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MINING PRACTICE AND METHODS AT THE UNITED VERDE EXTENSION MINING COMPANY, JEROME, ARIZ.

BY

RICHARD L. D'ARCY

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

MINING PRACTICE AND METHODS AT THE UNITED VERDE EXTENSION MINING COMPANY, JEROME, ARIZ.[1]

By Richard L. D'Arcy[2]

INTRODUCTION

This paper describing the mining practice and methods at the United Verde Extension mine, Jerome, Ariz., is one of a series of papers in preparation by the Bureau of Mines presenting the mining methods used in various mining districts of the United States.

The United Verde Extension mine is a massive, high-grade deposit of copper sulphide containing some gold and silver and is mined almost exclusively by the conventional square-set method with some local modifications.

About 450 men are employed underground and 1200 tons of direct smelting ore is produced per day. Figure 1 is a surface map of the Jerome district.

ACKNOWLEDGMENTS

The author acknowledges the assistance of Olaf Hondrum, chief engineer, and Roy H. Marks, efficiency engineer, United Verde Extension Mining Co., and also that of E. D. Gardner, supervising engineer, and C. H. Johnson, assistant mining engineer, U. S. Bureau of Mines, Tucson, Ariz.

HISTORY OF DISTRICT

The development of the Jerome mining district as an important source of copper, gold, and silver dates from the development of the mine of the United Verde Copper Co. This mine was located in 1876 and worked in a small way at shallow depth for its gold-silver values until purchased in 1889 by Senator W. A. Clark of Montana. Production from this mine increased steadily, especially after 1894, when the narrow-gauge railroad from Jerome Junction was built. From 1900 to 1918, inclusive, the mine produced slightly over 7 million

1. The Bureau of Mines will welcome reprinting of this paper, provided the following footnote acknowledgment is used: "Reprinted from U. S. Bureau of Mines Information Circular 6250."

2 - One of the consulting engineers, U. S. Bureau of Mines, General Superintendent, United Verde Extension Mining Co.

5%Cu

tons of ore containing 750,000,000 pounds of copper, 12,374,000 ounces of silver, and 403,000 ounces of gold. Recovery per ton for this period was about 100 pounds of copper, 1.75 ounces of silver, and 0.057 ounces of gold. From 1918 to date the United Verde has been one of the most important mines in Arizona, and the total metal value of its product probably has been greater than that of any other mine in the State.

The success of this mine encouraged capitalists to attempt to find other important ore bodies in the district; this led to the development of the United Verde Extension, the second large mine of the district.

The United Verde Extension mine was brought to successful production through the efforts of James S. Douglas and associates, who assumed the financing of the property from the time when it was a small prospect. Their efforts were rewarded in December, 1914, by the discovery of a small high-grade vein of chalcocite. Finally in January, 1916, a big lens of high-grade chalcocite was opened up on the 1400 level. This lens, when fully outlined on this level, proved to be oval, with a maximum length of 500 feet and a maximum width of 300 feet. Virtually all of the lens was clean, high-grade ore. From then on the mine rapidly became an important producer.

Production started in 1915 and has been maintained ever since. From 1915 to 1928, inclusive, the mine produced slightly over 2,000,000 tons of ore containing approximately 535,000,000 pounds of copper, 4,100,000 ounces of silver, and 76,000 ounces of gold, with a gross metal value of approximately $98,000,000.

GEOLOGY

The geology of the Jerome district has been described in detail by L. E. Reber, jr.[3] The Verde fault is perhaps the most striking structural feature of the district. This fault strikes about N. 40° W. and can be traced on the surface for miles. The dip is about 59° to the northeast. It is a normal fault, and has a known vertical downthrow of approximately 1,600 feet.

The United Verde mine is immediately west of the fault; that is to say, it is located in the footwall, while the United Verde Extension mine is close to the fault in the hanging wall.

The fault is directly responsible for the discovery of the United Verde mine. It cut through the mineralized zone, dropping the section to the east 1,600 feet, as has been stated, leaving the greater portion of the zone in the footwall but exposing it in the newly-formed hillside.

The geologic section (fig. 2) at right angles to the fault shows the sequence of the geological formations. The United Verde Extension shafts go through lava, conglomerate,

3 - Reber, L.E., Jr., Geology and Ore Deposits of the Jerome District: Min. and Met., May, 1920.

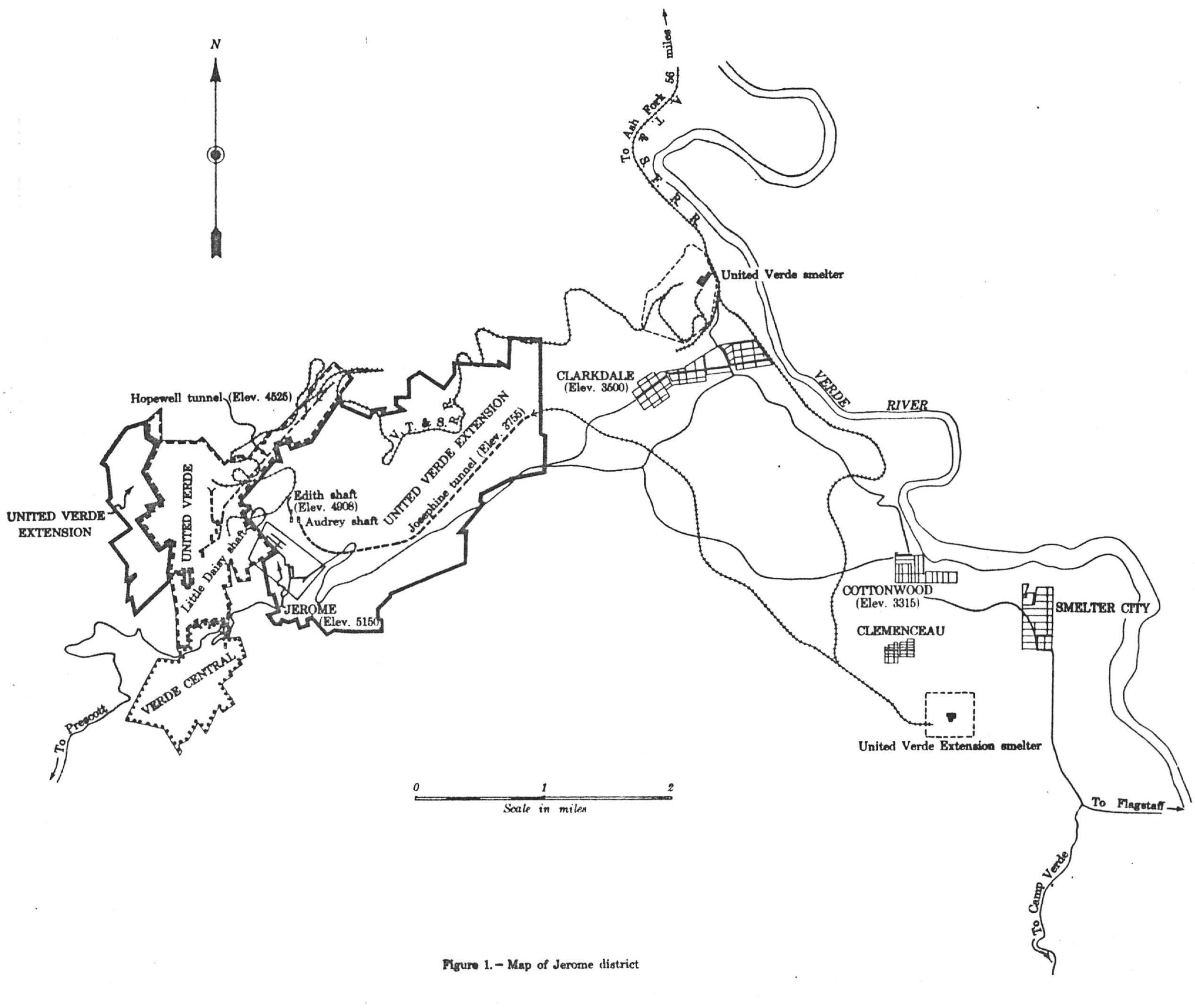


Figure 1. – Map of Jerome district

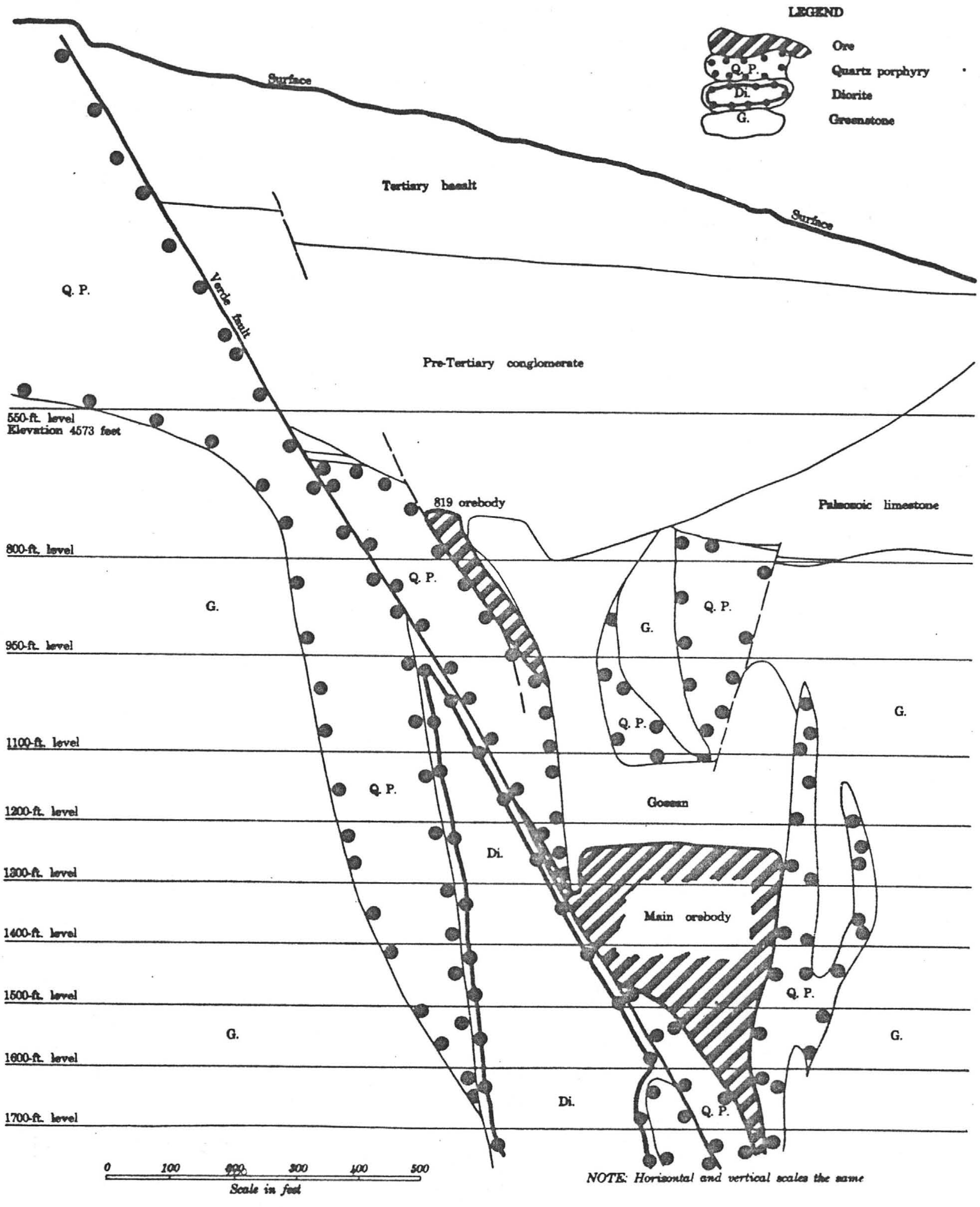


Figure 2. – Vertical geologic section (N. 45° E.) through main orebody

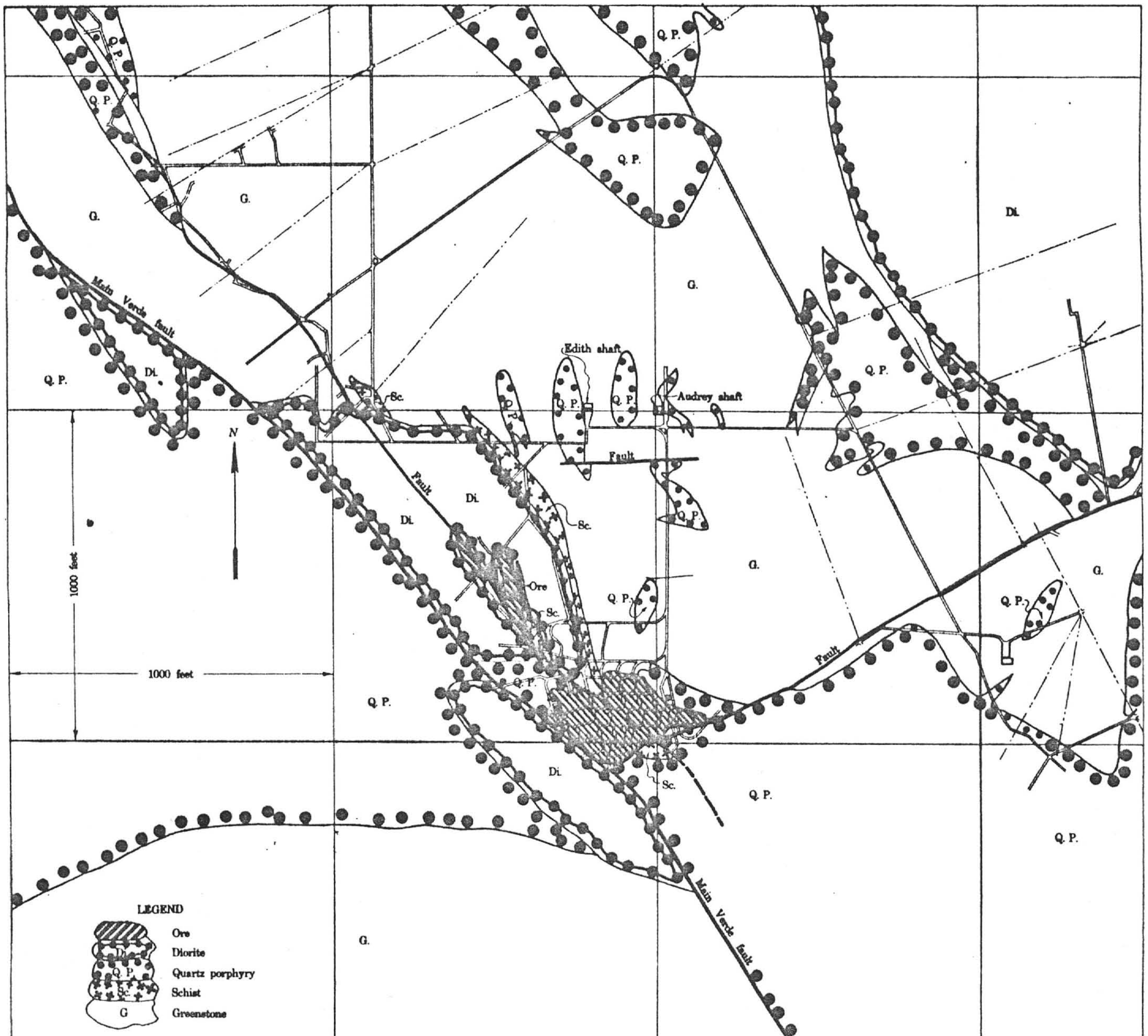
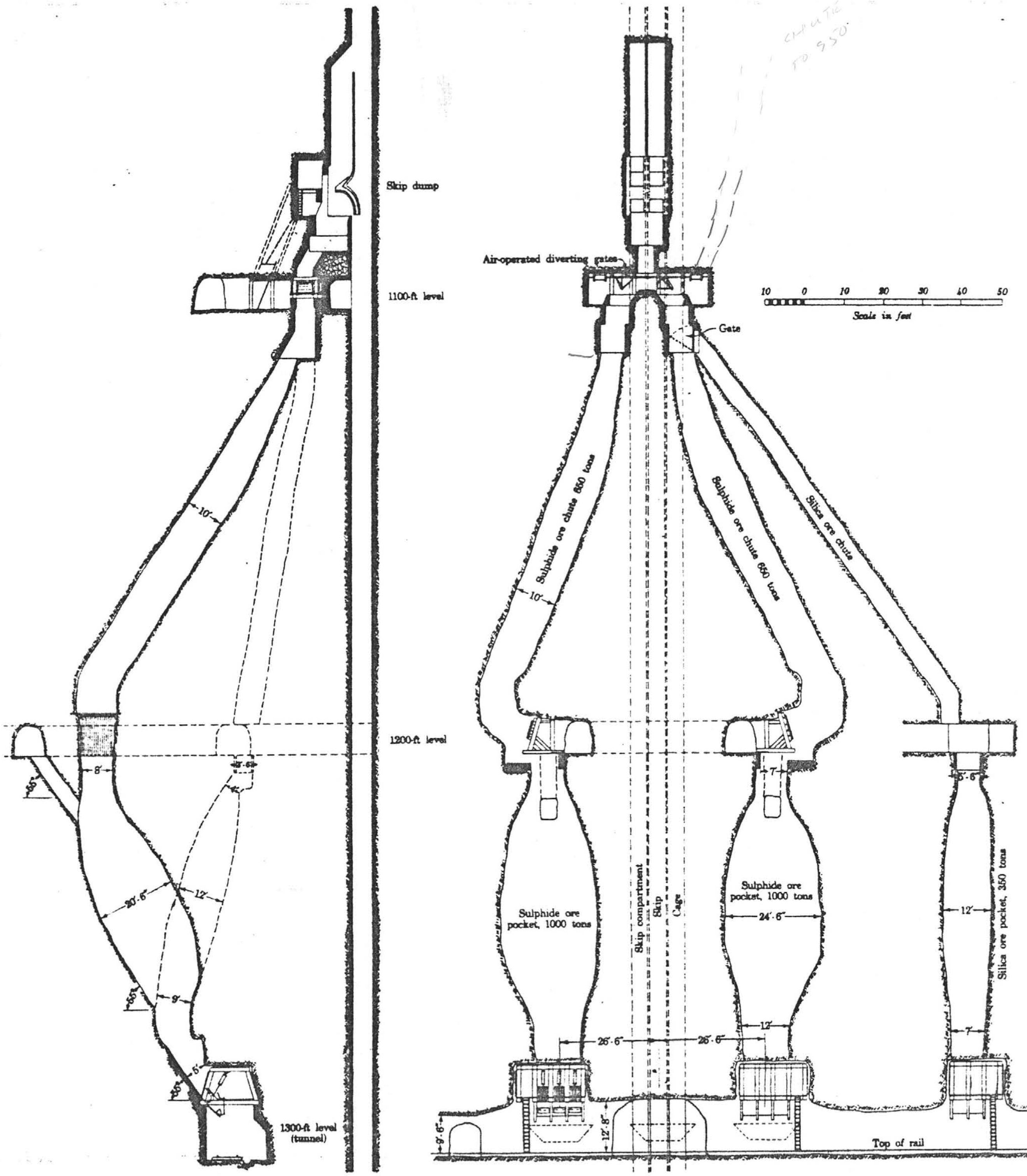


Figure 3. – Geologic plan of typical haulage level



PROJECTION LOOKING SOUTH

PROJECTION LOOKING WEST

Figure 4. – Loading pockets at Audrey shaft

limestone, and sandstone before encountering the pre-Cambrian rocks about 600 feet below the surface. The general distribution of the pre-Cambrian formations is shown in Figure 3, a plan of the 1400 level. The principal types of rock are diorite, quartz porphyry, greenstone, and schist. Greenstone is a name given to a variety of complex rocks, from fine-grained greenish black basic rocks, to light-colored rocks resembling rhyolites. Probably the schist is mainly altered quartz porphyry and altered greenstones of the more acid types. It is in the schist that most of the ore in the district is found.

