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**U. S. Vanadium
Development Co.**

**U. S. Vanadium
Development Co.**

REPUBLICAN
PHOENIX

Phoenix, Arizona

Phoenix, Arizona

SEE: BOOK V-VII A. L. FLAGG VANADIUM REPORTS



PROBABLY no mineral development in the United States is today attracting more attention than that of the United States Vanadium Development Co., with thirty-six (36) debt-free, high grade ore bearing claims in the famous Ray Consolidated Copper mines district of Arizona. The most sanguine claims of the directorate of the company have been more than affirmed by some of the country's best known and most competent engineers.

Already bodies of this vanadium bearing ore have been blocked out. A large force of men under a competent superintendent is engaged in the work of development. Plans for the erection of a 100-ton concentrating mill and reduction plant are under way, and an unlimited market has presented itself, assuring speedy disposition of the products of the company whenever they become available.

The officers comprise some of the most highly respected and most successful business and professional men of the South-

west, men whose names carry assurance of stability and broadmindedness. The stockholders, over three hundred in number, are conservative, far-seeing citizens, for the most part resident in Arizona, investors, not speculators. They have seen their stock go to par in a wonderfully short time and are making no effort to dispose of their holdings even at the advanced figure.

The purpose of this little book is not to set forth in glowing terms the dreams of promoters or the possibilities of a prospect. It is to present briefly facts and only facts, so far as they are obtainable. Extravagance in expression is avoided, conservatism predominates and only those statements are made that are substantiated by facts.

In a letter just received from Superintendent Lowe, he states the winze and lower tunnel are still in rich ore and that we have 25,000 tons of ore now on the dumps, sacked and blocked out.

Estimating this ore at \$100 per ton, which we consider a very low price, would give \$2,500,000 worth of ore ready for the mill. This would mean \$2.50 for every share of stock now outstanding.

OFFICERS AND DIRECTORS

DR. E. PAYNE PALMER, *President*

DR. O. E. PLATH, *Vice-President*

FRANKLIN D. LANE, *Secretary-Treasurer*

PETER MOHN H. H. TEMPLE

Mines located $3\frac{1}{2}$ miles Northeast of Ray Junction, Pinal County, Arizona.

Property consists of 36 claims free from debt, bond or lease.

Our shipping station is Erman, only $2\frac{1}{2}$ miles from our main works with easy grade and good road.

Abstract of Report on U. S. Vanadium Development Co., by C. J. Price, Mining Engineer

Los Angeles, Cal., October 11, 1916.

GEOLOGY

Limestone and diabase is the main rock formation of the district, with intrusions of diorite, andesite and other eruptive sediment rocks.

A very pronounced line of demarkation between the lime and diabase formation occurs on the Western portion of your Claims.

This line of demarkation is so pronounced that it can readily be traced by the naked eye across the country for miles.

WATER

A never failing supply of excellent water for domestic purposes is supplied by a spring on the Northwestern portion of your property, and I have no doubt but what plenty of water for at least 100 ton concentrating plant can be developed by cross-cutting on the bed rock in the gulch a short distance below the camp, or the same condition might apply in the gulch a short distance below the Gray Horse tunnel.

EQUIPMENT

The property is equipped with drill steel, hammers, picks, shovels, steel rails, cars, wheel barrows, blacksmith tools, etc., sufficient to prosecute development on a moderate scale.

Several large tents, lumber, a large cooking range, dishes, chairs, and in fact all kitchen utensils for taking cars of 15 to 20 men, had recently arrived at the property and is being whipped into shape near the spring (mentioned under "water") for a permanent camp.

VEIN OR VEINS

Several veins, varying in width from a few inches to 5 and 6 feet outcrop in various places, and traverses your property in a more or less Easterly and Westerly direction.

Considerable overburden consisting of gravel and earth soil covers the majority of your claims, especially is this the case where the limestone formation occurs.

This makes the tracing of the outcrop of the veins on the surface difficult.

DEVELOPMENT

Gray Horse Vein

On the Gray Horse Claim the best ore showing on your property is found, and the principal development of your group of claims has centered here. A tunnel, 210 feet long, has been run into the hill on this vein and an uprise 80 feet long, has been made to the surface, some 20 feet from the face of the tunnel, or 190 feet in from its portal. This tunnel has followed a well defined fissure, or cleavage, its entire distance and is in ore the entire 210 feet, said ore is continuous up to the surface as proved by upraise and open cut work on the surface.

Some 500 tons of good commercial ore is piled up on the dumps from this development work, and the best or richest ore exposed to date is in the floor of this tunnel as proven by samples carefully taken by a reputable engineer last February. A winze being sunk in one of the ore shoots below this tunnel level at the present time is producing excellent ore.

As stated, ore is continuous in this tunnel, but two well defined rich shoots are exposed in this tunnel trending into the mouth (Easterly) at an angle of about 20 degrees from the horizontal. A third shoot is exposed in the upraise and the tunnel was just cutting into it at the time of my visit. This same condition may continue on into the Apex Claim (see map) as I am told the outcrop has been found on the Eastern end of this claim.

Esperanza Vein

A tunnel 25 feet long, a shallow winze and several surface pits show this vein fairly well defined for a distance of two or three thousand feet in length and is 5 or 6 feet wide on the bottom of the winze. Showing of vanadium is very good.

Black Cap Vein

Ore is exposed in at least two places on this claim, showing vanadium crystals. Work to date is very meagre, but possibilities good.

RECOMMENDATIONS

For the present I recommend that you continue the present tunnel on the Gray Horse Vein, following the Cleavage or fissure, which in this instance was a channel that gave vent to the vanadium gasses, or solution, that came up from below, and in receding deposited the vanadium values in the gangue or vein matter with which it came in contact. You will in all probability encounter high and low grade shoots alternately as you advance, similar to those you have already passed through.

Also, sink a winze in one of the high grade shoots of ore already encountered, preferably the second one in from the mouth of the tunnel. In sinking follow the ore, even though you may have to sink on the incline.

On the Esperanza Vein I recommend you to sink a small shaft from the surface to a depth of 50 or 60 feet, then drift east and west on the vein from the foot of the shaft.

Tunneling on the Black Cap and sinking on the Ready Cash veins could be carried on simultaneously providing you wish to crowd prospecting.

It is essential that you complete your wagon road and ship a couple of carloads of ore to some reliable testing plant for treatment in order to ascertain the best method of recovering your values. This test should be closely followed by some member of your company, or some one in whom you have implicit confidence.

After this test is complete it should be in order for you to decide whether to continue shipping or figure on your own reduction plant.

CONCLUSIONS

The quantity of ore in sight on your property, from the small amount of prospecting done, and the high prices quoted for vanadium, leads one to believe that you have a valuable property, and one that warrants vigorous prospecting and developing. Respectfully submitted,

(Signed) C. J. PRICE,
Mining Engineer.

Topeka, Kas., Nov. 2, 1916.

To the President and Board of Directors,
of the U. S. Vanadium Development Co.,
Phoenix, Arizona.

Gentleman:

I paid a second visit to your property on October 29th, and was greatly pleased with the progress made in development work and the large amount and excellent quality of ore exposed by this work since my original report of October 11th.

The winze from the Gray Horse tunnel recommended by me at that time had on the 29th ulto., attained a depth of 29 feet, all in high grade ore. In fact, some of the richest ore yet encountered on the property is attained from the bottom of this winze.

The Gray Horse tunnel, extending East, has cut some good commercial ore, and at the time of my recent visit, the face of this tunnel was showing up well.

The prospecting on the Esperanza and Black Cap veins are in ore, but has not advanced far enough to determine the extent and possibility of these veins.

Improvement shown in your property by following recommendations made by me in my original report, prove my deductions at that time were correct and you are proving a large body of high grade ore.

