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Dover Copper
Morenci
Greenlee

# CONSOLIDATED COPPERMINES CORPORATION
~~KIMBERLY NEVADA~~

A. J. O'CONNOR
GENERAL MANAGER

JOHN EABY
CHIEF CLERK

Safford, Ariz.

May 1, 1952

Dear Penny:

The two areas mentioned in the March report in paragraphs 3 and 5 are still pending. Phil and I looked at one of them along with the American Mine. This one has a strike against it being included in the American Mine deal. The other one I will look at this month along with the new one that Larry has found in the Tres Hermanos Mountains.

American Metals have turned down the Adams property. It may be difficult to get a hold of this as Mr. Adams was dealing only with American Metals at the time we were looking at it. I find that I did not send you a copy of the last letter I wrote to Moore about the property. I will enclose it with this letter.

The examination on the Dover Copper Co. property at Morenci was postponed to May 2nd. Ray and I will take a look at it tomorrow.

I looked at three mines in New Mexico. Two west of Socorro in limestone, and one east of Albuquerque in Precambrian schist. None of the three are of interest to us.

Had a pleasant morning and lunch with your friend Bill Long. He showed me all the facilities at the School there and introduced me to all the Professors. He put me on to a lad that is quitting school, that has been working for his Masters. The man's name is Bill Tipton, and I have hired him to take the place of Bergman, He will go to work the 6th of June.

Vern is through to-day. He has bought himself a trailer house and is going to take a months vacation touring the States before accepting a job. He has been toying with the idea of giong to Columbia for some English Gold Mining Co.

I understand via the grapevine that John Hope is in Cuba. This probably so as the last time I saw him he told me he had a job to do outside of the U.S.A.

There has been some dope come thru on a mine in the Hellvetia Mining District. Ray seems to think that it is near the Rosemont. The maps and information are still enroute from Kimberly so we do not know exactly where it is.

Your folders and laces came to $4.43 plus $1.97 for postage. I will catch up with when you come home.

Howard Smith died quite suddenly with a heart attach a week ago.

With kindest personal regards to you and Kate.

Sincerely,

Frank.

PS Haven't been to Phoenix to look at your trees but will shortly. Have had abnormal amount of Rain for April.

Copied April 23, 1952

June 12, 1942

Mr. Tom Newell, Supt.,
Shattuck Denn Mining Corp.,
Bisbee, Arizona.

Dear Mr. Newell,

The following is a brief report on the Dover Mining Company, whose mining property is located in the Morenci mining district near the town of Morenci, Greenlee County, Arizona.

The Dover Copper Mining Company is an Arizona Corporation with a capital of 1,000,000 shares of which 300,000 shares have been issued. The control of the issued stock is owned by Mr. Waldo Tiscornia, Mr. James Tiscornia and Mr. E. J. Martin of St. Joseph, Michigan. The minority of the issued stock is owned by Mr. Thomas Cocks of Clifton, Arizona.

The Dover Copper Mining Company holdings were leased to the Auto Specialties Manufacturing Company of St. Joseph, Michigan, in May 1942. Under the lease agreement, the Auto Specialities Manufacturing Co., will undertake the management of future operations. Mr. Fred W. Sherman, has been appointed local manager at Clifton, in charge of activities.

The Dover Copper Mining holdings in the Morenci mining district comprise 135 mining claims and 7 mill sites situated west and north of the Copper mountain ore bodies generaly known as the Clay ore zone which in the past five years has been the scene of major development by the Phelps Dodge Corporation.

After an expenditure of $32,000,000.00, new development work has exposed an ore tonnage from which mining of copper ores by mechanical shovel operations at the rate of 25,000 tons daily started early in April 1942.

The tonnage mined is concentrated and concentrates smelted in plant units new and modern in every respect. The Phelps Dodge plant will treat custom ores in the near future.

The Auto Specialties Manufacturing Company, lessee, of the Dover Copper Mining Company, propose to develop and mine the copper ores on Dover ground. The new custom smelting plant at Morenci, will receive custom ores on or about September 1, 1942, after the completion of weighing and sampling plant facilities at the Pehlps Dodge works.

The Dover Copper Mining Company's mining claims cover an area of nearly 2000 acres of mineral lands. Most of these mining claims have been held by performance of annual assessment work. Within the past year, patent title has been received from the U.S. Government on 10 mining claims in two groups known as the Storm and Wilhelmina groups.

An application for patent to a third group of 20 mining claims and 7 mill sites known as the Keating-Copper plate group has been entered in the U.S. land office. This request for title is now being advertised as a prelude for issuance of title.

A fourth group known as the St. Joe-Tuckey group comprising 21 mining claims is being surveyed and monumented preparatory to making an application for Government titles. This group covers a porphyry area and a mineralized porphyry-limestone contact.

The remaining area covered by mining claims comprise the Margot Claims, the Anita Claims, the Bell Claims, the Tommall Claims, and the Silver Basin Claims, a total of 80 mining locations. The Auto Specialties Company, as lessee, will continue performance of annual assessment work. Eventually these claims will be surveyed for patent.

Four of the Tommall claims might be exchanged for four patented mining claims owned by the Pehlps Dodge Corporation. Negotiations are well advanced and may be completed in the near future.

The Morenci Mining District -

The development of this big Copper ore bearing area started in 1872, and it's development was due to the efforts of three important mining companies, namely, Detroit Copper Company, Arizona Copper Company, and Shannon Copper Company. The region obtained its greatest production in 1917.

All of the major operating companies were acquired by the Phelps Dodge Corporation in 1928.

During the period from 1932 to 1936, mining operations were discontinued and plans were prepared for the large scale shovel operations now being conducted. The financing of this project was completed in 1938.

The mining operations prior to 1932 resulted in the exposure of three types of ore deposits.

1. Ores bedded in limestone and on limestone porphyry contact. These deposits were located in Morenci and Metcalf.

2. Porphyry ores in Copper mountain area near Morenci.

3. Fissure veins west of Metcalf, at the base of Coranado Mountain, the best known vein called the Coronado Vein.

The ores of the #1 type are very nearly exhausted in the developed ore zone at Morenci.

Ores of #2 classification will furnish the tonnage for the new modern plant which will soon be expanded to mine, mill and smelting all output of 40,000 tons of 1% copper ore daily. Output at that rate will continue for more than 50 years.

The ores of #3 type for many years furnished the largest part of the tonnage and values produced by the Arizona Copper Company, the British Corporation which was eventually sold to the Phelps Dodge Corporation.

There are many indications that ores of the #3 type will again become important. Much of the area in which the fissure veins occur is, as yet, undeveloped, although many outcrops show strong copper ore showings. The backward state of development has been due mainly to transportation difficulties.

The Dover Copper Mining Company owns 20 mining claims in the Keating-Copper Plate group which, at this time, warrants a substantial development effort. The ores from this group of claims will be produced for a strong system of fissure veins similar in character to the Coronado vein.

The Keating Fissure Vein has been the scene of considerable development activity in the past. There is a good showing of oxidized copper ores silicates,

and carbonates of copper and copper glance, all secondarily enriched Copper Ores, now opened up a depth of 253 feet below surface. The Keating Vein is a fault fissure which strikes N. 57° E.

The Keating Fissure Vein dip is nearly vertical, but as depth is gained, the vein will dip South at a steep angle, probably 80°.

The Keating Vein has a strong outcrop on surface for the length of three full mining claims, although slight offsets are visible at surface at three different points.

The Keating Vein outcrops on the New Queen, New Gram, Anita 30 and the Victor Claim. The Victor Claim is a Phelps Dodge patented claim, but will soon be transferred to the Dover Copper Co., in an exchange agreement.

The total length of surface outcrop on the Keating Vein is nearly 5000 ft.

The surface outcrop has been explored by four adit tunnels to a depth of more than 100 feet below surface, both East and West on the Keating Vein.

The Keating shaft is located near the center of the New Queen claim and was sunk 320 feet below the lowest adit Tunnel level. The collar around the shaft has caved and some repair work is necessary before the workings from the Keating Shaft can be entered. Below the collar of the Keating shaft to the eastward, three levels have been driven, and from the workings it is said that $1,000,000.00 worth of copper ore was shipped during the war period 1915 to 1919. This record is hearsay, although a map has been made purporting to show that east of the Keating shaft, ore was mined and shipped from three small shoots of ore encountered in these workings. The map was made in 1929 from date prepared by R.B. Earling, mine superintendent of Arizona Copper Comapny in 1919.

The workings eastward from the Keating shaft are not accessible now, but can be reopened at a reasonable cost.

Keating Vein West of Keating Shaft-

An adit tunnel driven west at the same elevation as the collar of the Keating shaft follows the Keating Vein 640 feet. The vein is well market for the entire distance. The fissure is wide, shows much brecciated and copper stained vein matter. Two well defined ore shoots were encountered from which ore has been shipped. The ore shipments after some sorting assayed 19% copper and $6.50 per ton in gold and silver values.

The gold values averaged 8/100 oz. silver 6.0 oz. Copper contents varied from 14% to 21.8%. The ore was closely sorted and there is quite a large tonnage of low grade silicious ore on the dump at the entrance to the adit tunnel. The total amount of high grade shipped was 300 tons.

The largest ore shoot was encountered 250 feet west of the entrance to the adit and good silicious copper ore continued for 100 feet. The showing is made up of kidneys of copper glance embedded in a silicious vein matter. The vein material is made up of brecciated quartzite, diabase and granite fragments recemented by quartz.

The fault fissure separates granite from quartzite. The fissure forms a step fault with a down throw of 1000 or more feet to the south. There is much evidence of movement on the fault both vertical and along the strike of the vein. There is slight rake to the orebody from east to west.

The full width of vein material varies from 6 ft. upwards. Between the vein walls, a dyke of diabase follows the course of the vein. The diabase varies in width from 8 inches to 4 feet. Some copper replacement is observed at times in the diabase, but generally, the dyke rock is barren. This barren rock occurance in the vein must be carefully watched in the future, because its presence in the vein will have much bearing on the ore extraction method employed in the future.

A winze has been sunk in the center of the ore shoot to a depth of 60 feet. This winze is filled with water, but is said to have been sunk on a fair grade of copper ore.

The face of this adit level shows a brecciated vein, but of no value in copper. The material looks partially leached out and further development to the west is warranted.

Kimberly Cross Cut Tunnel -

The ore showing developed in the West Adit Tunnel at Keating Shaft level furnished the incentive for a development at greater depth which was undertaken in 1928. A tunnel was started in Horseshow Canyon, 253 feet vertically below the Adit level. This tunnel is known as the Kimberly Tunnel.

The mouth of the Kimberly Tunnel is located on the Phelps Dodge Kimberly claim. The tunnel was driven southeast crosscutting the formation. At 960 feet from the entrance, the crosscut tunnel entered the Keating Vein, cutting a strong exposure of copper ore and vein matter for a distance of fifty feet in width. The best showing is about 16 feet wide and this ore was followed both east and west of the cross-cut tunnel.

The ore shoot was exposed for a length of 300 feet, according to a longitudinal section map drawn in November 1929, draftsman is unknown, but the map is a part of the Dover Copper Company's record.

At this time, only 60 feet in length of this ore shoot is open for inspection. Mr. Tom Cocks guarantees the accuracey of the map and the picture which shows that raises had been driven and the ore shoot prepared for shrinkage stope mining.

From this shrinkage stope above the crosscut tunnel level, there is a record compiled of shipments amounting to nearly 3500 tons of ore assaying 5.25% copper. 1.5 oz. silver and 3/100 ozs. gold. Ore shipments from the Kimberly crosscut tunnel level were discontinued in March 1930.

Mr. Thomas Cocks was in charge of mining operations during the period from 1926 to 1930. Cocks says the raises in the orebody reached upward to within 30 feet of the winze below the west adit and that ore had been broken for shrinkage stope mining for a height of 126 feet above the Kimberly Tunnel level. Cocks reports that only a small portion of this broken ore was drawn from the stope, further that the ore width mined in this shrinkage stope averaged 16 feet.

The greatest ore width broken in the stope was 60 ft., but as no record of these mining operations was mapped, it is impossible to check the hearsay information.

The longitudinal section along the vein shows that the workings eastward from the crosscut did connect with the Keating Shaft. Cocks says that the east drift followed a diabase on what he thought was the hanging wall of the vein.

It is possible that an orebody has been exposed for a length of more than 200 feet on the Kimberly crosscut level. The ore shipments from this orebody, after

some sorting averaged better than 5% copper; and that kind of a showing warrants further development effort both laterally and in depth.

The development program planned for the immediate future follows:

First: Rehabilitate drifts and raises on the Kimberly Crosscut Tunnel level.

Second: Drive raise connection to West Adit level.

Third: Sink two compartment winze on ore below crosscut tunnel level.

Fourth: Re-enter top of shrinkage stope and prepare stope for ore extraction.

Fifth: Probably repair the Keating Shaft.

Sixth: Resurface and repair the mountain roads from Morenci to the Keating Mine - distance 8 miles.

Seventh: Install portable air compressor, and necessary equipment to begin development operations and ship ore said to be broken in the old stope.

TRANSPORTATION - TRUCKING:

Ore shipments and supplies will be handled through Morenci. Trucking charge for ore will be contracted at a cost of $1.50 per ton from the mine bins to the Morenci Sampling plant.

SMELTING:

The Keating mine ores are silicious ores desirable for converting copper operations and furnace fettling. It is proposed to mine and ship ores containing 4% copper, 75% Silica, 3/100 ozs. Gold and 1.5 ozs. Silver.

Negotiations undertaken up to date indicate that the cost of smelting will be $2.50 per ton of ore.

Deductions for smelting losses have not been agreed upon, however, the maximum allowance for this operation should not exceed 6 pounds of copper per ton of ore.

The expected revenue from one ton of silicious ore follows:

| | | | |
|---|---|---|---|
| Gold - .03 ozs. @ | $ 32.00 | = | $ 0.96 |
| Silver-1.5 ozs. @ | .34 | = | 0.96 |
| Copper-4% = 80 lbs. less 6 = 74 lbs. .. @ | .14½ | = | 10.73 |
| | Net Smelter | = | $12.65 |

COST:

| | | |
|---|---|---|
| Mining and development - | $ 4.00 | |
| Trucking - | 1.50 | |
| Smelting - | 2.50 | |
| Royalty - | .50 | |
| Federal Taxes - ? | | $ 8.50 |

Probahable profit before Fed. Taxes $ 4.15

EL PASO SMELTER:

A tentative contract for smelting silicious ore has been received from the American Smelting & Refining Co. The proposed contract is not favorable to the shipper.

The terms offered figure out as follows:
Maximum Shipment - 500 tons per month.
Ore Assay - Gold .03 ozs. Silver 1.5 ozs. Copper 4.0

| | | | |
|---|---|---|---|
| Payments: | Gold .03 @ $ 32.318 | | $ 0.97 |
| | Silver 1.0 | | 0.69 |
| | Copper 68.4 @ 9.05 | | 6.19 |
| | | | $ 7.85 |
| | Base Charge smelting | | 2.50 |
| | | | $ 5.35 |
| | Freight - | 2.12 | |
| | Switch - | 0.06 | |
| | Hoisture-2% | 0.05 | 2.23 |
| | NET AT CLIFTON - | | $ 3.12 |
| | Premium 68.4 @ 5¢ | | 3.42 |
| | | | $ 6.54 |
| | Mining $ 4.00 | | |
| (Mine to Clifton) | Trucking 2.00 | | 6.00 |
| | | NET | $ 0.54 |

The contract offered by the El Paso Smelting plant does not permit successful operation.

If the rates offered at Morenci are more favorable, particularly the deduction for copper loss, then the planned development and mining program could be undertaken. The ore deposits of the Keating Vein and of the Copper Plate Vein were made by ascending mineralizing solutions according to Waldemar Lindgren in his professional paper entitled "Copper Deposits of the Clifton Morenci district Arizona", issued in 1905.

It is my opinion that the Dover Copper Mining Company's Keating group of claims can be brought into production at comparatively small expense. There is reasonably assured tonnage of silicious copper ore very desirable and necessary for smelting plant operations at Morenci, and it is assumed that under the war program, the smelting rates for these silicious ores can be negotiated so that new copper can be produced without loss.

The lessee company has planned to spend $50,000.00 to reopen the mine and it has been estimated that htis capital investment can be returned if the mining program is carefully planned and executed. This work will be carried out by the lessee company.

The Dover Copper Mining Company has invested a large sum of money in assessment work, road building, development work and finally the unprofitable attempt to mine the Keating ores 1928 to 1930.

Since 1930, the Dover Copper Mining Company has held the possession of its mining claim locations by doing annual assessment work and recently has undertaken to apply for patent and obtain title from the United States Government for groups of claims already proven to warrant serious mining effort.

It is my recommendation that a capable and going mining corporation like the Shhttuck Denn Mining Corporation, should undertake to negotiate a sublease for a long term period on the Dover Copper Mining Company property from the Auto Specialties Manufacturing Company, Lessee, of the Dover Copper Mining Company.

Respectfully submitted
Arthur Houle / Sig.

APEX ONION SKIN

COMMENTS: on the Arthur Houle report to the Shattuck Denn M. Co., dated June 12, 1942.

**********

The Shattuck Denn is a successful mining company. Their stock is listed on the NY Curb and is, I believe, paying small dividends.

The company operated many years in Bisbee. Just lately, according to the press, the stockholders approved a sale of their Bisbee property to the Phelps-Dodge.

Mr. Houle worked for the Shattuck Denn some 12 years I am told.

My information is that at the time he made this report for the Shattuck Denn Co. it was undecided by the Dover Co. whether they would lease or deal with the S. D. Co., or with the Auto Specialties Mfg. Co. The last-named company took the lease, The Shattuck Denn about the same time acquired the old Iron King mine near Prescott, and which they are now operating.

This report of Mr. Houle's gives a good condensed history of the Dover, and of the expenditures made by the Phelps-Dodge before they got into production from the Clay ore body.

The report likewise gives a mining history of the district, types of ore deposits, etc., and considerable detail as to the Keating vein and mine (Dover). I failed to find any accompanying maps or charts, although it is believed some of the Keating sketches and sections were made about this time.

Since this report was made the title-status of the different claim groups he mentions has changed; and that status is correctly shown on the property map.

J. E. Busch
2/25/47

PRODUCTION OF THE KEATING MINE, MORENCI DISTRICT, GREENLEE COUNTY, ARIZONA

1913-1925, inclusive

| YEAR | WEIGHT | GOLD | SILVER | COPPER (WET ASSAY) |
|---|---|---|---|---|
| 1913 | 148 | -- | 558 | 43,492 |
| 1914 | 603 | -- | 147 | 96,810 |
| 1916 | 638 | -- | -- | 107,404 |
| 1917 | 638 | -- | -- | 92,506 |
| 1918 | 1,483 | 6.08 | 757 | 266,912 |
| 1919 | 143 | 2.00 | 222 | 31,595 |
| 1925 | 19 | 1.30 | 105 | 7,284 |

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

REGION IV

224 New Customhouse
Denver, Colorado
February 11, 1952

Mr. J. E. Busch, Office Engineer
Department of Mineral Resources
Mineral Building, Fairgrounds
Phoenix, Arizona

Dear Mr. Busch:

Your letter of January 25, 1952 addressed to the U. S. Bureau of Mines in Washington, D. C. regarding the Keating Mine, has been referred to me for reply. The records on file in the Statistics Branch of Region IV show that the mine began producing in 1912. Dan Grant of Metcalf, Arizona, did the assessment work at the property in 1912 and produced 18 tons of ore containing 1 ounce of gold, 154 ounces of silver, and 5,765 pounds of copper. In 1913 the property was operated by the Keating Copper Syndicate, Dan Grant, Superintendent, Metcalf, Arizona. During that year the mine was developed by a vertical shaft, 230 feet deep, with drifts amounting to 940 feet. In 1914 an incline shaft was sunk 325 feet with a total of 2,000 feet of drifts. In 1918 the vertical shaft had reached a depth of 300 feet with additional drifting. In 1918 the property was operated by the Grant Leasing Company. In 1926 the property was taken over by the Dover Copper Company and it is the owner of the property at the present time, with A. H. Zink, Secretary-Treasurer, St. Joseph, Michigan. Tom Cox is the agent, Box 1086, Clifton, Arizona. The property has been idle during recent years.