METHODS OF DEVELOPMENT AND MINING

Development

The mine is operated through two vertical 3-compartment shafts and a large cross-section haulage adit connecting both shafts on the 1300 level. Both shafts are of concrete, located about 200 feet apart and 1,000 feet north of the main ore-bearing zone. This location has been very satisfactory because the shafts have been in firm rock from collar to bottom; conditions have been ideal for the rather elaborate system of ore and waste pockets, skip-dump pockets, transfer raises, and tunnel-loading pockets immediately adjoining the shafts.

The layout of ore pockets at the Audrey shaft is shown in Figure 4. Ore from below the tunnel level is hoisted in 3-ton skips running in counterbalance to a point above the 1100 level; the skip is dumped by movable guides which show red lights in front of the hoisting engineer when in dumping position and green lights when the shaft is clear. The ore passes from the dumping point to an air-operated deflecting door on the 1100 level, which turns the ore one way or the other as desired. Three converging pockets meet just below this deflector, two for sulphide ore and one for silica converter ore. From these pockets the ore is loaded into trains of standard-gauge cars in the main haulage adit on the 1300 level. Control at this point is by means of finger gates made from bent 70-pound rails operated by air cylinders.

The main tunnel is 2-1/4 miles long and approximately 10 by 10 feet in cross section. Some sections of the tunnel are of solid-concrete arch construction, and others are timbered with 12 by 12 inch sets on 5-foot centers. About 4,000 feet is rock section with gunite coating, and the remainder is unsupported rock section.

From the portal of the tunnel a standard-gauge railroad connects with the smelter at Clemenceau about 5 miles distant (fig. 1). Haulage through the tunnel is with a 25-ton electric motor handling trains of eight 30-ton cars, which are made into trains of 16 cars each at the portal and taken to the smelter by a steam locomotive.

Levels are run on the 550, 800, 950, and 1100 foot elevations and on 100-foot intervals from 1100 to 1900 feet, inclusive. These elevations refer to distances below the collar of the Daisy, an old prospect shaft. The actual depth of each level below the collars of the Edith and Audrey main shafts is about 200 feet less than indicated. The main producing levels in the big ore lens are the 1300, 1400, 1500, and 1600. Production from outlying smaller ore bodies extends from the 550 to the 1700 levels.

Development details

Shafts

As stated before, both main shafts, known as the Audrey and Edith, are of solid concrete. The Audrey is the ore-hoisting shaft, while the Edith is used for handling men and supplies and development waste. The Audrey is operated one shift and the Edith three shifts per 24 hours. The Audrey shaft was equipped after the ore was found and was concreted immediately, but the Edith was sunk for prospecting purposes and was at first timbered. Later, it was concreted, and Figure 5 shows a cross section of the completed concrete. The changing of this shaft from timber to concrete was done partly on a cost-plus basis with a contractor in charge of the job, and partly by a picked mine crew working under a bonus agreement. A comparison of these two methods is rather instructive and is favorable to the bonus work, where each man participated in the benefits. Shaft-sinking has since been done under a similar agreement, with very satisfactory results.

Following are details of the shaft concreting costs:

Edith shaft concreting

Three-compartment shaft (2 hoisting compartments 4 feet by 5 feet 6 inches, and 1 manway and pipe compartment 5 feet 2 inches by 5 feet 6 inches), shaft wall containing 6 pipes in sizes varying from 2 to 8 inches.

Shaft concreted from 1400 level to surface, a distance of 1205 feet, including 7 stations.

Work started February 1, 1921; completed July 25, 1921.

Work was done in two sections; first section from 800 to surface, 575 feet on contract basis, second section, 1400 level to 800 level, 630 feet, was done on bonus basis on footage made per day.

The actual cost of mixing and placing the concrete in each section, not considering the preliminary cost of installing the crushing plant, removing old pipe lines, and placing guides and chairs in the concreted sections, was in each instance as follows:

1st section

575 feet, including 2 stations.
Work started February 1, 1921; finished
April 21, 80 days.
Average advance, 7.19 feet per day.

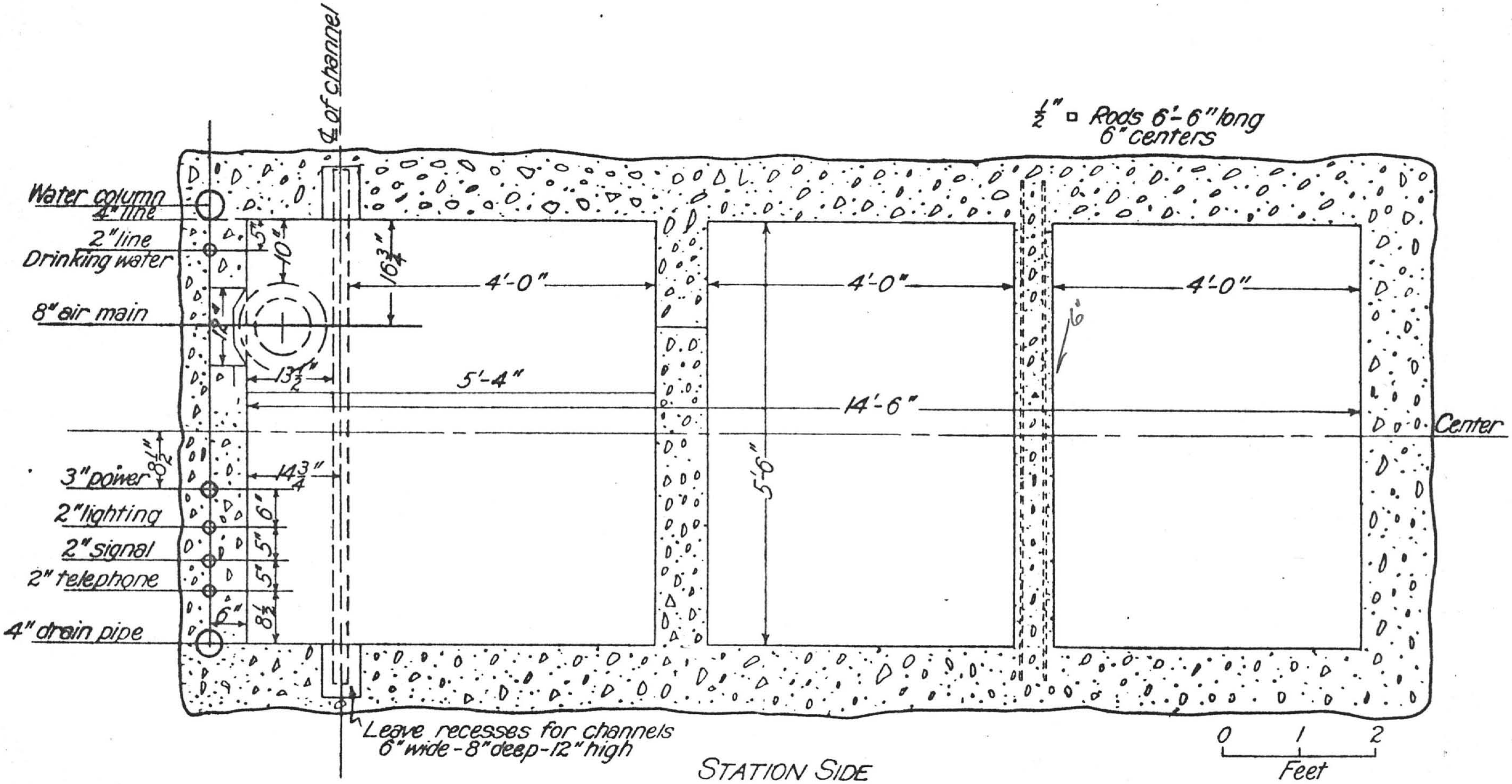


Figure 5.-Section of concrete, Edith Shaft

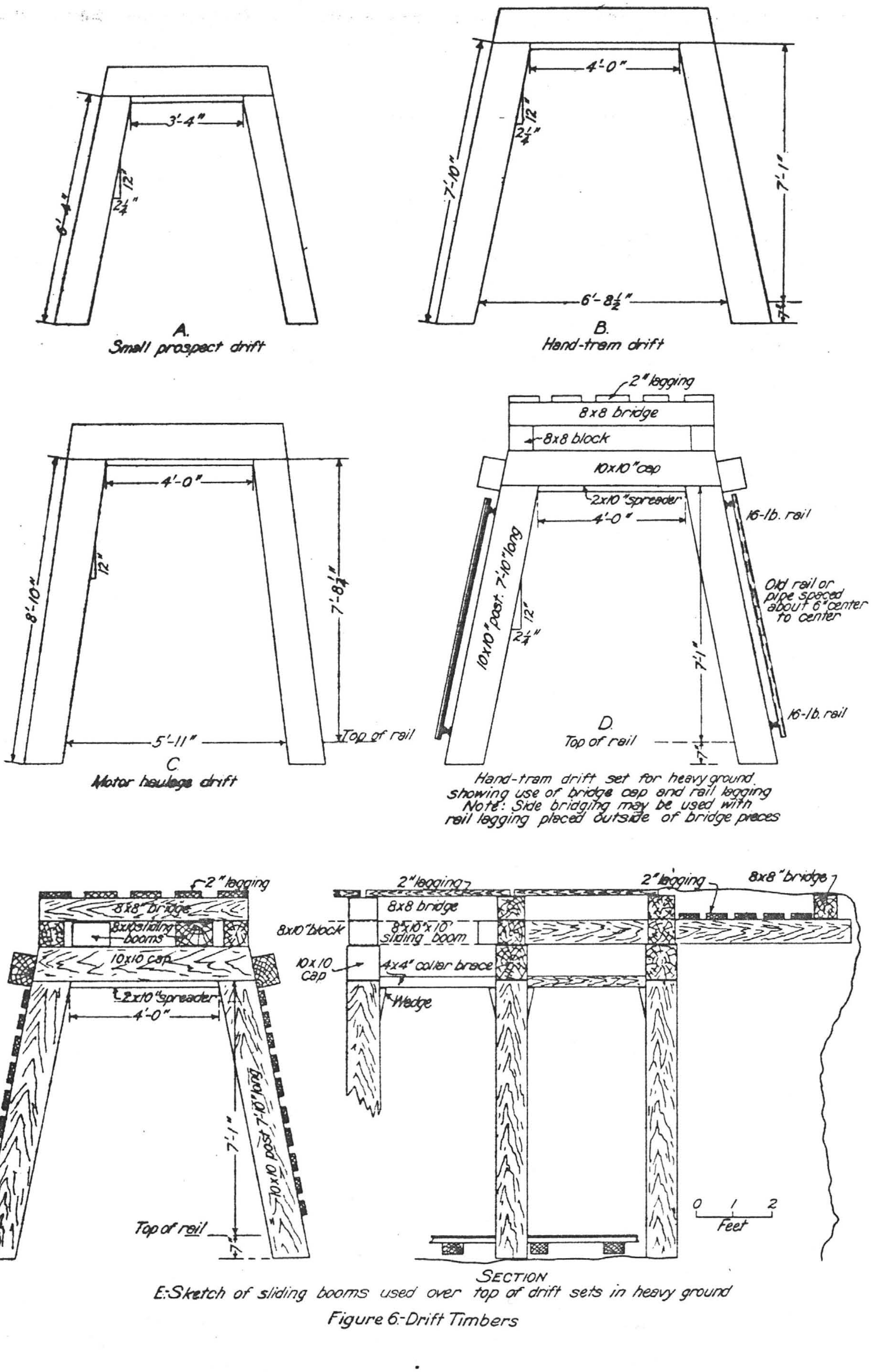


Figure 6.-Drift Timbers

Costs

Labor (including supervision at $10 per day)	$8,827.20
Cement (6,564 sacks at $1.10 per sack)	7,220.40
Sand and gravel, (1,498.1 yds. at $2.50 per yd.)	3,745.25
Power used hoisting and crushing (25,380 kw. h. at 2¢ per kw. h.)	507.60
Reinforcing iron, 10 lb. per ft. of shaft at 10¢ per lb.	575.00
Form lumber $1.50 per foot shaft	862.50
Bonus paid	3,075.00
Total cost for 575 feet	$24,812.95
Cost per foot	$43.14

2d section

Distance concreted, 630 feet, including 5 stations.
Work started May 1, 1921; finished July 25, 1921, 86 days.
Actual time of concreting this section of shaft, after deducting the time lost in cutting new stations, was 69 days, or an average per day of 9.13 feet.

Costs

Labor (including supervision at $225 per mo.)	$5,068.50
Cement used (6,256 sacks at $1.10 per sack)	6,881.60
Sand and gravel (1,434.5 yds. at $2.50 per yd.)	3,586.25
Power used hoisting and crushing (29,310 kw.h. at 2¢ per kw.h.).	586.20
Reinforcing iron, 10 lb. per ft. of shaft, at 10¢ per lb.	630.00
Form lumber (640 ft. of shaft at $1.50 per ft.)	945.00
Bonus paid	2,056.50
Total cost of completing section	$19,754.05
Cost per foot	$31.35

Mixture used was 1 part cement, 2 parts sand, 5 parts crushed rock, or 5-1/3 sacks of cement, 10 cubic feet fines, and 23 cubic feet crushed rock per yard of concrete in place.

Drifts

Many different rock conditions are found in the mine, varying from very hard quartz gossan to extremely heavy swelling ground. To meet these conditions several kinds of standard drift timbering are in use. Figure 6 (a), (b), and (c) show the various sets used for (a) a small prospect drift, (b) an ordinary hand-tramming drift, and (c) a motor drift;

also (d) shows the use of old rails or pipe in place of lagging in ground that is very soft and inclined to swell. It has been found that by using rail lagging in swelling ground the soft ground squeezes through between the rails, and very little pressure develops on the set itself. Figure 6 (e) shows a method of timbering in soft ground which is not bad enough to require spilling and still needs some support overhead. This is provided by carrying sliding booms over the sets which are pushed ahead as needed.

In the main haulage tunnel several different types of support were used, two of which are shown in Figures 7 (a) and (b).

Guniting

Guniting was used very successfully in a section of the main tunnel 4,000 feet long. This part of the tunnel was through an old recemented river-channel conglomerate, which was comparatively hard when first broken but after exposure to air and moisture tended to slack and slough. Had this not been gunited it would have needed timbering through the entire section. The gunite has now held for over 10 years. If this section had been supported by timber it would have needed at least one complete renewal of the timber. Gunite has been applied in other sections of the mine with little success, due to slight ground movements, that break the gunite and render it useless in a very short time.

A record of the cost of guniting this 4,000-foot section of the main tunnel follows.