When the winze above referred to attains a depth of 50 or 60 feet, I recommend that you run another tunnel, some 80 feet below the present one, and almost in line with it. You will, no doubt, encounter ore near its portal, and should drive on the cleavage or fissure, followed in the upper tunnel. This tunnel will eventually connect with the winze now being sunk, and will be your main working tunnel, as it is the lowest place at which you can attack this vein without sinking.

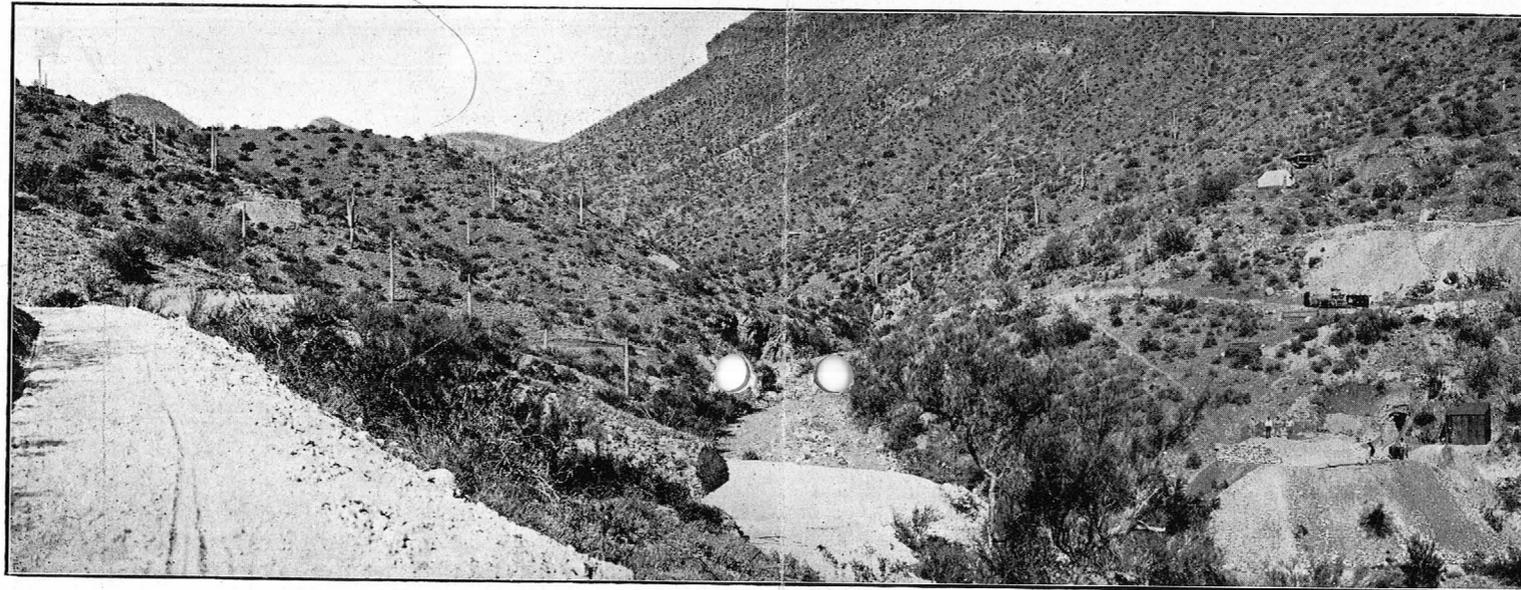
I congratulate you on your proven ore body.

Sincerely yours,

(Signed) C. J. PRICE,
Mining Engineer.

The winze referred to in Mr. Price's letter of November 2nd has been sunk and the lower tunnel has been driven in and connected with the winze and we are now sinking on the winze and driving the tunnel ahead and there is rich ore in both of these workings. The new road has been completed to our main workings and we are

now having the ore thoroughly tested by different processes to determine which process will save the greatest amount of the ore values, and when this is finished it is the intention to install a plant for the treatment of the ore at once.



ASSAY OFFICE OF J. S. NEALL,
307 N. First St. P. O. Box 1148
Phone 1035.

Phoenix, Ariz., Feb. 24, 1916.

This is to certify that the samples submitted to me for assay by U. S. Vanadium Development Company contain as follows per ton of 2000 pounds:

Marks	Percentage Vanadium Pentoxide
5	3.75
14	8.20
3 Tunnel	10.45

J. S. NEALL, Assayer.

Abstract of Report on the U. S. Vanadium Mine By J. C. Steele, Mining Engineer

Phoenix, Arizona, February 21, 1916.

canvas sheet and was broken to 1-inch size before quartering.

In making up samples for analysis, a composite sample composed of proportionate parts of each sample as the sample represented feet of ore, viz: 3 feet, 3 parts; 5 feet, 5 parts, respectively, was the relative weight of pulp taken to make a composite sample. This method was only used where the ore was fairly uniform and on consecutive samples. As a check on this work, the average of the tunnel samples give only a difference of .05% from the dump sample.

The sampling was made with the object of ascertaining the average value of all ore developed. Selected samples will give much higher results and it is probable that careful mining will eliminate waste, thereby increasing the grade of the ore.

SAMPLINGS

The dump at the Gray Horse was trenched for about 60 feet and a shoveled sample taken the entire length of the trench; this was broken and quartered on canvas and reduced to about 4 pounds. The tunnel was sampled at intervals of about 10 feet; the points are more definitely illustrated on map No. 1.

This sampling was executed in a systematic way by cutting about 2 pounds from each foot of ore, which would give a 10-pound sample from a 5-foot cross-section of ore. The ore, if cut from the roof, fell on a

A feature worthy of consideration is the fact that the samples Nos. 9 to 15 to 18 inclusive, and cut from the floor of the tunnel, averaged 4% and are represented by composite Sample D.

Composite A, made of Nos. 1 to 5 inclusive, was from the roof of the tunnel covering about the same distance on the vein shows 1.90% V_2O_5 or Vanadium Pentoxide. It was observed that the ore was of better grade; however, great care was taken in cleaning up, then cutting up several inches and brushing up again before cutting the sample. A sample from the dump at the shaft over the tunnel gave re-

turns of 1.70%, which indicates an increase in value with depth when compared to 2.6% the average of all samples taken from the tunnel.

The inclement weather prevented a more extended examination of the surface cuts and outcrop.

The percent given for all assays is the percentage of Vanadium Pentoxide or V²O⁵, this being the chemical form of the product as obtained by analysis.

ORE RESERVES

In the present state of development, the basis is very limited for the usual determination of positive ore. By reference to map No. 2, Block A., contains 3,100 tons above the tunnel. The samples as cut give an average width of about 5 feet and to be fairly safe 4 feet is taken as a basis of width or thickness.

Block B, contains 4,800 tons and extends 75 feet below A to about a level of the proposed lower tunnel. In some cases 50 feet of depth is allowed as positive ore, providing the vein is not less than 4 feet thick; also that the ore occurs in a well defined chute and not in lenses, and that there is no indication of faulting.

From the fact that this is a true fissure and all other features are favorable, one-half of Block B, or 2,400 tons is considered positive ore. The dumps contain over 500 tons X 3,100 X 2,400 tons plus 2,400, one-half of B = 17,000 tons probable ore. The possible ore is an elastic problem, having a wide range of possibilities, as a basis for comparative calculation 50% of the tonnage as indicated in Blocks D to J inclusive, would give 101,200 ÷ 2 = 50,600 tons, the above estimates are only made to illustrate the possibilities.

The Esperanza and Ready Cash veins will produce Vanadium ore, there is now probably 1,000 tons which could be mined from the surface, with development, a large tonnage of valuable ore is considered probable.

