CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

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UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. KRUG, SECRETARY

BUREAU OF MINES
James Boyd, Director

REPORT OF INVESTIGATIONS

BULLARD COPPER DEPOSIT
YAVAPAI COUNTY, ARIZ.

BY

MARLOW D. PHELPS AND CHAS. A KUMKE

ABSTRACT

REPORT OF INVESTIGATIONS

BULLARD COPPER DEPOSIT

PIERCE MINING DISTRICT, YAVAPAI COUNTY, ARIZ.

As a part of its wartime program to aid in the development of deposits of strategic minerals, the Bureau of Mines, upon request by the Phoenix, Arizona office of the Reconstruction Finance Corporation, investigated the feasibility of diamond drilling the undeveloped area adjacent to the stoped areas in the Bullard mine.

The Bullard mine is situated in the Pierce mining district in the southwestern corner of Yavapai County, Arizona, 12 miles northwest of Aguila, Arizona.

J. C. Bullard was the original locator in 1880. Ownership of the property has rested with the Bullard estate since then and all work at the mine has been performed by lessees.

In the nineties the property was leased to the Yuma Copper Co. They built a smelter and operated the mine for several years. No production records covering this early period are available.

Subsequently the mine was operated intermittently by different lessees. Records of ore shipments from 1935 to 1943 total 10,608 tons. At the time of the Bureau investigation Bullard Gold Mines, Inc., had leased the property and were operating the mines. This company shipped a total of 7,133.7 tons from November 1943 to September 1944 with a content of approximately 272,000 pounds of copper.

On August 24, 1944 diamond drilling was started by the Bureau. Four vertical holes were drilled totalling 313 feet. Drilling by the Bureau indicated ore at a distance of 30 to 75 feet in three different directions from the existing workings.

REPORT OF INVESTIGATIONS

UNITED STATES DEPARTMENT OF THE INTERIOR - BUREAU OF MINES

BULLARD COPPER DEPOSIT [1/]
PIERCE MINING DISTRICT, YAVAPAI COUNTY, ARIZ.

By Harlow D. Phelps [2/] and Chas. A. Kumke [2/]

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1/ The Bureau of Mines will welcome reprinting of this paper, proving the following Footnote acknowledgment is used: "Reprinted from Bureau of Mines Report of Investigation _____"

2/ Mining Engineers, Bureau of Mines, Tucson, Arizona.

INTRODUCTION

As a part of the wartime program to encourage production of stretegic minerals the Reconstruction Finance Corporation granted a loan to aid the operators in reopening and equipping the Bullard mine. In November 1943 the mine began regular shipments of silicons copper ore in the smelter at Hayden, Ariz.

It was requested by the Phoenix office of the Reconstruction Finance Corporation that the Bureau of Mines assist in prospecting the undeveloped area adjacent to old workings.

Early in 1944 the Federal Geological Survey completed a detailed study of the geology of the mine and recommended diamond drilling.

In May 1944 the property was visited by an engineer of the Bureau of Mines.[3/] , Four vertical holes, totaling 313 feet were drilled under the supervision of a Bureau engineer.[4/] This work was started August 24 and completed September 28, 1944.

ACKNOWLEDGMENTS

Special acknowledgment is made to the Federal Geological Survey for mapping and interpretation of the geology of the area and to J. H. Hedges, Chief, Tucson Branch, Mining Division, for advice and general direction. The metallurgical staff analyzed the samples under the direction of A. C. Rice, acting supervisising engineer, Rare and Precious Metals Experiment Station, Reno, Nev. Acknowledgment.

3/ Phelps, Harlow D. Mining Engineer, Tucson, Ariz.
4/ Grantham, R. M. Mining Engineer, Tucson, Ariz.

is also made of the cordial and prompt cooperation of the Phoenix office of the Reconstruction Finance Corporation in furnishing production and historical data.

LOCATION AND ACCESSIBILITY

The Bullard mine is in the Pierce mining district at the east end of the Harcuvar Mountains about 12 miles, by road, northwest of Aguila, Arizona, a small town on the Wickenburg-Parker cut-off of the Atchison-Topeka and Santa Fe Railway. Aguila is also on highway 60=70 about 27 miles west of Wickenburg, Arizona. It is the nearest rail shipping point for the Bullard mine. The mine is situated in Secs. 1, 2, 10, 11, and 12, T. S N., R. 10 W., Yavapai County, Ariz. There is a good dirt road to the mine ore bin with no excessive grades. (Figure 1.)

OWNERSHIP

J. C. Bullard located the mine in 1880. From that date to the present time the mine has remained in possession of the Bullard estate. The property consists of 28 patented lode claims (fig. 2) and a number of unpatented claims.

