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Excerpt from: ECONOMIC GEOLOGICAL RECONNAISSANCE
of CASA GRANDE MINING DISTRICT
By J. B. Tenney
(Arizona Bureau of Mines)

REWARD MINE

History and Production

The Reward Copper Mine was discovered at about the same time as the Vekol in 1879 or 1880. The price of copper at that time varied between eighteen and twenty six cents. Copper mines were then at a premium and by 1883, the mine had been acquired by a strong company known as the Reward Mining Company, a 110-foot incline had been sunk in ore and the U. S. Mint Report for that year reported 700 to 1000 tons of 26 percent ore on the dump ready for treatment. In the following year, after the development of water in an 800 foot well at the mine a small water-jacket blast furnace was erected. This was put in blast in 1885 and produced, according to the Tucson Star, 37,660 pounds of black copper. The price of copper had started to drop in 1883, and the average for 1884 was 13 cents and for 1885 was 11 cents.

The mine and smelter were closed late in 1885 and remained down until 1902 when the mine was acquired by a British company organized as the United Arizona Copper Company. The smelter was rebuilt and enlarged to a capacity of 30 tons a day and a small production was made in 1903.

In 1905, during the boom copper market of that year, the mine was bonded to a Bisbee and Duluth organization known as the Casa Grande Development Company, promoted by H. B. Hovland and Hoval A. Smith. A small tonnage of high grade ore was mined and shipped to the El Paso smelter in 1907 and 1908 after which the mine was closed. The option was surrendered in 1910. The mine was reopened during the World War years and a little ore was shipped and considerable development work was done by the present owners. The mine was again closed in 1920 and remained closed until 1929 when a lessee shipped 1000 tons of neutral slag from former smelting operations.

The total production of the mine has been about 450,000 pounds of copper with a gross value of about $75,000.

The mine is owned by Kimball Pomeroy and Dr. Schorneck of Mesa, Arizona.

Location and Mining Property

The mine is situated on the eastern slope of the easternmost ridge of the Vekol mountains, about mid-way of the length of the range. It is about five miles due east of the Vekol mine. The property is reached from Casa Grande by a 36-mile desert road, 29 miles of which is maintained as a county road, and seven miles of which is a fair desert road passable except under severe weather conditions.

The property consists of two patented claims and 27 claims held by location. Most of the work has been done on patented ground.

*

Mine Development

The principal work has been done from an inclined shaft sunk to a depth

of about 600 feet on an inclination of about 27 degrees. The shaft was sunk from the end of a cross-cut tunnel 100 feet long which cut the ore bed on which the shaft was sunk 50 feet below the outcrop. Levels are spaced at approximately 100 foot intervals, and several thousand feet of lateral work has been done on each side of the shaft. At the bottom of the incline a 225-foot winze was sunk at an inclination of 50 degrees for a distance of 25 feet followed by 200 feet of vertical winze. In addition to the lateral work, considerable stoping was done close to the shaft, and several prospect inclined raises and winzes were driven.

A thousand feet east of the inclined shaft a vertical shaft was sunk from which, judging by the size of the dump, considerable work was done. The shaft is badly caved and inaccessible.

Starting 1000 feet south of the shaft, on the eastern slopes of the ridge, are a series of open cuts, cross-cut tunnels and inclined shafts, aggregating several thousand feet of work, for a distance of about 4000 feet south of the main incline shaft. At the south end of this zone a 350-foot shaft was sunk, known as the Phonodoree shaft.

Geology and Ore Occurrence

The ore occurs entirely as bedded replacements of Pennsylvania limestone in close association although not generally in direct contact with porphyry dikes classified in the field as diorite porphyry. The dip of the limestone is west 15 to 20 degrees. The principal ore bed developed lies below 15 feet of calcareous, thin-bedded shale, which is overlain by ten feet of thin bedded brown quartzite, in turn overlain by a massive medium-grained limestone. The principal ore bed outcrops as copper-stained gossan about three feet thick for about 100 feet on the strike followed to the south by over 100 feet of massive garnet two to three feet thick. The main shaft was sunk near the center of the gossan outcrop and continued in oxidized ore to a depth on the incline of over 600 feet. The lateral work at each level developed a length and thickness of ore on each level of about the same as the length and thickness as that of gossan outcrop. South of the ore garnetized limestone was encountered on each leve. An inclined winze 100 feet deep was sunk at right angles to the bedding on the 300-foot level was driven in fresh limestone throughout. The ore bed terminated at the bottom of the inclined shaft against a strong fault striking north-south with vertical dip. The winze from the bottom of the shaft was started in the fault and was continued to the bottom in unaltered limestone.

East of the outcropping ore bed, covered by the mine dump and surface detrius, a north striking fault of several hundred feet occurs which has dropped the beds to the east several hundred feet as evidenced by the outcrops occurring in a low hill 500 feet east of the main workings on the eastern flanks of which a vertical shaft was sunk in an attempt to find the faulted segment of the ore. This shaft, now inaccessible, was sunk on an east-west nearly vertical fault associated with a strong copper-stained gossan. Judging from the dump at the shaft, the work was done in limestone and quartzite.

* About 1000 feet south of the main ore outcrop, on the eastern side of the ridge, a dike or mass of porphyry outcrops, classified in the field as diorite

porphyry. This dike with a generally north-south strike can be traced for over 3000 feet to the south. Its width is uncertain as the eastern side and a considerable part of the outcrop itself is covered by recent conglomerate or "caliche". Considerable mineralization accompanies the dike. At many points, certain favorable beds are strongly garnetized, and in several occurrences garnetization extends for several hundred feet down dip from the contacts. The garnet formed in the yellow lime garnet grossularite. Other beds have been intensely replaced with iron and copper sulphides which have been left as strong copper-stained gossans associated with veinlets of gypsu. Several thousand feet of work has been done on these various outcrops and in the Phonodoree shaft sunk on a massive limonite outcrop about 4000 feet south of the main Reward workings the only sulphide ore on the property was encountered as three beds replaced by zinc-blende associated with pyrite specularite, magnetite, and chalcopyrite. The thickness of mineralized beds in the southern contact deposits varies from a foot to ten feet and over. The copper occurs as veinlets and stain of chrysocolla in the gossans. The gossan material consists of limonite and much silky yellow jarosite. The grade is generally low in copper, although some small lenses of better grade ore were encountered.

Future Possibilities

The oxidized ore remaining in the main workings at the north end of the property is of medium grade, and requires considerable sorting to allow for shipment to a smelter at a profit. Oxidation is probably deep in this extremely arid part of the state. The present ground water level was encountered in the bottom of the winze off the bottom of the 600-foot inclined shaft, about 400 feet vertically below the level of the surrounding plain. It is, however, probable that oxidation extends considerably deeper than the present ground water table due to gradual rise of the table in the past as the valleys or plains were filled with detrital material washed in from the mountains. In the well sunk at the mine, permanent water was encountered at a depth of about 800 feet. The strong persistance of mineralization following favorable beds, demonstrated in those beds followed, makes the search for deep-level, sulphide ore attractive, as the possibilities are good for large bodies amenable to treatment by selective flotation. In this deep prospecting the search for ore in other beds than those now developed would be necessary.

In the southern end of the property the same conditions exist except that deep prospecting may encounter primary material richer in zinc than in copper.

*

LOCATION AND ACCESSIBILITY:

The Reward Group of claims is located thirty miles south of Casa Grande, in the Casa Grande Mining District, Pinal County, Arizona. Casa Grande is situated on the main line of the Southern Pacific Railroad.

The claims are reached by a good wagon road across a very flat country. Freighting is done by wagon at a cost of six dollars per ton from Casa Grande. Auto trucks could cut this cost considerably.

CLAIMS:

The property consists of two patented claims, area approximately 26 acres and twenty-nine unpatented, area approximately 406 acres. They are contiguous and cover all surface showings.

HISTORY OF PROPERTY:

The property was originally opened up nearly thirty years ago by an English Company who sunk the Zinc shaft on the Phonodoree claim 300 feet but did no lateral work and also drove the copper incline on the Reward Claim approximately 500 feet. They installed also a 30-ton circular Blast Furnace, which treated approximately one thousand tons of ore.

Since then the property has had a varied history. Hovaland and Smith interests, known as the Casa Grande Development Company, sunk the copper incline to the eighty level. Later the Reward Arizona Mining Company was organized and now it is known as the Casa Grande

*

Arizona Mining Company. The interests represented in the present company have sunk the vertical copper shaft 400 feet and done all the lateral work in the Zinc shaft and are now diamond drilling.

The development of the property seems, for the most part, ill-advised. Little or no attention was paid to the faults which opened the channels for the mineral bearing solutions.

DEVELOPMENTS OF THE DISTRICT:

The Lake Shore Mine, six miles to the East, recently taken over by Hollis & Company of Chicago, is shipping ore with Caterpillar equipment to the Sasco Smelter, thirty miles to the East. At Vekol the dumps of the Old Vekol Silver Mine are being retreated. There are several prospects in the adjoining country which may possibly possess some merit.

GEOLOGY:

A series of sedimentary beds consisting of shales, limestones and quartzites, capped by igneous flows, are tilted up in easy slopes from the flat desert country. These sediments strike, for the most part, northeasterly and dip to the west from 25° to 35°. Granite porphyry, andesite and rhyolite dykes are intruded in the sediments. The sediments are folded and faulted very extensively. Two or possibly three

* large fault movements are of utmost structural importance as forming easy channels for transition of mineral solutions.

DEVELOPMENTS and ORE-OCCURRENCE: Two distinct ore bodies have been developed on the property namely: Zinc and copper. The Zinc occurs mainly on the south end of the property in beds replacing garnetiferous limestone. These beds are cut in the workings of the Zinc shaft on the Phonodoree Claim and also in the long Zinc tunnel on the South Reward Claim.

In the Zinc shaft three or possibly four beds are cut. On the eighty foot level a short cross-cut to the west passed through a zinc bed from 6 to 8 feet thick containing oxidized zinc ore, also some Zinc and iron sulphides and quite a little magnetite. A sample taken here assayed 13.7% Zn., 26.8% Fe., 0.20% Cu., tr. Ag., Nil Au., 1.1% Pb. and 12.6% Ins.

West from the shaft on the 160-foot level, a short cross-cut opened up a zinc bed 4 to 6 feet thick. A sample taken here ran 7.8% Zn., 21.3% Fe., 0.20% Cu., 1.3% Pb., tr. Ag., nil Au., and 32.6 Insoluble. There was little or no oxidization here.

On the 200 level another bed of limestone and magnetite and zinc sulphide was cut. A small station was cut here. A sample taken here ran 12.3% Zn., 15.4% Fe., 0.11% Cu., Tr. AG., Nil AU., 1.0% Pb. and 36.2% Ins.

*

On the 300 level another bed, dipping west, was cut and about 100 feet of drifting done. This drift-

ing was done alongside of the ore. At the shaft a good cross-section of the bed was exposed. Here a sample was taken six feet wide assaying 12.7% Zn., 22.1% Fe., 1.3% Pb., tr. Ag., Nil Au., 25.4% Insoluble. No oxidization was present here.

A general sample was taken of ore on the dump, which was taken from the 300 foot level. This assayed 17.3% Zn., 22.5% Fe., 1.1% Pb., 0.17% Cu., Tr. Ag., Nil Au., 14.0% Ins.

The three zinc beds cut in the tunnel on the South Reward Claim are all oxidized, being replacements of garnetiferous limestones same as in the Zinc shaft. These beds could probably be correlated with those in the Zinc shaft. Bed No. 1 (See Map) six feet wide, ran 17.9% Zn. Bed No. 2, six feet wide ran 10.7% Zn. Bed No. 3 is a wide, badly shattered area of which a 3.5' streak assayed 14.5% Zn.

The copper occurs in garnetiferous limestone beds overlying the quartzites adjacent to faults in the limestones. The copper incline (See Map) is driven within one hundred feet south of the large East and West fault and approximately parallel to it. The copper mineralization is from one to two feet thick being replacement of the limestone and extends about 75 feet south from the plane. The garnets are very greatly altered to hematite giving the country rock an excessive red coloration. In two places in the workings the fault plane was encountered and copper mineralization is present here. No work was ever done on these beds on the north side of the fault. The copper

ore will run from 4% to 8%, carrying about 4 ounces in silver and one dollar in gold. There is no regular continuity of the ore as it occurs in lenses. At the 6th level a north and south fault occurs which increases the dip of the beds to almost vertical. The copper mineralization on the 7th level is smaller than on the 6th. The 8th level was under water and not open for inspection.

A large north and south fault drops the sediments, exposed in the copper Incline, about 300 feet. These beds are all cut in the main copper, vertical shaft on the George Claim eight hundred feet south of the Copper Incline. The shaft is 400 feet deep. The collar is apparently in the east and west fault plane. On the 165-foot level (See Map) a bed of garnetiferous limestone, highly altered to hematite, was cut. Some drifting was done on this bed with a little stoping. The main east and west fault was encountered here and a little drifting done on it. Some copper mineralization is found. On the 250 level another bed was cut, which showed little copper mineralization. A small amount of drifting was done here but the fault plane was not opened up. Below the 250 level the shaft is in iron-stained shales.

Diamond Drill Hold #1 on the Copper Wedge Claim (See
* Map) was put down 500 feet at 60°. At the 190 foot point, it passed through a garnetiferous limestone bed five feet thick, carrying some oxidized copper. A Small Section of

the core was assayed, giving 2.5% Cu. and 0.9 ounces AG. This hole is bottomed in an unaltered porphyry dyke carrying primary iron sulphide.

Hole No. 2 was put down north of the East and West fault at an inclination of 60° to a depth of 703 feet. This hole was oxidized throughout its entire length. The fault plane was encountered at the 480 foot point. From here to the bottom of the hole very small amount of the core was recovered. These pieces show altered beds of garnetiferous limestone.

Hole No. 3 (See Map) was put down vertically on the south side of the east and west fault to a depth of 1400 feet. This hold was oxidized to the 1000-foot point. Series of limestone and quartzite beds were encountered. At the 475-foot point an unaltered prophyry dyke was cut for 75 feet along the hole. Diabase intrusions in the quartzite were found from the 800 to the 1000-foot point. From the 1000 to the bottom of the hole, it was in unaltered diabase, carrying some primary sulphides. A little native copper was said to have been encountered at the 90-foot point in an oxidized garnetiferous limestone bed. This diabase is said to carry 0.1% to 0.4% Cu.

MINING EQUIPMENT.

At the vertical copper shaft, two 60-horsepower boilers, a steam hoist good for 500 feet, a 300 foot air compressor and the necessary feed pumps are installed. This equipment is all too small for further work in this shaft.

Water is obtained for camp purposes from an 800-foot drilled well. Water rises to within 175 feet of the surface. It is pumped from here to a tank on the hill and distributed by gravity. Several other small boilers are on the ground put in poor condition. Wood is used for fuel and can be obtained for $3.00 per cord. The diamond drilling is being done by E. J. Longyear & Co. at a cost of about $4.00 per foot.

CONCLUSIONS: No appreciable Zinc tonnage has been developed. However, there are possibilities of developing a fair tonnage. This zinc ore is probably amenable to treatment according to the results of a selective flotation test shown me by Mr. Effinger and made by Atkins & McCrea, 616 South Olive Street, Los Angeles, California.

The results are as follows:

	% Zn.	% Fe.	% Cu.	%Ins.
Heads	21.3	25.9	0.12	10.0
Middlings	11.5			
Concentrates	51.1	11.3	0.15	2.0
Tails	4.1	34.7		13.2

The east and west fault plane which influences the copper mineralization shows no mineralization on surface.

If commercial ore bodies of copper sulphides be found at depth, it will be along the fault planes. In the mine workings, wherever the fault was opened up, copper mineralization was found. Oxidization here extends to at least

1000 feet so not much could be expected before this depth.

The north and south fault plane has never been prospected. A vertical diamond drill hole put down so that it would cut the east and west fault at or near its intersection with the north and south fault at a depth of 1100 feet, ought to disclose the further value of the property. The porphyry dykes do not influence the copper mineralization for, whever they are encountered in drill holes as well as on surface, they are fresh and unaltered, showing no copper mineralization.

If the property could be obtained on a long term option, I would recommend it for further consideration.

Respectfully Submitted,

March 15, 1917 Original signed J. A. Ettlinger

*

S U M M A R Y

The Reward Group consists of 31 claims in the Casa Grande Mining District, Pinal County, Arizona.

Ore bodies consist of three garnetiferous limestone beds, replaces with zinc sulphides ranging from 6 to 8 feet wide and carry from seven to fifteen per cent Zinc. Copper ore body replacement of garnetiferous limestone superimposed on quartizite beds adjacent to fault planes.

No appreciable tonnage of either ores developed. Possibly a fair tonnage of zinc ores could be developed. If property could be obtained on long term option, I would recommend for further consideration.

