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05/07/86

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES FILE DATA

PRIMARY NAME: EL DORADO

ALTERNATE NAMES:
PATENTED CLAIMS MS 3521
CHRYSOTILE PROPERTY
OLD JOHN-MANVILLE PROPERTY
WESTERN CHEMICAL CO
VICTORY DEPOSIT

GILA COUNTY MILS NUMBER: 249A

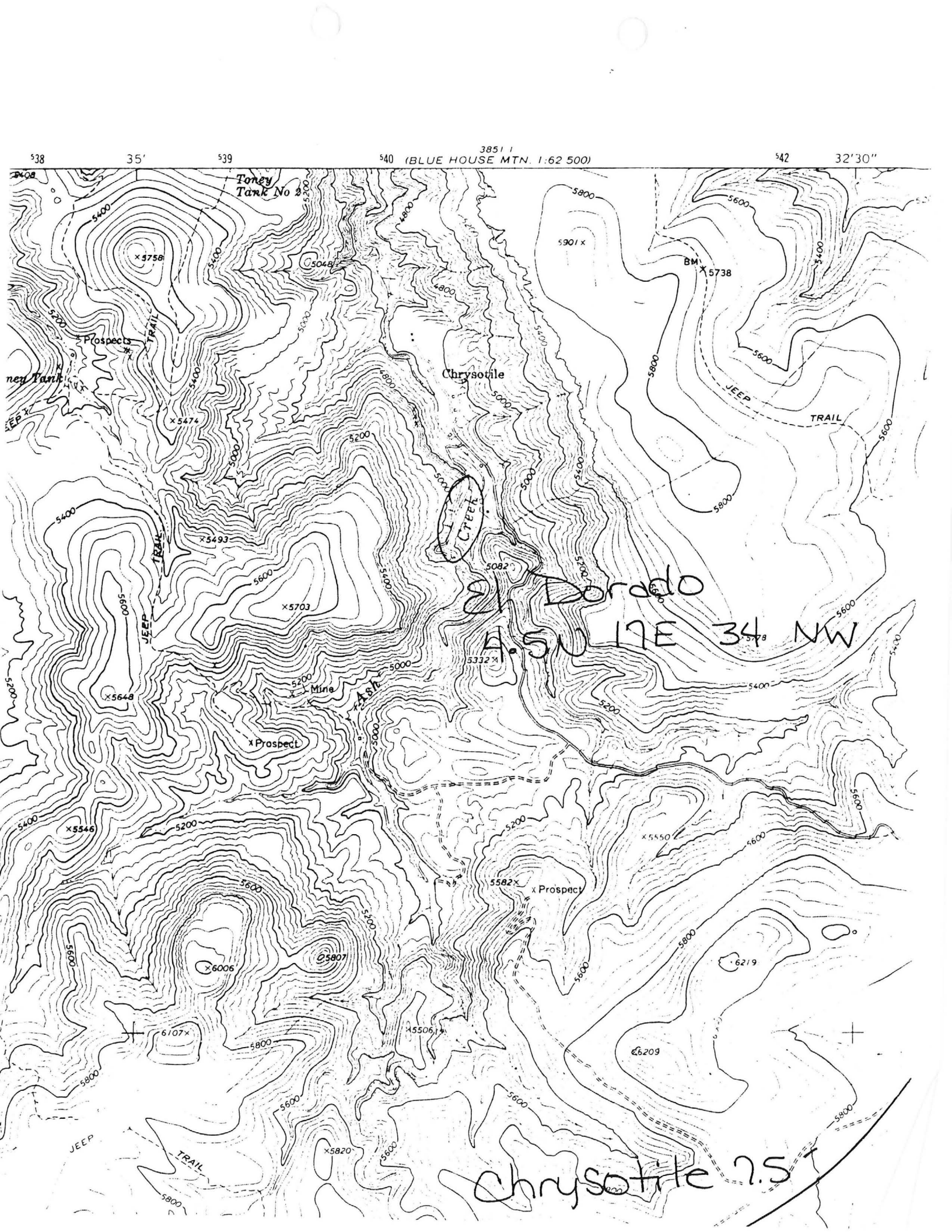
LOCATION: TOWNSHIP 4.5N RANGE 17 E SECTION 34 QTR. NW
LATITUDE: N 33DEG 44MIN 00SEC LONGITUDE: W 110DEG 33MIN 53SEC

TOPO MAP NAME: CHRYSOTILE - 7.5 MIN

CURRENT STATUS: PRODUCER

COMMODITY:
ASBESTOS - PRIMARY

BIBLIOGRAPHY:
ADMMR EL DORADO FILE
OP: JAQUAYS MINING CORP. 1978
BLM MINING DISTRICT SHEET 184, 185, 186
STEWART L A CHRYS-ASB DEPTS OF AZ USBM IC 7706 1955 P 27, 28
ADMMR DIR OF ACTIVE MINES IN AZ 1980 P 12
MSHA YELLOW SHEETS
ADMMR MAP OF UNDGRD ROLLED ALPH FILE UPSTAIRS


3851 I
538
35'
539
540
(BLUE HOUSE MTN. 1:62 500)
542
32'30"
Toney Tank No 2
Prospects
TRAIL
Chrysotile
JEEP
TRAIL
BM 5738
Creek
El Dorado
4.5N 17E 34 NW
Mine
Ash
Prospect
Prospect
JEEP
TRAIL
JEEP
TRAIL
Chrysotile 7.5'

ARIZONA DEPARTMENT OF MINES AND MINERAL RESOURCES

INFORMATION FROM MINE CARDS IN MUSEUM

ARIZONA
GILA COUNTY

El Dorado Mine MILS 249A-5-AKA El Dorado mine file
MM-9416 Chrysotile
MM-9417 Chrysotile
MM-9418 Chrysotile
K 607 Chrysotile

DEPARTMENT OF THE INTERIOR

BUREAU OF MINES

HEALTH AND SAFETY TECHNICAL SUPPORT

HEALTH STUDY (ASBESTOS DUST)
EL DORADO MINE
VICTORY MINE

JAQUAYS MINING CORPORATION
GLOBE, GILA COUNTY, ARIZONA

October 3, 1972

BY

Amin N. Alameddin
George W. Weems
James G. Inderberg

DENVER TECHNICAL SUPPORT CENTER

Glen W. Sutton
Chief

Originating Office
U.S. Bureau of Mines, Health and Safety
Denver Technical Support Center
Denver Federal Center, Building 55
Denver, Colorado 80225

Natural ventilation constituted the main source of air throughout the mine.

DESCRIPTION OF STUDY

The exposure of workers to asbestos containing airborne dust has been demonstrated to cause a pneumoconiosis called asbestosis, and asbestos-induced neoplasms. All control measures applicable to mineral dust control can be used for airborne asbestos, but to achieve safe levels of exposure requires stringent control practices.

At the El Dorado mine, the following conditions and practices were noted:

1. Holes were collared and drilled wet with pneumatic jackleg drills.

2. Water for drilling purposes were the main dust-control measures used at the mine.

3. Hard hats and safety footwear were worn by all employees. Eye protection was provided where needed.

4. It was reported that USBM approved respirators were provided, but no miners were observed wearing respirators at the time of the survey.

5. No change house was provided for the men.

6. An annual chest X-ray is being monitored by the Public Health Service.

7. The weather was cloudy, and it was drizzling all day.

Seventeen airborne asbestos dust samples were collected on membrane filters, using pumps calibrated on site prior to use to pull 1.4 liters of air per minute; these samples were counted in the Technical Support Center's Denver laboratory at approximately 460 magnification with phase contrast illumination according to the method established by the U. S. Public Health Service. Full-shift exposures were determined for three selected workers in El Dorado mine and one worker in the Victory mine. One general atmosphere sample was collected at the dump area. All airborne samples were collected in the breathing zones of the workers.

INTRODUCTION

This report is based on a health hazard evaluation of El Dorado (asbestos) and Victory (asbestos) mines, Globe, Arizona. It is one of a series of health investigations of asbestos mining and milling operations.

GENERAL INFORMATION

General and descriptive material included in the report is based on information secured at the time of the survey and does not reflect subsequent changes that may have occurred.

Both the underground Victory and El Dorado asbestos mines are at the site of an old mining town, Chrysotile, Arizona in the MacMillian mining district. The mines are reached by travelling about 33 miles on U. S. highway 60 from Globe, Arizona to a dirt road turning 0.7 miles on milepost 283. The mines are owned and operated by Jaquays Mining Corporation, Box 328, Globe, Arizona 85501. D. W. Jaquays is the president and general manager; J. L. Kleiner, Mine Superintendent. A total of 11 men 10 underground, worked one 8-hour shift a day, 6 days a week at El Dorado. The same number of men worked at the Victory mine.

The day of the survey, 11 men were working at El Dorado mine, and only 2 men were doing development work at the Victory mine.

El Dorado mine is opened by 5 interconnected adits. One is used as a main entry and the others are kept open for ventilation and additional exits.

The Victory mine has several openings; one adit was used for production and the others were used for ventilation and emergency exits.

A random room-and-pillar system of mining was used in both mines. The ore, chrysotile asbestos in serpentine, occurred as irregular lenses in competent horizontal beds of limestone. The ore was recovered by the resuing process.

Waste was blasted and slushed into worked-out areas, where it was dryed, walled, and gobbed. Exposed ore was blasted and hand sorted into a steel stone boat. A slusher was used to pull the stone boat to an ore pass. Ore was loaded into 20-cubic-foot cars and moved by battery-power Mancha locomotives and dumped on the grizzly in the sorting room over the ore bin. The ore was then hauled from the mine to the mill in Globe, Arizona by a contract trucker.

PARTMENT OF THE INTERIOR
BUREAU OF MI S

Mine: El Dorado & Victory **I.D. No:** 40004-0-02-004

Company: Jaquays Mining Corp. **Underground** X **Open Cut** __

Operated by: Jaquays Mining Corp.

Survey by: Bureau of Mines, Denver Technical Support Center

Location: Chrysotile, Gila County, Arizona

Survey dates: October 3, 1972

DISTRIBUTION:

Company officials:
D. W. Jaquays, President and General Manager

Assistant Director--Health and Safety Technical Support (2)
Chief--Pittsburgh Technical Support Center (1)
Assistant Director--Metal and Nonmetal Mine Health and Safety (2)
Chief, Health Div.--Metal and Nonmetal Mine Health and Safety (1)
Originating office: Technical Support Center, Denver, Co. (2)

State agencies:
Verne C. McCutchan, Arizona State Mine Inspector,
Phoenix, Arizona

District Manager: Allen D. Look, Alameda, CA
E. A. Morgan, Phoenix, AR

Other:

Bureau of Mines Liaison Officer: Floyd D. Everett
NIOSH Regional Administrator -- Douglas Johnson

Union: None

State Plan Coordinator: John Franz

DISCUSSION AND RESULTS

In 1967, the published TLV 1/ was 5 mmppcf (million particles per cubic foot of air) for asbestos-containing dusts when collected conventionally with the impinger or midget impinger and counted conventionally with the standardized light-field counting method. The number concentration represented the visible fragments (small) of asbestos fibers, plus the many associated mineral dust particles.

In 1968, the published "Notice of Intended Changes" proposed that (1) the 5 mppcf be reduced to 2 mppcf; and (2) an alternative figure of 12 fibers/ml (fibers per milliliter) greater than 5 microns in length be adopted - this figure was to be based on the membrane filter method at 430X phase contrast magnification.

The aforementioned two proposed changes were retained in 1969; in 1970, the published proposed changes (1) dispensed entirely with the impinger sampling method and its number concentration figure; and (2) recommended that the alternative value be changed from 12 fibers/ml greater than 5 microns in length to 5 fibers/ml greater than 5 microns in length.

In 1971, the "Notice of Intended changes" retained the 1970 proposal, and specified the membrane filter method at 400-450X magnification phase contrast illumination. Also, an excursion limit not to exceed 10 fibers/ml may be permitted for 15-minute periods each hour up to five times daily.

For purposes of this health study, it is believed that the 1972 proposed TLV figure and sampling method provides the best indication of the asbestos dust health hazard. This value has also been accepted by the U.S. Department of Labor, and on December 7, 1971, an emergency standard of 5 fibers/ml was published in the Federal Register. Therefore, the proposed 5 fibers/ml (on a time-weighted basis) is used as the threshold limit value.

1/ Threshold Limit Values for 1967, Recommended and Intended Changes; American Conference of Governmental Industrial Hygienists, 1967.

Fiber concentration and pertinent data for the individual airborne dust samples with the time-weighted average exposure for each individual are listed in Appendix I.

CONCLUSIONS AND RECOMMENDATIONS

The fiber concentrations in various areas are shown to be, for practical purposes, below the threshold limit of 5 fibers/ml. Recent information indicates that a value of 2 fibers/ml may be adopted in the future to assure adequate protection of the health of workers exposed to asbestos; therefore, control measures adopted should recognize such potential reduction.

