UNITED STATES
DEPARTMENT OF THE INTERIOR
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THE POOR MAN IRON DEPOSIT, KASAAN PENINSULA, PRINCE OF WALES ISLAND, SOUTHEASTERN ALASKA.

By

L. A. Warner and Matt S. Walton, Jr.

INTRODUCTION

The copper-bearing magnetite deposit, known as the Poor Man prospect, which is on the Iron King No. 3 claim of James Coleman, is 2 miles northwest of the village of Kasaan (see fig. 1) and 35 miles northwest of Ketchikan, the nearest port. The deposit is within 2,000 feet of tidewater in an area ranging in altitude from 50 feet to 200 feet. Outcrops are confined to stream valleys and to prospect cuts and trenches. Most of the area is covered with a veneer of vegetation, glacial drift, and alluvium. The deposit has been explored by three short adits on the west side, four shafts along the east margin, numerous pits and trenches, and 13 drill holes (see fig. 2).

Geologic, topographic, and magnetic surveys of the deposit were made by the Geological Survey in September, 1942. 1/ The Bureau of Mines trenched and sampled the deposit in November 1942 and diamond-drilled it during April and May 1943, at which time further studies were conducted by the Geological Survey.

GENERAL GEOLOGY

The geology in the vicinity of the Poor Man deposit is similar to that found elsewhere on Kasaan Peninsula and described by Wright. 2/ The oldest rocks comprise the Kasaan greenstone which consists mostly of metamorphosed volcanic flows, sills, and ash beds. Interbedded with these are layers of quartzite and graywacke and lenses of crystalline limestone which range in thickness from a few inches to more than a hundred feet. The regional strike of these rocks is in general northwesterly, although locally their attitude is complicated by folding and faulting.

1/ Warner, L. A. The Poor Man iron prospect, Kasaan peninsula, Prince of Wales Island, southeastern Alaska: U. S. Geol. Survey preliminary report to war agencies, 1942.

2/ Wright, C. W., Geology and ore deposits of Copper Mountain and Kasaan Peninsula, Alaska: U. S. Geol. Survey Prof. Paper 87, pp. 67-84, 1915.

The greenstone and associated rocks are cut by various dikes, including bostonite, syenite, diorite, gabbro, lamprophyre, and diabase. Most of the dikes strike from N. to N. 45° W., but occasional dikes strike northeasterly. The major faults trend northerly across the regional strike of the bedded rocks.

ORE DEPOSIT

General statement

The ore minerals have replaced and cemeted greenstone breccia fragments in a large fault zone which trends about N. 7° E. and dips from 55 W. to 75° W. At the surface the deposit is about 1,500 feet long and 50 feet to 150 feet wide (see fig. 2). It has been outlined fairly well by numerous trenches which extend across it. At some places the boundaries of the ore have been inferred from the results of the magnetic survey.

Previous development work

Prior to the drilling the only underground openings consisted of four shafts and three adits (see fig. 2). Ore is exposed at the collar of shaft 1, which is 15 feet deep and full of water. The dump indicates that ore was found throughout most of this depth. Shaft 2 is 60 feet deep and probably is mostly in ore. Shaft 3 is 20 feet deep and is reported to have been in ore throughout. The north end of the deposit is covered with glacial drift and shaft 4 was sunk to a depth of 10 feet in this material.

Adit 1 is 25 feet long and exposes irregular blocks of greenstone, some of which are several feet in diameter, in a matrix of ore. Adit 2, which connects with shaft 2, cuts through 60 feet of ore and exposes epidotized greenstone at the breast. The greenstone is separated from the ore by a north-trending fault which dips 70° W. The adit exposes several large blocks of greenstone in the ore. Adit 3 cuts through 45 feet of greenstone and penetrates the ore for 40 feet. The hanging-wall contact of the ore strikes north and dips about 55° W. The greenstone is much altered and is cut by numerous small faults, some of which are nearly parallel to the contact.

Geologic interpretation of diamond drilling

The Bureau of Mines' drilling program was conducted along lines suggested by the Geological Survey. 3/ However, the shattered wall rock adjacent to the deposit made drilling difficult and the originally proposed drill sites 100 feet west of the deposit had to be abandoned for set-ups closer to the west contact. Because the deposit dips westward, this arrangement was unfavorable for prospecting the body very far below its outcrop

3/Warner, L. A., op. cit., pp. 5 and 6.

Cross sections of the ore body in the planes of the drill holes are shown in figures 3 through 9. With two exceptions (hole no. 2 and hole no. 21) the drill holes were either vertical or inclined eastward across the ore body from near its western margin. Hole no. 21 strikes N. 15° E. nearly parallel to the eastern boundary of the ore. It was intended to prospect the body at its northern end. This hole was directed too far easterly and passed into the footwall of the ore at a slight angle before reaching the north end of the body.

In some holes dikes were cut at such angles as to furnish inadequate information regarding the ore body in that vicinity. For example, hole no. 19 (see fig. 5) penetrated the chilled hanging wall border of a dike, passed through the porphyritic central phase and ended in chilled-border material on the footwall. The dike footwall probably would have been cut and the presence or absence of ore beneath the dike determined had the hole been only a few feet longer. The hole was abandoned because of bad drilling conditions.

The fault zone in which the ore was deposited contains faulted segments of several north-trending dikes. Most of these segments were not replaced by magnetite. Blocks and lenses of greenstone, similar to those exposed in the adits, were encountered in most of the drill holes.

Geologic interpretation of magnetic surveys

Observations of magnetic anomalies were made with a dip needle and Brunton compass at fifty foot intervals over the area mapped. The magnetic data are shown in figure 10. Because magnetite is strongly paramagnetic, large dip-needle and compass deflections are produced by the ore body.

