UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF MINERALS EXPLORATION
FIELD TEAM, REGION I

FINAL REPORT
Amended Contract Idn-E484

By

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DAY MINES, INC.
Day Building
Wallace, Idaho

Docket No.:	DMEA-2719
Commodity:	Lead and Zinc
Prior Contract date:	February 5, 1953
Amended Contract date:	December 6, 1956
Termination date:	August 29, 1958

HERCULES MINE
Summit and Leland Mining Districts
Shoshone County, Idaho

Spokane, Washington May 1959

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INTRODUCTION

This report describes a project conducted jointly by Day Mines, Inc., and the Defense Mineral Exploration Administration, to explore the downward extension of the Hercules Structure for lead and zinc in an area vent of the main shaft.

Summary

The portal of the Hercules mine, No. 5 adit, is at Burke, Idaho; the mine is in sec. 4, T. 48 N., R. 5 E. Boise meridian, Shoshone County, Idaho. The purpose of the project was to test the structurally favorable Hercules vein zone between the Mercury and Hercules faults on the 1600 and 1900 levels (pla. 5 and 6). The Hercules vein, together with its western extension or faulted segment called the Rambler vein, is the only important vein structure known on the property. Both these structures were thoroughly explored on the 1600 and 1900 levels by crosscutting, drifting, sinking, raining, and long holing as provided for in the contract (pl. 6).

The completed project work included rehabilitating the shaft below the 1600 level; excavating 3 compartments of the main 4- component shaft 313 feet; excavating the 1600 level shaft station, pocket and sump; excavating the 1600 level winse station; raising the winse shaft-head and pocket; sinking the winse 350 feet from the 1600 to the 1900 level; excavating the 1900 level station and pocket; cross-cutting and drifting 4,268.1 feet on the 1600 and 1900 levels; raising 330.5 feet above the 1600 level to the 1500 level; core dirilling 2,135.5 feet; percussion drilling 1,267.5 feet; timbering 246 feet of crosscuts and drifts, and installing 63 rock bolts. The total accepted cost of the project was $396,900.53, and the Government participation at 50 percent was $198,450.27.

Drifting and cross-cutting westward along the Hercules vein to the Mercury fault showed it to be a strong, shear zone on the 1600 level, but only a few blebs and stringers of submarginal ore were found. However, drifting westward from the Mercury fault on the Rambler vein (pls. 5A and 6) disclosed commercial ore for about 60 feet, and the 578 raise was driven to the 1300 level exposing a limited tonnage of fair ore. A better looking and higher grade ore body was found on the 1600 level about 530 feet west of the

378 raise. The 435 raise was driven in this shoot, but the ore continued for only a short distance above the level. The western portion of the Rambler vein was barren of ore-grade material on the 1600 level.

Drifting on the Rambler vein on the 1900 level was disappointing. The vein continued strong both down dip and along strike, but although the vein was of a grade being mined elsewhere in the district, the high-grade ore found on the 1600 level was not found on the 1900 level. The 1900 level was soon abandoned after the project was terminated.

Recommendations

The project was certified on February 20, 1956, under the Prior Contract. No further participation by the Government is recommended for the property at this time.

Property

The land included in the exploration contract is owned by the Operator and consists of the following patented lode mining claims in the Summit and Leland Mining Districts, Shoshone County, Idaho:

Name	U. S. Survey No.
Protection	1654
Selkirk	2069
Mercury	1782
Tacoma	2101
Rambler	1904
Montana	2101
Granite Contact	1654
Mars	2101
Irene	2101

Ground excepted for these claims includes the following areas on the Hercules vein: above the 1900 level east of the Mercury fault, above the 1300 level between the Mercury fault and the 427 raise, and above the 1000 level west of the 427 raise and east of the present face of the 1000 level. The location of claims is shown on plate 4.

Special Agreement Concerning Royalty

In addition to royalty otherwise payable under the Amended Contract, the Operator, as principal, if the Operator is the producer or as surety, if the Operator is not the producer, shall pay to the Government a royalty on any production, regardless of where it comes from, that is transported or passed through any shaft, winse, raise, crosscut, drift, or other working to the cost of which the Government has contributed, for the same period, in the same manner and amount, and subject to the same conditions as

are provided in this Amended Contract: Provided, however, That not more than one royalty shall be due or paid on the same production.

GEOLOGY

Regional

The Hercules mine is in the Summit and Leland Mining Districts in the northwestern section of the Coeur d'Alene District, Shoshone County, Idaho (pl. 1). The general geology of the district has been adequately described in many published reports. Important among these are:

1. Ransome, F.L., Calkins, F.C., 1908, Geology and Ore Deposits of the Coeur d'Alene District, Idaho: U.S. Geological Survey Prof. Paper 62.
2. Umpleby, J.B., Jones, E.L., Jr., 1923, Geology and Ore Deposits of Shoshone County, Idaho: U.S. Geological Survey Bulletin 732.
3. Shenon, P.J., McConnel, R.H., 1959, Silver Belt of the Coeur d'Alene District; Idaho Bureau of Mines and Geology, Pamphlet 50.