HISTORY

In the 1890's the property was leased to the Yuma Copper Co. They built a small smelter and operated the mine for several years, largely for gold. Since then all the mining has been done by different lessees and very little exploratory work has ever been undertaken. Bullard Gold Mines, Inc. started operations in October 1943 with the aid of an R. F. C. loan.

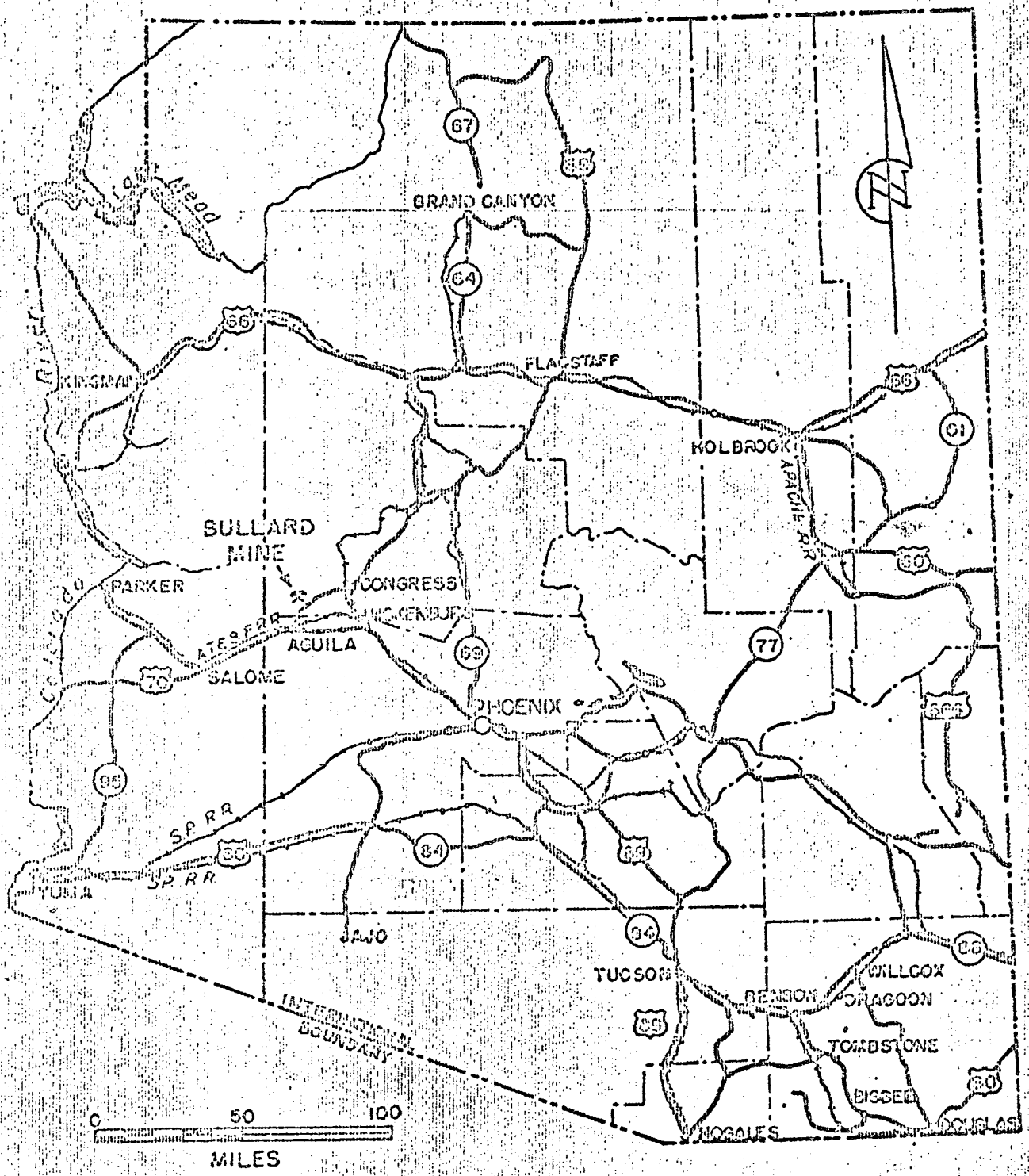
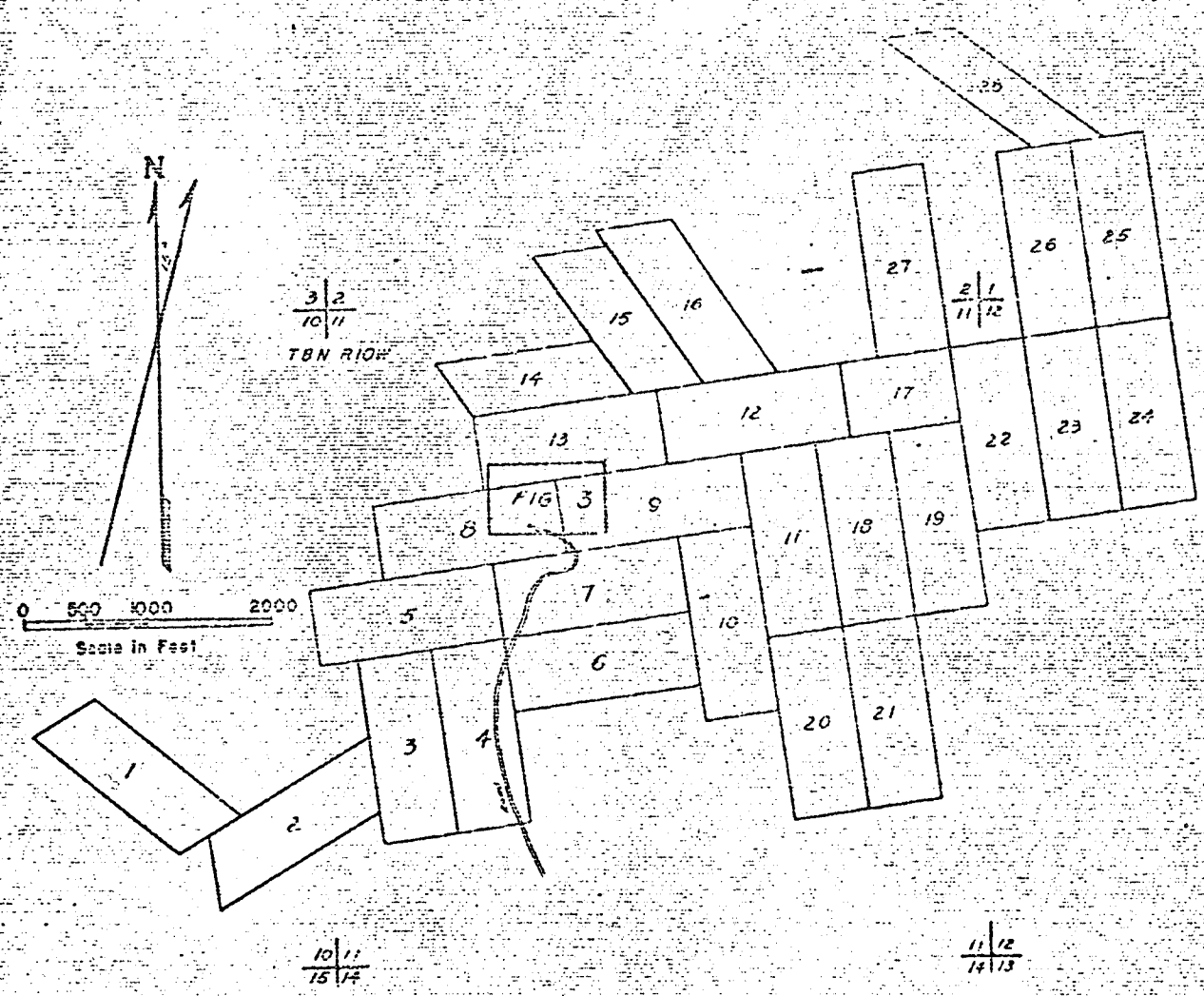