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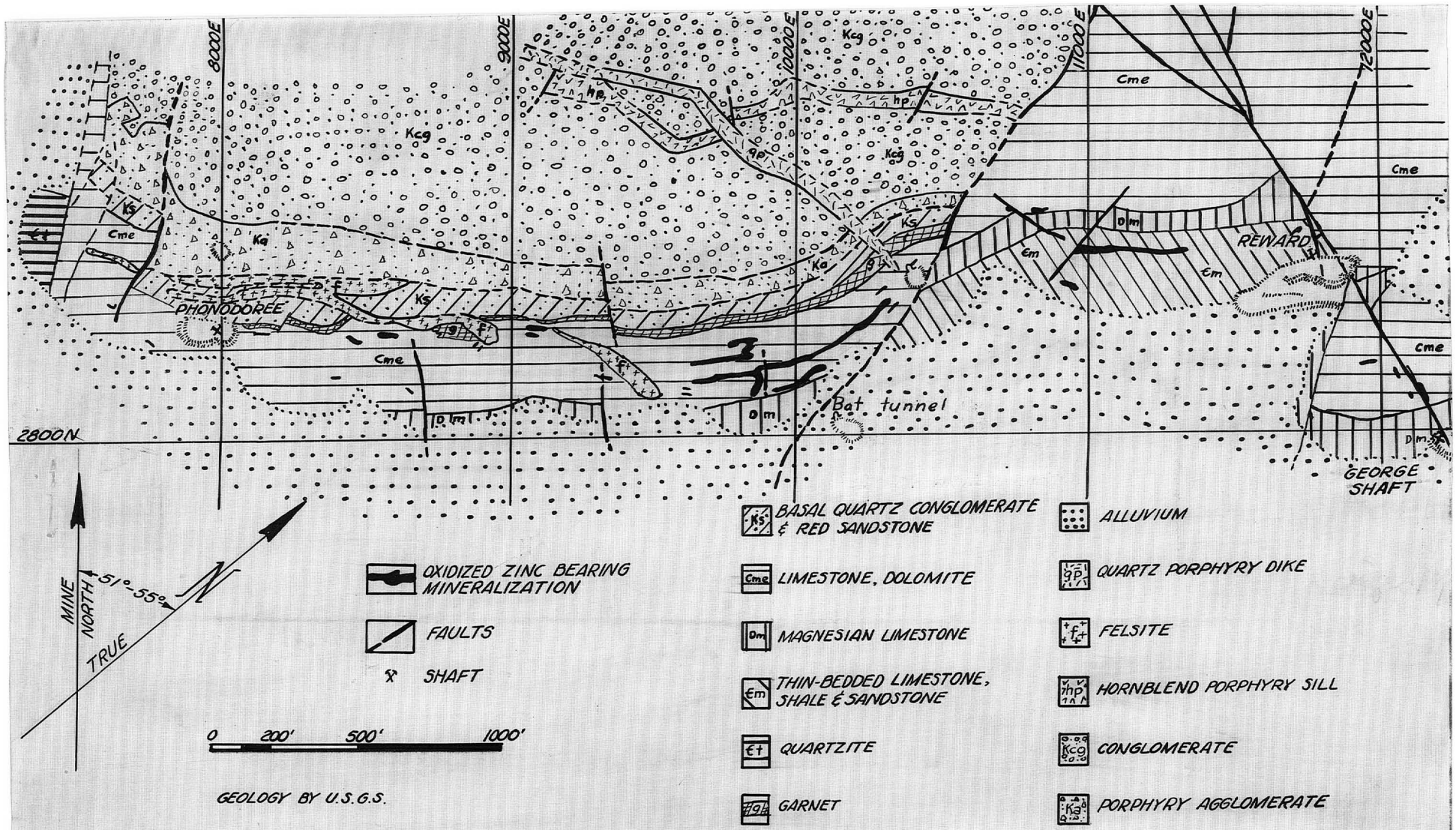
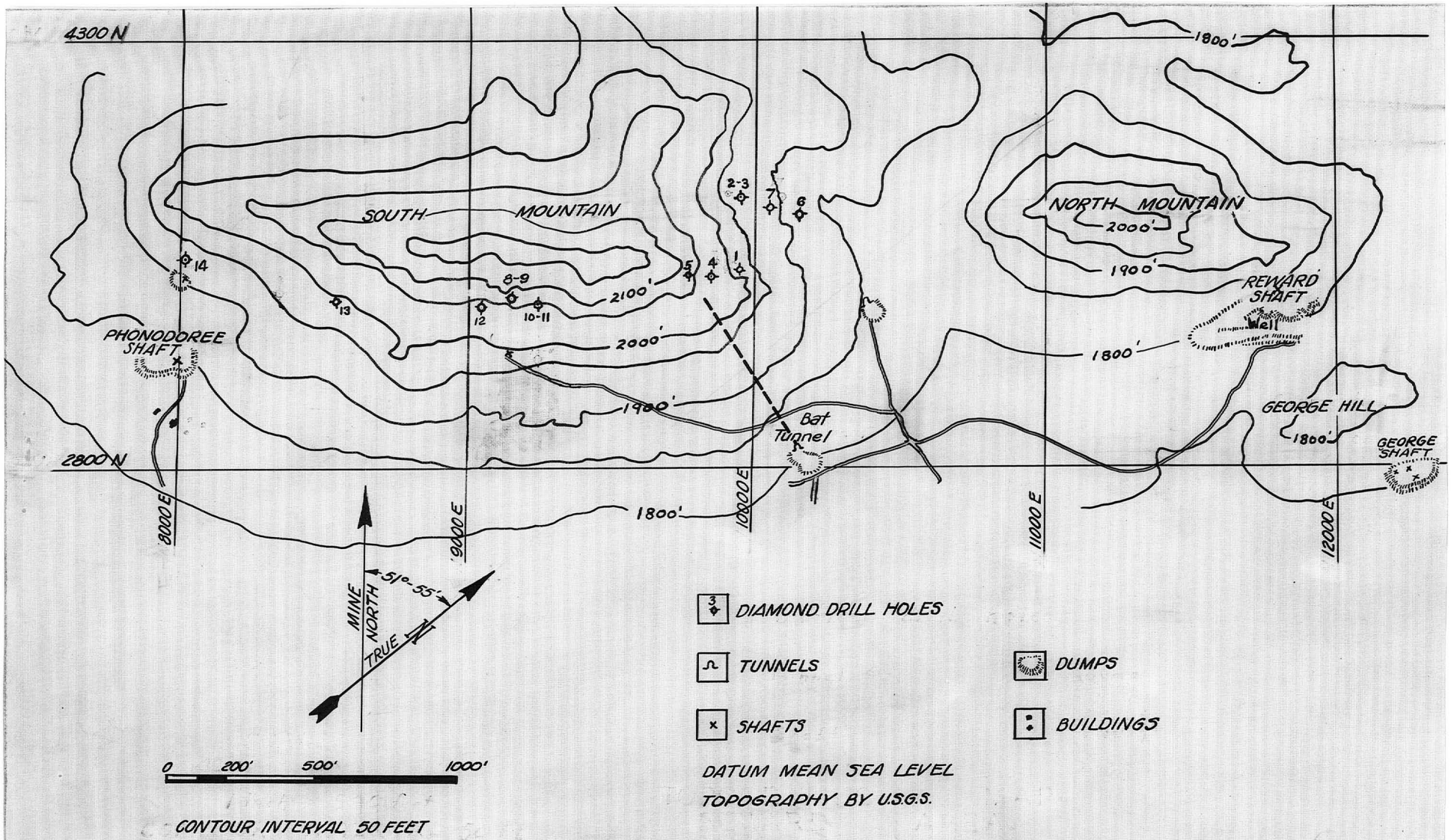


GEOLOGY BY U.S.G.S.

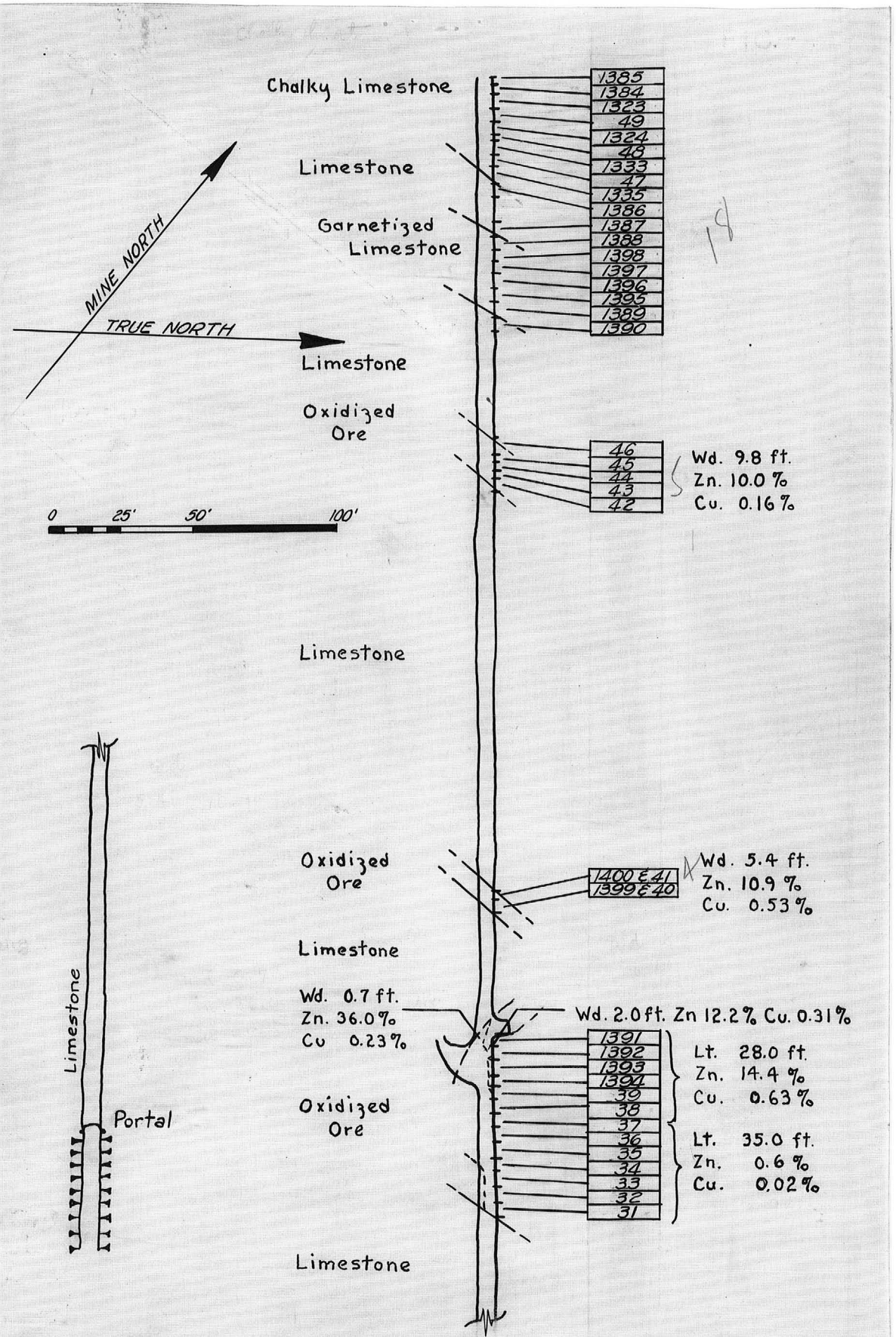
GEOLOGIC MAP OF REWARD ZINC PROJECT 1587 AREA, PIMA CO., ARIZ.