Production from 1913 through 1925 is given on the enclosed Form 6-1184.

Very truly yours,

J. H. East, Jr.,
Regional Director

Enclosure

AMERICAN SMELTING AND REFINING COMPANY

El Paso Smelting Works

P.O.Box 1111
El Paso, Texas

March 20, 1951

Mr. J. E. Busch, Superintendent
The Dover Copper Mining Company
30 East 6th Street
Tempe, Arizona

Dear Sir:

I believe we are now fully informed on the terms of the Gomez lease on your Company's property, the Bell No. 5 and it will be unnecessary for you to send us any additional information regarding the automatic extension clause. Thank you for your offer just the same.

As requested in your letter of March 10, I am pleased to show below a statement of receipts from the Gomez Brothers up to date:

| Date Rec'd. | Lot No. | Net Weight | Value per Ton Gross | Value per Ton Net | Royalty | Net Paid Shipper |
|---|---|---|---|---|---|---|
| 9/12/49 | 2861 | 99058 | $15.46 | $10.20 | $ 34.06 | $ 369.60 |
| 2/15/50 | 465 | 73313 | 34.52 | 27.92 | 87.19 | 831.49 |
| 7/26/50 | 2064 | 104869 | 20.30 | 14.70 | 65.95 | 584.48 |
| 10/5/50 | 2781 | 85614 | 16.04 | 10.60 | 37.33 | 322.94 |
| 2/19/51 | 454 | 114669 | 41.88 | 35.77 | 232.45 | 1610.16 |

Yours truly,

T. S. Duff

TSD/jhd

CC: Mr. D. V. Mulhern
Messrs. Cy and Manuel Gomez

REPORT OF OPERATIONS FOR 1945 AND JANUARY 1946

Auto Specialties Mfg. Co., Lessee
DOVER COPPER MINES

MINING

At about the end of January 1945, all the commercial ore was extracted from the stope lying southwest of No. 6 "A" manway. This stope produced most of the tonnage that was shipped during 1943 and 1944. The following month the shrinkage stope that was started during 1944, about 200 feet northeast of the No. 6 manway, was also depleted of commercial ore. With no more ore left in the two producing stopes, and continued prospecting in the various places not showing up any quantity of ore, it was decided to clean up what ore had been broken and what was in sight, and close operations for present. The ore was all cleaned out and mining was stopped on the last of March.

DEVELOPMENT WORK

A small amount of development work was done during January and February. The block of ground southeast of No. 6 "A" manway was prospected by raises and drifts, but not much ore was found in this section. The No. 1 Prospect raise section was also further prospected by drifts on the vein each side of the raise, but very little ore was found in this section also.

With the closing down of the Keating mine all the mine equipment, with the exception of the pipelines and the track, was removed from the mine. The two air compressors, the rock crusher and a 10 HP gasoline engine, were left in the mine yard. The two compressors remain in their sheds under cover, the crusher and engine on a platform at the foot of the stairway. The balance of the equipment was hauled to Dover Cam and is stored in the storage tunnel and sheds at the camp. The three tugger hoists, the two heavier trucks and one jackhammer and some of the other equipment was sold, but the balance we still have on hand.

SHIRE HOMESTEAD

A 6 HP gasoline engine and pump were installed at the Zorilla spring on the homestead so that water could be pumped on the orchard in the homestead, or up to the mine, if necessary. All piping was left intact between the Zorilla spring and the mine. The orchard was also fenced to keep the wandering cattle from destroying the water ditches between the fruit trees.

MINERAL DISCOVERY WORK FOR PATENTING

Patent Survey No. 4267 - St. Joe group - Bell group

When Mr. Paul N. Cutter, the Examining Engineer for the General Land Office, examined this group, he failed to find sufficient mineral on the St. Joe No. 1 and No. 2, and the Bell No. 8. He also reported insufficient improvements on the Bell No. 10 and the Tuckey No. 12. Additional work was then done on the

claims that were questionable, and sufficient mineral was discovered on the claims that lacked mineral, and more improvements were added to those lacking the full $500.00 worth of work. When Mr. Cutter later examined this group, he presumably found everything satisfactory.

Patent Surveys No. 4282 and 4283

In early September these two groups were examined by Mr. Cutter, for the General Land Office. It was believed he would turn in an adverse report on more than half of them, because of insufficient mineral showings. In December of 1945 and January 1946, further work was done on the two groups of claims and a definite showing of mineral was found on three of the claims in question. The balance of the questionable claims will be somewhat in doubt until re-examined by the General Land Office. The possibility of exposing a favorable showing of mineral on the weak claims does not look very promising at this time.

PRODUCTION

| | |
|---|---|
| Ore shipped | 1697.50 tons |
| Copper produced | 127.416 lbs. |
| Gold produced | 55.22 ozs. |
| Silver produced | 700.87 ozs. |

DEVELOPMENT FOOTAGE

| | |
|---|---|
| Drifts and Crosscuts | 145.5 feet |
| Raises | 62.0 feet |
| Total | 207.5 feet |

RE-CAPITULATION OF OPERATIONS, JUNE 1942 TO FEBRUARY 1, 1946

| | |
|---|---|
| Tons of ore shipped to smelter | 7,236.945 |
| Pounds of copper produced | 626,413.00 |
| Ounces of gold produced | 195.13 |
| Ounces of silver produced | 10,464.05 |

Average assay value of copper in ore shipped: 4.326%

DEVELOPMENT AT KEATING MINE

| | |
|---|---|
| Drifts and Crosscuts | 1,746.5 feet |
| Raises | 675.0 feet |
| Winzes sunk | 108.0 feet |
| Total | 2,529.5 feet |

EXCERPTS

from report

of Newton W. Emmens, Mining Engineer

June, 1929

************************

On the Keating group a very nice fissure vein has been developed by adits (tunnels) and shafts for a length of over 1500 feet and much ore has been shipped from there during past years.

Between the 125 foot level in the New Queen shaft and the surface to the northeast, ore to the value of $380,000 was shipped some years ago, and from the first shoot in the upper adit several carloads of high grade ore have been mined. Since the Keating property was acquired by the Dover Copper Mining Company, a number of cars of ore have been shipped. The following typical shipments will give and idea as to the value of this hand sorted ore:

(here follows a tabulation of shipments, not copied becuase ore shipments and value are given on the prints)

The Keating vein has been opened by two adits, the upper of which is 200 feet below the apex of the vein and the lower is 250 feet deeper. The ore shoot on the upper adit is 375 feet long and four to six feet wide, part of which has been stoped to surface. A new stope is being worked and high grade ore sorted for shipment. In the lower adit this shoot has been developed for 175 feet, with both drifts still in ore, and by stopes in which it has a width of from four to twenty feet, with an average of 8 feet. During the driving of the drifts and the opening of the stopes, numerous samples were taken daily, as the work progressed, the average of which gave 616% copper.....

In addition to this, there is the reasonable expectation of opening other ore shoots in the same vein, ore at greater depth, ore in parallel known veins, and the probability of developing big bodies of low grade ore, as will as finding other fissure veins like the Keating (one of which is already known to exist and is partly developed on the Tuckey claims) on some of the other groups.

At its present stage of development, the Dover cannot be classed as a big mine, but it is a very nice small producer with excellent opportunities of not only making a greatly increased output of excellent grade ore, but with possibilities of finding and developing big bodies of low grade ores in the porphyry belts on the Margot, Bell, Tuckey, and other groups.

COMMENTS:

Mr. Emmens is a Canadian mining engineer. I do not know him, nor have I heard anything re his ability and ethics except statements made to me by Mr. Tom Cocks before his death. Cocks seemed to think he was both capable and ethical in his work. Cocks says that during his examination the Dover was working - Cocks then being Superintendent. Emmens 'took over' for about two weeks, during which he mined and shipped the ore himself. These shipments are tabulated in the report. One such shipment of 39.26 tons contained 21.48% copper, 5.2 oz. silver, 0.12 oz. gold.

Mr. W. V. Tiscornia, President of the Dover Copper Company, requested that I keep the Emmens report in my possession. For this reason it is not being forwarded. It is informative as to the property as of that time but would be of little present-day value.

J. E. Busch
2/25/47

THE DOVER COPPER COMPANY

MORENCI, GREENLEE COUNTY, ARIZONA

SUMMARY

OF

DATA CONCERNING

PROPOSED

NEW DEVELOPMENT CAMPAIGN

FOR

YEAR 1942

ARTHUR HOULE
Mining Engineer
1303 East Fifth Street
Tucson, Arizona

April 10, 1942

Mr. Waldo V. Tiscornia, Vice President
Dover Copper Company
Morenci, Arizona

Dear Sir:

The following is a resume of matter discussed in conferences early in April 1942, relative to a possible resumption of copper production from the Dover Copper Company property, situated near Morenci, Greenlee County, Arizona.

Early in January, 1942, the War Production Board, through its subsidiary, The Metals Reserve Company, announced that a serious shortage existed for the metals, copper, lead and zinc.

In order to stimulate the production of copper, the price for that metal for all production above the average of 1940 and 1941 output would be bought by Metals Reserve Company, or its agents, at seventeen (17) cents per pound.

The ceiling price paid for normal production of previous years would continue at twelve (12) cents per pound of copper.

It is assumed that copper mining properties brought into production after January, 1942, and for a period of at least 2½ years, would receive the new copper price.

In order to obtain the new price for new production it is necessary for each producing company to register with the Metals Reserve Company for proper identification and thereafter support the new copper production by proper affadavits of the mining company, together with certified statements from the smelting company which smelted the new ore production to bullion.

Details for the time of payment of the 17 cent price for copper have not been announced by the United States Government, Metals Reserve Company, but such announcements are expected almost daily.

The prices to be paid for lead and zinc are to be increased under similar conditions.

As a result of this increase in price for new copper production definite plans are being considered to rehabilitate and reopen the mining workings on the various groups of mining claims owned and controlled by the Dover Copper Company.

As of the date April 10, 1942 copper production can be resumed from Dover Copper Company holdings, after a reasonably small capital

expenditure, if and when, the copper bearing ore can be concentrated or smelted locally.

The situation in review follows:-

The Pehlps Dodge Corporation are the owners of extensive copper mineral lands adjacent to the Dover Copper Company property near Morenci, Arizona. After five years of preparatory mining operations, and the building of milling and smelting plants resulting in an expenditure of more than $30,000,000.00, the P. D. Corporation is now just about ready to mine, concentrate and smelt its copper ores at the rate of 25000 tons of crude ore daily. This crude ore contains approximately 22 lbs. of copper per ton. At maximum capacity this new plant will output 500,000 pounds of copper daily.

The Phelps Dodge plant will receive custom ores and particularly such ores necessary to flux or assist the smelting of the products obtained from the Phelps Dodge mines.

Ores of the character suitable for fluxing and smelting with Phelps Dodge mill concentrates are obtainable from the Keating Mine of the Dover Copper Company. On April 9, 1942 Mr. H. M. Lavender, Genral Manager of Phelps Dodge Corporation stated smelting contracts for custom ores would be made for the Morenci plant on or about July 1, 1942. This date was set for the completion of the mechanical sampling plant now under construction. The building of this sampling mill has been delayed by war conditions.

The past record of the Keating Mine, together with available mapped data substantiated by information given by Mr. Thomas Cocks seems to indicate that the Keating Mine orebody from surface to the 300 foot level will produce 250,000 tons of silicious copper bearing ores. This silicious copper is estimated to average 4% copper, 1 oz. silver, 70¢ gold and 67% silica, 2% Alumina. Ore of that character will be very necessary for Phelps Dodge Morenci smelting operations and a favorable smelting contract can be negotiated.

The Keating Mine has been developed by a main shaft 320 feet deep, from which three levels at 100 foot intervals have been driven eastward on the vein. This work, now inaccessible, as mapped shows three ore shoots from which ore of an estimated value of $750,000.00 was shipped during World War #1.

During 1928 and up to 1930, the Keating vein west of the main shaft was opened up by a crosscut tunnel driven from Horseshoe Gulch. This tunnel is called the Kimberly Tunnel. The mouth of the tunnel is located on Phelps Dodge Kimberly Claim. The tunnel, which is 1000 feet long, cut the vein 253 feet below the collar of the Keating shaft. The intersection of the Keating tunnel and vein exposed silicious copper ore for a width of 28 feet. Shrinkage stopes started above this tunnel were opened up and production of 5500 tons of copper ore was obtained. Shipments to American Smelting and Refining Company plant at El Paso show returns varying from 11% down to 3.38% copper. Much of this ore was roughly hand sorted before shipment.

There is reported to be considerable tonnage of broken ore still available in the shrinkage stopes.

At this time only about 100 feet in length of the vein at its intersection with the Keating Tunnel is open for examination. During 1929 a map of record November 1929 shows a drift 700 feet long had been driven on the Keating vein. This drift connects with the Keating shaft at 253 feet below the collar of the shaft. The drift follows the footwall. A diabase dyke forms the footwall of the vein. The vein is a fissure cutting through granite and quartzite and the vein filling is a silicious breccia seamed with veinlets and kidneys of copper oxidized ores and copper glance (chalcocite). The ores to the 250 level are known as secondarily enriched copper ores. Pyrite is beginning to show below the Kimberly Tunnel level and it is probable that primary copper ores will be opened up within the next 200 feet in depth below the Kimberly crosscut tunnel level.

Two plans are suggested to reopen the Keating workings

First Recondition the Keating shaft first as proposed to you in my report dated August 5, 1941. This plan, in my judgement, is the soundest program for a permanent job because I think the Keating orebody will warrant such a program of development. The cost of repairing this shaft will be many times offset by better facilities it will provide to carry on furture development of the ore bearing vein east and west of the shaft location.

I advise more serious consideration of this plan at this time.

Second Begin the reopening of the Keating vein by the installation of a temporary power plant at the mouth of the Kimberly Tunnel.

The Phelps Dodge management has agreed as of April 9, 1942 to permit such temporary installations subject to a nominal monthly rental basis, also subject to a 30 day removal clause.

The temporary power plant at the Kimberly Tunnel should consist of:

1. 400 Cu. ft. capacity air compressor.
2. Drill sharpening plant.
3. Blacksmith and timber framing shop.
4. Change room.
5. Blowers and ventillation pipes.
6. Air operated hoist for winze sinking below tunnel.
7. Tugger equipment for raise development.
8. Tools, wil tank, gas tank, track and pipe.
9. Pump and pipe line for water supply.

Eventually all of these installations must of necessity be removed and permanently installed on the surface of the Keating group off of Phelps Dodge lands.

The immediate development campaign for the Kimberly Tunnel will consist of:-

First Reopening the Keating vein for a distance of 150 feet, both east and west of the junction of the Kimberly Tunnel and the orebody. Cost estimated at $5,000.00 completed and retimbered.

Second Sink a winze shaft to a depth of 100 feet below the tunnel level. This winze shaft will provide room below the 320 level of the Keating shaft - third level - for orepockets and a sump. Cost $40.00 per foot. This work should win 1000 tons of 4% ore.

Third Drive a two compartment raise from Kimberly Tunnel to west adit on Keating level. This raise will provide ventilation for the west side of the mine. Cost $25.00 per foot, total $6325.00. Win 2024 tons of 4% ore.

Fourth Drive face of west drift Kimberly level 600 feet to property line. Cost $12.00 per foot, total $7200.00. If in ore this heading will provide 3½ tons of ore for each foot advanced. It is probable these openings will win 5124 tons of 4% copper ore.

This development campaign can be accomplished within four months. From these new openings can be planned to block out the newly developed ores and map out a second campaign, the most important part of which, should be to connect new workings with the old Keating shaft on the bottom level of the mine.

SMELTING CONTRACTS

Two types of smelting contracts should be negotiated.

First Silicious Copper Ore.

Second Copper ores or concentrates containing more than 6% copper and containing less than 60% silica.

Silicious Copper Ore - Probable Contract from Phelps Dodge - Morenci, Arizona
Used in Converters and Reverberatory Furnace Fettling
70% Silica desired 4% Copper ore 12¢ Copper market
Pay for Copper less 6 lbs. per ton (slag loss)
4% ore - 80 lbs less 6 - 74 lbs.
Copper price 11.65¢ less 2.6¢ freight and refining - 9.05¢ per pound.

| | |
|---|---|
| 74 lbs. @ 9.05 cents - | $6.70 per ton |
| 1.0 oz. Silver @ $.69 | .69 |
| 2/100 oz. Gold @ $32.00 | .64 |
| Gross Value | $8.03 |

| | | | |
|---|---|---|---|
| Carried Forward | Gross Value | | $8.03 per ton |
| | Mining cost per ton | $4.00 | |
| | Trucking to Morenci | 2.00 | |
| | Smelting | 2.00 | |
| | | 8.00 | 8.00 |
| | | Net | $ .03 per ton |
| | Premium price on copper 5¢ on 74 lbs. | | 3.70 |
| | | Net | $3.73 |

Kimberly Tunnel Development First Campaign 5124 Tons of 4% ore

| | | |
|---|---|---|
| Recovery 5124 tons at $3.73 = | | $19,111.82 |
| Cost 300 feet retimbering | $5,000.00 | |
| Cost winze shaft | 4,000.00 | |
| Cost Raise to west adit | 6,325.00 | |
| | | 15,325.00 |
| | Net Income | $ 3,786.82 |

Compare A. S. & R. Open Contract on next page.

| | | |
|---|---|---|
| Plant and Equipment - Estimated | | |
| Second hand Compressor | $1,000.00 | New $2,800.00 |
| Second hand Drill Sharp | 800.00 | |
| Hoists | 800.00 | |
| Ventilation | 650.00 | |
| Roads and Bins | 2,000.00 | |
| Housing and shops | 4,000.00 | |
| Drill Steel, Tracks, Pipe | 2,000.00 | |
| Drill Machines and parts | 1,065.00 | |
| Utility Trucks | 1,800.00 | |
| Tools and Supplies | 2,500.00 | |
| Labor Installation | 2,100.00 | |
| Tanks, Water Line, Pump | 1,500.00 | |
| Assaying Supervision, 4 months | 2,600.00 | |
| Total | $20,815.00 | or $22.615.00 |

Capital Investment to Start

| | |
|---|---|
| Plant | $22,615.00 |
| Mine Development | 15,325.00 |
| Total | $34.940.00 |
| Probable Recovery 17¢ | 19,111.82 |
| Final Investment | $18,828.18 |

Silicious Copper Ore - A. S. & R. Open Contract - Ricard April 9, 1942

| | | |
|---|---|---|
| Gold 2/100 @ $32.31 | | $0.65 |
| Silver 1 oz. | | 0.69 |
| Copper 80 less 8 - 72 @ 95% - 68.6 @ 9.05¢ | | 6.21 |
| Total | | $7.55 |
| Base Smelting | $2.50 | |
| Truck to Clifton | 2.50 | |
| Freight to El Paso | 2.00 | |
| Mining | 4.00 | |
| Switching | 0.06 | |
| Total | $11.06 | 11.06 |
| Loss | | $ 3.51 |
| Premium 5¢ lb. on 68.6 lbs. | | 3.43 |
| Net Loss per ton 17¢ Cu$ | | 0.08 |

Rockwood, R. F. C. Engineer, Phoenix, stated silicious ores (70% $S_1O^2$) contracted at rates as low as $1.50 per ton.

Contract Shipping ores under 60% Silica - 6% copper - at Morenci, Arizona

| | | |
|---|---|---|
| 6% ore = 120 lbs. less 8 lbs = 112 @ 9.05¢ | | $10.14 |
| Gold 2/100 @ $32.31 | | 0.65 |
| Silver 1 oz. @ $0.69 | | 0.69 |
| | | $11.48 |
| Mining, Sorting | $5.00 | |
| Haul - Truck | 2.00 | |
| Smelting Base $3.65 | | |
| $S_1O^2$ 40% 2.00 | 5.65 | 12.65 |
| At 12¢ Market - Net Loss per ton | | $ 1.17 |
| Premium on 17¢ Copper 112 tons @ 5¢ | | 5.60 |
| Net per ton | | $ 4.43 |

The payments and costs estimated above have as yet no basis in fact, but are assumed costs and payments under reasonable conditions. The future uncertainties due to rises in costs of labor and supplies in these war times could adversely affect the costs above estimated. The figures as stated above furnish a basis for negotiation smelting contracts for the Keating Mine ore output.