The limits of the deposit are rather closely defined by the area of north (positive) dip-needle deflections. Surrounding the area underlain by ore is an area of low to moderate south (negative) dips. The horizontal anomaly (the amount of deflection of the compass needle from its normal declination), is westerly along the east margin of the ore body and is easterly along the west margin. Near the center of the magnetic disturbance caused by the ore body the horizontal anomaly is zero. The locus of all points of no horizontal anomaly is shown on figure 10 as the "median line of no horizontal anomaly".

At the time the magnetic survey was made no drilling had been done and the body was poorly exposed. Several inferences were made on the basis of the magnetic data regarding the continuity, attitude, depth, limits, and character of the deposit which have since been largely substantiated by drilling and additional trenching.

The fact that the area of north dips forms an elongated zone corresponding closely to the outcrop of the deposit and the regularity with which the median line of no horizontal anomaly follows this zone indicate that the deposit is roughly tabular and that its dip is probably greater than 45 degrees.

South dips of 5 degrees or more are almost entirely confined to the western side of the deposit. Positive (westerly) horizontal anomalies, which characterize.

the eastern side of the magnetic disturbance, are greater throughout than the negative (easterly) horizontal anomalies. These facts definitely indicate that the deposit dips westerly, a conclusion which has been substantiated by drilling.

Wherever a contact between ore and country rock was observed it is generally within the area of north dips. Therefore, it is probable that the deposit does not extend beyond the area of north dips. No conclusive evidence was obtained by trenching or drilling as to the termination of the deposit at either of its apparent ends, but the magnetic data practically eliminate any possibility that it extends appreciably beyond the boundaries shown.

Several discontinuities in the deposit are suggested by the magnetic data. Along section E--E' (see fig. 10) there is a sharp offset in the median line of no horizontal anomaly as well as two distinct areas of high north dips. Drilling and trenching indicate that these data reflect the presence of a large segment of dike rock in the deposit. The low dips north of section C--C' (see fig. 10) probably indicate the presence of a large lens of greenstone and a segment of a dike in the vein, both of which are partially exposed, as well as a distinct narrowing of the vein.

Between sections B--B' and C--C' is another sharp offset in the median line of no horizontal anomaly and a break in the area of north dips. Surface exposures indicate the presence of another thick segment of dike rock which is the apparent cause of the discontinuity.

North dips are closely confined to the area actually underlain by ore. If the deposit extended to considerable depth without substantial loss of width, positive dips would be encountered over an area considerably larger than that of its outcrop. Drilling reveals that the body becomes narrower with depth. The fact that the area of horizontal anomalies does not extend more than a few hundred feet on either side of the ore body suggests that the body does not continue to great depth, but specific estimate of depth cannot be made on the basis of present magnetic data.

Structural control of ore deposition

Both geologic and magnetic data indicate that at the surface the ore body pinches out short distances north and south of its outcrop. At its northern end the body terminates just south of a limestone cliff (see fig. 2). This outcrop is part of a wide belt of limestone which trends across the mineralized fault zone. Perhaps the deposit terminates because most of the movement along the fault zone may have been absorbed by the limestone without developing open fissures which would permit ore deposition. Careful search over an area of about 1 square mile around the north end of the ore body failed to reveal any more ore. Magnetic readings taken over this area were normal.

At its southern end the ore body disappears beneath a thick cover of alluvium and glacial drift which extends southward for several hundred feet. Magnetic readings indicate that the ore does not continue very far to the south beneath the cover. Scattered outcrops of limestone are found northwest and southeast of this covered area. The projected strike of the limestone passes through the covered area and it is possible that here, as at its northern end, the ore body terminates against a belt of limestone.

All of the sections through the body (see figs. 3 through 8) indicate that the hanging wall is steeper than the footwall and that the body pinches downward. The ore body appears to be widest where the footwall is less steep and to be narrow where the footwall is more steep. This generalization is best illustrated in comparing figures 6 and 7. Whereas the widths of the ore in the sections vary considerably at the surface, the widths are similar at 75 feet to 100 feet below the surface. It is possible that the width attained at this level may persist downward for many feet.

Probably the deposit is the base of a once more extensive podshaped ore shoot which formed in a bulge in the fault zone, the upper part having been removed by erosion. A fault zone of this magitude could normally be expected to extend downward for several hundred feet below the surface. It is possible that other bulges occur at depth in the plane of the fault and that ore bodies similar to the one exposed at the surface may be present. If the exposed ore is mined and further prospecting seems warranted, these possibilities might be worth consideration.

Character of the ore

The principal ore minerals are magnetite, pyrite, and chalcopyrite. Of these magnetite is by far the most abundant and pyrite is more abundant than chalcopyrite. The ore also contains recoverable amounts of gold and silver, very small amounts of titanium and phosphorous, and traces of manganese.

Magnetite was the earliest ore mineral to be deposited and it has cemented and replaced greenstone breccia fragments in the fault zone. Some of the pyrite may be contemporaneous with the magnetite but most of it is later. Chalcopyrite is commonly associated with quartz and calcite in a network of veinlets which cut the earlier ore minerals. The precious metals seem to be associated with the sulfides. The phosphorous and titanium are probably contained in unreplaced greenstone fragments, which contain accessory amounts of apatite and titanite.

Much of the gangue material in the ore body consists of blocks or lenses of altered greenstone and segments of dikes, which may comprise about 10 percent of the volume of the body. Most of these blocks of waste material are a few feet to several tens of feet in longest dimension. The cores reveal, however, that some of the high grade ore contains minute fragments of partially replaced greenstone. In places these reduce the tenor appreciably. A few euhedral garnets are in the magnetite. Apparently they were present in the brecciated greenstone prior to ore deposition and were not replaced when the ore-bearing solutions attached the greenstone. Veinlets of calcite and quartz are abundant but their effect on the quality of the ore is small.

Essentially the ore deposit consists of a vein-like mass of high-grade magnetite ore which is bordered on both the footwall and the hanging wall by several feet of low-grade material consisting of mineralized greenstone. The magnetite content of these marginal zones is small but they appear to contain as much chalcopyrite as the high-grade ore and parts of them might be mined for copper. This material consists mostly of veinlets of sulfide minerals and some magnetite is shattered greenstone.

