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BUREAU OF MINES
Denver, Colorado

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
1600 EAST FIRST SOUTH STREET
SALT LAKE CITY 12, UTAH

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August 3, 1956

Memorandum

To: W. M. Trower, Executive Officer, DMEA Field Team, Region III

From: Stephen S. Wilson

Subject: Docket No. DMEA 4838 (Lead-zinc), Pine Grove Mines (Wah Wah property), Beaver County, Utah

Enclosed are the original and eight copies of an engineering report covering investigation of the subject property for DMEA loan appraisal. The property was examined by W. R. Young with R. W. Gutenstein of the Survey. The brochure has been returned to your office under separate cover.

The applicant has requested a loan of $50,000 to conduct exploration consisting of 10,000 feet of diamond drilling in 11 holes, with photogeologic mapping of an area 8 miles wide by 10 miles long. The applicant proposes to explore the Black Bed (Tenno) in the vicinity of known mineralization. This limestone bed lies near the top of the Cambrian Pioche shale (Ophir) formation. In addition, the applicant plans to explore by drilling to the basal part of this formation to determine the presence or absence of a limestone bed which is a favorable host rock in other districts. The applicant's proposed work is divided into four stages. The applicant believes that lead-zinc ores of commercial grade will be found in the lower limestone bed, if present.

The examining engineer is of the opinion that the applicant's staging of the proposed exploratory work is not justified in view of known information concerning mineralization in the upper part of the Pioche shale formation. It has been shown by exploration and exploitation that the primary mineralization in the Black Bed is not sufficiently strong to sustain a mining operation. It is the opinion of the engineer that the area should be investigated by drilling the basal limestone bed of the Pioche shale formation below the zone of known mineralization.

The examining team recommends an alternate program consisting of two diamond drill holes under Stage I and three diamond drill holes under Stage II. The two holes under Stage I are to be drilled on opposite sides of the Tenno fault to ascertain the existence of a favorable limestone bed near the bottom of the Pioche shale below the zone of known mineralization. The estimated depth of hole No. 1 is 1,000 feet, and hole No. 2, 525 feet.

Reviewed by
DMEA OPERATING COMMITTEE

(date)

If results under Stage I are favorable, three holes are to be drilled under Stage II. The estimated depth of hole No. 3 is 825 feet; hole No. 4, 1,275 feet; and hole No. 5, 600 feet. The three holes under Stage II are planned as offset holes of Stage I drilling along the Tamo fault.

The alternate program outlined by the examining team appears to be the most logical approach for investigation of the property. However, I do not believe the proposed work may be termed exploration under DMEA standards. It is uncertain that the objective limestone bed is present near the base of the Picche shale, and, if present, no evidence is available to indicate that the bed is mineralized, other than the favorable character of the bed in other localities. Deep diamond drilling, 525 to 1,000 feet under Stage I and 800 to 1,275 feet under Stage II, may give inconclusive results. In effect, the applicant's proposal and the alternate proposal are planned to obtain geologic information.

If the Washington Office of DMEA agrees that the proposed work may properly be termed exploration, investigation by the alternate method proposed by the field examiners seems the most feasible. However, it is my opinion that the applicant should first, on his own account, demonstrate that the lower limestone bed in the Picche shale is present in the proposed project area. If the bed is encountered and favorable geologic evidence is disclosed, appraisal of the loan request should then be made.

Stephen R. Wilson
Stephen R. Wilson

cc: J. B. Clemmer

PINE GROVE MINES
WAR WAR PROPERTY
BEAVER COUNTY, UTAH
DMEA-4228
Lead-Zinc

CONFIDENTIAL
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or inspection

Engineering Report

By W. E. Young
Mining Engineer
Bureau of Mines

July 18, 1956

Reviewed by
DMEA OPERATING COMMITTEE

(date)

FIRE GROVE MINES
WAH WAH PROPERTY
BEAVER COUNTY, UTAH

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ILLUSTRATIONS

Fig. 1 Location map, Wah Wah mine, Beaver County, Utah
Fig. 2 Reconnaissance geologic map (attached to Survey report)
Fig. 3 Claim map
Fig. 4 Geologic plan with proposed work
Fig. 5 Vertical section through proposed drill hole No. 1
Fig. 6 Vertical section through proposed drill holes Nos. 2 and 3
Fig. 7 Vertical section through proposed drill holes Nos. 4 and 5

SUMMARY

J. D. Williams has applied for Government aid in an exploratory project at the Wah Wah lead-zinc mine in Beaver County, Utah. The property is held under lease from Wah Wah Mining Co. The applicant has proposed a project consisting of 21 diamond drill holes with photo-geologic mapping. The estimated cost of the applicant's proposed exploration is $83,992. The examiners have proposed an alternate plan consisting of 4,225 feet of diamond drilling in two stages. The estimated cost of the alternate program is $38,034.56.

Sedimentary rocks in the Wah Wah area consist of quartzite, shale, and limestone of Cambrian age. The basal Cambrian section here is thought to be similar to that known extensively throughout the Basin and Range province. In the vicinity of the mine the shale section is deeply covered with alluvium. No work has been done to ascertain the existence of limestone members near the base of the shale in the vicinity of the mine. These members are favorable host rocks for lead-zinc mineralization at many locations. Investigations of the lead-zinc occurrences at the top of the shale section have been made at the Wah Wah mine. This mineralization is thought to be sufficiently strong and extensive to justify investigation in the more receptive basal Cambrian limestone members.

The proposed alternate project is set up in two stages. The two holes of Stage I are designed to test the horizon in the most favorable location near the Tenco fault.

INTRODUCTION

Property of Pine Grove Mines was examined May 16, 1956, by a geologist of the Geological Survey and an engineer of the Bureau of Mines. Examination was made at the request of the Regional Field Team to determine the advisability of granting a Government-assistance loan. J. D. Williams, applicant, and E. R. Young, consulting geologist, accompanied the examining personnel during the period.

In the early days of mining the property produced a small tonnage of gold-silver-lead ores from fissures in quartzite. Interest was later transferred to lead-zinc replacement ores in limestone. A small tonnage of ore was shipped.

The applicant plans to further explore the area by diamond drilling and has requested funds for 10,935 feet of drilling in 21 holes and for photo-geologic mapping, in colored aerial photography, an area 8 by 10 miles in extent. A loan totaling $58,592 is requested to complete the work.

LOCATION, TOPOGRAPHY AND PHYSICAL FEATURES

The claim group which the applicant proposes to explore lies on the west side of the Wah Wah Range in Beaver County, Utah. This range is a prominent north-south range in the Basin and Range province. The claims are located in unsurveyed secs. 23, 24, 35, and 36, T. 28 S., R. 16 W., S.L.B. and M. (fig. 1).

Shipping points are located at Milford and Lund, Utah. Milford is 58 miles distant and Lund is 43 miles distant from the property. Housing facilities are available for a small crew at the mine. A camp should be established at the project site because of the distances from existing communities.

OWNERSHIP, HISTORY AND PRODUCTION

The property included under the applicant's lease consists of 22 patented lode mining claims and 32 unpatented lode mining claims held by right of location (fig. 3). The claims are listed as follows:

Patented

Name of claim	U. S. Survey No.
Jackson	4207
Revenue mine	"
Eldorado	"
Iron Duke	"
Pavington	"
Lafayette	"
Yuro	"
Gneraion	"
Baker	"
Rockies	4195
Rockies No. 2	"
Cliff	"
June	"
Tacoo	5201
Ben	"
El Kallah	"
Lessons	"
Queen	4215
Hickory	"
Southside	"
Man Hur	"
Eagles	"

Unpatented

Recorded in office of County Recorder, Beaver County, Utah

Name of claim	Book	Page
Ben No. 2	21	59
3	"	59
4	"	59
5	"	60
6	"	60
7	"	60
8	"	61
Zenzen No. 2	"	55
3	"	56
5	"	56
6	"	57
7	"	57
8	"	57
9	17	286
10	21	58
11	"	58
12	"	58
Reva	"	61
No. 2	"	61
3	"	62
4	"	62
Keystone	"	53
No. 1	"	54
2	"	54
3	"	54
4	"	55
5	"	55
6	17	453
7	"	454
8	"	454
9	"	455
10	"	455

The above property is owned by the Wah Wah Mining Co. and is under lease to James B. Williams and Ruth T. Williams.

The applicant has dedicated the following claims to the proposed exploratory project as being benefited by the work outlined in the application.

Patented claims

January
Tanno
Ben
El Kallah

Unpatented claims

Ben No. 8
Keva
Ben No. 2
Keva No. 2
Keva No. 3
Keystone
Keystone No. 1
Keystone No. 2

Mining in the area commenced about 1881 when prospectors were attracted by discovery of gold-silver-lead ores in fissures in quartzite. Several attempts were made to mine ores from the fissures but each met with little success. Interest was later transferred to lead-zinc replacement deposits in limestone.

Production records prior to 1937 are not complete. No information is available concerning production from vein-type deposits and the initial high-grade production from the Tanno shaft replacement deposits. Nothing is known concerning the size of vein-type deposits in quartzite, but caved stopes in the replacement zone indicate a sizable tonnage was shipped from this area. During 1937 the property was taken over and worked by R. C. Dugdale. Records show that 925.8 tons of lead-silver ore was shipped from the oxide zone. It appears that this ore was extracted from caved stopes which had been opened by the former company. In 1943 and 1944, 239.6 tons of lead-zinc sulphide

ore was shipped during the period of a Bureau of Mines drilling project. This ore was mined from small sulfide stringers in the shale below the oxide zone. In 1945 a lessee shipped 2,674.5 tons of zinc carbonate ore from the oxide block delineated by the Bureau of Mines diamond drilling. Settlement sheets indicate that no profit was realized from shipments from the last two of the above attempts at mining except under Government premium prices than existing.

DESCRIPTION OF THE DEPOSITS

The geologic setting in the Pine Grove area is similar to that found at Pioche, Nevada; Mt. Wheeler, Nevada; Eureka, Utah; and Ophir, Utah. Cambrian rocks consisting of a thick basal quartzite, a shale section with interbedded limestone and quartzite lenses overlain by Cambrian limestones, are found at each location. The sedimentary rocks strike roughly N. 20° E. and dip 20°-25° southeasterly in the vicinity of the mine. Pine Canyon lies along the axis of a broad, easterly plunging regional syncline. A strong east-west fault extends through the property and displaces the beds roughly 1,000 feet horizontally and 500 feet vertically. A stocklike body of quartz monzonite outcrops about 1,000 feet southeast of the Tasso shaft (fig. 3).

The quartzite member is typical of the Prospect Mountain quartzite of the Pioche district and the Tintic quartzite of the Tintic district. The overlying shales are roughly 800 feet thick

and are similar to the Picche shales of the Picche district. In the vicinity of the mine, the shale section is covered with alluvium, and no limestone is discernible until the upper limestone-shale contact is encountered. Two limestone members are present in the shale section in the canyon north of Pine Canyon. South of Pine Canyon the topography is such that weathered shale covers the formation outcrop and no limestone member may be seen. The replacement ore occurrence at the Wah Wah mine is in a black, shaly member at the top of the shale section. This member contains thin beds of black limestone. Above the shale is 1,800 feet or more of blocky, blue limestone.

Mineralization occurs in fissures in the quartzite, as replacement of limestone and shale in the Tasso area and at the contact of limestone and quartz monzonite near the Leu shaft. Most of the mine workings are caved and little is known concerning the ore occurrences at any place except at the Tasso shaft workings. This occurrence was studied in detail by geologists of the American Smelting and Refining Co. by geologists of the R.F.C., and by engineers of the Bureau of Mines. The property merited approval of exploration in each instance, and each of the above-mentioned groups conducted a project on the property. The work was confined to the upper shale or Black Bed (Tasso) except one diamond drill hole drilled by the American Smelting and Refining Co. This hole passed through the

Tasso fault zone into the south block and intersected the basal part of the Pioche shales. The log of the hole shows no limestone. A 40-foot section logged as altered quartzite may be silicified limestone. Inasmuch as this section corresponds to that in which other sections embody limestone and because of the proximity of the Tasso fault, this conclusion is not unlikely. This is the only known work in the basal part of the Pioche shale section.

The work in the Black Bed (Tasso) was carried beyond the confines of mineralization. A study of the occurrence indicates that the ore body resulted from secondary enrichment and that primary mineralization is low in lead-zinc content. The Black Bed (Tasso) is considered a poor host rock.

PROPOSED EXPLORATION

The applicant proposes to explore the property by drilling 21 drill holes. The work is divided into four stages. Stage I consists of seven holes all designed for penetration of the Black Bed (Tasso). Stage II consists of five holes all designed for intersection of the Wah Wah bed south of the Tasso fault zone. These two stages are independent of the other and one is not contingent on the results of the other. Stages III and IV are based on the results of Stages I and II and are planned principally for exploration of the Black Bed (Tasso) downdip. The twelve holes, which constitute the first phase of the project, will require a total of 3,954 feet of diamond drilling. The remaining 9 holes will require a total of 7,002 feet. The proposed locations of all holes are shown on figure 4.

It is considered that the above staging of the project is not justified in view of the information already known. It is the opinion of the examining team that the area should be investigated by drilling the basal beds of the Pioche shale below the zone of known mineralization. As an alternate proposal, recommendation is made that two holes be drilled to ascertain the existence of a receptive limestone bed near the base of the shale section. These two holes, one on each side of the Tenno fault, are planned to test the zone in the area of mineralization. The applicant's hole No. 1 is to be moved from coordinate position 10230 N. and 13660 E. to coordinate position 10300 N. and 13780 E. The hole is to be collared at 7,680 elevation and drilled at -67°, normal to the beds, for an estimated depth of 1,000 feet. Hole No. 2 corresponds to the applicant's hole No. 6. This hole is to be collared at an elevation of 7,540 feet and drilled to a depth estimated at 525 feet. These two holes aggregate 1,525 feet and constitute Stage I of the project. At this point the project is to be re-evaluated and, contingent upon the success of Stage I, Stage II is to consist of three additional holes. Drill hole No. 3 is to be collared at an elevation of 7,550 feet and drilled to an estimated depth of 625 feet. Drill hole No. 4 is to be collared at 7,600 feet and drilled to an estimated depth of 1,275 feet. Drill hole No. 5 is to be collared at 7,465 feet and drilled to an estimated depth of 600 feet. These holes are designed to offset holes of Stage I along the Tenno fault

zone which is thought to have provided access for mineralizing solutions. The total footage of 5 holes is 4,225 feet. Each hole is to be drilled 10 feet into Prospect Mountain quartzite (figs. 5, 6 and 7).

The applicant proposes aerial photography in color and photogeologic interpretation for an area 10 miles long and 8 miles wide. This work is not considered necessary and will not materially benefit the district at this stage.

It is estimated that the above work can be completed in 7 months.

PROJECT COSTS

Stage 1

Independent Contracts

Bulldozer, access roads and preparation of drill sites

16 hours at $15 per hour	$240.00	
Drayage (estimated)	100.00	
Total		$ 340.00

Diamond drilling, 2 holes, total footage 1,525 feet, maximum depth 1,000 feet, caliber NX size - complete AX size

Hole No.	Hole Depth Range			Unit price	Amount	
	0-400; 400-800; 800-1,200					
1	400			$5.60	$2,240.00	
		400		6.30	2,520.00	
			200	7.60	1,520.00	
Total						$6,280.00
2	400			$5.60	$2,240.00	
		125		6.30	787.50	
Total						$3,027.50

Total Independent contracts, Stage 1 — $9,647.50

Labor and supervision

1 surveyor, 2 days at $50 per day	$100.00	
1 geologist, 4 days at $50 per day	200.00	
1 bookkeeper, ½ month at $600 per month	300.00	
Total labor and supervision		$ 600.00
Operating material and supplies	None	
Operating equipment		
1 jeep station wagon, 300 miles at $.08 per mile		$ 24.00
Miscellaneous		
20 samples at $5.00 each (lead, zinc, gold and silver)		100.00
Total cost, Stage I		$10,371.50

Stage II

Independent Contracts

Bulldozer, (completed under Stage I)

Diamond drilling, 3 holes, total footage 2,700 feet, maximum depth 1,275 feet, collar size NX - complete AX

Hole No.	Hole Depth Zones	Unit price	Amount	
	0-400; 400-800; 800-1,200			
3	400	$5.60	$2,240.00	
	400	6.30	2,520.00	
	25	7.60	190.00	
Total				$ 4,950.00
4	400	$5.60	$2,240.00	
	400	6.30	2,520.00	
	400	7.60	3,040.00	
	75	9.00	675.00	
Total				$ 8,475.00

Hole No.	Hole Depth Range	Unit price	Amount	
	0-400; 400-800; 800-1,200			
5	400	$5.60	$ 2,240.00	
	200	6.30	1,260.00	
Total				$ 3,500.00
Total independent contracts, Stage II				$16,925.00

Labor and supervision

1 surveyor, 2 days at $50 per day	$ 100.00	
1 geologist, 4 days at $50 per day	200.00	
1 bookkeeper, ½ month at $600 per month	300.00	
Total labor and supervision		$ 600.00

Operating material and supplies	None	
Operating equipment		
1 jeep station wagon, 500 miles at $.08 per mile		$ 40.00
Miscellaneous		
20 samples at $5.00 each (Lead, zinc, gold and silver)		$ 100.00
Total cost Stage II		$17,665.00
Total project costs		$28,036.50

Summary of Project Costs

Cost of Stage I	$10,371.50
Cost of Stage II	17,665.00
Total cost of project	$28,036.50

CONCLUSIONS AND RECOMMENDATIONS

Lead-zinc mineralization occurs at the upper contact of the Pioche shales at the Wah Wah mine at Pine Grove, Beaver County, Utah. Lead-zinc-silver ores have been extracted at this horizon from replacement deposits that have undergone secondary enrichment. Considerable exploratory work has been done at this stratigraphic horizon. The mineralized occurrences in the district are sufficiently strong and widespread to indicate the district has possibilities of producing large tonnages of lead-zinc ores if a receptive limestone horizon is present.

The purpose of the proposed project is to explore for the favorable Lower Cambrian limestones below the zone of known mineralization.

Cost estimates in the application have been checked and revised and are considered reasonable and equitable. Contract drilling bids should be obtained from two other sources if the project merits approval.

Unit costs of drilling are high because of the depth of holes to be drilled. Also, the area is remote from established communities.

It is recommended that the above-described exploratory program, estimated to cost $28,036.50, be approved. However, provision should be made that the location, inclination, direction and depth of all holes be subject to Government approval. It is further recommended that all property held by the lessee in the district be encumbered inasmuch as the entire area may be benefited by the work.