Contracting Development Work

It is assumed that the mine can be prepared for production if 1000 feet of new development work for drifting , raising and winzes is completed. The capital outlay for plant and equipment must be made. A contractor could undertake the work and provide his own facilities. Labor is uncertain both in quality and quantity, however, bids could be entertained for the raise and winze development on the Kimberly Tunnel level, this work to be completed before July 1, 1942. The ores taken out in this development work could be stockpiled in Horseshow Gilch subject to summer rain flood risk. This question should be studied. In the meantime it is worth an effort to obtain permission to stockpile these silicious ores on the smelting company property as mine development work progresses.

Upon completion of the first program of development, and assuming this work has been accomplished under a contracting firm, it will again be necessary to plan for plant installation to carry on full mining operations. The contract plan of development might be considered only to get a start in reopening the property.

Future Operations

The Keating unit, after four months of development effort, either by contract or company account should be able to maintain a steady output of 3000 tons per month of 4% silicious copper ores shipable to Morenci under a favorable smelting agreement. From this tonnage a good profit is in prospect, therefore, an excellent opportunity is at hand to carry on future development of other units of the Dover Copper Company mineral bearing mining claims.

Patenting Questions

It is suggested at this time that the unpatented mining claims situated west of the "Storm Group" should be surveyed for patent. All of the patentable claims side lining on the south side of the Foxey, Missing Link, Lackawana and De Soto, the area which includes the St. Joe claims #1 to #10 and the Tuckey Claims No. 1 to No. 13 inclusive, plus the Bell Claims No. 1 to No. 11 inclusive are all potential copper ore bearing lands. The St. Joe group of claims are particularly valuable and warrant the necessary effort and expense to obtain title from the United States Government.

Exchange of Mining Claims

The possibilities of exchange of mining claims, Victor, Foxey, Lackawana, Missing Link and probably De Soto for certain claims in the Silver Basin area No. 4, 16, 19 and 21 of the Tom Wall group is a fair exchange because it would result in establishing contiguous holding s between the Margot and Tuckey claims of the

Dover Copper Company holdings. Geologically all of this area is potential copper ground worthy of extensive development effort.

The Victor claim should carry the west extension of the Keating vein and from this claim if it is exchanged, a development tunnel should be driven to cut under the Keating workings.

Summary

Recent conferences with smelting and mining company officials lead to the conclusion that until such time as the War Production Board and its subsidiary, Metals Reserve Company, set up definite rules for new copper production and the payment for that production at 17 cents per pound, commitments involving capital expenditures must be made on good faith and belief that reimbursement will eventually be received.

The Dover Copper Company, Keating Mine cannot be brought into profitable production at the present fixed price of twelve (12) cents per pound for copper.

Under favorable smelting contract for silicious copper bearing ores any ore of an average 3% copper content with 65% plus silica can be mined and smelted and meet present cost of production. Copper content in excess of 3% will net a profit.

It is suggested that details concerning rules and payments for increased copper metal prices for new production should be taken up in Washington, D. D. in the Office of Production Management, New Social Security Building
Branch H - Copper, Zinc, Brass and Copper Alloys
Chief - David A. Uebelacker
Assistant Chief Production - Frank A. Ayer (Formerly Manager Morenci)
Consultant - Harry Hayes ( Bisbee, Morenci)

For Loans interview Reconstruction Finance Corporation
Chief Engineer - H. R. Norton
Assistant Engineer - Don M. Rait (Bisbee, formerly Supt. Calumet & Ariz.)
Phoenix Office - W. B. Gohring, Chief
Interviewed Rockwood, Assistant, April 9, 1942.

It is probable that Mr. Frank A. Ayer, Assistant Chief Production, Branch H, Copper Department, New Social Security Building, Washington, D. C. would be the right person to interview. His knowledge of the Morenci District would result in a quick and clear understanding of all of the new production problems involved.

Respectfully submitted,

/s/ Arthur Houle, E.M.

Arthur Houle, E.M.

Copied April 25, 1952 / jmh

ARTHUR HOULE
Mining Engineer
1303 East Fifth Street
Tucson, Arizona

Morenci, Arizona
July 20, 1936

Mr. J. D. Douglas
Douglas, Arizona

Dear Mr. Douglas:

I submit the following preview of my observations up to date in this district and I trust it will give you an outline so that you can plan for the future if necessary or advisable:-

Keating Mine

Two men are employed at the junction of the main crosscut with the Keating vein. The heading north is the point of attack to reach the shaft. The advance has been only a few feet. More than 200 tons of broken low grade ore from the stope above has been shoveled up but as yet the two men (leasers) have not been able to timber the opening to start the place for spilling.

It is impossible to make any estimate about the time necessary or the expense involved in reopening this tunnel level. It is very probable the ore showing here is important. The nearby ore zone Coronado Mine of the P. D. developed by the workings from the Matilda and Horseshoe shafts continued from surface to the 1100 foot level and has been stoped very extensively wide and long from surface to the 800 foot level. I am told that the Coronado vein at the 1100 foot level is in low grade pyritic ore.

At this point, 1100 level, the bottom workings are connected with the main haulage level on which the ores are brought to No. 6 shaft in Morenci and here hoisted to the surface for milling. The Coronado vein and ore body was continuous for more than one mile in length. This vein strikes East and West and the Keating vein strikes N 58° E and is called a branch of the Coronado vein.

The Keating tunnel level is approximately 250 feet below the collar of the shaft at the surface out crop; therefore it is possible that 450 feet more depth can be expected from the present exposure of ore on the tunnel level.

The ore bins and tunnel entrance to the Keating vein are badly situated because they are located on the Kimberly claim of the P. D. Corp. Gallo had paid rental for the surface rights up to $40.00 per month. I

have been unable to get a clear cut story of how this tunnel site was selected but it is reasonable to suppose that the original surveys for the site were in error.

There are surface indications of parallel veins to the Keating as one goes southward toward the Copper Plate tunnel. The future development for this section should be planned by crosscuts from the Copper Plate Tunnel.

The elevation at the collar of the Keating shaft is 5500 feet (aneroid). The entrance of the Copper Plate tunnel is at elevation 4800 (aneroid). The distance between the two workings, mouth to mouth, is approximately 4500 feet. The nearest connection point from the face of Copper Plate tunnel is about 3000 feet distant.

Copper Plate Vein - Copper Plate Tunnel

The surface exposures of this vein are attractive. I believe the tunnel was driven to the right of the vein and a few short crosscuts driven North 40° West would be justifiable development work.

The vein is a fissure similar to the Keating. The strike of the vein is also N 50° E. A dike of diabase follows the vein and that is typical of the Coronado and Keating veins. The surface ores are silicious, showing spots of copper glance surrounded by silicates, oxides and carbonates.

The vein fissure cuts through the old granite and upward through the surface outcrop - cambrian quartzite. The ore makes in the granite porphyry and diabase filling and following the fissure.

The northeast face of the Copper Plate tunnel is just entering into the Margot No. 22 claim. The distance from this face to the Keating tunnel and vein below this tunnel level is about 3000 feet.

The Dover group of claims, south and west of the Copper Plate tunnel, is limestone cut by dikes of monzonite porphyry. The surface outcrops show very little mineral although greenish epidote is common.

Copper Plate Gulch

From the place where the Dover road cuts across the arroyo the Copper Plate gulch heads N 75° E toward the Pitts group. Southwest from the same point a road once connected with the Eagle Gold or sometimes called the Gold Belt group.

Up the canyon toward the Pitts ground fissure veins showing indications of copper have been exposed by prospect pits and assessment workings. There is not sufficient work done to demonstrate any more than indications of copper mineralization in fissure veins.

Copper Plate gulch is located 2 500 feet southeast of the Copper Plate tunnel.

## The Pitts Group

This ground begins about one mile east of the junction of the Dover and Gold Belt roads, This ground is surrounded on three sides - north, east and south - by P. D. patented claims.

One good looking and partially developed fissure vein has been exposed on surface and slightly below surface by two adit tunnels. A silicious copper ore showing spots of glance in a vein striking N 50° E. is exposed in these two adits. Four to six feet of vein matter is showing.

Below the surface outcrops at the base of the hill 200 feet deeper a crosscut tunnel was started to cut the vein. The tunnel is caved 140 feet from the mouth. The dump shows a little copper ore but conflicting stories are told of the development work. Pitts owners say the crosscut was not driven far enough to cut the vein and others say the vein was encountered but no ore cut. The work is old and it would appear that much of this ground could be relocated.

The group is marked by strong faults, block faulting, and I believe it is potential mineral ground where ore will be found in fissure veins like the Keating.

## Soto Fault - Eagle Gold

South of the Margot claims of the Dover and the south boundary of the Pitts group, we encounter the Soto Fault, one of the outstanding fault planes of the Copper Mountain Mining District. This fault strike East-West cuts through the clay ore body and joins the concentrator fault which strikes East-West. This is the center of the ore bearing area.

On the west end of this fault is located the patented claims of the Eagle Gold - Gold Belt group. Small pockets of copper ore have been mined from the Eagle property. The ore occurs as replacement deposits in a narrow belt of limestone on the south side of the Soto fault. The workings are badly caved and shaft timbers in four of the shafts are badly rotted. I have been unable to check any of the underground workings. The owners state that assay record and liquidation sheets of shipments from this property were destroyed in the Central Hotel fire at Clifton some years ago.

Going eastward from Eagle Gold along the Soto Fault can be observed a mineralized zone which is marked by strong outcrops on the De Soto, Cordova, Irving, Producer of P. D., then Stevens group, and again into P. D. ground through the Tough Nut, Esperanza, Clay, Waterloo claims and on to Chase Creek. Adjacent to and south of this fault is the big copper ore area of the district. This zone has been extensively developed on the east side of American Mountain.

## St. Joe, Tuckey, Burbon

On the west side of American Mountain and south of the Soto Fault, the Dover claim locations cover the Monzonite porphyry area situated between Pinkards Gulch and Gold Gulch. In this area are located the St. Joe group, Burbon and Tuckey groups, also the recently located Storm group.

The St. Joe claims and Burbon claims are the most promising, particularly St. Joe 5, 4 and 3 in the order named. The only development work is shallow holes and assessment tunnels. Copper stained porphyry, well kaolinized and fractured, indicates that nearly 100 acres of this ground justifies some pilot hole drilling for information which could lead to a more extensive development program. Tuckey 12 and 13 claims carry a continuation of the porphyry area to Pinkards Gulch.

The boundary of the Monzonite area brings limestone contacts in which there is observed much epidote, a little magnetite iron and occasional copper stains. There are many dikes of monzonite cutting into the limestones; however, indications of promising copper deposition in this section are not strong. Some gold prospecting in Pinkards Gulch and along Gold Gulch in Dover ground have not given encouraging results.

The Tuckey claims, other than Tuckey No. 12 and No. 13 and the claims called Bell, are not marked by anything more than contact metamorphic mineralization of very slight value.

Claims South of Gold Gulch

Covering this ground are eight patented claims belonging to P. D. Corp. and the Lakenan group.

The P. D. claims headed by Dorcas, Bacon Rind and Fairview and five more are good. The Lakenan group comprises a strip 1000 feet wide, extending about one mile westward down Gold Gulch. The Lakenan is optioned to a group of Californians promoting the development of a gold showing on the extreme west end of the group of claims.

Olive and Tiger Groups

Adjoining the Lakenan on the south there is a large group of mining claims covering exposures of Ordovician limestones cut by dikes and sills of diorite porphyry. The porphyry is generally fresh looking. On one of the limestone porphyry contacts an iron exposure, mostly magnetite, marks the Game Cock claim. In my opinion the mineral bearing zone has tailed out to a weak showing which does not offer much promise for future development.

Tom Wall Group

South of the Tiger ground and a strip of P. D. ground, covered by the patented claims Iron King, Iron Queen, Stamboul and Margarita, is situated the Silver Basin area. This is the section in which the Dover located the Tom Wall claims 1 to 12 and the Elsie Placers, which were contested before the land commission by the P. D. Corp. in June 1935 at Clifton and is again up under appeal before United States Land Commission in Washington, D. C.

The area comprises a flat basin nearly 1-½ miles wide, East to West, and 2 miles long, north to south. Near the north end of the basin at an elevation of 4700 the P. D. owns a patented mining claim called Free Coinage Number 2856. East and north of the Free Coinage are the Tom

Wall claims, all located on probable mineral bearing ground as is indicated by the Micawber (P. D.) patented 760, Sonora patented 3913 (P. D.), and Maud S patented 3913 (P. D.) and Keystone No. 3316 patent P. D.

Note that the elevation of the ground on the Free Coinage claim P. D. is 4700 feet above sea level. The elevation of the main haulage drift at No. 6 shaft just above the 4000 ton concentrator is 4655 feet above sea level.

The main ore body at Copper Mountain and the clay ore body will be mined from above the 4700 foot elevation.

The distance from the Humboldt shaft to surface in Silver Basin is about 7300 feet. The haulage level at the Humboldt shaft is at 4655 feet above sea level.

An interesting article published in 1924, written by Norman Carmichael and John Kiddie, shows that Morenci district ore output, if mined by underground mining methods, will all come from ores mined above 4700 above sea level and that all the mines are provided with electric ore transportation at the 4655 level.

It is a question therefore whether it would be possible to continue the 4655 level to Silver Basin and utilize that flat valley for a future milling plant site or if the Silver Basin would not be used for the future town site.

The town of Morenci and its closely congested housing facilities is being changed. As fast as houses are vacated and surface leases expire on residence lots, the houses are torn down and removed. This indicates therefore the building of a new town site when operations are resumed, and Silver Basin is ideally situated for that purpose.

Another Viewpoint is Offered

As a result of a study of the mineral area, it is my opinion that mining operations in the future will be conducted by steam shovel operations and Silver Basin will be the scene of very large leaching plant operations. The ground in the basin slopes gently to the south and the difference in elevation is just 200 feet in about 2 miles south from the Free Coinage patented mining claim.

The basin is the only area of equal size near Morenci which could be used for the new plant and this site could be made ready at very low cost. It is accessible without tunnels by a low pass which enters the basin from the Tiger group and for that possibility the Tiger group has value without considering mineral chances.

The low grade ore bodies, if mined by steam shovels, will be transported west to the Gold Gulch section and then southwest to Silver Basin. That is the best outlet for a transportation problem involving the movement of 20,000 tons of ore daily. Tailings disposal ground below Silver Basin is available.

It is certain therefore that the Tom Wall claims interfere with planning the future big scale operations of the P. D. Corporation, and I

am sure also that the Tom Wall claims are sound mineral land locations.

Respectfully submitted,

/s/ Arthur Houle

Copied April 24, 1952 / jmh

COMMENTS; on the Arthur Houle report for J. S. Douglas

**********

Mr. Douglas is well known in Arizona mining circles, He was principal promoter and owner of the United Verde Extension mine at Jerome. This venture uncovered a portion of the down-faulted United Verde ore body, resulting in a return of many millions to the stockholders.

I am advised that Mr. Douglas considered the organization of a company at Morenci which would include the Dover and all other then-idle properties near or adjoining the Dover. He employed Houle to make a general report, altho Douglas himself had been over the ground and knew general conditions. For some reason Mr. Douglas suddenly dropped this project, withdrew largely from all mining activity in Arizona, gave up his citizenship and moved to Canada.

Coronado vein; Note Houle's description, page 1, and extent and depth. This vein has been roughly spotted on the property map, and the Keating vein - a branch or spur of the Coronado - is also shown.

Dr. Waldemar Lindgren describes this vein in Prof. Paper No 43, U.S.G.S. (see index thereof; it is mentioned several places ].

It is likewise described on page 77, Arizona Bureau of Mines Bulletin No 145, - copy attached.

Copper Plate vein; This vein is a fault-fissure. The maps indicate over 1000 ft. of drifting. I was never underground but am told the mineralization was lean and spotty, although some ore was shipped under former ownership. The character of the fault, its coarse breccia in surface croppings, etc., would afford an easy channel for mineral-bearing solutions to circulate along considerable distance, laterally and vertically. Tom Cocks always insisted that the cross-cutting done under the Tiscornia management (Auto Specialties Mfg. Co. lease) was in the wrong direction. I do not find any assay charts of this work.

Pitts Group; These claims DO NOT BELONG to the Dover. They are said to be in an estate, and, it is also said, under long-term option to the Phelps-Dodge.

Soto Fault; This fault is described in Dr. Lindgren's paper, above cited. It is likewise mapped by the same able geologist in the Clifton Folio, U.S.G.S., Fig. 2, page 9. That map likewise shows the Concentrator fault, mentioned by Houle. Note that Houle says "This fault strikes East-West, cuts through the Clay ore body....."

In my patent work for the Dover I found ore along the margins of this fault (or maybe in the fault). Its evident connection with the intense mineralization that made the great Clay ore body makes for far above-average ore containing possibilities. It is roughly sketched on the property map.

**********************

St. Joe, Tuckey, Burbon. By this heading Houle was referring to groups of mining claims as they are generally called by the Dover officials and attorneys.

Attention is invited to Houle's statement re a possible disseminated ore body, ie, par. 1, page 4, of this copy.

During the course of my patent work on this ground, and before I knew Mr. Houle, or had ever seen his report, I came to the same conclusion.

The seamed and shattered porphyry in this particular area is of course badly leached, although there is found much copper in the form of carbonates etc when one does close prospecting. That mineral-bearing solutions have circulated in and through many of the veinlets and joint-planes cannot be doubted. The area is not far from the Clay ore-body, and some of the veins can be traced to the edge of the "pit". (see map)

The Arizona Bureau of Mines bulletin should be studied in this regard, ie, "Fissures and Disseminations in Monzonite Porphyry", pps 76-77.

Tiger group: This ground is in dispute; it is not shown on the Dover property map.

Tom Wall group: Proper spelling is 'Tom Wal'. These claims are owned by the Dover company but have not yet been surveyed for patent. I have never been on the claims. Part of the group was involved in a Land Office hearings case, Pehlps-Dodge vs Dover, and the final decision thereunder awarded most of the claims to the Dover.

Balance of report: The balance of the Houle report refers to an area known as "Silver Basin". It was then felt that the Phelps-Dodge would either place a townsite in this basin, or use the area for tailings disposal, etc.

I have not attempted to ascertain status of land or claims in this basin.

J. E. Busch
2/25/47

ARTHUR HOULE
Mining Engineer
1303 East Fifth Street
Tucson, Arizona

August 5, 1941

Mr. Waldo V. Tiscornia
The Dover Copper Mining Company
St. Joseph, Michigan

Dear Mr. Tiscornia:

Replying to your letter of July 28th, 1941, I shall offer the following suggestions relative to plans to begin the development work necessary to put the Dover Copper Mining Company's mineral holdings on a production basis:

First: - The Keating Group of Claims.

At the Keating, the crosscut tunnel which taps the copper ore is in good shape. The portal of the Keating, as you know, is situated on the South side of the narrow canyon and on Phelps Dodge ground.

Before starting any rehabilitating work on the tunnel section, I advise that you obtain a surface lease at nominal rental (say $ 10.00 per year, 5 years and option to renew on 5 year periods) for the ground necessary for dump room and plant installation and approach to the portal of the tunnel.

If such a lease is not obtainable, it would then be advisable to recondition the Keating Shaft, build a good road from the Copper Plate tunnel to the Keating shaft and then install a hoist, an air compressor and such service plant as necessary to reopen the Keating area from this shaft.