FIG. 2



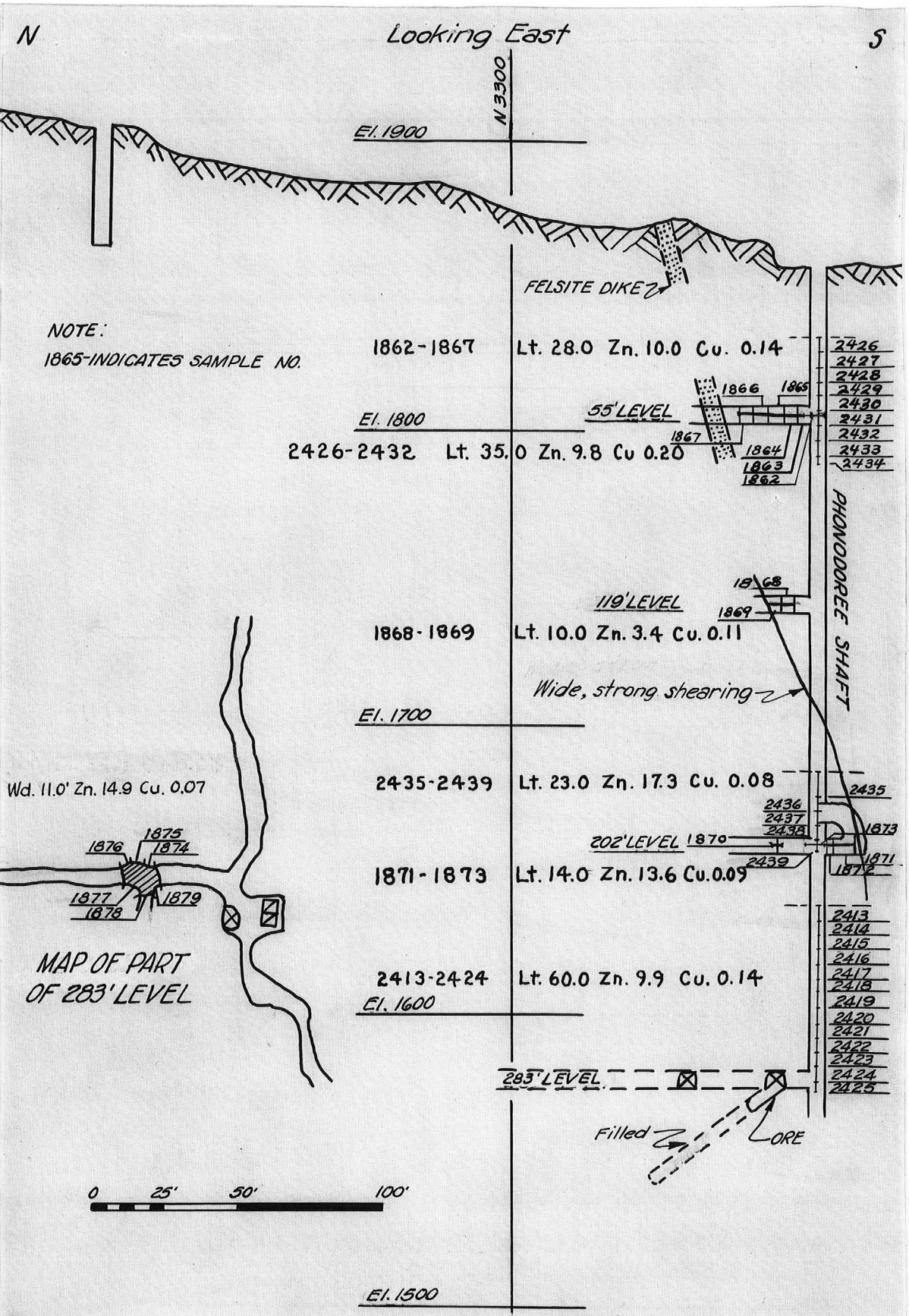
TOPOGRAPHICAL MAP OF REWARD AREA

FIG. 3



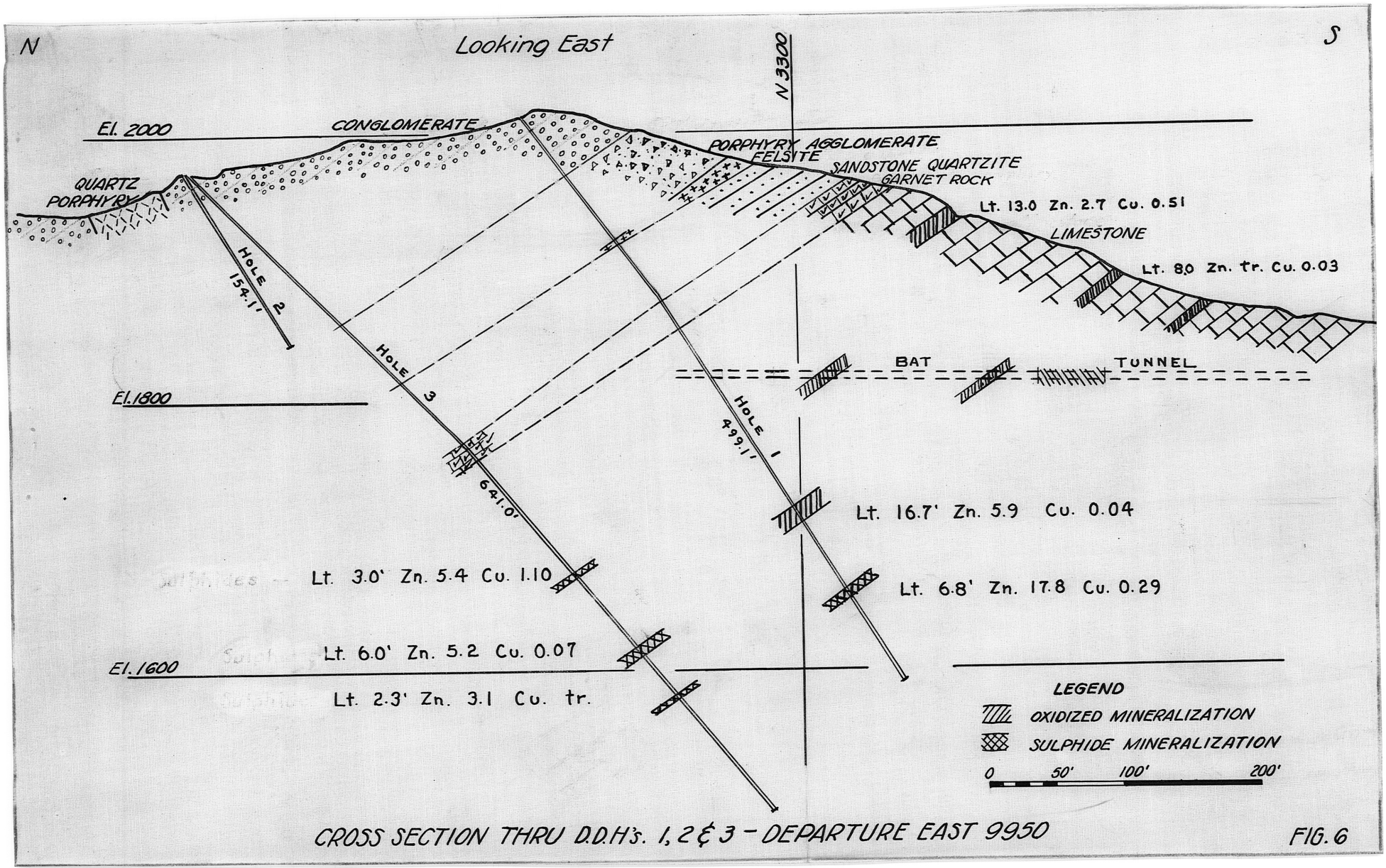
SAMPLE MAP OF BAT TUNNEL

FIG. 4



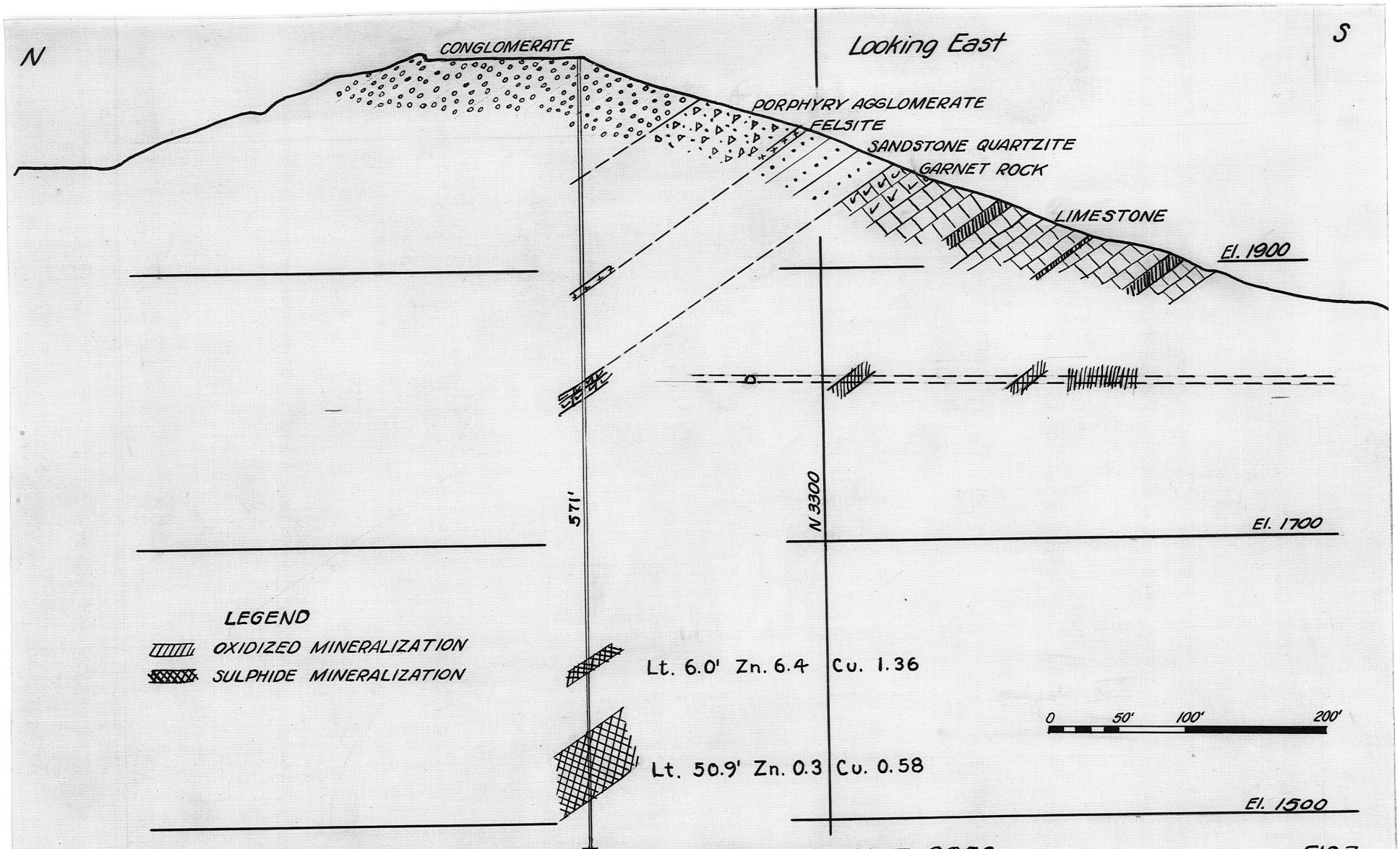
SAMPLE SECTION & MAP OF PHONODOREE SHAFT & WORKINGS

FIG. 5



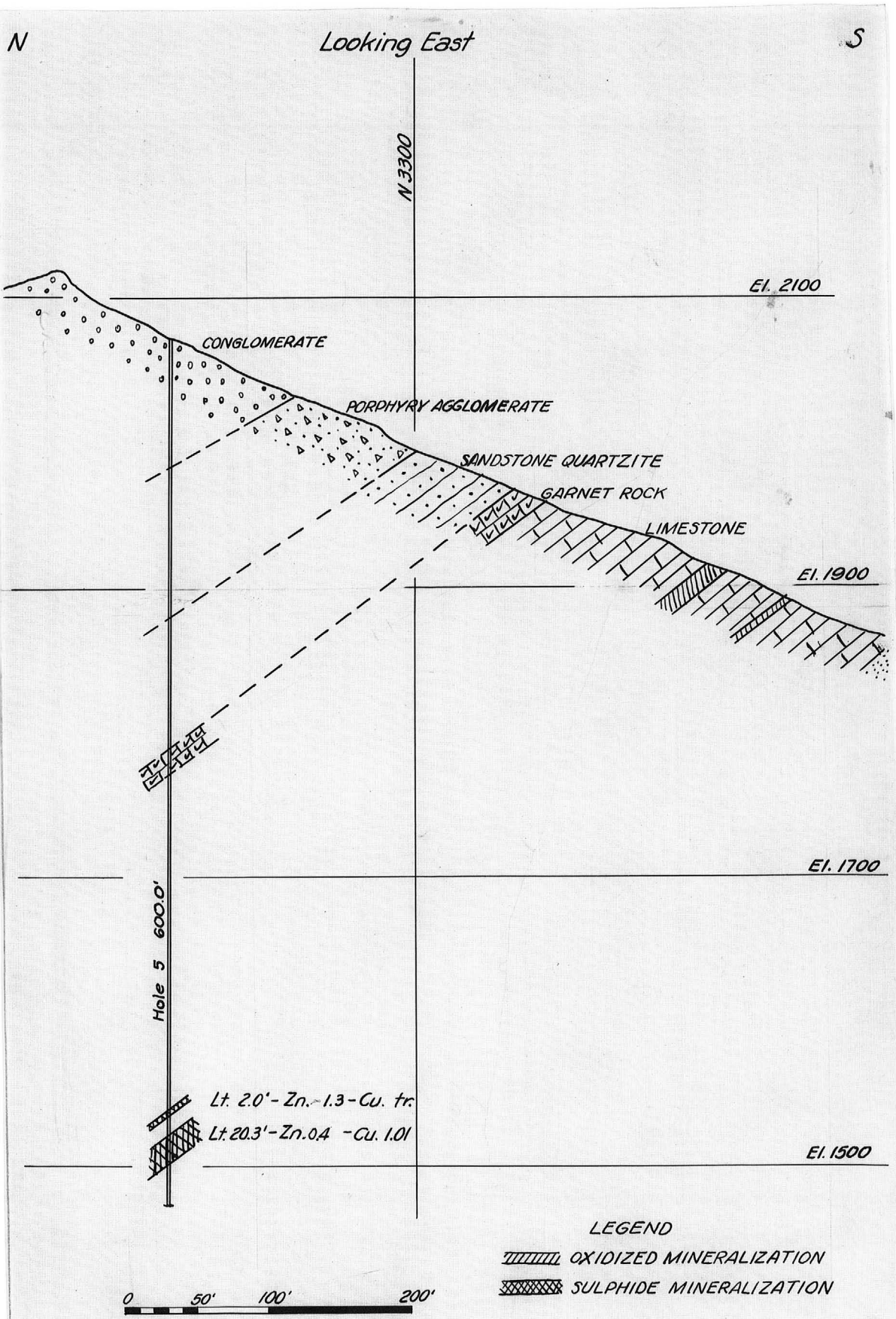
CROSS SECTION THRU D.D.H's. 1, 2 & 3 – DEPARTURE EAST 9950

FIG. 6



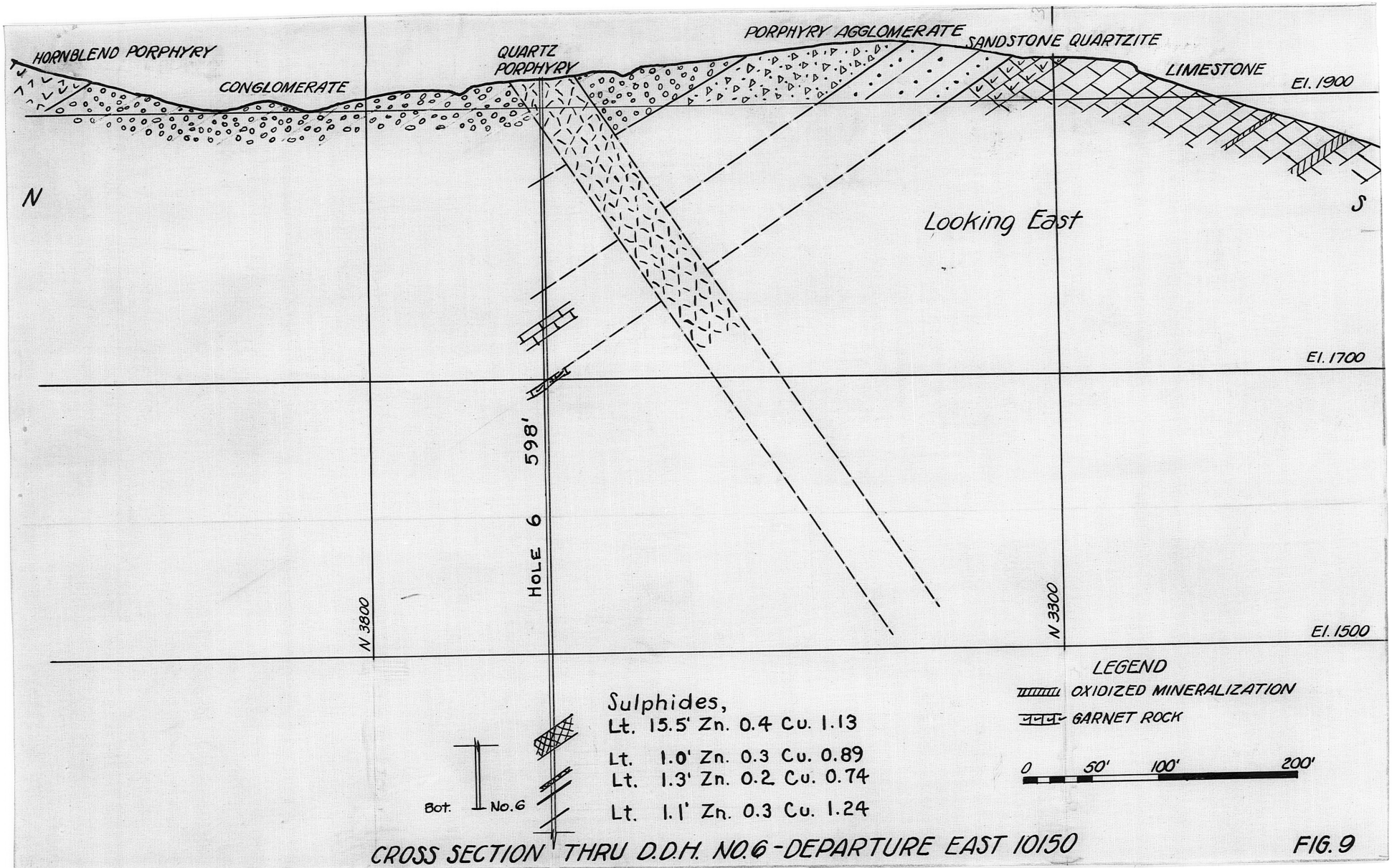
CROSS SECTION THRU D.D.H. NO.4 – DEPARTURE EAST 9850

FIG. 7



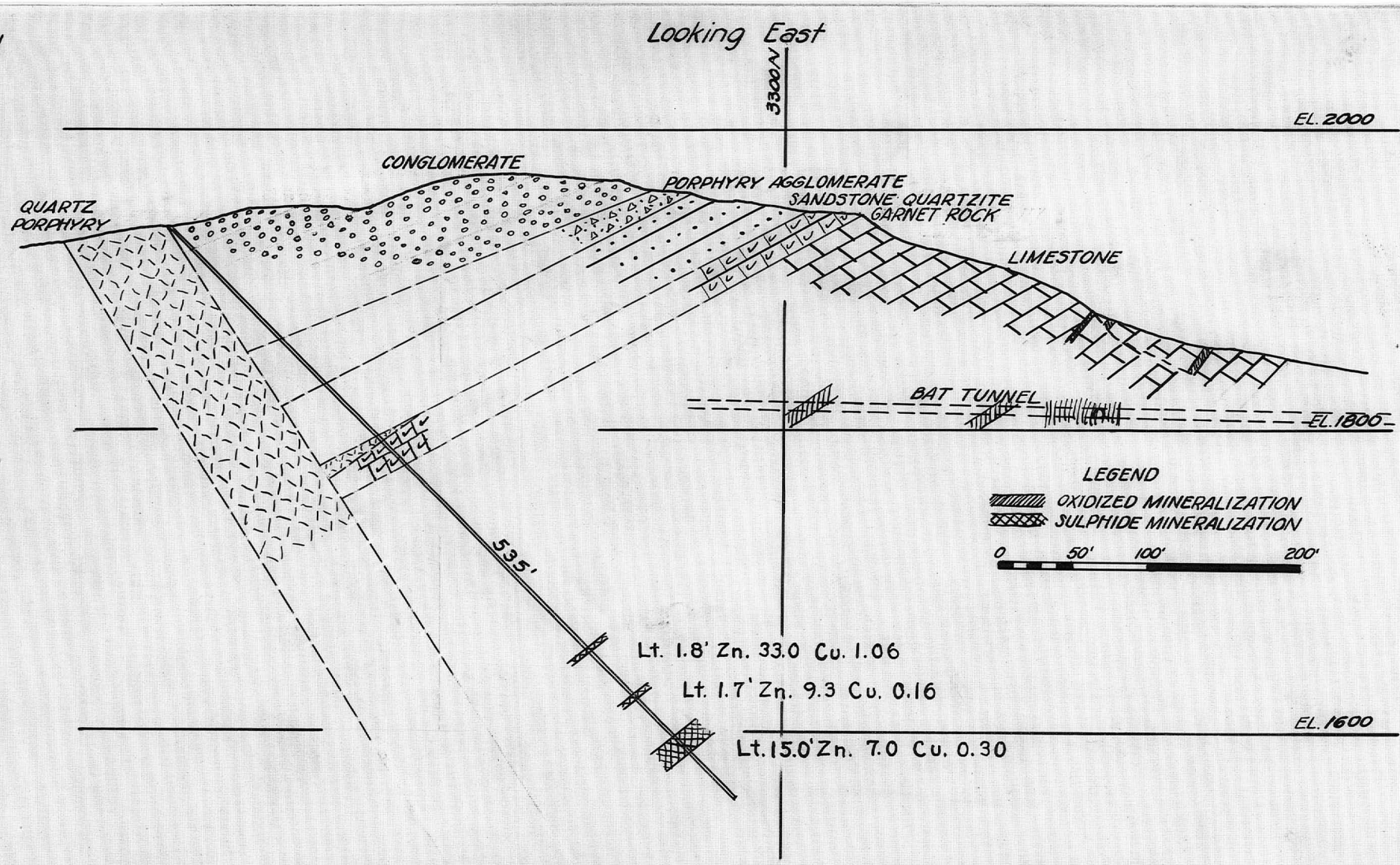
CROSS SECTION THRU D.D.H. NO. 5 - DEPARTURE EAST 9750

