3227

April 26, 1954

MEMORANDUM

To: Administrator, DMEA

From: Iron and Ferro-Alloys Division, DMEA

Subject: Denial of Application by Field Team, Region IV
Docket No. DMEA-3227 - Tungsten
Standard Tungsten Corporation
Black Rock (Tungsten King) No. 1. Claim
Cochise County, Arizona

The applicant requested exploration assistance in the amount of $33,180.00 to explore at greater depth a tungsten-bearing vein on the Black Rock (Tungsten King) No. 1 Claim, Cochise County, Arizona.

The area near the Tungsten King mine is underlain by pre-Cambrian schist that has been intruded by granite, but the contact between schist and granite is a fault zone along which prominent lamprophyre dikes and tungsten-bearing quartz veins occur.

Total mine workings on the main quartz vein include about 800 feet of drifts, raises and winzes and a small stope from which about 1000 tons of ore have been mined. The vein has been explored near the surface by several shallow shafts, pits and short adits.

Fifteen samples were taken in the mine by the DMEA engineers and gave the following results:

No.	Vein Width/ft.	%WO_3	No.	Vein Width/ft.	% WO_3
1	2.5	0.60	9	2.6	0.19
2	2.5	0.58	10	2.2	0.17
3	2.5	0.12	11	2.2	0.06
4	3.7	0.59	12	2.0	0.07
5	3.0	0.17	13	2.0	0.37
6	3.0	2.18	14	3.5	0.45
7	3.0	0.03	15	2.0	1.23
8	3.5	0.12			

Weighted Average: Width = 2.7 feet Percent WO_3 = 0.48

The examining engineers estimate that there is a reserve of 4000 tons of ore, containing an average of 0.55 percent WO_3, in the area for which exploration is proposed. The mill recoveries from this grade of tungsten ore would not ordinarily exceed about 7 pounds of WO_3 concentrates per ton, an amount which is too small to allow profitable operation.

The mine is also handicapped by difficult mining conditions caused by the low dip of the vein and by a hanging wall which is highly susceptible to caving.

The examining engineers conclude that this deposit contains only a small reserve of relatively low-grade ore, which is not regarded as significant under present conditions and therefore recommend that the application be denied.

The Field Team, Region IV, concurs in the recommendation of the examining engineers.

We concur in the denial.

W. S. Martin, Chief
Iron and Ferro-Alloys Division

JHopkins:foc
cc to: Docket
Code 400
Adm. Reading File
Operating Comm/

Yes be [illegible] & [illegible] on [illegible]

MAR 31 1954

FOR GOVERNMENT USE ONLY

Mr. W. H. King, Executive Officer
DMEA Field Team, Region IV
224 New Customhouse Building
Denver, Colorado

Re: Dooket No. DMEA 3227 - Tungsten
Standard Tungsten Corporation
Tungsten King Mine
Cochise County, Arizona

Dear Mr. King:

Certain information, which we believe should be passed on to you since it concerns the subject application, has come to our attention. We have been advised that Mr. Hu, president and founder of the captioned corporation, has a long history of organization, promotion, and bankruptcy. Listed below are some bankrupt companies of which Mr. Hu was the organizer and president:

China Motor Corporation
Delaware Corporation
China Motor Industries Corporation
Lytemobile Corporation
Auburn Metal Industries Corporation
United Motor Industries Corporation

If additional information on the same subject would be of use to you, the following could be consulted:

Federal Bureau of Investigation, Tucson, Arizona, and Washington, D. C.
Securities Division of Arizona Corporation Commission
Better Business Bureau of New York City
Foreign Assets Control, Files 7362 and 7527, U. S. Treasury Department, Washington, D. C.
Securities Exchange Commission, State of New York, New York, N. Y.
Dun and Bradstreet

Mrs. Sherer
172 X5397

Without knowing more about the applicant, or about the merits of his proposed project, I cannot comment further.

Sincerely yours,

A. O. Mitchell

Administrator

cc: DOCKET
FT, REG. IV
CODE 400
ADM. READ. FILE

WSMartin/ls 3/31/54

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

400

COPY

224 New Customhouse
Denver 2, Colorado

March 29, 1954.

WSM

Memorandum

To: Administrator, Defense Minerals Exploration Administration
Attention: 200

From: Field Team, Region IV

Subject: Report of Examination - DMEA Docket 3227 (Tungsten), Standard Tungsten Corporation, Cochise County, Arizona.

Enclosed are four copies of the report of examination on the subject docket, a copy of the letter of denial to the applicant, and two copies of Form 3b.

A confidential letter regarding the applicant is being forwarded to Mr. Mittendorf under separate cover.

/s/ John F. Shaw
For W. H. King

/s/ A. H. Koschmann

Enclosures

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

COPY

224 New Customhouse
Denver 2, Colorado

March 29, 1954.

Mr. S. C. Hu, President
Standard Tungsten Corporation
Box 247
Benson, Arizona

Re: Docket No. DMEA-3227

Dear Mr. Hu:

Reference is made to your application for Government aid on the Tungsten King No. 1 claim.

Projects approved by the Defense Minerals Exploration Administration must, in its judgment, show definite promise of yielding material of acceptable grade, and in quantities that will significantly improve the mineral supply position for the National Defense Program.

A careful study of your property and data available to this agency reveals that the probability of disclosing mineable reserves of tungsten is not considered sufficiently promising to justify Government participation. Under these circumstances, we regret to advise that your application for exploration aid is denied.

Very truly yours,

/s/ John F. Shaw
For W. H. King

/s/ A. H. Koschmann
Field Team, Region IV

HMC:cwm
cc: Docket
Administrator, DMEA
WRStorms
AFShride
AHKoschmann (2)
Chron.

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Mining Division
Region IV

March 29, 1954.

Memorandum

To: Field Team, Region IV

From: Chief, Mining Division, Region IV

Subject: Report of Examination - DMEA Docket 3227 (Tungsten), Standard Tungsten Corporation, Cochise County, Arizona.

Enclosed are nine copies of the engineering report on the subject docket.

The applicant requested $33,180.00 to explore the vein at greater depth.

The examining engineer concludes that no significant discovery would result from the proposed work and recommends that the application be denied.

We concur in this recommendation.

John F. Shaw
John F. Shaw
For W. H. King

Enclosures

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

March 23, 1954

Memorandum

To : W. H. King, Chief, Mining Division, Region IV

From : Chief, Mining Methods Br., Mining Div., Region IV

Subject : Report on Docket DMEA-3227, Standard Tungsten Corp.'s Black Rock (Tungsten King) No. 1 Claim, Cochise Mining District, Cochise County, Ariz.

Enclosed are original and 8 copies of the section on Summary, Conclusions and Recommendations by L. L. Farnham and R. W. Ageton of the Bureau of Mines and J. N. Faick of the Geological Survey, and the section on Engineering by Farnham and Ageton for the above report. I believe a separate section on the Geology already has been submitted by the Geological Survey.

Because of the small size of the deposit and its apparent low grade, the examiners believe that a significant discovery of tungsten ore would not result from the proposed exploration work. Therefore they recommend that the loan be denied. I concur with this recommendation. I believe J. N. Faick of the Geological Survey has submitted a confidential letter regarding the applicant.

Both the Bureau's and the Survey's brochures are enclosed.

Walter R. Storms

Walter R. Storms

CC W. H. King (8)
A. F. Shride
DMEA-3227
DF

WRStorms:frj

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Defense Minerals Exploration Administration
Denver Federal Center
Denver 2, Colorado

March 15, 1954

Memorandum

To: DMEA Field Team, Region IV

From: A. H. Koschmann

Subject: DMEA Docket 3227, Standard Tungsten Corporation, Tungsten King Mine, Cochise County, Arizona

Enclosed are 9 copies of a geological report by John N. Falck of the U. S. Geological Survey covering the above docket. It has been recommended that the loan be denied.

Also enclosed are 9 copies of a confidential letter by Mr. Falck concerning the applicant.

A. H. Koschmann
A. H. Koschmann
Supervising Geologist
Colorado-Wyoming

Enclosures (18)

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

P. O. Box 4126, University Station
Tucson 5, Arizona

March 11, 1954

Airmail

Memorandum

To: A. H. Koschmann GHK

From: John N. Faick

Subject: DMEA 3227, Standard Tungsten Corporation, Tungsten King Mine, Cochise County, Arizona

Under separate cover we are submitting the original and 8 copies of a geological report on the above subject. The report recommends denial of the application because it is believed the ore which may be discovered by the proposed project is not significant in either quantity or quality under present conditions.

The report is accompanied by a confidential letter which also recommends denial of the application because of a history of unethical conduct on the part of the president of the applicant corporation.

John N. Faick
Geologist

Copies to Koschmann (8)
Storms
Shride

JNFaick:mvt

Reviewed by
DMEA OPERATING COMMITTEE
4-15-54
(date)

UNITED STATES
DEPARTMENT OF THE INTERIOR
DOUGLAS McKAY, SECRETARY

DEFENSE MINERALS EXPLORATION ADMINISTRATION

REPORT OF EXAMINATION BY FIELD TEAM
REGION IV

DMEA-3237, Standard Tungsten Corp.'s Black Rock (Tungsten King) No. 1 Claim Cochise Mining District Cochise County, Arizona

L. L. Farnham and R. W. Ageton, Mining Engineers
U. S. Bureau of Mines

John N. Faick, Geologist
U. S. Geological Survey

March 1954

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

By L. L. Farnham[1], R. W. Ageton[1], and J. F. Faick[2]

Late in December 1953, the Standard Tungsten Corp. applied to the Defense Minerals Exploration Administration under the Defense Production Act of 1950, as amended, for an exploration loan amounting to $33,180. The application was docketed as DMEA-3227. The funds requested were to be used in the deeper exploration of a tungsten prospect situated in the Little Dragoon mountains of Cochise County, Ariz. The property was examined on January 26 and 27, 1954 by the writers.

The Black Rock (Tungsten King) No. 1 claim upon which the exploration was proposed has been worked intermittently on a small scale since the first World War. To date it has produced about 6.8 tons of scheelite concentrates said to have averaged about 60 percent WO_3. This would be equivalent to a total production of some 400 units of tungsten trioxide.

Scheelite mineralization in the area has been found in small scattered amounts for several thousand feet along the outcrop of a vein which follows a contact between pre-Cambrian schist and intrusive granite. The vein zone strikes northward and dips about 45 degrees eastward. Schist forms the hanging wall and granite occupies the footwall of the vein.

1/ Mining Engineers, U. S. Bureau of Mines
2/ Geologist, U. S. Geological Survey

The only portion of this long vein, that has encouraged any appreciable development, occurs in the area proposed for exploration. Here a short oresheet had been developed and largely exploited to an inclined depth of about 140 feet below the outcrop, by workings extending from a crosscut adit. A transverse fault-zone offset the vein in the vicinity of the crosscut and separated the oresheet into 2 main segments.

In the better mineralized portions of the vein, fairly coarse particles of scheelite were distributed erratically in irregular branches within narrow lenticular pods of quartz. The best ore, which furnished all the production, was found in the vein segment immediately south of the adit fault. In this section, between 1,000 and 1,500 tons was mined above the adit level in an irregular stope having a maximum strike length of not more than 150 feet. The main vein segment north of the fault zone was exposed at intervals for about 100 feet along the strike. This section of the vein was evidently lower in grade than the south segment and no stoping had been attempted.

Where the vein had been stoped, less than 60 percent of the area was found to be of minable width and grade. Over 40 percent of the area consisted of pillars which evidently occupied either the pinched portions of the vein or those portions that lacked appreciable scheelite.

The average grade of the minable portions of the deposit, as estimated from the production records, ranged from 0.45 to 0.68 percent WO_3. The average of 15 samples, that were taken by the

examiners, substantiated this grade range so it was concluded that the deposit could not be expected to average more than 0.60 percent WO_3.

If the vein was further developed at a depth of 100 feet below the present level and the oreshoot area proved to be 300 feet long with an average width of 3 feet, the block would contain 7,200 tons. As not more than 60 percent of this tonnage could be expected to be minable, it follows that the indicated potential of the deposit would be of the order of 40 tons per foot of depth with an average content of about 0.60 percent tungsten trioxide.

A deposit of this size and grade is not considered significant and as there is little likelihood that further exploration would disclose more substantial deposits, it is recommended that the loan application be denied.

STANDARD TUNGSTEN CORPORATION

(TUNGSTEN)

TUNGSTEN KING (BLACKROCK) MINE

COCHISE COUNTY, ARIZONA

DMEA 3227

by

John K. Faick

Geologist, U. S. Geological Survey

Reviewed by
DMEA OPERATING COMMITTEE

4-5-54
(date)

STANDARD TUNGSTEN CORPORATION

(TUNGSTEN)

TUNGSTEN KING (BLACK ROCK) MINE

COCHISE COUNTY, ARIZONA

DMA 3227

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INTRODUCTION

The Defense Minerals Exploration Administration is in receipt of an application from the Standard Tungsten Corporation, Box 247, Benson, Arizona, for Government assistance in exploration work estimated by the applicant to cost $33,180.40. The property for which exploration is proposed is the Tungsten King (Black Rock) mine, in Cochise County, Arizona. The mine is under the management of Mr. S. C. Hu, Congress Hotel, Tucson, Arizona, and H. C. Grundstedt, Phone 4-5614, Tucson, Arizona, respectively president and engineer of the Standard Tungsten Corporation.

The mine was examined January 26-27, 1954, by L. L. Farnham and R. Ogden, U. S. Bureau of Mines, and J. R. Cooper, U. S. Geological Survey.

On previous occasions the mine has been examined, mapped and sampled by engineers of the U. S. Bureau of Mines, and by private investigators.

GEOLOGY

The Tungsten King (or Black Rock) mine is situated on the western slope of the Little Dragoon Mountains in an area which drains westward into the San Pedro River. The mine is about N. 60° E., a distance of about 10 miles airline, from Benson, Arizona, and is reached by road via Fairbank (see Figure 1). The mine is located in the south-central part of the Dragoon quadrangle, which is presently under investigation by J. R. Cooper[1] for the U. S. Geological Survey.

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[1] Mr. Cooper kindly provided the base map for Figure 3.

The area near the Tungsten King mine and the region extending a considerable distance north and south of it, is underlain by pre-Cambrian schist on the east, and granite on the west. The granite is intrusive into the schist, but near the Tungsten King mine the contact between schist and granite is a fault zone along which there have been repeated movements. The contact zone strikes a few degrees east of north and dips easterly about 45 degrees. Prominent lamprophyre dikes and quartz veins crop out intermittently for several thousand feet along the contact zone.

As described by Wilson[1] "these veins form eastward-dipping lenticular segments from a few inches to 6 feet wide and locally several hundred feet long, which have been offset in places by faults. Their coarsely crystalline dull-white quartz contains a little pyrite, chalcopyrite and galena, and where oxidized, sparse iron oxide, copper stain and wulfenite. Scheelite, generally detectable only by panning or by short-wave ultraviolet light, occurs as irregularly distributed small particles at various places in the veins and to a minor extent in the adjacent walls."

On the Tungsten King No. 1 claim a 335-foot adit has been driven easterly through the contact zone along which is localized the principle quartz-scheelite vein. A drift, with a small stope above it, has explored the vein for more than 110 feet south of the adit. North of the adit, faulted segments of the vein, which have been displaced eastward with respect to the south part of the vein, have been explored by drifting and crosscutting for a distance of about 160 feet north of the adit. Total mine workings (see fig. 3) are about 800 feet of drifts, raises and winzes, and a small stope from which about 1000 tons of ore have been mined. The vein has been explored near the surface by several shallow shafts, pits, and short adits.

---

[1] Wilson, E.D., Tungsten Deposits of Arizona, Arizona Bur. of Mines Bull. 149, pp. 43-44, 1941

The ore zone, where exposed in the underground workings of the Tungsten King mine, consists of a quartz vein which ranges in width from about 6 inches to 4 feet thick. In addition there are many narrow discontinuous veins occurring as branch veins or separate veins in the altered host rocks. The principle quartz veins occupy fractured zones in a lamprophyre dike and to a slight extent replace it. The granite-schist fault contact, the lamprophyre dikes, the quartz veins and the zones of mineralization are practically co-extensive. The zone trends about N. 10° E., and dips easterly about 45 degrees.

Scheelite is widely distributed in the quartz and in a few places is disseminated in the wall rocks. The scheelite is soft and friable, but it usually coarse-grained and grains ranging in size from about 1/8 inch to one inch across are present in the ore. The scheelite is relatively pure as revealed by the blue-white fluorescence under the ultraviolet light.

The vein pinches and swells appreciably along the strike, and the quantity of scheelite varies considerably from place to place. These variations apparently are caused, at least in part, by intense pre-ore structural disturbances along the vein zone. Available evidence indicates that the vein is widest and the scheelite is most abundant in places where subsidiary fractures in the hanging wall enter the vein zone and merge with it.

PROPOSED EXPLORATION

On the main vein, approximately 40 feet south of where it is intersected by the adit, is a winze about 10 feet deep. The applicant's proposal for exploration (see figure 2) is to sink this winze an additional 100 feet in the plane of the vein and to drive a total of 650 feet of drifts along the vein from the bottom of the winze. All of the 650 feet of proposed drift probably will not be required as a crossfault displaces the vein at a point

about 350 feet south of the winze and it is not proposed to explore the faulted extension of the vein, and furthermore there is some evidence to suggest that the vein pinches out before reaching the crossfault. It is believed that 300 feet of drifting would be sufficient to explore the objective.

The applicant has indicated that he will start sinking the winze very soon, even before Government participation is approved.

PRODUCTION AND GRADE OF ORE

The only recorded production from previous operations, amounting to about 6.8 tons of concentrate is summarized in Table 1:

TABLE 1

Summary of Production

Period of operation	Production
World War I	About 5 tons of scheelite concentrate produced.
About 1940	About 800 pounds of concentrate produced.
March-September 1953	Approximately 400 tons of ore yielded between 2000 and 3100 pounds of concentrate, and 300 tons of tails are stockpiled for retreating.
September 1953	About 100 tons of ore yielded 800 pounds of concentrate. Coarse tails are stockpiled for retreatment.

It is probable that all concentrates obtained from previous operations have been produced by the use of jigs. The concentrate produced in this manner is not clean and free from impurities, therefore requires a flotation cleanup to get rid of excess S, Pb, Cu, As and P_2O_5.

The applicant provided analyses of 9 samples of the ore and mill products. These are shown in Table 2.

TABLE 2

Sample Results Provided by the Applicant

Sample No.	Location	Length of Sample	Percent WO_3
1	North Drift	4 feet	0.01
2	North Drift	4 feet	3.25
3	Stope	5 feet	6.05
4	Stope	3 feet	0.65
5	Stope	4 feet	4.43
6	Winze, S.Drift	3.5 feet	1.09
7	Heads of mill test		1.20
8	Middlings		0.32
9	Concentrates		62.3

The samples taken in the mine by the applicant were thought to have been poorly selected, and apparently yielded erroneous results; therefore 15 additional samples were taken by the DMRA examiners. Locations of the DMRA samples are shown on figures 3 and 4, and the analyses are given in Table 3.

TABLE 3

Results of sampling by the examiners

Sample Number	Sample or vein width	Percent WO_3
1	2.5	0.60
2	2.5	0.58
3	2.5	0.12
4	3.7	0.59
5	3.0	0.17
6	3.0	2.18
7	3.0	0.03

Sample Number	Sample or vein width	Percent WO_3
8	3.5	0.12
9	2.6	0.19
10	2.2	0.17
11	2.2	0.08
12	2.0	0.07
13	2.0	0.37
14	3.5	0.45
15	2.0	1.23

The weighted averages of the sample data in Table 3 indicates that the mineralized part of the vein has a width of 2.7 feet and a WO_3 content of .48 percent.

The tungsten is not uniformly distributed in the vein, however, as is shown by the DMEA samples and by the production records. In the stoped areas it is assumed that the highest grade and widest part of the vein has been mined out and the lowest grade and narrowest part of the vein are left in the pillars.

Samples 9 to 15 (Table 3) which were taken from stope pillars indicate an average vein width of 2.4 feet and a grade of 0.36 percent WO_3; however, production records indicate that higher grade ore has been mined. Stope measurements indicate the amount of ore produced was about 1000 tons, from which was obtained about 6.8 tons of concentrate according to available reports. If it is assumed that this concentrate contained 60 percent WO_3, then about 408 units, or 21,600 pounds of concentrate were recovered from the 1000 tons of ore, an indicated recoverable content of 0.41 percent WO_3. If it is assumed that the mill recovery was 60 percent of the WO_3 in the ore, then the average mill feed contained 0.68 percent WO_3.

Samples 4 to 8 inclusive, are taken from a sublevel where all of the ore was not removed, and it is believed these samples are essentially representative of the ore previously mined. These samples indicate a vein width of 3.2 feet and an average content of 0.60 percent WO_3 in the sublevel area.

Samples 1 to 3 inclusive, taken from the vein where it is exposed in the drift north of the adit, in an area where there has been no mining, averaged 0.43 percent WO_3, and a vein width of 2.5 feet.

The above data on the width and grade of the ore is summarized as follows:

Description	Average vein width in feet	Percent WO_3
Calculated grade of 1000 tons of ore produced		0.68
Weighted average of all DMEA samples	2.7	0.48
Unmined north segment of vein	2.5	0.43
Samples of stope pillars	2.4	0.36
Samples of sublevel	3.2	0.60

Thus it is indicated that the tungsten content of the unmined parts of the vein ranges from about 0.4 to 0.7 percent and the average metal content appears to be about 0.55 percent WO_3, and the average width of the scheelite-bearing vein is about 2.7 feet.

The U. S. Bureau of Mines has a record, dated February 17, 1941, of 19 samples taken from various places on the Tungsten King property. Of these samples 13 of them, taken from the outcrop north of the area considered for exploration, contained an average of slightly over .01 percent WO_3. In the area for which exploration is presently proposed, 6 of the Bureau samples averaged about 0.2 percent WO_3, and 3 of these, which represent ore from the stope, averaged 0.36 percent WO_3, which is the same as the DMEA examiners obtained from the pillars on the adit level.

ORE RESERVES

Reserves are estimated only for the part of the vein which could be explored by the applicant's proposed exploration program, i. e. the unmined portion extending 100 feet down the dip of the vein. For convenience it is assumed that strike distance of 300 feet would be explored south of the cross fault that displaces the vein at the adit, and the average vein width accepted as 2.7 feet. If a factor of 12 feet per ton is used then a reserve of about 6750 tons of indicated and inferred reserves is probably present below the adit level in the area to be explored. However, not all of the vein material in this zone is mineable, as is shown by the record of previous stoping operations above the adit level. In the old stope about 57 percent of the vein has been mined and about 43 percent remains as pillars in which the vein was either too narrow or too low-grade to be mineable. Thus if this ratio of ore to waste persists throughout the vein then the above mentioned 6750 ton reserve should be reduced to about 4050 tons.

