3400 0021

(286)
Item 21

Supplementary Memorandum

on the

M. G. L. TUNGSTEN PROPERTY

Nightingale District, Pershing County, Nevada

T. B. Nolan (3)
D. M. Lemmon
S. G. Lasky
File

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY

M. R. Klepper
Assistant Geologist
August IO, I943

Supplementary Memorandum

on the

M. G. L. TUNGSTEN PROPERTY

Nightingale District, Pershing County, Nevada

Abstract

During July, the writer revisited the M. G. L. mining property in western Pershing County, Nevada, and mapped the geology of underground workings and of one surface area not previously mapped. During the first year of operation which ended August I, 22,500 tons of ore were milled and I0,050 units of WO_3 were recovered. A flotation unit has recently been added to the mill circuit. Recovery in the future may exceed 90%. Reserves total 7500 tons of measured ore, 6750 tons of indicated ore, and I2,250 tons of inferred ore, averaging about five tenths of a percent WO_3. About 50% of this reserve is in the South ore body of the mine area and 40% is in the North ore body

Underground work during the past eight months has developed a segment of the North ore body lying north of a post-mineral fault. Although most of the ore in this zone is very low grade, a 5 foot width of commercial grade is being stoped above the B level, and a zone of about the same width has been developed for a length of 40 feet on the C level. A level was driven to intersect the South ore body, 80 feet below the B level. This level passed directly from schist into granodiorite. A raise driven to the B level is in tactite from 25 feet above the lower level. Most of this tactite is non-commercial. Small lenses of ore have been prospected farther east on the property, but none of these contain any substantial tonnage of commercial ore.

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY

Introduction

D During November I942, the writer and C. M. Swinney made a geologic study of the M. G. L. mine area and submitted a memorandum in which the results of this study were summarized. In July, I943, the writer revisited the area and mapped (I), the geology of mine workings completed since November I942, and (2) the surface geology of a mineralized area one mile east of the Main ore body. Other areas in which scheelite occurs were examined with the aid of an ultraviolet lamp. Peter Joralemon assisted in this work, and C. W. Chesterman mapped, on airphoto base, the geology of the contact zone along which the tungsten deposits in the Nightingale District occur. This

area extends from the M. G. L. mill at the mouth of Cowles Canyon, eastward to the Meyer property near the crest of the range, and thence southward through the Nightingale and Garfield-Force properties.

Production

During the first year of operation, which ended August I, I943, about 22,000 tons of ore w ere milled and I0,050 units of WO_3 were recovered. At least 90% of this ore has come from the South ore body in the M. G. L. mine. Most of the remainder came from the North ore body; a few hundred tons from the Emerwell No. I claim. Flotation has recently been added to the mill circuit. Mr. John Goetzsche, mill Superintendent, anticipated that recovery will exceed 90%. Between five thousand and seven thousand tons of slime tails, reported to average almost 0.2% WO_3 will be retreated. Sand tails, since the beginning of the operation, have contained less than 0.I% WO_3.

Geology

The geology along the contact zone is shown on Plate 6. The geologic features of the entire zone are typified by the Mine area, described in the previous memorandum. Between the main granodiorite mass and the thick sequence of metasediments, there is usually a zone of intensely intruded metamorphic rocks. In some places blocks of metamorphic rocks are completely isolated by granite. The tungsten ore on the property occurs in altered calcareous rocks in the contact zone.

During the recent study the geology of a small area along the contact zone was mapped. (See Plate 5). Another area in which ore occurs was mapped by J. Emerson and J. Wells of the U. S. Corporation.(See Plate 4).

In both of those areas the scheelite occurs in metamorphosed calcareous beds that are either along the margin of the main belt of metasediments or in the pendants within the granite mass.

Scheelite Deposits

The nature of the deposits in the mine area ~~were~~ was described in the previous memorandum. The same general features are applicable to the deposits described in more detail in the following paragraphs.

Mine area: South ore body.- About 25,000 tons of ore have been broken from the Main ore body between the B level and the surface. Mr. Glyachenkoff, mine Superintendent, believes that all ore above the B level will have been exhausted when 5000 tons remaining as pillars are mined. Although the average grade of tactite in the ore body is estimated to be 0.75% WO_3, the grade of ore milled has been only 0.5% WO_3. This variance is explained by the large volume of barren marble that was broken during stoping.

The A level, driven beneath the north end of the North ore body, passes directly from schist into granite. A raise, driven from the A level to the B level, is in tactite from 35 feet above the B level, but only a few small streaks of commercial ore occur in this tactite. The writer believes that this raise follows along the northwest margin of the ore body, not far from the granodiorite contact. If this belief is correct, the low values are not especially discouraging, for the grade is spotty near the contact on the B level and in the stope. The writer's interpretation of the continuation of this ore body beneath the B level is shown on revised sections A-A' and B-B'. If this interpretation is correct, between 5000 and 10,000 tons of ore may be inferred below the B level. probably average between 0.6 and 0.75% WO_3.

Mine area: North ore body.- The North ore body has been explored by the B and C Levels. A wide zone of tactite was found on the B level north of the Timoshenko fault. The writer believes that this tactite and the tactite south of the Timoshenko fault (see Plates 2 and 2-A) are part of the same belt of calcareous metasediments, and that the tactite zone exposed on the C level and at the surface is in the block overlying (north of) the Timoshenko fault. This interpretation is illustrated by section F-F' on Plate 3.

As pointed out in the previous memorandum, most of the ore south of the Timoshenko fault on the B Level is sub-commercial. A raise driven to the C Level starts in this zone. The raise is inaccessible at present, but it passes from tactite into schist at some point below the C Level, possibly at a branch of the Timoshenko fault. (See section F-F').

Low-grade, but probably commercial ore, is explored for a length of 45 feet on the C Level. Here a width of 5 feet may average 0.4% WO_3. This ore lies beneath the south end of the outcrop of the North ore zone in the position predicted by projection. It seems likely that the northern part of the zone extends more or less continuously from the surface to the B level, as shown in Plate 3, section E-E'. Two stopes have been started in this zone above the B level, and it is possible that a zone 100 feet long and 4 to 8 feet wide may yield ore averaging 0.4 to 0.5% WO_3. If this zone is more or less continuous from the B level to the outcrop, it may contain between 5000 and 10,000 tons of ore. After the C level has been driven northward to intersect the projected position of this zone, an estimate of the tonnage and grade of ore contained can be made with more assurance.

Central ore zone: The geology of the central ore zone was mapped by John Emerson and John Wells of the M. G. L. Corp. (See Plate 4). The writer made minor changes on this map, and examined all tactite showings under ultra-violet light.

The area is underlain by granodiorite, containing a few small pendants of schist and metamorphosed calcareous sediments. Several lenses of tactite occur in the calcareous metasediments, but in only two pendants, those labeled A and B, is there any ore of commercial grade.

About half of the exposed area of pendant A is tactite. Most of the ~~contact~~ tactite is a dense, dark brown garnet rock containing only scattered crystals of scheelite. Narrow beds of coarse-grained tactite contain 0.5 to 0.75% WO_3. None of these zones are wide enough to be mined. At the southern tip of the pendant there is a small zone that may average 0.4% WO_3.

The dimensions of pendant B are 30 x 25 feet. About two thirds of the pendant is tactite. The remainder is barren calc-silicate hornfels and quartzose contact rock. Half of the tactite portion averages better than 2.0% WO_3. The other half is low grade.

The pendant probably contains 50 tons of 1.5% WO_3 ore per foot of depth. It is probably cut off by granite at a shallow depth, and, if so, contains only several hundred tons of ore. If, however, it is the top of a larger pendant, it may contain a substantially larger tonnage of ore.

Emerwell No. I Claim: The Emerwell No. I claim covers the contact zone at the east end of the property. On this claim, metamorphosed calcareous sediments lie within the contact zone. Scheelite has been deposited locally in the metasediments.

Zone I is a pendant of interbedded calc-silicate hornfels and tactite. The calc-silicate hornfels, a fine-grained white and brown rock, probably consisting of tremolite, quartz, calcite, and diopside, predominates. Scheelite is disseminated through the tactite beds, and occurs along cracks in the hornfels. Scheelite occurs throughout the pendant but its distribution is spotty. The type of mineralization resembles, but is lower grade than, the main Meyer ore body, a mile farther to the east along the same contact.

The most promising zones have been blasted to a depth of about three feet, and a reasonable estimate of grade of ore can be made by examining under ultra-violet light. It is estimated that the entire zone may average 0.2% WO_3. Zones that are probably too small to mine profitably by underground or open cut methods may average five tenths of a percent WO_3. The pendant probably contains 700 or 800 tons of mineralized rock per foot of depth, but the tonnage of commercial ore is small and scattered.

Zone 2 is along the margin of the main metasedimentary belt, but in other respects resembles Zone I. It is probable that the granodiorite mass expands downward and cuts off the calcareous metasediments at a relatively shallow depth. Narrow tactite streaks contain 1.0% WO_3, but no zone that could be mined averages more than 0.2% WO_3.

Zone 3 also lies in calcareous metasediments along the granodiorite contact. 200 tons of ore were mined from an open cut on the best showing of ore. No assays of the mill heads were made, but Mr. Emerson estimates that the ore averaged between 0.4 and 0.5% WO_3. The floor of the open cut is covered with broken rock, but Mr. Emerson states that the circular ore body continues into the floor. A few beds of tactite are interbedded with the calc-

silicate hornfels bordering the open cut, but the amount of scheelite is small. An area southwest of the cut is covered with low-grade ore float, but most of it appears to have been blasted from the cut. In this float-covered area, bedrock mineralized with scheelite is exposed in a few places, and some commercial ore may occur.

It is not likely that more than a few hundred tons of ore will be produced from the Emerwell claims

Other mineralized areas.- Scheelite has been deposited in altered calcareous sediments at several other places along the contact between the mine and the east end of the property. The two best areas examined by the writer lie between the mine area and the Central ore zone.

An open cut south of the canyon road exposes 9 feet of layered tactite averaging between 0.4 and 0.5% WO_3. The zone has a granodiorite footwall, and granodiorite crops out within 50 feet of the projected strike of the ore to the north. The ore lens is probably short, but trenches should be dug across its projected strike to determine the length, average width, and grade.

On the steep hill slope north of the road, tactite from 2 to 6 feet wide borders calcareous metasediments for 75 feet along the granodiorite contact. It is estimated that, of this, a lens 50 feet long, and one and a half feet wide, may average 0.5% WO_3.

Ore Reserves

Area	Ore Body	Measured Tons	Measured % WO_3	Measured Units	Indicated Tons	Indicated % WO_3	Indicated Units	Inferred Tons	Inferred % WO_3	Inferred Units	Total Tons	Total Units
Mine Area	South											
	Above B level	6,000*	0.5	3,000	1,000**	0.5	500				7,000	3,500
	Below B level				1,000	0.6	600	6,000	0.6	3,600	7,000	4200
	Total	6,000		3,000	2,000		1,100	6,000		3,600	14,000	7700
	North											
	South of fault	500	0.3	150	1500	0.3	450	2000	0.3	600	4000	1200
	North of fault											
	B to C level	500	0.4	200	2000	0.4	800	2000	0.4	800	4500	1800
	C to surface	500	0.5	250	1000	0.5	500	1000	0.5	500	2500	1250
	Total	1,500		600	4,500		1,750	5,000		1,900	11,000	4,250
Central Ore Zone	Zone A	Zones of commercial grade are too small to be mined										
	Zone B				250	1.5	375	500	1.5	750	750	1,125
Emerwell No. 1 Claim	Zone 1	Zones of commercial grade are probably too small to be mined.										
	Zone 2	Zones of commercial grade are probably too small to be mined.										
	Zone 3							250	0.4	100	250	100
Other Small Lenses								500	0.4	200	500	200
Grand Total		7,500		3,600	6,750		3,225	12,250		6,550	26,500	13,375

* Broken ore and pillars

** Pillars

PLATE I

3400 0021

Item 21

GEOLOGIC AND TOPOGRAPHIC MAP of THE M.G.L. MINE AREA

PERSHING COUNTY, NEVADA

M.R. KLEPPER U.S. GEOLOGICAL SURVEY
C.M. SWINNEY NOVEMBER 1942

SCALE

0 5 10 20 30 40 50 60 70 80 90 100 200 Feet.

DATUM ASSUMED CONTOUR INTERVAL 10'

EXPLANATION

- Granodiorite detritus.
- Granodiorite. Including pegmatite.
- Schist with lit-par-lit intrusions of granodiorite.
- Granodiorite with hornfels inclusions.
- Schist and Slate.
- Hornfels.
- Marble.
- T — Tactite. T_H = Hornfelsic Tactite. T_P = Pyroxene-rich Tactite. T_Q = Quartz-rich Tactite. Density of color indicates approximate grade of ore.
- C — Quartzose Intrusives containing garnet and epidote.
- Faults.
- Contacts - Located
- Contacts - Approximate
- Contacts - Gradational
- Underground Workings.
- "A" Level, EL. 4917'
- "B" Level, EL. 5000'
- "B½" Level, EL. 5031'
- "B⅔" Level, EL. 5062'
- "C" Level, EL. 5091'