Size of tunnel	10 by 10 feet
Footage gunited	4,098
Mixture used	1 cement to 3 sand
Applications	2 coats

Costs

Labor	$2,581.29
Cement (2,056 sacks at $1.10 per sack)	2,250.60
Sand (263 yds. at $2.50 per yd.)	657.50
Machinery repairs and supplies	282.84
Total cost	$5,772.23
Cost per linear foot of tunnel	1.40
Cost per sq. ft., approximately	.046

Bulkhead drift sets

A system of holding extremely heavy gangways through the pillars in the main ore body is shown in Figure 8. It has been found that solid timber bulkhead built as shown, using the waste ends of timber that accumulate in a mine of this kind, will hold a ground pressure that would break ordinary heavy timber sets several times a year. In fact, on one level a section of this kind of bulkheading put in on one side of a drift opposite a solid

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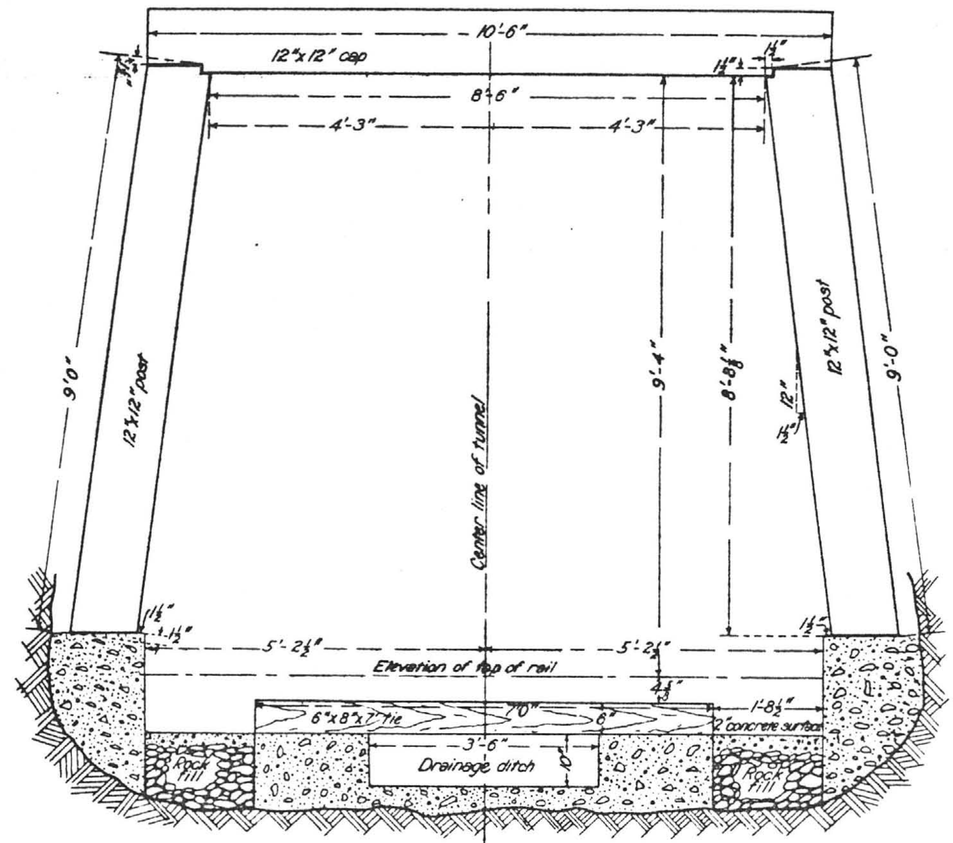


Figure 7-A.-Standard 12"x12" Tunnel Timber

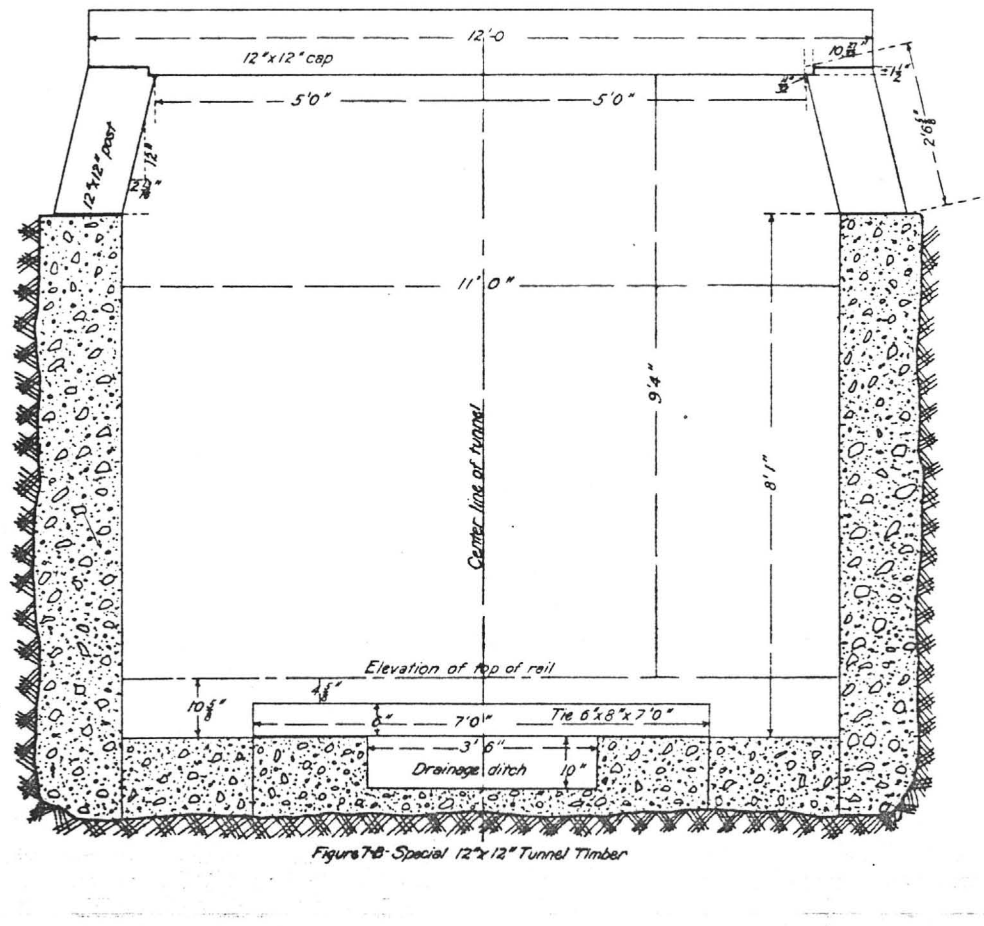


Figure 7-B-Special 12"x12" Tunnel Timber

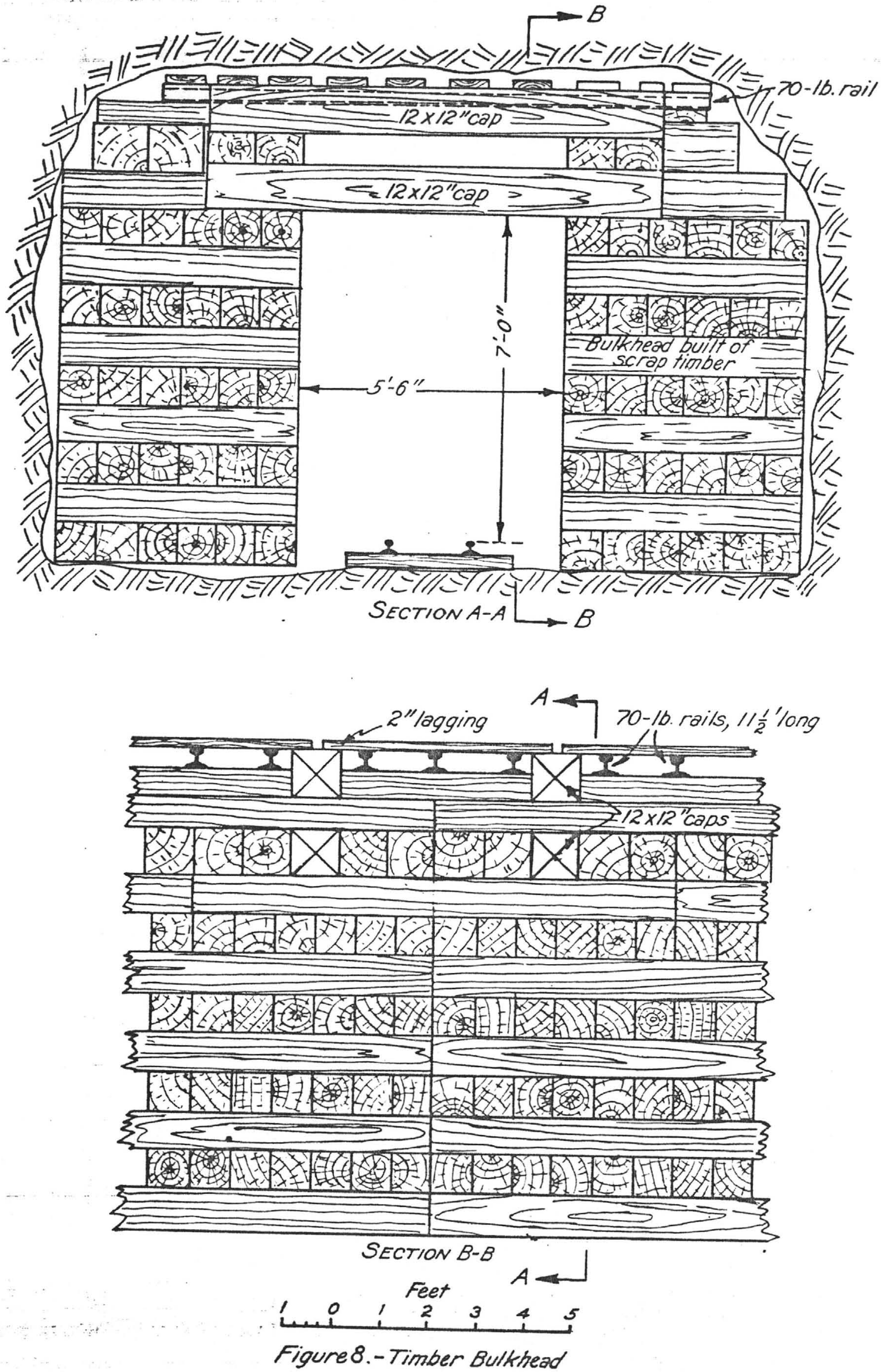


Figure 8.-Timber Bulkhead

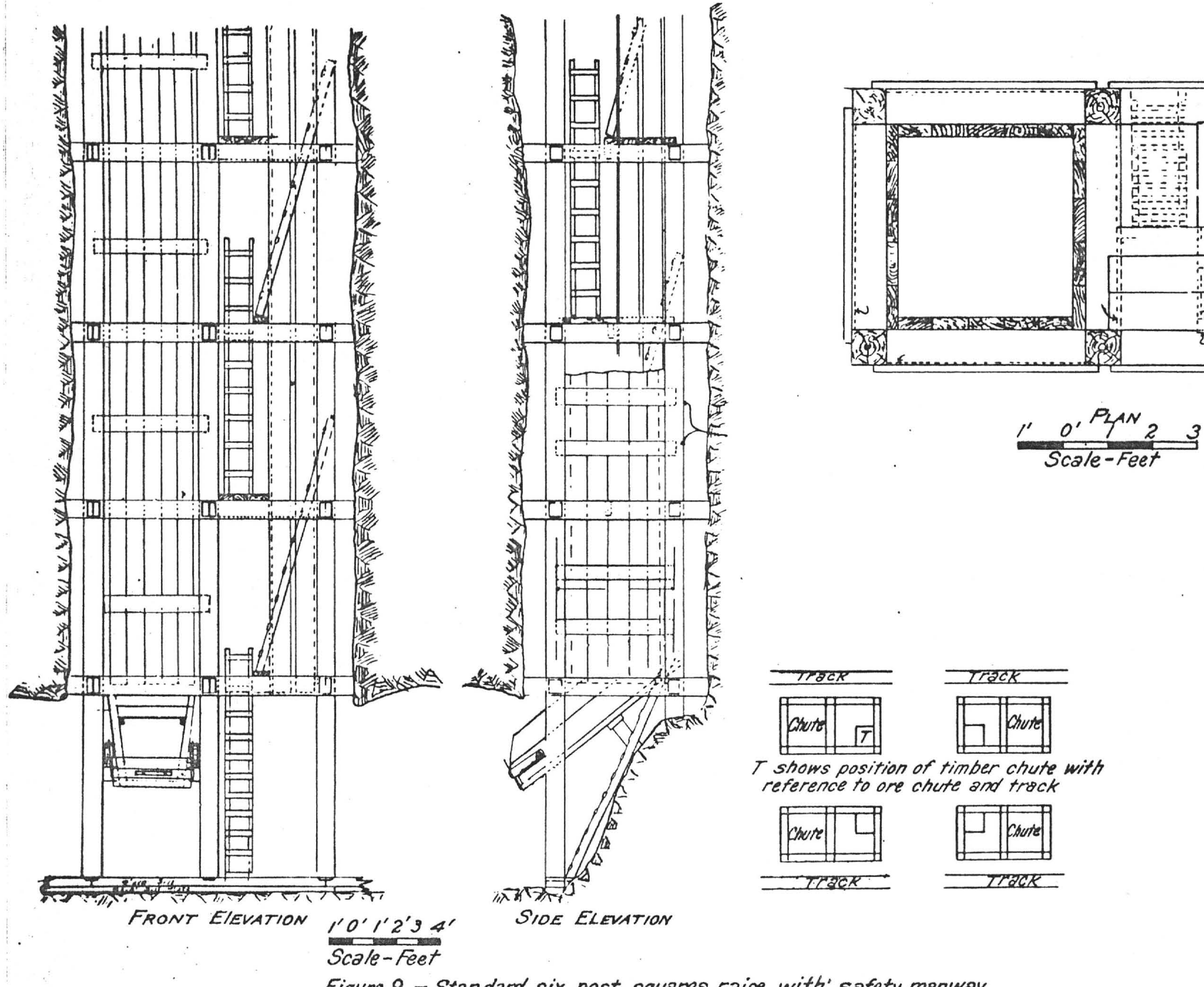
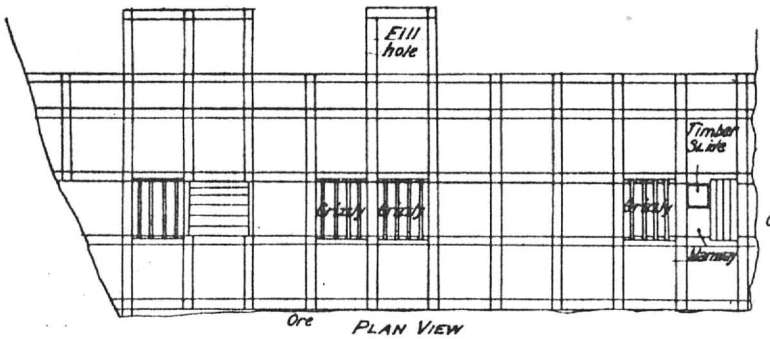


Figure 9. – Standard six post squares raise with safety manway



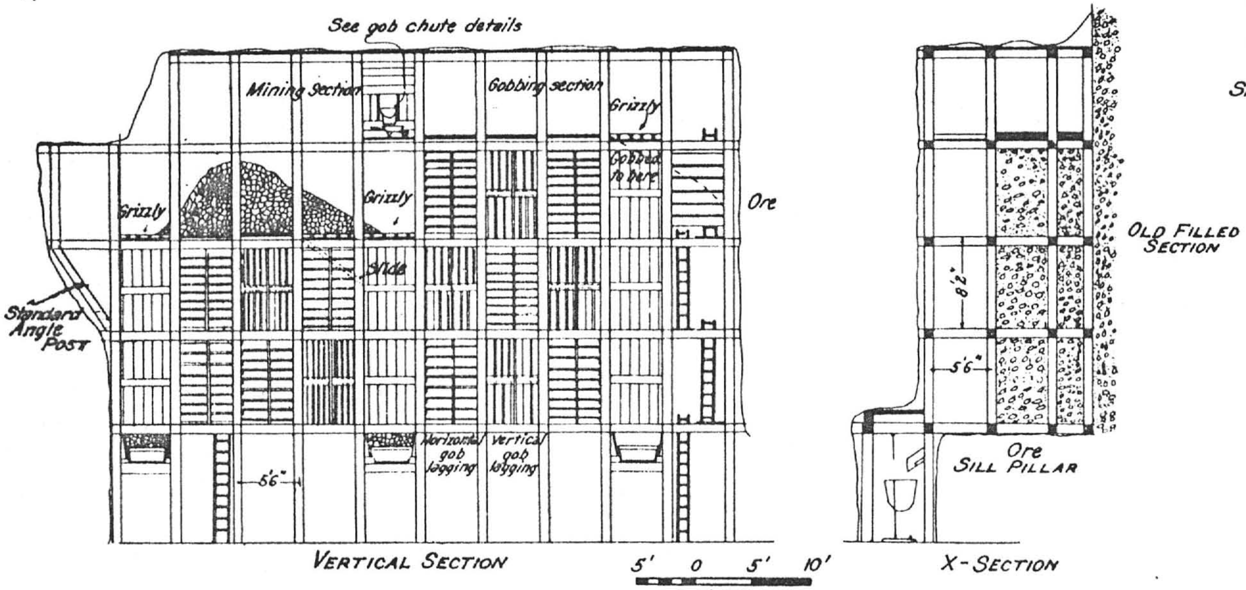
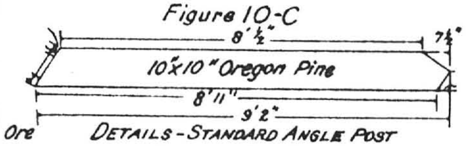


Figure 10-A: Typical Square Set Stoping Method

Figure 10-C



DETAILS - STANDARD ANGLE POST

1 0 1 2 3

Scale-Feet

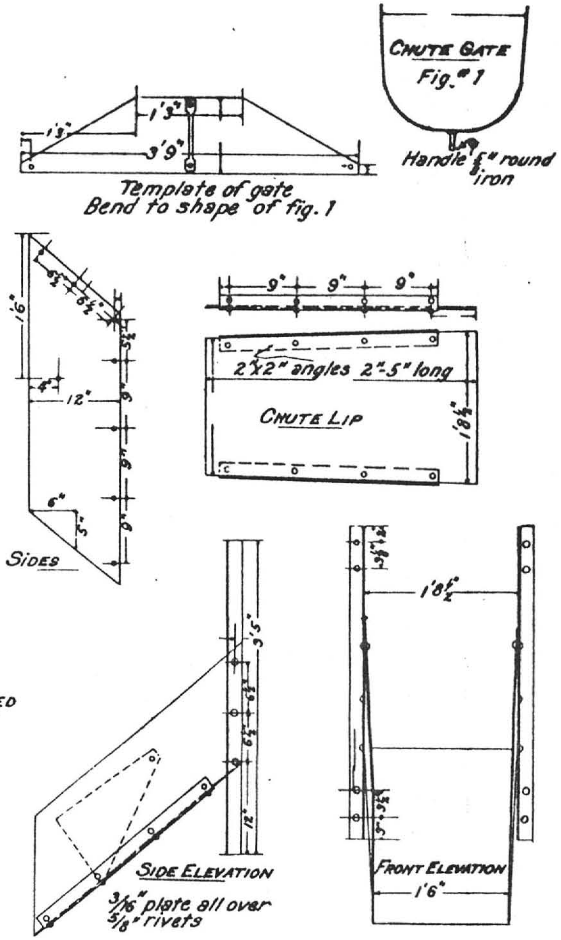


Figure 10-B: GOB CHUTE DETAILS

1' 0 1' 2'

Scale-Feet

reinforced concrete bulkhead 5 feet thick has stood the strain very well, while the concrete has been forced out of place and cracked and has had to be blasted away to make clearance for gangways.