The ore body at the Keating tunnel level is a mixture of oxide and copper glance ores. From this mixture, a small tonnage of shipping ore could be hand sorted and mined by selective mining (picking out the good spots). This is expensive and wasteful. Again, you remember that when the property was operated about 10 years ago, the orebody was mined by opening up shrinkage stopes. The shipments of ore during that period gradually dropped in value of metals until it was not profitable to ship. The mixture of oxidized and glance ores is not opened up enough to warrant the assumption that a combined flotation, concentration and leaching plant could be erected and profitably operated. Therefore, it is necessary to plan for the Keating vein the mining of ores to be obtained from deeper levels than the main tunnel.

I suggest, therefore, that you start at once to recondition the Keating shaft, head frame, collar and shaft timbering to the bottom level.

After repairing the shaft, begin the drifitng of drifts, east and west on the Keating vein, and make raise connection to the main tunnel level.

This new work should find a good tonnage of ore amenable to flotation concentration and the concentrates would be the best kind of material to ship to the custom smelter.

The Keating vein should, and in my opinion, will open up into the same kind of an orebody as was mined in the Coronado vein of the old English company. I think the Keating will develop into a good mine.

In planning to reopen the ore vein tapped by the Keating shaft, it will be necessary first to build a trucking road from the Copper Plate area. Afterwards install:

1. Hoist
2. Air Compressor
3. Drill sharpener and blacksmith shop
4. Small warehouse
5. Timber shed
6. Change room
7. Foreman's office.

Since receiving your inquiry, I have obtained data on some second hand mine equipment represented in items 1, 2 and 3. I find I can obtain the major part of the equipment for the first three parts of the program which could be purchased, checked over and hauled to the Keating shaft and installed for about $4,000.00. A new surface plant for the same purpose would cost installed about $11,000.00.

Careful buying of good second hand equipment and installing this kind of a plant would serve your purpose best at this time in reopening the Keating ore vein. I would plant to open the Keating shaft to a vertical depth of 600 feet below the collar of the shaft.

The mine organization would include a foreman and a crew of 20 to 25, including shaftmen, miners, muckers, carpenter, blacksmith, drill sharpener, hoistman, compressor man and surface men for the first six months period of rehabilitation. The average cost of labor will be $6.00 per man per day.

Labor cost at most mining operations represent 30% of the total operating cost, therefore, the daily expense will be about $500.00, estimated at this time, but of course, some of this "out of pocket" expense will come back from the ores shipped.

Second:-

Just as soon as the Keating is reopened, plans should be made to start development work at the Copper Plate. Surface showings on this ground will pay to work by leasers, if compressed air is provided by the company. Also, some crosscut work should be driven to the north. One crosscut should be driven which will eventually connect with the Keating shaft workings. This is long range exploration, but can be accomplished gradually.

In outlining this rehabilitation work, I want to impress upon you that the beginning of the production of copper from the Dover Copper Company holdings cannot be done by any "short cut" methods, and if you expect to reopen your holdings in that way, you are going to find the work more expensive than you anticipate.

To work the Copper Plate area, a second air compressor plant of 350 cibuc feet capacity should be installed at the portal of the Copper Plate tunnel. A good, new portable plant preferred.

Do not plan to build any milling plant or concentration plant until you have reopened the mine workings sufficiently to prove that a good tonnage of ore is available for milling operation.

Third: - Leasing System.

The average type of leasing groups of men are not financially able to furnish equipment necessary to carry on successful mining operations.

If you want to plan working the mining claims under any system of leasing, I would advise that the Dover Copper Company purchase good portable equipment, and good hoisting equipment easily moveable. This equipment would be put to use by the leasers on a rental beais. Royalty schedules subject to 90 day cancellation or modification clauses can be worked out fair to both sides.

I appreciate that the Dover Copper Company, Tiscornia interests, wants to attempt to undertake a sound constructive job which will work out as helpful to the Defense Program of our government. I think the idea is very commendable, and if my services will help to get this program over, I would like to advise you along sound lines based on my many years of experience in the operation of copper properties.

To plan the program for you, I believe that if you would give me an estimate of the capital outlay, you plan to put into this mining operation, I would then be able to outline the best method to make this capital expenditure a sound constructive work program.

This preliminary statement, along general lines, answers some of the questions set out in your letter of July 26, 1941. I want to impress upon you that installing a mill at this time should not be considered. You must open up an assured tonnage of ore adaptable to milling or concentrating operations first.

I shall be glad to have your comments and if I can assist you, I shall serve to the best of my ability.

Yours very truly,

(Signed) Arthur Houle

Copied April 24, 1952/ jmh

# THE DOVER COPPER MINING CO.

## Summarized data.

**Property:**

Generally known in the Clifton-Morenci region as the "Dover", but often referred to as the "Keating mine."

**Owner:**

The Dover Copper Mining Co., hdqts., St. Joseph, Mich. W.V.Tiscornia is president and controls the company. No stock is in the hands of the public.

D.V.Mulhern, 302 Arizona Title Bldg., Phoenix, is attorney and Arizona agent.

**Location:**

In Greenlee county, Ariz. The southern part of the property is about 1 mile southerly from Morenci, the nearest town and post-office.

By legal description the property lies within sections 1, 11, 12, 13, & 14, Tp. 4 S., R. 28 E.; and sections 6, 7, 17, 18, 19, 20, 21, 28, 29 & 33, Tp. 4 S., R. 29 E., G&SRM.

**Acreage and title:**

A condensed summary of property holdings follows:

1563.13 acres patented as mining claims ( 88 lodes)
32.61 " " " mill sites ( 7 millsites)
784.66 " " " homestead and scrip land.

2380.40 " patented

253.27 " ( 17 lode claims) for which Final Certificate is held.
250.10 " surveyed for patent but not in pending application.
110.00 ", approximately, held under the mining laws by possessory right and annual labor.

This acreage may be grouped for practical purposes as

1,816.40 acres lode claims, patented, and final certificate;
250.10 " " " surveyed for patent.
110.00 " " " possessory right under mining locations.
2,176.50 acres as mining claims.
817.27 " as millsites, homestead, and scrip (patented)

2,993.77 " total

Acreage and title, continued,

Current taxes are all paid and no liens are of record against the property.

Production:

Accurate records since this company's ownership disclose:

| Period. | dry weight. (tons) | Cu % | Cu lbs. recovery settlement. |
|---|---|---|---|
| Nov.'26 Aug.'30 | 3,690 | 7.37 | 543,906. |
| June '42 Feb. '46 | 7,236 | 4.32 | 599,170. |

The last ore mined (1942-46) contained 195.13 oz. gold, and 10,464.15 oz. silver.

No calculation has been made of the gold-silver content of ore shipped during first period above, (1926-30). However, the ore was all from the same vein; therefore, it is fair to assume it contained a higher proportionate gold-silver value.

Additional production from other than the Keating vein is conservatively estimated at $10,000.00 - principally in gold & silver and shipped by lessees.

Geology & Mineralization:

Geology of the district, and including this property, is well and accurately described by Dr. Waldemar Lindgren in U.S.Geological Survey Professional Paper # 43, published in 1905.

A later report by B.S.Butler and Eldred D. Wilson, both of the Arizona Bureau of Mines, is found in that bureau's bulletin #145, published in 1938.

Summarized, about 1000 ft. of Paleozoic quartzite, limestone and shales rest upon a basement of pre-Cambrian granite. Upon the eroded surface of these rocks, in certain parts of the district, is a variable thickness of Cretaceous sandstones and shales.

> " Masses of granitic and dioritic porphyries were intruded in the older rocks after the deposition of the Cretaceous series, and form stocks, dikes, loccoliths, and sheets.
> All of the above mentioned rocks have participated in an uplift and a warping or doming succeeded by faulting. The effects of vigorous faulting are especially striking. "
> (Lindgren )

Geology & Mineralization, continued.

Lava flows, principally thyolite and basalt, later covered parts of the region. Following this was a very active period of erosion during which great accumulations of gravels were deposited. This is called Gila conglomerate.

Faulting is assumed to be of two major divisions: the first phase was probable reopening of old crustal lines of weakness. These are of a general NE-SW trend, and perhaps account for the sheeting and orientation of the intrusive porphyries. The second phase was the younger faults of NW-SE trend.

Local faults have complicated the structure, with the resulting mosiac of tilted and crushed blocks and shatter zones.

Mineralization has been divided into three main types, per the geologists above cited. These are

(1) replacement deposits in sedimentary rocks;
(2) fissures and disseminations in the porphyry;
(3) fault fissures of the Coronado type.

Lindgren has shown that the NE-SW veins cut alike the porphyry, granite, and sedimentary rocks.

On this property, only the 'vein type' of ore deposit has been developed, and such development is confined almost entirely to one vein, namely, the Keating vein. This vein is of the "Coronado type", described in some detail in Lindgren's paper.

The Keating vein is not far from the Coronado. It can hardly be said to be a "parallel vein", because of different strike. But in structure, vein-filling, ore occurence, they are identical --though the Keating is not as wide.

Production from the Keating vein since 1926, and during intermittent periods of operation, is given on page 2 hereof. Figures are not available prior to 1926, but it is known that considerable ore was shipped by the old English Co ( Keating) who once owned the property, and later by lessees.

All ore shipped is from above the 600 ft level ( i.e., depth below outcrop). If the mineralization is of same type as the Coronado it is fair to assume that the next 500 feet of depth will contain additional ore bodies before the lean pyrites are encountered.

Other possibilities: The 'Soto fault' has been described by Lindgren and is shown on his geologic map. Locally, at Morenci, this fault is referred to as the 'Producer fault.' This fault fissure is traceable into the Clay ore-body, and, because it is a major fracture, it has been the channel for copper migration along the fault.

Surface mineralization is found in surface exposures along

this fissure and upon claims owned by this company. Such mineralization does not appear to this writer as "fault drag". Dikes of porphyry and diabase follow the fissure, and such intrusion was before mineralization. ( see Lindgren re Coronado fissure. )

The Copper Plate fissure showed some enriched copper sulphide ore under a barren, oxidized capping. Drifting along the fissure did not attain much vertical depth, due to the topography and gradient -- the fissure being almost parallel to a gulch.

Porphyry mineralization: Survey 4230 ( see map ) abuts the Phelps-Dodge property in an area where the surface rock is the typical shattered, seamed, feebly-mineralized porphyry overlying the Clay ore-body. A good exposure thereof is found along the Dover road crossing these claims, i.e, Storm, Rainy Day, and Hurricane. There is some visible mineralization, some of which assayed 0.6% Cu in a 20-ft section. However, the area is badly leached, and, as stated, shattered and seamed and criss-crossed by innumerable seams and veinlets.

This area, with the adjoining claims to the west, gives an acreage that is worthy of (1) detailed mapping and sampling, and, (2) drilling for disseminated ore bodies. Neither has been done by the owner company.

Other portions of the property deserve detailed examination and sampling. However, in this writer's opinion, the foregoing areas offer greatest promise of early returns.

Conclusions:

This property is a nearly compact body of patented claims of about 15,000 feet length, north & south, by some 7,000 feet width, east & west, in the "St. Joe basin" ( company term for area of possible disseminated ore bodies. ).

It lies in the best copper-producing area in Arizona, and adjoins for 15,000 feet the property of the State's major copper producer, namely, Morenci mine, Phelps-Dodge Corpn.

It is accessible by roads already constructed. Underground workings may require some re-timbering prior to examination.

J.E.Busch;
for the Dover Copper M.Co.

Jan. 21, 1952.

Addenda:

U. S. Bureau of Mines records give the pre-Dover production of the Keating mine for the period 1913-1925 as 646,003 lbs. copper and 1889 oz. silver. This was largely by different lessees.

The pre-1913 production is not known. However, the Keating was working in 1903, per record reports, and sorted ore was packed by burros to Morenci.

GREENLEE COUNTY, ARIZONA

THE DOVER COPPER MINING CO.

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It is accessible by roads already constructed. Underground workings may require some re-timbering prior to examination.

J. E. Busch;
for the Dover Copper M. Co.

Jan. 21, 1952

Copied April 24, 1952 / jmh

COPY

CONSOLIDATED COPPERMINES CORPORATION — MEMORANDUM

FROM: R. W. Ludden, Assistant Geologist — CITY: Safford, Arizona

TO: J. Frank Sharp, Exploration Superintendent — DATE: July 25, 1952

SUBJECT: THE LIME - CAP PROPERTY GREENLEE COUNTY, ARIZONA.

CONCLUSIONS:

The showing of mineralization underground in comparison to the surface showing, the persistance of the vein as far as it has been exposed, and the quantity of lead and zinc which it contains are impressive. Discouraging features are the complete oxidation of the zone with no sign of sulfides and the flat dip of the vein. However, because of the post-mineral volcanic cover to the west, the metal content of the vein, and its persistance as exhibitied by the upper adit, I recommend that this property be given more consideration.

INTRODUCTION:

This examination was made by me on July 10, 1952. I was accompanied on this investigation by Matt Danenhauer and E. L. Hagan, representing the owners.

The property consists of 12 contiguous, unpatented claims. It is in sections 8, 17, and 18 of T. 2 S., R. 29 E., approximately 8 miles north of Morenci, Arizona.

Several cars of ore have been shipped from the property. Mining was carried on from a development adit now 375 feet long and a haulage adit 410 feet long, which is 52 feet below the upper level. The two tunnels are connected by a raise. Other workings consist of location work and short prospect tunnels.

GEOLOGY:

The rocks consist largely of a series of Paleozoic limestones, shales, and sandstones over-lain by Tertiary basalt and rhyolite. The bedding of the Paleozoic sediments in the mine area strikes about 40° northeast and dips from 20° to 30° northwest.

A narrow, mineralized, vertical fault zone that strikes east-west and emerges from beneath the basalt appears to be cut off by a well mineralized flat fault that strikes 70° northeast and dips about 20° north. It looks like a bedding plane fault, but its strike does not seem to agree with the strike of the bedding. Production from the Lime Cap mine has come from this flat fault zone. At the end of the upper adit another flat fault, believed to be post-mineral, that strikes 20° northeast and dips 20° west has faulted a barren sandstone bed against the vein. The face of this level is in the barren sandstone. The amount and direction of displacement of this fault were not definitely determined, but if the sandstone bed that crops out at the portal of the upper adit is the same bed that is exposed at the face, then the hanging wall side is up approximately 100 feet.

The mineralized zone which averages about ten feet thick is developed for approximately 325 feet of strike length. It is thoroughly oxidized and appears to be partially leached. Rock alteration is comparatively weak and consists of little more than a recrystalization of the limestone, the development of a minor amount of garnet, and a small amount of silicification. The lead and zinc minerals were not definitely identified. No copper minerals were seen; however, sparse "relief"

COPY

CONSOLIDATED COPPERMINES CORPORATION MEMORANDUM

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TO J. Frank Sharp, Exploration Superintendent DATE July 25, 1952

SUBJECT THE LIME - CAP PROPERTY GREENLEE COUNTY, ARIZONA.



limonite was noted in the vein. A strong showing of manganese occurs along most of the vein.

Several cars of lead-zinc carbonate ore were shipped and are reported to have contained:

(1) 8% to 16% - lead,
(2) 16% to 23% - zinc,
(3) 8% to 20% - manganese,
(4) Tr. to .35% - copper,
(5) Tr. to $3.00 - gold and silver.

Because of the flat dip of the vein and the post-mineral volcanic cover, the location and depth of the sulfide zone is problematical.

Although no other mineralization was observed in the immediate vicinity of the Lime Cap mine, several other flat-lying, similarly mineralized, and oxidized veins were noted on the property. They appear to occur at about the same stratographic horizon as the Lime Cap.

SAMPLING:

The drift in the mineralized zone, the upper adit, is reported to have been sampled by the owners. They cut channel samples across the vein about every 25 feet along the strike for 300 feet. A weighted composit of their figures gives an average sampled width of 2.3 feet over a length of 300 feet that averages 9.0% lead and 14.8% zinc.

The following samples were taken during this investigation:

(1) Sample No. 4853 - Au. Tr., Ag. 0.20 oz., Cu. 0.64%, Pb. 12.30%, Zn. 5.54%, this is a 4½ foot chip sample across the vein twenty feet from the face of the upper adit, oxides;

(2) Sample No. 4854 - Au. Tr., Ag. 0.24 oz., Cu. 0.42%, Pb. 7.60%, Zn. 7.13%, this is a five foot chip sample across the vein five feet north of the main raise in the upper adit, near the center of the workings, oxides;

(3) Sample No. 4855 - Au. Tr., Ag. 0.62 oz., Cu. 0.48%, Pb. 7.30%, Zn. 7.42%, this is a 5½ foot chip sample across the vein 65 feet from the portal of the upper adit, oxides;

(4) Sample No. 4856 - Au. Tr., Ag. 0.26 oz., Cu. 0.15%, Pb. 0.90%, Zn. 2.17%, this is a 3½ foot chip sample across the vein, 15 feet down the incline shaft above the powder magazine, oxides;

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CONSOLIDATED COPPERMINES CORPORATION — MEMORANDUM

FROM: R. W. Ludden, Assistant Geologist — CITY: Safford, Arizona

TO: J. Frank Sharp, Exploration Superintendent — DATE: July 25, 1952

SUBJECT: THE LIME - CAP PROPERTY GREENLEE COUNTY, ARIZONA.



For comparison purposes three samples were taken in the upper adit during this examination. They were taken about 125 feet apart; they were chip samples having an average length of 5 feet across the vein; and they assayed an average of 9.2% lead, 6.7% zinc, and 0.51% copper.

R. W. Ludden

R. W. Ludden

RWL/ jmh
cc: Mr. E. N. Pennebaker
Mr. Thomas G. Moore

COPY

CONSOLIDATED COPPERMINES CORPORATION — MEMORANDUM

FROM: R. W. Ludden, Assistant Geologist — CITY: Safford, Arizona

TO: J. Frank Sharp, Exploration Superintendent — DATE: July 28, 1952

SUBJECT: THE CELTIC, PROSPERITY, EXPECTATION, AND POLARIS CLAIM GROUPS IN GREENLEE COUNTY, ARIZONA.

CONCLUSIONS:

The major portion of prospecting and development work on the Prosperity, Expectation, and Polaris claim groups was primarily concerned with silver and gold, although a few high grade pockets of copper ore have been mined from that area. The granite and porphyry in the southwestern part of the Expectation group (see accompaning map) are light to moderately fractured, altered, and mineralized and show only sporadic evidence of copper. Mineralization to the northeast is generally confined to veins in fault zones and along porphyry dikes. Production from these veins has been small, and judging from surface indications and dump material they warrent no further investigation.

I recommend that the Prosperity, Expectation, and the Polaris claim groups receive no more attention.

The Celtic claim group (see accompanying map) is the most attractive of the four. The southwestern half of the group is generally well fractured, well altered, and well mineralized. This end of the property is within 2000 feet of workings having a history of a large copper production. The sporadic indication of copper in the leached outcrops, on old dumps, and in washes where sulfides are exposed is somewhat discouraging. Although I am pessimistic as to the possibilities of this group, the location, mineralization, and alteration on its claims in the south should not be ignored.

I recommend that the Celtic group be given further consideration.

INTRODUCTION:

These claim groups were examined by me on July 11, 14, and 18th. I was accompanied on this investigation by E. L. Hagan and on part of it by C. Stevens, both representing the owners.

The Celtic group consists of fifteen contiguous, unpatented claims. They are in sections 34, 35, 2 and 3 of R. 29 E., Tps. 3 and 4 S. (See accompaning map).

The Expectation group is composed of eight contiguous, unpatented claims. They are in section 35 of R. 29 E., T. 3 S. ( See accompanying map).

The Prosperity group is made up of eight contiguous, unpatented claims. They are mostly in section 35 of R. 29 E., T. 3 S. ( See accompanying map).

The Polaris group consists of forty-one contiguous, unpatented claims. They are in sections 25, 26, 35, 36, 30 and 31 of Rs. 29 and 30 E., T. 3 S. (See accompanying map).

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CONSOLIDATED COPPERMINES CORPORATION MEMORANDUM

FROM R. W. Ludden, Assistant Geologist CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent DATE July 28, 1952

SUBJECT THE CELTIC, PROSPERITY, EXPECTATION, AND POLARIS CLAIM GROUPS IN GREENLEE COUNTY, ARIZONA.