No other hazardous dust conditions were observed directly. From the observations, the following recommendations are pertinent:

a. No change house was available. To minimize contamination of an employee's home with asbestos carried in on work-clothing and footwear, it is recommended that suitable lockers and shower facilities be provided.

ACKNOWLEDGMENT

The authors appreciate the cooperation of company officials and employees.

APPENDIX I

Date Collected: October 3, 1972

Sample No.	Sampling Time Start	Stop	JOB TITLE Location and Operation	Calculated Conc Fibers/ml >5 Microns
El Dorado Mine				
J-1	7:21	8:21	Trammer: At main level - Tramming Loading - Dumping ore at ore bin	0.04
J-2	8:21	10:40	Same	0.14
J-3	10:40	11:52	Same	0.00
J-4	11:52	15:13	Same	0.04
	Trammer Time Weighted Average (TWA) = 0.06 Fibers/ml			
A-1	7:15	8:25	Miner: At bottom drift 15E- Mucking and Loading Cars	0.11
A-2	8:25	11:10	Same	0.12
A-3	11:10	11:45	Same	0.35
A-4	11:45	13:44	Same	0.16
A-5	13:44	15:18	Same	0.08
			Miner TWA = 0.14 Fibers/ml	
G-1	7:12	8:07	Driller: Drilling at the ore stope	0.58
G-2	8:07	11:55	Same	0.14
G-6	11:55	14:20	Same	0.00
G-8	14:20	15:20	Same	0.20
			Driller TWA = 0.16 Fibers/ml	
G-3	8:54	11:43	Area Sample: At ore bin	0.22
G-5	11:43	14:54	Same	0.06
			Area Sample TWA = 0.14 Fibers/ml	

APPENDIX I

Date Collected: October 3, 1972

Sample No.	Sampling Time Start	Stop	JOB TITLE Location and Operation	Calculated Conc. Fibers/ml 5 Microns
Victory Mine				
G-4	10:22	12:00	Driller: Developing 500 stope	0.32
G-7	12:00	15:15	Same	0.35
			Driller TWA = 0.34 Fibers/ml	

ARIZONA DEPARTMENT OF MINERAL RESOURCES
Mineral Building, Fairgrounds
Phoenix, Arizona

1. Information from: Mike Sawyer

   Address: U.S.B.M. Intermountain Field Operation Center, Denver

2. Mine: El Dorado 3. No. of Claims - Patented ____

   Unpatented ____

4. Location: ____

5. Sec ____ Tp ____ Range ____ 6. Mining District Chrysotile

7. Owner: Jacquay's Asbestos

8. Address: ____

9. Operating Co.: same

10. Address: ____

11. President: D. W. Jacquay 12. Gen. Mgr.: ____

13. Principal Metals: asbestos 14. No. Employed: ____

15. Mill, Type & Capacity: ____

16. Present Operations: (a) Down ☒ (b) Assessment work ☐ (c) Exploration ☐
    (d) Production ☐ (e) Rate ____ tpd.

17. New Work Planned: If a buyer is not found - the pillars will be mined and the mine allowed to cave.

18. Miscl. Notes: Mr. Sawyer reported meeting with Mr. Jacquay and visiting the mine with his mine superintendent. The mine is idle, but maintained and is for sale along with the mill in Globe. Mr. Jacquay's estimates there are reserves of 5,000 tons of fiber of which approximately 1% might be longer than 3". The current stopping area is now 100' above the haulage level and will rise as stopping progresses up the gentle dipping beds. The mine was shut down in January.

Date: June 2, 1982

Ken A. Phillips
(Signature)

Ken A. Phillips
(Field Engineer)

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

FIELD ENGINEERS REPORT

Mine Chrysotile

Date November 20, 1959

District Seneca, Gila County

Engineer Lewis A. Smith

Subject: ~~Mine visit~~ Conference with Jaquays

Property: 76 claims in all, 12 of which are patented. This is the status of the property as acquired by the Arizona Asbestos Association (Johns-Manville Co.). About 1942 all property, but 22 patented claims, was relinquished. The mine equipment and mill were dismantled in 1945. In 1951 Western Chemical Co. acquired the property and constructed a crude crushing and fiberizing mill. The property was acquired in mid 1959 by D. W. Jaquays Co.

Location: Sec. 32, T. 5 N., R. 17 E., 32 miles on Hwy. 60, 3 miles west by dirt road.

Geology: The work and geology is most adequately described in U. S. Bureau of Mines I.C. 7706, pp 28-32. Present work consists of the construction of an adequate road to the mine, a distance of 3 miles from Highway 60 to the west. The mine (Victory) is being cleaned up preparatory to mining pillars and new ground. The mine clean up is well along and will be lighted. Some pillars were previously extracted and as a result the ~~mine~~ mines are heavy in places. Jaquays reports that a good reserve, in pillars and areas not worked out, is present. Since the old Jaquays Co. mill is inactive because of transfer of old equipment to the new mill, no mining of fiber is being done here or at the Regal Mine.

The fiber is soft in some seams, while in others it is harsh, or semi-harsh. The Victory mine is said to have had soft fiber in the main. The other two mines lean more toward harsh fiber. More can be told at a later date when the mine is cleaned up further. Work thus far has been concentrated upon exposing immediate stoping areas.

DEPARTMENT OF MINERAL RESOURCES

STATE OF ARIZONA

FIELD ENGINEERS REPORT

Mine Regal and Chrysotile Date January 18, 1962

District Chrysotile District - Gila County Engineer

Subject: Interview with D. W. Jaquays and Rienhart

The Regal mine exploration program, while bleak for a time, is now encountering the ore zone again. This deposit has been severely disrupted by transverse faults. The Chrysotile has a good ore zone which has of late largely supplied the mill. The Chrysotile fiber is quite good. Jaquays reported that he was swamped with orders for No. 3 (filter grade), but could not fill all of them. His last price was $425 per ton, which he feels like Neal, is too low to make much. Since some lower grades are not moving well, it is felt that a price of $475 to $500 would be necessary to permit the needed development work.

ASBESTOS SURVEY

NAME OF PROPERTY Chrysotile

OWNER - Name Western Chemical Co. OPERATOR: Name Western Chemical Co.
Address 3270 E. Washington Blvd. Los Angeles, Calif. Address Box 1041 Globe, Arizona

TYPE OF ORE: Asbestos Soft Fiber

Length of Fibre

Soft Hard

PRODUCTION (tons of crude ore)

Past Our production in the past has not been regular

Present Three to Five tons Monthly

Estimated Future Production Five to ten tons Monthly

ORE RESERVES:

Ore in Place

Probable Ore Impossible to estimate

IS YOUR ORE THE TYPE THAT COULD BE MILLED WITH OTHER ORE IN YOUR DISTRICT? Yes
We do custom mill work for other mines in our area.

Note. Our primary intrest is in the shorter groups of asbestos, which we are milling from the dumps, left here by former operators.

Signed: Western Chemical Co.
G. R. Haynes G. R. Haynes

March, 1954

Arizona Department of Mineral Resources
Phoenix, Arizona

Western Chemical Co., (formerly the Chrysotile mine of the Johns-Manville Co.)

Owner and Operator-Western Chemical Co.,
Jerry Haynes, Supt.
Globe, Arizona.

This property was acquired by Western Chemical and a mill errected to work the dumps and such mined ore as the company might produce or on a custom mill basis. Most of the effort to date has been in running old dumps and mill dumps left by the Johns-Manville operation. The company has from time to time mined small tonnages of ore from easily accessable fiber left from earlier operation as their market demands require and when men used on the dump work were free for such work. Some few leases were granted but were not too satisfactory and the leasees quit, in at least one case due to innexperience in the asbestos business. The report on this property has not come in and so production and capcity of the mill are not known, but the mill can probably handle 10 tons per 8 hour shift or more when making crudes. The capacity when fiberizing will be lower than the crude mill. Arizona Asbestos Mining Co. has their ore milled here. Crown Asbestos Mines, Inc. had their ore milled here prior to the construction of their own mill. Triple Star Mining Co. will probably have their fiber milled here, as only a few miles separate this mine and the mill.
The writer has seen only a small part of the old workings, which are very extensive and partly inaccessable, but from maps and conversations with those who have seen other parts of the mine believes that a considerable tonnage of good fiber remains, but that much of it would require considerable expenditure to extract as most of tracks and air lines have been removed and some portals and parts of tunnels closed by caves. Some experienced men believe this would be a financially successful venture if correctly handled and financed, at present market prices.

CHRYSOTILE ASBESTOS

Asbestos

Gila 4 - 3 T 4 N, R 17 E

J. Manville Corp., Globe

Mng Ariz Jour 6/52

WESTERN CHEMICAL CO. -

New Process for floor tile developing by Western Chemical Co. Mix - Limestone and asbestos and ground 200 mesh. Percentages balanced by use of multiple screen machine.

-

Min World 8/1956

CHRYSOTILE

Ash Creek Canyon located in the Apache Mountains of Arizona, five thousand feet above sea level, until a few years ago known only to a few active cowboys who would occasionally round up wild cattle in the vicinity of Bar Hole or hunted brown bears and mountain lions who were killing their horses, now shelters the little village of Chrysotile which boasts the largest underground asbestos mine on the continent. Within a mile of the Mine Office stands the famous Rock House with its many portholes built by cowboys as protection against the Apache braves. Many stories of this district, where a gloved right hand was unknown until a few years ago, and a 40-some-odd on the hip is still a common thing, may be told.

In 1914 this canyon whose walls tower from 800 to 1000 feet above the creek bed echoed to the whack of the prospector's pick and the hoarse, even-song of his burro. The West brothers, cowboy prospectors, or "optimists of the hills" whose "miners' compass" was the swinging tail of their pack burro, staked out the first claims in this now-famous canyon. After they had filed on several claims their next worry was, "what will we do with it?"

After sometime Messrs. Fisk and Snell of Globe, Arizona became interested and began mining on a small scale under the management of Mr. N. A. Nelson.

A year or two later Mr. C. H. Shoemaker visited the property with the result that it was soon acquired by the Johns-Manville Corporation. This was the starting point of a camp which up to that time was without a name. Knowing of no other name more suitable, Mr. Shoemaker decided it should be named "Chrysotile" a name closely allied with asbestos of which this mine has produced many tons and has proven worthy of its name.

From early 1916 the mine actually began to grow under the able management of Mr. N. A. Nelson. Semi-diesel Air Compressors were installed, a task accompanied with many hardships as there were no roads over which to transport heavy machinery and mule teams and pack burros had to do that which is ordinarily done with flatcars and locomotives.

Soon a few tents were replaced with stone buildings, the tin mess hall was replaced with a two-story stone building of ample size for mess hall and store and the frame shack that housed the compressor was replaced with a stone structure; road improvements were started, and in general the camp took on an atmosphere of permanency. Most of these improvements being made after the writer came to Chrysotile in the spring of 1920.

Since 1922 work has been carried on under the direction of Mr. Frank Knuckey. Several hundred feet of tunnels have been driven, new full-diesel engines have been installed as well as more powerful rock drills, an electric mule to replace hand trammers, generators for light and power and for electric refrigeration in mess hall and staff houses and for lighting the camp. As recent as 1927 the writer recalls Mr. Shoemaker asking to be allowed the privilege of being "torch bearer" when escorting a party one evening from the Superintendent's house to the power house. Since then lights have been installed from one end of the camp to the other and it is now safe to walk around at night without the "torch" which in the very-recent past was used as a safety measure to guard against the possible stepping on the business end of a rattlesnake that might be enjoying peaceful slumber, on the hot sandy road.

A garden has been built up and maintained in a very efficient manner and abundant fruits and vegetables are furnished in season. Corn, watermellons, cantaloupes, tomatoes, and the like are furnished the Staff free of charge, a consideration which is highly appreciated after a hard winter.

From the garden the Staff Houses are located on the eastern side of Ash Creek for a distance of one mile, ending with the store, which is a two-story rock house containing store and mess hall. Below the store are the Company Plant Buildings which include the Powerhouse, Fibre House, Office, Warehouse, Blacksmith Shop, Carpenter Shop, and Shift-Boss Office.

From the Shift-Boss Office it is about one-quarter mile to Sonora where all of the spanish-speaking employees live. As Mexicans constitute about 95% of the employees at this location, Sonora is the largest resident section of camp. From here the canyon narrows again and soon terminates in two perpendicular walls only a few feet apart through which Ash Creek flows into Salt River.

On the eastern side of Ash Creek the ground gradually rises higher until it is crowned with some very high, brightly-colored cliffs. These cliffs are from 200 to 1000 feet high and reflect many bright colors against the setting sun.

On the western side of Ash Creek a very high mountain comes down almost to the water's edge, thus cutting off the view in that direction.

The climate here is most ideal. The summers are warm but never to the extreme. At night one is always able to sleep comfortably as it is always cool at night at this altitude. The fall, or Indian summer, is particularly nice, lasting about four months. During this period there is very little rain. The days are long and very bright with the nights very cool. This sort of weather is very invigorating. The winters are not to the extreme, however, we do have some snow but never enough to prevent surface labor.