Revised to July 20, 1943

3A00 0021

286

Item 21

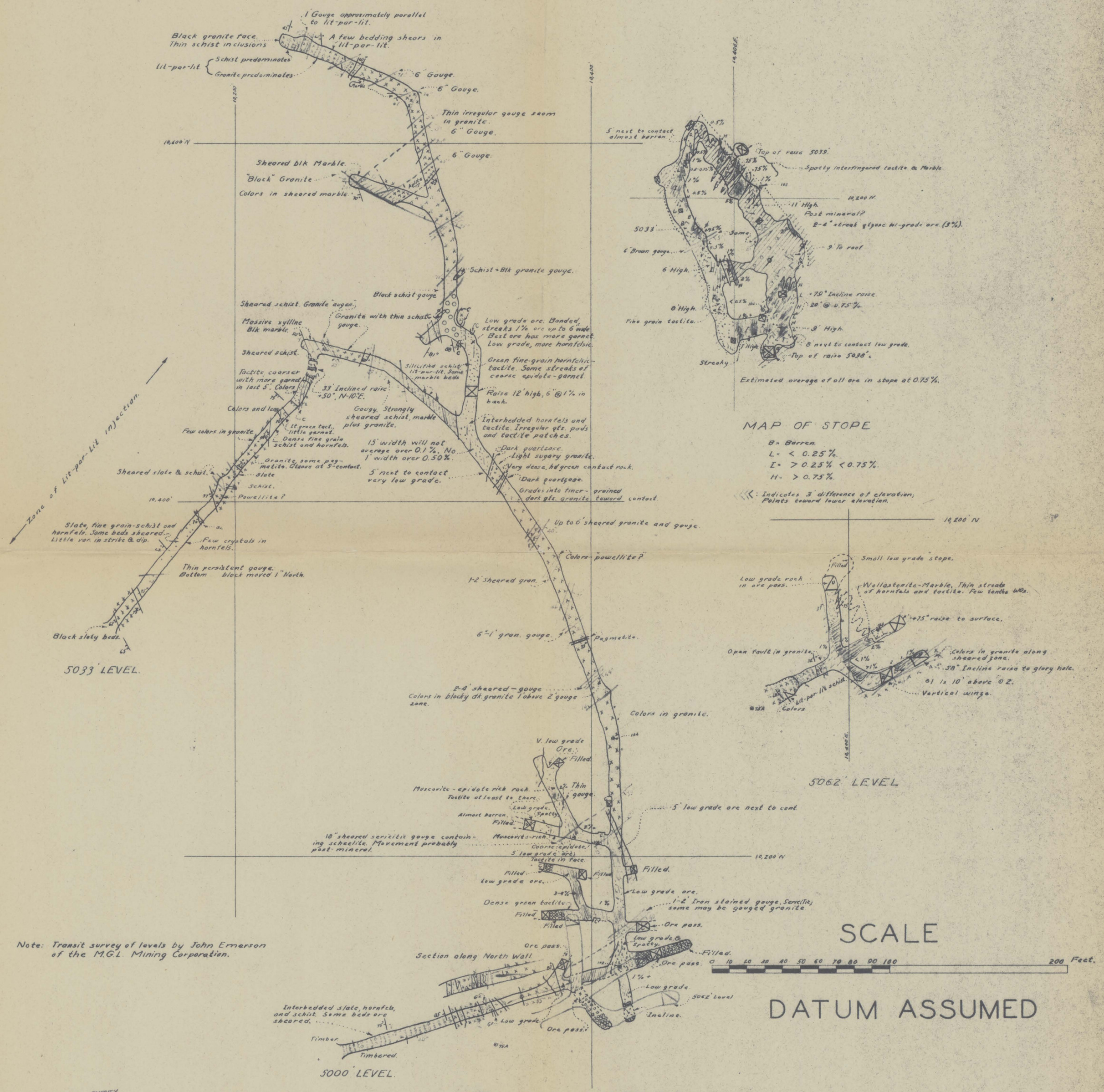
PLATE 2

GEOLOGIC MAP of THE M. G. L. MINE WORKINGS

PERSHING COUNTY, NEVADA

M. R. KLEPPER U.S. GEOLOGICAL SURVEY
C. M. SWINNEY

NOVEMBER 1942



3400 0021 (286) Item 21

PLATE 2-A

MAP OF THE M.G.L. MINE WORKINGS*

SHOWING GEOLOGY OF WORKINGS

COMPLETED SINCE NOVEMBER 1942

PERSHING COUNTY, NEVADA

M.R. KLEPPER — P. JORALEMON

U.S. GEOLOGICAL SURVEY — JULY 1943

SCALE

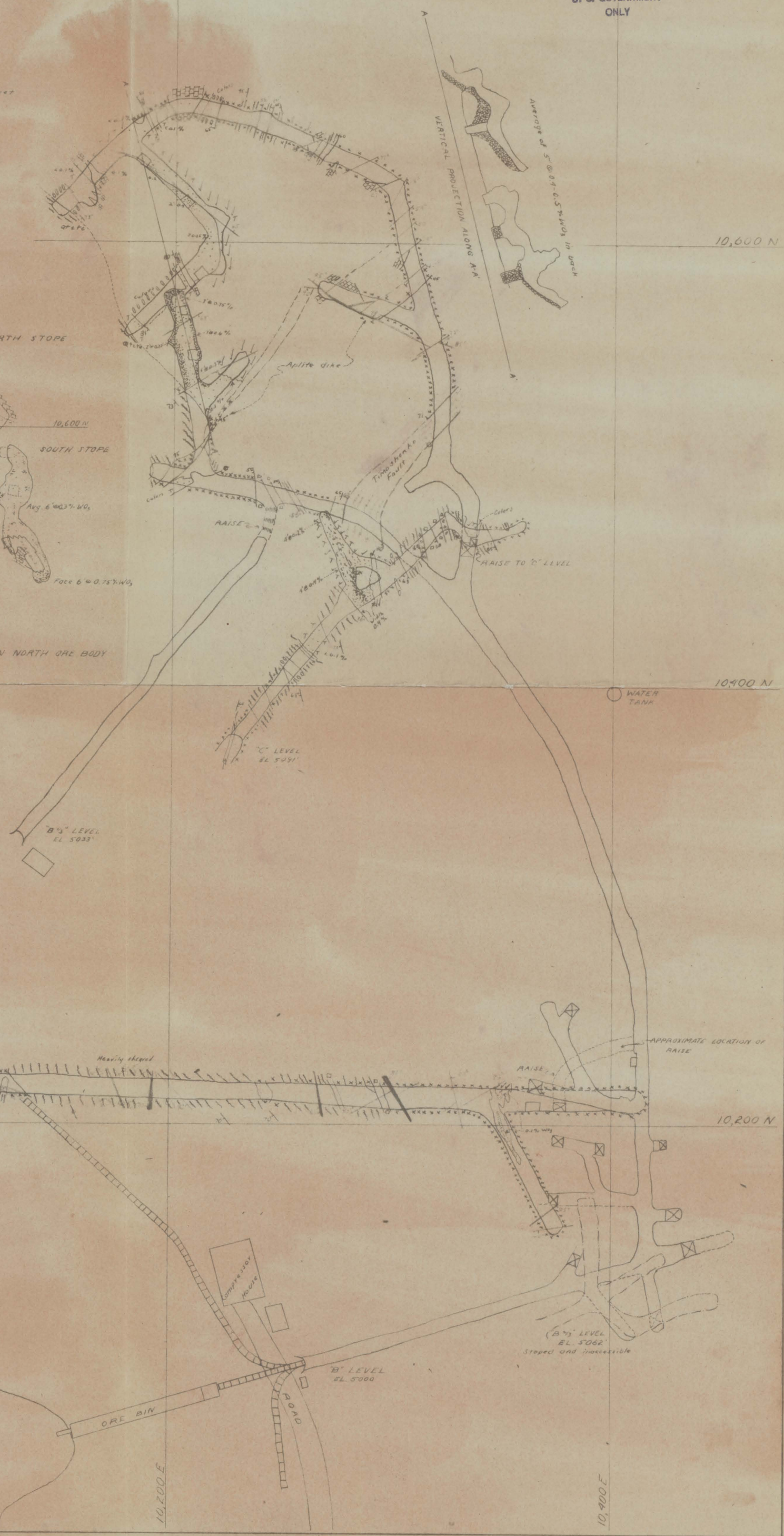
0 25 50 100 150 200 feet

EXPLANATION

- Schist, slate, and quartzite
- Marble and limestone
- Calc-silicate hornfels, locally containing a little scheelite
- Tactite - concentration of dots shows estimated grade in range from 0.0 - 1.0% WO_3
- Quartzose contact rock
- Altered basic dike
- Granodiorite and aplite
- Contact
- Contact, projected
- Fault

* Supplement to Plate 2

GEOLOGIC PLAN OF STOPES IN NORTH ORE BODY



SECTIONS TO ACCOMPANY

GEOLOGIC MAP OF M.G.L. MINE AREA

PERSHING COUNTY NEVADA

M.R. KLEPPER U.S. GEOLOGICAL SURVEY, JULY, 1943

SCALE

EXPLANATION

Tactite: concentration of dots indicates approximate grade in range between 0.00 and 1.5% WO_3

Schist and slate

Calc-silicate hornfels

Limestone and marble

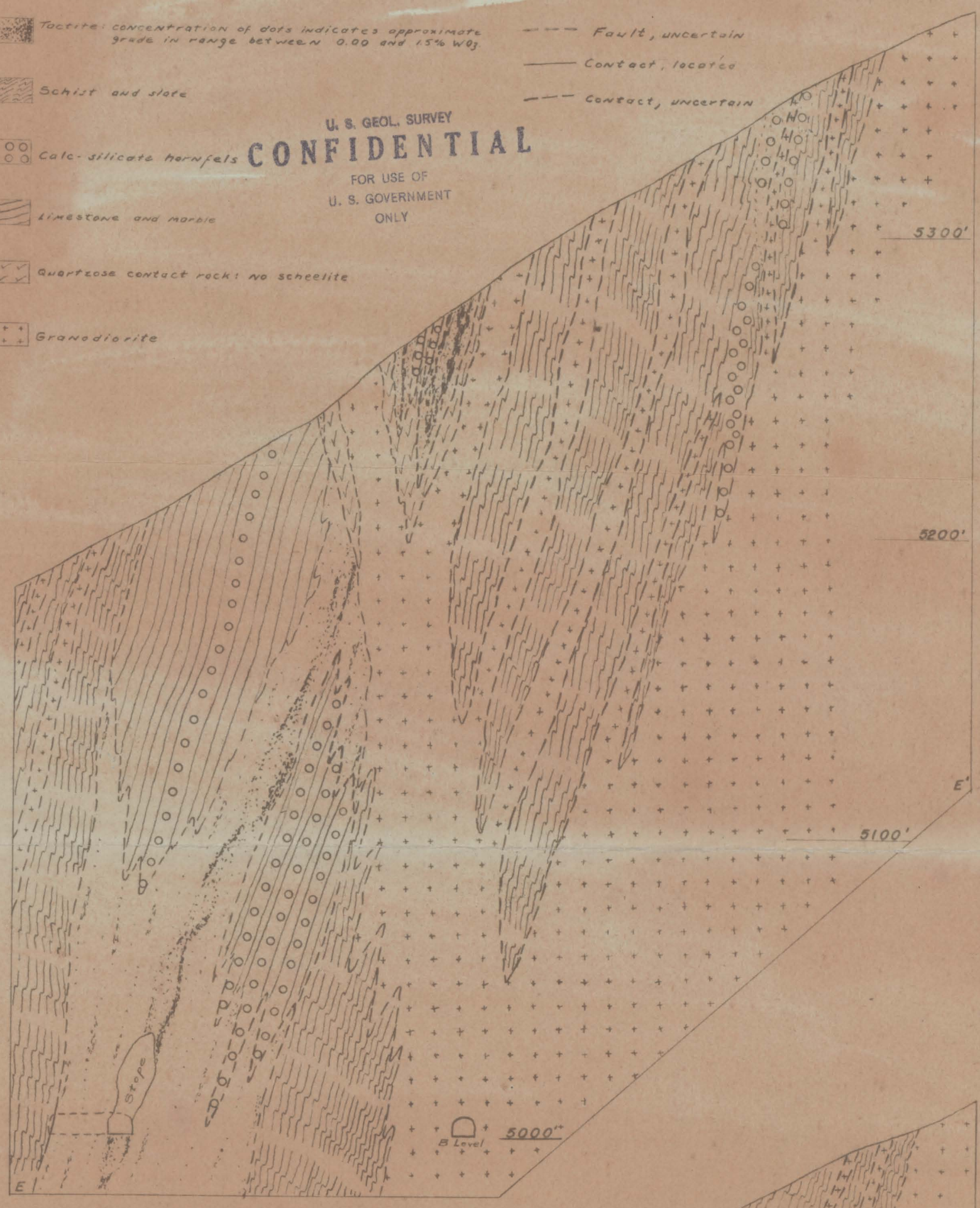
Quartzose contact rock: no scheelite

Granodiorite

Fault, uncertain

Contact, located

Contact, uncertain



SECTION ALONG E-E'

SECTION ALONG F-F'

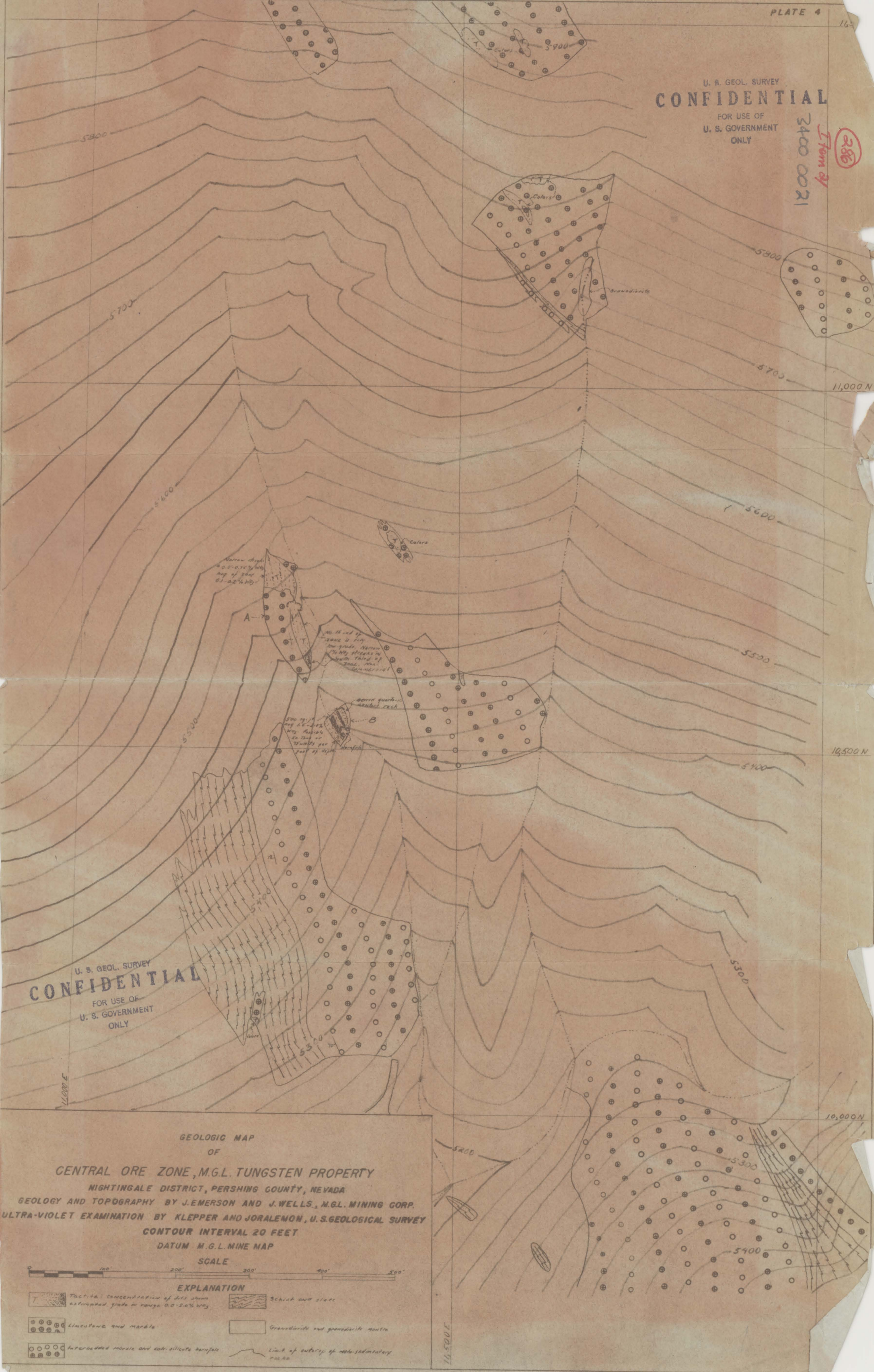

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY
3400 0021
Colors
Granodiorite
5900
5800
5700
5600
5500
5400
5300
11,000 N
10,500 N
10,000 N
11,000 E
11,500 E
A
B
GEOLOGIC MAP
OF
CENTRAL ORE ZONE, M.G.L. TUNGSTEN PROPERTY
NIGHTINGALE DISTRICT, PERSHING COUNTY, NEVADA
GEOLOGY AND TOPOGRAPHY BY J. EMERSON AND J. WELLS, M.G.L. MINING CORP.
ULTRA-VIOLET EXAMINATION BY KLEPPER AND JORALEMON, U.S. GEOLOGICAL SURVEY
CONTOUR INTERVAL 20 FEET
DATUM M.G.L. MINE MAP
SCALE
0 100' 200' 300' 400' 500'
EXPLANATION
Tactite: concentration of dots shows estimated grade in range 0.0-2.0% WO3
Limestone and marble
Interbedded marble and calc-silicate hornfels
Schist and slate
Granodiorite and granodiorite mantle
Limit of outcrop of meta-sedimentary rocks

PLATE 5

GEOLOGIC MAP
OF
PART OF THE EMERWELL NO.1 CLAIM

M.G.L. MINING CORPORATION

NIGHTINGALE DISTRICT, PERSHING COUNTY, NEVADA

M.R. KLEPPER — P. JORALEMON

U.S. GEOLOGICAL SURVEY — JULY 1943

CONTOUR INTERVAL 10 FEET

DATUM BY ANEROID FROM M.G.L. MINE

SCALE

PLATE 6

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY

RECONNAISSANCE MAP OF THE CENTRAL NIGHTINGALE RANGE

SHOWING GEOLOGY IN VICINITY OF KNOWN SCHEELITE DEPOSITS

CHURCHILL, PERSHING, AND WASHOE COUNTIES, NEVADA

C. W. CHESTERMAN U. S. GEOLOGICAL SURVEY

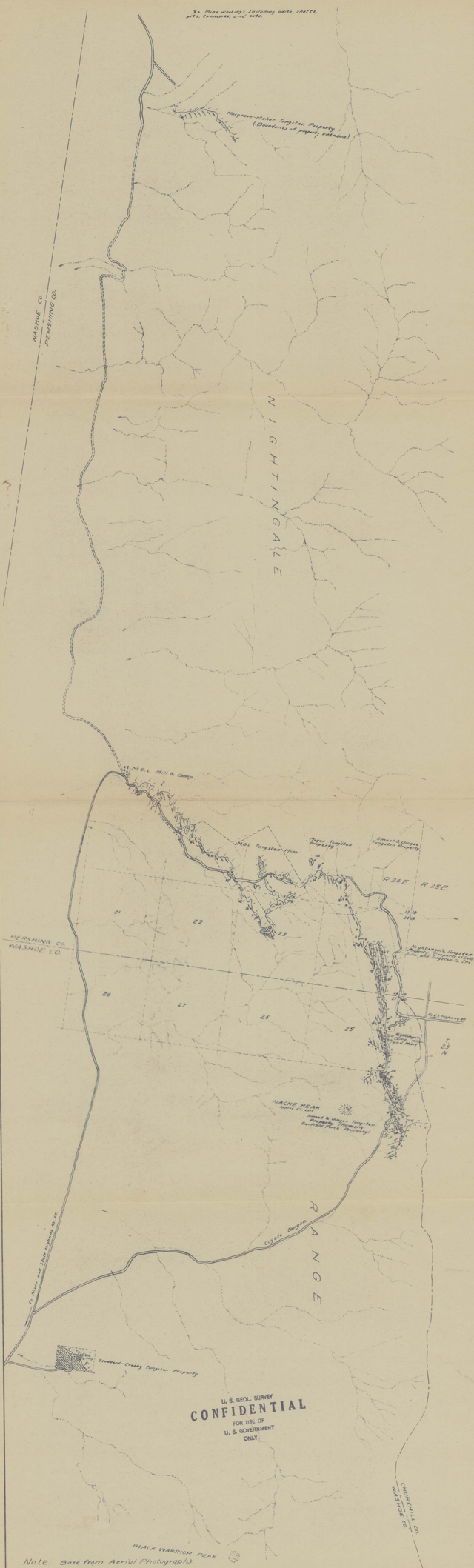
JULY 1943

SCALE (Approximate)

0 1000 2000 3000 4000 Feet

EXPLANATION

- Quartz flows, breccia, tuff and tuffaceous conglomerate.
- Limestone and marble.
- Granodiorite and related intrusive rocks.
- Hornfels.
- Rhyolite.
- Schist and slate.



