6000 0079 (0760)

Idaho Mining Corporation

OFFICE: 591 - 25 ROAD
MAIL: P.O. BOX 2183
GRAND JUNCTION, COLORADO 81501
PHONE: 303 - 243-7806

March 9, 1979

Mr. Cliff Mark
Cyprus Exploration Company
555 S. Flower St.
Los Angeles, CA 90071

Re: Calico Iron Deposit

Dear Cliff:

Alan Bakewell visited Grand Junction last weekend to discuss the Northumberland property, during which discussions I made brief mention to him of the Calico iron deposit, and thought it would be appropriate if I brought you up to date on the status of the Walker River Reservation properties at this time. Our exclusive mineral prospecting permit expired on February 13, 1978. Prior to that time, we had applied for leases on three tracts of land as shown on the accompanying maps and described in the cover letter dated Feb. 10, 1978. Two of these tracts encompassed the Calico deposit, and the other covers the main Hottentot anomaly, and extends eastward to cover the Badger anomaly. The Badger anomaly is quite interesting. It is a very small magnetic anomaly, but when we drilled the one hole which we got down to the objective (BA #4), we found some very significant copper values, and highly interesting rock types. A log of that drill hole is attached for your perusal. Additionally, hole H-100 was drilled on the main Hottentot anomaly, about 1 mile northwest of the Badger hole, and had good iron values, with accessory copper from 710' to 828'. At that depth, we lost circulation, (air-rotary drilling) and took a 3' core run from 828-831', which assayed 52.8% Fe and .138 % Cu. We discontinued drilling after taking the core.

The leases which we applied for have not yet been granted, but are caught up in the red tape of the Bureau of Indian Affairs. We have no reason to think that they will not be granted, as I think that they have no alternative, unless they can show that there are overwhelming environmental considerations that mitigate against the lease. The only fly in the ointment in the overall picture on the reservation is relatively minor, and that is that the BIA has taken the position that the Hottentot lease has expired of its own term and they do not wish to reinstate it. We feel this is grossly unfair, since we had agreements with the BIA officials and with the USGS minerals supervisor, Ernie Blessing, that so long as market conditions for iron ore were poor, we could extend the lease until the market conditions improved. Nevertheless, if you were to get involved in the Calico/Badger/Hottentot leases, I am sure they would consider granting a lease on this 330 acres. The tract which was formerly contained in our lease contains the shallow iron/copper deposits which we called the South Hottentot.

In view of the improved conditions of the copper market, I thought it best that we run this by you again to let you know that we still have control of the land, and see if it is a target in which you might now be interested.

Kindest Regards,

Bill

W. L. Wilson

WLW/jb

6000 0079 (0766) (3)

THE HOTTENTOT DEPOSITS

WALKER RIVER INDIAN RESERVATION, NEVADA

By: W. L. WILSON

April 5, 1973

INTRODUCTION

The Hottentot area was discovered, prior to the performance of an aerial magnetic survey of the Reservation, while conducting a reconnaissance of areas deemed geologically favorable for the occurrence of iron or iron-copper deposits. One such area, later called the "North Hottentot", was examined, and magnetite float that was noted in a wash was traced approximately half a mile upstream to its source, an unpretentious outcrop of magnetite-hematite. A preliminary ground magnetic survey and preliminary geologic map were made, and it was decided that the anomalous conditions present were indicative of a favorable exploration target. Subsequent exploration proved that multi-million ton deposits of iron-copper ore exists at a relatively shallow depth of burial on this property, and a potentially larger deposit in the 100,000,000 ton size range may exist at depth.

LOCATION AND ACCESSIBILITY

The Hottentot deposits are situate approximately 12 miles East of Schurz, Mineral County, Nevada. U. S. Highway 95, a primary road, passes through Schurz and access to the property from Schurz is by improved gravel road. Numerous dirt and rock roads give access to various portions of the property.

The Hazen to Mina standard guage branch line of the Southern Pacific Railroad passes through Schurz, Nevada, approximately 12 miles West of the deposit. Topography is such that a haulage road and/or a railroad spur could be readily built and maintained into the area of the prospect, in fact an old railroad roadbed from Schurz to Rawhide runs within one mile of the deposits, and could be rehabilitated at low cost if the deposit were to be placed into production.

The local climate is typical of the arid Southwest, with hot dry summers, accompanied by occasional thunderstorms, and fairly mild winters, during which modest amounts of snow can be expected. Average annual precipitation is on the order of 5-7". Year-round operations can be maintained without difficulty or unusual problems, based on climatic data and ten years operating experience in the area.

Maximum topographic relief within the area is approximately 250 feet, and most of the slopes are gentle. A large portion of the area is covered with tertiary volcanics and alluvium and building and maintenance of roads is quite simple.

Vegetation is limited to desert varieties of low bushes and grasses.

PROPERTY AND OWNERSHIP

The entire area of the Hottentot deposits prospect lies within the boundaries of the Walker River Paiute Reservation. Walker-Martel Mining Co., has a lease on 330 acres covering the south and east Hottentot deposits, which it has agreed to assign to Idaho Mining Corporation. Idaho has applied for an Exclusive Mineral Prospecting Permit on all lands of the Walker River Paiute Tribe, which would include the north Hottentot deposit.

Incorporated in the permit is the sole and exclusive right to select leases, on specified terms and conditions, on the permitted lands. These leases run for a primary term of ten years, and can be extended thereafter so long as minerals are produced in paying quantities.

GEOLOGIC SETTING OF THE RESERVATION

The Walker River Indian Reservation lies in an area of Mesozoic sedimentary, volcanic, and intrusive rocks that are overlain by a thick section of volcanic rocks of Tertiary and Quaternary age. The Mesozoic is represented by the Excelsior, Luning, Gabbs, and Sunrise formations, especially in the Gillis Range to the south, where the Excelsior is thrust over the Luning formation by the Gillis thrust. These rocks have been intruded by Mesozoic granitic rocks ranging in composition from granite to gabbro. In the northern part of the

Reservation the Mesozoic rocks are poorly exposed, being found only in occasional outcrops along the northern extension of the strike-slip fault proposed by Ferguson and Muller (1949, p. 29). Most of the Reservation, except the Gillis Range and the Black Mountain area west of Walker Lake, is overlain by a thick section of volcanic rocks and alluvium of Tertiary and Quaternary age. These volcanic rocks have been divided by Ross (1961) and others as:

Pre-Esmeralda, consisting of intermediate to felsic volcanic rocks, which are commonly altered and mineralized.

Esmeralda, consisting of rhyolite tuffs, shales, sandstone, and conglomerates.

Post-Esmeralda, consisting of two series, felsic and intermediate in composition.

Late Tertiary and Quaternary, consisting of mafic flows and intrusives.

These rocks are interbedded in the northern part of the Reservation, and a study of them is being made basin by basin. As pointed out by Ross (1961), the above division is an oversimplification of the volcanic section.

GEOLOGY OF THE HOTTENTOT AREA

Although relatively few rock types are present in the area of the Hottentot prospect, the structural relations are complex. No Mesozoic rocks are exposed, except a small outcrop of fine-grained intrusive in the area of the outcrop of magnetite, and two small slivers of metamorphic rocks associated with the intrusive. The intrusive is fine-grained, highly silicified, and partly albitized at the surface, and an analysis of the drill-hole samples showed it to be dioritic in composition. Except for this small exposure, the entire area of interest is overlain by quartz-latite tuff, which in part is overlain by four distinct volcanic flows of intermediate composition, and all are intruded by mafic plugs, with mafic flows in some areas. There are several small dikes, andesitic to basaltic in composition, present in the South Hottentot area. Lacustrine deposits of Lahontan age overlie these rocks to the west.

The quartz-latite tuff overlying the fine-grained intrusive in the South Hottentot area appears to show a distinct alteration pattern, almost co-extensive with the presumed limits of mineralization as discovered in drill holes and as projected on the basis of magnetic anomalies; however, this may be fortuitious, and probably represents alteration resulting from the emplacement of dikes and nearby plugs of basalt.

Thin sections of samples from the drill holes indicated that the underlying granitic rocks ranged from gabbro to diorite and quartz monzonite in composition. These rocks were highly silicified and somewhat albitized in the area of mineralization; away from the mineralized zones they showed chloritic and argillic alteration. A small amount of calc-silicate rock was found in one hole near the iron outcrop.

Approximately one mile to the northwest is an outcrop of granite that contains a small amount of gold-quartz mineralization, and two miles to the southeast there is an exposure of quartz monzonite. As a whole, pre-Tertiary outcrops are meager.

The mineralization in the Hottentot area consists of magnetite, hematite, pyrite, chalcopyrite, and traces of galena. The magnetite occurs as pods and somewhat irregular lense-shaped bodies in the diorite. It appears to be genetically as well as spatially related to the diorite. Subsequent alteration and oxidation have changed part of the magnetite to hematite. Pyrite occurs as disseminated grains and minute veinlets in some areas. Chalcopyrite occurs sporadically through the ore zone, but is more frequently seen in the area of drill hole H-6. A few grains of galena were found in the lower part of drill hole H-1.

This area lies along the northern extension of a strike-slip fault described by Ferguson and Muller (1949), Locke and others (1940), and by others. Some right-lateral movement is indicated in the South Hottentot area, and possibly up to 2,000 feet of right-lateral movement is indicated on the strike-slip fault immediately south and west of the Hottentot area. This movement has been post-Miocene in age. These northwesterly trending faults cut lacustrine deposits of Lahontan age in the area immediately north of Schurz, about 12 miles to the west, and in turn are cut by northeasterly trending faults. This faulting appears to have a beginning in late Mesozoic time, and to have continued throughout the Cenozoic, and possibly is still active at the present time. Both the granitic and mafic intrusives as well as the vents for the pyroclastic material, may have been controlled by this northwesterly trending structure.

GEOPHYSICAL SURVEYS

Detailed ground magnetic surveys were performed, together with geologic mapping of the overall Hottentot area.

An aerial magnetic survey of the entire Reservation, flown at 500 feet above terrain, gave substantially the same picture as the ground magnetics in the Hottentot area, with one important difference. Even though flight lines were interspaced in this particular area to achieve 1/6 mile spacing, instead of the normal 1/3 mile interval used on the rest of the reservation, the southeasternmost anomaly shown previously, managed to escape detection by being between even these close-spaced flight lines.

The interpretation of both ground and aerial magnetics in this general area is vastly complicated by the presence of magnetic volcanic rocks, highly polarized (remnance) in certain areas, some of which are located close to the known iron deposits. Extensive surveys using Induced Polarization, Self-Potential, AFMAG, and ELTRAN Resistivity were performed.

DRILLING AND ORE RESERVES

Drilling has proven the existence of three separate deposits of iron ore, viz the North, South and Southeast Hottentot deposits. These deposits are geologically and mineralogically very similar to the Calico deposit, and may, in fact, be faulted portions of the Calico, offset several miles along a right-lateral strike-slip fault. } *

A. South Deposit.

This deposit has a very small outcrop, but drilling has delineated approximately one million tons of iron ore, and it is quite likely that an additional 1 to 5 million tons of mill ore could be developed with additional drilling. The deposit has not been limited in any direction. This deposit would be mined by open pit methods, with a very favorable stripping ratio.

B. Southeast Deposit.

This deposit is "blind", i.e. does not outcrop but is buried by 150-200' of recent volcanics. It is a geophysical discovery, with principal credit going to magnetic surveys. This deposit presently has proven reserves of approximately one million tons of relatively high-grade ore (approximately 50% Fe) with accessory copper in the range of .10 to .20%. The deposit is open on all sides, and will likely total 2 to 5 million tons when completely developed. It is susceptible of open pit mining.

C. North Deposit.

The top of this deposit as shown by drilling is some 700' below the surface. It may become shallower as drilling progresses to the east, perhaps on the order of 500'. Only three holes have been drilled, and no estimate of tonnage is possible, but the magnetic anomaly over this deposit is much larger than either the South or Southeast Deposits. Mining would most likely have to be by underground methods, probably block caving.

MARKETING.

The principal market for the product of this type deposit is presently in Japan. At least one firm has been mining, milling and shipping this type iron to Japanese steel mills for 15 years. Five years ago that firm was quite anxious to move its mill to this deposit, but terms with Occidental Minerals, the then lessee of the deposit, could not be agreed upon. The recent re-valuations of the Japanese Yen vis a vis the dollar should place us in a stronger position to enter the Japanese market.

SUMMARY

If a market for the product can be developed, at a suitable price, this deposit can be placed into immediate production. It will be a low-cost open pit mine. Concentration of the ore would be by crushing, grinding and magnetic separation, which is about the least expensive milling technique known, both in terms of capital and operating costs. Production would be on the order of 2,000 tons per day.

The North Deposit has a potential size, based on geophysical surveys, of 100,000,000 tons. In addition, because of substantial amounts of copper encountered in drilling to develop the iron, exploration for copper around the periphery of the iron deposits could very likely be productive.

IDAHO MINING CORPORATION

By W. L. Wilson
W. L. WILSON

References:

Ferguson, F. G., and Muller, S. W., 1949, Structural geology of the Hawthorne and Tonopah quadrangles, Nevada: U. S. Geol. Survey Prof. Paper 216.

Locks, Augustus, Billinglsey, P. R., and Mayo, E. B., 1940, Sierra Nevada tectonic patterns: Geol. Soc. America Bull., v. 51, p. 513-540.

Ross, D. C., 1961, Geology and mineral deposits of Mineral County, Nevada: Nevada Bur. Mines Bull. 58.

Lawrence, E. F. and Wilson, W. L., 1965, Exploration of the Hottentot Prospect, Walker River Indian Reservation, Nevada.

6000 0079 (0760)

22 Apr 1969

EVALUATION OF IRON ORE RESERVES
SOUTH HOTTENTOT PROJECT
WALKER RIVER INDIAN RESERVATION
MINERAL COUNTY, NEVADA

INTRODUCTION

The primary purpose of this report is to determine if sufficient iron ore reserves exist, at the South Hottentot Project, to allow presentation of data to a mining company for lease mining.

The secondary purpose is to recommend the type of exploration which will best develope further reserves.

HISTORY

Drilling commenced at the Hottentot project in October 1963 and continued, intermittently, through August 1968.

The original plan was to develope a shallow ore body which could be mined immediately to provide operating income. Due to marketing conditions it was not possible to sell the ore developed but exploration continued until the Calico project took priority.