FIG. 8



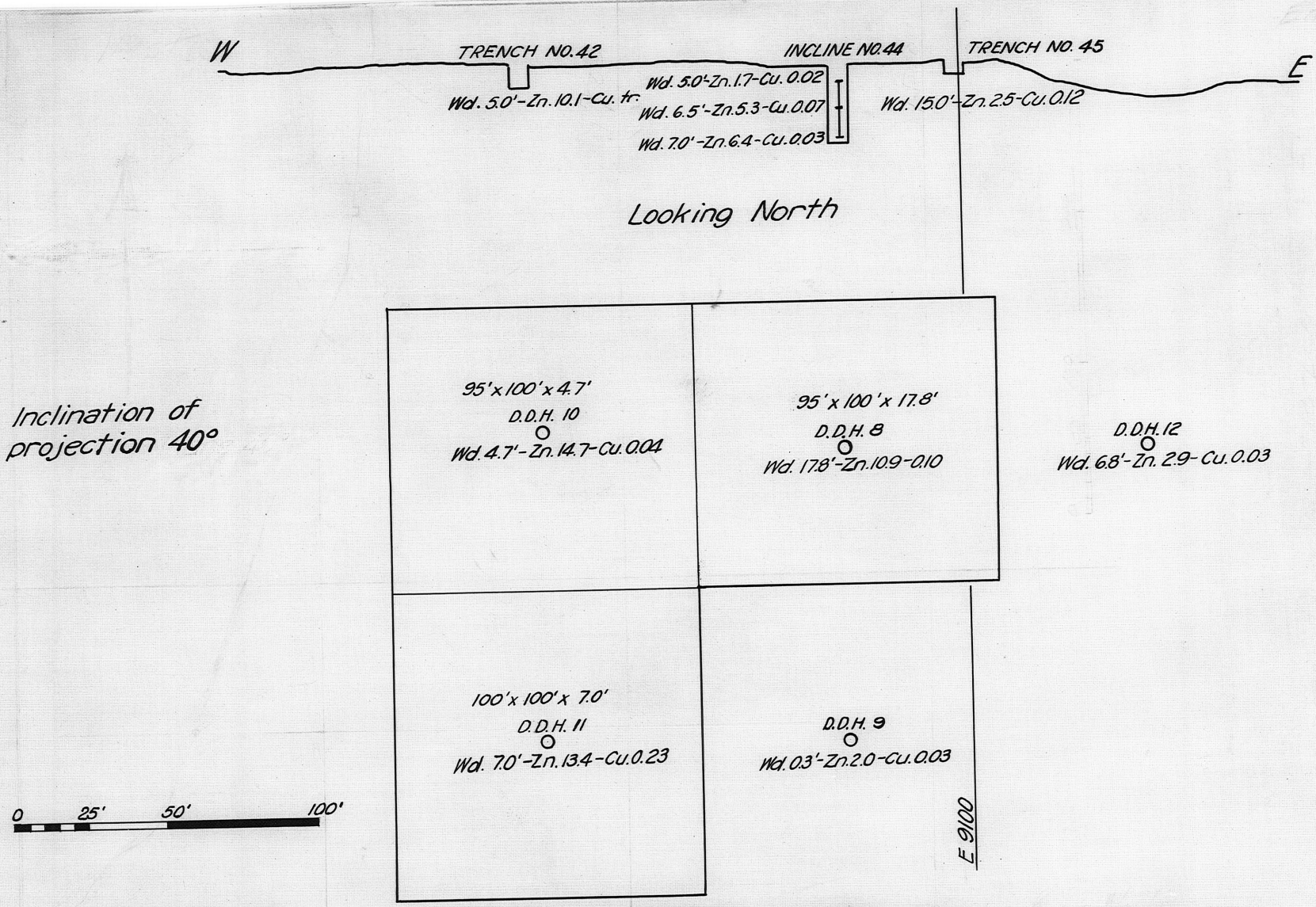
CROSS SECTION THRU D.D.H. NO. 6 - DEPARTURE EAST 10150

FIG. 9



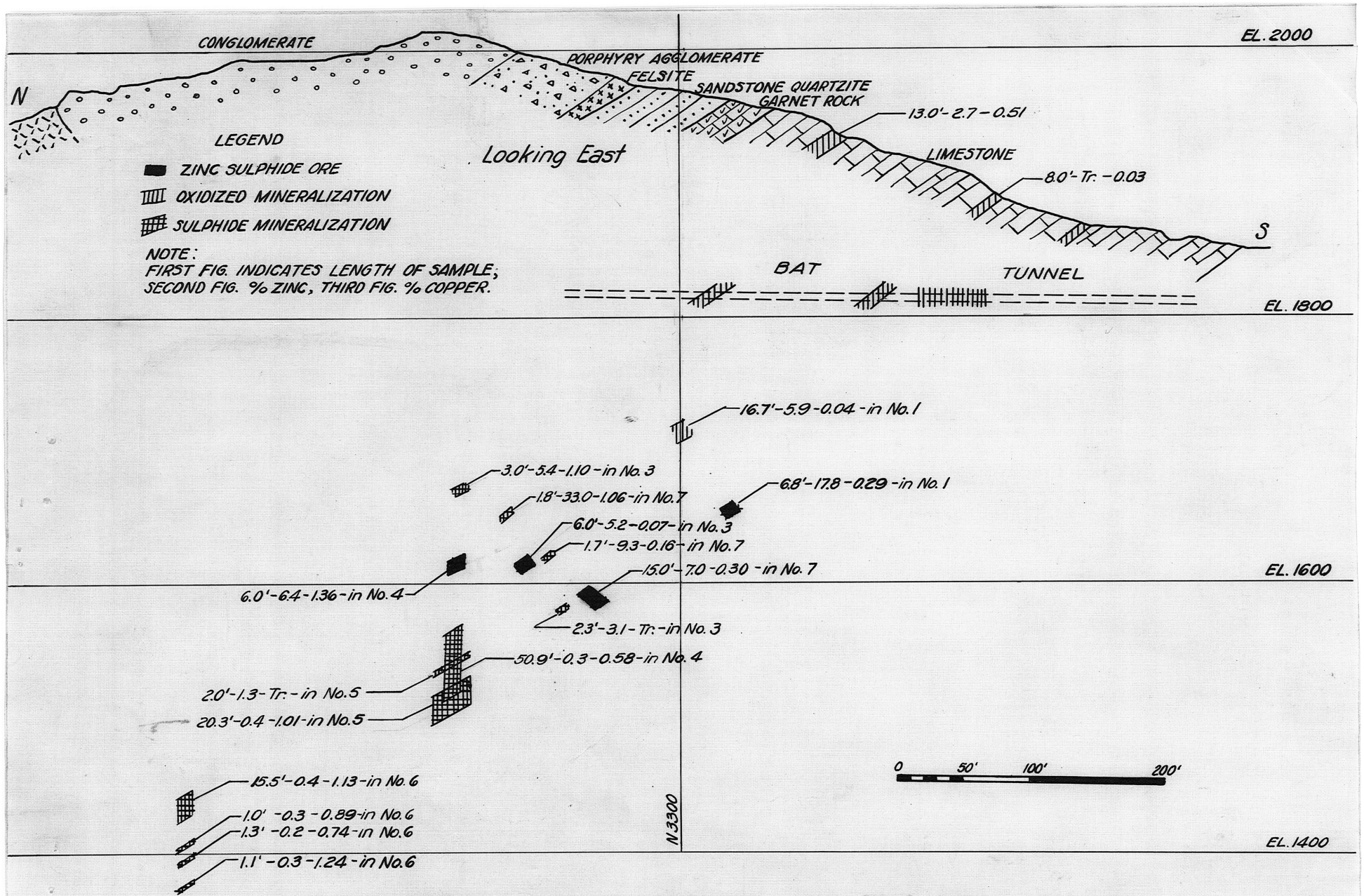
CROSS-SECTION THRU D.D.H. NO. 7-DEPARTURE EAST 10050