Note: Base from Aerial Photographs.

3400 00 21

286

J Ham 21

3400 0021

286 A
Item 21

Report on the

M. G. L. MINE (TUNGSTEN)

Pershing County, Nevada

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY

Nolan (2)
Lemmon
Lasky
Allen (2)
File (M. R. Klepper)

M. R. Klepper
Assistant Geologist
U.S. Geological Survey
December 11, 1942

CONTENTS

Report on the
M. G. L. MINE
Pershing County, Nevada

ABSTRACT

The M. G. L. mine is in the west flank of the Nightingale Range, western Pershing County, Nevada, nineteen miles by road north of Nixon.

Two scheelite ore bodies and a number of zones of low grade scheelite mineralization occur in the zone of intense contact metamorphism between granodiorite and marble and hornfels beds. The South ore body is an irregular tactite pipe. 7700 tons of 0.6% WO_3 ore have already been mined from it, and between 15,000 and 17,500 tons of ore of the same grade are blocked out. It is likely that an equal amount of ore will be found below the present workings. The North body is an irregular rim of low grade tactite ore surrounding a block of marble and hornfels beds. One small shoot of 1.0% WO_3 ore is known, and others will probably be found. This body is expected to yield between 2,000 and 7,000 tons of ore averaging between 0.75% and 1.0% WO_3.

Development of the mine was started in the spring of 1942. The first ore was milled in August; by the end of November 7,735 tons of ore had been milled and 3617 units of WO_3 recovered.

INTRODUCTION

The writer's study of the M. G. L. mine between November 5 and 19, 1942, was part of the strategic-mineral investigation program of the U. S. Geological Survey. A geologic and topographic map of the area in the vicinity of the mine was made, geology was plotted on a map of the underground workings made by the company engineer, and the stope in the South ore body was mapped. In this work the writer was capably assisted by C. M. Swinney. Most of the maps were drafted by C. W. Chesterman. Mr. Arthur Letts, Jr. granted permission to study the property, and the staff at the mine cordially cooperated with the writer during this study.

LOCATION

The M. G. L. property is on the west flank of the Nightingale (Truckee) Range in the Nightingale Mining District, southwestern Pershing County, Nevada. The mine is on the steep north side of Cowles Canyon, three miles east of the dry bed of Lake Winnemucca. In the area mapped elevations vary between 4900' and 5500'.

The camp and mill are 16½ miles north of Nixon, Washoe County, Nevada via a graded dirt road which follows the eastern shore of the dry lake. A 2½ mile graded dirt road follows the canyon to the mine. Fernley, 20 miles southeast of Nixon by surfaced road, is the nearest freight depot.

Only unusually severe weather will impede production, for the company is equipped to keep the road between the mine and the mill open, even during heavy snow storms.

PERTINENT FACTS ABOUT THE PROPERTY

Ownership.- This property was owned for a number of years by C. R. Cowles and associates (1). About a year ago it was acquired by the M. G. L. Mining Corp. (2). Members of the mine staff assert that Mr. Letts has spent at least $300,000 to construct the mill and camp, equip the mine, and develop the South ore body.

Production.- Hess and Larsen state that " about 80 tons of ore milled in 1918 gave approximately 1.28% WO_3" (p.285). I can find no record of any other production until the property was acquired by the M. G. L. Mining Corp. This company has been milling ore since August 1942, and has recovered 3617 units of WO_3. (See appendix for tabulation of production). This concentrate has been stockpiled at the mill and will be retreated in the magnetic separator before it is sold. There is enough ore blocked out between the surface and the 5000' level to assure a production of between 1000 and 1500 units of WO_3 per month until July 1943. There has been no exploration done below the 5000' level.

Mine equipment and workings.- The mine is equipped with the most modern machinery, including a model 1500-K Ingersoll-Rand compressor, a mucking machine, a bulldozer, and a Caterpillar loader. Mine workings comprise about 1100' of drifts and cross cuts on three levels, a few hundred feet of raises, a stope from which 3000 tons of ore have been mined, and a glory hole whose dimensions are 40' x 30' x 20' deep.

(1). It was called the Cowles property by Hess and Larsen in U. S. G. S. Bull. 725-D, pp. 283-285.

(2). M. G. L. Mining Corp., Arthur Letts, Jr., Pres., 301 Subway Terminal Bldg., Los Angeles, California.

Mill.- The mill and camp are at the mouth of Cowles Canyon, 2½ miles west of the mine by road. Ample water for milling is supplied by a well in the dry lake bed, half a mile west of the mill. Water for domestic use is hauled from Wadsworth.

The mill is equipped with a primary crusher, rod mill, classifier, eight tables, and a magnetic separator. Electric power is produced by three diesel generators. Recently Mr. Letts and Mr. Roy Hardy, Consulting Engineer, have been considering the advisability of adding flotation cells.

7735 tons of ore have been milled since the operation started in August 1942. During October and November an average of 90 tons of ore was milled daily. 72,341 pounds of WO_3, an average of 9.4 pounds per ton, have been recovered. There is not enough assay information to calculate the average recovery, but it is believed to be between 80% and 85%.

GEOLOGY

Rock units.- The area mapped is along the intrusive contact zone between granodiorite and a thick sequence of somber-colored, mildly metamorphosed argillaceous and calcareous sedimentary rocks (3).

The metamorphic sequence consists of slate, argillite, hornfels, marble, and fine-grained biotite schist. It underlies the southwestern part of the map area and extends west to the steep front of the range, a distance of 2½ miles, and at least as far south.

(3). The metamorphic sequence and the granodiorite are believed to be continuous with similar rocks on the east side of the range, which were described by Ward Smith in U. S. G. S. Bull. 936-B, pp. 42-44, 1942.

Between the mildly metamorphic sequence and the granodiorite lies a contact zone, averaging 300' wide, in which intrusion is complex and metamorphism more intense. Areas of schist and slate are invaded parallel to the bedding by many granodiorite tongues; areas of marble and hornfels are cut into irregular-shaped blocks by granodiorite dikes. The downward extension of these blocks is probably as irregular as their outcrop. (See geologic map and sections enclosed). Clusters of wollastonite and tremolite are common in the marble. Tactite has been formed around the margins of part of the marble belt, and in some places as far as 50' from a granodiorite contact.

The granodiorite is a gray crystalline rock of medium-coarse grain. Plagioclase, orthoclase, and quartz are the most abundant minerals. Biotite and hornblende make up about 10% of the rock. Most surface exposures have been stained light brown by weathering of the iron-bearing minerals. Lenses and irregular patches of pegmatite are common near the margin of the main mass. A few aplite dikes cut the metamorphic rocks in the area mapped. One of these can be followed to the main granodiorite contact where it blends with the granodiorite and loses its identity.

Almost all of the tactite bodies are separated from granodiorite by dikes of an unusual intrusive rock. Narrow tongues of this rock also penetrate between tactite and the marble-hornfels sequence, and in a few places cut across marble and hornfels beds and granodiorite. Different specimens of this rock vary considerably in composition, but all exhibit a granitic texture and contain between 70% and 90% of quartz. Epidote, pyroxene, garnet and hornblende,

alone or in various conbinations, make up 10%-30%. Small amounts of pyrite, pyrrhotite, chalcopyrite, and molybdenite (?) occur locally. The rock is believed to be the solidified ressidue of the solutions that transformed marble to tactite. It had probably solidified before any scheelite was introduced. In the remainder of the report this rock will be called "quartzose intrusive".

Structure.- The metamorphic rocks strike northwest and dip steeply southwest. In the northwestern part of the area mapped, they curve gradually toward the west. Deviation from this prevailing attitude is found (1) in a few small pendants which have been rotated, and (2) in the roughly circular area, about 150' in diameter, that includes the South ore body.

The beds in the block containing the South ore body strike northeast and dip vertically or steeply northwest. (See map). This block has been revolved 90 degrees from the prevailing trend, but is separated from normally trending beds to the south and west by only a few feet of intrusive rock. Quartzose intrusive rock, varying from 1' to 20' wide, almost completely encircles the block. The main granodiorite lies to the north and east, and a narrow granodiorite tongue containing hornfels inclusions lies between the quartzose intrusion and the lit-par-lit beds to the south and west. The same peculiar structural features are found in the mine workings. No other marble has been found along the projection of the normal or anomalous strike to the south, east or west. No logical explanation for this structure has been evolved. It is almost impossible to postulate a fault that is in accord with all of the field evidence, On the other hand, if it is a rotated pendant, where is the southward continuation of the marble belt?

The main granodiorite contact trends northwest and, in general, parallels the strike of the metamorphic rocks. On the map this contact has been designated as arbitrary, and placed as closely as possible to the limit of hornfels inclusions and lit-par-lit beds. The downward course of the contact is probably as irregular as the surface trace. Dikes of granodiorite, pegmatite, and aplite intrude the metamorphic rocks. In the southwestern part of the area, they are few and small.

The metamorphic rocks and the granodiorite contact everywhere dip steeply, and so, in general, do the tactite bodies. For example, on the 5000' level the South ore body lies almost vertically beneath the outcrop, and on the same level, 250' north of the South ore body, a low grade tactite body lies almost vertically beneath the outcrop of another ore body.

Post-ore faults which displace the rocks a few feet are exposed on the surface and in the mine workings, but no fault of large displacement was found.

Contact metamorphism.- Metamorphism has been more intense near the contact than elsewhere. Near the contact limestone and argillaceous limestone has been altered to tactite and dense, dark-colored hornfels, which in some places grades into tactite along the strike. Farther from the contact wollastonite, tremolite and diopside marble and light-colored hornfels predominate. Biotite schist and slate are coarser-grained near the contact than elsewhere.

Tactite is the only rock in the area that contains worthwhile amounts of scheelite. Most of the tactite is a coarse-grained, green or brown rock. In general, quartz is the most abundant

mineral, followed in order by garnet, calcite, epidote, pyroxene, and more or less scheelite. Some tactite contains a little pyrite, pyrrhotite, chalcopyrite, and molybdenite. All of these minerals are unevenly distributed, so that selected specimens commonly show great differences in mineral composition. The most common variety in the South ore body contains about 40% quartz, 35% garnet, 10% calcite, 10% epidote, and 5% other minerals, including scheelite.

Garnet crystals vary from 0.1" to 3" in diameter, and from pale cinnamon to dark red in color. Some of the tactite is made up almost entirely of garnet. Pale green or gray epidote (or clinozoisite) prisms, not uncommonly 6" long, are most common in quartz-rich tactite. Scheelite crystals are colorless, gray, or cream-colored. Most of the crystals are equidimensional and range between 0.1" and 0.5" on a side, but broken pieces 3" square have been found in the ore bin. In most high grade ore specimens quartz predominates, epidote is common, and garnet is scarce. However, in average mill ore, garnet, next to quartz, i s the most common mineral.

ORE BODIES

Localization

In the vicinity of the contact between granodiorite and the marble-hornfels sequence part of the sedimentary rocks have been altered to tactite or heavy, dark-colored hornfels. At the contact almost all of the beds have been altered; farther from the contact only the most susceptible beds. Some of the tactite is scheelite ore; some contains low grade scheelite mineralization; some is barren. No clues to explain the erratic distribution of scheelite within the tactite bodies have been recognized.

South Ore Body

Size and shape.- The South ore body crops out as a semi-circular rim around a block of marble and hornfels. The widest part of this ore rim has been mined from the glory hole at the south end of the ore body. (See map) Between the surface and the 5000' level, an average depth of 125', the rim of tactite ore gradually encroaches upon the barren marble and hornfels core. On the 5000' level the ore body is elliptical and averages 130' long by 30' wide, about the same size as the entire marble-hornfels block at the surface. (See map of underground workings and sections). Seven thousand tons of ore have already been mined from this body. Between 15,000 and 17,500 tons remain above the 5000' level. No exploration has been done below this level, and there is little basis to predict what the size and shape of the body may be at depth.

Grade and reserves.- Estimates of grade of ore and reserves are based on the production record to date and detailed mapping of the ore body. 7735 tons of ore have been milled and 72,341 pounds of WO_3 recovered, and average of 9.4 pounds per ton. Part of this ore has been mined from the 5000' level, part from a stope level 35' higher, part from the glory hole, and part from connecting raises. Most of these workings have been driven to prepare the ore body for mining by the shrinkage method. They outline and cut across the ore body, but do not attempt to follow high grade zones.

It is my opinion that a block containing between 15,000 and 17,500 tons of ore that will yield between 9 and 10 pounds of WO_3

per ton can be mined from above the 5000' level. At the present rate of production, this ore would supply the mill until July 1943, and between 7000 and 8000 units of WO_3 would be recovered. If flotation cells are installed immediately, there is a chance to increase this recovery by 500 units.

The available assay information suggests that the recovery averages between 80% and 85%. Therefore, the grade of the 7735 tons of ore already mined has been between 0.55% and 0.60% WO_3. All of the tactite in this ore body probably averages 0.75% WO_3, but dilution with barren marble decreases the grade of the mill feed to the figure cited above.

The ellipse of ore on the 5000' level contains 400 tons of ore per foot of depth. If a body of the same dimensions is found in the adit that will soon be driven 75' below the 5000' level, 30,000 additional tons of ore will be indicated, enough to assure continuous handling of 90 to 100 tons daily until July 1944. No reliable estimate of reserves beneath the 5000' level can be made until this adit has been driven.

North Ore Body

Size and shape.- The North ore body is an irregular rim of tactite around a block of the same marble-hornfels beds. It is separated from the South ore body by a tongue of granite 200' wide. Only a few hundred tons of ore have been removed from surface cuts. None has been milled.

This rim averages about 5' wide and is estimated to average less than 0.5% WO_3. At the north end a zone 40' long by 15' wide may average 1.0% WO_3. In the 5000' level a low grade zone, 80'

long and 15' wide, has been exposed. It contains narrow streaks of 1.0% ore, but the entire body is estimated to average only 0.1% WO_3. It is believed to be a continuation of the ore body exposed at the surface. The information available suggests that this body is a discontinuous, elliptical, low grade rim which, here and there, contains small shoots of higher grade ore.