In 1966 the Walker River Tribe requested that some portion of the reservation be leased, in order to provide rental income to the tribe. Walker-Martel decided to lease a 330 acre portion of the South Hottentot because it was the only area on the reservation that was even close to possible production. On May 3, 1966 Mining Lease Contract # 14-20-0450-5727 was signed. This lease provides for an annual rental of $1.00 per acre plus an annual exploration expenditure of $1.00 per acre. Since that time, only a minimum amount of exploration money has been expended yearly.

GEOLOGY

The geology of the area has been adequately described in previous reports but a brief description of the zone immediately surrounding the ore is being included in this report.

Outcrops of fine grained intrusive occur in the vicinity of the series 3 and series 6 drill holes. The intrusive ranges from gabbro to diorite and quartz monzonite in composition. The orebody is apparently a tactite zone bounding the intrusive(s), probably as a replacement of limestone or limestone units in either the Luning or Excelsior formations.

Seven of the eight series 3 holes, drilled near station Zero on the base line, encountered ore grade mineralization. The iron ore minerals are composed of magnetite, hematite and limonite. The ore body is largely oxidized. Drill hole data indicates that the ore forms a semi-circular pattern around hole 3E, which was barren. The ore dips to the north and to the south away from the barren area but post mineral faulting has complicated the structural pattern so that the apparent dip of the ore on the east side of the barren area is to the north and west. The average dip is about 10° except where faulting abruptly increased the apparent dip between holes.

The drill pattern surrounding hole 6 encountered ore grade mineralization in 4 out of 5 holes. The ore is apparently wrapping around a diorite - quartz monzonite intrusive and is dipping 40° north. The drilling suggests that the intrusive originally outcropped as a steep-sided hill and during this time the iron zones were also outcropping and undergoing erosion and oxidation. The post-ore volcanic units were laid down on this surface. The faulting at hole 6 is less pronounced than near the series 3 holes so the ore in this area will probably lie in a more even or consistant zone.

ORE RESERVES

Iron mineralization and ore outcrops at hole 3D and at the 20 foot shaft near hole 3C. Holes 3F and 3G encountered ore at 20 feet below the surface. Hole 3 penetrated an ore zone at 41 feet but personal observation, at the time the hole was drilled, showed that the ore was first encountered at about 25-30 feet with the rotary bit. Sudden loss of circulation prevented any return until hard ore was found at 41 feet and the hole was cased. A soft limonite-hematite layer probably overlies the magnetite-hematite ore in this hole. The top of the best developed ore zone lies on a line through holes 3F, 3, 3C, and 3G at a depth of 0-20 feet. The bottom of this zone lies at a depth of 125 to 157 feet below the surface.

The ore in the series 6 drill holes lies from 168 to 424 feet below the surface.

Ore reserves are based on a 50 foot square area of influence around isolated holes and half the distance between holes where the drilling is close spaced; (see figures 1 and 2).

TABLE 1 – Series 3 holes

Hole	Depth	Dimensions		Cubic feet		Tons	Grade(Fe)
3	41-126	85x90x50	=	382,500 ÷ 9	=	42,900	58 %
	171-200	29x90x50	=	130,500 ÷ 9	=	14,900	45.5%
3A	130-147	17x70x50	=	59,500 ÷ 9	=	6,611	54.3%
3B	125-355	230x70x50	=	805,000 ÷ 9	=	89,494	35.3%
3C	49-158	109x115x50 109x 15x50	=	708,500 ÷ 9	=	78,722	44.9%
3D	0-95	95x70x50	=	332,500 ÷ 9	=	36,944	33.5%
3F	19-49	30x80x50	=	120,000 ÷ 9	=	13,333	50.2%
	72-135	63x80x50	=	252,000 ÷ 9	=	28,000	44.3%
3G	19- 96	77x95x50	=	365,750 ÷ 9	=	40,639	51.3%
	133-151	18x95x50	=	85,500 ÷ 9	=	9,500	50.4%
3H	163-178	15x50x50	=	37,500 ÷ 9	=	4,167	56 %
				TOTAL		365,210	44.2% average

Random assays from drill core show mineral content other than Fe as follows : Cu .05-.315% P .08-.12% S .07-1.36% SiO_2 8-21%.

RECOMMENDATIONS

Two drill holes (6E and 6C) are now ready to be cored, thus saving about $1600 in rotary drill costs. Both holes are located in a very favorable area, where the thickest ore zone has been encountered in previous drilling.

It is recommended that a one hole drill program should commence immediately in order to satisfy the lease committments at a minimum expenditure. Hole 6C is preferred over 6E because it is cased and also because it lies further within the area of higher magnetic influence.

The drill cost is based on figures submitted by the Reno District Office of Boyles Brothers Drilling Company.

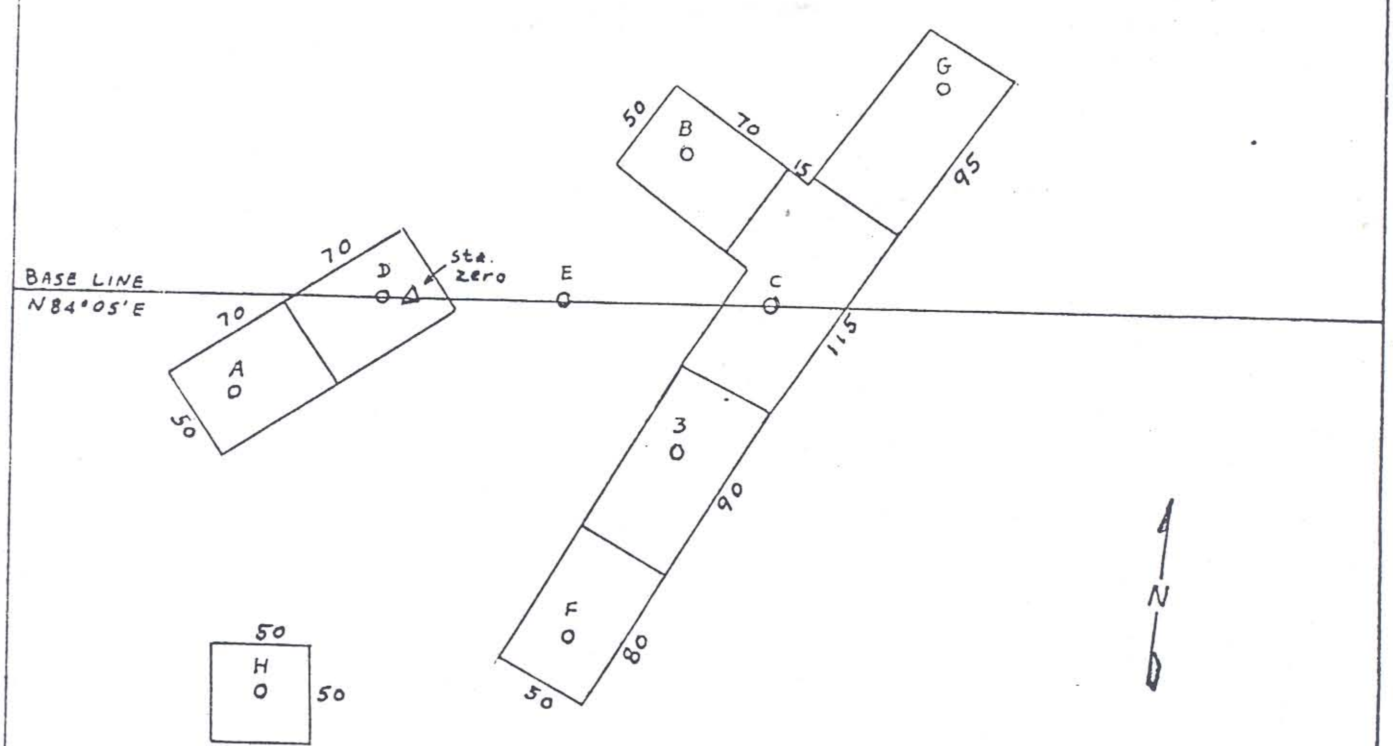
ESTIMATED DIRECT DRILL COST	
Mobilization	$ 300.00
240 feet NX @ $9.50 per foot	2280.00
Water truck - rental, driver, mileage 12 shifts	467.00
Core boxes 25 @ $1.00	25.00
Cleaning and cement time 5 hrs. @ $17.00	85.00
Drill hole additives 36 sacks @ $ 4.50	162.00
Subsistance for 3 men @ $5.00 each - 12 shifts	180.00
Average drill cost of $14.58 per foot	$ 3499.00
OTHER COSTS	
Assays 20 @ $5.00	100.00
Sample preparation labor	50.00
Freight (samples)	20.00
Supervision 4 days @ $50.00	200.00
	$ 370.00
TOTAL DRILL PROGRAM COST	$ 3869.00

April 22, 1969

Respectfully Submitted,

John H. Volgamore

John H. Volgamore
Geologist



ORE RESERVE BLOCKS

SERIES 3

DRILL HOLES

scale 1"=100'

April 1969

Figure 1

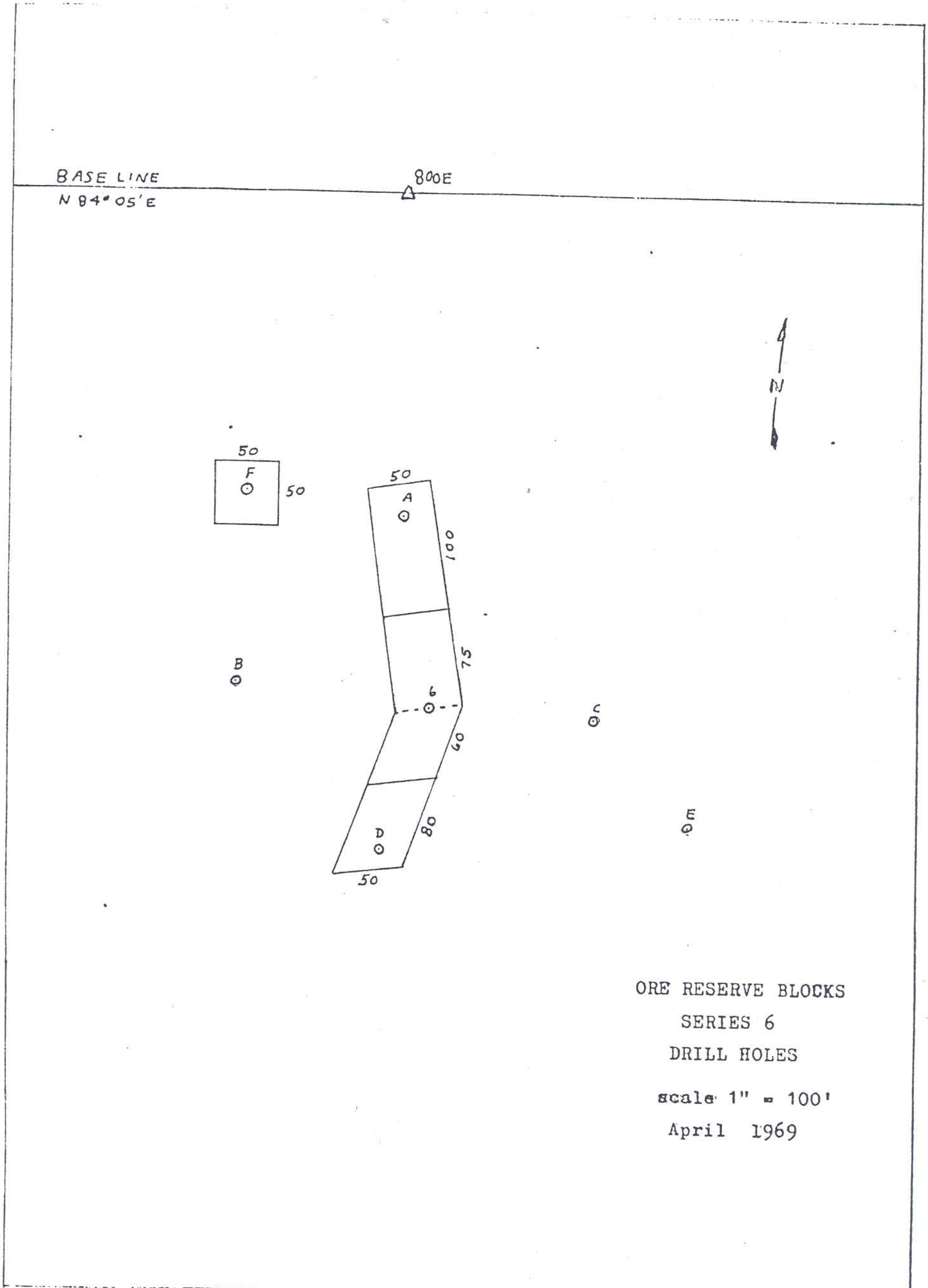

BASE LINE
N 84° 05'E
800E
N
50
F
50
50
A
100
B
75
6
C
60
E
D
80
50
ORE RESERVE BLOCKS
SERIES 6
DRILL HOLES
scale 1" = 100'
April 1969

Figure 2

Supplementary Report on Hole H6C

Hole H6C was drilled during May 1969 and the following assay results were obtained:

Sample #	Depth	S %	Cu %	Fe %
R6C - 1	203-213	.068	.03	47.5
2	213-223	.054	.08	52.0
3	223-233	.085	.17	52.0
4	233-243	.710	.08	51.5
5	243-253	2.260	.21	54.5
6	253-263	1.180	.10	48.5
7	263-273	.390	.02	40.0
	Average grade	.679	.099	46.23

The drill hole was sampled in 10 foot increments from 203 to 403 . but only the top 70 feet was used for ore reserves. The interval from 273 to 393 averaged 1.296 % S, .099 % Cu, and 16.1 % Fe. The bottom 10 foot sample, from 393 to 403, was in the diorite intrusive and assayed .009 % S, .012 % Cu, and 2.10 % Fe.

Using a triangular configuration between holes 6, 6A, and 6C, and using the formula ½(a x b) the following ore reserve data was obtained:

Hole	Depth	Dimensions	Cubic Ft.	Tons	Grade % Fe	Cu	S
H6C	203-273	½(160x140) x 70	784,000 ÷ 9 =	87,100			
		½(45x28) x 70	44,100 ÷ 9 =	4,900			
				92,000	46.23	.099	.679

THE PROBABLE RESERVES OF BLOCKS 3 AND 6 NOW TOTAL:

706,987 TONS.

