CONTACT INFORMATION
Mining Records Curator
Arizona Geological Survey
3550 N. Central Ave, 2nd floor
Phoenix, AZ, 85012
602-771-1601
http://www.azgs.az.gov
inquiries@azgs.az.gov

Dec. 9, 1975

Lunch with W. Pettijohn, Parsons, Jordan-Rep. and director of Hecla. Following information re: Lakeshore Mine.

1. Expect full production end of second quarter 1976-positive cash flow third quarter 1976 with increased price for copper.
2. Oxide ore leaching is in stream with purchased acid and scrap iron. Flotation plant is working and stacking concentrates.
3. Cathodes are under contract to Southwire, but he does not know grade. Probably will go thru Southwire furnace and refinery in Georgia.
4. Roaster has not yet run-neither acid plant which is "Lurgi" design and construction. Questionable?
5. Reduction of iron oxide has not yet run-also Lurgi design and built. Similar operation at Falconbridge in Canada failed miserably.
6. Including $15 million working capitol, El Paso has guaranteed $196 million into the project.
7. Pettijohn will arrange technical visit for us.
8. The banks have been very cooperative in forwarding operating expenses to Hecla, according to Bill Pettijohn.

HL

April 30, 1970

Mr. William A. Griffith
Research Director
Hecla Mining Company
Wallace, Idaho 83873

Dear Bill:

This confirms our discussion in Denver on April 22, 1970, and subsequent telephone conversations.

Essex is interested in participating in the Lakeshore Project and would be willing to explore a wide range of mutual programs with Hecla. The possibilities include the following:

1. Essex would join with Hecla (and El Paso) in the Lakeshore Project sharing the investment, participating in the revenue and being entitled to an equitable share of the product.

2. Essex would participate with Hecla to the extent of funding the concentrate processing plant which at this point it is estimated would require $25,000,000. This would still provide for Hecla managing the plant as an integral part of the total operation. Essex would have first call on Hecla's share of the output at a price providing a reasonable return on the investment.

3. Essex would contract to buy and Hecla to sell all or part of Hecla's share of the copper production on a long term basis. The intent of the contract would be to give Hecla some benefits of the current pricing yet offer long term market security. It was recognized that the quality of electrowon cathodes is not comparable to electrolytic cathodes, thus, a formula for pricing would need to reflect this differential. A minimum quality would be stipulated in a specification.

4. Essex would contract for production as in Item 3 above but payment would be in advance to provide capital. Payment would be against delivery of electrowon cathodes at a specified schedule.

Although the above only summarizes the possibilities discussed, it does state the more practical arrangements. Needless to say, these are only summaries of the points in our conversation and do not represent any formal agreements or understanding. As I agreed, I am enclosing a letter of understanding which would establish a basis for further discussion on long term contracting as referred in Item 3.

I look forward to an opportunity to establish a basis for participation by Essex in this project. Please do not hesitate to call upon me at any time you feel that I can contribute to the success of your program.

Very truly yours,

Howard Lanier, Manager
Copper Processing Operations

HL/mcc

HL Copy

ESSEX

ESSEX INTERNATIONAL, INC.
MAGNET WIRE DIVISION
1601 WALL STREET, FORT WAYNE, INDIANA 46804 • PHONE: (219) 743-0311

April 30, 1970

Mr. William A. Griffith
Research Director
Hecla Mining Company
Wallace, Idaho 83873

Dear Mr. Griffith:

This confirms the intent of Essex International, Inc. to purchase and Hecla to sell electrowon cathodes and "cement" copper from the mining and production facilities at the Lakeshore Project in Arizona, which is a joint venture between Hecla and El Paso Natural Gas Company.

Essex would purchase all of the electrowon cathode production accruing to Hecla from its agreement with El Paso Natural Gas, assuming cathode quality typical of industrial standards for this product is achieved and contingent upon the quality meeting a minimum specification to be established by Essex. The price for the electrowon cathode to be delivered in any month would be determined by a formula as follows:

$$\left(\frac{\text{PRODUCERS PLUS COMEX}}{2}\right) - 2 \text{ cents}$$

PRODUCERS means the lowest producer copper quotation for electrolytic cathode copper at the close of business on the first calendar day of each month.

COMEX means the monthly settlement price for the sixth month future commodity exchange quotation for electrolytic cathode copper.

Essex would participate with Hecla in the development of technology for conversion of cement copper into marketable form usable by Essex. An agreement on pricing is contingent upon the quality of the cement copper product and the technology required. However, a minimum price would be the lowest producer electrolytic cathode quotation less our expense for conventional smelting. This is a statement of intent of the parties recognizing the willingness of Essex to participate in the product development giving Essex first rights for all or part of the cement copper production.

The term of this understanding would cover a period of 10 years starting within six months from the initial start-up of production at the Lakeshore Project with an option by Essex to extend the contract an additional 10 years. This letter is an expression of intent, is not a firm contract to purchase copper, and confers no rights upon Hecla or a third party.

Very truly yours,

Howard Lanier, Manager
Copper Processing Operations

HL/mcc

3/20/70

FILE MEMO.

SUBJECT: HECLA MINING CO.

WHILE AT HAZEN RESEARCH ON 3/20/70 I RAN INTO KEN SCHELLINGER FORMERLY OF KCC RESEARCH & NOW A PROJECT ENGINEER FOR PARSON JURDEN IN NYC.

KEN SUGGESTED I CONTACT HECLA MINING CO IN WALLACE IDAHO REGARDING HANDLING THEIR COPPER PRODUCTION. THE MAN IN CHARGE OF THE DEVELOPMENT IS BILL GRIFFITH. I SHALL CONTACT TO REVIEW THE PRODUCTION PLANS & DETERMINE IF OUR PARTICIPATION COULD BENEFIT THE PARTIES.

H.

EL PASO NATURAL GAS COMPANY

LAKESHORE PROPERTY

PRELIMINARY REPORT

A Subsidiary of GFI Computer, Inc.

RICHARD F. HEWLETT
Chairman of the Board

CORPORATE OFFICE
7107 NORTH CRACLE
TUCSON, ARIZONA 85704
602 / 297-1141

January 14, 1969

El Paso Lakeshore

Total Tonnage	322,319,280	470,000,000 – 1973 Metals week.
Average Grade	0.80646 '81	24,000,000 – 1.69% Cu Tactite Zone

Planned output – 68,845 TPY copper < 30,765 cathode / 38,080 cement
+ moly credits

A Subsidiary of GFI Computer, Inc.

RICHARD F. HEWLETT
Chairman of the Board

CORPORATE OFFICE
7107 NORTH ORACLE
TUCSON, ARIZONA 85704
602 / 297-1141

LAKESHORE GEOLOGIC ORE RESERVE SUMMARY

November 1, 1968

cut off grade (high) most of computations in report @ 0.4%

Block Caving Reserves
(0.50% Cu, +200 Ft. Vertical Columns)

	Tonnage	Grade
Proven		
Porphyry	107,934,500	0.802
Tactite	10,022,700	1.728
	(24,000,000 — 1973)	(1.69)
Probable		
Porphyry	24,161,250	0.816
Total		
Proven & Probable		
Porphyry	132,095,750	0.805
Porphyry with Tactite	142,118,450	0.870

Open Pit Reserves
(+0.40% Cu, 50 Ft. Benches)

	Tonnage	Grade
Total		
Proven, Probable and Inferred	? 263,099,260	0.785

263,099,260
142,118,450
405,217,710

LAKE SHORE PROJECT SUMMARY OF ORE RESERVES AS OF OCT. 30, 1968.

1. PORPHYRY RESERVES FOR ORE GREATER THAN 200 FEET THICK
CUT-OFF GRADE FOR PORPHYRY = 0.50

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	0.802	107,934,500
PROBABLE ORE	0.816	24,161,250
TOTAL ORE	0.805	132,095,750

>200' thick cutoff 0.40 (Block caving ore)

✳ → NOTE--TOTAL PORPHYRY RESERVES INCLUDES 9,258,700 TONS OF TACTITE WHICH LIES UNDER THE PORPHYRY.

2. TACTITE RESERVES FOR THE ENTIRE ORE BODY
CUT-OFF GRADE = 1.00

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	1.752	16,675,000
PROBABLE ORE	1.967	2,606,400
TOTAL ORE	1.781	19,281,400

9,000,000 tons of Tactite ore under porphyry

✳ → 3. TACTITE RESERVES OUTSIDE THE PORPHYRY AREA
CUT-OFF GRADE = 1.00

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	1.663	7,894,100
PROBABLE ORE	1.967	2,128,600
TOTAL ORE	1.728	10,022,700

UG.

O.P. (?).

4. OXIDE RESERVES

CUT-OFF GRADE	GRADE	TONNAGE
0.20	0.476	206,271,000
0.75	1.085	21,182,900
1.00	1.400	10,826,700

outcrop area - how deep.

NOTE--TO OBTAIN THE TOTAL SULPHIDE TONNAGE, ADD THE PORPHYRY RESERVES TO THE TACTITE RESERVES OUTSIDE THE PORPHYRY.
TOTAL SULPHIDE = 132,095,750 + 10,022,700 = 142,118,450
AVERAGE GRADE = 0.870

cut-off grade

LAKE SHORE PROJECT ORE RESERVES AT +0.50 PORPHYRY --

PROVEN RESERVES

	9/20/68				10/30/68		
I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF	NO.	AVERAGE	TONNAGE
1	1159	0.860	83948128.	50.	1396	0.832	119897072.
2	1077	0.858	82648752.	100.	1323	0.830	118729792.
3	866	0.834	77033952.	150.	1116	0.813	113230832.
4	706	0.819	71231248.	200.	969	0.802	107934576.
5	609	0.811	66770416.	250.	869	0.796	103335824.
6	548	0.803	63310208.	300.	813	0.793	100143328.
7	472	0.793	58181872.	350.	759	0.791	96535200.
8	417	0.782	53907288.	400.	696	0.790	91645424.
9	352	0.768	48180416.	450.	626	0.790	85443744.
10	310	0.766	44042504.	500.	557	0.790	78611040.

These are the most common heights of blocks used in block caving operations.

what does the No. column represent. - # of assays - holes - blocks?

LAKESHORE OPEN PIT POTENTIAL

Proven, Probable, Inferred
(0.40% Sulphide Copper Cut-Off) — oxides included

GEOLOGIC SULPHIDE RESERVES

October 30, 1968

Level	Tonnage	Grade
950	1,336,020	1.078
900	1,841,396	1.055
850	4,091,395	1.024
800	6,637,092	0.750
750	8,854,832	0.716
700	10,720,422	0.638
650	13,653,215	0.819
600	17,072,568	0.689
550 ↑ 450'	17,725,793	0.813
500	17,642,460	0.804
450	18,180,094	1.046
400	19,940,845 ←	1.009
350	16,306,439	0.886
300	15,913,966	0.738
250	14,478,484	0.857
200'	11,682,787	0.608
150	12,134,399	0.793
100	9,653,218	0.686
50	9,397,842	0.559
0	6,266,124	0.550
- 50	7,177,414	0.746
- 100	7,099,457	0.599
- 150	5,870,963	0.707
- 200	1,317,203	0.483
- 250	3.024,191	0.660
- 300	5,080,641	0.605
TOTAL	263,099,260	0.785

Sea Level (?)

Tactite Zone

Total depth = 1250'

CONCLUSIONS

1. Smaller tonnage mining methods appear optimum; for high rate of return over a short period of time.

Mining Method	Ore Tonnage	Capital Investment	Rate of Return
Blast Hole Stoping	13,780,000	16,051,250	16.50
Sub-Level Caving	13,780,000	16,037,750	10.05
Blast Hole Stoping	25,000,000	16,878,100	9.40
Block Caving	25,000,000	40,000,000	11.44
* → Block Caving	60,000,000	42,873,496	--

@ 41¢ copper (1968 average price)
1969 – 47¢

2. A very detailed capital cost estimate must be made to more accurately evaluate the economics of the deposit.

capital costs for blast hole + sub-level caving will have the lowest initial cost. Over the life of the mine block caving will most certainly have the lowest capital cost. (providing the ground is caveable)

Blast hole stoping would be combined with open pit operation – could have high initial capital cost.

RECOMMENDATIONS

From the following study, the following recommendations are made in order of their importance:

1. Drill for more high-grade ore in or near the tactite zone. Where is tactite in reference to porphyry.
2. Simultaneous with one (1) above, initiate a detailed capital cost study that includes mine layout for the various mining methods considered in this report. Kay Pincock is recommended for this study (Resumé in Appendix C).
3. Simultaneous with two (2) above, a computer study should be made to develop optimum mining sequences to maximize the grade for small increments of time to ~~increase~~ stabilize the rate of return. The determined sequences should then be re-run through the financial analysis program.
4. A trend analysis on future copper prices, ~~wage~~ mining costs and the economic importance of copper in the next 20 years.

RICHARD F. HEWLETT & ASSOCIATES
COMPUTER APPLICATIONS CONSULTANTS
TO THE MINERAL INDUSTRY
7107 No. Oracle Road
Casas Adobes Center
Tucson, Arizona 85704

Residence
?9-9086 (602)

Office
297-1141 (602)

☆ Exploration
☆ Development
☆ Mining
☆ Milling
☆ Metal Processing

May 1, 1968

(3 1/2 months from contractual agreement to final report.)

Mr. John R. Reynolds
Supt. of Exploration
Mines Division
El Paso Natural Gas Company
El Paso, Texas

Dear Mr. Reynolds:

Attached to this report you will find the computer output as per our proposal of 10 January 1968. The analysis is based on the following criteria and assumptions:

1. All assay data was obtained from the El Paso drill hole logs supplied by Mr. Claude Barron.
2. A visit to the Lakeshore property was made by Mr. John M. Anderson and Dr. Charles Fair on 19 January 1968. Mr. Jim Synder escorted them on a tour of the property and showed us representative samples of drill core.
3. The financial analysis is based on typical North American mining costs, recovery and dilution. It must be realized that an intensive study will be required before a final solution to the most economic method may be resolved. However, this analysis will serve to illustrate to your company the economic impact of varying underground mining costs, recoveries and dilution.

4. Please note that all assay data are total copper (combined oxide and sulfide.) As per your instructions we have assumed that all assay values in the "tactite" zone are sulfide copper, and hence recoverable. If it appears that the Lakeshore deposit is amenable to a "bulk" mining method such as block caving it will be essential that the copper assay values in the porphyry type rocks be re-evaluated to determine the sulfide content. Gold, silver, molybdenum and iron values have not been included in this economic analysis.

how about this!

MoS2 is indicated

5. During Mr. Reynolds visit to Tucson on 13 March John Anderson reviewed the estimated operating and capital costs for various mining methods and various concentrator capacities. There is no doubt that these costs will require revision as more detailed cost data is acquired by your firm.

6. With regard to the feasibility of underground exploration it will be essential that the ore body be further tested to assertain:

   a. Metallurgical recovery, grinding index, etc.
   b. Ground conditions, which will govern mining methods.
   c. Verifications of tonnage and grade of ore as indicated by drilling.

7. From preliminary observations, it appears an exploration shaft might best be located in the area of hole 27.

location ?

However, before a major expenditure is made for an exploration shaft with underground development work, it is our recommendation that El Paso employ a mining engineer to assertain the most suitable location for an exploration shaft. Due consideration should be given to potential ground subsidence should a caving method be employed. In otherwords, it may be more beneficial to locate the exploration shaft at a great distance from the ore body to insure that it will ultimately be useful. If the shaft is located in such a position that ground subsidence would endanger it, its value as a ventilation shaft, or secondary access would be nullified. Before a shaft is sunk, it is recommended that a diamond drill hole be put down at the proposed site to assertain that no ore is present at that location.

potential!!

8. Metal prices and other financial criteria, i.e., depreciation, depletion, royalties, taxation rates, etc. are as specified by El Paso. Should you wish any of these factors varied, or when you obtain other capital cost data which will significantly alter this analysis it will be possible to recompute the economics of the Lakeshore deposits. All of the drill hole data is now key punched and any variations to the capital and operating costs data can readily be evaluated.

are these data cards available also?

most certainly-!

Further, more detailed work should be undertaken to establish the gold, silver, molybdenum, and iron values or credits per ton for entry into the financial analysis.

Sincerely,

Richard F. Hewlett

Richard F. Hewlett

RFH:jag

ORE RESERVES

The ore reserves were computed of the total ore body for all rock types, for only the tactite ore body, and for a minimum of 10 and 30 vertical feet as a height cut-off, as well as for grade cut-off's. The three basic alternatives are shown in figure 1. Notice that the tactite ore body is a relatively small tonnage high grade deposit when compared with the total deposit (all rock types). Also, it is obvious that the ore reserves computed using a 10 foot vertical cut-off would have a higher grade for the same tonnage due to the dilution required in thin ore zones to make a 30 foot minimum vertical height. Therefore the following definitions were used for geologic and minable ore reserves:

Geologic Reserves - The total tonnage of material present in the ore body having a grade above the cut-off grade.