With the exception of the Polaris group, work on these properties has consisted of: location work; several tunnels from 50 to 300 feet long; and a few shafts from 50 to 200 feet deep.

It is reported that small shipments of gold, silver, and copper ores have been intermittently mined from the Polaris property during the last fifty years. Development work and mining has been concentrated along two veins, the Black Prince and the Golden Eagle, on the extreme eastern part of the property. Old reports state that the Black Prince vein was developed by about 2000 feet of workings and the Golden Eagle vein by 800 feet of workings. Smaller veins on the property have been explored by numerous shallow shafts and tunnels.

Two horizontal diamond drill holes and one churn drill hole are reported to have been drilled some time ago from Placer Gulch. One old diamond drill site was seen about 2000 feet up this wash from King Gulch. The hole appeared to be flat and was drilled from the bottom of the gulch in a southeast direction into Celtic ground. No information could be obtained concerning these drill holes.

GEOLOGY:

Outcrops in this region consist of the Precambrian granite, granite porphyry, quartz monzonite porphyry, Paleozoic sediments, and Tertiary volcanics.

The major structure is a prominent set of fractures, faults, and shear zones that strike from 45° to 60° northeast and have a variable steep dip. Most of the outcrops on the Celtic group are generally well fractured and faulted. The rocks in the southwestern portion of the Expectation group are moderately fractured; however, proceeding northeasterly the intensity of the fracturing decreases rapidly and appears to resolve into a number of persistant and somewhat prominent fault zones with the usual northeast strike and steep dip.

The unweathered granite which crops out on the Paloris group generally has a fresh appearence. Occasionally where it is cut by mineralized porphyry dikes or fault zones it may be moderately to well altered in their immediate vicinity. Mineralization consists predominantly of quartz and pyrite. Small amounts of chalcopyrite and chalcocite were noted on a few dumps. Gold and silver are reported to occur in most veins on this property.

No evidence of notable metallization was seen on the Expectation or Prosperity groups. The quartz monzonite porphyry and granite are moderately pyritized and lightly to moderately altered in the southwestern portion of the Expectation group; here, sparse evidence of copper is generally confined to small, widely spaced zones. The dumps of two tunnels that cut the sulfide zone in this area exhibit moderately pyritized rock and very little chalcocite or

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CONSOLIDATED COPPERMINES CORPORATION MEMORANDUM

TO R. W. Ludden, Assistant Geologist CITY Safford, Arizona

FROM J. Frank Sharp, Exploration Superintendent DATE July 28, 1952

SUBJECT THE CELTIC, PROSPERITY, EXPECTATION, AND POLARIS CLAIM GROUPS IN GREENLEE COUNTY, ARIZONA.



chalcopyrite. One of these adits was examined, and the only evidence of copper that could be seen underground was a small amount of copper sulfate which had deposited along a few fractures.

It is well established that Phelps Dodge has a low grade ore body, which has not been drilled, that includes the King mine and extends into the workings across the King Gulch. A brief examination was made of part of the surface over the King mine workings, and although the concentration of limonite after chalcocite decreases toward the northeast, some of the outcrops on the south end of the Celtic property compare favorably with the King surface. They are generally well altered to kaolin, sericite, and silica. The outcrops other than those in the main gulches are well leached. The depth of oxidation appears to vary from a few feet in the deep washes to about 250 feet on the high ridges.

In the pyrite areas that cropout in the lower part of Placer Gulch only a very small amount of chalcocite was found. The dumps of two shafts and a few short adits in the same part of this gulch are composed chiefly of pyritized granite and exhibit little or no showing of copper. This evidence appears discouraging, but the bottom of Placer Gulch could be below the main part of the enriched zone.

The prospectable limit to the northeast on Celtic ground is tentatively placed at about one-third of a mile up Placer Gulch from King Gulch.

SUMMARY:

A reconnaissance of the Polaris, Prosperity, and Expectation groups disclosed a vein type of mineralization in fault zones and porphyry dikes. The veins are composed chiefly of quartz, pyrite, and sericite, but they occasionally contain small amounts of gold, silver, and copper. The faults and dikes strike northeasterly and are generally found in comparatively fresh Precambrian granite or porphyry intrusive. Although the fault zones and dikes are often persistant, they do not usually exhibit evidence of worth-while mineralization. Therefore, I believe these claim groups warrant no further consideration.

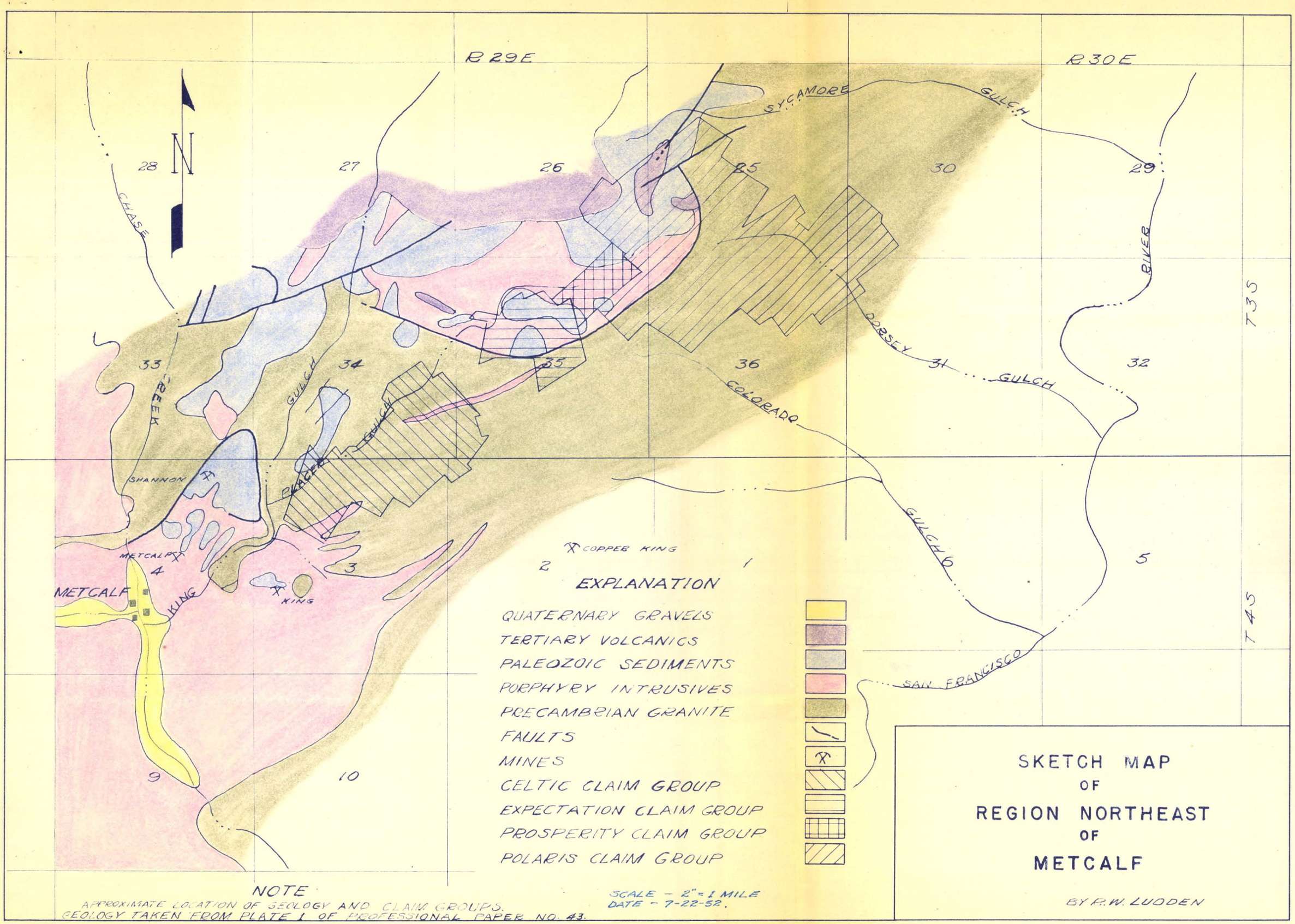
The Celtic group, because of its display of mineralization and attractive location, does create more interest. In my opinion, the outcrops on the Celtic group, particularly on its south end, should receive a more thorough examination in order to make a reliable evaluation of the property.

SAMPLING:

Because no rock was seen on these groups that contained a significant amount of copper, no sampling was undertaken during this examination.

R.W. Ludden
R. W. Ludden

RWL/ jmh
cc:- Mr. E. N. Pennebaker
Mr. Thomas G. Moore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COPPER KING
DORSEY
GULCH
COLORADO
GULCH
SAN FRANCISCO
RIVER
EXPLANATION
QUATERNARY GRAVELS
TERTIARY VOLCANICS
PALEOZOIC SEDIMENTS
PORPHYRY INTRUSIVES
PRECAMBRIAN GRANITE
FAULTS
MINES
CELTIC CLAIM GROUP
EXPECTATION CLAIM GROUP
PROSPERITY CLAIM GROUP
POLARIS CLAIM GROUP
NOTE
APPROXIMATE LOCATION OF GEOLOGY AND CLAIM GROUPS.
GEOLOGY TAKEN FROM PLATE I OF PROFESSIONAL PAPER NO. 43.
SCALE - 2" = 1 MILE
DATE - 7-22-52.
SKETCH MAP
OF
REGION NORTHEAST
OF
METCALF
BY F. W. LUDDEN

E W Bennebaker

Report on

DOVER COPPER MINING COMPANY
PROPERTY CLIFTON-MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA

By R. W. Ludden

XXXXXXXXXXXXXX
Safford, Arizona

June 26, 1952

Mr. D. V. Mulhern
302 Arizona Title Building
Phoenix, Arizona

Dear Mr. Mulhern:

I am sending under separate cover and via registered mail, all the maps and reports lent to us on the Dover Copper Mining Co.

Our report on the Dover Copper Mining Property has been written and circulated and it is the consensus of opinion that our exploration dollars could be spent to greater advantage on some other venture rather than on the Dover ground.

Mr. Ludden and myself wish to express our appreciation and thanks to you and Mr. Busch for all the courtesies extended us.

Yours truly,

J. Frank Sharp

J. Frank Sharp
Exploration Superintendent

CC: Mr. E. N. Pennebaker
Mr. T. G. Moore
Mr. A. J. O'Connor
Mr. J. E. Busch

JFS/mec

EWP.

COPY

CONSOLIDATED COPPERMINES CORPORATION — MEMORANDUM

FROM: R. W. Ludden, Assistant Geologist — CITY: Safford, Arizona

TO: J. Frank Sharp, Exploration Superintendent — DATE: June 6, 1952

SUBJECT: DOVER COPPER MINING COMPANY
CLIFTON- MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA

CONCLUSIONS:

The Silver Basin group displays a few small mineralized zones in the sediments from which a minor amount of gold-silver ore has been mined. The diorite porphyry that crops out in this area reveals no noteable evidence of mineralization.

The Wilhelmina group exhibits evidence of sporadic copper metallization in a few zones. The main interest in the group, however, has been concentrated along a mineralized fault zone about 20 feet wide and 800 feet long from which a few hundred tons of gold-silver ore has been mined.

The Storm group covers sporadically altered and mineralized granite porphyry which shows no indication of worthwhile metallization.

The Pinkard and Copper Plate Gulch group displays several persistent and well mineralized fault zones; however, metallization associated with them is far too meager and spotty to be of interest. Several dikes, sills, and irregular masses of porphyry which range in composition from granite to diorite have intruded the sediments and old granite in this area. Much of this porphyry is either fresh or weakly mineralized, and none of its cropings suggest a "disseminated copper" type of deposit.

The Keating group contains the only mine on the property, the Keating, with a noteworthy production record; however, judging from a surface and under-ground examination, the mineralized fault zone in which the mine occurs could not contain sufficient additional ore to warrant further investigation. Other mineralized zones that crop out on this group do not exhibit worthwhile evidence of copper or are too small to be of interest.

In summary, ore deposits in this region occur in, or are closely associated with, the late Cretaceous or early Tertiary porphyry intrusives. The porphyry outcrops on the Dover property do not exhibit noteable evidence of a "disseminated copper" or a worthwhile vein type deposit. Mineralization in the sediments and Precambrian granite, although often strong and persistent, does not display an adequate indication of ore minerals to warrant additional investigation. The quantity of ore which might be delineated in the Keating zone would be insufficient to justify exploration.

It is recommended that this property receive no further attention.

INTRODUCTION:

LOCATION AND EXAMINATION:

The Dover property lies within sections 1, 11, 12, 13, and 14, of T. 4 S., R. 28 E.; and sections 6, 7, 17, 18, 19, 20, 21, 28, 29 and 33, of T. 4 S., R. 29 E., about two miles west of Morenci in Greenlee County, Arizona.

CONSOLIDATED COPPERMINES CORPORATION

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MEMORANDUM

FROM R. W. Ludden, Assistant Geologist

CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent

DATE June 6, 1952

SUBJECT DOVER COPPER MINING COMPANY
CLIFTON - MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA



The examination of this area was conducted by my assistant, L. Gonzalez, and me from May 2nd through May 14th . We were accompanied on part of this investigation by J. E. Bush, representing the owners, and J. F. Sharp, Exploration Superintendent.

OWNERSHIP AND PROPERTY:

These holdings are owned by the Dover Copper Mining Co., St. Joseph, Michigan. The president, W. V. Tiscornia, controls the company, and D. V. Mulhern, 302 Arizona Title Building, Phoenix, is attorney and Arizona agent.

The property is divided into two separate areas (see accompanying map). The southern area is composed of 564 acres of script and 21 claims, four of which are unpatented. The northern holdings are composed of 159 acres of homestead land, 136 acres of script, seven patented mill sites, and 99 claims, 3 of which are unpatented.

PRODUCTION:

The first work is reported to have been done on the Keating zone in the late 1800s or early 1900s, but the only available production records begin with the year 1913. The U. S. Bureau of Mines records give the production of the Keating Mine, from 1913 to 1925, as 646, 003 pounds of copper and 1889 ounces of gold. The present owners acquired the property in 1926. They mined the Keating vein intermittently from 1926 to 1946 and during that time shipped ore containing 1,143,076 pounds of copper. Available information lists the gold and silver content for ore shipped from 1942 to 1946 as 195.13 ounces of gold and 10,464.15 ounces of silver. This period accounts for slightly more than half of the company's total copper production. In a report for the Dover Copper Mining Company, J. E. Bush states that production from this property other than the Keating vein consisted chiefly of gold and silver ores having an estimated value of 10,000 dollars.

DEVELOPMENT:

The major development and mining on the property was done on the Keating fault zone and is shown on the accompanying vertical projection. The zone has been developed for about 1400 feet along the strike and to a maximum depth of 500 feet. The Keating shaft was used during the development and mining of the levels shown on the projection northeast of the shaft. The only accessible workings in the mine are: (1) Kimberly crosscut, which was driven from the Phelps Dodge Company's Kimberly claim 940 feet in a southeastern direction to the Keating zone; (2) all of the New level, - 253, except the first 370 feet southwest of the Keating shaft; (3) winze No. 2; and (4) sub levels -70 and -100.

CONSOLIDATED COPPERMINES CORPORATION COPY MEMORANDUM

FROM R. W. Ludden, Assistant Geologist CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent DATE June 6, 1952

SUBJECT DOVER COPPER MINING COMPANY
CLIFTON - MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA



The portal of a prospect adit, the Copper Plate Tunnel, is in the northeast corner of the Margot 19 claim. Very little cross cutting or mining was done from this adit which is about 1300 feet long and was driven in a northeast direction.

Several adits from 200 to 300 feet long were driven on mineralized zones near the intersection of Pinkard Gulch and Gold Gulch (see accompanying map). Numerous short adits, shallow shafts, and pits were noted on the property.

DIVISION OF PROPERTY FOR DISCUSSION PURPOSES:

Because of its large size and variation in mineralization, the property has been divided into arbitrary areas in order to facilitate discussion.

Silver Basin group:

This group occupies Silver Basin and forms the southern end of the property. It is composed of script in the south and the Tom Wal claims to the north.

Wilhelmina group:

This group is just north of the Silver Basin area and consists of four claims, the Petite 37, Perfect 36, Lucky 38, and the Wilhelmina.

Storm group:

These claims are the closest Dover holdings to the Phelps Dodge open pit. The claims in the group, the Cyclone, Hurricane, Tornado, Rainy Day, Storm, Burbon No. 2, and St. Joe No. 5, are in the southwest corner of section 17 of T. 4 S., R. 28 E..

Pinkard and Copper Plate Gulch group:

This area is situated near the center of the property. It extends from the Bell claims in the south to the Margot 18 and 19 and Anita 25 in the north and includes all the intervening claims west of the Storm group.

Keating group:

This group forms the northern-most extent of the Dover property. It extends north from the Pinkard and Copper Plate Gulch group and east from the mill sites.

CONSOLIDATED COPPERMINES CORPORATION COPY MEMORANDUM

FROM R. W. Ludden, Assistant Geologist CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent DATE June 6, 1952

SUBJECT DOVER COPPER MINING COMPANY
CLIFTON - MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA



GEOLOGY:

GENERAL:

A series of quartzites, sandstones, shales, and limestones, which were separated into formations and assigned to periods by Lindgren, rest upon a coarse-grained Precambrian granite. These rocks were intruded by a porphyry, which ranges in composition from a granite to a diorite, and broken by two major sets of high-angle faults and fractures; the predominant set strikes from 60° to 75° northeast and a less prominent set strikes from 35° to 45° northwest. Probably beginning in the last stages of the porphyry intrusion, and continuing for some time thereafter, the rocks in the district were penetrated by mineralizing solutions believed to be genetically related to the porphyry.

SILVER BASIN GROUP:

The porphyry exposed on this group, the diorite porphyry phase, is near the southern extent of the porphyry outcrops in the region. Other rocks in this area consist principally of Cretaceous shales and sandstones. Mineralization composed largely of quartz, hematite, magnetite, and limonite after pyrite is generally confined to a few widely spaced fault zones in the sediments. No notable metallization was observed, but small shipments of gold-silver ore are reported to have been made from the area. The diorite porphyry outcrops exhibit little evidence of alteration or mineralization. The predominant fractures strike from 60° to 70° northeast and dip steeply north.

WILHELMINA GROUP:

Outcrops consist largely of diorite porphyry, sandstones, and shales. Small widely spaced mineralized zones in the sediments containing copper oxides crop out at various places on the group. The diorite porphyry is comparatively fresh and contains little evidence of mineralization.

The most outstanding mineralization occurs in a high-angle fault zone about twenty feet wide and eight hundred feet long on the Wilhelmina claim. It strikes about north 60° east and cuts sandstone and shales. The sandstone fault breccia along a portion of the zone is cemented with silica and forms a prominent outcrop. An examination of the surface indicates that mineralization of the zone consisted largely of silification and pyritization with sporadic copper and gold metallization. Much of the wall rock is altered to sericite, quartz, and kaolin.

FROM R. W. Ludden, Assistant Geologist CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent DATE June 6, 1952

SUBJECT DOVER COPPER MINING COMPANY
CLIFTON - MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA



STORM GROUP:

The major rock type, granite porphyry, is moderately fractured, lightly mineralized, and lightly altered. Between the west rim of the Phelps Dodge open pit and this group, a distance of about 2000 feet, the intensity of the mineralization and alteration decreases sharply. Sporadic evidence of copper mineralization (copper oxides and limonite after chalcocite) and rock alteration minerals (sericite, kaolin, and chalcocite) occur in small isolated zones and fractures with quartz and pyrite. The depth of oxidation does not generally exceed fifty feet.

PINKARD AND COPPER PLATE GULCH GROUP:

The porphyry in the group varies in composition from a granite to a diorite and occurs as sills, dikes, and irregular masses. A large area of coarse-grained Precambrian granite crops out west of Copper Plate Gulch (see accompanying map). The remaining rock types consist largely of quartzites, shales, and limestones.