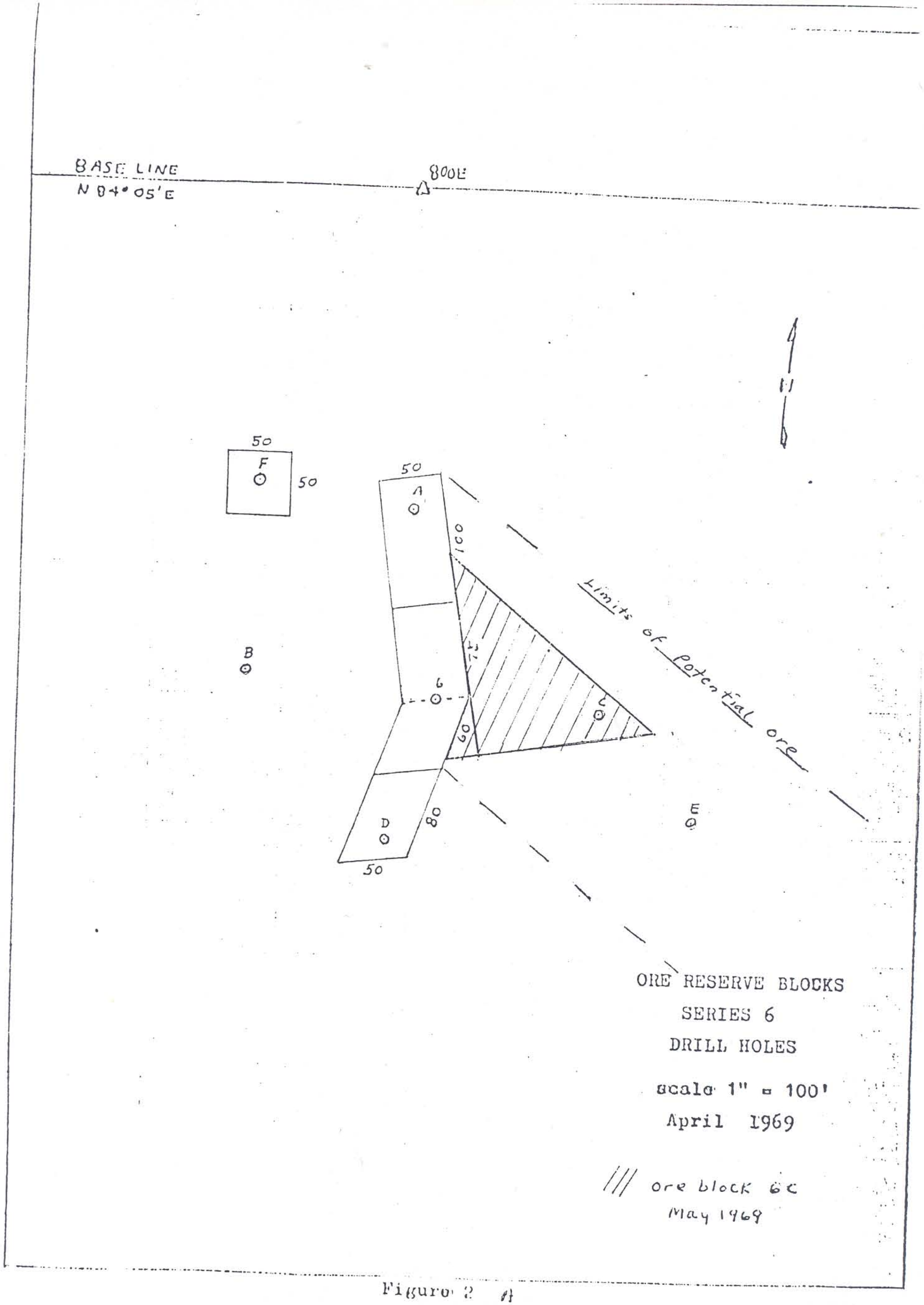
The average grade remains at 46.2% Fe, .10-.15% Cu and about .679% S.

June 18, 1969

Respectfully Submitted,

John H. Volgamore

John H. Volgamore
Geologist



BASE LINE
N 84° 05'E
800E
N
50
F
50
50
A
100
B
6
60
D
80
50
E
Limits of potential ore
ORE RESERVE BLOCKS
SERIES 6
DRILL HOLES
scale 1" = 100'
April 1969
/// ore block 6C
May 1969

Figure 2 A

6000 0079 (0760)

DIAMOND CORE DRILLING
DIAMOND DRILLING EQUIPMENT
GROUTING
FOUNDATION TESTING
MINING
QUARRYING
SHAFT SINKING
TUNNEL DRIVING
MINE PLANT DESIGN
AND FABRICATION

Boyles Bros.
DRILLING COMPANY

CONTRACTORS-ENGINEERS-GEOLOGISTS

P.O. Box 946 600 Industrial Way
SPARKS, NEVADA 89431

Phone (702) 358-5188

General Offices and Plant
1624 Pioneer Road P. O. Box 58
SALT LAKE CITY, UTAH 84110
Phone (801) 487-3671
BRANCH OFFICES
ARIZONA (PHOENIX)
CALIFORNIA (AUBURN)
COLORADO (GOLDEN)
KENTUCKY (LOUISVILLE)
NEVADA (SPARKS)
OKLAHOMA (NORMAN)
WASHINGTON (SPOKANE)
CHILE (SANTIAGO)
CABLE: BOYLESBROS
MEXICO, D.F.
PERU (LIMA)
CABLE: BOYLESCOP

April 14, 1969

Mr. John Volgamore
Occidental Minerals Corporation
100 Washington Street
Reno, Nevada

Dear Mr. Volgamore:

The following are prices that I wish to submit for drilling on the Hottentot Claims near Schurz, Nevada.

1. Mobilization - $300.00

2. Drilling Rates:

	NC	NX	BX
0 to 500 feet	$10.00	$9.50	$9.00
500 to 1000 feet	10.75	10.25	10.00

3. Setting up on previously drilled holes, cleaning and casing in prepartion for coring will be charged at $17.00 an hour.

4. Cementing, if necessary, will be charged at $17.00 an hour plus cost of cement.

5. Drilling mud, additives and lost ciraulation material will be charged at list price f o b the job.

6. Water will be charged at $225.00 per month for truck rental plus 15¢ per mile and drivers wages at $2.45 an hour plus payroll taxes and insurance.

7. Casing lost in the hole or left at customers request will be charged at list price f o b the job.

8. Roads and drill sites to be furnished at no cost to Boyles Bros.

9. A subsistance charge of $5.00 per day per man will be charged.

I realize these prices are higher than in the past but we have encountered some very rough ground in this area and we usually lost money on the drilling. The subsistance charge is necessary because of the remote area and it is impossible to get crews without paying their expenses.

If you decide to have us do this work, we should be able to assemble crews and equipment within 10 days after notification.

Thank you,

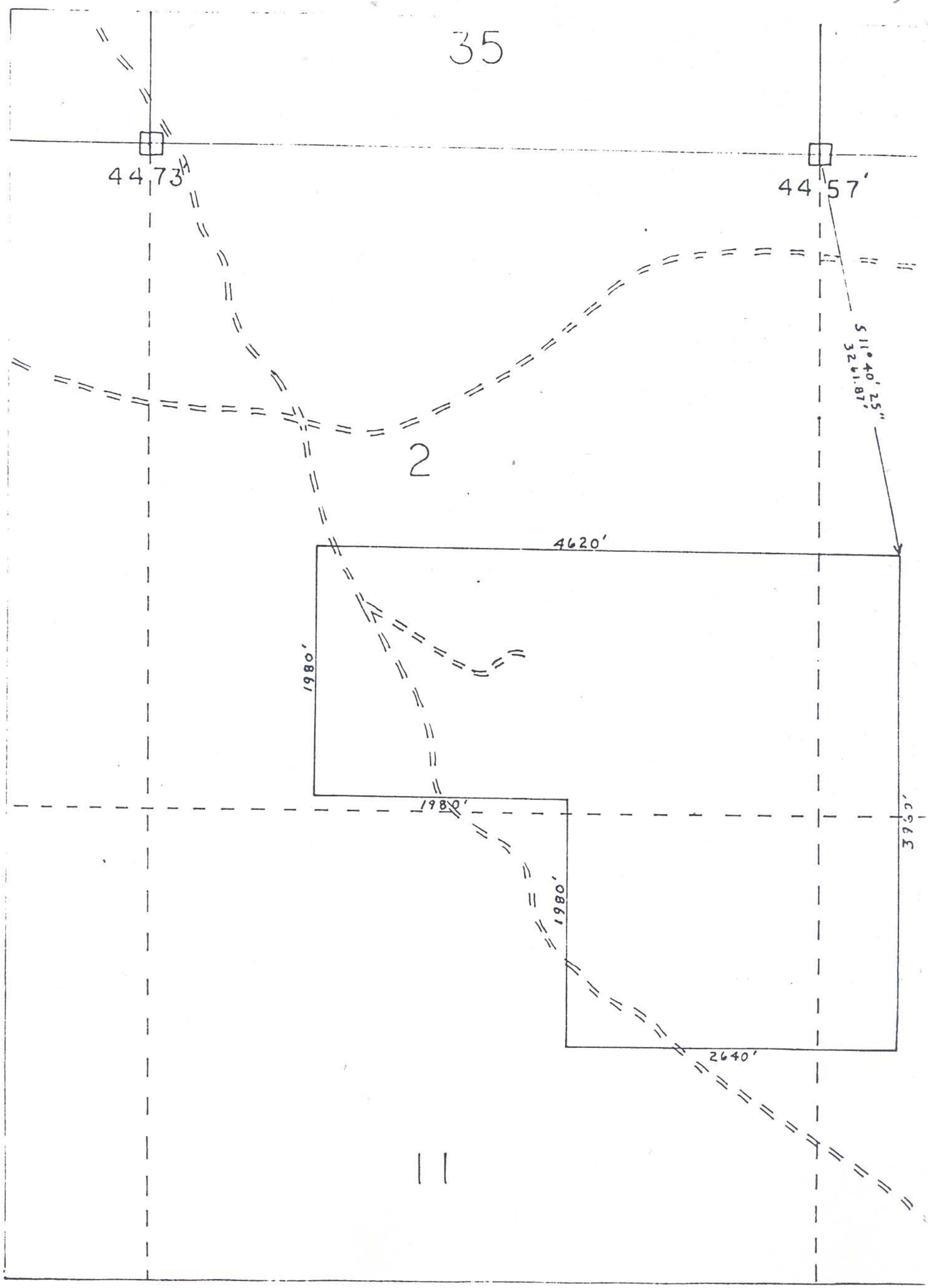
Yours truly,

Joe Fetterhoff

Joe Fetterhoff
District Manager

JF:sc

6000 0079 (0760)



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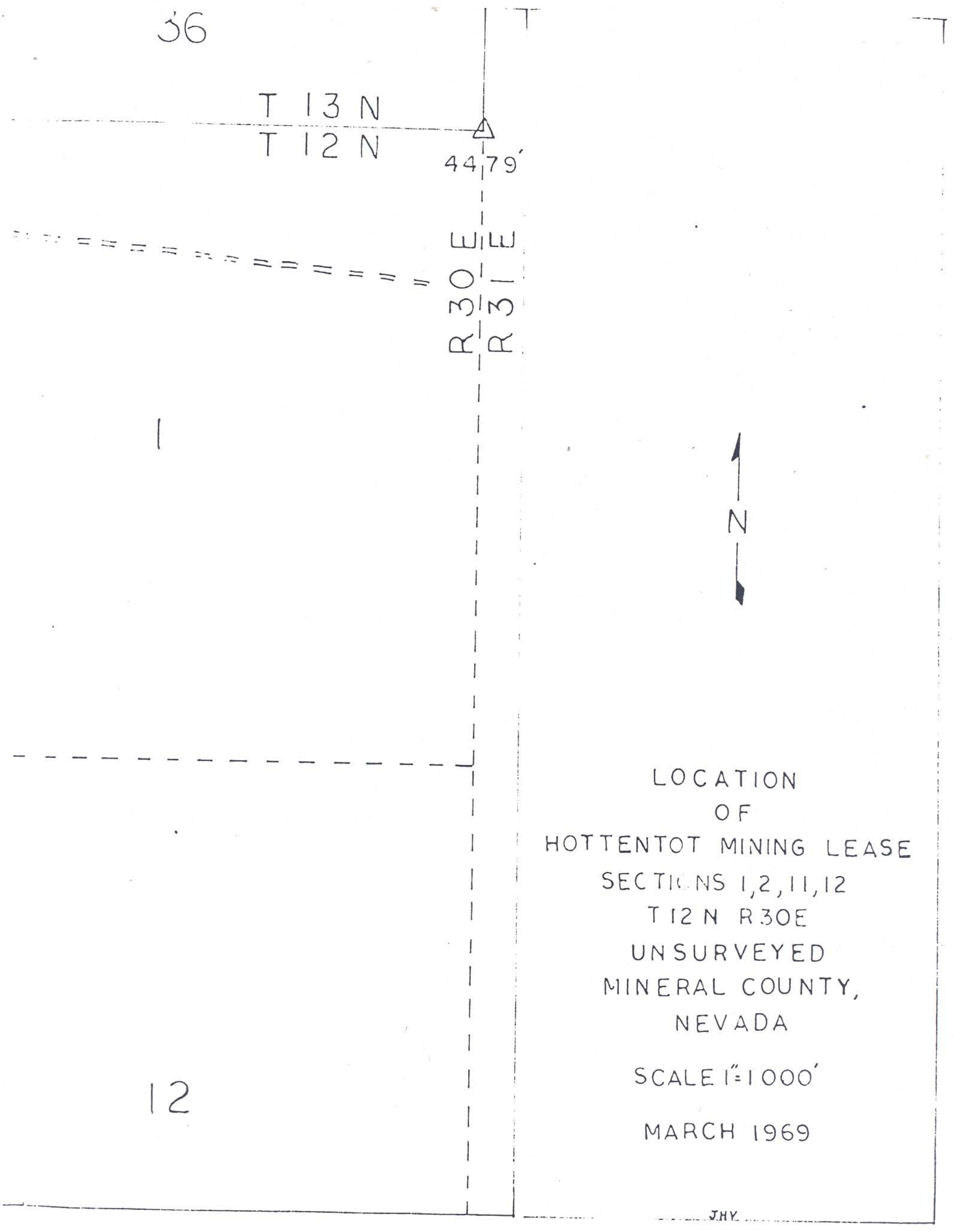