Minable Reserves - The total tonnage of material which would be mined for a given cut-off grade within the ore body.

Geologic and minable reserves are different in several ways. Pockets of material above the cut-off grade but too small to mine, are included in the geologic reserves, but not minable reserves. Pockets of waste within the ore zones which must be mined with the ore are included in minable reserves, but not in geologic reserves. Dilution at the periphery of the ore zone is not included in either estimate.

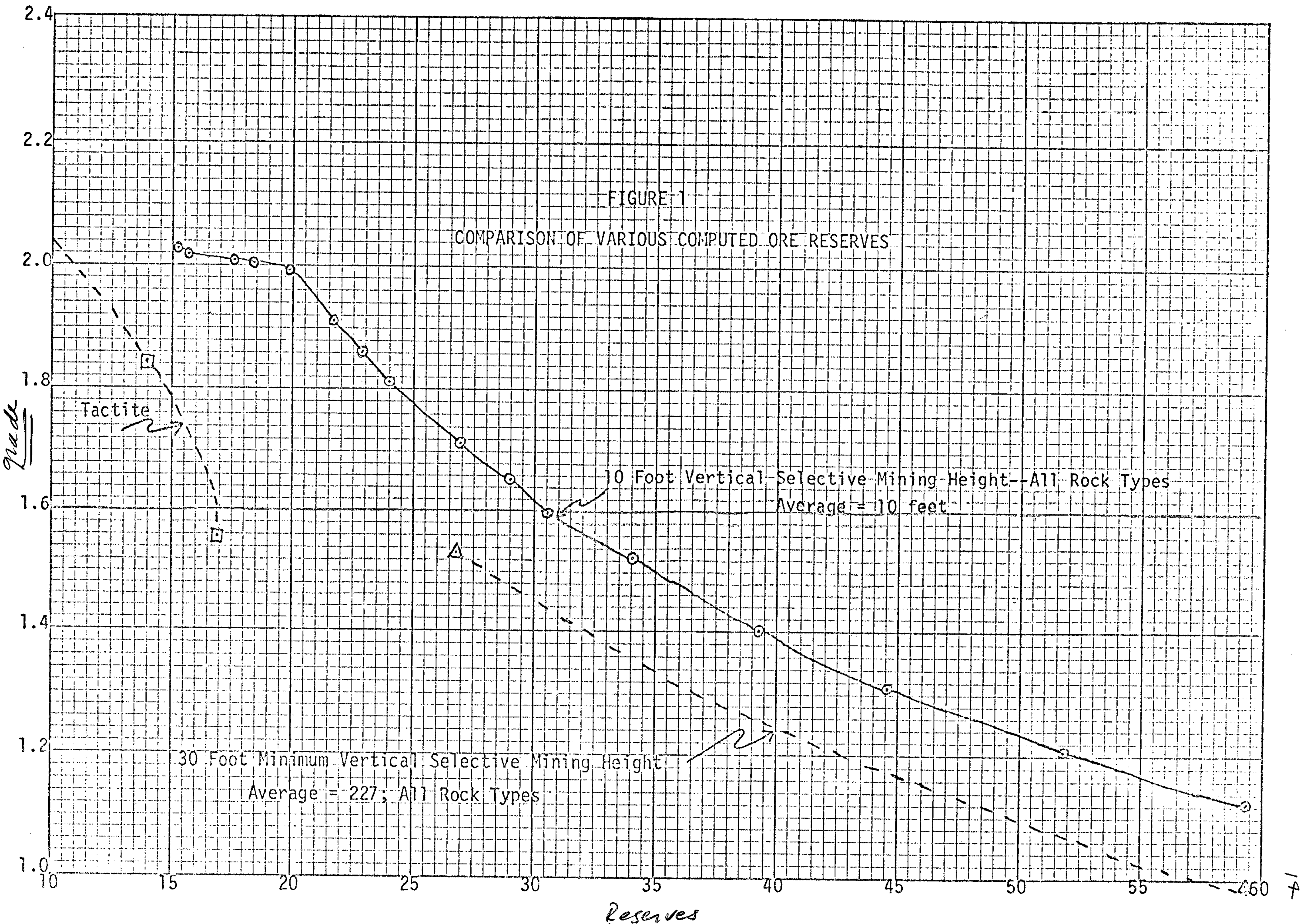
FIGURE 1
COMPARISON OF VARIOUS COMPUTED ORE RESERVES
10 Foot Vertical Selective Mining Height--All Rock Types
Average = 10 feet
30 Foot Minimum Vertical Selective Mining Height
Average = 227; All Rock Types
Tactite
grade
Reserves
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
10
15
20
25
30
35
40
45
50
55
60

Table 1 presents the computed sulphide ore reserves summary for the deposit in the area drilled. The area considered is shown in other figures. As previously mentioned, the minable ore reserves are lower in grade than are the thinner zoned geologic ore reserves.

Table 2 shows the ore reserves computed for the same total volume and hence tonnage for a 10 foot vertical interval. It is not economically possible to mine the deposit by open-pit or underground using a 10 foot selective mining height for this ore body, but these computed geologic reserves serve to indicate to maximum ore reserves possible by very expensive mining methods. The important factor displayed by comparing tables 1 and 2 is that the grade drop is only from 1.12 to 0.99 when using a minimum of 30 vertical feet as a cut-off.

Table 3 presents the basic drill hole data used to compute the minable ore reserves shown in table 1 for all rock types. 22 holes numbered from 1-48

Table 4 shows the computed ore reserves for all rock types for various cut-off thicknesses. Notice that the 0 cut-off is really 30 feet (as a minimum). This table shows that only a very small tonnage is below a 50 foot thickness (a block-caving consideration).

Table 5 presents the basic drill hole data for a 0.75% sulphide copper cut-off grade. Table 6 shows the computed results for various vertical thicknesses. Again, a relatively small tonnage lies below a 50 foot vertical thickness.

The geologic oxide copper ore reserves from the surface to the top of the mixed zone are shown in table 7. For each cut-off grade is a computed tonnage, grade, and plus - or - minus confidence interval. For example, the confidence interval for a cut-off of 0 is 0.29 - 0.31 and for a cut-off grade of 0.50, the confidence interval is 0.71 - 0.79 (at the 95% level). The total thickness of grade of oxide material per drill hole is presented in table 8.

Table 9 summarizes the elevations of the bottoms of oxide, mixed and sulphide per drill hole.

TABLE 1 (30' vertical interval?)

LAKESHORE

MINABLE
SULPHIDE ORE RESERVE SUMMARY

(Tactite Zone)

Cut-off	Tonnage	Grade	
0.50	16,837,608	1.55	Tactite Zone
0.75	13,780,000	1.84	
1.00	6,669,614	2.19	
2.00	457,202	--	
	(All Rock Types)		
0.50	59,338,007	0.9887	porphyry + tactite
0.75	26,753,524	1.531	

TABLE 2

LAKESHORE GEOLOGIC ORE RESERVES

SULPHIDE ZONE

ALL ROCK TYPES

10' vertical interval, mining height.

Cut-off Grade, % CU	Tonnage	Average Grade
0.50	59,338,007	1.12
0.55	51,790,213	1.21
0.60	44,539,108	1.31
0.65	39,210,555	1.40
0.70	34,036,281	1.52
0.75	31,075,314	1.59
0.80	29,004,418	1.65
0.85	26,933,521	1.71
0.90	24,120,900	1.81
0.95	22,785,795	1.86
1.00	21,604,968	1.91
1.05	19,979,107	1.99
1.10	18,347,312	2.07
1.15	17,463,175	2.11
1.20	15,831,380	2.21
1.25	15,245,934	2.25

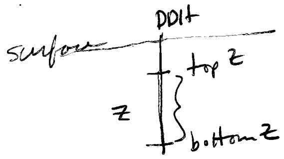

TABLE 3

LAKESHORE SULPHIDE

320
190
510

(0.50 Cut-Off)

Drill Hole	Top Z	Bottom Z	(Top Z − Bot Z) Thickness	Grade
46	510	320	190	1.254
* — 48	500	210	290	1.573
45	760	260	500 *	0.66326
47	510	350	160	1.16775
38	540	430	110	0.94827
43	790	140	650 *	0.83979
40	720	260	460	0.54906
* — 39	600	350	250	1.43804
29	570	420	150	0.99366
37	560	450	110	1.15336
30	790	470	320	0.87821
1A	820	320	500 *	0.77099
3	780	530	250	1.00571
8	660	540	120	1.23957
36	880	850	30	0.52333
27	810	740	70	0.48128
* — 42	880	760	120	2.06182
* — 28	840	810	30	2.66066
10	860	820	40	0.69200
4	780	710	70	0.75700
* — 42	880	760	120	2.06182
* — 5	740	650	90	2.21188
41	?	?	600 *	0.749

(?)

looks like on drill hole was added in twice (#42)

[locate holes 48, 39, 42, 28, 5, 46]

TABLE 4

LAKESHORE

ORE RESERVES COMPUTED FOR A PERIPHERAL CUT-OFF GRADE OF 0.50% SULPHIDE COPPER

Vertical Thickness Cut-Off, Ft.	Tonnage	Grade, % S CU
(+) 0 - (30 ft. min.)	59,338,007	0.98870
(+) 50	58,519,478	
(+) 100	56,515,628	
(+) 150	50,360,743	
(+) 200	45,606,731	
(+) 250	41,511,450	
(+) 300	35,028,407	
(+) 350	31,701,169	
(+) 400	28,174,841	
(+) 450	24,812,702	
(+) 500	20,383,556	
(+) 550	14,151,406	
(+) 600	3,852,291	

Can probably block cave 100' blocks and still maintain 10 - 30,000 Tpd.

TABLE 5

LAKESHORE

SULPHIDE

(0.75 Cut-Off)

Drill Hole	Top Z	Bottom Z	Thickness	Grade
46	500	330	170	1.330
48	410	210	200	2.036
45	300	260	40	0.9635
47	450	350	100	1.4976
38	520	460	60	1.25633
43	790	480	310	1.019
40	--	--	--	--
39	500	360	140	2.10921
29	570	450	120	1.09982
37	560	470	90	1.28855
30	550	470	80	1.58275
1A	510	480	30	4.41766
3	670	540	130	1.42992
8	650	550	100	1.36959
36	870	860	10	1.981
27	--	--	--	--
42	880	770	110	2.19444
28	840	810	30	2.66066
10	840	830	10	1.039
4	750	710	40	0.91650
42	880	770	110	2.19444
5	740	660	80	2.41862
41	710	450	260	0.903

TABLE 6

LAKESHORE

ORE RESERVES COMPUTED FOR A PERIPHERAL CUT-OFF GRADE OF 0.75% SULPHIDE COPPER

Vertical Thickness Cut-off, Ft.	Tonnage	Grade, % S.CU
(+) 0 - (30 ft. min.)	26,753,527	1.531
(+) 50	24,522,052	
(+) 100	19,183,453	
(+) 150	12,650,079	
(+) 200	8,191,568	
(+) 250	3,976,214	
(+) 300	374,419	

+300' @ 0.5% c/o Res - 35,028,400 !!

with a decrease of 0.25% reserves drop 98%

TABLE 7

LAKESHORE

OXIDE COPPER

ORE RESERVES
IN SULPHIDE AREA

Cut-off	Tonnage	Grade	±CI
0.00	206,517,841	0.30	0.01
0.05	164,367,549	0.38	0.01
0.10	159,080,692	0.39	0.01
0.15	146,607,015	0.41	0.02
0.20	132,315,980	0.44	0.02
0.25	115,794,553	0.47	0.02
0.30	96,567,742	0.51	0.02
0.35	74,201,860	0.56	0.02
0.40	56,544,585	0.62	0.03
0.45	43,740,479	0.68	0.03
0.50	32,485,256	0.75	0.04

Discussion w/ C. Chase:

This oxide ore has too much $CaCO_3$ to leach at this lowa grade using acid. An ammonium leach may be used but recovery is too poor.

(@ acid cost 1¢/16). Maybe be a break even proposition if there is acid that needs to be neutralized or wasted.

TABLE 8

LAKESHORE

OXIDE

DH	Thickness ft.	Grade
48	1092.5	0.236
46	1025.2	0.182
45	940.6	0.336
47	977.4	0.264
38	954.4	0.265
43	955.3	0.410
40	958.0	0.400
39	924.8	0.305
29	817.6	0.274
4	843.9	0.473
37	902.2	0.126
10	820.6	0.287
30	839.7	0.265
1A	849.7	0.204
3	853.1	0.358
5	854.0	0.293
29	817.6	0.274
28	757.5	0.612
8	848.1	0.231
36	839.5	0.086
27	840.8	0.403
42	759.3	0.380

TABLE 9

LAKESHORE

Elevations of Oxide, Mixed, and Sulphide Mineralization

Drill Hole	Bottom Oxide / Top Mixed	Bottom Mixed / Top Sulphide	Bottom Sulphide
48	670	570	80
46	750	710	310
45	820	760	70
47	770	710	200
38	810	770	360
43	810	790	100
40	810	730	200
39	840	690	300
37	870	860	340
30	920	790	210
1A	1050	850	250
3	920	840	-20
29	930	810	340
8	920	830	430
36	940	880	790
27	930	820	430
42	940	880	720
28	990	840	650
10	970	890	540
4	940	840	190
5	920	850	590
33	1040	920	360

CONFIDENCE INTERVAL ANALYSIS

Tables 10, 11, and 12 show the computer output from the preliminary confidence interval analysis for the sulphide, oxide, and mixed zones, respectively. On these tables INT is the assay cut-off interval (cut-off grade); PCT is the relative percentage of data above the 0.50% copper cut-off grade; AVG is the average geologic grade for the cut-off grade; DEV is the standard deviation of the average geologic grade; and CI is the 95% confidence interval of the average geologic grade indicated by the present drilling(for a 0.50% cut-off, the average grade is 1.12% copper $\pm$ 0.08 -- the range of the average grade then is 1.04 to 1.20). The number of additional samples required to produce a desired (acceptable) confidence interval (CI) can be easily computed.

The drilling to date in the sulphide zone has been adaquate for computing ore tonnage due to the geometry of the mineralization. It is shown for blast hole stoping that the rate of return varies with the grade variation as follows:

Confidence Interval	Rate of Return
Lower	12.21
Average-expected	16.50
Upper	20.13 .

This clearly points out on the low end that underground drifting is required at a later date to prove-up the grade and investigate the ground. However, it is not recommended at this time. Additional surface drilling should be done to prove up more high-grade ore (plus 1.15%). A spacing similar to the previous is more than adaquate for that purpose.

TABLE 10

LAKE SHORE CUTOFF GRADES FOR 10-FOOT COMPOSITES IN THE SULFIDE ZONE. 4/19/6

INT.	FREQ	PCT	AVG	DEV	CI	INT.
0.50	401	100.00	1.12	0.85	0.08	0.50
0.55	350	87.28	1.21	0.88	0.09	0.55
0.60	301	75.06	1.31	0.90	0.10	0.60
0.65	265	66.08	1.40	0.93	0.11	0.65
0.70	230	57.36	1.52	0.94	0.12	0.70
0.75	210	52.37	1.59	0.95	0.13	0.75
0.80	196	48.88	1.65	0.96	0.14	0.80
0.85	182	45.39	1.71	0.97	0.14	0.85
0.90	163	40.65	1.81	0.98	0.15	0.90
0.95	154	38.40	1.86	0.98	0.16	0.95
1.00	146	36.41	1.91	0.99	0.16	1.00
1.05	135	33.67	1.99	0.99	0.17	1.05
1.10	124	30.92	2.07	0.99	0.18	1.10
1.15	118	29.43	2.11	0.99	0.18	1.15
1.20	107	26.68	2.21	1.00	0.19	1.20
1.25	103	25.69	2.25	1.00	0.20	1.25
1.30	94	23.44	2.34	0.99	0.20	1.30
1.35	89	22.19	2.40	0.99	0.21	1.35
1.40	84	20.95	2.46	0.99	0.22	1.40
1.45	79	19.70	2.53	0.98	0.22	1.45
1.50	75	18.70	2.58	0.98	0.23	1.50

95% confidence interval (CI)

INT.: cut-off grade

PCT: % data points above cut-off grade (0.5%)

AVG: Avg geologic grade for cut-off grade

DEV: standard deviation of avg. geologic grade

TABLE 11

LAKE SHORE CUTOFF GRADES FOR 10-FOOT COMPOSITES IN THE OXIDE ZONE, 4/19/68.