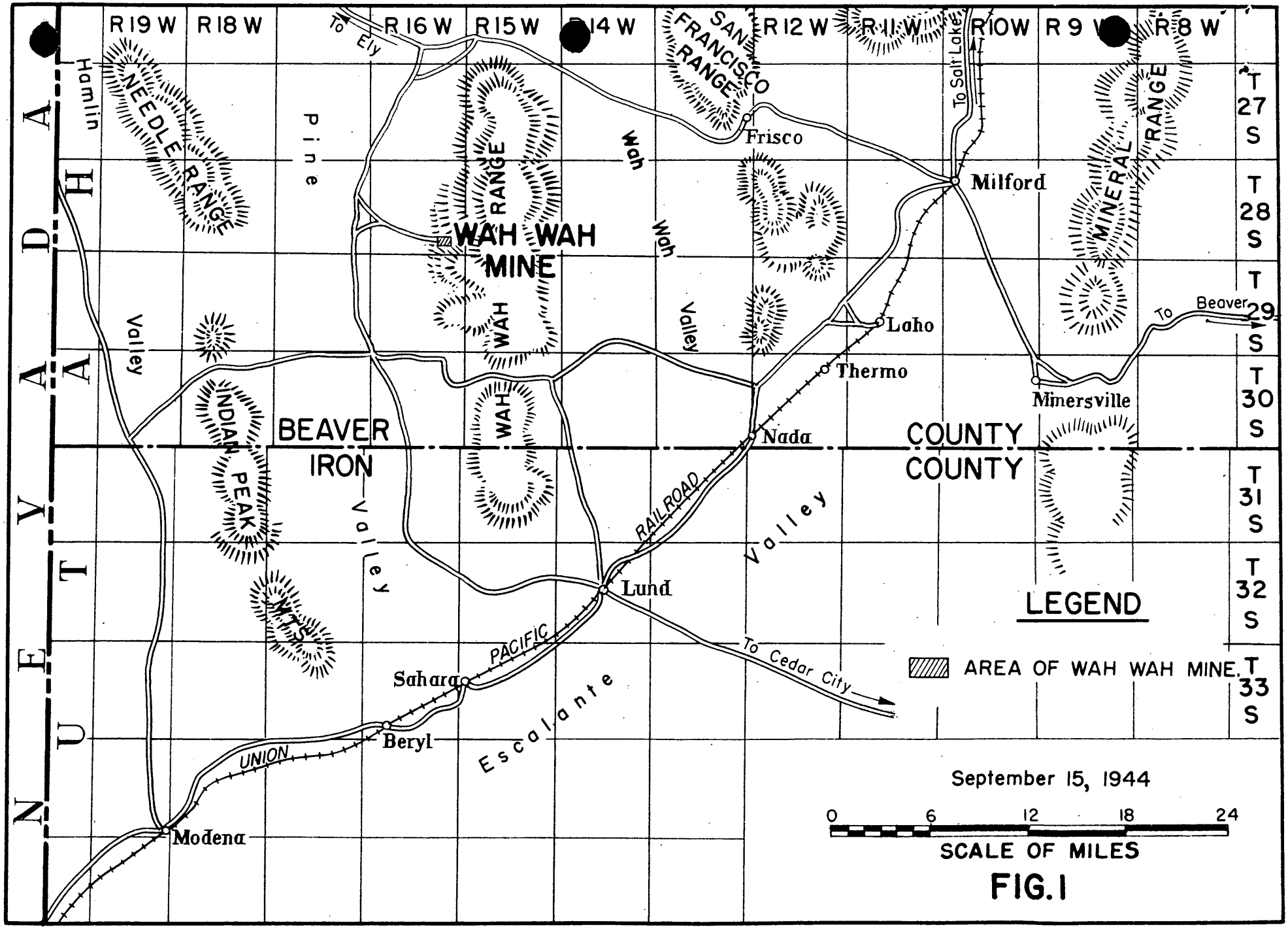
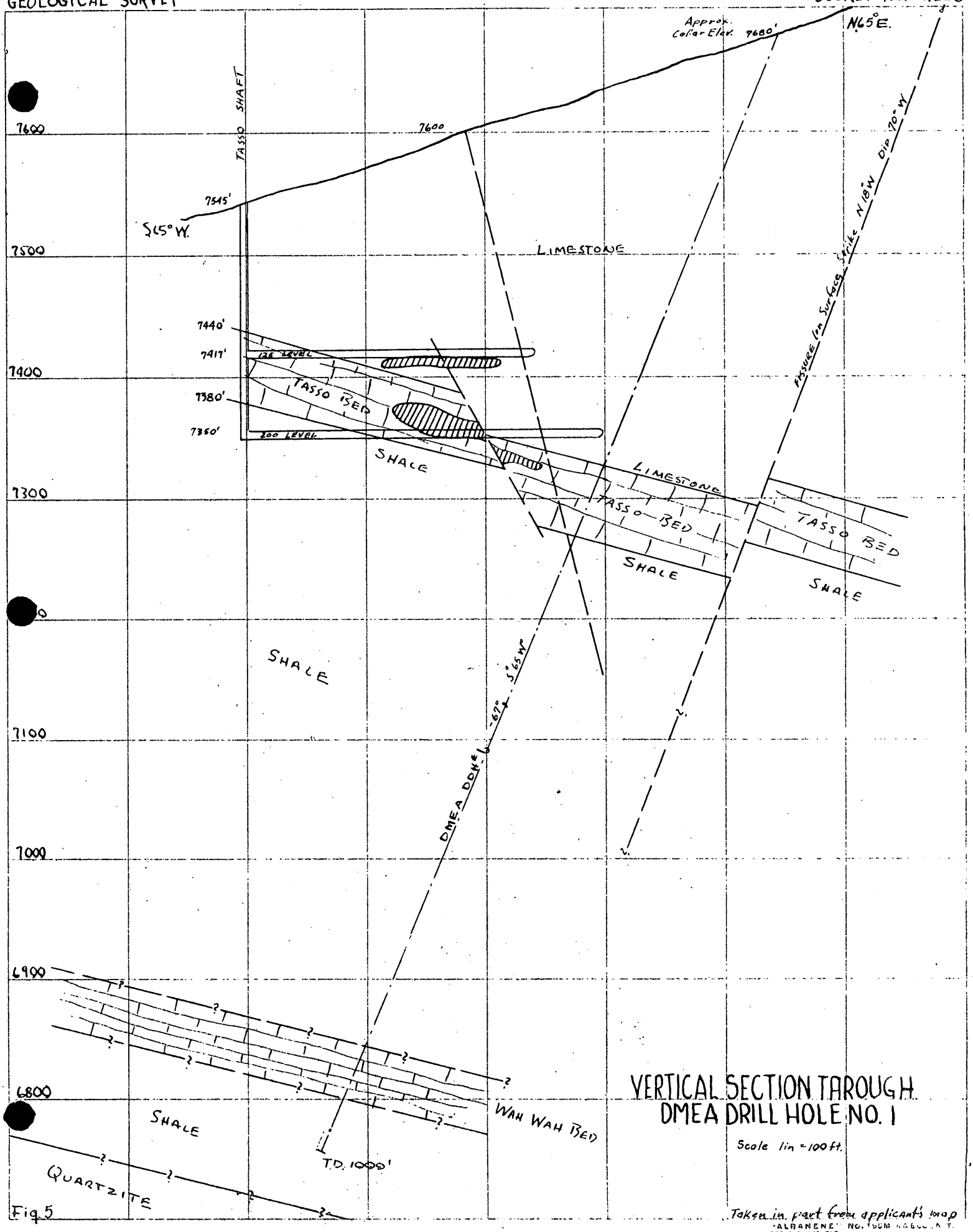


FIG. 1

Location Map of Wah Wah Mine, Project 15—110, Beaver County, Utah.

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLE NO. 1

Scale 1in = 100 ft.

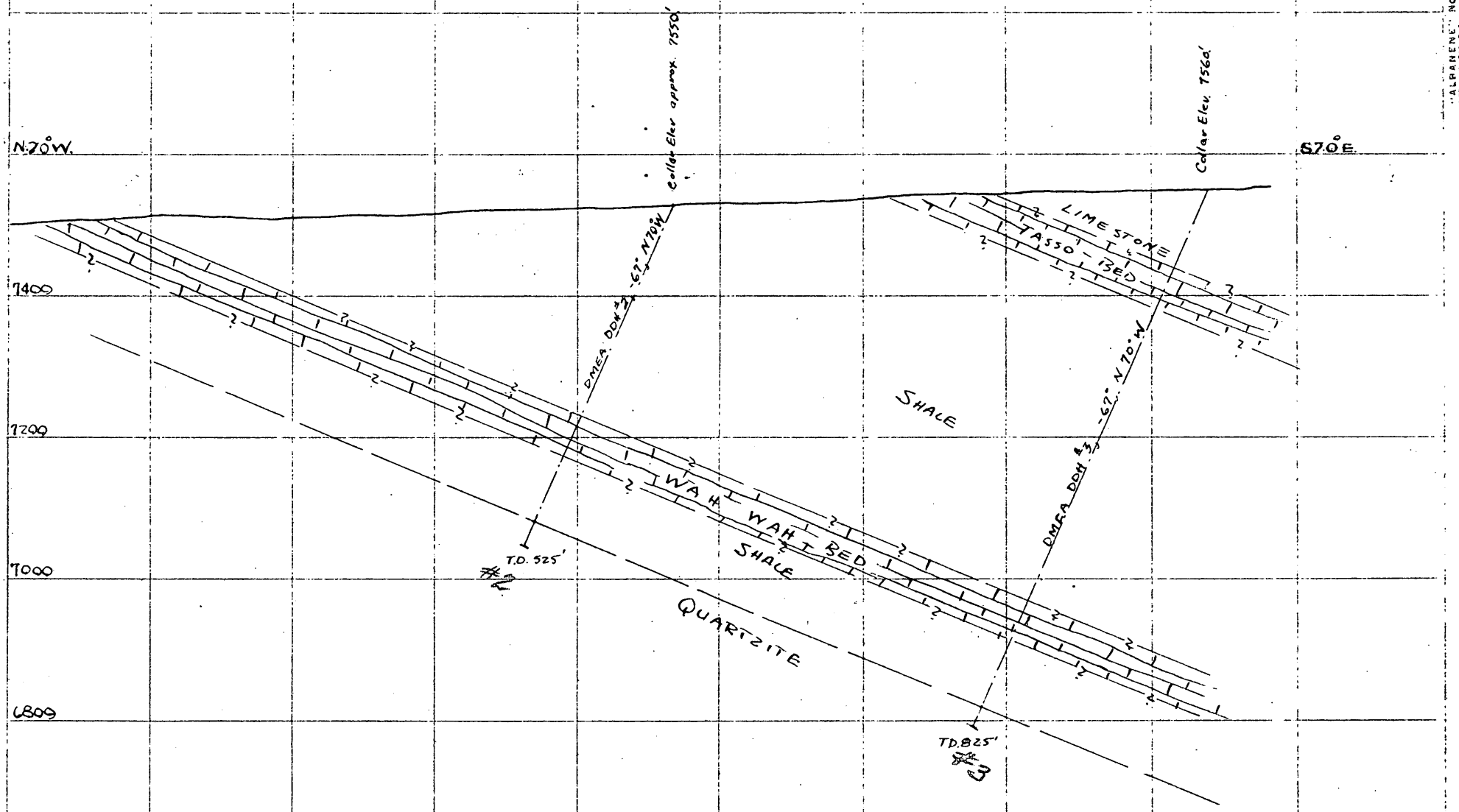
Fig. 5

Taken in part from applicant's map

ALBANENE NO. [illegible] N.Y.
REG. U.S. PAT. OFF
KWO 7-56

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH DMEA DRILLHOLES NOS. 2 & 3

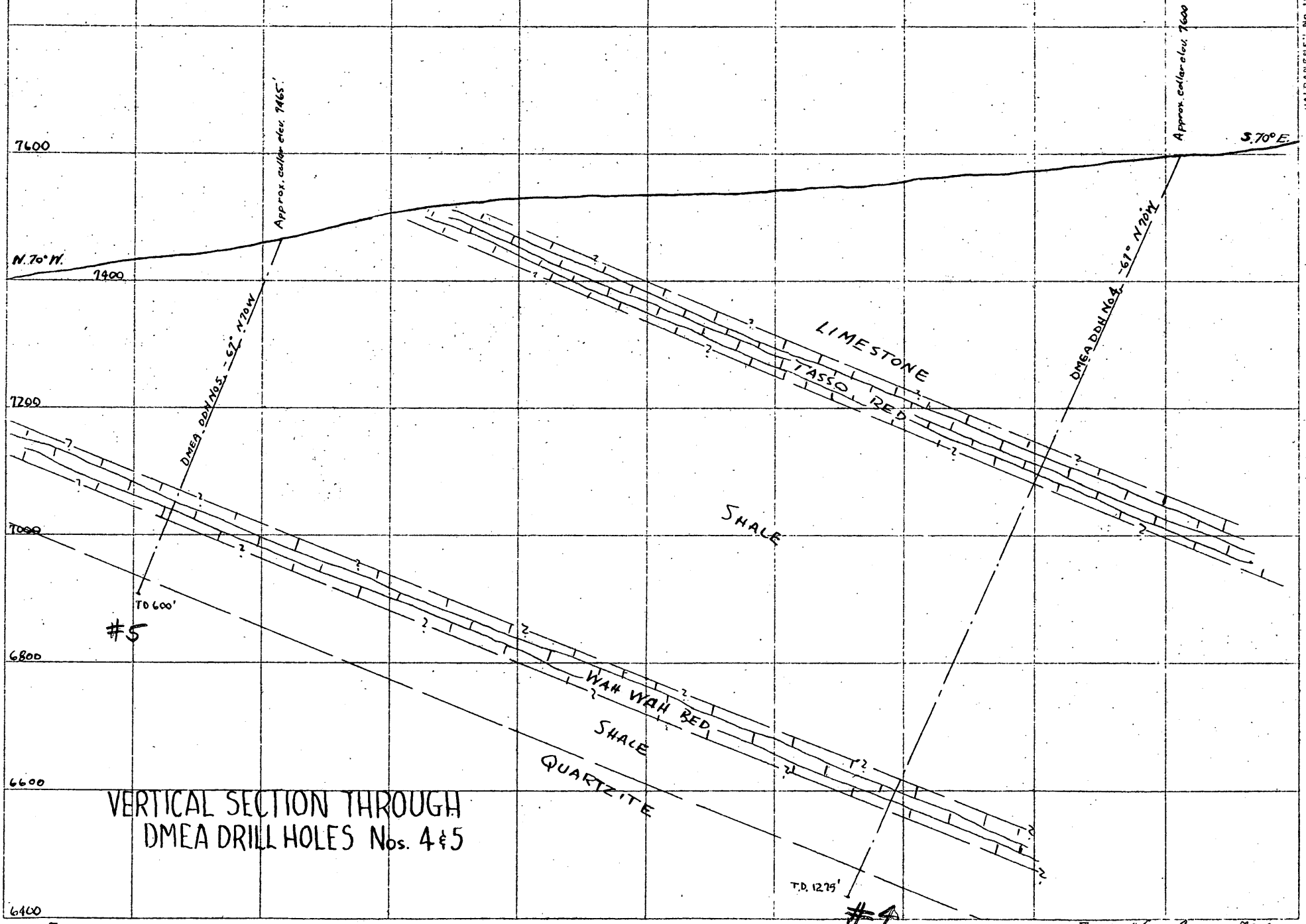
Scale 1in = 200ft.

Fig. 6

Prepared from Company maps
R40 7-58

U. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLES Nos. 4 & 5

FIG. 7

Prepared from Company Maps
12-20 7-56

"ALDARENE" NO. 196M K&E CO., N.Y.
REG. U.S. PAT. OFF.

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Defense Minerals Exploration Administration
Denver Federal Center
Denver, Colorado

RECEIVED
AUG 13 1956

August 8, 1956

Memorandum

To: Executive Officer, DMEA Field Team, Region III

From: T. N. Barshman

Subject: DMEA Docket 4229 (Lead-zinc), Pine Grove Mines (Wah-wah mine), Beaver County, Utah

I have reviewed both the geologic and engineering reports on the subject property and while the geologic deductions appear sound, I believe that the project recommended by the examiners impinges on, or in fact may be, prospecting.

There are four unknowns in regard to the target; (1) the Wah-Wah or CM bed is not known to be present in the target area although there is every reason to assume it is present; (2) if present, the Wah-Wah bed may or may not be favorable for ore deposition; (3) if present and favorable, the Wah-Wah bed may not have been exposed to mineralizing solutions ascending along the Tasso fault in the area to be explored; and (4) if present, favorable, and exposed to mineralizing solutions the Wah-Wah bed may or may not contain significant lead-zinc ore deposits.

The presence of ore in the target area thus depends upon at least four unknown factors the adverse character of any one of which would doom the project to failure. Exploration is

Reviewed by
DMEA OPERATING COMMITTEE

(date)

at best risky and DMEA projects should not be limited to the so called "sure bets". However, in this particular case it is my opinion that the applicant has not presented sufficient evidence of the geologic probability of finding significant ore deposits in the Wah-Wah mine area, and I suggest that the application for exploration assistance be denied. Should prospecting by the applicant eliminate some of the unknown factors, the ore potential of the Wah-Wah bed could be assessed and perhaps a project approved.

If the project recommended by the examiners is believed to be justified by the available data, the program proposed by them appears to be a conservative and logical method of exploring for ore in limestone beds in the lower part of the Cambrian ~~shield~~ shale (Pioche?).

F. M. Harshman
Member, Field Team

FMHarshman:mp

MINERAL DEPOSITS
DMEA
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JUL 16 1956
U. S.
GEOLOGICAL SURVEY
DENVER, COLORADO

DMEA
Date Rec'd.
JUL 16 1956
BUREAU OF MINES
Denver, Colorado

926 Federal Bldg.
Salt Lake City 1, Utah
July 13, 1956

Memorandum

To: E. H. Harshman, DMEA Field Team, Region III

From: R. W. Gaterstock

Subject: DMEA Docket 4236 (Lead-zinc) Pine Grove Mines (Wah Wah Mines), Beaver County, Utah.

Enclosed are 9 copies of an initial geologic report on the subject property. With the exception of Fig. 2 all of the illustrations pertaining to this report are being prepared by USGS and will be transmitted with the USGS report.

The Wah Wah property is underlain by Cambrian quartzite, shale and limestone in sequence correlative with the Ely, Nevada section. Mining operations in the higher limestone beds suggest possible mineralization in the unexposed limestone believed to be present in the underlying shale formation. Such is the basis for the proposed exploration program. A proposed program, alternate to that submitted by the applicant, is considerably reduced in cost but aims at the same primary objective, the Wah Wah or CM bed.

It is recommended that the revised exploration program be approved and that the government enter into a contract with the applicant to accomplish this program.

R. W. Gaterstock

cc: S. R. Wilson

Reviewed by
DMEA OPERATING COMMITTEE

PINK GROVE MINES

BEAVER COUNTY, UTAH

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or inspection

DMEA DOCKET 4228

Initial Geologic Report

By R. W. Osterwick
U. S. Geological Survey

Reviewed by
DMEA OPERATING COMMITTEE

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ILLUSTRATIONS

Figure 1. Location Map.

Figure 2. Reconnaissance Geologic Map of Wah Wah Range.

Figure 3. Claim and corrected geologic map of Alma area.

Figure 4. Map of Drill hole locations.

Figure 5. Section through DGSA DDH No. 1.

Figure 6. Section through DGSA DDH Nos. 2 and 3.

Figure 7. Section through DGSA DDH Nos. 4 and 5.

Note: All figures except No. 2 accompany DGSM report.

SUMMARY

James B. Williams submitted an application for government assistance to explore for lead-zinc ore in the Wah Wah Mine area, Pine Grove Mining District, Beaver County, Utah. The applicant has proposed an extensive drilling program the total cost of which is estimated as $66,952.00.

The Wah Wah property is situate in Pine Grove Canyon on the west flank of the north trending Wah Wah Range. The claim area is underlain by Cambrian sediments which include quartzite, shale and limestone. A short distance to the southeast of the area with which this report is concerned a stock-like body of quartz monzonite has intruded the sediments. Structurally, the area lies on the west flank of a northeasterly trending and plunging syncline. The only major fault in the mine area strikes easterly along Pine Grove Canyon.

Early production in the district was realized from lead-zinc-silver bearing fissures in the basal Cambrian quartzite. Much later the existence of bedded ore replacements in the high Cambrian limestone was recognized. The district stratigraphy is generally correlative with the Pioche, Ravenna and Ophir and Tintic sections in Utah. Their correlation forms the basis for the proposed exploration program. It is the applicant's contention that the shale unit lying between the underlying quartzite and the overlying limestone is directly correlative with the Pioche shale and should therefore contain the equivalent of the CM limestone bed. Although no direct evidence of the existence of this bed in the mine area is available, the regional persistence of the other stratigraphic horizons would tend to substantiate the theory.

Mineralization in the upper limestone which has been partially exploited by the Inaco workings has not proved to be of economic significance. However, the very presence of ore mineralization in this stratigraphically higher bed infers upward migration of ore bearing solutions which must have passed through the objective OK or Ush Ush bed.

A considerably reduced alternate exploration program is offered by the field examiners which has as its primary objective the Ush Ush limestone. All of the holes proposed are in close proximity to the Inaco fault which may be an access channelway for the mineralizing solutions. In addition, the holes are directed into the area underlying the zone of mineralization encountered in the upper limestone (or Inaco bed). Subsidiary targets in the holes, wherever practicable, consist of the possible extensions of mineralization in the upper limestone.

It is felt that the alternate exploration program will adequately explore the primary target and it is therefore recommended that the government enter into a contract with the applicant to accomplish the staged exploration program proposed by the examining DMRA field team.

INTRODUCTION

On March 24, 1956 Mr. James D. Williams of Salt Lake City, Utah, doing business as Pine Grove Mines, submitted an application (Docket DMEA [illegible]) for DMEA assistance on a proposed exploration program for lead-zinc ore at the Wah Wah Mine property in Beaver County, Utah.

At the request of the Region III DMEA Field Team a joint field examination, to determine the feasibility of the applicant's proposals, was conducted May 16, 1956 by W. R. Young (DMEA) and R. M. Osterstock (USGS). The examiners were accompanied in the field by Mr. James Williams, the applicant, and Mr. Earl Young, a geologist retained in an advisory capacity by the applicant.

Inasmuch as numerous maps of the mine area have been compiled by interested private parties and other government agencies no attempt was made by the field examiners to remap or resample the property. Spot checking of certain of the more salient geological features pertaining to the proposed exploration, as well as careful study of the existing maps, is believed to have provided sufficient evidence to justify the conclusions and recommendations contained in the body of this report.

The applicant's proposals involve a diamond drilling program designed to test the lead-zinc ore potential of lower and middle Cambrian limestone beds. The total estimated cost of the applicant's proposed exploration program is $[illegible],[illegible].00.

Location and accessibility

The Pine Grove Mine property is situate in Section 25, 26, 27, 34, 36, T. 28 S., R. 16 W. and in Section 2, T. 29 S., R. 16 W., S.B and M (unsurveyed) Pine Grove Mining District, Beaver County, Utah (Fig. 1), on

the west flank of the Wah Wah Range. The altitude of the mine area ranges from about 7,200 feet on the flat alluvial-filled Pine Grove Canyon floor to more than 8,000 feet at the top of precipitous limestone cliffs which form the subsidiary canyon walls.

A year around stream of culinary quality water, in sufficient quantity to service a mine camp and small milling operation, flows down Pine Grove Canyon. Although the area has been logged-off, a few remaining large Ponderosa pines land remain upon and might, if necessary, be utilized for mine timber. Pinon and juniper scrub is abundant throughout the canyon.