SUMMARY OF ORE RESERVES

Positive ore.....	6,000 tons
Probable ore.....	17,000 tons
Probable ore.....	50,600 tons

<i>Assays</i>	
No. Sample	No. Feet Cut
1	8
2	1
3	5
4	4
5	3 Composite sample
	<u>21</u> A. Assay = 1.9%
6	4
7	5
8	3
14	1
	<u>13</u> B. Assay = 2.8%
9	1
15	3.5
16	5
17	3
18	7
	<u>19.5</u> C. Assay = 4%
19	8.5
20	3
21	1
22	3
	<u>15.5</u> Assay = 1.6%

The foot percentage average = 2.6%

SAMPLE

No. 12	Dump Gray Horse tunnel assay	2.65%
No. 13-2	Class D. Gray Horse tunnel assay88%
No. 10	Ready Cash cut in gulch.....	1.1 %
No. 23	Ready Cash dump.....	.40%
No. 24	Ready Cash cut N. of vein25%
No. 25	Esperanza 6 feet face winze	1.66%
No. 26	Esperanza dump.....	1.55%
No. 27	Gray Horse dump at shaft	1.70%

INDUSTRIAL APPLICATION

The most important use for vanadium is in the manufacture of special steel alloys. Owing to the properties above referred to the vanadium introduced into the molten iron decomposes the suboxide of iron with the result that the easily fusible vanadium oxide passes into the slag, together with the Vanadium Nitride formed at the same time; the vanadium thus acts as a scavenger, removing the deleterious nitrogen and oxide compounds, leaving a strong coherent metal which is at the same time free from "dryness." The vanadium in solid solution in the carbonless portions of the iron renders the metal coherent and less liable to disintegration, at the same time exerting a third influence by its chemically combined carbon; there is an increase in strength in the inverse ratio to the percentage of graphite present in the iron. The amount of vanadium remaining in the steel does not amount to more than 0.22 per cent.

There is a marked increase in the figures given for tensile and transverse tests by cast-iron treated with vanadium. Increased compression power is also produced without loss of hardness. The most valuable property, however, is its resistance to abrasion, rendering the vanadium iron extremely suitable for locomotive and automobile cylinders and bushings; in the case of cylinders, the metal assumes a mirror-like polish which has distinct advantages.

The introduction of vanadium into iron practically eliminates the troublesome porosity which so often spoils a complex piece of casting. In the case of steels, the advantage of the introduction of vanadium is at once apparent when it is realized that the static power is unaltered, while the dynamic power is enormously increased, thus affording a steel particularly suitable for all parts of the machines which are subject to continual shock. On this account it has been used for motors of every kind.

The vanadium steels are most useful for

high-speed tools on account of their increased hardness on the temperatures rising at a red heat they do not lose any of their properties. The effect on steel is three-fold:

1. It dissolves in the carbonless portion of the iron, which it toughens and renders more impermeable to the carbide, doing much to prevent segregation of the carbide.
2. It removes the deleterious oxides and nitrides and dissolves gases and toughens the steel.
3. It forms complex carbides with other carbide-forming metals, such as chromium and nickel, if these metals are present, thus enhancing the static strength of the steel.

Vanadium bronzes and other alloys are also coming into use; they show an increased strength and toughness and are more compact, without any loss of electrical conductivity. The bronzes show a resistance to abrasion, which renders them suitable for trolley wheels and bronze gears.

CONCLUSION

The foregoing facts and deductions are self-explanatory and need no further comment. The excellent showing made by the veins and the valuable metallic contents justify the writer in stating that it is a property of great merit and vast possibilities.

Respectfully submitted,

(Signed) J. C. STEELE,
Mining Engineer.

AMERICAN VANADIUM COMPANY

From Engineering and Mining Journal, August 26, 1916.

"VANADIUM has caused a sensation this week through the announcement that all the stock of the American Vanadium Co., which practically controls most of the output and has built up a large business in the

sale of the ore and metal and in the making of vanadium steel, has been sold to a syndicate of Philadelphia and New York capitalists for \$7,000,000 which is \$1,000 per share. The price is payable \$650 in cash and \$350 in notes or stock of the new company which is to be organized. The old company is owned in Philadelphia and Pittsburgh and has \$700,000 stock. The new company which will retain the name of the old, will have a capital of \$13,500,000, made up of \$5,000,000 of 7% preferred stock, \$6,000,000 of common, and \$2,500,000 of 6% short-term notes. At the head of the syndicate which takes over the company are, J. L. Replogle and Kuhn, Loeb & Co. With them are associated Cassatt & Co., of Philadelphia, Chandler Bros. & Co., Harrison Williams, and half a dozen others. Mr. Replogle, now vice-president and general manager of the company, will be made president after the conclusion of the sale. James J. Flannery, head of the present company, will become chairman of the board."

Standard Corporation Service (New York) for
August, 1916.

AMERICAN VANADIUM COMPANY

(1) TRANSFER TO BANKING SYNDICATE PLANNED—A dispatch from Pittsburgh, Pa., August 21, 1916, stated that this company, controlled by the Flannery interests of Pittsburgh, the largest concern of its kind in the world, probably would pass into the hands of an Eastern Banking Syndicate which was offered \$7,000,000, or \$1,000 for each of its 7,000 shares. It was understood that the syndicate represented a group of steel men who contemplated the formation of a new company for the production of vanadium. It was known definitely that the works were

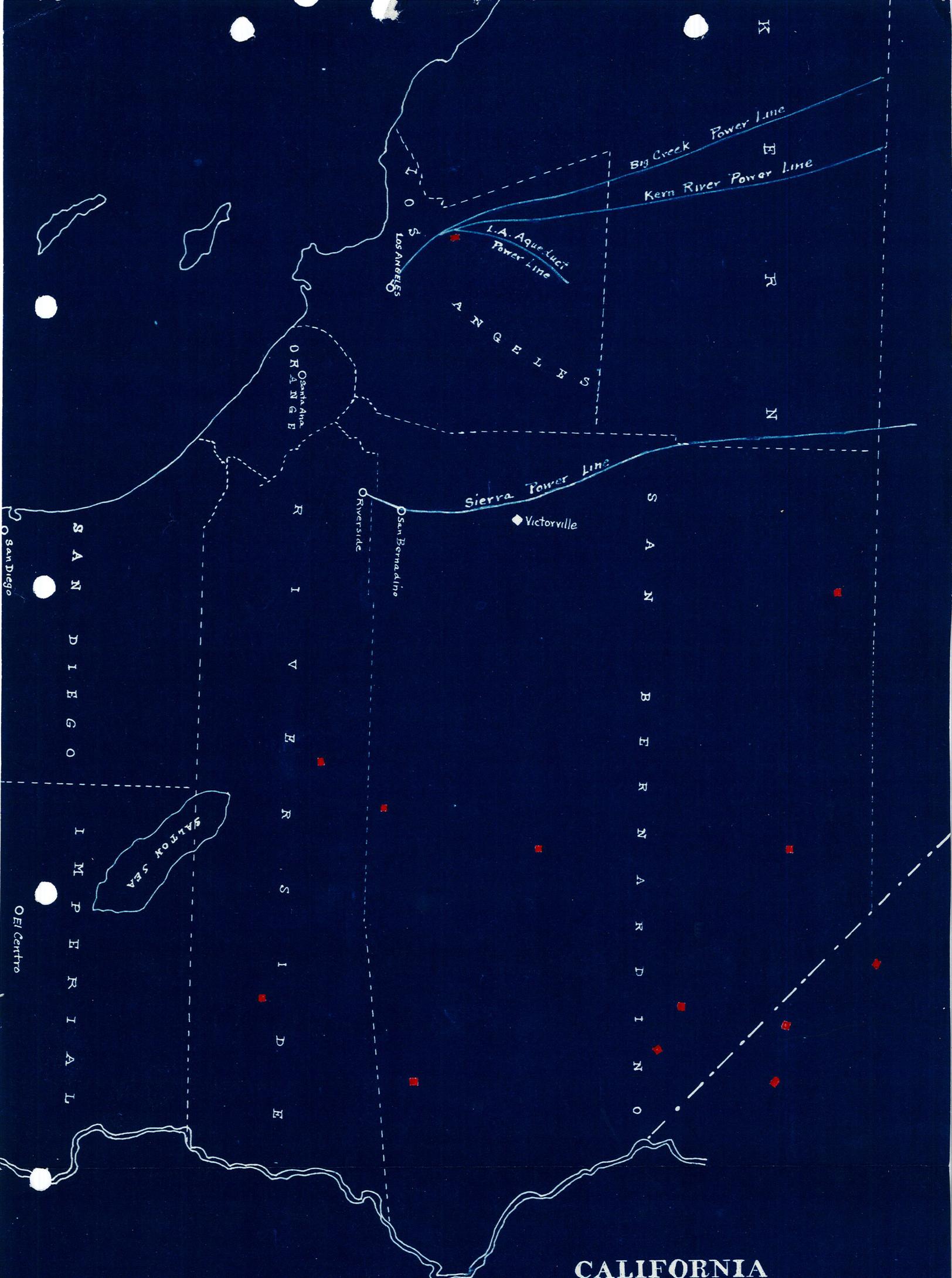
to remain at Kirwan Station, near Bridgeville, Pa., where the company has an investment of more than \$600,000.