Reserves

The total length of the deposit is about 1500 feet (see fig. 2). The average thickness of the main vein-like mass at the surface is about 85 feet. By projection downward of the boundaries of the body as shown on the cross sections (see figs. 3 through 9) the average distance to which the ore extends down the dip below the center of the body at the surface is estimated to be at least 200 feet. The body therefore may be treated as a triangular prism 1500 feet long, 85 feet wide and 200 feet deep, having a volume of 12,750,000 cu. ft. Assuming that 10 percent of this volume is waste and using a factor of 8.5 cu. ft. of ore to a long ton, the vein-like magnetite body contains about 1,350,000 long tons of ore. Of this amount, approximately two-thirds lies above the diamond-drill holes and therefore might be classed as measured and indicated ore. The remaining third of the body is inferred ore. The amount of inferred ore may be larger if the ore body widens below the level of the drill holes or continues downward without appreciable loss of width.

Analytical data furnished by the Bureau of Mines indicate that the magnetite ore body contains an average of 52.4 percent of iron. The average copper content is only 0.25 percent although some samples contained more than 1 percent. Gold averages 0.032 oz. per long ton and silver 0.071 oz. per long ton. About 0.03 percent of phosphorous and 0.04 percent of titanium are present. The sulfur content averages 3.72 percent and the copper and precious metals are contained in the sulfide minerals.

The bordering zones of low-grade material on each wall of the vein-like magnetite body probably amount to at least 150,000 long tons. The iron content of this material is low but the copper content is probably as much as, or more than, that of the high-grade ore. Parts of it may be of sufficient grade to furnish low grade copper ore in event the magnetite deposit is mined.

SUMMARY AND CONCLUSIONS

The Poor Man iron deposit comprises an irregular vein-like body of magnetite ore which has replaced brecciated greenstone in a large fault zone. Geologic and magnetic studies conducted by the Geological Survey indicate that at the surface the deposit is about 1500 feet long and averages 85 feet wide. The deposit has been prospected by diamond drilling, carried on by the Bureau of Mines, to an average depth of more than 100 feet down the dip of the fault zone, and the ore is estimated to extend downward for at least another 100 feet. This deposit appears to be the base of a once more extensive pod-shaped ore shoot, the greater part of which has been removed by erosion.

Magnetite is the principal ore mineral but pyrite and chalcopyrite are present in noticeable quantities. The magnetite chiefly replaces greenstone and the sulfides occur as disseminated grains or as fracture fillings in the magnetite and greenstone. Blocks of unmineralized greenstone and faulted segments of dikes are found in the ore. Most of these are at least several feet in diameter. Some of the ore contains minute fragments of partially replaced greenstone which locally reduce the tenor.

Analyses furnished by the Bureau of Mines show that the magnetite ore contains 52.4 percent of iron and recoverable amounts of copper, gold, and silver. Phosphorous and titanium are not present in harmful quantities but the sulfur content averages 3.72 percent. The copper and precious metals are contained in the sulfide minerals.

On the basis of geologic and magnetic studies and of information obtained from diamond drilling, the deposit is estimated to contain about 1,350,000 long tons of magnetite ore of which two-thirds is classed as measured and indicated ore and the remainder as inferred ore. Low-grade zones of mineralized greenstone on either wall of the vein-like body of magnetite are estimated to comprise an additional 150,000 long tons of material, parts of which may be minable for copper.

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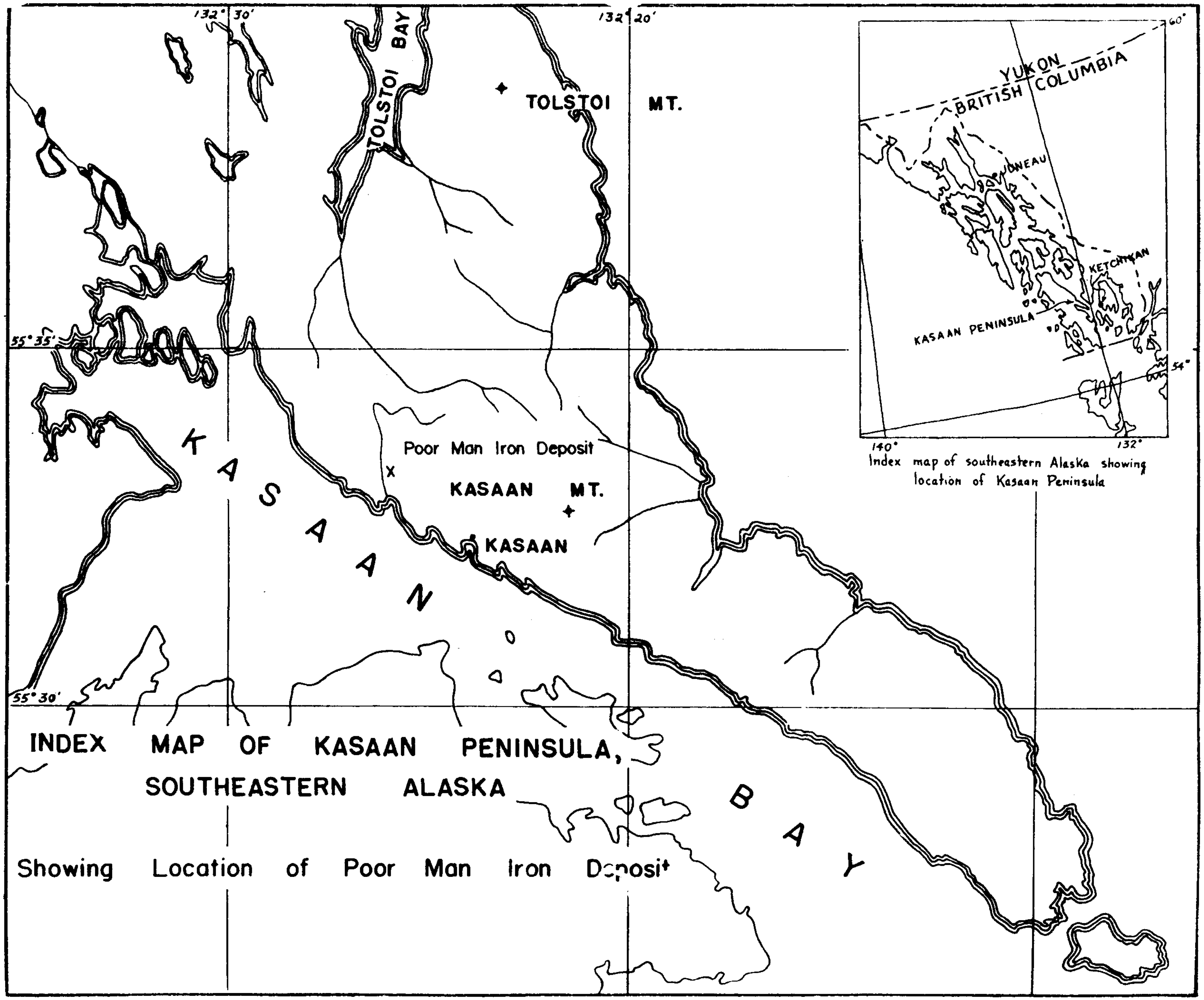