The mineralization is characterized by mineralized fault zones in the sediments and small pyritized areas in the porphyry. The fault zones frequently contain large amounts of quartz, magnetite, hematite, and pyrite, and occasionally contain small amounts of copper, gold, and silver. The limestone is generally epidotized and often garnetized in the immediate vicinity of the mineralized zones and along porphyry contacts. The major fractures are persistent and commonly strike from 55° to 75° northeast and dip from 70° to 80° north. They average from two to four feet in width and from 1000 to 1500 feet in length. The larger mineralized fault zones, such as the Desoto and Copper Plate faults (see map) can be traced for several thousand feet and are usually from twenty to forty feet wide. They are sporadically mineralized along most of their length and locally heavily mineralized with quartz, magnetite, hematite, and pyrite. Outcrops and development work on these zones exhibit no worthwhile evidence of metallization.

Mineralization in the porphyry consists largely of local pyritized areas containing sporadic evidence of copper metallization. The intensity of rock alteration varies greatly and consists principally of the formation of sericite, kaolin, silica, epidote, and chlorite. These areas are generally moderately fractured by a set of fractures which strikes from 65° to 75° northeast and dips from 70° to 80° north, and a less intense set which strikes from 35° to 45° northwest and is vertical. Depth of oxidation is usually just a few feet and pyrite can often be found on the surface.

KEATING GROUP:

Quartzites, limestones, and Precambrian granite containing

acid and basic porphyry dikes that frequently intruded along fractures, are the principal rock types. Mineralization is confined to fault zones and appears to consist of two types; one is composed chiefly of quartz, magnetite, and hematite, and the other is made up of varing amounts of copper minerals associated with quartz and pyrite. The most outstanding metallization observed on the Dover property, known as the Keating vein, is of the second type. It occurs in a fault zone on the New Queen and Anita No. 30 claims (see map) that appears to be a spur of the Coronado fault, one of the larger fault zones in the region. Reports indicate that a large tonnage of high-grade copper oxide ore and secondary chalcocite ore has been mined at several locations along the Coronado fault; but the grade of the sulfide ore depreciated rapidly in depth and merged into low-grade primary mineralization at an average depth of from 600 to 700 feet. Mineralization in the Keating zone appears to be of the same type. Possibly several thousand tons of ore remain in this zone but it is believed that the great bulk of the ore has been mined. This conclusion is the result of the following evidence: (1) the mine has been stoped from the surface to a depth of 450 feet; (2) an examination of a level 500 feet below the surface beneath the most productive area, revealed only sporadic copper oxides and limonite after chalcocite; (3) promising mineralized areas along the fault zone, as indicated by its outcrops, have either been prospected or mined on; and (4) the "prospectable" length of the zone, about 1400 feet, has been opened up to an average depth of 350 feet.

The Keating zone, which strikes about 60° northeast and dips steeply north, cuts quartzite and granite. Most of the production has come from the granite. The ore consists principally of a combination of the oxidized minerals, chrysocolla, malachite, and limonite, and the sulphides, pyrite and chalcocite. The sulfide zone has not been penetrated by the workings that were investigated. The fault zone contains discontinuous porphyry dikes which are generally well altered and therefore difficult to identify, but they are believed to range in composition from granite to diorite. Much of the granite and porphyry in the fault zone has been silicified, sericitized,and kaolinized. The alteration and mineralization decreases rapidly away from the ore zone.

Near its intersection with the Coronado fissure, the Keating fault zone merges into a comparatively wide, indistinct, "intersection zone" composed of fractures sympathetic in attitude to both faults. Progressing southwest from the "intersection zone" the Keating fault becomes more definite. It begins to show evidence of notable mineralization about ¼ of a mile southwest of the Coronado zone where it cuts a basic porphyry dike that strikes about north 60° west and dips 60° to the north. At the shaft, a few hundred feet down the hill from the dike, a cross fault striking about north 60° west and dipping 60° north has dropped the hanging wall

from 200 to 300 feet. Silicification and iron staining were the only evidence of mineralization noted along this fault. Proceeding southwest, outcrops of the zone show evidence of good mineralization for a distance of about 1200 feet. The fractures then become tight, the zone widens considerably, and the mineralization decreases appreciably after it passes into a large mass of diorite porphyry. It cuts about 300 or 400 feet of the porphyry and then becomes partially covered, less definite, and consequently hard to trace. What appears to be the same fracture crops out about 1000 feet further southwest on the northeast corner of the Victor claim (see map). It can be traced southwest through granite and quartzite to the west end of this claim where it becomes covered by talus. For a distance of about 500 feet before it disappears under the talus, the zone shows evidence of minor metallization in the form of copper oxides and limonite after chalcocite over a width of from two to four feet.

The Copper Plate Tunnel extends 1300 feet in a northeast direction from its portal in the northeast corner of the Margot 19 claim. It was driven in a fault zone in the Precambrian granite. Portions of the zone contain a sericitized and kaolinized basic dike. The first 1000 feet of the adit exhibits well oxidized and leached rock containing sparse evidence of copper in the form of copper oxides and limonite after chalcocite. The last 300 feet of the drift has about 350 feet of back and cuts partially oxidized and moderate to heavily pyritized granite. Most of the rock in the zone is comparatively well altered; however, the intensity of alteration and mineralization decreases rapidly from the borders of the zone outward.

A few small mineralized zones of the Keating type crop out between it and the Copper Plate Tunnel, but they are too small and their metallization too sporadic to be of interest.

SUMMARY:

The major portion of the mineralization on the Dover property is confined to fault zones and is composed primarily of quartz, magnetite, hematite, pyrite, and rock alteration minerals epidote, garnet, kaolin, sericite, and chlorite. If they contain any metallization it is generally sparse and consists principally of gold, silver, and copper. All of the premineral rocks have been mineralized to some degree. The predominant fracture system, which is premineral, is made up of a set that strikes from 65° to 75° northeast and dips 80° north, and a much less prominent set that strikes from 35° to 45° northwest and dips steeply northeast. Minor mineralization was observed in the northwest set, but the northeast set of fractures contain the principle mineralization. The depth of oxidation at various places on the property ranges from the surface (disseminated pyrite in porphyry) to a

CONSOLIDATED COPPERMINES CORPORATION

# COPY

MEMORANDUM

FROM R. W. Ludden, Assistant Geologist

CITY Safford, Arizona

TO J. Frank Sharp, Exploration Superintendent

DATE June 6, 1952

SUBJECT DOVER COPPER MINING COMPANY
CLIFTON - MORENCI DISTRICT
GREENLEE COUNTY, ARIZONA



depth of more than 500 feet (in the Keating zone). Secondary enrichment is widespread in the district, but on this property, with the exception of the Keating zone, is of little importance. The best showings of copper metallization occur on the Keating group.

SAMPLING:

Although the Dover property is very large, only a small amount of sampling was necessary.

KEATING MINE:

Sample number 4916 - Tr. Au., 0.27 oz. Ag., 0.22% Cu.; from sub-level - 70, below Kimberly cross-cut level; 18 foot chip sample across cross-cut 30 feet northeast of winze; oxidized and leached Precambrian granite; sparse copper oxides; copper leached from sampled area estimated to be a maximum of 1½%, as judged from limonite after chalcocite; no better evidence of metallization on level.

Sample number 4928 - Tr. Au., 0.21 oz. Ag., 0.21% Cu.; from - 100 level, below Kimberly cross-cut; 35 foot chip sample in cross-cut 60 feet northeast of winze number two; in oxidized and leached Precambrian granite; one isolated showing of very sparse chalcocite; copper leached from sampled area estimated to be a maximum of 1%, as judged from limonite after chalcocite; no better evidence of metallization on level.

COPPER PLATE TUNNEL:

Sample number 4852 - .01 oz. Au., 0.63 oz. Ag., .026% Cu.; grab sample of sulfides from dump; heavy pyrite.

HURRICANE CLAIM:

Sample number 4851 - Tr. Au., .06 oz. Ag., .05% Cu.; 75 foot grab sample from west side line of Hurricane claim east along Dover road, taken from north side of Dover road cut; sampling cut oxidized and mineralized zones from two to four feet apart; sporadic hematite was noted in some of the zones; no sulfides or indication of worthwhile copper metallization was observed.

R. W. Ludden

R. W. Ludden

RWL/ jmh
cc: E. N. Pennebaker
Chester D. Tripp
Thomas G. Moore
A. J. O'Connor

COPY

DOVER COPPER MINING CO.
REPORT BY
NEWTON W. EMMENS

N E W T O N W. E M M E N S
Mining Engineer
San Francisco, Calif.

September 30, 1931

Address reply to me at
926 - 1411 Fourth Ave., Bldg.,
Seattle, Washington

H. M. A. Miller, Esq.,
406 Montgomery Street,
San Francisco, Cal.

DOVER MINE

Dear Sir:

I beg to hand you herewith my report, made in June 1929, on the Dover Copper Mines in Arizona. Since that report was made I did some work on the property and made some shipments of ore.

The following is a record of this work:-

The ore shoot on the Keating claim was opened up, the drifts pushed ahead and stopes opened. From the stopes the ore was hand-sorted and the higher grade shipped to the El Paso Smelter, as follows:

| Date 1929 | Tons | Assay Gold | Silver | Copper |
|---|---|---|---|---|
| June 10 | 51.767 | 0.03 oz. | 0.8 oz. | 5.25% |
| June 17 | 50.846 | 0.03 | 1.3 | 8.24 |
| June 18 | 54.262 | 0.03 | 1.2 | 6.77 |
| June 22 | 50.015 | 0.03 | 1.0 | 5.98 |
| June 25 | 60.726 | ---- | 0.9 | 5.54 |
| June 27 | 61.825 | ---- | 0.9 | 5.56 |
| July 1 | 53.930 | 0.02 | 1.0 | 5.71 |
| July 6 | 56.490 | 0.03 | 1.4 | 5.66 |
| July 12 | 64.470 | 0.02 | 1.25 | 5.73 |
| July 20 | 52.01 | 0.02 | 1.2 | 7.27 |
| July 27 | 64.460 | 0.03 | 1.6 | 8.00 |
| Aug. 21 | 51.594 | 0.03 | 2.15 | 10.62 |
| Aug. 22 | 45.929 | 0.035 | 2.2 | 10.46 |
| Sept. 16 | 45.800 | 0.02 | 1.9 | 11.09 |
| Sept. 19 | 50.122 | 0.03 | 2.0 | 10.81 |
| Sept. 22 | 55.254 | 0.03 | 1.7 | 9.30 |
| Oct. 7 | 49.791 | 0.03 | 2.1 | 9.44 |

In mining the ore from which this high-grade ore was sorted there was broken and left in the stopes five tons of mill ore for each ton of shipping. Careful records were taken of this milling ore and assays regularly made. It will average 40¢ in gold; 1 ounce in silver; and 4.3% in copper to the ton.

Only the northern limit of the oreshoot had been reached at the time I left Morenci, the south face of the drift still being in good ore.

H. M. A. Miller.

DOVER MINE

The Keating shaft, originally sunk to a depth of 350 feet, with levels opened north and south from the 200 foot level, was cleaned out and retimbered to the 125 foot level, and work was still in progress in this shaft, cleaning out, retimbering, and getting ready to mine ore, at the time I left. This ore can be mined through the Keating tunnel level by continuing the north drift, as the shaft is sunk on the same vein.

Additional surface investigation both by myself alone and in company with Major John F. Duling, (Central Building, Los Angeles) shows the existance of an important body of mineralized porphyry which it is believed from assays and tests will average around 2% copper and can be mined on a large scale at a low cost. This is in addition to the small high-grade vein which is exposed in a gulch, and from which some ore was mined and shipped during the late war.

From the results of my investigations, the work done under my direction, and the geological conditions under which the ore was deposited, it is my opinion that in this Dover property there is the making of one of the major copper mines in Arizona, and in this opinion I believe you will find Major Duling to concur.

Respectfully submitted,

(signed) Newton W. Emmems,
Mining Engineer.

Seattle Washington,
September 30, 1931.

Copied May 3, 1952/ jmh

# REPORT

on the

# DOVER COPPER MINES

COPPER MOUNTAIN DISTRICT

GREENLEE COUNTY

ARIZONA

By

Newton W. Emmens,
R. P. E.
Mining Engineer

1929

926 - 1411 Fourth Ave., Bldg.,
Seattle, Wash.

Plate A

Morenci

Looking northeast from mine road, showing mine workings, town and mill of Phelps Dodge Corporation.

NEWTON W. EMMONS
Mining Engineer

Professional Engineer
Province of British Columbia
Province of Alberta.

2325 York Street,
Vancouver, Canada.

Los Angeles, Calif.
June 5, 1929.

California Consolidated Copper, Inc.,
Los Angeles, California

Dear Sirs:

In accordance with your instructions I have examined the properties of the Dover Copper Mining Co., situated in the Copper Mountain division of the Morenci Mining District, Greenlee County, Arizona, and hand you herewith my detailed report thereon.

In my examination every assistance desired was rendered me by Mr. Thomas Cocks, under whose direction the mine is being operated, and all records and other data were placed at my disposal by the business manager, Mr. Waldo Tiscornia. To these two gentlemen I desire to express my appreciation of their uniform courtesy and consideration.

The property consists of 118 mineral claims, 30 millsites, and 4 townsites containing a total of 1820 acres more or less. All the properties are held by location under the United States and Arizona mining laws, all the requirements of which having been complied with, the titles are in good standing. The properties are all surveyed and patents can be obtained quickly by making the necessary applications and paying the fees into the U. S. Land Office for the District. The mineral claims are divided into eight groups known, respectively, as the Anita (29 claims): the Bell (11 claims); the St. Joe (10 claims); the Bourbon (3 claims); the Margot (22 claims); the Keating (7 claims); the Tom Wal (12 claims); and the Tuckey (13 claims).

The nearest town to the property is that of Morenci where there is mail, telegraph, and telephone service and from which place the several properties are reached by road. The nearest railroad point is Clifton, in the valley of the San Francisco river, at the base of the mountains on which Morenci is situate. The two towns are

connected by an excellent highway.

The Morenci District is the oldest copper camp in Arizona with a recorded production of 1,806,000,000 pounds of copper during the past 56 years, and a present output of between 50,000,000 and 60,000,000 pounds per annum. The concentrating plant at Morenci is now treating 4,000 tons of ore a day from the mines of the Phelps Dodge Corporation, who now own all the developed mines in the Morenci-Metcalf field.

The ore deposits on the Dover properties are of two types, those occurring as veins occupying fissures or fracture planes, and those occurring as disseminated deposits in the porphyries, schists, and quartzites, or as replacements in the limestones. The fissure veins are usually higher in copper content than the other deposits, are persistent for distances ranging from a few hundred feet to two miles or more, have a width of from a few inches to 40 feet and attain depths of several thousand feet for the major fissures. The disseminated ore deposits are what are termed low grade deposits, that is, having a copper content of from 1% to 3%, they are of great size, reaching lengths of several thousand feet, widths of upwards of 600 feet and thicknesses of 100 to 200 feet. Owing to their large size and uniformity they lend themselves to the cheapest kind of mining and to tremendous daily output, with a consequent low per ton cost.

With the exception of on the Keating group, development work on the Dover properties has been mainly confined to the necessary assessment work to keep the claims in good standing, and to prospect them for copper-bearing veins, and disseminated deposits. There are a number of good showings on the several groups that are well worthy of systematic development with every expectation of opening up payable ore bodies of magnitude, but there is no tonnage of ore as yet developed. This matter is treated at length in the attached report.

On the Keating group a very nice fissure vein has been developed by adits (tunnels)and shafts for a length of over 1500 feet and much ore has been shipped there-

from during past years. Between the 125 foot level in the New Queen shaft and the surface to the northeast, ore to the value of $380,000 was shipped some years ago, and from the first ore shoot in the upper adit several carloads of high grade ore have been mined. Since the Keating property was acquired by the Dover Copper Mining Company, a number of cars of ore have been shipped. The following typical shipments will give an idea as to the value of this hand-sorted ore:

| Tons | Hold Oz. | Silver Oz. | Copper | Value |
|---|---|---|---|---|
| 39.26 | 0.12 | 5.2 | 21.48 | $ 1590.45 |
| 57.35 | 0.07 | 4.9 | 14.64 | 1264.35 |
| 44.00 | ---- | 1.8 | 7.33 | 976.36 |
| 41.75 | 0.04 | 2.2 | 9.83 | 1310.95 |

The Keating vein has been opened by two adits, the upper of which is 200 feet below the apex of the vein and the lower is 250 feet deeper. The ore shoot in the upper adit is 375 feet long and four to six feet wide, part of which has been stoped to surface. A new stope is now being worked and high grade ore sorted for shipment. In the lower adit this shoot has been developed for 175 feet, with both drifts still in ore, and by stopes in which it has a width of from four to twenty feet, with an average of 8 feet. During the driving of the drifts and the opening of the stopes numerous samples were taken daily, as the work progressed, the average assay of which gave 6.6% copper. The silver was not assayed for in each samples, but enough assays have been made to indicate a content of 0.25 ounces silver to the unit of copper.

While there is no ore that can be designated as POSITIVE ore, that is ore opened on three or four sides, there are two blocks of what may fairly be designated as PROBABLE ore, that is ore exposed on two sides, amounting to 42,140 tons. In addition to this there is POSSIBLE ore to the extent of 145,693 tons down to a depth of 300 feet below the lower adit.

The estimated value of this ore is based on 50 cents per ounce for silver and 15 cents per pound for copper less the smelter deduction of 2.5 cents. The average silver contents of the ore is taken at 1.65 ounces of which 90% will be recovered and

paid for, with a copper content of 6.6% of which 85% will be recovered. Taking these figures as a basis for valuation it makes the ore worth $15,1925 per ton gross, and makes the blocks worth:-

| | | |
|---|---|---|
| PROBABLE ore | 43,140 tons @ $15,1925 - | $ 640,211.95 |
| POSSIBLE ore | 145,693 tons @ $15,1925 - | $2, 213,440.90 |

As is shown in the report, the cost of mining, milling, freight and treatment on this ore, will be $6.00 per ton, making a total of $1,126,998 for the 187,833 tons of ore, and leaving a gross profit of $1,676,654.85.

The ore presents no difficulties in its treatment and in making a satisfactory recovery. The oxidized ores can be leached and the sulphide ore concentrated by flotation, both being well known and thoroughly established processes.

To prove up, and block out this ore will require an investment of $40,000 in mining plant and underground development, and a 100 ton daily capacity mill will cost $100,000 to which must be added $25,000 for providing transportation for the ore from mine to mill, and the concentrates to the railroad, also for water pipe-lines to the plant from the main public-service water lines in Gold gulch. If to these figures there be added another $25,000 for contingencies, the total investment required, exclusive of the purchase price of the property, will be $190,000 which if the ore be there as assumed, will leave a profit of $1,486,654.85.

In addition to this, there is the reasonable expectation of opening other ore shoots in the same vein, ore at greater depth, ore in parallel known veins, and the probability of developing big bodies of low grade ore, as well as finding other fissure veins like the Keating (one of which is already known to exist and is partly developed on the Tuckey claims) on some of the other groups.

While the Dover mine cannot be classed as a big mine at its present state of development it is a most promising property, well worth intelligent and systematic development, and as such it is unhesitatingly recommended for your acquisition, as

under the exceptionally favorable terms upon which the controlling interest can be obtained it should prove a very profitable venture, and a valuable acquisition for your company.

For additional information regarding the Dover properties and the district in which they are located, you are respectfully referred to the accompanying report.

Your attention is particularly directed to the recommendations at the end of the report, and it is suggested that these be carried out at the earliest possible date in order that the mine may be operated to the best advantage, and greater profit of all concerned.

Respectfully submitted,

Newton W. Emmens (signed)

Mining Engineer.

Copied May 3, 1952/ jmh

REPORT

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## PROPERTY and LOCATION

The property of the Dover Mining Company comprises 118 mineral claims, 30 mill sites, and 4 townsites of approximately 160 acres each, situate in the Copper mountain division of the Clifton-Morenci mining district, Greenlee County, Arizona.