From the top of the high cliffs partly surrounding camp the nicest view may be obtained. From here one can see the garden and the trees growing along Ash Creek. One can also see the roofs of the Staff Houses as they seem to peek from beneath the shade of some large tree and below can be seen the white tops of the houses in Sonora, with thin spirals of smoke curling upward; the view being lost in the darkness of the narrow canyon below.

For some reason, possibly our isolation, we unlike most every other J-M plant, cannot boast of men with long service records. This is truer of the Americans than of the Mexicans. It seems that after an American has been here a year or so he suddenly becomes "stake bound" a term generally applied to a person having too much money to stay in the hills, and craving the white lights.

It is not unusual for an employee to notify the Office that he has "got 'em rolled up and is taking 'em along", meaning that he has got his outfit together and is ready to leave camp. It seems that the bright sun light, warm nights and light air gives a "can't be worried" feeling to most of our inhabitants.

Next to Mr. Knuckey, Joe Castaneda has the longest continuous service record having been here since January 1927. Mr. Castaneda has, however, worked at this location at different times since early 1916. Mr. Knuckey and Mr. Castaneda were together in early 1917 in the Sierra Ancha Mountains some fifty miles from Chrysotile, mining asbestos for the American Ores & Asbestos Company, then controlled by the U. S. Asbestos Company.

Our present Staff consists of:

Frank Knuckey, Superintendent
G. V. Stevens, Assistant to Superintendent and Engineer
Joe Castaneda, Mine Foreman
R. A. Grange, Accountant
G. F. Dean, Assistant to Mr. Grange
H. E. Claude, Stenographer
H. M. Blanchard, Master Mechanic

Because our location is so far from other towns, and because its size prohibits moving pictures, etc. our social activities are somewhat limited. Yet this does not mean that we are without forms of entertainment for we are not. One of our best entertainments is hiking. Our climate is so ideal that there is seldom a day but that a person may take a long hike into the hills surrounding Chrysotile. From camp there are many trails leading off into the mountains, any one of which offers beautiful scenery to recompense the hiker. Some of these are trails used by cowboys, some are used by woodpackers, others lead to neighboring mines or cattle ranches, and some are used by moonshiners. One may climb up into the pines to enjoy their cool, restful shade or they may spend the day climbing steep cliffs which offer many a thrill to the seasoned hiker. Then again, one may spend their time on level mesas upon which there are many rabbits, quails, rattlesnakes, deer, fox, coyotes and even occasionally a bear. This offers keen enjoyment to the hunter.

Each month we have two dances. The mess hall is of sufficient size to accommodate twenty to thirty couples at one time. To attend one of our dances is indeed a rare treat. Everybody attends and this includes the young and the old. One of the adjoining rooms is used for a nursery to take care of the sleeping children while their parents are dancing. Lunch is always served and any of our J-M friends who may be in this vicinity are cordially invited. A good time is always assured as we are as one group, there being none but J-M employees in this camp.

In the summer we quite often dance in Sonora (name of our Mexican section) where there is a large stone house called Casa Hidalgo that has a small park in front of it. Here we dance on the ground but the ground is so hard that it is almost like dancing on cement. It is hard to describe this picture but if one could see our little camp lost in the surrounding mountains, and could see one of our open-air dances in the wonderful Arizona moonlight, with just enough light to make objects discernible, and see the moving figures and hear the soft drumming of the banjos, they would realize this a picture likely never to be forgotten.

During the winter we gather at the different homes and spend the evenings playing bridge or making candy. Mr. and Mrs. Knuckey quite often keep 'open house' and many gather to listen to the music from their radiola or to hear the radio news of the outside world.

Last but not least, the knights take their respective seats at the Round Table and an evening is sometimes spent in the ancient pastime of trying to guess whether the next card will break you or just give you twenty-one.

Pay day in Chrysotile is the one time when all of our employees seem very happy. Upon these occasions, most of them being of a music and fun-loving nature, sing and play guitars and banjos until far into the night. This form of entertainment is never interferred with but a strict vigilance is necessary to keep the camp dry. Oh-Be-Joyful (in liquid form) is absolutely forbidden in this camp at all time and is one thing strictly enforced by our

Superintendent. Some of our close neighbors try to slip this liquid into camp by coming down the steep cliffs after night, but this most usually ends in a trip to town for the offender and his loss of fire arms and stock in trade. On one occasion an employee, while under the influence of this refreshment arrived at the conclusion that he was a foot specialist and was humorously trying to remove corns from the feet of his suffering patient with the aid of a forty-five. A few days in our bastile, however, served to convince him that he was a miner and not a surgeon. The white mule, or mountain dew, of Arizona is very detrimental to mining efficiency and for this reason has been completely barred from camp. Anyone breaking this rule is soon asked to leave camp and somehow none have refused this request.

Arizona ranks high in education and Chrysotile keeps pace with the rest of the state. Although we are practically isolated during the winter months we have a good school for the youngsters of camp, lasting nine months each year.

This school is divided into two divisions, ie., the primary and intermediate grades. Approximately thirty pupils are enrolled this year, Miss Barnette having charge of the intermediate grades and Miss Jackson having charge of the primary department.

The instructing is rather difficult owing to the fact that most of the pupils are Mexicans and most of them do not speak English. They do not have the background that our American children have and for this reason it takes longer to teach them things that American children know before they start to school. It usually requires two to three terms before the pupil has a knowledge of the English language. However, the fact that children from this school quite frequently transfer to other schools throughout the state, without being demoted speaks well for our school.

All pencils, books, supplies of instruction are furnished the students free so that there is no excuse for a child not attending. A truant officer has been appointed to see that all children between the ages of six and sixteen attend school.

The school is under the efficient supervision of the County School Superintendent and operated in step with all other County Schools and is supported by county funds. The mine management each year ask the County Supervisors for the necessary amount to operate the school.

MINING

From the many tunnels driven under the ore zone, branch raises are put into the fibre-bearing rock. These raises play a very important part as they disclose the presence or absence of fibre.

Mining is of the room and pillar with backfill method, meaning in general, that a room is mined out in the solid rock about five feet high, and sometimes fifty feet square. At intervals little pillars of rock are allowed to remain to hold up the "back" or ceiling, thereby eliminating the use of timber as roof supports. The asbestos fibre which occurs practically horizontal, or in blanket formation, varying in thickness from three inches to almost nothing and sometimes occurring in two streaks within the height of the stope or room, is separated from the rock by hand hammers and is placed in boxes, according to grade, and later bagged and transported to the surface. The rock from which the fibre is cobbed is then shoveled back out of the miners' way and automatically backfills the room, thereby preventing cave-ins. After the room is well filled with waste the pillars are then removed if they contain fibre. The rock that cannot be used to backfill, for lack of space, is shoveled into a chute and later trammed to the surface waste dump.

The fibre is transferred from the mine entrances to the receiving platform close to the warehouse where it is inspected, graded, and bagged in sacks of approximately 100 lbs. each and then stored in the warehouse. To one not familiar with Arizona methods of transportation, the transferring of fibre from the mine to warehouse is interesting as ofttimes "desert canaries" or burros (sometimes called donkeys) are used for this purpose. Two bags containing about 120 lbs. each are placed on the animal's back and this patient beast of burden wanders merrily off in the direction of the warehouse seemingly knowing just what it is supposed to do. It is also interesting to note how well the burro seems to understand the Mexican language and how well the Mexican and burro work together.

A new road from camp to our El Dorado workings (on west side of Ash Creek) has recently been completed. This gives us access to this part of the mine with our Dodge truck. Burros were formerly used but the completion of this new road means that burros will not be used in the transporting of fibre from tunnels to receiving shed except during heavy storms when the condition of the road prohibits the use of our truck.

The fibre is later transported from the mine warehouse to a warehouse at Rice, a station on the Southern Pacific Railroad, some forty-two miles from Chrysotile. The road between these two points passes over an elevation of 6500 feet, through wonderful timbered country and passes by the San Carlos Indian Saw Mill which was dismantled just a few years ago.

Under favorable road conditions the transfer is taken care of by motor trucks. While the road connecting camp with Rice is usually in fair condition, the heavy rains and occasional snows sometime make trucking a difficult task. It is rather discouraging to get stuck at night and have to unload the entire load of fibre, and thus lighten the truck until it can be gotten out of the mud or back on the road. This, however, is not an unusual situation and explains why all Arizona truck drivers carry "Balloons".

When the road gets "too tough" the burros are again pressed into service, carrying two bags of 100 lbs. each over the rough forty-two miles, a task usually accomplished in two days. It is customary for one man to handle ten burros--two men with twenty burros constitutes the usual burro train. The asbestos fibre is then shipped by rail, sometimes rail and water, to the factory needing the material.

Globe, Arizona is our nearest town; a mining camp of approximately 12,000 population. This is also our nearest telephone and telegraph station so one can readily see that main events can sometime happen several days before we know it at Chrysotile. One instance in particular that the writer remembers is a visit by Mr. C. H. Shoemaker who came from Quebec to visit Chrysotile. Mr. Shoemaker stepped out of an auto at Chrysotile and after the customary 'good morning' handed me a telegram which he picked up at the Globe Office. It was a message from Mr. C. H. Shoemaker advising me of his intended trip to Chrysotile. It is a rare privilege to send a message across the continent and deliver it yourself, but such it was in the case of Mr. Shoemaker's visit to Chrysotile in 1926.

CHRYSOTILE MINE — GILA COUNTY

Active February 1962
Active Mine List Oct. 1962 - 48 men

Conference with D. W. Jaquays and Al Gerhardt

Jaquays had some very intersting photos of a very wide asbestos band that was recently encountered at the Chrysotile mine. The fiber is 2½ to 3 inches long. However, he said it looked pretty but he has not sold a ton of No. 1 in a year.

Inventories, according to Gerhardt, are at an all time high and sales have mainly been confined to filter grades that are almost all No. 3 grade. Operations have been somewhat curtailed since the inventories are mainly No. 2 shorts, neither of which are selling well. Jaquays can see little hope of overcoming the surplus in view of the low price on South African chrysotile and heavy competition from California shorts. His reserves at the Regal and Chrysotile Mines are good, at present. LAS Memo 1-30-64

Visited the Chrysotile mine with Alvin Gerhardt, Sen. Supt. of Jaquays Mining Corp., Frank Padgett - Mine Supt., had 16 men working, producing filter grade fiber. Development was well advanced, mined-out stopes all back filled and mine very clean. Some 3" - 3½" soft fiber was developed but not being mined at this time. Production about 12 to 18 mine cars a day. EGW Memo 5-28-64

Active Mine List Oct. 1967 - 40 men
Active Mine List April 1968 - 40 men
Active Mine List Oct. 1968 - 30 men
Active Mine List April 1969 - 30 men

Jaquays Asbestos Corporation, Globe, is mining and milling at capacity. Alvin W. Gerhardt is supt., employing approximately 30 men at its mill and the Regal and Chrysotile mines. Pay Dirt 10-1969

CHRYSOTILE MINE GILA COUNTY

Information from Mine Inspector's Office - August 15, 1957

Chrysotile Mine - Chrysotile District 50 claims (1-4-57) Gila County

American Fubre Corp. - Box 1611 - Globe, Arizona
Pres. - A. H. McRae - 340 3rd St. N.W. - Albuquerque, New Mexico
Sec. - Paul Melacon - " " " " " "
Supt. - L. E. Town - P.O. Drawer 2980 - Globe, Arizona

Asbestos - 400 tons per month - Pillar stopes

CHRYSOTILE MINE GILA COUNTY

Active Mine List Oct. 1959
Active Mine List Feb. 1960

This property active. LAS Globe ASMOA 3-17-60

Active September 1960
Active February 1961

Property active Oct. 1961

CHRYSOTILE MINE GILA COUNTY

Jaquays is taking over the old Chrysotile (Johns-Manville) mine from Western Chemical. "American Fibre is out of business, at least in that end of it."
FPK Note 5-7-59

NOTES ON THE GEOLOGY AND STRUCTURE OF VICTORY MINE

Johns-Manville Products Corp.

Chrysotile, Arizona

W. B. Millar

Consulting Mining Geologist
Asbestos Division
Johns-Manville Corporation
New York City

Feb. 1942.

NOTES ON THE GEOLOGY AND STRUCTURE OF VICTORY MINE

Johns-Manville Products Corporation

Chrysotile, Arizona

INTRODUCTION

The working out in detail of the geological structures and economic geology of Victory mine will require some little time as the mine has many openings and access to some of these is difficult or impossible at present. The mine has been idle for more than ten years and during this time the inevitable decay has set in requiring of the present operators a considerable amount of cleaning up and the re-supporting before travel thru all the mine can be accomplished expeditiously. However, certain features of the geology and structure have been studied by the writer with a view of making these "Notes"which, perhaps, will be of use in the more detailed work which should follow as opportunity presents. It will be assumed here that the writer's report on the geology of El Dorado mine, across and up the canyon 1200', is familiar to the reader.