Using generalized figures, we can state that there is a reserve of about 4000 tons of ore containing between 0.4 and 0.7 percent WO_3, an average of 0.55 percent WO_3, in the area for which exploration is proposed. Undoubtedly additional ore is present in zones for which exploration is not proposed, and in areas which the applicant is unwilling to subordinate.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Investigation of the Tungsten King vein, which the applicant proposes to explore with Government aid, reveals that about 4000 tons of ore containing 0.55 percent WO_3 may be present in the zone for which exploration is proposed. Mill recoveries from this grade of tungsten ore would not ordinarily exceed about 7 pounds WO_3 concentrate per ton, an amount which is too small to allow profitable operation. The mine is also handicapped by difficult mining conditions caused by the low dip of the vein and by a hanging wall which is highly susceptible to caving.

As this deposit contains only a small reserve of relatively low-grade ore, which is not regarded as significant under present conditions, it is recommended that the application be denied.

MAR 1954
RECEIVED
U.S. Geological Survey
Water Resources Branch
Denver

DMEA-3227, STANDARD TUNGSTEN CORP.'S
BLACK ROCK (TUNGSTEN KING) NO. 1 CLAIM
COCHISE MINING DISTRICT
COCHISE COUNTY, ARIZONA

Engineering Report

By L. L. Farnham and R. W. Ageton
Mining Engineers
U. S. Bureau of Mines

March 1954

Reviewed by
DMEA OPERATING COMMITTEE
4-5-54
(date)

DMA-3227, STANDARD TUNGSTEN CORP.'S
BLACK ROCK (TUNGSTEN KING) NO. 1 CLAIM
COCHISE MINING DISTRICT
COCHISE COUNTY, ARIZONA

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INTRODUCTION

On December 23, 1954, the Executive Officer of the Defense Minerals Exploration Administration, Region IV, requested that an examination and report be made on the feasibility of Government participation in the further exploration of the Tungsten King (Black Rock) No. 1 claim, Cochise County, Ariz. The funds requested were to be used to explore a scheelite prospect at greater depth. The cost of the proposed work, as estimated by the applicant, would amount to $33,180. The application was docketed as DMEA-3227.

The property was visited on January 26 and 27, 1954, by John N. Faick of the Geological Survey, and L. L. Farnham and R. W. Ageton of the Bureau of Mines. The examiners were accompanied by Henry G. Grundstedt, a mining engineer employed by the applicant company.

ACKNOWLEDGMENTS

Acknowledgments are made to Henry G. Grundstedt and S. C. Hu of the applicant corporation for their help during the examination. The information resulting from former investigations of the property, made by engineers of the U. S. Bureau of Mines, was used in the preparation of this report.

LOCATION AND PHYSICAL FEATURES

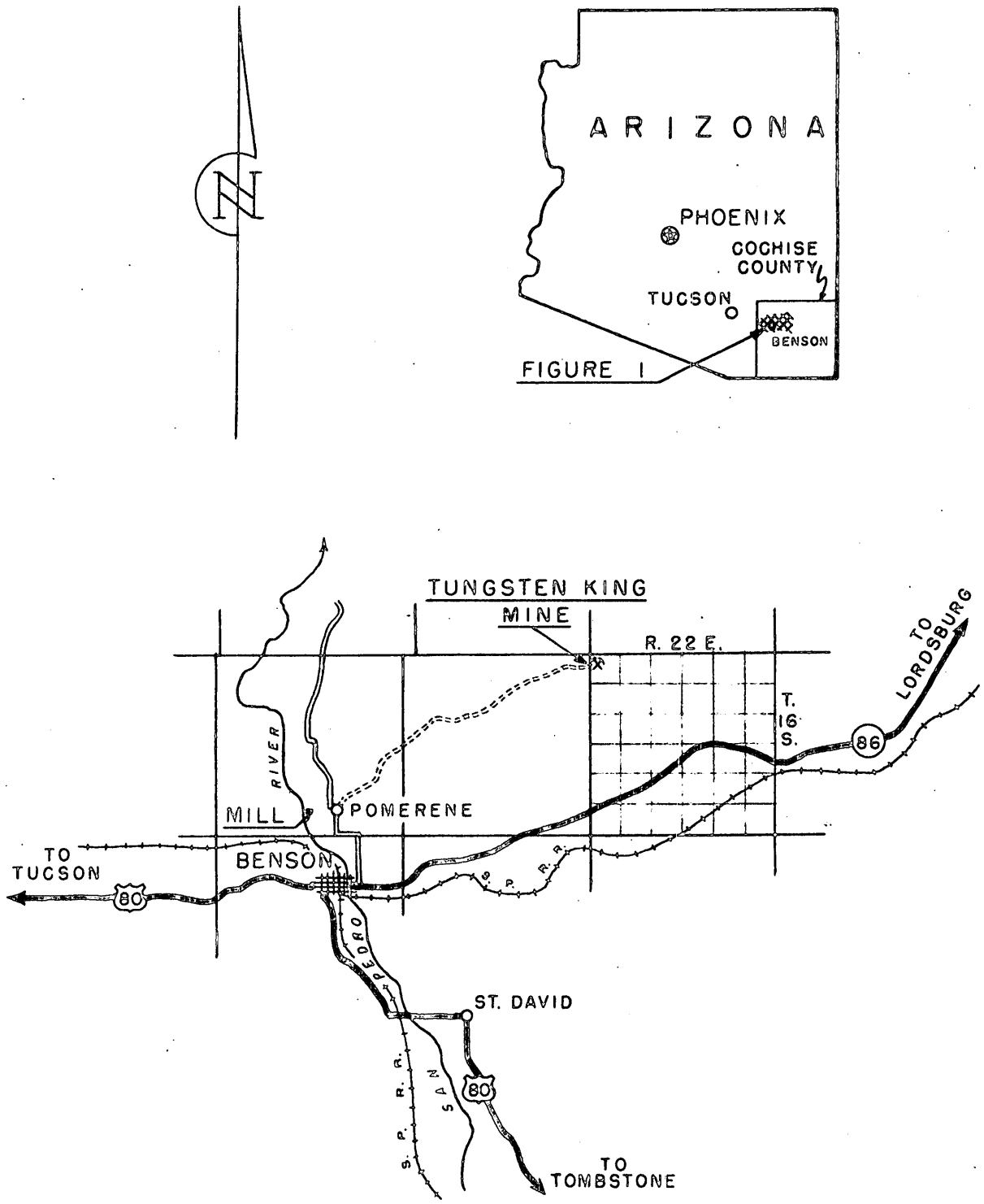
The subject property is situated in sec. 6, T. 16 S., R. 22 E. in the Cochise mining district, Cochise County, Ariz. The site of the proposed exploration can be reached from the town of Benson

by following U. S. Highway 86 for 4 miles in an easterly direction, thence about 3 miles northward to the small farming community of Pomerene. The mine is reached from Pomerene by following a crooked dirt road for 11 miles to the northeast. The last quarter mile of the road has a 30 percent grade. This steep section was recently capped with concrete by the applicant and is now passable in an ordinary automobile (figure 1).

The Tungsten King claims lie well up near the crest along the western slope of the Little Dragoon mountains at an altitude of about 5,200 feet above sea level.

HISTORY AND PRODUCTION

Tungsten minerals were found in the general area as early as 1900. The subject claim first was located in 1913 by J. J. Wien of Benson, Ariz. During the first World War the records show that 5 tons of scheelite concentrates were produced by Wien from surface exposures on the claim. In 1929, the property was purchased by other parties and a 300-foot crosscut adit was driven which intersected the vein at a depth of about 130 feet below the best ore exposed on the outcrop. Very little if any production resulted from this work and the operations were terminated in 1931. The property was not active again until 1937 when Miles M. Carpenter of Tucson secured a lease and produced 800 pounds of concentrates in a small mill. These operations ceased in 1941. The property evidently was idle from 1941 until 1952 when it was acquired by



MARCH 1954

DMEA 3227

FIGURE 1. - LOCATION MAP

TUNGSTEN KING (BLACK ROCK) MINE - COCHISE COUNTY, ARIZONA

the Kramer Mining and Milling Co. This company constructed a small concentrator on the San Pedro river near Pearce and is said to have mined and milled about 400 tons of ore from which 2,000 pounds of concentrates were recovered. The applicant company acquired the property late in 1953 and to date has produced 800 pounds of concentrates from 100 tons of ore.

According to these records the intermittent operations of the property during the past 40 years has resulted in the production of 6.8 tons of concentrates, which if they contained an average of 60 percent WO_3 would be equivalent to 408 units of tungsten trioxide.

OWNERSHIP AND EXTENT

The Tungsten King or Black Rock group includes 22 unpatented lode claims. Only a portion of one of these claims, known as the Black Rock (Tungsten King) No. 1, was included by the applicant in the proposed project.

The ownership of the group is obscure. According to exhibit AA in the brochure, the applicant company has a 75 percent interest in this No. 1 claim through an assignment from Kelley & Co. This assignment was executed by S. C. Hu as trustee for Kelley & Co. S. C. Hu is also president of the applicant company, the Standard Tungsten Corp. There is nothing to show that Kelley & Co. owned the claim or that S. C. Hu had the authority to make the assignment.

DESCRIPTION OF THE DEPOSIT

The area in the vicinity of the subject property is underlain with granite on the west and schist on the east. The contact between these formations is a fault zone which strikes northward and dips about 45° eastward. Localized along this fault-contact throughout a strike length of several thousand feet, there is one or more lamprophyre dikes and numerous lenticular quartz segments. The quartz fills fractures in the dike, and the enclosing schist and granite. In the area proposed for exploration the lenticular quartz segments range from a few inches to 5 feet wide, and are exposed for several hundred feet along the strike. A prominent cross-fault offsets the vein in the immediate vicinity of the proposed work (figure 2). The vein pinches and swells abruptly along both the strike and the dip. It is apparently widest where oblique fractures in the hanging wall intersect the main vein zone.

Spots showing small amounts of scheelite are found along the entire outcrop of the contact zone. However, the only portion of the vein that has been found productive occurs in the area proposed for exploration. Here appreciable amounts of scheelite are distributed as erratic bunches in the lenticular quartz pods for about 300 feet along the strike of the vein zone. This area has been developed and exploited on a single level by workings extending from a cross-cut adit (figure 2).

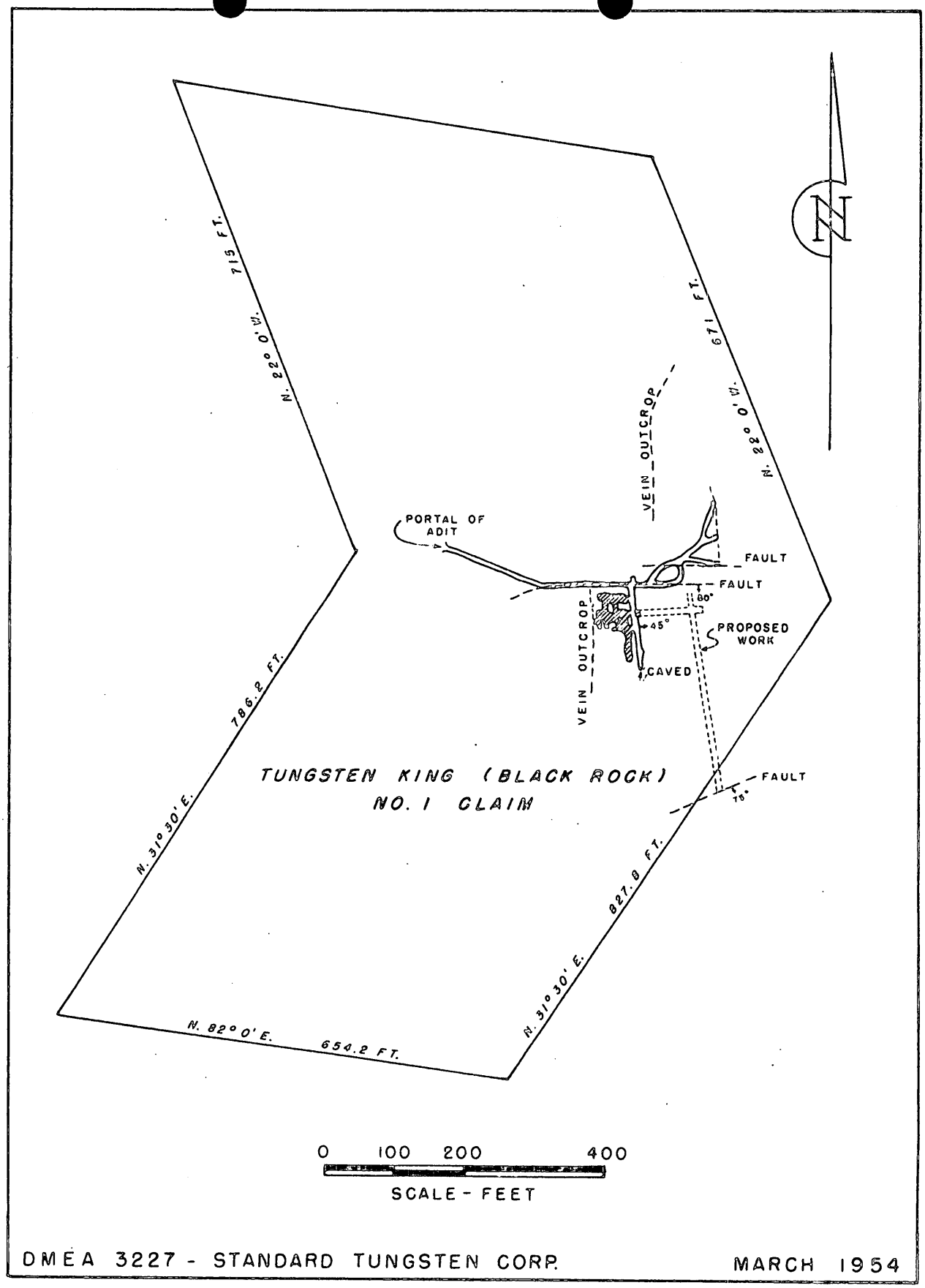


FIGURE 2. - TUNGSTEN KING (BLACK ROCK) NO. 1 CLAIM
COCHISE COUNTY, ARIZONA

ORE RESERVES

The examiners cut 15 samples across the vein in various places in the adit workings. The location of these samples is shown on figure 4 and the results, as determined in the Tucson laboratory of the Bureau of Mines, are as follows:

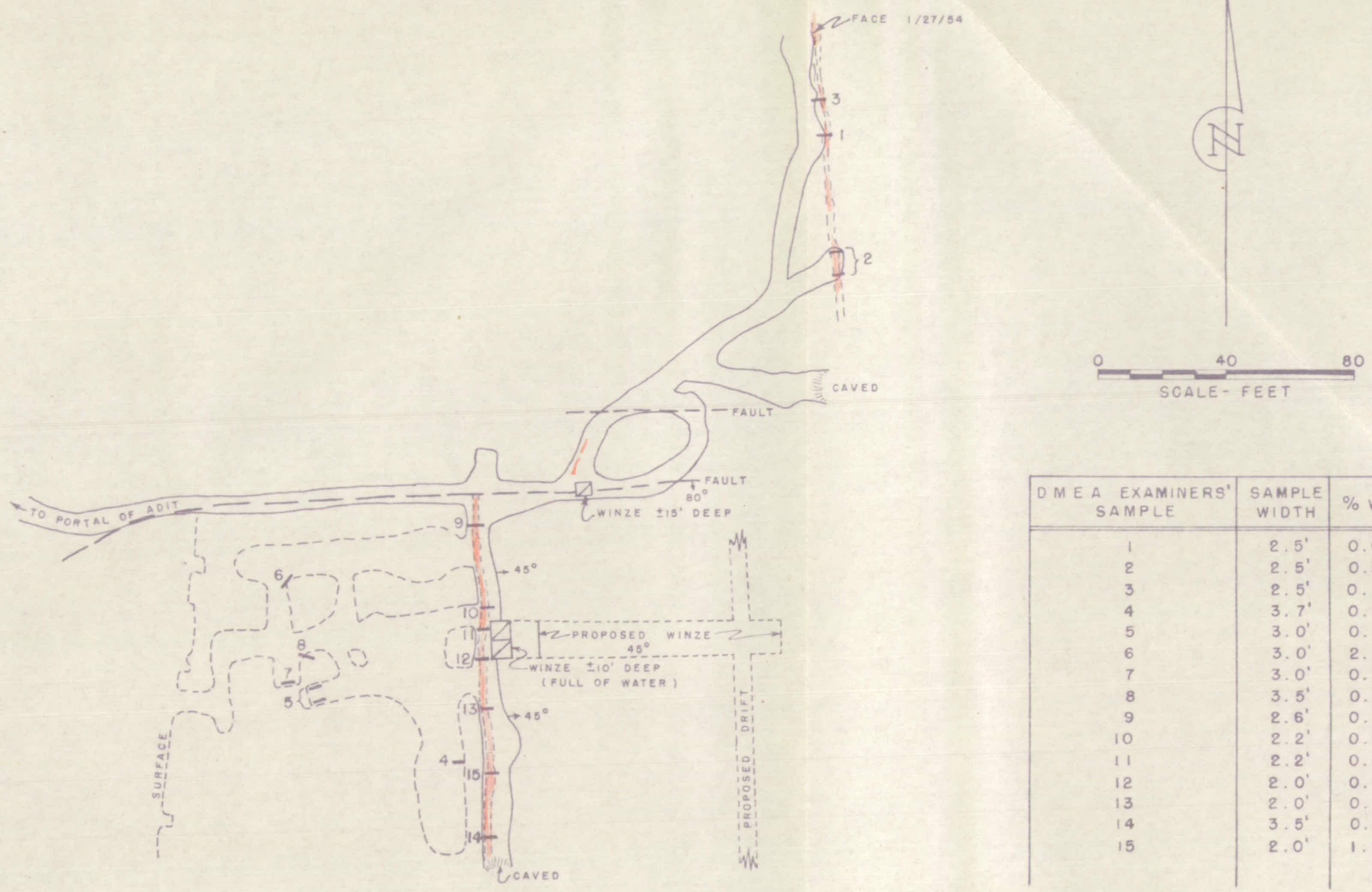
Sample No.	Location	Width, ft.	Percent WO_3
1	Vein north of adit fault	2.5	0.60
2	" " " " "	2.5	0.58
3	" " " " "	2.5	0.12
4	Stope south of adit fault	3.7	0.59
5	" " " " "	3.0	0.17
6	" " " " "	3.0	2.18
7	" " " " "	3.0	0.03
8	" " " " "	3.5	0.12
9	Pillars over south drift	2.6	0.19
10	" " " "	2.2	0.17
11	" " " "	2.2	0.06
12	" " " "	2.0	0.07
13	" " " "	2.0	0.37
14	" " " "	3.5	0.45
15	" " " "	2.0	1.23

The weighted average of all of the above samples was 0.48 percent WO_3 with an average width of 2.7 feet.

Samples Nos. 1 to 3, inclusive, taken in the vein segment north of the adit fault, averaged 0.43 percent WO_3 over an average vein width of 2.5 feet.

Samples 4 to 8 were taken in a sub-level in the stope where all the better ore had not as yet been mined. These samples averaged 0.60 percent WO_3 with a width of 3.2 feet.

Samples 9 to 15 were cut in the pillars remaining in the back of the south drift, directly below the stoped area. These 7 samples averaged 0.36 percent WO_3 with a width of 2.4 feet. For the most



DMEA EXAMINERS' SAMPLE	SAMPLE WIDTH	% WO_3
1	2.5'	0.60
2	2.5'	0.58
3	2.5'	0.12
4	3.7'	0.59
5	3.0'	0.17
6	3.0'	2.18
7	3.0'	0.03
8	3.5'	0.12
9	2.6'	0.19
10	2.2'	0.17
11	2.2'	0.06
12	2.0'	0.07
13	2.0'	0.37
14	3.5'	0.45
15	2.0'	1.23

DMEA 3227 - STANDARD TUNGSTEN CORP.

MARCH 1954

FIGURE 4. - SAMPLE MAP OF THE TUNGSTEN KING (BLACK ROCK) MINE
COCHISE COUNTY, ARIZONA

part the pillars that were sampled were not mined because they evidently occupied the poorer and pinched portions of the vein. If the back of this drift had been sampled before the removal of the higher grade ore, the results no doubt would have shown a somewhat higher tungsten content than indicated by the present sampling. It is conceivable that the drift originally may have had an average tungsten content comparable to that of the sub-level where higher grade ore was still in place. These sub-level samples averaged 0.60 percent WO_3 and if this grade was assigned as the average of the 7 drift samples, then the average of all the examiners' samples would have been 0.56 percent WO_3, instead of 0.48 percent.

Measurements in the accessible stopes indicated that about 1,000 tons of ore had been mined. There was evidence of additional stoping in the caved area at the south end of the adit workings, so no doubt more than 1,000 tons of ore had been stoped. The recorded production from the property has amounted to 408 units of tungsten trioxide. If this was recovered from 1,000 tons of ore, the average recovery would have been 0.41 units of WO_3 per ton milled. If a maximum of 1,500 tons was actually mined, then the average recovery would have been but 0.27 units per ton milled. Assuming the mill recovered 60 percent of the scheelite in the ore, then the average grade of the mine ore would have been 0.68 percent WO_3 if 1,000 tons was milled, and 0.45 percent WO_3 in case 1,500 tons was milled. As it was quite evident that more than 1,000 tons had been mined, it follows that the average grade of the ore was less than 0.68 percent and may have been considerably lower, depending upon the tonnage actually mined and milled.

The examiners' samples averaged 0.48 percent WO_3. After making allowances for an area thought to be too low in grade to be representative, the examiners' samples averaged 0.56 percent WO_3. Judged on the basis of available production data and by the sampling, it appears safe to presume that the average grade of the deposit would not exceed 0.6 percent WO_3.

The applicant's sample results as shown in the application, averaged nearly 3.0 percent WO_3. It was obvious with ultra violet light that the applicant's samples were taken largely in the highest grade spots exposed in the workings.

Measurements in the stoped area showed that about 43 percent of the vein had been left as pillars and 57 percent had been extracted. The pillars included the pinched areas between the lenses as well as areas that lacked appreciable scheelite. It is reasonable to believe that this condition will persist so in any future development it appears probable that not more than 60 percent of the oreshoot area would be minable.

There are a few hundred tons of indicated ore, similar to that previously mined, remaining above the present level.

PRESENT STATUS

In addition to numerous cuts and pits along the outcrop, the oreshoot on the subject claim has been explored on a single level by a 275-foot adit and some 254 feet of drifts and crosscuts. The drift along the vein to the south was caved at a distance of 120 feet from the adit, so it could not be determined whether this

work had reached the southern limits of the oreshoot. However, on the surface the vein pinched and showed no appreciable scheelite beyond a distance of about 130 feet south of the adit. The stoped area, which furnished all the production, is directly above the south drift. An inclined winze, full of water at the time of the visit, located some 40 feet south of the adit, had been sunk to a depth of about 10 feet below the floor of the south drift. The first stage of the proposed project contemplated the further sinking of this winze.