FIG. 10



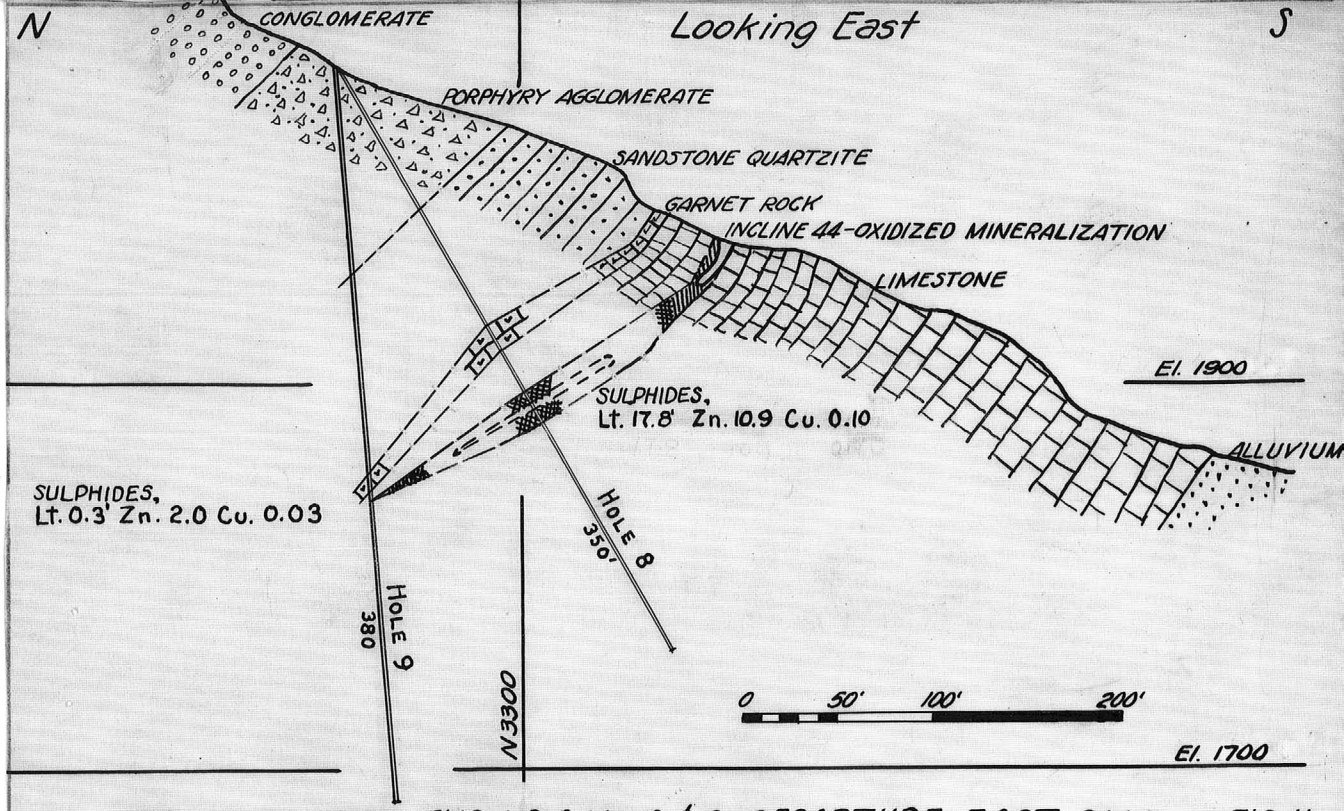
ORE BLOCK LONGITUDINAL PROJECTION

FIG. 16

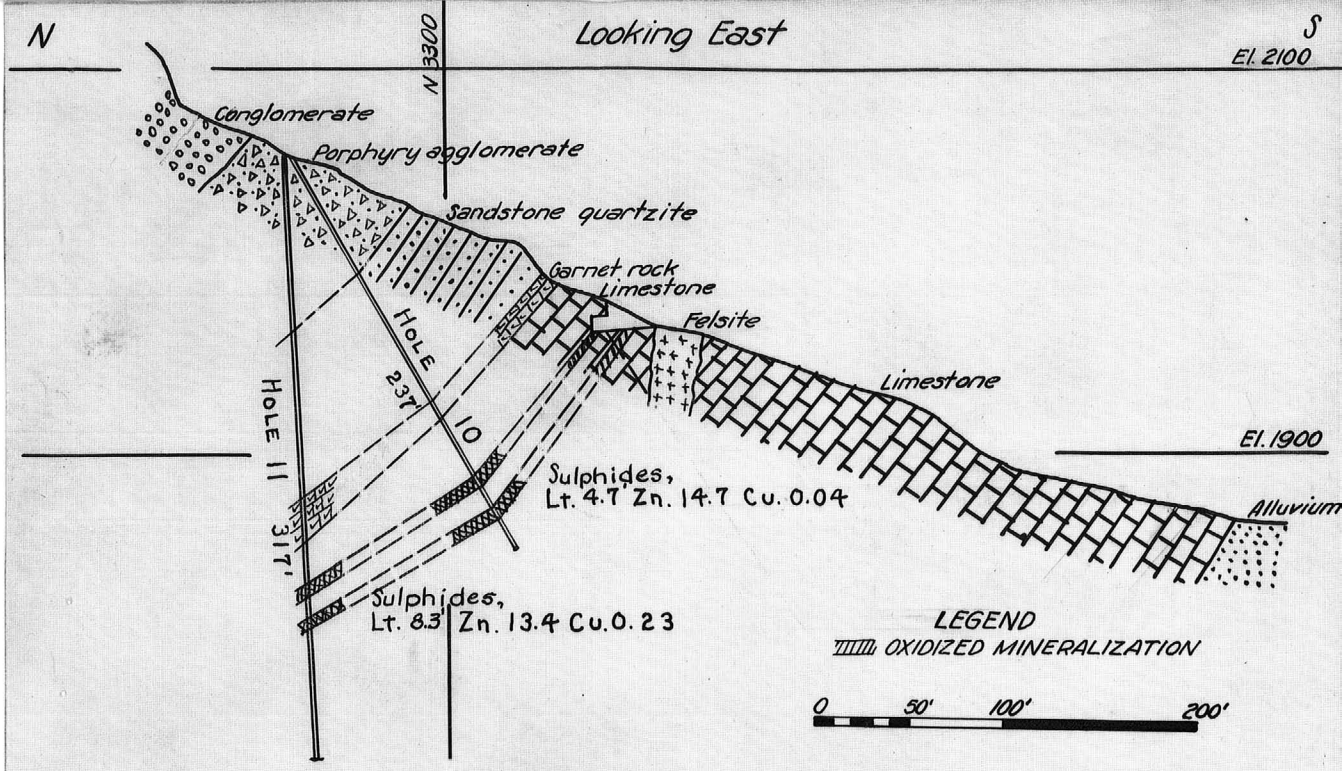


COMPOSITE CROSS SECTION SHOWING VALUES IN D.D. HOLES 1 TO 7 INCLUSIVE

FIG. 17

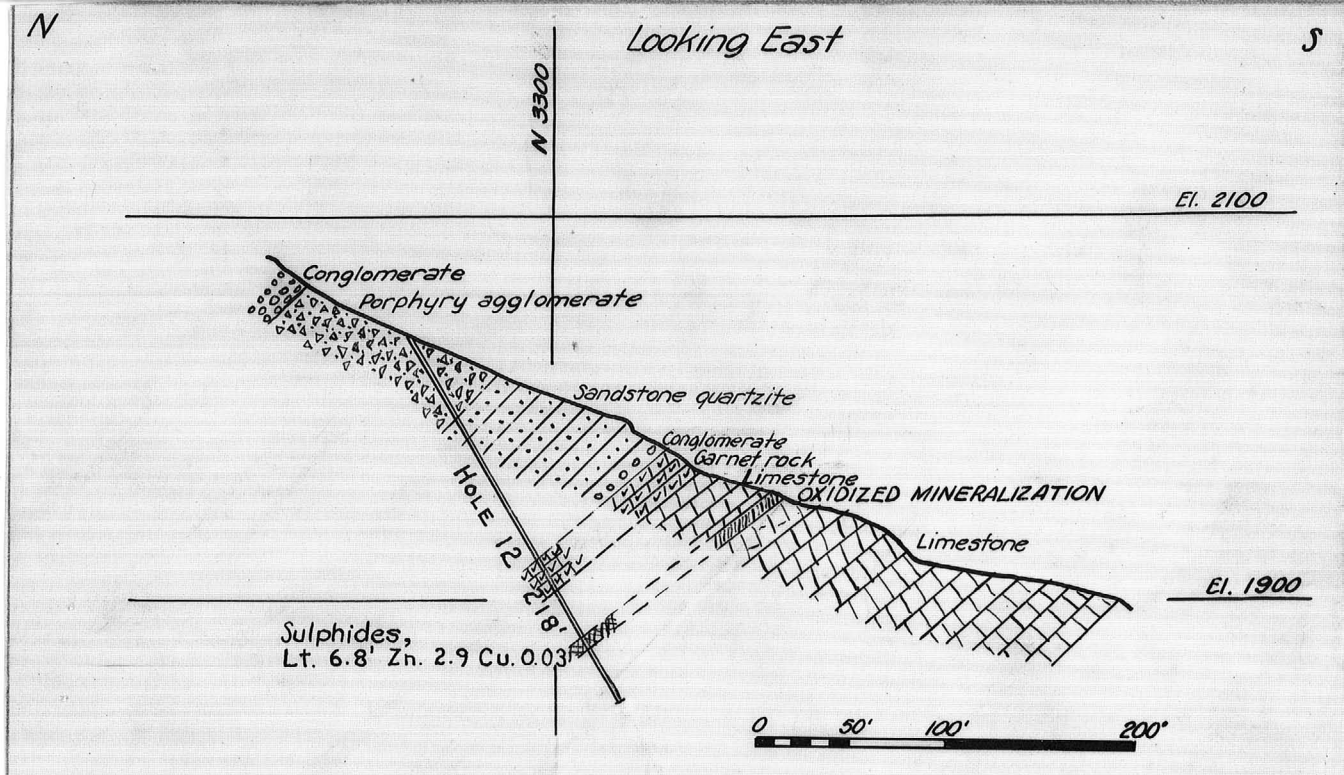


CROSS SECTION THRU D.D.H's. 8 & 9 - DEPARTURE EAST 9140 FIG. 11



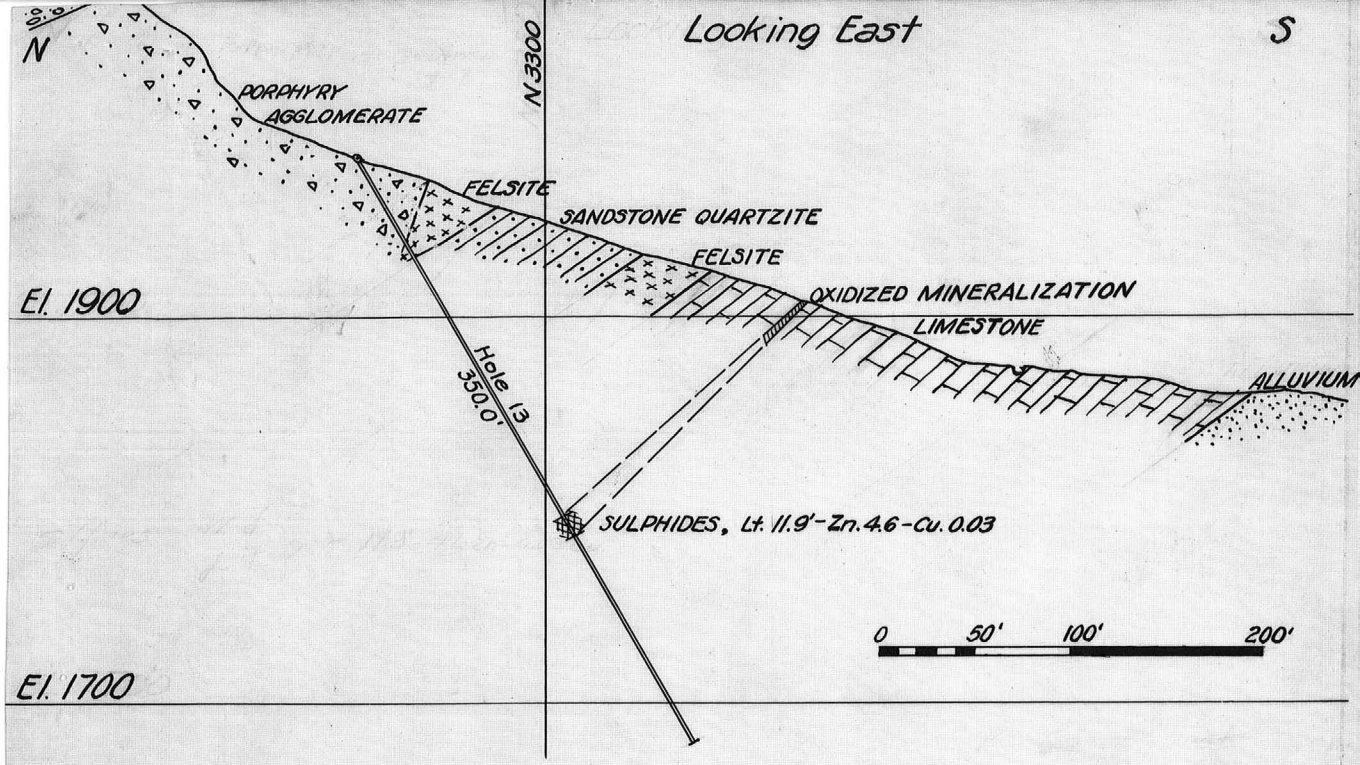
CROSS SECTION THRU D.D.H's. 10 & 11 - DEPARTURE EAST 9240

FIG. 12



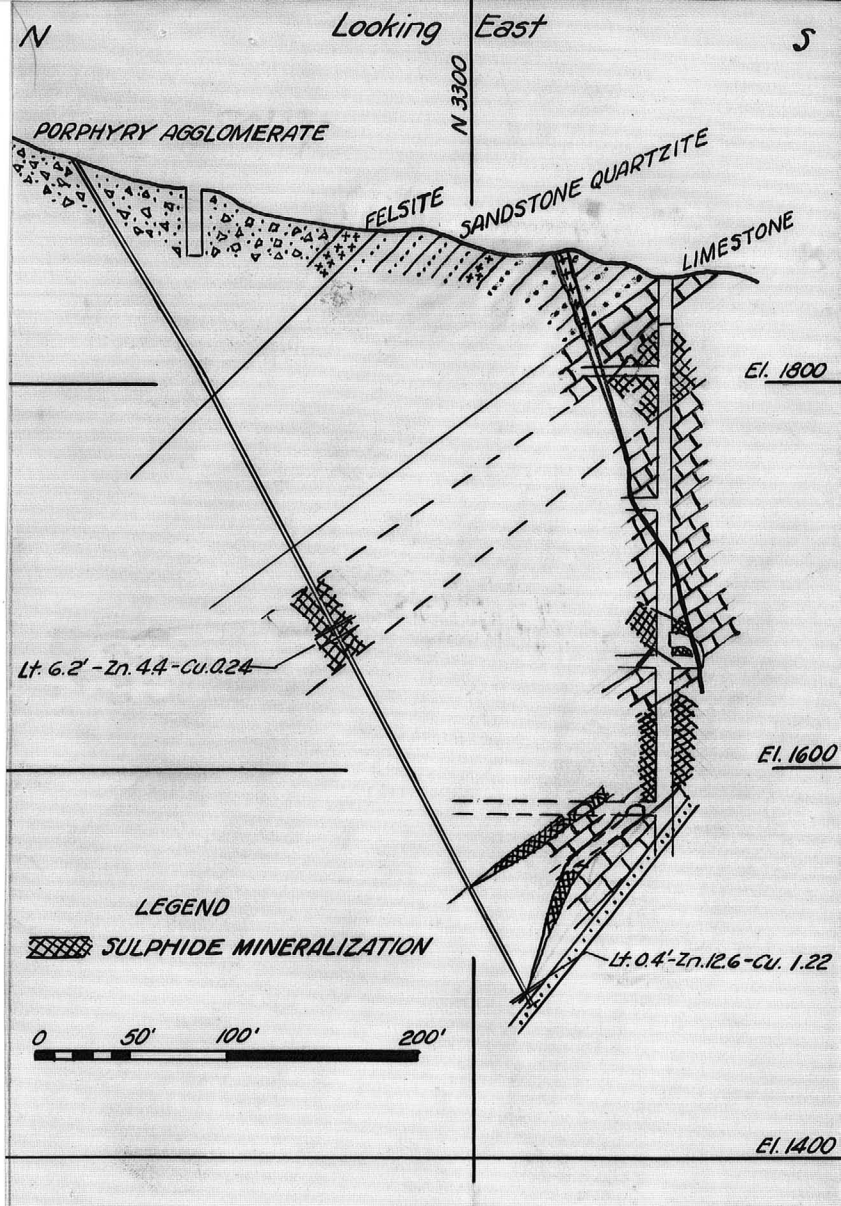
CROSS SECTION THRU D.D.H. NO. 12-DEPARTURE EAST 9040

FIG. 13



CROSS SECTION THRU D.D.H. NO. 13 - DEPARTURE EAST 8540

FIG. 14



CROSS SECTION THRU D.D.H. NO. 14 - DEPARTURE EAST 8040

FIG. 15

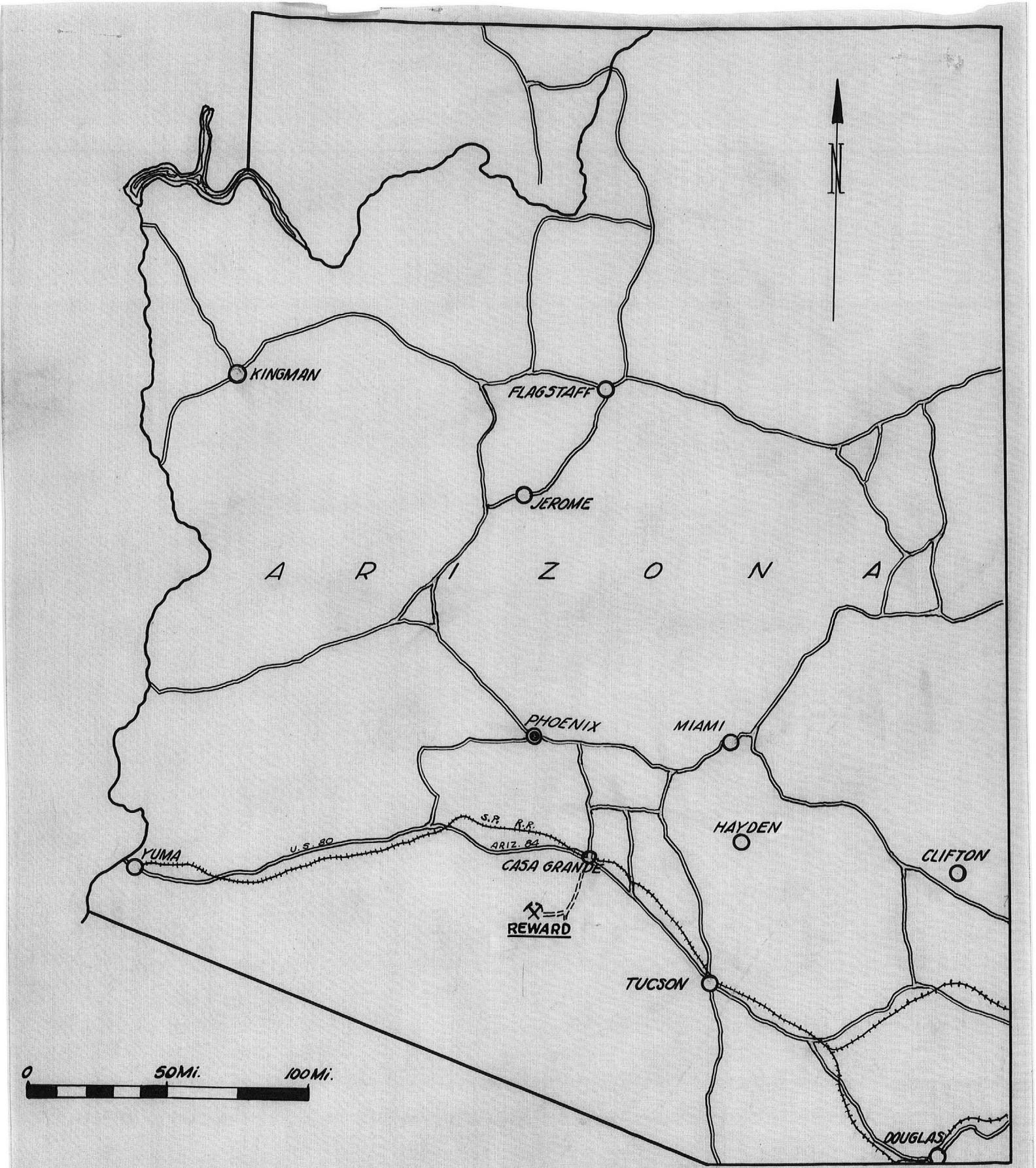


FIG. 1 - LOCATION MAP OF REWARD ZINC PROPERTY

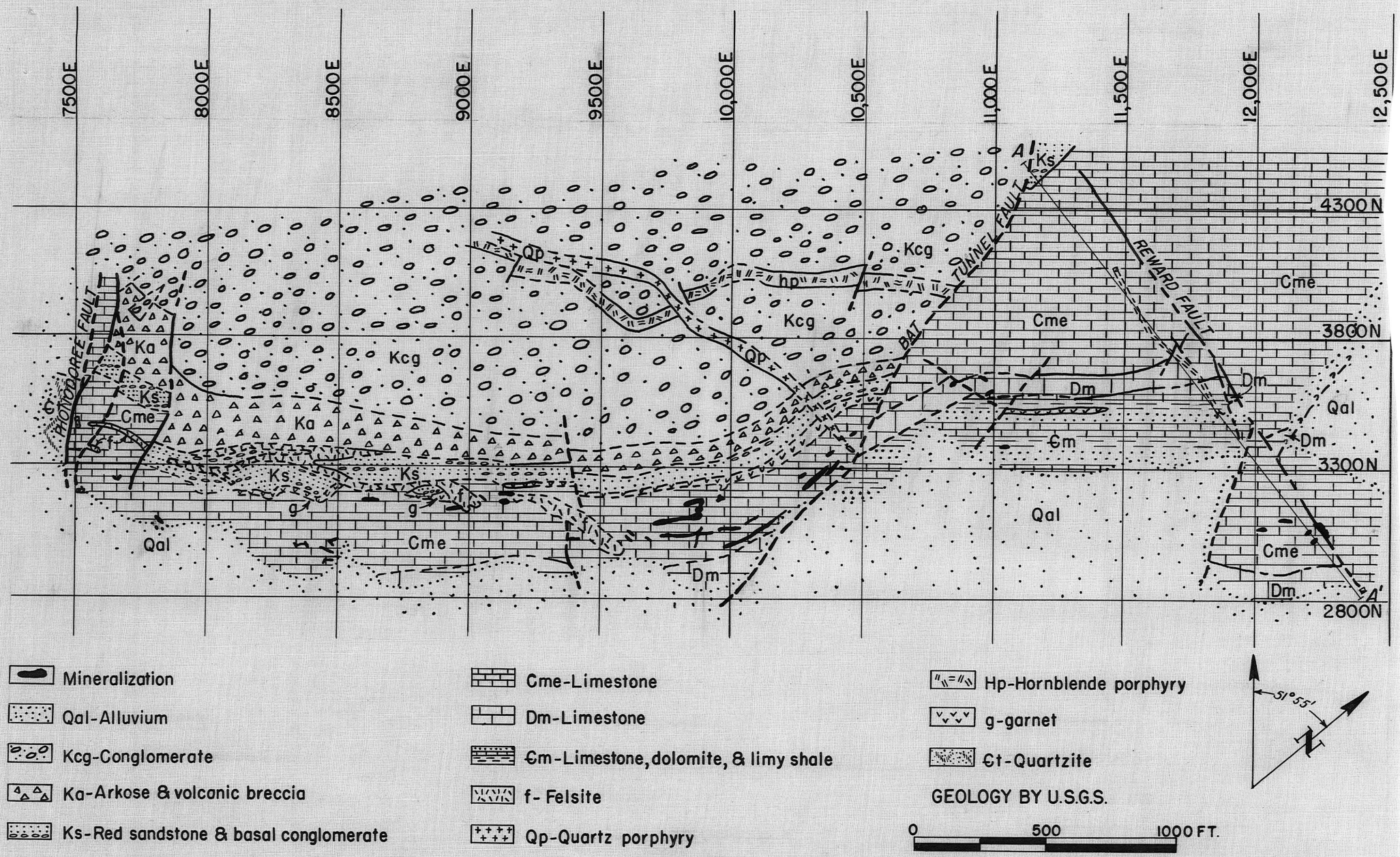


FIG. 2-GEOLOGIC MAP OF REWARD ZINC AREA-PROJECT 1587-PINAL CO., ARIZ.