DIABASE STRUCTURES

Investigations in El Dorado mine and El Dorado North show that the larger irregularities in the surface of the intrusive diabase have not only affected the structures in overlying limestones to some degree but also have an important relation to the localization of the best concentrations of asbestos in those limestones. The most important diabase structure is the so-called "roll" which is the result of the diabase intrusion cutting rather sharply up into overlying limestones rather than continuing along some more or less horizontal limestone bedding plane or fracture.

This rise in the diabase appears similar to a fold (anticline) and does, indeed, fold the surrounding limestones to some degree owing to the intrusive forces involved.

The foregoing "review" is introductory to the following which is concerned with the diabase structures in the Victory mine. It was evident that "rolls" in the diabase should be expected if the delineation of the structures in El Dorado and El Dorado North were to have added confirmation in Victory mine.

DIABASE STRUCTURES - T-40 AREA

One of the most notable of the diabase rolls in Victory mine can be traced from haulageway T-40-5, thru T-40, to T-40-4, T-40-2 and T-40-1. Past stoping work on both the Gila and Pinal ore levels shows clearly how important this roll (call it ROLL No. 4) has been to fiber concentration. All the ore in the area northeast of Roll No. 4 is considered as genetically related to it, and the farther from the roll one goes, the poorer the ore becomes. The contour mapping of ROLL No. 4 should provide some interesting specific information.

T - 17 AREA

T-17 is a tunnel-haulageway which follows the Gila level from the outcrop (nearly above T-40 portal) to the main diabase mass which cuts off Victory mine and all mineralization on the northwest, a distance of about 600'. T-17 has two sharp turns in it but its average direction is about N 20 degrees West from outcrop to diabase.

T-17 diabase structure is too complicated to cover here with any detail. It can be seen, however, that at least two rolls in the diabase occur and in

both cases cut off ore in the Gila level, and in one case for certain cuts off ore in the zone of fiberization which lies between the Gila and Pinal levels in this part of the mine. The diabase does not cut high enough to actually remove the Pinal level limestone bed (and hence the ore), but the limestone has been considerably affected and also the localization of the ore.

GENERAL STRUCTURE AND FORM OF VICTORY MINE

The main producing area of Victory as now stoped is some 1200' long and trends about N 60 degrees E from the outcrop, along which fiber can be found for about 600'. At the northeast end of the producing area the width is 300' and beyond this point the dimensions will presumably pinch down rapidly. This quadrilateral shape, as noted, can then be bounded as follows: On the southwest, - outcrop along Ash Creek Canyon; on the northwest, - main diabase mass cutting off all limestone and ore; on the northeast, - ore pinched or believed to be pinching out; on the southeast, - ore pinched out or limestone beds cut off by several rolls in the diabase.

The above 1200' of length can be divided into four sections going from the outcrop to the northeast end based on the localization of ore and/or the geologic structure:

SECTION 1: Goes from the outcrop northeast to T-17, about 300'. The most productive stoping was on the Pinal level. The diabase does not show here but the limestone is fractured and tilted in various directions. Notable structural features in the diabase underlie the Pinal and can be seen along T-17 as previously described.

SECTION 2: Goes from T-17 northeast for 250' to start of SECTION 3 mineralization. SECTION 2 is a very lean area and would appear to be a "high" on the structure rather than one of the limbs of a fold which are known to be more favorable to mineralization.

SECTION 3: Goes from SECTION 2 to ROLL No. 4, a distance of about 250'. Ore is found here in both Pinal and Gila levels. There are some complexities in the structural pattern but these minor folds and faults are related in one way or another to the basic structure, ROLL No. 4.

SECTION 4: Goes from ROLL No. 4 northeast for about 400' to the end of stoping and an apparent lessening of mineralization. Section 4 is on the northeast flank of ROLL No. 4 and all mineralization seems surely to be related to that structure.

ORE DEPOSITS

Past stoping operations have served to delimit the orebodies in a large number of places. The main diabase mass on the northwest is the limiting feature in that direction. There may be extensions of known fiber areas to the northeast but the outlook is not too hopeful and the same comment applies to the area immediately southeast of T-40. One concluded, therefore that from this main fiber zone of Victory mine future ore will have to be won for the most part by advancing old stope faces and by taking out pillars. Working out just where and how to do this will require thotful study. There seems to be no question, however, but that considerable quantities of fiber remain in Victory, both of mill grade and longer. It may not be economically sound to try and recover all of it, but it seems to the writer that quite a large part can be reached without undue expense.

RECOMMENDATIONS

Victory mine should be geologically mapped just as was done, or is being done, for El Dorado mine. In connection with such work the many remaining ore faces can be studied, i. e. and "ore survey" made, and plans be drawn up for recoveries by the best and most economical methods.

Not included in these brief "Notes" are discussions of various openings (tunnels ans stopes) which lie southeast of the main Victory mine. These too, are worthy of detailed study as some of them indicate the presence of workable mill grade fiber.

GEOLOGY OF EL DORADO NORTH ASBESTOS DEPOSIT

Johns-Manville Prod. Corp.

Chrysotile, Arizona

W. B. MILLAR

Consulting Mining Geologist
Asbestos Division,
Johns-Manville Corp.
New York City.

February 1942.

GEOLOGY OF EL DORADO NORTH ASBESTOS DEPOSIT

Johns-Manville Products Corp

Chrysotile, Arizona

INTRODUCTION

It will be assumed here that the reader is already familiar with the data contained in the report on El Dorado mine. The El Dorado North area is discussed separately not because the geologic conditions are different, but because it is located some 1000' along the outcrop going northwest from the portal of EL RIGHT in EL DORADO mine, and hence cannot be mined in conjunction with EL DORADO but will have to be reached by a special road and should, therefore, be considered as a unit mining project to be judged on its own merits.

GENERAL AND ECONOMIC GEOLOGY

The same diabase mass noted in the El DORADO report underlies and cuts thru the limestone formations, and once again the chemically favorable limestone bed known as the "Gila level" is serpentinized and carries economic quantities of asbestos fiber over a considerable area. The fiber zone lies from 1' to 1¼' above the diabase-limestone contact and, as this fact would indicate, the contact is irregular but forms a definite geologic structure which has profoundly influenced the deposition of the ore.

The Gila level limestone bed in EL DORADO NORTH is remarkably similar to that described as occurring in the main stope area of EL DORADO Mine. A massive white to gray-white, pure, magnesium limestone was the original rock but as now found it is altered at the top where serpentinization and fiberization has taken place, a zone generally 8" to 20" wide.

Scattered thruout the bed are nodular shaped yellow to greenish brown serpentine replacements a few inches long.

The asbestos found is for the most part of good quality, and some of it is as good as any to be found at Chrysotile. No. 2 Crude shows on a number of the ore faces, and if future prospecting work results in increasing the size of the deposit, the EL DORADO NORTH area may prove a worth while addition to the Company's ore reserves.

GEOLOGIC STRUCTURE

In the study of the EL DORADO mine it was shown that "rolls" in the diabase a phenomenon of intrusion, had affected the overlying limestone beds and also had played some part, probably an important one, in the localization of economic quantities of fiber. This thesis of structural controls for the asbestos ore receives added support when the structure in EL DORADO NORTH is noted.

Reference should now be made to the map with the plan view of EL DORADO NORTH. Three tunnels enter the area, two of them connecting, and all have branches. What is not shown on the map is the extent of the stoping which was done during the past operations, and so far as the writer knows this information has not been compiled. Of particular interest to note is the line labeled "West Boundary of Ore Zone" which marks the end of fiber mineralization in a westerly direction, the reason for the fiber terminating being a rise (ROLL No. 3) in the diabase which cuts off the ore, or causes it to pinch out just before it would be cut off.

ROLL No. 3 is so numbered because it is exactly the same type of geologic structure as ROLLS 1 and 2 in EL DORADO mine.

Furthermore, its effect on ore localization has been the same, that is, on its east and southeast side there is a concentration of good fiber, while beyond it to the west workable ore has yet to be found. The strong inference is that the roll in the diabase acted as a dam or provided a controlling channelway for the mineralizing solutions.

ROLL No. 3 outcrops just northwest of the portal of T 65, and its action of cutting thru the limestone beds and terminating the Gila ore level can be clearly seen here. The ROLL can also be observed at other points within the mine, and the feature to note is that the distance from the outcrop (portals of the three tunnels) to the ROLL increases from north to south. Thus the horizontal measurements across the ore deposit is greatest in T 30 (about 160'), and from T 30 southward practically nothing is known. The shape of the fiber bearing area is therefore that of a wedge with its point beyond the portal of T 65 on the north and its widest known part T 30 itself on the south side.

Now along T 30 as its southwest end is approached the diabase-limestone contact is rising at a gentle angle and the fiber mineralization appears to pinch out before the point is reached where the diabase would actually cut off the limestone bed carrying the ore. The tunnel ends before it can definitely be established whether at some point beyond the end the diabase rises sharply (as it does where seen in T 6 and T 65), or whether ROLL No. 3 flattens by the time it reaches T 30 and can therefore be expected to flatten still more in the unknown area south of T 30. These matters are of importance for a steep roll is known to frequently accompany mineral concentrations whereas a flat-lying diabase (therefore more or less structureless) may allow for a wide spread

mineralization with little or none of it in economic concentrations.

RECOMMENDATIONS PROSPECTING WORK:

The area of major interest in EL DORADO NORTH is the unexplored area southeast or south of T 30, and there is little factual information to guide one's expectations. The outcrop southeast of T 30 portal is in large part blanketed by overburden for about 100' and what little can be seen there is totally inadequate to condemn the area. The indicated procedure would be to run an exploratory drift thru the ore starting from a point about midway in T 30 and progressing in a direction about South 5 degrees West. If such a drift stays in workable ore for 100', a crosscut running west should next be made to establish the position of ROLL No. 3, if still present, and in any case the limits of mineralization in this direction. Further plans for proper ore development can only be made after preliminary prospecting shws the size of the deposit to be such as to warrant expanding operations.

ORE SURVEY

As previously noted, there appears to be no record of past stoping operations in EL DORADO NORTH. A transit survey should be made to get this information and at the same time calculations can be made regarding the amount of ore which has been at least partly developed by the old workings. There are excellent fiber faces now showing, and only a relatively small area shows the fiber to be in black serpentine. It is believed that enough really good ore remains practically in sight to warrant going after it anytime, but a measured survey of what is actually available is the safest first step to take in any recovery program.

TRANSPORT SURVEY:

In addition to the ore survey it will be necessary to run a survey to determine the best method of getting the ore from the mine down the steep hillside, across Ash Creek, and up the other side to the mill. At present no road is available on the deposit side of Ash Creek, but with a Caterpillar and blade available a dry weather road should not cost more to build than, say, the selling price of a couple of tons of the pure white A-47 type fiber which can be had in some abundance in EL DORADO NORTH.

PLAN VIEW
EL DORADO NORTH

CHRYSOTILE, ARIZONA.

SCALE 1" = 50' FEB. 1942

DRAWN BY: W. Hindley

GEOLOGY OF EL DORADO MINE

Johns-Manville Products Corporation

Chrysotile, Arizona

W.B. MILLAR

Consulting Mining Geologist
Asbestos Division,
Johns-Manville Corp.
New York City.

GEOLOGY OF EL DORADO MINE

Johns-Manville Prod. Corp

Chrysotile, Ariz

INTRODUCTION

A study of the geology and structure of the El Dorado mine was undertaken for the purpose of aiding the start of a program of ore development and in the building up of ore reserves. The foundation for any sound mining program should be a full understanding not only of where the ore is but also the controlling factors that put it there. Altho complete knowledge of these matters is sometimes arrived at only when the last ton of ore is removed, still a careful geologic study will almost certainly give a key to the proper mining procedures to use on the way to that last ton, and furthermore will minimize the costs of the purely exploratory work.

It is necessary in a report of this nature to remember that the results of the work, the conclusions reached, should primarily bear economic fruit, altho perhaps at the same time being of general scientific interest. Hence an effort will be made here to stress the economic factors of the study and leave those features which appear now to be chiefly of academic interest to later and less urgent days.

As mining work and ore extraction proceed in El Dorado new and useful facts are sure to be found which could and should extend the scope and accuracy of this report. Let those, therefore, who study and utilize the data contained herein be prepared to similarly record and use such new progress data as may from time to time come to light. The geologic picture and interpretations will thus build up and increase in usefulness with advancing knowledge.

SUMMARY AND CONCLUSIONS

By following the contact between the limestone and the diabase, and mapping it, it is possible to show exactly the major geologic structures in the El Dorado mine. The relationship of the best asbestos ore to these structures in then noted, and the nature of the ore horizons themselves are discussed. The conclusions reached point with certainty to the fact that the localization of ore is dependent in part, and probably in large part, on the geologic structures in the surrounding and underlying rocks, and that a study and understanding of the geological features should thus go hand in hand with present and future mining and prospecting activities.

A discussion of the ore faces as now seen is included and some forecasts are made of where various types of ore can be expected from future mining operations.