INT.	FREQ	PCT	AVG	DEV	CI	INT.
0.00	1837	100.00	0.30	0.28	0.01	0.00
0.05	1462	79.59	0.38	0.26	0.01	0.05
0.10	1415	77.03	0.39	0.26	0.01	0.10
0.15	1304	70.99	0.41	0.26	0.01	0.15
0.20	1177	64.07	0.44	0.26	0.02	0.20
0.25	1030	56.07	0.47	0.27	0.02	0.25
0.30	859	46.76	0.51	0.28	0.02	0.30
0.35	660	35.93	0.56	0.29	0.02	0.35
0.40	503	27.38	0.62	0.31	0.03	0.40
0.45	389	21.18	0.68	0.34	0.03	0.45
0.50	289	15.73	0.75	0.36	0.04	0.50

TABLE 12

LAKE SHORE CUTOFF GRADES FOR 10-FOOT COMPOSITES IN THE MIXED ZONE, 4/19/68.

INT.	FREQ	PCT	AVG	DEV	CI	INT.
0.50	65	100.00	0.79	0.64	0.16	0.50
0.55	50	76.92	0.87	0.71	0.20	0.55
0.60	37	56.92	0.97	0.80	0.27	0.60
0.65	23	35.38	1.19	0.96	0.42	0.65
0.70	17	26.15	1.36	1.07	0.55	0.70
0.75	11	16.92	1.71	1.20	0.81	0.75
0.80	11	16.92	1.71	1.20	0.81	0.80
0.85	10	15.38	1.80	1.23	0.88	0.85
0.90	9	13.85	1.90	1.26	0.97	0.90
0.95	7	10.77	2.19	1.30	1.20	0.95
1.00	5	7.69	2.67	1.22	1.52	1.00
1.05	5	7.69	2.67	1.22	1.52	1.05
1.10	5	7.69	2.67	1.22	1.52	1.10
1.15	5	7.69	2.67	1.22	1.52	1.15
1.20	5	7.69	2.67	1.22	1.52	1.20
1.25	5	7.69	2.67	1.22	1.52	1.25
1.30	5	7.69	2.67	1.22	1.52	1.30
1.35	3	4.62	3.56	0.11	0.27	1.35
1.40	3	4.62	3.56	0.11	0.27	1.40
1.45	3	4.62	3.56	0.11	0.27	1.45
1.50	3	4.62	3.56	0.11	0.27	1.50

Standard deviation is much too big

PRELIMINARY FINANCIAL ANALYSIS

For this analysis costs and calculation procedures detailed in this report have been assumed. Based on these assumptions a simulation model has been developed relating the cash flow of the property to ore reserves, mining method, price, costs, and financing method.

The following variables were included in the analysis:

1. mining cost/ton
2. milling cost/ton
3. plant cost/ton
4. admin. cost/ton
5. capital investment required per ton of daily production capacity
6. pre-production costs
7. working capital
8. underground development costs per ton of ore
9. percent dilution and dilution grade
10. mill recovery
11. mine recovery
12. price of cu/lb.
13. ton/day capacity
14. rate for present value calculation
15. interest rate on loan
16. total tons of ore

17. grade of ore
18. percent of capital investment for equipment which must be depreciated and replaced
19. life of equipment
20. royalty on net smelter return
21. method of repayment of loan

Since the time between initiation of the project and the beginning of production will vary with the mining method, all cases were analyzed using the point of time when production starts as the base for present value and rate of return calculations.

No credit for values contained in the ore other than copper was used.

Appendix A describes the calculations in detail and Appendix B contains some examples of the computer printout for financial analysis of the various mining mehtods.

what other credits may be in the ore

C. Chase - Au + Ag credits are indicated because of the complicated process in which the milling + electrowinning is being done. Could be that the copper is almost by-product in nature.

WRIGHT ENGINEERS LIMITED

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1101 WEST PENDER STREET • VANCOUVER 1, B.C., CANADA

March 11, 1968

Mr. John Anderson,
7107 North Oracle Road,
Tucson, Arizona

Re: Sampling Plant

Dear John:

As discussed with you on the phone Friday, I am pleased to send you some information concerning the sampling plant that was used for Brenda and is now being used at Highmont.

The equipment, consisting of a Model S25 Automatic sampling system, a Syntron vibrating feeder, a No. 12 Denver gyratory crusher and a 40" Denver vezin sampler, cost approximately $6,000. U.S.

The Tower steelwork, the installation cost for labour and material and the electrical installation cost totalled another $6,000. U.S. for a total of $12,000.

Not included in the foregoing was the site preparation which was done by the client.

In addition to the foregoing, we rented a portable crushing plant, an H90B payloader, an H70 payloader and a light truck which cost about $495. U.S. per day.

As power was not available, we rented a 15 KV electric set at $435. U.S. per month.

I hope this preliminary information will be useful to you and your client and when you get back to Vancouver we will be very pleased to discuss the details with you. We, of course, have detailed drawings of this system all of which worked very well.

Yours sincerely,

H. M. Wright

HMW/aa

DISCUSSION OF FINANCIAL ANALYSIS RESULTS

Tables 14 thru 22 give the results of the financial analysis showing the effect of changes in mining methods, costs, grades and other variables.

Table 14 shows that blasthole stoping of 13,780,000 tons at 1.84% Cu is the best method of mining from an economic point of view. This case was used to show the effect of changes in other variables on the total cashflow and rate of return.

for only copper credits

Table 15 shows the effect of mill recovery on cashflow and rate of return. A change of 1% in mill recovery results in a change of approximately 1 million in total cashflow.

From Table 16, it is obvious that the capital investment required is a critical factor. A change of 10% in the capital investment causes a change of about 15% in the rate of return from 16.50% to either 19.16% or 14.21%.

Table 17 relates the change in mining costs (or any other operating cost) to the cashflow and rate of return. An increase of $.50 per ton in operating costs could cause a change of about 5.2 million in total cashflow.

Table 18 shows the effect of changes in the interest rate for bank financing on the cashflow and rate of return. The effect of any change in the royalty rate is shown in Table 19.

Table 20 shows the effect of price changes and Table 21 the effect of grade variations. If the grade for the example case is actually 1.70% instead of 1.84 the rate of return would drop from 16.50% to 12.21% and the cashflow from 39.5 million to 32.9 million.

The financial analysis indicates that:

1. A more detailed capital cost estimated should be made for blasthole stoping, sub-level caving and block caving.
2. Further work should be done with the ore reserve estimates in order to develop mining sequences. If it is possible to mine the higher grade material in the early years of the mine life, the rate of return would increase considerably.
3. The distribution of gold, silver, and molybdenum values should be determined and their value included in the financial analysis.

Apparently there are a substancial amount of Au, Ag values

PRE PRODUCTION COSTS

Acquisition and pre-production costs of surface drilling. To 1 April, 68.		$500,000	
Shaft cost (to 1400 Ft.) not incl. headframe or hoist (based on Centennial quote).	$ (293/FT)	$410,000	2,100,000
1 station and loading pocket.		20,000	—
Shaft site test hole (water).		25,000	—
Pumping shaft.		80,000	—
Headframe and hoist installed.		55,000	6,000,000
3000 Ft. u.g. development @ $85 Ft. (assume contracted).		255,000	360,000
U.G. diamond drilling 50,000 Ft. @ $5.00.		250,000	500,000
U.G. percussion drilling 50,000 Ft. @ $1.50		75,000	200,000
Sampling plant (installed).		30,000	100,000
Preparation of leach area for waste development, bins for bulk samples & misc. surface installations.		100,000	500,000
Total		$1,800,000	$10,260,000

PRE-PRODUCTION & PRODUCTION SCHEDULES

1.	Assume shaft sinking commences	1 July, 1968	
	12 months to complete to 1400	1 July, 1969	— 6-8 months
2.	3000 Ft. u.g. development		
	@ 500 Ft./month = 6 months	1 Jan., 1970	
3.	U.G. drilling and feasability study		
	6 months	1 July, 1970	
4.	Plant construction &		
	primary mine development commences	1 July, 1970	

5. Construction complete & production commences — 1 July, 1972

CAPITAL COST SCHEDULE

METHOD	BLOCK	SUB LEVEL	BLASTHOLE	CUT & FILL	SQUARE SET
Tons/day	10,000	3000	3000	2000	1000
* Cost/ton capacity	$4000 (4800)	$5000	$5000	$5500	$6000
Cost $	40,000,000	15,000,000	15,000,000	11,000,000	6,000,000
Less pre-prod.	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
Less u.g. prim.	(Cost determined by ore reserve x $0.35/ton) (?) (Tons x $/ton = $)				
Yields	Capital cost per ton capacity				

how was this figure derived - May be a little high.
for a 50,000 TPD opn - $200,000,000 capital cost.

BLOCK CAVING

MINING	—	$2.60	
MILLING	—	0.85	
HAULAGE	—	0.04	
		3.49	— 0.349
IITDA			.07
Smelting			.04
Refining			.03
			0.489 /lb cu

TABLE 13

LAKESHORE

ESTIMATED COSTS PER TON AND ASSUMPTIONS USED FOR FINANCIAL ANALYSIS

MINING METHOD	BLOCK CAVING	SUB-LEVEL CAVING	BLASTHOLE STOPING	CUT & FILL	SQUARE SET
Mining	2.00 (2.60)	3.25	2.75	5.25	9.00
Milling	0.75 (.85)	0.90	0.90	1.10	1.10
Plant	0.25	0.30	0.30	0.35	0.35
Administration	0.85	0.90	0.90	1.00	1.00
Marketing	See Smelter Schedule				
Total Excl. marketing	$3.85	$5.35	$4.85	$7.70	$11.45
Daily Capacity	10,000	3000	3000	2000	1000
Mine Recovery	85%	87%	90%	95%	95%
Dilution	12%	18%	10%	7%	5%
Cut Off Grade	To be Calculated				

check San Manuel, Climax recovery averages

93%

TABLE 14

LAKESHORE

ECONOMIC COMPARISON OF DIFFERENT MINING METHODS

MINING METHOD	TONNAGE AND GRADE	TOTAL CASH FLOW	CAPITAL INVESTMENT	RATE OF RETURN
* Block-Caving	25,000,000 at 1.53	59,909,608	40,000,000	11.44
* Block-Caving	60,000,000 at 0.99	- 5,519,327	42,873,496	---
Sub-Level Caving	25,000,000 at 1.53	24,291,324	17,776,648	2.28
Sub-Level Caving	13,780,000 at 1.84	30,230,980	16,037,750	10.05
Blast Hole Stoping	25,000,000 at 1.53	43,383,832	16,878,100	9.40
Blast Hole Stoping	13,780,000 at 1.84	39,516,352	16,051,250	16.50
Cut & Fill	13,780,000 at 1.84	- 2,565,135	12,149,398	---
Cut & Fill	6,669,615 at 2.19	12,905,636	11,681,356	2.02
Square Set	6,669,615 at 2.19	-14,159,052	6,367,115	---

Development cost to obtain 40,000 TPD — ?

TABLE 15

LAKESHORE

EFFECT OF MILL RECOVERY ON FINANCIAL ANALYSIS *

MILL RECOVERY	TOTAL CASHFLOW	RATE OF RETURN
.90	37,695,440	15.31
.91	38,678,808	15.94
.92	39,516,352	16.50
.93	40,353,896	17.06
.94	41,173,064	17.62

* Case used in mining 13,780,000 tons at 1.84% Cu using blasthole stoping.

TABLE 16

LAKESHORE

EFFECT OF CAPITAL INVESTMENT REQUIRED PER TON OR MILL CAPACITY ON FINANCIAL ANALYSIS *

CAPITAL REQUIRED PER TON DAILY MILL CAPACITY	TOTAL CASHFLOW	CAPITAL INVESTMENT	RATE OF RETURN
3500	38,025,488	11,101,250	26.37
4500	39,118,248	14,401,250	19.16
5000	39,516,352	16,051,248	16.50
5500	39,711,056	17,701,252	14.21
6500	39,639,832	21,001,240	10.42
7500	39,278,544	24,301,252	7.39

* Case used is mining 13,780,000 tons at 1.84 % Cu using blasthole stoping.

TABLE 17

LAKESHORE

EFFECT OF MINING COST ON FINANCIAL ANALYSIS *

MINING COST PER TON	TOTAL CASHFLOW	RATE OF RETURN
2.25	43,386,952	19.20
2.75	39,516,344	16.50
3.25	34,328,648	13.14
3.75	28,833,492	9.45

* Case used in mining 13,780,000 tons at 1.84% Cu using blasthole stoping.

TABLE 18

LAKESHORE

EFFECT OF INTEREST RATE FOR BANK LOAN ON FINANCIAL ANALYSIS *

INTEREST RATE	TOTAL CASHFLOW	RATE OF RETURN
.05	40,251,632	17.31
.06	39,892,608	16.91
.07	39,516,352	16.50
.08	39,122,328	16.08
.09	38,694,960	15.65

* Case used in mining 13,780,000 tons at 1.84% Cu using blasthole stoping.

TABLE 19

LAKESHORE

EFFECT OF ROYALTY PAYMENT ON FINANCIAL ANALYSIS *

ROYALTY	TOTAL CASHFLOW	RATE OF RETURN
.05	43,215,872	19.08
.06	42,507,264	18.59
.07	41,793,080	18.10
.08	41,049,376	17.58
.09	40,299,016	17.05
.10	39,516,344	16.50
.11	38,669,336	15.93
.12	37,651,128	15.29

* Case used in mining 13.780,000 tons at 1.84% Cu using blasthole stoping.

TABLE 20

LAKESHORE

EFFECT OF PRICE CHANGES ON FINANCIAL ANALYSIS *

PRICE	TOTAL CASHFLOW	CAPITAL INVESTMENT	RATE OF RETURN	CHANGE Δ
38	27,894,824	16,051,250	8.80	--
39	30,918,468	16,051,250	10.87	2.07
40	33,883,584	16,051,250	12.85	1.98
41	36,792,000	16,051,250	14.74	1.89
42	39,516,352	16,051,250	16.50	1.76
43	41,909,064	16,051,250	18.11	1.61
44	44,220,088	16,051,250	19.63	1.52
45	46,463,824	16,051,250	21.10	1.47
46	48,630,056	16,051,250	22.49	1.39

* Case used is mining 13,780,000 tons at 1.84% Cu using blasthole stoping.

figured over a short life

TABLE 21

LAKESHORE

EFFECT OF GRADE VARIATION ON FINANCIAL ANALYSIS *

GRADE	TOTAL CASHFLOW	RATE OF RETURN
1.70	32,914,896	12.21
1.74	34,854,768	13.49
1.78	36,792,968	14.74
1.82	38,705,256	15.96
1.84	39,516,352	16.50
1.86	40,327,424	17.05
1.90	41,908,248	18.11
1.94	43,457,232	19.13
1.98	44,979,904	20.13

* Case used in mining 13,780,000 tons at 1.84% Cu using blasthole stoping.

TABLE 22

LAKESHORE

EFFECT OF OPERATING COST PER TON ON THE FINANCIAL ANALYSIS *

Operating Cost / Ton	Total Cashflow	Rate of Return
2.85	53,555,232	25.86
3.35	50,198,096	23.69
3.85	46,840,968	21.52
4.35	43,386,952	19.20
4.85	39,516,352	16.50
5.35	34,328,648	13.14
5.85	28,833,488	9.45
6.35	22,899,368	5.21

* Case used is 13,780,000 tons at 1.84% Cu mined by blasthole stoping. Operating cost includes mining, milling, administrative and plant.