James J. Flannery held more than a controlling interest in the company and was its president. He had advised the acceptance of the bankers' proposition by the other stockholders. An option had been taken on two-thirds of the stock.

The Vanadium Company, was a close corporation. The last quotations on the stock, so far as could be learned, were \$500 to \$550, with a small sale recently. The company was organized in 1906 by the Flannery interests, and was capitalized at \$700,000, which was represented by preferred stock only at \$100 par. There were no bonds. It had large ore deposits in Peru. Vanadium, the company's sole product, was quoted at approximately \$250 a pound.

(2) RECAPITULATION—It was stated August 23, 1916, in connection with the recapitulation of the company that the new organization would have a capital of \$13,500,000, represented by \$5,000,000 preferred stock, \$6,000,000 common stock and approximately \$2,500,000 in 6% short-term notes. The stockholders of the old company had been offered \$65 in cash in 6% notes for each share of old stock. This exchange would call for \$4,550,000 in cash and \$2,450,000 in 6% notes, the old company having been capitalized at \$700,000 in stock and being free from bonded indebtedness.

The stock of the company would be underwritten by a syndicate composed of Kuhn, Loeb & Co., Cassatt & Co., of Philadelphia; J. L. Replogle, vice-president of the company; Chandler Bros. & Co., Harrison Williams, and others. Subscriptions to the syndicate had been closed, the issues having been oversubscribed about 300%. The largest participants in the syndicate underwriting were said to be J. L. Replogle, Harrison Williams and Kuhn, Loeb & Co.



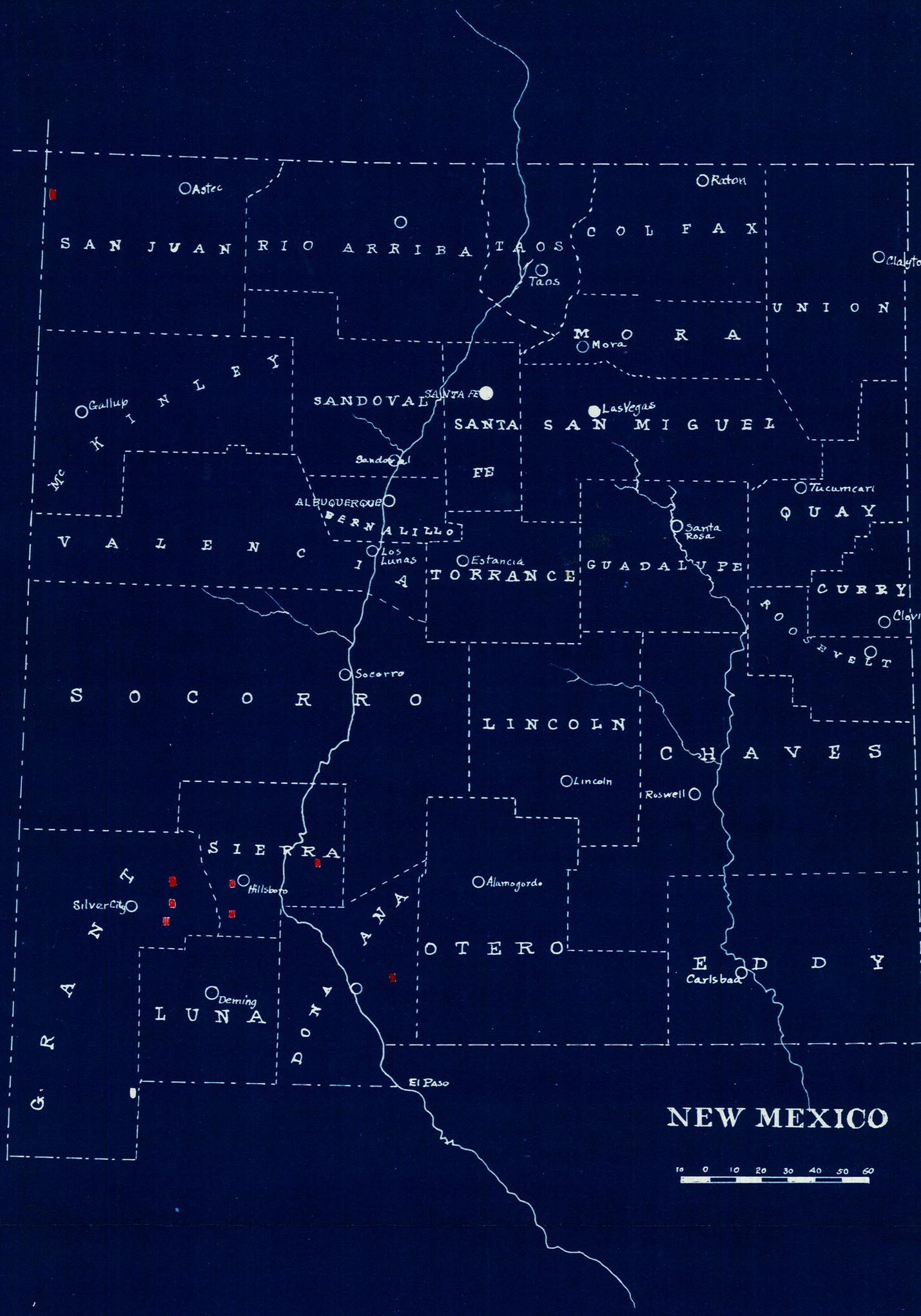
CALIFORNIA
(Southern Part)