With the report are a plan and cross-sections made with a view to simplifying and aiding in the understanding of the geologic structures involved.

Some specific recommendations are made regarding prospecting and ore development activities.

No estimate is given of potential ore tonnages in El Dorado mine. Until a program of ore development is underway and proper data are available any estimate would be nothing but a guess.

ARIZONA ASBESTOS DEPOSITS: GENERAL GEOLOGICAL FEATURES

All Arizona asbestos deposits have the same basic geologic features. The Serpentine, or serpentine and fiber, occur in certain chemically favorable limestone horizons or beds which have been mineralized by the action of hot

solutions traveling thru the limestones along bedding planes or fractures. These solutions had their origin in or accompanied intrusive diabase rocks which cut thru or into the limestones and frequently followed along bedding planes to form flat-lying lenses or sills.

The limestones, which are included in a series of sedimentary rocks other members of which are quartzite, sandstone, conglomerate and shale, doubtless had some regional structure previous to the intrusion of the diabase. Such structures consisted of very gentle folds or monoclines, accompanied by a certain amount of fracturing and faulting. The diabase, pushing its way into the sedimentary series, imposed local structural features on the regional structure. Thus we find localized folds, "rolls", domes and sets of fractures and faults in the diabase, and these local structures are frequently reflected in the enclosing sedimentary rocks. If, for example, the surface of a diabase sill is mapped by means of contours (lines joining points of equal elevation above sea level), and it is found to form a dome, then it is quite likely that the limestone formation immediately above the diabase will also be domed.

These local structures in the rocks are particularly noted here as they undoubtedly affected the direction and speed of travel of the mineralizing solutions. When the solutions traveled in such a way as to encounter the chemically satisfactory limestones, then the opportunity existed for serpentine or fiber and serpentine to form. With indefinite and poorly marked structures the fiber deposits might be pockety or non-existent. That is, favorable limestone beds with no local favorable structural features may remain barren or too low grade to work. The formation of good fibre deposits required the proper sedimentary and intrusive rocks, the proper structural relationships between them, and finally the mineralizing solutions.

These conditions are quite frequently met with in part (small deposits); a complete set of satisfactory conditions (big deposits) are rare indeed.

EL DORADO MINE: GEOLOGY AND STRUCTURE - GENERAL DESCRIPTION

With the foregoing outline in mind of general geological conditions in Arizona asbestos deposits it is possible to study in detail and with better understanding the conditions at EL DORADO mine. Here is found a bedded limestone formation cut by and underlain by an intrusive diabase mass. Imposed on a low angle regional dip to the north are structures in the limestone which include minor, but important, folds, faults and fractures, in several instances reflecting similar structures in the underlying diabase. The asbestos fibre and/or serpentine occurs in three distinct bands or zones which for convenience have been given the names, from upper to lower, of Pinal Level, Gila Level, and Lower Gila Level. The word "level" as used here means that the same ore horizon is being followed by continuous mine openings and does not mean horizontal. As such mine openings for the most part follow the angles of the geologic structures they are, in fact, rarely horizontal.

Within the three ore zones the asbestos fibre varies in quality, length and value from point to point, sometimes from foot to foot. This feature, common to all asbestos deposits, is difficult to completely explain and so will not be attempted in this report. What will be noted is that the locations of economic (minable) bodies of fiber in the three zones frequently appear to be dependent on the geologic structures in the limestone and diabase, and from this it is concluded that consistent use of structural data will be of advantage in all development and exploratory work.

EL DORADO MINE: DETAILED STRUCTURE OF DIABASE AND LIMESTONE

PLAN NO. 1 should now be studied. This is a plan view of EL DORADO (as tho looking down from an airplane) and was drawn for the particular purpose of showing what the surface of the diabase would look like if the overlying limestone and other formations were miraculously removed. The surface is irregular and to show the shape of the various irregularities lines are drawn which connect points of equal elevation above sea level. These lines are called sub-surface or structural contour lines and are the geologic counterpart of ordinary surface contour lines which show elevations (such as mountains) and depressions (such as valleys) on the earth's surface.

IF CROSS-SECTION NO. 1 is now studied in connection with PLAN NO. 1, the diabase structure should be clear. A cross-section view is a picture of what one would see if a vertical slice were made down thru the earth and then the sides were pushed apart so that the observer could walk in and look at the cut from top to bottom. In the corss-sections presented here the formations lying between the ore-bearing limestones and the surface of the ground are not shown as they have no bearing on the subjects discussed.

Going from southeast to northwest the diabase enters the map area with its surface (henceforth called "contact" since the diabase and overlying limestone contact at this surface) gently dipping with no marked structural features. Then comes the first of the so-called "rolls", ROLL NO. 1, in the contact where the diabase rises relatively steeply, about 30' in a horizontal distance of less than 50' measured along EL RIGHT. This roll is a phenomenon of intrusion and not a fold, but the forces involved were of sufficient intensity to push up the overlying limestone strata and thereby give rise to a minor fold.

This action of the diabase in cutting up thru the limestone and at the same time pushing up the immediately overlying limestone beds is one to observe carefully since the effect on the ore beds may be important. For example; If the chemically favorable limestone horizon or bed which carries the ore is cut off by the diabase, then the ore is gone. On the other hand, if the diabase has simply pushed the favorable limestone bed into a fold or dome, then the ore may be found anywhere in the resulting structure and probably in concentrations varying with the type of structure.

In the case of ROLL No. 1, noted above, the diabase did not cut high enough to remove the favorable limestone bed and hence ore is found on the southeast flank of the fold and to some extent on the crest.

On CROSS-SECTION No. 1 it can be seen that from the crest of ROLL No. 1 the diabase dips off to the northeast until ROLL No. 2 is encountered. ROLL No. 2 is a relatively small feature as geologic structures go, being some 8' to 17' high, but it is important because it cuts off the limestone bed at the top of which is the Gila level ore zone. The folding of the overlying limestone beds is very localized the action being chiefly one of cutting thru the lime rather than forcing it out of position. No ore has yet been found in the immediate area beyond (northwest) of ROLL No. 2 and it is thus at present believed to be the northwest boundary of the most productive part of El DORADO mine and as such is an important structural feature.

Any cross-section is, of course, a view of a vertical slice thru the earth in one particular direction. Thus CROSS-SECTION No. 1 has a direction North 5 degrees West. CROSS-SECTION No. 2 is now made to cut the first one at about right angles, the direction of slice being South 75 degrees West.

In this direction the diabase will be seen to rise until a point is reached where it becomes horizontal and then, apparently, the contact reverses its dip in the still unmined area beyond the present working face. The effect of this dip reversal on the ore must be carefully studied as the work progresses since it is probable that the character of the ore will also change.

As just noted, from PLAN No. 1 and the CROSS-SECTIONS the general structure of EL DORADO mine as so far developed can be seen. This structure can be summarized as follows: Limestone with a regional dip into the northeast quadrant had imposed on it by a diabase intrusion two gently plunging folds (underlain by "rolls" in the diabase) which strike about parallel to each other and are about 450' apart. The main part of EL DORADO mine is thus roughly quadrangular with ROLL No. 1 and its southeast flank on the southeast side; the outcrop and valley of Ash Creek on the northeast; ROLL No. 2 on the northwest; and an unexplored area on the southwest. Minor structural features as faults, fractures and small irregularities occur within these major boundaries, and their effect where notable will be discussed under ORE DEPOSITS, a subject which can now be studied with easier understanding since a major controlling factor in ore deposition, the geologic structure, has been explained.

EL DORADO MINE: ORE DEPOSITS - NATURE OF LIMESTONE HOST ROCK

Most of the ore from EL DORADO has come from the Gila level. This level is a partucular bed of limestone which over its most productive area directly overlies the diabase. The serpentine-fiber zone in the limestone, 4" to 2' in width, varies from 4½' to 6' above the diabase-limestone contact in the general area between ROLLS 1 and 2, and this area has been the most consistent producer of minable fiber.

Between the ore zone and the diabase the limestone is generally white to gray-white pure magnesium limestone, often with faint blackline bedding planes (?)

showing, and with nodules of greenish brown serpentine, or serpentine and fiber, scattered thruout the formation. This limestone is uniform and massive and can be considered as a unit from the standpoint of chemical uniformity.

It is believed that to get the best ore conditions, that is, continuous serpentine with minable beds of fiber over considerable areas, it is necessary to have as a starting factor in the mineralization a rather massive "bed" (say 3' to 6') of pure magnesium limestone. There may be fine bedding planes in the above "bed", but in general the full thickness noted will be extraordinarily uniform even if composed of a whole series of what might be called microscopic beds.

The opposite to the massive pure limestone bed is where the limestone is thin-bedded or "platy". This would be, for example, where over a six foot vertical exposure one could see a half dozen beds of white, gray or brown hard limestone separated by another half dozen beds of gray to white chalky or shaly limestone. Serpentine and fiber do occur in such platy formations, and there may even be rich pockets. The writer, however, has yet to see where a persistent well mineralized fiber horizon can be followed any distance, say 100', in a thin bedded, platy limestone.

A possible conclusion from this is that when studying outcrops any good fiber seen in a thin-bedded limestone formation should be explored for continuity before making any estimates of quantity available. Similarly, where ore in a massive bed, generally at the top of the bed, passes into ore in a thin-bedded formation, the fact should be noted with a suspicion that the ore may decrease in quality or pinch out.

Another factor deals with the purity of the limestone host rock. It is an [illegible] that dirty limestones are never well fiberized for any distance.

There are, of course, many gradations from hard, dense, white, pure magnesium limestone to the dirty, soft gray, shaly limestone, and it is not possible now to say where a dividing line could be drawn between chemically satisfactory host rocks for serpentine and asbestos, and those which are unsatisfactory. The point to be stressed is that once a bed or zone of limestone has been demonstrated to be satisfactory, and lithologic changes observed as mining advances should be noted and considered with care. If any massive bed of white limestone which had ore at the top for several hundred feet began to thin out into several narrow beds, the writer would say that the orebody would be ended shortly in that direction. Conversely, any ore in a thin-bedded limestone horizon at surface (outcropping) is not likely to continue for several hundred feet when followed underground unless several of the thin beds come together to form a more massive bed.

EL DORADO MINE: ORE DEPOSITS - STRUCTURAL RELATIONSHIPS

The Gila level has already been noted as the most peristent and productive ore horizon in EL DORADO. The relation of the most productive areas on the Gila level to the geologic structures in the limestone and underlying diabase will now be discussed.

Most of the stoped out area on the Gila level represents mining work done to recover No. 1 and 2 Crudes. Mining to get "mill ore" was started in 1940 and has continued on a small scale. Thus the most completely stoped areas can be for the most part taken as the best mineralized areas. Using this criterion it will be seen on the plan and cross-sections that the best ore came from two areas, one southeast of ROLL No. 1, and one southeast of ROLL No. 2 (between the ROLLS), and that this last area is the most continuous and productive stoped area.

It is a fair assumption from observable facts that ore deposition is related to the ROLLS in the diabase and the resulting folding in the overlying limestones. One explanation is that the mineralizing solutions were impeded in their flow thru the limestones by the folds in the rocks just as a dam across a stream impedes the flow of water along the stream's course. Another explanation, possibly a corollary to the first, is that the structures in the rocks gave a definite channel way which directed and concentrated the flow of the mineralizing solutions just as the banks of a stream confine its waters to specific areas. However, the theory of ore deposition is less important here than the observable facts concerning it which can be utilized in mining and exploratory work.

Going in a southwesterly direction ROLL No. 1 dies out as a well marked structure. A definite southeast limb to the fold also disappears as does the rather sharp crest to the fold. It is believed that ore conditions are not likely to improve with mining progress in a southwest direction, that is, in the direction in which EL MAIN would be advanced.

As noted previously, ROLL No. 2 cuts thru the chemically favorable limestone bed and thereby terminates the ore insofar as is now known. All along the southeast side of ROLL No. 2 there is workable fiber altho the ore is of relatively poor grade because of the black serpentine enclosing it, a subject discussed later in the report.

The maximum width of stoped area southeast of ROLL No. 2 is in the area traversed by haulageway EL RIGHT. From here there are continuous stopes trending first northwest, then west, and more lately southwest as it becomes necessary to vere away from and run parallel to ROLL No. 2 beyond which there is no ore known.

Walking thru these stopes one climbs up gradually on the top of the diabase (used as the stope floor) until stope Survey Station 2366 is reached. From here the diabase surface slopes downward to the northwest thus indicating a change in the general geologic structure. To the south and southwest of this Station are ore faces (as this is written) and all that is known is that the diabase continues to rise in these directions for an unknown distance. The ore faces here show only a small percent of the longer fiber but are generally rich in short fiber. There is, therefore, no evidence that mineralization is fading out in these directions. However, any marked change in the structure of the underlying and enclosing rocks as above noted cannot be passed over without due consideration. It is well to remember that if one accepts the basic premise that ore and structure are related, then major changes in the latter should sooner or later be reflected by changes in the former. Thus mining in the northwestern end of EL DORADO'S stopes should go hand-in-hand with geologic study so that forecasts can be made of changing ore conditions.