Figure 1.- Location map, Bullard mine, Yavapai County, Arizona.



PATENTED LODE CLAIMS

No.	Name	Mineral Survey
1	Stonewall	3402
2	Connection	"
3	Last Scan	"
4	Democrat	"
5	State	"
6	Arizona	"
7	Avalanche	2467
8	Swasp Stake	"
9	Washington	"
10	International	"
11	Producer	"
12	Rattler	"
13	Home Stake	"
14	North Star	"
15	Emily	"
16	Stellar	"
17	Napoleon	3403
18	Joy Bird	"
19	Venice	"
20	Butte	"
21	Nevada	"
22	Amazon	"
23	Chancellor	"
24	South Wing	"
25	Augustus	"
26	Sulla	"
27	Newborn	"
28	North Extension	"

Figure 2.– Claim map, Bullard mine.

PRODUCTION

There are no records of the early production from the mine. It was probably small.

Records of ore shipments from 1935 to 1943 total 10,608 tons, according to data furnished by the Reconstruction Finance Corporation.

From November 1943 to September 1944 Ballard Gold Mines, Inc. shipped a total of 7,183.7 tons with a content of approximately 242,000 pounds of copper.

GENERAL FEATURES

The claims cover a considerable area at the eastern end of the Hopewell Mountains. The patented claims extend approximately 1-3/4 miles in a northeasterly, and southwesterly direction (Fig. 2). The altitude, as indicated by the topographic map of the State, compiled by the Federal Geological Survey and published by the Arizona Bureau of Mines, ranges from 2,800 to 3,200 feet.