Grade and reserves.- No reliable estimates of grade or reserves can be made until this ore body has been explored more thoroughly. From the work done so far it seems likely that no large ore shoot which can be mined by shrinkage exists.

The shoot exposed at the north end at the surface probably contains 60 tons of 1% WO_3 ore per foot of depth and may yield a few thousand tons. If a few other shoots of comparable size and grade are found between 5000 and 10,000 tons of ore may be mined from this body.

Other Scheelite-bearing Bodies

The small pendants near the north edge of the map are too low in grade to be considered as potential ore. It is also likely that most of them terminate at shallow depth and contain only a small tonnage.

SUMMARY OF RESERVES

Ore body	Measurable and Indicated: Tons ore	Grade (% WO3)	Units WO3 at 80% rec'y.	Inferred: Tons ore	Grade (% WO3)	Units WO3 at 80% rec'y.
South	17,500	(1) 0.6	8400	15,000	(2) 0.6	7200
North	2,000	(3) 1.0	1600	5,000	(4) 0.75	3000
Total	19,500		10,000	20,000		10,200

(1). Above 5000' level.

(2). Below 5000' level.

(3). Shoot exposed on surface at north end of ore body.

(4). Undiscovered shoots.

RECOMMENDATIONS

I recommend that a member of the Geological Survey visit the M. G. L. property during the spring of 1943. At that time the underground geologic maps should be brought up to date and a larger surface area should be mapped. Aerial photographs of this area are available. The additional surface mapping is desirable, because it may lead to a clearer understanding of the structure in the vicinity of the mine, and because some zones of scheelite mineralization have not yet been mapped. The work in mind will require between two and four weeks.

APPENDIX

Production of

M. G. L. MINE

During 1942

	August	September	October	November	Total
Dry tons ore milled	737	1502	2876	2620	7735
Pounds conc. produced	17,563	30,063	43,894	26,814	118,334
Assay, % WO_3	60	60	60	65	61
Units WO_3 produced	526.9	901.9	1316.8	871.45	3617.05

(286)
Item 21

3400 0021

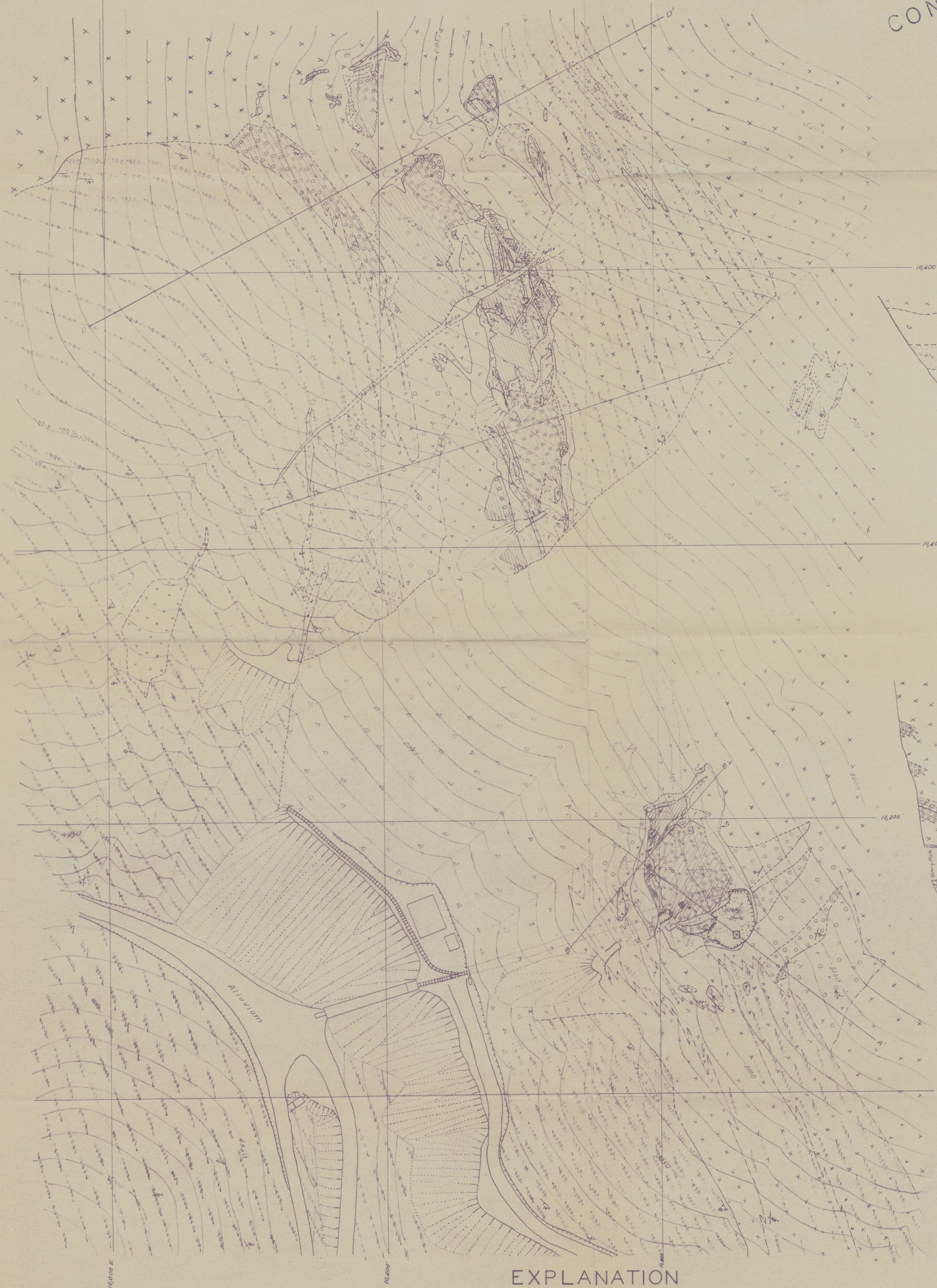
GEOLOGIC AND TOPOGRAPHIC MAP
of
THE M.G.L. MINE AREA
PERSHING COUNTY, NEVADA

M.R.KLEPPER U.S. GEOLOGICAL SURVEY
C.M.SWINNEY NOVEMBER 1942

SCALE

0 5 10 20 30 40 50 60 70 80 90 100 200 Feet

DATUM ASSUMED CONTOUR INTERVAL 10'



EXPLANATION

△ Granodiorite detritus.

× Granodiorite. Including pegmatite.

Schist with lit-par-lit intrusions of granodiorite.

×○ Granodiorite with hornfels inclusions.

▨ Schist and Slate.

○ Hornfels.

▤ Marble.

T Tactite
T_H = Hornfelsic Tactite.
T_P = Pyroxene-rich Tactite.
T_Q = Quartz-rich Tactite.
Density of color indicates approximate grade of ore.

C Quartzose Intrusives containing garnet and epidote.

Faults.
Contacts - Located
Contacts - Approximate.
Contacts - Gradational.

Underground Workings.
5000' Level.
5033' Level.
5062' Level.

SECTIONS TO ACCOMPANY MAP of THE M. G. L. MINE AREA

PERSHING COUNTY, NEVADA

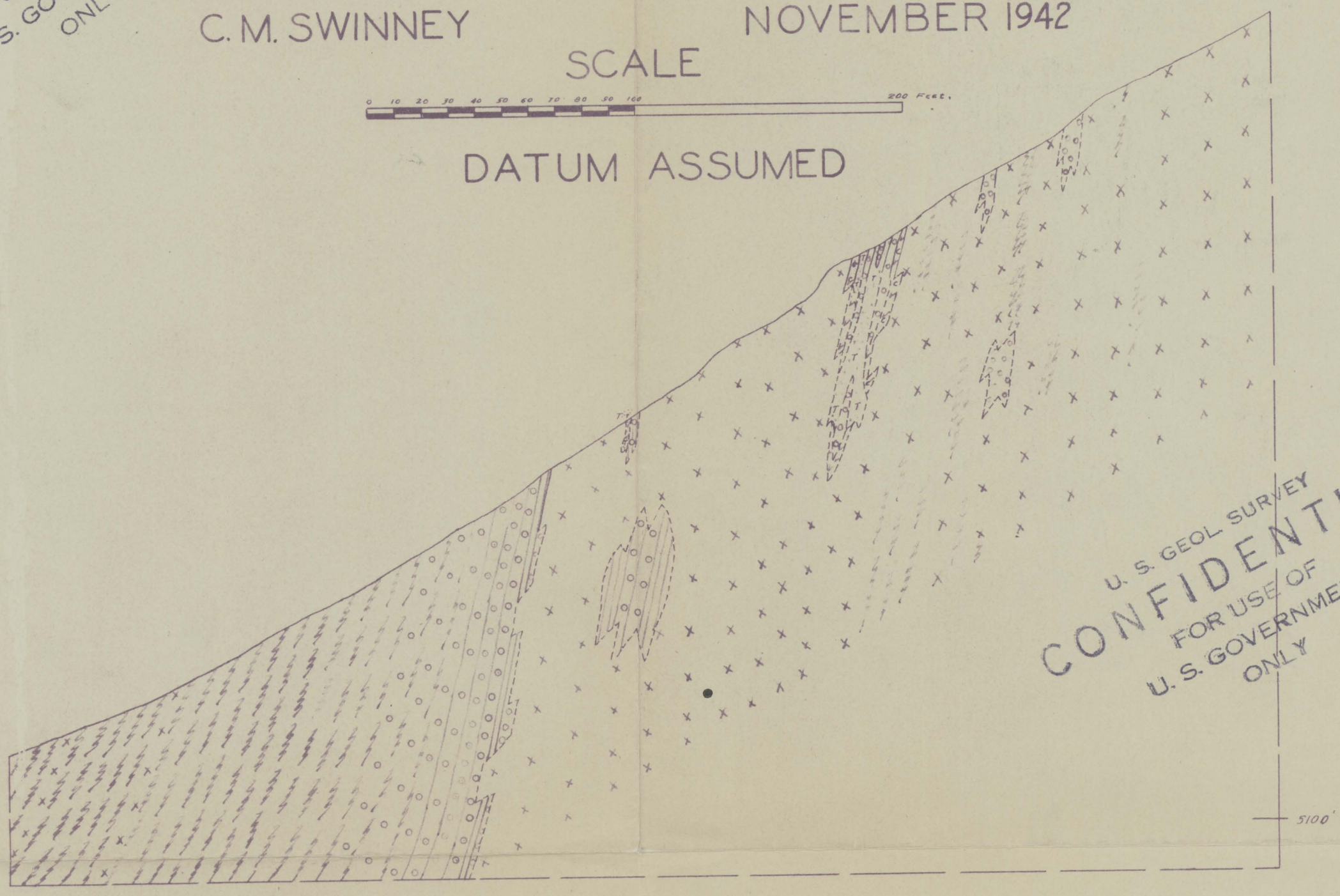
M. R. KLEPPER U.S. GEOLOGICAL SURVEY
C. M. SWINNEY

NOVEMBER 1942

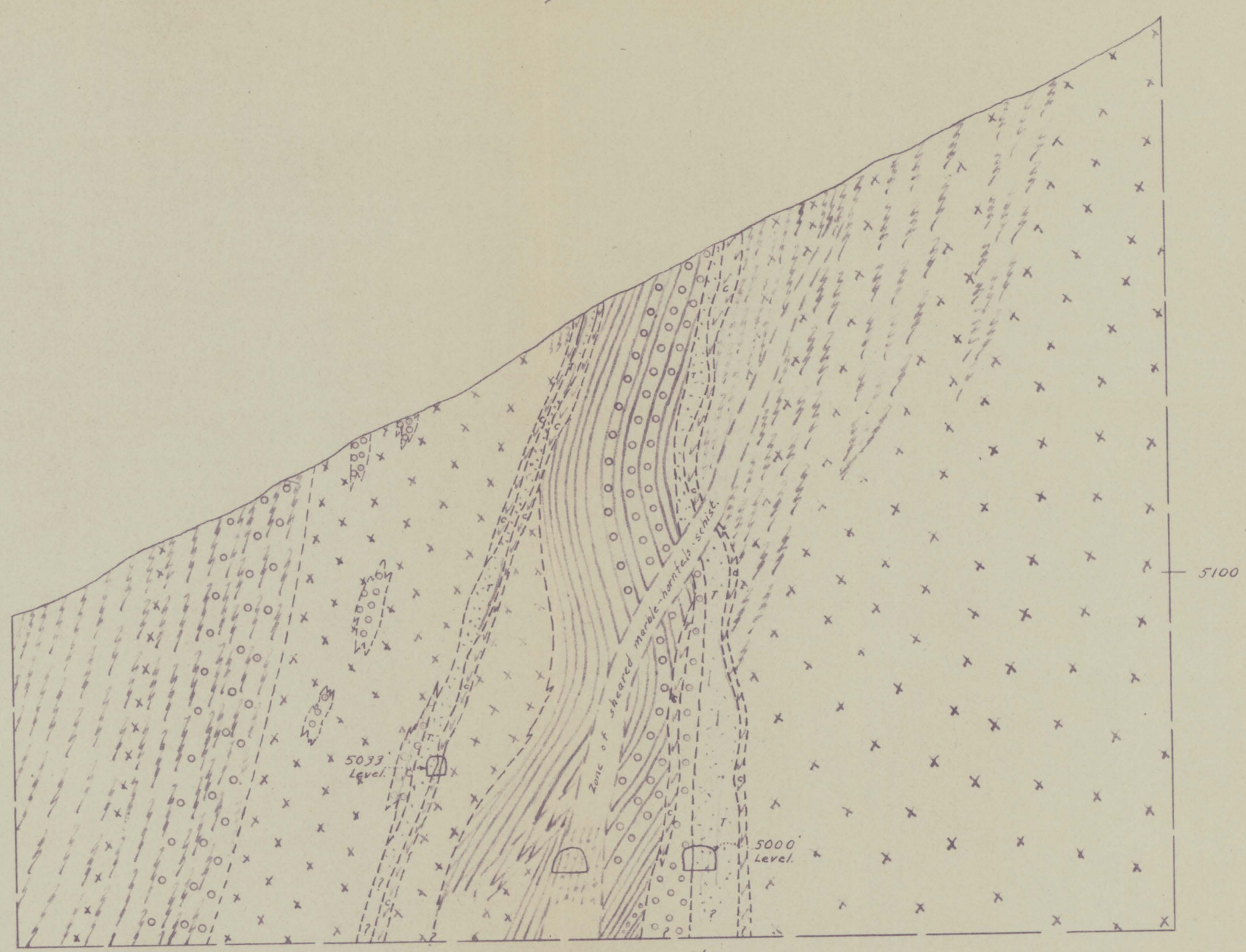
SCALE

0 10 20 30 40 50 60 70 80 90 100 200 Feet.

DATUM ASSUMED



Section along D–D'



Section along C–C'

EXPLANATION

- Granodiorite Including pegmatite.
- Schist lit-par-lit intrusions in granodiorite.
- Schist with horntels inclusions.
- Schist and Slate.
- Horntels.
- Quartzose intrusives containing garnet & epidote.
- Marble.
- Tactite. Density of color indicates grade of Ore.
- Faults.
- Contacts – approximate.