The property may be reached by travelling 40 miles westerly from Milford on Utah State Highway No. 21 on paved and improved graveled road, thence bear southerly on graded dirt road for 13 miles, thence turn east (left) on graded dirt road for 5 miles to the western edge of the Pine Grove Claim area.

Lund, the nearest rail shipping point, lies about 42 miles southeast of the mine area and is made accessible by a recently constructed Forest Service road.

History and production

Although the Pine Grove Mining District was originally organized in 1873, there was little activity until 1879 when the district was reorganized. By 1881 several small near-surface operations in the quartzite were producing small tonnages of high grade lead-silver-gold ore. These homogenite ore bodies were rapidly mined out and interest in the area declined again. The first large scale development program was instigated about 1900 when the Revenue Mining Company consolidated about 46 claims and undertook a major exploration program designed to develop at depth in the quartzite

the same lead-silver-gold fissures already exploited at the surface. No record of production from this phase of operation is available. Following this period of activity the district remained essentially idle for about 30 years except for corporate reorganizations and sporadic small exploratory ventures. One important development, during the latter part of the long static period was the recognition of replacement ore bodies in the limestone with the subsequent sinking of the Inase shaft. Renewed interest in the district accompanied the discovery of replacement ore and considerable exploration was effected. R. C. Ruphle organized the Wah Wah Mining Company in 1937 after having gained title to a large part of the claimed area in the district. From 1937-1940 the Wah Wah Mining Co. expended about $48,000 for exploration which resulted in the discovery of some ore. Lack of finances forced another period of inactivity until 1942 when the U. S. Bureau of Mines started a project in the Inase workings (Fig. 3) which was resumed before reaching its objectives. This exploration was continued, however, with R.F.C. funds and this phase was followed by a U. S. Bureau of Mines diamond drilling program which was completed in April 1944. During 1945 the company shipped a moderate tonnage of zinc carbonate ore from the Inase 200 foot level. There has been no activity at the property since 1945. Below is a brief summary of the recorded production from the Wah Wah property:

1873 - 1937 (Production unknown, presumed to be mostly Au-Ag fissure ore from quartzite.)

	Tons	Au	Ag	Pb	Zn	Type
1938 - 1939	925.6	0.07	8.0	11.0	—	oxide
1940 - 1944	239.6	0.02	2.4	4.2	4.4	sulfide
1945	1,392.0	—	0.90	—	13.1	oxide
	70.5	0.14	2.80	2.3	7.6	sulfide
	46.5	0.04	5.70	8.9	—	oxide

The present applicant holds by lease with an option to purchase the entire Wah Wah Mining Co. property, consisting of twenty-two patented and thirty-two unpatented mining claims.

Property and ownership

The property consists of 54 mining claims owned by the Wah Wah Mining Co., RFD Box 569, Woods Cross, Utah and the entire Wah Wah Mining Company property, consisting of twenty-two patented and 32 unpatented mining claims, is under lease, dated November 19, 1955, for 25 years with an option to purchase to the applicant, James B. Williams and Ruth T. Williams, 409 Felt Bldg., Salt Lake City, Utah (Fig. 3).

The twenty-two patented lode mining claims are as follows:

January	U.	S.	Survey	No.	4087
Revenue Mine	"	"	"	"	"
Eldorado	"	"	"	"	"
Iron Duke	"	"	"	"	"
Farrington	"	"	"	"	"
Lafayette	"	"	"	"	"
Tuve	"	"	"	"	"
Chearnion	"	"	"	"	"
Baker	"	"	"	"	"
Bachelor	U.	S.	Survey	No.	4195
Bachelor No. 2	"	"	"	"	"
Cliff	"	"	"	"	"
June	"	"	"	"	"
Tempe	U.	S.	Survey	No.	5083
Ben	"	"	"	"	"
Elizabeth	"	"	"	"	"
Zum Zum	"	"	"	"	"
Queen	U.	S.	Survey	No.	4815
Midway	"	"	"	"	"
Southside	"	"	"	"	"
Sun Star	"	"	"	"	"
Sophie	"	"	"	"	"

The thirty-two unpatented lode mining claims are as follows:

Name of Claim	Book	Page
Ben No. 2	21	59
Ben No. 3	21	59
Ben No. 4	21	59
Ben No. 5	21	60
Ben No. 6	21	60
Ben No. 7	21	60
Ben No. 8	21	61
Ben Ben No. 2	21	55
Ben Ben No. 3	21	56
Ben Ben No. 5	21	56
Ben Ben No. 6	21	57
Ben Ben No. 7	21	57
Ben Ben No. 8	21	57
Ben Ben No. 9	17	206
Ben Ben No. 10	21	58
Ben Ben No. 11	21	58
Ben Ben No. 12	21	58
Bevo	21	61
Bevo No. 2	21	61
Bevo No. 3	21	62
Bevo No. 4	21	62
Keystone	21	53
Keystone No. 1	21	54
Keystone No. 2	21	54
Keystone No. 3	21	54
Keystone No. 4	21	55
Keystone No. 5	21	55
Keystone No. 6	17	453
Keystone No. 7	17	454
Keystone No. 8	17	454
Keystone No. 9	17	455
Keystone No. 10	17	455

Each of the above unpatented claims is recorded in the office of the County Recorder, Beaver County, Utah. Only twelve claims are dedicated by the applicant to the BMA project. These include four patented claims: Jeanery, Tessa, Ben and Ellellaby and eight unpatented claims: Ben No. 8, Bevo, Ben No. 2, Bevo No. 2, Bevo No. 3, Keystone, Keystone No. 1, and Keystone No. 2 (see fig. 2). There are no vertical limits involved.

No legal instrument providing for "Owners Consent to Lien" was included with the application unless paragraph two of Section 23 of the lease agreement may be so interpreted.

Development

The Wah Wah Mines Company property includes the great bulk of the Pine Grove district which has been subjected to exploration and mining activity in the past and, therefore, a detailed description of all of the workings is impractical. As noted in the foregoing "History and Production" section of this report, the early activity in the district was largely confined to the high grade gold-silver-lead bearing fissures in the Cambrian Prospect Mountain quartzite. Numerous shafts, tunnels, and prospect pits mark this phase of the exploitation of the region, generally to the west of the area with which the present application is concerned. The early work reached its culmination about 1920 with the consolidation of 46 claims by the Revenue Mining Co. This group instituted what was considered an extensive exploration program in the quartzite. Not until the 1930's was attention directed to replacement ore in the limestone area. By far the largest single discovery in the limestone is the Tempe mine which is serviced by a 200 foot vertical shaft. Three underground levels and the tunnel level represent nearly 1,500 feet of lateral workings. Underground diamond drilling amounts to 675 feet by the USBM, 421 feet by AS and R and 99 feet of above drilling by AS and R. The exploratory operations aimed at ore in the limestone in the Lee shaft; these workings are presently inaccessible and nothing is known of the production therefrom.

GEOLOGY

The Wah Wah Mountains are a typical fault block range of the basin and range province. Wah Wah Valley separates the Wah Wah Range from the San Francisco Range on the east and White Sage Valley separates the Wah Wah Range from the Needle Range on the west. The exposed sediments, which range in age from Cambrian to Mississippian are uplifted and gently tilted to the west by a north-south trending normal fault bounding the west edge of the range. Tertiary volcanics mantle much of the eastern half of the range. A stock-like body of quartz monzonite has intruded the sediments a short distance to the southeast of the Topaz mine workings.

The stratigraphic section exposed in the area with which this report is concerned includes from oldest to youngest:

Prospect Mtn. quartzite--only the upper beds of this basal Cambrian formation are exposed in the mine area. The highly resistant, thick to thin bedded relatively coarse-grained quartzite generally forms precipitous slopes. Although the rock is white to buff on fresh surfaces its weathered appearance is tan to brown. Much of the early production in the district was gained from manganiferous fissures in this formation. The Ophir and Tintic mining districts of Utah and the Pioche mining district of Nevada each contain a correlative section of this persistent Cambrian quartzite.

Conformably overlying the Prospect Mountain quartzite is a thick Cambrian shale which is believed to be correlative with the Pioche shale of the Pioche Mining district of Nevada. A similar correlation may be drawn from the Ophir and Tintic mining districts of Utah where a Cambrian shale again overlies basal Cambrian quartzite. Yellow, buff, brown and reddish-green argillaceous and micaceous shales make up the bulk of this

formation. At least one apparently persistent band of dense, coarse-grained quartzite about 40 feet above the base of the shale is found in the section about 1/2 mile north of the Bunce shaft. Generally, the formation includes one or more interpolated beds of limestone which, in other nearby mining districts, have been particularly receptive to ore mineralization. No direct evidence of the existence of such limestone beds was found in the area immediately adjacent to the mine. It is, however, entirely possible that a limestone unit does exist in the shale but is not exposed because of the relatively low resistance to erosion of the predominantly shale formation. The shale, which invariably forms a topographic low as a result of its susceptibility to erosion, may easily be traced northward along strike from the mine area. Perhaps 1 1/2 miles north of Pine Grove Canyon an hump near the center of a low shale saddle indicates the presence of a more resistant zone which may be limestone. One or two miles south of Wah Wah pass (about 8 miles north of Pine Grove Canyon) there are outcrops of limestone beds in the stratigraphically lower half of the Cambrian shale (see fig. 2). The applicant suggests that this limestone unit is directly correlative with the C.M. bed of the Fleche district in Nevada, approximately 46 miles to the southeast. In the Pine Grove district this limestone has been termed the Wah Wah bed by the applicant. Its stratigraphic position is expected to be less than 100 feet above the Prospect Mtn. quartzite and it is anticipated that the unit will be 45-50 feet thick. It is possible that other thinner limestone beds may be present in the shale section, however, the uncertain persistence of such beds precludes their inclusion as significant potential ore zones.

Much of the eastern half of the Wah Wah Range is covered by Tertiary volcanics which range in composition from rhyolite through latite and andesite.

In a regional sense the structure of the portion of the Wah Wah Range, with which this report is concerned, may be described as a broad northwesterly trending and plunging syncline (Fig. 2). Although a few minor flexures have been superimposed the major structural trend is remarkably uniform. Only one large fault is noted in the mine area. The applicant refers to this N-W striking structure as the Tunnel fault. The outcrop pattern indicates that the relative movement along this fault is down on the north. There are numerous diversely oriented smaller fault structures in the area adjacent to the Wah Wah mine; none of them, however, appears to have affected any significant disturbance of the strata. The applicant postulates that the Tunnel fault has acted as the main access channelway for the mineralizing solutions which entered the mine area.

ORE DEPOSITS

A discussion of the ore deposits in the Pine Grove district must necessarily be confined to those ore bodies occurring in the upper black limestone bed, referred to locally as the Tunnel bed (correlative with the "Black Prince" bed of the Pioche district).

The ore bodies which have been exposed in the mine area are principally disseminated galena and sphalerite replacements of the receptive beds. Above the 125 foot level of the Wah Wah mine oxidation of the ore has been almost complete, only limonite and lead carbonate remain, namely all of the original zinc content has been removed. Below the 125 foot level zinc carbonate is present as a precipitant from the descending oxidizing

solutions. It has been estimated that the zinc carbonate ores will persist to a point about 50 feet below the 200 foot level. Oxidation of the ore bodies below the 125 foot level is not complete, consequently most of the lead occurs in its primary sulfide form. Most of the ore contains a small amount of silver and gold and some chalcopyrite was identified by the USBM laboratory in Salt Lake City. The gangue is principally pyrite, quartz and unreplaced country rock.

The shape of the ore bodies may best be described as irregular pipes exhibiting tabular offshoots into particularly receptive beds. In a large sense, all of the known ore bodies fall within a zone which may have been influenced by the Tenno fault. In detail the individual ore bodies appear to have been localized by minor faults and fissures as well as by bedding. The presence of a zone-vertical pebble dike exposed in the zinc workings may have exerted some influence on the localization of the ore but the relationship is not clear.

Virtually nothing is known of the ore deposits which have been prospected east of the Tenno shaft area. Most of this zone parallels the northern border of the quartz monzonite intrusive and may be a result of contact phenomena.

Following an extensive sampling of the accessible workings, coupled with a drilling program, the applicant reports that the U. S. Bureau of Mines estimated the following ore reserves for the Hah Hah mine:

Class	Sulfide Ore			
Indicated	Zinc carbonate	36,000 tons	8.25% zinc	0.5 oz. Ag.
Indicated	Lead carbonate	26,000 tons	10.9% lead	8.1 oz. Ag.
	Sulfide Ore			
Indicated	Lead--zinc	3,000 tons	4.25 pb, 4.45 zn	2.4 oz. Ag.
Inferred	Lead -zinc	16,000 tons	2.9% pb, 2.5% zn	2.8 oz. Ag.

It is extremely unlikely that production from the mine will provide tonnages such as are estimated; the extreme selectivity required with its attendant high mining cost prohibits operation of the property even at today's advanced metal prices.

Inasmuch as the present application involves multiple targets, namely the Tamo ore horizon and the stratigraphically lower Wah Wah bed, a brief statement regarding the expected mineralization in the lower bed is in order. Although the Wah Wah bed has not yet been exposed in the mine area it is considered a logical exploration objective for the following reasons: it serves as the first replaceable horizon; it generally is capped by a rather impervious shale horizon; the competent limestone having impermeable over- and underlying beds is crushed and broken when subjected to stress and thus prepared for ore emplacement; ore mineralization in the underlying quartzite as well as in the overlying Tamo bed indicates upward migration of mineralizing solutions which must have passed through the Wah Wah bed.

The entire sequence of requisite features has been duplicated in the Pioche district of Nevada and to some extent in the Ophir and Tintic districts of Utah. In each of these instances, the resultant ore bodies are primarily bedding replacements.

As has been pointed out in the "Geologic" section of this report, the areal persistence of the quartzite-shale w/intercalated limestone-limestone sequence over Utah and Nevada is sufficiently impressive to warrant the conclusion that the sequence will obtain in the project area.

No ore reserves are estimated for the objective Wah Wah bed.

PROPOSED EXPLORATION

The applicant has proposed an extensive two part exploration program consisting of diamond drilling and aerial photography.

The diamond drilling is to include 22 drill holes, totalling 10,954 feet to be drilled in four stages.

First Stage (2,186 ft.) - 7 drill holes designed to explore for offsets and extensions of the known ore bodies mined from the Tanco shaft. This work confined to the upper or Tanco bed.

Second Stage (1,786 ft.) - 5 drill holes designed to explore for mineralization emanating from the Tanco fault zone in the lower or Wah Wah (CM) bed.

Third Stage (3,380 ft.) - 5 drill holes, 4 of which are designed to continue the drilling of the first stage. The fifth hole would also penetrate the Tanco bed but would continue down to the Wah Wah bed.

Fourth Stage (3,602 ft.) - 4 drill holes designed to explore the Tanco bed for mineralization adjacent to the intrusive contact.

The portion of the applicant's proposals dealing with aerial photography involves vertical stereoscopic color photography of the central portion of the Wah Wah Range. Photo-geologic interpretation with the construction of a base geologic map is the ultimate objective of this work.

An analysis of the applicant's proposals and objectives reveals the exploration program to have two separate targets, the Tanco bed and the Wah Wah bed. Past mining operations and exploration in the Tanco bed have demonstrated that its mineralization is generally spotty and not attractive as an individual target. Mr. W. H. Young, the engineer in charge of exploratory work for the BSMM, reports that the Tanco bed does not appear capable of sustained production of significant tonnage and grade. Consequently, the Wah Wah bed looms as the only interesting objective. With virtually no evidence at hand regarding mineralization in this horizon

except that the bed has great areal persistence and is receptive in other mining districts, exploration must necessarily be of a "wild cat" nature. Perhaps the most encouraging evidence is the apparent localization of mineralization in the adjacent sediments (i.e. Quartzite and Tenno bed) by the Tenno fault zone. If, as appears to be the case, this fault zone served as an access channelway for the mineralization, it is therefore, logical to presume that exploration in the Wah Wah bed should be directed into the area of influence of the fault zone. On the basis of these observations the following alternate exploration program is offered by the field examining team (see fig. 4).

Stage I - Total drilling 1,525 feet.

DDH 1, Coor. 10,300 N.-13,700 E., -65°, S. 65° W. approx. collar elevation 7,665, T.D. 1,000 ft. (fig. 5). Primary target is the Wah Wah bed under the most heavily mineralized area in the upper or Tenno bed. Subordinate target is the northeasterly extension of the mineralization in the Tenno bed. Hole will collar in middle Cambrian limestone and bottom in Prospect Mtn. quartzite.

DDH 2, (same location as William's No. 6), -65°, N. 70° W., approx. collar elev. 7,550. T. D. 525 ft. (fig. 6). Target is the Wah Wah bed just south of Tenno fault and opposite the Tenno ore zone. Hole will collar in upper Pioche shale and bottom in Prospect Mtn. quartzite.

Stage II - (contingent upon results of Stage I) Total drilling 2,700 ft.

DDH 3, (same location as Williams No. 17) -65° N. 70° W., approx. collar elev. 7,560. T. D. 825 feet (fig. 6). Designed to test the Wah Wah bed in the south fault block down dip from DDH No. 1. Hole is located adjacent to Tenno fault zone and therefore should fall

within zone influenced by fault. As with DDH No. 1 this hole offers a subordinate target, the Tunno bed, which will also be penetrated in close proximity to the Tunno fault. Hole will collar in middle Cambrian limestone and bottom in Prospect Mtn. quartzite.

DDH 4, (same location as Millican's No. 13) -67°, N. 70° W., approx. collar elev. 7,600, T. D. 1,275 feet (Fig. 7). This hole is designed to test the Wah Wah bed in the north fault block in the area between Tunno fault and the ore bodies mined from the Tunno shaft. Although the Wah Wah bed is the primary target, the Tunno bed will also be encountered.

DDH 5, (same location as Millican's No. 12) -67°, N. 70° W., approx. collar elev. 7,465, T. D. 600 ft. (Fig. 7). This hole is designed to test the Wah Wah bed only in the north fault block. Hole positioned in close proximity to Tunno fault and therefore should be within sphere of influence of this localizing structure.

The total drilling of both stages offered in the accepting field team's alternate exploration program is 4,225 feet. Although the primary objective of the alternate program is the lower or Wah Wah bed, the holes are so located as to offer the optimum number of penetrations of the subordinate Tunno bed. The alternate program is set up in Stages in the event that Wah Wah bed is not present in the section or does not appear to be receptive to mineralization. It is not the purpose of this program to search out the ore possibilities of the upper or Tunno bed and in the event that this subordinate target appears more promising after completion of Stage I than the primary objective, the Wah Wah bed, it is not recommended that the program as set up, be continued through Stage II.

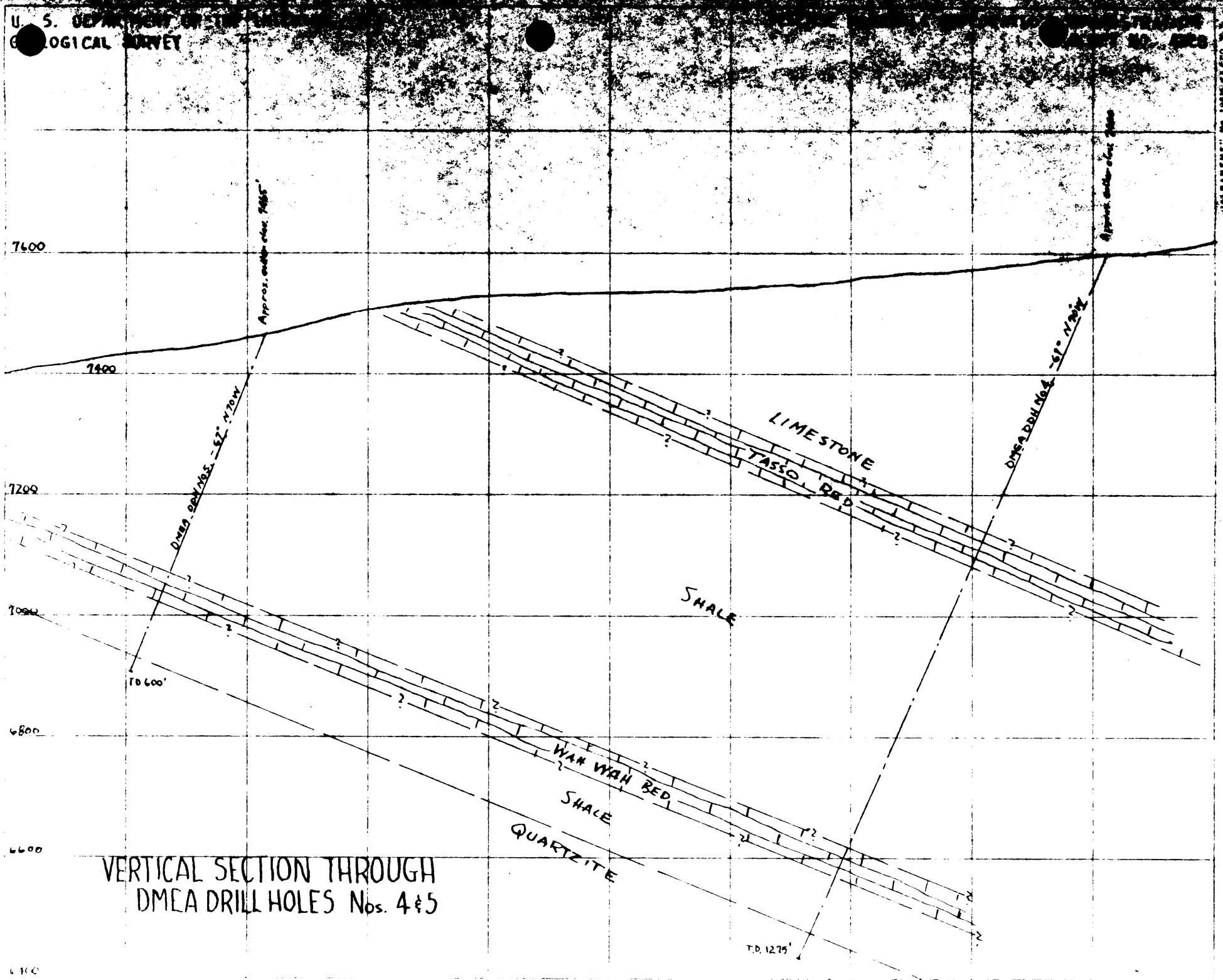
All of the holes drilled should be bottomed in the Prospect Mtn. quartzite in order to assure that drilling will not be halted prematurely in lime beds overlying the target Wah Wah bed.