The exposures and outcrops over the principal workings form the slope of a horseshoe around the northerly, westerly, and southerly sides of the eastern ridge (Fig. 3).

Desert scrub and scattered plants adapted to the arid climate of Arizona, comprise the principal vegetation. Summer months are extremely hot and the winters are mild. Water for domestic purposes and mining operations is hauled 12 miles from Aguila where it is purchased from the Santa Fe Railway.

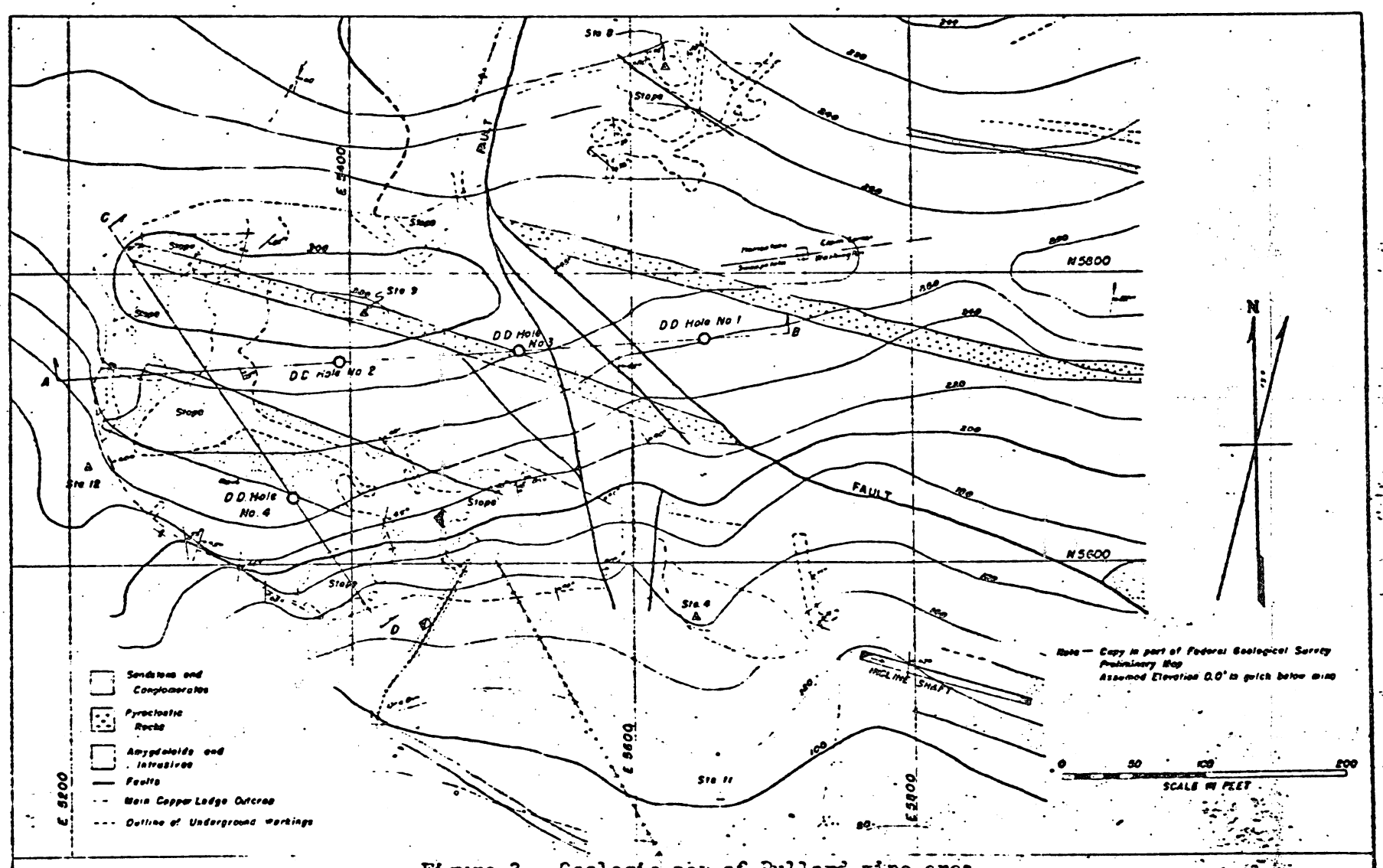


Figure 3 - Geologic map of Dullard mine area

A small power plant at the mine furnishes power and lights for mining operations. If large operations were considered, power could probably be brought in from the Parker Dam-Phoenix transmission line which passes about 10 miles south of the mine.

LIVING CONDITIONS AND LABOR

No living quarters are provided at the mine and only limited accommodations are available at Aguila. The management furnishes transportation for the miners to and from Wickenburg - an 80-mile round trip.

GEOLOGY AND ORE OCCURRENCE

Schist, penetrated by large masses of granites, comprises the prevailing country rock of the Harquahar Mountains (Darton, U. of A. Bull. 117, p. 223).

