine Stark is now running. Set tunnel recovery.

Now large proportion of mill feed coming from another property which Stark has under lease & bond.

B of M. eventually drilled & with ~~good~~ average recovery & not much difficulty

Given up idea of 600' displacement.

Projected decomposed sections in hole 11 to Stark vein & through supposed fault to surface ~~at~~ at elevation of portal. Located this position on surface — projection several hundred feet (1500'±). No vein exposed at location. Operators now trending.

No intersection in drill hole appeared to be ore.

Fault plotted in wrong position.

Vein split plunges to NE. Wonder if this has any bearing on localization of ore.

Very bad ground, moderately abundant water.

Vein narrows in Pinto than in Gneiss

+	Footage	−
5	0	4 1/2
1	10	−6
3	20	−4
6	30	3 1/2
6	40	3 1/2
5 1/2	50	3
0	48	− 4 1/2
4	60	3
3 1/2	70	3
2 1/2	80	3 1/2
	86	

Top

564N 1/63E 82' −
N59 1/2 E

R	F	L	R	F	R
3 1/2	0	3 1/2	1 1/2	6	4 1/2
1	4	4	2 1/2	9	6
2	11	3	2	14	4
3+	16	2 1/2	3 1/2	19	−
3 1/2	23	2	3 1/2 ES 23	22 24	6 1/2 4 1/2 ES
4 1/2	25	1 1/2	4 1/2	26	
3 1/2	31	2	4 1/2	29	8
3 1/2	36	3	3 1/2	34 ES	7 1/2
2	46	4	2 1/2	36	4
2 1/2	52	3 1/2			
3 1/2	57	1 1/2			
3	63	3 1/2			
2	71	2 1/2			
2	81	2			

~~S76W -16°~~ 39½

N77E +15°

L	E	R
3	7	1½
3½	16	2½
3½	24	3
3	32	2
2	38	2¾

(40)
+8½

(19)
7

(12)
7½

(2)
7

S 83 1/2 W ☆ [illegible]

350' [illegible]
from pt. [illegible] 5 to 4

London Vein – 45 W 51' ☆
Second vein
30-35' above upper Porton
60' or so from [illegible]

From same point S 65 W 35' to pt. 192
[illegible] of London.

Shaft western End Vein No 3.
Vein 3' to 5' wide.
Strike N 49° E 150'-200' above
Dip 83° to N.W. CREEK
in gneiss followed in pits, [illegible]
about 200' NE on st.

Amelia vein
Strike N 43° E – N. 40° E
Dip. V

Silver Top Dis-Shaft To Caved Shaft
Strike S. 41 W. 75° to Caved Shaft

Survey Stake with Nail
Bears S 37° E - 75' From 75' Shaft
on Silver tip.

Hanging Wall Grain Hard wall Little Parts.

London Fraction. Ka B.T.
Bearing N 26 E
Dip -V

London Front Post N 20 E

Air Shaft Breaking out on London
Strike. N 30° E
Dip. V

Lower London Lumnar.
Strike N 17° E

Sept. 27, 1944 Star Mine

U.S.B.M. DH#1	39.2 - 40.7	No. 2 Vein 20" Wide Good Pb+Zn S in sludge Very little core.
	308 - 310.5	No. 3 Vein 30" Some Pb+Zn S in sludge. Half core.
	410 - 414	No. 4 vein 4' Good Pb+Zn S in core & sludge Fair core recov.
	420 - 422.5	No. 4 vein 30" Same notes as above.
	459 - 477	No. 5 vein 18' Fair Pb+Zn S in core & sludge 5' Recov. 462 - 466 Oster marked as mineralized zone.
	580 - 582	No. 6 vein 2' Brown vein mat. No sulphides showing. Good recov.

STAR MINE, Cascade County, Montana

The following information was obtained from a conversation with John Munzenrider of the Helena, Montana, office of the Bureau of Mines, June 30, 1944.

The Bureau of Mines has all but completed the crosscut they were driving. It is now intended to diamond drill ahead of the crosscut face in an attempt to intersect other veins. It appears that the drilling is not being done to intersect any particular vein but only to cut the zone in which veins occur on the surface without hope that one of these veins will be picked up with depth.

The vein cut by the crosscut at about 115 feet is about 6 feet wide and assays approximately 1% lead and 1% zinc. It is reported that it contains abundant quartz. This description suggests the type of vein which occurs on the surface to the north and east of the portal of the Star tunnel. The mine operators intend to drift along this vein in the hope that a better grade of material will be found.

Frank C. Armstrong
Northwest Regional Office
July 10, 1944

FCA:vg

cc:McKnight

STAR MINE, Cascade County, Montana

The following information was obtained from a conversation with John Munzenrider of the Helena, Montana, office of the Bureau of Mines, June 30, 1944.

The Bureau of Mines has all but completed the crosscut they were driving. It is now intended to diamond drill ahead of the crosscut face in an attempt to intersect other veins. It appears that the drilling is not being done to intersect any particular vein but only to cut the zone in which veins occur on the surface without hope that one of these veins will be picked up with depth.

The vein cut by the crosscut at about 115 feet is about 6 feet wide and assays approximately 1% lead and 1% zinc. It is reported that it contains abundant quartz. This description suggests the type of vein which occurs on the surface to the north and east of the portal of the Star tunnel. The mine operators intend to drift along this vein in the hope that a better grade of material will be found.

Frank C. Armstrong
Northwest Regional Office
July 10, 1944

FCA:vg

cc:McKnight

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

MONTANA DISTRICT
WESTERN REGION

November 15, 1944

502 FIRST NATIONAL BANK
HELENA, MONTANA

U.S.G.S.
RECEIVED
NOV 17 1944
Refer to:

Mr. Frank C. Armstrong
U.S. Geological Survey
707 Peyton Bldg.,
Spokane, Washington

Dear Frank:

Enclosed herewith is a copy of the assays of Hole #1, Project 15-146 at Neihart, Montana. I think, on the basis of these assays, that the U.S.G.S. and the U.S.B.M. should arrive at tonnage and grade figures which agree very closely - no tons and no grade!

If I can send any additional information to help you with your report, please let me know.

Very truly yours,

Tom

Thomas Oster
Mining Engineer

Enc.

Form WM-18V (July, 1943)

BUREAU OF MINES
STRATEGIC MINERALS PROGRAM
RECORD OF DIAMOND DRILL HOLE VALUES

HOLE NO: 1
Location: 5684 N, 5565 E
Elevation of collar:
Depth: 700'
Dip: + 0°30'
Bearing: N 46°31' W
Date begun: 7/12/44
Date finished: 9/10/44

PROJECT: 15-146 Star Mine
Location: Belhart, Montana

U.S.G.S. RECEIVED NOV 17 1944 Refer to:

Footage			Sample Nos.		Analyses								Adjusted Average			
					Core				Sludge							
From:	To:	Feet:	Core	Sludge	Pb	Zn	Au	Ag	Pb	Zn	Au	Ag				
39.5	41.5	2.0			0.2	0.4	Trace	None	8.9	0.2	Trace	1.45				
104	106	2.0			0.2	0.3	"	"								
102	108	6.0							0.2	0.2	"	0.20				
141	142.5	1.5			0.2	0.2	"	"								
307	309	2.0			0.3	0.2	"	0.15	0.2	0.3	"	0.25				
409	412.5	3.5			0.2	0.2	"	None	0.2	0.3	"	0.20				
412.5	415	2.5			0.3	0.2	"	"								
412.5	419.5	7.0							0.2	0.3	"	None				
419.5	420.5	1.0							0.2	0.3	"	"				
420	423	2.0			0.2	0.3	"	None								
441.5	446	4.5							0.2	0.3	"	0.15				
445.5	448	2.5			0.1	0.1	"	"								
446	448	2.0							0.2	0.3	"	0.25				
459	461.5	2.5			0.1	0.1	"	"								
457	461.5	4.5							0.2	0.3	"	None				
461.5	466	4.5			0.1	1.2	"	"	0.2	0.3	"	"				
466	471	5.0			0.1	0.2	"	"	0.2	0.3	"	0.40				
471	473.5	2.5			0.1	0.6	"	0.40	0.2	0.3	"	0.45				
473.5	476	2.5			0.1	0.2	"	0.20	0.3	0.4	"	0.45				
476	479	3.0			0.1	0.1	"	None								
416.5	520.5	4.0			0.1	0.1	"	"								
520.5	525	4.5			0.1	0.1	"	"								
525	529.5	4.5			0.1	0.1	"	0.20	0.3	0.3	"	None				
529.5	533	4.5			0.1	0.1	"	None	0.2	0.4	"	None				
580	584	4.0			0.1	0.1	"	0.20								

Form WM-18V (July, 1943)

BUREAU OF MINES
STRATEGIC MINERALS PROGRAM
RECORD OF DIAMOND DRILL HOLE VALUES

HOLE NO:
Location:
Elevation of collar:
Depth:
Dip:
Bearing:
Date begun:
Date finished:

PROJECT:
Location:

Footage			Sample Nos.		Core				Analyses Sludge				Adjusted Average			
From:	To:	Feet:	Core	Sludge					Pb	Zn	Au	Ag				
580	582.5	2.5							0.2	0.4	Trace	0.30				
582.5	584	1.5							0.2	0.3	"	None				

The exploratory work was done during the summer of 1944. A crosscut was driven west from a point 1,000 feet from the portal of the Star adit. This was discontinued after driving 140 feet because of the slow progress being made. From the breast of the crosscut, a diamond drill hole was extended 700 feet west. Three veins were encountered which were mineralized but none contained ore of commercial grade or width.

Two of these veins can be prospected by the operators at a reasonable cost by a small amount of crosscutting and drifting. It is advisable to perform this work before abandoning the Star adit.

No additional exploratory work is planned by the Bureau of Mines.