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that in the Pine Grove Mining district the likelihood of discovering mineable ore bodies is considerably enhanced by the probable existence of a limestone bed within the Cambrian Pioche formation. The areal persistence of the conventional stratigraphic sequence, from quartzite to shale with intercalated limestone to massive limestone, throughout western Utah and eastern Nevada is sufficient to conclude that the project area will contain the objective Wah Wah limestone. It is further concluded that the Wah Wah limestone is correlative with the receptive Gk bed of the Pioche district and therefore may be expected to offer a favorable target particularly in areas of known mineralization. That the future of the district lies with the ore potential of the lower receptive horizon (Wah Wah bed) is demonstrated by the relatively futile efforts to develop significant tonnages of ore grade in the upper receptive horizon (Inane bed).

It is recommended, therefore, that the alternate exploration program as described in this report be approved for government assistance. The program is substantially the same as that offered by the applicant in that the primary target is the Wah Wah bed. Where possible the proposed drill holes will also penetrate the subordinate Inane bed. It is the opinion of the writer that the staged alternate program will adequately explore the primary target bed for ore mineralization and that additional drilling would fall under a phase of development which is not a part of the RFCA program. Prior to the activation of Stage II of the proposed program it is recommended that the applicant must receive written approval from the government.

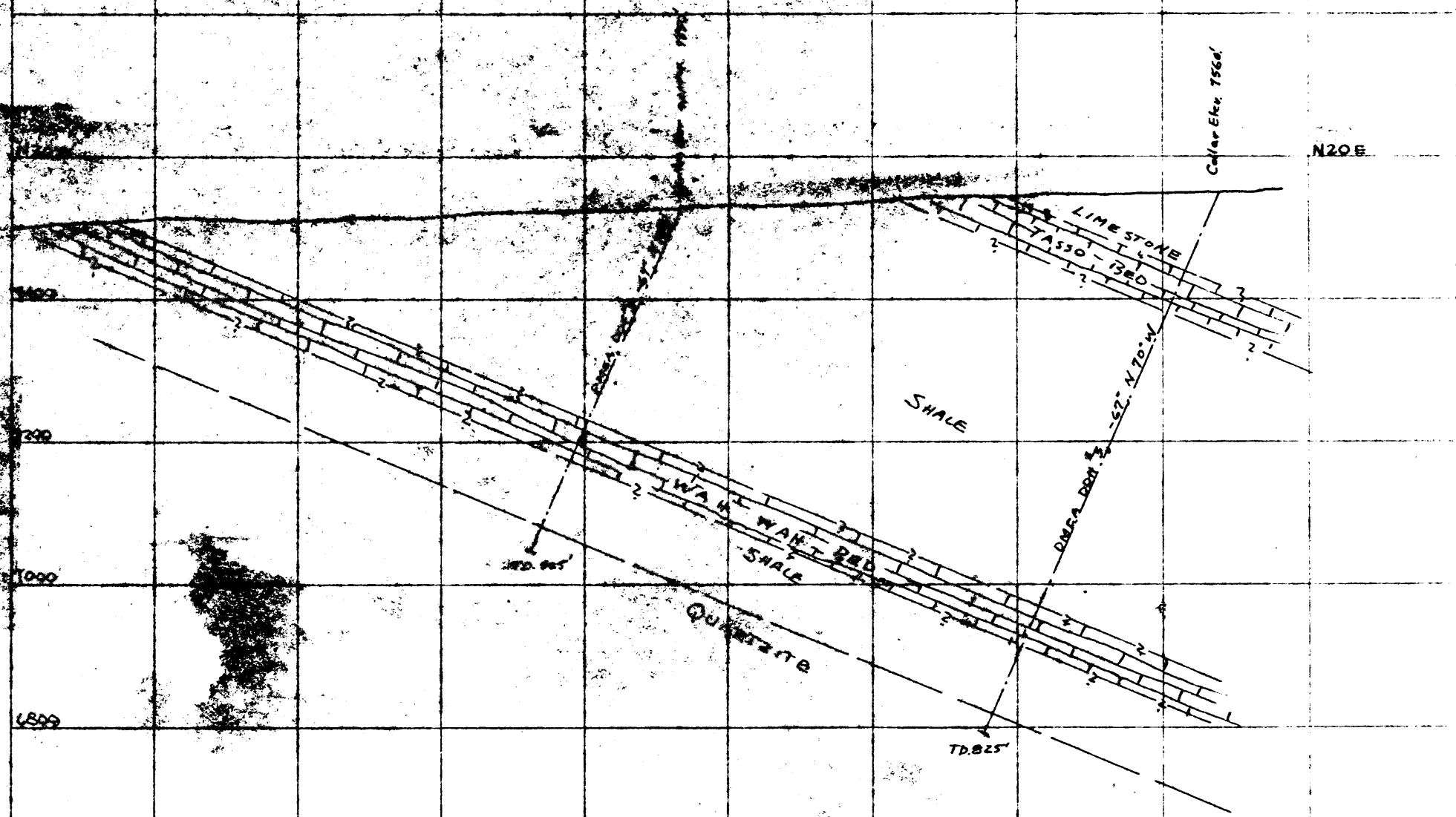
It is further recommended that the entire block of ground now held by the applicant (22 patented claims and 32 unpatented claims) be subordinated to the proposed BMEA project.



VERTICAL SECTION THROUGH
DMEA DRILL HOLES Nos. 4 & 5

FIG 7

Prepared from Company Maps



VERTICAL SECTION THROUGH DMEA DRILL HOLES NOS. 2 & 3

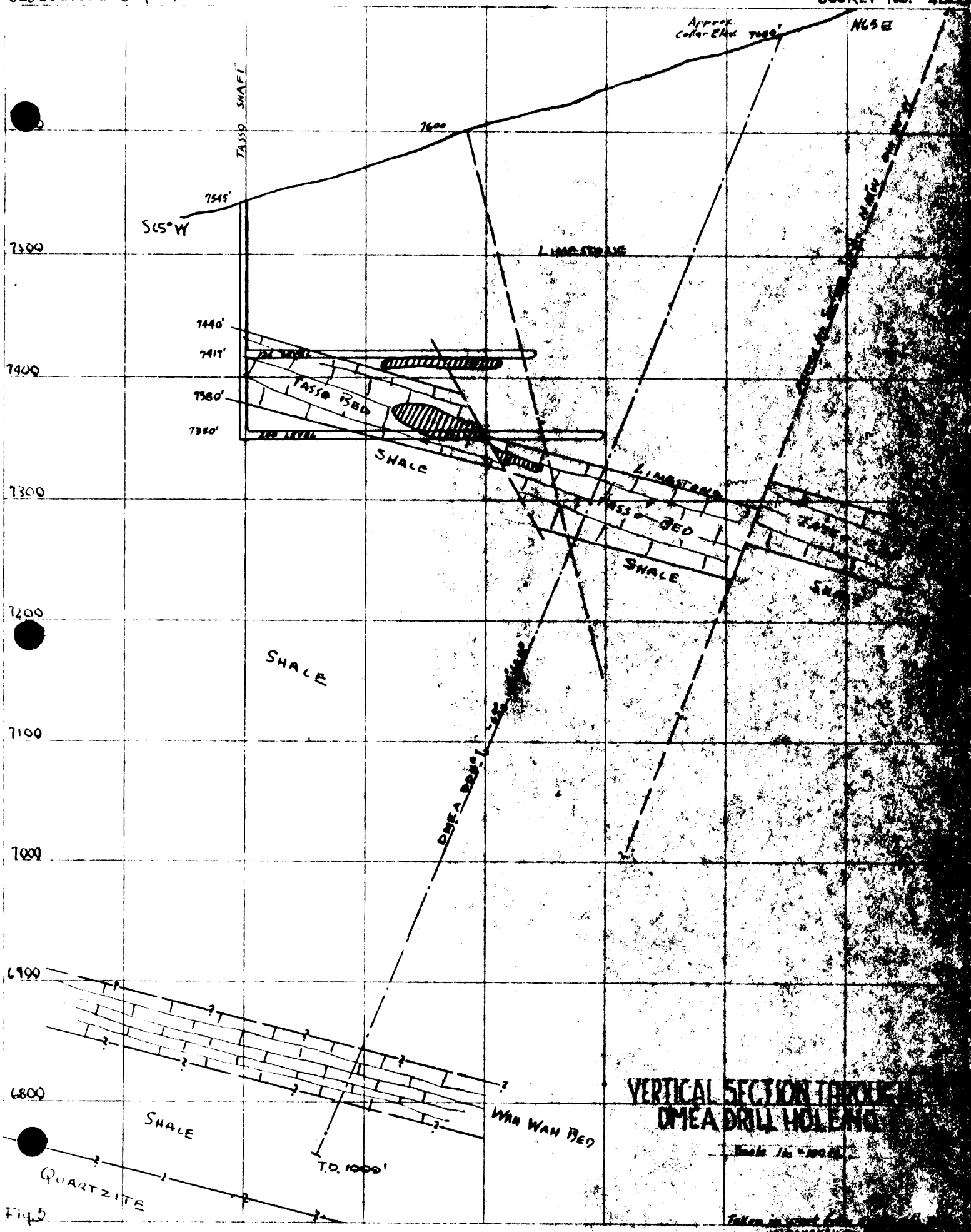
Scale 1in = 200ft.

Fig 6

Prepared from Company maps
R.W.O. 7-16

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH DMEA DRILL HOLE NO.

Fig. 5

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
1600 EAST FIRST SOUTH STREET
SALT LAKE CITY 12, UTAH

DMEA
Date Rec'd.
AUG 6 1956
BUREAU OF MINES
Denver, Colorado

TRANSMITTED August 3, 1956

RECEIVED
AUG 13 1956

Memorandum AUG 9 1956

To: W. M. Traver, Executive Officer, DMEA Field Team, Region III

From: Stephen R. Wilson

Subject: Docket No. DMEA 4228 (Lead-zinc), Pine Grove Mines (Wah Wah property), Beaver County, Utah

Enclosed are the original and eight copies of an engineering report covering investigation of the subject property for DMEA loan appraisal. The property was examined by W. E. Young with R. W. Osterstock of the Survey. The brochure has been returned to your office under separate cover.

The applicant has requested a loan of $88,592 to conduct exploration consisting of 10,596 feet of diamond drilling in 21 holes, with photogeologic mapping of an area 8 miles wide by 10 miles long. The applicant proposes to explore the Black Bed (Tasso) in the vicinity of known mineralization. This limestone bed lies near the top of the Cambrian Pioche shale (Ophir) formation. In addition, the applicant plans to explore by drilling to the basal part of this formation to determine the presence or absence of a limestone bed which is a favorable host rock in other districts. The applicant's proposed work is divided into four stages. The applicant believes that lead-zinc ores of commercial grade will be found in the lower limestone bed, if present.

The examining engineer is of the opinion that the applicant's staging of the proposed exploratory work is not justified in view of known information concerning mineralization in the upper part of the Pioche shale formation. It has been shown by exploration and exploitation that the primary mineralization in the Black Bed is not sufficiently strong to sustain a mining operation. It is the opinion of the engineer that the area should be investigated by drilling the basal limestone bed of the Pioche shale formation below the zone of known mineralization.

The examining team recommends an alternate program consisting of two diamond drill holes under Stage I and three diamond drill holes under Stage II. The two holes under Stage I are to be drilled on opposite sides of the Tasso fault to ascertain the existence of a favorable limestone bed near the bottom of the Pioche shale below the zone of known mineralization. The estimated depth of hole No. 1 is 1,000 feet, and hole No. 2, 525 feet.

Reviewed by
DMEA OPERATING COMMITTEE
8-17-56
(date)

If results under Stage I are favorable, three holes are to be drilled under Stage II. The estimated depth of hole No. 3 is 525 feet; hole No. 4, 1,275 feet; and hole No. 5, 600 feet. The three holes under Stage II are planned as offset holes of Stage I drilling along the Tasco fault.

The alternate program outlined by the examining team appears to be the most logical approach for investigation of the property. However, I do not believe the proposed work may be termed exploration under IMEA standards. It is uncertain that the objective limestone bed is present near the base of the Pioche shale, and, if present, no evidence is available to indicate that the bed is mineralized, other than the favorable character of the bed in other localities. Deep diamond drilling, 525 to 1,000 feet under Stage I and 600 to 1,275 feet under Stage II, may give inconclusive results. In effect, the applicant's proposal and the alternate proposal are planned to obtain geologic information.

If the Washington Office of IMEA agrees that the proposed work may properly be termed exploration, investigation by the alternate method proposed by the field examiners seems the most feasible. However, it is my opinion that the applicant should first, on his own account, demonstrate that the lower limestone bed in the Pioche shale is present in the proposed project area. If the bed is encountered and favorable geologic evidence is disclosed, appraisal of the loan request should then be made.

Stephen R Wilson
Stephen R. Wilson

cc: J. B. Clemmer

RECEIVED
AUG 13 1956

PINE GROVE MINES
WAH WAH PROPERTY
BEAVER COUNTY, UTAH
DMEA-4228
Lead-Zinc

CONFIDENTIAL
not for public quotation
or inspection

Engineering Report

By W. E. Young
Mining Engineer
Bureau of Mines

July 18, 1956

Reviewed by
DMEA OPERATING COMMITTEE
8-17-56
(date)

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PINE GROVE MINES
WAH WAH PROPERTY
BEAVER COUNTY, UTAH

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Fig. 7 Vertical section through proposed drill holes Nos. 4 and 5

SUMMARY

J. D. Williams has applied for Government aid in an exploratory project at the Wah Wah lead-zinc mine in Beaver County, Utah. The property is held under lease from Wah Wah Mining Co. The applicant has proposed a project consisting of 21 diamond drill holes with photo-geologic mapping. The estimated cost of the applicant's proposed exploration is $88,592. The examiners have proposed an alternate plan consisting of 4,225 feet of diamond drilling in two stages. The estimated cost of the alternate program is $28,036.56.

Sedimentary rocks in the Wah Wah area consist of quartzite, shale, and limestone of Cambrian age. The basal Cambrian section here is thought to be similar to that known extensively throughout the Basin and Range province. In the vicinity of the mine the shale section is deeply covered with alluvium. No work has been done to ascertain the existence of limestone members near the base of the shale in the vicinity of the mine. These members are favorable host rocks for lead-zinc mineralization at many locations. Investigations of the lead-zinc occurrence at the top of the shale section have been made at the Wah Wah mine. This mineralization is thought to be sufficiently strong and extensive to justify investigation in the more receptive basal Cambrian limestone members.

The proposed alternate project is set up in two stages. The two holes of Stage I are designed to test the horizon in the most favorable location near the Tasso fault.

INTRODUCTION

Property of Pine Grove Mines was examined May 16, 1956, by a geologist of the Geological Survey and an engineer of the Bureau of Mines. Examination was made at the request of the Regional Field Team to determine the advisability of granting a Government-assistance loan. J. D. Williams, applicant, and E. B. Young, consulting geologist, accompanied the examining personnel during the period.

In the early days of mining the property produced a small tonnage of gold-silver-lead ores from fissures in quartzite. Interest was later transferred to lead-zinc replacement ores in limestone. A small tonnage of ore was shipped.

The applicant plans to further explore the area by diamond drilling and has requested funds for 10,956 feet of drilling in 21 holes and for photo-geologic mapping, in colored aerial photography, an area 8 by 10 miles in extent. A loan totaling $88,592 is requested to complete the work.

LOCATION, TOPOGRAPHY AND PHYSICAL FEATURES

The claim group which the applicant proposes to explore lies on the west side of the Wah Wah Range in Beaver County, Utah. This range is a prominent north-south range in the Basin and Range province. The claims are located in unsurveyed secs. 25, 26, 35, and 36, T. 28 S., R. 16 W., S.L.B. and M. (fig. 1).

Shipping points are located at Milford and Lund, Utah. Milford is 58 miles distant and Lund is 42 miles distant from the property. Housing facilities are available for a small crew at the mine. A camp should be established at the project site because of the distances from existing communities.

OWNERSHIP, HISTORY AND PRODUCTION

The property included under the applicant's lease consists of 22 patented lode mining claims and 32 unpatented lode mining claims held by right of location (fig. 3). The claims are listed as follows:

Patented

Name of claim	U. S. Survey No.
January	4887
Revenue mine	"
Eldorado	"
Iron Duke	"
Parrington	"
Lafayette	"
Turo	"
Charmion	"
Heber	"
Buckbee	4195
Buckbee No. 2	"
Cliff	"
June	"
Tasso	5201
Ben	"
El Kallah	"
Zemzem	"
Queen	4815
Midway	"
Southside	"
Ben Hur	"
Sapho	"

Unpatented

Recorded in office of County Recorder, Beaver County, Utah

Name of claim	Book	Page
Ben No. 2	21	59
3	"	59
4	"	59
5	"	60
6	"	60
7	"	60
8	"	61
Zemzem No. 2	"	55
3	"	56
5	"	56
6	"	57
7	"	57
8	"	57
9	17	286
10	21	58
11	"	58
12	"	58
Reva	"	61
No. 2	"	61
3	"	62
4	"	62
Keystone	"	53
No. 1	"	54
2	"	54
3	"	54
4	"	55
5	"	55
6	17	453
7	"	454
8	"	454
9	"	455
10	"	455

The above property is owned by the Wah Wah Mining Co. and is under lease to James D. Williams and Ruth T. Williams.

The applicant has dedicated the following claims to the proposed exploratory project as being benefited by the work outlined in the application.

Patented claims

January
Tasso
Ben
El Kallah

Unpatented claims

Ben No. 8
Reva
Ben No. 2
Reva No. 2
Reva No. 3
Keystone
Keystone No. 1
Keystone No. 2

Mining in the area commenced about 1881 when prospectors were attracted by discovery of gold-silver-lead ores in fissures in quartzite. Several attempts were made to mine ores from the fissures but each met with little success. Interest was later transferred to lead-zinc replacement deposits in limestone.

Production records prior to 1937 are not complete. No information is available concerning production from vein-type deposits and the initial high-grade production from the Tasso shaft replacement deposits. Nothing is known concerning the size of vein-type deposits in quartzite, but caved stopes in the replacement zone indicate a sizable tonnage was shipped from this area. During 1937 the property was taken over and worked by R. C. Dugdale. Records show that 925.8 tons of lead-silver ore was shipped from the oxide zone. It appears that this ore was extracted from caved stopes which had been opened by the former company. In 1943 and 1944, 239.6 tons of lead-zinc sulphide

ore was shipped during the period of a Bureau of Mines drilling project. This ore was mined from small sulfide stringers in the shale below the oxide zone. In 1945 a lessee shipped 2,674.5 tons of zinc carbonate ore from the oxide block delineated by the Bureau of Mines diamond drilling. Settlement sheets indicate that no profit was realized from shipments from the last two of the above attempts at mining except under Government premium prices then existing.

DESCRIPTION OF THE DEPOSITS

The geologic setting in the Pine Grove area is similar to that found at Pioche, Nevada; Mt. Wheeler, Nevada; Eureka, Utah; and Ophir, Utah. Cambrian rocks consisting of a thick basal quartzite, a shale section with interbedded limestone and quartzite lenses overlain by Cambrian limestones, are found at each location. The sedimentary rocks strike roughly N. 20° E. and dip 20°-25° southeasterly in the vicinity of the mine. Pine Canyon lies along the axis of a broad, easterly plunging regional syncline. A strong east-west fault extends through the property and displaces the beds roughly 1,000 feet horizontally and 500 feet vertically. A stocklike body of quartz monzonite outcrops about 1,000 feet southeast of the Tasso shaft (fig. 3).

The quartzite member is typical of the Prospect Mountain quartzite of the Pioche district and the Tintic quartzite of the Tintic district. The overlying shales are roughly 800 feet thick

and are similar to the Pioche shales of the Pioche district. In the vicinity of the mine, the shale section is covered with alluvium, and no limestone is discernible until the upper limestone-shale contact is encountered. Two limestone members are present in the shale section in the canyon north of Pine Canyon. South of Pine Canyon the topography is such that weathered shale covers the formation outcrop and no limestone member may be seen. The replacement ore occurrence at the Wah Wah mine is in a black, shaly member at the top of the shale section. This member contains thin beds of black limestone. Above the shale is 1,800 feet or more of blocky, blue limestone.