Northwest of ROLL No. 2 three raises have intersected the Gila level and ore is missing in each case. Neither the serpentine or the fiber found give much encouragement for further work in this direction. However, as this is rather scanty information on which to base a flat statement that no ore will be found northwest of ROLL No. 2 for an indeterminate distance (presumably until another roll in the diabase is approached), it is recommended that further exploratory work be undertaken in the questionable area. As will be shown in the discussion of the EL DORADO NORTH mineralized zone (separate report), another roll in the diabase does occur and "make ore", but the location is far removed (about 1000') from ROLL No. 2, and it is hoped that not all of the intervening area will prove to be barren.

The northeast side of EL DORADO mine is the outcrop along the valley of Ash Creek. The main stoped area on the Gila level discussed above does not extend all the way to the surface altho some fiber doubtless so persists. At the present time some stoping operations are progressing in this direction (northeast and east from the end of the main stope area) but only short fiber is being encountered and there is a considerable amount of black serpentine. Not much good ore from the Gila level is expected in this direction, but some will come from the mining in the Lower Gila level described elsewhere, which underlies the Gila in part of this area.

EL DORADO MINE: PINAL LEVEL - DESCRIPTION AND GEOLOGY

The Gila level, described above, has proved the largest and most uniform fiber producing level. Next in importance is the Pinal level, 28' to 30' above the Gila. The bed or horizon of the limestone in which Pinal fiber is found is apparently persistent over all of EL DORADO mine, but the amount of fiber found from point to point and its quality vary considerably. In short, the Pinal level has proved productive and economically workable over only a small part of its total area. Further exploration on the level may develop other spots to be mined.

In the Pinal the fiber bearing zone averages about 2" in width and is characteristically a light green color due to serpentinization. The nature of the original limestone bed is presumed to be a white, fairly pure magnesium limestone. As now seen it is altered to some degree through out its entire width. Underlying and overlying the Pinal are gray or brownish limestone beds, sometimes massive and at other times thin-bedded, and frequently appearing to vary in chemical composition and general characteristics. The often "platy" appearance of the beds enclosing the Pinal ore bed might be

considered as a factor unfavorable to uniform fiber mineralization over a large area, and whereas this may well be so to a degree, it may be offset by the fact that the Pinal bed itself must have been chemically an excellent host rock and rather uniform throughout.

The major Pinal workings lie on the southeast side of ROLL No. 1. Altho the main diabase mass is not seen anywhere on the Pinal, and altho the folding caused by the diabase intrusion is much less pronounced than on the Gila level 30' below, still it seems to be so that it was a structural control which concentrated the fiber occurrence on the Pinal in the area noted: The effect of the formation of ROLL NO. 1 on the adjacent limestones was not only to arch them into a fold, but there was also developed a complex fracture system. Thru these fractures the mineralizing solutions were able to travel with relative ease and furthermore their course was deflected upwards by the presence of ROLL No. 1. Thus it appears that the only fair mineralization on the Gila level southeast of ROLL No. 1 was more than made up for by the migration of solutions thru the Gila and on up the many fractures to the next chemically favorable horizon, the Pinal level, where fairly extensive mineralization took place. The mineralization in the Pinal level at the north end of EL RIGHT may have been aided by the same mechanisms as just described. This last area is, of course, related structurally to ROLL No. 2.

Between ROLLS 1 and 2 where the Gila level mineralization is as uniformly good as is generally found in Arizona asbestos deposits, there is much less vertical fracturing, and the overlying Pinal, so far as known, is poor in fiber except in scattered "spots". A conclusion to be drawn is that where the limestones on the Gila level are severely fractured there is a possibility that the fiber above in the Pinal may be better concentrated. (Note: There

is, of course, some post-mineral fracturing which bears no relation to fober in the Pinal or anywhere else.)

It is likely that the chief factor in the localization of fiber on the Pinal level was the chemical excellence of the limestone bed which was mineralized. The second factor was the number and distribution of vertical fractures leading upwards from the diabase and geologic structures below. A third factor probably had to do with the attitude of the Pinal bed itself and the nature and position of the enclosing limestone beds. All in all, there seems to be no sure way to lay out prospecting operations to open up new areas on the Pinal level. The evidence todate indicates that minable areas over the main part of EL DORADO mine are likely to be spotty rather than continuous, but this does not mean that the search for them should be neglected. Exploratory crosscuts should be run from any raise which shows hopeful fiber concentrations.

EL DORADO MINE: LOWER GILA LEVEL - DESCRIPTION AND GEOLOGY

This fiber level is interesting in that it differs in a number of respects from the Gila and Pinal levels. The Lower Gila mineralization occurs in a limestone body which has been cut off from the main limestone formations by a split in the diabase intrusion and is, therefore, completely surrounded by diabase except, of course, at the outcrop. The top surface of that part of the diabase which overlies the Lower Gila is the main surface or contact which has been contoured on PLAN No. 1. (See also CROSS-SECTION No. 2 for a picture of the Lower Gila.) The top surface of the underlying part of the diabase rises (going east to west) and finally joins the upper diabase and by so doing ends the enclosed limestone and the Lower Gila fiber level.

The approximate outline of the Lower Gila is marked on PLAN No. 1. Only part of the level is actually visible and it can only be inferred, therefore, that the level continues as far as EL R T8 as shown by the dotted line. If the level is continuous, it will be noted that its length is about 450' maximum with a maximum width of 150', the total shape being similar to that of a long piece of pie.

The chief mine workings on the level consist of Tunnels 67 and 11, with most of the stoping done along the south side of T 11. The fiber still to be seen in these workings is for the most part white, semi-harsh, semi-brittle material with hardly a face showing that does not carry some fiber at least 1/2" long. Rather extensive showings of No 2 fiber can be seen in a number of places, and No. 1 Crude is not hard to find.

The area which has been stoped lies in badly fractured limestone and continued mining here will encounter some difficulties. Also considerable clean-up and repair of supports will be necessary before any of the old stope faces can be advanced. A considerable block of ore lies between T11 and T 67, but the remaining reserve is problematical until the continuation of the Lower Gila level to the west is proved. To do this the writer suggests that T 67 be continued in the Lower Gila level in about the same direction that the tunnel has been run in from the outcrop.

Aside from the fractured nature of the limestone, which may become less as the outcrop is left behind, the chief criticism of the Lower Gila level is the fact that much of the fiber as now seen is more or less enclosed by black serpentine. However, as most of the future mining on the Lower Gila may well be for the purpose of getting out from time to time a relatively few tons of long, white, semi-harsh fiber, it is likely that black serpentine will not interfere with maintenance of the pure white color.

Any milled short fibers from the Lower Gila are likely to become grayish-white as is expected when black serpentine is fiberized along with white fiber.

The ore zone on the Lower Gila occurs within 4' of the bottom contact of the overlying diabase and varies up to 18" in thickness. There is probably some sign of fiber everywhere in the Lower Gila, altho only a part of the whole will be of economic value. The explanation of the localization of the ore is probably that a chemically favorable limestone bed was very readily attacked by hot solutions emanating from intrusive diabase which completely surrounded the bed and gave the solutions ample time to complete the alteration and mineralization. It can be noted in passing that the descriptions of a number of Arizona asbestos occurrences show the deposits to be located in similar bodies of limestone completely isolated in the intrusive diabase.

EL DORADO MINE: ORE RESERVES

PINAL LEVEL: MAIN AREA: - In the main stoped area of the Pinal (southeast of ROLL No. 1) there remain pillars and unfinished stopes. Some of the best ore faces at present visible in EL DORADO can be seen here, and the area warrants a fiber survey in which enough measurements are taken to estimate tonnages and hence the expense warranted to reopen this part of the mine. The writer believes that carefully controlled work in and beyond the Pinal old workings will yield surprisingly good fiber returns.

NORTH SIDE: - In the Pinal workings on the north side of EL DORADO (area above EL R T 10) the ground is badly fractured and the fiber varies from brittle to semi-harsh, with lesser amounts of better quality material. The fact that some of the stope faces on the south side show considerable quantities of mill fiber would indicate the desirability of doing some exploring here.

GILA LEVEL: NORTH SIDE:- The stope faces all along the north side of the main Gila level stoped area (southeast side of ROLL No. 2) show black serpentine, generally with fair quantities of mill fiber. Altho the presence of black serpentine narrows the uses to which the processed fiber can be put, still for other uses this area contains a considerable quantity of fiber. This black serpentine can be mined in the direction of ROLL No. 2 with the knowledge that when this structural feature in encountered the ore will be cut off. With this fact available, plus a good geologic map, it will be possible to make a fiber survey and estimate with some accuracy the amount of black serpentine fiber between the present stope faces and ROLL No. 2.

MAIN STOPE AREA - WEST AND SOUTHWEST END:- The main Gila level stope area has at the time this is written (Feb.'42) a working face about 300' long at its west and southwest end. The fiber showing has a low percent of the longer grades, but is fair to good mill ore for the shorter grades. Nothing is known concerning the extent and quality of the ore farther on to the west and southwest and unless exploratory crosscuts are run ahead of mining (recommended) or raises are put up from advanced positions on haulage levels not yet mined, nothing will be known before the ore is actually taken out. As previously noted, the diabase-limestone contact has begun to change, probably reverse, its dip in this area which should at least warn the operators to keep an eye open for changing ore conditions. It is expected that considerable quantities of short milling grade fiber will come from the area lying beyond the present stope faces. There is no good reason to believe that special quantities of long fiber will be found.

SOUTHEAST SIDE:- On the southeast (outcrop) side of EL DORADO mine Tunnel 71 is being driven in about 180' to connect with mine haulageway EL 2.

The Gila level is above T 71 all the way along and presumably will not be explored by raises until the tunnel is completed. Where the Gila ore outcrops above the tunnel portal some fair to good fiber can be seen, and it is reported that good showings of fiber persist for at least 60' in the general direction T 71 is advancing. However, the quantity of good Gila level ore to be found in this area, and which will be tapped by raises from T 71 and from the end of EL 2, must be considered as speculative for the time being. The ore seen in raises in EL 2, EL 4, and EL MAIN bordering this area, and in the outcrop southwest of T 71 would seem to indicate that short fiber in no unusual concentrations can be expected and that fair sized areas of longer fiber material will be rare or lacking. The mining work being done will serve in the end to prospect the area, a procedure which, of course, is to be recommended.

SOUTHEAST AND EAST SIDE: - The faces of some of the old stopes and some of the pillars in the area southeast of ROLL No. 1 and east of EL RIGHT show workable quantities of mill ore. In neither area does there appear to be substantial quantities of such "reserve" ore, but this does not mean that a plan should not be made for its recovery from those places where the cost would not be excessive.

LOWER GILA LEVEL: The fiber on the Lower Gila is mostly semi-harsh, semi-brittle and altho for the most part pure white in color is slightly pink in certain areas. It is probable that all the fiber from the Lower Gila will have to be treated separately and marketed for special uses. It is believed that considerable quantities of fiber will be found on the Lower Gila, but until some exploratory work is undertaken to extend the known boundaries of the ore bearing zone it is impossible to be very definite.

The largest semi-developed area with good ore faces showing lies in the block bounded on the north by T 67 and on the south and west by curving T 11. This block could be explored and mined from T 67 and thus avoid some of the complexities involved in putting T 11 into safe working condition.

SPECIFIC RECOMMENDATIONS

Most of the following suggestions have been noted or indicated elsewhere in the report but are repeated here for convenience.

PROSPECTING AND ORE DEVELOPMENT ACTIVITIES: -

1. West and Southwest End of Main Gila Level Stope: The haulage level El 1 will probably be advanced under the ore zone. Rather than continue to mine this haulageway beyond the limits of ore overhead, it would seem good plan to advance exploratory crosscuts in the ore, say 50' ahead of the working faces, and then advance the haulage way a similar amount. This would result in ore being developed continuously ahead of mining, its grade would be established, and it would prevent needless drifting on the haulage level.

2. From Raise 3 on EL R T 8: (Note: To avoid confusion the Raises mentioned here and below are not shown on PLAN No. 1.) An exploratory crosscut on the Gila level advancing at about N 20 degrees West would serve to show more clearly whether any ore can be expected in the general area northwest of ROLL No. 2. Another crosscut from Raises 10, 11, or 12 on EL R T 4 going N 20 degrees W would give further information on this important matter.

3. Work out the extension and boundaries of the Lower Gila level by continuing T 67 in a direction about South 70 degrees West.