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Figure 1

FIGURE 3

SECTION A-A' THROUGH DIAMOND DRILL HOLES NO'S 1 AND 2
POOR MAN IRON DEPOSIT

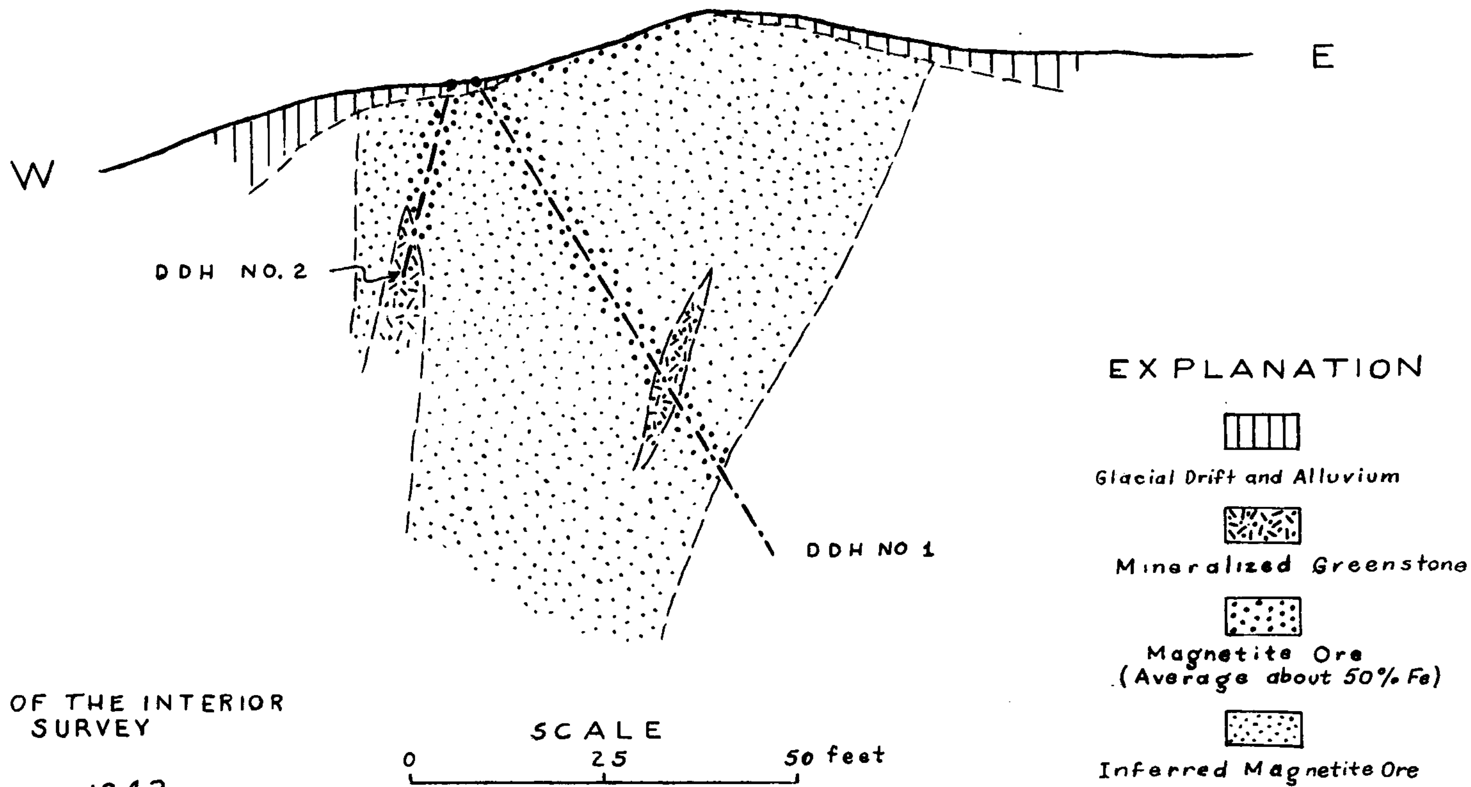

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FIGURE 4