Introduction

The Star mine was first examined by an engineer[1] of the Federal Bureau of Mines in November 1942. As a result of this examination, a report was submitted which recommended that the Bureau conduct an exploratory project on the property. Active work on the project was started in February 1944 and continued into September 1944.

The property is situated about 1 mile north of Neihart, Cascade County, Montana. A branch line of the Great Northern Railroad passes by the property and furnishes transportation facilities to the various mines and the town of Neihart.

The original examination was made with the assistance of Mr. L. F. Stark, mine superintendent, who furnished the maps, production records, and history of the property for use in this report.

History

The Star mine was one of the first mines discovered in the Neihart mining district. Early prospecting by trenches, shallow shafts, and a few adits,

---

1/ George H. Bennett, mining engineer

indicated a persistent vein which had good silver values near the surface. The first ore shipped from the property was from these surface prospects. Later, the upper and lower London adits were driven on the Star vein and a large amount of high-grade argentiferous lead carbonate ore was mined and shipped from these workings.

The ore shoot which was exploited in the London adits continues down to the Star adit level and is over 600 feet in length at this elevation. Most of the high grade blocks of ore were mined and the property was abandoned. During the ensuing years, lessees mined the few remaining high-grade ore bodies.

The present operators obtained the property in 1939, built a mill, and have maintained a steady production of concentrates since that time. Lower grade ore left in the stopes by the original miners was mined and milled, and new ore was developed by extending the main drift.

Physical Features and Communications

The Neihart district is situated on the northeast slope of the Little Belt mountains. Belt Creek and its tributaries have cut deep gulches and the resulting topography is very rugged. Numerous small streams drain the area, furnishing sufficient water for mining and milling enterprises. The area is heavily forested, and most of the mine timber used in the district is supplied by nearby sawmills.

Highway No. 89 connects Neihart with the town of Great Falls, Montana, which is 61 miles northwest, and White Sulphur Springs, Montana, which is 43 miles south. This highway is maintained throughout the entire year.

A branch line of the Great Northern Railroad also furnishes transportation facilities to the town of Neihart.

Electric power is supplied to the Neihart district by the Montana Power Company. This power is utilized by the Star mine and mill and by several other

mining operators in the vicinity.

Labor and Living Conditions

Neihart is primarily a mining camp and its chief source of income is from the mines in the immediate vicinity of the town. Like most mining camps, Neihart has experienced several periods of boom followed by intervals of inactivity. Many of the houses are in need of repair, but can be made habitable at small expense. During the summer of 1944 when the Bureau of Mines project at the Star mine was being carried out, there were several empty houses in the town. The small hotel also will accomodate a limited number of men.

The supply of skilled miners and mill men in the Neihart area has been insufficient for many months, and most of the mines have been forced to operate at reduced capacity. Considerable controversy concerning wage scales, resulting in three different wage rates being paid in the camp at one time, caused dissatisfaction among the miners and prompted many of them to leave the district. In September 1944, the War Manpower Commission recognized $7.00 per day for miners as the established wage rate.

Property and Equipment

Title to the entire property of the Star mine is held by Mrs. Loretta L. Rives of Conrad, Montana.

The following mining claims and equipment are included in the property:

MINING CLAIMS

Name of Claim		Area Patented Claims - Acres	Area Unpatented Claims - Acres
Southern Star,	Sur. No. 10208	18.2	
Evening Star,	Sur. No. 3519	18.6	
Morning Star,	Sur. No. 3518	16.0	
Climax,	Sur. No. 3370	12.3	
Tunnel Site,	Sur. No. 2110	1.4	
Star Fraction,	Sur. No. 3850	4.7	
London,	Sur. No. 2111	14.6	
Fraction,	Sur. No. 2701	1.5	

Name of Claim		Area Patented Claims - Acres	Area Unpatented Claims - Acres
Silver Edge	(Unpatented)		19.3
Silver Bottom	"		20.6
Silver Care	"		16.8
Silver Cord	"		20.1
Silver Tip	"		20.4
	TOTALS	87.3	97.2

TOTAL AREA OF CLAIMS - 184.5 acres

MINING EQUIPMENT

1 G. E. 1½ ton electric tramer with batteries and charger
12 one-ton mine cars
12 Edison electric mine lamps and charger
Complete blacksmith shop and tools
1 electric portable freezing saw
1 - 3' x 16' air receiver
6,000 feet 2-inch and 3-inch air line
3,000 feet mine rails
3 tons drill steel
1 Cochise 75 heavy duty jack hammer
1 I.R. heavy duty jack hammer
1 Cochise No. 4 stoper
8 I.R. 30 11 stopers
1 Cleveland stoper
400 feet air hose
1 Pressure tank
1 2½ inch sump pump, 126 gallons-per-minute capacity
1 G.E. 7½ H.P. air tugger with cable
1 2-stage I.R. air compressor, 325 cubic feet with 50 H.P. electric motor
1 Single stage I.R. air compressor, 125 cubic feet with 25 H.P. electric motor

MILLING EQUIPMENT

1 9" x 15" Blake-type crusher with 15 H.P. electric motor
1 18" belt conveyer and 1 H.P. electric motor
1 Challenge ore feeder and 1/2 H.P. electric motor
1 Union Iron Works 40" x 4½' cone-type ball mill, with 50 H.P. electric motor
1 Simplex Union Iron Works classifier with 3 H.P. electric motor
1 4' x 4' conditioner, with 3 H.P. electric motor
6 Union Iron Works 24" flotation cells with 3 - 3 H.P. electric motors
2 Denver No. 18 flotation cells with 5 H.P. electric motor
1 10 H.P. boiler
1 12' x 16' steel dryer with a 2-inch steam coils
6 settling tanks

Mine Workings

The Star mine is developed by three main adits on the Star vein. They are as follows:

Name of Tunnel	Elevation	Lineal feet of drift
Upper London Adit	5,834	100
Lower London Adit	5,734	413
Star Adit	5,600	2,216
	TOTAL.....	2,729

The two London adits were driven many years ago and have been abandoned. Both are now caved and inaccessible. The Star adit was started by former operators and completed by the present owners. This adit is open and is now used for haulage. Three short winzes have been sunk on the vein from the Star adit but no ore has been mined below this level.

Description of the Deposit

The country rock in the vicinity of the Star mine is diorite (locally called Pinto diorite) and diorite gneiss. The Star vein cuts the diorite, striking N. 30° E. and dipping very steeply to the northwest. The vein is a true fissure and conforms in strike and dip with the numerous other veins in the district. Two sets of post-mineral faults are in evidence in the Star mine. Several cross-faults have offset the vein, but in most cases the displacement has been only a few feet. Strong strike faults, representing the most recent faulting in the area, have crushed and ground the ore, with the result that mining is difficult and requires much timber.

The Star vein varies from 4 to 17 feet in width. High-grade ore is usually from 4 inches to 2 feet in width, contained in the low-grade material which makes up the bulk of the vein filling. The low-grade ore is a mixture of altered Pinto diorite, gouge, and ground up sulfide ore. The entire width of the vein is mined for mill feed.

The ore is complex, containing galena, sphalerite, chalcopyrite, pyrite, stephanite, pyrargyrite, quartz, and native silver. The pyrite contains a small amount of gold.

The average mill head assays 4.5 ounces of silver to the ton, 3.2 percent of lead, 2.5 percent of zinc, and a trace of gold.

Surface exploration at the time of the original examination exposed several parallel veins west of the Star vein. Very little prospecting had been done along these veins, although surface sampling indicated the presence of mineralization. Subsequent drilling showed that these veins persisted to the depth of the Star adit.

Ore Reserves

Only one known block of ore remains in the mine above the Star adit. This block contains an estimated 5,000 tons of milling grade ore. At the present rate of production this ore will last about 6 months. If additional ore reserves are to be developed in the Star vein, it will be necessary to sink a shaft and drift under the main ore shoot.

During recent months, the operators of the mine have supplemented the Star ore with dump material obtained from the Galt mine, a nearby property. Preliminary work is now under way to reopen the Equator mine, where a large tonnage of ore in unworked portions of the mine and in old gobs is anticipated. If results are satisfactory, it may be possible to prolong the life of the operation for several years. It is believed that the cost of mining the Equator ore and hauling it to the Star mill will be less than developing the Star vein below the present level, because of the added expense of pumping and hoisting that it would entail.

Mining Method

Because of the extensive post-mineral strike faulting along the Star vein, the vein filling is crushed and very soft in most places. As a result, the drifts and stopes require prompt and careful timbering. Drift timbers must be constantly checked, and through heavy ground it is necessary to replace or double

up the sets at frequent intervals.

Stoping is done with conventional square set timbers. All timber framing is done at the mine. Square timber is used whenever available because less time is consumed in framing and setting the timbers. An electrically powered skill-saw is used to frame the sets.

The extremely soft ground breaks easily, requiring only 3 or 4 holes 3 feet deep to break a stope round. The ore loosened by the blast is picked down and a square set is immediately put into place. Rock for back fill is blasted from the hanging wall. Filling is done as soon after removing the ore as is practicable in order to prevent caving.

Stopers or light jackhammers are used, working with an air pressure of about 90 pounds per square inch at the machine. The holes are loaded with three sticks of 40 percent Dupont gelatin powder, thus 5 or 6 pounds of powder breaks 14 cars or about 10 tons of ore. Stoping produces 4 tons of ore per man shift.

Milling Method

The ore, as delivered to the head of the mill, requires very little crushing. It is put through a 9 inch by 16 inch Blake-type crusher and crushed to minus 1 inch in a single stage. About 15 tons of crushed ore is delivered to the fine ore bin in 3 hours. A 40" x 4½' cone type ball mill grinds the ore to minus 80-mesh at the rate of 15 to 20 tons each 8 hours.

Conventional flotation practices are used to produce a bulk concentrate. The product is dried on steam coils and stored for shipment.

Assays of mill heads and tails are taken at very infrequent intervals, and no accurate data are available concerning recoveries.

Exploratory work performed by the Bureau of Mines

As a result of the original examination by the Bureau of Mines, an exploratory program was recommended to explore the parallel veins west of the Star vein.