Raises

Three kinds of timbered raises are run in the mine. Wherever the work is to be followed by square-set stoping the standard 2-compartment square-set raise shown in Figure 9 is used. The chute compartment is lined with 2 or 3 inch Oregon fir lining, depending upon the service expected. The manway provides a timber slide in one corner and has landing platforms on each floor. In addition to the square-set raise two kinds of cribbed raises are in use. The smaller raise is timbered with 3-inch Oregon fir cribbing, giving two compartments 3-1/2 by 3-1/2 feet in the clear. For heavier use cribbing is made of 6 by 8 inch material and compartments are 4 by 4 feet in the clear.

Stoping

Because of the heavy massive nature of the main ore body, the richness of the ore, and the necessity for mining in such a way that no blocks of sulphide ore are allowed to move and generate heat only the square-set system of mining with stopes tightly filled with waste has ever been used in the main sulphide lens. By using the square-set system of mining with stopes tightly filled with waste complete extraction of the main ore body has been possible with practically no dilution. Moreover, this system has allowed careful prospecting of the walls, which has resulted in finding many small rich lenses of ore that would otherwise have been missed.

A typical stope is shown in plan and section in Figure 10 (a). The stope sections are usually 3 sets wide in fairly solid ore and 2 sets wide in the heavier ground. If the ore is very badly broken it is sometimes removed in slices a single set in width. Slices are taken 100 feet high, as that is the interval between levels throughout the mine. The length of the slice may be anything to suit the conditions, usually being from 10 to 20 sets. Ore chutes are placed in about every fourth set, and alternate chutes have manways beside them. By spacing chutes in this manner and leaving slides with grizzlies in adjoining sets as shown the shoveling of ore into chutes is virtually eliminated. If no weight develops on the timbers after one floor is removed another is removed and sometimes several more before filling with waste. This reduces the cost of mining, as most of the ore rolls to the chutes, and a large part of the fill can be run into place by gravity. When several floors are mined before filling the timber is protected from the fall of the blasted ore by placing grizzlies of 70-pound rails, 6 feet long, held in metal holders, immediately below the mining floor. By using metal holders the grizzlies are moved very readily and placed where needed. After one section is finished it is filled entirely, except the chutes and manways needed for entrance to and mining of the next slice. The chutes also serve for fill holes for running waste into the new section. By having a fill hole in about every sixth set and mining several floors before filling there is very little shoveling of waste fill. If conditions are such that the waste will not spread a light metal gob chute is placed in the fill hole and the waste spread with a car or wheelbarrow. Figure 10 (b) shows the details of the chute gate.

All timber used in stoping is standardized (fig. 11). Figure 10 (c) shows a standard angle post for offsetting a set. In the heavier sulphide stopes nearly all timber is 10 by 10 Oregon fir, but in the lighter ground much 8 by 8 Oregon fir is used. In the heaviest sill-floor gangways all timber is of 12 by 12 dimensions.

Although the general method of mining used is the well-known square-set system several modifications have been developed locally to apply to conditions existing in this particular ore body. A general technique of mining under this system has been developed, which has an all-important bearing upon the efficiency and safety of the mining, especially in holding the unmined pillars so that there is no movement of ore, with resultant heat and danger of fire.

A system of mining badly broken pillars by stoping up through the center with small square-set cuts, then tying across the top with timber stringers and slicing the sides downward, has been quite successfully used. This method is shown in Figure 12. On most of the producing levels in the main ore body the mining has been done in such a way that pillars usually about six sets wide have been left over the main extraction gangways, extending vertically from level to level. These pillars have been standing for many years while the ore on both sides and on the level above has been removed. Resultant movement has in many instances thoroughly broken these pillars so that they would be very difficult to mine by ordinary square-setting from the bottom upward. Moreover, the gob lining between the pillars and old stope sections is often found to be rotten and broken. By taking a small square-set slice up through the middle of the pillar, using as a cutting point the old chute and manway in the section previously mined and filled, then tying across the top under the old filled level above and coming down with a series of 10 by 10 timber stringers from pilot sets to the old gob line, it has been found that these pillars can be removed very effectively. Quite often this ore between the sets and the old gob can be taken down by the use of a bar alone, without using explosives at all. If the old gob line is broken or rotten it is braced back by stulls between the stringers and new cross lagging. After one-half is finished it is filled with waste dumped in from the level above and the other half mined the same way. After all the mining is completed everything is filled except a chute and manway on the advancing side to be used as a cutting point for the next slice.

Underground transportation

Main haulage levels in the main ore body are maintained on the 1400 and 1600 levels, and the ore from the levels above is passed through a series of transfer raises. Haulage on these levels is done with 5-ton trolley locomotives running on tracks with 30-pound rails and minimum curves of 25-foot radius. The car used in this haulage is the 30 cubic foot side-dump car shown in Figure 13. Cars of this type have been in continuous operation for 12 years and have proved satisfactory. Chute doors used throughout the mine are illustrated in Figure 14. This type of chute door was copied from one used in the United Verde mine. The same type of door, operated by an air cylinder, is in use on most of the main haulage transfer chutes. A 16-cubic foot car used for hand tramming is also shown in Figure 14.