The bulk of the work north of the adit consisted of drifting and crosscutting that were driven to locate the northern faulted segment of the vein. The recent work here, which was in progress at the time of the visit, had exposed the vein in 3 separated spots by short crosscuts from a footwall drift.

At the time of the visit, the applicant was engaged in the erection of what was said to be a 150-ton mill on the site of the former Kramer mill near the San Pedro River about 0.8 miles west of Pomerene. The mill will use rolls for secondary crushing, followed by jigs and tables. The resulting gravity concentrates will be reground in a small ball mill and the accessory sulphide minerals removed by flotation.

PROPOSED EXPLORATION

The applicant proposed exploring the vein at greater depth by means of 150 feet of inclined winze and 650 feet of lateral work from the bottom of the winze.

In case any further exploration was warranted, it appeared to the examiners that the more promising portions of the vein could be adequately explored from a winze 100 feet deep and by not more than 450 feet of drifting and crosscutting. The indicated length of the oreshoot in the segment of the vein south of the adit fault is not more than 150 feet. Judged by surface exposures and the underground work to date, the length of the ore-bearing portion of the main vein segment north of the adit fault-zone probably will not exceed 150 feet. To reach this northern segment from the proposed winze would require about 150 feet of crosscutting through barren schist. Thus a total of 450 feet of lateral work would suffice, 300 feet of which would probably cover the full extent of the oreshoot in both segments of the vein.

A block 300 feet long, 3 feet thick, and 100 feet high would contain 7,200 tons. As discussed previously, less than 60 percent of this tonnage could be expected to be of minable width and grade, hence the potential of the proposed work would be of the order of 4,000 tons with a probable grade of not more than 0.6 percent WO_3.

COST OF THE PROJECT

The applicant's estimates of the cost of the proposed work are quoted as follows:

6 a.	Independent contractors and contracts:	None
6 b.	Labor, supervision and consultants:	
	For 150 feet of winze; estimated at 285 man-days of labor plus supervision and consulting service	$5,244.00
	For 650 feet of drift; estimated at 700 man-days of labor plus supervision and consulting service:	12,920.00
		$18,164.00

6 c.	Operating material and supplies		
	Powder, fuse & caps	$1,800.00	
	Timber	1,200.00	
	Fuel for power	1,600.00	
	Pipe and track	1,000.00	$5,600.00
6 d.	Operating equipment - depreciation or rentals for approximately 18 months:		
	Compressor (315 c.f.m.)	$2,000.00	
	2 - rock drills	300.00	
	Hoist and motors	100.00	
	Blowers, welding equipment, general repairing & maintenance, hand tools and perishable items	1,000.00	$3,400.00
6 e.	Rehabilitation and repairs		None
6 f.	Miscellaneous -		
	Analytical work	$500.00	
	Accounting	500.00	
	Compensation and employers' liability insurance and payroll taxes	2,000.00	$3,000.00
Total of above items			$30,164.00
6 h.	10% of above as contingencies		3,016.40
	Total estimated cost of the exploration		$ 33,180.40

Applicant's cost on per foot basis:

150 feet of winze: $33,180.40 x (285 man days) / (985 man days) $9,600.00

Cost per foot of winze - $64.00
650 feet of drift; $33,180.40
less $9,600 = $23,580.40
Cost per foot of drift - $36.28

The cost of drifting, as estimated by the applicant, appears reasonable, but the cost of sinking the winze has been underestimated. The minimum labor required to sink the proposed winze would be approximately as follows:

	Cost per shift
1 - Miner @ $2.00 an hour	$16.00
1 - Miner's helper @ $1.75	14.00
1 - Hoistman @ $1.75	14.00
1 - Trammer @ $1.625	13.00
1 - Part time supervisor	10.00
	$67.00
Overtime for 48 hours a week	5.58
Liability insurance & payroll taxes(14%)	10.16
Total labor cost per shift	$82.74

The hanging wall of the vein is fractured and when wet will be "heavy" so the entire winze will have to be well timbered, and no doubt more or less timber will be necessary in drifts. A moderate flow of water can be expected. Under these conditions it appears doubtful that much more than one foot of advance per shift could be realized in the winze. On this basis and presuming that the labor represents about 70 percent of the total cost, the actual cost of the winze would be about $118 a foot.

The cost of drifting would probably range between $35 and $40 a foot, depending upon the amount of timbering required.

The equipment to be furnished by the applicant, consisting essentially of a second-hand 315 c.f.m. portable compressor, 2 rock drills, a tugger hoist, and 3 mine cars, has a total value of about $4,200. The depreciation on this equipment, based on a life of 5 years, would amount to $70 a month.

By working 2 shifts daily for 25 days a month the proposed work could be completed in from 6 to 8 months.

ECONOMIC CONSIDERATIONS

In mining a vein such as the Tungsten King with a width ranging from 2 to 3 feet, not much more than one ton of ore ordinarily can be produced per man-shift. With an average wage rate of $1.75 an hour and after including overtime, liability insurance and payroll taxes, a man-shift would cost about $17. Thus the labor cost would be $17 a ton. Under present conditions labor probably represents about 70 percent of the mining cost. On that basis the cost of mining at the subject property could be expected to be of the order of $24 a ton. Based on the ratio of ore to waste as indicated by the former stoping, the cost of exploration and development would be at least $5 per ton of ore milled. The applicant's mill is about 12 miles from the mine. To truck the ore this distance would cost $1.50 a ton. Milling and marketing the concentrates will no doubt cost at least $4.00 a ton. Hence the total direct operating cost would be of the order of $35 a ton. In order to "break even", assuming a mill recovery of 70 percent in a marketable concentrate valued at $63 a unit, the ore should contain about 0.8 percent WO_3. If it were desirable to assure the sustained production of the property's tungsten, a profit would be necessary. Under present prices this would require an ore containing about 1.0 percent WO_3 which is evidently nearly twice the average indicated grade of the deposit.

CONCLUSIONS AND RECOMMENDATIONS

The Tungsten King deposits are considered too small in relation to their grade to become an important source of tungsten. At best, the indicated potential of the vein is of the order of 40 tons per foot of depth extension. Production records and sample results show that the average grade of the deposit will probably not exceed 0.60 percent WO_3. As there is no reason to believe that further exploration would be likely to disclose larger or higher grade deposits, it is recommended that the loan application be denied.

A confidential letter concerning the applicant corporation was included with the geological report.

400
Docket
Surname
Hopkins
Martin

April 26, 1954

MEMORANDUM

To: Administrator, DMEA

From: Iron and Ferro-Alloys Division, DMEA

Subject: Denial of Application by Field Team, Region IV
Docket No. DMEA-3227 - Tungsten
Standard Tungsten Corporation
Black Rock (Tungsten King) No. 1. Claim
Cochise County, Arizona

The applicant requested exploration assistance in the amount of $33,180.00 to explore at greater depth a tungsten-bearing vein on the Black Rock (Tungsten King) No. 1 Claim, Cochise County, Arizona.

The area near the Tungsten King mine is underlain by pre-Cambrian schist that has been intruded by granite, but the contact between schist and granite is a fault zone along which prominent lamprophyre dikes and tungsten-bearing quartz veins occur.

Total mine workings on the main quartz vein include about 800 feet of drifts, raises and winzes and a small stope from which about 1000 tons of ore have been mined. The vein has been explored near the surface by several shallow shafts, pits and short adits.

Fifteen samples were taken in the mine by the DMEA engineers and gave the following results:

No.	Vein Width/ft.	WO_3	No.	Vein Width/ft.	% WO_3
1	2.5	0.60	9	2.6	0.19
2	2.5	0.58	10	2.2	0.17
3	2.5	0.12	11	2.2	0.06
4	3.7	0.59	12	2.0	0.07
5	3.0	0.17	13	2.0	0.37
6	3.0	2.18	14	3.5	0.45
7	3.0	0.03	15	2.0	1.23
8	3.5	0.12			

Weighted Average: Width = 2.7 feet Percent WO_3 = 0.48

R.C.S.

The examining engineers estimate that there is a reserve of 4000 tons of ore, containing an average of 0.55 percent WO_3, in the area for which exploration is proposed. The mill recoveries from this grade of tungsten ore would not ordinarily exceed about 7 pounds of WO_3 concentrates per ton, an amount which is too small to allow profitable operation.

The mine is also handicapped by difficult mining conditions caused by the low dip of the vein and by a hanging wall which is highly susceptible to caving.

The examining engineers conclude that this deposit contains only a small reserve of relatively low-grade ore, which is not regarded as significant under present conditions and therefore recommend that the application be denied.

The Field Team, Region IV, concurs in the recommendation of the examining engineers.

We concur in the denial.

W. S. Martin, Chief
Iron and Ferro-Alloys Division

JHopkins:foe
cc to: Docket
Code 400
Adm. Reading File
Operating Comm/

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

April 26, 1954

MEMORANDUM

To: Administrator, DMEA

From: Iron and Ferro-Alloys Division, DMEA

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The examining engineers estimate that there is a reserve of 4000 tons of ore, containing an average of 0.55 percent WO_3, in the area for which exploration is proposed. The mill recoveries from this grade of tungsten ore would not ordinarily exceed about 7 pounds of WO_3 concentrates per ton, an amount which is too small to allow profitable operation.

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The examining engineers conclude that this deposit contains only a small reserve of relatively low-grade ore, which is not regarded as significant under present conditions and therefore recommend that the application be denied.

The Field Team, Region IV, concurs in the recommendation of the examining engineers.

We concur in the denial.

W S Martin
W. S. Martin, Chief
Iron and Ferro-Alloys Division

400

Martin
Porter
Hoffland
Johnson

MAR 31 1954

FOR GOVERNMENT USE ONLY

Mr. W. H. King, Executive Officer
DMEA Field Team, Region IV
224 New Customhouse Building
Denver, Colorado

Re: Docket No. DMEA 3227 - Tungsten
Standard Tungsten Corporation
Tungsten King Mine
Cochise County, Arizona

Dear Mr. King:

Certain information, which we believe should be passed on to you since it concerns the subject application, has come to our attention. We have been advised that Mr. Hu, president and founder of the captioned corporation, has a long history of organization, promotion, and bankruptcy. Listed below are some bankrupt companies of which Mr. Hu was the organizer and president:

China Motor Corporation
Delaware Corporation
China Motor Industries Corporation
Lytemobile Corporation
Auburn Metal Industries Corporation
United Motor Industries Corporation

If additional information on the same subject would be of use to you, the following could be consulted:

Federal Bureau of Investigation, Tucson, Arizona, and Washington, D. C.
Securities Division of Arizona Corporation Commission
Better Business Bureau of New York City
Foreign Assets Control, Files 7362 and 7527, U. S. Treasury Department, Washington, D. C.
Securities Exchange Commission, State of New York, New York, N. Y.
Dun and Bradstreet

Without knowing more about the applicant, or about the merits of his proposed project, I cannot comment further.

Sincerely yours,

C. O. Mittendorf
Administrator

cc: DOCKET
FT, REG. IV
CODE 400
ADM. READ. FILE

WSMartin/ls 3/31/54

R. Cash 3/31/54

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

224 New Customhouse
Denver 2, Colorado

March 29, 1954.

Mr. S. C. Hu, President
Standard Tungsten Corporation
Box 247
Benson, Arizona

Re: Docket No. DMEA-3227

Dear Mr. Hu:

Reference is made to your application for Government aid on the Tungsten King No. 1 claim.

Projects approved by the Defense Minerals Exploration Administration must, in its judgment, show definite promise of yielding material of acceptable grade, and in quantities that will significantly improve the mineral supply position for the National Defense Program.

A careful study of your property and data available to this agency reveals that the probability of disclosing mineable reserves of tungsten is not considered sufficiently promising to justify Government participation. Under these circumstances, we regret to advise that your application for exploration aid is denied.

Very truly yours,

John F. Shaw
For W. H. King

HMC:cwm

cc: Docket
Administrator, DMEA
WRStorms
AFShride
AHKoschmann (2)
Chron.

A. H. Koschmann
Field Team, Region IV

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

MAR 2 1954

224 New Customhouse
Denver 2, Colorado

March 29, 1954.

Memorandum

To: Administrator, Defense Minerals Exploration Administration
Attention: 200

From: Field Team, Region IV

Subject: Report of Examination - DMEA Docket 3227 (Tungsten), Standard Tungsten Corporation, Cochise County, Arizona.

Enclosed are four copies of the report of examination on the subject docket, a copy of the letter of denial to the applicant, and two copies of Form 3b.

A confidential letter regarding the applicant is being forwarded to Mr. Mittendorf under separate cover.

John F. Shaw
For W. H. King

A. H. Koschmann

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

224 New Customhouse
Denver 2, Colorado

March 29, 1954.

Memorandum

To: Administrator, Defense Minerals Exploration Administration
Attention: 200

From: Field Team, Region IV

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John F. Shaw
For W. H. King

A. H. Koschmann
A. H. Koschmann

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Mining Division
Region IV

March 29, 1954.

Memorandum

To: Field Team, Region IV

From: Chief, Mining Division, Region IV

Subject: Report of Examination - DMEA Docket 3227 (Tungsten), Standard Tungsten Corporation, Cochise County, Arizona.

Enclosed are nine copies of the engineering report on the subject docket.

The applicant requested $33,180.00 to explore the vein at greater depth.

The examining engineer concludes that no significant discovery would result from the proposed work and recommends that the application be denied.

We concur in this recommendation.

John F. Shaw
For W. H. King

Enclosures

March 23, 1954

Memorandum

To : W. H. King, Chief, Mining Division, Region IV

From : Chief, Mining Methods Br., Mining Div., Region IV

Subject : Report on Docket DMEA-3227, Standard Tungsten Corp.'s Black Rock (Tungsten King) No. 1 Claim, Cochise Mining District, Cochise County, Ariz.

Enclosed are original and 8 copies of the section on Summary, Conclusions and Recommendations by L. L. Farnham and R. W. Ageton of the Bureau of Mines and J. N. Faick of the Geological Survey, and the section on Engineering by Farnham and Ageton for the above report. I believe a separate section on the Geology already has been submitted by the Geological Survey.

Because of the small size of the deposit and its apparent low grade, the examiners believe that a significant discovery of tungsten ore would not result from the proposed exploration work. Therefore they recommend that the loan be denied. I concur with this recommendation. I believe J. N. Faick of the Geological Survey has submitted a confidential letter regarding the applicant.

Both the Bureau's and the Survey's brochures are enclosed.

Walter R. Storms

Walter R. Storms

CC W. H. King (8)
A. F. Shride
DMEA-3227
DF

WRStorms:frj

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Defense Minerals Exploration Administration
Denver Federal Center
Denver 2, Colorado

March 15, 1954

Memorandum

To: DMEA Field Team, Region IV

From: A. H. Koschmann

Subject: DMEA Docket 3227, Standard Tungsten Corporation, Tungsten King Mine, Cochise County, Arizona

Enclosed are 9 copies of a geological report by John M. Falck of the U. S. Geological Survey covering the above docket. It has been recommended that the loan be denied.

Also enclosed are 9 copies of a confidential letter by Mr. Falck concerning the applicant.

A. H. Koschmann
A. H. Koschmann
Supervising Geologist
Colorado-Wyoming

Enclosures (18)

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

P. O. Box 4126, University Station
Tucson 5, Arizona

March 11, 1954

Airmail

Memorandum

To: A. H. Koschmann AHK

From: John N. Faick

Subject: DMEA 3227, Standard Tungsten Corporation, Tungsten King Mine, Cochise County, Arizona

Under separate cover we are submitting the original and 8 copies of a geological report on the above subject. The report recommends denial of the application because it is believed the ore which may be discovered by the proposed project is not significant in either quantity or quality under present conditions.

The report is accompanied by a confidential letter which also recommends denial of the application because of a history of unethical conduct on the part of the president of the applicant corporation.

John N. Faick
Geologist

Copies to Koschmann (8)
Storms
Shride

JNFaick:mvt

UNITED STATES
DEPARTMENT OF THE INTERIOR
DOUGLAS McKAY, SECRETARY

DEFENSE MINERALS EXPLORATION ADMINISTRATION

REPORT OF EXAMINATION BY FIELD TEAM
REGION IV

DMEA-3227, Standard Tungsten Corp.'s Black Rock (Tungsten King) No. 1 Claim Cochise Mining District Cochise County, Arizona

L. L. Farnham and R. W. Ageton, Mining Engineers
U. S. Bureau of Mines

John N. Faick, Geologist
U. S. Geological Survey

March 1954

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

By L. L. Farnham[1], R. W. Ageton[1], and J. F. Faick[2]

Late in December 1953, the Standard Tungsten Corp. applied to the Defense Minerals Exploration Administration under the Defense Production Act of 1950, as amended, for an exploration loan amounting to $33,180. The application was docketed as DMEA-3227. The funds requested were to be used in the deeper exploration of a tungsten prospect situated in the Little Dragoon mountains of Cochise County, Ariz. The property was examined on January 26 and 27, 1954 by the writers.

The Black Rock (Tungsten King) No. 1 claim upon which the exploration was proposed has been worked intermittently on a small scale since the first World War. To date it has produced about 6.8 tons of scheelite concentrates said to have averaged about 60 percent WO_3. This would be equivalent to a total production of some 400 units of tungsten trioxide.

Scheelite mineralization in the area has been found in small scattered amounts for several thousand feet along the outcrop of a vein which follows a contact between pre-Cambrian schist and intrusive granite. The vein zone strikes northward and dips about 45 degrees eastward. Schist forms the hanging wall and granite occupies the footwall of the vein.

1/ Mining Engineers, U. S. Bureau of Mines
2/ Geologist, U. S. Geological Survey

The only portion of this long vein, that has encouraged any appreciable development, occurs in the area proposed for exploration. Here a short oreshoot had been developed and largely exploited to an inclined depth of about 140 feet below the outcrop, by workings extending from a crosscut adit. A transverse fault-zone offset the vein in the vicinity of the crosscut and separated the oreshoot into 2 main segments.

In the better mineralized portions of the vein, fairly coarse particles of scheelite were distributed erratically in irregular branches within narrow lenticular pods of quartz. The best ore, which furnished all the production, was found in the vein segment immediately south of the adit fault. In this section, between 1,000 and 1,500 tons was mined above the adit level in an irregular stope having a maximum strike length of not more than 150 feet. The main vein segment north of the fault zone was exposed at intervals for about 100 feet along the strike. This section of the vein was evidently lower in grade than the south segment and no stoping had been attempted.

Where the vein had been stoped, less than 60 percent of the area was found to be of minable width and grade. Over 40 percent of the area consisted of pillars which evidently occupied either the pinched portions of the vein or those portions that lacked appreciable scheelite.

The average grade of the minable portions of the deposit, as estimated from the production records, ranged from 0.45 to 0.68 percent WO_3. The average of 15 samples, that were taken by the

examiners, substantiated this grade range so it was concluded that the deposit could not be expected to average more than 0.60 percent WO_3.

If the vein was further developed at a depth of 100 feet below the present level and the oreshoot area proved to be 300 feet long with an average width of 3 feet, the block would contain 7,200 tons. As not more than 60 percent of this tonnage could be expected to be minable, it follows that the indicated potential of the deposit would be of the order of 40 tons per foot of depth with an average content of about 0.60 percent tungsten trioxide.

A deposit of this size and grade is not considered significant and as there is little likelihood that further exploration would disclose more substantial deposits, it is recommended that the loan application be denied.

STANDARD TUNGSTEN CORPORATION

(TUNGSTEN)

TUNGSTEN KING (BLACKROCK) MINE

COCHISE COUNTY, ARIZONA

DMEA 3227

by

John N. Faick

Geologist, U. S. Geological Survey

STANDARD TUNGSTEN CORPORATION

(TUNGSTEN)

TUNGSTEN KING (BLACK ROCK) MINE

COCHISE COUNTY, ARIZONA

DMEA 3227

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INTRODUCTION

The Defense Minerals Exploration Administration is in receipt of an application from the Standard Tungsten Corporation, Box 247, Benson, Arizona, for Government assistance in exploration work estimated by the applicant to cost $33,180.40. The property for which exploration is proposed is the Tungsten King (Black Rock) mine, in Cochise County, Arizona. The mine is under the management of Mr. S. C. Hu, Congress Hotel, Tucson, Arizona, and H. G. Grundstedt, Phone 4-5614, Tucson, Arizona, respectively president and engineer of the Standard Tungsten Corporation.

The mine was examined January 26-27, 1954, by L. L. Farnham and R. Ageton, U. S. Bureau of Mines, and J. N. Faick, U. S. Geological Survey.

On previous occasions the mine has been examined, mapped and sampled by engineers of the U. S. Bureau of Mines, and by private investigators.

GEOLOGY

The Tungsten King (or Black Rock) mine is situated on the western slope of the Little Dragoon Mountains in an area which drains westward into the San Pedro River. The mine is about N. 60° E., a distance of about 10 miles airline, from Benson, Arizona, and is reached by road via Pomerene (see figure 1). The mine is located in the south-central part of the Dragoon quadrangle, which is presently under investigation by J. R. Cooper[1] for the U. S. Geological Survey.

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[1] Mr. Cooper kindly provided the base map for Figure 3.

The area near the Tungsten King mine and the region extending a considerable distance north and south of it, is underlain by pre-Cambrian schist on the east, and granite on the west. The granite is intrusive into the schist, but near the Tungsten King mine the contact between schist and granite is a fault zone along which there have been repeated movements. The contact zone strikes a few degrees east of north and dips easterly about 45 degrees. Prominent lamprophyre dikes and quartz veins crop out intermittently for several thousand feet along the contact zone.

As described by Wilson[1] "these veins form eastward-dipping lenticular segments from a few inches to 6 feet wide and locally several hundred feet long, which have been offset in places by faults. Their coarsely crystalline dull-white quartz contains a little pyrite, chalcopyrite and galena, and where oxidized, sparse iron oxide, copper stain and wulfenite. Scheelite, generally detectable only by panning or by short-wave ultraviolet light, occurs as irregularly distributed small particles at various places in the veins and to a minor extent in the adjacent walls."

On the Tungsten King No. 1 claim a 335-foot adit has been driven easterly through the contact zone along which is localized the principle quartz-scheelite vein. A drift, with a small stope above it, has explored the vein for more than 110 feet south of the adit. North of the adit, faulted segments of the vein, which have been displaced eastward with respect to the south part of the vein, have been explored by drifting and crosscutting for a distance of about 160 feet north of the adit. Total mine workings (see fig. 3) are about 800 feet of drifts, raises and winzes, and a small stope from which about 1000 tons of ore have been mined. The vein has been explored near the surface by several shallow shafts, pits, and short adits.

[1] Wilson, E.D., Tungsten Deposits of Arizona, Arizona Bur. of Mines Bull. 148, pp. 43-44, 1941.

The ore zone, where exposed in the underground workings of the Tungsten King mine, consists of a quartz vein which ranges in width from about 6 inches to 4 feet thick. In addition there are many narrow discontinuous veins occurring as branch veins or separate veins in the altered host rocks. The principle quartz veins occupy fractured zones in a lamprophyre dike and to a slight extent replace it. The granite-schist fault contact, the lamprophyre dikes, the quartz veins and the zones of mineralization are practically co-extensive. The zone trends about N. 10° E., and dips easterly about 45 degrees.