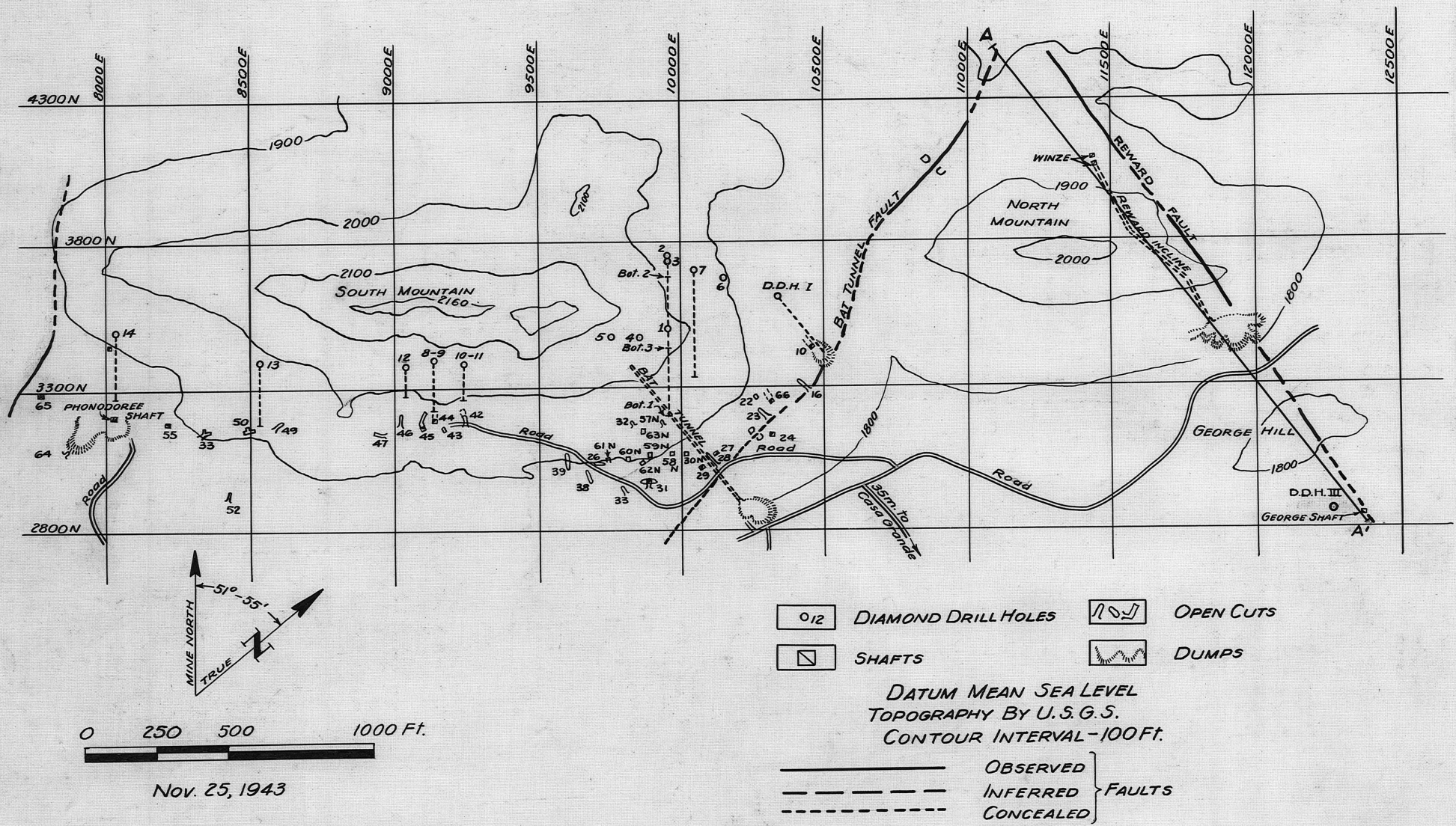


FIG.3-MAP OF REWARD AREA SHOWING DRILL HOLES AND SAMPLE LOCATIONS

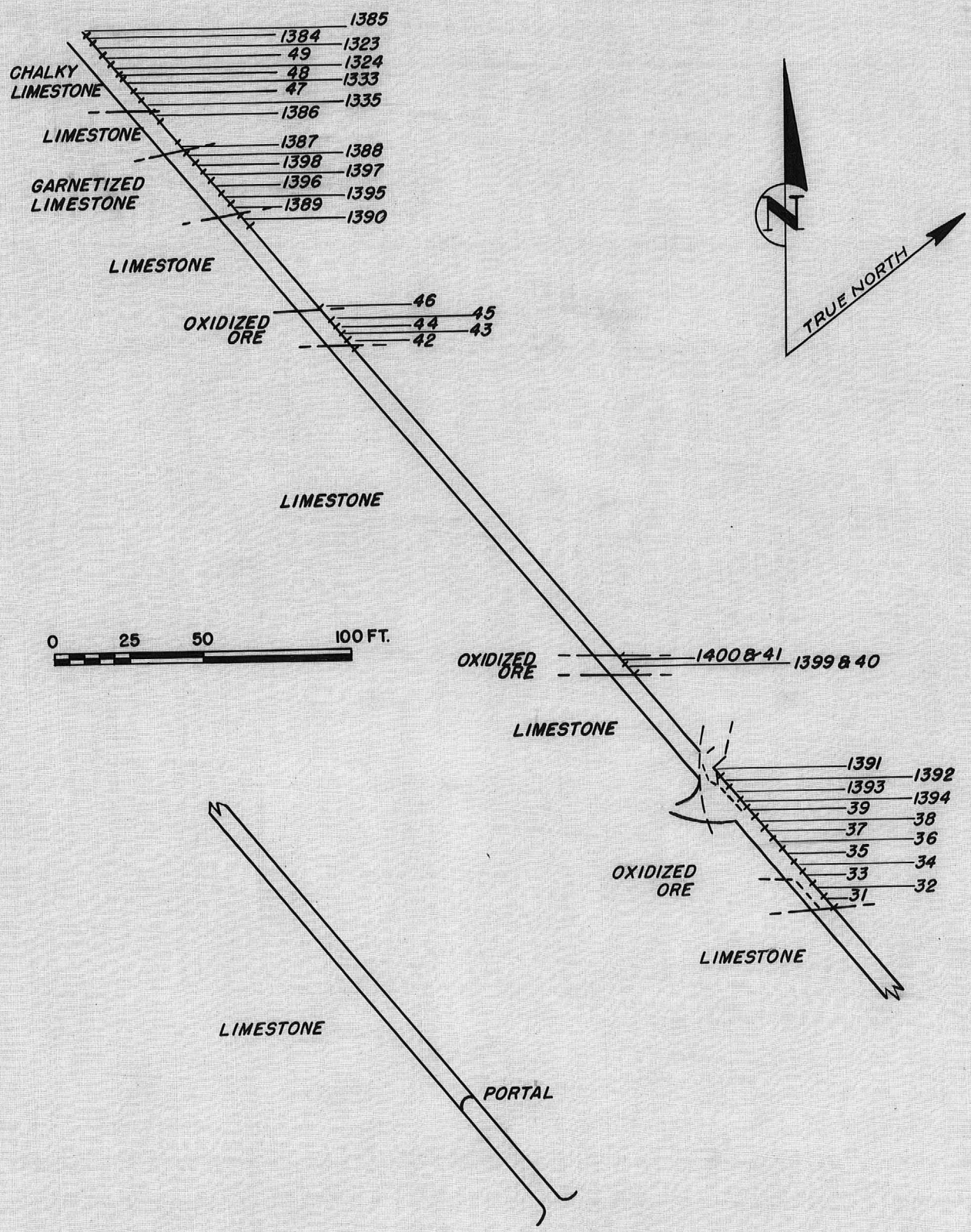


FIG. 4-SAMPLE PLAT OF BAT TUNNEL-PROJECT 1587

Trim line

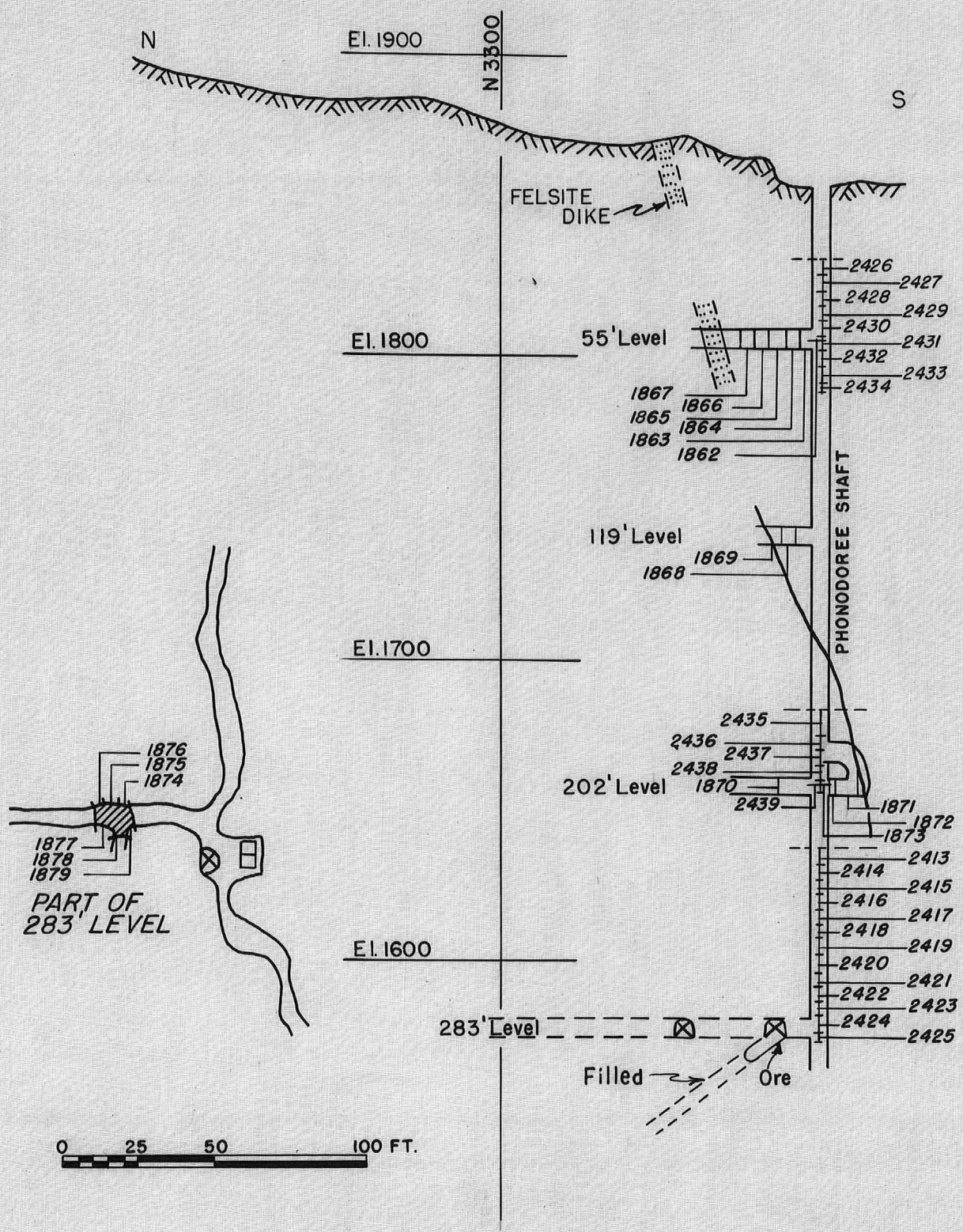


FIG. 5-SAMPLE PLAT OF PHONODOREE SHAFT-PROJECT 1587

Trim Line

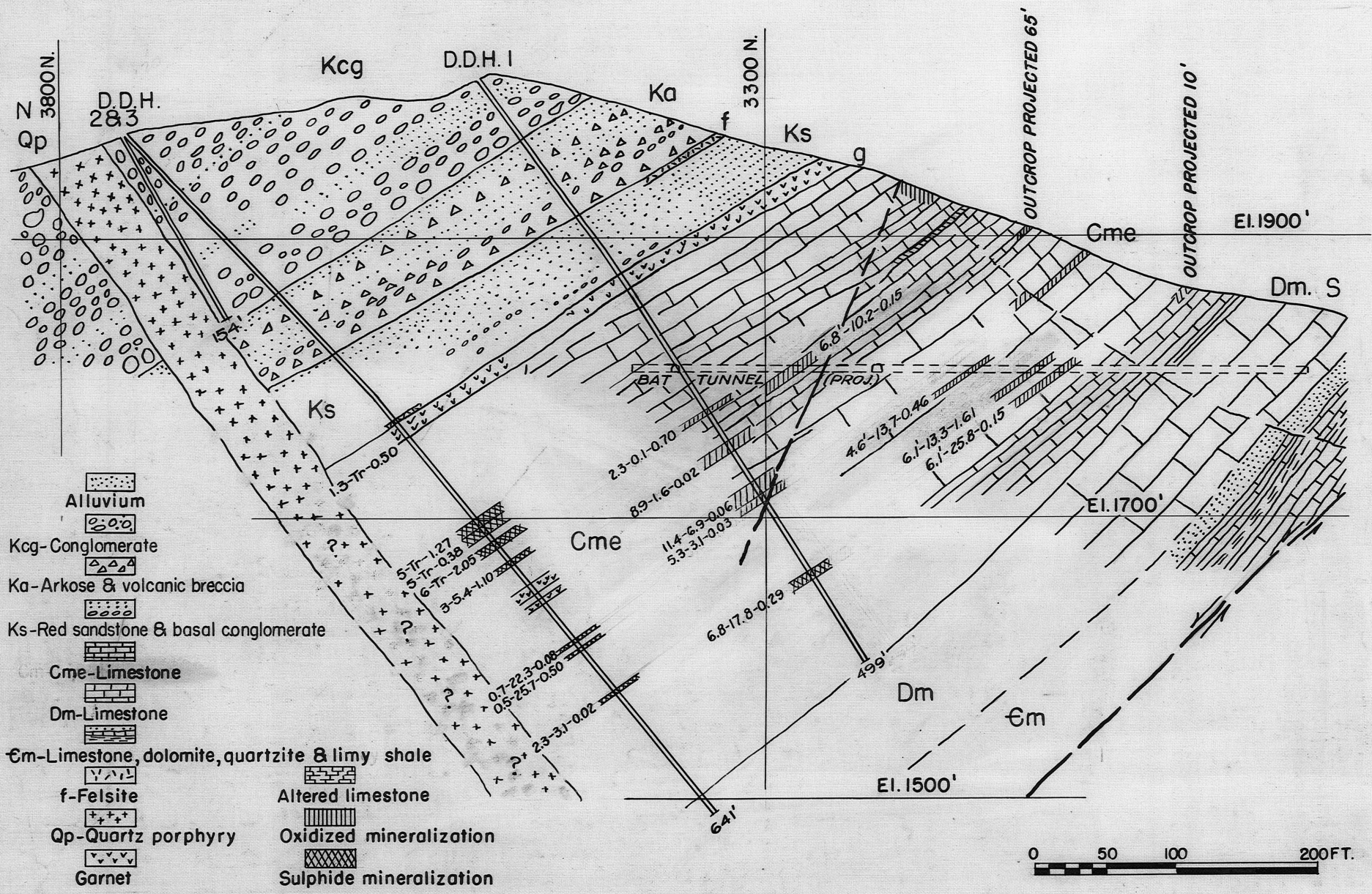


FIG. 6 – CROSS SECTION AT 9950E. THROUGH HOLES 1, 2 & 3, REWARD ZINC PROJECT 1587

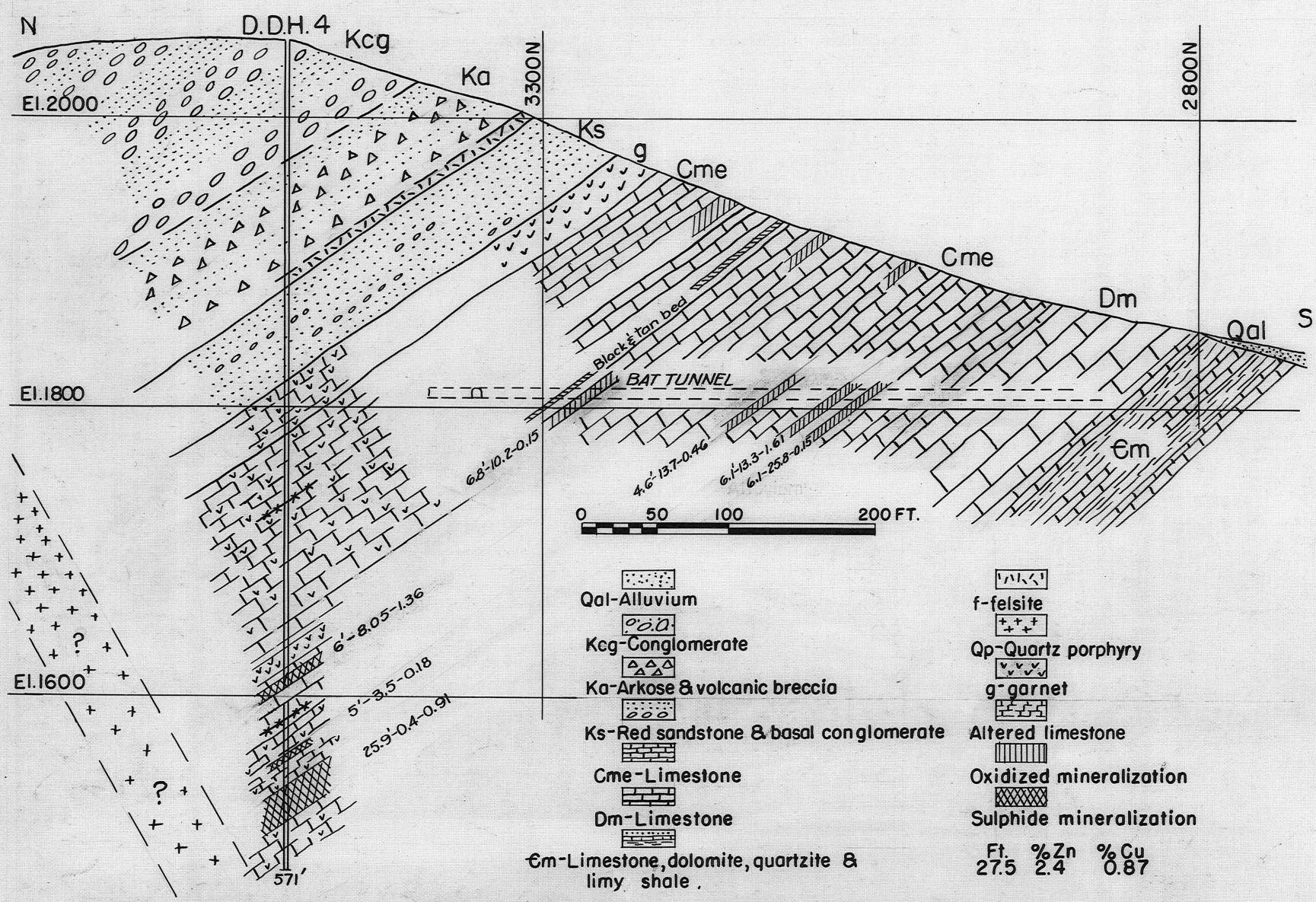


FIG. 7-CROSS SECTION AT 9,850 E. THROUGH HOLE 4, REWARD ZINC PROJECT 1587