In brief, the county rock of the Coeur d'Alene district consists of metamorphosed sediments of he Precambrian Belt series that have been folded, faulted, and intruded by granitic rocks and dikes of various types. The Belt series rocks in this area have been subdivided into six formations on the basis of lithology. Form the bottom of the series to the top the formations are: Prichard, Burke, Revett, St. Regis, Wallace, and Striped Peak. The total section is at least 23,000 feet thick and is composed essentially of very fine-grained quartzite, argillicous quartzite, and argillite beds (pl. 2).

A very striking structural feature of the district is the west northwesterly trending Osburn fault or fault zone (pl. 1) which has been traced intermittently through the district for over 30 miles. Locally, the fault zone ranges in width from 100 to 200 feet and wherever exposed dips steeply south. The extent of the preore movement is not known, but it is believed it may have a postore strike-slip movement of about 16 miles. Many smaller faults cut and offset the ore bodies.

Local Geology

The ore deposits of the Hercules mine are in and along the Hercules vein or vein structure which is an irregularly filled, persistent shear zone trending through partially crunched and shattered county rock. It is composed of a munber of strands extending from the hanging wall and footwall of the zone. The main Hercules vein is a replacement vein and strikes about N. 70-80 degrees W. and dips southerly at an average of about 75 degrees, but both the strike and dip vary within short distances. To the west of the main shaft the vein ahs been faulted by the northeasterly striking , west-dipping Hercules fault and below the 600 levelby the northerly striking, east-dipping Mercury fault, seemingly a split off the

Hercules fault (pls. 2, 5, and 6). There are also a number of minor northerly striking faults that have slightly offset the Hercules fault strike almost parallel to each other (pl. 6) and most of the offset of the vein is horizontal.

The country rock is composed of thin- to medium-bedded argillites and argillaceous quartzites of the Prichard and Burke formations. The contact between the formations is gradational. The mine workings from the surface to about the 800 level are in the Prichard formation.

A prominent feature bordering the Hercules workings on the west is the North Com stock considered to be an outlier of the Idaho batholith of Late Cretaceous age (pl. 2). The principal rock of this igneous intrustion is a coarse-grained, light-gray, porphyritic monzonite containing black crystals of hornblende. Locally, the rock is referred to as "granite," but granite is rare and the rock comprises a wide variety of types: According to Verne C. Fryklund, Jr., of the Survey, "The veins cut hornfels zones surrounding the stocks, and this feature plus actual crosscutting relationships show that the base metal veins are later than the stocks. As shown by the zoning of the barren gangue minerals in the veins surrounding the stocks, there appears to be good evidence that the stocks were hot, and cooling, while the early gangue minerals were being introduced."

The only published description of the Hercules mine geology is that of B. Stringham, F. McIntosh, and G.M. Crosby (Mineralization and Hydrothermal Alternation in the Hercules Mine, Burke, Idaho, 1953: Mining Engineering, p. 1278-1282). According to these authors, the Hercules mine was discovered in 1886, but production did not start until 1902. The Hercules vein has been explored to a vertical depth of 3,600 feet below its outcrop and along a strike length of 3,600 feet on certain of the lower mine levels. Incomplete records show that from 1912 to about 1925 the mine produced 2.5 million tons of ore containing 9.4 percent load and 7.6 ounces silver per ton, together with an estimated 2 percent zinc, 0.3 percent copper, and 20 percent iron.

A soil survey made in 1953, with Survey cooperation, showed that the Hercules vein probably extends much farther west on the surface than had been supposed, but it has not yet been traced to the monzonite contact.

The mineralized stages of the Hercules vein have been summarized as follows:

1. Early silicates (garnet, amphibole, biotite) with very early pyrite.

2. Siderite.

3. Magnetite and hematite.

4. Sulfides; pyrrhotite first, followed at the end by sphalerite and galena.

5. Calcite and pyrite.

The stages are more complex than noted, and a number of subdivisions are possible.

THE PROJECT

The Hercules is one of seven mines adjacent to the Gem monzonite stocks that have important production records. The other mines are the Frisco (Gem), Interstate, Rex (Sixteen to One), Success (Granite), Sunset, and Tamarack. Old records are incomplete, but available data show these seven mines have produced nearly 11 million tone of ore containing about 50 million ounces silver, over 1.5 billion pounds lead and zinc combined. The Hercules mine alone produced almost half of the load. This impressive production record warranted consideration of further exploration of the Hercules structure to the west toward the North Gem stock and down dip from the lower levels in the mine.

There were no criteria that would indicate bottoming of the Hercules ore shoots. This is also true of ore shoots in other parts of the district. The main ore body is irregular in outline, extending over a variable strike length of 400-1,500 geet and intersected by strong transverse faults (Hercules and Mercury) that have been traced from the higher to lower levels. These strong structures within the mine area, together with discoveries already made along these same structures in other parts of the mine, lent encouragement to the exploration project as one wherein the discovery of a significant ore body might reasonably be expected.