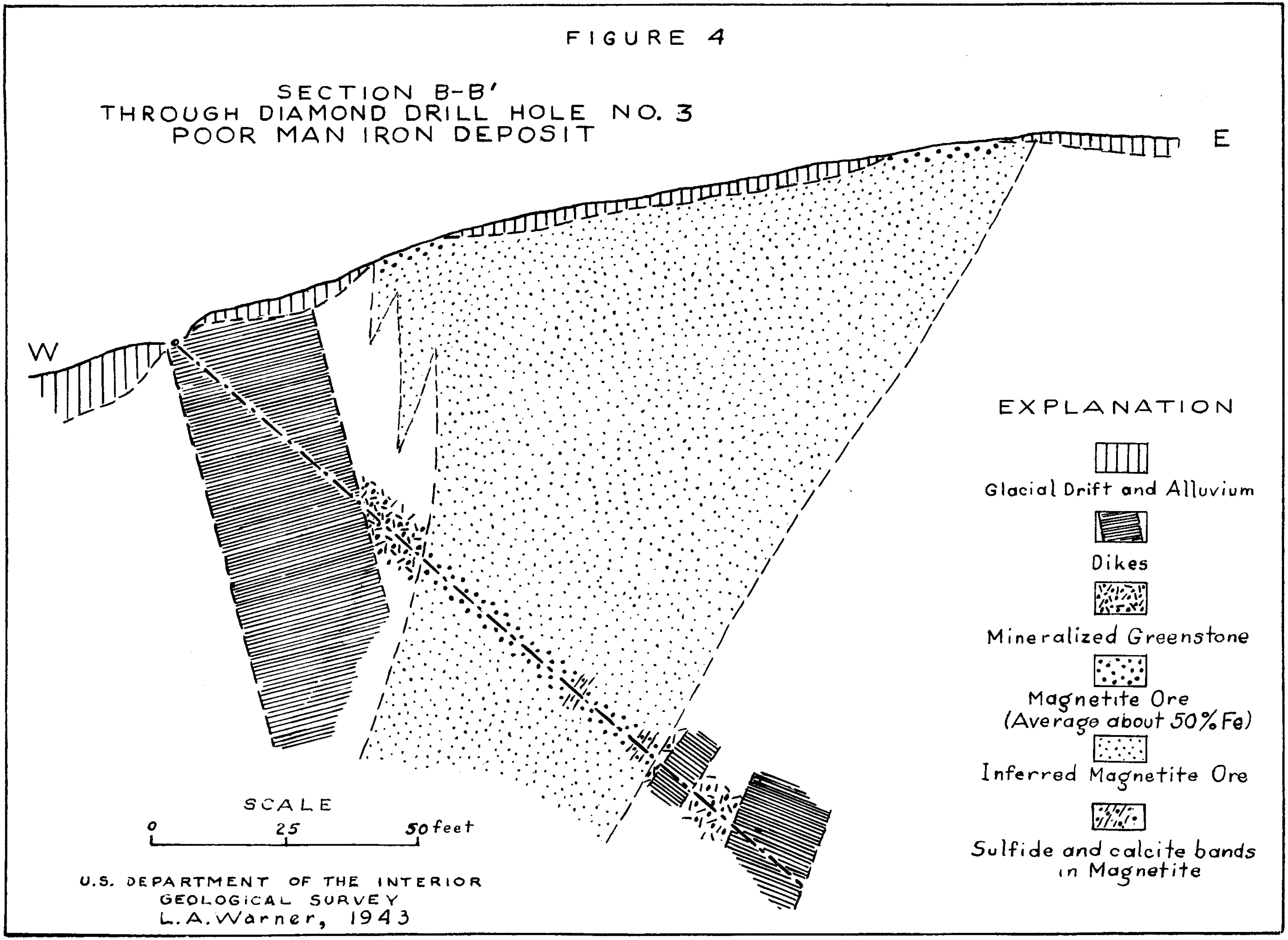

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FIGURE 5

SECTION C-C′
THROUGH DIAMOND DRILL HOLES NO'S 7, 8, AND 19
POOR MAN IRON DEPOSIT

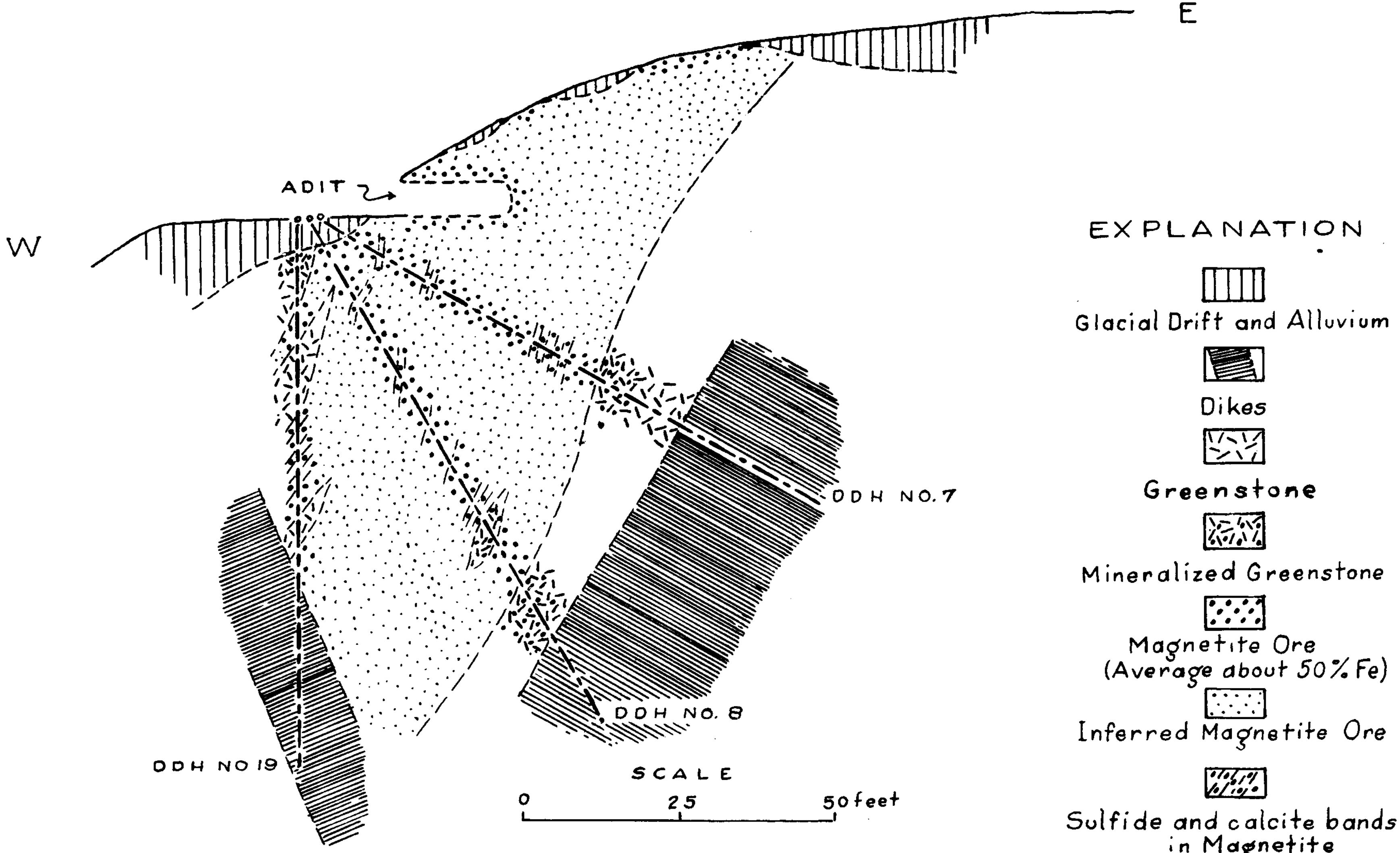