In the preliminary report it was pointed out that the discovery of new ore bodies in these previously unexplored veins would prolong the life of the mine, and assure a steady production of metals for the war.

The first vein west of the Star adit was explored by means of a crosscut driven from a point about 1,000 feet from the portal. This crosscut had previously been driven about 25 feet, and the Bureau continued it for a distance of 140 feet (fig. 1).

This work was done by a contractor who furnished all labor, supplies, and equipment. Specifications called for a 5 feet by 7 feet cross-section. The price bid and accepted by the Bureau of Mines was $10.00 a foot.

Crosscutting was started on February 24 and continued until June 18, 1944. Progress was very slow because of the extreme shortage of labor. The Pinto diorite and diorite gneiss were difficult to drill, being very hard and tough. Twenty-four holes were required to pull a 4-foot round, two shifts being required to complete the round. Fifteen detachable bits were used. A heavy Thor jackhammer on a shell mounting, supplied with 90 pounds of air pressure per square inch, was satisfactory for drilling. Dupont 40 percent gelatin was used for blasting, but the holes would not break to their full depth. Holes were drilled 5 feet deep to pull 4-foot rounds.

The first vein was intersected about 145 feet west of the Star adit. This vein has approximately the same strike and dip as the Star vein. When the crosscut intersected the vein, the true width of the fissure was about 5.5 feet, but very little mineralization was observed. Near the center of the vein, a 6-inch width of quartz and fault gouge contained small amounts of lead and zinc sulfides. The rest of the vein filling was partly crushed and altered country rock.

The following samples were taken:

Sample No.	Description	Width Feet	%Pb	%Zn	Oz.Au	Oz.Ag
240	N.side x-cut footwall (0'-1.4)	1.4	0.6	0.3	Trace	0.5
241	N.side x-cut (1.4-3.5)	2.1	0.4	0.5	"	0.3
242	N.side x-cut hanging wall (3.5 - 5.5)	2.0	0.6	0.4	"	0.2
243	S.side x-cut footwall (0 -1.4)	1.4	0.4	0.3	"	0.9
244	S.side x-cut hanging wall (1.4 - 5.2)	3.8	0.6	0.6	"	0.6

The vein was prospected by the mine operators for a distance of about 20 feet northeast and about 50 feet southwest. One additional sample was taken from the breast of the drift at a point 40 feet southwest of the crosscut. This sample represented 5 inches of quartz near the center of the vein and assayed 3.0 percent lead, 1.2 percent zinc, trace of gold, and 46.6 ounces of silver to the ton. Because of the narrow width this does not constitute ore, but the high silver content justifies further exploration.

The crosscut was advanced 20 feet beyond the first vein, and was discontinued because of the slow progress being made. At this point a station was cut out for a diamond drill setup.

The contract was let for a 700-foot diamond drill hole to be drilled from the breast of the crosscut. The price specified was $5.50 a foot for EX size hole. Drilling got underway on July 12, 1944, and the hole was completed on September 10, 1944. An W. J. Longyear Junior Straitline rig, powered by a 10 H.P. electric motor, was used to drill the hole. The entire hole was drilled EX size.

The driller used Hardhed A.A. quality machine-set bits made by J. K. Smit and Sons, Inc. Six bits were used during the job, being replaced by a new one when about 80 percent of the life of the bit had been used. The bits drilled an average of about 117 feet at an average bit cost of 50 cents a foot.

A feed gear ratio of 500 revolutions per inch of advance drilled the hole at a rate of 1 foot each 15 minutes of drilling time. Drilling conditions remained constant throughout the entire hole. No unusual conditions were encountered and no cementing was necessary. After drilling about 40 feet, a small vein was encountered which produced a steady flow of water from the collar of the hole. This flow increased as the hole gained depth.

Core recovery was consistantly good, averaging 77 percent for the entire hole. Sludge samples were saved only though mineralized sections or doubtful areas where core recovery was below average.

The hole (fig. 1) was collared about 3 feet above the track level in the breast of the crosscut and started with a dip of + 0°30'. No survey of the hole was made but it is believed that there was very little variation in bearing or dip. The uniformity of the rock, the practice of maintaining constant drill speeds, and the use of a 10-foot core barrel all tended to reduce directional variation to a minimum.

Results of the diamond drilling were not encouraging. A narrow vein was intersected between 39.5 feet and 41.5 feet. Core from this vein contained small amounts of sulfides but assays were low. The sludge representing the 2-foot run assayed 6.9 percent lead, 1.45 ounces of silver to the ton, a small amount of zinc, and a trace of gold. The core for the same run (54 percent recovery) assayed only 0.2 percent lead, 0.4 percent zinc, trace of gold, and no silver.

A vein was encountered from 462 feet to 466 feet with a zone of bleached diorite on both sides. Sulfides were visible in the core and the assay showed 1.2 percent zinc, but negligible values in lead, gold, and silver. The sludge sample for the same section contained very small amounts of these minerals.

Other sections throughout the drill hole contained minor amounts of quartz and bleached diorite, but assays did not show commercial amounts of minerals.

Form [illegible]-16, included in the appendix of this report, gives data concerning the hole including a detailed log. Form [illegible]-16 F gives all assay data for the samples submitted.

The cost of the entire project, including 140 feet of crosscutting and 700 feet of diamond drilling, is shown in detail in the appendix of this report.

Conclusions

1. The Star vein has produced a substantial tonnage of ore. Most of the high-grade ore above the Star adit was mined and shipped to the smelter by former operations. The present operators have mined and milled the low-grade ore and gobs left in the stopes.

2. The block of ore now being exploited, which contains not more than 6 months' supply for the mill, is the last known ore in the Star vein above the level of the Star adit.

3. Future development on the Star vein requires the sinking of a shaft or winze. Mining costs would be greatly increased because of the additional expense of hoisting and pumping.

4. To supplement production from the Star mine, the operators have obtained leases on nearby properties which have substantial tonnages of dumps, gobs, and mine ore.

5. Exploratory work by the Bureau of Mines did not discover new ore bodies. Three veins west of the Star veins did, however, show some mineralization. They are:

a. The first vein west, which was cut by the crosscut at a distance of 145 feet from the Star vein.

b. The second vein west, at a distance of 205 feet from the Star vein.

c. The third vein west, at a distance of 625 feet from the Star vein.

6. The future operation of the Star mill probably depends upon the operators success in developing the Equator and Salt mines, or developing ore bodies in the three veins west of the Star vein.

Recommendations

No further exploratory work is planned by the Bureau of Mines.

Before abandoning the Star adit, the operator should explore by drifting the first and second veins west of the Star vein. The drift on the first vein west should be extended both north and south far enough to determine the character of the vein. The second vein west could be intersected by advancing the Bureau of Mines crosscut 40 feet west. If these two veins do not produce commercial ore, the Star adit should be abandoned.

The third vein west should be explored more thoroughly by surface prospecting before any underground work is planned.

W.M.R._____ April 1943

WAR MINERALS REPORT *

Report of the Bureau of Mines to Secretary of the Interior, Harold L. Ickes

STAR MINE
Cascade County, Montana

- Lead-Zinc -

SUMMARY

Operations at the Star Mine have produced 1,039 ounces gold, 143,994 ounces silver, 1,201,938 pounds of lead or gross receipts of $189,089.00. The ore reserves at present are sufficient to run the 50 ton mill for a period of 6 months. During this period an additional 180 ounces of gold, 24,884 ounces of silver and 205,045 pounds of lead will be produced.

Up to the present time, only a bulk concentrate assaying silver 60 ounces, lead 42 percent, zinc 18 percent has been produced. The product has been sold to the East Helena Lead Smelter where a penalty has been taken for the zinc. This condition has taken most of the profit from the mining operation and as a result development work ahead of mining has been curtailed.

Providing a drilling program indicates additional tonnage in the veins adjacent to the West Branch of No. 1 Vein now being mined, the present operators will remodel the mill to produce both a lead and zinc concentrate. The development of any ore indicated by the diamond drilling program will be immediately undertaken by the Star Mine. A crosscut will be driven to inter-

* The War Minerals Reports of the Bureau of Mines are issued by the United States Department of the Interior to give official expression to the conclusions reached on various investigations relating to domestic minerals. These reports are based upon the field work of the Bureau of Mines and upon data made available to the Department from other sources. The primary purpose of these reports is to provide essential information to the war agencies of the United States Government and to assist owners and operators of mining properties in the production of minerals vital to the prosecution of the war.

Summary (cont.)

sent the veins and the ore will be developed by drifting and raising.

The Star Mine is not now financially able to inaugurate a diamond drilling program to indicate the ore in the #2 and #3 Veins, and unless aided, will be forced to close the mine when the present ore reserves are depleted. In order to keep this mine producing during the war period, the Bureau of Mines proposes to undertake the drilling program as outlined in this report. If favorable values are indicated, the Star Mine can raise the capital needed to carry out the development work necessary to bring these veins on adjoining properties into production.

Introduction

The Star Mine was examined November 29, 1942 by an engineer from the U. S. Bureau of Mines. This property is situated one mile north of Neihart, Cascade County, Montana. A branch line of the Great Northern Railroad passes by the property and furnished transportation facilities to the various mines and the town of Neihart.

The examination was made with the assistance of Mr. L. B. Stonk, Mine Superintendent, who furnished the maps, production records and history of the property, all of which are used in this report.