In the area of the Dullard mine there are many intrusive rocks. A preliminary map, by the Federal Geological Survey (fig. 3) shows sandstone, conglomerate and pyroclastic rocks associated with volcanics and intrusives. Extensive faulting is apparent over the entire area, and the ore occurs in irregular vein and replacement deposits adjacent to a low-angle fault plane. The strike of this fault varies from N. 50° E. to N. 75° E. and the dip from 20° SE to 25° SE. Predominating minerals are copper carbonates and silicates with small amounts of sulfides as chalcocite. Gangue material is quartzose in character, and as the ore is also low in alumina, it is desired by the smelter as flux.

There is a variation in the thickness of the mineralized zone from 2 to 9 feet. The average thickness is probably less than 4 feet.

Gold, silver, and copper values are erratic and apparently there is no proportional relationship between the gold and copper. Much of the gold is "free" and the miners follow the gold, for shipping ore, by panning the faces in the stopes and drifts.

MINE DEVELOPMENT

Apparently no systematic development plan was ever followed. The miners followed the ore in tunnels, inclined shafts, and stopes. Some of the workings are shown on the Geological Survey map referred to. Most of the ore mined by Bullard Gold Mines, Inc. has come from the large stope on the south side of the mountain.

The ore is mined in open stopes, with occasional pillars for support. The ground stands well and very little timbering is required. The ore may be classified as fairly hard. It breaks well from the hanging wall or the footwall, but seldom from both. Horses of waste and overlaps of ore have increased the mining difficulties and the problem of differentiating between ore and waste.

Broken ore in the stopes is slushed down a raise into an underground ore bin. From here it is trammed to an outside bin from which it is loaded into trucks.

EQUIPMENT

Mine equipment consists of:

1- 320 cu. ft. compressor

1- 160 cu. ft. compressor

2- Slusher hoists with scrapers

1- Air "Tugger" hoist

2- Hoists

3- Jackhammer rock drills

1- Stoper drill

1- Truck

Some steel, tram cars and miscellaneous equipment.

WORK BY BUREAU OF MINES

Four vertical diamond drill holes were drilled by the Bureau as follows:

Hole No. 1 (fig.4) located east of the fault zone, showed a trace of gold and copper at a depth of 37.2 feet which continued to 54.4 feet. From 54.4 to 60.0 feet, a vein width of 5.2 feet assuming the dip of the vein to be 20°, the weighted average is 0.196 ounce gold and 0.20 ounce silver per ton and 1.27 percent copper. The hole was continued to 75.4 feet with no further mineral showing.

Hole No. 2 (fig. 4), located about 60 feet north and east of the areas stoped, showed a trace of gold and copper for 4.4 feet (46.0 to 50.4 feet). From 50.4 to 51.5 feet (1.1 feet) the average is 1.50 percent copper but only a trace of gold. The ore in the