Scheelite is widely distributed in the quartz and in a few places is disseminated in the wall rocks. The scheelite is soft and friable, but is usually coarse-grained and grains ranging in size from about 1/8 inch to one inch across are present in the ore. The scheelite is relatively pure as revealed by the blue-white fluorescence under the ultraviolet light.

The vein pinches and swells appreciably along the strike, and the quantity of scheelite varies considerably from place to place. These variations apparently are caused, at least in part, by intense pre-ore structural disturbances along the vein zone. Available evidence indicates that the vein is widest and the scheelite is most abundant in places where subsidiary fractures in the hanging wall enter the vein zone and merge with it.

PROPOSED EXPLORATION

On the main vein, approximately 40 feet south of where it is intersected by the adit, is a winze about 10 feet deep. The applicant's proposal for exploration (see figure 2) is to sink this winze an additional 100 feet in the plane of the vein and to drive a total of 650 feet of drifts along the vein from the bottom of the winze. All of the 650 feet of proposed drift probably will not be required as a crossfault displaces the vein at a point

about 350 feet south of the winze and it is not proposed to explore the faulted extension of the vein, and furthermore there is some evidence to suggest that the vein pinches out before reaching the crossfault. It is believed that 300 feet of drifting would be sufficient to explore the objective.

The applicant has indicated that he will start sinking the winze very soon, even before Government participation is approved.

PRODUCTION AND GRADE OF ORE

The only recorded production from previous operations, amounting to about 6.8 tons of concentrate is summarized in Table 1:

TABLE 1

Summary of Production

Period of operation	Production
World War I	About 5 tons of scheelite concentrate produced.
About 1940	About 800 pounds of concentrate produced.
March-September 1953	Approximately 400 tons of ore yielded between 2000 and 3100 pounds of concentrate, and 300 tons of tails are stockpiled for retreating.
September 1953	About 100 tons of ore yielded 800 pounds of concentrate. Coarse tails are stockpiled for retreatment.

It is probable that all concentrates obtained from previous operations have been produced by the use of jigs. The concentrate produced in this manner is not clean and free from impurities, therefore requires a flotation cleanup to get rid of excess S, Pb, CU, As and P_2O_5.

The applicant provided analyses of 9 samples of the ore and mill products. These are shown in Table 2.

TABLE 2

Sample Results Provided by the Applicant

Sample No.	Location	Length of Sample	Percent WO_3
1	North Drift	4 feet	0.81
2	North Drift	4 feet	3.25
3	Stope	5 feet	6.65
4	Stope	3 feet	0.85
5	Stope	4 feet	4.43
6	Winze, S.Drift	3.5 feet	1.09
7	Heads of mill test		1.28
8	Middlings		0.32
9	Concentrates		62.3

The samples taken in the mine by the applicant were thought to have been poorly selected, and apparently yielded erroneous results; therefore 15 additional samples were taken by the DMEA examiners. Locations of the DMEA samples are shown on figures 3 and 4, and the analyses are given in Table 3.

TABLE 3

Results of sampling by the examiners

Sample Number	Sample or vein width	Percent WO_3
1	2.5	0.60
2	2.5	0.58
3	2.5	0.12
4	3.7	0.59
5	3.0	0.17
6	3.0	2.18
7	3.0	0.03

Sample Number	Sample or vein width	Percent WO_3
8	3.5	0.12
9	2.6	0.19
10	2.2	0.17
11	2.2	0.06
12	2.0	0.07
13	2.0	0.37
14	3.5	0.45
15	2.0	1.23

The weighted averages of the sample data in Table 3 indicates that the mineralized part of the vein has a width of 2.7 feet and a WO_3 content of .48 percent.

The tungsten is not uniformly distributed in the vein, however, as is shown by the DMEA samples and by the production records. In the stoped areas it is assumed that the highest grade and widest part of the vein has been mined out and the lowest grade and narrowest part of the vein are left in the pillars.

Samples 9 to 15 (Table 3) which were taken from stope pillars indicate an average vein width of 2.4 feet and a grade of 0.36 percent WO_3; however, production records indicate that higher grade ore has been mined. Stope measurements indicate the amount of ore produced was about 1000 tons, from which was obtained about 6.8 tons of concentrate according to available reports. If it is assumed that this concentrate contained 60 percent WO_3, then about 408 units, or 81,600 pounds of concentrate were recovered from the 1000 tons of ore, an indicated recoverable content of 0.41 percent WO_3. If it is assumed that the mill recovery was 60 percent of the WO_3 in the ore, then the average mill feed contained 0.68 percent WO_3.

Samples 4 to 8 inclusive, are taken from a sublevel where all of the ore was not removed, and it is believed these samples are essentially representative of the ore previously mined. These samples indicate a vein width of 3.2 feet and an average content of 0.60 percent WO_3 in the sublevel area.

Samples 1 to 3 inclusive, taken from the vein where it is exposed in the drift north of the adit, in an area where there has been no mining, averaged 0.43 percent WO_3, and a vein width of 2.5 feet.

The above data on the width and grade of the ore is summarized as follows:

Description	Average vein width in feet	Percent WO_3
Calculated grade of 1000 tons of ore produced		0.68
Weighted average of all DMEA samples	2.7	0.48
Unmined north segment of vein	2.5	0.43
Samples of stope pillars	2.4	0.36
Samples of sublevel	3.2	0.60

Thus it is indicated that the tungsten content of the unmined parts of the vein ranges from about 0.4 to 0.7 percent and the average metal content appears to be about 0.55 percent WO_3, and the average width of the scheelite-bearing vein is about 2.7 feet.

The U. S. Bureau of Mines has a record, dated February 17, 1941, of 19 samples taken from various places on the Tungsten King property. Of these samples 13 of them, taken from the outcrop north of the area considered for exploration, contained an average of slightly over .01 percent WO_3. In the area for which exploration is presently proposed, 6 of the Bureau samples averaged about 0.2 percent WO_3, and 3 of these, which represent ore from the stope, averaged 0.36 percent WO_3; which is the same as the DMEA examiners obtained from the pillars on the adit level.

ORE RESERVES

Reserves are estimated only for the part of the vein which could be explored by the applicant's proposed exploration program, i. e. the unmined portion extending 100 feet down the dip of the vein. For convenience it is assumed that strike distance of 300 feet would be explored south of the cross fault that displaces the vein at the adit, and the average vein width accepted as 2.7 feet. If a factor of 12 feet per ton is used then a reserve of about 6750 tons of indicated and inferred reserves is probably present below the adit level in the area to be explored. However, not all of the vein material in this zone is mineable, as is shown by the record of previous stoping operations above the adit level. In the old stope about 57 percent of the vein has been mined and about 43 percent remains as pillars in which the vein was either too narrow or too low-grade to be mineable. Thus if this ratio of ore to waste persists throughout the vein then the above mentioned 6750 ton reserve should be reduced to about 4050 tons.

Using generalized figures, we can state that there is a reserve of about 4000 tons of ore containing between 0.4 and 0.7 percent WO_3, an average of 0.55 percent WO_3, in the area for which exploration is proposed. Undoubtedly additional ore is present in zones for which exploration is not proposed, and in areas which the applicant is unwilling to subordinate.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Investigation of the Tungsten King vein, which the applicant proposes to explore with Government aid, reveals that about 4000 tons of ore containing 0.55 percent WO_3 may be present in the zone for which exploration is proposed. Mill recoveries from this grade of tungsten ore would not ordinarily exceed about 7 pounds WO_3 concentrate per ton, an amount which is too small to allow profitable operation. The mine is also handicapped by difficult mining conditions caused by the low dip of the vein and by a hanging wall which is highly susceptible to caving.

As this deposit contains only a small reserve of relatively low-grade ore, which is not regarded as significant under present conditions, it is recommended that the application be denied.

DMEA-3227, STANDARD TUNGSTEN CORP.'S BLACK ROCK (TUNGSTEN KING) NO. 1 CLAIM COCHISE MINING DISTRICT COCHISE COUNTY, ARIZONA

Engineering Report

By L. L. Farnham and R. W. Ageton
Mining Engineers
U. S. Bureau of Mines

March 1954

DMEA-3227, STANDARD TUNGSTEN CORP.'S
BLACK ROCK (TUNGSTEN KING) NO. 1 CLAIM
COCHISE MINING DISTRICT
COCHISE COUNTY, ARIZONA

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INTRODUCTION

On December 23, 1954, the Executive Officer of the Defense Minerals Exploration Administration, Region IV, requested that an examination and report be made on the feasibility of Government participation in the further exploration of the Tungsten King (Black Rock) No. 1 claim, Cochise County, Ariz. The funds requested were to be used to explore a scheelite prospect at greater depth. The cost of the proposed work, as estimated by the applicant, would amount to $33,180. The application was docketed as DMEA-3227.

The property was visited on January 26 and 27, 1954, by John N. Faick of the Geological Survey, and L. L. Farnham and R. W. Ageton of the Bureau of Mines. The examiners were accompanied by Henry G. Grundstedt, a mining engineer employed by the applicant company.

ACKNOWLEDGMENTS

Acknowledgments are made to Henry G. Grundstedt and S. C. Hu of the applicant corporation for their help during the examination. The information resulting from former investigations of the property, made by engineers of the U. S. Bureau of Mines, was used in the preparation of this report.

LOCATION AND PHYSICAL FEATURES

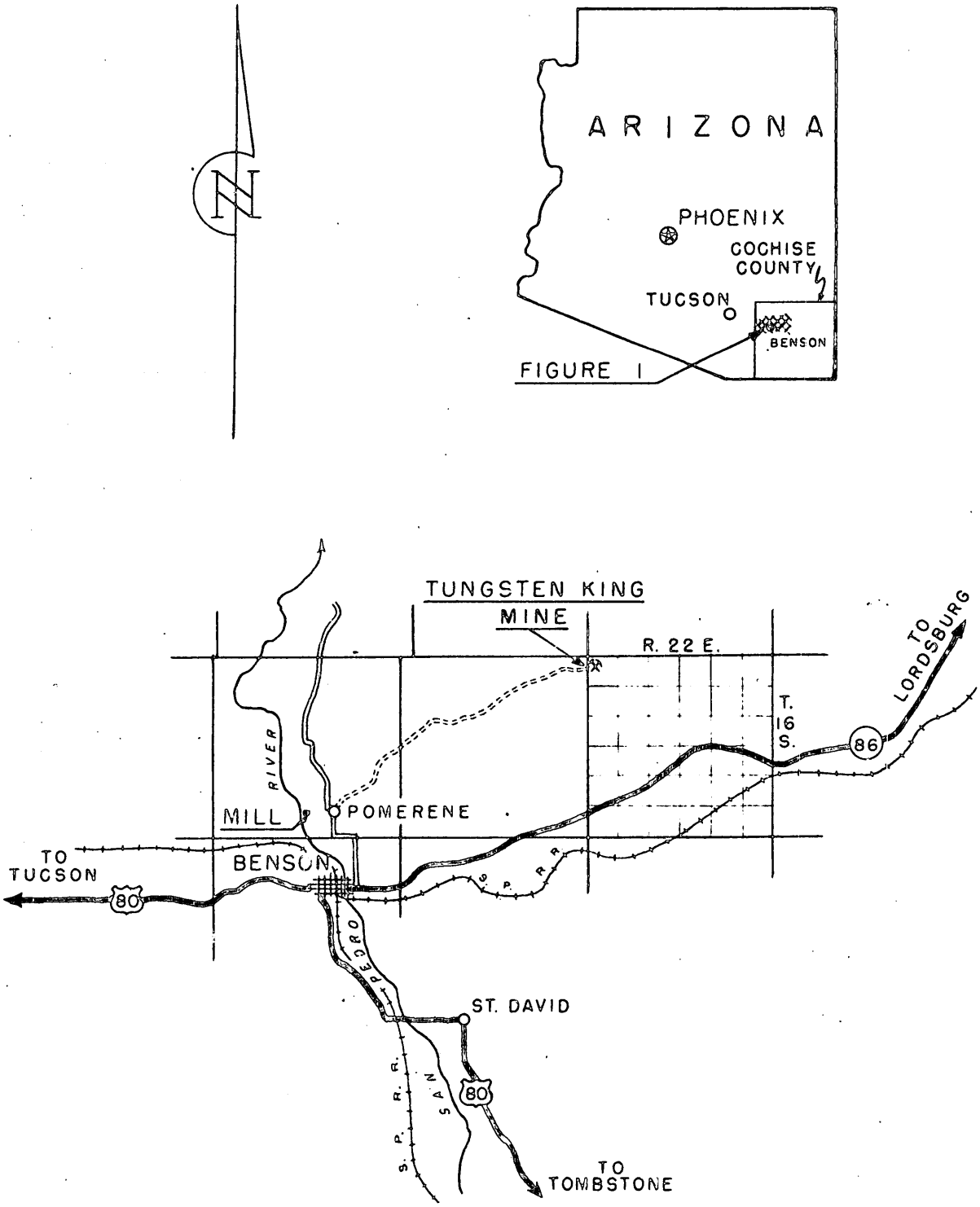
The subject property is situated in sec. 6, T. 16 S., R. 22 E. in the Cochise mining district, Cochise County, Ariz. The site of the proposed exploration can be reached from the town of Benson

by following U. S. Highway 86 for 4 miles in an easterly direction, thence about 3 miles northward to the small farming community of Pomerene. The mine is reached from Pomerene by following a crooked dirt road for 11 miles to the northeast. The last quarter mile of the road has a 30 percent grade. This steep section was recently capped with concrete by the applicant and is now passable in an ordinary automobile (figure 1).

The Tungsten King claims lie well up near the crest along the western slope of the Little Dragoon mountains at an altitude of about 5,200 feet above sea level.

HISTORY AND PRODUCTION

Tungsten minerals were found in the general area as early as 1900. The subject claim first was located in 1913 by J. J. Wien of Benson, Ariz. During the first World War the records show that 5 tons of scheelite concentrates were produced by Wien from surface exposures on the claim. In 1929, the property was purchased by other parties and a 300-foot crosscut adit was driven which intersected the vein at a depth of about 130 feet below the best ore exposed on the outcrop. Very little if any production resulted from this work and the operations were terminated in 1931. The property was not active again until 1937 when Miles M. Carpenter of Tucson secured a lease and produced 800 pounds of concentrates in a small mill. These operations ceased in 1941. The property evidently was idle from 1941 until 1952 when it was acquired by



MARCH 1954 DMEA 3227

FIGURE 1. - LOCATION MAP

TUNGSTEN KING (BLACK ROCK) MINE - COCHISE COUNTY, ARIZONA

the Kramer Mining and Milling Co. This company constructed a small concentrator on the San Pedro river near Pomerene and is said to have mined and milled about 400 tons of ore from which 2,000 pounds of concentrates were recovered. The applicant company acquired the property late in 1953 and to date has produced 800 pounds of concentrates from 100 tons of ore.

According to these records the intermittent operations of the property during the past 40 years has resulted in the production of 6.8 tons of concentrates, which if they contained an average of 60 percent WO_3 would be equivalent to 408 units of tungsten trioxide.

OWNERSHIP AND EXTENT

The Tungsten King or Black Rock group includes 22 unpatented lode claims, oOnly a portion of one of these claims, known as the Black Rock (Tungsten King) No. 1, was included by the applicant in the proposed project.

The ownership of the group is obscure. According to exhibit AA in the brochure, the applicant company has a 75 percent interest in this No. 1 claim through an assignment from Kelley & Co. This assignment was executed by S. C. Hu as trustee for Kelley & Co. S. C. Hu is also president of the applicant company, the Standard Tungsten Corp. There is nothing to show that Kelley & Co. owned the claim or that S. C. Hu had the authority to make the assignment.

DESCRIPTION OF THE DEPOSIT

The area in the vicinity of the subject property is underlain with granite on the west and schist on the east. The contact between these formations is a fault zone which strikes northward and dips about 45° eastward. Localized along this fault-contact throughout a strike length of several thousand feet, there is one or more lamprophyre dikes and numerous lenticular quartz segments. The quartz fills fractures in the dike, and the enclosing schist and granite. In the area proposed for exploration the lenticular quartz segments range from a few inches to 5 feet wide, and are exposed for several hundred feet along the strike. A prominent cross-fault offsets the vein in the immediate vicinity of the proposed work (figure 2). The vein pinches and swells abruptly along both the strike and the dip. It is apparently widest where oblique fractures in the hanging wall intersect the main vein zone.

Spots showing small amounts of scheelite are found along the entire outcrop of the contact zone. However, the only portion of the vein that has been found productive occurs in the area proposed for exploration. Here appreciable amounts of scheelite are distributed as erratic bunches in the lenticular quartz pods for about 300 feet along the strike of the vein zone. This area has been developed and exploited on a single level by workings extending from a cross-cut adit (figure 2).

ORE RESERVES

The examiners cut 15 samples across the vein in various places in the adit workings. The location of these samples is shown on figure 4 and the results, as determined in the Tucson laboratory of the Bureau of Mines, are as follows:

Sample No.	Location	Width, ft.	Percent WO_3
1	Vein north of adit fault	2.5	0.60
2	" " " " "	2.5	0.58
3	" " " " "	2.5	0.12
4	Stope south of adit fault	3.7	0.59
5	" " " " "	3.0	0.17
6	" " " " "	3.0	2.18
7	" " " " "	3.0	0.03
8	" " " " "	3.5	0.12
9	Pillars over south drift	2.6	0.19
10	" " " "	2.2	0.17
11	" " " "	2.2	0.06
12	" " " "	2.0	0.07
13	" " " "	2.0	0.37
14	" " " "	3.5	0.45
15	" " " "	2.0	1.23

The weighted average of all of the above samples was 0.48 percent WO_3 with an average width of 2.7 feet.

Samples Nos. 1 to 3, inclusive, taken in the vein segment north of the adit fault, averaged 0.43 percent WO_3 over an average vein width of 2.5 feet.

Samples 4 to 8 were taken in a sub-level in the stope where all the better ore had not as yet been mined. These samples averaged 0.60 percent WO_3 with a width of 3.2 feet.

Samples 9 to 15 were cut in the pillars remaining in the back of the south drift, directly below the stoped area. These 7 samples averaged 0.36 percent WO_3 with a width of 2.4 feet. For the most

part the pillars that were sampled were not mined because they evidently occupied the poorer and pinched portions of the vein. If the back of this drift had been sampled before the removal of the higher grade ore, the results no doubt would have shown a somewhat higher tungsten content than indicated by the present sampling. It is conceivable that the drift originally may have had an average tungsten content comparable to that of the sub-level where higher grade ore was still in place. These sub-level samples averaged 0.60 percent WO_3 and if this grade was assigned as the average of the 7 drift samples, then the average of all the examiners' samples would have been 0.56 percent WO_3, instead of 0.48 percent.

Measurements in the accessible stopes indicated that about 1,000 tons of ore had been mined. There was evidence of additional stoping in the caved area at the south end of the adit workings, so no doubt more than 1,000 tons of ore had been stoped. The recorded production from the property has amounted to 408 units of tungsten trioxide. If this was recovered from 1,000 tons of ore, the average recovery would have been 0.41 units of WO_3 per ton milled. If a maximum of 1,500 tons was actually mined, then the average recovery would have been but 0.27 units per ton milled. Assuming the mill recovered 60 percent of the scheelite in the ore, then the average grade of the mine ore would have been 0.68 percent WO_3 if 1,000 tons was milled, and 0.45 percent WO_3 in case 1,500 tons was milled. As it was quite evident that more than 1,000 tons had been mined, it follows that the average grade of the ore was less than 0.68 percent and may have been considerably lower, depending upon the tonnage actually mined and milled.

The examiners' samples averaged 0.48 percent WO_3. After making allowances for an area thought to be too low in grade to be representative, the examiners' samples averaged 0.56 percent WO_3. Judged on the basis of available production data and by the sampling, it appears safe to presume that the average grade of the deposit would not exceed 0.6 percent WO_3.

The applicant's sample results as shown in the application, averaged nearly 3.0 percent WO_3. It was obvious with ultra violet light that the applicant's samples were taken largely in the highest grade spots exposed in the workings.

Measurements in the stoped area showed that about 43 percent of the vein had been left as pillars and 57 percent had been extracted. The pillars included the pinched areas between the leases as well as areas that lacked appreciable scheelite. It is reasonable to believe that this condition will persist so in any future development it appears probable that not more than 60 percent of the oreshoot area would be minable.

There are a few hundred tons of indicated ore, similar to that previously mined, remaining above the present level.

PRESENT STATUS

In addition to numerous cuts and pits along the outcrop, the oreshoot on the subject claim has been explored on a single level by a 275-foot adit and some 254 feet of drifts and crosscuts. The drift along the vein to the south was caved at a distance of 120 feet from the adit, so it could not be determined whether this

work had reached the southern limits of the oreshoot. However, on the surface the vein pinched and showed no appreciable scheelite beyond a distance of about 130 feet south of the adit. The stoped area, which furnished all the production, is directly above the south drift. An inclined winze, full of water at the time of the visit, located some 40 feet south of the adit, had been sunk to a depth of about 10 feet below the floor of the south drift. The first stage of the proposed project contemplated the further sinking of this winze.

The bulk of the work north of the adit consisted of drifting and crosscutting that were driven to locate the northern faulted segment of the vein. The recent work here, which was in progress at the time of the visit, had exposed the vein in 3 separated spots by short crosscuts from a footwall drift.

At the time of the visit, the applicant was engaged in the erection of what was said to be a 150-ton mill on the site of the former Kramer mill near the San Pedro River about 0.8 miles west of Pomerene. The mill will use rolls for secondary crushing, followed by jigs and tables. The resulting gravity concentrates will be reground in a small ball mill and the accessory sulphide minerals removed by flotation.

PROPOSED EXPLORATION

The applicant proposed exploring the vein at greater depth by means of 150 feet of inclined winze and 650 feet of lateral work from the bottom of the winze.

In case any further exploration was warranted, it appeared to the examiners that the more promising portions of the vein could be adequately explored from a winze 100 feet deep and by not more than 450 feet of drifting and crosscutting. The indicated length of the oreshoot in the segment of the vein south of the adit fault is not more than 150 feet. Judged by surface exposures and the underground work to date, the length of the ore-bearing portion of the main vein segment north of the adit fault-zone probably will not exceed 150 feet. To reach this northern segment from the proposed winze would require about 150 feet of crosscutting through barren schist. Thus a total of 450 feet of lateral work would suffice, 300 feet of which would probably cover the full extent of the oreshoot in both segments of the vein.

A block 300 feet long, 3 feet thick, and 100 feet high would contain 7,200 tons. As discussed previously, less than 60 percent of this tonnage could be expected to be of minable width and grade, hence the potential of the proposed work would be of the order of 4,000 tons with a probable grade of not more than 0.6 percent WO_3.