History

The Star Mine was discovered in the early days and the veins were opened by shallow shafts and tunnels. During this time the upper and lower London tunnels were driven in on the No. 1 Vein and high grade silver-lead ore was mined and shipped. The Star tunnel was driven later and started a short distance above the creek level on the Evening Star Claim, as shown on Fig. 1. The tunnel was driven as a drift on vein "A", which produced

History (cont.)

a small amount of direct shipping ore while passing through the Evening Star and Morning Star Claims. As the tunnel passed beneath the upper London tunnel, however, high grade silver-lead ore was encountered in No. 1 vein and a large tonnage of this class of ore was mined and shipped to the smelter. After the bulk of this ore was mined out, the property was worked intermittently by lessees, until the present operators took over the mine. The present operators have been working the lower grade blocks of ore which were left by the old time miners. The ore is being milled and a bulk concentrate shipped to the East Helena Smelter. A new ore body has recently been opened up in the Star tunnel in the East Branch No. 1 Vein, (Fig. 2) which is producing all of the ore now being milled.

Physical Features and Communications

The Star tunnel is located at an elevation of approximately 5,600 feet and attains an average depth of 40 feet for each 100 feet of drifting on the vein. The vein strikes into the main range of mountains lying to the east of Belt Creek and a maximum depth of about 1,400 feet can be obtained below the summit of this mountain range.

Mine timber is delivered to the mine by local dealers. Electric power from the Montana Power Company lines is used to drive the mill and mine machinery. Water is obtained from Belt Creek.

Labor and Living Conditions

The town of Neihart is located one mile from the mine and has facilities to accommodate the crew needed in a ny operations at this property. Board and room is furnished at the cost of $60.00 per month per person.

Stores in Neihart carry stocks of staple articles which can supply all

Labor and Living Conditions (cont.)

ordinary needs. Any mining supplies and equipment can be shipped in from Helena, Montana, or Great Falls, Montana.

Local labor is now being used in all operations at the property. It would be necessary to train some additional workmen in order to fill out the crews for a larger operation.

Property of the Star Mine

Title to the entire property of the Star Mine is held by Mrs. Loretta L. Rives of Conrad, Pondera County, Montana

The accompanying map shows the claims comprising the Star group and a list of these claims is as follows:

Name of Claim	Area patented claims - Acres	Area location Acres
Southern Star, Sur. No. 10808	18.2	
Evening Star, Sur. No. 3519	18.5	
Morning Star, Sur. No. 3518	16.0	
Climax, Sur. No. 3570	12.3	
Tunnel Site, Sur. No. 2110	1.4	
Star Fraction, Sur. No. 3550	4.7	
Landon, Sur. No. 2111	14.6	
Fraction Sur. No. 3701	1.5	
Silver Mine (unpatented)		19.3
Silver Bottom (unpatented)		30.6
Silver Bare (Unpatented)		16.8
Silver Cord (unpatented)		20.1
Silver Tip (unpatented)		20.4
TOTALS	57.5	97.2

These mining claims comprise a total area of 154.3 acres.

The mining equipment consists of the following:

one G. E. 1½ ton electric trammer with two Edison Batteries & charging plant complete.
12 one-ton mine cars.
12 Edison electric mine lamps & charging plant.
Complete Blacksmith shop and tools, including electric drill and grinders.
One electric portable timber framing saw & framing shed.
One 3' x 16' air receiver.
5,000 feet new 2 inch air line and about the same of one-inch line

Property of the Star Mine (cont.)

3,000 feet 16#, 20#, and 30# mine rails
3 ton mine, drill steel
Mine, steel munking sheets
1 Cochise 75 heavy duty jack hammer wet
1 IR light " " " "
1 Cochise No. 4 stoper wet
6 IR BG 11 stopers
1 Cleveland rotor wet stoper
Complete list repairs for above machines
400 feet Air Hose 3/4 inch
1 pressure tank
One 2½ sump pump, 125 gal. per minute cap. 4 suction hoses
One GD 7½ H.P. air tugger and 500 feet 3/8 cable and 200 ft. 1/2 Cable.
Six months supply mine timber and plank
Every miner has complete set wrenches, saws and axes.
Six months supply valves, and hose connections on hand.

The milling equipment consists of the following:

One 9 x 15 Blake type Crusher and 15 H.P. Electric Motor.
One 16 inch belt conveyor and 1 H.P. Electric Motor.
One Challenge Ore Feeder and 1/2 H.P. Electric Motor.
One Union Iron Works 40" x 4½' cone type Ball Mill, estimated 50 ton cap. and 50 H.P. Motor.
One Simplex Union Iron Works Classifier and 3 H.P. Electric Motor.
One 4' x 4' Condition and 3 H.P. Electric Motor
Six Union Iron Works 24 inch Flotation Cells and 3 -3 H.P. Electric Motors.
Two Denver No. 18 Special Sub A. Flotation Cells and 5 H.P. Motor.
One 10 H.P. Boiler for heating the plant and drying concentrates.
One 12' x 16' x 14" Steel dryer with two inch steam coils through it.
Six settling tanks.
One two stage IR Air Compressor, 325 cu. ft. and 50 H.P. Electric Motor, bought new.
One single stage old type 125 cu. ft. IR Compressor and 25 H.P electric motor.
Mine, Reagent feeders too numerous to list.

Description of the Deposit

The country rock in the vicinity of the Star Mine is pinto diorite. The veins occur as true fissure veins in the diorite, accompanied by strike faults which sometimes form the footwall and sometimes the hanging wall of the vein. Cross faults were also noted which cut and displace the fissure, but in turn are intersected and displaced by the younger strike faults. Thus three ages of veins and faults were noted in the Star tunnel as follows:

Description of the Deposit (cont.)

1. The true fissure veins which are the oldest in age and carry the ore.

2. The cross fault veins next in age, and barren.

3. The strike faults, or post mineral faults, which are youngest in age, and also barren.

In some places along No. 1 Vein, gaps occur in the stopes which are caused by slight offsets made by the cross faults and a later faulting and pulling apart caused by the strike faults. These segments of the fissure can be picked up by short cross cuts or by drilling with either a long hole drill or a small diamond drill. The No. 1 Vein is thrown entirely outside of the drift in the last drifting done in the Star Tunnel, where the working follows the post mineral or strike fault. A strong cross fault was noted at survey station number 13, (Fig. 2) which shows displacement to the east and vein "A" is displaced in this direction.

Mining the No. 1 vein is difficult and expensive on account of the heavy ground caused by the faulting of the fissure. It is necessary to timber the stopes with square set timbers and f illing is kept close to the working faces in order to prevent caves.

Mine Workings

The Star mine is developed by three main tunnels driven in on Vein "A" and No. 1 vein as is shown in (Fig. 2). They are as follows:

Name of Tunnel	Elevation	Lineal feet drift
Upper London Tunnel	5,854	100
Lower London Tunnel	5,734	411
Star Tunnel	5,600	2,218
Total		2,729

The above does not include numerous small shafts, tunnels, cuts and raises.

Ore Reserves

The ore reserves at present are confined to the west branch of the No. 1 vein (Fig. 2). The Superintendent, Mr. L. B. Stark, calculates 9,000 tons of ore in this block averaging 4.5 ounces of silver, 3.8 percent lead, and 2.5 percent zinc. This block contains enough ore to run the mill for a period of six months.

It is possible that a much larger tonnage of ore may be developed in the No. 2 and No. 3 veins located west of the No. 1 vein. Surface samples taken from a ll these veins assayed as follows: (See Fig. 1 for location of samples.)

Location of Sample	Sample Number	Width in feet	Gold Ozs.	Silver Ozs.	Lead Percent	Zinc Percent
No. 1 Vein, Lower Cut	67	1.0	Trace	0.4	0.8	0.35
No. 1 Vein, Upper cut	68	1.8	Trace	0.4	8.7	0.55
No. 2 Vein, Upper pit Dump Sample	69		Trace	2.8	4.1	2.85
No. 3 Vein, Dump Sample	70		Trace	3.4	3.9	6.25

Samples Nos. 67 and 68 were oxidized ore taken close to the surface in shallow cuts on No. 1 vein. This vein is probably the same vein as is being mined at present in the Star tunnel. The fault at survey station 13 (Fig. 2) in the Star tunnel has displaced vein "A" to the east and the No. 1 vein was picked up at survey station 12; development continued on the No. 1 vein from this point northeasterly. All of the ore mined by the present operators has been extracted from this vein.

The No. 2 vein and the No. 3 vein are still to the west of the Star Tunnel (Fig. 1) and are the veins that can be developed by drilling and crosscutting. The two dump samples, Nos. 69 and 70, give an indication as to what type of ore can be expected in these veins.

The Ore

The No. 1 vein is from 4 to 17 feet in width and the ore occurs as more or less solid streaks, 4 inches to 2 feet thick in the fissure filling. The filling consists of altered pinto diorite crushed by the post mineral strike faults. Scattered ore was seen in the altered material of the fissure. The vein is mined between the walls of the fissure for a milling grade of ore and no sorting of the high grade streaks is attempted.

The ore consists of galena, sphalerite, chalcopyrite, pyrite, stephanite, pyrargyrite, quartz and native silver. The pyrite carries a small amount of gold.

The ore delivered to the head of the mill assays as follows: 4.5 ounces of silver, 5.2 percent of lead, 2.5 percent of zinc. Four tons of concentrates are produced from 50 tons of heads assaying as follows: 50 ounces of silver, 42 percent lead, 16 percent zinc. This concentrate is now being shipped to the East Helena Smelter, where a penalty is being taken for the zinc.

Plans for Company Operations

Providing drilling of the veins to the west indicates ore of milling grade, the present operators of the Star Mine will a rossout to these veins and develop the ore by drifting. These veins will be intersected at a depth of 450 feet below the surface, therefore prospects of developing a considerable tonnage of ore in a short period of time are insured, if the veins are found to be consistent at depth.

Prospecting for the offset segments in the Star vein will be carried out either by short drill holes or crosscuts.

The mill will be remodeled in order to save a zinc concentrate. This will require additional flotation cells, a filter and thickener.