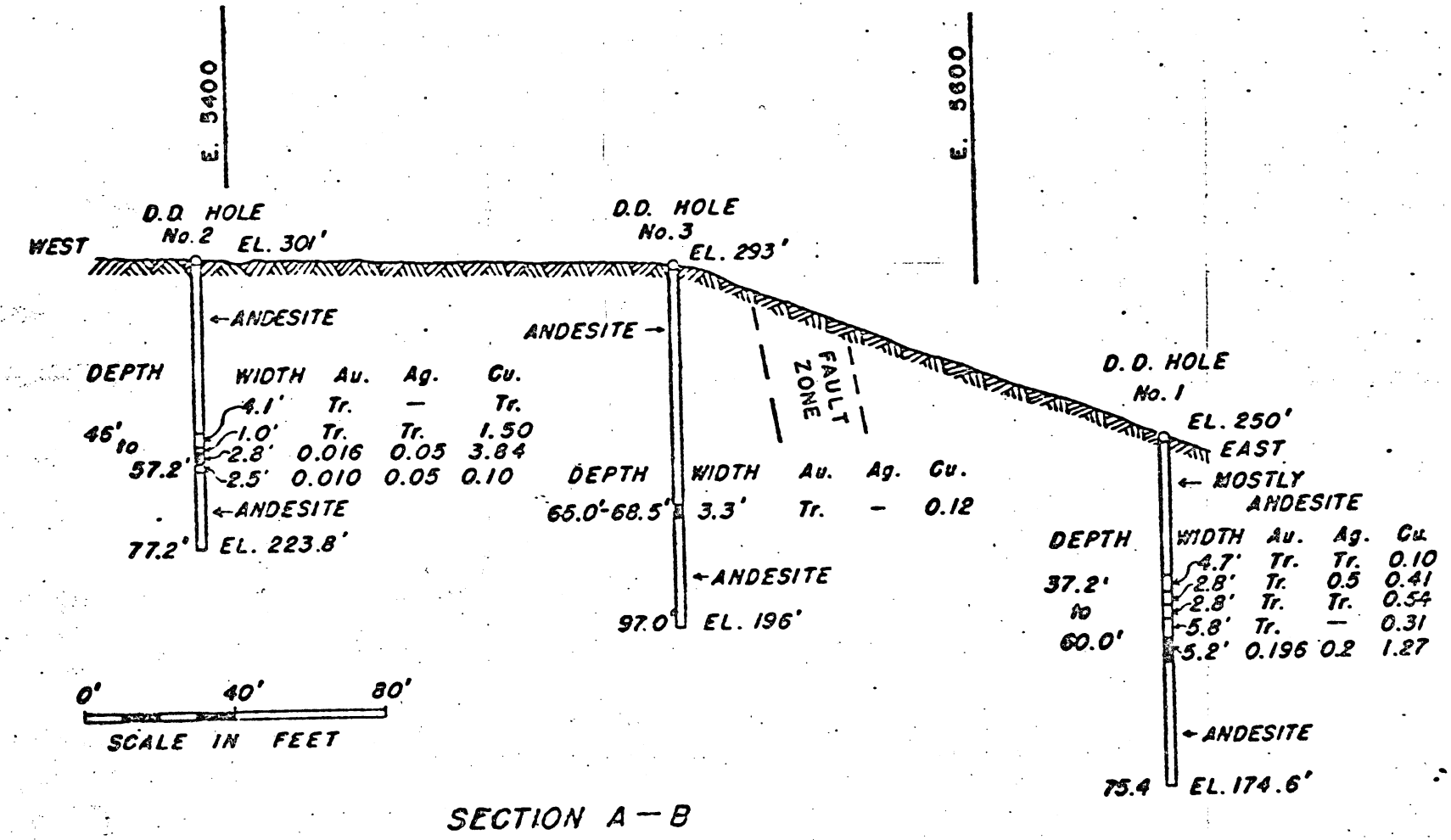


Figure 4 - Section through drill holes 1, 2, and 3

vein occurs at a depth of 51.5 to 54.5 feet, representing a vein width of 2.8 feet. It has a weighted average of 0.016 ounce gold per ton, 0.05 ounce silver per ton, and 3.64 percent copper. The next 2.7 feet showed a trace of gold and copper. This hole was continued to a depth of 77.2 feet but showed no additional values.

Hole No. 3, located halfway between holes 1 and 2 on the same east-west line and just west of the fault zone, was drilled to a depth of 97.0 feet but showed no ore. A sample from 65.0 to 68.5 feet showed some quartz, which assayed a trace in gold and 0.12 percent copper.

Hole 4 (fig. 5), located about 30 feet west of a face in the main stope, showed ore from 37.2 to 40.2 feet, 2.8 feet wide. The weighted average is 0.07 ounce gold, 0.10 ounce silver per ton, and 2.88 percent copper. The interval from 40.2 to 42.0 feet assayed a trace in gold and 0.35 percent copper. The hole was bottomed at 63.2 feet.

Drilling by the Bureau of Mines indicated ore at a distance of 30 to 75 feet in three different directions from the present workings.