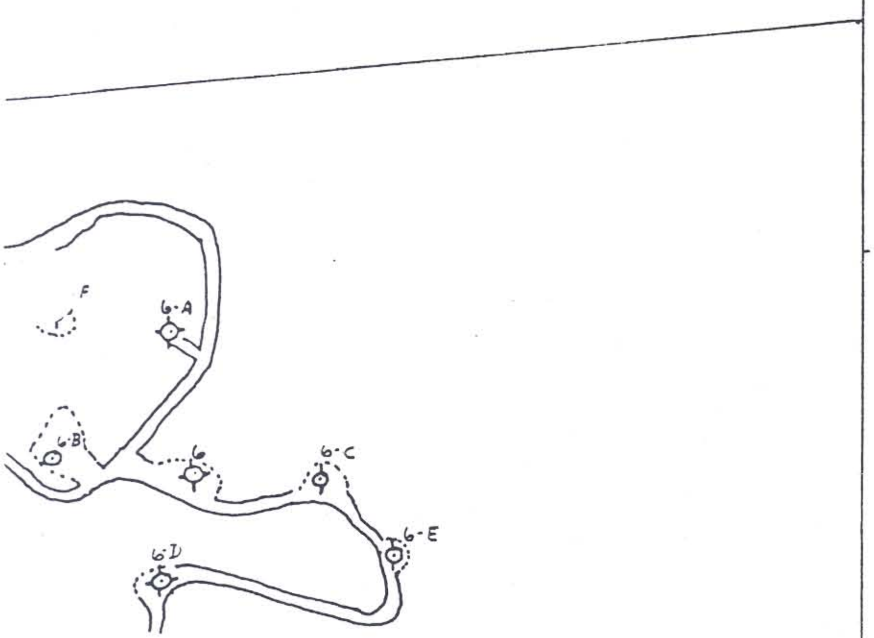
LOCATION
OF
HOTTENTOT MINING LEASE
SECTIONS 1, 2, 11, 12
T 12 N R 30 E
UNSURVEYED
MINERAL COUNTY,
NEVADA

SCALE 1" = 1000'

MARCH 1969

6000 0079 (0760)

6000 0079 (0760)



ORE GRADE MINERAL

MINERALIZED

BARREN

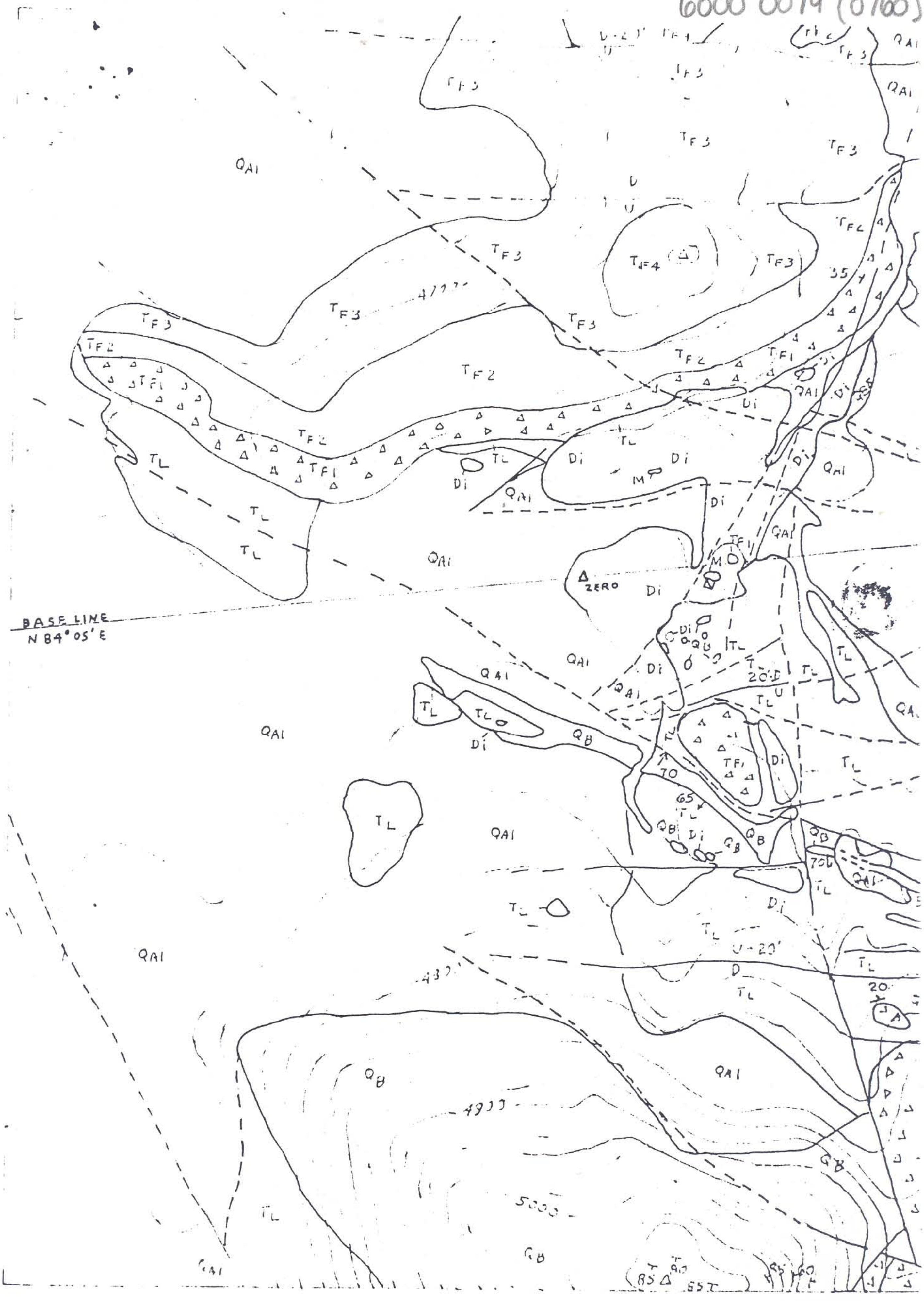
ROTARY ONLY
READY TO CORE

N

LOCATION MAP
OF
DRILL HOLES
AND ROADS
SOUTH HOTTENTOT AREA
SEC 2 T12N R30E
MINERAL COUNTY
NEVADA
SCALE 1" = 200'
MARCH 1969

JHV

6000 0079 (0760)



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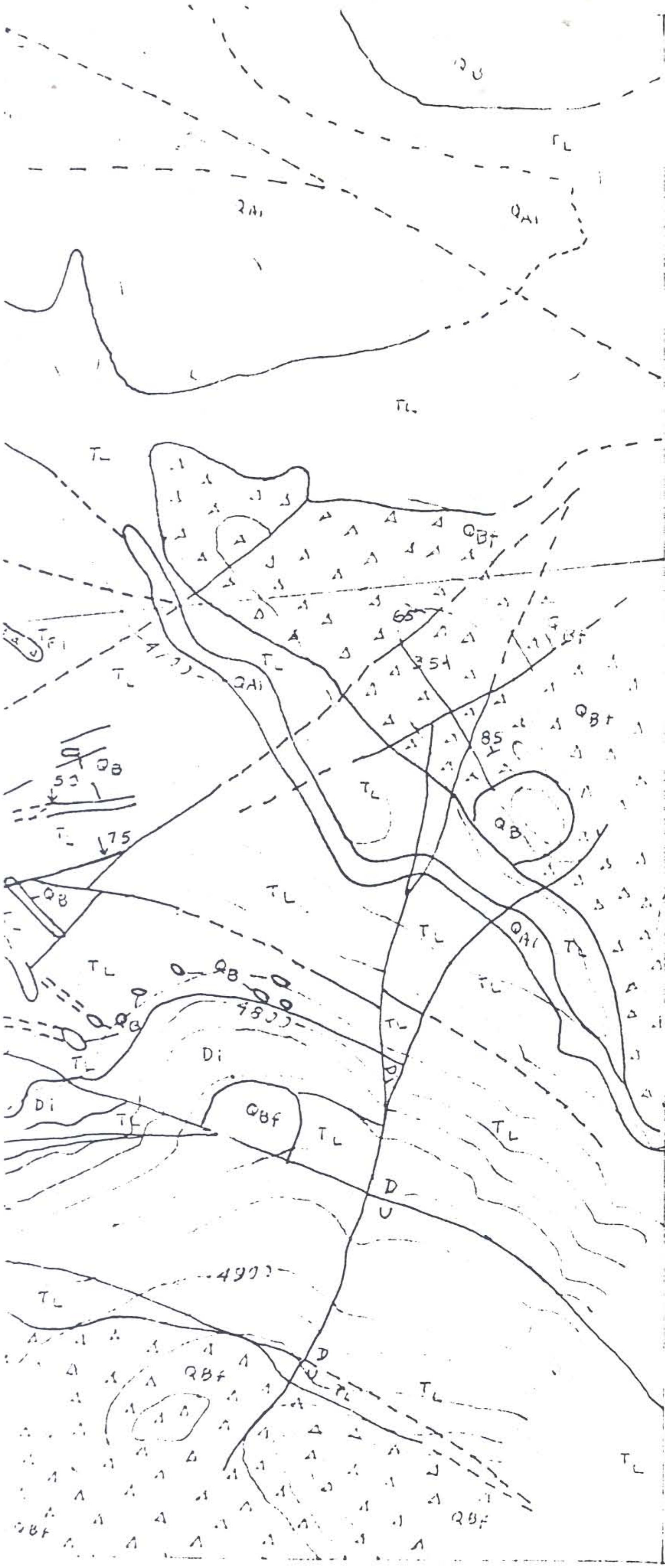


QUATERNARY
- [QAl] Alluvium
- [QBf] Basalt and andesite flows
- [QB] Basalt and andesite plugs and dikes

TERTIARY
- [TF4] Intermediate volcanic flows, gray in color
- [TF3] Intermediate volcanic flow, reddish in color
- [TF2] Intermediate volcanic flow, brownish in color
- [TAF1] Andesitic volcanic flow
- [TL] Quartz-latite tuff, white to greenish, same as V-1

MESOZOIC
- [Di] Fine-grained intrusive, probably diorite
- [M] Metamorphics, around shaft area only

Contacts

Faults

Shaft

N

GEOLOGIC MAP OF SOUTH HOTTENTOT AREA

SEC. 2 T12N R30E

MINERAL COUNTY

NEVADA

SCALE 1" = 200'