APPENDIX A

Mine Recovery (93% recovery)

$A = 55.8 \times 10^6$ tons

LAKESHORE

FINANCIAL ANALYSIS MODEL

MINE RECOVERY

$$A = B \times C$$

where:

A = Tons of ore mined

B = Tons of ore in minable ore zones

C = Mine recovery

DILUTION

$$Ore = A + A \times D$$

$$GO = (GD \times A + DG \times A \times D) / Ore$$

where:

Ore = Tons of material mined and sent to mill

GO = Grade of ore sent to mill

A = Tons of ore mined

GD = Grade of ore

DG = Grade of dilution

D = Percent dilution

CAPITAL INVESTMENT-ORIGINAL

$$TCAP = CT \times TPD$$

where was this figure found

where:

TCAP = Total capital investment initially

CT = Capital required per ton of daily capacity

TPD = Tons per day mill capacity

CAPITAL INVESTMENT-ORIGINAL (CONTINUED)

UGC = OR x DC

where:

UGC = Underground development cost

OR = Tons of ore reserves

DC = Underground development cost per ton of ore reserves

WC = 90 x OPC x TPD

where:

WC = Working capital based on 90 days operating costs

OPC = Operating cost per ton

TPD = Tons per day mill capacity

PP = $1,800,000.00

where:

PP = Preproduction cost

DEPRECIATION

BASE = TCAP - UGC - WC - PP

DPL = (BASE - PCT x BASE) / LIFE
DPQ = (PCT x BASE) / EQL
DEP = DPL + DPQ

where:

BASE = Initial total to be depreciated

PCT = Percent of base for equipment

LIFE = Mine life

EQL = Equipment life

DPL = Yearly amount for depreciation of capital over mine life

DPQ = Yearly amount for depreciation of capital for equipment over life of equipment

DEP = Total yearly depreciation

At the end of every EQL years [BASE x PCT] is required to replace equipment

YEARLY PRODUCTION

PRO = TPD x 360

where:

PRO = Yearly production rate

TPD = Daily production rate

NET SMELTER RETURN

V = G x REC x TON x 20.0 x 26.5 / 28.0

where:

V = Gross value of ore

G = Grade of ore (including dilution)

REC = Mill recovery

TON = Yearly production rate

RCU = G x 20.0 x REC x TON

ACU = RCU x 26.5 / 28.0

where:

RCU = Pounds Cu recovered

ACU = Pounds Cu accountable

SC = RCU x 27.265 / 560

FC = 4.58 x RCU / 509.6

RC = .0425 x ACU

where:

SC = Smelting cost

FC = Freight cost to Hayden

RC = Refining and delivery cost

NET = V - FC - SC-RC

where:

NET = Net Smelter return

ROYALTY

ROY = PCT x NET

where:

ROY = Royalty payment

PCT = Percent royalty

NET = Net Smelter Return

INTEREST

INT = RATE x BAL

where:

INT = Interest Payment at year end

RATE= Interest rate

BAL = Loan Balance

TAXATION

TAX = .54 x TAXIN - CRDT

where:

TAX = Federal tax, no allowance for local, and state taxes

TAXIN= Taxable income after allowable deductions for depreciation, depletion, interest, royalty, and development

CRDT = Capital investment credit at .07 of capital invested and deducted from tax up to 50% of tax

Depletion taken as smaller of 15% of new smelter return or 50% of taxable income

CASHFLOW CALCULATION

CF = NET - OPC - ROY - INT - TAX

where:

CF = Cashflow

NET = Net smelter return

OPC = Operating costs

ROY = Royalty payment
INT = Interest payment
TAX = Federal tax

REPAYMENT OF LOAN

$$PAY = CF \times PCT$$

$$BAL = BAL - PAY$$

where:

PAY = Loan payment

CF = Cashflow

PCT = Percent of cashflow to be used each year for loan repayment

BAL = Loan balance

PRESENT VALUE AND RATE OF RETURN

$$PV = \sum_{n=1}^{n=L} \frac{CF_n}{(1 + R)^n}$$

where:

PV = Present value at rate R

CF_n = Cashflow for year N

L = Life of mine

R = Rate of return

when:

$$\sum_{n=1}^{n=L} \frac{CAP_n}{(1 + R)^n} = \sum_{n=1}^{n=L} \frac{CF_n}{(1 + R)^n}$$

R = Discounted rate of return

CAP_n = Capital investment in year N

CF_n = Cashflow for year N

L = Life

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☆ Exploration
☆ Development
☆ Mining
☆ Milling
☆ Metal Processing

May 8, 1968

Mr. Windsor H. Nordin
Mining Division
El Paso Natural Gas Company
Box 1492
El Paso, Texas

Dear Mr. Nordin:

Enclosed is a description of the method used to calculate the rate of return as requested by you in our telephone conversation May 7. Also I have enclosed a copy of an example of the calculation procedure for a simple case. This is the method used by the program.

After reviewing the method I found that the replacement capital was not discounted, resulting in a lower rate of return than would be the case. Enclosed is also an example discounting the capital for replacement of equipment and the results of reruning the main cases with the new method.

If you have any questions concerning the methods and/or results, please do not hesitate to call me.

Sincerely,

A Frederick Banfield, JR

A. Frederick Banfield, Jr.

AFB:jag
enclosure

RATE OF RETURN CALCULATION

(Procedure Used in Lakeshore Financial Analysis Program)

C = Total Capital Investment

CF_n= Cashflow for Year

R = Rate of Return - Unknown

The rate of return is that rate which when used to discount the cashflow back to the present results in a present value of the cashflow equal to the capital investment.

OR

$$C = \frac{CF_1}{(1.+R)} + \frac{CF_2}{(1.+R)^2} + \frac{CF_3}{(1.+R)^3} - - \frac{CF_n}{(1.+R)^n}$$

where:

N is Last Year of Mine Life

CF is known for Each Year

R is determined by successive approximations (trial and error)

EXAMPLE:

YEAR	CASHFLOW	CAPITAL INVESTMENT
1	$ 5,000	$16,000
2	6,000	
3	4,000	
4	4,000	
5	6,000	
6	4,000	

Find R so that

$$16{,}000 = \frac{5{,}000}{(1+R)} + \frac{6{,}000}{(1+R)^2} + \frac{4{,}000}{(1+R)^3} + \frac{4{,}000}{(1+R)^4} + \frac{6{,}000}{(1+R)^5} + \frac{4{,}000}{(1+R)^6}$$

By trial and error

First guess $R = .10$

Year (n)	Cashflow	R = 10% $\frac{1}{(1+R)^n}$	R = 10% $\frac{CF_n}{(1+R)^n}$	R = 18% $\frac{1}{(1+R)^n}$	R = 18% $\frac{CF_n}{(1+R)^n}$	R = 20% $\frac{1}{(1+R)^n}$	R = 20% $\frac{CF_n}{(1+R)^n}$
1	5000	.909	4,545	.847	4,235	.833	4,165
2	6000	.826	4,956	.718	4.308	.694	4,164
3	4000	.751	3,004	.609	2,436	.579	2,316
4	4000	.683	2,732	.516	2,064	.482	1,928
5	6000	.621	3,726	.437	2,622	.402	2,412
6	4000	.564	2,256	.370	1,480	.335	1,340
TOTAL	29000		21,219		17,145		16,325

From the table above, if R = .10 the present value is 21,219. Since this is greater than 16,000, we know R should be greater. For R = .18 the present value is 17,145, and for R = .20 the present value is 16,325. Therefore the rate of return is slightly more than 20%. The computer makes basically the same calaulation, but much faster and more accurately.

CALCULATION OF RATE OF RETURN

(Revised to Discount Replacement Capital)

For Blasthole Stoping of 13,780,000 tons at 1.84% CU

			* DISCOUNTED AT 17.58%	
YEAR	CASHFLOW	CAPITAL	CASHFLOW	CAPITAL
1970	2967274	15000002	2523479	15000002
1971	3006791	0	2174640	0
1972	3044413	0	1872535	0
1973	3228753	0	1688897	0
1974	3194873	0	1421229	0
1975	3144886	0	1189755	0
1976	3144886	0	1011812	0
1977	3218473	1051250	880616	338221
1978	3144886	0	731786	0
1979	3144886	0	622338	0
1980	3144886	0	529259	0
1981	3144886	0	450101	0
1982	1986476	0	241786	0
TOTAL	39516352	16051250	15338218	15338218

Rate of Return = 17.58 %

* Capital is discounted from beginning of year

Cashflow is discounted for year end

MINING COST	2.75
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1309500.00
UG/TON	0.10
DIL	0.10
MILL REC	0.92
MINE REC	0.90
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT OF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.60
ROYALTY PERCENT	0.10

CASH FLOW = 39516352.
LOAN REPAYMENT = 16051248.
CASH AVAIL = 23465112.

PRESENT VALUE = 21775268.
CAPITAL INVESTMENT = 16051250.
RATE OF RETURN = 0.1758

MINING COST	2.75
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1309500.00
UG/TON	0.10
DIL	0.10
MILL REC	0.92
MINE REC	0.90
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.60
ROYALTY PERCENT	0.10

CASH FLOW = 43383832.
LOAN REPAYMENT = 16878096.
CASH AVAIL = 26505752.

PRESENT VALUE = 16105376.
CAPITAL INVESTMENT = 16878100.
RATE OF RETURN = 0.1034

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING 61

MINING COST	2.00
MILLING COST	0.75
PLANT	0.25
ADMIN	0.85
CAP/TPD	4000.00
PRE-PRO	1800000.25
WORKING CAP	3465000.00
UG/TON	0.10
DIL	0.12
MILL REC	0.92
MINE REC	0.85
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.05
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	10000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

CASH FLOW = 59909608.
LOAN REPAYMENT = 40000000.
CASH AVAIL = 19909616.

PRESENT VALUE = 41903664.
CAPITAL INVESTMENT = 40000008.
RATE OF RETURN = 0.1144

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING

MINING COST	2.00
MILLING COST	0.75
PLANT	0.25
ADMIN	0.85
CAP/TPD	4000.00
PRE-PRO	1800000.25
WORKING CAP	3465000.00
UG/TON	0.10
OIL	0.12
MILL REC	0.92
MINE REC	0.85
TOTAL TONS	60000008.10
INTEREST	0.07
PCT EQUIP	0.05
LIFE EQUIP	8.00
PCT OF PAY LOAN	1.00
AVG GRADE	0.99
PRICE	0.42
TPD	10,000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

CASH FLOW = -5519327.
LOAN REPAYMENT = 0.
CASH AVAIL = -5519327.

PRESENT VALUE = -2570153.
CAPITAL INVESTMENT = 42873496.
RATE OF RETURN = 0.0000

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

MINING COST	3.25
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1444500.00
UG/TON	0.10
DIL	0.18
MILL REC	0.92
MINE REC	0.87
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.50
ROYALTY PERCENT	0.10

CASH FLOW = 24291324.
LOAN REPAYMENT = 17776624.
CASH AVAIL = 6514706.

PRESENT VALUE = 7555879.
CAPITAL INVESTMENT = 17776648.
RATE OF RETURN = 0.0267

 64

MINING COST	3.25
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1444500.00
UG/TON	0.10
DIL	0.18
MILL REC	0.92
MINE REC	0.87
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.50
ROYALTY PERCENT	0.10

CASH FLOW = 30230980.
LOAN REPAYMENT = 16037742.
CASH AVAIL = 14193248.

PRESENT VALUE = 16088140.
CAPITAL INVESTMENT = 16037750.
RATE OF RETURN = 0.1067

MINING COST	5.25
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	5500.00
PRE-PRO	1800000.25
WORKING CAP	1386000.00
UG/TON	0.15
DIL	0.07
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	2000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

CASH FLOW = -2565135.
LOAN REPAYMENT = 0.
CASH AVAIL = -2565135.

PRESENT VALUE = -1000973.
CAPITAL INVESTMENT = 12149398.
RATE OF RETURN = 0.0000

** LAKESHORE FINANCIAL ANALYSIS ** SQUARE SET

MINING COST	9.00
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	6000.00
PRE-PRO	1800000.25
WORKING CAP	1030500.00
UG/TON	0.20
DIL	0.05
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	6669616.01
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	2.19
PRICE	0.42
TPD	1000.00
RATE	0.10
DILUTION GRADE	0.70
ROYALTY PERCENT	0.10

CASH FLOW = -14159052.
LOAN REPAYMENT = 0.
CASH AVAIL = -14159052.

PRESENT VALUE = -6312930.
CAPITAL INVESTMENT = 6367115.
RATE OF RETURN = 1.0918

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

MINING COST	5.25
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	5500.00
PRE-PRO	1800000.25
WORKING CAP	1386000.00
UG/TON	0.15
DIL	0.07
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	6669616.01
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	2.19
PRICE	0.42
TPD	2000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

CASH FLOW = 12905636.
LOAN REPAYMENT = 11681354.
CASH AVAIL = 1224281.

PRESENT VALUE = 7832989.
CAPITAL INVESTMENT = 11681356.
RATE. OF RETURN = 0.0217

APPENDIX B

MINING COST	2.75
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PROD	1800000.25
WORKING CAP	1309500.00
US/TON	0.10
DIL	0.10
MILL REC	0.92
MINE REC	0.90
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT OF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.60
ROYALTY PERCENT	0.10

** LAKES-ORE FINANCIAL ANALYSIS ** BLASTHOLE STOPING

	TONS	GRADE	IRS ACC	NET S.R.	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
70.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	1049999.	7147194.
71.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	842290.	6939485.
72.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	631815.	6729009.
73.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	418706.	6515900.
74.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	192693.	6289888.
75.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
76.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
77.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
78.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
79.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
80.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
81.	1080000.	1.7272	32485548.	10283638.	1028363.	5238000.	859194.	0.	6097194.
82.	682185.	1.7272	20519596.	6495691.	649569.	3308598.	542712.	0.	3851311.
	13642186.	1.7272	410345920.	129899296.	12989924.	66164536.	10853044.	3135505.	80153104.

** LAKES-ORE FINANCIAL ANALYSIS ** BLASTHOLE STOPING

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	2198080.	0.	0.	2967274.	2967274.	0.
1971.	2315789.	622934.	168192.	3006791.	3006791.	0.
1972.	2526265.	1263132.	341045.	3044413.	3044413.	0.
1973.	2739374.	1369687.	369815.	3228753.	3228753.	0.
1974.	2965386.	1482693.	629707.	3194873.	2752769.	442104.
1975.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1976.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1977.	3158080.	1542545.	798801.	3218473.	1051250.	2167223.
1978.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1979.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1980.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1981.	3158080.	1542545.	872388.	3144886.	0.	3144886.
1982.	1994810.	974353.	551047.	1986476.	0.	1986476.
	36756240.	16510610.	8092938.	39516352.	16051248.	23465112.

PRESENT VALUE = 21775268.
CAPITAL INVESTMENT = 16051250.
RATE OF RETURN = 0.1650

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

71

MINING COST	3.25
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1444500.00
UG/TON	0.10
DIL	0.18
MILL REC	0.92
MINE REC	0.87
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.50
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	CP-COST	DPREC	INTEREST	TOTAL COST
1970.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	1049999.	7624842.
1971.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	914477.	7489320.
1972.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	769469.	7344311.
1973.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	620505.	7195348.
1974.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	469743.	7044585.
1975.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	309852.	6884694.
1976.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	140279.	6715122.
1977.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1978.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1979.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1980.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1981.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1982.	1080000.	1.6355	30761288.	9737806.	973780.	5777999.	796843.	0.	6574842.
1983.	106534.	1.6355	3034380.	960564.	96056.	569958.	78602.	0.	648561.
	14146520.	1.6355	402931072.	127551936.	12755198.	75683872.	10437564.	4274327.	90395792.

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	1139183.	0.	0.	1936026.	1936026.	0.
1971.	1274705.	0.	0.	2071548.	2071548.	0.
1972.	1419714.	327800.	88506.	2128051.	2128051.	0.
1973.	1568677.	784338.	211771.	2153749.	2153749.	0.
1974.	1719440.	859720.	232124.	2284159.	2284159.	0.
1975.	1879331.	939665.	253709.	2422465.	2422465.	0.
1976.	2048903.	1024451.	289315.	2556431.	2003997.	552433.
1977.	2189183.	1094591.	518436.	2467589.	1037750.	1429839.
1978.	2189183.	1094591.	591079.	2394947.	0.	2394947.
1979.	2189183.	1094591.	591079.	2394947.	0.	2394947.
1980.	2189183.	1094591.	591079.	2394947.	0.	2394947.
1981.	2189183.	1094591.	591079.	2394947.	0.	2394947.
1982.	2189183.	1094591.	591079.	2394947.	0.	2394947.
1983.	215947.	107973.	58305.	236244.	0.	236244.
	24400980.	10611494.	4607564.	30230980.	16037742.	14193248.

PRESENT VALUE = 16088140.
CAPITAL INVESTMENT = 16037750.
RATE OF RETURN = 0.1005

** LAKESHORE FINANCIAL ANALYSIS ** BLASTHOLE STOPING

MINING COST	2.75
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1309500.00
UG/TON	0.10
DIL	0.10
MILL REC	0.92
MINE REC	0.90
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.60
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** BLASTHOLE STOPING

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	1049999.	6772835.
1971.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	947995.	6670830.
1972.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	838850.	6561686.
1973.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	722066.	6444901.
1974.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	599285.	6322120.
1975.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	479179.	6202014.
1976.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	351800.	6074636.
1977.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	216709.	5939544.
1978.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	139171.	5862007.
1979.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1980.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1981.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1982.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1983.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1984.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1985.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1986.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1987.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1988.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1989.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1990.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1991.	1080000.	1.4454	27185276.	8605782.	860578.	5238000.	484835.	0.	5722835.
1992.	989963.	1.4454	24918908.	7888339.	788833.	4801321.	444416.	0.	5245737.
	24749964.	1.4454	622993921.	197215328.	19721520.	120037104.	11110788.	5345056.	136493088.