On other levels where the tonnage produced is much less and where the working

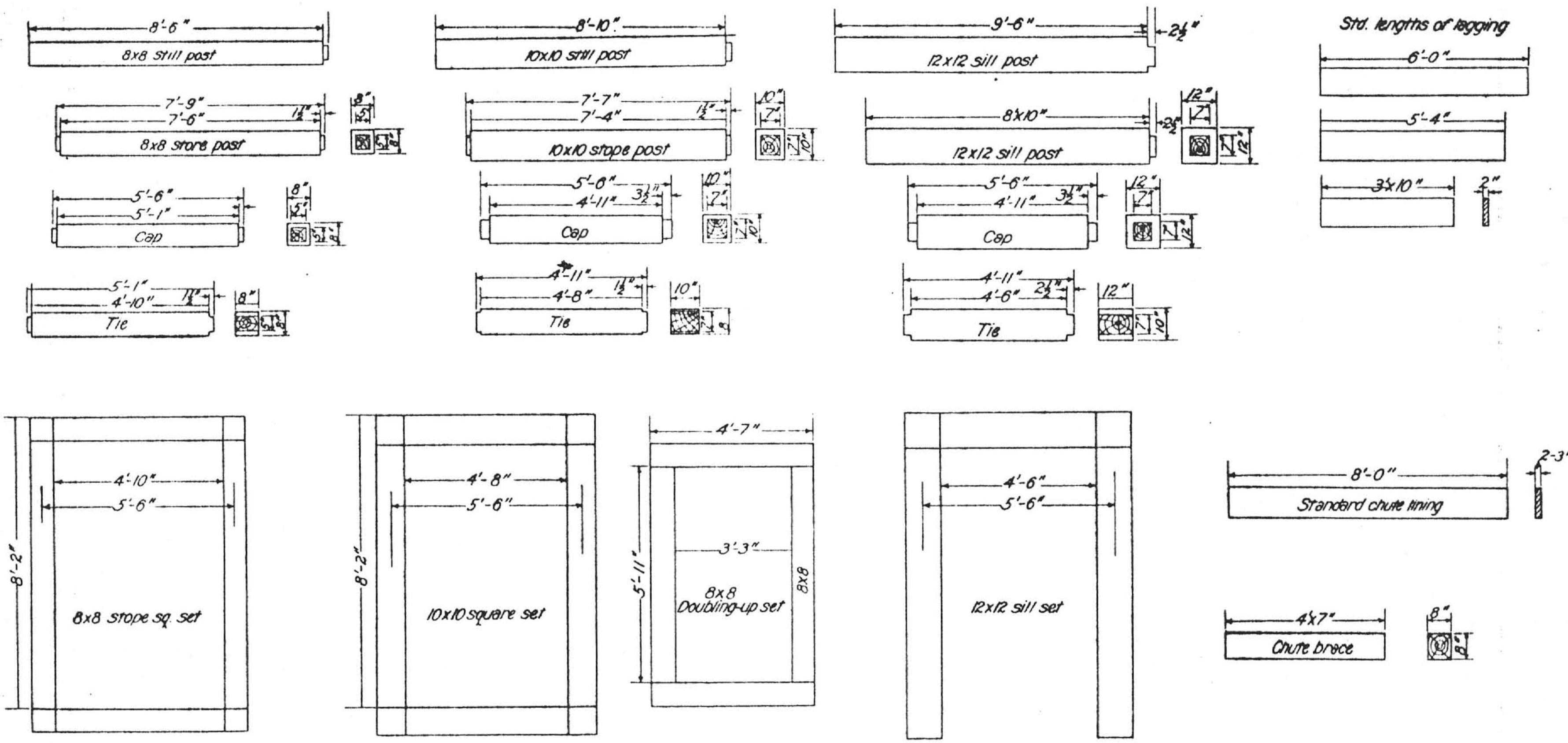


Figure 11.- Standard Stope Timber

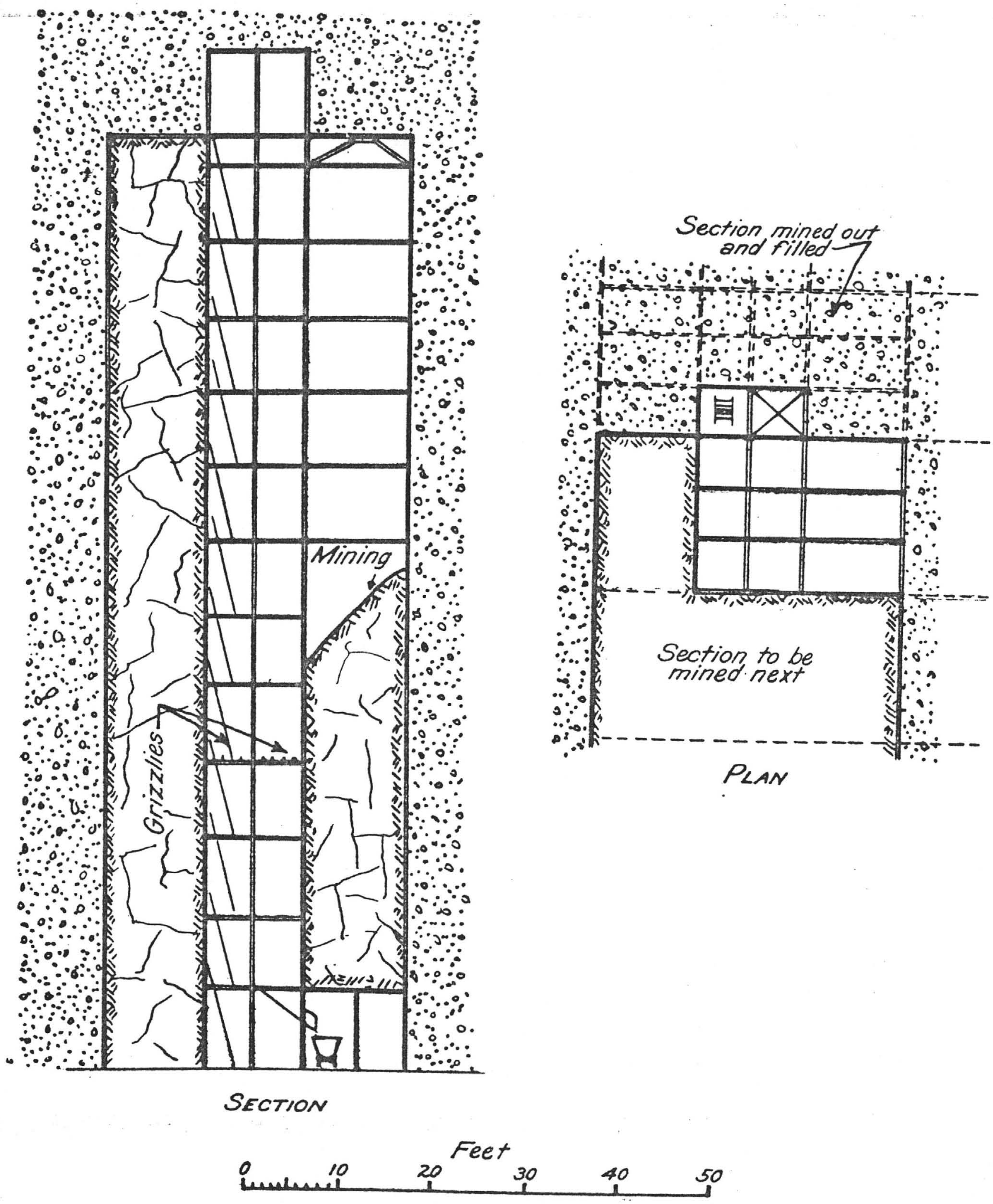


Figure 12.- Modified Mitchell slice used for mining pillars

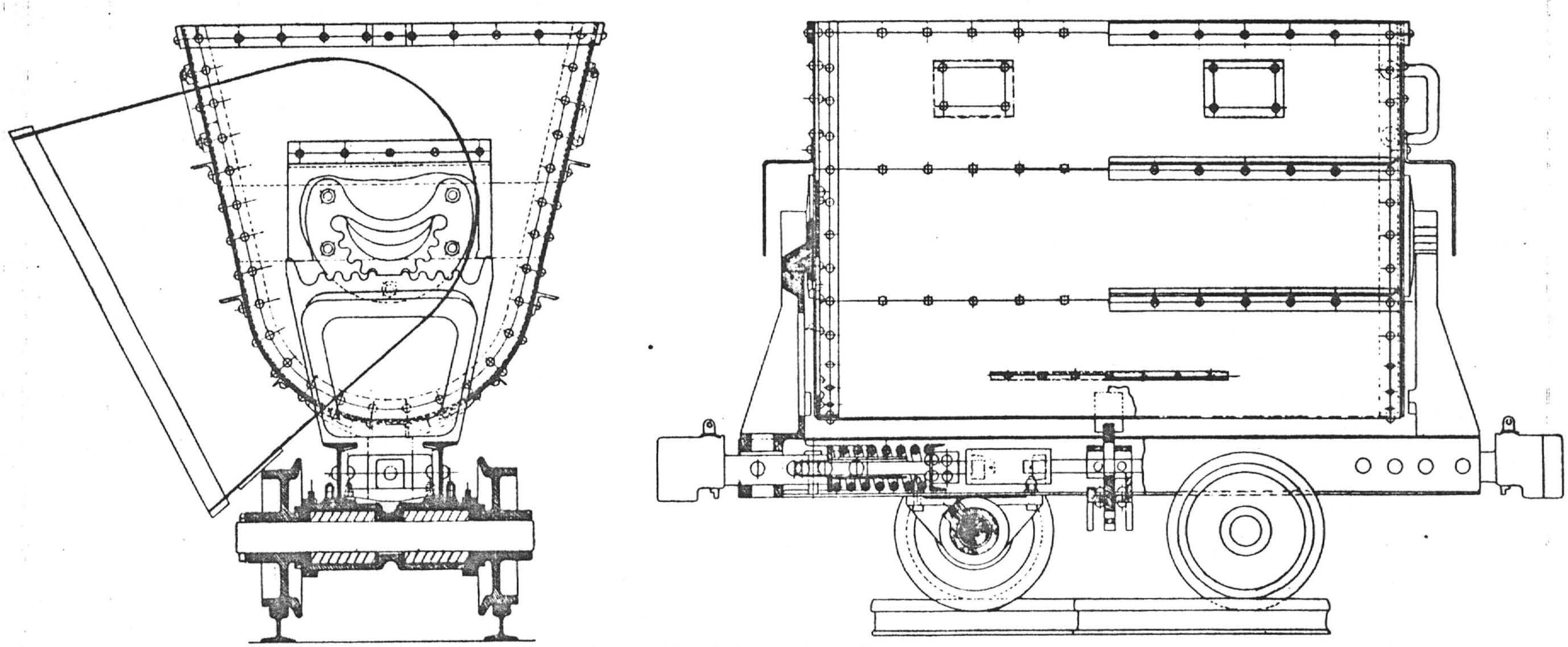


Figure 13.- 30-Cu.Ft. Mine car

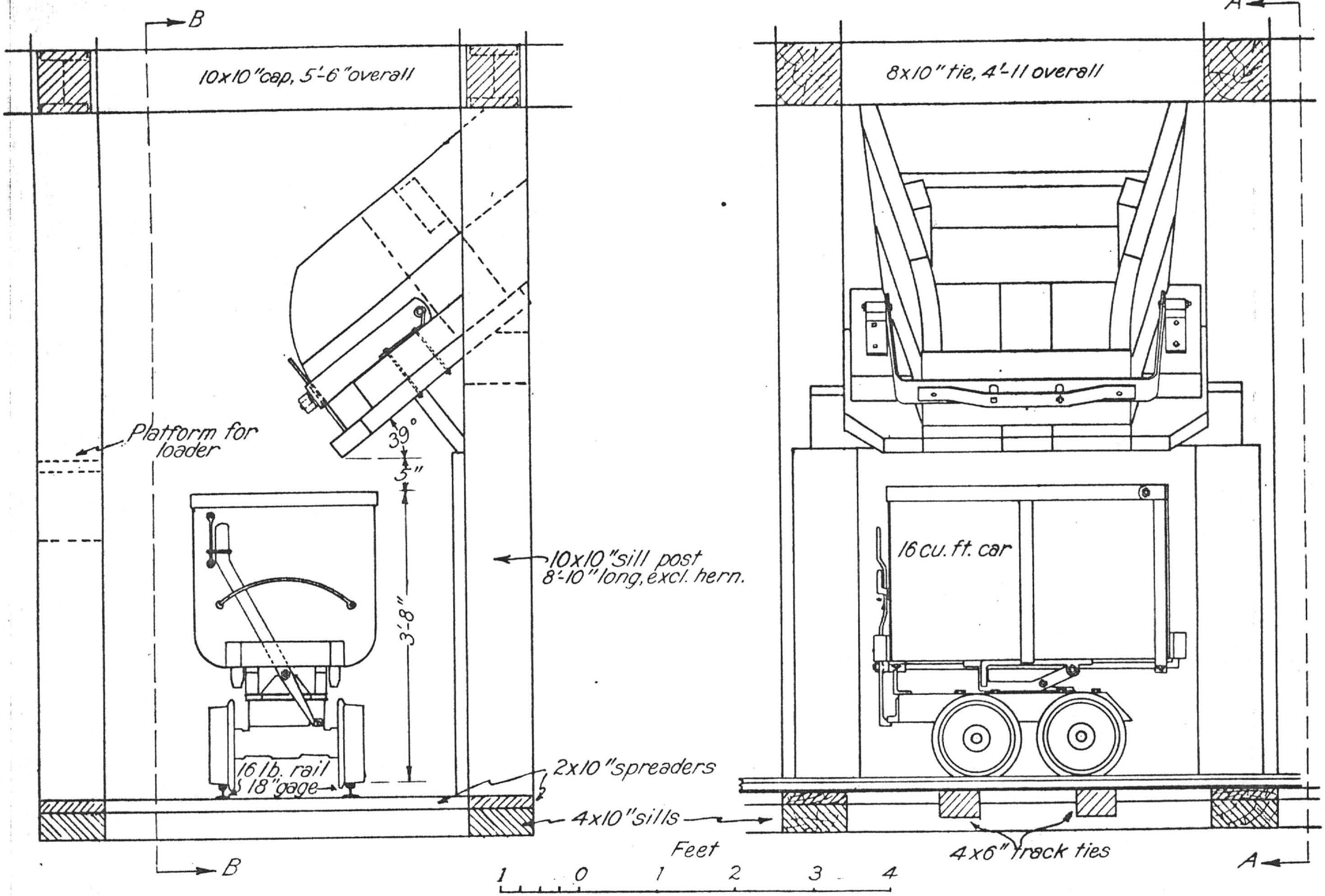


Figure 14. - United Verde Chute Gate and 16-Cu. Ft. Car

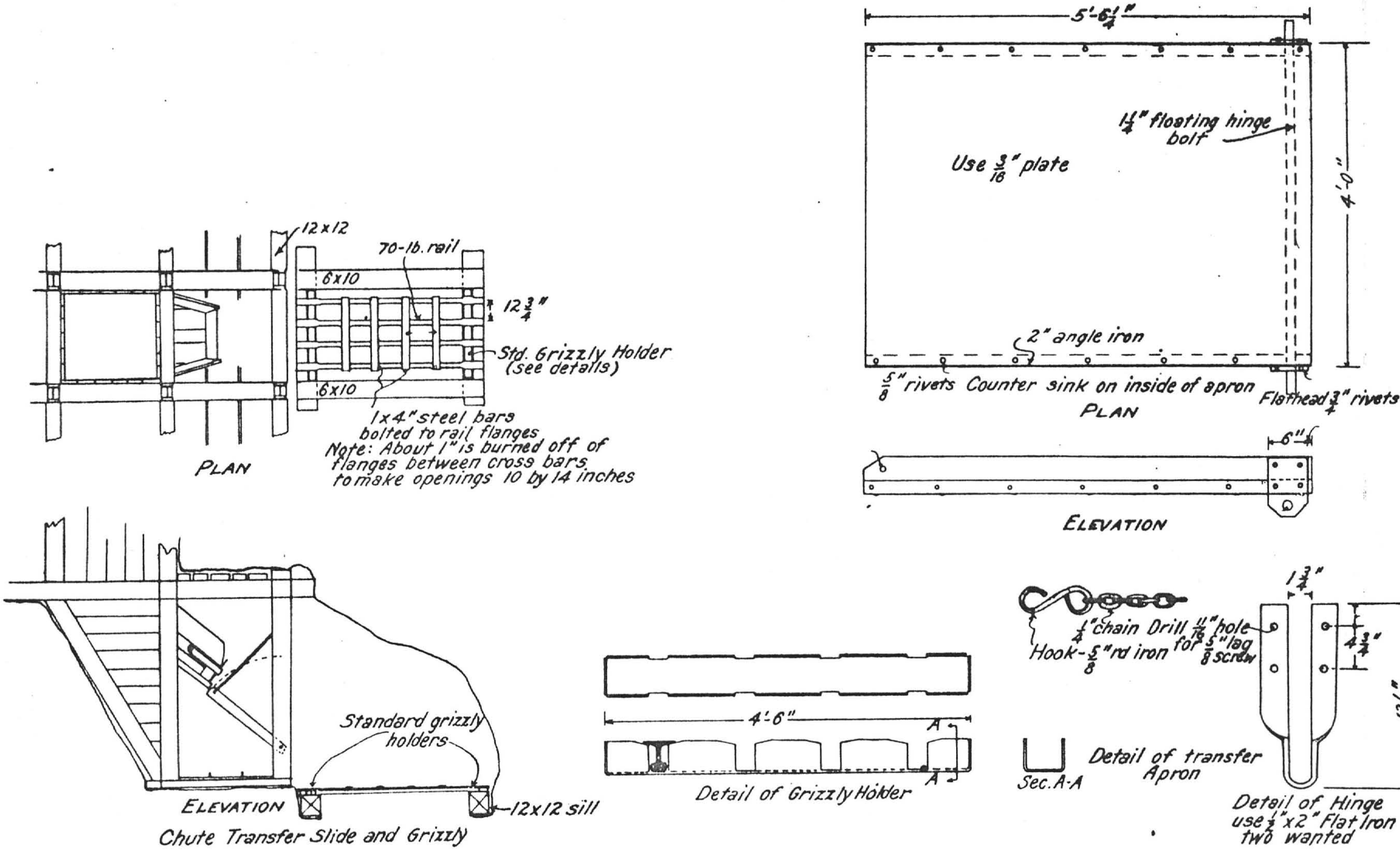


Figure 15.- Chute Transfer Slide and Grizzly

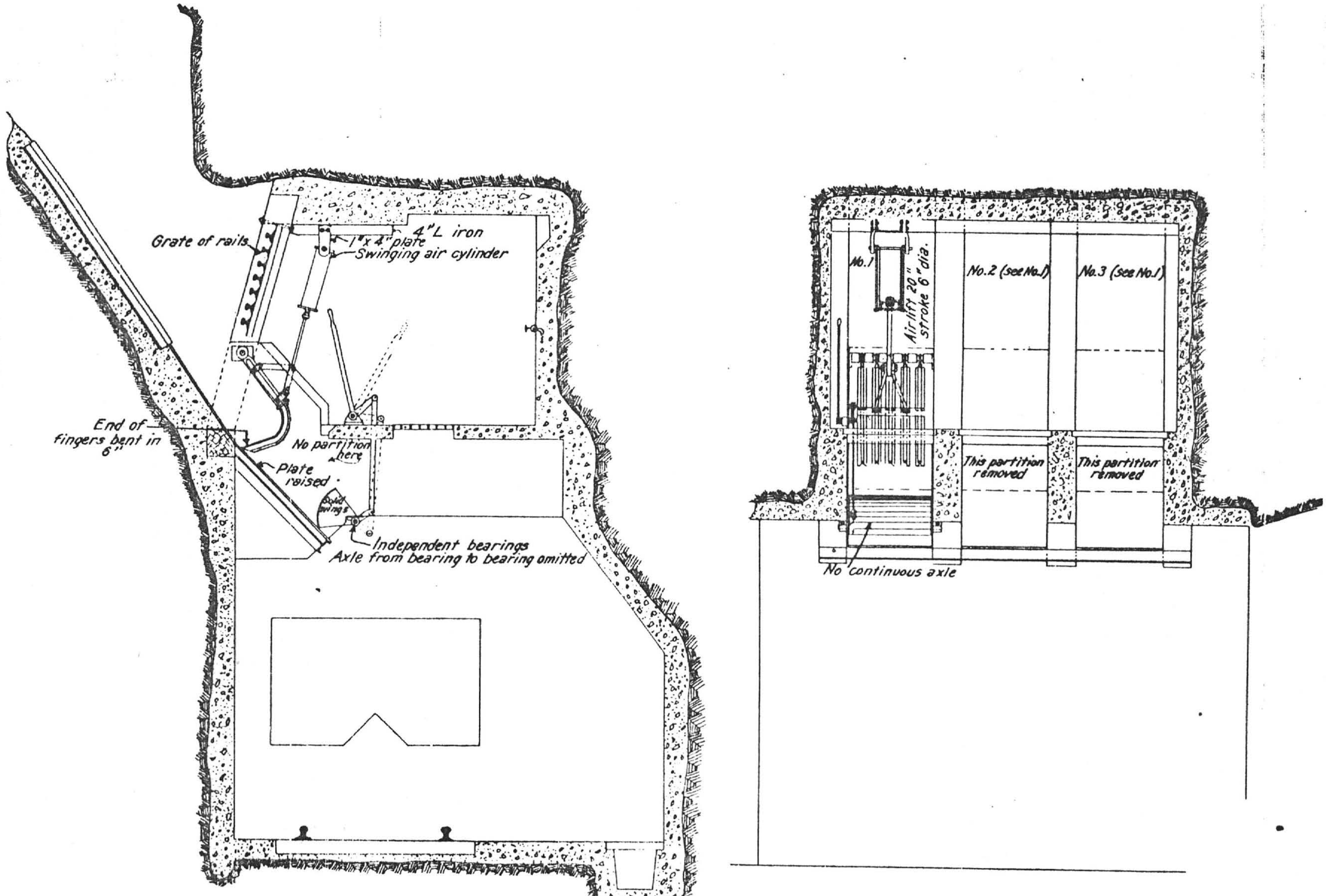


Figure 16.- Loading gates Main Ore Pocket

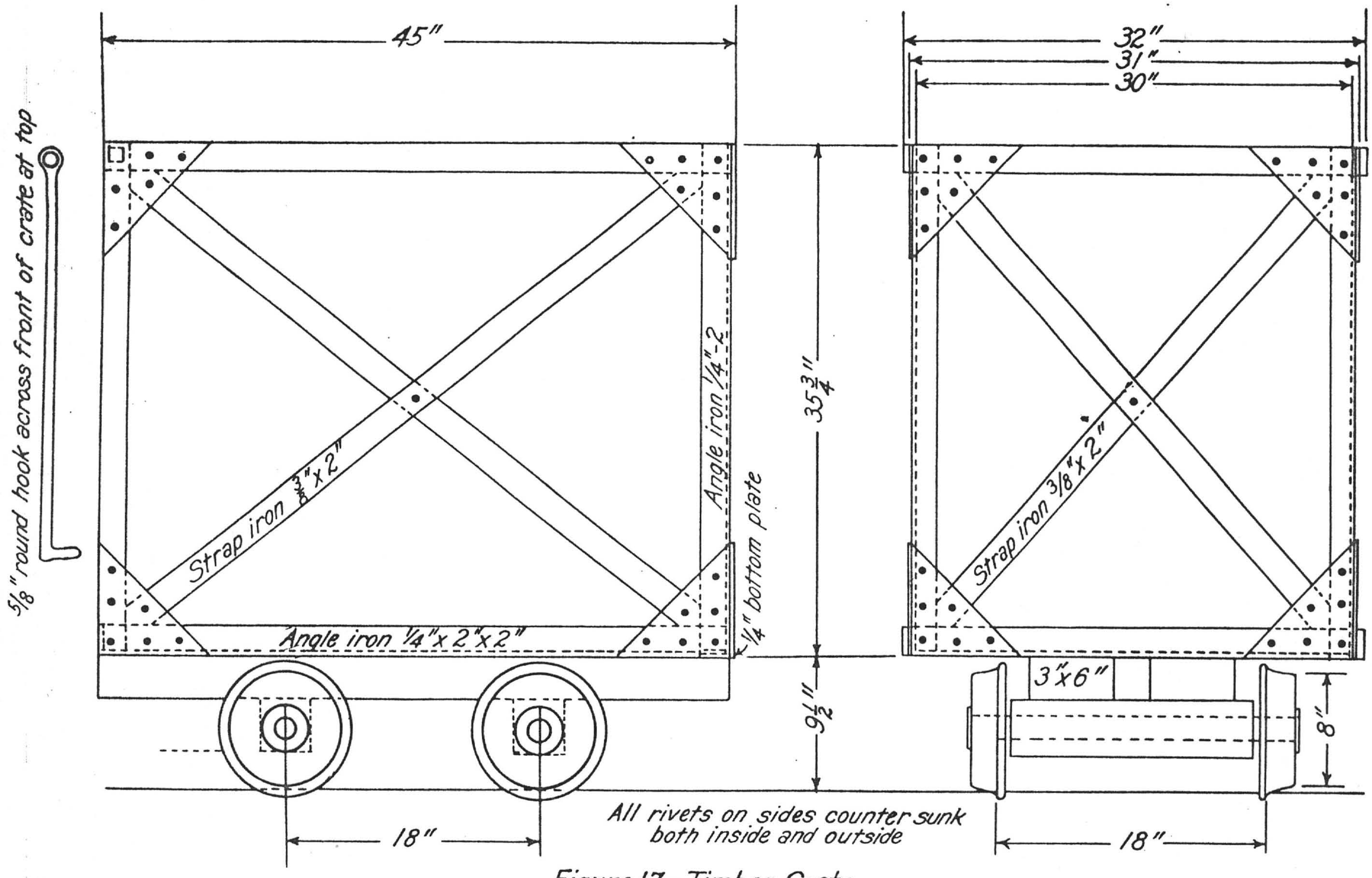


Figure 17.- Timber Crate

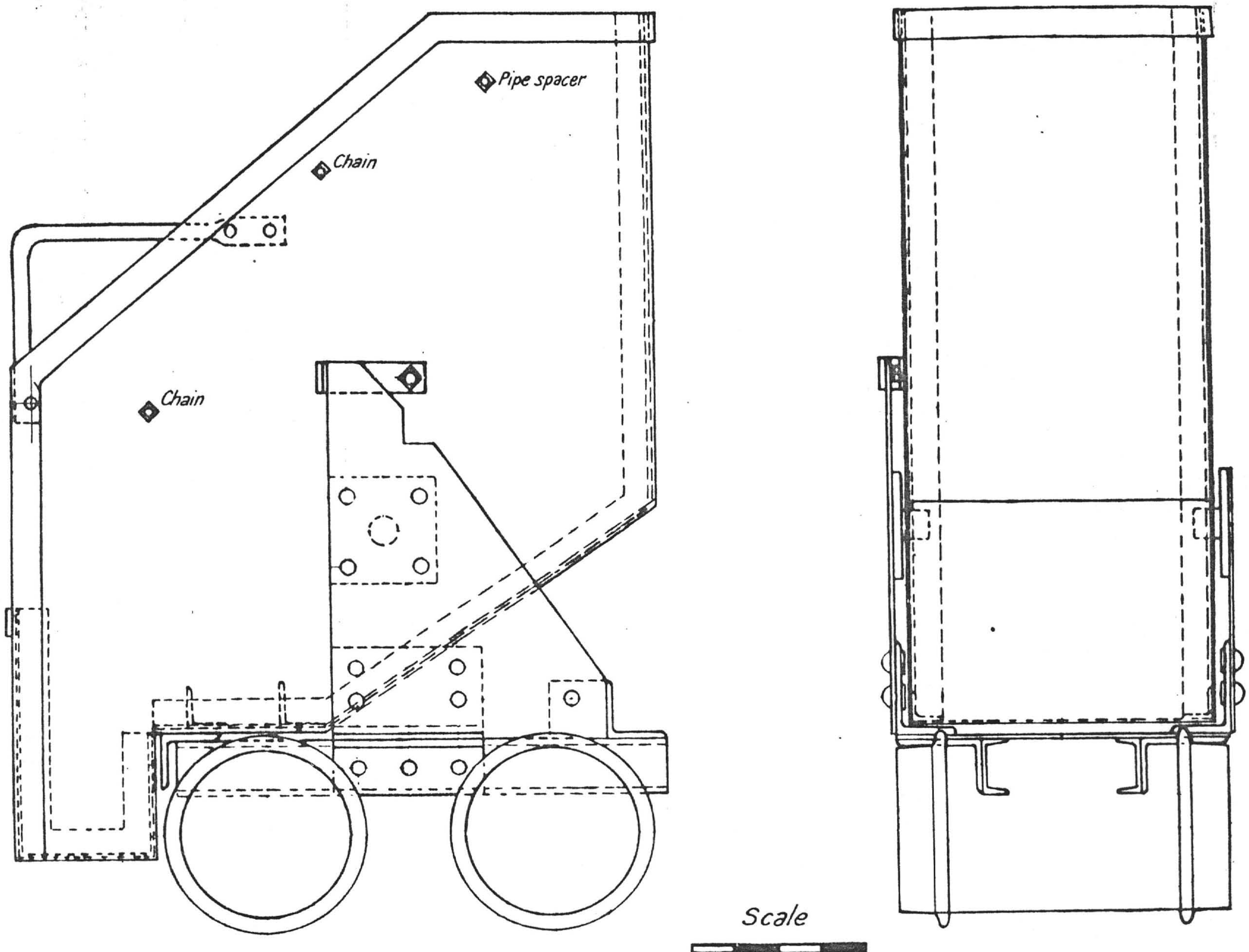


Figure 18.-Car for drill steel

places are widely separated much of the tramming is done with small storage-battery motors. Six of these are in use in various sections of the mine. They have proved satisfactory for moving small tonnages of ore from scattered workings and for handling development waste from long prospect headings.

Figure 15 shows the transfer apron and grizzly used on a level for transferring ore directly from a chute into an ore pass.

Figure 16 shows the loading gates of the main ore pocket on the 1300 level.

Figure 17 shows the timber crate used for handling timber in the cages and Figure 18 the details of the car for handling drill steel in the mine.