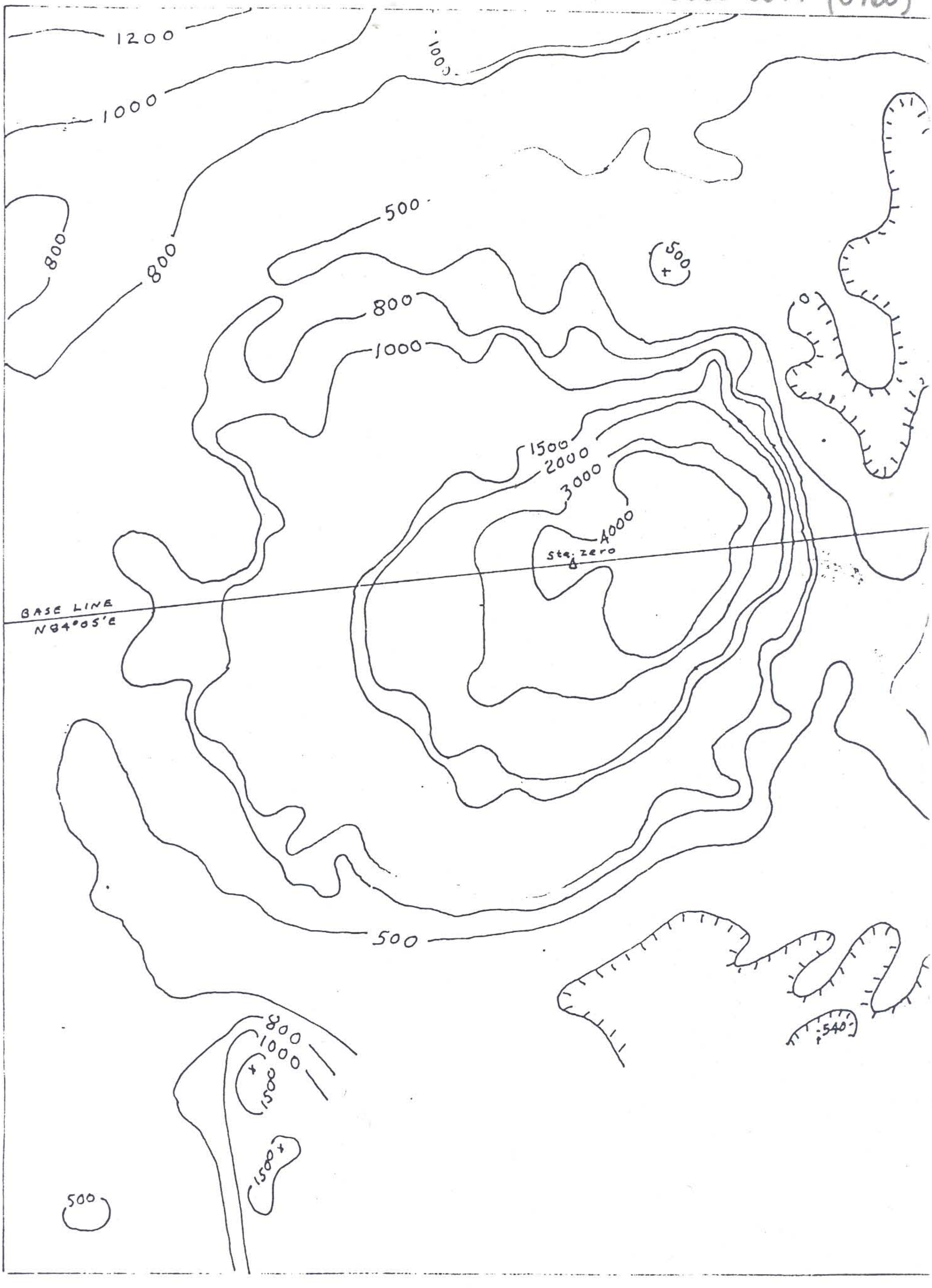
MARCH 1969

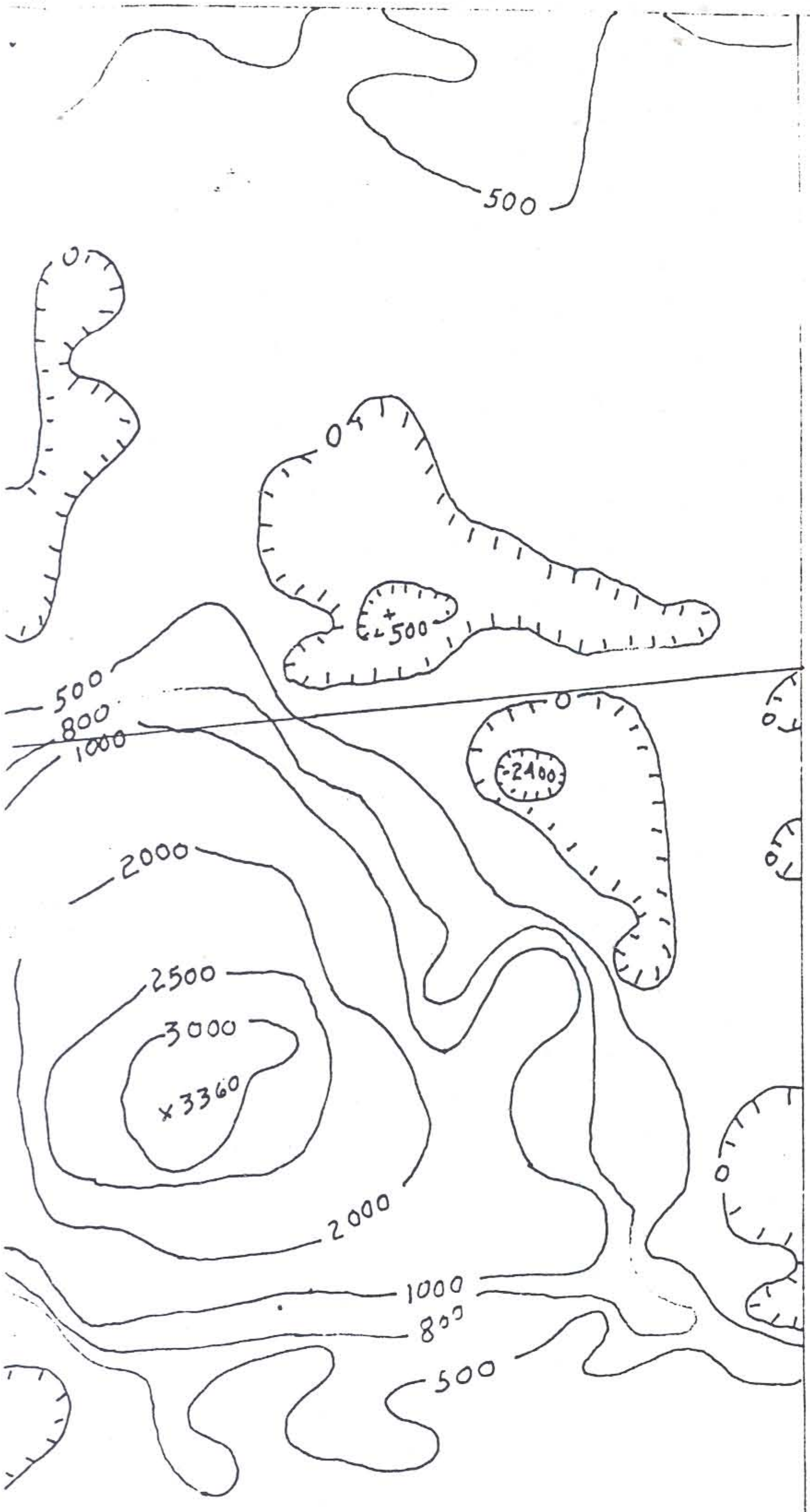
GEOLOGY E. F. LAWRENCE

TOPOGRAPHY J. H. VOLGAMORE

JHV

6000 0079 (0760)





GROUND MAGNETICS
CONTOUR MAP
OF
SOUTH HOTTENTOT AREA
SEC 2 T12N R30E
MINERAL COUNTY
NEVADA
SCALE 1" = 200'
MARCH 1969

JHV

SPEED MESSAGE

6000 0079 (0760)

TO: W. L. Wilson
2685 Thomas Jefferson
Reno, Nevada

FROM: ROBERT L. REDMOND
1080 Pine Ridge Drive
Reno, Nevada 89502

SUBJECT: HOLT : Review : HOTTENTOT.

DATE: MARCH 9 1966

Attached is a copy of the review made by Robert E. HOLT, 2/25/66, of all HOTTENTOT COMPLEX Data.

Some of his recommendations are presently in progress and will be reported when the data is available. Further drilling recommendations will be made to LA upon receipt of McPher IP reports.

SIGNED: R L Redmond

6000 0079 (0760)

NEVADA BUREAU OF MINES

Vernon E. Scheid, Director

REPORT 13

PAPERS PRESENTED AT THE AIME PACIFIC SOUTHWEST MINERAL INDUSTRY CONFERENCE SPARKS, NEVADA, MAY 5-7, 1965

PART A

GENERAL SESSION

and Session on

EXPLORATION AND MINE DEVELOPMENT IN NEVADA

MACKAY SCHOOL OF MINES

UNIVERSITY OF NEVADA

RENO, NEVADA

1966

EXPLORATION OF THE HOTTENTOT PROSPECT, WALKER RIVER INDIAN RESERVATION, NEVADA

By E.F. LAWRENCE, Consulting Mining Geologist
W.L. WILSON, Explor. Manager, Idaho Mining Co.

INTRODUCTION

The Walker River Indian Reservation comprises an area of some 500 square miles in west-central Nevada. Operating under an exclusive mineral prospecting permit, Idaho Mining Corp. and Martel Mining Co. have conducted an extensive mineral exploration program on the reservation during the past 2 years. Acknowledgement is given to the companies for permission to make public this information, and to Mr. R. L. Redmond, General Manager of Martel Mining Co., for his kind assistance.

The purpose of this paper is to describe in some detail the geologic and geophysical investigations of an individual prospect; this discussion therefore will be limited to one area called the "Hottentot" prospect (fig. 1).

The Hottentot prospect was discovered, prior to the performance of an aerial magnetic survey of the Reservation, while conducting a reconnaissance of areas deemed geologically favorable for the occurrence of iron or iron-copper deposits, 'at is, areas around the flanks of intrusive complexes where a favorable host rock : the deposition of these minerals was either present or inferred. One such area, later called the "North Hottentot", was examined, and magnetite float that was noted in a wash was traced approximately half a mile upstream to its source, an unpretentious outcrop of magnetite-hematite. A preliminary ground magnetic survey and preliminary geologic map were made, and it was decided that the anomalous conditions present were indicative of a favorable exploration target.

GEOLOGIC SETTING OF THE RESERVATION

The Walker River Indian Reservation lies in an area of Mesozoic sedimentary, volcanic, and intrusive rocks that are overlain by a thick section of volcanic rocks of Tertiary and Quaternary age. The Mesozoic is represented by the Excelsior, Luning, Gabbs, and Sunrise formations, especially in the Gillis Range to the south, where the Excelsior is thrust over the Luning formation by the Gillis thrust. These rocks have been intruded by Mesozoic granitic rocks ranging in composition from granite to gabbro. In the northern part of the Reservation the Mesozoic rocks are poorly exposed, being found only in occasional outcrops along the northern extension of the strike-slip fault proposed by Ferguson and Muller (1949, p. 29). Most of the Reservation, except the Gillis Range and the Black Mountain area west of Walker Lake, is overlain by a thick section of volcanic rocks and alluvium of Tertiary and Quaternary age. These volcanic rocks have been divided by Ross (1961) and others

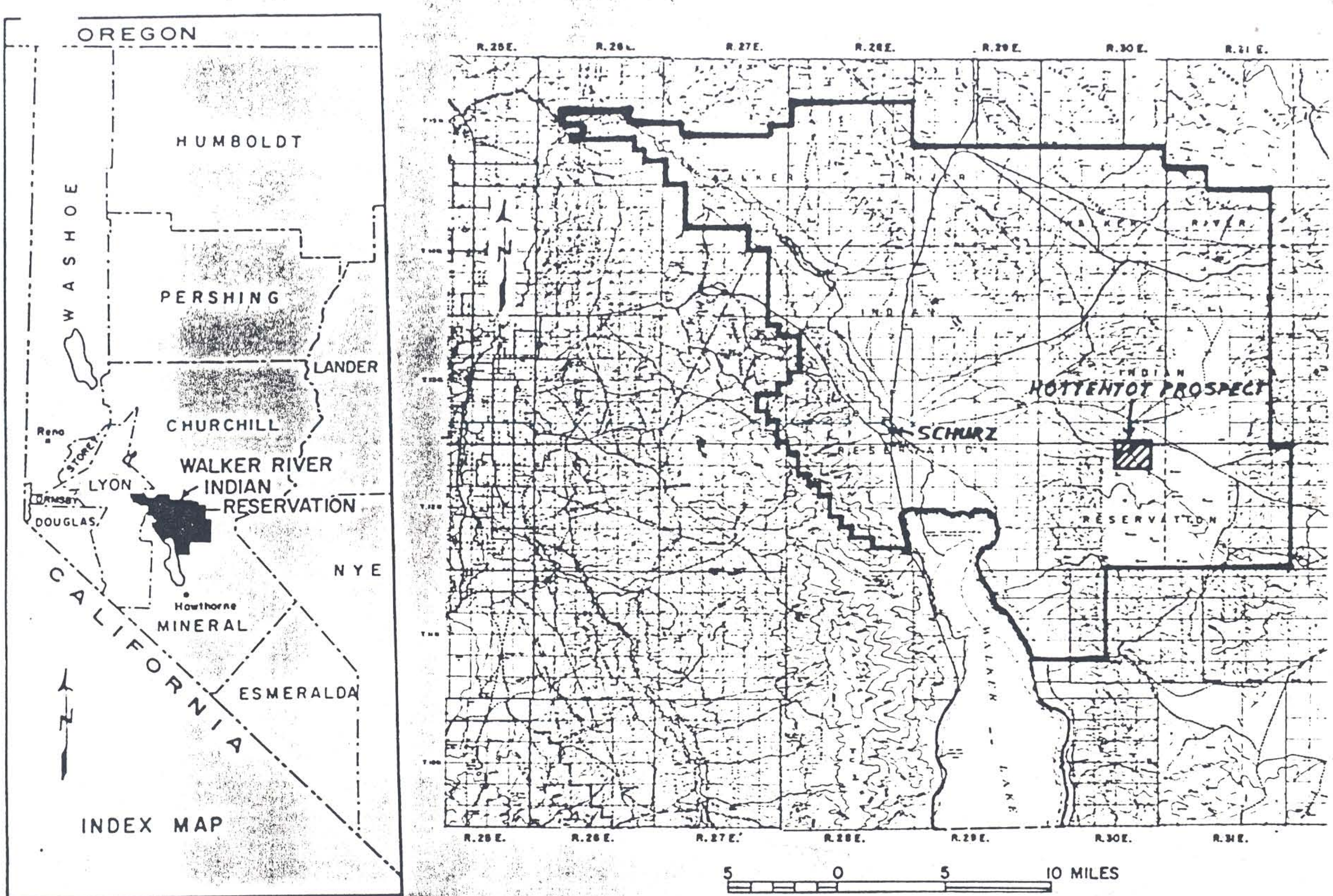


FIGURE 1. At left is an index map showing the size and location of the Walker River Indian Reservation. The map at the right shows the location of the Hottentot area in the Reservation.

Pre-Esmeralda, consisting of intermediate to felsic volcanic rocks, which are commonly altered and mineralized.

Esmeralda, consisting of rhyolite tuffs, shales, sandstone, and conglomerates.

Post-Esmeralda, consisting of two series, felsic and intermediate in composition.

Late Tertiary and Quaternary, consisting of mafic flows and intrusives. These rocks are interbedded in the northern part of the Reservation, and a study of them is being made basin by basin. As pointed out by Ross (1961), the above division is an over-simplification of the volcanic section.

GEOLOGY OF THE HOTTENTOT AREA

Although relatively few rock types are present in the area of the Hottentot prospect, the structural relations are complex (see fig. 2). No Mesozoic rocks are exposed, except a small outcrop of fine-grained intrusive (Mzi) in the area of the outcrop of magnetite, and two small slivers of metamorphic rocks associated with the intrusive. The intrusive is fine-grained, highly silicified, and partly albitized at the surface, and an analysis of drill-hole samples showed it to be dioritic in composition. Except for this small exposure, the entire area of interest is overlain by quartz-latite tuff, which in part is overlain by four distinct volcanic flows of intermediate composition (Tv), and all are intruded by mafic plugs (Qba), with mafic flows (Qbf) in some areas. There are several small dikes, andesitic to basaltic in composition (Qba), present in the South Hottentot area. Lacustrine deposits of Lahontan age overlies these rocks to the west.

The quartz-latite tuff (Tql) overlying the fine-grained intrusive in the South entot area appears to show a distinct alteration pattern, almost co-extensive with the presumed limits of mineralization as discovered in drill holes and as projected on the basis of magnetic anomalies; however, this may be fortuitious, and probably represents alteration resulting from the emplacement of dikes and nearby plugs of basalt.

Thin sections of samples from the drill holes indicated that the underlying granitic rocks ranged from gabbro to diorite and quartz monzonite in composition. These rocks were highly silicified and somewhat albitized in the area of mineralization; away from the mineralized zones they showed chloritic and argillic alteration (see figs. 5, 9). A small amount of calc-silicate rock was found in one hole near the iron outcrop.

Approximately 1 mile to the northwest is an outcrop of granite that contains a small amount of gold-quartz mineralization, and 2 miles to the southeast there is an exposure of quartz monzonite. As a whole, pre-Tertiary outcrops are meager.

The mineralization in the Hottentot area consists of magnetite, hematite, pyrite, chalcopyrite, and traces of galena. The magnetite occurs as pods and somewhat irregular lense-shaped bodies in the diorite. It appears to be genetically as well as spatially related to the diorite. Subsequent alteration and oxidation have changed part of the magnetite to hematite. Pyrite occurs as disseminated grains and minute veinlets in some areas. Chalcopyrite occurs sporadically through the ore zone, but is more frequently in the area of drill hole H-6. A few grains of galena e found in the lower part of drill hole H-1.