Trim line

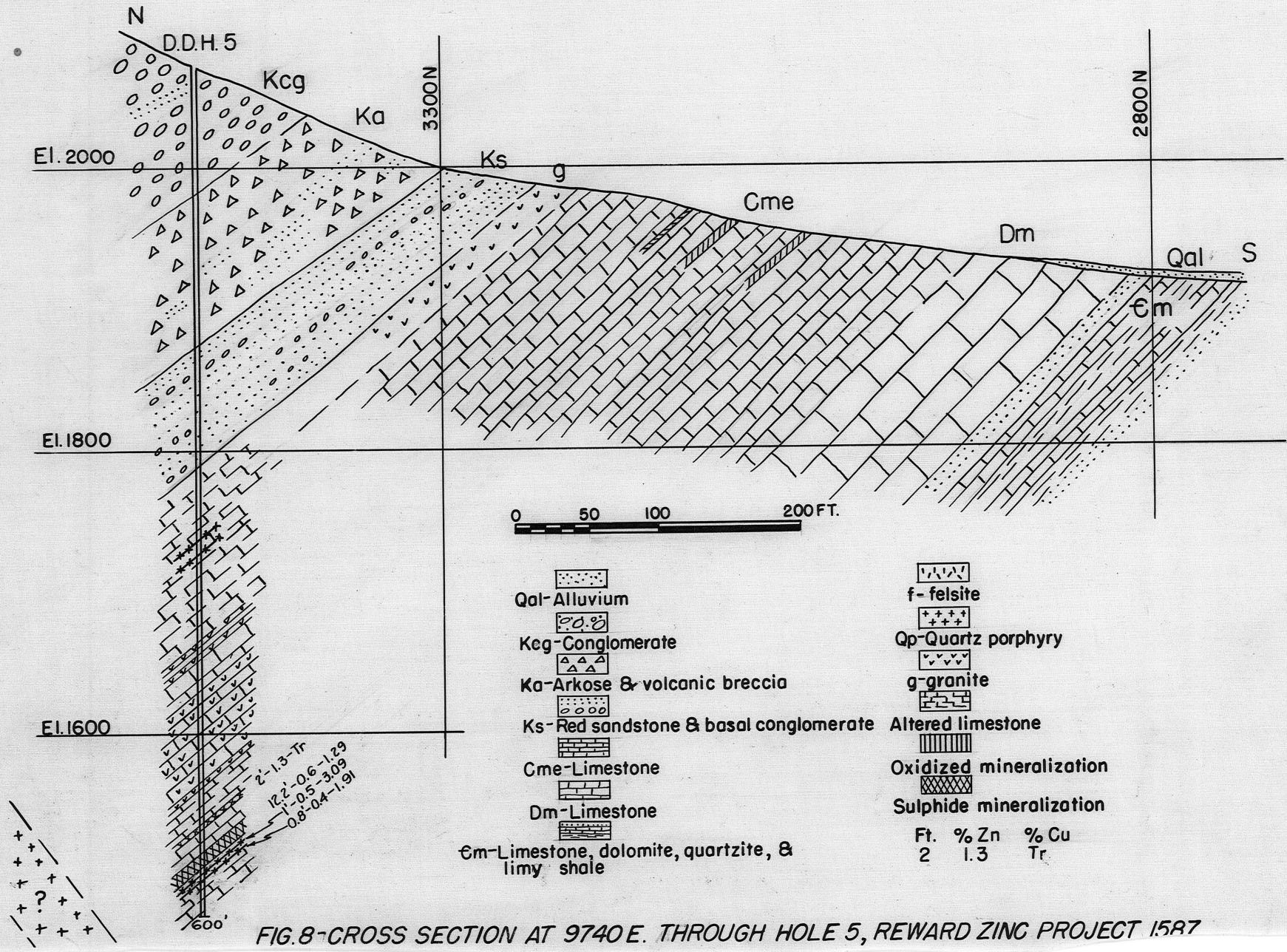


FIG. 8-CROSS SECTION AT 9740 E. THROUGH HOLE 5, REWARD ZINC PROJECT 1587

Trim line

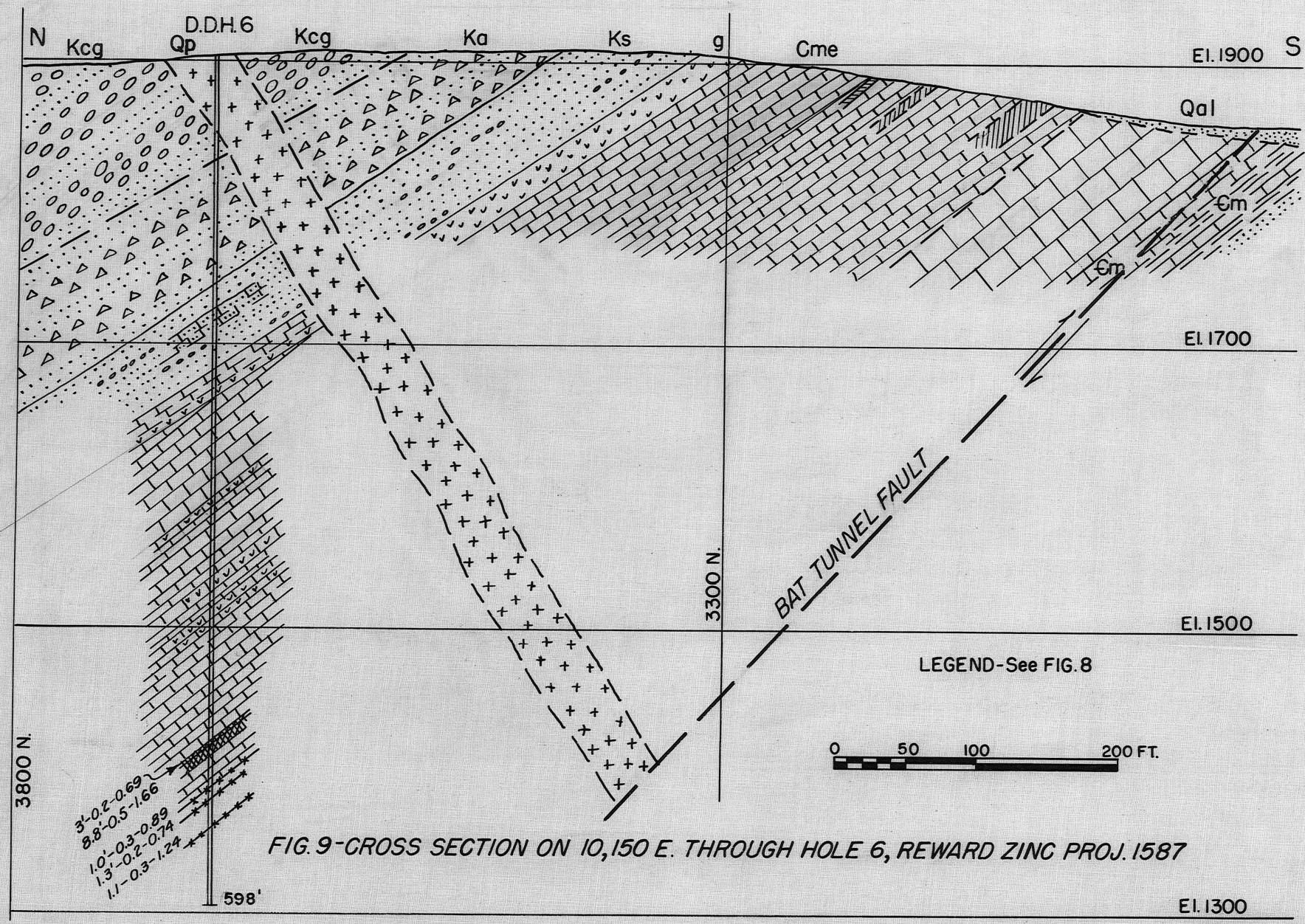


FIG. 9-CROSS SECTION ON 10,150 E. THROUGH HOLE 6, REWARD ZINC PROJ. 1587

Trim line

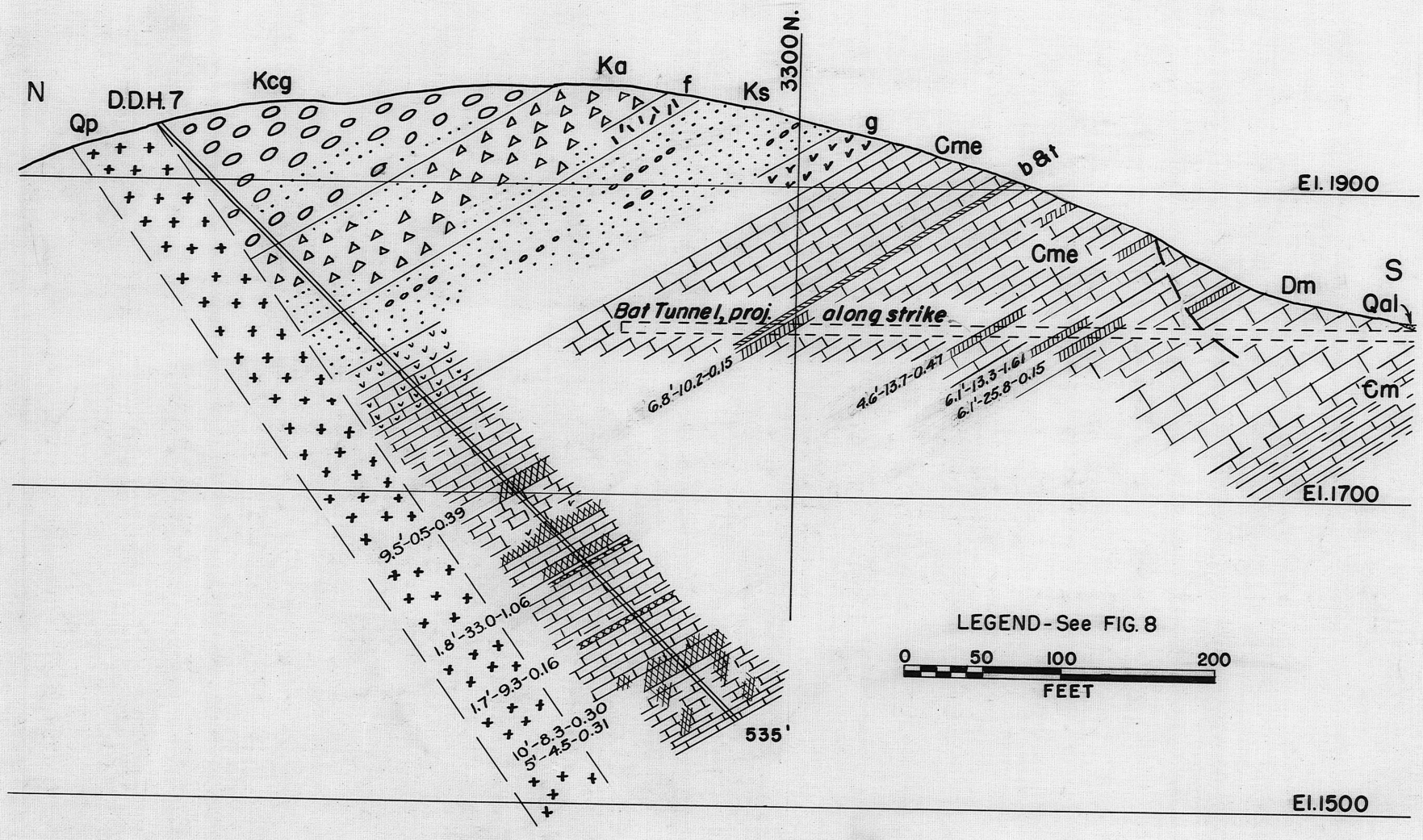


FIG. 10-CROSS SECTION THROUGH HOLE 7, REWARD ZINC, PROJECT 1587

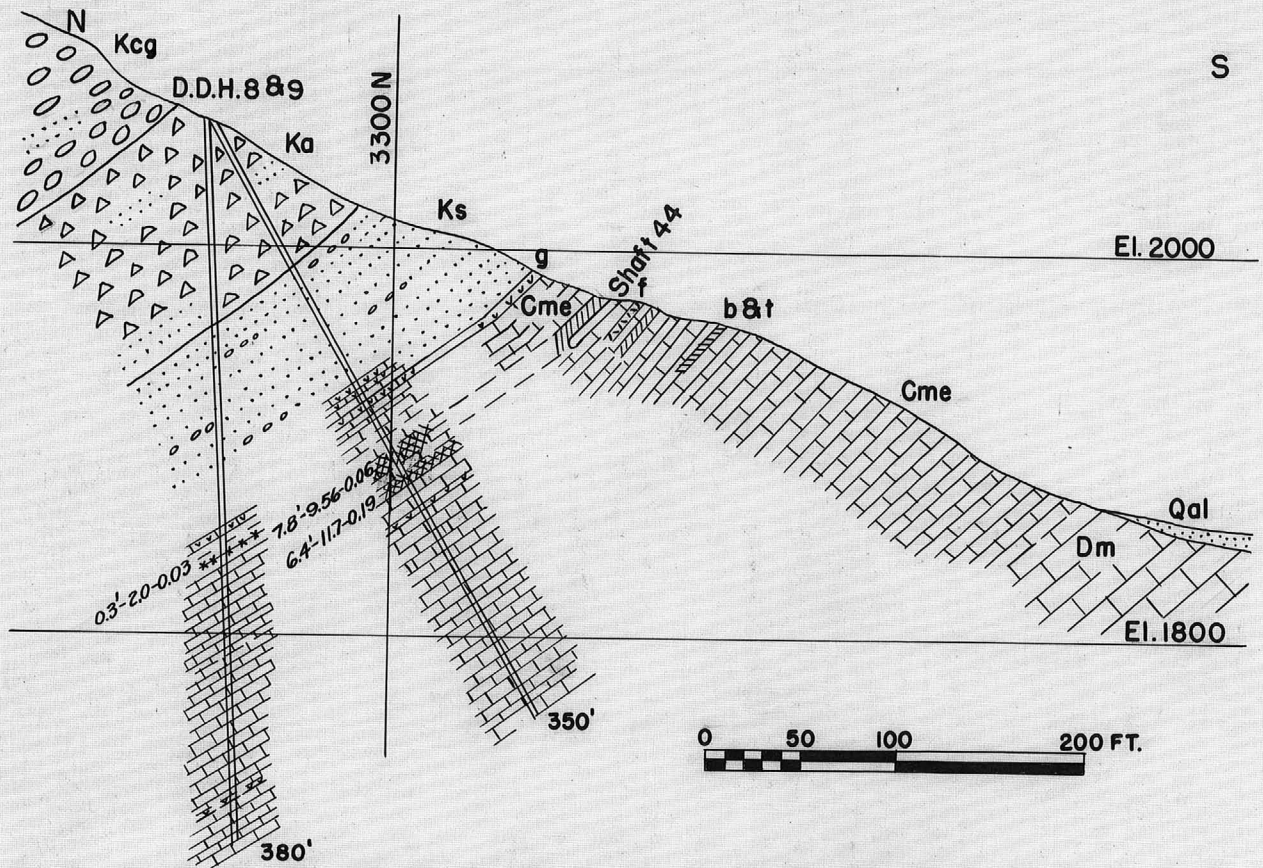


FIG. 11-CROSS SECTION ON 9140 E. THROUGH HOLES 8&9 AND SHAFT 44, PROJ. 1587

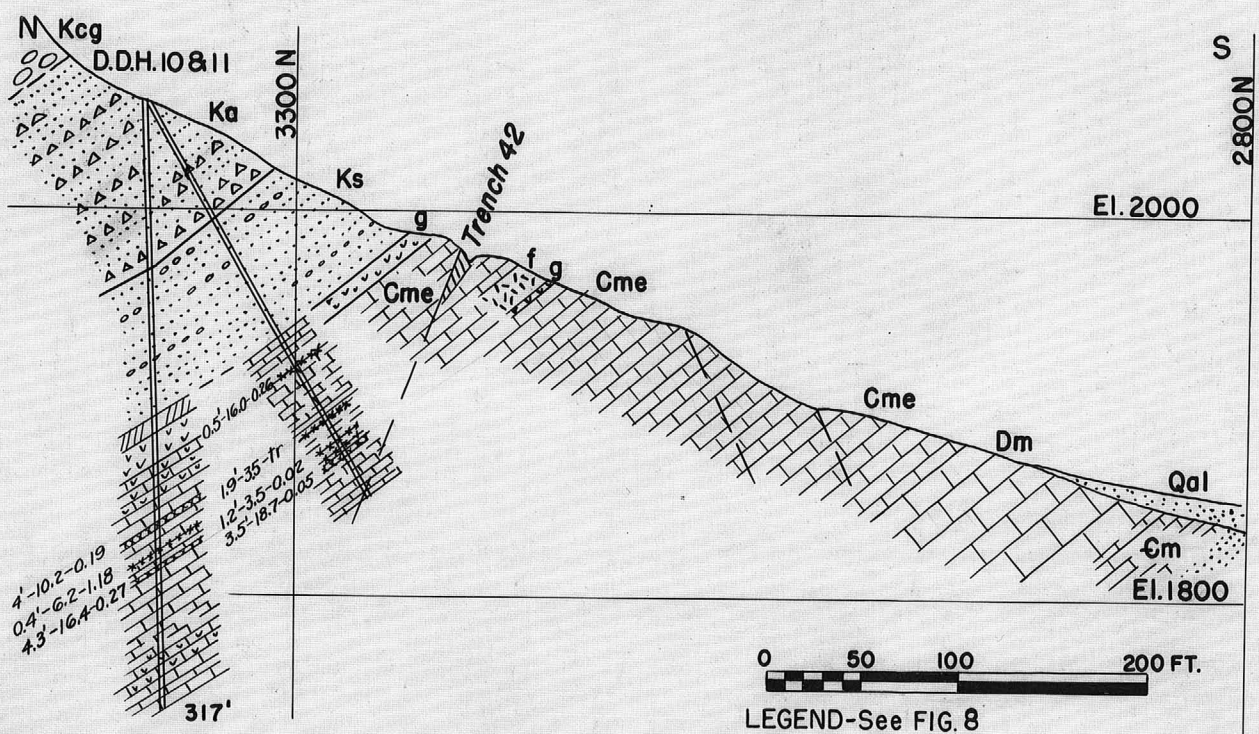