Exploration Proposed to be Performed by the Bureau of Mines

The Bureau of Mines plans to drill three holes to prospect the offset segments of the veins as shown in Figures 1 and 2 and in the following table:

Location of Setup	Hole No.	Lineal feet of Hole	Course of Hole
In Star Tunnel, Survey Station #13, (Fig.1)	1	900	N 84°; 4 Horizontal
In Star Tunnel, Survey Station #44, (Fig.1)	2	900	N 56°; 4 Horizontal
In Star Tunnel, Survey Station #64 (Fig.3)	3	1,000	N 56°; 8 Down 19°
Totals		2,800	

Total overall cost - 2,800 feet @ $6.00 per foot - $16,800.00

The ore in Vein "A" was very erratic where developed in the initial drifting of the Star tunnel, so exploration for this vein to the north of the main fault is not recommended. The extension of Vein "A" lies to the east of the No. 1 vein and north of the main fault.

The proposed diamond drill hole No. 1 will prospect the No. 1 and No. 2 veins south of the main fault (shown on Fig. 1) at a depth of 400 feet below the surface. The proposed diamond drill holes No. 2 and No. 3 will explore vein No. 2 and vein No. 3 to depths of 450 feet and 500 feet respectively below the surface north of the main fault. The purpose of this work is to indicate whether or not these veins go to depth and are continuous on strike both to the south and north of the main fault. Information will also be obtained as to what values may be expected, should development of the veins be carried out by the Star Mining Company.

Time required to Start Production

The time required for the proposed exploration is as follows:

Proposed Exploration by Bureau of Mines	Time in Days
Drill hole Star tunnel Hole #1	60
Drill hole Star Tunnel Hole #2	60
Drill hole Star Tunnel Hole #3	60
Proposed Exploration by Company	
Crosscut from Star tunnel to cut #2 vein	60
Crosscut from Star tunnel to cut #3 vein	120

It will be seen from the above outline that 60 days will be required to drill the No. 1 hole. If a sufficient showing is indicated in the number 2 vein, it will take two months to drive a crosscut to this vein and two months to drift and place the vein into production, by stoping operations. Thus it will require a total of six months time to put the number 2 vein into production to keep the mill operating at full capacity.

It will take four months to crosscut to the number 3 vein (Fig. 1) from the present workings, which, with the two months required to drill the vein makes a total period of six months. It will require two months time to bring this vein into production by drifting and stoping operations. Thus it will take a total of eight months to bring the number 3 vein into production.

The changes to be made in the mill can be completed during the period that crosscutting is being done to intersect the veins.

Conclusions

1. The Star Mine has a substantial record of past production and has been operating continuously during the past three years.

2. All past production has been from the No. 1 vein.

Conclusions (cont.)

3. Ore reserves are now getting low.

4. By developing faulted segments of the No. 1 vein, additional ore can be opened up.

5. At least two other parallel veins exist, which could be developed from the Star workings.

6. These parallel veins could be tested at depth by diamond drilling from the Star workings.

7. The present mill produces only a bulk lead-zinc concentrate which is sold to the East Helena lead smelter at a disadvantage, since a penalty is charged against the zinc.

8. Present ore reserves are not sufficient to justify a modification in the mill to make both a lead and zinc concentrate.

9. In case the two parallel veins are found to be productive at depth, the operating company will do the necessary development work to get these veins into production. At that time, the remodeling of the mill to make a separate lead and zinc c concentrate will also be justified, and will be carried out.

Recommendations

In order to keep this mine in production, the Bureau of Mines plans to test the two additional veins by 2,800 feet of diamond drilling. The Bureau will also keep in touch with mining operations and assist in the development of the faulted segments of the No. 1 vein.

Memorandum

Star Lead-Zinc Mine, Cascade County, Montana

The Star Mine is located one mile north of the town of Neihart, Cascade County, Montana, just across Belt Creek immediately east of U. S. Highway No. 89.

The property was visited at the request of E. W. Hassman, District Engineer for the Bureau of Mines at Helena, Montana. The Bureau is starting, or perhaps already has started, a project on this property and has asked the cooperation of the Geological Survey. The morning of January 10 was spent in company with Mr. L. R. Stark, the superintendent, in going through the Star Tunnel and the working stopes above it.

The Star Mine is equipped with a 50-ton mill. For the past three years the mine has produced a silver-lead-zinc concentrate, averaging about 60 oz/ag per ton, 42% Pb, 16% Zn. It is shipped to the smelter at East Helena where a penalty is charged for the zinc. Because of lack of funds to keep development far enough ahead of stoping, the Bureau intends to help the mine develop some more ore.

The ore occurs as stringers associated with quartz in northeast trending and westerly dipping fault zones in the Pinto diorite country rock. Underground the Pinto diorite slacks badly on exposure to air. Because of post-mineral movement the stringers within the fault zones are badly broken and discontinuous. A few minor cross faults offset the ore a short distance. The ore minerals are galena and sphalerite.

The Bureau has proposed some development on the basis that the horizontal displacement on the cross fault located near station 15 on the Bureau of Mines' Fig. 2 is in the neighborhood of 600'. This amount of displacement is shown on the Bureau's claim map (Fig. 1). According to Mr. Sharp, a stope, immediately above the drift on the northeast side of the fault, broke through the fault in being mined to the southwest and picked up what appeared to be the continuation of the same vein offset only three feet to the northwest. This was not observed by the writer for the stope had caved. This would agree with W. H. Weed's statement in Geologic Folio 56 that displacement on the faults in the Neihart district has not been great. It is the writer's opinion that the movement probably has not been large on this cross fault. However, no work was done to substantiate this opinion.

At the time of the visit the ground was heavily covered with snow, but Mr. Sharp says that the veins shown on Fig. 1 in the Bureau of Mines' report are actually exposed on surface. He is of the opinion that they are different veins from the one he has been mining. It makes little difference to the mine management, however, whether the proposed development discloses new ore or a faulted extension of an old vein.

Since writing the War Minerals Report, the Bureau has decided to crosscut rather than diamond drill because of the difficulty of recovering the core and keeping a hole open in that ground. The crosscut is to be driven by the company and the Bureau is to pay them $10.00 a foot for driving it. The rest of the cost is to be borne by the company. At last information, this arrangement had not been approved in Washington but it was thought it would be very soon.

If the surface geology of the mine had been mapped and correlated with the underground geology, new development could be directed better. However, since the Bureau has already planned the exploration and in all probability has started it by now, the next best thing would be to map the surface and underground as an aid in interpreting the results of the Bureau's work. It is believed that this would be a service to the mine and might possibly put it in a position to enlarge its present operation. Because of thick forest and adverse topography, it is estimated that it would take two men about three weeks to map the underground and surface.

FRANK C. ARMSTRONG
Northwest Regional Office
April 12, 1944

cc:

Hewett	1
McKnight	2
Newman	1
Zimmerley	1
Spokane	2

Memorandum

Star Lead-Zinc Mine, Cascade County, Montana

The Star Mine is located one mile north of the town of Neihart, Cascade County, Montana, just across Belt Creek immediately east of U. S. Highway No. 89.

The property was visited at the request of E. W. Hanson, District Engineer for the Bureau of Mines at Helena, Montana. The Bureau is starting, or perhaps already has started, a project on this property and has asked the cooperation of the Geological Survey. The morning of January 10 was spent in company with Mr. L. E. Stark, the superintendent, in going through the Star Tunnel and the working stopes above it.

The Star Mine is equipped with a 50-ton mill. For the past three years the mine has produced a silver-lead-zinc concentrate, averaging about 60 oz/ag per ton, 48% Pb, 18% Zn. It is shipped to the smelter at East Helena where a penalty is charged for the zinc. Because of lack of funds to keep development far enough ahead of stoping, the Bureau intends to help the mine develop some more ore.

The ore occurs as stringers associated with quartz in northeast trending and westerly dipping fault zones in the Pinto diorite country rock. Underground the Pinto diorite slacks badly on exposure to air. Because of post-mineral movement the stringers within the fault zones are badly broken and discontinuous. A few minor cross faults offset the ore a short distance. The ore minerals are galena and sphalerite.

The Bureau has proposed some development on the basis that the horizontal displacement on the cross fault located near station 15 on the Bureau of Mines' Fig. 2 is in the neighborhood of 800'. This amount of displacement is shown on the Bureau's claim map (Fig. 1). According to Mr. Sharp, a stope, immediately above the drift on the northeast side of the fault, broke through the fault in being mined to the southwest and picked up what appeared to be the continuation of the same vein offset only three feet to the northwest. This was not observed by the writer for the stope had caved. This would agree with W. M. Weed's statement in Geologic Folio 86 that displacement on the faults in the Neihart district has not been great. It is the writer's opinion that the movement probably has not been large on this cross fault. However, no work was done to substantiate this opinion.

At the time of the visit the ground was heavily covered with snow, but Mr. Sharp says that the veins shown on Fig. 1 in the Bureau of Mines' report are actually exposed on surface. He is of the opinion that they are different veins from the one he has been mining. It makes little difference to the mine management, however, whether the proposed development discloses new ore or a faulted extension of an old vein.

Since writing the War Minerals Report, the Bureau has decided to crosscut rather than diamond drill because of the difficulty of recovering the core and keeping a hole open in that ground. The crosscut is to be driven by the company and the Bureau is to pay them $10.00 a foot for driving it. The rest of the cost is to be borne by the company. At last information, this arrangement had not been approved in Washington but it was thought it would be very soon.

If the surface geology of the mine had been mapped and correlated with the underground geology, new development could be directed better. However, since the Bureau has already planned the exploration and in all probability has started it by now, the next best thing would be to map the surface and underground as an aid in interpreting the results of the Bureau's work. It is believed that this would be a service to the mine and might possibly put it in a position to enlarge its present operation. Because of thick forest and adverse topography, it is estimated that it would take two men about three weeks to map the underground and surface.

FRANK C. ARMSTRONG
Northwest Regional Office
April 12, 1944

cc:

Hewett	1
McKnight	2
Newman	1
Zimmerley	1
Spokane	2

707 Peyton Bldg.
Spokane 8, Washington
Nov. 17, 1944

Mr. Thomas Oster
U. S. Bureau of Mines
302 First National Bank Bldg.
Helena, Montana

Dear Tom:

Thanks for the assay data on the Star Mine drill hole. You are right, there will be no disagreement over the tonnage and grade.