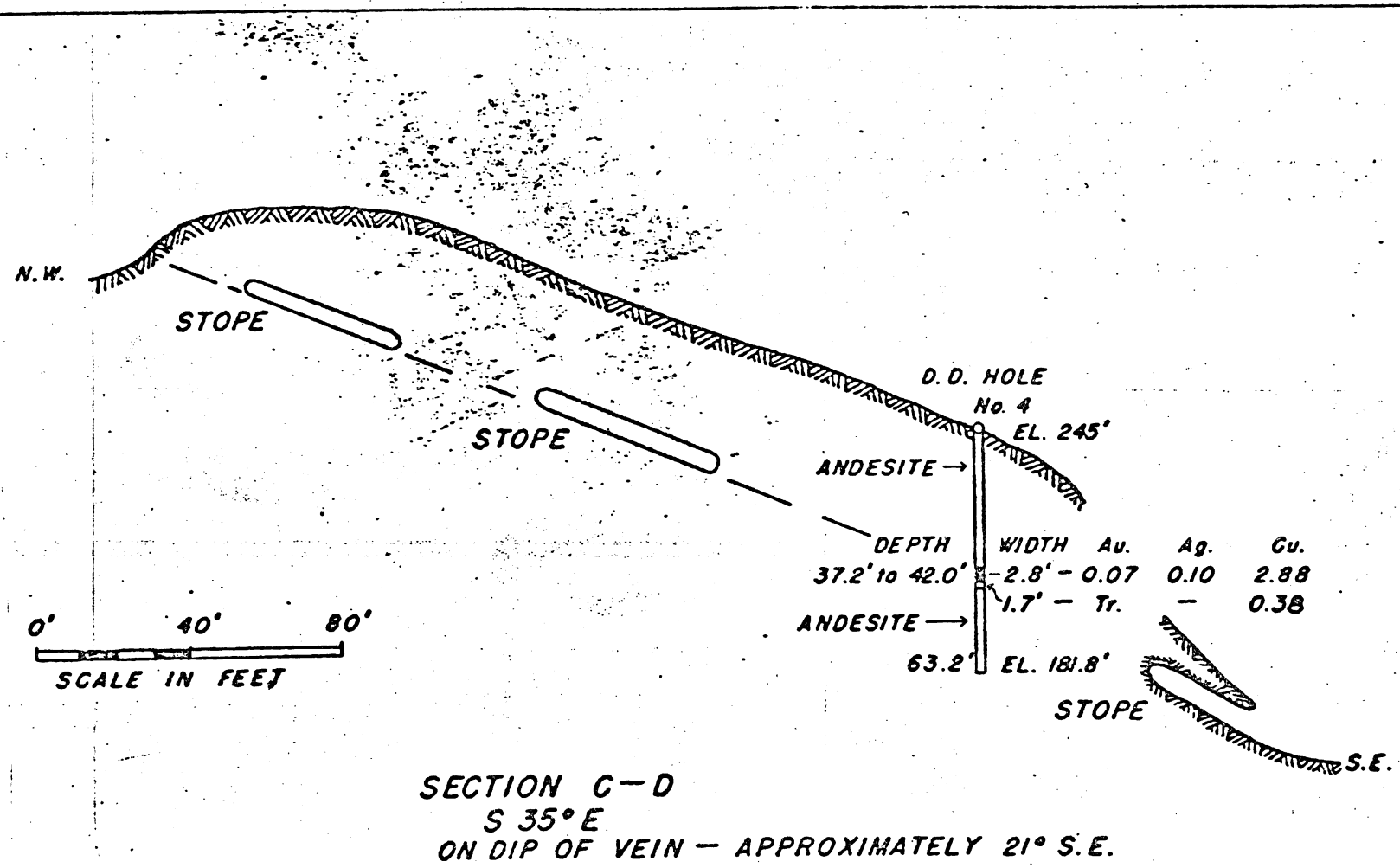
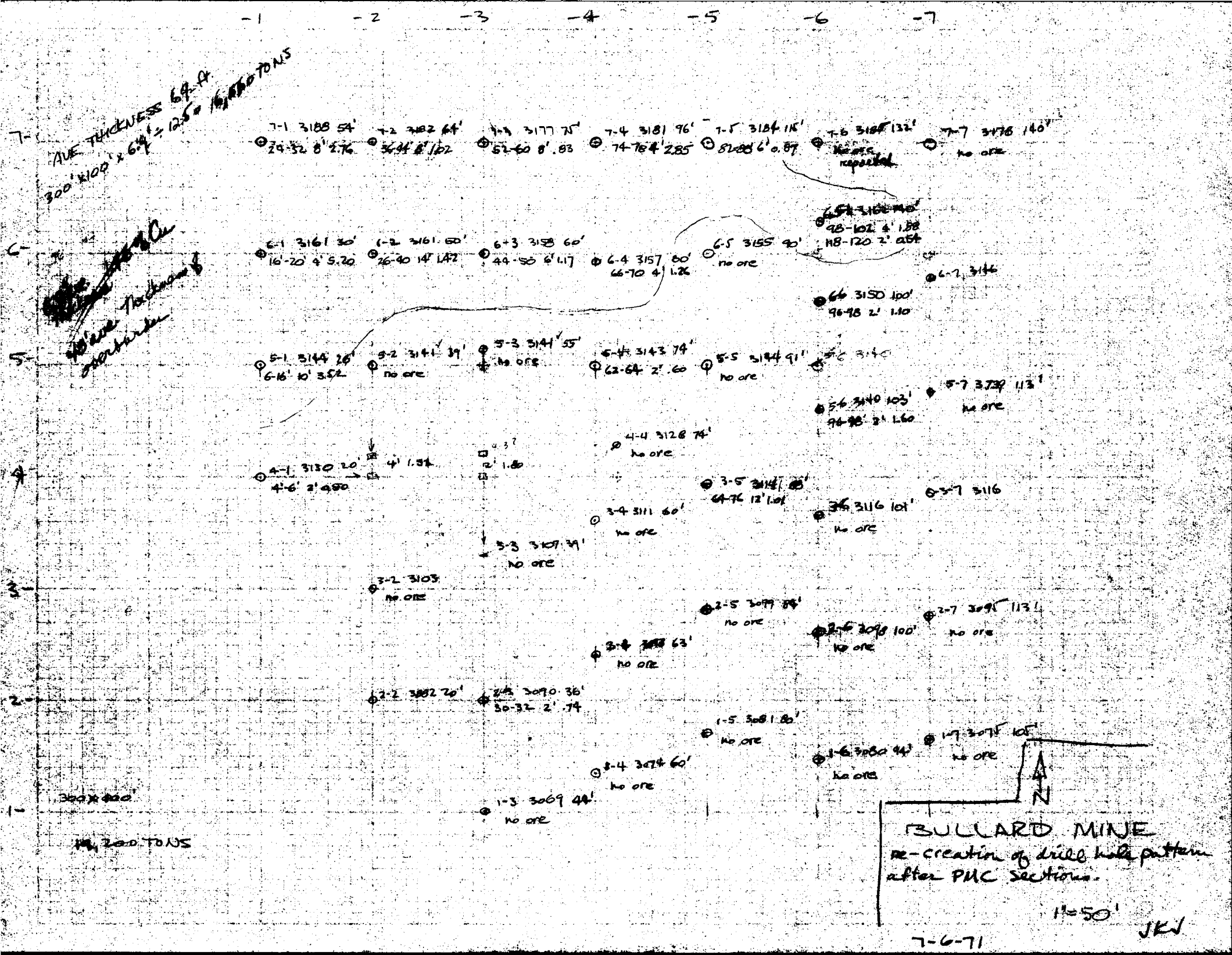