Mineralization occurs in fissures in the quartzite, as replacement of limestone and shale in the Tasso area and at the contact of limestone and quartz monzonite near the Lou shaft. Most of the mine workings are caved and little is known concerning the ore occurrences at any place except at the Tasso shaft workings. This occurrence was studied in detail by geologists of the American Smelting and Refining Co. by geologists of the R.F.C., and by engineers of the Bureau of Mines. The property merited approval of exploration in each instance, and each of the above-mentioned groups conducted a project on the property. The work was confined to the upper shale or Black Bed (Tasso) except one diamond drill hole drilled by the American Smelting and Refining Co. This hole passed through the

Tasso fault zone into the south block and intersected the basal part of the Pioche shales. The log of the hole shows no limestone. A 40-foot section logged as altered quartzite may be silicified limestone. Inasmuch as this section corresponds to that in which other sections embody limestone and because of the proximity of the Tasso fault, this conclusion is not unlikely. This is the only known work in the basal part of the Pioche shale section.

The work in the Black Bed (Tasso) was carried beyond the confines of mineralization. A study of the occurrence indicates that the ore body resulted from secondary enrichment and that primary mineralization is low in lead-zinc content. The Black Bed (Tasso) is considered a poor host rock.

PROPOSED EXPLORATION

The applicant proposes to explore the property by drilling 21 drill holes. The work is divided into four stages. Stage I consists of seven holes all designed for penetration of the Black Bed (Tasso). Stage II consists of five holes all designed for intersection of the Wah Wah bed south of the Tasso fault zone. These two stages are independent of the other and one is not contingent on the results of the other. Stages III and IV are based on the results of Stages I and II and are planned principally for exploration of the Black Bed (Tasso) downdip. The twelve holes, which constitute the first phase of the project, will require a total of 3,954 feet of diamond drilling. The remaining 9 holes will require a total of 7,002 feet. The proposed locations of all holes are shown on figure 4.

It is considered that the above staging of the project is not justified in view of the information already known. It is the opinion of the examining team that the area should be investigated by drilling the basal beds of the Pioche shale below the zone of known mineralization. As an alternate proposal, recommendation is made that two holes be drilled to ascertain the existence of a receptive limestone bed near the base of the shale section. These two holes, one on each side of the Tasso fault, are planned to test the zone in the area of mineralization. The applicant's hole No. 1 is to be moved from coordinate position 10230 N. and 13680 E. to coordinate position 10300 N. and 13780 E. The hole is to be collared at 7,680 elevation and drilled at -67°, normal to the beds, for an estimated depth of 1,000 feet. Hole No. 2 corresponds to the applicant's hole No. 8. This hole is to be collared at an elevation of 7,550 feet and drilled to a depth estimated at 525 feet. These two holes aggregate 1,525 feet and constitute Stage I of the project. At this point the project is to be re-evaluated and, contingent upon the success of Stage I, Stage II is to consist of three additional holes. Drill hole No. 3 is to be collared at an elevation of 7,550 feet and drilled to an estimated depth of 825 feet. Drill hole No. 4 is to be collared at 7,600 feet and drilled to an estimated depth of 1,275 feet. Drill hole No. 5 is to be collared at 7,465 feet and drilled to an estimated depth of 600 feet. These holes are designed to offset holes of Stage I along the Tasso fault

zone which is thought to have provided access for mineralizing solutions. The total footage of 5 holes is 4,225 feet. Each hole is to be drilled 10 feet into Prospect Mountain quartzite (figs. 5, 6 and 7).

The applicant proposes aerial photography in color and photogeologic interpretation for an area 10 miles long and 8 miles wide. This work is not considered necessary and will not materially benefit the district at this stage.

It is estimated that the above work can be completed in 7 months.

PROJECT COSTS

Stage I

Independent Contracts

Bulldozer, access roads and preparation of drill sites

16 hours at $15 per hour ----------	$240.00	
Drayage (estimated) ----------	100.00	
Total----------		$ 340.00

Diamond drilling, 2 holes, total footage 1,525 feet, maximum depth 1,000 feet, collar NX size - complete AX size

Hole No.	Hole Depth Range	Unit price	Amount	
	0-400; 400-800; 800-1,200			
1	400	$5.60	$2,240.00	
	400	6.30	2,520.00	
	200	7.60	1,520.00	
	Total ----------			$6,280.00
2	400	$5.60	$2,240.00	
	125	6.30	787.50	
	Total ----------			$3,027.50
	Total independent contracts, Stage I ---			$9,647.50

Labor and supervision

1 surveyor, 2 days at $50 per day ---------	$100.00	
1 geologist, 4 days at $50 per day --------	200.00	
1 bookkeeper, ½ month at $600 per month ---	300.00	
Total labor and supervision ----------		$ 600.00
Operating material and supplies ----------	None	
Operating equipment		
1 jeep station wagon, 300 miles at $.08 per mile		$ 24.00
Miscellaneous		
20 samples at $5.00 each ---------- (Lead, zinc, gold and silver)		100.00
Total cost, Stage I ----------		$10,371.50

Stage II

Independent Contracts

Bulldozer, (completed under Stage I)

Diamond drilling, 3 holes, total footage 2,700 feet, maximum depth 1,275 feet, collar size NX - complete AX

Hole No.	Hole Depth Range				Unit price	Amount	
	0-400; 400-800; 800-1,200						
3	400				$5.60	$2,240.00	
		400			6.30	2,520.00	
			25		7.60	190.00	
Total ----------							$ 4,950.00
4	400				$5.60	$2,240.00	
		400			6.30	2,520.00	
			400		7.60	3,040.00	
				75	9.00	675.00	
Total ----------							$ 8,475.00

Hole No.	Hole Depth Range	Unit price	Amount	
	0-400; 400-800; 800-1,200			
5	400	$5.60	$ 2,240.00	
	200	6.30	1,260.00	
Total ----------				$ 3,500.00
Total independent contracts, Stage II ----				$16,925.00
Labor and supervision				
1 surveyor, 2 days at $50 per day --------			$ 100.00	
1 geologist, 4 days at $50 per day -------			200.00	
1 bookkeeper, ½ month at $600 per month --			300.00	
Total labor and supervision ----------				$ 600.00
Operating material and supplies ----------			None	
Operating equipment				
1 jeep station wagon, 500 miles at $.08 per mile				$ 40.00
Miscellaneous				
20 samples at $5.00 each ---------- (Lead, zinc, gold and silver)				$ 100.00
Total cost Stage II ----------				$17,665.00
Total project costs ----------				$28,036.50

Summary of Project Costs

Cost of Stage I ----------	$10,371.50
Cost of Stage II ----------	17,665.00
Total cost of project ----------	$28,036.50

CONCLUSIONS AND RECOMMENDATIONS

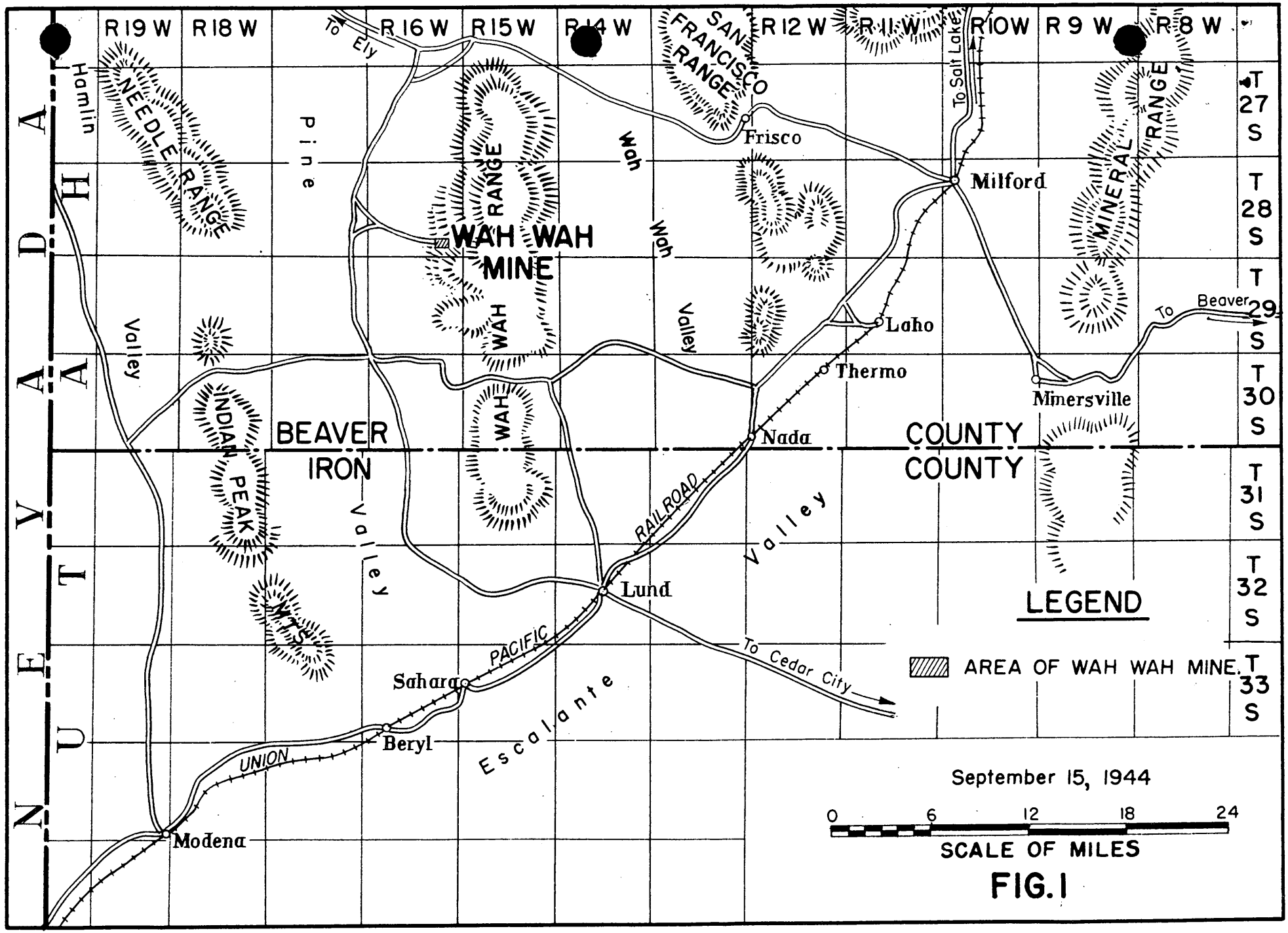
Lead-zinc mineralization occurs at the upper contact of the Pioche shales at the Wah Wah mine at Pine Grove, Beaver County, Utah. Lead-zinc-silver ores have been extracted at this horizon from replacement deposits that have undergone secondary enrichment. Considerable exploratory work has been done at this stratigraphic horizon. The mineralized occurrences in the district are sufficiently strong and widespread to indicate the district has possibilities of producing large tonnages of lead-zinc ores if a receptive limestone horizon is present.

The purpose of the proposed project is to explore for the favorable lower Cambrian limestones below the zone of known mineralization.

Cost estimates in the application have been checked and revised and are considered reasonable and equitable. Contract drilling bids should be obtained from two other sources if the project merits approval.

Unit costs of drilling are high because of the depth of holes to be drilled. Also, the area is remote from established communities.

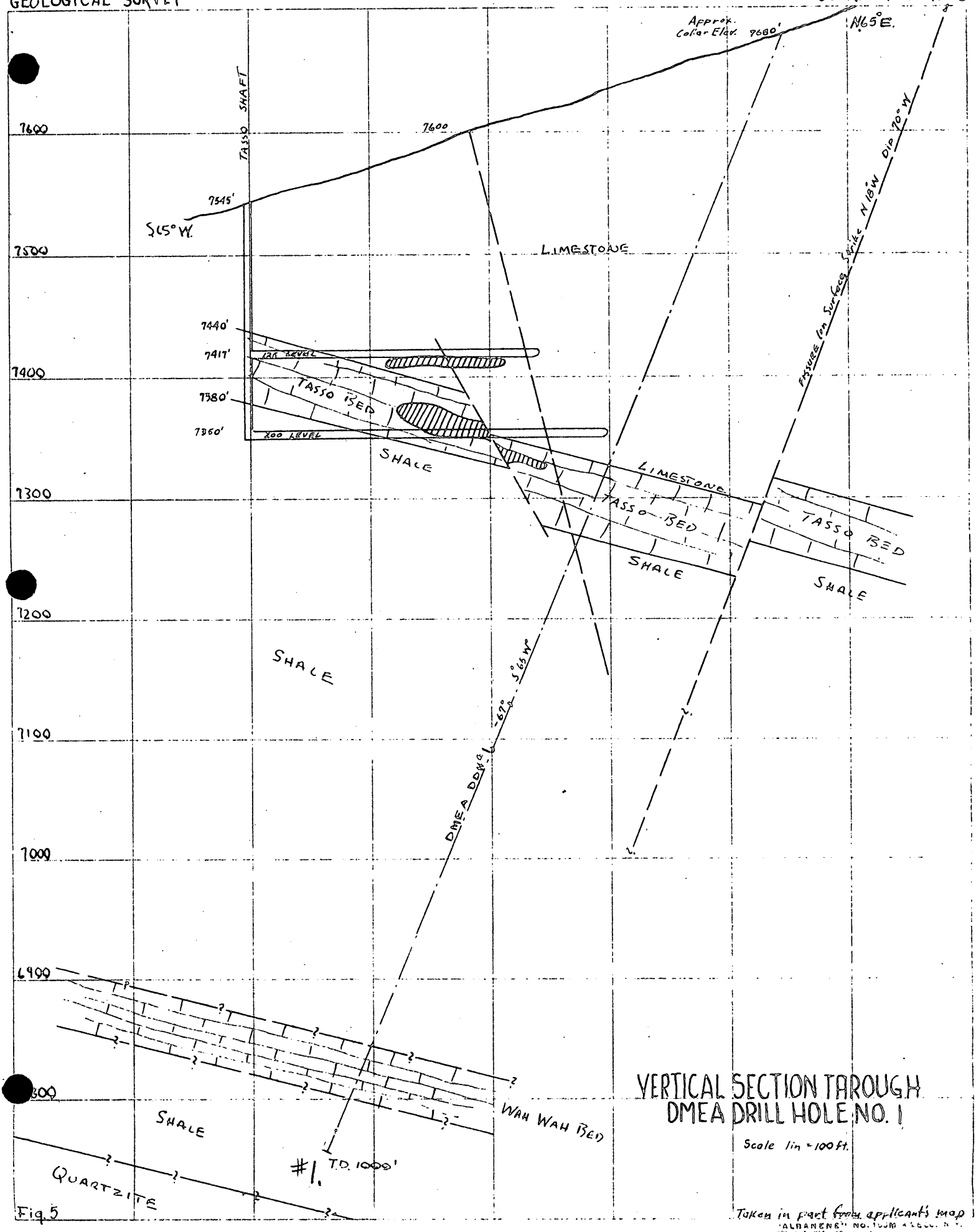
It is recommended that the above-described exploratory program, estimated to cost $28,036.50, be approved. However, provision should be made that the location, inclination, direction and depth of all holes be subject to Government approval. It is further recommended that all property held by the lessee in the district be encumbered inasmuch as the entire area may be benefited by the work.



Location Map of Wah Wah Mine, Project 15-110, Beaver County, Utah.

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLE NO. 1

Scale 1in = 100 ft.

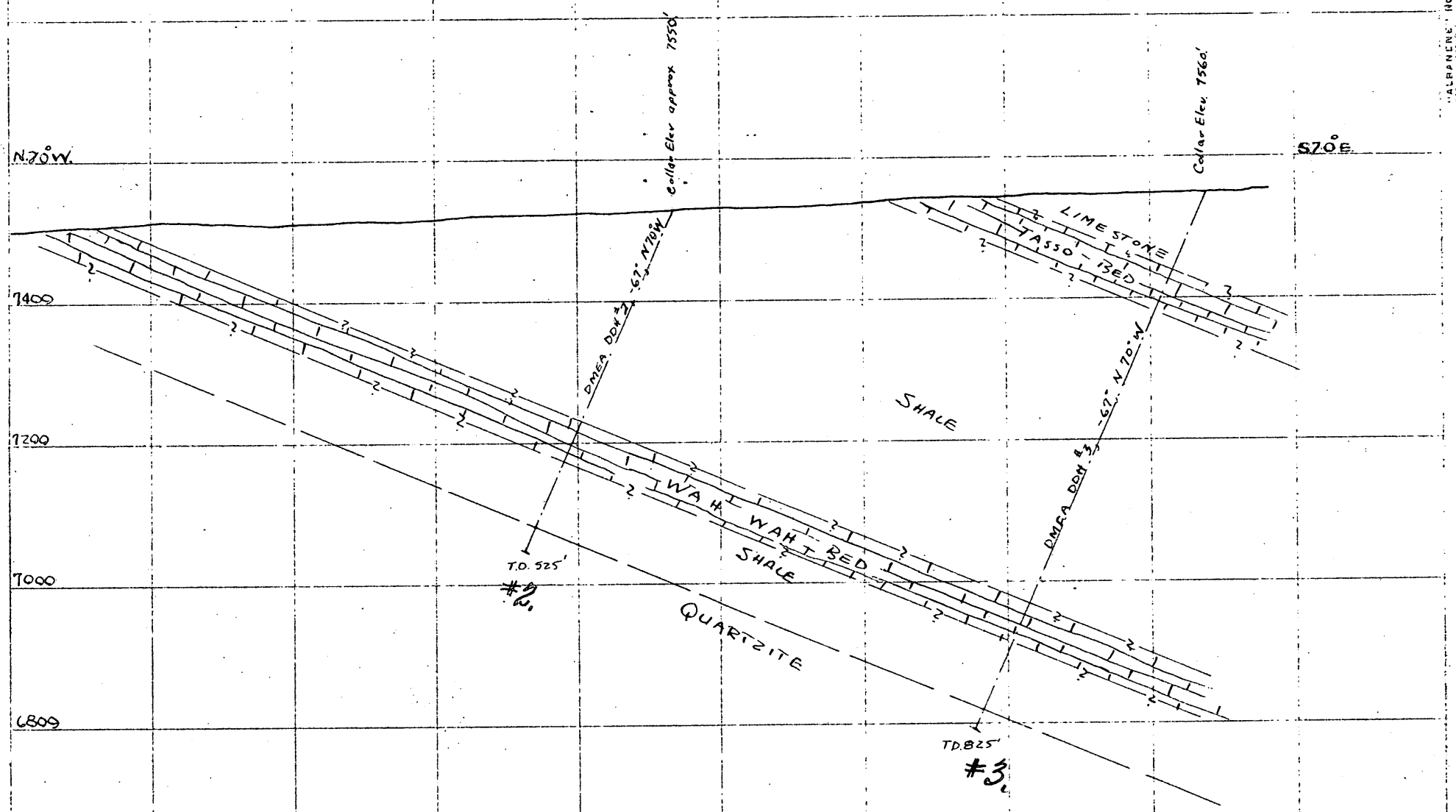
Fig. 5

Taken in part from applicant's map

"ALBANENE" NO. 1008 A. ALBANENE N. Y.
REG. U.S. PAT. OFF.
REO. 7-36

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH DMEA DRILLHOLES NOS. 2 & 3

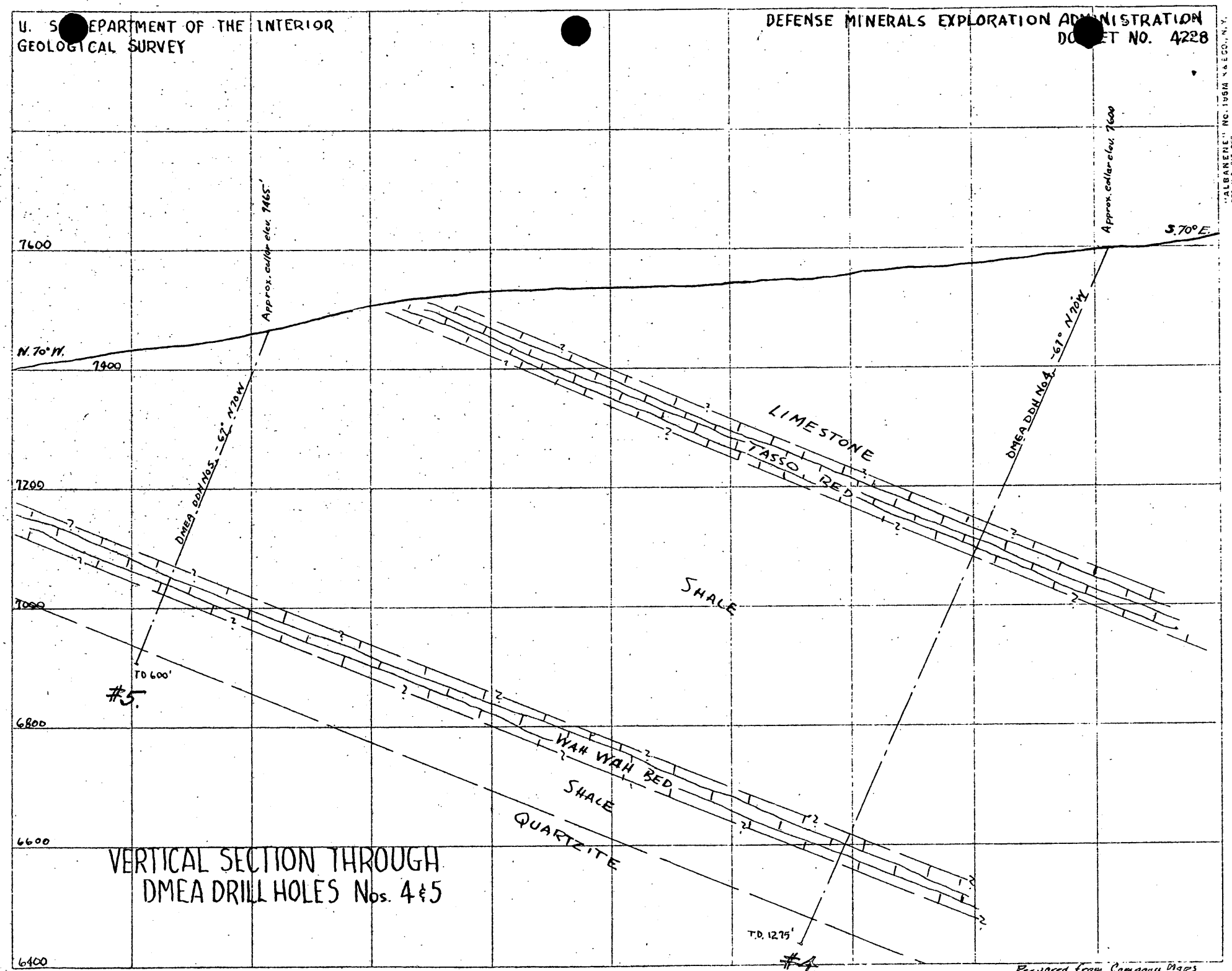
Scale 1in = 200ft

Fig. 6

Prepared from Company maps
RWO 7-56

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLES Nos. 4 & 5

FIG. 7

Prepared from Company Maps
12-20-7-56

"ALBANENE" NO. 1964 K&E CO., N.Y.
REG. U.S. PAT. OFF.