Day Mines, Inc., submitted on application in September 1952 for Government aid under the DMEA program to explore the Hercules vein structure below the present 1300 level. Work items in the proposed program included rehabilitating about 70 feet of the main shaft bottom section, deepening 3 compartments of the 4-compartment shaft 330 feet, excavating a station, pocket and sump on the new 1600 level, drifting and crosscutting 2,900 feet westerly on the 1600 level, core drilling 1,000 feet in 4 holes to probe the Hercules vein, and raising an estimated 320 feet from the 1600 to the 1300 level.

The application was reviewed by the Government, and after several small changes of the application, and exploration contract was signed February 5, 1953. The contract authorized rehabilitation of the old Hercules vertical shaft below the 1200 level, 330 feet of shaft sinking to the 1600 level, 6,200 cubic feet of excavation and installation of new station, 3,900 cubic feet for excavation of pocket and sump, 2,640 feet of drifting and crosscutting, 830 feet of timbering, 1,000 feet of diamond drilling AX size, and 320 feet of raising from the 1600 to 1300 level. The total estimated cost of the project was $242,860 with the Government participation at 50 percent, or $121,450. The expiration date of the contract was February 5, 1955, or 2 years from date of contract.

Contract work on rehabilitation of the old shaft, sinking to and establishing a station on the 1600 level began on February 19, 1955, and was completed the first part of October 1955. Country rocks encountered during the shaft sinking were all medium- to thin- bedded argillites and argillaceous quartzites of the Prichard formation. No significant structures or mineralized bodies were found. Bedding planes were essentially flat.

Crosscutting S. 82.5 degrees W. from the 1600 level station to intersect the Hercules vein began October 15, 1953. The footwall of he vein was cut at 780 feet, and crosscutting continued on line for another 80 feet where a very hard grunerite-magnetite-pyrrhotite vein material was found. This zone of hard stringers of grunerite, magnetite, pyrrhotite, garnet and biotite was approximately 45 feet in thickness. Minor amounts of pyrrhotite disseminated in the beds were noted throughout all the crosscut.

Drifting was started westward along the footwall of the Hercules vein structure which strikes about N. 70 degrees W. At about 1,080 feet from the shaft the hanging wall and footwall of the vein zone joined and continued until the Mercury fault striking N. 15 degrees E. was cut at 1,615 feet from the shaft (pl. 6).

The Mercury fault offsets the Hercules vein structure 250 feet to the north and the western part of structure beyond the Mercury fault is known as the Rambler vein from earlier work on the 1000 level of the Rambler claim.

The west segment of the Hercules structure (Rambler vein) strikes east-west and dips 72 degrees S. About 50 feet west of where the vein was intercepted a raise (568) was driven to the 1300 level (pl. 6). The drift continued west for another 550 feet where the vein split into many short distorted veins with varying strikes forming a complex structure called "The Knot." A raise (435, pls. 5A and 6) was driven from "The Knot" in showings of fair ore. Drift samples from the vein for a distance of 145 feet showed an average grade of 1.1 ounces silver per ton, 2.8 percent lead, and 4.6 percent zinc over an average width of 5.3 feet.

Drifting continued westward along the main vein from "The Knot" in a S. 72 degrees W. direction with fair ore showings, than southerly at about S. 45 degrees W. for 215 feet where a very good ore shoot was developed. Samples which averaged 4.4 feet wide carried ore values of 2.1 ounces silver per ton, 4.5 percent lead, and 14.0 percent zinc. However, the ore shoot proved to be very limited in vertical extent, and further drifting as the vein showed that the western limit of the ore had been reached. Drifting on the 1600 level was discontinued in another 150 feet.

Work was continued under Stage II of the contract, with the sinking of a 500-foot vertical wince at the west edge of "The Knot" to the 1900 level. This work followed by crosscutting to the vein and drifting westerly disclosed barren and submarginal vein along a strike length of over 600 feet. The wall so the drift were long holed at intervals throughout its length.

Amendment No. 1 (May 3, 1954) increased the drifting and crosscutting on the 1600 level to 2,640 feet. This work was in lieu of a raise designated in the contract and was to be done at no additional cost.

Amendment No. 2 (November 10, 1954) provided for 650 feet additional west drift, completion of the 378 raise to the 1300 level, increased the diamond drilling to 2,000 feet, added 5 more patented claims to the original 4, extended the completion time 6 months to August 5, 1955, extended payment period from 10 to 12 years, and increased the total estimated cost of the project to $288,710.

Amendment No. 3 (April 6, 1955) provided for a total of 313 feet of shaft, 6,456 cubic feet of pocket excavation, 3,595.8 feet of drifts and crosscuts on the 1600 level, 246 feet of timbering, 330.5 feet of timbered raise, 1,361.5 feet of diamond drilling on an actual cost basis, and an additional 2,000 feet of diamond drilling at $3.50 per foot subsequent to April 6, 1955. The total cost was not changed by this amendment.