This area lies along the northern extension of a strike-slip fault described by

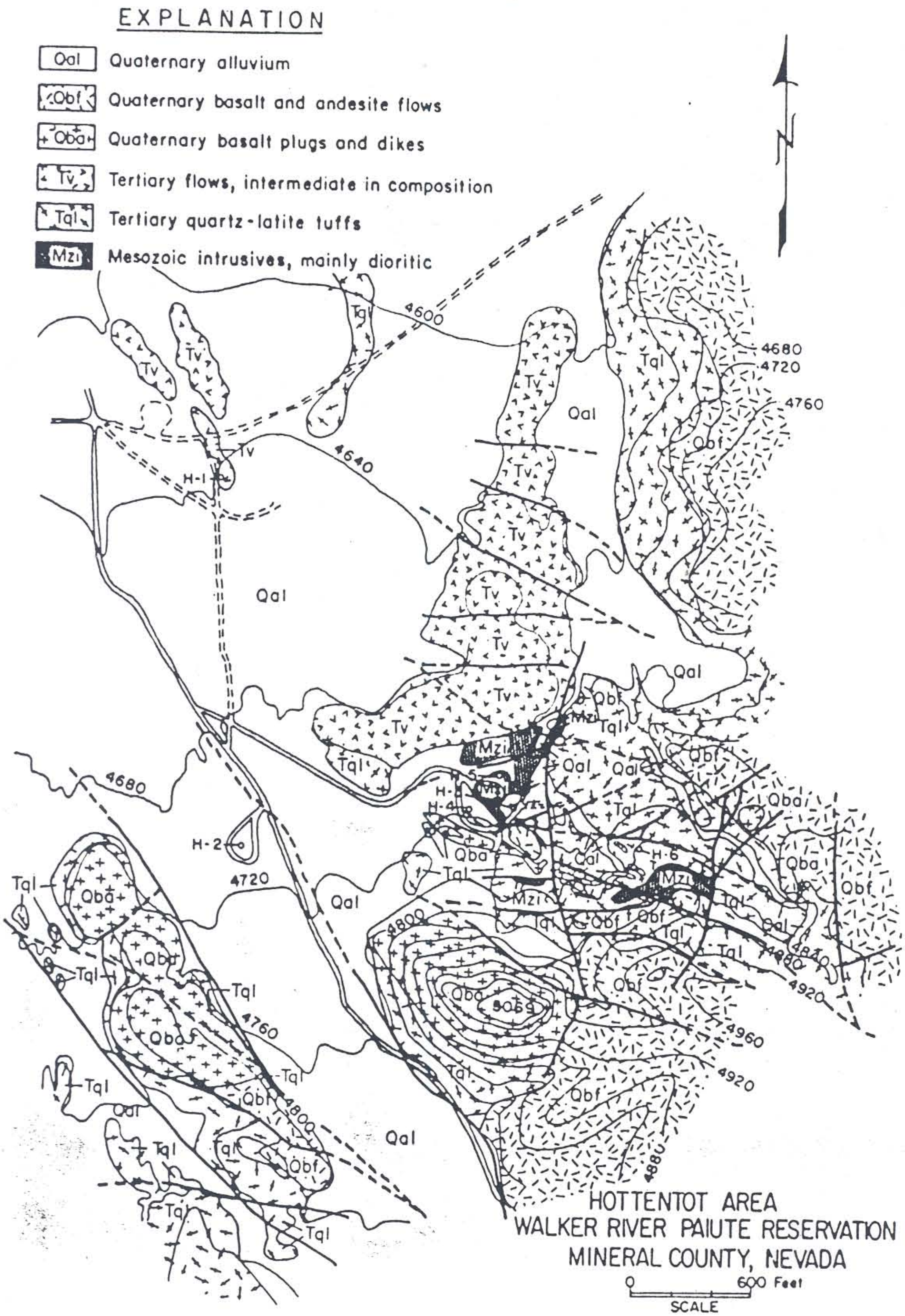


FIGURE 2. Geologic map of a part of the Hottentot area.

Ferguson and Muller (1949), Locke and others (1940), and by others. Some right-lateral movement is indicated in the South Hottentot area, and possibly up to 2,000 ·et of right-lateral movement is indicated on the strike-slip fault immediately ›uth and west of the Hottentot area. This movement has been post-Miocene in age. These northwesterly trending faults cut lacustrine deposits of Lahontan age in the area immediately north of Schurz, about 12 miles to the west, and in turn are cut by northeasterly trending faults. This faulting appears to have a beginning in late Mesozoic time, and to have continued throughout the Cenozoic, and possibly is still active at the present time. Both the granitic and mafic intrusives as well as the vents for the pyroclastic material, may have been controlled by this northwesterly trending structure.

GEOPHYSICAL SURVEYS

A detailed ground magnetic survey (fig. 3) was performed, together with geologic mapping of the overall Hottentot area.

An aerial magnetic survey, flown at 500 feet above terrain, gave substantially the same picture as the ground magnetics (fig. 4), with one important difference. Even though flight lines were interspaced in this particular area to achieve 1/6 mile spacing, instead of the normal 1/3 mile interval used on the rest of the reservation, the southeasternmost anomaly shown previously, managed to escape detection by being between even these close-spaced flight lines.

The interpretation of both ground and aerial magnetics in this general area is vastly complicated by the presence of magnetic volcanic rocks, highly polarized ('-emnance) in certain areas, some of which are located close to the known iron ›osits.

After doing some test work with Induced Polarization and AFMAG, drill hole H-1 was located at the approximate center of the magnetic anomaly (fig. 3) with the greatest areal extent. After penetrating 706 feet of essentially barren tuffs, the drill went abruptly into a medium-to coarse-grained diorite (see fig. 5), and at 713 feet into 32 feet of massive magnetite that contains more than 50 percent iron, a few percent pyrite, and a little scattered chalcopyrite. The hole from 745 feet to the bottom at 1228 feet was in diorite, and was mineralized with traces of iron, copper, and a little lead. Although narrow intervals of better mineralization were encountered between 878 and 921 feet, nothing which would normally be called ore was found, considering the depths and thicknesses involved. It was felt that this quantity of magnetite was not sufficient to account for the observed magnetite anomaly. A detailed IP survey (time domain) was subsequently performed and showed no anomaly under drill hole H-1 (fig. 6).

Hole H-2 was spotted on the basis of an IP anomaly on the south flank of the large magnetic anomaly (see fig. 3), in the hope that it represented sulphide mineralization near the border of the magnetic mass causing the anomaly. The IP-Resistivity line through this drill hole (fig. 6) shows a definite top to the anomaly, indicating that the source of the anomaly did not outcrop, and the metal factors associated with this anomaly were fairly large, although the frequency effects were only of moderate strength. Although there is some inductive coupling present to complicate the picture, the anomaly turned out to be real, but seems to have been caused by gnetite on the order of 3 to 5 percent, disseminated as grains and crystals in a .

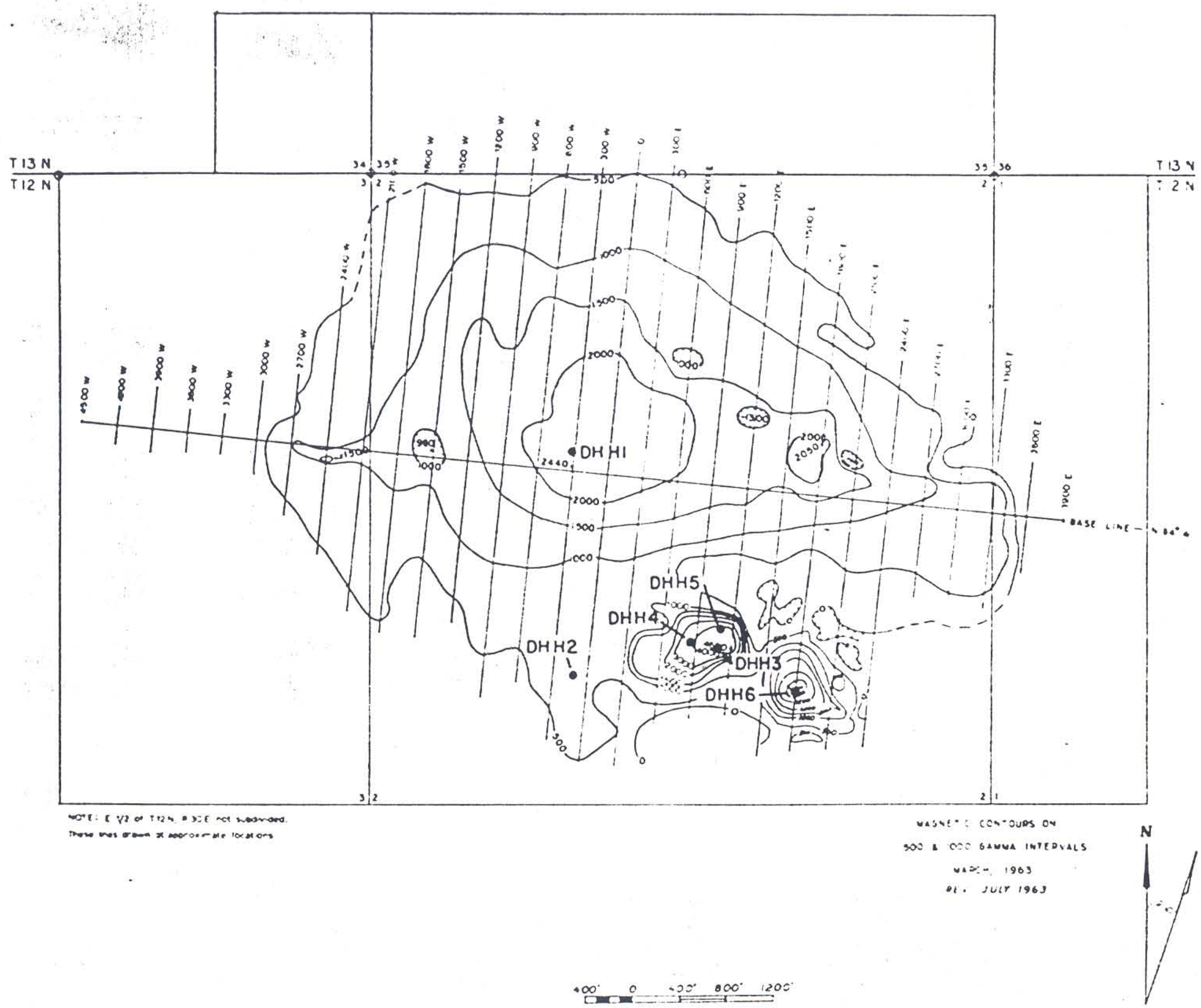


FIGURE 3. Ground magnetic contour map of the Hottentot area.

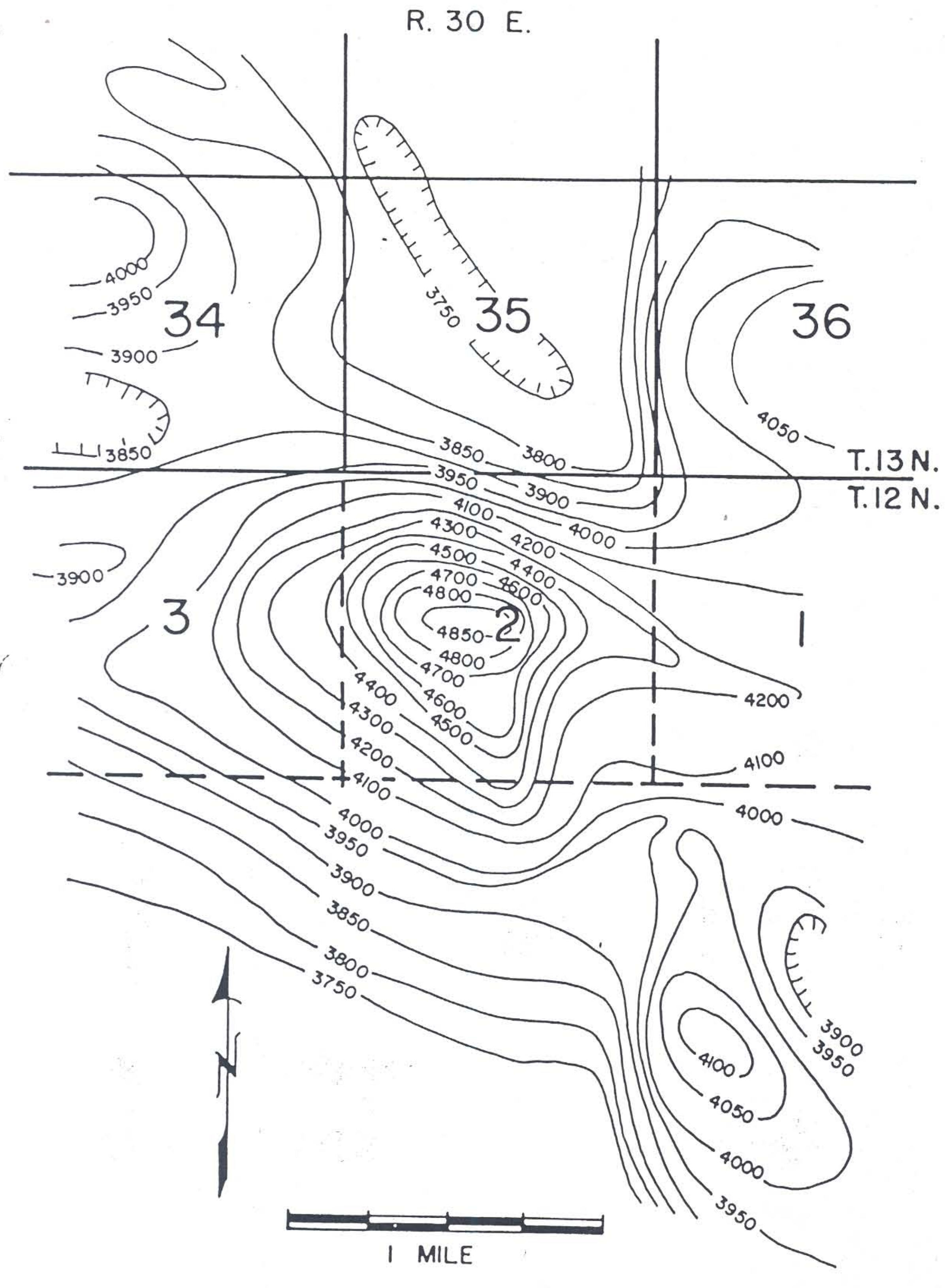
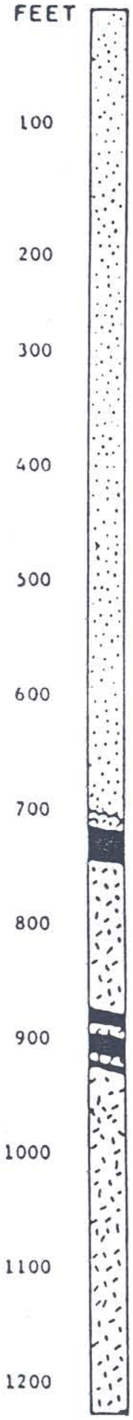


FIGURE 4. Aeromagnetic contour map of the Hottentot area. Compare coverage with smaller ground magnetic contour map shown in figure 3.