ARIZONA

SCALE OF MILES
0 10 20 30 40 50 60



○Astec

○Raton

SAN JUAN RIO ARRIBA TAOS COLFAX

○Clayton

○Taos

UNION

○Mora

MORA

○Santa Fe

SANDOVAL SANTA FE

○Las Vegas

SANTA FE SAN MIGUEL

○Gallup

○Albuquerque

○Santa Rosa

QUAY

○Tucumcari

○Los Lunas

○Estancia

GUADALUPE

○Santa Rosa

CURRY

○Clavis

○Socorro

SOCORRO LINCOLN

○Lincoln

CHAVES

○Roswell

SIERRA

○Alamogordo

OTERO

○Silver City

○Hilbeto

○Deming

LUNA

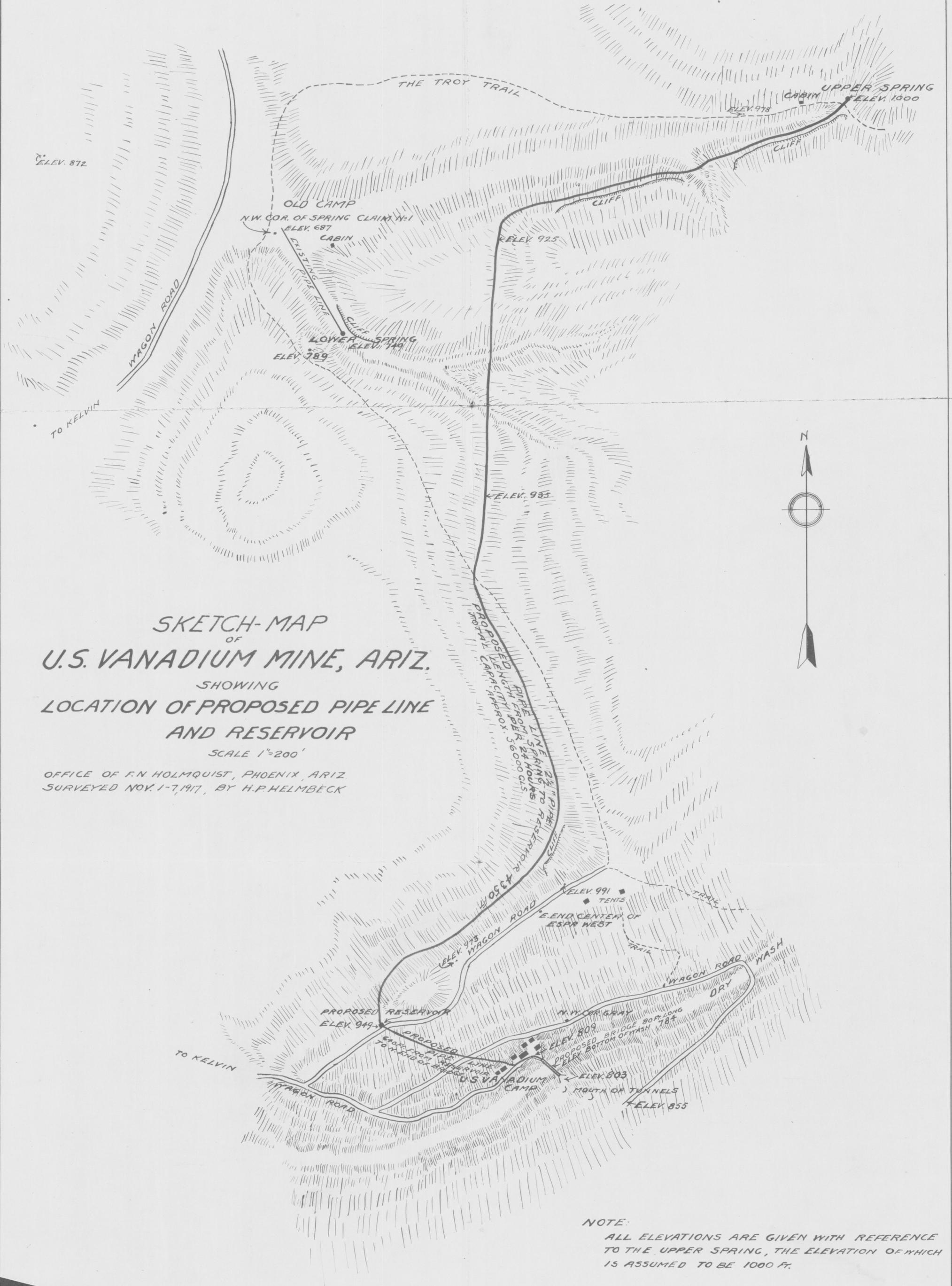
○Carlsbad

EDDY

○El Paso

NEW MEXICO





SKETCH-MAP
 OF
 U.S. VANADIUM MINE, ARIZ.
 SHOWING
 LOCATION OF PROPOSED PIPE LINE
 AND RESERVOIR
 SCALE 1"=200'

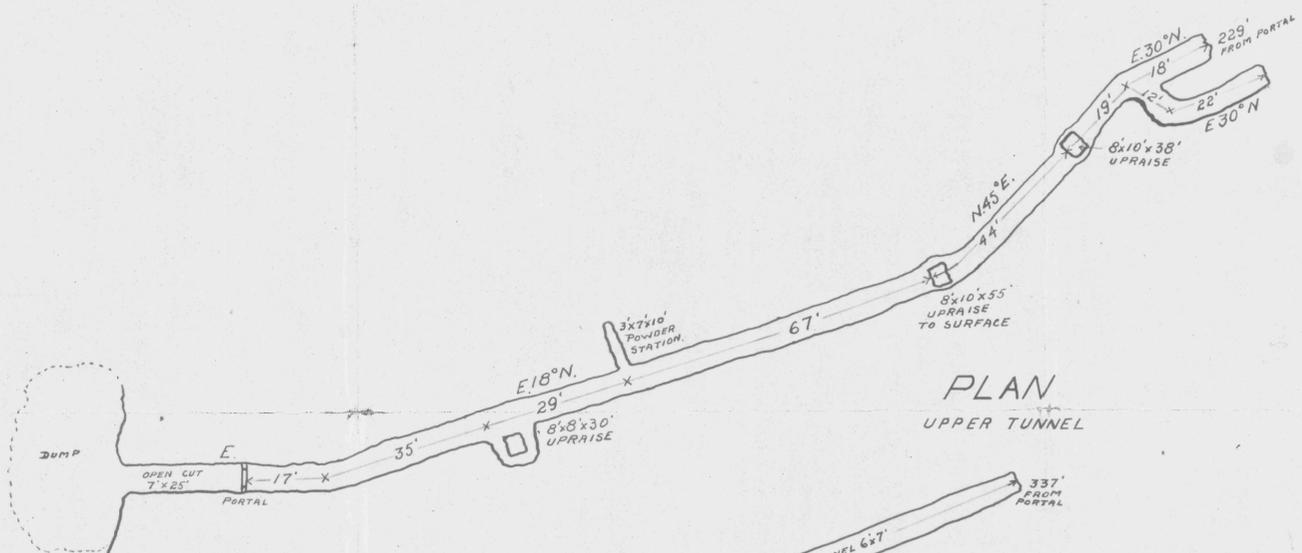
OFFICE OF F.N. HOLMQUIST, PHOENIX, ARIZ.
 SURVEYED NOV. 1-7, 1917, BY H.P. HELMBECK

NOTE:
 ALL ELEVATIONS ARE GIVEN WITH REFERENCE
 TO THE UPPER SPRING, THE ELEVATION OF WHICH
 IS ASSUMED TO BE 1000 FT.

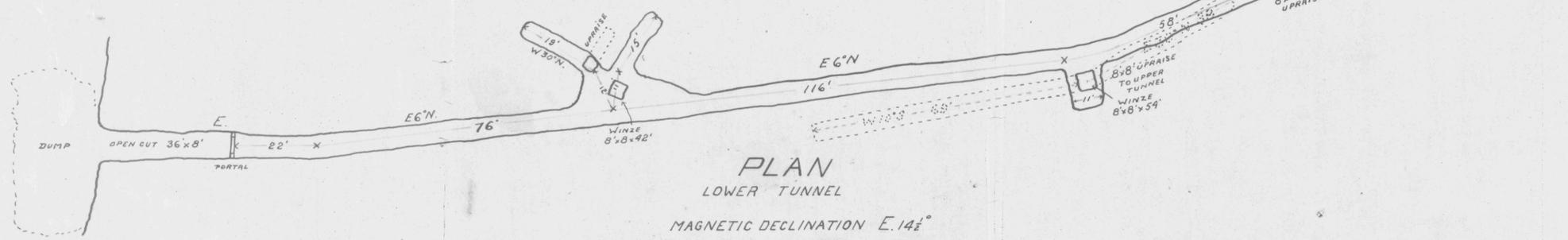
PLAN AND CROSS SECTION
 UNDERGROUND WORKINGS
 MINE OF
 U.S. VANADIUM DEVELOPMENT CO.

PINAL COUNTY
 ARIZONA.
 1917.