Amendment No. 4 (March 7, 1956) provided for an extension of the completion date from 50 to 44 months and decreased the payment period from 12 to 11 years. The total estimated cost was not changed. An audit by C.E. Fisher in April 1956 showed that the total accepted cost for work to date was $273,300.48, of which the Government's share was $136,650.24.

The project was amended on December 6, 1956, by a short term contract, which considered the work done under the Prior Contract as Stage I. Stage II work involved driving a 70 foot pilot drift for hoist-room on the 1600 level, sinking a 2-compartment 350-foot vertical wince from the 1600 level Rambler drift and exploring the vein on the 1900 level by 1,000 feet of drift and crosscut. This raised the total cost of the project to an allowable $415,250 and extended the program until December 5, 1958.

Amendment No. 1 under the Amended Contract, dated July 2, 1958, allowed a total of 950 feet of crosscutting and drifting on the 1900 level and a total of 1,600 feet of long-hole percussion drilling on the 1600, 1750, and 1900 levels, as approved by the Government. No increase in estimated cost was allowed.

All drifting and long-hole drilling ceased on the 1900 levels as of May 23, 1958; the equipment and installations were removed and the level was allowed to flood. Long-hole drilling continued on the 1600 level until late July 1958. Eight long holes, aggregating 302 feet, were drilled from the 1600 level. The mineralization found was not considered ore grade at present metal prices. A Termination Agreement affective August 10, 1958, was signed on August 29, 1958.

Ore Reserves

In his final report the Operator's estimate based solely on 1600 level assays is limited to ore above the 1600 level and amounts to:

Class	Tons	Oz.Ag/ton	% Pb	%Zn
Indicated	14,150	2.0	4.7	6.7
Inferred	30.550	1.3	3.5	5.3
Total	44,700	1.5	3.7	5.7

On the 1900 level there is an ore shoot 160 feet long that averages 2.6 feet wide and contains 2.8 ounces silver per ton, 7.2 percent lead, and 9.2 percent zinc that probably s the same as the westernmost ore block on the 1600 level. The average width of 39 samples taken over a drift length of 250 feet of barren rock to give a calculated width of 5.8 feet, averaging 2.0 ounces silver per ton, 4.7 percent lead, and 6.7 percent zinc. On the 1900 level II samples taken over a length of 160 feet have an average width of 2.6 feet to which has been added 2.4 feet of barren rock to give a calculated width of 5.0 feet averaging 1.4 ounces silver per ton, 3.7 percent lead, and 4.8 percent zinc. The distance between the 1600 and 1900 levels measured in the plane of the vein is about 315 feet. Considering these facts and using the Operator's tonnage factor of 9.75 cubic feet per ton, there is in addition to the Operator's estimate a block of indicated ore between the 1600 and 1900 levels that contains 31,500 tons averaging 1.7 ounces silver per ton, 4.2 percent lead, and 5.8 percent zinc.

Diamond drill holes on the 1900 level show the presence of some low-grade material, but there is insufficient data to infer reserves.

The total estimated reserves resulting from the DMEA project are:

	Tons	Oz. Ag/ton	%Pb	%Zn
Indicated (above 1600)	14,150	2.0	4.7	6.7
Indicated (between 1600 and 1900)	31,500	1.7	4.2	5.8
Total indicated	45,650	1.8	4.3	6.1
Inferred (above 1600)	30,550	1.3	3.3	5.3
Total reserve	76,200	1.5	3.9	5.8

This estimate is believed to be conservative as the Operator tied his estimate of reserves above the 1600 level to metal prices of 90 cents per ounce for silver, 15 cents per pound for lead, and 12 cents per pound for zinc, and a mining cost of $13 per ton. IN 1955 he estimated an indicated reserve of 145,000 tons of ore averaging 1.2 ounces silver per ton, 2.9 percent lead, and 6.8 percent zinc between the 1000 and 1600 levels. Part of this ore has been mined, but it is probable that considerable tonnage remains in this area which will be mined if and when metal prices are higher. Just what this extra tonnage and its grade might be is difficult to determine at this time, but it would probably equal the total reserve figure estimated above.

Summary of Factual Data

The following tabulations shows the work items authorized, units approved, unit costs and total costs:

Item	Units authorized	Units completed	Unit cost	Total cost
Stage I				
Shaft rehabilitation	$8,123.00	$8,123.00	$8,123.00	8,123.00
Shaft sinking	313 ft	313 ft	200/ft	62,600.00
Sump and pocket	6,200 cu ft	6,200 cu ft	$.65/cu ft	4,030.00
Improvements	$1,000	$1,000	$1,000	8,586.48
Crosscutting and drifting	3,505.8 ft	3,389 ft	$48/ft	162,672.00
Raising	330.5 ft	330.5 ft	$70/ft	23,135.00
Timbering drift	246 ft	246 ft	$5/ft	1,230.00
Core drilling	1,361.5 ft	1,361.5 ft	$3.30/ft	4,492.00
Core drilling	2,000 ft	772 ft	$3.50/ft	2,702.00
Total accepted cost Stage I				$278,570.48
Stage II				
Winze station	1,600 cu ft	1,600 cu ft	$0.75/cu ft	$1,200.00
Winze head raise	75 ft	75 ft	$74/ft	5,550.00
Winze head pocket	50 ft	50 ft	$42/ft	2,100.00
Sinking winze	350 ft	350 ft	$157.50/ft	55,125.00
1900 level station	2,600 cu ft	2,600 cu ft	$0.90/cu ft	2,340.00
1900 level pocket	35 ft	35 ft	$47/ft	1,645.00
Improvements	$6,020.00	$6,020.00	$6,020.00	6,020.00
Crosscutting and drifting	1,020 ft	879.1 ft	$48/ft	42,196.80
Percussion drilling	1,600 ft	1,267.5 ft	$1.5 /ft	1,901.25
Rock Bolts	250 ea	63 ea	$4 ea	252.00
Total accepted cost Stage II				$118,330.05
Total accepted cost Stages I and II				$396,600.53

Total amount of the contract	$415,250.00
Government's share at 50 percent	207,625.00
Total amount expended	$396,900.53
Government participation	198,450.27
Total amount unexpended	$18,349.47
Government's share unexpended	9,174.73
Net value of production during contract period	1/$794,395.40
Royalty received on production during contract period	1/$39,718.77
Total value of production through December 1958	1/$904,270.60
Total royalty received on production through December 1958	1/$45,213.53

1/ Subject to audit

The Government acquired no equity in equipment used on the project.

Discussion of Conclusions

This has been a very successful project and under favorable market conditions would undoubtedly repay the Government's investment. The vein material indicated in the 1900 level drill holes might justify further exploration by crosscutting, drifting and raising if a more favorable metal price should materialize. There is also an area above the 1000 level that, under the same conditions, m8ight justifiabley be explored. However, it is doubtful that the Government would be justified in aiding further exploration at this time.

Enclosures
Distribution:

CMS (3)	Docket
USBM (3)	Sample
USGS (SRO)	

Retyped August 27, 2002 by Christina Tuggle

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1500 levels were drifted, 2,183.5 feet; [illegible] drilling, 1,287.5 feet; timbering 245 feet of crosscuts and drifts, and installing 63 rock bolts. The total expended cost of the project was $396,900.53, and the Government participation at 50 percent was $198,450.27.

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3. Shenon, P. J., McConnel, R. H., 1939, Silver Belt of the Coeur d'Alene District: Idaho Bureau of Mines and Geology, Pamphlet 50.

In brief, the country rock of the Coeur d'Alene District consists of metamorphosed sediments of the Precambrian Belt series that have been folded, faulted, and intruded by granitic rocks and dikes of various types. The Belt series rocks in this area have been subdivided into six formations on the basis of lithology. From the bottom of the series to the top the formations are:

Prichard, Burke, Revett, St. Joe, Wallace, and Striped Peak. The total section is at least 25,000 feet thick and is composed essentially of very fine-grained quartzite, argillaceous quartzite, and argillite beds (pl. 2).

A very striking structural feature of the district is the west northwesterly trending Osburn fault or fault zone (pl. 1) which has been traced intermittently through the district for over 30 miles. Locally, the fault zone ranges in width from 100 to 200 feet and wherever exposed dips steeply south. The extent of the preore movement is not known, but it is believed it may have a postore strike-slip movement of about 16 miles. Many smaller faults cut and offset the ore bodies.

Local Geology

The ore deposits of the Hercules mine are in and along the Hercules vein or vein structure which is an irregularly filled, persistent shear zone trending through partially crushed and shattered country rock. It is composed of a number of strands extending from the hanging wall and footwall of the zone. The main Hercules vein is a replacement vein and strikes about N. 70°-80° W. and dips southerly at an average of about 75°, but both the strike and dip vary within short distances. To the west of the main shaft the vein has been faulted by the northwesterly striking, west-dipping Hercules fault and below the 600 level by the northerly striking, east-dipping Mercury fault, seemingly a split off the Hercules fault (pls. 2, 3, and 6). There are also a number of minor northerly striking faults that have slightly offset the Hercules vein. On the 1600 and 1900 levels the Rambler vein and Hercules fault strike almost parallel to each other (pl. 6) and most of the offset of the vein is horizontal.

The country rock is composed of thin- to medium-bedded argillites and argillaceous quartzites of the Prichard and Burke formations. The contact between the formation is gradational. The mine workings from the surface to about the 800 level are in the Burke formation and those below the 800 level are in the Prichard formation.