The properties are held by location under the mining laws of the United States and State of Arizona, all requirements of which have been complied with, so that the titles are in good standing. The claims have been surveyed, and the boundaries properly marked upon the ground, so that patents can be quickly obtained upon filing the requisite notices and paying the patent fees to the U. S. Land Office of the district. The mineral claims are divided into 9 groups, whose locations relative to each other are shown on the accompanying map. The groups and claims comprising each, together with their approximate acreage are as follows:

| | |
|---|---|
| ANITA GROUP | |
| Anita claims Nos. 1 to 29 | 300 acres |
| BELL GROUP | |
| Bell claims Nos. 1 to 11 | 180 acres |
| BOURBON GROUP | |
| Bourbon claims Nos. 1 to 3 | 30 acres |
| MARGOT GROUP | |
| Margot claims Nos. 1 to 22 | 420 acres |
| KEATING GROUP | |
| New Queen | |
| New Deep Down | |
| New St. Paul | |
| New Gramercy | |
| New Keystone | |
| New Confidence | |
| New Black Boy | 130 acres |
| ST. JOE GROUP | |
| St. Joe Claims Nos. 1 to 10 | 100 acres |

TOM WAL GROUP
Tom Wal Claims Nos. 1 to 12 200 acres

TUCKEY GROUP
Tuckey claims Nos. 1 to 13 250 acres

In addition to the foregoing, there have been located four fractional claims to cover the ground lying between certain of the claims, which was found to be outside the boundaries when the lines were surveyed. These fractions are known as Anita Nos. 30, 31, 32 and a fourth very small fraction to which a name has not yet been given.

As will be noted from the map, the mill sites comprising a total of some 150 acres, are located at the southeast end of the properties and are in the valley shown on the photograph, Plate II. The townsites are located in what is known as Silver Basin, a comparatively gently sloping valley near the head of Silver Basin Creek, some 5 miles northwest of the San Francisco river valley and at approximately 1200 feet greater elevation. The location of this townsite is shown in Plates I and II, and on the map.

## ACCESSIBILITY

The nearest town to the Dover properties is Morenci, which is connected by railroad and a good automobile road with Clifton, the terminus of the Arizona and New Mexico railroad, a branch of the Southern Pacific, extending from Lordsburg, New Mexico to Clifton, Arizona. A daily train service is maintained on this line carrying passengers, mail, express and freight. Between Clifton and Morenci there is, in addition to the train service, an automobile stage which makes regular trips.

Clifton is on the Coronado highway and can be reached by automobile southward from Springville; eastward from Phoenix by way of Globe; or northwest from Lordsburg, New Mexico.

Morenci

Dover

Townsite

Railroad Grade

Plate I

Looking towards Morenci and Dover townsite on the distant mountains from Safford - Morenci highway. Showing old railroad grade to be utilized to connect Dover with the South Pacific railway.

Townsite

Plate II

Dover townsite from the road to the mine. Looking down Silver Basin Creek towards the valley of Eagle Creek.

From Morenci to the properties, an automobile road has been constructed, which, when widened and improved, as is now contemplated, will serve for the moving of ore and freight till such a time as development warrants the building of a town at the Dover site and the provision of rail facilities.

A railroad reconnaissance has been made from the grade of the old Morenci Southern railroad to the Dover townsite, and there will be no difficulty in building this line. The Morenci railroad is now abandoned, it having been replaced by the Arizona and New Mexico, from Clifton southward, and by lines owned and operated by the Phelps Dodge Corporation between Morenci - Clifton and Metcalf - Clifton. The abandoned grade of the old Morenci Southern is available, and can be put in a good state of repair at a comparatively small expense compared with the cost of grading a new line. This road will connect with the Southern Pacific at Guthrie, a station a few miles south of Clifton.

## HISTORY

In the May 30, 1929 issue of the Mining Journal of Arizona, there is an interesting article entitled "A History of the Clifton-Morenci District" by Geo. M. Robinson of the Phelps Dodge Corporation, from which the following is largely taken.

Morenci is the oldest copper camp in Arizona. The first discoveries of copper ore having been made in 1869, and the first claim the Arizona Central, having been located in February 1870. Very little work, however, was done on this property until the Congressional Act of May 10, 1872, which opened the mineral lands for location and exploration on much more favorable terms. In 1872 Robert Metcalf and other miners, located properties on Copper and Coronado mountains, upon which consider-

able development was done with such promising results, that a small abode smelter was built on Chase creek about half way between Clifton and Metcalf. This smelter had a capacity of one ton of ore per day, using charcoal for fuel and a hand bellows for obtaining the necessary blast. In 1873 this smelter was removed to Clifton and 20" gauge railway was built from the foot of the Longfellow incline to the smelter. This was the commencement of the first railway in Arizona. At first mules and gravity supplied the power. At the mine the ore was loaded into the cars, and the mules were mounted on a platform car in the rear of the train, which was coasted down to the smelter. After dumping the ore, the mules hauled the empty cars back. In 1874, the Longfellow and adjoining claims were acquired by a Scotch Company, which later was transferred to the Arizona Copper Company, Ltd. In 1875, the Detroit Mining Company was organized, and acquired the Arizona Central, Copper mountain, Montesano, and Yankie claims on Copper mountain. The principal camp for this group was located in the grove of Oaks and cedar at the head of what is now known as Morenci gulch, and the name "Morenci", given to the camp, was after a town in Michigan. During the next five years development was carried on under great difficulties, due to great distances over which supplies had to be brought in, and the copper produced and transported to market, and from the frequent raids by the Indians, which nearly proved too great a handicap. In 1880 however, enough ore had been developed to justify the building of a smelter, which was done on the San Francisco river about three miles below Clifton. Ore was hauled to this smelter in wagons, but not infrequently these would be waylaid by the Indians, the drivers killed and the horses stolen. In 1882, this smelter was removed to a location in Morenci, where it was operated until about 1897, when the company sold out to Phelps Dodge &

Company. Transportation into the district was provided in 1882, by the building of the Arizona and New Mexico railway from Lordsburg, New Mexico to Clifton. This was 36" gauge road. Later this railroad was taken over by the Southern Pacific, made into a standard gauge and added to their system. In 1901, the Shannon Copper Company was organized to take over and develop a group of properties on the Shannon mountain near Metcalf. They built a concentrator and smelter near Clifton and 36" gauge railway to connect the plants with the mines. In 1918, after a number of years of very successful operation this company sold out to the Arizona Copper Company. In 1921 the Arizona Copper Company sold their properties to the Phelps Dodge Corporation, thus giving that company the ownership of the developed mines in the Morenci-Metcalf field.

The early ores mined consisted of copper oxides and carbonates containing 25% and over in copper which were comparatively easily worked by the more or less crude processes employed at that time. Later as depth was attained, these ores turned to low grade sulphides necessitating an entirely different method of treatment, which, at the present time is represented by the big flotation concentrating mill at Morenci, handling its 4000 tons of ore a day. The concentrates are smelted at the Phelps Dodge Smelter located on the San Francisco river about a mile and a half below the town of Clifton. This smelter is very efficient, and produces the highest grade of fire refined copper in the country. Up to the end of the year 1928 the Clifton-Morenci district in its life of 56 years, has a recorded production of 1,806,000,000 pounds of copper and a present annual production of between 50,000,000 and 60,000,000 pounds.

## TOPOGRAPHY

The Clifton-Morenci area lies within the great copper-belt mountain region of Arizona which traverses the State in a northwesterly direction from

PLATE III

Eagle Creek

From pipe-line bridge at the pump station.

the Mexican line to the Colorado river, and like the Globe-Miami district is characterized by short parallel mountain ranges separated by deep narrow valleys in which faulting has played a major part in determining the structural feature.

The more important valleys traversing the Copper mountain Mining district are those of Chase creek on the northeast and Eagle creek on the southwest. These creeks have a general northwesterly course, occupy steel-sided, narrow valleys which in places become box canyons with walls rising vertically on either side to a height of five hundred feet above the creek bed, and having gradients of 200 to 300 feet to the mile in the case of Chase creek, and 30 to 50 feet in that of Eagle Creek. Tributary to these main creeks are a series of transverse gulches. Except during the rains these gulches are dry, al though in a few of them there are small springs from which water enough for domestic purposes can be obtained by sining wells, notably in Gold and Horse-shoe gulches. The main water supply for the district is obtained from Eagle creek, a short distance north of the mouth of Gold gulch, where there is a pumping station, from which the water is conveyed by pipe lines to the mines. With the exception of the San Francisco River, this is the most important stream in the Clifton-Morenci district and has an ample flow of water at all times. Plates III and IV are views of this creek.

The mountain slopes are steep, rocky and support only a scant growth of thorny bushes and cacti. These latter when in blossom, add a charg to the landscape, particularly the Yuccas, which on some of the higher mountain hills, notably American mountain, grow in profusion. When in full bloom with their spikes of white blossoms attaining to a height of 10 to 15 feet, they form a beautiful picture and make the beholder agree with the old Spaniards who gave the name "The candles of God" to these lovely plants.

PLATE IV

Eagle Creek Canyon

Looking down stream about a mile above the pump station.

The photographs accompanying this report give a good idea of the topography of the region under discussion.

## GEOLOGY

The geology of the Clifton-Morenci district is described in detail by Valdemar Lindgren in Professional Paper No. 43 U. S. Geological Survey, so that it will only be dealt with in a general way in this report.

The sedimentary rocks consist of quartzites, schists, shales, sandstone and limestones resting upon pre-Cambrian granite. In the valley of the San Francisco river; the lower portions of Chase creek; in Gold gulch; Copper plate gulch and a few other places in the district, there are deposits of Gila conglomerate. Towards the southwest in the valley of Eagle creek extending a short distance up Horseshoe, Copperplate and Gold gulches, there are beds of lave and tuff overlying the older rocks, and it is in these lave-flows that Eagle creek has cut its canyon.

The sedimentary rocks are cut and intruded by a series of dykes consisting of diabase and porphyry of several different kinds. In the formation of the ore bodies, the porphyry has played an important part, not only because its intrusion fissured the rocks, thus forming avenues for the circulation of the ore-bearing solutions, but also because the mineralization seems to have been directly connected with this intrusive, and in many instances the porphyry itself contains commercial ore bodies. Faulting has also played an important part in the formation of the ore bodies because the movement of the rocks opened channels through which the ore bearing solutions, emanating from the cooling igneous rocks, could circulate and deposti their mineral content partly by the filling of pre-existing cavities and partly by replacement of the

crushed rock. Some of the more important ore bodies in the district are associated with the major faults, notably that known as the Coronado fault, where the granite has been brought up into contact with the quartzite, making a fissure along which the famous Coronado vein was formed. The strike of this Coronado fault is a little south of west and north of east. A number of northeast-southwest cracks or fissures extend outward from the Coronado fault, several of which contain veins of commericial ore.

In addition to these mail faults, there are a series of minor faults having northwesterly strikes, but these minor faults appear to be of a later date, in that they throw the ore bodies.

## ORE DEPOSITS

The ore deposits of the Clifton- Morenci district are of two types, those occurring as veins occupying fissures traversing the formations or accompanying diabase dykes; the other are disseminated deposits in which the copper bearing minerals are diffused throughout the mass of porphyry dykes, along zones in the schists and quartzites or as replacments in the limestones.

The fissure veins are persistent in length for distances of from a few hundred feet to as much as 2 miles. In width they vary from a few inches to 40 feet and over, with well defined, clean-cut walls. The disseminated ore bodies are much greater in size even though lower in copper content. They attain widths of 600 feet, lengths of several thousand feet and are several hundred feet in thickness. The size of the workable ore body depends very largely upon the market price of copper, and the costs of production. The ore is not separated from the containing rock by any well defined line of demarcation, but rather fades out into barren rock as it gets farther away from the channels of mineralization, so that the width of an ore body is determined more by the cost of production per pound of copper than by anything else. When copper is

selling at 18 cents a pound, a lower grade of ore can be profitable mined than when it is selling at 14 cents.

## DEVELOPMENT

As will be seen from the map, the properties comprising the Dover mine cover an extensive area, and are divided into several groups some of which are separated from the others by claims held by different owners. In describing the development work therefore, it will be done by groups commencing with the Tom Wal group at the southern end.

TOM WAL GROUP.

Consists of 12 mineral claims located on the ridge south of the Dover townsite and adjoining it. There are a number of narrow veins on which pits and shallow adits have been driven, and in the flat at the foot of the hill quite a little work was done on some veins carrying gold. It is stated that several shipments were made from these workings, but the results are not known. There is evidence of copper in several places as shown by the staining of the rocks, but nothing of commercial value has been developed as yet.

ST. JOE GROUP

Consists of 10 claims in which there is a belt of porphyry stained with copper, and a number of cross fissures upon which shallow adits have been driven. Some ore was shipped from the higher grade streaks encountered in doing this work. Plate V shows some of the workings on the north side of Pinkars gulch. No commercial ore bodies have yet been discovered, although it is considered probable that payable ore may be found in the porphyry at depth, beneath the zones of oxidation.

TUCKEY GROUP.

Consists of 13 claims, and has a good showing of ore in the floor of a gulch where it has been followed by outcrop, cuts, and shallow pits, for a length of three claims. The vein has an east and west strike, dips to the north, and is on the contact between lime and diabase. It has been developed by a shaft from the floor of the gulch, and some ore has been stoped. The shaft and stope is filled with rock washed into it from the hillside, and is now inaccessible. It is stated to be 75 feet deep, and the vein to be 7 feet wide in the bottom, of good grade copper ore. Two carloads of ore shipped from this shaft during the war are stated to have yielded $8,000.00. This is considered to be a prospect worthy of some development work.

BELL GROUP.

Consists of 11 claims located on the south side of Gold gulch adjoining the St. Joe group. On this group, on the northside of the creek, there is a prominent outcrop of magnetite, which in places is stained with copper. This magnetite forms the capping to a belt of quartzite having a northwesterly strike and extending from Gold gulch to the bluff on Copper mountain overlooking Morenci. This outcrop is shown in Plate VI. A number of cuts and pits have been made in this magnetite and several adits have been driven into the underlying quartzite without finding commercial ore. In several other places on the Bell group ore has been found in shallow pits, trenches, and adits, and small shipments have been made by leasers, but no systematic development work has ever been undertaken and no body of commercial ore has been opened up.

MARGOT-ANITA GROUP.

Consists of 51 claims on the west slope of American mountain, and adjoins the Keating group on the northeast (Plate VII). A wide porphyry dyke crosses

these claims, and near the top of the hill shows considerable copper stain. A number of pits, shallow shafts and cuts have been made in the mineralized porphyry, and some ore from the higher grade streaks and trenches has been shipped by leasers.

On the Margot No. 19 claim, an adit was driven some years ago, for a distance of 1500 feet, but did not encounter a commerical ore body. Very little cross-cutting was done from this adit, although there is copper showing in several places along its sides. A short distance back from the face, a streak of ore was found on which a winze was sunk for a few feet, and upon which some drifting was done. The results were inconclusive.

KEATING GROUP.

Consists of 7 claims on the south slope of American mountain, on the south side of Horseshow gulch. (Plate VIII). The main ore deposit on this group consists of a well defined vein having a strike of northeast-southwest with a slight southerly dip. The fissure is an off-shoot from the Coronado fault and has been traced by surface work and outcrop for over a thousand feet. The vein has been developed by adits driven from Horseshoe gulch both to the northeast and southwest. A shaft was sunk on the vein from the floor of the gulch on the New Queen claim to a depth, it is stated, of 375 feet (Plate IX). Drifts were run to the northeast from the 125 foot level, two stopes were opened which are stated to contain ore averaging 17% copper. At the time of the writer's visit this shaft had only been repaired down to a 125 foot level, below which point it was inaccessible, owing to caving. On the south side of the gulch an adit had been driven in on the vein for a distance of 600 feet, and has developed an ore-shoot 375 feet long and from 8 to 12 feet wide.

While this property was under lease to Scotland and Grant, prior to

its acquisition by the Dover Company, all the ore north of the shaft between the 125 foot level and surface was stoped, as was also a block of ore above the southwest adit (Plate X). Detail records on the shipments are not available, but it is stated that the value of the ore shipped was in excess of $380,000.00. Since the property has been acquired by the Dover Company, a new stope has been opened in the southwest adit exposing ore for 100 feet in length and four to six feet wide, the whole of which will average 7% copper. At the present time this material is being mined and hand-sorted to a 20% product.

From a point further down Horseshoe gulch at an elevation of 250 feet below the upper adit, a cross-cut was driven to the vein which was encountered at a distance of 1000 feet from the portal (Plate XI). This cross-cut first passes through quartzite, then through some red granite, followed by porphyry which is mineralized with copper, and forms the wall of the vein. No drifting has been done in the porphyry, but it might be well at some future time to prospect this with the expectation of developing an important tonnage of low grade ore. Drifts have been started both to the northeast and southwest on the vein, and are in good ore all the way. These drifts are now in 100 feet to the northeast and 75 feet to the southwest respectively from the crosscut, and are being continued. Stopes have been opened above these drafts and a raise is being made to connect with the upper adit. In driving these drifts and opening the stopes, the ore broken is hand-sorted, the higher grade material shipped to the smelter and the lower grade material being stored in the mine or on the dump for future treatment. Three of the cars shipped yielded 0.04 ounces gold; 1.8 ounces silver; 7.33% copper; 0.07 ounces gold; 2.2 ounces silver, 9.83% copper, 4.9 ounces silver and 14.64% copper respectively. With the stopes opened, it is expected that future shipments will be of a better average grade. It is expected that they

will contain not less than 12 to 15% copper.

The ore being mined is highly oxidized but contains bunches of copper sulphide (chalcocite) and oxide (cuprite). These bunches constitute high grade ore, much of it assaying in excess of 40% copper and 9 ounces of silver to the ton. In doing this development work, average samples of the face of the drift were taken every day; samples were taken from each car as it came from the mine; samples were likewise taken from each face of the stope; and a number of composite samples were assayed as a check on the mine and car samples. The average of all these assays are as follows:

| | |
|---|---|
| East Drift | West Drift |
| 7.63% Copper | 6.68% Copper |
| No. 1 Stope | No. 2 Stope |
| 7.06% Copper | 5.60% Copper |
| Car Samples | |
| 6.04% Copper | |

which are considered to give a very fair average of the copper contents of the ore, as mined without any attempt at sorting, or the rejection of waste. Assays were not madr for silver or gold, except in a few samples.

The silver contents of this ore is quite variable, and does not appear to have any ratio to that of the copper. Some samples containing 41% copper, assay only 9 ounces in silver, while others assaying 21% copper, contain 16 ounces of silver; and again, a sample assaying 40.5% copper assayed 31.4 ounces in silver to the ton. The car loads

of ore shipped all contained some silver as will be seen from the returns quoted in this report, and, for the purpose of arriving at a valuation of the average ore, the silver will be taken at 0.25 ounces to each unit of copper, the copper being taken at 6.6% which is the average of the mine and car samples.

## ORE RESERVES

As will be apparent from what has already been stated, the only ore of which any tonnage has been developed is that in the Keating mine, where, in the upper adit, an ore shoot 375 feet long has been opened and part of it stoped to surface (Plate X). This ore can be taken to have an average width of 8 feet and will average 6.6% copper and 1.65 ounces silver to the ton as mined, without any sorting. The stope now being mined above this level has a length of 100 feet and is approximately 125 feet average depth below surface, so that there is here a block of probable ore measuring 8 x 125 x 100 feet - 100,000 cubic feet which at 14 cubic feet to the ton equals 7,140 tons.

The ore shoot on the lower adit has a proven length of 125 feet, with ore in the face of both drifts, has an average width of 8 feet, and is 250 feet below the upper adit on the floor of which level the shoot has a length of 375 feet. This gives a tabular block of probable ore of 8 x 250 x 245' or approximately 35,000 tons.