COST OF THE PROJECT

The applicant's estimates of the cost of the proposed work are quoted as follows:

6 a.	Independent contractors and contracts: ----------	None
6 b.	Labor, supervision and consultants:	
	For 150 feet of winze; estimated at 285 man-days of labor plus supervision and consulting service ----------	$5,244.00
	For 650 feet of drift; estimated at 700 man-days of labor plus supervision and consulting service: ----------	12,920.00
		$18,164.00

6 c.	Operating material and supplies		
	Powder, fuse & caps	$1,800.00	
	Timber	1,200.00	
	Fuel for power	1,600.00	
	Pipe and track	1,000.00	$5,600.00
6 d.	Operating equipment - depreciation or rentals for approximately 18 months:		
	Compressor (315 c.f.m.)	$2,000.00	
	2 - rock drills	300.00	
	Hoist and motors	100.00	
	Blowers, welding equipment, general repairing & maintenance, hand tools and perishable items	1,000.00	$3,400.00
6 e.	Rehabilitation and repairs		None
6 f.	Miscellaneous -		
	Analytical work	$500.00	
	Accounting	500.00	
	Compensation and employers' liability insurance and payroll taxes	2,000.00	$3,000.00
Total of above items			$30,164.00
6 h.	10% of above as contingencies		3,016.40
	Total estimated cost of the exploration		$ 33,180.40

Applicant's cost on per foot basis:

150 feet of winze: $33,180.40 x $\frac{\text{(285 man days)}}{\text{(985 man days)}}$ $9,600.00

Cost per foot of winze - $64.00
650 feet of drift; $33,180.40
less $9,600 = $23,580.40
Cost per foot of drift - $36.28

The cost of drifting, as estimated by the applicant, appears reasonable, but the cost of sinking the winze has been underestimated. The minimum labor required to sink the proposed winze would be approximately as follows:

	Cost per shift
1 - Miner @ $2.00 an hour	$16.00
1 - Miner's helper @ $1.75	14.00
1 - Hoistman @ $1.75	14.00
1 - Trammer @ $1.625	13.00
1 - Part time supervisor	10.00
	$67.00
Overtime for 48 hours a week	5.58
Liability insurance & payroll taxes(14%)	10.16
Total labor cost per shift	$82.74

The hanging wall of the vein is fractured and when wet will be "heavy" so the entire winze will have to be well timbered, and no doubt more or less timber will be necessary in drifts. A moderate flow of water can be expected. Under these conditions it appears doubtful that much more than one foot of advance per shift could be realized in the winze. On this basis and presuming that the labor represents about 70 percent of the total cost, the actual cost of the winze would be about $118 a foot.

The cost of drifting would probably range between $35 and $40 a foot, depending upon the amount of timbering required.

The equipment to be furnished by the applicant, consisting essentially of a second-hand 315 c.f.m. portable compressor, 2 rock drills, a tugger hoist, and 3 mine cars, has a total value of about $4,200. The depreciation on this equipment, based on a life of 5 years, would amount to $70 a month.

By working 2 shifts daily for 25 days a month the proposed work could be completed in from 6 to 8 months.

ECONOMIC CONSIDERATIONS

In mining a vein such as the Tungsten King with a width ranging from 2 to 3 feet, not much more than one ton of ore ordinarily can be produced per man-shift. With an average wage rate of $1.75 an hour and after including overtime, liability insurance and payroll taxes, a man-shift would cost about $17. Thus the labor cost would be $17 a ton. Under present conditions labor probably represents about 70 percent of the mining cost. On that basis the cost of mining at the subject property could be expected to be of the order of $24 a ton. Based on the ratio of ore to waste as indicated by the former stoping, the cost of exploration and development would be at least $5 per ton of ore milled. The applicant's mill is about 12 miles from the mine. To truck the ore this distance would cost $1.50 a ton. Milling and marketing the concentrates will no doubt cost at least $4.00 a ton. Hence the total direct operating cost would be of the order of $35 a ton. In order to "break even", assuming a mill recovery of 70 percent in a marketable concentrate valued at $63 a unit, the ore should contain about 0.8 percent WO_3. If it were desirable to assure the sustained production of the property's tungsten, a profit would be necessary. Under present prices this would require an ore containing about 1.0 percent WO_3 which is evidently nearly twice the average indicated grade of the deposit.

CONCLUSIONS AND RECOMMENDATIONS

The Tungsten King deposits are considered too small in relation to their grade to become an important source of tungsten. At best, the indicated potential of the vein is of the order of 40 tons per foot of depth extension. Production records and sample results show that the average grade of the deposit will probably not exceed 0.60 percent WO_3. As there is no reason to believe that further exploration would be likely to disclose larger or higher grade deposits, it is recommended that the loan application be denied.

A confidential letter concerning the applicant corporation was included with the geological report.

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
P. O. Box 4126, University Station
Tucson 5, Arizona

[Not Security]

March 10, 1954

CONFIDENTIAL letter to accompany report on DMEA 3227, Standard Tungsten Corporation, Tungsten King Mine, Cochise County, Arizona.

To Whom It May Concern:

After examining the Tungsten King mine and mill of the Standard Tungsten Corporation, for the Defense Minerals Exploration Administration, it appeared advisable to check the reliability of the Corporation's president and founder, Mr. S. C. Hu, and to determine the manner in which his business affairs are normally conducted. This investigation resulted in contacting the Better Business Bureau of Tucson, Incorporated, Mr. Norman Horwitz, manager, where there is filed a voluminous record on activities of Mr. Hu. A very small part of this record is transmitted herein with Mr. Horwitz's permission.

The available data indicate that Mr. Hu has a long history of organization, promotion and bankruptcy. His method of operation appears to be to organize and promote a corporation with himself as president, and after the corporation is financed by the sale of stock, to permit the corporation to go into bankruptcy. That the Standard Tungsten Corporation will follow the same pattern as the other corporations organized by Mr. Hu is a definite possibility as is indicated by a prospectus of the corporation, a copy of which is filed at the Tucson Better Business Bureau.

A partial list of bankrupt companies of which Mr. Hu was the organizer and president is as follows:

China Motor Corporation
Delaware Corporation
China Motor Industries Corporation
Lytemobile Corporation
Auburn Metal Industries Corporation
United Motor Industries Corporation

Apparently the record of unethical business affairs in which Mr. Hu has participated is not only very large but widely distributed. As sources of additional information, if needed, Mr. Horwitz recommends the following:

MAR 1954
RECEIVED
U.S. Geological Survey
Minerals Deposits Branch
Denver

Federal Bureau of Investigation, Tucson, Arizona, and Washington, D. C.
Securities Division of Arizona Corporation Commission
Better Business Bureau of New York City
Foreign Assets Control, Files 7362, and 7527, U. S. Treasury Department, Washington, D. C.
Securities Exchange Commission, State of New York, N. Y. C.
Dun and Bradstreet

Mrs. Shearer
172-5397
has the references;
also has an FBI memo
WSM
3/3/54

The above record is far from complete but is sufficient to show that the Defense Minerals Exploration Administration probably should not participate in any exploration proposals submitted by Mr. Hu or the Standard Tungsten Corporation. It is not unlikely that DMEA participation would be interpreted by many individuals as indicating Government approval of the manner in which the affairs of the Standard Tungsten Corporation are conducted, and such interpretation would be detrimental to the Government.

John N. Faick

John N. Faick
Geologist

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

December 28, 1953

Memorandum

To: Executive Officer, DMEA Field Team, Region IV

From: Chief, Operation's Control and Statistics Division

Subject: Assignment of Docket Number DMEA-3227

There is listed below the assigned docket number to an application recently received from Region IV.

DMEA-3227 Standard Tungsten Corporation

ROBERT E. ADAMS

Robert E. Adams
Chief, Operation's Control
and Statistics Division

Standard Tungsten Corporation
Box 247
Benson, Arizona

December 28, 1953

Subject: DMEA-3227
Re: Exploration Assistance
Black Rock-Tungsten King

Mr. S. O. Hu:

The receipt of your application dated December 18, 1953, for exploration assistance under the Defense Production Act of 1950, as amended, is hereby acknowledged.

Your application has been assigned Docket Number DMEA-3227 and referred to the Executive Officer, Region IV, 224 New Customhouse Building, Denver 2, Colorado.

Kindly refer to DMEA-3227 in any future correspondence relating to your application.

Sincerely yours,

ROBERT E. ADAMS

Robert E. Adams
Chief, Operation's Control
and Statistics Division

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

DEPARTMENT OF THE INTERIOR
Bureau of Mines Library
DEC 29 1953

224 New Customhouse
Denver 2, Colorado

December 24, 1953.

Memorandum

To: Administrator, Defense Minerals Exploration Administration
Attention: Code 200

From: Executive Officer, DMEA Field Team, Region IV

Subject: Docketing for Exploration Assistance

Enclosed herewith in duplicate is DMA Form 3a and MF-103 and supporting data pertaining to the following application for Government assistance in exploration work:

Standard Tungsten Corporation (Tungsten)
Box 247
Benson, Arizona

W. H. King

W. H. King

Enclosures

UNITED STATES
DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION
WASHINGTON 25, D. C.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 28 1953

224 New Customhouse
Denver 2, Colorado

December 24, 1953.

Memorandum

To: Administrator, Defense Minerals Exploration Administration
Attention: Code 200

From: Executive Officer, DMEA Field Team, Region IV

Subject: Docketing for Exploration Assistance

Enclosed herewith in duplicate is DMA Form 3a and MF-103 and supporting data pertaining to the following application for Government assistance in exploration work:

Standard Tungsten Corporation (Tungsten)
Box 247
Benson, Arizona

W H King
W. H. King

Enclosures

MF-103
(Revised April 1952)

UNITED STATES DEPARTMENT OF THE INTERIOR
DEFENSE MINERALS EXPLORATION ADMINISTRATION

Form Approved.
Budget Bureau No. 42-R1035.2.

DEPARTMENT OF THE INTERIOR
Defense Minerals Administration
RECEIVED
DEC 28 1953

APPLICATION FOR AID IN AN EXPLORATION PROJECT, PURSUANT TO DMEA ORDER 1, UNDER THE DEFENSE PRODUCTION ACT OF 1950, AS AMENDED

Not to be filled in by applicant

Docket No. DMEA-3227
Metal or Mineral
Date Received 12-28-53
Estimated Cost
Participation (Government %)

INSTRUCTIONS

1. *Name of applicant.*—(*a*) State here your full legal name, in the form in which you will wish to contract, and your mailing address: Standard Tungsten Corporation, Box 247, Benson, Arizona; a corporation organized under the laws of State of Delaware; S.C. Hu-president, 311 East Congress Street, Tucson, Ariz. Howard R. Amundsen-secretary, 40 East 64th Street, New York City, N.Y.; David Huang-treasurer, Rm 804, 75 West Street, New York City 6, New York

(*b*) If other than an individual, add to your name above whether a corporation, partnership, etc., and the name of the State in which incorporated or otherwise organized. see (a) above

(*c*) If a corporation, add to above statement, titles, names and addresses of officers. see (a) above

(*d*) If a partnership, add to the above statement the names and addresses of all partners. not applicable

2. *General.*—Read DMEA Order 1, "Government Aid in Defense Exploration Projects," before completing this application. Submit this application and all accompanying papers in quadruplicate (four copies), with your name and address on each sheet of the application and on all accompanying papers. Where sufficient space is not provided on the form for all required information, state it on an accompanying paper, with a reference in each case to the instruction to which it refers by number. Comply with all applicable instructions; or, if not applicable, so state. File the application with Defense Minerals Exploration Administration, Department of the Interior, Washington 25, D. C., or with the nearest field executive officer thereof.

3. *Applicant's property rights.*—(*a*) State the legal description of the land upon which you wish to explore, including all land which you possess or control that may be benefited by the exploration, and excluding any land or interest in land which is not to be included in the exploration project contract All interests in Black Rock(Tungsten King)Claim #1, to be derived from exploration and mining of ore out from proposed winze located approximately at center of claim, excluding all interests derived by mining at present production area and present northward drift on present level. (Claim recorded in CoChise County Office: Book #94 p.137 and Book #57 p.415)

(*b*) State any mine name by which the property is known. Black Rock Claim

(*c*) State your interest in the land, whether owner, lessee, purchaser under contract, or otherwise Owner by assignment (see Exhibit AA attached)

(*d*) If you are not the owner, submit with this application a copy of the lease, contract, or other document under which you control the property.

(*e*) If you own the land, describe any liens or encumbrances on it royalty payment of 10% of net ~~[illegible]~~ mill or smelter return out from production of Black Rock-Tungsten King mining group upto $35,000.

(*f*) If the land consists of unpatented claims, add to the description above, the book and page numbers for each recorded location notice. Cochise County Record: Book #94, p.137 and Book # 57, p.415

4. *Physical description.*—(*a*) Describe in detail any mining or exploration operations which have been or now are being conducted upon the land, including existing mine workings and production facilities. State your interest, if any, in such operations. Also describe accessibility of mine workings for examination purposes. see Exhibit A attached

(*b*) State past and current production, and ore reserves, if any, giving quantities and grades. see Exhibit A attached

(*c*) Describe the geologic features of the property, including mineralization, type of deposit (vein, bedded, etc.), and your reasons for wishing to explore. Illustrate with maps or sketches. Send with your application (but not necessarily as a part of it) any geologic or engineering report, assay maps, or other technologic information you may have, indicating on each whether you require its return to you. see Exhibit A attached

(*d*) State the facts with respect to the accessibility of the project: Access roads, distances to shipping, supply and residence points. see Exhibit A attached

(*e*) State the availability of manpower, materials, supplies, equipment, water, and power. see Exhibit A attached

5. *The exploration project.*—(*a*) State the mineral or minerals for which you wish to explore

Tungsten Ore (Scheelite)

(*b*) Describe fully the proposed work, including a map or sketch of the property showing a plan (and cross sections if needed) of any present mine workings, and the location of the proposed exploration work as related to such features as contacts, veins, ore-bearing beds, etc. see Exhibit A item 4c and maps attached

(*c*) The work will start within 30 days and be completed within 20 months from the date of an exploration project contract.

(*d*) State the operating experience and background of the applicant with relation to the ability to carry out such exploration project, and also that of the person or persons who will supervise the operations. see Exhibit B attached

6. *Estimate of costs.*—Furnish a detailed estimate of the costs of the proposed work (you will have to use a separate sheet), under the following headings. Add the totals under all headings to give the estimated total cost of the project:

(*a*) *Independent contracts.*—(Note.—If the applicant does not intend to let any of the work to contractors, write "none" after this item. To the extent that the work is to be contracted, do not repeat the cost of the contract-work in subsequent items.) State the cost of any proposed independent contracts for the performance of all or any part of the work, expressed in terms of units of work (such as per foot of drilling, per foot of drifting, per hour of bulldozer operations, per cubic yard of material moved, etc.). 6a,6b,6c,6d,6e,6f,6g,6h-all see Exhibit C attached

(*b*) *Labor, supervision, consultants.*—Include an itemized schedule of numbers, classes and rates of wages, salaries or fees for necessary labor, supervision and engineering and geological consultants.

(*c*) *Operating materials and supplies.*—Furnish an itemized list, including items of equipment costing less than $50 each, and power, water and fuel.

(*d*) *Operating equipment.*—Furnish an itemized list of any operating equipment to be rented, purchased, or which is owned and will be furnished by the Operator, with the estimated rental, purchase price, or suggested use-allowance based on present value, as the case may be.

(*e*) *Rehabilitation and repairs.*—Furnish a detailed list showing the cost of any necessary initial rehabilitation or repairs of existing buildings, installations, fixtures, and movable operating equipment, now owned by the Operator and which will be devoted to the exploration project.

(*f*) *New buildings, improvements, installations.*—Furnish a detailed list showing the cost of any necessary buildings, fixed improvements, or installations to be purchased, installed or constructed for the benefit of the exploration project.

(*g*) *Miscellaneous.*—Furnish a detailed list showing the cost of repairs to and maintenance of operating equipment (not including initial rehabilitation or repairs of the Operator's equipment), analytical work, accounting, workmen's compensation and employers' liability insurance, and payroll taxes.

(*h*) *Contingencies.*—Give an estimate of any necessary allowances for contingencies not included in the costs stated above.

NOTE.—No items of general overhead, corporate management, interest, taxes (other than payroll and sales taxes), or any other indirect costs, or work performed or costs incurred before the date of the contract, should be included in the estimate of costs.

7. (*a*) Are you prepared to furnish your share of the cost of the proposed project in accordance with the regulations on Government participation (Sec. 7, DMEA No. 1)? Yes

(*b*) How do you propose to furnish your share of the costs? Money

[x] Money [ ] Use of equipment owned by you [ ] Other

Explain in detail on acompanying paper.

CERTIFICATION

The undersigned, whether as an individual, corporate officer, partner, or otherwise, both in his own behalf and acting for the applicant, certifies that the information set forth in this form and accompanying papers is correct and complete, to the best of his knowledge and belief.

Dated December 18th, 1953, 195

STANDARD TUNGSTEN CORPORATION
(Applicant)

By S.C.Hu, president

Title 18, U. S. Code (Crimes), Section 1001, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.

U. S. GOVERNMENT PRINTING OFFICE 16—66551-1

EXHIBIT A.

ATTACHED SHEET FOR: Item 4. Physical description

4a. present operation and accessibility for examination

The Tungsten King - Black Rock group mines are presently being mined for production and shipment of tungsten ore. The production is being carried out on Claim #1, where the proposed exploration project is scheduled. In the past year, the ore has been shipped for 11 miles to a tungsten mill at Pomerene, Arizona, where it is processed for production of 60% tungsten concentrates. The rate of shipment has been intermittent. The maximum daily rate of shipment was 15 to 25 tons. Approximately four hundred tons of ore were shipped during six month period, March to September, 1953. One hundred tons were shipped in the month of September, 1953. The majority and controlling interest of both the mine and the mill are held by the applicant, who at present is engaged in enlarging the mill facilities to increase its production capacity from 15-ton-per-day to 150-ton-per-day.

The mine workings can be reached for examination by driving about 10 miles from Pomerene, Arizona on good dirt road, then driving 1000 feet on a newly cement-paved mountain road uphill to the tunnel entrance of the mine.

The details of present mining operation are described in the engineering report in Exhibit B and in maps attached. The production facilities are shown also in exhibits K & L attached.

4b. production and ore reserve and market

The early production from this mine was described by Bulletin no:148, Geological Series no:14, Arizona State Bureau of Mines as follows:".....During world war I, it was developed by open cuts.....yield 5 tons of high-grade scheelite concentrates. When visited in January 1940, the Tungsten King group under a lease produced about 800 pounds of concentrates with a small gravity pilot plant....." During the period of March to September 1953, approximately 400 tons of ore were shipped and processed by the applicant's predecessor, Kramer mining & milling company. From this 400 tons of ore, about 300 tons of un-processed coarse particles have been stockpiled, and about 2000 pounds of over-60% tungsten concentrates have been produced and sold by S.O.Kra

for the applicant's account on October 9th,1953, at current market price. Approximately one hundred tons of ore were shipped and processed by the applicant in September,1953; and about 800 pounds of 60% tungsten concentrates were produced, while all of the coarse particles were stockpiled. This 800 pounds of concentrates are presently in applicant's storage.

Production summary:

Period during World War I,	5 tons of high grade scheelite concentrates according to Arizona State Geological bulletin no:148, no details available
Period around 1940,	800 pounds of concentrates by a small gravity pilot plant,also according to Arizona geological bulletin no:148,no details available
Period March-September,1953	400 tons of ore shipped and processed, all coarse particles were stockpiled at present Pomerene Mill, from fine particles about 2000 pounds of 60% concentrates were produced and sold by S.C. Kramer for the applicant's account
Period September,1953	100 tons of ore shipped and processed, all coarse particles are ~~being~~ stored and stockpiled at the applicant's Pomerene Mill. From the fine particles about 800 pounds of 60% concentrates were produced and are now in the applicant's storage

The ore reserves are estimated in the engineering reports, attached as Exhibit D. to this application. The grade of the ore ranges from 0.5% to 1.5% of tungsten trioxide contents.

Under the present U.S.Government Tungsten purchasing & stockpiling program, the market and demand of domestically produced tungsten concentratesare is to be very stable at least upto 1958(~~as~~ program recently extended by Congress). This is reflected by the fact that only 10% of the proposed stockpiling purchase by Government has been bought to date. 90% of the stockpiling purchase remains to be made. The price is to be steady and to be at the fixed figure of $63.00 per 20-pound unit of 60% tungsten concentrates. General Services Administration has issued Certificate of Authorization (Domestic Tungsten Program) no:9-2286 to the applicant , and has authorized the applicant to deliver to Government tungsten concentrates at Government price in accordance with the U.S.Domestic Tungsten Program.

Exh. A-2

4c. geological features of the property & reasons for exploration

The geological features, as described by Arizona Bureau of Mines, Geological series no:14, bulletin no:148, are as follows: " In the subject area pre-cambrian schist on the east is invaded by granite on the west, which in turn is intruded by northeastward trending aplite dikes upto about one foot wide. Scheelite-bearing quartz veins crop out intermittently for some several thousand feet along this granite schist contact and in adjacent schist. These veins form eastward dipping lenticular segments from a few inches to six feet wide, offset in places by faults."

Exhibits D.,F.,G. and H of this application further describe the details of the property's geological feature

Present mining operation on the property reveals the ore bearing vein upto six feet wide in places,with a depth of 200 feet from present mining and working level to mountain surfaces.

WE PROPOSE,IN THIS APPLICATION, TO SINK A WINZE OF 150 feet FROM PRESENT MINING LEVEL AND TO DRIFT A TOTAL OF 650 FEET (with 10'-15' allowance as sump) FROM THE BOTTOM OF THE PROPOSED WINZE IN BOTH SOUTHWARD AND NORTHWARD DIRECTIONS. The winze is to be sunk along the ore-bearing vein. The southward drift at a 150-ft-sub-level is to be along the ore-bearing vein also, and is to reach a fault in the south. The northward drift at a 150-ft-sublevel is to cut through a fault and to reach and to pick up the ore-bearing vein, and then to drive along the ore-bearing vein. By so doing, we believe that the general idea of existence of ore at a lower level and to the extent beyond the ends of present south-north drift. This will also reveal the greater possibilities of ore reserve to deeper depth as well as in both directions southward and northward, parallel to the surface vein-showing, which extends several thousand feet.

4d. accessibility of the project

The project location of exploration can be reached by driving 4 miles from Benson,Arizona along paved highway, then drive about 10 miles along good dirt road, then drive about 1000 feet uphill on a newly cement-paved mountain road to the entrance of the tunnel of mine workings. The applicant's tungsten mill with a 150-ton

Exh. A-3

designed capacity per day is within 11 miles from the proposed exploration area. The ore developed can be trucked to the mill by truck in about two hours per round trip or faster.

The projected exploration is within 10 miles from the town of Pomerene with 500 population; within 15 miles from Benson, Arizona of 2000 population; and within 60 miles from Tucson, Arizona of 100,000 population. Supply of material and labor have been proven satisfactory, as the applicant and its predecessor have been mining and milling tungsten ore in the area for past year or two years.