A prominent feature bordering the Hercules workings on the west is the North Gem stock considered to be an outlier of the Idaho batholith of Late Cretaceous age (pl. 2). The principal rock of this igneous intrusion is a coarse-grained, light-gray, porphyritic monzonite containing black crystals of hornblende. Locally, the rock is referred to as "granite," but granite is rare and the rock comprises a wide variety of types. According to Verne C. Fryklund, Jr., of the Survey, "The veins cut hornfels zones surrounding the stocks, and this feature plus actual crosscutting

relationships show that the base metal veins are later than the stocks. As shown by the zoning of the barren gangue minerals in the veins surrounding the stocks, there appears to be good evidence that the stocks were hot, and cooling, while the early gangue minerals were being introduced."

The only published description of the Hercules mine geology is that of B. Stringham, F. McIntosh, and G. M. Crosby (Mineralization and Hydrothermal Alteration in the Hercules Mine, Burke, Idaho, 1933: Mining Engineering, p. 1270-1282). According to these authors, the Hercules mine was discovered in 1886, but production did not start until 1902. The Hercules vein has been explored to a vertical depth of 3,600 feet below its outcrop and along a strike length of 3,600 feet on certain of the lower mine levels. Incomplete records show that from 1912 to about 1925 the mine produced 2½ million tons of ore containing 9.4 percent lead and 7.7 ounces silver per ton, together with an estimated 2 percent zinc, 0.3 percent copper, and 20 percent iron.

A soil survey made in 1955, with Survey cooperation, showed that the Hercules vein probably extends much farther west on the surface than had been supposed, but it has not yet been traced to the monzonite contact.

The mineralized stages of the Hercules vein have been summarized as follows:

1. Early silicates (garnet, amphibole, biotite) with very early pyrite.

2. Siderite.

3. Magnetite and hematite.

4. Sulfides; pyrrhotite first, followed at the end by sphalerite and galena.

5. Calcite and pyrite.

The stages are more complex than noted, and a number of subdivisions are possible.

THE PROJECT

The Hercules is one of seven mines adjacent to the Gem monzonite stocks that have important production records. The other mines are the Frisco (Gem), Interstate, Rex (Sixteen to One), Success (Granite), Sunset, and Tamarack. Old records are incomplete, but available data show these seven mines have produced nearly 11 million tons of ore containing about 50 million ounces silver, over $1\frac{1}{2}$ billion pounds lead, and over 1 billion pounds of zinc, or approximately $1\frac{1}{4}$ million tons lead and zinc combined. The Hercules mine alone produced almost half of the lead. This impressive production record warranted consideration of further exploration of the Hercules structure to the west toward the North Gem stock and down dip from the lower levels in the mine.

There were no criteria that would indicate bottoming of the Hercules ore shoots. This is also true of ore shoots in other parts of the district. The main ore body is irregular in outline, extending over a variable strike length of 400-1,500 feet and intersected by strong transverse faults (Hercules and Mercury) that have been traced from the higher to lower levels. These strong structures within the mine area, together with discoveries already made along these same structures in other parts of the mine, lent encouragement to the exploration project as one wherein the discovery of a significant ore body might reasonably be expected.

Day Mines, Inc., submitted an application in September 1952 for Government aid under the DMEA program to explore the Hercules vein structure below the present 1300 level. Work items in the proposed program included rehabilitating about 70 feet of the main shaft bottom section, deepening 3 compartments of the 4-compartment shaft 330 feet, excavating a station, pocket and sump on the new 1600 level, drifting and crosscutting 2,900 feet westerly on the 1600 level, core drilling 1,000 feet in 4 holes to probe the Hercules vein, and raising an estimated 320 feet from the 1600 to the 1300 level.

The application was reviewed by the Government, and after several small changes of the application, an exploration contract was signed February 5, 1953. The contract authorized rehabilitation of the old Hercules vertical shaft below the 1200 level, 330 feet of shaft sinking to the 1600 level, 6,200 cubic feet of excavation and installation of new station, 3,900 cubic feet for excavation of pocket and sump, 2,840 feet of drifting and crosscutting, 830 feet of timbering, 1,000 feet of diamond drilling, AX size, and 320 feet of raising from the 1600 to 1300 level. The total estimated

cost of the project was $242,850 with the Government participation at 50 percent, or $121,450. The expiration date of the contract was February 5, 1955, or 2 years from date of contract.

Contract work on rehabilitation of the old shaft, sinking to and establishing a station on the 1600 level began on February 19, 1953, and was completed the first part of October 1953. Country rocks encountered during the shaft sinking were all medium- to thin-bedded argillites and argillaceous quartzites of the Prichard formation. No significant structures or mineralized bodies were found. Bedding planes were essentially flat.

Crosscutting S. 82½° W. from the 1600 level station to intersect the Hercules vein began October 15, 1953. The footwall of the vein was cut at 760 feet, and crosscutting continued on line for another 80 feet where a very hard grunerite-magnetite-pyrrhotite vein material was found. This zone of hard stringers of grunerite, magnetite, pyrrhotite, garnet and biotite was approximately 45 feet in thickness. Minor amounts of pyrrhotite disseminated in the beds were noted throughout all the crosscut.

Drifting was started westward along the footwall of the Hercules vein structure which strikes about N. 70° W. At about 1,080 feet from the shaft the hanging wall and footwall of the vein zone joined and continued until the Mercury fault striking N. 15° E. was cut at 1,615 feet from the shaft (pl. 6).