With best regards,

Sincerely yours,

FCA:mb

FRANK C. ARMSTRONG

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

MONTANA DISTRICT
WESTERN REGION

302 FIRST NATIONAL BANK
HELENA, MONTANA

October 28, 1944

U.S.G.S.
RECEIVED
OCT 30 1944
Refer To:

Mr. Frank C. Armstrong
707 Peyton Building
Spokane, Washington

Dear Frank:

Reference is made to your note of October 26 asking for details of the survey at the Star Mine. Mont

My objective in making the survey was primarily to obtain the true bearing of the Diamond Drill hole. No rights or lefts were taken through the drift, but it is practically all timbered and can be assumed to be about 5 feet in width.

I am enclosing a sketch of the crosscut driven by the Bureau which shows the detailed outline from the main drift to the parallel drift on the new vein. This is a Brunton survey and may not check the transit perfectly, but I'm sure you can use it with minor adjustments.

Very truly yours,

Tom Oster

Thomas W. Oster
Associate Mining Engineer

707 Peyton Building
Spokane 8, Washington
October 26, 1944

Mr. Thomas W. Oster
302 First National Bank Building
Helena, Montana

Star Mine Cross Cut

Dear Tom:

Thanks for the information on the Star Mine Project. Do you have any rights and lefts on your transit survey to give the details of the drift; or better still, could you send me a tracing of the drift outline? That would save me a lot of work.

With best regards,

Sincerely yours,

Frank C. Armstrong

FCA:vg

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

MONTANA DISTRICT
WESTERN REGION

302 FIRST NATIONAL BANK
HELENA, MONTANA

October 23, 1944

U.S.G.S.
RECEIVED
OCT 25 1944
Refer To:

Mr. Frank C. Armstrong
707 Peyton Building
Spokane 8, Washington

Dear Frank:

Reference is made to your letter of Oct. 19, 1944 asking for data concerning the Star Project. Answers to your questions are as follows:

1.) Bearing - N 46° 31' W, Dip - + 0°30', Elevation of Collar - 5620.0 (Portal is 5600' assumed elevation). No survey of the hole was made. Assays will be sent to you when received from Reno.

2.) Enclosed is a copy of my notes for the transit survey of the mine from the portal to the collar of the hole. I have not put this survey on a grid yet, but will use station #1 as 5,000 N, 5,000 E. Line 1 - 2 is N 55° 45' E.

The following samples were taken of the vein cut by the Bureau crosscut:

Sample No.	Description	%Pb	%Zn	Oz Au/Ton	Oz Ag/Ton
240	N.E. side where X-cut cut vein. E. to W. 0 - 1.4	0.6	0.3	Trace	0.5
241	N.E. side 1.4 - 3.5	0.4	0.5	Trace	0.3
242	N.E side 3.5 - 4.2	0.6	0.4	Trace	0.2
243	S.W. side 0 - 1.4	0.4	0.3	Trace	0.9
244	S.W. side 1.4 - 5.2	0.6	0.6	Trace	0.6
258	Drift on Vein to S.W. @ 40' 0.6 of Vein	3.0	1.2	Trace	46.6

3.) Your question was "Did you have much difficulty drilling D.D.H. #2?"

Only one hole was drilled. No unusual difficulties were encountered. Rods were pulled 174 times for an average run of about 4 feet. Drilling the 700' hole required 52 days. The contract price was $5.50 a foot and no extras were paid for.

4.) The dump ore now being milled by Stark at the Star mill is from the old Galt mine. Stark estimates about 5,000 to 7,000 tons in the dump. He also claims that old gobs in the mine may contain as much as 200,000 tons of mill ore.

Mr. Frank C. Armstrong (cont'd.)

A large mill sample of this material was sent to Salt Lake for mill tests.

Stark also has a lease on the Equator mine, just below the Galt. He plans to open this mine and mill the ore at the Star mill.

Assays will be sent to you as soon as received. I hope this covers everything but if you want any other information, I'll be glad to supply it if I am able.

Very truly yours,

Tom.

Thomas W. Oster
Mining Engineer

Enc.

STAR MINE SURVEY
Portal to Collar of Hole
by Thomas W. Oster

B. S.	Sta.	F.S.	Angle Right	Dist.	Vert. Angle	H.I.	H.F.S.	H. Tr.	Remarks
	1	30		27.10	-9°53'	-1.07	0	0	Nail at end of shed
30	1	2	174°53'	122.89	0°00'	-1.07	+2.98	-3.0	Nail in back
1	2	3	161°31'	39.15	0°00'	-1.53	+2.64	-3.9	Nail in back
2	3	4	191°32'	48.73	0°00'	-2.02	+1.67	-3.8	" " "
3	4	5	192°34	27.32	0°00'	- 1.15	+1.94	-3.5	" " "
4	5	6	159°33'	54.40	0°00'	-0.93	+2.72	-3.4	1' Rt. of ℄)
									" 18' to ℄ winze
									33' X-Cut Rt.
5	6	7	163°34'	46.95	0°00'	-1.92	+2.52	-3.6	36' winze Lft.
6	7	8	208°28'	22.96	0°00'	-1.56	+1.96	-4.0	℄ - Timber
7	8	9	164°53'	35.01	0°00'	-1.40	+2.27	-3.6	" "
8	9	10	189°34'	34.58	0°00'	-1.45	+2.26	-3.3	" "
9	10	11	158°52'	24.18	0°00'	-1.30	+1.90	-4.0	1' Lt. of ℄
10	11	12	218°10'	66.84	0°00'	-1.39	+1.72	-3.9	℄ Drift
11	12	13	166°43'	59.21	-1°13'	-0.98	+2.66	-2.7	1'Lt. of ℄
12	13	14	216°59'	37.67	0°00'	-1.05	+1.93	-3.8	℄
13	14	15	183°54'	68.51	0°00'	-1.09	+2.05	-3.7	51' X-cut Lt.
14	15	16	169°42'	41.92	0°00'	-1.26	+1.76	-4.0	℄
15	16	17	118°17'	36.52	0°00'	-1.14	+1.75	-3.8	℄
16	17	18	204°05'	15.20	0°00'	-1.03	+1.15	-4.1	X-cut left
17	18	19	206°53'	28.46	0°00'	-0.70	+1.00	-4.4	
18	19	20	137°36'	37.39	0°00'	-0.92	+1.57	-4.3	
19	20	21	201°56'	19.64	0°00'	-0.94	+1.88	-4.7	X-cut Rt.
20	21	22	136°09'	22.01	0°00'	-1.79	+1.43	-4.4	11.5 X-cut Lt.
21	22	23	192°04'	23.28	0°00'	-1.05	+1.23	-4.2	
22	23	24	139°47'	15.04	0°00'	-1.37	+1.70	-3.7	
23	24	25	154°14'	21.22	0°00'	-1.41	+2.18	-3.9	℄ X-cut
"	"		193°						Drift
24	25	26	198°29'	31.70	0°00'	- 1.51	+2.53	-4.5	℄ X-cut
25	26	27	162°16'	36.15	0°00'	-2.30	+2.36	-4.4	℄ " "
26	27	28	188°38'	38.76	0°00'	-2.07	+2.60	-4.2	1' Rt. of ℄ Nail in drill stand

℄ = Center Line

Star Mine Survey (Cont'd.) Page 2

B. S.	Sta.	F.S.	Angle Right	Dist.	Vert. Angle	H.I.	H.F.S.	H.Tr.	Remarks
26	27	29	183°40'	69.90	-0°16'	-2.49	+0.00	-3.0	(3.0 Above Tr. Level)
27	29	Collar D.D.Hole	176°19'	20.5	0°00				This is bearing of Hole
27	29	Breast	264°	21.3					
27	29	"	86°	51.4					

707 Peyton Building
Spokane 8, Washington

October 19, 1944

Mr. T. W. Oster
U. S. Bureau of Mines
Helena, Montana

Dear Tom: Re: Star Mine

Would you please send me the following information on the Star Project:

1) Bearing, dip, coordinates, and elevation of D. D. H. #1. Location and results of the sections assayed in this hole when you get them. Results of any dip tests or other surveys if any were taken.

2) Could I get a copy of your transit survey of the tunnel and crosscut with your coordinate grid on it. I want to use it in a memorandum I am preparing. Proper acknowledgement will be given. Also results, widths, and location of any assays on the two veins exposed in crosscut.

3) Did you have much difficulty drilling D. D. H. 2? If so, what sort?

4) What is the name of the mine from which Stark is now obtaining much of his ore? Its the one he recently leased.

I would appreciate it if you would send this information as soon as conveniently possible. The assays will probably be delayed, but they could be sent later.

Thank you for going to this trouble for me. Give my best to everyone in the office.

With best regards,

Sincerely yours,

Frank C. Armstrong

FCA:vg

3

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON 25
D. C.

U.S.G.S.
RECEIVED
APR 26 1944
Ans to:

April 22, 1944.

Mr. Frank C. Armstrong,
U. S. Geological Survey,
707 Peyton Building,
Spokane 8, Washington.

Dear Frank:

In reply to your letter of April 13 concerning the Star Mine:

At one stage in this exploration game I had the Neihart district high on my list of those in which we might be of some help in making a district study. Had we had the men available in the summer time to carry out such a study, there would presumably have been some recommendations forthcoming on exploration, but I doubt if the particular exploration that the Bureau is doing on the Star would have been among them. I studied the War Minerals Report and found a lot of things that I thought were wrong with it; the Spokane office has a copy of my comments, which you have doubtless seen. Presumably this project was selected, like so many other of the Bureau projects, by having the operators of the Star mine get in their bid for help first.