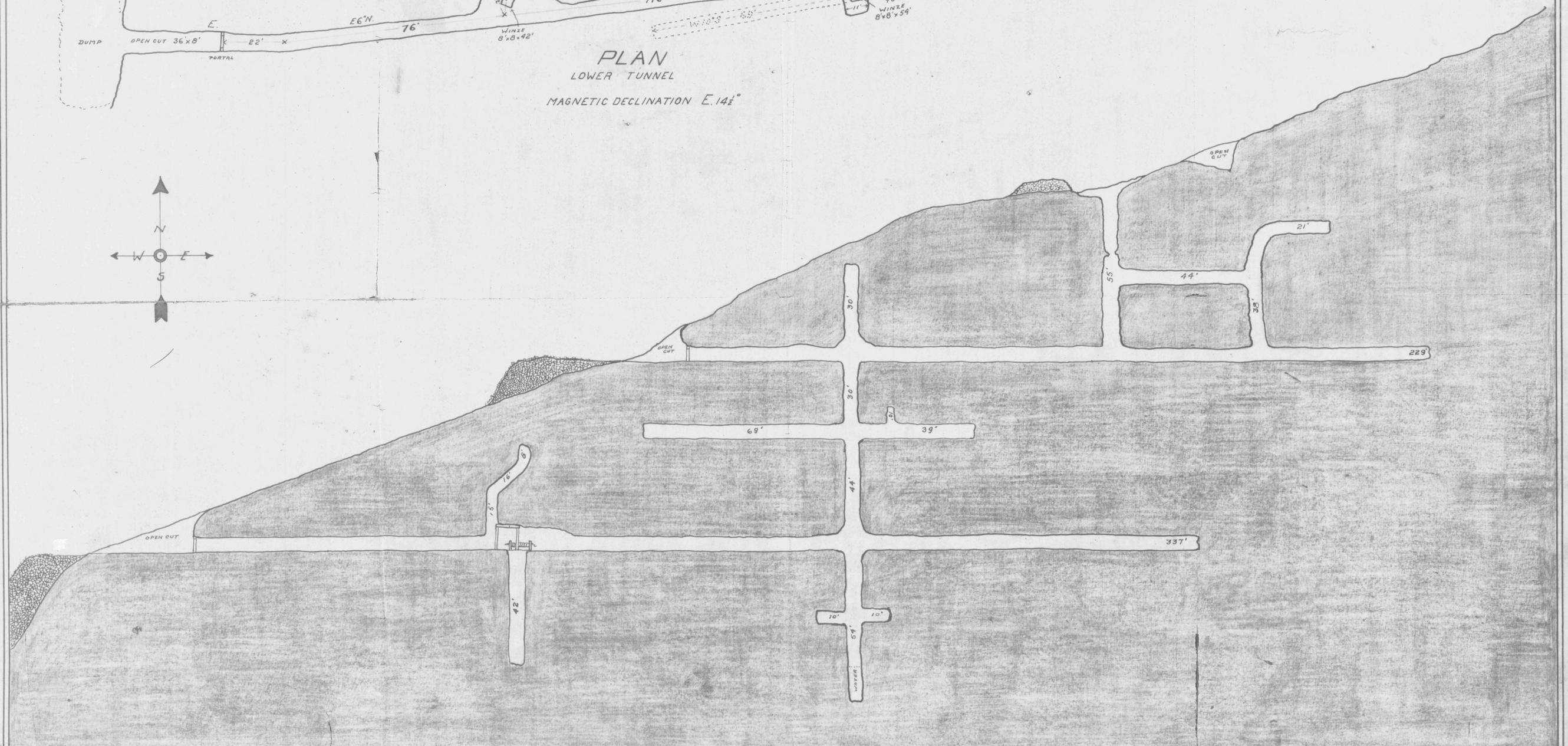
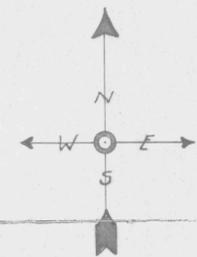
SCALE 1"=10'



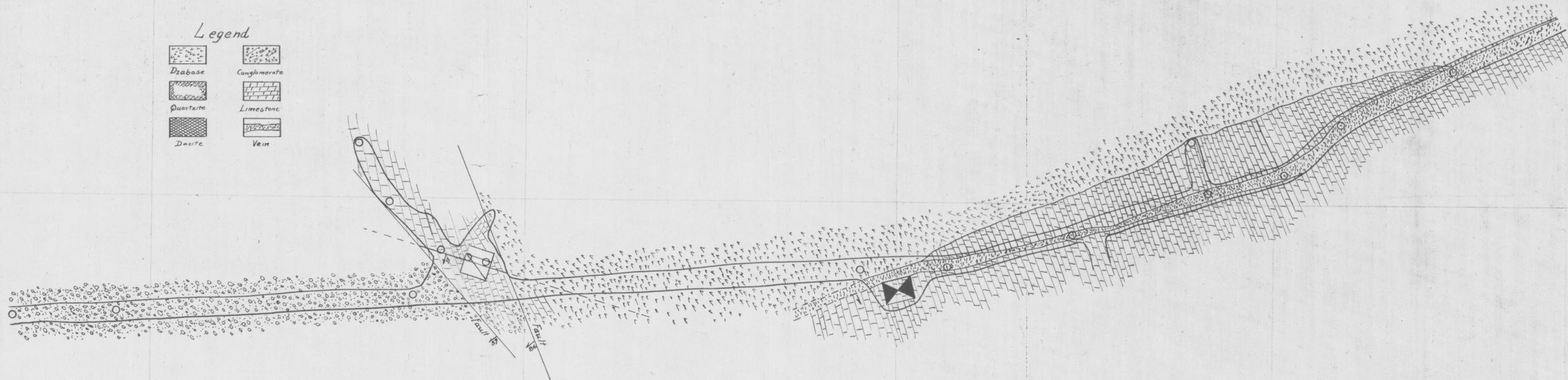
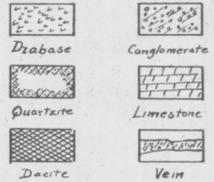
PLAN
 UPPER TUNNEL