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FIGURE 6

SECTION D-D'
THROUGH DIAMOND DRILL HOLE NO 9
POOR MAN IRON DEPOSIT

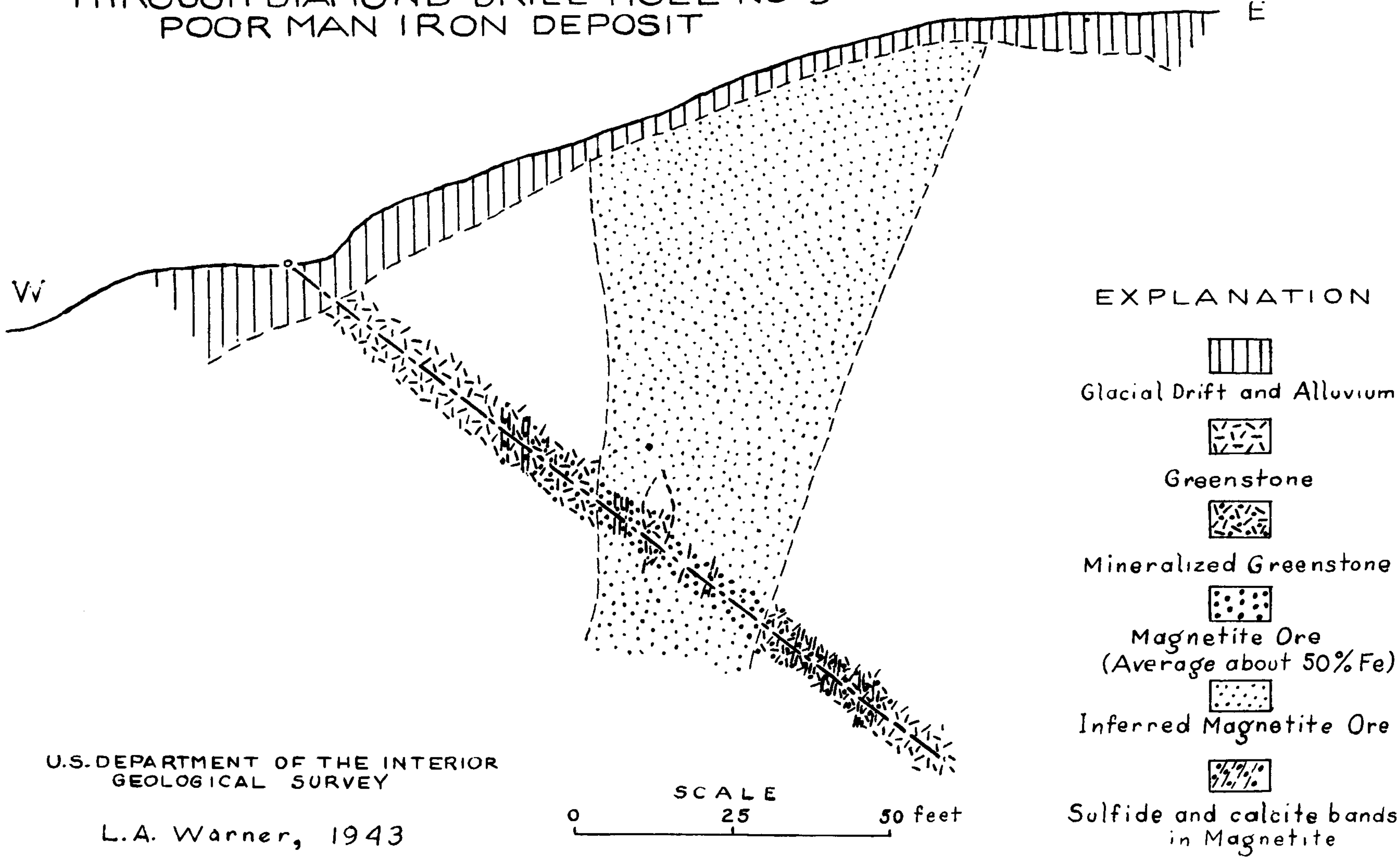

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FIGURE 7

SECTION E-E'
THROUGH DIAMOND DRILL HOLES NO'S 11 AND 12