H-1



0 - 703	Tuff, rhyolitic to quartz latitic in composition, vitric in part, considerable argillization to 340 feet, partially chloritized to 703 feet, fine to coarse grained, welded in part,
703 - 713'	Diorite in a highly sheared zone, heavy clay and gouge.
713 - 744'	Mineralized zone, with magnetite, small amount pyrite, scattered chalcopyrite, some chloritized actinolite, small amount quartz and calcite. 32 feet averaged 50%+ iron.
744 - 878'	Diorite, highly argillized, partially silicified and chloritized, considerable shearing.
878 - 888'	Mineralized zone, with 5 to 30% magnetite, 5% pyrite, and scattered grains of chalcopyrite, diorite completely argillized and chloritized.
888 - 921'	Diorite with two narrow zones of magnetite, same as above.
921 - 1228'	Diorite, composed of andesine(?) and actinolite, with up to 10% k-feldspar, 3% quartz; considerable argillization, chloritization, and partially silicified in areas; some albitization noted; large amountshearing and brecciation; pyrite up to 5% to 1158'; sporadic chalcopyrite.

FIGURE 5. Log of drill hole H-1.

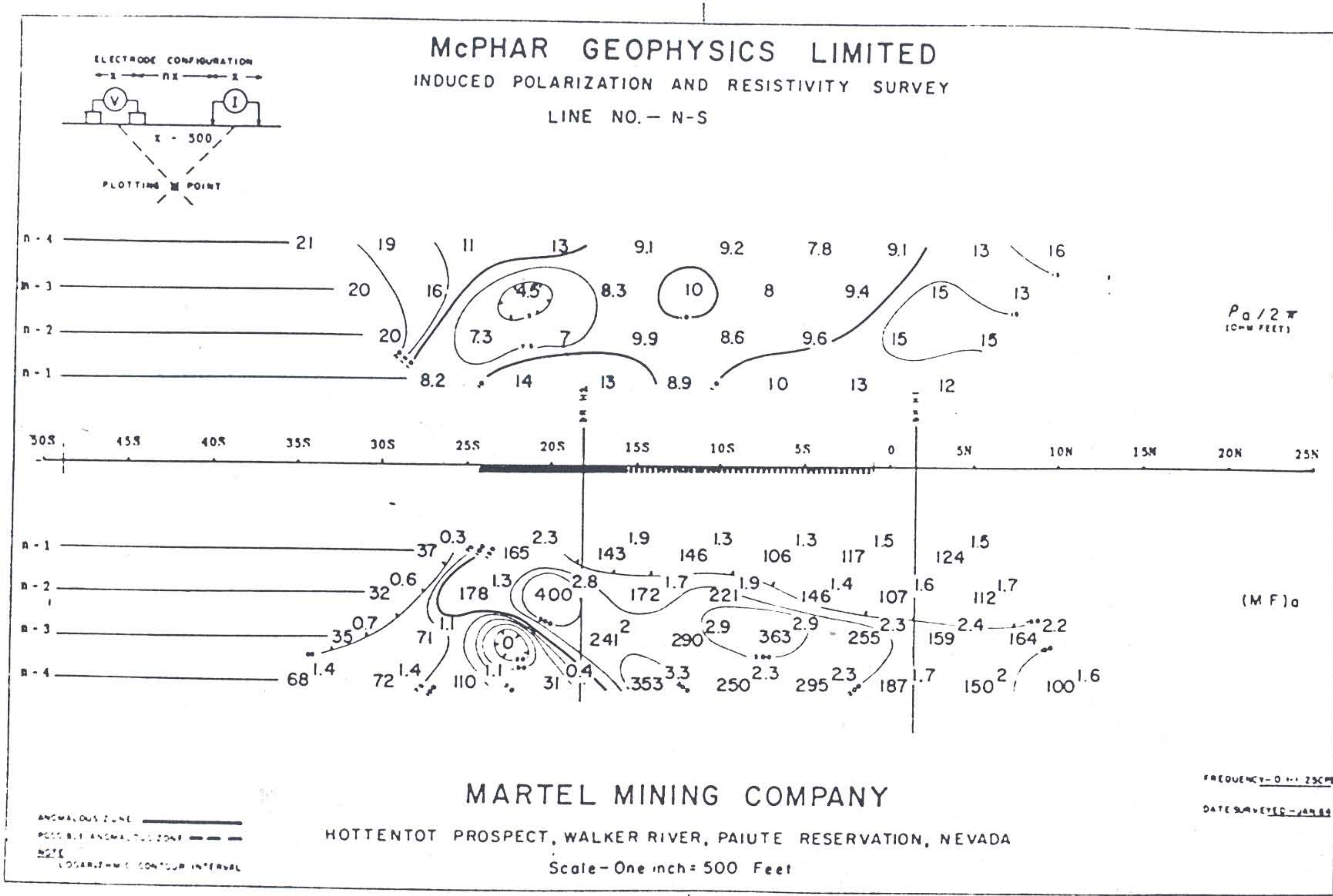


FIGURE 6. Induced polarization and resistivity survey along a north-south line through drill holes H-1 and H-2.

quartz-latite tuff throughout the 800 feet of the hole. Laboratory measurements of the IP effects of the drill core gave good agreement with the values observed along the lines.

Drill hole H-3 was located on a shallow magnetic anomaly near the iron outcrop, and was drilled as a rotary hole until mineralization was encountered. A magnetic profile through this location (fig. 7) was interpreted to mean that we had a pipe-like body coming to the surface, mineralized with magnetite, but that this pipe-like body was superimposed on a larger magnetic mass at some moderate depth (fig. 8). Although the anomaly had a relatively low intensity, this hole was commenced, acting on the premise that the shape and pattern are more important than the absolute values. This hole was located far enough away from the presumed pipe-like body to escape its surface and near-surface influence, that is, it was located outside of the point of inflection of the magnetic curve attributable to the pipe-like body in order to determine if the anomaly beyond the limits of this body was caused by an iron deposit, and if so, to determine the grade, thickness, and other characteristics. At a depth of between 20 and 25 feet, somewhat shallower than anticipated, magnetite-hematite came to the surface in the drill cuttings, and coring was commenced, but with no recovery until 41 feet. From 41 to 126 feet the section assayed more than 58 percent iron. This gave a minimum of 85 feet thickness of a good grade iron, with low impurities. The mineralized section contained intermixed magnetite and hematite, with hematite predominating (fig. 9). The presence of the hematite at least in part accounted for the low value of the magnetic anomaly over this area. The measured values of magnetic susceptibility for this section are approximately 10 percent of the value of equal grade magnetite from

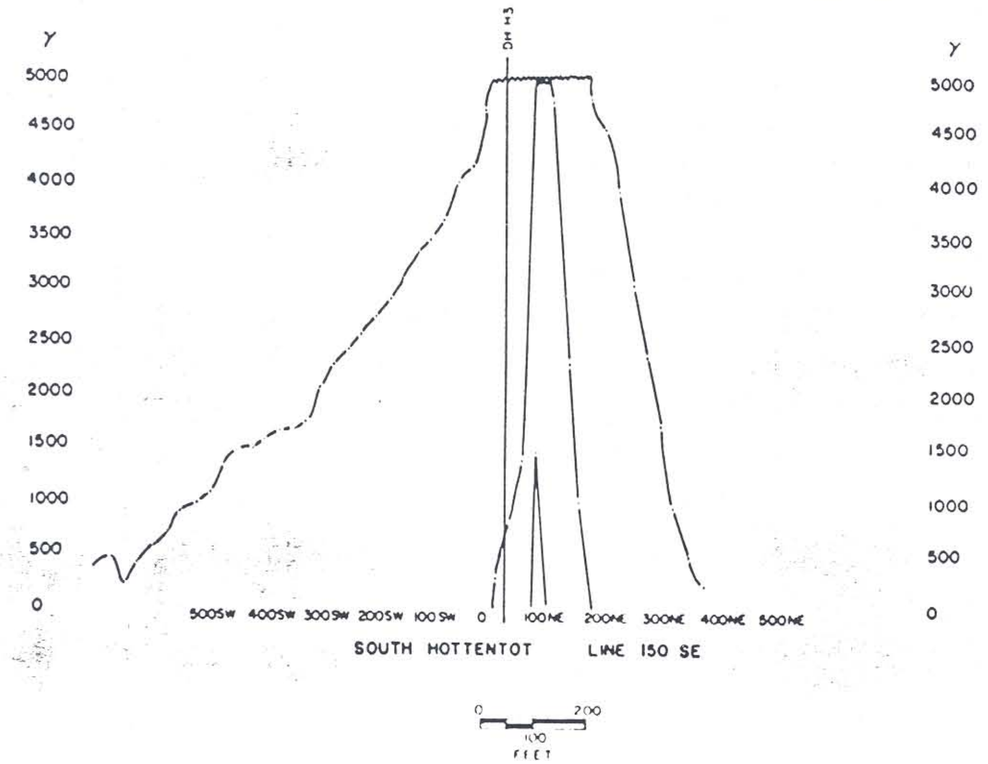


FIGURE 7. Magnetic profile through drill hole H-3.

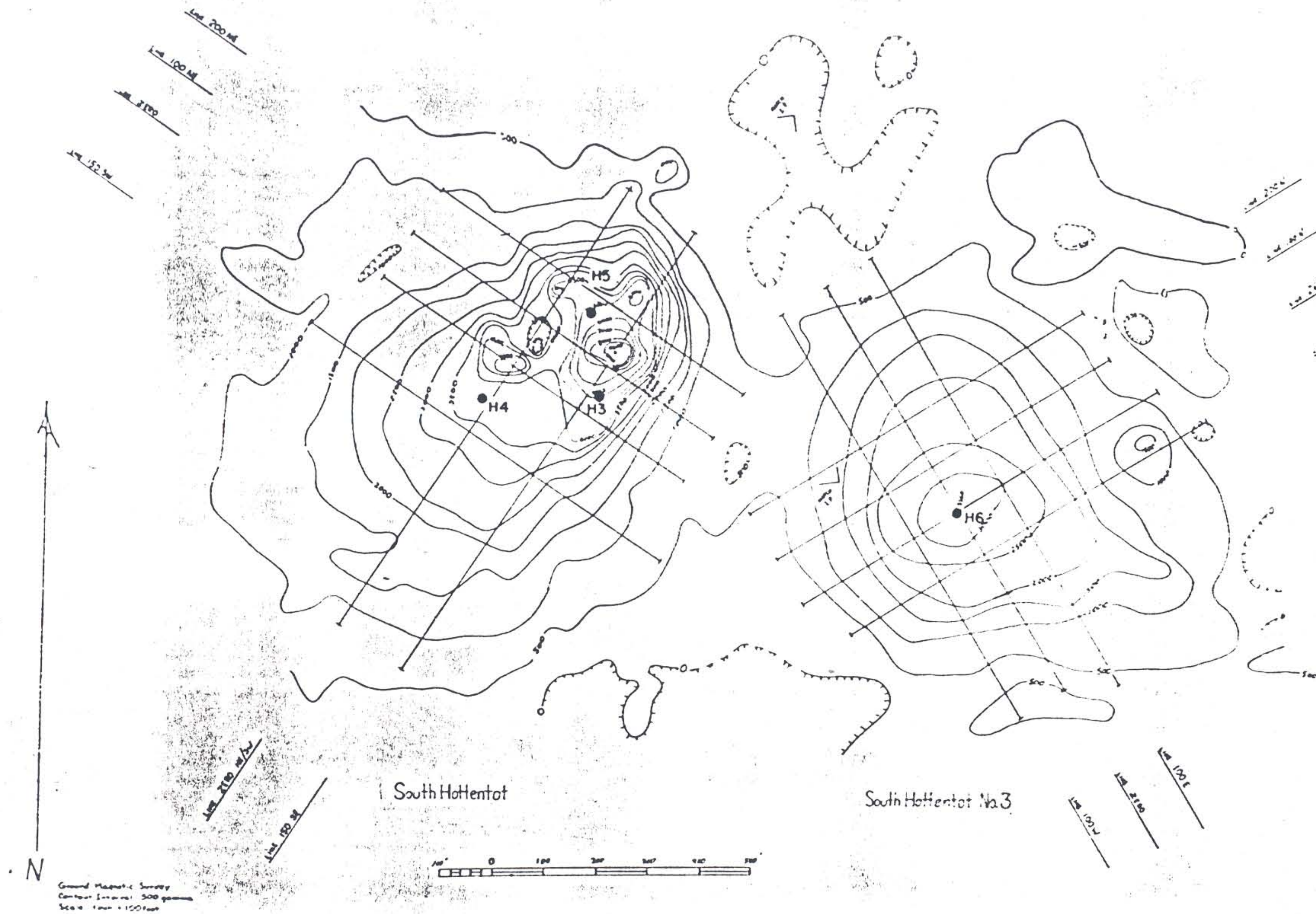


FIGURE 8. Detailed ground magnetic contour map of the South Hottentot area. Compare with figure 3.