3400 0021

286

I tom 21

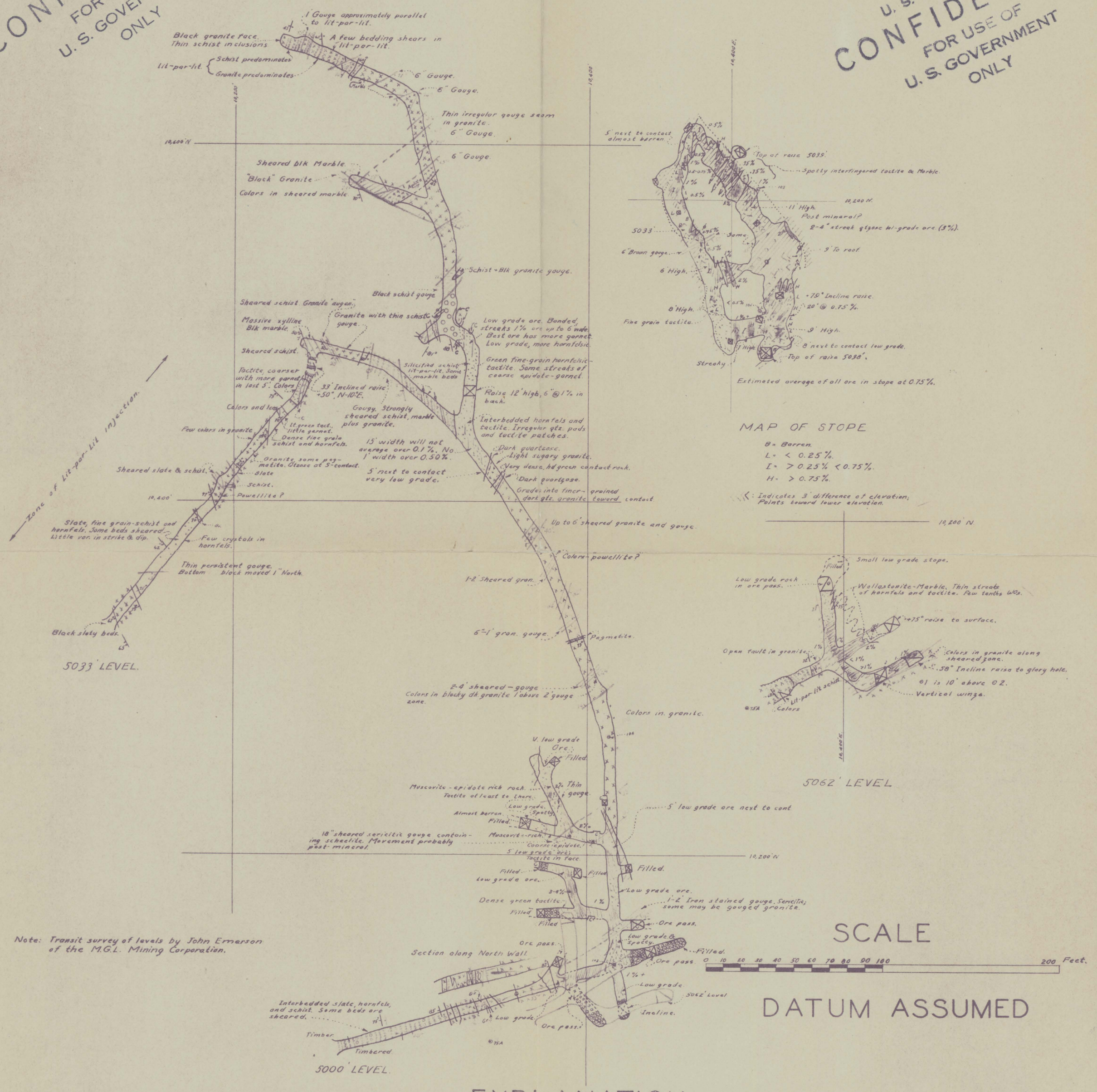
GEOLOGIC MAP of THE M. G. L. MINE WORKINGS

PERSHING COUNTY, NEVADA

M. R. KLEPPER U.S. GEOLOGICAL SURVEY
C. M. SWINNEY

NOVEMBER 1942

U. S. GEOL. SURVEY
CONFIDENTIAL
FOR USE OF
U. S. GOVERNMENT
ONLY



Note: Transit survey of levels by John Emerson of the M.G.L. Mining Corporation.

34000021

286

Item 21

(Copy 1)

Report on the

M. G. L. MINE (TUNGSTEN)

Pershing County, Nevada

U. S. GEOL. SURVEY

CONFIDENTIAL

FOR USE OF

U. S. GOVERNMENT

ONLY

Nolan (2)
Lemmon
Lasky
Allen (2)
File (M. R. Klepper)

M. R. Klepper
Assistant Geologist
U.S. Geological Survey
December 11, 1942

CONTENTS

Report on the
M. G. L. MINE
Pershing County, Nevada

ABSTRACT

The M. G. L. mine is in the west flank of the Nightingale Range, western Pershing County, Nevada, nineteen miles by road north of Nixon.

Two scheelite ore bodies and a number of zones of low grade scheelite mineralization occur in the zone of intense contact metamorphism between granodiorite and marble and hornfels beds. The South ore body is an irregular tactite pipe. 7700 tons of 0.6% WO_3 ore have already been mined from it, and between 15,000 and 17,500 tons of ore of the same grade are blocked out. It is likely that an equal amount of ore will be found below the present workings. The North body is an irregular rim of low grade tactite ore surrounding a block of marble and hornfels beds. One small shoot of 1.0% WO_3 ore is known, and others will probably be found. This body is expected to yield between 2,000 and 7,000 tons of ore averaging between 0.75% and 1.0% WO_3.

Development of the mine was started in the spring of 1942. The first ore was milled in August; by the end of November 7,735 tons of ore had been milled and 3617 units of WO_3 recovered.

INTRODUCTION

The writer's study of the M. G. L. mine between November 5 and 19, 1942, was part of the strategic-mineral investigation program of the U. S. Geological Survey. A geologic and topographic map of the area in the vicinity of the mine was made, geology was plotted on a map of the underground workings made by the company engineer, and the stope in the South ore body was mapped. In this work the writer was capably assisted by C. M. Swinney. Most of the maps were drafted by C. W. Chesterman. Mr. Arthur Letts, Jr. granted permission to study the property, and the staff at the mine cordially cooperated with the writer during this study.

LOCATION

The M. G. L. property is on the west flank of the Nightingale (Truckee) Range in the Nightingale Mining District, southwestern Pershing County, Nevada. The mine is on the steep north side of Cowles Canyon, three miles east of the dry bed of Lake Winnemucca. In the area mapped elevations vary between 4900' and 5500'.

The camp and mill are 16½ miles north of Nixon, Washoe County, Nevada via a graded dirt road which follows the eastern shore of the dry lake. A 2½ mile graded dirt road follows the canyon to the mine. Fernley, 20 miles southeast of Nixon by surfaced road, is the nearest freight depot.

Only unusually severe weather will impede production, for the company is equipped to keep the road between the mine and the mill open, even during heavy snow storms.

PERTINENT FACTS ABOUT THE PROPERTY

Ownership.- This property was owned for a number of years by C. R. Cowles and associates (1). About a year ago it was acquired by the M. G. L. Mining Corp. (2). Members of the mine staff assert that Mr. Letts has spent at least $300,000 to construct the mill and camp, equip the mine, and develop the South ore body.

Production.- Hess and Larsen state that " about 80 tons of ore milled in 1918 gave approximately 1.28% WO_3" (p.285). I can find no record of any other production until the property was acquired by the M. G. L. Mining Corp. This company has been milling ore since August 1942, and has recovered 3617 units of WO_3. (See appendix for tabulation of production). This concentrate has been stockpiled at the mill and will be retreated in the magnetic separator before it is sold. There is enough ore blocked out between the surface and the 5000' level to assure a production of between 1000 and 1500 units of WO_3 per month until July 1943. There has been no exploration done below the 5000' level.

Mine equipment and workings.- The mine is equipped with the most modern machinery, including a model 3900 Ingersoll-Rand compressor, a mucking machine, a bulldozer, and a Caterpillar loader. Mine workings comprise about 1100' of drifts and crosscuts on three levels, a few hundred feet of raises, a stope from which 3000 tons of ore have been mined, and a glory hole whose dimensions are 40' x 30' x 20' deep.

(1). It was called the Cowles property by Hess and Larsen in U. S. G. S. Bull. 725-D, pp.283-285.

(2). M. G. L. Mining Corp., Arthur Letts, Jr., Pres., 301 Subway Terminal Bldg., Los Angeles, California.

Mill.- The mill and camp are at the mouth of Cowles Canyon, 2½ miles west of the mine by road. Ample water for milling is supplied by a well in the dry lake bed, half a mile west of the mill. Water for domestic use is hauled from Wadsworth.

The mill is equipped with a primary crusher, rod mill, classifier, eight tables, and a magnetic separator. Electric power is produced by three diesel generators. Recently Mr. Letts and Mr. Roy Hardy, Consulting Engineer, have been considering the advisability of adding flotation cells.

7735 tons of ore have been milled since the operation started in August 1942. During October and November an average of 90 tons of ore was milled daily. 72,341 pounds of WO_3, an average of 9.4 pounds per ton, have been recovered. There is not enough assay information to calculate the average recovery, but it is believed to be between 80% and 85%.

GEOLOGY

Rock units.- The area mapped is along the intrusive contact zone between granodiorite and a thick sequence of dark-colored, mildly metamorphosed argillaceous and calcareous sedimentary rocks (3).

The metamorphic sequence consists of slate, argillite, hornfels, marble, and fine-grained biotite schist. It underlies the southwestern part of the map area and extends west to the steep front of the range, a distance of 2½ miles, and at least as far south.

(3). The metamorphic sequence and the granodiorite are believed to be continuous with similar rocks on the east side of the range, which were described by Ward Smith in U. S. G. S. Bull. 936-B, pp. 42-44, 1942.

Between the mildly metamorphic sequence and the granodiorite lies a contact zone, averaging 300' wide, in which intrusion is complex and metamorphism more intense. Areas of schist and slate are invaded parallel to the bedding by many granodiorite tongues; areas of marble and hornfels are cut into irregular-shaped blocks by granodiorite dikes. The downward extension of these blocks is probably as irregular as their outcrop. (See geologic map and sections enclosed). Clusters of wollastonite and tremolite are common in the marble. Tactite has been formed around the margins of part of the marble belt, and in some places as far as 50' from a granodiorite contact.

The granodiorite is a gray crystalline rock of medium-coarse grain. Plagioclase, orthoclase, and quartz are the most abundant minerals. Biotite and hornblende make up about 10% of the rock. Most surface exposures have been stained light brown by weathering of the iron-bearing minerals. Lenses and irregular patches of pegmatite are common near the margin of the main mass. A few aplite dikes cut the metamorphic rocks in the area mapped. One of these can be followed to the main granodiorite contact where it blends with the granodiorite and loses its identity.

Almost all of the tactite bodies are separated from granodiorite by dikes of an unusual intrusive rock. Narrow tongues of this rock also penetrate between tactite and the marble-hornfels sequence, and in a few places cut across marble and hornfels beds and granodiorite. Different specimens of this rock vary considerably in composition, but all exhibit a granitic texture and contain between 70% and 90% of quartz. Epidote, pyroxene, garnet and hornblende,

alone or in various conbinations, make up 10%-30%. Small amounts of pyrite, pyrrhotite, chalcopyrite, and molybdenite (?) occur locally. The rock is believed to be the solidified reasidue of the solutions that transformed marble to tactite. It had probably solidified before any scheelite was introduced. In the remainder of the report this rock will be called "quartzose intrusive".

Structure.- The metamorphic rocks strike northwest and dip steeply southwest. In the northwestern part of the area mapped, they curve gradually toward the west. Deviation from this prevailing attitude is found (1) in a few small pendants which have been rotated, and (2) in the roughly circular area, about 150' in diameter, that includes the South ore body.

The beds in the block containing the South ore body strike northeast and dip vertically or steeply northwest. (See map). This block has been revolved 90 degrees from the prevailing trend, but is separated from normally trending beds to the south and west by only a few feet of intrusive rock. Quartzose intrusive rock, varying from 1' to 20' wide, almost completely encircles the block. The main granodiorite lies to the north and east, and a narrow granodiorite tongue containing hornfels inclusions lies between the quartzose intrusion and the lit-par-lit beds to the south and west. The same peculiar structural features are found in the mine workings. No other marble has been found along the projection of the normal or anomalous strike to the south, east or west. No logical explanation for this structure has been evolved. It is almost impossible to postulate a fault that is in accord with all of the field evidence, On the other hand, if it is a rotated pendant, where is the southward continuation of the marble belt?

The main granodiorite contact trends northwest and, in general, parallels the strike of the metamorphic rocks. On the map this contact has been designated as arbitrary, and placed as closely as possible to the limit of hornfels inclusions and lit-par-lit beds. The downward course of the contact is probably as irregular as the surface trace. Dikes of granodiorite, pegmatite, and aplite intrude the metamorphic rocks. In the southwestern part of the area, they are few and small.

The metamorphic rocks and the granodiorite contact everywhere dip steeply, and so, in general, do the tactite bodies. For example, on the 5000' level the South ore body lies almost vertically beneath the outcrop, and on the same level, 250' north of the South ore body, a low grade tactite body lies almost vertically beneath the outcrop of another ore body.

Post-ore faults which displace the rocks a few feet are exposed on the surface and in the mine workings, but no fault of large displacement was found.

Contact metamorphism.- Metamorphism has been more intense near the contact than elsewhere. Near the contact limestone and argillaceous limestone has been altered to tactite and dense, dark-colored hornfels, which in some places grades into tactite along the strike. Farther from the contact wollastonite, tremolite and diopside marble and light-colored hornfels predominate. Biotite schist and slate are coarser-grained near the contact than elsewhere.

Tactite is the only rock in the area that contains worthwhile amounts of scheelite. Most of the tactite is a coarse-grained, green or brown rock. In general, quartz is the most abundant

mineral, followed in order by garnet, calcite, epidote, pyroxene, and more or less scheelite. Some tactite contains a little pyrite, pyrrhotite, chalcopyrite, and molybdenite. All of these minerals are unevenly distributed, so that selected specimens commonly show great differences in mineral composition. The most common variety in the South ore body contains about 40% quartz, 35% garnet, 10% calcity, 10% epidote, and 5% other minerals, including scheelite.

Garnet crystals vary from 0.1" to 3" in diameter, and from pale cinnamon to dark red in color. Some of the tactite is made up almost entirely of garnet. Pale green or gray epidote (or clinozoisite) prisms, not uncommonly 6" long, are most common in quartz-rich tactite. Scheelite crystals are colorless, gray, or cream-colored. Most of the crystals are equidimensional and range between 0.1" and 0.5" on a side, but broken pieces 3" square have been found in the ore bin. In most high grade ore specimens quartz predominates, epidote is common, and garnet is scarce. However, in average mill ore, garnet, next to quartz, i s the most common mineral.

ORE BODIES

Localization

In the vicinity of the contact between granodiorite and the marble-hornfels sequence part of the sedimentary rocks have been altered to tactite or heavy, dark-colored hornfels. At the contact almost all of the beds have been altered; farther from the contact only the most susceptible beds. Some of the tactite is scheelite ore; some contains low grade scheelite mineralization; some is barren. No clues to explain the erratic distribution of scheelite within the tactite bodies have been recognized.

South Ore Body

Size and shape.- The South ore body crops out as a semi-circular rim around a block of marble and hornfels. The widest part of this ore rim has been mined from the glory hole at the south end of the ore body. (See map) Between the surface and the 5000' level, an average depth of 125', the rim of tactite ore gradually encroaches upon the barren marble and hornfels core. On the 5000' level the ore body is elliptical and averages 130' long by 30' wide, about the same size as the entire marble-hornfels block at the surface. (See map of underground workings and sections). Seven thousand tons of ore have already been mined from this body. Between 15,000 and 17,500 tons remain above the 5000' level. No exploration has been done below this level, and there is little basis to predict what the size and shape of the body may be at depth.

Grade and reserves.- Estimates of grade of ore and reserves are based on the production record to date and detailed mapping of the ore body. 7735 tons of ore have been milled and 72,341 pounds of WO_3 recovered, and average of 9.4 pounds per ton. Part of this ore has been mined from the 5000' level, part from a stope level 35' higher, part from the glory hole, and part from connecting raises. Most of these workings have been driven to prepare the ore body for mining by the shrinkage method. They outline and cut across the ore body, but do not attempt to follow high grade zones.

It is my opinion that a block containing between 15,000 and 17,500 tons of ore that will yield between 9 and 10 pounds of WO_3

per ton can be mined from above the 5000' level. At the present rate of production, this ore would supply the mill until July 1943, and between 7000 and 8000 units of WO_3 would be recovered. If flotation cells are installed immediately, there is a chance to increase this recovery by 500 units.

The available assay information suggests that the recovery averages between 80% and 85%. Therefore, the grade of the 7735 tons of ore already mined has been between 0.55% and 0.60% WO_3. All of the tactite in this ore body probably averages 0.75% WO_3, but dilution with barren marble decreases the grade of the mill feed to the figure cited above.