Figure 5 - Section through main stope and drill hole 4



-1 -2 -3 -4 -5 -6 -7
AVE THICKNESS 64 ft
300' x 100' x 64' ÷ 12.5 = 16,560 TONS
7-1 3188 54' 24-32 8' 2.76
7-2 3182 64' 36-44 8' 1.02
7-3 3177 75' 52-60 8' .83
7-4 3181 96' 74-78 4' 2.85
7-5 3184 115' 82-88 6' 0.87
7-6 3185 132' no ore reported
7-7 3178 140' no ore
6-1 3161 30' 16'-20' 4' 5.20
6-2 3161 50' 26-40 14' 1.42
6-3 3158 60' 44-50 6' 1.17
6-4 3157 80' 66-70 4' 1.26
6-5 3155 90' no ore
98-102 4' 1.88
118-120 2' 0.54
6-7 3146
66 3150 100' 96-98 2' 1.10
5-1 3144 26' 6-16' 10' 3.52
5-2 3141 39' no ore
5-3 3141 55' no ore
5-4 3143 74' 62-64 2' .60
5-5 3144 91' no ore
5-6 3140 103' 96-98 2' 1.60
5-7 3139 113' no ore
4-1 3130 20' 4'-6' 2' 4.80
4' 1.52
2' 1.80
4-4 3128 74' no ore
3-5 3114 88' 64-76 12' 1.01
3-6 3116 101' no ore
3-7 3116
3-4 3111 60' no ore
3-3 3107 39' no ore
3-2 3103 no ore
2-5 3099 84' no ore
2-6 3098 100' no ore
2-7 3095 113' no ore
3-4 3098 63' no ore
2-2 3082 20'
2-3 3090 36' 30-32 2' .74
1-5 3081 80' no ore
1-6 3080 94' no ore
1-7 3075 105' no ore
3-4 3074 60' no ore
1-3 3069 44' no ore
300 x 100'
19,200 TONS
N
BULLARD MINE
re-creation of drill hole pattern after PMC sections.
1" = 50'
JKJ
7-6-71

CAPITOL EXPLORATION

25% each. Larry Drake
Fred Frasier - Investments, Insurance, Cols.
Bill Murray Attorney Portland
Jerry Willis
Willis & Drake have option to buy out Frasier.

---

we have ± to July 10

MON.

Larry Drake 887-6152

AGUILA COPPER
576 acres patented land

2 groups (120 acre group, another 456 acre group)

74 unpatented claims to west adjoining & partly surrounding

PATENTED LAND KNOWN AS BULLARD

near Aguila, to NW.

Private Corp, CAPEX, owned by 4 people including Larry Drake.

625,000 TONS 2% ore

5 million lbs Cu./yr. for 5 years.

might develop 3 or 4 million tons.

POWDERED METALS DRILLED OUT COPPER.

Payment due ~~already July~~ July 25 to PMC

1) DOWN PAYMENT $75,000 advance against royalties

2) 90 DAY OPTION $125,000 for 51% interest

to check out feasibility of 500 TPD plant

3) INSTALL PLANT, 500 TPD

$400,000 to $500,000 COST

Based on sections provided by Larry Drake the drilled out area contains about 16,000 tons at 1.96% Cu, and is covered by an average of 48 feet of apparently barren material. Average ore thickness is 7 feet. If this average thickness were projected throughout the entire area known to be underlain by the vein, a surface area of some 920,000 square feet, the resulting potential would be 515,000 tons.