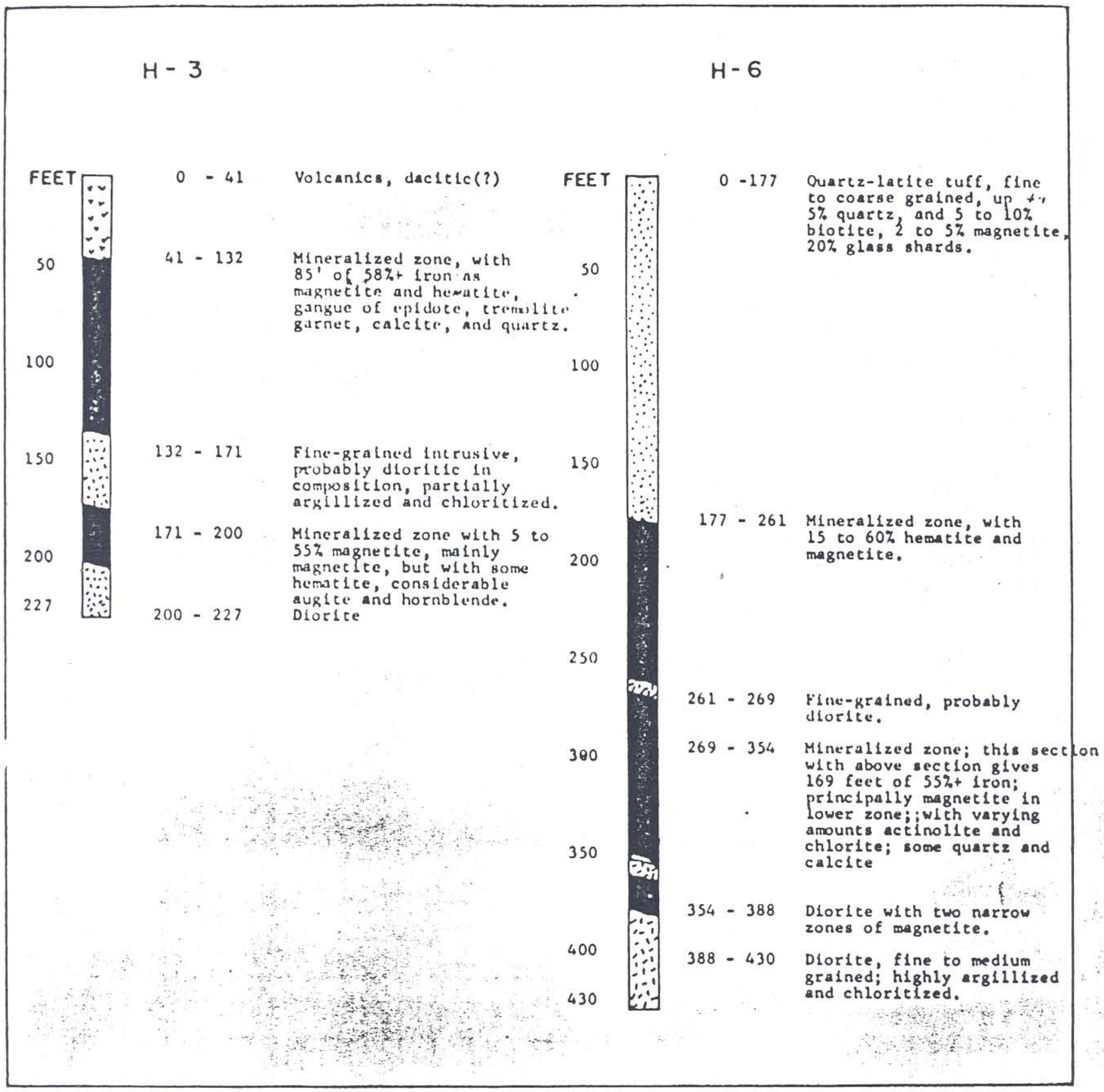


FIGURE 9. Logs of drill holes H-3 and H-6.

H-1 and from other magnetite occurrences in this general area. Diorite was encountered from 126 to 171 feet, then an additional 30 feet of iron mineralization, predominantly magnetite, was encountered between 171 and 201 feet. This zone gave accordingly higher susceptibilities, but was lower in grade, about 45 percent iron. Diorite was found underlying the mineralization.

Hole H-4 was offset 235 feet to the west. Nearly all material between 84.5 and 130 feet was lost, but that which was recovered contained some magnetite-hematite.

The 17-foot interval from 130 to 147 feet assayed more than 54 percent iron. Once again, susceptibilities were low, even lower than those encountered in H-3.

To obviate the problem of losing the top of the mineralization, H-5 was cored from the surface, and it was thought that it would be fairly shallow to the top of the iron. This hole was located in a magnetic saddle, between two highs, however, and subsequent drilling revealed the absence of iron below. Various interpretations could be made to fit the absence of iron under this location; the important knowledge gained was that the mineralization was not persistent throughout the areal extent of the anomaly. After passing through 125 feet of hard, siliceous fine-grained diorite, the drill encountered a mineralized zone, and a thickness of approximately 140 feet of rock containing more than 50 percent iron, excluding a few waste splits, was drilled before leaving the mineralized zone. This section had a higher proportion of magnetite to hematite and higher susceptibilities than the material in H-3 and H-4, and considerable pyrite in the lower sections.

The anomaly under drill hole H-6 seemed to be more uniform, and to be of about the same lateral extent as that at the South Hottentot, but at somewhat greater depth. It was decided to test this anomaly before proceeding with drilling out the South Hottentot. This hole was started with some trepidation, because there is a polarized, magnetic volcanic unit outcropping near the center of the anomaly, and because of the absence of a clear IP anomaly (fig. 10). The shapes of the magnetic curves were good (fig. 11), and suggested that the anomaly was caused by a cylindrical mass of fairly large dimensions, approximately 300 to 400 feet in diameter, dipping steeply to the north, situated at a moderate depth. A hole was drilled through 177 feet of tuff before encountering high-grade magnetite-hematite mineralization. A total thickness of 177 feet, excluding one 8.5 foot waste split, was recovered, averaging approximately 55 percent iron (see fig. 9). The upper section was predominantly hematite, with susceptibilities of approximately 20 percent of equivalent grade magnetite, and portions of the lower section, which was predominantly magnetite, approached the normal values for magnetic susceptibility of high-grade magnetite. This lower magnetite-rich section contains about 8 to 10 percent sulfides, and the bottom 74 feet averaged 0.18 percent copper. An additional 21.8 feet of 48-percent-plus iron was encountered below 8 feet of waste. The waste and the rock under the iron was again diorite. The character of the diorite is more basic in H-l, becoming finer-grained and more silicified near the South Hottentot, and especially so near the present surface.

RESULTS

An extensive amount of geology, geochemistry, and geophysics has been performed in this and adjacent areas, and the following observations may be of interest for further exploration of this type:

(1) Geochemical lines, both wash and soil samples, primarily run for copper, show a slightly higher than usual background, but no significant patterns or anomalies in the area of the Hottentot. Small amounts of mercury are detectable geochemically, but do not seem to exhibit a definitive pattern.

(2) Self-potential does not seem to be of much value. IP does show moderate effects on the magnetite; however the resistivity of the massive magnetite and some of the associated rocks is so low that this induces many problems both in operations

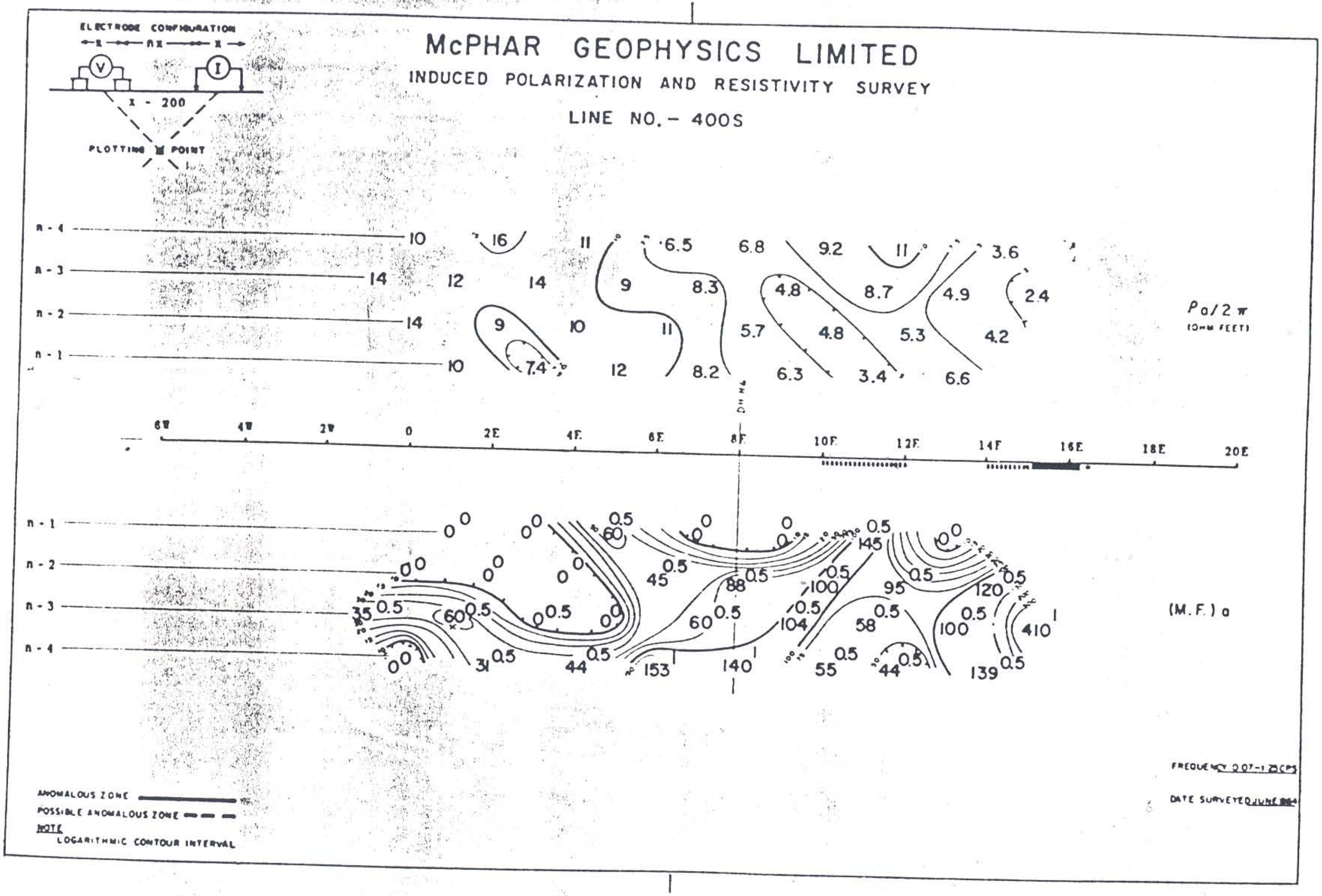


FIGURE 10. Induced polarization and resistivity survey along an east-west line through drill hole H-6.

and interpretation. Normally, IP would be expected to locate a target of this size, metal content and moderate depth, especially considering the high content of sulphides; however the observed IP effects were found to be lower for mineralization in massive form than for an equivalent metal content in a disseminated body. The hematite that was encountered did not give appreciable IP effects, as contrasted to the surrounding rocks, and probably is not locatable by IP.

(3) AFMAG probably will give some valuable information over magnetite, however this desert region is an area of many conductors, most of which are not caused by massive mineralization. Small, portable refraction seismographs may be useful, as test work indicates that magnetite exhibits a very high velocity, however their depth limitations present a handicap. Resistivity measurements, primarily using the Eltran electrode configuration (dipole-dipole) have been useful, however once again there is the problem of many conductors, complicated by the situation of the magnetite exhibiting very low resistivities, and the hematite exhibiting quite high values, which allows for a variety of interpretations.

(4) Magnetic surveying is probably the most reliable single method for locating iron ore deposits. It allows the most unique interpretation of all the field geophysical techniques. However the presence of many volcanic units which exhibit considerable magnetism must be considered.

The most success to date has come from a combination of geology, ground magnetics, aerial magnetics, and Eltran resistivity. A positive ground magnetic anomaly is expected over a presumed magnetite deposit, correlative in some manner with the aerial magnetic expression. The resistivity measurements usually show a low, coincident with the magnetic high, surrounded by a zone of higher resistivities which is perhaps representative of a zone of silicification around the mineral deposit.

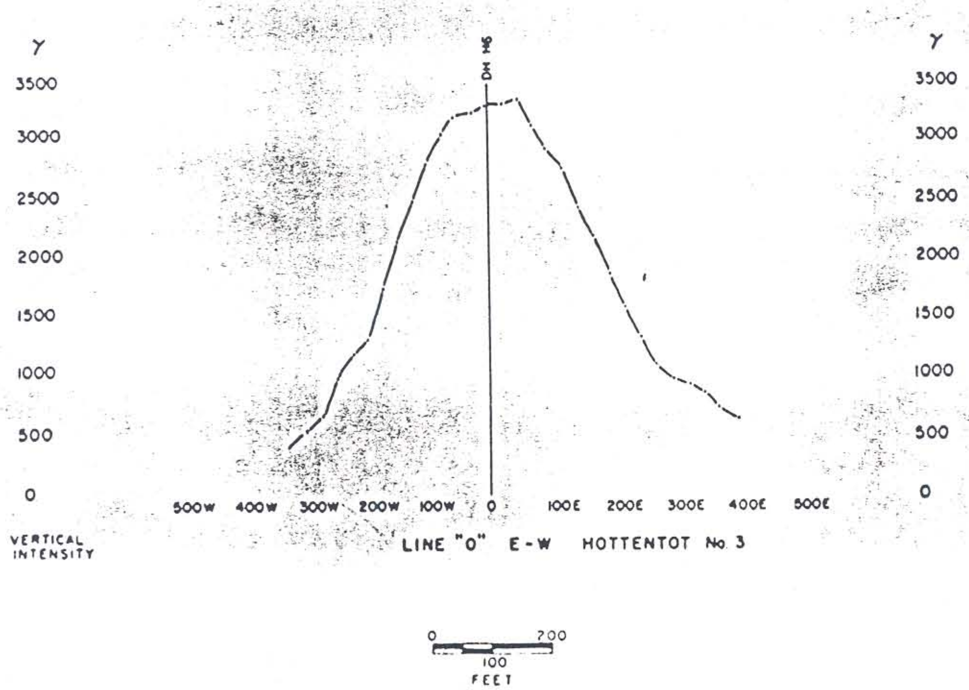


FIGURE 11. Magnetic profile along an east-west line through drill hole H-6.

It is apparent from the foregoing that largely unknown quantities are being considered, and with many of the geophysical techniques used, either a high or a low value is sought, and it is not known beforehand which. When this is the case, by admixing the media causing the anomaly in just the proper proportion, it is theoretically possible to have no observable anomaly. In nature this rarely seems to happen, however, and it is felt that the geology of this type deposit is usually so complex that some patterns will emerge, and if the best available techniques are used, at least some of the buried deposits can be found.

REFERENCES

Ferguson, F. G., and Muller, S. W., 1949, Structural geology of the Hawthorne and Tonopah quadrangles, Nevada: U. S. Geol. Survey Prof. Paper 216.

Locke, Augustus, Billingsley, P. R., and Mayo, E. B., 1940, Sierra Nevada tectonic patterns: Geol. Soc. America Bull., v. 51, p. 513-540.

Ross, D. C., 1961, Geology and mineral deposits of Mineral County, Nevada: Nevada Bur. Mines Bull. 58.