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

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Defense Minerals Exploration Administration
Denver Federal Center
Denver, Colorado

August 8, 1956

Memorandum

To: Executive Officer, DMEA Field Team, Region III

From: E. W. Harshman

Subject: DMEA Docket 422[illegible] (Lead-zinc), Pine Grove Mines (Wah-Wah mine), Beaver County, Utah

I have reviewed both the geologic and engineering reports on the subject property and while the geologic deductions appear sound, I believe that the project recommended by the examiners impinges on, or in fact may be, prospecting.

There are four unknowns in regard to the target; (1) the Wah-Wah or CM bed is not known to be present in the target area although there is every reason to assume it is present; (2) if present, the Wah-Wah bed may or may not be favorable for ore deposition; (3) if present and favorable, the Wah-Wah bed may not have been exposed to mineralizing solutions ascending along the Tasso fault in the area to be explored; and (4) if present, favorable, and exposed to mineralizing solutions the Wah-Wah bed may or may not contain significant lead-zinc ore deposits.

The presence of ore in the target area thus depends upon at least four unknown factors the adverse character of any one of which would doom the project to failure. Exploration is

Reviewed by
DMEA OPERATING COMMITTEE
8-17-56
(date)

at best risky and DMEA projects should not be limited to the so called "sure bets". However, in this particular case it is my opinion that the applicant has not presented sufficient evidence of the geologic probability of finding significant ore deposits in the Wah-Wah mine area, and I suggest that the application for exploration assistance be denied. Should prospecting by the applicant eliminate some of the unknown factors, the ore potential of the Wah-Wah bed could be assessed and perhaps a project approved.

If the project recommended by the examiners is believed to be justified by the available data, the program proposed by them appears to be a conservative and logical method of exploring for ore in limestone beds in the lower part of the Cambrian shale (Pioche?).

E. N. Harshman

E. N. Harshman
Member, Field Team

ENHarshman:mp

JUL 16 1956

506 Federal Bldg.
Salt Lake City 1, Utah
July 13, 1956

DMEA
Date Rec'd.
JUL 16 1956
BUREAU OF MINES
Denver, Colorado

Memorandum

To: E. N. Harshman, DMEA Field Team, Region III

From: R. W. Outerstock

Subject: DMEA Docket 4228 (Lead-zinc) Pine Grove Mines (Wah Wah Mine), Beaver County, Utah.

Enclosed are 9 copies of an initial geologic report on the subject property. With the exception of Fig. 2 all of the illustrations pertaining to this report are being prepared by USBM and will be transmitted with the USBM report.

The Wah Wah property is underlain by Cambrian quartzite, shale and limestone in sequence correlative with the Pioche, Nevada section. Mining operations in the higher limestone beds suggest possible mineralization in the unexposed limestone believed to be present in the underlying shale formation. Such is the basis for the proposed exploration program. A proposed program, alternate to that submitted by the applicant, is considerably reduced in cost but aims at the same primary objective, the Wah Wah or CM bed.

It is recommended that the revised exploration program be approved and that the government enter into a contract with the applicant to accomplish this program.

R. W. Outerstock

cc: S. R. Wilson

Reviewed by
DMEA OPERATING COMMITTEE
8-17-56
(date)

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PINE GROVE MINES

BEAVER COUNTY, UTAH

CONFIDENTIAL
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or inspection

DMEA DOCKET 4228

Initial Geologic Report

By R. W. Osterstock
U. S. Geological Survey

Reviewed by
DMEA OPERATING COMMITTEE
8-17-56
(date)

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ILLUSTRATIONS

Figure 1. Location Map.

Figure 2. Reconnaissance Geologic Map of Wah Wah Range.

Figure 3. Claim and corrected geologic map of Mine area.

Figure 4. Map of Drill hole locations.

Figure 5. Section through DMEA DDH No. 1.

Figure 6. Section through DMEA DDH Nos. 2 and 3.

Figure 7. Section through DMEA DDH Nos. 4 and 5.

Note: All figures except No. 2 accompany USBM report.

SUMMARY

James D. Williams submitted an application for government assistance to explore for lead-zinc ore in the Wah Wah Mine area, Pine Grove Mining District, Beaver County, Utah. The applicant has proposed an extensive drilling program the total cost of which is estimated as $88,952.00.

The Wah Wah property is situate in Pine Grove Canyon on the west flank of the north trending Wah Wah Range. The claim area is underlain by Cambrian sediments which include quartzite, shale and limestone. A short distance to the southeast of the area with which this report is concerned a stock-like body of quartz monzonite has intruded the sediments. Structurally, the area lies on the west flank of a northeasterly trending and plunging syncline. The only major fault in the mine area strikes easterly along Pine Grove Canyon.

Early production in the district was realized from lead-zinc-silver bearing fissures in the basal Cambrian quartzite. Much later the existence of bedded ore replacements in the high Cambrian limestone was recognized. The district stratigraphy is generally correlative with the Pioche, Nevada and Ophir and Tintic sections in Utah. Their correlation forms the basis for the proposed exploration program. It is the applicant's contention that the shale unit lying between the underlying quartzite and the overlying limestone is directly correlative with the Pioche shale and should therefore contain the equivalent of the CM limestone bed. Although no direct evidence of the existence of this bed in the mine area is available, the regional persistence of the other stratigraphic horizons would tend to substantiate the theory.

Mineralization in the upper limestone which has been partially exploited by the Tasso workings has not proved to be of economic significance. However, the very presence of ore mineralization in this stratigraphically higher bed infers upward migration of ore bearing solutions which must have passed through the objective CM or Wah Wah bed.

A considerably reduced alternate exploration program is offered by the field examiners which has as its primary objective the Wah Wah limestone. All of the holes proposed are in close proximity to the Tasso fault which may be an access channelway for the mineralizing solutions. In addition, the holes are directed into the area underlying the zone of mineralization encountered in the upper limestone (or Tasso bed). Subordinate targets in the holes, wherever practicable, consist of the possible extensions of mineralization in the upper limestone.

It is felt that the alternate exploration program will adequately explore the primary target and it is therefore recommended that the government enter into a contract with the applicant to accomplish the staged exploration program proposed by the examining DMEA field team.

INTRODUCTION

On March 24, 1956 Mr. James D. Williams of Salt Lake City, Utah, doing business as Pine Grove Mines, submitted an application (Docket DMEA 4228) for DMEA assistance on a proposed exploration program for lead-zinc ore at the Wah Wah Mine property in Beaver County, Utah.

At the request of the Region III DMEA Field Team a joint field examination, to determine the feasibility of the applicant's proposals, was conducted May 16, 1956 by W. B. Young (USBM) and R. W. Osterstock (USGS). The examiners were accompanied in the field by Mr. James Williams, the applicant, and Mr. Earl Young, a geologist retained in an advisory capacity by the applicant.

Inasmuch as numerous maps of the mine area have been compiled by interested private parties and other government agencies no attempt was made by the field examiners to remap or resample the property. Spot checking of certain of the more salient geological features pertaining to the proposed exploration, as well as careful study of the existing maps, is believed to have provided sufficient evidence to justify the conclusions and recommendations contained in the body of this report.

The applicant's proposals involve a diamond drilling program designed to test the lead-zinc ore potential of lower and middle Cambrian limestone beds. The total estimated cost of the applicant's proposed exploration program is $88,592.00.

Location and accessibility

The Pine Grove Mine property is situate in Section 25, 26, 27, 34, 36, T. 28 S., R. 16 W. and in Section 2, T. 29 S., R. 16 W., SLB and M (unsurveyed) Pine Grove Mining District, Beaver County, Utah (fig. 1), on

the west flank of the Wah Wah Range. The altitude of the mine area ranges from about 7,200 feet on the flat alluvial-filled Pine Grove Canyon floor to more than 8,000 feet at the top of precipitous limestone cliffs which form the subordinate canyon walls.

A year around stream of culinary quality water, in sufficient quantity to service a mine camp and small milling operation, flows down Pine Grove Canyon. Although the area has been logged-off, a few remaining large Ponderosa pines lend scenic appeal and might, if necessary, be utilized for mine timber. Pinon and juniper scrub is abundant throughout the canyon.

The property may be reached by travelling 40 miles westerly from Milford on Utah State Highway No. 21 on paved and improved graveled road, thence bear southerly on graded dirt road for 13 miles, thence turn east (left) on graded dirt road for 5 miles to the western edge of the Pine Grove Claim area.

Lund, the nearest rail shipping point, lies about 42 miles southeast of the mine area and is made accessible by a recently constructed Grazing Service road.

History and production

Although the Pine Grove Mining District was originally organized in 1873, there was little activity until 1879 when the district was reorganized. By 1881 several small near-surface operations in the quartzite were producing small tonnages of high grade lead-silver-gold ore. These bonanza-like ore bodies were rapidly mined out and interest in the area declined again. The first large scale development program was instigated about 1900 when the Revenue Mining Company consolidated about 46 claims and undertook a major exploration program designed to develop at depth in the quartzite

the same lead-silver-gold fissures already exploited at the surface. No record of production from this phase of operation is available. Following this period of activity the district remained essentially idle for about 30 years except for corporate reorganizations and sporadic small exploratory ventures. One important development, during the latter part of the long static period was the recognition of replacement ore bodies in the limestone with the subsequent sinking of the Tasso shaft. Renewed interest in the district accompanied the discovery of replacement ore and considerable exploration was effected. R. C. Dugdale organized the Wah Wah Mining Company in 1937 after having gained title to a large part of the claimed area in the district. From 1937-1940 the Wah Wah Mining Co. expended about $48,000 for exploration which resulted in the discovery of some ore. Lack of finances forced another period of inactivity until 1942 when the U. S. Bureau of Mines started a project in the Tasso workings (fig. 3) which was recessed before reaching its objectives. This exploration was continued, however, with R.F.C. funds and this phase was followed by a U. S. Bureau of Mines diamond drilling program which was completed in April 1944. During 1945 the company shipped a moderate tonnage of zinc carbonate ore from the Tasso 200 foot level. There has been no activity at the property since 1945. Below is a brief summary of the recorded production from the Wah Wah property:

1873 - 1937 (Production unknown, presumed to be mostly Au-Ag fissure ore from quartzite.)

	Tons	Au	Ag	Pb	Zinc	Type
1938 - 1939	925.8	0.07	8.0	11.0	—	oxide
1943 - 1944	239.6	0.02	2.4	4.2	4.4	sulfide
1945	1,392.0	—	0.50	—	13.1	oxide
	70.5	0.14	2.80	2.3	7.6	sulfide
	46.5	0.04	5.70	8.9	—	oxide

The present applicant holds by lease with an option to purchase the entire Wah Wah Mining Co. property, consisting of twenty-two patented and thirty-two unpatented mining claims.

Property and ownership

The property consists of 54 mining claims owned by the Wah Wah Mining Co., RFD Box 569, Woods Cross, Utah and the entire Wah Wah Mining Company property, consisting of twenty-two patented and 32 unpatented mining claims, is under lease, dated November 19, 1955, for 25 years with an option to purchase to the applicant, James D. Williams and Ruth T. Williams, 409 Felt Bldg., Salt Lake City, Utah (fig. 3).

The twenty-two patented lode mining claims are as follows:

January	U.	S.	Survey	No.	4887
Revenue Mine	"	"	"	"	"
Eldorado	"	"	"	"	"
Iron Duke	"	"	"	"	"
Parrington	"	"	"	"	"
Lafayette	"	"	"	"	"
Turo	"	"	"	"	"
Charmion	"	"	"	"	"
Heber	"	"	"	"	"
Buckbee	U.	S.	Survey	No.	4195
Buckbee No. 2	"	"	"	"	"
Cliff	"	"	"	"	"
June	"	"	"	"	"
Tasso	U.	S.	Survey	No.	5201
Ben	"	"	"	"	"
Elkallah	"	"	"	"	"
Zem Zem	"	"	"	"	"
Queen	U.	S.	Survey	No.	4815
Midway	"	"	"	"	"
Southside	"	"	"	"	"
Ben Hur	"	"	"	"	"
Sapho	"	"	"	"	"

The thirty-two unpatented lode mining claims are as follows:

Name of Claim	Book	and Page
Ben No. 2	21	59
Ben No. 3	21	59
Ben No. 4	21	59
Ben No. 5	21	60
Ben No. 6	21	60
Ben No. 7	21	60
Ben No. 8	21	61
Zem Zem No. 2	21	55
Zem Zem No. 3	21	56
Zem Zem No. 5	21	56
Zem Zem No. 6	21	57
Zem Zem No. 7	21	57
Zem Zem No. 8	21	57
Zem Zem No. 9	17	286
Zem Zem No. 10	21	58
Zem Zem No. 11	21	58
Zem Zem No. 12	21	58
Reva	21	61
Reva No. 2	21	61
Reva No. 3	21	62
Reva No. 4	21	62
Keystone	21	53
Keystone No. 1	21	54
Keystone No. 2	21	54
Keystone No. 3	21	54
Keystone No. 4	21	55
Keystone No. 5	21	55
Keystone No. 6	17	453
Keystone No. 7	17	454
Keystone No. 8	17	454
Keystone No. 9	17	455
Keystone No. 10	17	455

Each of the above unpatented claims is recorded in the office of the County Recorder, Beaver County, Utah. Only twelve claims are dedicated by the applicant to the DMEA project. These include four patented claims: January, Tasso, Ben and Elkallah; and eight unpatented claims: Ben No. 8, Reva, Ben No. 2, Reva No. 2, Reva No. 3, Keystone, Keystone No. 1, and Keystone No. 2 (see fig. 2). There are no vertical limits involved.

No legal instrument providing for "Owners Consent to Lien" was included with the application unless paragraph two of Section 23 of the lease agreement may be so interpreted.

Development

The Wah Wah Mines Company property includes the great bulk of the Pine Grove district which has been subjected to exploration and mining activity in the past and, therefore, a detailed description of all of the workings is impractical. As noted in the foregoing "History and Production" section of this report, the early activity in the district was largely confined to the high grade gold-silver-lead bearing fissures in the Cambrian Prospect Mountain quartzite. Numerous shafts, tunnels, and prospect pits mark this phase of the exploitation of the region, generally to the west of the area with which the present application is concerned. The early work reached its culmination about 1900 with the consolidation of 46 claims by the Revenue Mining Co. This group instituted what was considered an extensive exploration program in the quartzite. Not until the 1930's was attention directed to replacement ore in the limestone area. By far the largest single discovery in the limestone is the Tasso mine which is serviced by a 200 foot vertical shaft. Three underground levels and the tunnel level represent nearly 1500 feet of lateral workings. Underground diamond drilling amounts to 675 feet by the USBM, 471 feet by AS and R and 59 feet of churn drilling by AS and R. The easternmost operation aimed at ore in the limestone is the Lue shaft; these workings are presently inaccessible and nothing is known of the production therefrom.

GEOLOGY

The Wah Wah Mountains are a typical fault block range of the basin and range province. Wah Wah Valley separates the Wah Wah Range from the San Francisco Range on the east and White Sage Valley separates the Wah Wah Range from the Needle Range on the west. The exposed sediments, which range in age from Cambrian to Mississippian are uplifted and gently tilted to the east by a north-south trending normal fault bounding the west edge of the range. Tertiary volcanics mantle much of the eastern half of the range. A stock-like body of quartz monzonite has intruded the sediments a short distance to the southeast of the Tasso mine workings.

The stratigraphic section exposed in the area with which this report is concerned includes from oldest to youngest:

Prospect Mtn. quartzite—only the upper beds of this basal Cambrian formation are exposed in the mine area. The highly resistant, thick to thin bedded relatively coarse-grained quartzite generally forms precipitous slopes. Although the rock is white to buff on fresh surfaces its weathered appearance is tan to brown. Much of the early production in the district was gained frommineralized fissures in this formation. The Ophir and Tintic mining districts of Utah and the Pioche mining district of Nevada each contain a correlative section of this persistent Cambrian quartzite.

Conformably overlying the Prospect Mountain quartzite is a thick Cambrian shale which is believed to be correlative with the Pioche shale of the Pioche Mining district of Nevada. A similar correlation may be drawn from the Ophir and Tintic mining districts of Utah where a Cambrian shale again overlies basal Cambrian quartzite. Yellow, buff, brown and reddish-green argillaceous and micaceous shales make up the bulk of this

formation. At least one apparently persistent band of dense, coarse-grained quartzite about 40 feet above the base of the shale is found in the section about 1/2 mile north of the Tasso shaft. Generally, the formation includes one or more intercalated beds of limestone which, in other nearby mining districts, have been particularly receptive to ore mineralization. No direct evidence of the existence of such limestone beds was found in the area immediately adjacent to the mine. It is, however, entirely possible that a limestone unit does exist in the shale but is not exposed because of the relatively low resistance to erosion of the predominantly shale formation. The shale, which invariably forms a topographic low as a result of its susceptibility to erosion, may easily be traced northward along strike from the mine area. Perhaps 1 1/2 miles north of Pine Grove Canyon an hump near the center of a low shale saddle indicates the presence of a more resistant zone which may be limestone. One or two miles south of Wah Wah pass (about 8 miles north of Pine Grove Canyon) there are outcrops of limestone beds in the stratigraphically lower half of the Cambrian shale (see fig. 2). The applicant suggests that this limestone unit is directly correlative with the C.M. bed of the Pioche district in Nevada, approximately 46 miles to the southwest. In the Pine Grove district this limestone has been termed the Wah Wah bed by the applicant. Its stratigraphic position is expected to be less than 100 feet above the Prospect Mtn. quartzite and it is anticipated that the unit will be 45-50 feet thick. It is possible that other thinner limestone beds may be present in the shale section, however, the uncertain persistance of such beds precludes their inclusion as significant potential ore zones.

Conformably overlying the Pioche shale section is a thick series of limestone beds, generally dark gray, fine- to medium-grained and thickly bedded in the lower half of the section. The upper half of the limestone is light gray and fine-grained in thick but distinct beds. The entire unit is believed to be correlative with the middle Cambrian Lyndon limestone as described by Wheeler and Lemmon (Cambrian Formations of the Eureka and Pioche Districts, Nevada, Univ. of Nevada Bull., Vol. 33, No. 3, 1939). The applicant further correlates the lower dark colored limestone beds of the Lyndon formation with the so-called "Black Prince" horizon, a productive unit of the Pioche District. In the application this lower dark unit is referred to as the "Tasso" limestone bed. Various reports which describe the mineralization in the Pine Grove district erroneously refer to this zone as black shale in the upper part of the Pioche shale section. Virtually all of the recent mining operations in the district have been confined to this zone and during World War II the U. S. Bureau of Mines investigated the ore potential of the zone.

Other higher Cambrian strata are present in the district but these have no bearing on the present application.