** LAKESHORE FINANCIAL ANALYSIS ** BLASTHOLE STOPING

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	972368.	0.	0.	1457203.	1457203.	0.
1971.	1074373.	0.	0.	1559208.	1559208.	0.
1972.	1183517.	0.	0.	1668352.	1668352.	0.
1973.	1300302.	115280.	31125.	1754011.	1754011.	0.
1974.	1423083.	711541.	192116.	1715802.	1715802.	0.
1975.	1543189.	771594.	208330.	1819694.	1819694.	0.
1976.	1670567.	835283.	225526.	1929876.	1929876.	0.
1977.	1805659.	902829.	243763.	2046730.	2046730.	0.
1978.	1883196.	941598.	293592.	2074439.	1988166.	86272.
1979.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1980.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1981.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1982.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1983.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1984.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1985.	2022368.	1011184.	480305.	2026898.	939050.	1087848.
1986.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1987.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1988.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1989.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1990.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1991.	2022368.	1011184.	546039.	1961164.	0.	1961164.
1992.	1853768.	926884.	500517.	1797667.	0.	1797667.
	41000808.	18350404.	8727748.	43383832.	16878096.	26505752.

PRESENT VALUE = 16105376.
CAPITAL INVESTMENT = 16878100.
RATE OF RETURN = 0.0940

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

MINING COST	5.25
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	5500.00
PRE-PRO	1800000.25
WORKING CAP	1386000.00
UG/TON	0.15
DIL	0.07
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	13780002.02
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.84
PRICE	0.42
TPD	2000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1971.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1972.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1973.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1974.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1975.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1976.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1977.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	769999.	6644451.
1978.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1979.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1980.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1981.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1982.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1983.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1984.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1985.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	810228.	6684680.
1986.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	850457.	6724908.
1987.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	850457.	6724908.
1988.	720000.	1.7392	21807236.	6903307.	690330.	5543999.	330452.	850457.	6724908.
1989.	327355.	1.7392	9914894.	3138662.	313866.	2520639.	150243.	386669.	3057553.
	14007334.	1.7392	424252352.	134301376.	13430140.	107856464.	6428834.	15579856.	129865216.

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	-431474.	0.	0.	-101022.	0.	-101022.
1971.	-431474.	0.	0.	-101022.	0.	-101022.
1972.	-431474.	0.	0.	-101022.	0.	-101022.
1973.	-431474.	0.	0.	-101022.	0.	-101022.
1974.	-431474.	0.	0.	-101022.	0.	-101022.
1975.	-431474.	0.	0.	-101022.	0.	-101022.
1976.	-431474.	0.	0.	-101022.	0.	-101022.
1977.	-431474.	0.	0.	-101022.	0.	-101022.
1978.	-471703.	0.	0.	-141251.	0.	-141251.
1979.	-471703.	0.	0.	-141251.	0.	-141251.
1980.	-471703.	0.	0.	-141251.	0.	-141251.
1981.	-471703.	0.	0.	-141251.	0.	-141251.
1982.	-471703.	0.	0.	-141251.	0.	-141251.
1983.	-471703.	0.	0.	-141251.	0.	-141251.
1984.	-471703.	0.	0.	-141251.	0.	-141251.
1985.	-471703.	0.	0.	-141251.	0.	-141251.
1986.	-511931.	0.	0.	-181479.	0.	-181479.
1987.	-511931.	0.	0.	-181479.	0.	-181479.
1988.	-511931.	0.	0.	-181479.	0.	-181479.
1989.	-232756.	0.	0.	-82512.	0.	-82512.
	-8993972.	0.	0.	-2565135.	0.	-2565135.

PRESENT VALUE = -1000973.
CAPITAL INVESTMENT = 12149398.
RATE OF RETURN = 0.0000

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

MINING COST	5.25
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	5500.00
PRE-PRO	1800000.25
WORKING CAP	1386000.00
UG/TON	0.15
DIL	0.07
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	6669616.01
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	2.19
PRICE	0.42
TPD	2000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	769999.	7012388.
1971.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	695278.	6937666.
1972.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	615325.	6857713.
1973.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	529776.	6772164.
1974.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	438238.	6680627.
1975.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	340293.	6582682.
1976.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	241587.	6483976.
1977.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	138358.	6380746.
1978.	720000.	2.0663	25908536.	8201616.	820161.	5543999.	698389.	76573.	6318961.
1979.	299658.	2.0663	10782950.	3413454.	341345.	2307373.	290664.	0.	2598037.
	6779654.	2.0663	243959680.	77227952.	7722796.	52203336.	6576169.	3845430.	62624936.

** LAKESHORE FINANCIAL ANALYSIS ** CUT AND FILL

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	369066.	0.	0.	1067456.	1067456.	0.
1971.	443788.	0.	0.	1142178.	1142178.	0.
1972.	523741.	0.	0.	1222131.	1222131.	0.
1973.	609290.	0.	0.	1307680.	1307680.	0.
1974.	700827.	0.	0.	1399217.	1399217.	0.
1975.	798772.	322523.	87081.	1410081.	1410081.	0.
1976.	897478.	448739.	121159.	1474708.	1474708.	0.
1977.	1000708.	500354.	135095.	1564002.	1564002.	0.
1978.	1062493.	531246.	143436.	1617446.	1093901.	523544.
1979.	474071.	237035.	63999.	700736.	0.	700736.
	6880238.	2039899.	550772.	12905636.	11681354.	1224281.

PRESENT VALUE = 7832989.
CAPITAL INVESTMENT = 11681356.
RATE OF RETURN = 0.0202

** LAKESHORE FINANCIAL ANALYSIS ** SQUARE SET

MINING COST	9.00
MILLING COST	1.10
PLANT	0.35
ADMIN	1.00
CAP/TPD	6000.00
PRE-PRO	1800000.25
WORKING CAP	1030500.00
UG/TON	0.20
DIL	0.05
MILL REC	0.92
MINE REC	0.95
TOTAL TONS	6669616.01
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	2.19
PRICE	0.42
TPD	1000.00
RATE	0.10
DILUTION GRADE	0.70
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** SQUARE SET

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1971.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1972.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1973.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1974.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1975.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1976.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1977.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	419999.	4651892.
1978.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1979.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1980.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1981.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1982.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1983.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1984.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1985.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	432849.	4664741.
1986.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	445697.	4677590.
1987.	360000.	2.1190	13284606.	4205380.	420537.	4121999.	109893.	445697.	4677590.
1988.	172931.	2.1190	6381472.	2020121.	202012.	1980067.	52788.	214098.	2246954.
	6652922.	2.1190	245504064.	77716896.	7771685.	76175968.	2030863.	7928275.	86135120.

** LAKESHORE FINANCIAL ANALYSIS ** SQUARE SET

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	-867049.	0.	0.	-757156.	0.	-757156.
1971.	-867049.	0.	0.	-757156.	0.	-757156.
1972.	-867049.	0.	0.	-757156.	0.	-757156.
1973.	-867049.	0.	0.	-757156.	0.	-757156.
1974.	-867049.	0.	0.	-757156.	0.	-757156.
1975.	-867049.	0.	0.	-757156.	0.	-757156.
1976.	-867049.	0.	0.	-757156.	0.	-757156.
1977.	-867049.	0.	0.	-757156.	0.	-757156.
1978.	-879898.	0.	0.	-770005.	0.	-770005.
1979.	-879898.	0.	0.	-770005.	0.	-770005.
1980.	-879898.	0.	0.	-770005.	0.	-770005.
1981.	-879898.	0.	0.	-770005.	0.	-770005.
1982.	-879898.	0.	0.	-770005.	0.	-770005.
1983.	-879898.	0.	0.	-770005.	0.	-770005.
1984.	-879898.	0.	0.	-770005.	0.	-770005.
1985.	-879898.	0.	0.	-770005.	0.	-770005.
1986.	-892747.	0.	0.	-782854.	0.	-782854.
1987.	-892747.	0.	0.	-782854.	0.	-782854.
1988.	-428845.	0.	0.	-376056.	0.	-376056.
	-16189916.	0.	0.	-14159052.	0.	-14159052.

PRESENT VALUE = -6312930.
CAPITAL INVESTMENT = 6367115.
RATE OF RETURN = ~~1.1388~~

MINING COST	2.00
MILLING COST	0.75
PLANT	0.25
ADMIN	0.85
CAP/TPD	4000.00
PRE-PRO	1800000.25
WORKING CAP	3465000.00
UG/TON	0.10
DIL	0.12
MILL REC	0.92
MINE REC	0.85
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.05
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	10000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	2799999.	21236216.
1971.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	2218048.	20654264.
1972.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	1630861.	20067080.
1973.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	1013437.	19449656.
1974.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	358628.	18794844.
1975.	3600000.	1.3982	87656032.	27748428.	2774842.	13860000.	4576218.	0.	18436216.
1976.	2199991.	1.3982	53567352.	16957304.	1695730.	8469966.	2796566.	0.	11266532.
	23799992.	1.3982	579503361.	183447808.	18344784.	91629920.	30253864.	8020974.	129904768.

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	3737370.	0.	0.	8313588.	8313588.	0.
1971.	4319323.	1878346.	507153.	8388386.	8388386.	0.
1972.	4906507.	2453253.	662378.	8820346.	8820346.	0.
1973.	5523931.	2761965.	745730.	9354418.	9354418.	0.
1974.	6178743.	3089371.	834130.	9920830.	5123265.	4797565.
1975.	6537371.	3268685.	1714482.	9399106.	0.	9399106.
1976.	3995040.	1997520.	1078660.	5712946.	0.	5712946.
	35198280.	15449140.	5542535.	59909608.	40000000.	19909616.

PRESENT VALUE = 41903664.
CAPITAL INVESTMENT = 40000008.
RATE OF RETURN = 0.1144

MINING COST	2.00
MILLING COST	0.75
PLANT	0.25
ADMIN	0.85
CAP/TPD	4000.00
PRE-PRO	1800000.25
WORKING CAP	3465000.00
UG/TON	0.10
DIL	0.12
MILL REC	0.92
MINE REC	0.85
TOTAL TONS	60000008.10
INTEREST	0.07
PCT EQUIP	0.05
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	0.99
PRICE	0.42
TPD	10000.00
RATE	0.10
DILUTION GRADE	0.30
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING

YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1971.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1972.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1973.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1974.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1975.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1976.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1977.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2799999.	18545732.
1978.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1979.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1980.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1981.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1982.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1983.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1984.	3600000.	0.9160	57429816.	18180004.	1818000.	13860000.	1885734.	2900571.	18646304.
1985.	3119964.	0.9160	49771920.	15755818.	1575581.	12011860.	1634284.	2513799.	16159942.
	57119968.	0.9160	911218561.	288455808.	28845548.	219911584.	29920280.	45217752.	295049728.

** LAKESHORE FINANCIAL ANALYSIS ** BLOCK CAVING

YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	-2183728.	0.	0.	-297993.	0.	-297993.
1971.	-2183728.	0.	0.	-297993.	0.	-297993.
1972.	-2183728.	0.	0.	-297993.	0.	-297993.
1973.	-2183728.	0.	0.	-297993.	0.	-297993.
1974.	-2183728.	0.	0.	-297993.	0.	-297993.
1975.	-2183728.	0.	0.	-297993.	0.	-297993.
1976.	-2183728.	0.	0.	-297993.	0.	-297993.
1977.	-2183728.	0.	0.	-297993.	0.	-297993.
1978.	-2284300.	0.	0.	-398565.	0.	-398565.
1979.	-2284300.	0.	0.	-398565.	0.	-398565.
1980.	-2284300.	0.	0.	-398565.	0.	-398565.
1981.	-2284300.	0.	0.	-398565.	0.	-398565.
1982.	-2284300.	0.	0.	-398565.	0.	-398565.
1983.	-2284300.	0.	0.	-398565.	0.	-398565.
1984.	-2284300.	0.	0.	-398565.	0.	-398565.
1985.	-1979705.	0.	0.	-345421.	0.	-345421.
	-35439592.	0.	0.	-5519327.	0.	-5519327.

PRESENT VALUE = -2570153.
CAPITAL INVESTMENT = 42873496.
RATE OF RETURN = 0.0000

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

MINING COST	3.25
MILLING COST	0.90
PLANT	0.30
ADMIN	0.90
CAP/TPD	5000.00
PRE-PRO	1800000.25
WORKING CAP	1444500.00
UG/TON	0.10
DIL	0.18
MILL REC	0.92
MINE REC	0.87
TOTAL TONS	25000004.04
INTEREST	0.07
PCT EQUIP	0.10
LIFE EQUIP	8.00
PCT CF PAY LOAN	1.00
AVG GRADE	1.53
PRICE	0.42
TPD	3000.00
RATE	0.10
DILUTION GRADE	0.50
ROYALTY PERCENT	0.10

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

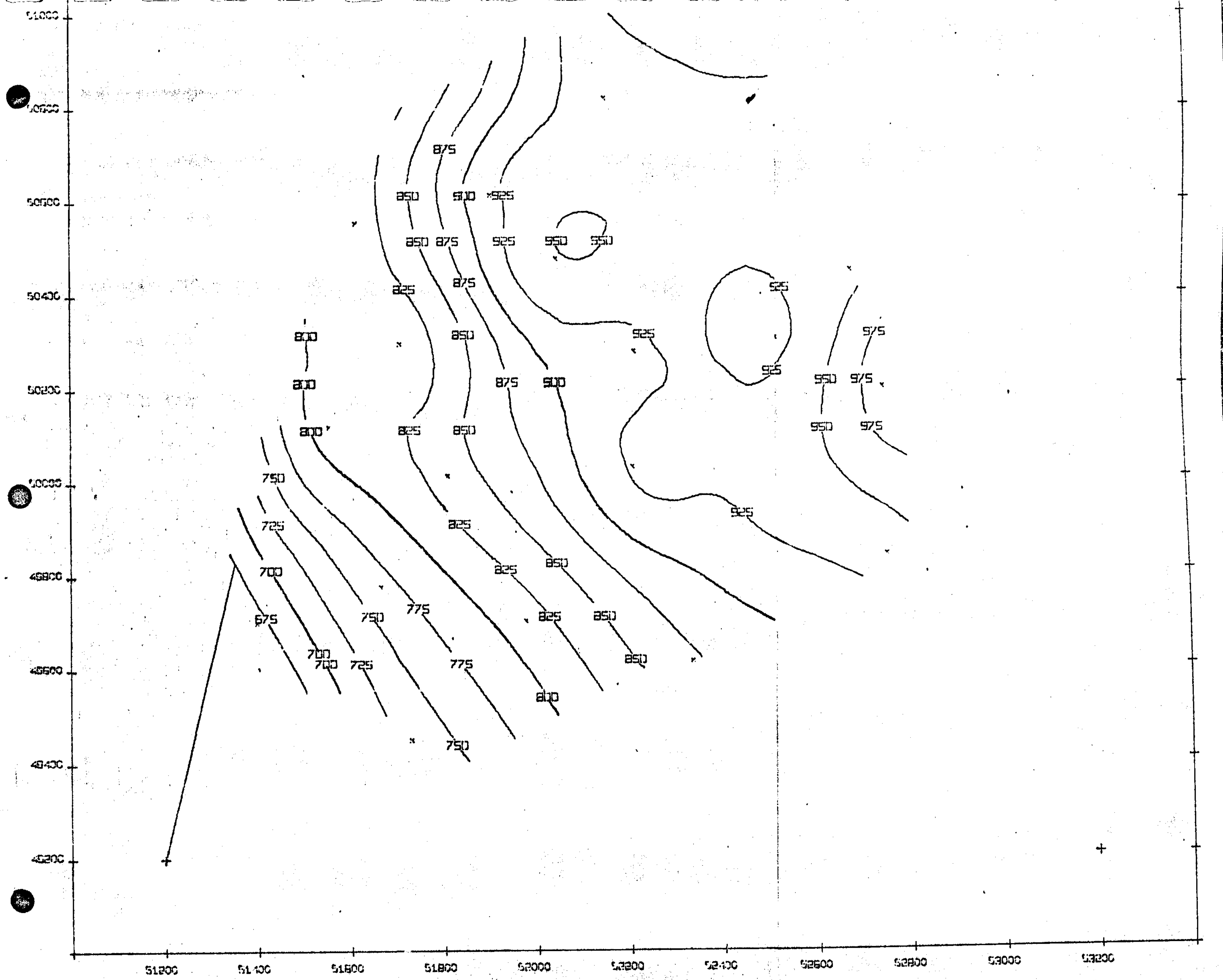
YEAR	TONS	GRADE	IBS ACC	NET SM R	ROYALTY	OP-COST	DPREC	INTEREST	TOTAL COST
1970.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	1049999.	7290773.
1971.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	1013016.	7253790.
1972.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	973444.	7214217.
1973.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	931101.	7171875.
1974.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	885795.	7126569.
1975.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	837317.	7078091.
1976.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	785446.	7026220.
1977.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	729944.	6970717.
1978.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	735345.	6976118.
1979.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	676335.	6917109.
1980.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	613195.	6853969.
1981.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	545636.	6786409.
1982.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	473347.	6714120.
1983.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	395997.	6636771.
1984.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	319583.	6560357.
1985.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	238993.	6479767.
1986.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	218311.	6459085.
1987.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	131588.	6372362.
1988.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	39615.	6280389.
1989.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	0.	6240773.
1990.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	0.	6240773.
1991.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	0.	6240773.
1992.	1080000.	1.3728	25820360.	8173703.	817370.	5777999.	462774.	0.	6240773.
1993.	824961.	1.3728	19722956.	6243506.	624350.	4413541.	353492.	0.	4767032.
	25664912.	1.3728	613590913.	194238528.	19423856.	137307296.	10997300.	11593998.	159898720.