The ellipse of ore on the 5000' level contains 400 tons of ore per foot of depth. If a body of the same dimensions is found in the adit that will soon be driven 75' below the 5000' level, 30,000 additional tons of ore will be indicated, enough to assure continuous handling of 90 to 100 tons daily until July 1944. No reliable estimate of reserves beneath the 5000' level can be made until this adit has been driven.

North Ore Body

Size and shape.- The North ore body is an irregular rim of tactite around a block of the same marble-hornfels beds. It is separated from the South ore body by a tongue of granite 200' wide. Only a few hundred tons of ore have been removed from surface cuts. None has been milled.

This rim averages about 5' wide and is estimated to average less than 0.5% WO_3. At the north end a zone 40' long by 15' wide may average 1.0% WO_3. In the 5000' level a low grade zone, 80'

long and 15' wide, has been exposed. It contains narrow streaks of 1.0% ore, but the entire body is estimated to average only 0.1% WO_3. It is believed to be a continuation of the ore body exposed at the surface. The information available suggests that this body is a discontinuous, elliptical, low grade rim which, here and there, contains small shoots of higher grade ore.

Grade and reserves.- No reliable estimates of grade or reserves can be made until this ore body has been explored more thoroughly. From the work done so far it seems likely that no large ore shoot which can be mined by shrinkage exists.

The shoot exposed at the north end at the surface probably contains 60 tons of 1% WO_3 ore per foot of depth and may yield a few thousand tons. If a few other shoots of comparable size and grade are found between 5000 and 10,000 tons of ore may be mined from this body.

Other Scheelite-bearing Bodies

The small pendants near the north edge of the map are too low in grade to be considered as potential ore. It is also likely that most of them terminate at shallow depth and contain only a small tonnage.

SUMMARY OF RESERVES

	Measurable and Indicated			Inferred		
Ore body	Tons ore	Grade (% WO_3)	Units WO_3 at 80% rec'y.	Tons ore	Grade (% WO_3)	Units WO_3 at 80% rec'y.
South	17,500	(1) 0.6	8400	15,000	(2) 0.6	7200
North	2,000	(3) 1.0	1600	5,000	(4) 0.75	3000
Total	19,500		10,000	20,000		10,200

(1). Above 5000' level.

(2). Below 5000' level.

(3). Shoot exposed on surface at north end of ore body.

(4). Undiscovered shoots.

RECOMMENDATIONS

I recommend that a member of the Geological Survey visit the M. G. L. property during the spring of 1943. At that time the underground geologic maps should be brought up to date and a larger surface area should be mapped. Aerial photographs of this area are available. The additional surface mapping is desirable, because it may lead to a clearer understanding of the structure in the vicinity of the mine, and because some zones of scheelite mineralization have not yet been mapped. The work in mind will require between two and four weeks.

APPENDIX

Production of

W. C. L. MINE

During 1942

	August	September	October	November	Total
Dry tons ore milled	737	1502	2876	2620	7735
Pounds conc. produced	17,563	30,063	43,894	26,814	118,334
Assay, % WO_3	60	60	60	65	61
Units WO_3 produced	526.9	901.9	1316.8	871.45	3617.05

3400 0021

286

Item 21

(Copy 2)

Report on the

M. G. L. MINE (TUNGSTEN)

Pershing County, Nevada

Nolan (2)
Lemmon
Lasky
Allen (2)
File (M. R. Klepper)

M. R. Klepper
Assistant Geologist
U.S. Geological Survey
December 11, 1942

CONTENTS

Report on the
M. G. L. MINE
Pershing County, Nevada

ABSTRACT

The M. G. L. mine is in the west flank of the Nightingale Range, western Pershing County, Nevada, nineteen miles by road north of Nixon.

Two scheelite ore bodies and a number of zones of low grade scheelite mineralization occur in the zone of intense contact metamorphism between granodiorite and marble and hornfels beds. The South ore body is an irregular tactite pipe. 7700 tons of 0.6% WO_3 ore have already been mined from it, and between 15,000 and 17,500 tons of ore of the same grade are blocked out. It is likely that an equal amount of ore will be found below the present workings. The North body is an irregular rim of low grade tactite ore surrounding a block of marble and hornfels beds. One small shoot of 1.0% WO_3 ore is known, and others will probably be found. This body is expected to yield between 2,000 and 7,000 tons of ore averaging between 0.75% and 1.0% WO_3.

Development of the mine was started in the spring of 1942. The first ore was milled in August; by the end of November 7,735 tons of ore had been milled and 3617 units of WO_3 recovered.

INTRODUCTION

The writer's study of the M. G. L. mine between November 5 and 19, 1942, was part of the strategic-mineral investigation program of the U. S. Geological Survey. A geologic and topographic map of the area in the vicinity of the mine was made, geology was plotted on a map of the underground workings made by the company engineer, and the stope in the South ore body was mapped. In this work the writer was capably assisted by G. M. Swinney. Most of the maps were drafted by C. W. Chesterman. Mr. Arthur Letts, Jr. granted permission to study the property, and the staff at the mine cordially cooperated with the writer during this study.

LOCATION

The M. G. L. property is on the west flank of the Nightingale (Truckee) Range in the Nightingale Mining District, southwestern Pershing County, Nevada. The mine is on the steep north side of Cowles Canyon, three miles east of the dry bed of Lake Winnemucca. In the area mapped elevations vary between 4900' and 5500'.

The camp and mill are 16½ miles north of Nixon, Washoe County, Nevada via a graded dirt road which follows the eastern shore of the dry lake. A 2½ mile graded dirt road follows the canyon to the mine. Fernley, 20 miles southeast of Nixon by surfaced road, is the nearest freight depot.

Only unusually severe weather will impede production, for the company is equipped to keep the road between the mine and the mill open, even during heavy snow storms.

PERTINENT FACTS ABOUT THE PROPERTY

Ownership.- This property was owned for a number of years by C. R. Cowles and associates (1). About a year ago it was acquired by the M. G. L. Mining Corp. (2). Members of the mine staff assert that Mr. Letts has spent at least $300,000 to construct the mill and camp, equip the mine, and develop the South ore body.

Production.- Hess and Larsen state that " about 80 tons of ore milled in 1918 gave approximately 1.28% WO_3" (p.285). I can find no record of any other production until the property was acquired by the M. G. L. Mining Corp. This company has been milling ore since August 1942, and has recovered 3617 units of WO_3. (See appendix for tabulation of production). This concentrate has been stockpiled at the mill and will be retreated in the magnetic separator before it is sold. There is enough ore blocked out between the surface and the 5000' level to assure a production of between 1000 and 1500 units of WO_3 per month until July 1943. There has been no exploration done below the 5000' level.

Mine equipment and workings.- The mine is equipped with the most modern machinery, including a model 1500-K Ingersoll-Rand compressor, a mucking machine, a bulldozer, and a Caterpillar loader. Mine workings comprise about 1100' of drifts and crosscuts on three levels, a few hundred feet of raises, a stope from which 3000 tons of ore have been mined, and a glory hole whose dimensions are 40' x 30' x 20' deep.

(1). It was called the Cowles property by Hess and Larsen in U. S. G. S. Bull. 725-D, pp. 283-285.

(2). M. G. L. Mining Corp., Arthur Letts, Jr., Pres., 301 Subway Terminal Bldg., Los Angeles, California.

Mill.- The mill and camp are at the mouth of Cowles Canyon, 2½ miles west of the mine by road. Ample water for milling is supplied by a well in the dry lake bed, half a mile west of the mill. Water for domestic use is hauled from Wadsworth.

The mill is equipped with a primary crusher, rod mill, classifier, eight tables, and a magnetic separator. Electric power is produced by three diesel generators. Recently Mr. Letts and Mr. Roy Hardy, Consulting Engineer, have been considering the advisability of adding flotation cells.

7735 tons of ore have been milled since the operation started in August 1942. During October and November an average of 90 tons of ore was milled daily. 72,341 pounds of WO_3, an average of 9.4 pounds per ton, have been recovered. There is not enough assay information to calculate the average recovery, but it is believed to be between 80% and 85%.

GEOLOGY

Rock units.- The area mapped is along the intrusive contact zone between granodiorite and a thick sequence of somber-colored, mildly metamorphosed argillaceous and calcareous sedimentary rocks (3).

The metamorphic sequence consists of slate, argillite, hornfels, marble, and fine-grained biotite schist. It underlies the southwestern part of the map area and extends west to the steep front of the range, a distance of 2½ miles, and at least as far south.

(3). The metamorphic sequence and the granodiorite are believed to be continuous with similar rocks on the east side of the range, which were described by Ward Smith in U. S. G. S. Bull. 936-B, pp. 42-44, 1942.

Between the mildly metamorphic sequence and the granodiorite lies a contact zone, averaging 300' wide, in which intrusion is complex and metamorphism more intense. Areas of schist and slate are invaded parallel to the bedding by many granodiorite tongues; areas of marble and hornfels are cut into irregular-shaped blocks by granodiorite dikes. The downward extension of these blocks is probably as irregular as their outcrop. (See geologic map and sections enclosed). Clusters of wollastonite and tremolite are common in the marble. Tactite has been formed around the margins of part of the marble belt, and in some places as far as 50' from a granodiorite contact.

The granodiorite is a gray crystalline rock of medium-coarse grain. Plagioclase, orthoclase, and quartz are the most abundant minerals. Biotite and hornblende make up about 10% of the rock. Most surface exposures have been stained light brown by weathering of the iron-bearing minerals. Lenses and irregular patches of pegmatite are common near the margin of the main mass. A few aplite dikes cut the metamorphic rocks in the area mapped. One of these can be followed to the main granodiorite contact where it blends with the granodiorite and loses its identity.

Almost all of the tactite bodies are separated from granodiorite by dikes of an unusual intrusive rock. Narrow tongues of this rock also penetrate between tactite and the marble-hornfels sequence, and in a few places cut across marble and hornfels beds and granodiorite. Different specimens of this rock vary considerably in composition, but all exhibit a granitic texture and contain between 70% and 90% of quartz. Epidote, pyroxene, garnet and hornblende,

alone or in various conbinations, make up 10%-30%. Small amounts of pyrite, pyrrhotite, chalcopyrite, and molybdenite (?) occur locally. The rock is believed to be the solidified ressidue of the solutions that transformed marble to tactite. It had probably solidified before any scheelite was introduced. In the remainder of the report this rock will be called "quartzose intrusive".

Structure.- The metamorphic rocks strike northwest and dip steeply southwest. In the northwestern part of the area mapped, they curve gradually toward the west. Deviation from this prevailing attitude is found (1) in a few small pendants which have been rotated, and (2) in the roughly circular area, about 150' in diameter, that includes the South ore body.

The beds in the block containing the South ore body strike northeast and dip vertically or steeply northwest. (See map). This block has been revolved 90 degrees from the prevailing trend, but is separated from normally trending beds to the south and west by only a few feet of intrusive rock. Quartzose intrusive rock, varying from 1' to 20' wide, almost completely encircles the block. The main granodiorite lies to the north and east, and a narrow granodiorite tongue containing hornfels inclusions lies between the quartzose intrusion and the lit-par-lit beds to the south and west. The same peculiar structural features are found in the mine workings. No other marble has been found along the projection of the normal or anomalous strike to the south, east or west. No logical explanation for this structure has been evolved. It is almost impossible to postulate a fault that is in accord with all of the field evidence, On the other hand, if it is a rotated pendant, where is the southward continuation of the marble belt?

The main granodiorite contact trends northwest and, in general, parallels the strike of the metamorphic rocks. On the map this contact has been designated as arbitrary, and placed as closely as possible to the limit of hornfels inclusions and lit-par-lit beds. The downward course of the contact is probably as irregular as the surface trace. Dikes of granodiorite, pegmatite, and aplite intrude the metamorphic rocks. In the southwestern part of the area, they are few and small.

The metamorphic rocks and the granodiorite contact everywhere dip steeply, and so, in general, do the tactite bodies. For example, on the 5000' level the South ore body lies almost vertically beneath the outcrop, and on the same level, 250' north of the South ore body, a low grade tactite body lies almost vertically beneath the outcrop of another ore body.

Post-ore faults which displace the rocks a few feet are exposed on the surface and in the mine workings, but no fault of large displacement was found.

Contact metamorphism.- Metamorphism has been more intense near the contact than elsewhere. Near the contact limestone and argillaceous limestone has been altered to tactite and dense, dark-colored hornfels, which in some places grades into tactite along the strike. Farther from the contact wollastonite, tremolite and diopside marble and light-colored hornfels predominate. Biotite schist and slate are coarser-grained near the contact than elsewhere.

Tactite is the only rock in the area that contains worthwhile amounts of scheelite. Most of the tactite is a coarse-grained, green or brown rock. In general, quartz is the most abundant

mineral, followed in order by garnet, calcite, epidote, pyroxene, and more or less scheelite. Some tactite contains a little pyrite, pyrrhotite, chalcopyrite, and molybdenite. All of these minerals are unevenly distributed, so that selected specimens commonly show great differences in mineral composition. The most common variety in the South ore body contains about 40% quartz, 35% garnet, 10% calcite, 10% epidote, and 5% other minerals, including scheelite.

Garnet crystals vary from 0.1" to 3" in diameter, and from pale cinnamon to dark red in color. Some of the tactite is made up almost entirely of garnet. Pale green or gray epidote (or clinozoisite) prisms, not uncommonly 6" long, are most common in quartz-rich tactite. Scheelite crystals are colorless, gray, or cream-colored. Most of the crystals are equidimensional and range between 0.1" and 0.5" on a side, but broken pieces 3" square have been found in the ore bin. In most high grade ore specimens quartz predominates, epidote is common, and garnet is scarce. However, in average mill ore, garnet, next to quartz, i s the most common mineral.

ORE BODIES

Localization

In the vicinity of the contact between granodiorite and the marble-hornfels sequence part of the sedimentary rocks have been altered to tactite or heavy, dark-colored hornfels. At the contact almost all of the beds have been altered; farther from the contact only the most susceptible beds. Some of the tactite is scheelite ore; some contains low grade scheelite mineralization; some is barren. No clues to explain the erratic distribution of scheelite within the tactite bodies have been recognized.

South Ore Body

Size and shape.- The South ore body crops out as a semi-circular rim around a block of marble and hornfels. The widest part of this ore rim has been mined from the glory hole at the south end of the ore body. (See map) Between the surface and the 5000' level, an average depth of 125', the rim of tactite ore gradually encroaches upon the barren marble and hornfels core. On the 5000' level the ore body is elliptical and averages 130' long by 30' wide, about the same size as the entire marble-hornfels block at the surface. (See map of underground workings and sections). Seven thousand tons of ore have already been mined from this body. Between 15,000 and 17,500 tons remain above the 5000' level. No exploration has been done below this level, and there is little basis to predict what the size and shape of the body may be at depth.

Grade and reserves.- Estimates of grade of ore and reserves are based on the production record to date and detailed mapping of the ore body. 7735 tons of ore have been milled and 72,341 pounds of WO_3 recovered, and average of 9.4 pounds per ton. Part of this ore has been mined from the 5000' level, part from a stope level 35' higher, part from the glory hole, and part from connecting raises. Most of these workings have been driven to prepare the ore body for mining by the shrinkage method. They outline and cut across the ore body, but do not attempt to follow high grade zones.

It is my opinion that a block containing between 15,000 and 17,500 tons of ore that will yield between 9 and 10 pounds of WO_3

per ton can be mined from above the 5000' level. At the present rate of production, this ore would supply the mill until July 1943, and between 7000 and 8000 units of WO_3 would be recovered. If flotation cells are installed immediately, there is a chance to increase this recovery by 500 units.

The available assay information suggests that the recovery averages between 80% and 85%. Therefore, the grade of the 7735 tons of ore already mined has been between 0.55% and 0.60% WO_3. All of the tactite in this ore body probably averages 0.75% WO_3, but dilution with barren marble decreases the grade of the mill feed to the figure cited above.

The ellipse of ore on the 5000' level contains 400 tons of ore per foot of depth. If a body of the same dimensions is found in the adit that will soon be driven 75' below the 5000' level, 30,000 additional tons of ore will be indicated, enough to assure continuous handling of 90 to 100 tons daily until July 1944. No reliable estimate of reserves beneath the 5000' level can be made until this adit has been driven.