4e. manpower, material, supplies, equipment, water and power.

As the projected exploration location is within driving distance from near-by towns and cities: Pomerene, Benson and Tucson, Arizona as mentioned above, necessary manpower, material and various supply are available for efficient operation. The applicant at present is in possession of adequate amount of machinery and equipment for exploration: including 4 portable compressors: (315 cfm, 315 cfm, 210 cfm and 85 cfm) 5 rock drills, 3 hoists, etc. together with a 150 ton ore processing, jig, table and flotation mill. Water and gasoline for power are also available for efficient working program. (water from shaft at the mine, gasoline to be delivered in drums by gasoline dealer on one hour notice).

Exh. A-4

CONGRESS HOTEL ▪ ▪ Tucson, Arizona
EVERY ROOM WITH BATH ÷ ÷ AIR CONDITIONED
R. H. SWARTZ, MANAGER W. W. PATRICK, OPERATOR

THE INTERIOR
Minerals Administration
RECEIVED
DEC 28 1953

December 17th, 1953

Standard Tungsten Corporation
Box 247, Benson, Arizona

Dear Sirs:

For value received, the undersigned hereby assign to you 75% of all of the interest of the following described ~~and~~ mining claims:

"One Claim, (Unpatented) located at Little Dragoon Mountain, Cochise County, Arizona, known as Black Rock (Tungsten King) Mining Claim number one (#1) recorded with Cochise County Recorder's Office in Docket #94 p.137 and Docket #57 p.415"

The undersigned represents that he is the owner on record of the subject mining claim, subject only to royalty payment of 10% of net Mill or Smelter return out from production of the 22 group-claims of Black Rock - Tungsten King Mine. The subject claim is a part of the 22-claim-group. This assignment however would be automatically cancelled in case of Bankruptcy of your Company.

Kelly & Company

(Copy)

by: S.C.Hu, trustee

See America First

Exh. AA

EXHIBIT B.

Attached sheet for item 5d: operating experience and background of the applicant

The applicant at present is engaged in actual mining development and production work and in milling operation. We are operating with a working force of about twenty people: experienced engineers, geologists, mining foremen, miners and mill mechanics. At present, we are developing and mining simutaneously at Silver Hill Mine, Paradise, Arizona, Granite Peak Mine, Rodeo, New Mexico, and at Tungsten King-Black Rock Mine, Pomerene, Arizona. Also, we have been operating a tungsten mill at Pomerene, Arizona; and are now engaged in enlarging the mill capacity from 15 ton daily to 150 ton daily. We schedule to be in enlarged and increased production before the Summer, 1954. We are fully equiped to do all types of work in Tungsten Mining field: including surveying, mapping, exploration(tunneling, shafting, drifting, crosscutting, raising and sinking), mining, milling and trading. We are financially stable with current bank cash balance in excess of $100,000.00 for the past year. A partial list of the general experience and background of our management and operating staff is as follows:

Howard R. Amundsen, graduated from Montana School of Mines and Western Reserve Graduate school; served as field engineer for War Production Board, subsequently as U.S. manager and as Commisioner of Truck and Engine Rebuilding Factory, Ministry of Communication, Republic of China.

James Baize, graduated with B.S. degree from North Western University, Chicago; worked as student engineer in automotive shops, as mining operator in Arivaca, Arizona, and as engineer with Infilco Engineering Co., Tucson, Arizona.

Henry G. Grundstedt, graduated from University of Arizona with B.S. degree in Mining Engineering; able to speak German, Spanish and English; worked as miner and as engineer in several mines; served as Chief engineer for Christmas Copper Corporation, Christmas, Arizona, responsible for underground survey, diamond drilling, mapping, structure analysis, and geological research; served as Field engineer with Copco Pacific Ltd. for field demonstration of Swedish Rock drilling machine and field geological and mining consultation; worked as general consulting engineer in mining and geological field.

Exhibit B-1

S.C.Hu, B.S. in engineering from Chiao-Tung University, Shanghai; M.S. in engineering from Rensselaer Polytechnic Institute, Troy, N.Y.; Doctor of engineering from M.I.T., Cambridge, Mass.; receipient of Sloane Research Fellowship and Winner of Salisbury Prize, Graduate School, M.I.T.; full member of Honorary Scientific Society, Sigma Xi; worked as engineer with General Electric Company, Berger Manufacturing Co., United Aircraft Co.; as Chief engineer of Jet Construction with Aerojet Corp.; as Chief engineer with China Aircraft Corp., and with United Motor Industries Corp..

David Huang, B.S. in engineering, Wuhan University, China; M.S. in engineering, M.I.T. Cambridge, Mass.; worked as engineer with Central Machine Work, Inc. Celanese Corp. of America, Oscar Kohorn Co., and A.J. Maurer Co.; Mr. Huang is from one of the most outstanding families on China in the field of ferrous and non-ferrous metals, brother in law of former Governor of Formosa and son of a director of National Supreme Policy Board to Chiang Kai-shek.

Othel Conger and Ralph Pursley; both are experienced mining foremen with over twenty five years of experience as miners and mining foreman.

Ferdinand A. De Wiess, graduated from University of Vienna, Austria; able to speak English, French, German, Italian, Dutch and Portuguese; worked as inventor, engineer and financial expert with Austrain Department of Commerce, with Briggs Clarifier Co., with Stevenson Jordan and Harrison, Inc., Spacarb, Inc., and Aero-affiliates, Inc. of New York.

EXHIBIT B-2

EXHIBIT C.

ATTACHED SHEET TO ITEM 6: ESTIMATE OF COSTS

For proposed 150 feet of shaft (winze) and 650 feet of drift at the bottom of the winze (drift southward and drift northward) (with 10'-15' allowance as water sump)

6a. Independent contractors and contracts ... none

6b. Labor, supervision, consultants -

For 150 feet of winze: estimated at 285 man-day of labor plus supervision & engineering & consulting service ...		$5,244.00
For 650 feet of drift: estimated at 700 man-day of labor plus supervision & engineering & consulting service ...		$12,920.00
		$18,164.00

6c. Operating material & supplies

Powder, fuse & caps	$1,800.00	
Timber	$1,200	
Fuel for power (gasoline & diesel & oil)	$1,600	
Rails, fish plates, pipes, etc.	$1,000	$ 5,600.00

6d. Operating equipment - depreciation or rentals for approximately 18 months

Compressor (315 c.f.m.)	$2,000	
2 Rock drills, fittings hoses & steels	$ 300	
Hoists, motors, etc.	$ 100	
Ventilation blowers, welding equipment, general repairing & maintenance equipment & hand tools & perishable items	$1,000	$ 3,400.00

6e. Rehibilitation & repairs - none

6f. Miscellanneous - analytical work $500
accounting $500
workman's compensation & employer's liab. insurance & payroll tax $2,000 — $ 3,000.00

Total of items above $30,164.00

6h. 10% of above total as contigencies (10% of $30,164.00) — $ 3,016.40

$33,180.40

This total exploration cost of $33,180.40 is further analyzed on the next page

Exh- C-1

Company's (applicant's) share and Government's share

Total exploration cost $33,180.40

25% of $33,180.40 ....$ 8,295.10
75% of $33,180.40 ....$24,885.30

Cost on "per foot basis"

150 foot of winze: $33,180.40 x (285 man-day/985 total); $9,600.00

Cost per foot of proposed winze $64./foot

650 foot of drift: $33,180.40 minus $9,600.00: $23,580.40

Cost per foot of proposed drift $36.28/foot

EXHIBIT C-2

EXHIBIT D.

ENGINEERING & GEOLOGICAL REPORT ON BLACK ROCK-TUNGSTEN KING MINE NEAR BENSON, COCHISE COUNTY, ARIZONA

By: Henry G. Grundstedt, Dec. 17th, 1953

The property is located approximately 15 miles northeast of Benson, Cochise County, Arizona. The mine is in the Little Dragoon Mountains, east of San Pedro river at a point 10 miles northeast of the town of Pomerene, Arizona.

Twenty two unpatented claims: claims 1 through 22, comprise the property. The claims are well located with respect to the trend of the vein structure. Mr. S.C. Kramer is the former owner of the above claims. A good road leads to the town of Pomerene from Arizona State Highway no: 86. From Pomerene a fair road leads to the mine. Timber is lacking at the property, and all timber must be hauled in. There is water enough for operation. The topography at the mine is rugged and steep. The weather is pleasant all the year around, and does not effect the operation at all. The elevation of the mine is approximately 1000 feet higher than the town of Benson.

The country rocks in the area are granite and sericitic schists. The granite which is porphyritic forms the footwall of a vein of scheelite, and the schist forms the hanging wall. Some of the schist contains seams of calcite. The vein of scheelite is well defined and seems to have an average thickness of approximately 3.5 feet. The vein strikes approximately S 8 degrees E, and dips 44 degrees to the east. A south dipping, east trending fault (King Fault #1) cuts across the vein at almost right angles. From the appearance of the fault it seems the fault has developed a horizontal movement which has resulted in moving the hanging wall block to the east. This interpretation is substantiated by the reappearance of the vein to the north and east. Movement along the fault is about 76 feet. The vein can be seen again on the surface where it outcrops and where it has been exposed by trenching and open cuts. Observations on the surface outcrops of the vein appear to indicate, that in areas where the vein "pinches-out", the void is replaced with a soft, altered schist, different in texture than the true hanging wall schist. Samples taken from parts of the surface outcrops showed scheelite when exposed to an ultra-violet lamp.

Development in the mine (in claim # 1) to date consists of approximately 750 feet of 5x7

HGG

drift, this figure may be low as one of the drift is caved and the exact extent of it beyond the cave can not be determined. In the east end of the mine there is a winze approximately 4x4x18 feet deep. The winze is full of water most of the time and the drilling water for the mining operation is supplied from this winze. In the south part of the mine there is an inclined stope where the vein is presently being mined. Approximately 500 tons of the ore have been taken from the stope. Operations for the sinking of a new winze have been started in the south drift. The winze will be inclined, and along the dip of the vein. The winze at present has been sunk to a depth of approximately 10 feet, all in good ore. The vein thickness at the bottom of the winze is approximately three and one half feet (3.5')thick.

On the basis of the ore now exposed in the south stope, winze and vein exposures in the N.E. section of the mine, the following estimate of ore reserves are obtained;

Developed(Tons)	4,400
Probable (tons)	12,200
Possible	140,000

It is reasonable to assume that the total over-all tonnage may eventually be greater than calculated, but the writer believes these estimates are well-founded, as based on geological relations and the exposures revealed by the present development.

The figure for probable ore was obtained by assuming future development would be done along the vein to the south, continuing southward until the fault is reached. Development described above would be in writer's opinion the most likely place for future development.

In calculating reserves the writer did not take into consideration the possibility of the vein continuing in depth (continuance of vein below zero elevation or track level). This would be another good possibility for future development.

From the foregoing it can be stated that more development and exploration work should be done to eliminate some of the great risk which is presently involved. By more exploration work, much of this risk could probably be eliminated.

Respectfully submitted

Henry G. Grundstedt

Henry G.Grundstedt

Tucson,Arizona
Dec.17th,1953

EXH.D.-2

EXHIBIT E. ASSAY REPORTS FOR SAMPLES TAKEN FROM CONCENTRATES AT MILL AND FROM ORE VEIN AT THE MINE, TUNGSTEN KING-BLACK ROCK 22 CLAIM MINING GROUP.

Ore from mine (at locations shown in map per Exhibit H. attached) original copy is submitted with the first copy of this application, date 12/18/1953

Sample no: #	Assayer	location	sample & vein width	% WO3
#1	Jacobs Assay Office, Tucson	north drift	4 ft	0.81%
#2	" " " "	north drift	4 ft	3.25%
#3	" " " "	stope, s.drift	5 ft	6.65%
#4	" " " "	stope, S.drift	3 ft	0.85%
#5	" " " "	stope, S.drift	4 ft	4.43%
#6	" " " "	winse, S.drift	3.5 ft	1.09%

****

Tungsten Concentrates at Mill, [illegible]

Date	Assayer & remarks		% WO3
Sept.1,1953	Jacobs Assay Office, Tucson, Certificate no: 50546, and certificate no: 50548	Head	1.28%
		Middlings	0.32%
		Concentrates:	62.3%
Oct.13,1953	Denver Equipment Report, Ore Testing Div., Denver, Colorado, based on 50 pound sample of concentrates (scheelite)	WO3 contents:	57.6%
July 10, 1953, Hawley & Hawley, Douglas, Arizona		WO3 contents:	62.94%

EXHIBIT E.

EXHIBIT F. GENERAL LOCATION OF THE 22-CLAIM TUNGSTEN KING - BLACK ROCK MINE, LOCATED AT LITTLE DRAGOON MOUNTAIN, COCHISE COUNTY, ARIZONA; THE PROPOSED LOCATION OF EXPLORATION WORK AT THE CENTER OF CLAIM #1 OF THE MINING GROUP

EXHIBIT G. GEOLOGICAL & CONTOUR MAP OF CLAIM #1 OF TUNGSTEN KING - BLACK ROCK MINE GROUP

EXHIBIT H. MAP OF PRESENT WORKINGS AND PRESENT PRODUCTION AREA; SHOWING LOCATIONS OF SIX SAMPLES TAKEN ON Dec. 10 to Dec.15, 1953 AND ASSAYED ON Dec. 18, 1953, WITH WO3 CONTENTS OF: 0.81%, 3.25%, 6.65%, 0.85%, 4.43% and 1.09%

EXHIBIT J. SECTION MAP ACROSS THE STOPE FROM SOUTH DRIFT TO MOUNTAIN SURFACE; SHOWING CROSSECTION OF PRESENTLY KNOWN ORE-BEARING VEIN

EXHIBIT K. PRESENTLY EXISTING MILL WITH MILL BUILDING NOW UNDER CONSTRUCTION AT POMERENE, ARIZONA; ABOUT 10 MILES FROM THE PROPOSED LOCATION OF EXPLORATION WORK

EXHIBIT L. SCHEMATIC DIAGRAM OF THE POMERENE MILL, POMERENE, ARIZONA, NOW UNDER CONSTRUCTION

ENTERED AS SECOND CLASS MATTER

MINING ENGINEERING

PUBLISHED BY

THE AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS INC.
29 WEST 39th STREET, NEW YORK 18, N. Y.

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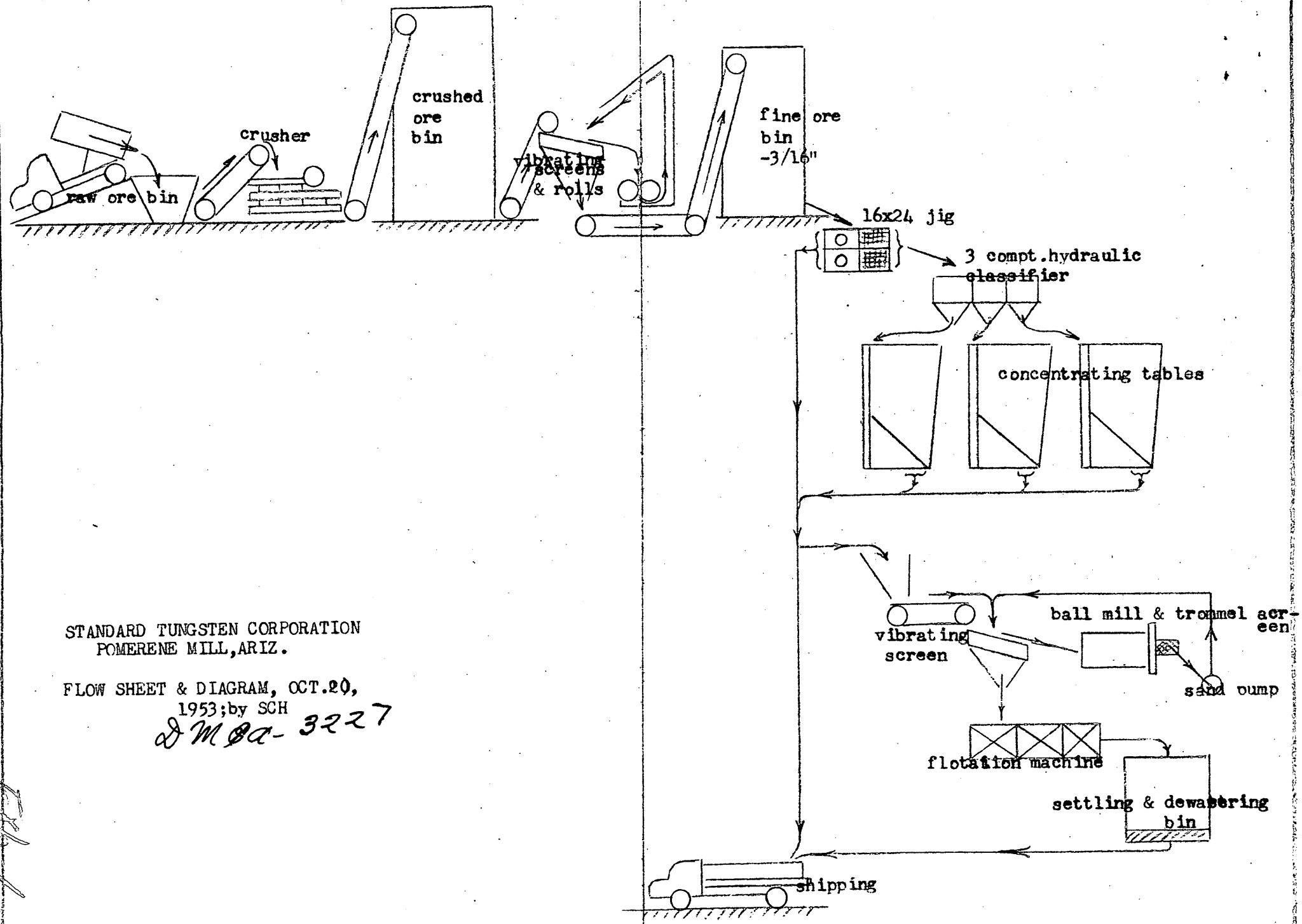
18TH & C STS., N.W. ORD. 27
WASHINGTON 25, D.C.

S-296
N12-53
2
MIN.



STANDARD TUNGSTEN CORPORATION
POMERENE MILL, ARIZ.

FLOW SHEET & DIAGRAM, OCT. 20, 1953; by SCH

DMBa-3227

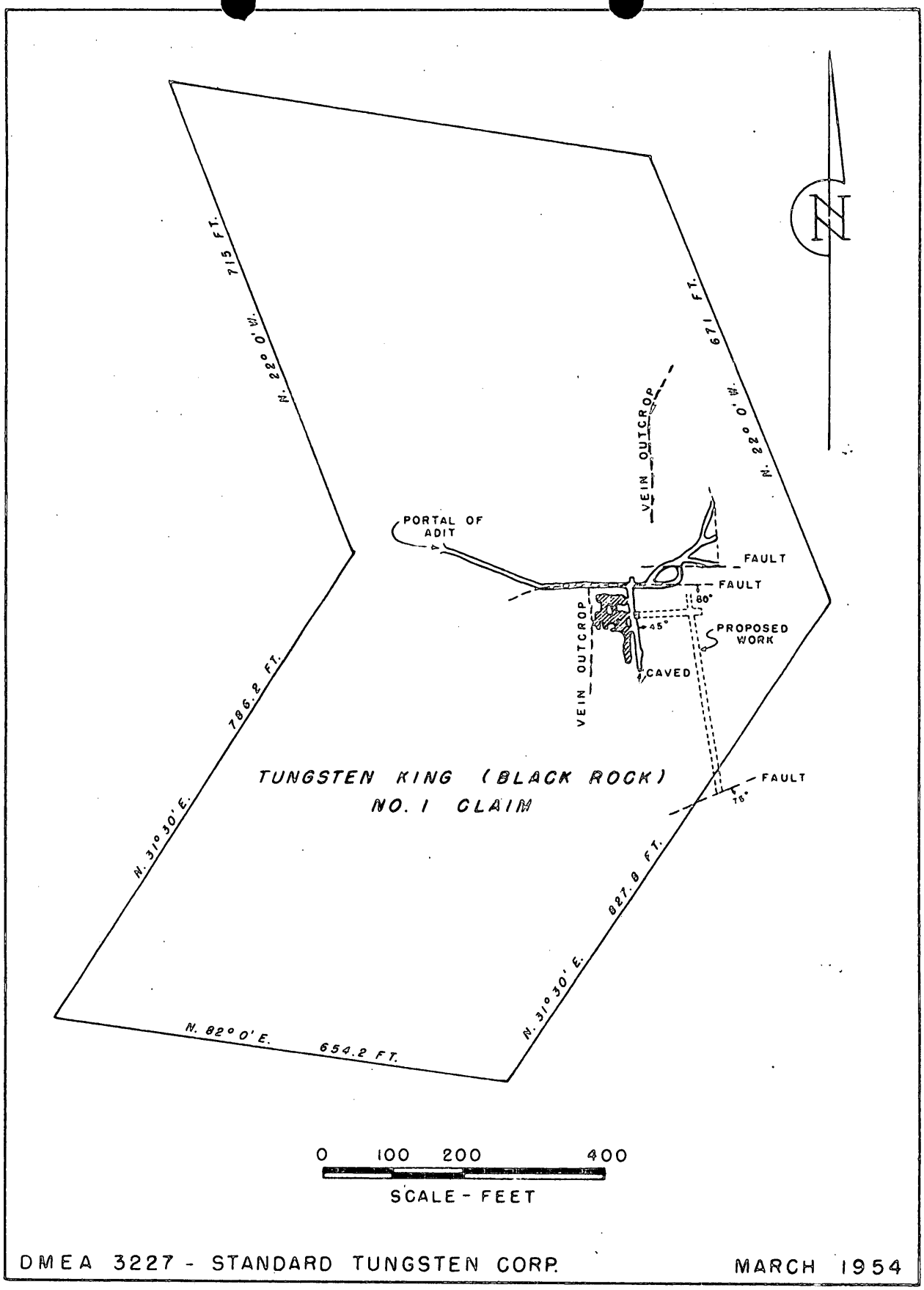
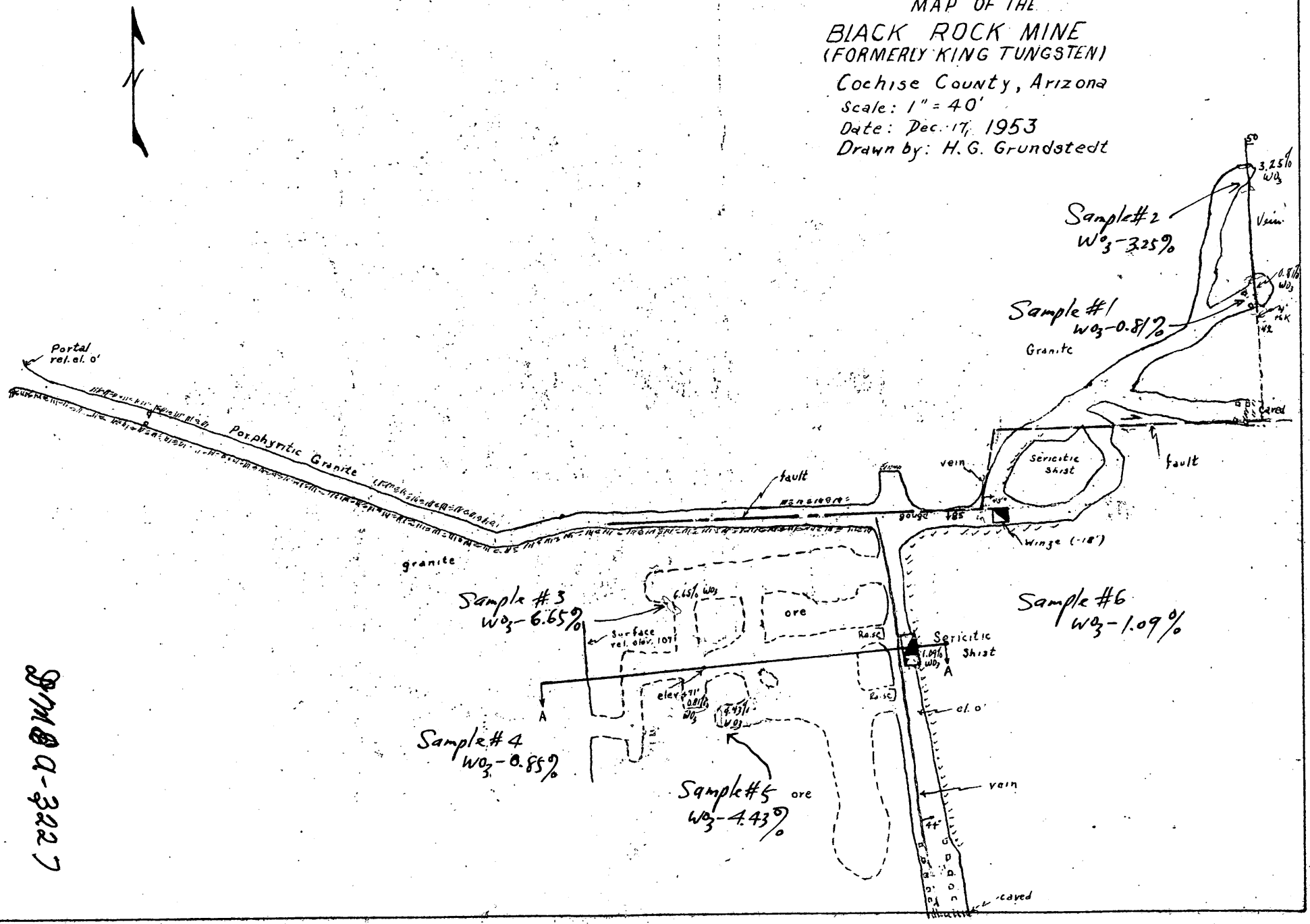