PLAN
 LOWER TUNNEL
 MAGNETIC DECLINATION E. 14 1/2°

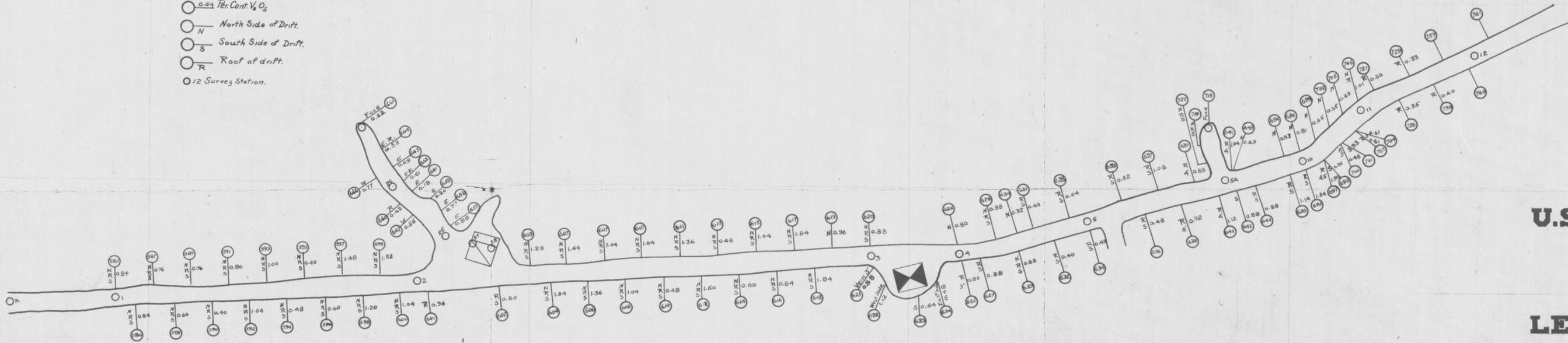


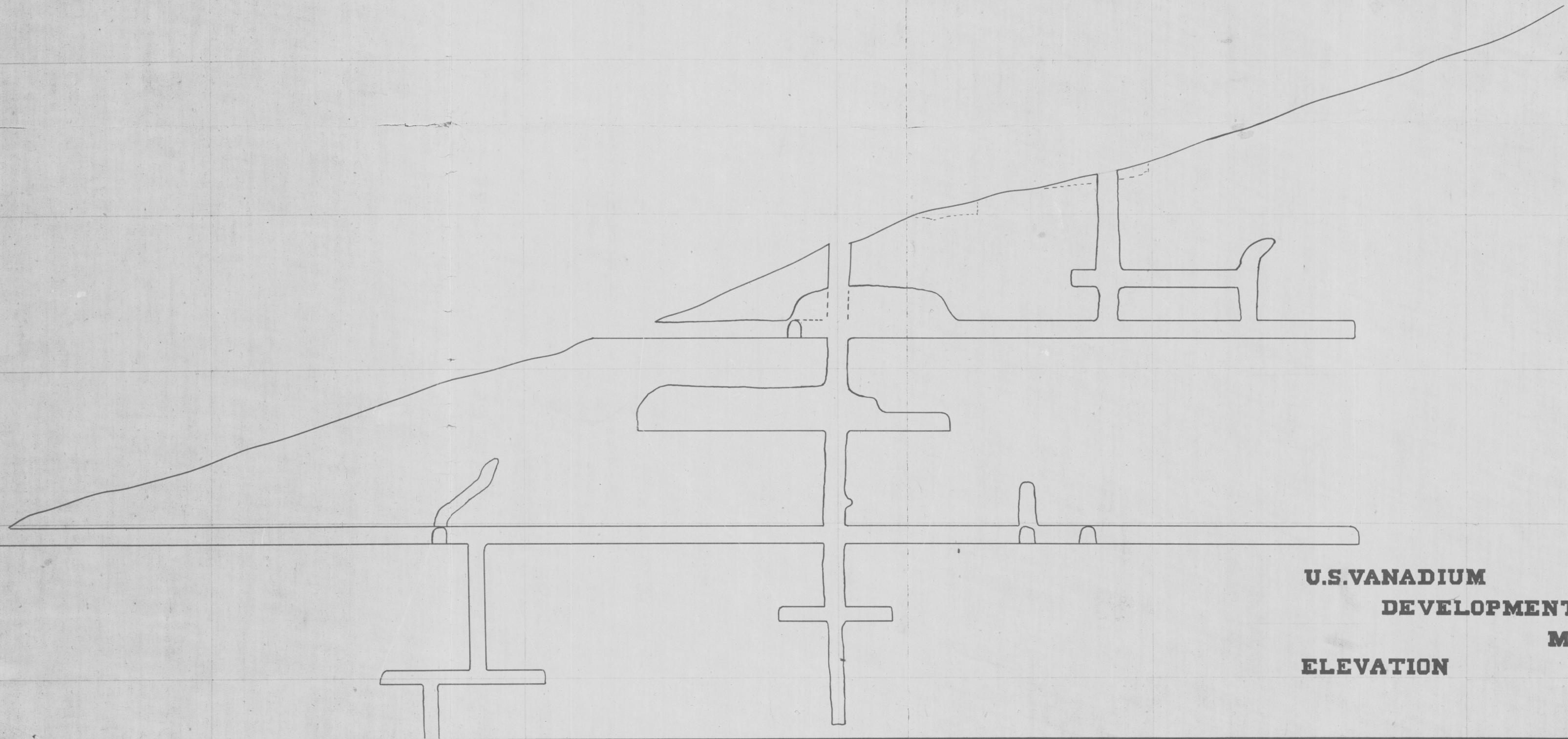
Legend



Legend.

- Sample No.
- 0.5% Per. Cent. V_2O_5
- North Side of Drift.
- South Side of Drift.
- Roof of drift.
- 1/2 Survey Station.





2850

2800

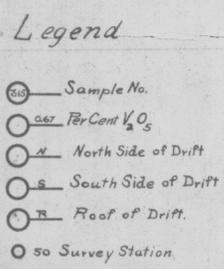
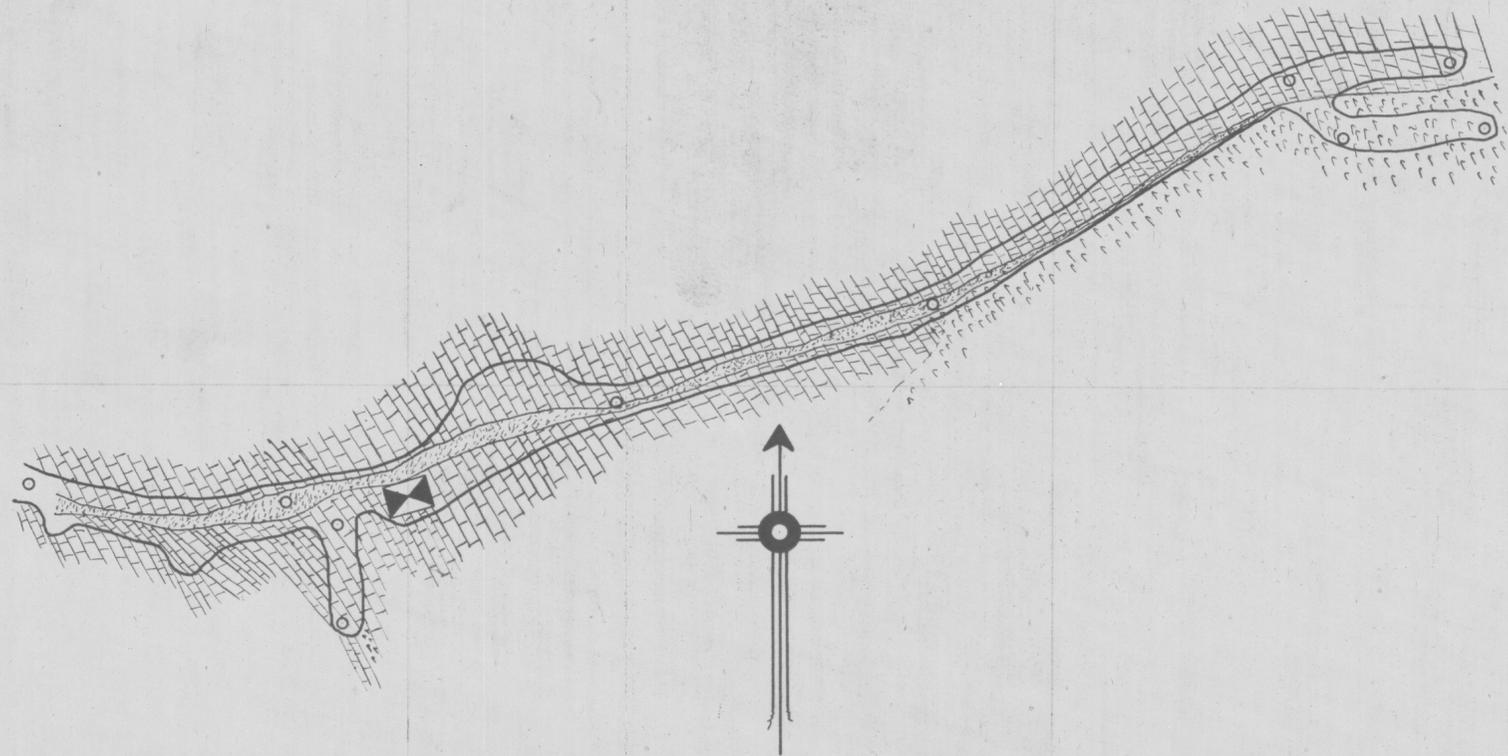
2750

2700

**U.S. VANADIUM
DEVELOPMENT CO.
MINE.
ELEVATION**

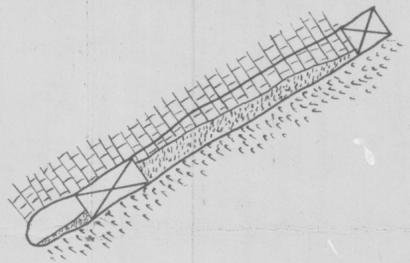
**U.S. VANADIUM
DEVELOPMENT CO.**



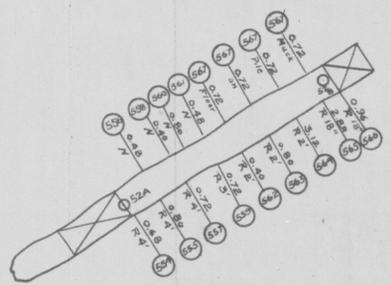
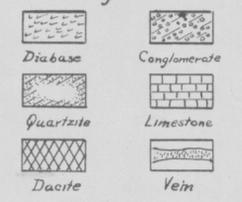


**U.S. VANADIUM
DEVELOPMENT CO.
LEVEL 2810 MINE**

Scale 1 in. = 20 ft.