Approximately 1,000 feet southeast of the Tasso shaft is the western edge of a quartz monzonite intrusion. The stock-like body, about one mile long in an E-W direction and 1/2 mile wide in a N-S direction, effects a discordant relation with the surrounding sediments. Whether there is any genetic relation of this intrusion to the ore deposits is not known. A pebble dike, present in the workings of the Wah Wah Mine, appears to have afforded some form of control on the emplacement of the ore bodies; this structure and a basic dike are the only evidence of igneous activity in the immediate mine area.

Much of the eastern half of the Wah Wah Range is covered by Tertiary volcanics which range in composition from rhyolite through latite and andesite.

In a regional sense the structure of the portion of the Wah Wah Range, with which this report is concerned, may be described as a broad northeasterly trending and plunging syncline (fig. 2). Although a few minor flexures have been superimposed the major structural trend is remarkably uniform. Only one large fault is noted in the mine area. The applicant refers to this E-W striking structure as the Tasso fault. The outcrop pattern indicates that the relative movement along this fault is down on the north. There are numerous diversely oriented smaller fault structures in the area adjacent to the Wah Wah mine; none of these, however, appears to have afforded any significant disturbance of the strata. The applicant postulates that the Tasso fault has acted as the main access channelway for the mineralizing solutions which entered the mine area.

ORE DEPOSITS

A discussion of the ore deposits in the Pine Grove district must necessarily be confined to those ore bodies occurring in the upper black limestone bed, referred to locally as the Tasso bed (correlative with the "Black Prince" bed of the Pioche district).

The ore bodies which have been exposed in the mine area are principally disseminated galena and sphalerite replacements of the receptive beds. Above the 125 foot level of the Wah Wah mine oxidation of the ore has been almost complete, only limonite and lead carbonate remain, nearly all of the original zinc content has been removed. Below the 125 foot level zinc carbonate is present as a precipitant from the descending oxidizing

solutions. It has been estimated that the zinc carbonate ores will persist to a point about 20 feet below the 200 foot level. Oxidation of the ore bodies below the 125 foot level is not complete, consequently most of the lead occurs in its primary sulfide form. Most of the ore contains a small amount of silver and gold and some chalcopyrite was identified by the USBM laboratory in Salt Lake City. The gangue is principally pyrite, quartz and unreplaced country rock.

The shape of the ore bodies may best be described as irregular pipes exhibiting tabular offshoots into particularly receptive beds. In a large sense, all of the known ore bodies fall within a zone which may have been influenced by the Tasso fault. In detail the individual ore bodies appear to have been locallized by minor faults and fissures as well as by bedding. The presence of a near-vertical pebble dike exposed in the mine workings may have exercised some influence on the locallization of the ore but the relationship is not clear.

Virtually nothing is known of the ore deposits which have been prospected east of the Tasso shaft area. Most of this zone parallels the northern border of the quartz monzonite intrusive and may be a result of contact phenomena.

Following an extensive sampling of the accessible workings, coupled with a drilling program, the applicant reports that the U. S. Bureau of Mines estimated the following ore reserves for the Wah Wah mine:

Class	Oxide Ore			
Indicated	Zinc carbonate	38,500 tons	8.21% zinc	0.5 oz. Ag.
Indicated	Lead carbonate	26,900 tons	10.5% lead	8.1 oz. Ag.
	Sulfide Ore			
Indicated	Lead—zinc	3,000 tons	4.2% pb, 4.4% zn	2.4 oz. Ag.
Inferred	Lead -zinc	10,000 tons	2.9% pb, 2.8% zn	2.8 oz. Ag.

It is extremely unlikely that production from the mine will provide tonnages such as are estimated; the extreme selectivity required with its attendent high mining cost prohibits operation of the property even at today's advanced metal prices.

Inasmuch as the present application involves multiple targets, namely the Tasso ore horizon and the stratigraphically lower Wah Wah bed, a brief statement regarding the expected mineralization in the lower bed is in order. Although the Wah Wah bed has not yet been exposed in the mine area it is considered a logical exploration objective for the following reasons: it serves as the first replaceable horizon; it generally is capped by a rather impermeable shale horizon; the competent limestone having incompetent over- and underlying beds is crushed and broken when subjected to stress and thus prepared for ore emplacement; ore mineralization in the underlying quartzite as well as in the overlying Tasso bed indicates upward migration of mineralizing solutions which must have passed through the Wah Wah bed.

The entire sequence of requisite features has been duplicated in the Pioche district of Nevada and to some extent in the Ophir and Tintic districts of Utah. In each of these instances, the resultant ore bodies are primarily bedding replacements.

As has been pointed out in the "Geologic" section of this report, the areal persistence of the quartzite-shale w/intercalated limestone-limestone sequence over Utah and Nevada is sufficiently impressive to warrant the conclusion that the sequence will obtain in the project area.

No ore reserves are estimated for the objective Wah Wah bed.

PROPOSED EXPLORATION

The applicant has proposed an extensive two part exploration program consisting of diamond drilling and aerial photography.

The diamond drilling is to include 21 drill holes, totalling 10,956 feet to be drilled in four stages.

First Stage (2,186 ft.) - 7 drill holes designed to explore for offsets and extensions of the known ore bodies mined from the Tasso shaft. This work confined to the upper or Tasso bed.

Second Stage (1,786 ft.) - 5 drill holes designed to explore for mineralization emanating from the Tasso fault zone in the lower or Wah Wah (CM) bed.

Third Stage (3,380 ft.) - 5 drill holes, 4 of which are designed to continue the drilling of the first stage. The fifth hole would also penetrate the Tasso bed but would continue down to the Wah Wah bed.

Fourth Stage (3,622 ft.) - 4 drill holes designed to explore the Tasso bed for mineralization adjacent to the intrusive contact.

The portion of the applicant's proposals dealing with aerial photography involves vertical stereoscopic color photography of the central portion of the Wah Wah Range. Photo-geologic interpretation with the construction of a base geologic map is the ultimate objective of this work.

An analysis of the applicant's proposals and objectives reveals the exploration program to have two separate targets, the Tasso bed and the Wah Wah bed. Past mining operations and exploration in the Tasso bed have demonstrated that its mineralization is generally spotty and not attractive as an individual target. Mr. W. B. Young, the engineer in charge of exploratory work for the USBM, reports that the Tasso bed does not appear capable of sustained production of significant tonnage and grade. Consequently, the Wah Wah bed looms as the only interesting objective. With virtually no evidence at hand regarding mineralization in this horizon

except that the bed has great areal persistance and is receptive in other mining districts, exploration must necessarily be of a "wild cat" nature. Perhaps the most encouraging evidence is the apparent locallization of mineralization in the adjacent sediments (i.e. Quartzite and Tasso bed) by the Tasso fault zone. If, as appears to be the case, this fault zone served as an access channelway for the mineralization, it is therefore, logical to presume that exploration in the Wah Wah bed should be directed into the area of influence of the fault zone. On the basis of these observations the following alternate exploration program is offered by the field examining team (see fig. 4).

Stage I - Total drilling 1,525 feet.

DDH 1, Coor. 10,300 N.-13,780 E., -67°, S. 65° W. approx. collar elevation 7,680, T.D. 1,000 ft. (fig. 5). Primary target is the Wah Wah bed under the most heavily mineralized area in the upper or Tasso bed. Subordinate target is the northeasterly extension of the mineralization in the Tasso bed. Hole will collar in middle Cambrian limestone and bottom in Prospect Mtn. quartzite.

DDH 2, (same location as William's No. 8), -67°, N. 70° W., approx. collar elev. 7,550. T. D. 525 ft. (fig. 6). Target is the Wah Wah bed just south of Tasso fault and opposite the Tasso ore zone. Hole will collar in upper Pioche shale and bottom in Prospect Mtn. quartzite.

Stage II - (contingent upon results of Stage I) Total drilling 2,700 ft.

DDH 3, (same location as Williams No. 17) -67° N. 70° W., approx. collar elev. 7,560. T. D. 825 feet (fig. 6). Designed to test the Wah Wah bed in the south fault block down dip from DDH No. 2. Hole is located adjacent to Tasso fault zone and therefore should fall

within zone influenced by fault. As with DDH No. 1 this hole offers a subordinate target, the Tasso bed, which will also be penetrated in close proximity to the Tasso fault. Hole will collar in middle Cambrian limestone and bottom in Prospect Mtn. quartzite.

DDH 4, (same location as William's No. 13) -67°, N. 70° W., approx. collar elev. 7,600, T. D. 1,275 feet (fig. 7). This hole is designed to test the Wah Wah bed in the north fault block in the area between Tasso fault and the ore bodies mined from the Tasso shaft. Although the Wah Wah bed is the primary target, the Tasso bed will also be encountered.

DDH 5, (same location as William's No. 12) -67°, N. 70° W., approx. collar elev. 7,465, T. D. 600 ft. (fig. 7). This hole is designed to test the Wah Wah bed only in the north fault block. Hole positioned in close proximity to Tasso fault and therefore should be within sphere of influence of this locallizing structure.

The total drilling of both stages offered in the examining field team's alternate exploration program is 4,225 feet. Although the primary objective of the alternate program is the lower or Wah Wah bed, the holes are so located as to offer the optimum number of penetrations of the subordinate Tasso bed. The alternate program is set up in Stages in the event that Wah Wah bed is not present in the section or does not appear to be receptive to mineralization. It is not the purpose of this program to search out the ore possibilities of the upper or Tasso bed and in the event that this subordinate target appears more promising after completion of Stage I than the primary objective, the Wah Wah bed, it is not recommended that the program as set up, be continued through Stage II.

All of the holes drilled should be bottomed in the Prospect Mtn. quartzite in order to assure that drilling will not be halted prematurely in lime beds overlying the target Wah Wah bed.

CONCLUSIONS AND RECOMMENDATIONS

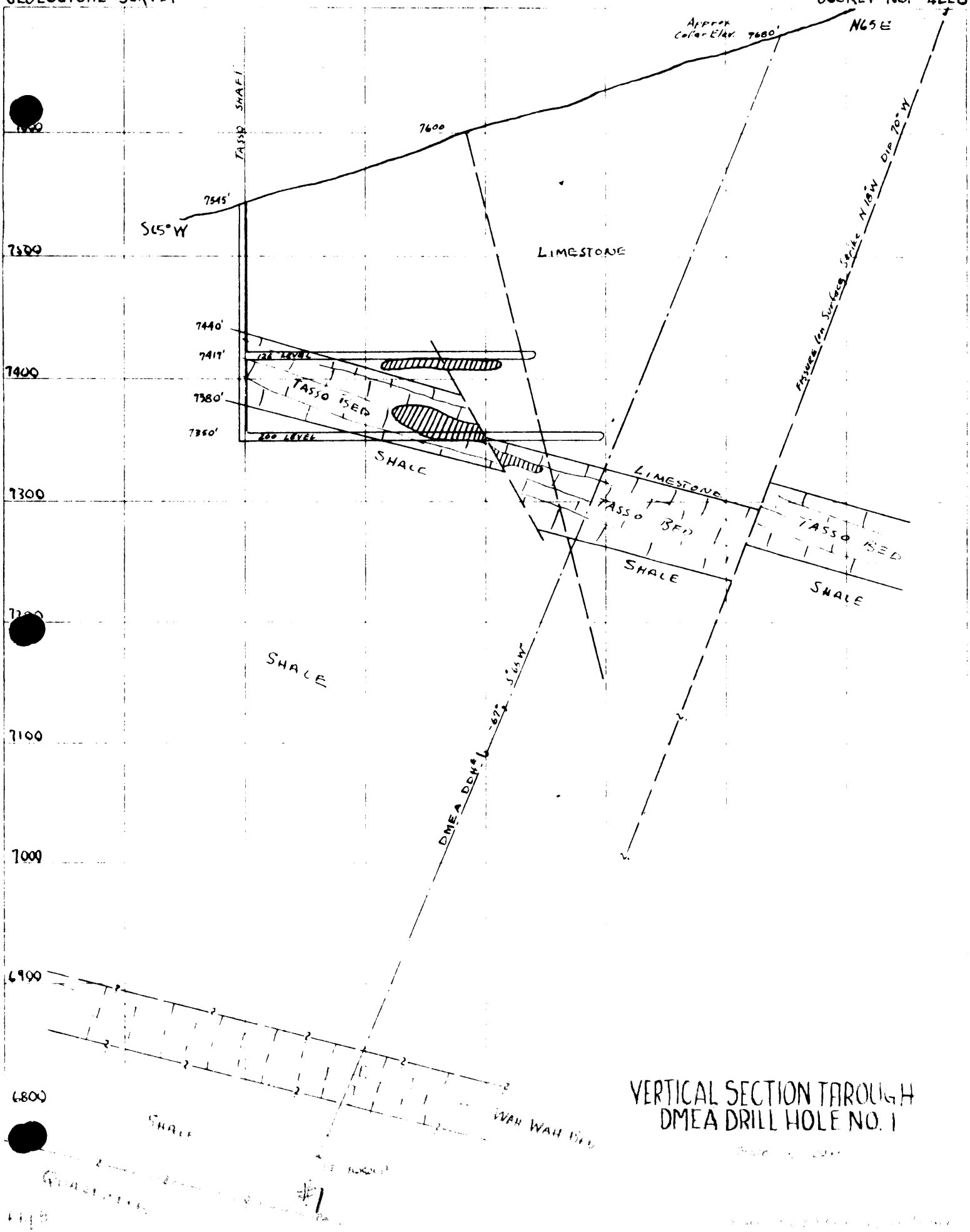
It is concluded that in the Pine Grove Mining district the likelihood of discovering mineable ore bodies is considerably enhanced by the probable existence of a limestone bed within the Cambrian Pioche formation. The areal persistenct of the conventional stratigraphic sequence, from quartzite to shale with intercalated limestone to massive limestone, throughout western Utah and eastern Nevada is sufficient to conclude that the project area will contain the objective Wah Wah limestone. It is further concluded that the Wah Wah limestone is correlative with the receptive CM bed of the Pioche district and therefore may be expected to offer a favorable target particularly in areas of known mineralization. That the future of the district lies with the ore potential of the lower receptive horizon (Wah Wah bed) is demonstrated by the relatively futile efforts to develop significant tonnages of ore grade in the upper receptive horizon (Tasso bed).

It is recommended, therefore, that the alternate exploration program as described in this report be approved for government assistance. The program is substantially the same as that offered by the applicant in that the primary target is the Wah Wah bed. Where possible the proposed drill holes will also penetrate the subordinate Tasso bed. It is the opinion of the writer that the staged alternate program will adequately explore the primary target bed for ore mineralization and that additional drilling would fall under a phase of development which is not a part of the DMEA program. Prior to the activation of Stage II of the proposed program it is recommended that the applicant must receive written approval from the government.

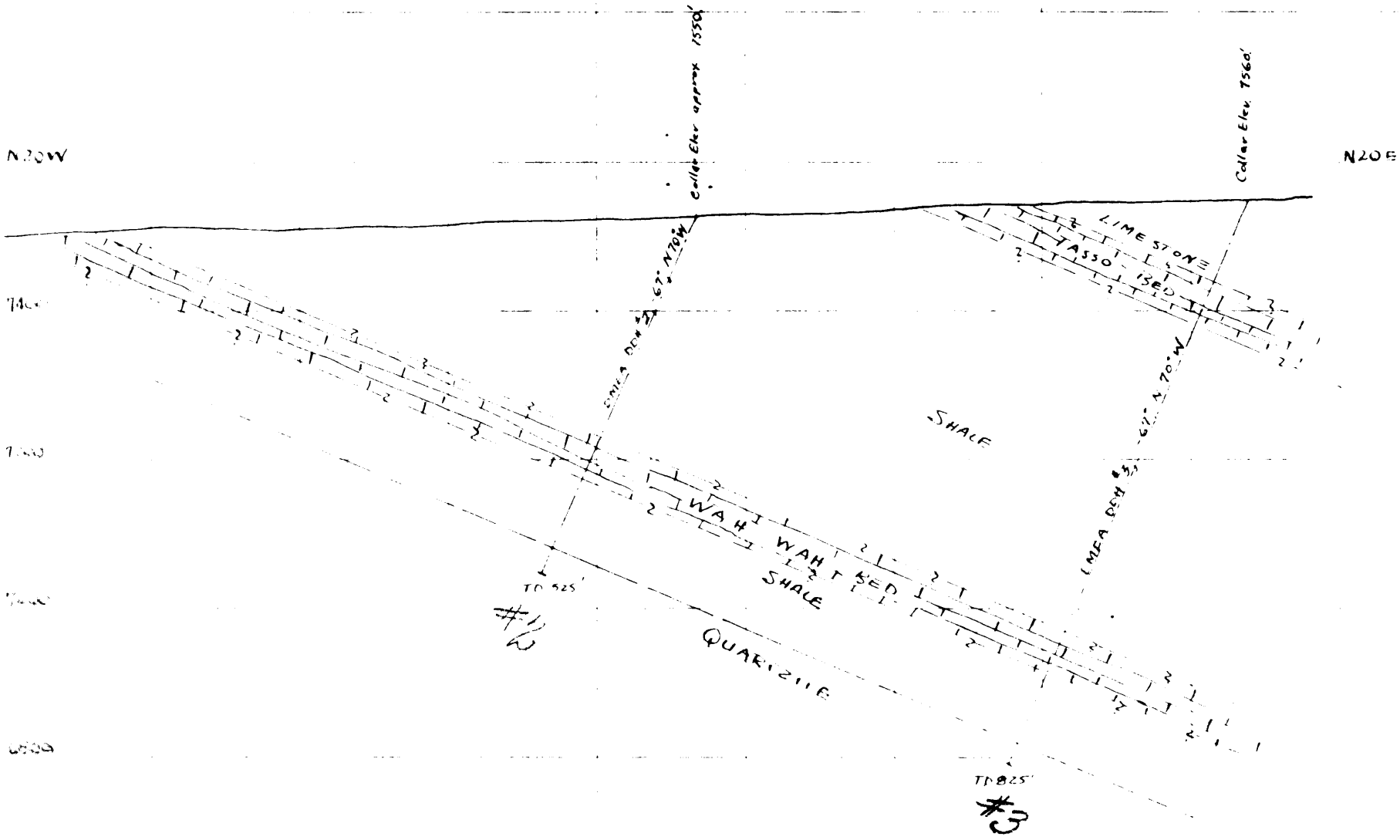
It is further recommended that the entire block of ground now held by the applicant (22 patented claims and 32 unpatented claims) be subordinated to the proposed DMEA project.