CONTRACTS

In an effort to obtain better progress and more efficiency drifting and raising are generally done on contract. All contracts are let directly through the superintendent's office. In a raise the contract specifies the footage to drive to the next level. In drifting the footage is generally limited to 100 feet, although contracts have been let for more. The contract stipulates the price per foot, the price per set of timber, the size of opening required, and, in a raise, the kind of timbering. The contractor pays for all explosives used. The contractor gets his regular day-pay check on pay days, and settlement on his contract is deferred until the first of the month. Settlement is then made according to the engineer's measurement and payment made on the 15th of the month.

Drifting contracts may run for months. When a contract is completed the contractor obtains settlement immediately, if he so requests.

Bonus work was tried out some years ago. In the stopes it resulted in hurried and consequently poor mining. The saving effected was not considered enough to compensate for this disadvantage. In drifting and raising difficulty was experienced in setting rates. The straight contract system was decided upon as being more acceptable to the workmen.

VENTILATION

The mine is ventilated mechanically by a surface exhaust fan installed at the top of a return-air system extending to the 1200 level. Rock temperatures are not very high, but a considerable amount of heat is generated by oxidation and timber decay, and the system is predicated entirely upon providing comfortable working conditions and control in case of a mine fire.

A multivane, forward-curved blade, single-inlet, single-width, centrifugal fan is used, with a 78-1/2-inch rotor operated at 346 r.p.m. by belt drive from a 250-hp., 2,200-volt, 60-cycle, 3-phase, 585-r.p.m. slip-ring induction motor. It exhausts from a 6.33 by 15.0 foot raise through a 10-foot concrete duct on a 30-degree slope and 4.5 by 5.5 feet in section. This fan is at present exhausting 100,000 cubic feet per minute of air saturated at 70°.

A single-inlet, single-width, multivane, forward-curved blade centrifugal fan, with 52-3/8 inch rotor, is connected to the opposite end of the air raise by a similar concrete duct; this is an auxiliary installation and is installed to operate at 590 r.p.m. by belt drive from a 75-hp., 2,200-volt, 875-r.p.m. induction motor. Each fan duct has a winch-operated door hinged to the floor and held in place both by fan pressure and gravity.

All long development headings are ventilated by fan-pipe installations, using small air or electrically-operated blowers, with 10-inch galvanized-iron piping.

FIRE HAZARDS

On account of the heavy ground in the mine considerable timber is required. Due to this and to the fact that the main ore body carries a high sulphur content a fire menace is always present. Timber bulkheads are used to maintain haulage and extraction drifts in various parts of the stoping sections of the mine. To control any fire starting from the above conditions fire hydrants and standpipes are placed at all places where hazards exist.

A fire patrol is maintained on the graveyard shift, and all hazardous places are wet down two and three times a week. In addition, large independent fire lines are maintained on the main working levels. These lines are direct-connected to the pump columns where a large source of water would be available if needed. In addition to this, all air lines can be converted into water lines in a few minutes by the use of installed by-passes.

In the timbered section of the Edith shaft sprays are placed at 300-foot intervals, and the timbers in this shaft are wet down at least three times a week.

FIRE-FIGHTING EQUIPMENT

A complete mine rescue station is maintained with all the necessary fire-fighting equipment. Figure 19 illustrates a small portable disk fan. This type of fan has proved successful in other parts of the Southwest in fighting fires. The fan is equipped with a 110-volt, alternating-current, single-phase, 60-cycle, 850 revolutions per minute, General Electric repulsion motor. It is mounted on a mine truck with a reel carrying 1,000 feet of No. 14 duplex rubber cable that can be connected to the lighting circuit. The fan and reel are mounted on a turntable and can be locked in any position desired. Figure 20 shows an emergency tool truck for fire-fighting.

Sets of oxygen breathing apparatus and gas masks are kept on hand, and men have been trained in their use. Fifteen active rescue men are required to practice rescue and fire-fighting at least twice a month. These practices are followed by occasional maneuvers in which all apparatus men participate. Apparatus men practice on company time and are paid a bonus of $7.50 a month.

All shift bosses, jigger bosses, and tool nippers are trained in first aid, and first-aid stations or cabinets are maintained on all active levels. The training of apparatus and first-aid men is in charge of the safety engineer, who is also responsible for the maintenance of the rescue station.

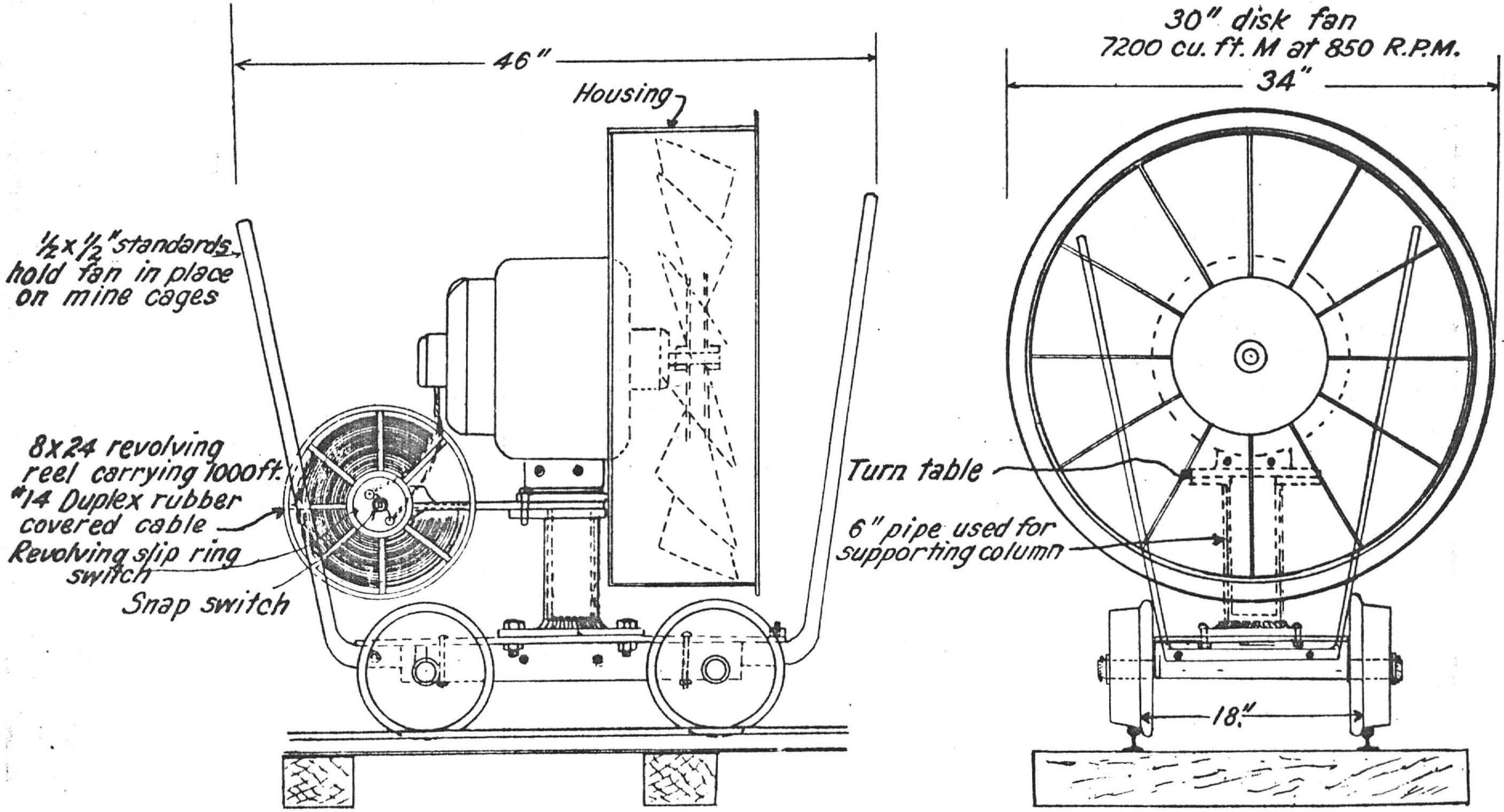


Figure 19 — Portable Ventilation Fan Used for Mine Fire Fighting

ACCIDENT PREVENTION

The safety engineer makes daily inspections and reports all unsafe conditions to the mine superintendent, mine foreman, and the shift boss on each run visited. Safety propaganda in the form of bulletins and individual talks by the safety engineer on inspection trips through the mine impresses the safety idea upon the men. Safety committees have been tried and abandoned in favor of the present method.

UNITED VERDE EXTENSION MINING COMPANY

EFFICIENCY DATA

YEAR 1928

Tons mined per man (stoping shifts)	4.84
Tons mined per man (underground shifts)	2.47
Tons mined per man (total shifts)	2.00
Feet advanced per man (development shifts)	1.17
Mine timbers and handling cost (per 1000 board feet)	36.24
Mine timbers and handling cost per ton	.67
Mine timbers (board feet per ton)	16.82
Total board feet used per ton	18.53
Pounds power per foot advanced	6.14
Feet fuse per foot advanced	19.10
Number caps per foot advanced	3.29
Pounds carbide per underground shift	.85
Pounds powder in stope per ton	.39
Feet fuse in stope per ton	1.93
Number caps in stope per ton	.35

UNITED VERDE EXTENSION MINING COMPANY

MINING COSTS

YEAR 1928

Tons shipped during period: 275,212

	Cost per ton
Prospecting and development	$0.611
Extraction	1.710
Repairs and maintenance	.260
Ventilation	.068
Haulage	.357
Hoisting	.151
Pumping and drainage	.039
Underground miscellaneous	.107
Rock drills	.152
Compressed air	.092
Waste pit	.005
Office and general	.738
TOTAL COST PER TON	$4.286

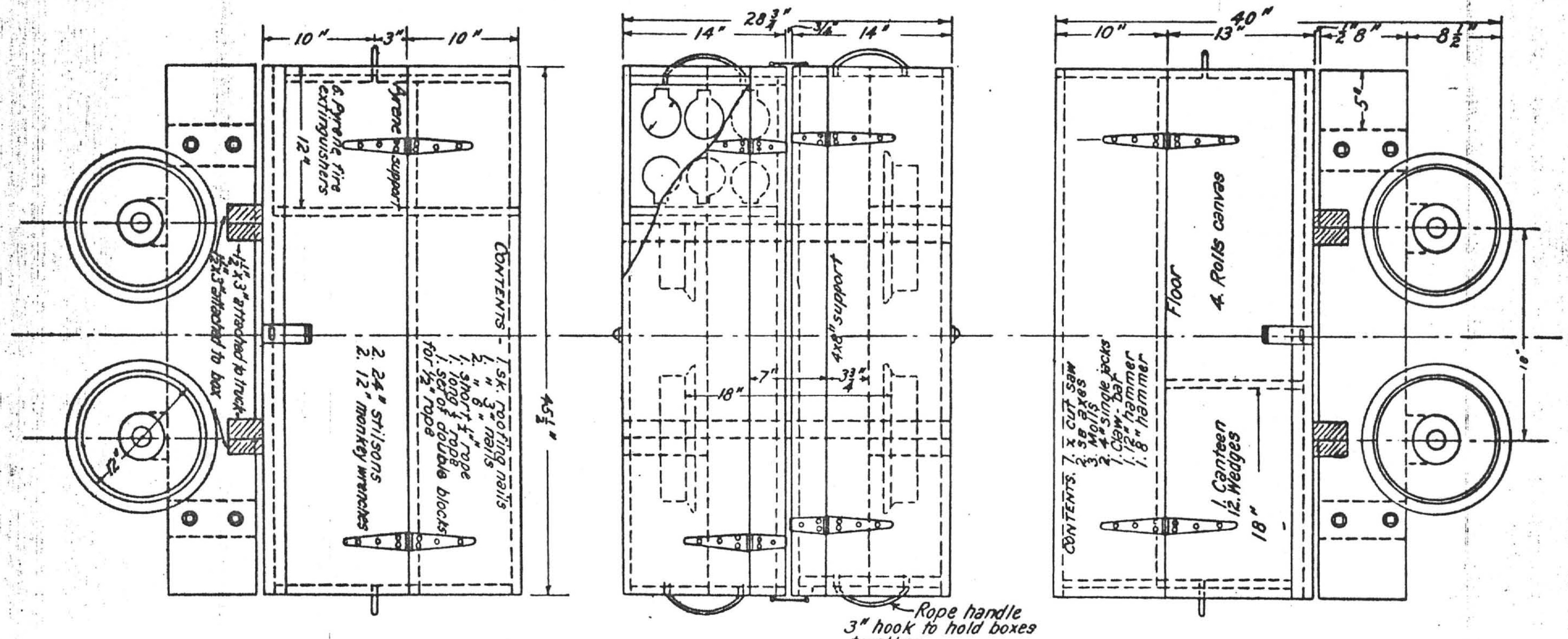


Figure 20.- Emergency Tool Truck for Helmet Teams United Verde Extension Mining Co. Jerome, Ariz.

Carole

MEMORANDUM

TO: Carole A. O'Brien

FROM: R.W. Hodder

DATE: December 12, 1987

SUBJECT: Brief review of drilling from the 902 station, 950 level, UVX Project.

INTRODUCTION

Since Don's and my last joint memorandum of October 31, 1987, 7 holes totalling 1163 feet have been completed from the 902 station on the 950 level. Viewing the assay intervals in the most objective manner, and taking the newest coordinates of the drill station (11,390N, 7,207E) the 902 zone has a length of 180 feet, a thickness of 35 feet, and a height of 60 feet for a total of 378,000 cubic feet which, at 15 cubic feet per ton represents 25,000 tons. This tonnage would have more than 0.25 oz Au (eq) per ton and less than 5% total iron. I am reluctant to add any low grade material to this, or to make the above figures less speculative until we have replotted drill stations and resurveyed the azimuths of drill holes so we can fully assess true thicknesses of the assayed intervals.

Hole 902-4, which you asked about a week ago, exemplifies the problem. Using the coordinates of the drill station originally as 11,405N, 7,215E, aximuth 175° and inclination +14°. This hole has a gritty chert intersection of 80' to 204', with 2 intersections, 99-112' of 0.14 oz Au, 17.4 oz Ag/ton and 165-192' of 0.16 oz Au, 12.0 oz Ag/ton with intervening low grade material. This drill hole with the same aximuth and inclination but the new drill station coordinates (11,390N, 7,207E) would cut the gritty chert at a considerably lesser angle for a greater apparent width. In brief, the intersection of the target is probably much more oblique than planned which accounts for the long intersection of favorable rock with wide spaced intervals of significant assays. We must reconstruct plans and sections which will give a full appreciation of the relocated drill station relative to the target. The location problem also affects the position of the 902 zone relative to the M3 and 809 zones.

Although very speculative because drill hole locations are still to be worked into new plans and sections, it may be helpful to update the running total of potential for the Verde area. On September 3, 1987 we estimated potential as follows:

	Tons	Grade oz Au (eq)	% Fe
M-3 zone	115,000	0.21	~ 16
809 zone	41,000	0.26	~ 9
Combined	156,000	0.22	~ 14

We can speculatively add to this as follows:

	Tons	Grade oz Au (eq)	% Fe
809-9, an extension to the 809-zone	~ 20,000	~ 0.20	< 5
902-zone	~ 25,000	~ 0.29	< 5
All Combined	~ 200,000	~ 0.23	~ 10

If the above now represents one half of the potential of the Verde area, than the total Verde area potential is estimated at 2x200,000 or~400,000 tons of 0.23 Au (eq) and 10% Fe. Hence, the 902-zone appears to have slightly lowered the extrapolated overall Verde area tons, slightly increased the gold equivalent grade and lowered the percentage of iron.

Don plans to follow the memorandum with revised tables summarizing the 902 drilling as soon as the 902 holes are surveyed as to corrected azimuths.

GEOLOGY

The 902 drilling together with the excellent exposures in 902-W, 906, and 911 workings, 950 level as documented in Don's photographic compendium of November 30 support the concensus from the M-3 and 809 zones that the sequence of rock types in the Verde area is as follows from east to west:

1) Diorite with successively westward change in alteration mineral assemblages from propylitic to argillic to silicic.

2) Massive beige chert breccia with fragments of grey chert averaging 1/4" in diameter and accounting for 40% of the rock. This is barren.

3) Banded beige chert breccia with clasts comparable in size and abundance to massive beige chert breccia but with a faint color banding in the matrix. The colors are dull reds and purples. Bands may be contorted. This rock is also barren.

4) Ironstone or hematite chert breccia with 1/2" clasts of dense black to maroon hematite, generally clast-supported in hematite silica matrix. Total iron content is estimated at 20 to 50%. Precious metal content is erratic in this rock in the 902 zone and ranges from short intervals of 0.15 oz Au per ton to long intervals of 0.01 oz Au per ton. The average is approximately .03 oz Au per ton and 1.0 oz Ag per ton.

5) Grey chert breccia has 1/4" clasts of grey chert to blood red chert in the first 20 feet, giving way to grey chert clasts in a tan matrix of fine to medium grained quartz. Matrix is 40% of the rock. Gold content is typically 0.03 to 0.15 oz per ton and silver is 0.4 to 3.0 oz per ton. This rock type is not always present and appears in some instances to be part of the hematitic clast breccia which flanks it to the east and which encroaches upon it by increasing iron content, or it may grade into the gritty chert breccia through an increase in quartz grain size in both clasts and matrix, and almost exclusively

limonite or geothite rather than hematite stain in the clasts and matrix. Grey chert breccia may host malachite on very tight fractures in clasts and matrix.

6) Gritty chert breccia has 40 to 60% clasts of grey chert and gritty chert which average 1/2" in diameter but vary greatly in texture, grain size, clast size and shape. Clasts can be banded, crackle-fractured or massive. The quartz is fine to medium grained, saccharoidal, and the coarsest of all quartz in these quartz-rich rocks flanking the diorite. This rock is also the most persistently gold-bearing and has 0.03 to 0.5 oz Au per ton generally with 0.5 to more than 10 oz Au per ton.