Legend

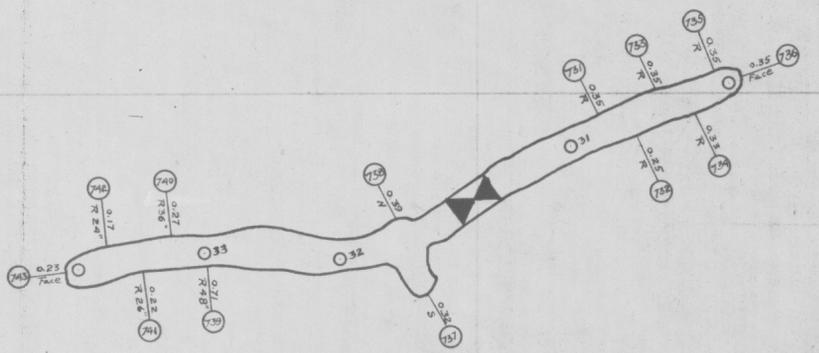
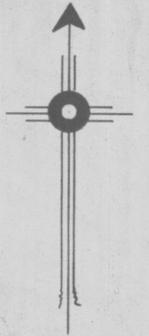
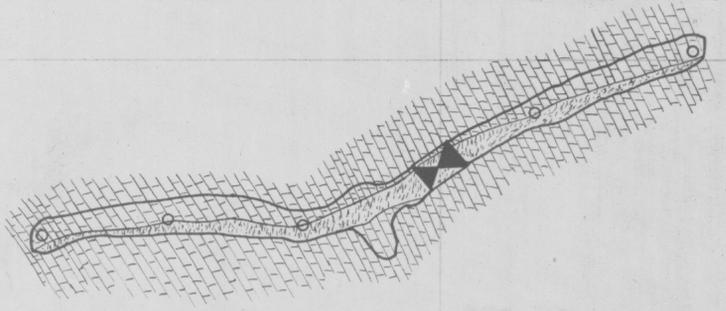


Legend

- Sample No.
- 0.95 78r Cent V₂O₂
- North Side of Drift
- South Side of Drift
- Roof of Drift
- 59 Survey Station.



LEVEL 2826

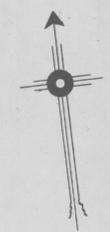


**U.S. VANADIUM
DEVELOPMENT CO.
MINE.**

LEVEL 2770

Scale 1 in = 20 feet.

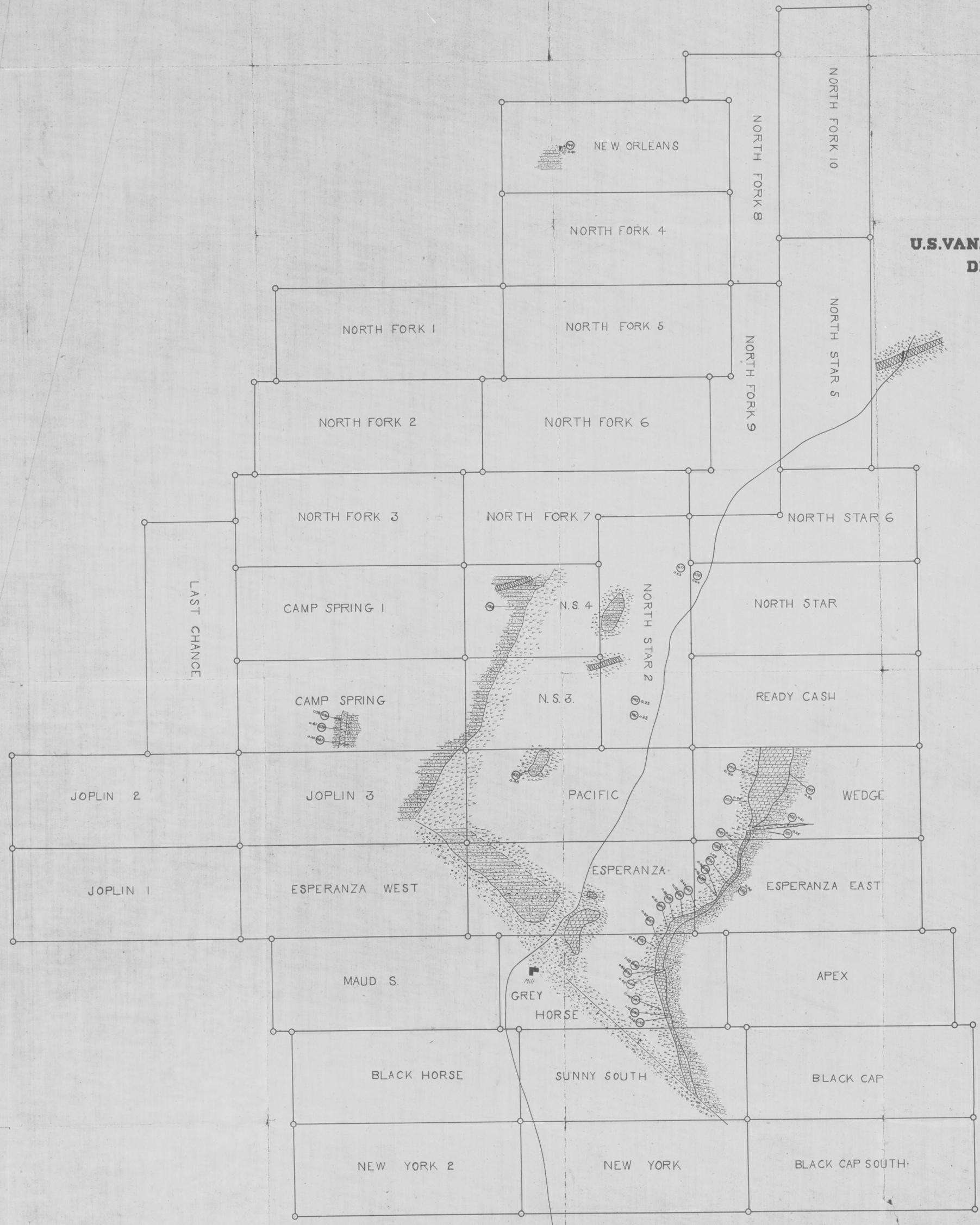
**U.S. VANADIUM
DEVELOPMENT CO.**



Legend

Diabase	Conglomerate
Quartzite	Limestone
Gneiss	Vein
Dacite	Sample No.
	V. West 1/4, Q.

Scale 1 in. = 500 ft



LAST CHANCE

NEW ORLEANS

NORTH FORK 4

NORTH FORK 1

NORTH FORK 5

NORTH FORK 2

NORTH FORK 6

NORTH FORK 3

NORTH FORK 7

NORTH STAR 6

CAMP SPRING 1

N.S. 4

NORTH STAR

CAMP SPRING

N.S. 3

READY CASH

JOPLIN 2

JOPLIN 3

PACIFIC

WEDGE

JOPLIN 1

ESPERANZA WEST

ESPERANZA

ESPERANZA EAST

MAUD S.

GREY HORSE

APEX

BLACK HORSE

SUNNY SOUTH

BLACK CAP

NEW YORK 2

NEW YORK

BLACK CAP SOUTH