North Ore Body

Size and shape.- The North ore body is an irregular rim of tactite around a block of the same marble-hornfels beds. It is separated from the South ore body by a tongue of granite 200' wide. Only a few hundred tons of ore have been removed from surface cuts. None has been milled.

This rim averages about 5' wide and is estimated to average less than 0.5% WO_3. At the north end a zone 40' long by 15' wide may average 1.0% WO_3. In the 5000' level a low grade zone, 80'

long and 15' wide, has been exposed. It contains narrow streaks of 1.0% ore, but the entire body is estimated to average only 0.1% WO_3. It is believed to be a continuation of the ore body exposed at the surface. The information available suggests that this body is a discontinuous, elliptical, low grade rim which, here and there, contains small shoots of higher grade ore.

Grade and reserves.- No reliable estimates of grade or reserves can be made until this ore body has been explored more thoroughly. From the work done so far it seems likely that no large ore shoot which can be mined by shrinkage exists.

The shoot exposed at the north end at the surface probably contains 60 tons of 1% WO_3 ore per foot of depth and may yield a few thousand tons. If a few other shoots of comparable size and grade are found between 5000 and 10,000 tons of ore may be mined from this body.

Other Scheelite-bearing Bodies

The small pendants near the north edge of the map are too low in grade to be considered as potential ore. It is also likely that most of them terminate at shallow depth and contain only a small tonnage.

SUMMARY OF RESERVES

	Measurable and Indicated			Inferred		
Ore body	Tons ore	Grade (% WO_3)	Units WO_3 at 80% rec'y.	Tons ore	Grade (% WO_3)	Units WO_3 at 80% rec'y.
South	17,500 (1)	0.6	8400	15,000 (2)	0.6	7200
North	2,000 (3)	1.0	1600	5,000 (4)	0.75	3000
Total	19,500		10,000	20,000		10,200

(1). Above 5000' level.

(2). Below 5000' level.

(3). Shoot exposed on surface at north end of ore body.

(4). Undiscovered shoots.

RECOMMENDATIONS

I recommend that a member of the Geological Survey visit the M. G. L. property during the spring of 1943. At that time the underground geologic maps should be brought up to date and a larger surface area should be mapped. Aerial photographs of this area are available. The additional surface mapping is desirable, because it may lead to a clearer understanding of the structure in the vicinity of the mine, and because some zones of scheelite mineralization have not yet been mapped. The work in mind will require between two and four weeks.

APPENDIX

Production of

M. G. L. MINE

During 1942

	August	September	October	November	Total
Dry tons ore milled	737	1502	2876	2620	7735
Pounds conc. produced	17,563	30,063	43,894	26,814	118,334
Assay, % WO_3	60	60	60	65	61
Units WO_3 produced	526.9	901.9	1316.8	871.45	3617.05

(286)
PLATE I
Item 21

GEOLOGIC AND TOPOGRAPHIC MAP of THE M.G.L. MINE AREA

PERSHING COUNTY, NEVADA

M.R. KLEPPER U.S. GEOLOGICAL SURVEY
C.M. SWINNEY NOVEMBER 1942

SCALE

0 5 10 20 30 40 50 60 70 80 90 100 200 Feet.

DATUM ASSUMED CONTOUR INTERVAL 10'

EXPLANATION

- Granodiorite detritus.
- Granodiorite. Including pegmatite.
- Schist with lit-par-lit intrusions of granodiorite.
- Granodiorite with hornfels inclusions.
- Schist and Slate.
- Hornfels.
- Marble.
- T — Tactite. T_H = Hornfelsic Tactite. T_P = Pyroxene-rich Tactite. T_Q = Quartz-rich Tactite. Density of color indicates approximate grade of ore.
- C — Quartzose Intrusives containing garnet and epidote.
- Faults.
- Contacts - Located.
- Contacts - Approximate.
- Contacts - Gradational.

Underground Workings.
- "A" Level, El. 4917'
- "B" Level, El. 5000'
- "B½" Level, El. 5031'
- "B⅔" Level, El. 5062'
- "C" Level, El. 5091'

Revised to July 20, 1943

3100 0021

PLATE 2

Item 21

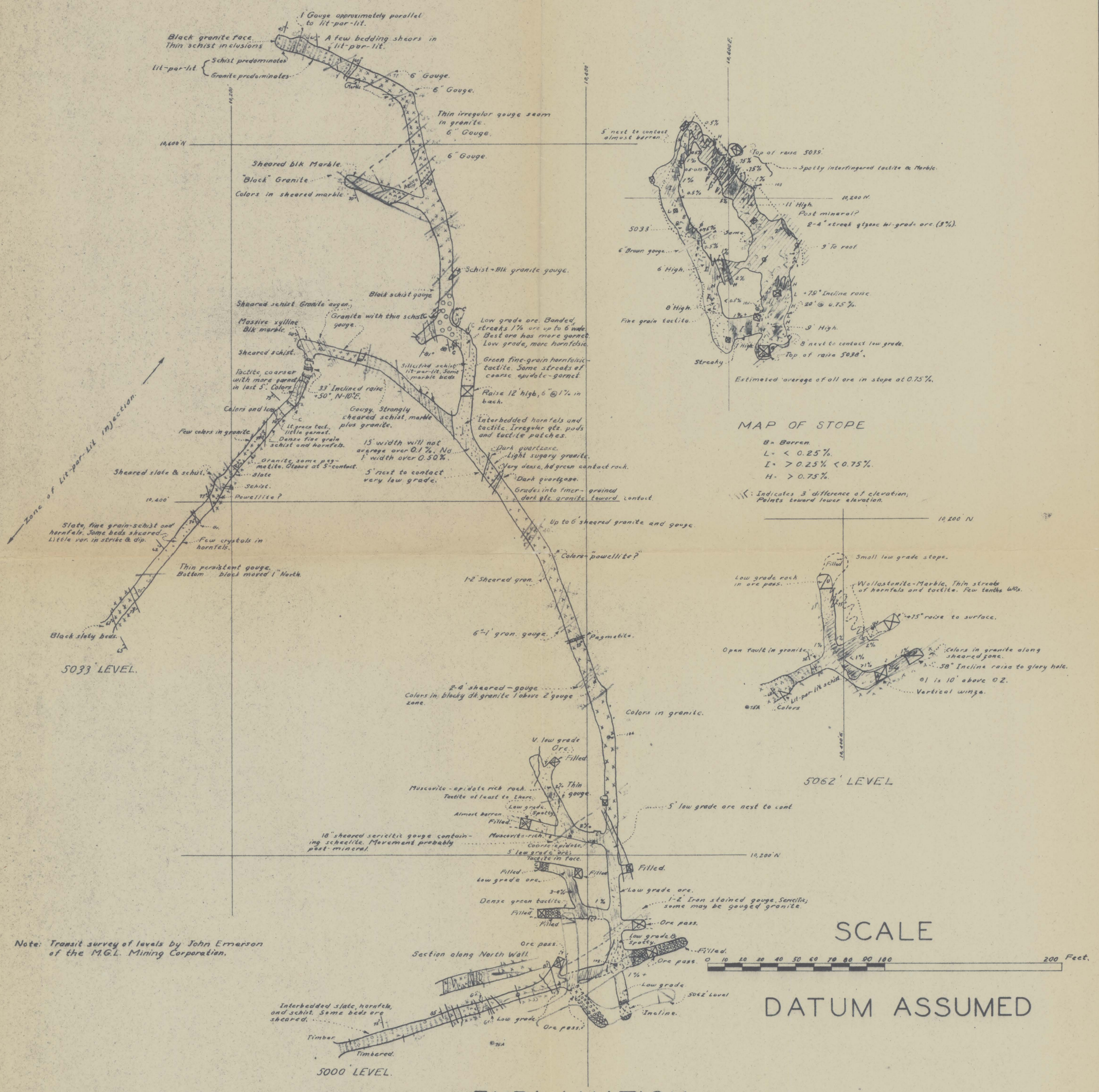
3400 0021

GEOLOGIC MAP of THE M. G. L. MINE WORKINGS

PERSHING COUNTY, NEVADA

M. R. KLEPPER U.S. GEOLOGICAL SURVEY
C. M. SWINNEY

NOVEMBER 1942



Note: Transit survey of levels by John Emerson of the M.G.L. Mining Corporation.

3400 0021

(286)

PLATE 2-A

Item 21

MAP OF THE M.G.L. MINE WORKINGS*

SHOWING GEOLOGY OF WORKINGS

COMPLETED SINCE NOVEMBER 1942

PERSHING COUNTY, NEVADA

M.R. KLEPPER — P. JORALEMON

U.S. GEOLOGICAL SURVEY — JULY 1943

SCALE

0 10 20 30 40 50 100 150 200 feet

EXPLANATION

- Schist, slate, and quartzite
- Marble and limestone
- Calc-silicate hornfels, locally containing a little scheelite
- Tactite - concentration of dots shows estimated grade in range from 0.0 - 1.0% WO_3
- Quartzose contact rock
- Altered basic dike
- Granodiorite and aplite
- Contact
- Contact, projected
- Fault

* Supplement to Plate 2

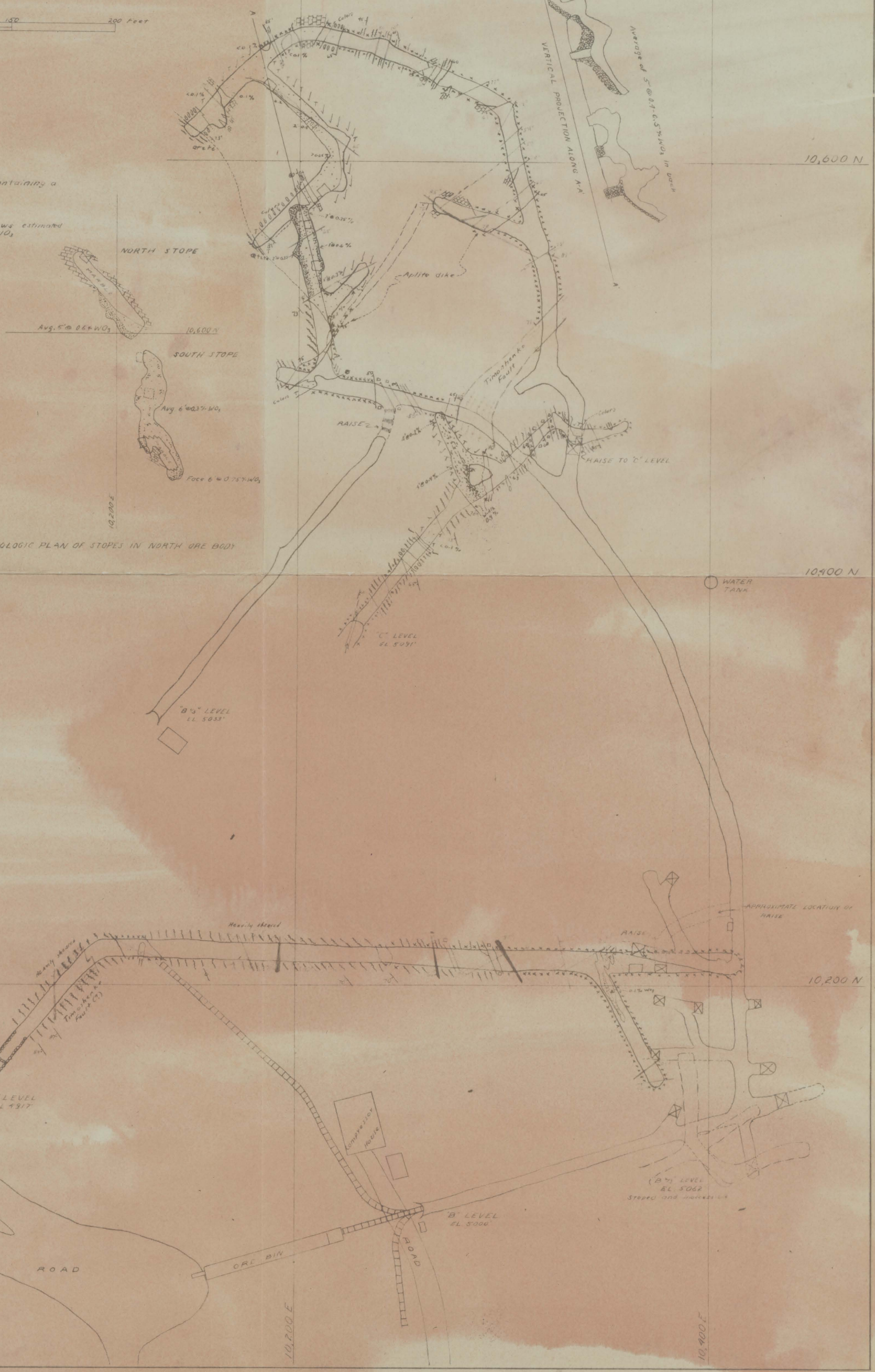


PLATE 5

GEOLOGIC MAP OF PART OF THE EMERWELL NO.1 CLAIM

M.G.L. MINING CORPORATION

NIGHTINGALE DISTRICT, PERSHING COUNTY, NEVADA

M.R. KLEPPER P. JORALEMON

U.S. GEOLOGICAL SURVEY JULY 1943

CONTOUR INTERVAL 10 FEET

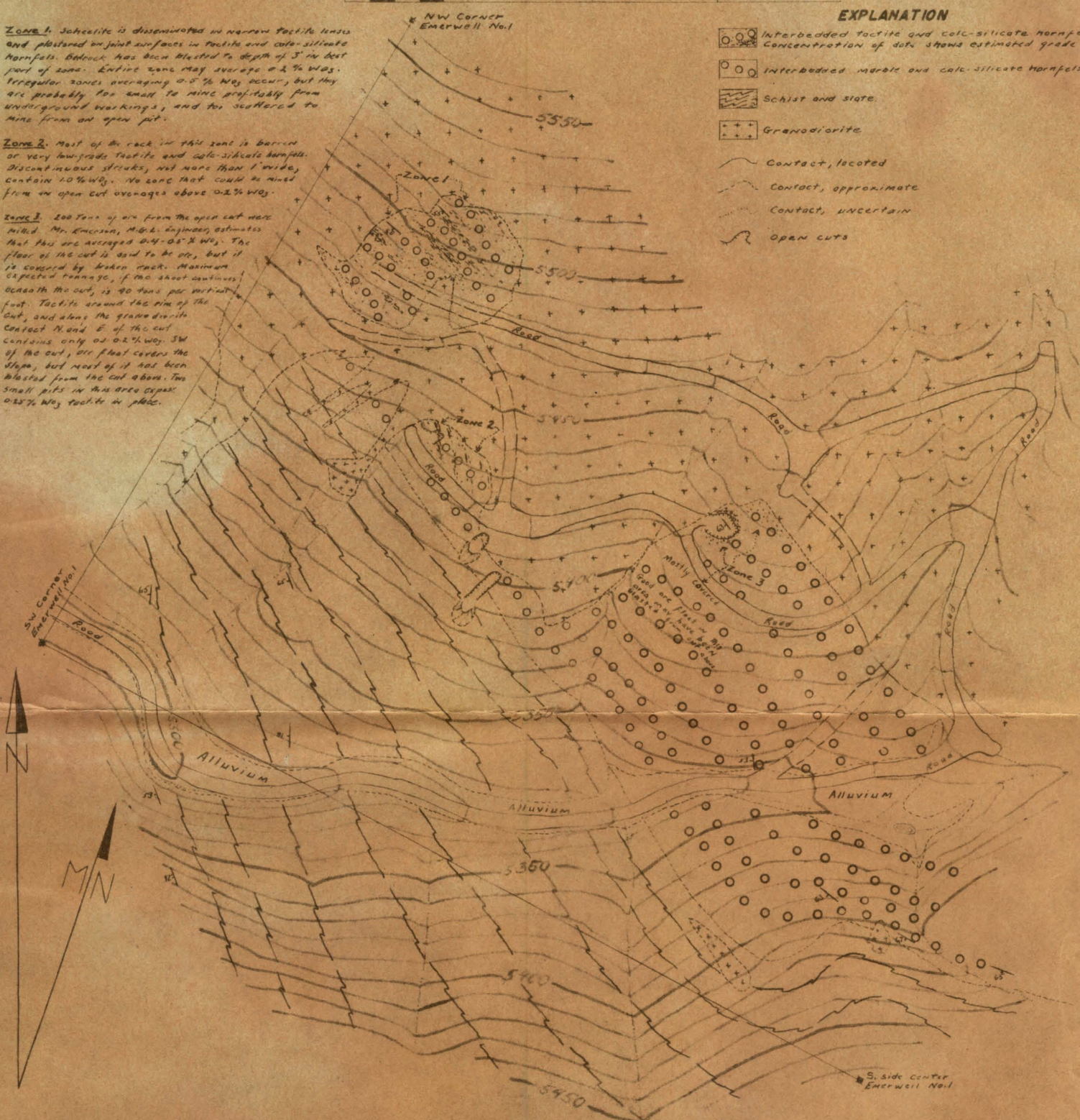
DATUM BY ANEROID FROM M.G.L. MINE

SCALE

Zone 1. Scheelite is disseminated in narrow tactite lenses and plastered on joint surfaces in tactite and calc-silicate hornfels. Bedrock has been blasted to depth of 3' in best part of zone. Entire zone may average 0.2 % WO_3. Irregular zones averaging 0.5 % WO_3 occur, but they are probably too small to mine profitably from underground workings, and too scattered to mine from an open pit.