U. S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLE NO. 1



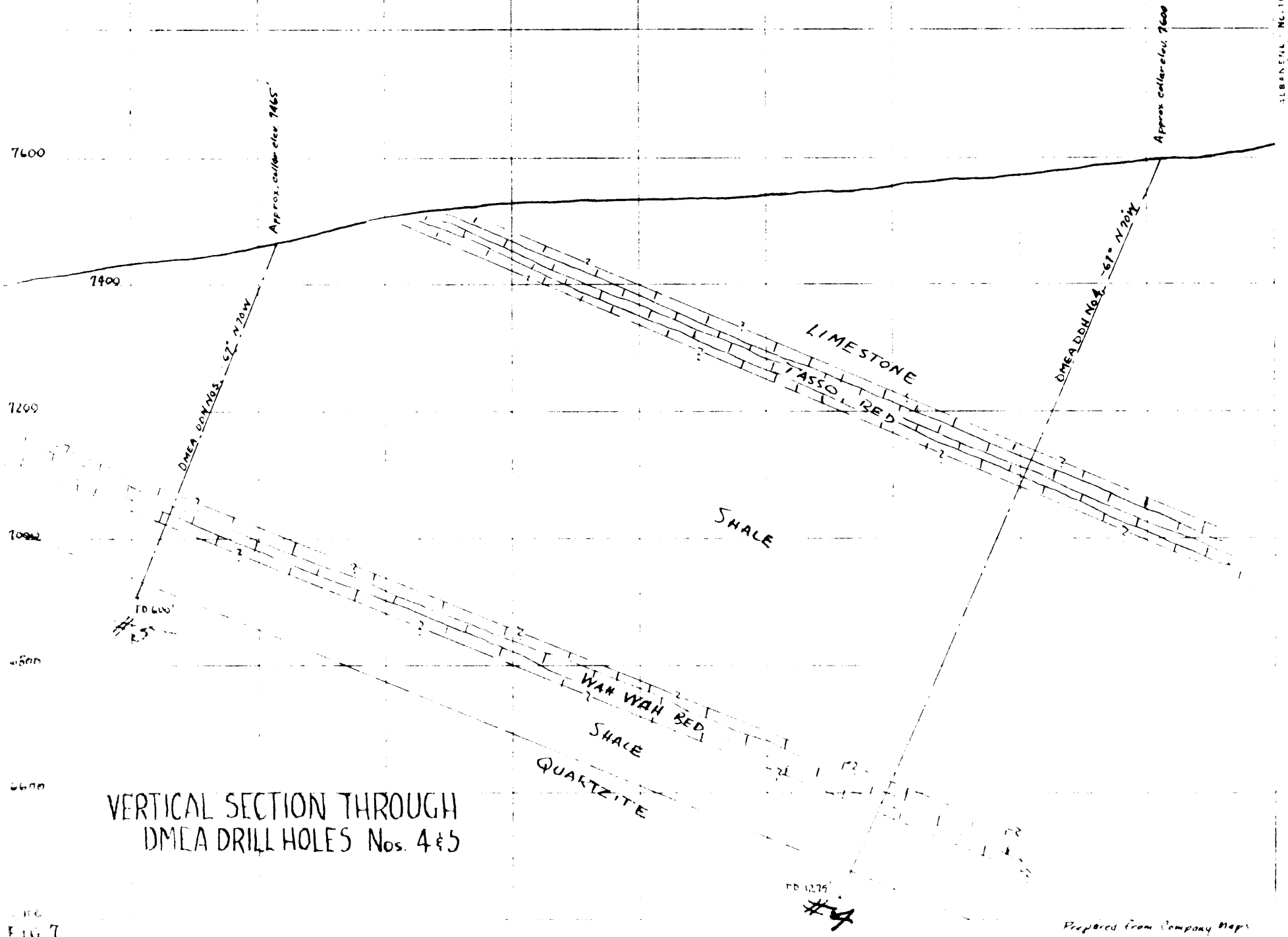
VERTICAL SECTION THROUGH DMEA DRILLHOLES NOS. 2 & 3

Scale 1in = 200ft

Prepared from company maps

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

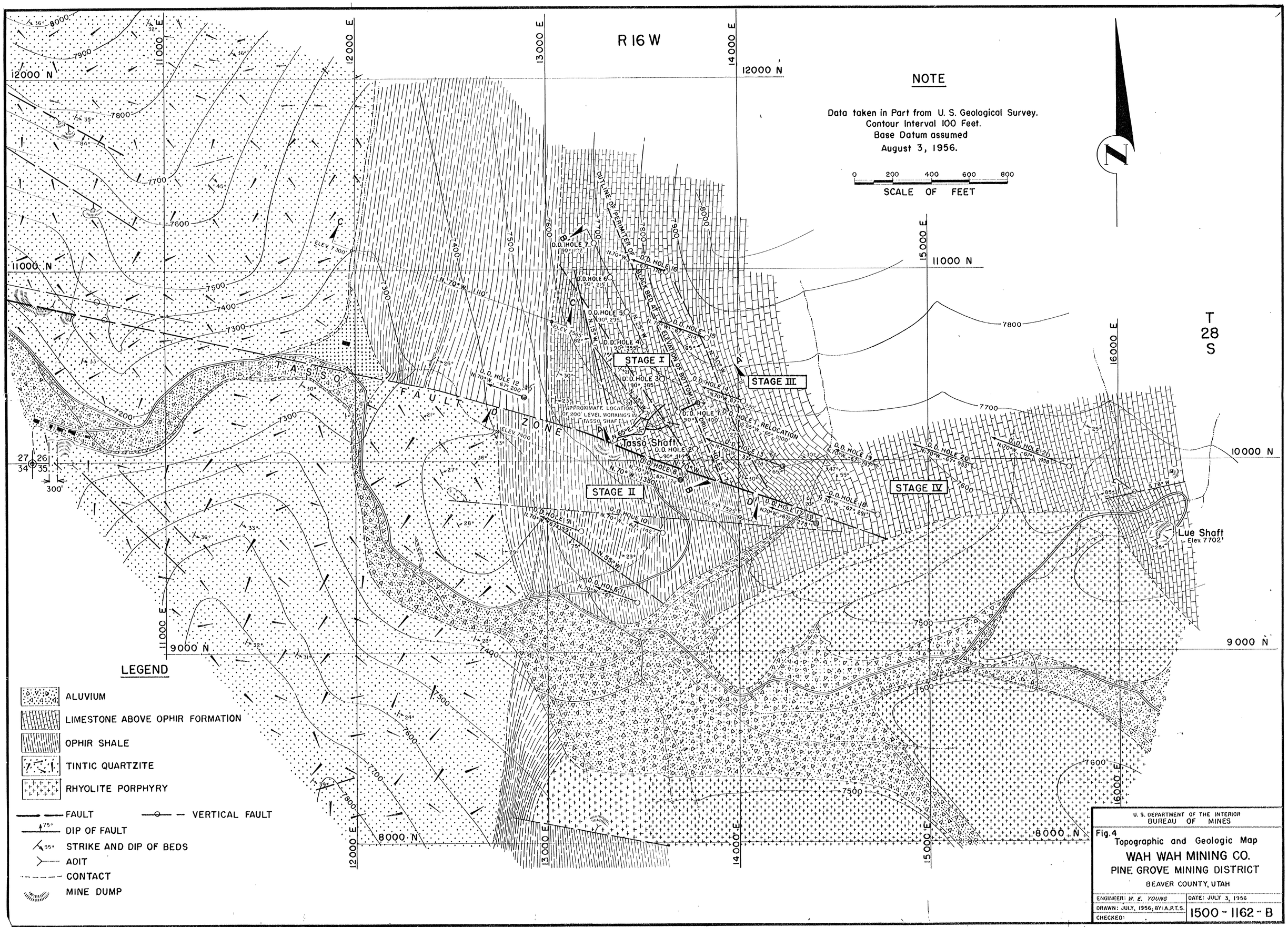
DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



VERTICAL SECTION THROUGH
DMEA DRILL HOLES Nos. 4 & 5

Fig. 7

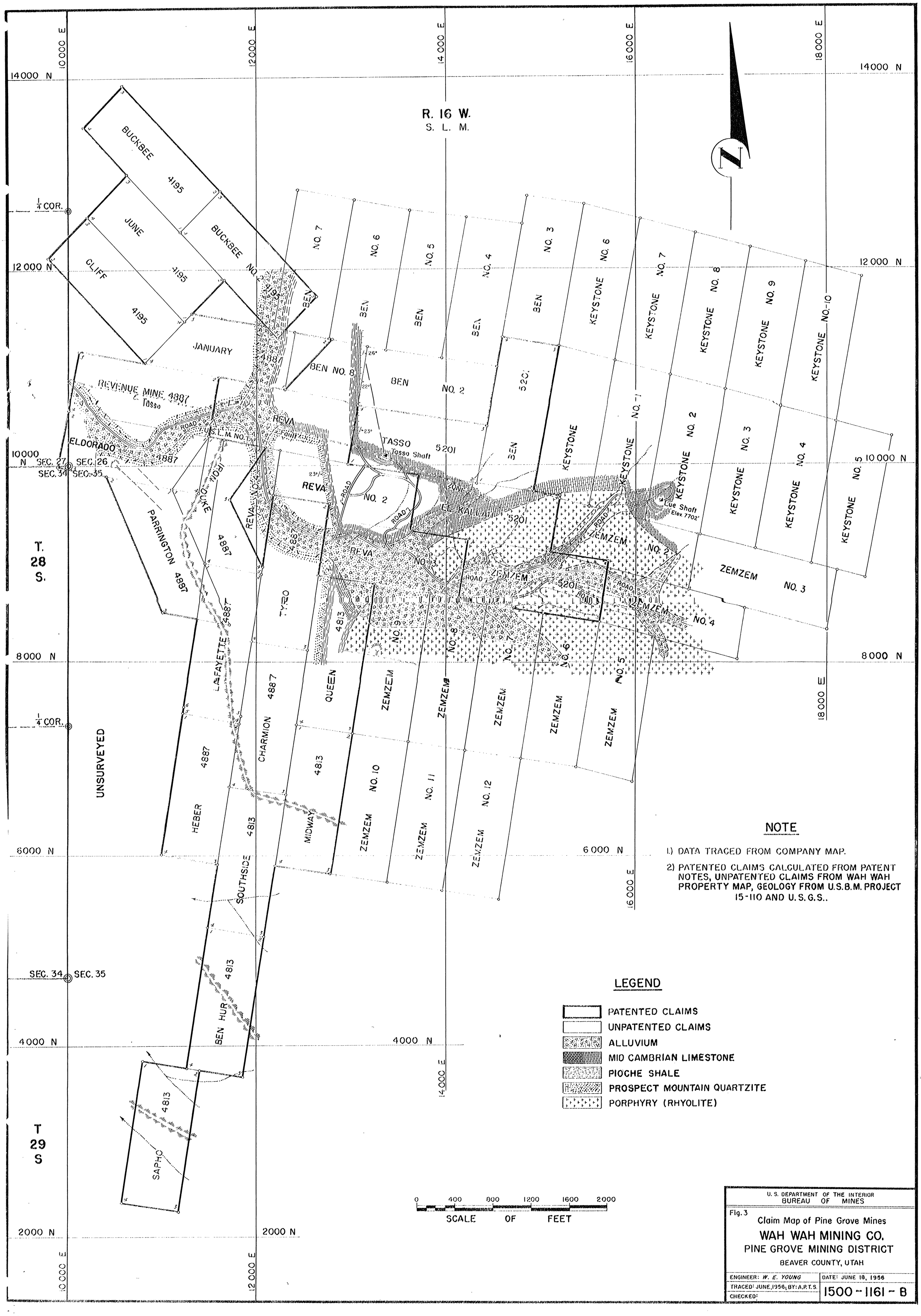
Prepared from Company Maps

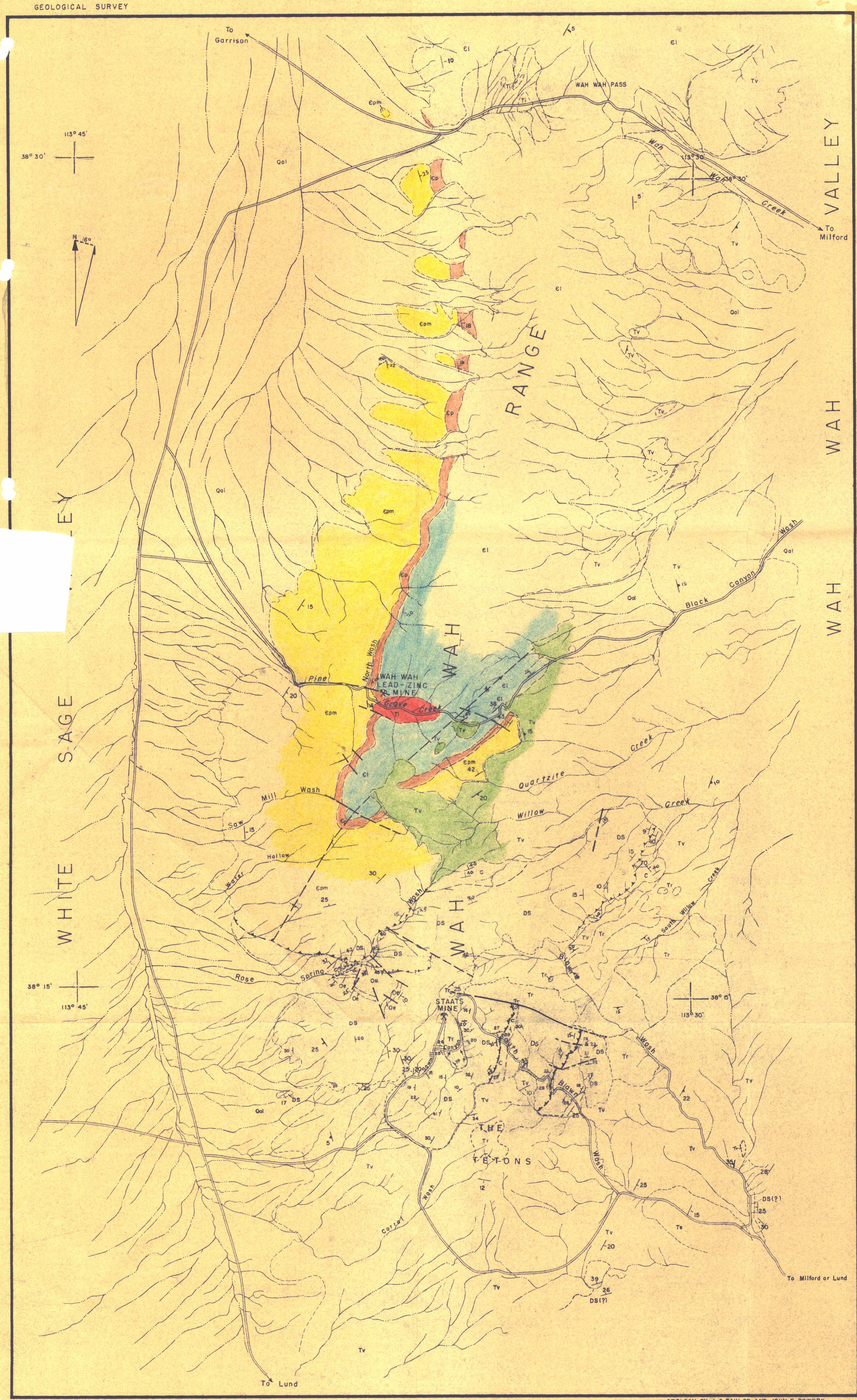


U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Fig. 4
Topographic and Geologic Map
WAH WAH MINING CO.
PINE GROVE MINING DISTRICT
BEAVER COUNTY, UTAH

ENGINEER: W. E. YOUNG	DATE: JULY 3, 1956
DRAWN: JULY, 1956, BY: A.P.T.S.	1500 - 1162 - B
CHECKED:	


R. 16 W.
S. L. M.
T. 28 S.
T 29 S
BUCKBEE 4195
JUNE 4195
CLIFF 4195
JANUARY 4887
BUCKBEE NO. 2 4195
BEN NO. 8
REVENUE MINE 4887
Tasso
ELDORADO 4887
U.S.L.M. NO. 1
REVA
REVA NO. 4
REVA NO. 2
REVA NO. 3
TASSO
Tasso Shaft
EL KALAM
ZEMZEM NO. 2
ZEMZEM NO. 3
ZEMZEM NO. 4
Cue Shaft
Elev. 7702'
PARRINGTON 4887
IRON DUKE 4887
TYRO
LAFAYETTE 4887
CHARMION 4887
QUEEN
HEBER 4887
MIDWAY 4813
SOUTHSIDE 4813
BEN HUR 4813
SAPHO 4813
UNSURVEYED
SEC. 27 SEC. 26
SEC. 34 SEC. 35
1/4 COR.
BEN NO. 2
BEN NO. 3
BEN NO. 4
BEN NO. 5
BEN NO. 6
BEN NO. 7
KEYSTONE NO. 1
KEYSTONE NO. 2
KEYSTONE NO. 3
KEYSTONE NO. 4
KEYSTONE NO. 5
KEYSTONE NO. 6
KEYSTONE NO. 7
KEYSTONE NO. 8
KEYSTONE NO. 9
KEYSTONE NO. 10
ZEMZEM NO. 5
ZEMZEM NO. 6
ZEMZEM NO. 7
ZEMZEM NO. 8
ZEMZEM NO. 9
ZEMZEM NO. 10
ZEMZEM NO. 11
ZEMZEM NO. 12
ROAD
14000 N
12000 N
10000 N
8000 N
6000 N
4000 N
2000 N
10000 E
12000 E
14000 E
16000 E
18000 E
0 400 800 1200 1600 2000
SCALE OF FEET
NOTE
1.) DATA TRACED FROM COMPANY MAP.
2) PATENTED CLAIMS CALCULATED FROM PATENT NOTES, UNPATENTED CLAIMS FROM WAH WAH PROPERTY MAP, GEOLOGY FROM U.S.B.M. PROJECT 15-110 AND U.S.G.S..
LEGEND
PATENTED CLAIMS
UNPATENTED CLAIMS
ALLUVIUM
MID CAMBRIAN LIMESTONE
PIOCHE SHALE
PROSPECT MOUNTAIN QUARTZITE
PORPHYRY (RHYOLITE)
U. S. DEPARTMENT OF THE INTERIOR
BUREAU OF MINES
Fig. 3
Claim Map of Pine Grove Mines
WAH WAH MINING CO.
PINE GROVE MINING DISTRICT
BEAVER COUNTY, UTAH
ENGINEER: W. E. YOUNG
DATE: JUNE 18, 1956
TRACED: JUNE, 1956; BY: A.P.T.S.
CHECKED:
1500 - 1161 - B



EXPLANATION

QUATERNARY

Qal — Alluvium

UNCONFORMITY

TERTIARY

Ts — Tuffaceous sandstone

Tr — Rhyolite plugs and dikes

Tv — Rhyolite latite andesite and basalt

Ti — Monzonite and quartz monzonite

Unconformity

PALEOZOIC

Mississippian

C — Limestone and dolomitic limestone. Cherty in part, may include limestone of Pennsylvaian age.

Devonian and Silurian

DS — Dolomite limestone and quartzite. Dolomite, quartzite and minor amounts of limestone in Devonian. Massive dark Dolomite in Silurian. May also include ordovician dolomite in lower part.

Ordovician

Oe, Ou — Eureka quartzite Oe and undifferentiated limestone and dolomite Ou.

Cambrian

Ꞓl — Limestone and dolomitic limestone

Ꞓp — Pioche shale

Ꞓpm — Prospect mountain quartzite

Contact (Dashed where approximately located)

Fault (Dashed where approximately located)

Thrust fault (Barbs point to direction of upper plate)

30 — Strike and dip of beds

20 — Approximate strike and dip of beds

18 — Strike and dip of overturned beds

20 — Strike and dip of flow banding

Vertical flow banding

Axis of syncline showing pitch

Approximate location of Latitude and Longitude lines

BASE COMPILED FROM ARIAL PHOTO INDEX SHEETS

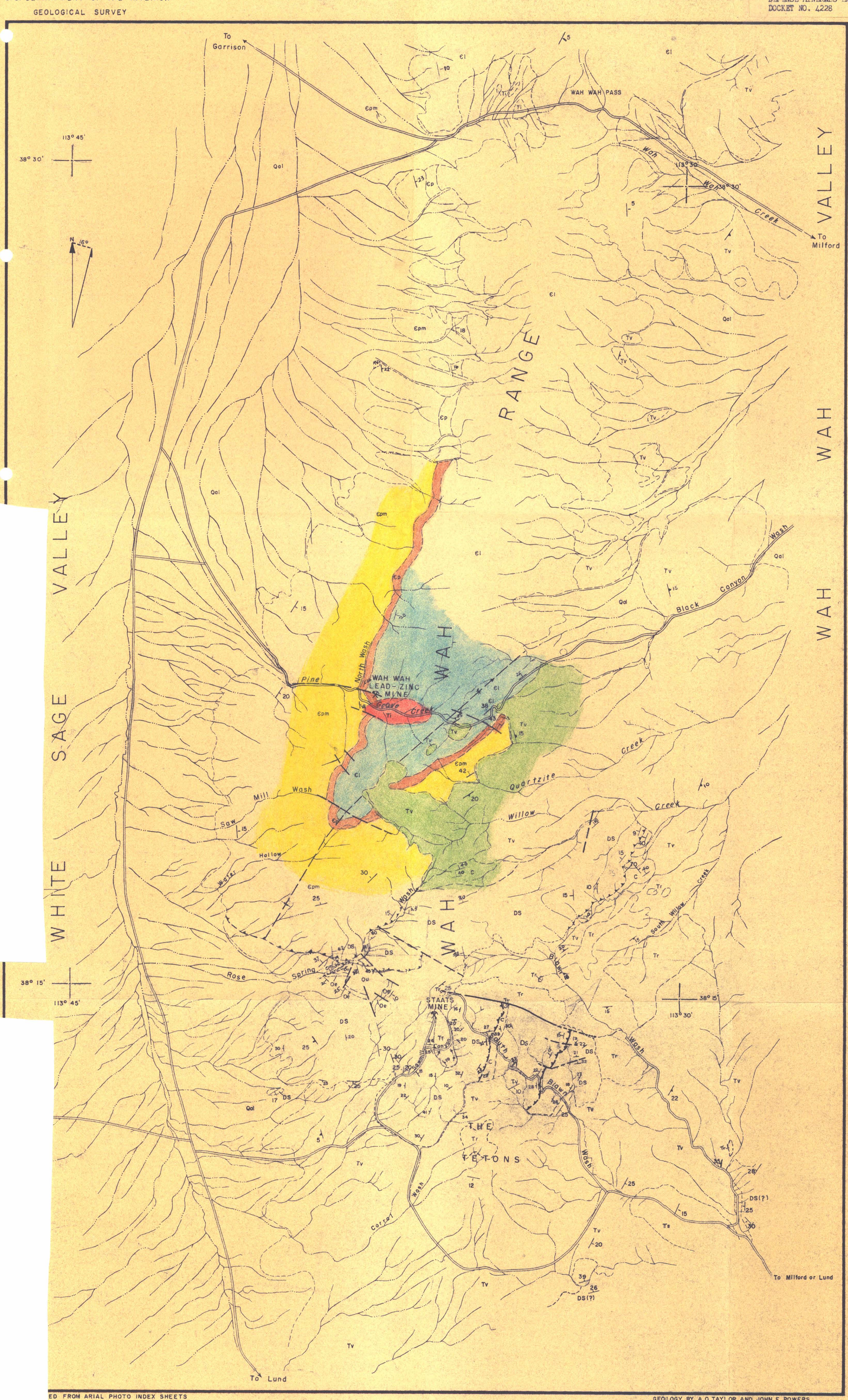
GEOLOGY BY A.O. TAYLOR AND JOHN F. POWERS
AUGUST, 1953

FIG. 2 RECONNAISSANCE GEOLOGIC MAP of the WAH WAH RANGE, BEAVER COUNTY, UTAH

1 0 1 2 MILES

U.S. DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

DEFENSE MINERALS EXPLORATION ADMINISTRATION
DOCKET NO. 4228



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