** LAKESHORE FINANCIAL ANALYSIS ** SUB LEVEL CAVING

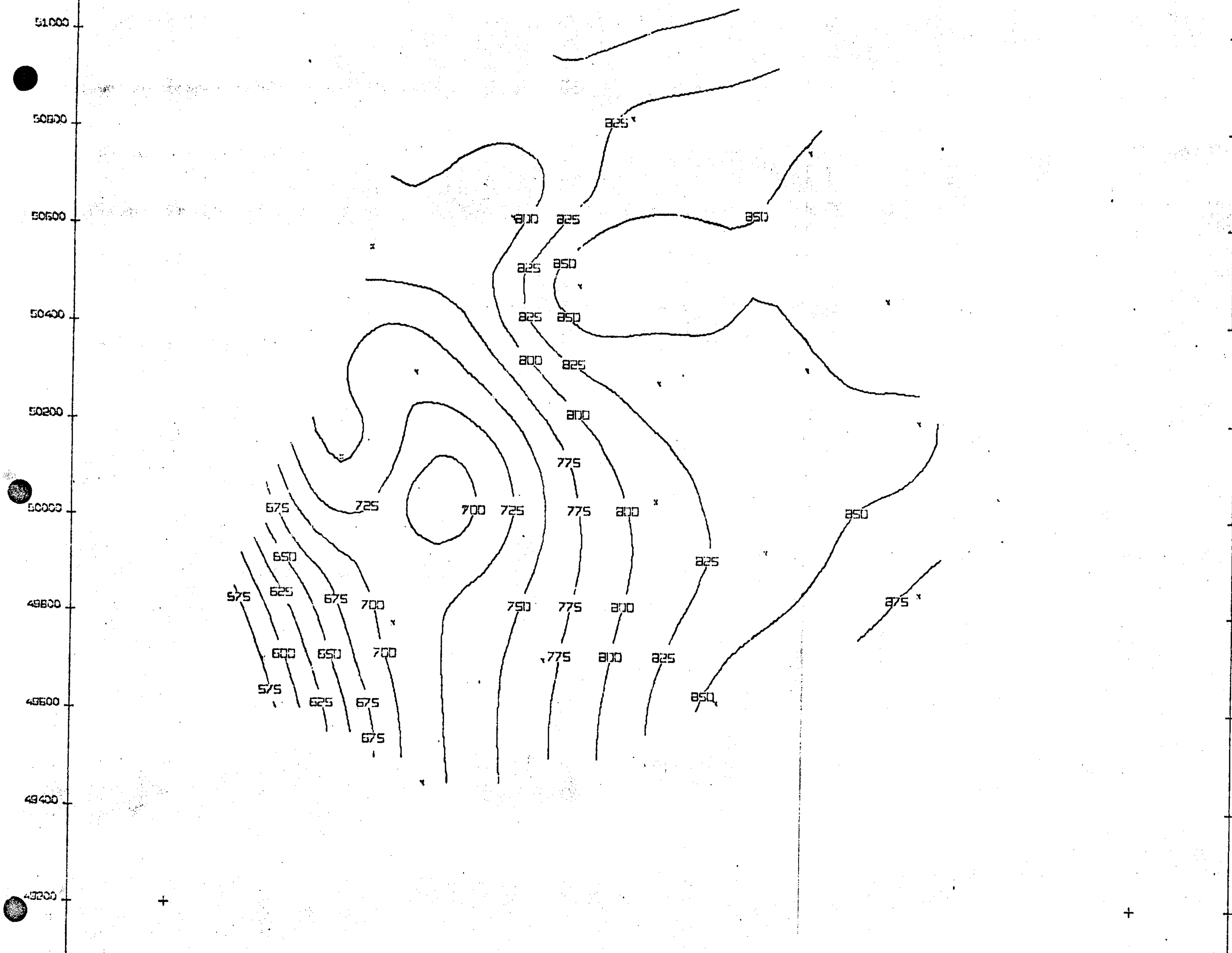
YEAR	OP-MARGIN	DEPLETION	FD-TAX	CASH FLOW	LOAN-PAY	CASH-AVAIL
1970.	65559.	0.	0.	528334.	528334.	0.
1971.	102542.	0.	0.	565317.	565317.	0.
1972.	147115.	0.	0.	604890.	604890.	0.
1973.	184457.	0.	0.	647232.	647232.	0.
1974.	229763.	0.	0.	692538.	692538.	0.
1975.	278241.	0.	0.	741016.	741016.	0.
1976.	330112.	0.	0.	792887.	792887.	0.
1977.	385615.	0.	0.	848390.	848390.	0.
1978.	380214.	0.	0.	842989.	842989.	0.
1979.	439223.	0.	0.	901998.	901998.	0.
1980.	502363.	0.	0.	965138.	965138.	0.
1981.	569924.	0.	0.	1032698.	1032698.	0.
1982.	642213.	0.	0.	1104988.	1104988.	0.
1983.	719562.	335957.	90708.	1091628.	1091628.	0.
1984.	795976.	397988.	107456.	1151294.	1151294.	0.
1985.	876566.	438283.	118336.	1221004.	1221004.	0.
1986.	897248.	448624.	121123.	1238894.	1238894.	0.
1987.	983971.	491985.	132836.	1313909.	1313909.	0.
1988.	1075944.	537972.	145252.	1393466.	565931.	827534.
1989.	1115560.	557780.	150600.	1427734.	0.	1427734.
1990.	1115560.	557780.	150600.	1427734.	0.	1427734.
1991.	1115560.	557780.	150600.	1427734.	0.	1427734.
1992.	1115560.	557780.	289145.	1289189.	0.	1289189.
1993.	852123.	426061.	165284.	1040330.	925550.	114780.
	14915964.	5307988.	1621949.	24291324.	17776624.	6514706.

PRESENT VALUE = 7555879.
CAPITAL INVESTMENT = 17776648.
RATE OF RETURN = 0.0228

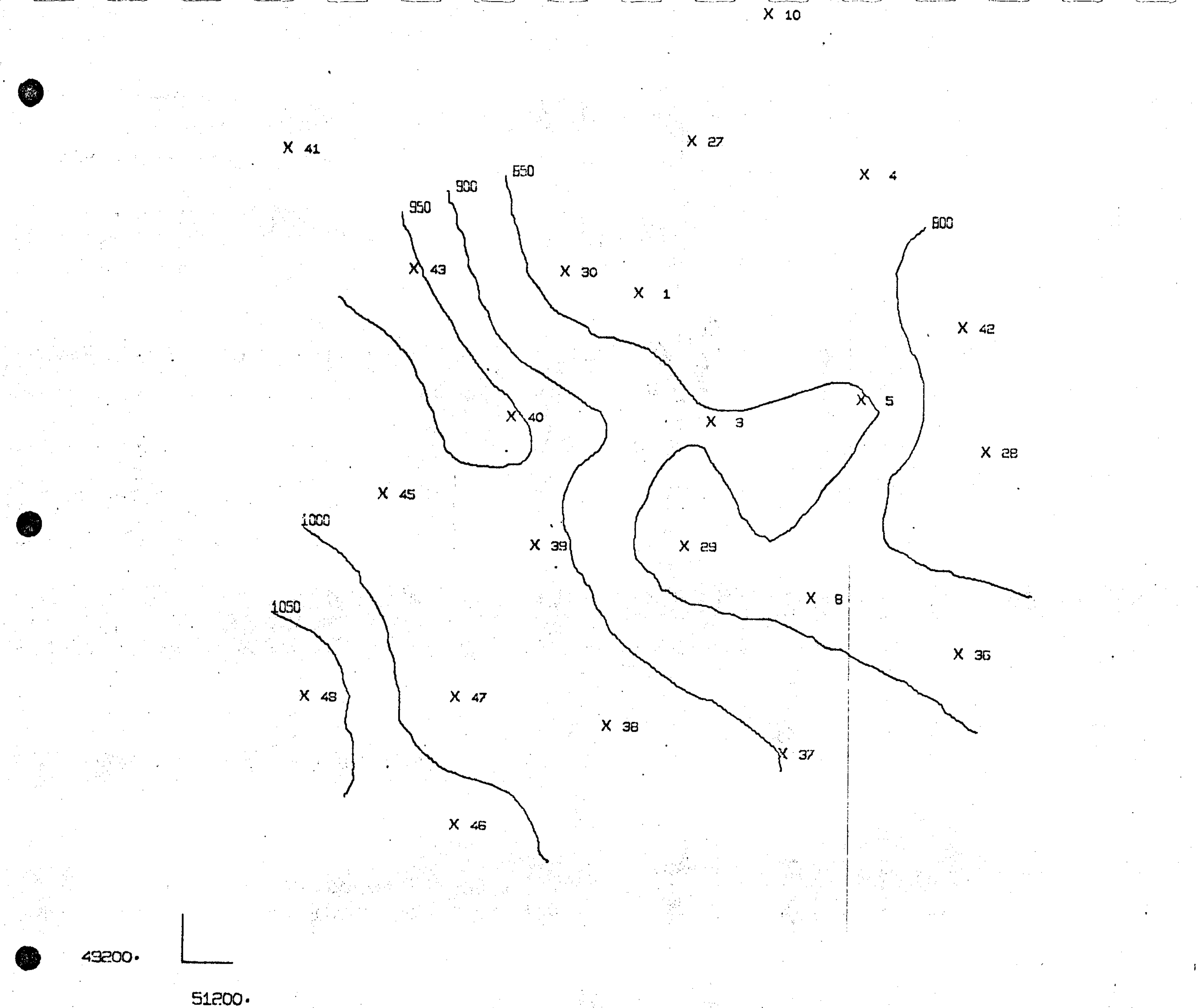
APPENDIX D



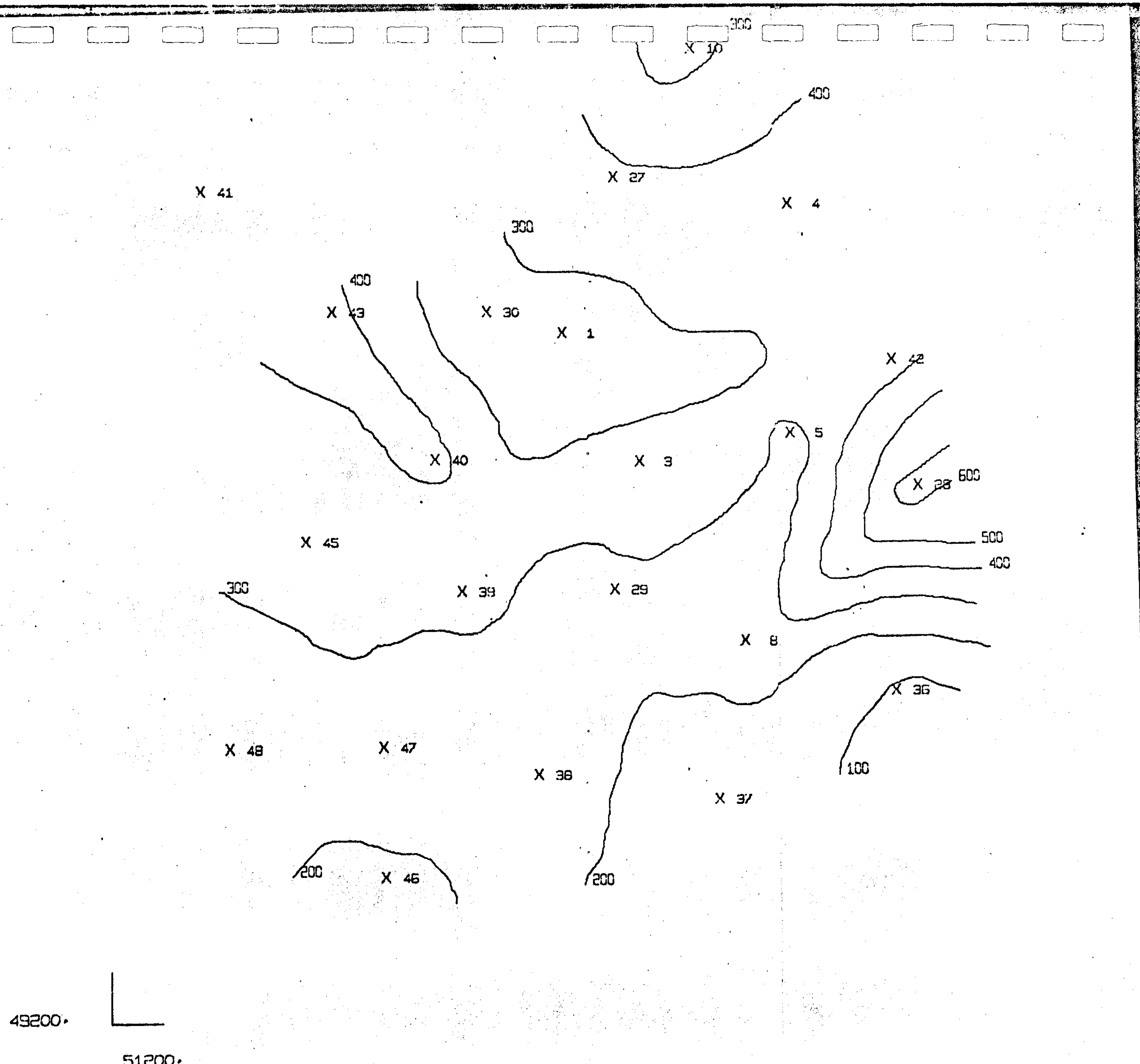
(CONTOURS IN FEET)



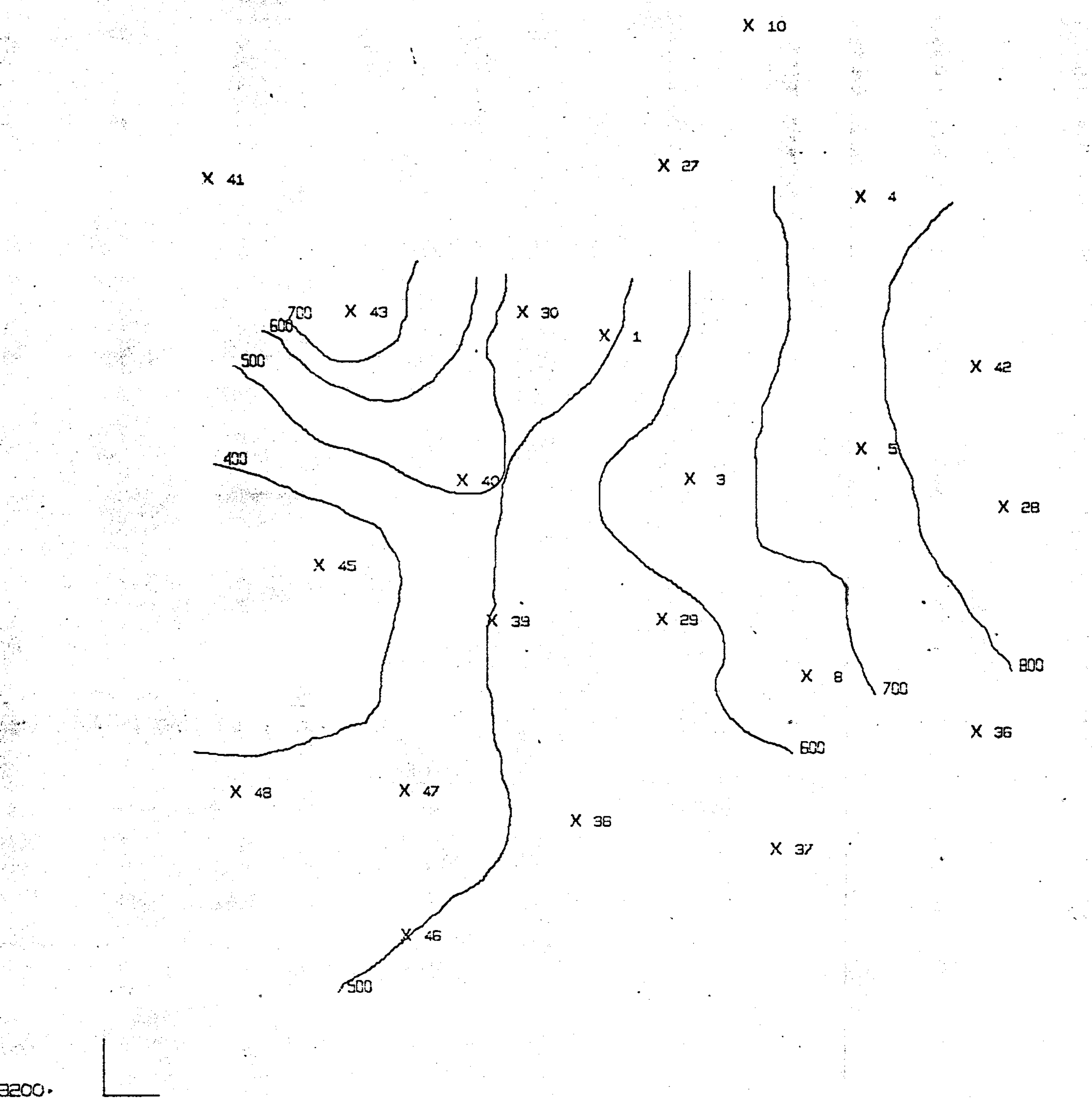
LAKE SHORE TOP OF SULPHIDE 4/11/68 - ELEVATION IN FEET