In summary, the Verde area in the 902 zone continues to be a very silicic and brecciated margin to the diorite with the gold confined to ironstone and grey to gritty chert breccia. The interval of blood red, jasper-like, fragments within grey chert breccia is appearing consistently and may be useful as a primary marker horizon. The greatest gold content is with the coarsest quartz grains in fragments or matrix, and the least iron content. The iron is limonite and geothite rather than hematite in these higher grade intervals.

The coarsest quartz and greatest gold-bearing areas are lense-like in section and "Y"-shaped in plan with greatest gold content at the bifurcation of the "Y".

Geologic Studies by Students

I have a fourth year student, Ian Sloan, doing a project on the petrography of the chert breccias. The objective here is to describe clasts and matrix, to 1) develop criteria, if possible, for original silica content and silicification and 2) to describe and speculate on the origin of the breccias which presently appear to us to be hydrothermal chemical breccias related to silicification and introduction of the metals. I am taking back this time samples for chemical analyses so that we might have a look at major and minor element distribution from diorite to gritty chert breccia.

I have a graduate student, Peter McLean, examining polished sections of gritty chert breccia in order to determine the opaque minerals and the nature of the gold and gold-bearing minerals. Peter has already had quite a good look at material from M-3 and I am taking him two additional samples which reportedly have high arsenic, lead, zinc, and copper.

Chris Eastoe and John Guilbert at the University of Arizona have proposed that an MSc candidate, Jim Bossman, consider a thesis topic at the UVX. Such work surely adds some specific information and if it has a relatively short term it can be quite helpful. I think Mr. Bossman could perhaps be encouraged to study the nature of the ironstone flanking the grey chert breccia and gritty chert breccia, or the siliceous copper ore. Although the latter is not well exposed it could be a real contribution to know, just as in the ironstone, whether this is hypogene or supergene. It would help in evaluating the distribution of the gold which may have been affected by a range of primary to secondary processes.

Recommendations

1) The surveying is still a point of contention on the project and will be until there are base plans of workings and drill stations that include the mine grid. We will need these plans in compiling all of the drilling and sampling. One way to expedite their production, and to resolve the confidence issue in the current data, and to establish a base from which we can go forward, would be to contract out a mine survey and base map preparation. It would give a clean start, would not overly distract present personnel from their work, and could be a foundation for a clear division of who does what in the future. I heartily recommend this to provide the base upon which the hard won data can be plotted with the least time, frustration and cost. It could be done on weekends before the end of the year.

2) The geological terminology is evolving somewhat from zone to zone through the Verde area. I shall press along with Ian Sloan's petrographic work and be in touch with Don in a continued attempt to be consistent in describing these rocks as we compile the metal distribution.

3) Academic studies can contribute information which will help in understanding metal distribution and hence improve predictability in exploration and extraction. I encourage these studies and recommend that modest sums, on the order of a few hundred dollars, be available to pay for analyses in the course of this work. Each study should have clear goals and a term consistent with the project's schedule. I do not recommend a thesis on the geology of the UVX but rather smaller specific studies of petrography, mineralogy or geochemistry and that any support go into data production. The larger, more general studies, are more consistent with a mine in operation.

RWH:sk

Carole

U.V.X. 902 D.D.S. DRILLING/ASSAY SUMMARY

D.D.H.	Initial inclination of hole	Ratio of true thickness to drill intercept	High grade intercepts: Drill intercept (feet)	True thickness (feet)	Grade (oz/t) Au	Ag	Low grade intercepts: Drill intercept (feet)	True thickness (feet)	Grade (oz/t) Au	Ag
902-1	+40°	~.70	None	---	--	--	88-93 182-222	3.5 28	.15 .06	4.1 1.7
902-2	+14°	~.87	82-105	20	.23	7.1	79-107	24	.21	6.1
902-3	+25°	~.87	50-96	40	.13	7.3	50-110	52	.12	6.1
902-4	+14°	~.70	99-112 165-192	9 19	.14 .16	12.4 12.0	80-90 99-204	7 74	.13 .10	2.3 6.1
902-5	+25°	~.87	None	--	--	--	80-92	10	.08	1.5
902-6	+45°	~.70	Assays pending							
902-7	+45°	Now drilling								

Compiled by Don White
Updated to Nov. 30, 1987

Carole

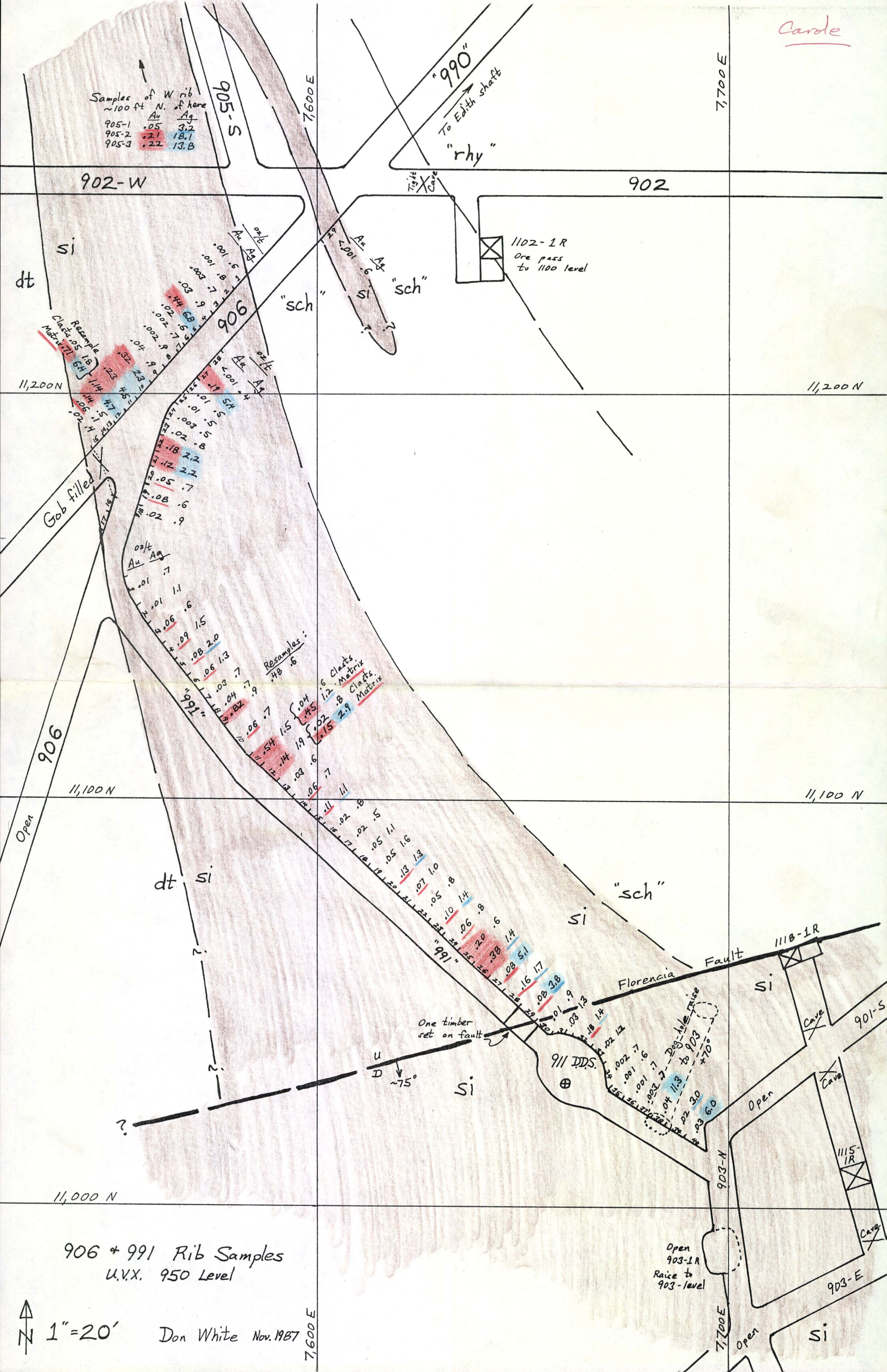
U.V.X. 902 D.D.S.* DRILLHOLE SUMMARY

D.D.H.	Orientation at collar		Length of Hole (feet)	Chert Intercepts	Angle of Intercept to Bedding
	Azimuth	Inclination			
902-1	175° (S5°E)	+40°	230	65-230+	~ 45°
902-2	200° (S20°W)	+14°	194	39-107 155-194+	~ 60°
902-3	230° (S50°W)	+25°	120	34-110	~ 60°
902-4	175° (S5°E)	+14°	215	50-215+	~ 45°
902-5	250° (S70°W)	+25°	98	51-98+	~ 60°
902-6	250° (S70°W)	+45°	146	49-143	~ 45°
902-7	230° (S50°W)	+45°	— Now	drilling	—

* 902 Diamond Drill Station; surveyed center of rotation of drill rig:

Mine grid 11,405N 7,215E 4,180' Elev. ?

Compiled by Don White
Updated to Nov. 30, 1987


Carole
Samples of W rib ~100 ft N. of here
Au Ag
905-1 .05 3.2
905-2 .21 18.1
905-3 .22 13.8
905-S
7,600 E
"990"
To Edith shaft
"rhy"
7,700 E
902-W
902
Tight Cave
1102-1R
Ore pass to 1100 level
si
dt
"sch"
906
Resample
Clasts .05 1.8
Matrix .71 6.4
11,200 N
Gob filled
oz/t Au Ag
Resamples: .48 .6
Clasts
Matrix
"991"
11,100 N
Open
Florencia Fault
1118-1R
901-S
Cave
One timber set on fault
911 DDS.
Dog-hole raise to 903 +70
U
D
~75°
903-N
1115-1R
11,000 N
Open 903-1R Raise to 903-level
903-E
906 + 991 Rib Samples
U.V.X. 950 Level
1" = 20'
Don White Nov. 1987
N

M E M O

TO: Carole A. O'Brien, Anthony F. Budge

FROM: Don White

DATE: November 15, 1987

SUBJECT: Visit to the U.V.X. by Dan Maxwell

Dan Maxwell of Southwest Exploration, Inc., Silver City, NM, visited the U.V.X. for better than half a day, Nov. 12, 1987. At Carole's request I gave him a complete tour and listened to any comments he had. Some reactions he had are worth passing along.

1) The timbering now being done in areas of bad back is not proper. He feels the using of 2"x8/10" and 3"x8/10" on their broad sides is overly costly and not as strong in the event of heavy ground. He says lagging should not be used for timbering high backs, rather he recommends 4"x6" or 4"x8" timbers resting on their narrow sides to minimize timber cost and maximize strength.

2) His impression of the track work is poor. He says the turns and switches in particular are not suitable for production haulage. Indeed my own experience is difficulty in negotiating many spots with light rolling-stock and I notice drill steel (pry-bars) at many sites, indicative of frequent derailments. I have also noticed several locomotive derailments at key places, both time consuming and hazardous. Pete's crews are clearly hired from drifting backgrounds and lay rail only for lack of anyone else to do so. Improvements in the rail system will be required as production nears.

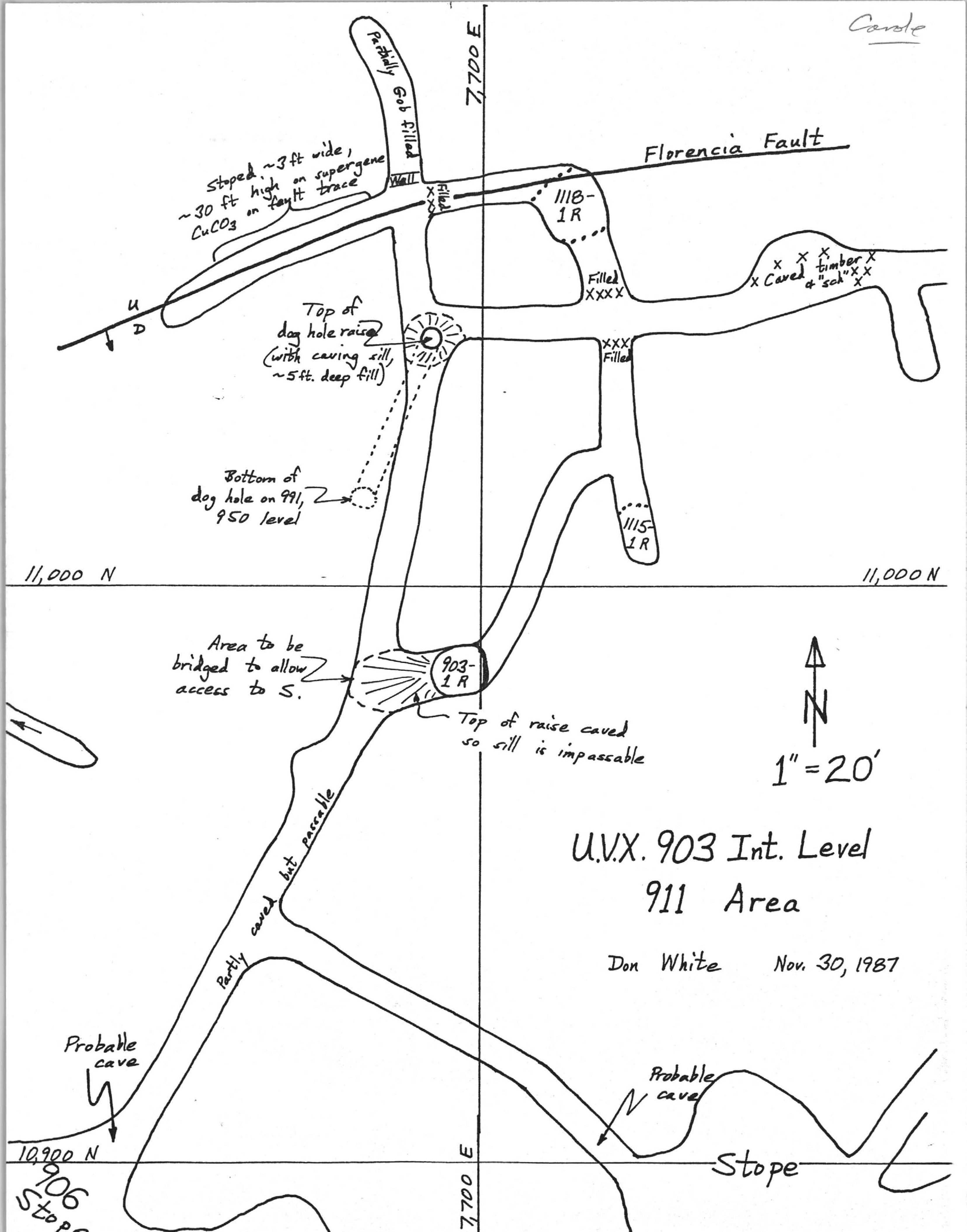
3) Rail grade control has been almost non-existent. There is still no system for laying rail at predetermined gradients as required for linkages of tunnels being worked on from opposite ends to form a circuit (as on the 902-W, 950 level).

4) Blast-hole drilling in chert is going to be a major cost/time factor in overall mining costs/plans. Caving of the holes upon withdrawal of the drill steel, or even inability to withdraw the drilled steel, is now costing much time, broken steel, etc. The sooner systems are worked out to handle chert drilling the better. Many parameters may be varied. Bit type (button vs. chisel vs. knockoff cross-type) water usage, hole diameter (fewer, larger blast-holes may be advantageous) and possible use of sleeves, disposable or reuseable, are all to be considered.

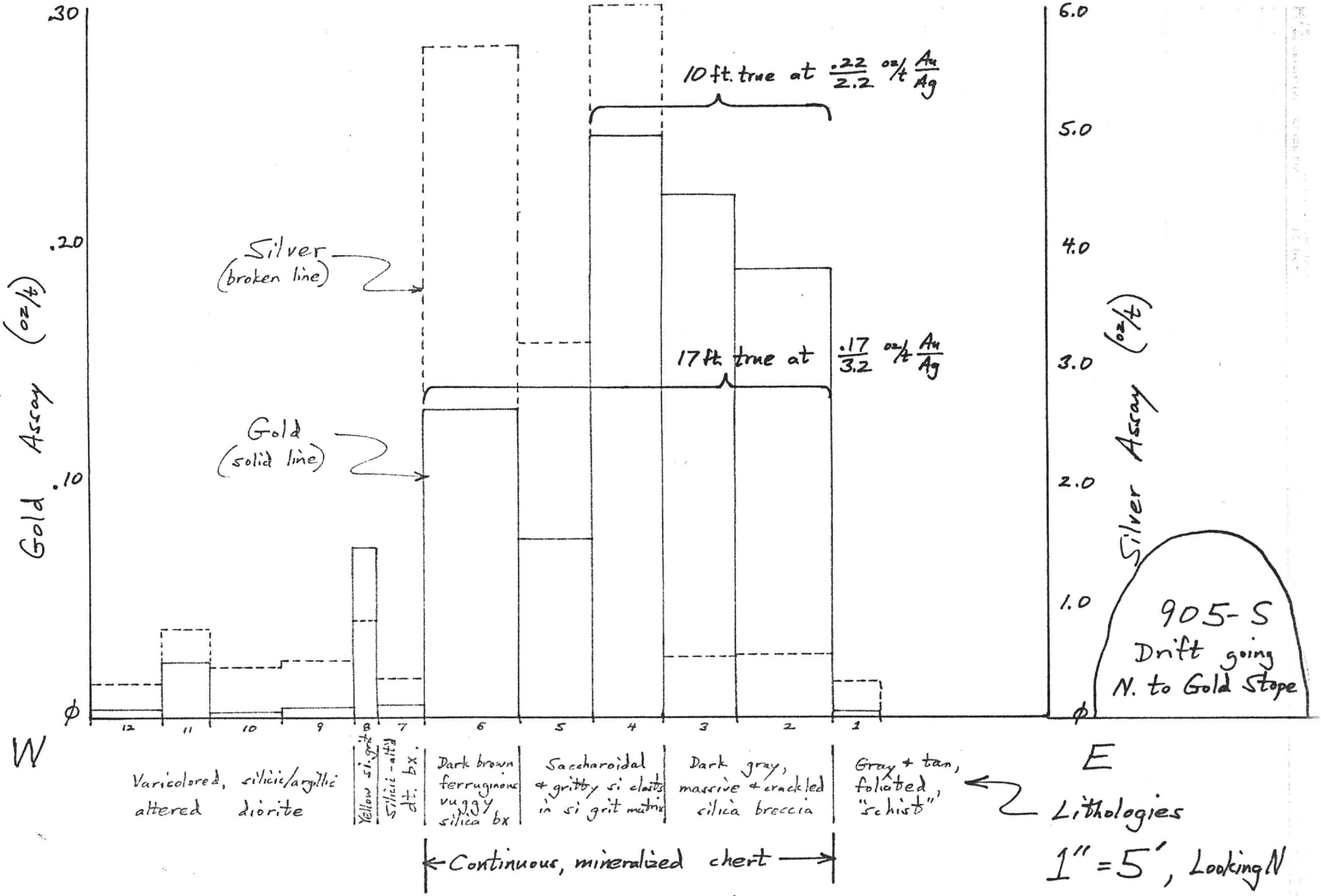
5) Dan suspects that heap leaching may be a viable alternative for that portion of UVX reserves amenable to leaching (mainly the silica grit; no crushing or grinding needed, high recoveries probable - one bottle roll thus far suggests 93% recovery of Au in first 24 hours). He suggests costing this alternative (his estimate about $5./s.t. including plant and operating costs) and consideration of the Martin Limestone terraces just NE of the UVX (below Bell's houses, on Verde property) as sites within 0.1 mile of gentle downgrade haulage with intrinsic safety in that the limestone would neutralize any HCN leakage.