FIG. 12-CROSS SECTION 9240 E. THROUGH HOLES 10 & 11, PROJECT 1587

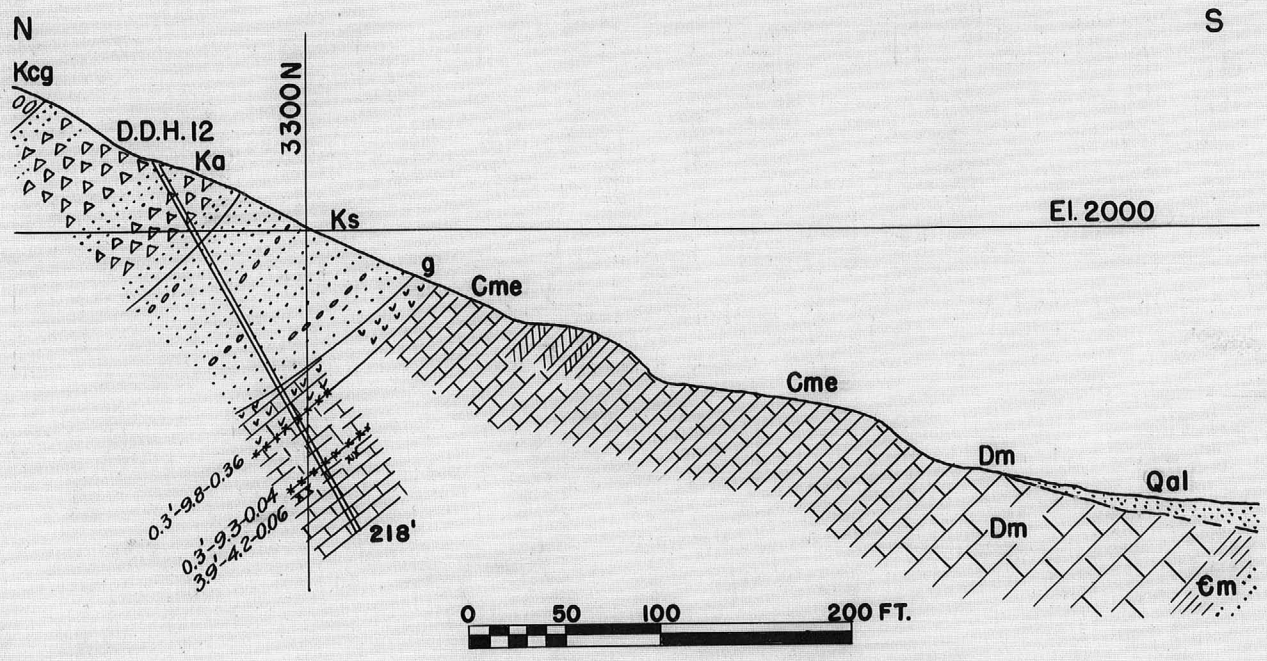


FIG. 13 - CROSS SECTION ON 9040 E. THROUGH HOLE 12, REWARD ZINC, PROJECT 1587

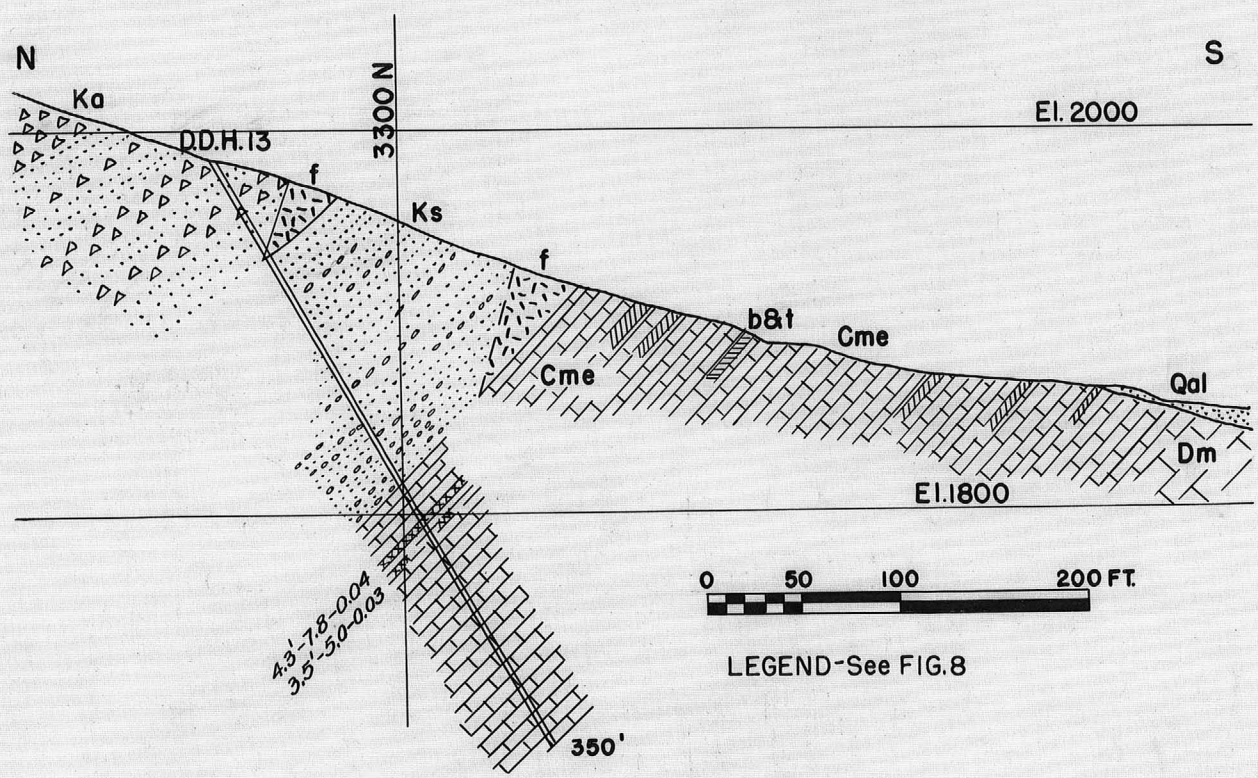


FIG. 14 - CROSS SECTION ON 8540 E. THROUGH HOLE 13, REWARD ZINC, PROJECT 1587

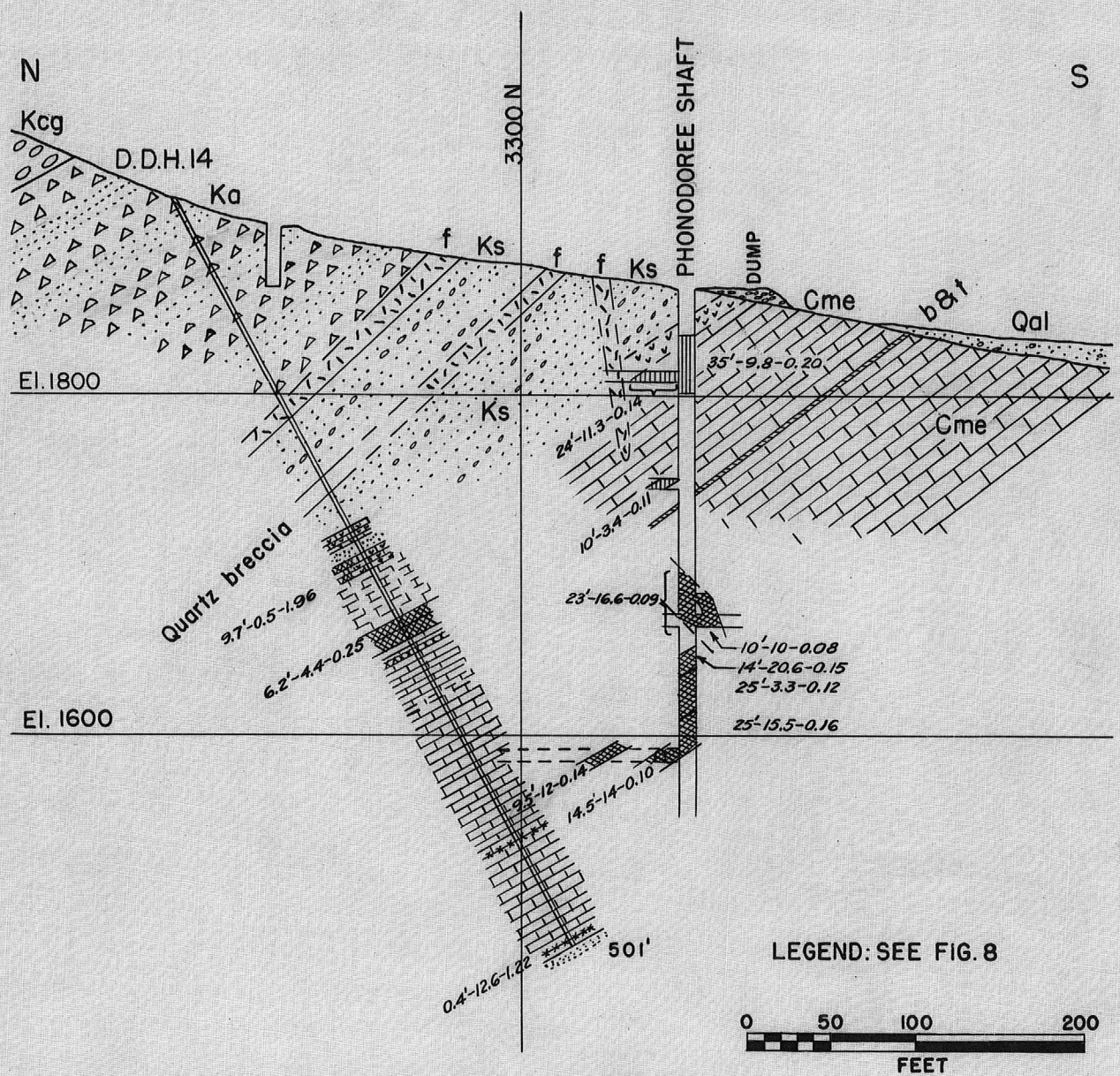


FIG. 15 - SECTION THROUGH HOLE 14 & PHONODOREE SHAFT, PROJECT 1587

Trim line

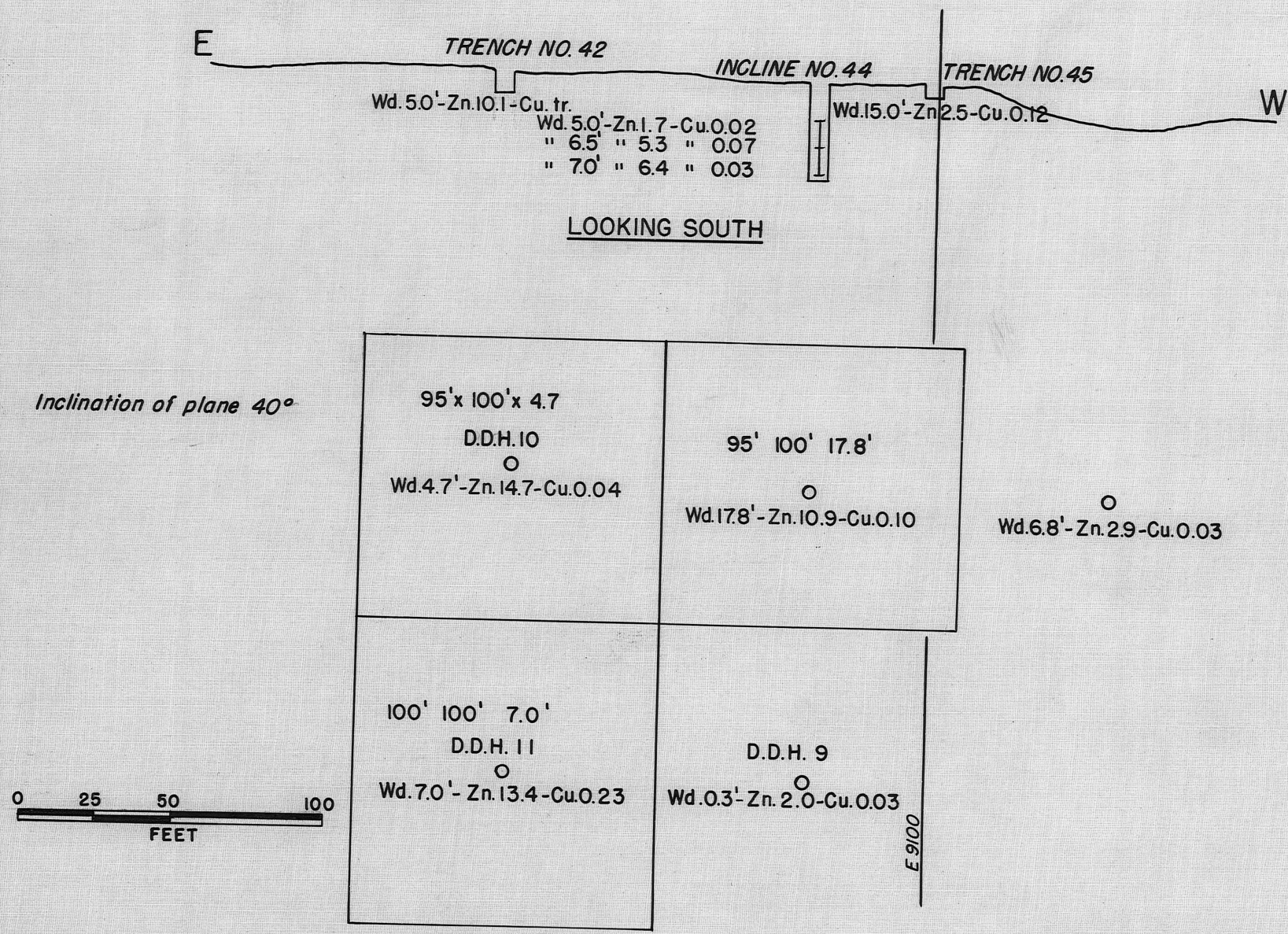


FIG. 17-PLAN IN PLANE OF THE VEIN OF ORE BLOCK IN AREA OF 44 INCLINE, PROJ. 1587, ARIZONA