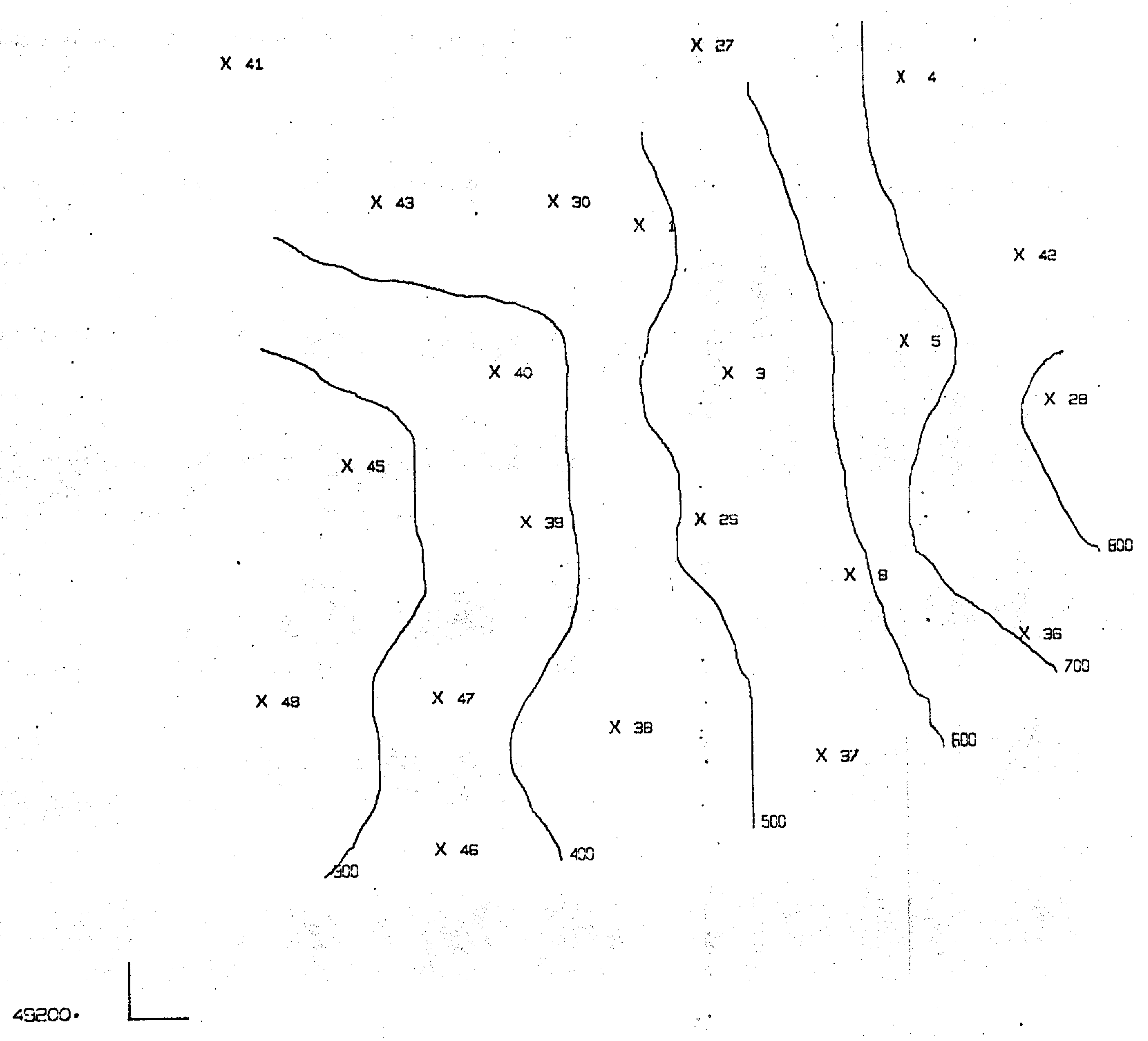
LAKE SHORE OXIDE THICKNESS 4/18/68 (CONTOURS IN FEET)



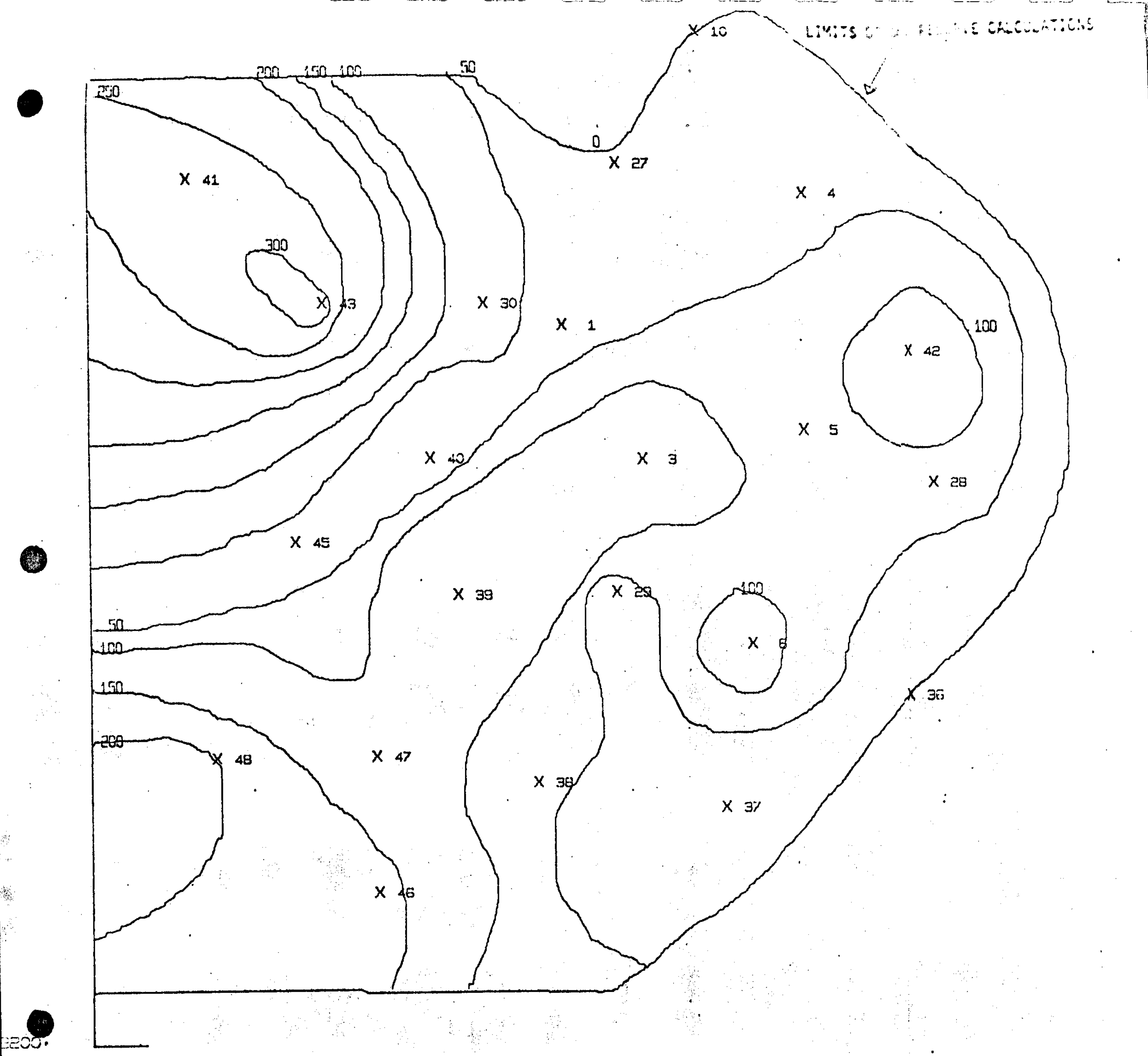
LAKE SHORE GRADE CONTOUR OF OXIDE 4/18/68 (CONTOURS IN .XXX % OX. CU)



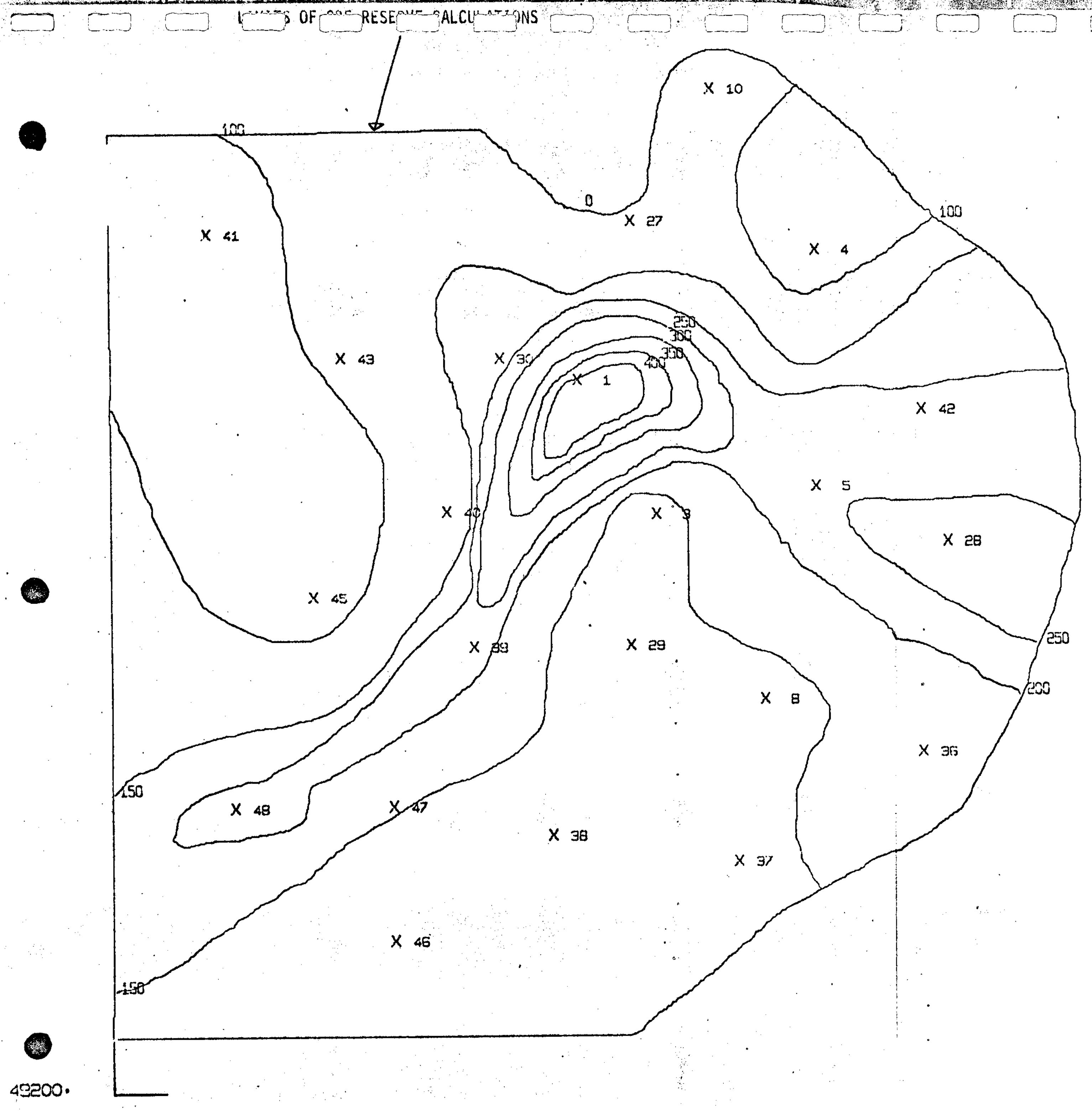
LAKE SHORE TOP ELEVATION OF .75 CU 4/17/68 (SULPHIDE) - CONTOURS IN FEET



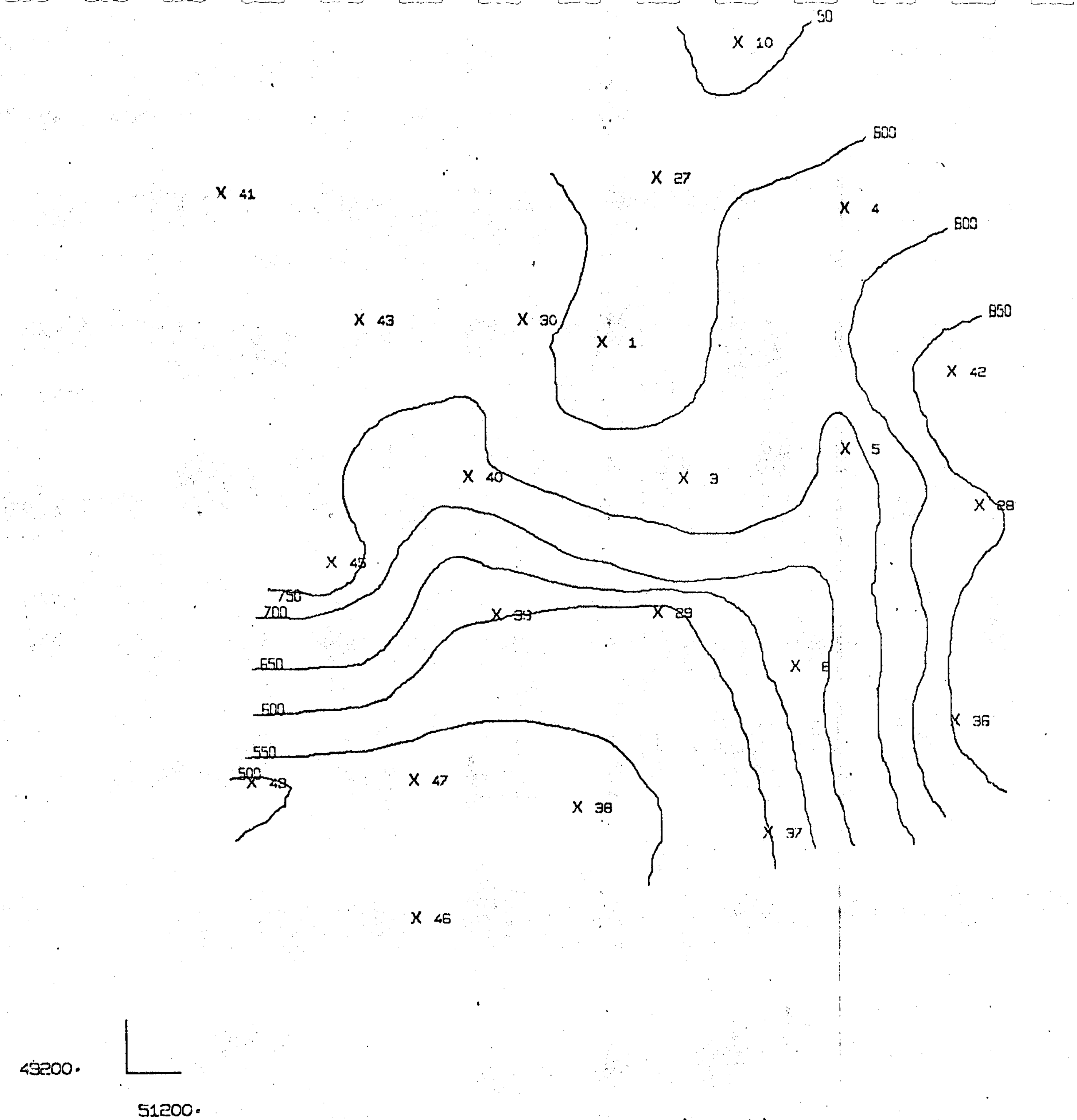
LAKE SHORE BOTTOM ELEVATION OF ·75 CU 4/18/68 (SULPHIDE) - CONTOURS IN FEET