POOR MAN IRON DEPOSIT

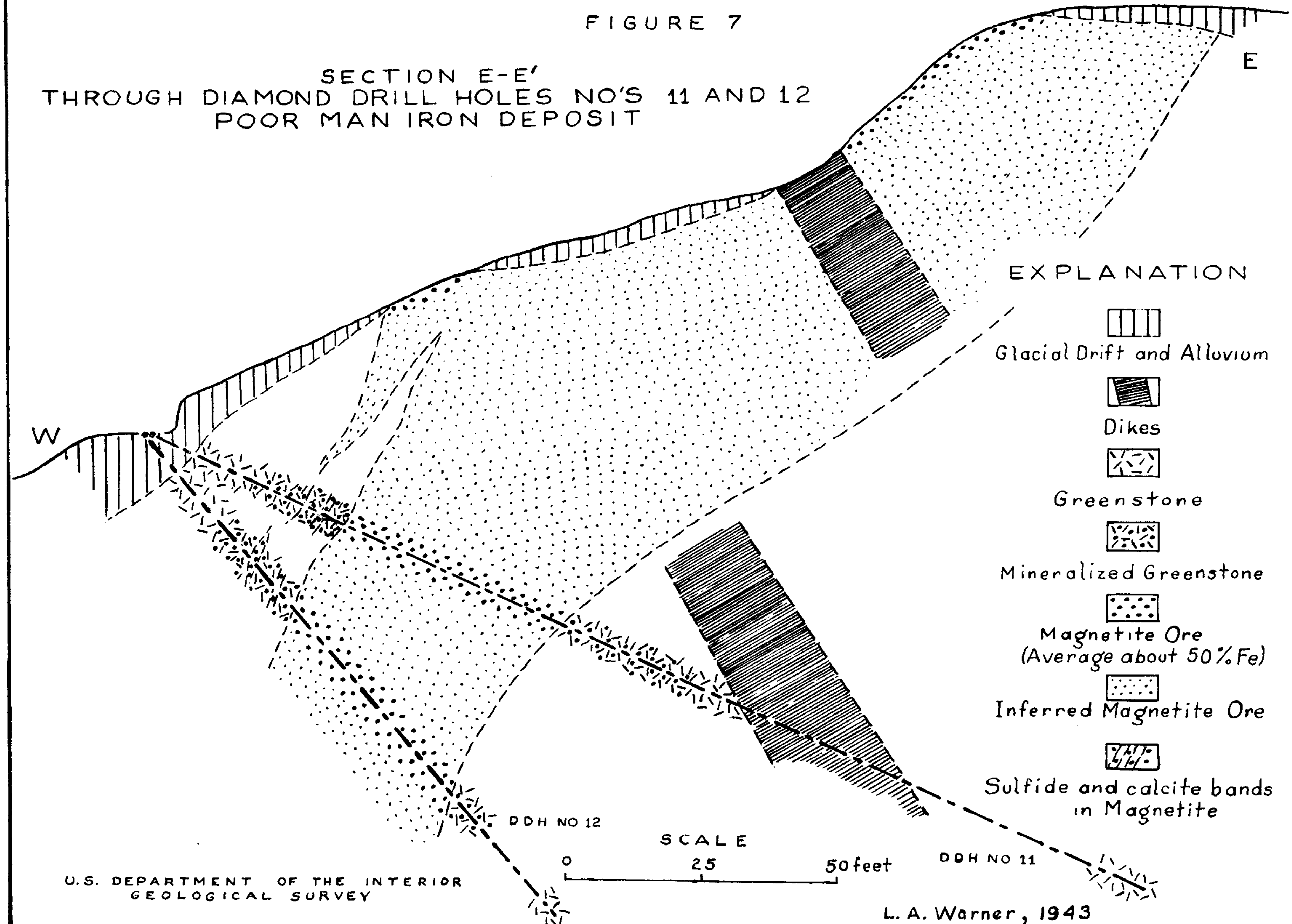

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FIGURE 8

SECTION F-F'
THROUGH DIAMOND DRILL HOLES NO'S 13 AND 14
POOR MAN IRON DEPOSIT

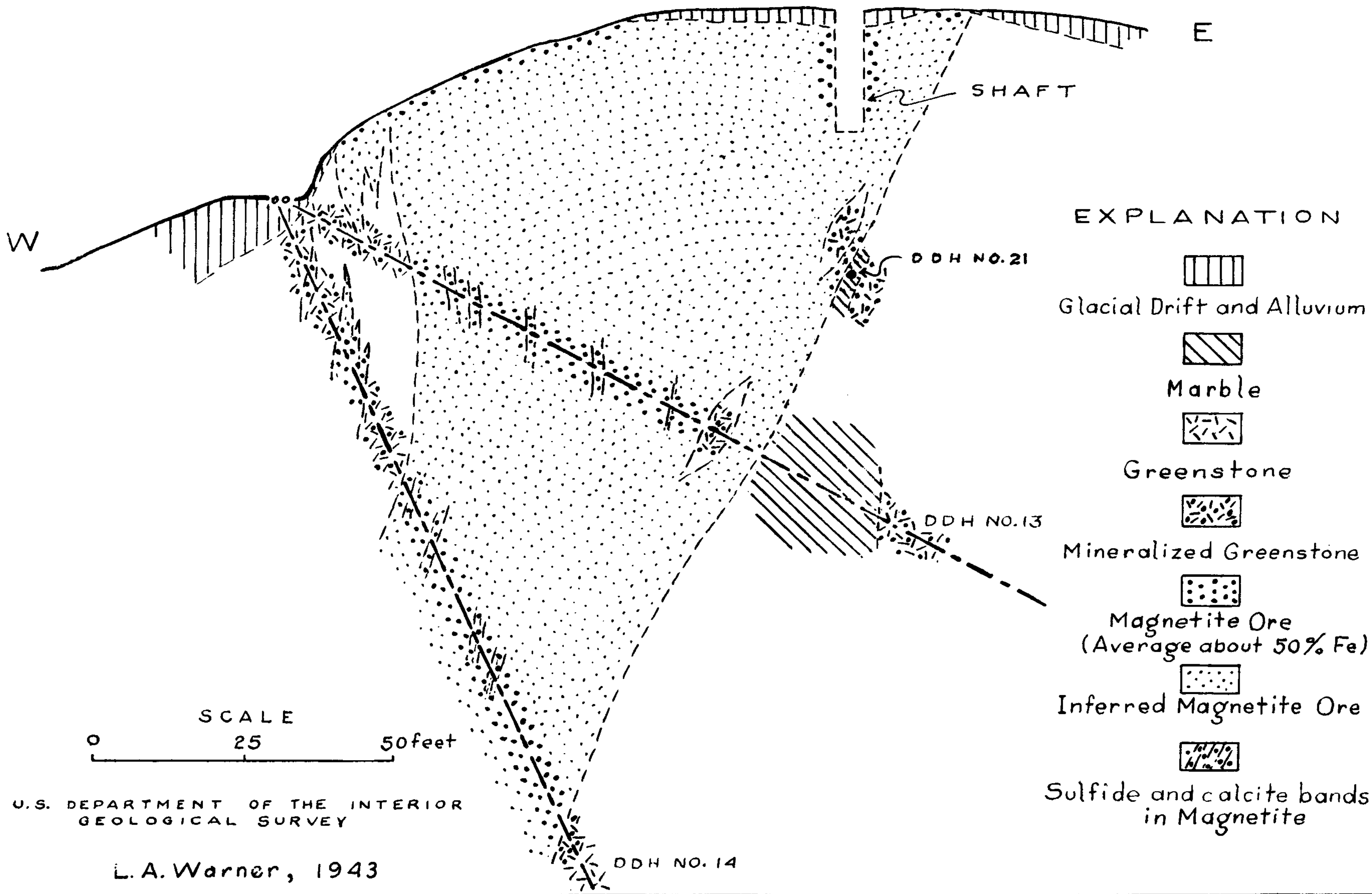