The Mercury fault offsets the Hercules vein structure 250 feet to the north and the western part of structure beyond the Mercury fault is known as the Rambler vein from earlier work on the 1000 level of the Rambler claim.

The west segment of the Hercules structure (Rambler vein) strikes east-west and dips 72° S. About 30 feet west of where the vein was intersected a raise (378) was driven to the 1300 level (pl. 6). The drift continued west for another 350 feet where the vein split into many short distorted veins with varying strikes forming a complex structure called "The Knot." A raise (435, pls. 5A and 6) was driven from "The Knot" in showings of fair ore. Drift samples from the vein for a distance of 145 feet showed an average grade of 1.1 ounces silver per ton, 2.8 percent lead, and 4.6 percent zinc over an average width of 5.3 feet.

Drifting continued westward along the main vein from "The Knot" in a S. 72° W. direction with fair ore showings, then southerly at about S. 45° W. for 215 feet where a very good ore shoot was developed. Samples which averaged 4.4 feet wide carried ore values of 2.1 ounces silver per ton, 4.5 percent lead, and 14.0 percent zinc. However, the ore shoot proved to be very limited in vertical extent, and further drifting on the vein showed that the western limit of the ore had been reached. Drifting on the 1600 level was discontinued in another 150 feet.

Work was continued under Stage II of the contract, with the sinking of a 370-foot vertical winze at the west edge of "The Knot" to the 1900 level. This work followed by crosscutting to the vein and drifting westerly disclosed barren and submarginal vein along a strike length of over 600 feet. The walls of the drift were long holed at intervals throughout its length.

Amendment No. 1 (May 3, 1954) increased the drifting and crosscutting on the 1600 level to 2,640 feet. This work was in lieu of a raise designated in the contract and was to be done at no additional cost.

Amendment No. 2 (November 10, 1954) provided for 630 feet additional west drift, completion of the 378 raise to the 1500 level, increased the diamond drilling to 2,000 feet, added 5 more patented claims to the original 4, extended the completion time 6 months to August 5, 1955, extended payment period from 10 to 12 years, and increased the total estimated cost of the project to $238,710.

Amendment No. 3 (April 6, 1955) provided for a total of 313 feet of shaft, 6,496 cubic feet of pocket excavation, 3,505.8 feet of drifts and crosscuts on the 1600 level, 246 feet of timbering, 330.5 feet of timbered raise, 1,351.5 feet of diamond drilling on an actual cost basis, and an additional 2,000 feet of diamond drilling at $3.50 per foot subsequent to April 6, 1955. The total cost was not changed by this amendment.

Amendment No. 4 (March 7, 1956) provided for an extension of the completion date from 30 to 44 months and decreased the payment period from 12 to 11 years. The total estimated cost was not changed. An audit by C. E. Fisher in April 1956 showed that the total accepted cost for work to date was $273,300.48, of which the Government's share was $136,650.24.

The project was awarded on December 6, 1956, by a short term contract, which considered the work done under the Prior Contract as Stage I. Stage II work involved driving a 70-foot Pilot drift for hoist-room on the 1600 level, sinking a 2-compartment 330-foot vertical winze from the 1600 level Rambler drift and exploring the vein on the 1900 level by 1,000 feet of drift and crosscut. This raised the total cost of the project to an allowable $415,250 and extended the program until December 5, 1958.

Amendment No. 1 under the Amended Contract, dated July 2, 1958, allowed a total of 950 feet of crosscutting and drifting on the 1900 level and a total of 1,600 feet of long-hole percussion drilling on the 1600, 1750, and 1900 levels, as approved by the Government. No increase in estimated cost was allowed.

All drifting and long-hole drilling ceased on the 1900 level as of May 23, 1958; the equipment and installations were removed and the level was allowed to flood. Long-hole drilling continued on the 1600 level until late July 1958. Eight long holes, aggregating 302 feet, were drilled from the 1600 level. The mineralization found was not considered ore grade at present metal prices. A Termination Agreement effective August 10, 1958, was signed on August 29, 1958.

Ore Reserves

In his final report the Operator's estimate based solely on 1600 level assays is limited to ore above the 1600 level and amounts to:

Class	Tons	Oz Ag/ton	% Pb	% Zn
Indicated	14,150	2.0	4.7	6.7
Inferred	30,550	1.3	3.3	5.3
Total	44,700	1.5	3.7	5.7

On the 1900 level there is an ore shoot 160 feet long that averages 2.6 feet wide and contains 2.8 ounces silver per ton, 7.2 percent lead, and 9.2 percent zinc that probably is the same as the westernmost ore block on the 1600 level. The average width of 39 samples taken over a drift length of 230 feet on the 1600 level is 3.3 feet to which the Operator has added 2.5 feet of barren rock to give a calculated width of 5.8 feet, averaging 2.0 ounces silver per ton, 4.7 percent lead, and 6.7 percent zinc. On the 1900 level 11 samples taken over a length of 160 feet have an average width of 2.6 feet to which has been added 2.4 feet of barren rock to give a calculated width of 5.0 feet averaging 1.4 ounces silver per ton, 3.7 percent lead, and 4.8 percent zinc. The distance between the 1600 and 1900 levels measured in the plane of the vein is about 315 feet. Considering these facts and using the Operator's tonnage factor of 9.75 cubic feet per ton, there is in addition to the Operator's estimate a block of indicated ore between the 1600 and 1900 levels that contains 31,500 tons averaging 1.7 ounces silver per ton, 4.2 percent lead, and 5.8 percent zinc.