My reaction on this project is the same as what I wrote Phil under date of January 8, 1944, regarding the Old Toledo Mine; namely, that within our personnel limitations we should strive to cooperate with the Bureau on worthwhile projects initiated by them, but that we shouldn't waste our time on their duds. The War Minerals Report suggests that this is a dud. Your memorandum states that the Bureau has undertaken the job because the company wasn't financially able to keep up its development, which seems to me a poor reason for carrying on the work. The best that they can hope for in this exploration doesn't amount to much. If the Bureau wastes its efforts in keeping the marginal small producers going, it seems to me that they will accomplish little in the end.

Your skepticism as to the large amount of offset on the fault near station 13 substantiates the conclusions in Memoir 13 of the Montana Bureau of Mines and Geology. Hence, the Bureau's efforts are being directed, not toward finding an offset portion of the Star vein which is unique in being the only good vein in the Pinto

FOR VICTORY
BUY
UNITED STATES
WAR
BONDS
AND
STAMPS

diorite, but rather toward finding a new vein in unknown ground in the diorite, which past study of the geology of the district has shown to be an unfavorable host rock.

The only excuse that I can see for giving any consideration to this project would be as a personal favor to Newman, and to corroborate our unfavorable preliminary opinions of the project. If Phil thinks this might be worthwhile, I would offer no objection. However, I will have no one available for the job, so that it would have to be done by personnel of the Spokane office.

Sincerely,

Mac

Edwin T. McKnight.

707 Peyton Building
Spokane 8, Washington

April 13, 1944

Mr. E. T. McKnight
U. S. Geological Survey
Washington 25, D.C.

Dear Mr. McKnight:

Enclosed please find a memorandum on the Star Mine.

I cannot help but think that the work being done by the Bureau should be done by the company. I think it eventually would be, if the Bureau had not offered to do it. The setup appears to be similar to the Toledo job, except that to map the surface and underground would take longer than it did at the Toledo.

We would like your opinion on how far we should go in cooperating with the Bureau on this job.

With best regards,

Sincerely yours,

FRANK C. ARMSTRONG

FCA/fg
cc: Geo. Hewett

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
WASHINGTON

June 25, 1943

MEMORANDUM for Mr. C. E. Julihn,
Bureau of Mines.

Returned herewith is your copy of War Minerals Report No. 321, "Star Mine, Cascade County, Montana." Thank you for the extra copy for our files.

The report has been studied by our commodity geologist on lead-zinc who offers the following comments:

"This report, in Figure 1, presents a more complex structural picture than that given in the most recent published report on the district (Montana Bureau Mines and Geology, Memoir 13, 1935), which did not recognize the fault crossing the Star tunnel near the proposed location of D. D. Hole No. 1. A large part of the exploration proposed in the War Minerals Report is conceivably based on the interpretation that this is a post-mineral rather than a pre-mineral fault, the crucial decision hinging on whether veins 2 and 3 on the northeast side of the fault crop out on the surface. Of course, if veins actually are exposed on the surface in the places indicated on Fig. 1, it would be immaterial whether the veins to be prospected by holes 2 and 3 are actually faulted extensions of the veins that were sampled (p. 7) or are entirely new veins. In view of the common tendency for mining men to assume that the faults crossing a vein are post mineral, this War Minerals Report would be more complete and more convincing if some description were given of the outcrops and some statement given of the evidence for dating this fault with respect to the mineralization, to show that the project engineer has considered the questions involved.

"The earlier reports stress the fact that the Pinto diorite is a comparatively unfavorable host rock for the veins because of the tendency for the veins to narrow when they enter this formation. The Star No. 1 vein is apparently the outstanding exception, but the quoted widths on the faulted extension of this vein (p. 7) are narrow.

"The description of post mineral faulting along the Star vein (pp. 5-6; p. 8, line 3) and the description of the heavy ground caused thereby (middle of p. 6) raises the question of whether the veins will core properly. Presumably this has been considered by the project engineer.

"Suggested changes in wording are indicated on pp. 5 and 6.

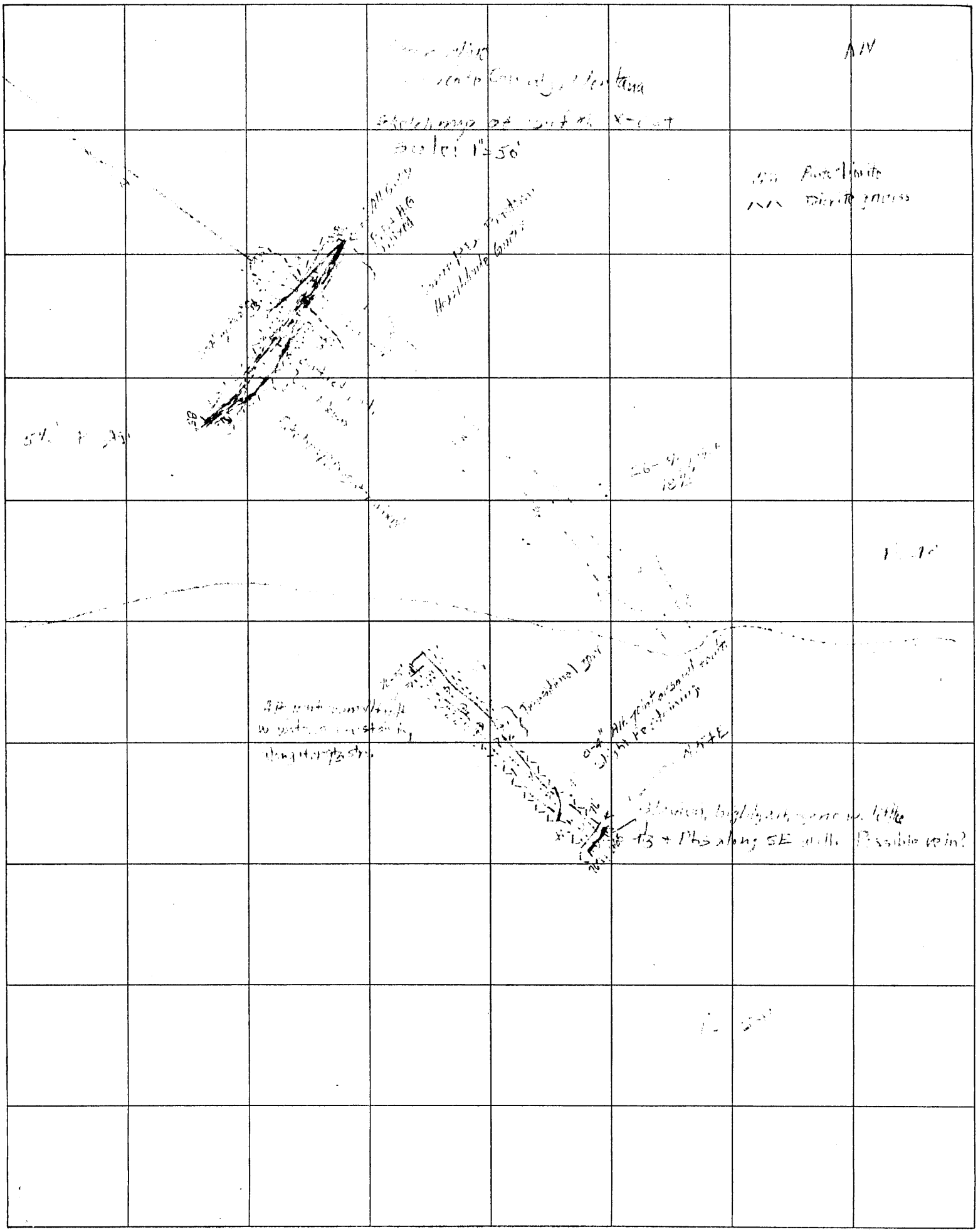
"On page 8, line 7, substitute polybasite for stephanite (see U. S. Geol. Survey 20th Ann. Rept, part 3, pp. 407, 408). Stephanite is a rare mineral in the district and is not even listed in the Montana Bureau report mentioned above."