4. Exploratory crosscuts on the Pinal level would give useful information:

(a) On the southeast side of EL DORADO: One crosscut could go north or northwest from the stope face around the eastern branch of Raise 1 of EL 3

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LOWER GILA LEVEL: The fiber on the Lower Gila is mostly semi-harsh, semi-brittle and altho for the most part pure white in color is slightly pink in certain areas. It is probable that all the fiber from the Lower Gila will have to be treated separately and marketed for special uses. It is believed that considerable quantities of fiber will be found on the Lower Gila, but until some exploratory work is undertaken to extend the known boundaries of the ore bearing zone it is impossible to be very definite.

to explore the continuation of the ore seen there. Also the possibilities of extending the Pinal level to the south and/or west from Raise 3, EL 2 should be studied. (b) On the north side of EL DORADO: A crosscut could go about south from the best looking area along the stope face which runs eastward from Survey Station 2313 and thereby explore the continuation of Pinal ore in this southward direction.

5. An ore survey should be carefully made in all old workings to estimate the quantity of fiber remaining in pillars and in old stope walls. By this method, plus an occasional exploratory crosscut, a considerable reserve tonnage of mill ore can be readily built up at no great cost. Such ore faces are and have been easily available for anyone to see, but the failure to make a record and classification of such ore with notes added as to its availability makes the ore only a little better than useless when it comes to long range planning. Hand to mouth mining in the Arizona Asbestos business may be necessary to some degree, but not to the degree that has been standard practice and apparently is still.

6. The southeast section of EL DORADO mine is now being opened by Tunnel 71. Raises from this tunnel and from EL2 should be put up, as has been planned, to explore for ore. Failure to find workable deposits here would indicate poor possibilities all along the outcrop from here to the southwest.

Chrysotile, Arizona
November 23, 1930

Mr. C. H. Shoemaker, VP&GM
Arizona Asbestos Association.
c/o Johns-Manville Corporation,
292 Madison Avenue,
New York City.

ASBESTOS MINING IN ARIZONA
YOUR NIGHT LETTER NOV.18Th

Your night letter of November 18th was somewhat delayed owing to interrupted mail service caused by a slight fall of snow.

The following data is as complete as I can furnish on such short notice. You are, of course, acquainted with the fact that no books were kept at this location prior to 1928 and the information regarding production and shipments prior to 1923, as found in the files here, there and everywhere, is incomplete and in most instances no billing price is given but notes made indicating that the price, etc., was taken care of by New York. I also feel that some shipments were made of which I can find no record. No doubt all these records are on file in the New York office but that doesn't help any in replying to your message.

The records indicate that the original asbestos claims, located on Ash Creek, were located January, 1914, by Albert and William West. Apparently ten were located at that time. These were soon acquired by the Arizona Asbestos Association and mining operations started the same year. Others were located in 1915, 1916, 1918, 1920, 1921 and 1929 until a total of seventy-six claims are now owned by the Association, twenty-two of which were patented in 1922. It will be noted that the mine was practically inactive from 1921 to 1926.

The following indicates the number of men employed during the past four months: July, 73, August, 53, September, 58, October, 64, or an average of 62 men.

The next attached shows the production, or shipments, by years together with the billing price as far as indicated by records available at this location. The data for the years 1928, 1929 and 1930 I believe to be complete.

Fibre by Grades Produced by ARIZONA ASBESTOS ASSOCIATION
From 1914 to October 31, 1930

Year	Tons #1	Tons #2	Tons A	Tons AA	Tons AAA	Tons AAAA	Tons B	Tons BB	Total Tons	Billing Price
1914	46.150								46.150	
1915	227.200		9.900	.700	2.850	3.700			244.350	
1916	449.150	45.150	80.825	18.975	25.875	34.875			654.850	
1917	562.030	153.875	124.400	46.400	58.900	114.000			1059.750	
1918	40.450	30.350							70.800	
	(Note: We have no record of shipments or billing prices for above; it is shown in the records only as Production.)									
1919	122.670	165.631	22.659	13.666	24.468	37.313			386.407	
1920	92.653	871.642	8.705	7.139	12.919	31.350	(Samples .303)		1024.711	
1921	31.723									$900.00
		106.532								500.00
			.052							250.00
				.507						125.00
					.155					70.00
						.923				50.00
							.027			250.00
								.937		125.00
							(Samples .028)		140.884	
	(25.372 added under #1 for check on totals)									
1922	Total tons No. 1 and No. 2 not segregated								25.372	
1923	No record of shipments									
1924	31.143	36.631					3.416		71.190	
1925	16.926	57.371		(Sweepings .068)			.716	7.291	82.372	
1926	84.268	66.719							150.987	
1927	145.452	439.243							584.695	
1928	88.449									450.00
		659.069							747.518	250.00
										450.00
1929	42.981									
		370.023							413.004	250.00
1929										450.00
to	45.996									250.00
Sept		303.935							349.931	
1930	2052.613	3,306.71	246.541	87.387	125.235	222.161	4.304	8.559	6052.971	

Date Typed: 11-23-30
RWD

The following is a brief resume of other Asbestos Mines and Properties in Arizona in the order in which the writer views their importance. It is noted that all deposits of importance yet discovered are in Gila County. More complete data is available should it be necessary.

REGAL ASBESTOS MINES

Located about six miles north of Chrysotile on the south bank of Salt River, consisting of twenty-five unpatented mining claims. The original claims, ten in number, seem to have been located by a Mr. Larsen in 1915. In 1918 this property was developed by the Colorado-Arizon Asbestos Mining Co., with a small production. I was not watching operations very closely in those days but estimate their production as probably 100 tons of #1 and #2 crude. The Denver-Arizona Asbestos Company also produced a few tons of crude from this property in 1919. The claims were purchased in 1919 by Mr. E. Schaaf-Regalman and relocated shortly thereafter. It was left idle except for assessment work from April 1921 until 1925. During 1925-1927 lessees mined 200 tons #1 crude. In June, 1927, the company resumed regular development and production and erected a so called mill in 1928 continuing operation until June 1929, shipping approximately ten cars of fibre. Since June, 1929 the property has been in care of the custodian.

KYLE AND PIERCE
Allene Asbestos Association

This group, which consists of fourteen unpatented claims, is situated approximately twenty-seven miles north west of Chrysotile on Sloane Creek. This ground was located by Kyle and Pierce in 1916. Fifteen tons of #1 and #2 crude was shipped in 1917, three tons in 1918 and five tons during 1919 and 1920. In 1921 forty tons was mined. From 1921 to 1928 approximately twenty tons was mined by Mr. Kyle and two Mexicans working only when assessment work was necessary. In 1928 E. M. Smith (Emsco) purchased half interest in this property (bought out Pierce). About fifteen tons of fibre was mined then operations were suspended owing to disagreement between Kyle and Emsco. The writer believes this property to be a good prospect and as yet unscratched.

CIENEGA MINE
(Emsco)

Situated about four miles north of Chrysotile on the San Carlos Indian Reservation consists of fifteen claims located in May, 1921, by Robert Anderson, G. England, McRobinson and Hardiman. Thirty-one tons of crude fibre, about half of which was #1, was shipped from the property up to the first quarter of 1928. Late in 1928 Emsco purchased this property for $65000.00 and erected a mill, operating on a small scale up to October 18, 1929. It is reported that they shipped five cars of fibre, all of which had been through the mill, and that the mine is now practically worked out. I have not visited this property since August 14, 1929, so am not up to date on the actual condition of the mine.

BEAR CANYON PROPERTY
Operated by Loasbey-Matteson

This property, located on the San Carlos Indian Reservation about twenty-miles from Chrysotile and twenty-one miles from San Carlos(formerly Rice), consists of twenty-one claims and was discovered by Mr. John Osborn and Mr. Tee Hinton, cattlemen, in 1908, and located for the Apache Asbestos Company by Mr. Hinton on July 1, 1928.

A small amount of fibre was mined in 1921 and the property then lay practically idle until relocated by Lunn and Matthews in 1927. In 1928 it was purchased by Keasbey-Mattison and, I understood, five - thirty ton cars of #1 and #2 crude were shipped during their period of operation which was from about March, 1929, to July, 1930. I understand that the only work done since July is the driving of one tunnel. Please note my letter of September 11th in this connection.

INTERNATIONAL ASBESTOS COMPANY
Formerly American Ores and Asbestos

Located about twenty-five miles from Chrysotile and about forty-two miles from Globe. This property, thirty claims, was originally located by Stevens-Welch and Watkins in 1916 and was purchased and operated by the United States Asbestos Company in 1917 under the management of the late Charles F. Sloane. Operations were later carried on by the Raybestos Company under the direction of Captain Schutts and the mine closed January 15, 1921. I do not know the exact amount of fibre shipped from this property but it is in the neighborhood of 1500 tons of #1 and #2 crude, mostly #1. Some of the finest fibre mined in Arizona was produced at this property. Since 1921 the mine has been practically idle except for some milling operations conducted on the dump by Mr. W.G. Shanley. Mr. Shanley acquired the property in 1922 by relocation and formed the International Asbestos Company. In my opinion this mine is not worked out as reported when Raybestos shut down and I feel certain that many tons of crude can be recovered in the old workings and further development, properly directed, would reveal the presence of more fibre.

PIERCE WHITEMAN PROPERTY

This property, forty claims, located approximately twenty-five miles north west of Chrysotile and six miles south of Kyle and Pierce (Allene Asbestos Association) and about 107 miles by road from Globe.

Some thirty or forty tons of #1 and #2 crude have been mined from this location by Mr. Pierce since its discovery in 1913. In 1928 it was purchased by E. M. Smith Company (Emsco) who operated only a few months then let title go back to the original owners. Since Emsco pulled stakes in 1928 Mr. Pierce has driven a tunnel over one hundred feet into the hill directly across the canyon a distance of approximately three hundred feet from where Emsco concentrated their mining activities and has a showing of #1 fibre from one inch to three inches in length for practically the entire length of the tunnel, this strata pitching into the hill about 12°. I saw this fibre, in place, on October 9th, this year, I believe this deposit to be very limited however.

TRIANGLE ASBESTOS COMPANY

The Triangle Asbestos Company has seventy-two claims, all of which except fourteen, are in one group situated in the vicinity of Walnut Creek, approximately twenty-six miles north west of Chrysotile and 108 miles by road from Globe. Originally located by Kennedy, Sloan, Wolf, Hardiman and the writer, 1916 and 1917. During 1922, 1923, 1924 the property was held by the Riga Asbestos Company and a few small shipments were made. I do not know the tonnage. In August, 1927, it came under the control of W.M. Tenney and he erected a small mill, rolls and screen and produced approximately sixty tons of fibre, about forty of which is today in Kyle's warehouse at Globe. They suspended operations in September, 1929, and nothing has been done except assessment work since that time. This property has a lot of milling fibre but very inaccessible.

CROSTHWAITE STEWART CORPORATION
Gloria Mine

Located five miles north of Chrysotile, consisting of four claims, is part of the group of claims formerly owned by the Penn Asbestos Mining Company. Most of the rock mined from this location was freighted to the Regal Mine by Cat. and trailer and put through the Regal Mill. I do not know their tonnage but it was small, possibly fifty tons, mostly harsh fibre. Operated by Crosthwaite Stewart Corporation 1928-1929.

PENN ASBESTOS CROUP
Seventy-two Springs

These claims, seventeen in number, unpatented, are situated about four and a half miles north of Chrysotile and were originally worked by the Penn Asbestos Mining and Refining Company in 1917. A few tons of crude was shipped in 1917 and 1918 and the property then lay idle until July, 1929, at which time it was worked by the Industrial Asbestos Corporation (H. S. Mirkesell). After a months operation they closed and reopened again in September, 1929, under the direction of Mr. G. C. Andrews who mined twenty-four and three quarters tons of #1 and #2 crude from the Shoemaker claim and suspended operations again on February 9, 1930. Nothing has been done at this property since and it is again under the control of Mr. Pat. Montez.

CAN CARLOS ASBESTOS MINING CO.

Located on the banks of the Salt River in the San Carlos Indian Reservation, nine miles north of Chrysotile, and controlled by a Mr. Riedhead. Some fibre was mined during 1922, 1923 and 1926, 1927. Possibly between seventy-five and one hundred tons were shipped, some very good #1 and #2 crude was mined but the deposit appears to the writer to be very limited. This property, I believe, was offered to Johns-Manville some two or three years ago for four million dollars, a matinee price.

GLOBE ASBESTOS COMPANY

Located two and a half miles west of Chrysotile and consists of fifty-seven unpatented claims located mostly in 1919 and operated later by A. E. Minium and G. W. Locke, mining some #1 and #2 crude during 1920, 1921 and 1922 but less then fifty tons were produced and the property, as far as developed, seems to be without merit as an Asbestos Mine.

FRIDAY CLAIM

This property is located one and a half miles south of the American Ores mine and is part of the former Clarke property which consisted of twenty-seven unpatented claims and was worked during 1920 and 1921 by the Globe Asbestos Company at which time they shipped some three cars of #1 and #2 crude. This property has not been worked actively since that time and has since been relocated by Mr. Roger Kyle. This property still has some merit.