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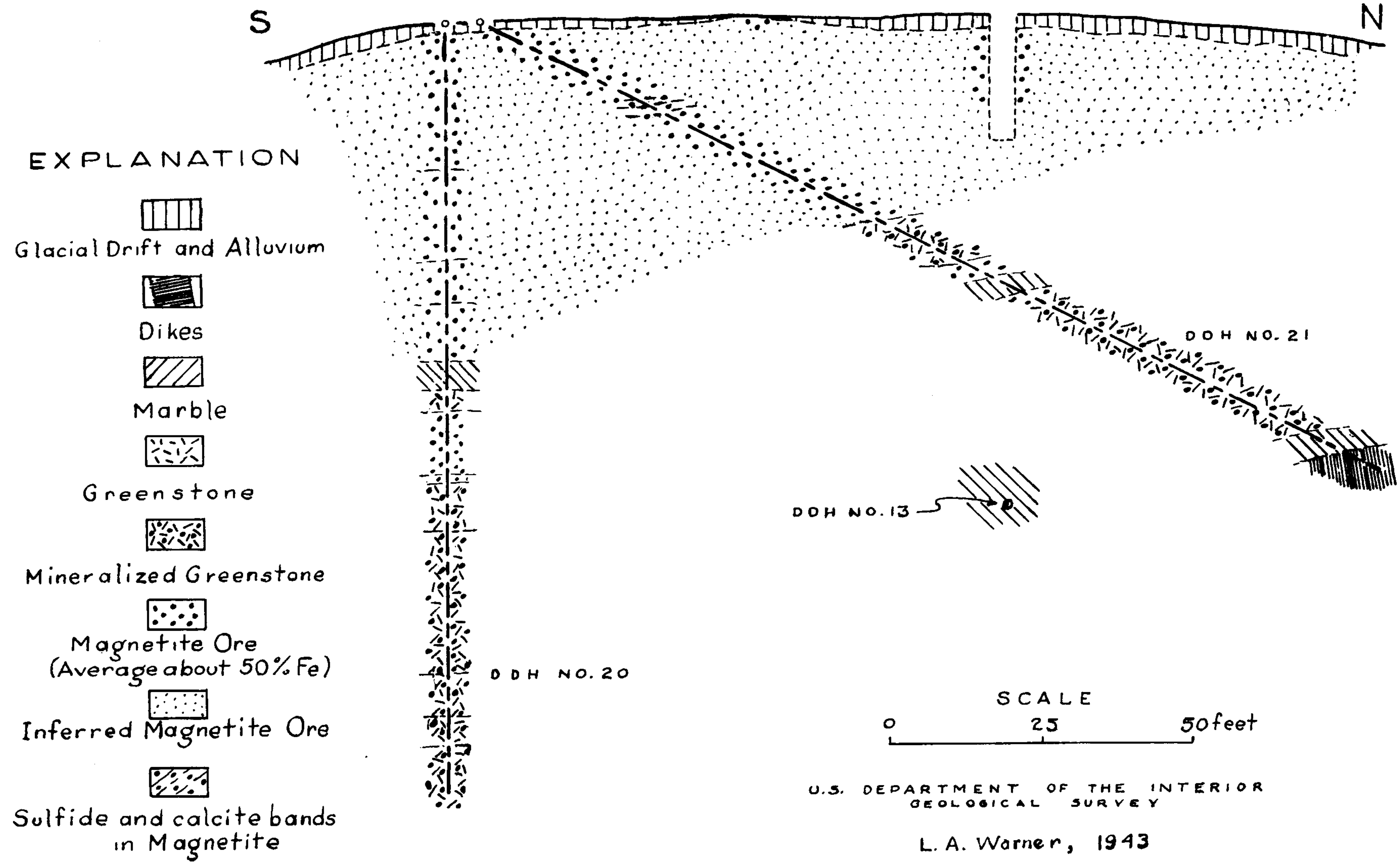
FIGURE 9

SECTION G-G' THROUGH DIAMOND DRILL HOLES NO'S 20 AND 21, POOR MAN IRON DEPOSIT



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