NOTED
JUN 28 1943

T. B. Nolan

Attach.
cc: Shenon

Director



TRACING PAPER 195M K & E CO., N. Y.
38274

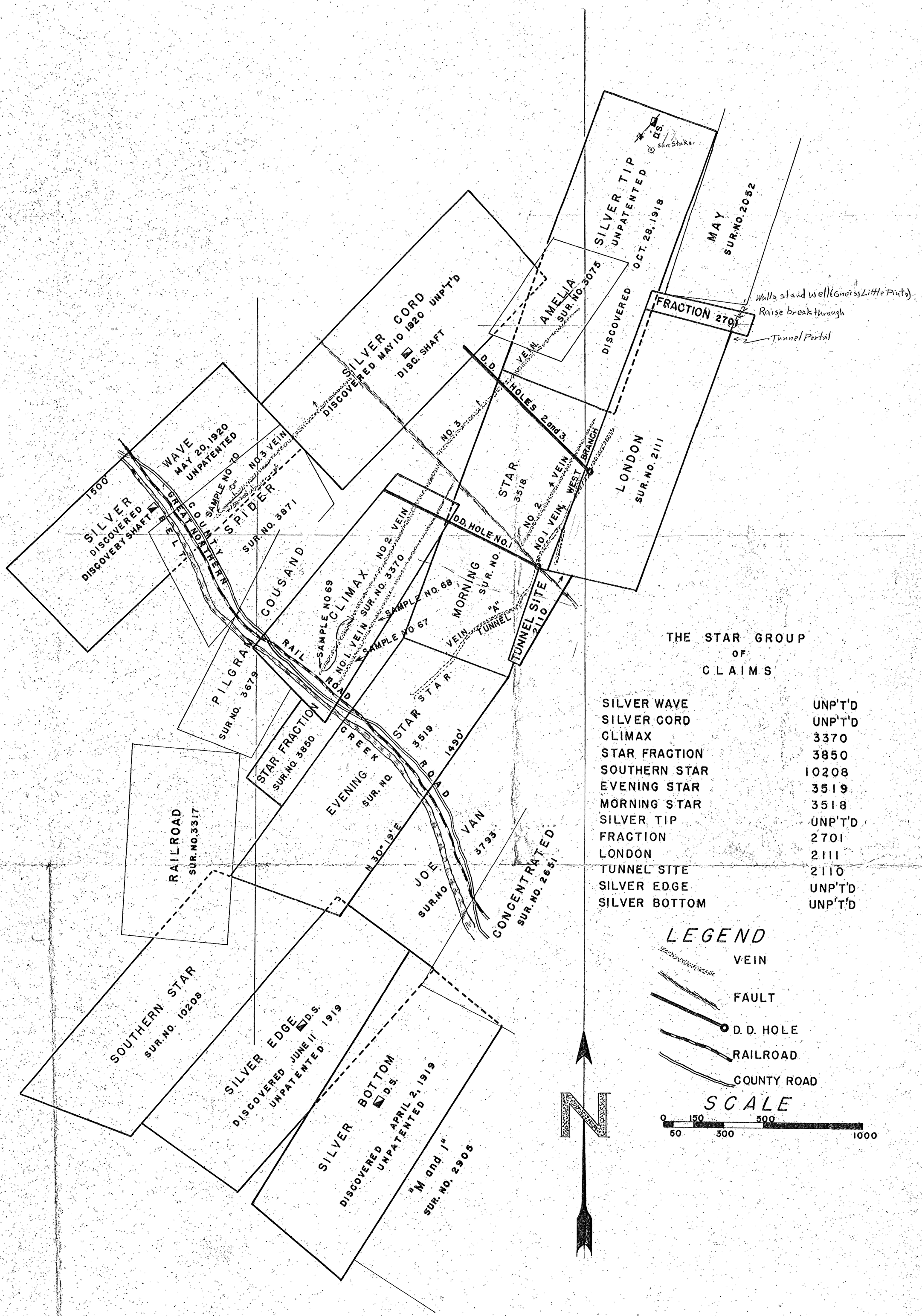


FIG. I THE STAR GROUP OF CLAIMS, CASCADE COUNTY, MONTANA.

A-VI-21

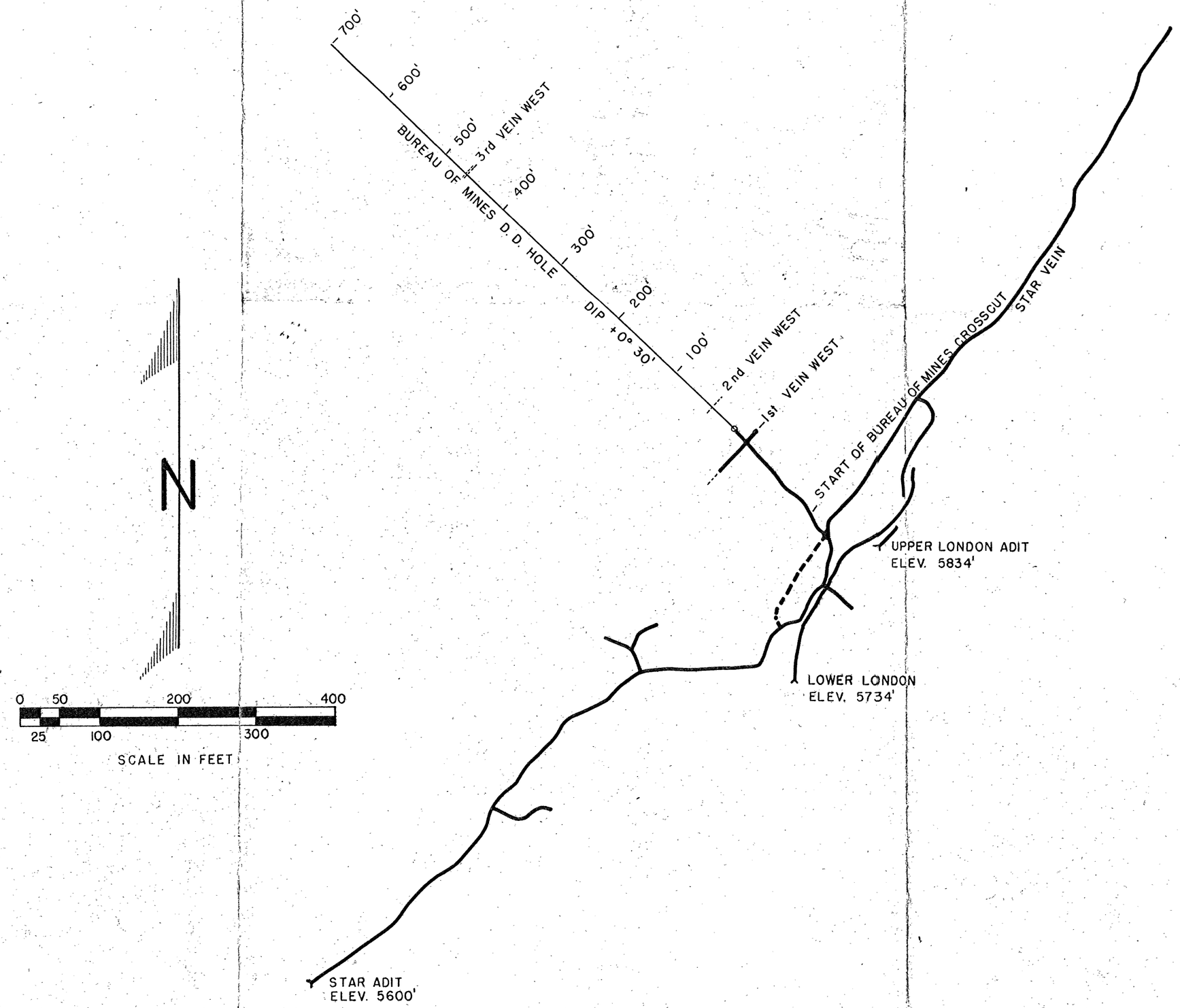


FIG. 1 — STAR MINE, CASCADE COUNTY, MONTANA

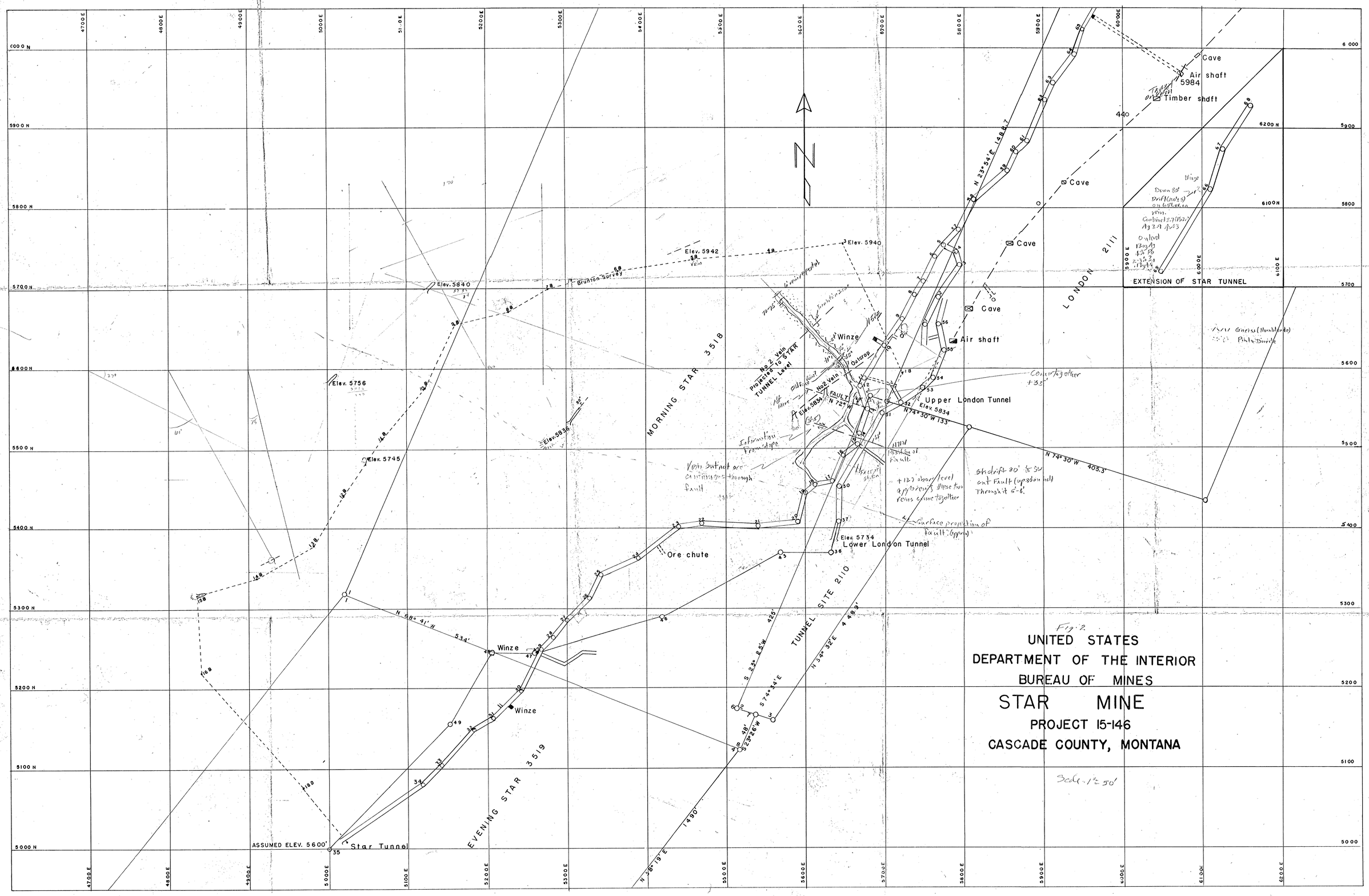


Fig. 2.

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

STAR MINE

PROJECT 15-146
CASCADE COUNTY, MONTANA