6) We talked about the smelter flux market and the chemical characteristics of flux that are deleterious. In that context our iron content was covered, and I was referred onward to Mr. Eric Partelpoeg, Asst. Supt. of P.D.'s Hidalgo, NM Smelter (505-436-2211). Mr. Partelpoeg confirms that indeed iron in any form, sulfide or oxide, is deleterious in that it consumes energy and increases the mass of slag. However, our iron oxides will not aggravate any SO_2 emissions problem. Our nearly alumina-free, high silica, high gold and high silver values have sufficient appeal that the standard smelter flux contract (all we have looked at thus far) is not sacred. Mr. Don Farquhar of P.D.'s Morenci office (602-865-4521) who apparently would head up any flux contract negotiations for P.D., would probably consent to an increased iron allowance in light of the chemical characteristics and quantity of UVX flux available. This needs to be investigated.

DW:sk



Carole
Partially Gob filled
7,700 E
Florencia Fault
Stoped ~3 ft wide, ~30 ft high on supergene $CuCO_3$ on fault trace
Wall
Filled
1118-1R
Filled XXXX
Caved timber & "sch"
U
D
Top of dog hole raise (with caving sill, ~5 ft. deep fill)
XXX Filled
Bottom of dog hole on 991, 950 level
1115-1R
11,000 N
11,000 N
Area to be bridged to allow access to S.
903-1R
Top of raise caved so sill is impassable
N
1" = 20'
U.V.X. 903 Int. Level
911 Area
Don White Nov. 30, 1987
Partly caved but passable
Probable cave
Probable cave
10,900 N
906 Stope
Stope
7,700 E

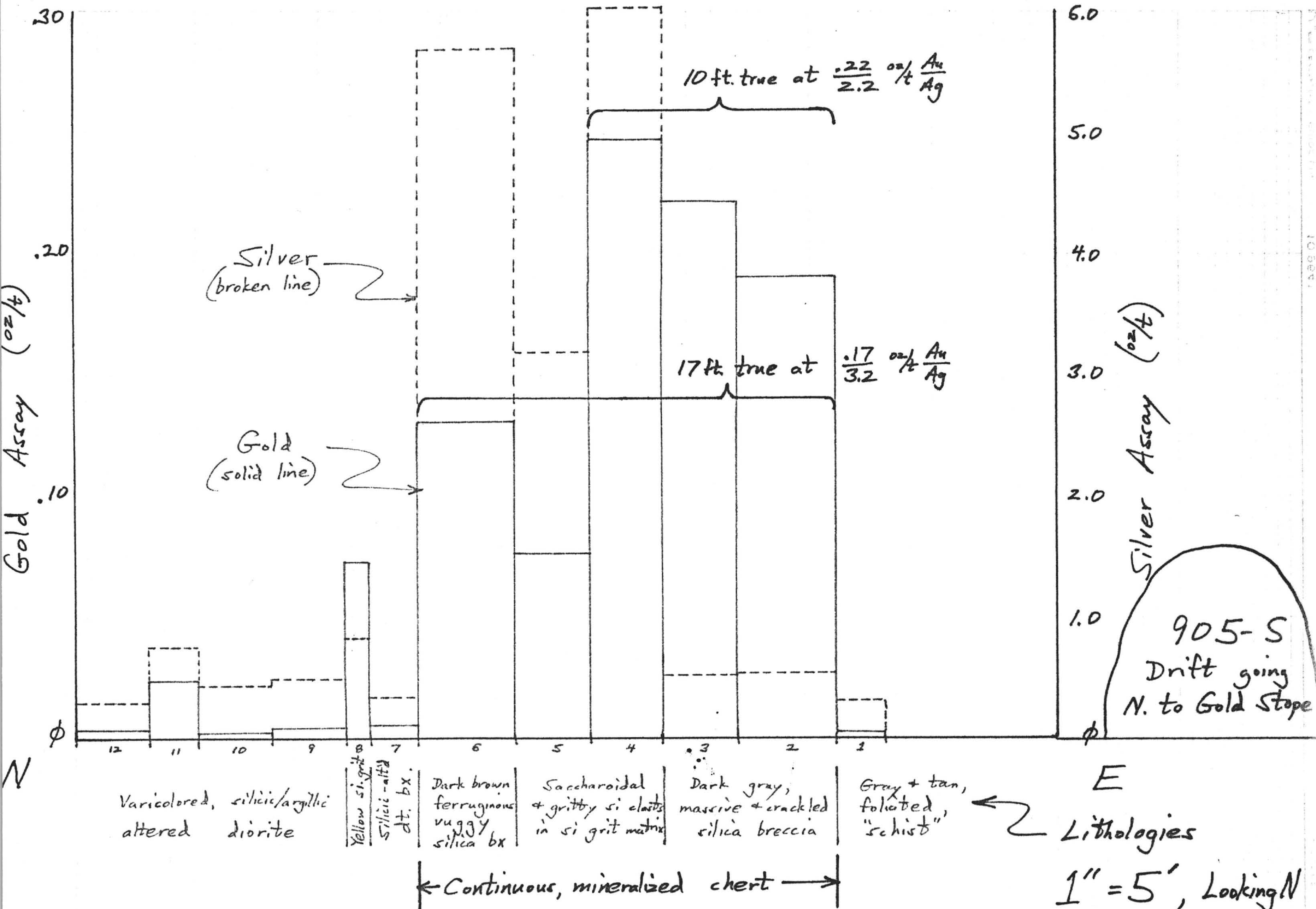


U.V.X. 902-W Crosscut, S. of Gold Stope

Assay histogram for N. rib, continuous chip samples.

1" = 5', Looking N

Don White - Dec., 1987



U.V.X. 902-W Crosscut, S. of Gold Stope
Assay histogram for N. rib, continuous chip samples.

Don White - Dec., 1987

Conde

U.V.X. Check Assays

Don White
Dec. 1987

			Au (oz/t) IK	Au (oz/t) Skyline	Au (oz/t) Chemex	Ag (oz/t) IK	Ag (oz/t) Skyline	Ag (oz/t) Chemex
809-4	315	318	.978	.810	.980	1.97	.41	1.50
809-4	322	326	.570	.445	.463	1.87	1.61	1.30
809-4	326	330	.245	.090	.255	8.03	.05	6.90
809-4	330	334	.079	.060	.070	2.14	.22	7.75
809-6	272	275	.571	.050	.052	1.69	1.33	1.80
809-7	288	290	.063	.075	.055	1.25	3.56	4.45
809-7	290	292	.348	.275	.360	3.56	1.77	2.50

			Au IK	Au Chemex	Ag IK	Ag Chemex
809-8	155	158	.144	.150	4.38	3.90
809-8	158	160	.056	.058	1.34	.87
809-8	160	162	.042	.047	1.43	.78
809-8	187	190	.102	.420	2.92	.65
809-8	190	192	.019	.011	.99	.33
809-9	83	85	.230	.240	1.30	.38
809-9	85	87	.053	.059	.78	.23
809-9	105	107	.433	.430	.86	.26
809-9	107	109	.700	.720	.97	.35
809-9	109	111	.100	.115	.62	.16
809-9	143	148	.075	.055	.81	.26
809-9	152	154	.493	.500	1.55	.59

Chemex Labs Inc.
Analytical Chemists * Geochemists * Registered Assayers
994 WEST GLENDALE AVE., SUITE 7, SPARKS, NEVADA, U.S.A. 89431
PHONE (702) 356-5395

To : BUDGE, A.F. (MINING) LTD.
EAST SHOEMAN LANE, STE. 111-B-(E)
SCOTTSDALE, ARIZONA
85251
Project :
Comments: ATTN: CAROLE O'BRIEN CC: DON WHITE-AZ

*Page No. : 1
Tot. Pages: 1
Date : 30-NOV-87
Invoice # : I-8726358
P.O. # :

CERTIFICATE OF ANALYSIS A8726358

SAMPLE DESCRIPTION	PREP CODE		Ag FA oz/T	Au FA oz/T
809-4-315-318	214	227	1.50	0.980
809-4-322-326	214	227	1.30	0.463
809-4-326-330	214	227	6.90	0.255
809-4-330-334	214	227	7.75	0.070
809-6-272-275	214	227	1.80	0.052
809-7-288-290	214	227	4.45	0.055
809-7-290-292	214	227	2.50	0.360
809-8-155-158	214	227	3.90	0.150
809-8-158-160	214	227	0.87	0.058
809-8-160-162	214	227	0.78	0.047
809-8-187-190	214	227	0.65	0.420
809-8-190-192	214	227	0.33	0.011
809-9-083-085	214	227	0.38	0.240
809-9-085-087	214	227	0.23	0.059
809-9-105-107	214	227	0.26	0.430
809-9-107-109	214	227	0.35	0.720
809-9-109-111	214	227	0.16	0.115
809-9-143-148	214	227	0.26	0.055
809-9-152-154	214	227	0.59	0.500

ALL ASSAY DETERMINATIONS ARE PERFORMED OR SUPERVISED BY B.C. CERTIFIED ASSAYERS

CERTIFICATION : ____________

Don White
521 E. Willis St.
Prescott, AZ 86301
602/778-3140

October 31, 1987

UUX Batch 84

CHEMEX LABS, INC.
994 Glendale Ave.
Unit 7
Sparks, NV 89431

Dear Sirs:

Please perform one assay ton gold and silver fire assays with gravimetric finish on the nineteen (19) following pulp samples.

1	809-4 - 315-318
2	809-4 - 322-326
3	809-4 - 326-330
4	809-4 - 330-334
5	809-6 - 272-275
6	809-7 - 288-290
7	809-7 - 290-292
8	809-8 - 155-158
9	809-8 - 158-160
10	809-8 - 160-162
11	809-8 - 187-190
12	809-8 - 190-192
13	809-9 - 83-85
14	809-9 - 85-87
15	809-9 - 105-107
16	809-9 - 107-109
17	809-9 - 109-111
18	809-9 - 143-148
19	809-9 - 152-154

Please be sure to homogenize each pulp before taking your split for assay.

The report and billing should be sent to:

Carole A. O'Brien
A.F. BUDGE (MINING) LTD.
7340 East Shoeman Ln.
Suite 111-B-(E)
Scottsdale, AZ 85251

with a copy to me in Prescott, AZ. Also please promptly return the pulps to me at the Prescott address.

Thank you,

Don White

Don White
Geologist, C.P.G.

cc: Carole A. O'Brien

SKYLINE LABS, INC.
1775 W. Sahuaro Dr. • P.O. Box 50106
Tucson, Arizona 85703
(602) 622-4836

REPORT OF ANALYSIS

JOB NO. UQX 052
September 22, 1987

MR. DON WHITE
521 East Willis St.
Prescott, AZ 86301

Analysis of 20 Pulp Samples

Circled samples checked again at Chemex/Reno.

ITEM	SAMPLE NUMBER	Δ Au	Au IX	FIRE ASSAY Au (oz/t)	FIRE ASSAY Ag (oz/t)	Ag IX	Δ Ag
(1)	809-4-315-318	-.168	.978	.810	.41	1.97	-1.56
2	809-4-318-322	.005	2.540	2.545	3.05	3.84	-.79
(3)	809-4-322-326	-.125	.570	.445	1.61	1.87	-.26
(4)	809-4-326-330	-.155	.245	.090	.05	8.03	-7.98
(5)	809-4-330-334	-.019	.079	.060	.22	2.14	-1.92
6	809-5-135-137	-.002	.007	.005	.57	.50	.07
7	809-5-137-140	.007	.128	.135	1.12	2.99	-1.87
8	809-5-140-142	.008	.047	.055	.74	2.23	-1.49
9	809-5-142-145	-.030	.120	.090	1.59	2.01	-.42
10	809-5-145-148	-.024	.274	.250	.91	1.09	-.18
11	809-6-264-267	-.006	.116	.110	1.07	.93	.14
12	809-6-267-270	-.003	.023	.020	.84	.75	.09
13	809-6-270-272	-.023	.083	.060	1.00	.97	.03
(14)	809-6-272-275	-.521	.571	.050	1.33	1.69	-.36
15	809-6-275-278	-.004	.009	.005	.39	.32	.07
16	809-7-283-286	-.015	.080	.065	1.07	1.69	-.62
17	809-7-286-288	-.012	.052	.040	1.07	3.36	-2.29
(18)	809-7-288-290	.012	.063	.075	3.56	1.25	2.31
(19)	809-7-290-292	-.073	.348	.275	1.77	3.56	-1.79
20	809-7-292-294	-.001	.041	.040	1.13	.24	.89

cc: Mr. Don White

Carole

U.V.X. 902 D.D.S.* DRILLHOLE SUMMARY

D.D.H.	Orientation at collar: Azimuth	Orientation at collar: Inclination	Length of Hole (feet)	Chert Intercepts	Angle of Intercept to Bedding
902-1	175° (S5°E)	+40°	230	65-230+	~45°
902-2	200° (S20°W)	+14°	194	39-107 155-194+	~60°
902-3	230° (S50°W)	+25°	120	34-110	~60°
902-4	175° (S5°E)	+14°	215	50-215+	~45°
902-5	250° (S70°W)	+25°	98	51-98+	~60°
902-6	250° (S70°W)	+45°	146	49-143	~45°
902-7	230° (S50°W)	+45°	160	37-159	~45°

To be revised when resurveyed

* 902 Diamond Drill Station; surveyed center of rotation of drill rig:

Mine grid 11,390 N 7,207E ~4,180' Elev.

Compiled by Don White
Updated to Dec. 10, 1987

Carole

Subject to revision as function of azimuth surveys

U.V.X. 902 D.D.S. DRILLING/ASSAY SUMMARY

D.D.H.	Initial inclination of hole	Ratio of true thickness to drill intercept	High grade intercepts: Drill intercept (feet)	High grade intercepts: True thickness (feet)	High grade intercepts: Grade (oz/t) Au	High grade intercepts: Grade (oz/t) Ag	Low grade intercepts: Drill intercept (feet)	Low grade intercepts: True thickness (feet)	Low grade intercepts: Grade (oz/t) Au	Low grade intercepts: Grade (oz/t) Ag
902-1	+40°	~.70	None	---	--	--	88-93 182-222	3.5 28	.15 .06	4.1 1.7
902-2	+14°	~.87	82-105	20	.23	7.1	79-107	24	.21	6.1
902-3	+25°	~.87	50-96	40	.13	7.3	50-110	52	.12	6.1
902-4	+14°	~.70	99-112 165-192	9 19	.14 .16	12.4 12.0	80-90 99-204	7 74	.13 .10	2.3 6.1
902-5	+25°	~.87	None	--	--	--	80-92	10	.08	1.5
902-6	+45°	~.70	None	--	--	--	60-74 97-105	10 6	.09 .13	5.0 3.2
902-7	+45°	~.70	78-90	8	.31	7.5	None	--	--	--

Compiled by Don White
Updated to Dec. 10, 1987

Carole

MEMO

TO: Carole A. O'Brien, A.F. Budge

FROM: Don White

DATE: December 13, 1987

SUBJECT: Meeting with Verde Exploration folks

Paul Handverger had two other Verde Exploration Ltd. board members out to visit last week and on December 11th visited the UVX engineering office and toured underground. Visiting was John Menke, president, and Don Jenkins.

They did not ask for any presentation but were around the office and appearing curious so we started chatting. John then asked to see the mine model. We talked about it and them some core, the present drilling plans, and what is known about smelter terms and flux specifications.

I had met John Menke perhaps two years past. Both then and now he impressed me as being a very thoughtful person, a good listener, and a gentleman. Don Jenkins is very quiet. He's an Amherst economics major and now in finance.

John Menke offered his assistance via contacts in the industry. One connection is that Richard Moolick is on Verde's board. He is a recently retired executive officer and former board member of Phelps Dodge. Thus he may be able to connect to someone who can get action and answers on our request for a lease/J.V. of the United Verde. Other contacts John mentioned are with smelting firms including Sumitomo, Magma, and Newmont.

John Menke's comments after a short tour underground with Joe Fernandez were that it was a very clean, well organized mine. He thought it looked like good work, very professionally done. He wished us luck in finding lots of gold.

Mr. Menke did mention the obligation by Budge to drill Paul's designated copper target in the deep footwall of the Verde fault. I reminded him that it hasn't been done yet because the sites available until recently did not allow very good chances of completing such a hole and thus Paul had not wished a likely abortive effort even attempted. Paul acknowledged that. We then discussed the impact of the newly accessed areas such as the 902-W tunnel, 950 level. It is likely that a station such as the future 906 and/or 907 drill stations could be utilized for "Paul's hole." John's reminder was that it is a condition of the lease and they still want it drilled eventually.

DW:sk