The possible ore tonnage may be based upon the following data: From the work done in the upper adit, the New Queen shaft, the levels driven the refrom, and the old workings north of the shaft, the

ore is shown to extend for a horizontal distance of 500 feet, and there is no reason to think it will not be equally as long at a depth of 300 feet below the lower adit. If this be assumed and no likewise assume an average mineable width of 8 feet, we have 102,837 tons. In addition, there is the ore between the north end of the stope in the lower adit, and the shaft above the adit level, a distance of 200 feet; this adds another 28,571 tons to which must be added the ore north of the shaft between the 250 and 125 foot level, (it having been stoped out above the 125 foot level. Assuming 200 feet is the length of this ore, and 8 feet as its width, we have a fourth block of 14,285 tons of possible ore. Estimating the value of this ore, on the basis of a recovery of 85% of the copper at a net price to the mine of 12.5 cents per pound; a recovery of 90% of the silver and being paid 50 cents per ounce for it; assuming that the ore averages 1.65 ounces silver, and 6.6% copper, gives:

| | |
|---|---|
| 1.65 ounces silver @ 90% - 1.485 ounces @ 50¢ | $0.7425 |
| 6.6% copper - 136 pounds @ 85¢ | |
| - 115.6 lbs. @ 12.5¢ | 14.4500 |
| Total Value | $15.1925 per T. |

The value of the ore that can reasonable be counted on is therefore:

PROBABLE ORE

| | |
|---|---|
| Above upper adit | 7.140 tons |
| Between upper and lower adit | 35.000 tons |
| Total | 42.140 tons @ @$15.1925 |
| | $640,211.95 |

POSSIBLE ORE

| | |
|---|---|
| Below lower adit level | 102,837 tons |
| Between north stope and shaft above lower adit level | 28,571 tons |
| North of shaft between 250 and 125 foot levels | 14,285 tons |
| Total | 143,693 tons @ $15.1925 - $2.213,440.90 |

This takes into consideration only ore down to the 300 foot level below the lower adit over a length of 600 feet, and does not take into consideration any ore that may and probably will be found in other parts of the vein, and in parallel veins of which there are several as yet undeveloped. Nor does it take into consideration the lower grade material and the wider parts of the ore body, where it extends out into the walls, so that the possible ore tonnage may be safely assumed to be at least two or three times the figures given.

No attempt is made to give any estimates of possible tonnages and values on any of the other claims or groups because of lack of development but there is ore in the Tuckey vein on the Tuckey group; in the porphyry on the Margot claims; and on the St. Joe, Bell, and Tom Wal groups as shown by surface outcrop and the little work that has been done. It is likely that systematic and carefully planned development will open up bodies of payable ore of some magnitude but there is as yet insufficient data upon which to base any estimates of tonnage.

## ORE TREATMENT

Up to the present time the ore from the Keating vein has been shipped direct to the smelter without any preliminary treatment, and for the present it is recommended that this course be continued, hand-sorting the ore to maintain a grade of 10% copper or over, and sorting

the lower grade material in the stopes or on a dump for future treatment, when there shall be a sufficient tonnage of ore actually blocked out to justify the errection of a plant for that purpose.

There is now a contract with the American Smelting and Refining Company, whereby this company agrees to pay for;

> All the gold contained in the ore (when 0.03 ounces or over per ton) at $19.50 per ounce.
>
> For 95% of the silver at New York quotations.
>
> For 90% of the copper (wet assay) at New York quotations for electrolytic wire bars, less a deduction of 2.5 cents per pound (for refining and marketing).

The copper from the low grade oxidized ores can be extracted with sulphuric acid or any one of several processes for leaching this type of ore. Should there be any appreciable amount of sulphides in the ore, it would be necessary to use a combination process, whereby the sulphides were separated by concentration (flotation) and the oxidized residue then leached. In this type of ore, a recovery of over 85% of the copper can be made in the mill.

When the sulphide zone is reached the ore can be concentrated in a flotat on plant and the concentrates then smelted. This is a standard process, and the ore presents no difficulties in the recovery of its mineral contents.

## COSTS

The cost at present of hauling ore from the mine to the railroad at Clifton is $2.60 per ton, but this can be reduced when contemplated improvements to the road are completed and when a larger daily output is maintained.

The freight rate from Clifton to the Smelter at El Paso, is from

$2.00 to $2.90 per ton, based on a sliding scale according to the value of the ore.

The smelting charge on this ore is also on a sliding scale according to the value of the ore, based on a minimum of $2.50 per ton when the value does not exceed $15.00. For each $1.00 increase in value 10 cents is added to this base charge up to a maximum additional charge of $2.50 per ton making a total smelting cost of $6.00 per ton.

The wages prevalent in the district are:-

| | |
|---|---|
| Shift bosses | $4.50 per day |
| Blacksmiths | $4.50 per day |
| Miners | $4.00 per day |
| Muckers | $ 3.50 per day |
| Outside labor | $3.00 per day |

Drifting and cross-cutting costs $12.00 to $15.00 per foot.

Shaft sinking, 2 compartment, costs $45.00 to $50.00 per foot.

Mining costs are governed to some extent by the daily tonnage produced and are approximately as follows:

| | | |
|---|---|---|
| Mining | $1.50 | |
| Sorting | 0.20 | |
| Development | 0.80 | |
| Supplies | 0.50 | |
| Assaying | 0.10 | |
| Administration | 0.50 | |
| | | $3.60 per ton |

assuming that the ore is sorted to 8% copper or better. To this must be added a hauling, freight and treatment charge of $8.90 per ton, based on a 15 cent copper market, making a total production cost of $12.50 per ton or 8.68 cents per pound of copper produced and sold.

If the ore was taken as broken and treated in a mill, the quantity produced by the same force would be greatly increased, because all ore of whatever grade material would be sent to the plant and no sorting out

of the low grade material or selective mining, would be necessary. This would reduce the total cost of mining to not over $2.50 per ton, covering all items. The milling costs depend, in large measure on the type of plant required to treat the ore and the tonnage handled. It is estimated that a 100 ton combination mill, that is a combination of concentration and leaching, can treat this class of ore at a cost of $2.00 per ton and makes a recovery in excess of 85% of the copper and silver, so that the total cost of mining and milling, including administration, will not be over $4.50 per ton to which must be added a hauling, freight and treatment charge of $1.50 per ton of crude ore, making a gross total of $6.00 per ton. It has been shown that the average copper content of the ore body in the Keating mine as developed on the lower adit is 6.6%. If this for the sake of conservation, be taken at 5% and if the recovery in the mill be taken at 85%, followed by a smelter recovery of 90% of copper in the mill product, the cost per pound of copper produced and sold will be 6.5359 cents.

## ESTIMATED PROFITS

From the foregoing figures it will be noted that the largest item of cost is that of hauling, freight and smelting, therefore the higher the grade of ore shipped the greater the margin of profit, because the costs do not increase in proportion to the richness of the ore. To illustrate this the following examples are given. based on a market price of 15 cents per pound for copper and allowing for the smelter deduction 2.5 cents from the price and 10% smelter loss.

| | | |
|---|---|---|
| 8% copper - 160 lbs @ 90% - 144 lbs. | | |
| 144 lbs. of copper @ 12.5 (15 - 2.5) cents - | $16.10 | |
| Hauling, freight & smelting | 8.90 | |
| Gross Profit | | $7.20 |
| 12% copper - 240 pounds @ 90% - 216 lbs. | | |
| 216 lbs. of copper @ 12.5 (15 - 2.5) cents - | 27.00 | |
| Hauling, freight and smelting | 9.70 | $17.30 |

The cost of mining, sorting and placing in bins at the mine of the 8% ore

is approximately $3.60 per ton on a 50 tons daily production, leaving a net profit margin of $3.60 per ton. To bring the ore shipped up to a 12% product would require a somewhat larger production from the mine, necessitating more miners and ore sorters, this would increase the cost of production per ton of ore shipped, to $5.00 per ton but would increase the net profit margin to $12.30. These figures do not take account of the small amount of silver in the ore which would probably add about $1.00 per ton to the profits.

In mining and sorting this ore there would be left in the mine, in the stopes or on the dump a greater tonnage of low grade ore than that shipped, and this ore would have to be treated in a mill on the ground at some future date.

With a mill on the ground the same force that was employed in mining and sorting the ore to a shipping grade, 8 to 12% and over, would produce a much larger tonnage at a lower per ton cost, and operations would be carried out on a more economical basis, especially in regard to the administrative end of the business. With a production of ore averaging 5% copper, a mill saving of 85% and a smelter saving of 90% of the copper in the concentrates, the profits on a 15 cent copper market would be:-

| | | |
|---|---|---|
| 5% copper - 100 lbs. @ 85% - 85 lbs. @ 90% - 76.5 lbs. | | |
| 76.5 lbs. of copper @ 12.5 (15 - 2.5) cents plus | 9.5625 | |
| Mining, milling, freight & treatment | 6.0000 | |
| Net Profit Margin | | $3.5625 per ton |

or a cost of 7.8431 cents per pound of copper produced and sold.

Added to this, account must be taken of the small quantity of silver in the ore, amounting to approximately 1.25 ounces to the ton on a 5% ore. Of this the mill should save 90% of which the smelter would pay for 95%, so that the net recovery would be 1.069 ounces which at 50 cents per ounce is worth $00.5345.

This added to the net yield of the copper, gives a total net profit on the ore of $4.0970 per ton, or $409.70 per day on a 100 tons daily output. Taking 300 working days to the year gives an annual net profit of $122,910.00

## RECOMMENDATIONS

At its present state of development, the Dover cannot be classed as a big mine but it is a very nice small producer with excellent opportunities of not only making a greatly increased output of excellent grade ore, but with possibilities of finding and developing big bodies of low grade ores in the porphyry belts on the Margot, Bell, Tuckey and other groups.

It is therefore recommended that the controlling interest be acquired upon the terms discussed, and that the following programme of work be carried out as rapidly as possible:

1. Widen the road from the mine to Morenci, so as to provide some passing places and flatten out some of the sharper curves by cutting back into the hill.

2. Provide proper housing facilities for the mine crew by building a boarding house and some two room cottages, which later can be rented to the miners at a small monthly rental.

3. Install an 8 drill compressor and engine, together with drill sharpener and steel.

4. Drive the lower adit ahead to the northeast with two shifts, so as to open up more ore and to connect with the New Queen shaft.

5. Drive the lower adit ahead in a southwesterly direction, following the ore, with one shift.

6. Raise from the stopes in the lower adit, to the upper adit, for the purpose of developing more ore, opening stoping ground, and providing necessary ventilation.

7. Cross cut to the eastward from the south drift in the lower adit, at a point 50 feet in from the crosscut, with the expectation of picking up a parallel ore body.

8. Explore both sides of the stopes by crosscuts where the

ore makes off into the walls.

9. Continue mining and shipping ore broken in development and in the stopes now opened. Sort this up to 10% or better copper content, and ship as heretofore, but do not sacrifice grade in order to make tonnage.

10. Make a detailed study of the ore showing on the other groups, notably on the Tuckey, Margot, Bell and St. Joe, with a view of opening up bodies of low grade milling ores.

To carry out this programme it is estimated that the sum of $25,000 should be provided and it is recommended that this be done, believing that the results attained and the returns received will handsomely repay an outlay.

It is estimated that it will require two months to carry out the above programme. It is further recommended that at the end of that time a re-examination of the mine be made and a more extensive programme of operation be then drawn up based upon the results of this preliminary work.

Respectfully submitted

(signed) Newton W. Emmens

Mining Engineer.

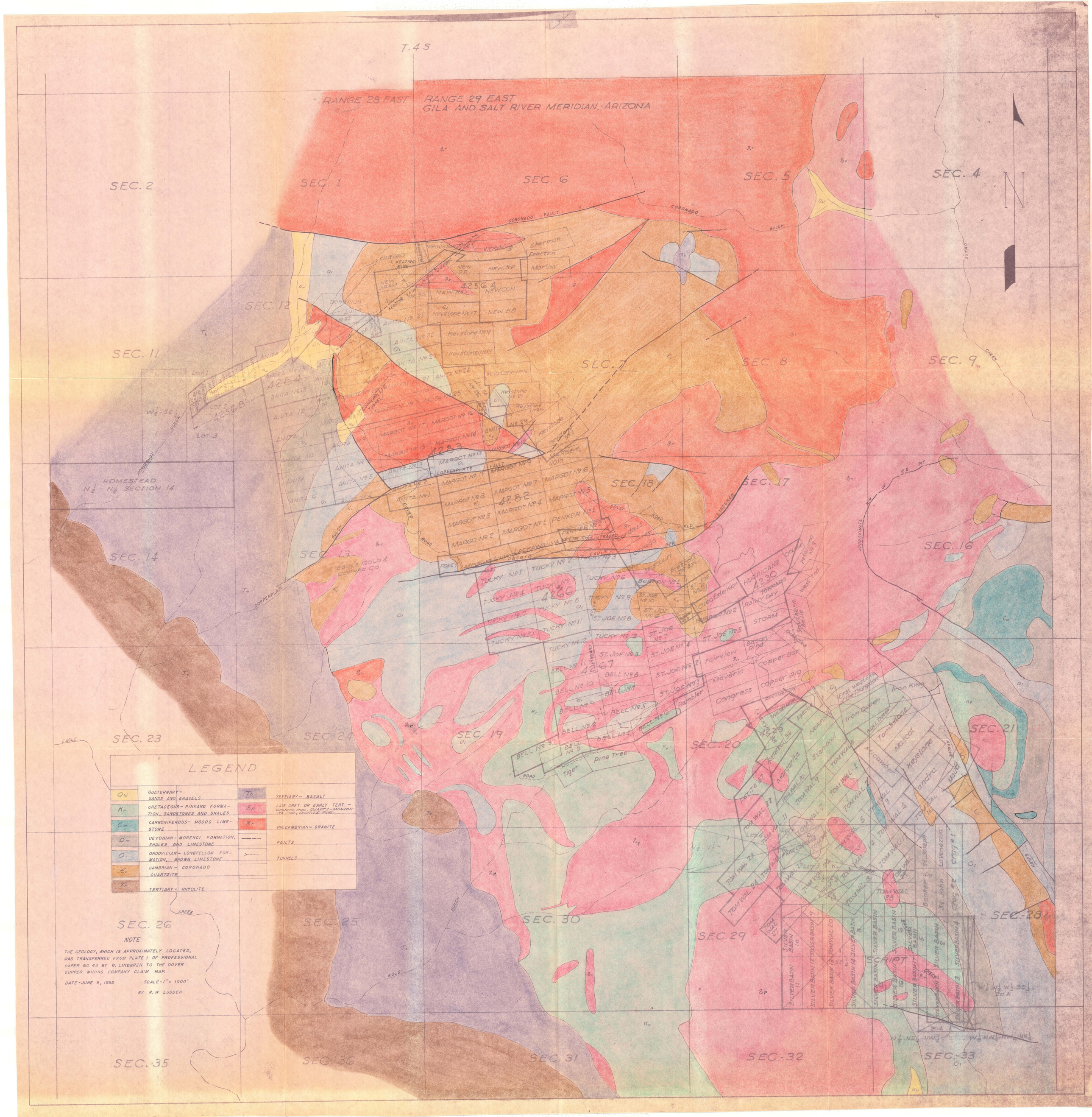
Los Angeles, California.

June 6, 1929

926- 1411 Fourth Avenue Building

Seattle, Wash.

Copied May 6, 1952 /jmh


T.4S
RANGE 28 EAST
RANGE 29 EAST
GILA AND SALT RIVER MERIDIAN,-ARIZONA
SEC. 2
SEC. 1
SEC. 6
SEC. 5
SEC. 4
SEC. 12
SEC. 11
SEC. 7
SEC. 8
SEC. 9
SEC. 18
SEC. 17
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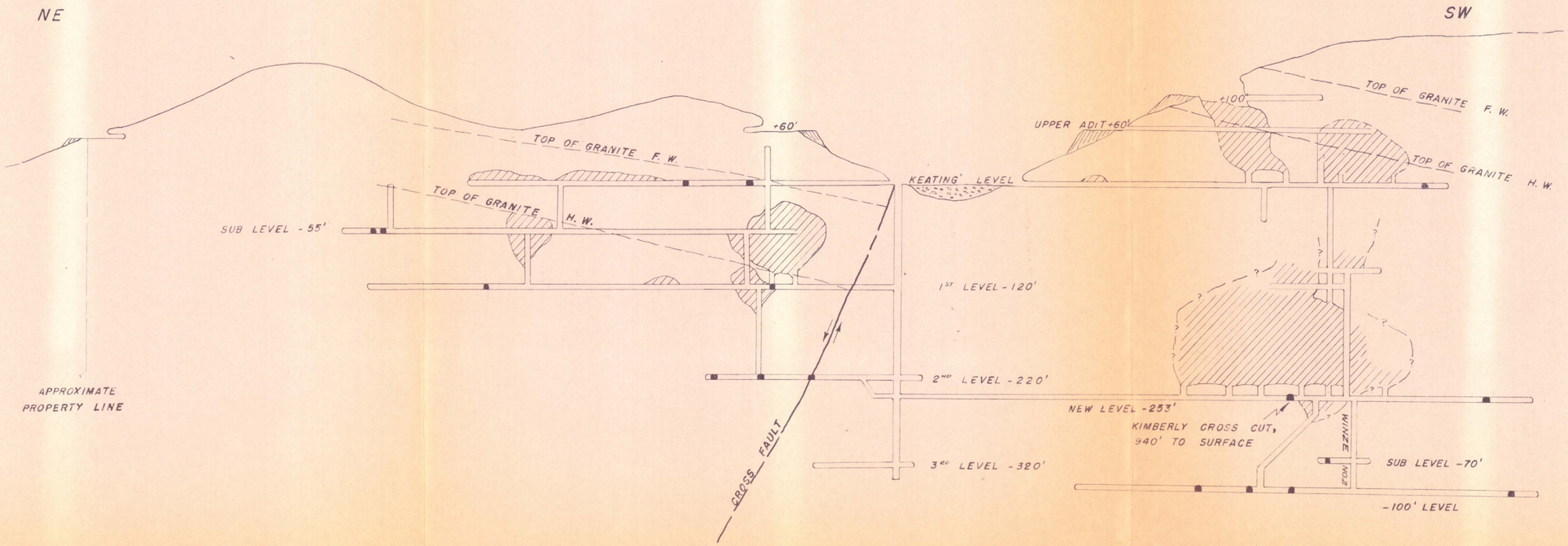
SEC. 28
SEC. 35
SEC. 36
SEC. 31
SEC. 32
SEC. 33
HOMESTEAD
N½ - N½ SECTION 14
CORONADO FAULT
CORONADO GULCH
COPPERPLATE
DOVER ROAD
LINDGREN
EAGLE GOLD & COPPER CO.
EAGLE
CREEK
GULCH
GOLD
APPROXIMATE RIM OF P.D. PIT
LEGEND
Qal QUATERNARY - SANDS AND GRAVELS
Kp CRETACEOUS - PINKARD FORMATION, SANDSTONES AND SHALES
Cm CARBONIFEROUS - MODOC LIMESTONE
Dm DEVONIAN - MORENCI FORMATION, SHALES AND LIMESTONE
Ol ORDOVICIAN - LONGFELLOW FORMATION, BROWN LIMESTONE
Єc CAMBRIAN - CORONADO QUARTZITE
Tr TERTIARY - RHYOLITE
Tb TERTIARY - BASALT
gp LATE CRET. OR EARLY TERT. - GRANITE POR., QUARTZ-MONZONITE POR., DIORITE POR.
gr PRECAMBRIAN - GRANITE
FAULTS
TUNNELS
NOTE
THE GEOLOGY, WHICH IS APPROXIMATELY LOCATED, WAS TRANSFERRED FROM PLATE 1 OF PROFESSIONAL PAPER NO. 43 BY W. LINDGREN TO THE DOVER COPPER MINING COMPANY CLAIM MAP.
DATE - JUNE 9, 1952
SCALE - 1" = 1000'
BY R. W. LUDDEN




## NOTE

THIS IS A PROJECTION ON A VERTICAL NE–SW PLANE THRU THE KEATING SHAFT.
THE MAJOR PORTION OF THE DATA WAS TAKEN FROM COMPANY MINE MAPS.

# VERTICAL PROJECTION

LOOKING NORTHWEST
AT

# KEATING MINE

SCALE – 1" = 100'  DATE – JUNE 2, 1952

COMPILED BY R. W. LUDDEN