Zone 2. Most of the rock in this zone is barren or very low-grade tactite and calc-silicate hornfels. Discontinuous streaks, not more than 1' wide, contain 1.0 % WO_3. No zone that could be mined from an open cut averages above 0.2 % WO_3.

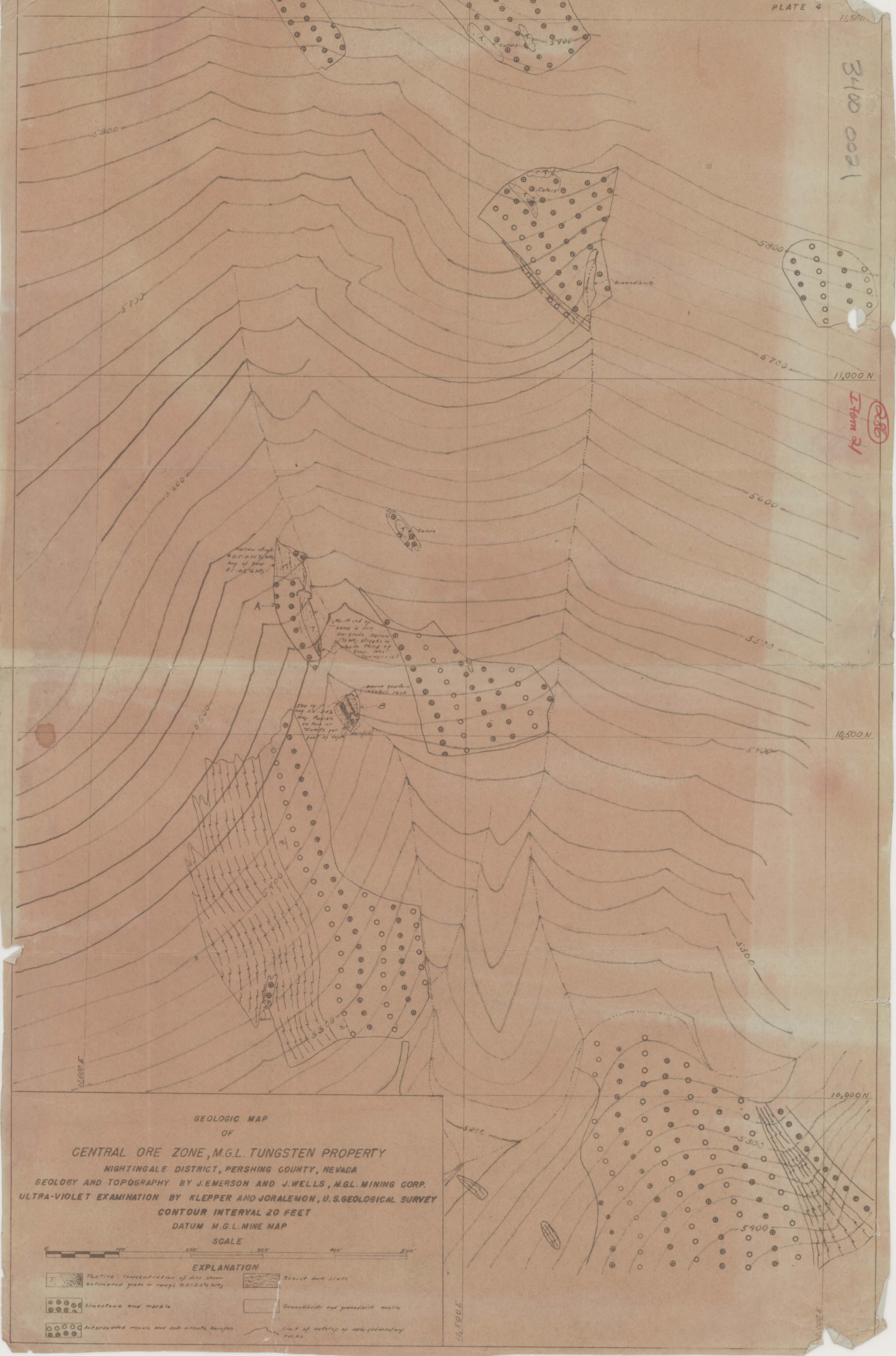
Zone 3. 200 Tons of ore from the open cut were milled. Mr. Emerson, M.G.L. Engineer, estimates that this ore averaged 0.4-0.5 % WO_3. The floor of the cut is said to be ore, but it is covered by broken rock. Maximum expected tonnage, if the sheet continues beneath the cut, is 40 tons per vertical foot. Tactite around the rim of the cut, and along the granodiorite contact N. and E. of the cut contains only ca 0.2 % WO_3. SW of the cut, ore float covers the slope, but most of it has been blasted from the cut above. Two small pits in this area expose 0.25 % WO_3 tactite in place.



EXPLANATION

- Interbedded tactite and calc-silicate hornfels. Concentration of dots shows estimated grade from 0.0-0.75 % WO_3
- Interbedded marble and calc-silicate hornfels. Barren.
- Schist and slate.
- Granodiorite.
- Contact, located
- Contact, approximate
- Contact, uncertain
- Open cuts

PLATE 4



GEOLOGIC MAP
OF
CENTRAL ORE ZONE, M.G.L. TUNGSTEN PROPERTY
NIGHTINGALE DISTRICT, PERSHING COUNTY, NEVADA
GEOLOGY AND TOPOGRAPHY BY J. EMERSON AND J. WELLS, M.G.L. MINING CORP.
ULTRA-VIOLET EXAMINATION BY KLEPPER AND JORALEMON, U.S. GEOLOGICAL SURVEY
CONTOUR INTERVAL 20 FEET
DATUM M.G.L. MINE MAP
SCALE
0 100' 200' 300' 400' 500'

EXPLANATION

- T. Tactite: concentration of dots shows estimated grade in range 0.0-2.0% WO_3
- Limestone and marble
- Interbedded marble and calc-silicate hornfels
- Schist and slate
- Granodiorite and granodiorite mantle
- Limit of outcrop of meta-sedimentary rocks

3400 0021

Item 21

PLATE 5

GEOLOGIC MAP OF PART OF THE EMERWELL NO.1 CLAIM

M.G.L. MINING CORPORATION

NIGHTINGALE DISTRICT, PERSHING COUNTY, NEVADA

M.R. KLEPPER P. JORALEMON

U.S. GEOLOGICAL SURVEY JULY 1943

CONTOUR INTERVAL 10 FEET

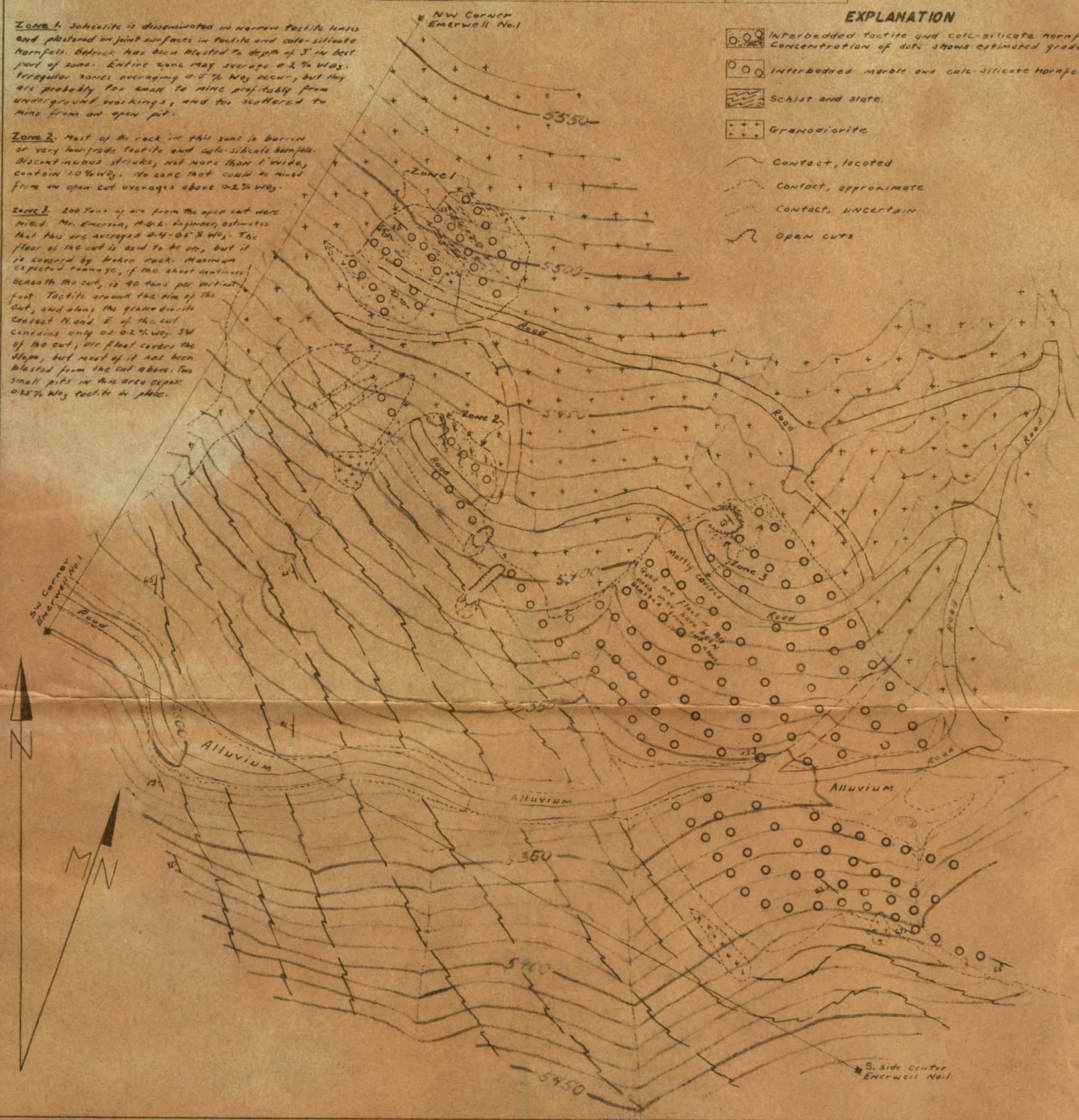
DATUM BY ANEROID FROM M.G.L. MINE

SCALE

Zone 1. Scheelite is disseminated in narrow tactite lenses and plastered on joint surfaces in tactite and calc-silicate hornfels. Bedrock has been blasted to depth of 3' in best part of zone. Entire zone may average 0.2% WO_3. Irregular zones averaging 0.5% WO_3 occur, but they are probably too small to mine profitably from underground workings, and too scattered to mine from an open pit.

Zone 2. Most of the rock in this zone is barren or very low-grade tactite and calc-silicate hornfels. Discontinuous streaks, not more than 1' wide, contain 1.0% WO_3. No zone that could be mined from an open cut averages above 0.2% WO_3.

Zone 3. 200 Tons of ore from the open cut were milled. Mr. Emerson, M.G.L. engineer, estimates that this ore averaged 0.4-0.5% WO_3. The floor of the cut is said to be ore, but it is covered by broken rock. Maximum expected tonnage, if the shoot continues beneath the cut, is 40 tons per vertical foot. Tactite around the rim of the cut, and along the granodiorite contact N. and E. of the cut contains only an 0.2% WO_3. SW of the cut, ore float covers the slope, but most of it has been blasted from the cut above. Two small pits in this area expose 0.25% WO_3 tactite in place.



EXPLANATION

- Interbedded tactite and calc-silicate hornfels.
- Concentration of dots shows estimated grade from 0.0-0.75% WO_3
- Interbedded marble and calc-silicate hornfels. Barren.
- Schist and slate.
- Granodiorite
- Contact, located
- Contact, approximate
- Contact, uncertain
- Open cuts

PLATE 6

3400 0021

RECONNAISSANCE MAP
OF
THE CENTRAL NIGHTINGALE RANGE
SHOWING GEOLOGY IN VICINITY OF KNOWN SCHEELITE DEPOSITS
CHURCHILL, PERSHING, AND WASHOE COUNTIES, NEVADA

C. W. CHESTERMAN U. S. GEOLOGICAL SURVEY

JULY 1943

SCALE (Approximate)
0 2000 4000 6000 Feet

EXPLANATION

Basalt, Flows, breccia, tuff and tuffaceous sediments.

Limestone and marble.

Granodiorite and related intrusive rocks.

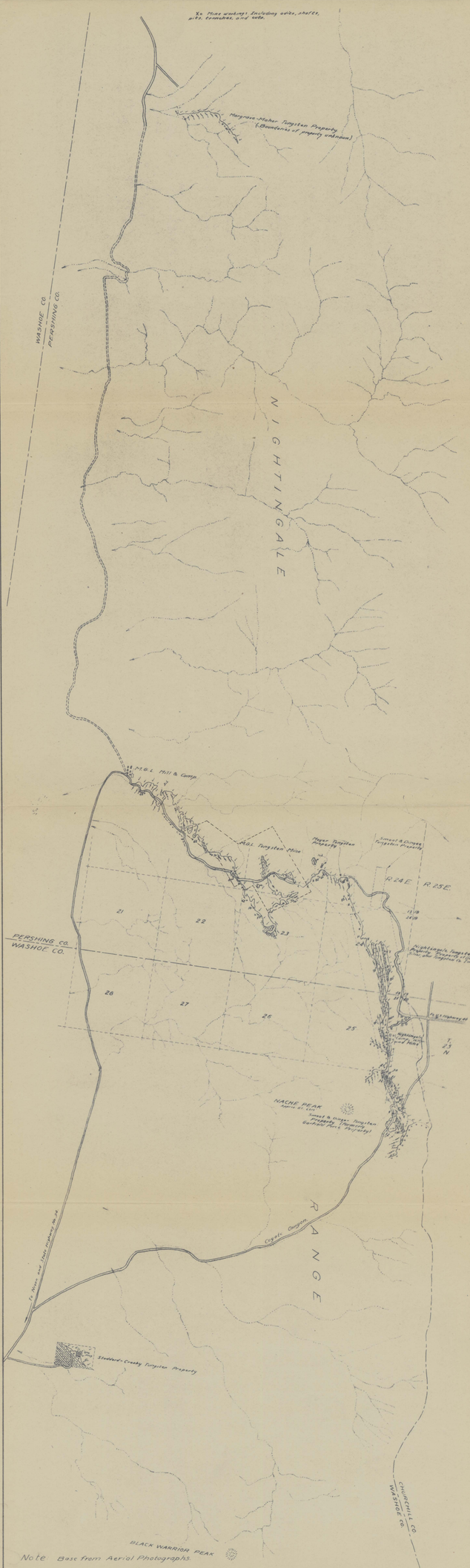
Hornfels.

Rockite.

Schist and slate.

Mine workings, including adits, shafts, pits, trenches, and cuts.

Item 21



Note Base from Aerial Photographs.