There are numerous other prospects but I believe they can be regarded as such. Some of these have, however, produced several tons of good crude fibre and are all located practically within a radius of thirty-five miles of Chrysotile. Among the better prospects are Sloane Group, Pueblo Group, Reynolds Falls Group, Oak Creek Group, all located in the vicinity of the old American Ores Mine. Lorie and Lona Claims, Riverside Group, Seven Star Group, Kyle Group, located in the vicinity of Chrysotile, Upper Bear Canyon also seems to be viewed as of considerable importance by some. I note articles of incorporation being published at this date by Lone Eagles Mines, Incorporated, by W. W. McGart, G. McGart, Of Hollywood, California, and Mr. Graham Fost of Globe. I know Mr. Foster to be interested in the Upper Bear Canyon Group, located on Indian Reservation, and Reynolds Creek Group, located in the Sierra Ancha region. Also articles of incorporation of the Imperial Asbestos Company, Ltd., by J. L. B. Boullium, S. J. Brubaker, A. M. Boullium, Erma B. Sanders and W. C. Petchner, all of California, are being published at this time. I have noticed several parties from Californa have been looking over prospects in this district during the last few months.

ARIZONA ASBESTOS ASSOCIATION

Frank Knuckey
Superintendent.

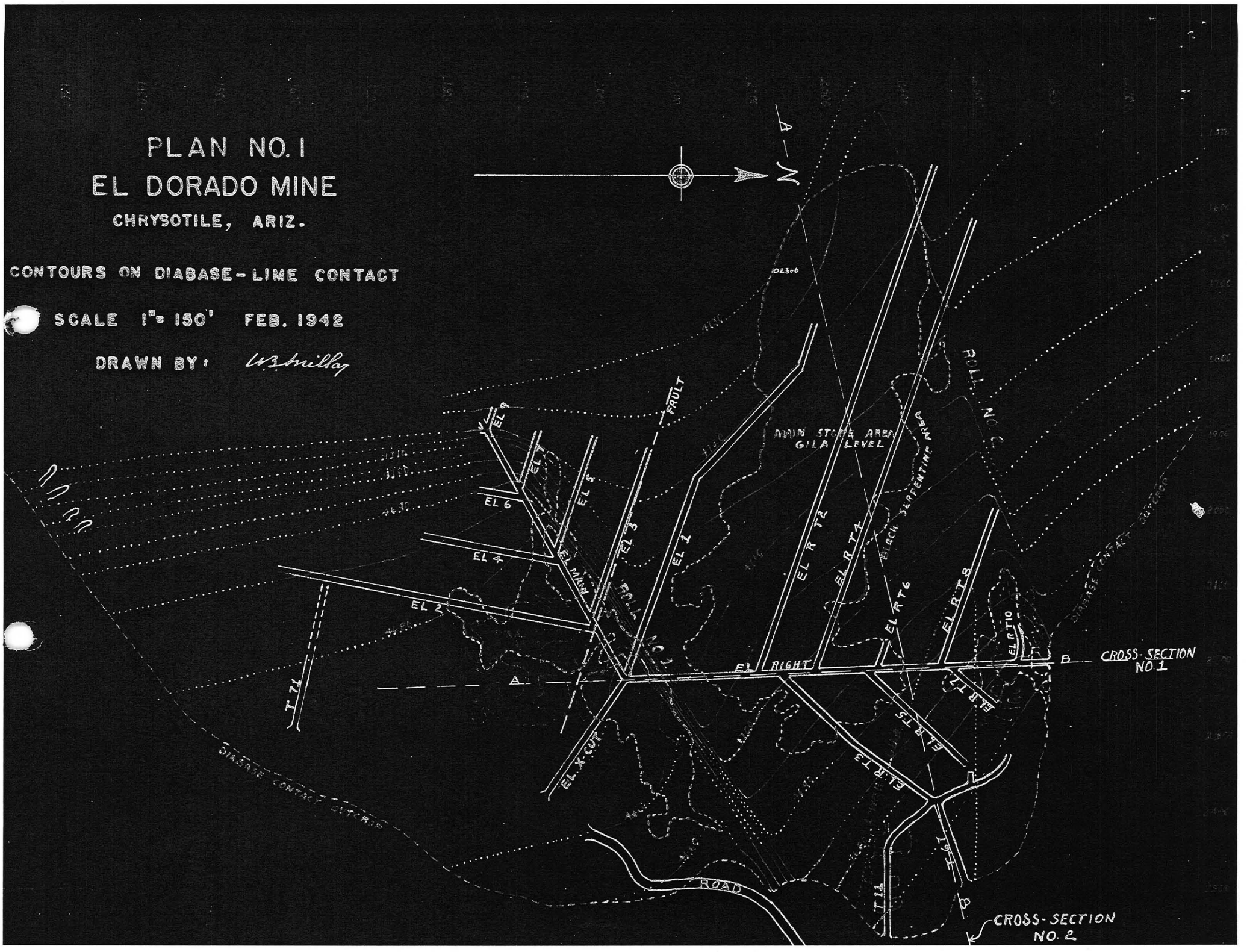
FK/RWD
cc - Mr. C. H. Shoemaker, VP&GM - Asbestos.

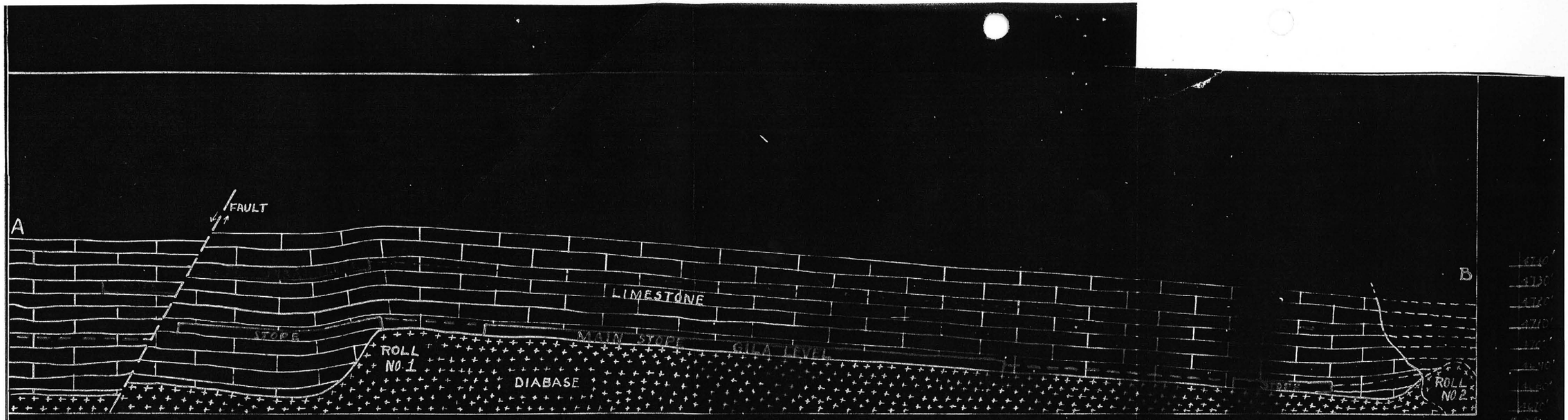
PLAN NO. 1
EL DORADO MINE
CHRYSOTILE, ARIZ.

CONTOURS ON DIABASE-LIME CONTACT

SCALE 1" = 150' FEB. 1942

DRAWN BY: W.S. Smiley





CROSS-SECTION NO. 1

EL DORADO MINE

CHRYSOTILE, ARIZONA.

SCALE 1"=50' FEB. 1942

DRAWN BY: W. Smith

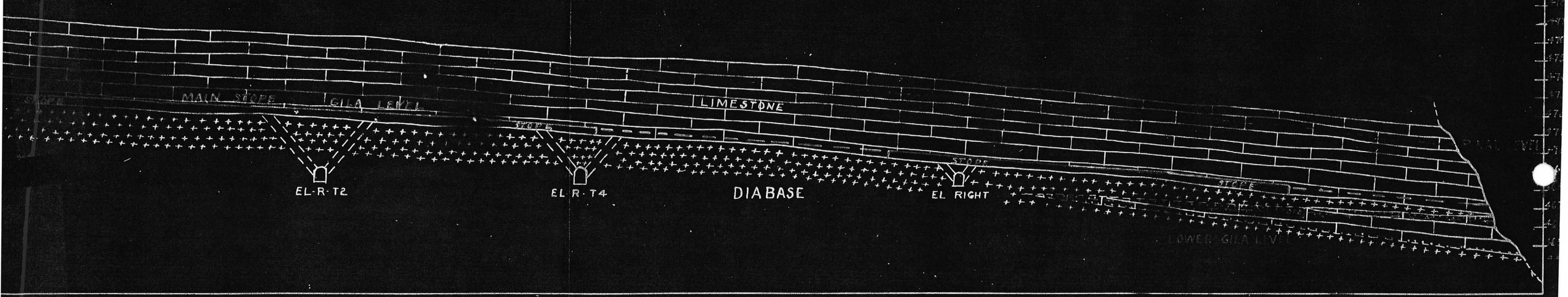
CROSS-SECTION NO. 2

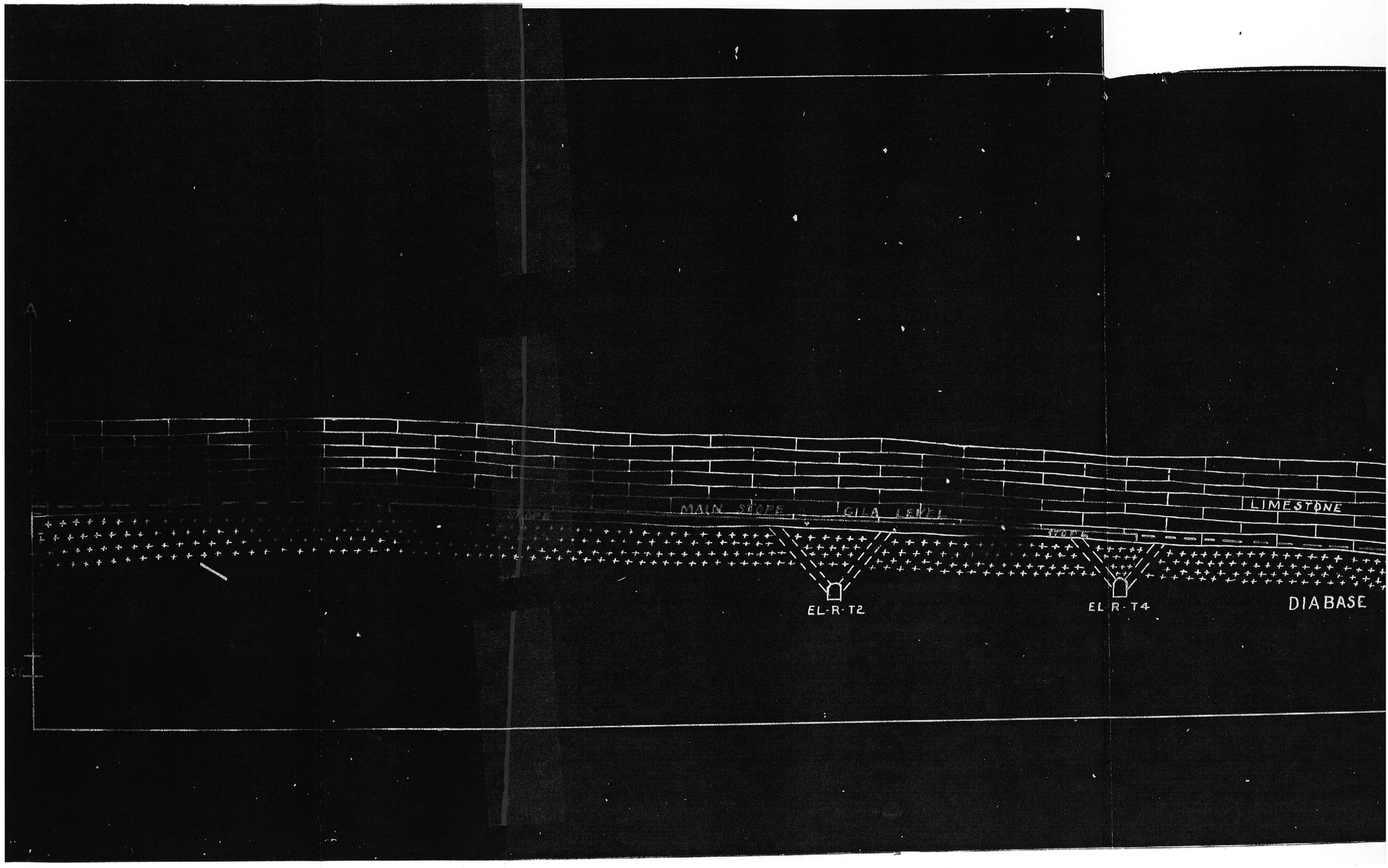
EL DORADO MINE

CHRYSOTILE, ARIZ.

SCALE 1" = 50' FEB. 1942

DRAWN BY : W.J. Milby




A
MAIN SLOPE
GILA LEVEL
LIMESTONE
EL-R-T2
EL-R-T4
DIABASE