FIGURE 2. - TUNGSTEN KING (BLACK ROCK) NO. 1 CLAIM
COCHISE COUNTY, ARIZONA

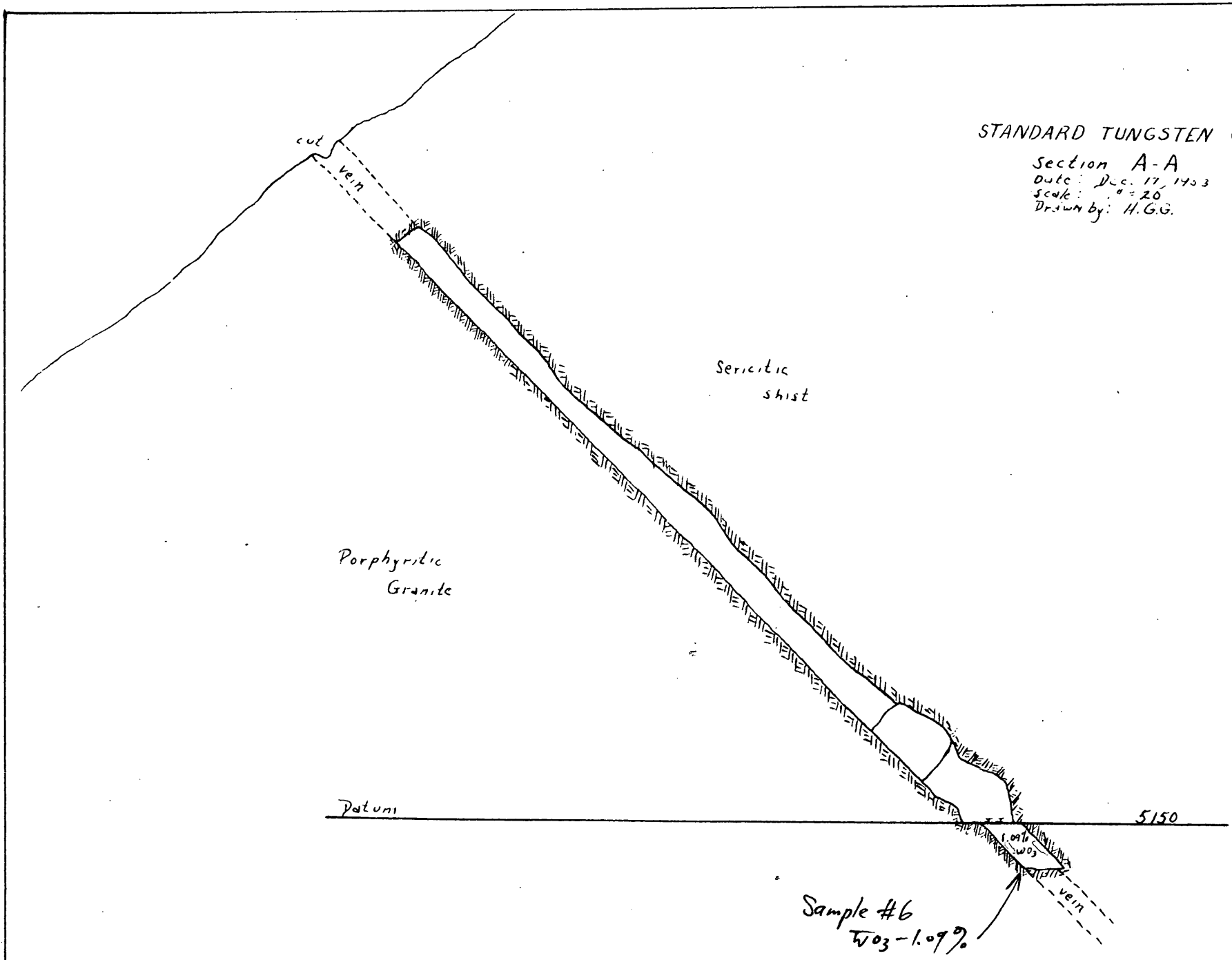
MAP OF THE
BLACK ROCK MINE
(FORMERLY KING TUNGSTEN)
Cochise County, Arizona
Scale: 1" = 40'
Date: Dec. 17, 1953
Drawn by: H. G. Grundstedt



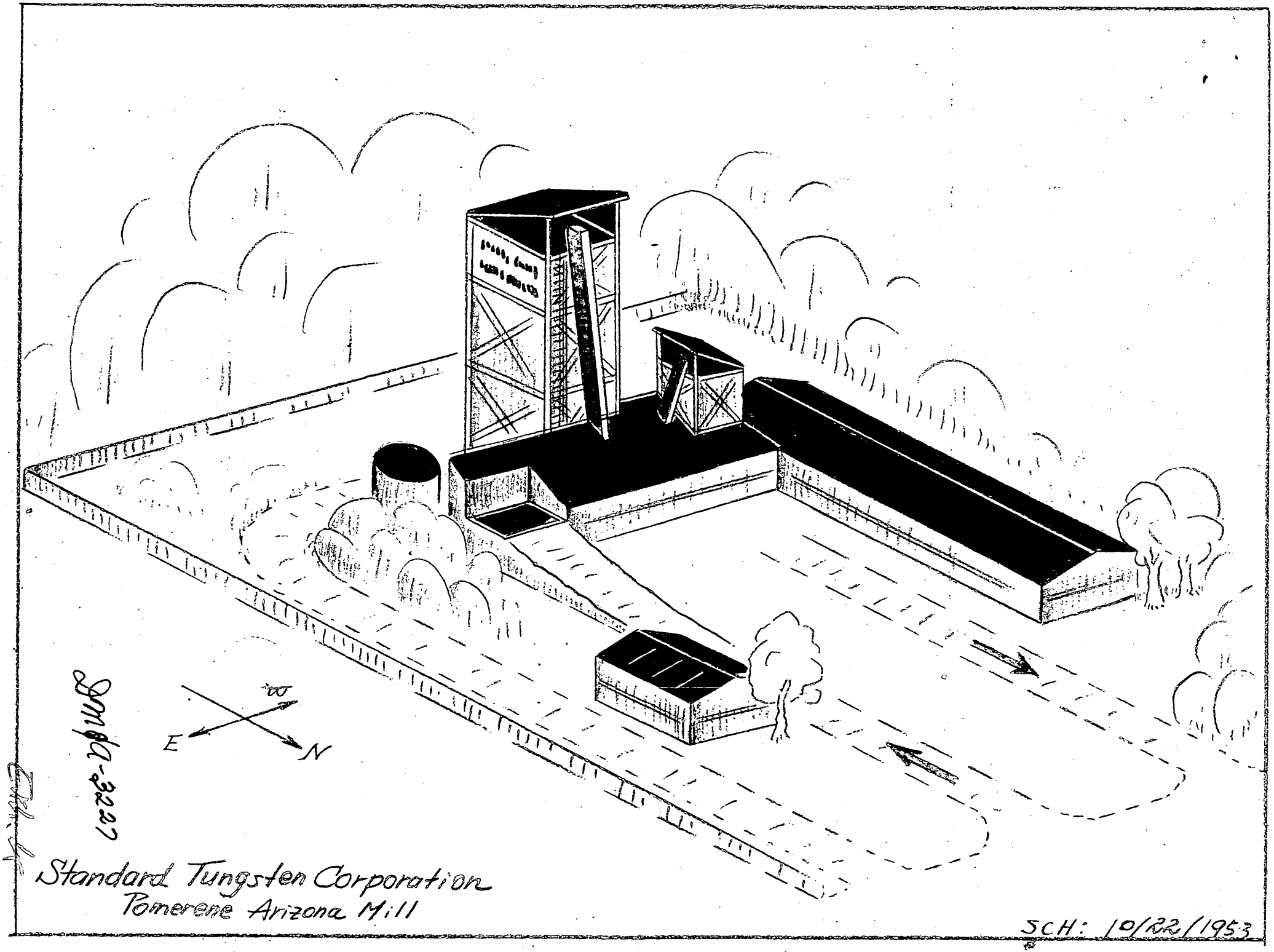
SMA Q-3227

STANDARD TUNGSTEN Corp.

Section A-A
Date: Dec. 17, 1953
Scale: 1" = 20'
Drawn by: H.G.G.



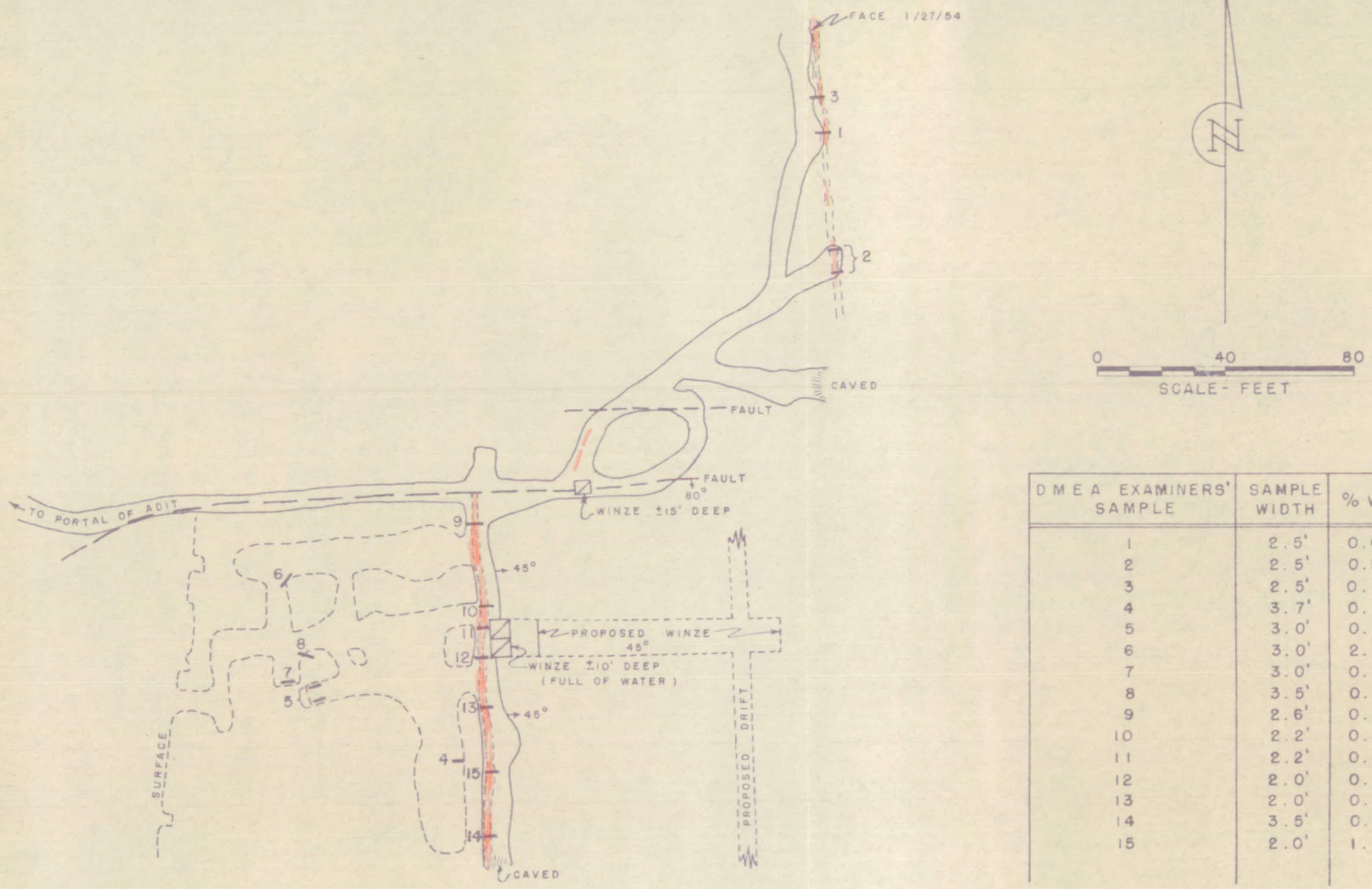
Exh. J



Standard Tungsten Corporation
Pomerene Arizona Mill

SCH: 10/22/1953

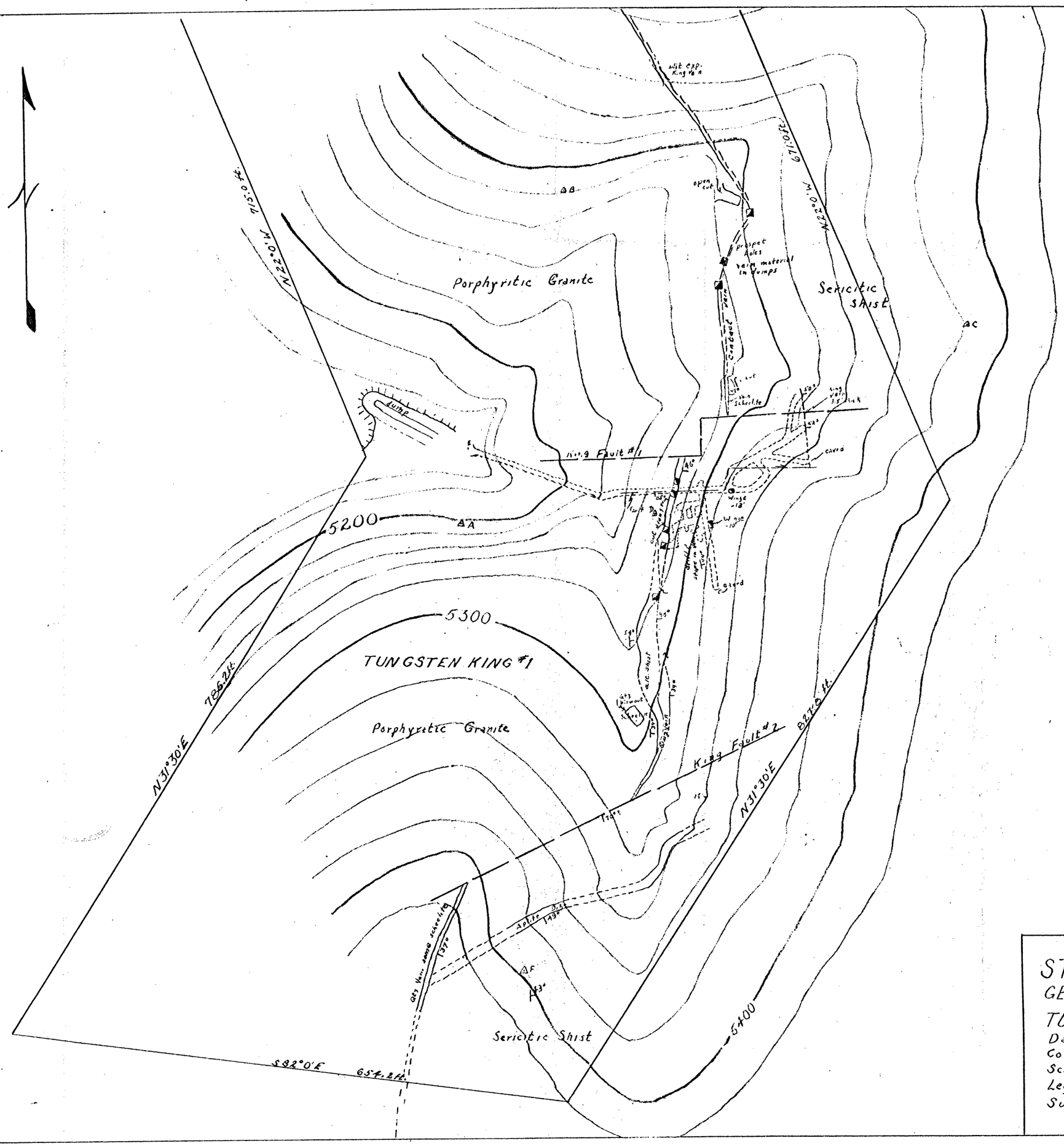
DMQ-3227



DMEA EXAMINERS' SAMPLE	SAMPLE WIDTH	% WO_3
1	2.5'	0.60
2	2.5'	0.58
3	2.5'	0.12
4	3.7'	0.59
5	3.0'	0.17
6	3.0'	2.18
7	3.0'	0.03
8	3.5'	0.12
9	2.6'	0.19
10	2.2'	0.17
11	2.2'	0.06
12	2.0'	0.07
13	2.0'	0.37
14	3.5'	0.45
15	2.0'	1.23

DMEA 3227 - STANDARD TUNGSTEN CORP. MARCH 1954

FIGURE 4. - SAMPLE MAP OF THE TUNGSTEN KING (BLACK ROCK) MINE
COCHISE COUNTY, ARIZONA

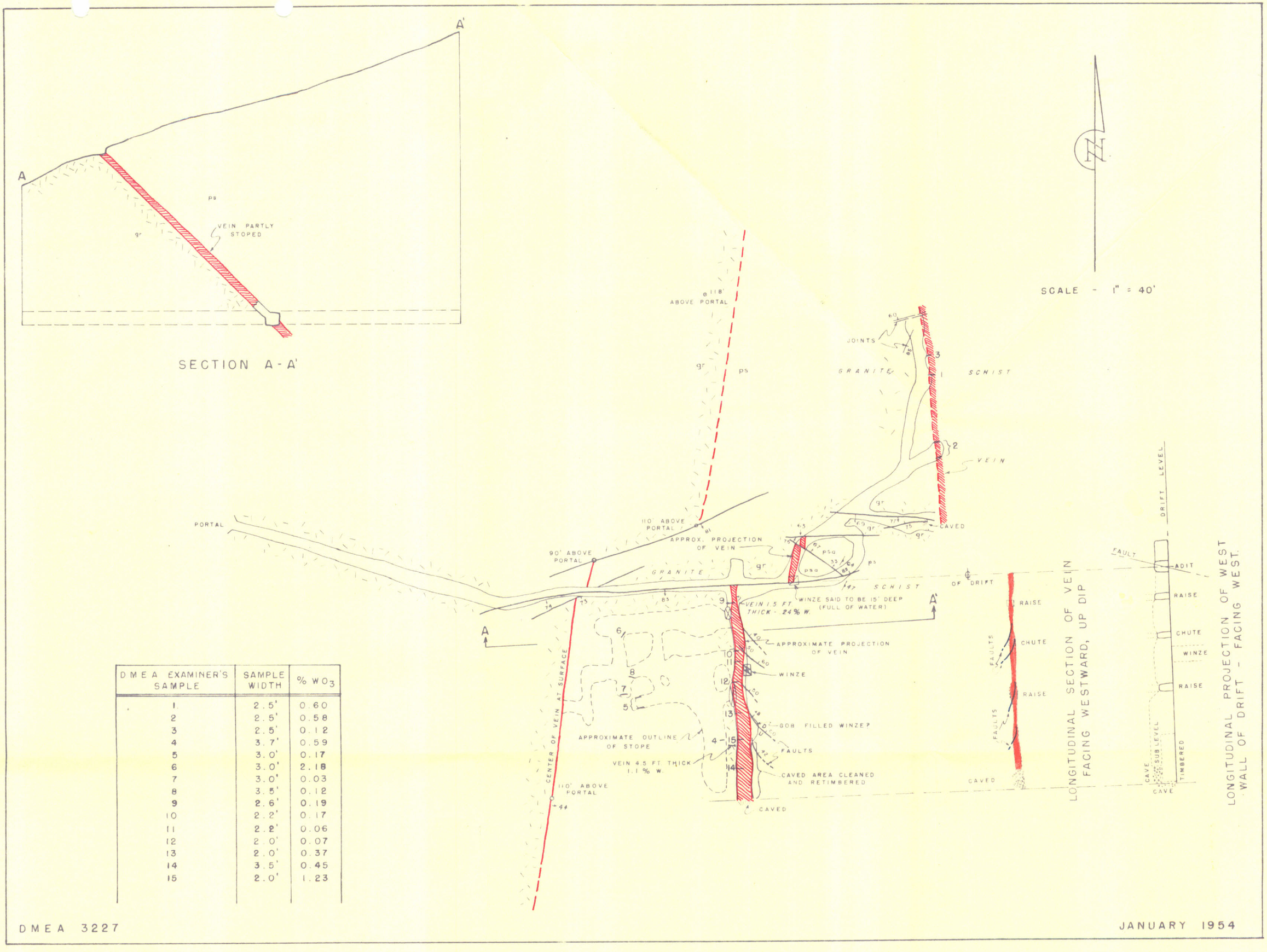


STANDARD TUNGSTEN CORP.
GEOLOGICAL & CONTOUR MAP
of
TUNGSTEN KING CLAIM NO. 1

Date: Dec. 17, 1953
Contour Interval: 20 ft.
Scale: 1" = 100'
Legend: :::::: underground workings
Survey by: H. G. Grundstedt