Diamond drill holes on the 1900 level show the presence of some low-grade material, but there is insufficient data to infer reserves.

The total estimated reserves resulting from the MZA project are:

	Tons	Oz.Ag/ton	% Pb	% Zn
Indicated (above 1600)	14,150	2.0	4.7	6.7
Indicated (between 1600-1900)	31,500	1.7	4.2	5.8
Total indicated	45,650	1.8	4.3	6.1
Inferred (above 1600)	30,550	1.3	3.3	5.3
Total reserve	76,200	1.5	3.9	5.8

This estimate is believed to be conservative as the Operator tied his estimate of reserves above the 1600 level to metal prices of 90 cents per ounce for silver, 15 cents per pound for lead, and 12 cents per pound for zinc, and a mining cost of $13 per ton. In 1955 he estimated an indicated reserve of 145,000 tons of ore averaging 1.2 ounces silver per ton, 2.9 percent lead, and 6.8 percent zinc between the 1000 and 1600 levels. Part of this ore has been mined, but it is probable that considerable tonnage remains in this area which will be mined if and when metal prices are higher. Just what this extra tonnage and its grade might be is difficult to determine at this time, but it would probably equal the total reserve figure estimated above.

Summary of Planned Data

The following tabulation shows the work items authorized, units approved, unit costs and total costs:

Item	Units authorized	Units completed	Unit cost	Total cost
Stage I				
Shaft rehabilitation	$8,123.00	$8,123.00	$8,123.00	$ 8,123.00
Shaft sinking	313 ft	313 ft	200/ft	62,600.00
Shaft station	6,200 cu ft	6,200 cu ft	$0.65/cu ft	4,030.00
Sump and pocket	6,456 cu ft	6,456 cu ft	$1.33/cu ft	8,586.48
Improvements	$1,000.00	$1,000.00	$1,000.00	1,000.00
Crosscutting and drifting	3,505.8 ft	3,389 ft	$48/ft	162,672.00
Raising	330.5 ft	330.5 ft	$70/ft	23,135.00
Timbering drift	246 ft	246 ft	$5/ft	1,230.00
Core drilling	1,361.5 ft	1,361.5 ft	$3.30/ft	4,492.00
Core drilling	2,000 ft	772 ft	$3.50/ft	2,702.00
Total accepted cost - Stage I				$278,570.48
Stage II				
Winze station	1,600 cu ft	1,600 cu ft	$0.75/cu ft	$ 1,200.00
Winze head raise	75 ft	75 ft	$74/ft	5,550.00
Winze head pocket	50 ft	50 ft	$42/ft	2,100.00
Sinking winze	350 ft	350 ft	$157.50/ft	55,125.00
1900 level station	2,600 cu ft	2,600 cu ft	$0.90/cu ft	2,340.00
1900 level pocket	35 ft	35 ft	$47/ft	1,645.00
Improvements	$6,020.00	$6,020.00	$6,020.00	6,020.00
Crosscutting and drifting	1,020 ft	879.1 ft	$48/ft	42,196.00
Percussion drilling	1,600 ft	1,267.5 ft	$1.50/ft	1,901.25
Rock bolts	250 ea	63 ea	$4 ea	252.00
Total accepted cost - Stage II				$118,330.05
Total accepted cost - Stages I and II				$396,900.53

Total amount of the contract	$[illegible],850.00
Government's share at 50 percent	207,[illegible].00
Total amount expended	$395,900.55
Government participation	198,450.27
Total amount unexpended	$ 18,349.47
Government's share unexpended	9,174.73
Net value of production during contract period	1/$794,395.40
Royalty received on production during contract period	1/$ 39,719.77
Total value of production through December 1958	1/$904,270.60
Total royalty received on production through December 1958.	1/$ 45,213.53
Percent of Government participation repaid	22.8 percent

1/ Subject to audit.

The Government acquired no equity in equipment used on the project.

Discussion of Conclusions

This has been a very successful project and under favorable market conditions would undoubtedly repay the Government's investment. The vein material indicated in the 1950 level drill holes might justify further exploration by crosscutting, drifting and raising if a more favorable metal price should materialize. There is also an area above the 1050 level that, under the same conditions, might justifiably be explored. However, it is doubtful that the Government would be justified in adding further exploration at this time.

Enclosures
Distribution:
OIL-5) Docket
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