DMEA-3227

Exh. G



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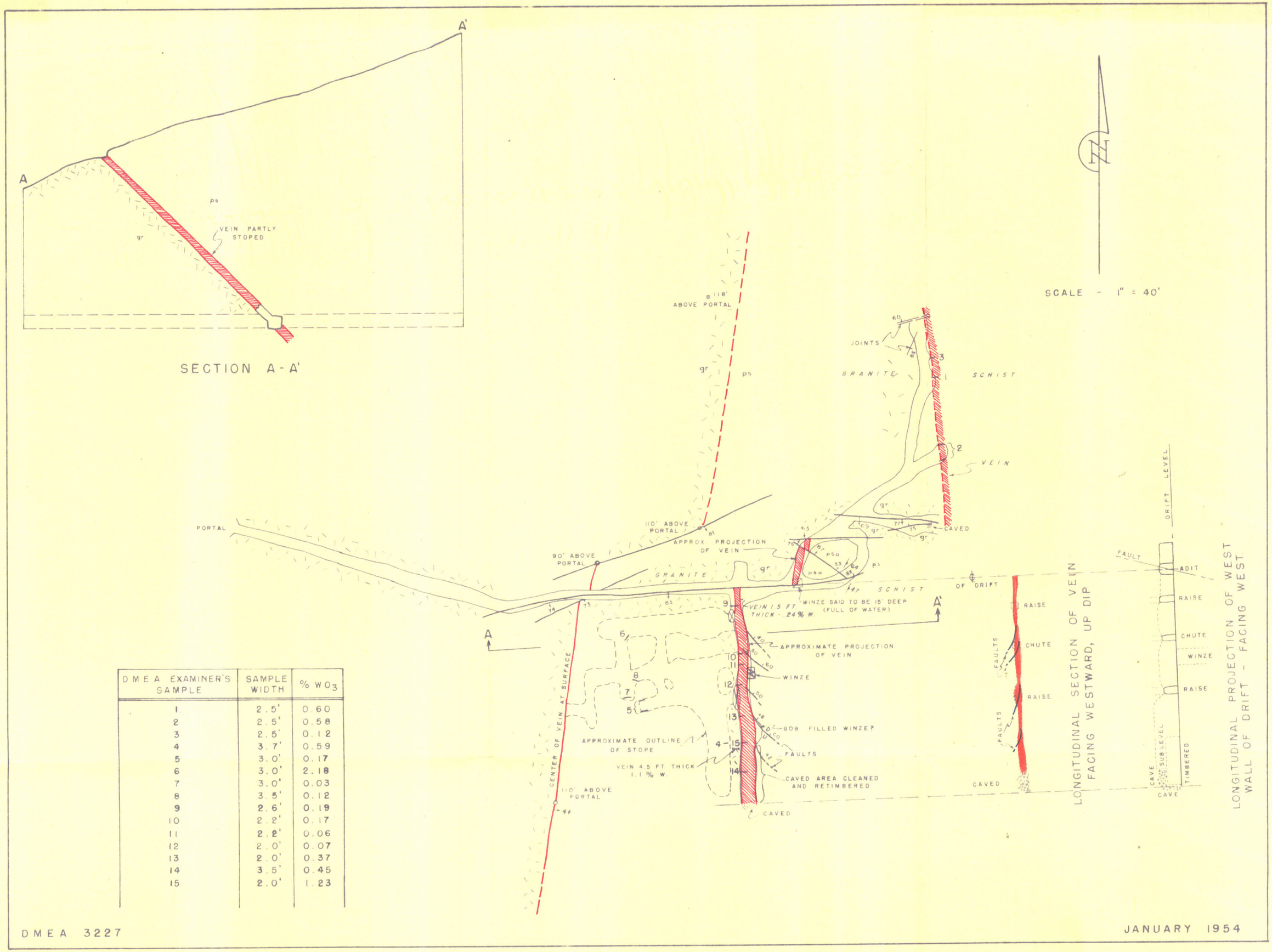
5	3.0'	0.17
6	3.0'	2.18
7	3.0'	0.03
8	3.5'	0.12
9	2.6'	0.19
10	2.2'	0.17
11	2.2'	0.06
12	2.0'	0.07
13	2.0'	0.37
14	3.5'	0.45
15	2.0'	1.23

FIGURE 3. - GEOLOGIC MAP OF THE TUNGSTEN KING MINE
COCHISE COUNTY, ARIZONA



DMEA EXAMINER'S SAMPLE	SAMPLE WIDTH	% WO_3
1	2.5'	0.60
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3	2.5'	0.12
4	3.7'	0.59
5	3.0'	0.17
6	3.0'	2.18
7	3.0'	0.03
8	3.5'	0.12
9	2.6'	0.19
10	2.2'	0.17
11	2.2'	0.06
12	2.0'	0.07
13	2.0'	0.37
14	3.5'	0.45
15	2.0'	1.23

FIGURE 3. - GEOLOGIC MAP OF THE TUNGSTEN KING MINE
COCHISE COUNTY, ARIZONA

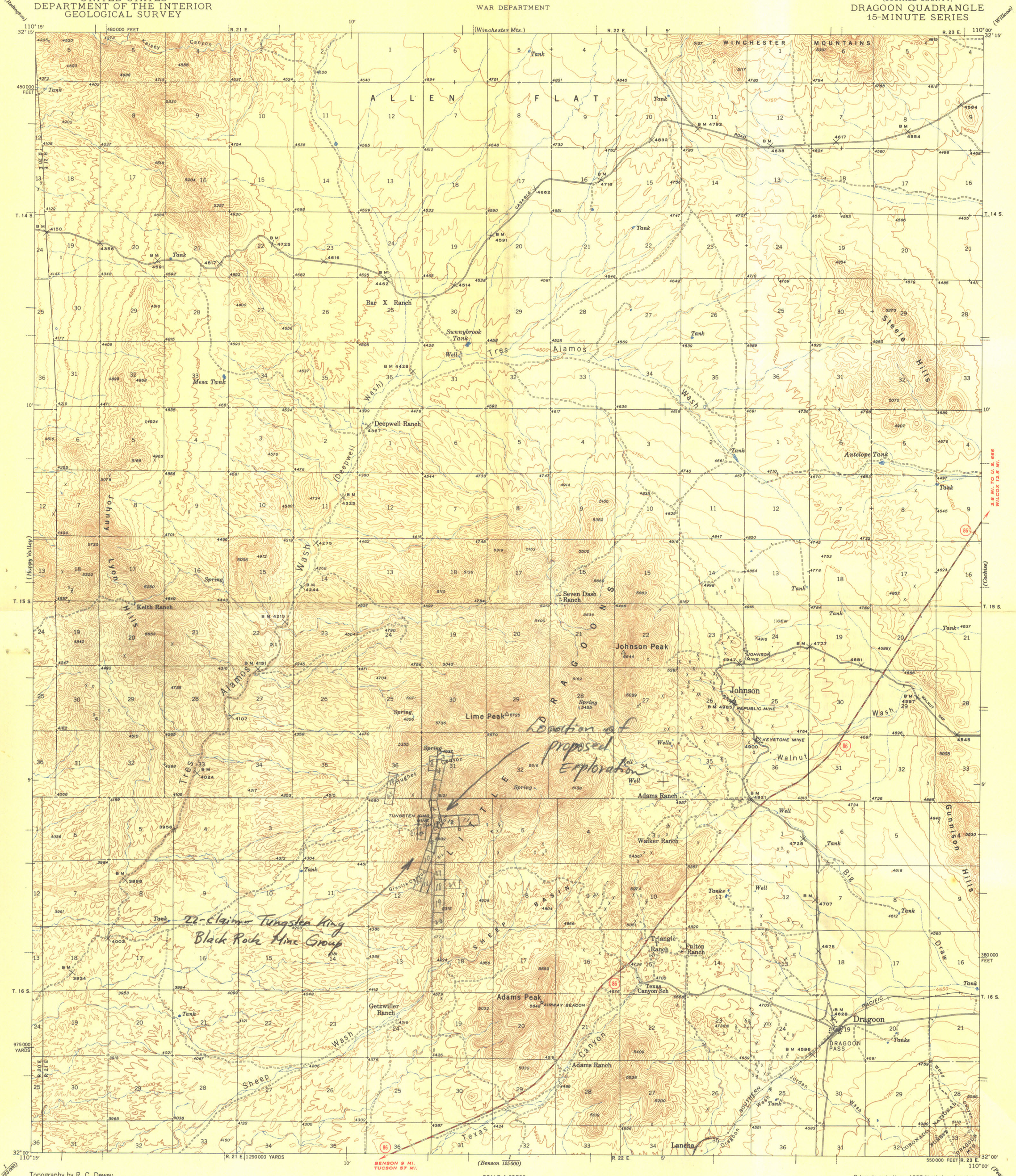
Exh. F

B M&U-3227

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WAR DEPARTMENT

ARIZONA
(COCHISE COUNTY)
DRAGOON QUADRANGLE
15-MINUTE SERIES



Topography by R. C. Dewey,
C. C. Cooper, and K. A. Bunker

Surveyed in 1940–41

ROAD CLASSIFICATION

HARD-SURFACE ALL WEATHER ROADS		DRY WEATHER ROADS
Heavy-duty	4 LANE 2 LANE	Improved dirt
Medium-duty	4 LANE 2 LANE	Unimproved dirt
Loose-surface, graded, or narrow hard-surface		

U. S. Route State Route

TRUE NORTH
MAGNETIC NORTH
14°
APPROXIMATE MEAN DECLINATION, 1941

SCALE 1:62500

1 ½ 0 1 2 3 4 MILES

3000 0 3000 6000 9000 12000 15000 18000 21000 FEET

1 .5 0 1 2 3 4 5 KILOMETERS

Contour interval 50 feet
Datum is mean sea level

Polyconic projection. 1927 North American datum
5000 yard grid based on U. S. zone system, F
10000 foot grid based on Arizona (East)
rectangular coordinate system

DRAGOON, ARIZ.
Edition of 1943
reprinted 1948
N3200—W11000/15

15

THE TOPOGRAPHIC MAPS OF THE UNITED STATES

The United States Geological Survey is making a series of standard topographic maps to cover the United States. This work has been in progress since 1882, and the published maps cover more than 47 percent of the country, exclusive of outlying possessions.

The maps are published on sheets that measure about 16½ by 20 inches. Under the general plan adopted the country is divided into quadrangles bounded by parallels of latitude and meridians of longitude. These quadrangles are mapped on different scales, the scale selected for each map being that which is best adapted to general use in the development of the country, and consequently, though the standard maps are of nearly uniform size, the areas that they represent are of different sizes. On the lower margin of each map are printed graphic scales showing distances in feet, meters, miles, and kilometers. In addition, the scale of the map is shown by a fraction expressing a fixed ratio between linear measurements on the map and corresponding distances on the ground. For example, the scale $\frac{1}{62,500}$ means that 1 unit on the map (such as 1 inch, 1 foot, or 1 meter) represents 62,500 of the same units on the earth's surface.

Although some areas are surveyed and some maps are compiled and published on special scales for special purposes, the standard topographic surveys and the resulting maps have for many years been of three types, differentiated as follows:

1. Surveys of areas in which there are problems of great public importance—relating, for example, to mineral development, irrigation, or reclamation of swamp areas—are made with sufficient detail to be used in the publication of maps on a scale of $\frac{1}{31,680}$ (1 inch = one-half mile) or $\frac{1}{24,000}$ (1 inch = 2,000 feet), with a contour interval of 1 to 100 feet, according to the relief of the particular area mapped.

2. Surveys of areas in which there are problems of average public importance, such as most of the basin of the Mississippi and its tributaries, are made with sufficient detail to be used in the publication of maps on a scale of $\frac{1}{62,500}$ (1 inch = nearly 1 mile), with a contour interval of 10 to 100 feet.

3. Surveys of areas in which the problems are of minor public importance, such as much of the mountain or desert region of Arizona or New Mexico, and the high mountain area of the northwest, are made with sufficient detail to be used in the publication of maps on a scale of $\frac{1}{125,000}$ (1 inch = nearly 2 miles) or $\frac{1}{250,000}$ (1 inch = nearly 4 miles), with a contour interval of 20 to 250 feet.

The aerial camera is now being used in mapping. From the information recorded on the photographs, planimetric maps, which show only drainage and culture, have been made for some areas in the United States. By the use of stereoscopic plotting apparatus, aerial photographs are utilized also in the making of the regular topographic maps, which show relief as well as drainage and culture.

A topographic survey of Alaska has been in progress since 1898, and nearly 44 percent of its area has now been mapped. About 15 percent of the Territory has been covered by maps on a scale of $\frac{1}{500,000}$ (1 inch = nearly 8 miles). For most of the remainder of the area surveyed the maps published are on a scale of $\frac{1}{250,000}$ (1 inch = nearly 4 miles). For some areas of particular economic importance, covering about 4,300 square miles, the maps published are on a scale of $\frac{1}{62,500}$ (1 inch = nearly 1 mile) or larger. In addition to the area covered by topographic maps, about 11,300 square miles of southeastern Alaska has been covered by planimetric maps on scales of $\frac{1}{125,000}$ and $\frac{1}{250,000}$.

The Hawaiian Islands have been surveyed, and the resulting maps are published on a scale of $\frac{1}{62,500}$.

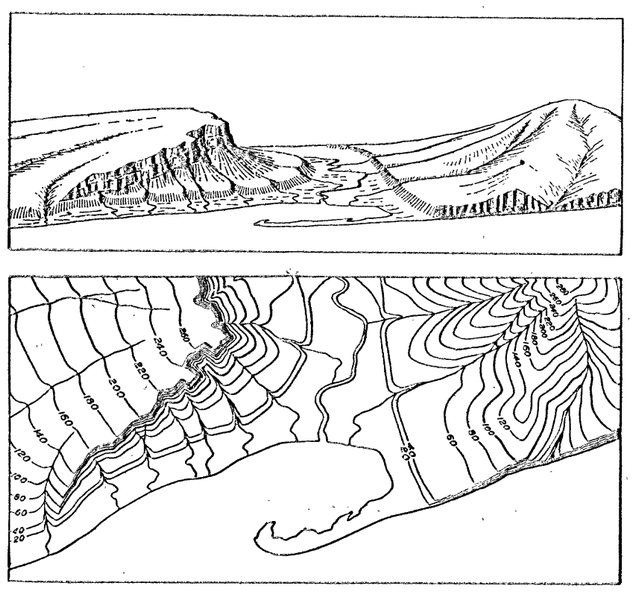
A survey of Puerto Rico is now in progress. The scale of the published maps is $\frac{1}{30,000}$.

The features shown on topographic maps may be arranged in three groups—(1) water, including seas, lakes, rivers, canals, swamps, and other bodies of water; (2) relief, including mountains, hills, valleys, and other features of the land surface; (3) culture (works of man), such as towns, cities, roads, railroads, and boundaries. The symbols used to represent these features are shown and explained below. Variations appear on some earlier maps, and additional features are represented on some special maps.

All the water features are represented in blue, the smaller streams and canals by single blue lines and the larger streams by double lines. The larger streams, lakes, and the sea are accentuated by blue water lining or blue tint. Intermittent streams—those whose beds are dry for a large part of the year—are shown by lines of blue dots and dashes.

Relief is shown by contour lines in brown, which on a few maps are supplemented by shading showing the effect of light thrown from the northwest across the area represented, for the purpose of giving the appearance of relief and thus aiding in the interpretation of the contour lines. A contour line represents an imaginary line on the ground (a contour) every part of which is at the same altitude above sea level. Such a line could be drawn at any altitude, but in practice only the contours at certain regular intervals of altitude are shown. The datum or zero of altitude of the Geological Survey maps is mean sea level. The 20-foot contour would be the shore line if the sea should rise 20 feet above mean sea level. Contour lines show the shape of the hills, mountains, and valleys, as well as their altitude. Successive contour lines that are far apart on the map indicate a gentle slope, lines that are close together indicate a steep slope, and lines that run together indicate a cliff.

The manner in which contour lines express altitude, form, and grade is shown in the figure below.



The sketch represents a river valley that lies between two hills. In the foreground is the sea, with a bay that is partly enclosed by a hooked sand bar. On each side of the valley is a terrace into which small streams have cut narrow gullies. The hill on the right has a rounded summit and gently sloping spurs separated by ravines. The spurs are truncated at their lower ends by a sea cliff. The hill at the left terminates abruptly at the valley in a steep scarp, from which it slopes gradually away and forms an inclined tableland that is traversed by a few shallow gullies. On the map each of these features is represented, directly beneath its position in the sketch, by contour lines.

The contour interval, or the vertical distance in feet between one contour and the next, is stated at the bottom of each map. This interval differs according to the topography of the area mapped: in a flat country it may be as small as 1 foot; in a mountainous region it may be as great as 250 feet. In order that the contours may be read more easily certain contour lines, every fourth or fifth, are made heavier than the others and are accompanied by figures showing altitude. The heights of many points—such as road intersections, summits, surfaces of lakes, and benchmarks—are also given on the map in figures, which show altitudes to the nearest foot only. More precise figures for the altitudes of benchmarks are given in the Geological Survey's bulletins on spirit leveling. The geodetic coordinates of triangulation and transit-traverse stations are also published in bulletins.

Lettering and the works of man are shown in black. Boundaries, such as those of a State, county, city, land grant, township, or reservation, are shown by continuous or broken lines of different kinds and weights. Public roads suitable for motor travel the greater part of the year are shown by solid double lines; poor public roads and private roads by dashed double lines; trails by dashed single lines. Additional public road classification if available is shown by red overprint.

Each quadrangle is designated by the name of a city, town, or prominent natural feature within it, and on the margins of the map are printed the names of adjoining quadrangles of which maps have been published. More than 4,100 quadrangles in the United States have been surveyed, and maps of them similar to the one on the other side of this sheet have been published.

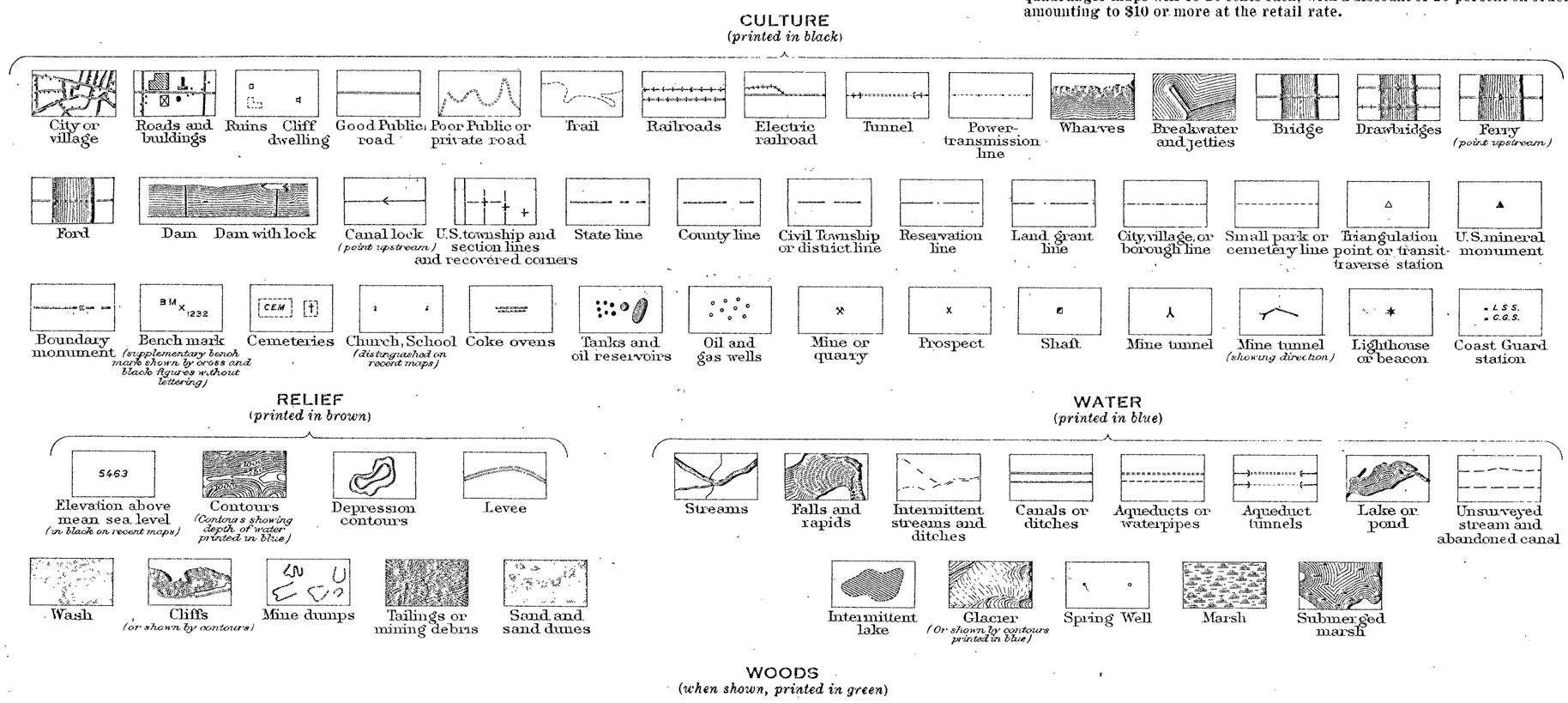
Geologic maps of some of the areas shown on the topographic maps have been published in the form of folios. Each folio includes maps showing the topography, geology, underground structure, and mineral deposits of the area mapped, and several pages of descriptive text. The text explains the maps and describes the topographic and geologic features of the country and its mineral products. Two hundred twenty-five folios have been published.

Index maps of each State and of Alaska and Hawaii showing the areas covered by topographic maps and geologic folios published by the United States Geological Survey may be obtained free. Copies of the standard topographic maps may be obtained for 10 cents each; some special maps are sold at different prices. A discount of 40 percent is allowed on an order amounting to $5 or more at the retail price. The discount is allowed on an order for maps alone, either of one kind or in any assortment, or for maps together with geologic folios. The geologic folios are sold for 25 cents or more each, the price depending on the size of the folio. A circular describing the folios will be sent on request.

Applications for maps or folios should be accompanied by cash, draft, or money order (not postage stamps) and should be addressed to

THE DIRECTOR,
United States Geological Survey,
Washington, D. C.

November 1937.

STANDARD SYMBOLS

NOTE:—Effective on and after October 1, 1946, the price of standard topographic quadrangle maps will be 20 cents each, with a discount of 20 percent on orders amounting to $10 or more at the retail rate.