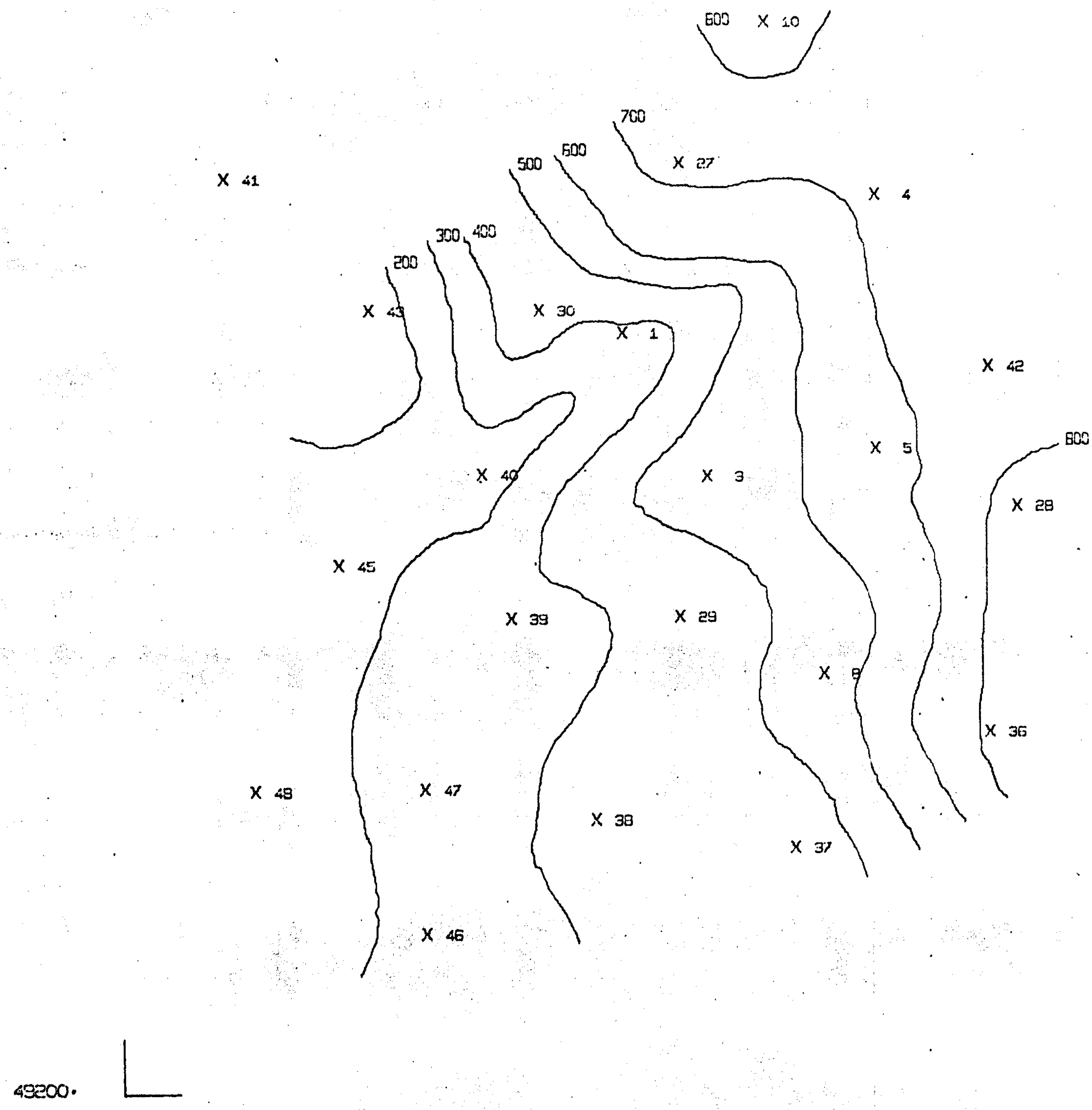
LAKE SHORE THICKNESS OF .75 CU 4/17/68 (SULPHIDE) - CONTOURS IN FEET



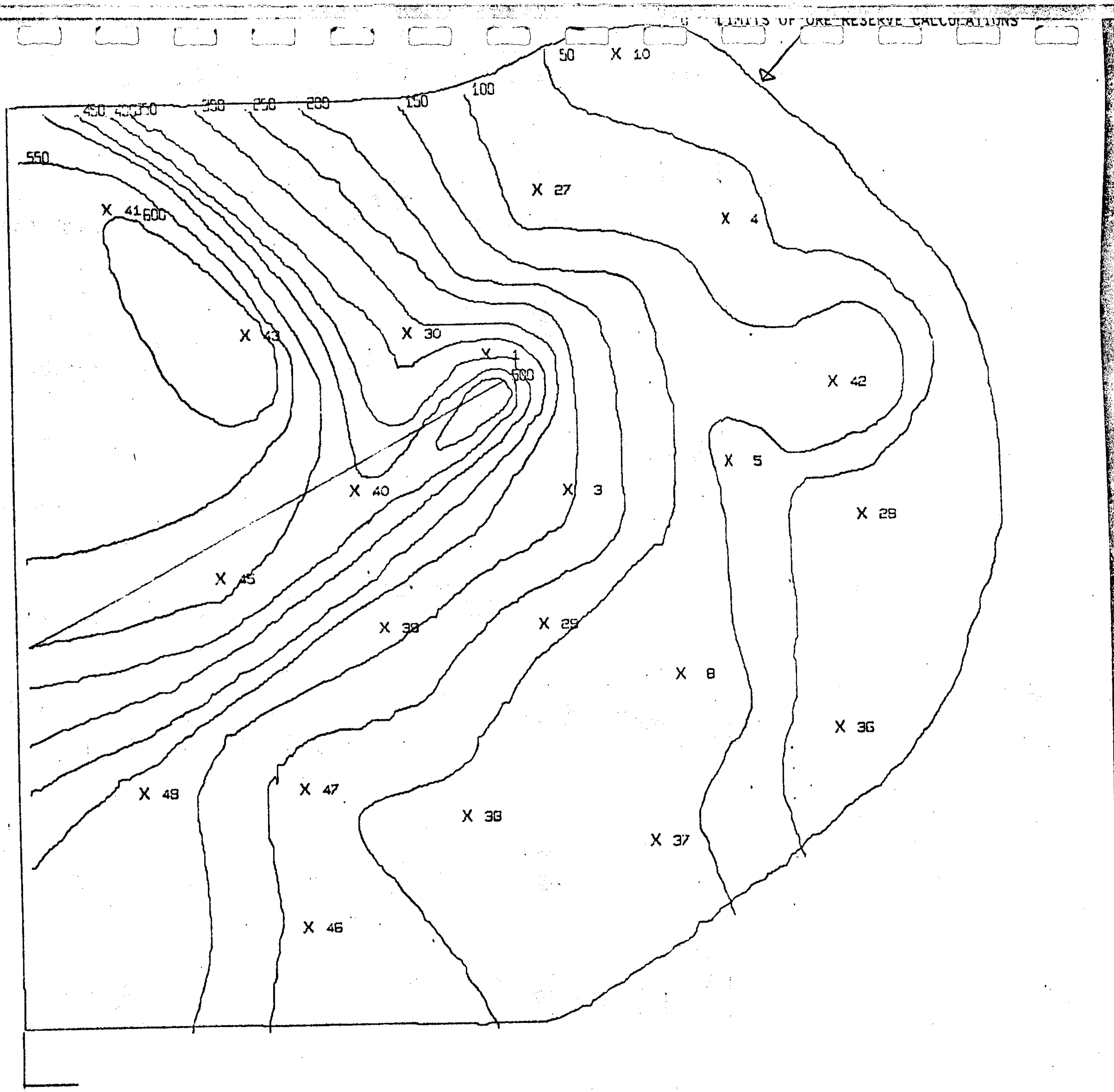
LAKE SHORE GRADE CONTOURS FOR 0.75 CU 4/20/68 (SULPHIDE) - CONTOURS IN X.XX % CU



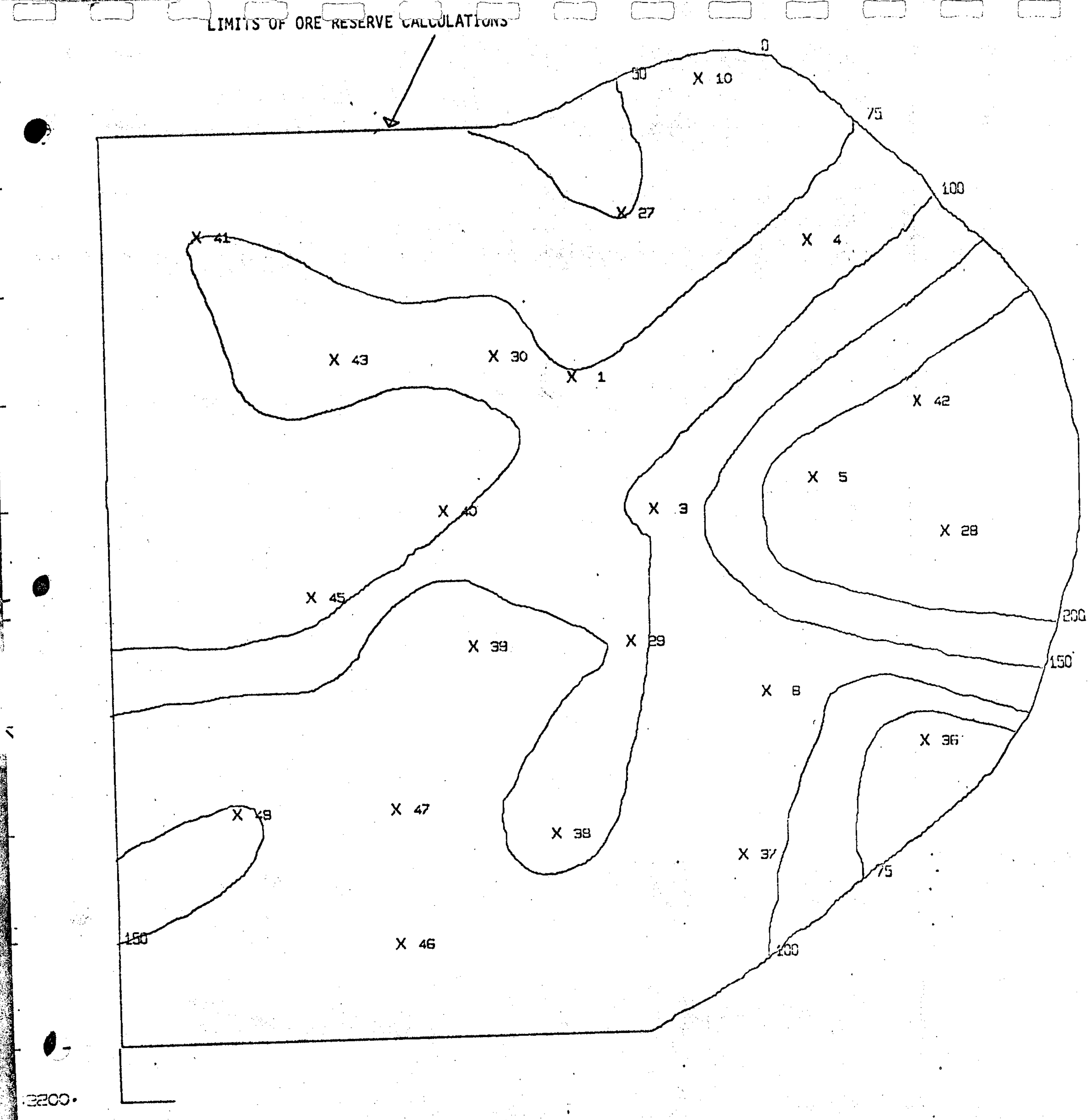
LAKE SHORE TOP OF 0.50 CU 4/20/68 (SULPHIDE) - CONTOURS IN FEET



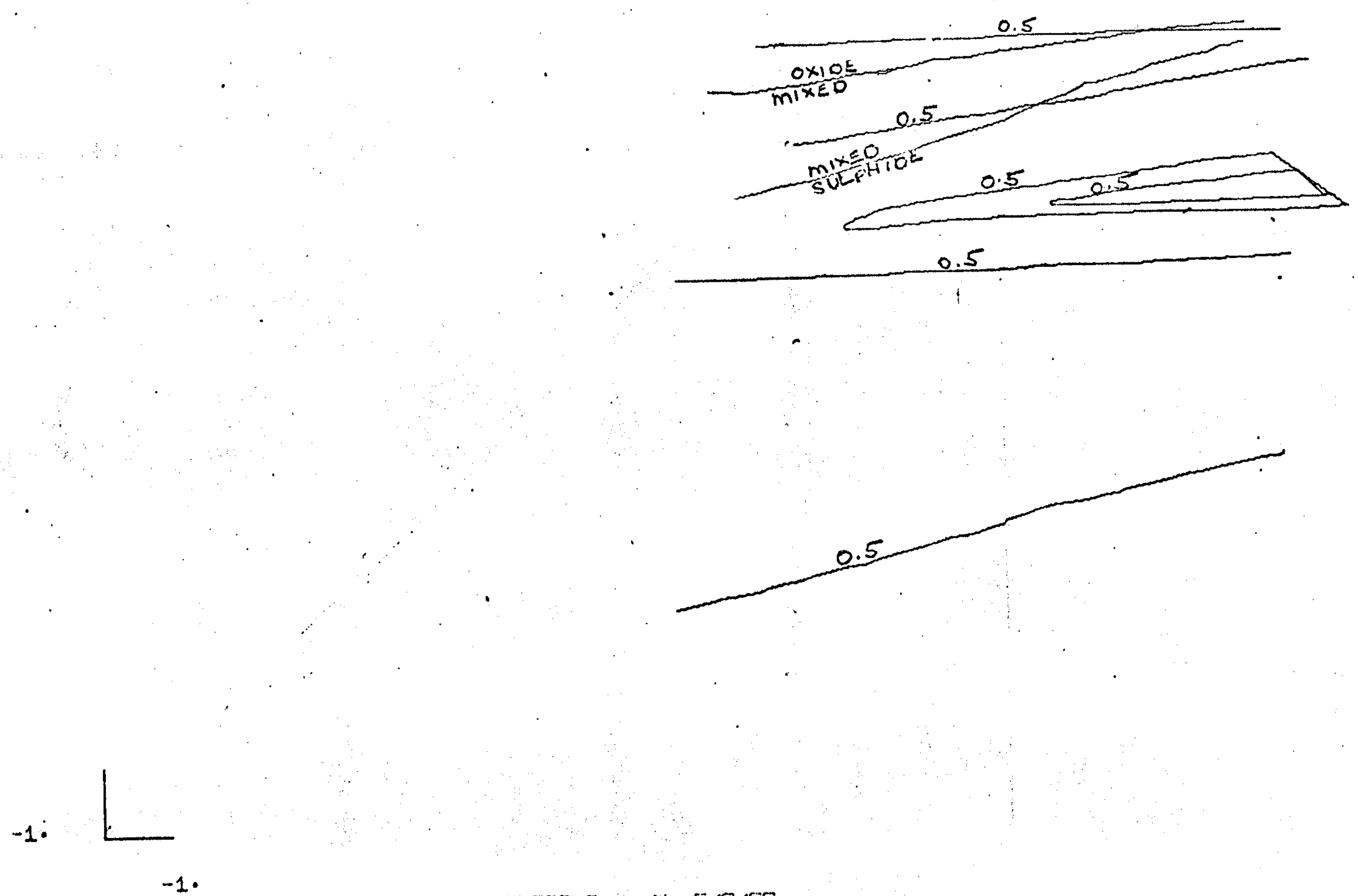
LAKE SHORE BOTTOM OF 0.50 CU 4/20/68 (SULPHIDE) - CONTOURS IN FEET



LAKE SHCRE THICKNESS OF 0.50 CU 4/20/68 (SULPHIDE) - CONTOURS IN FEET

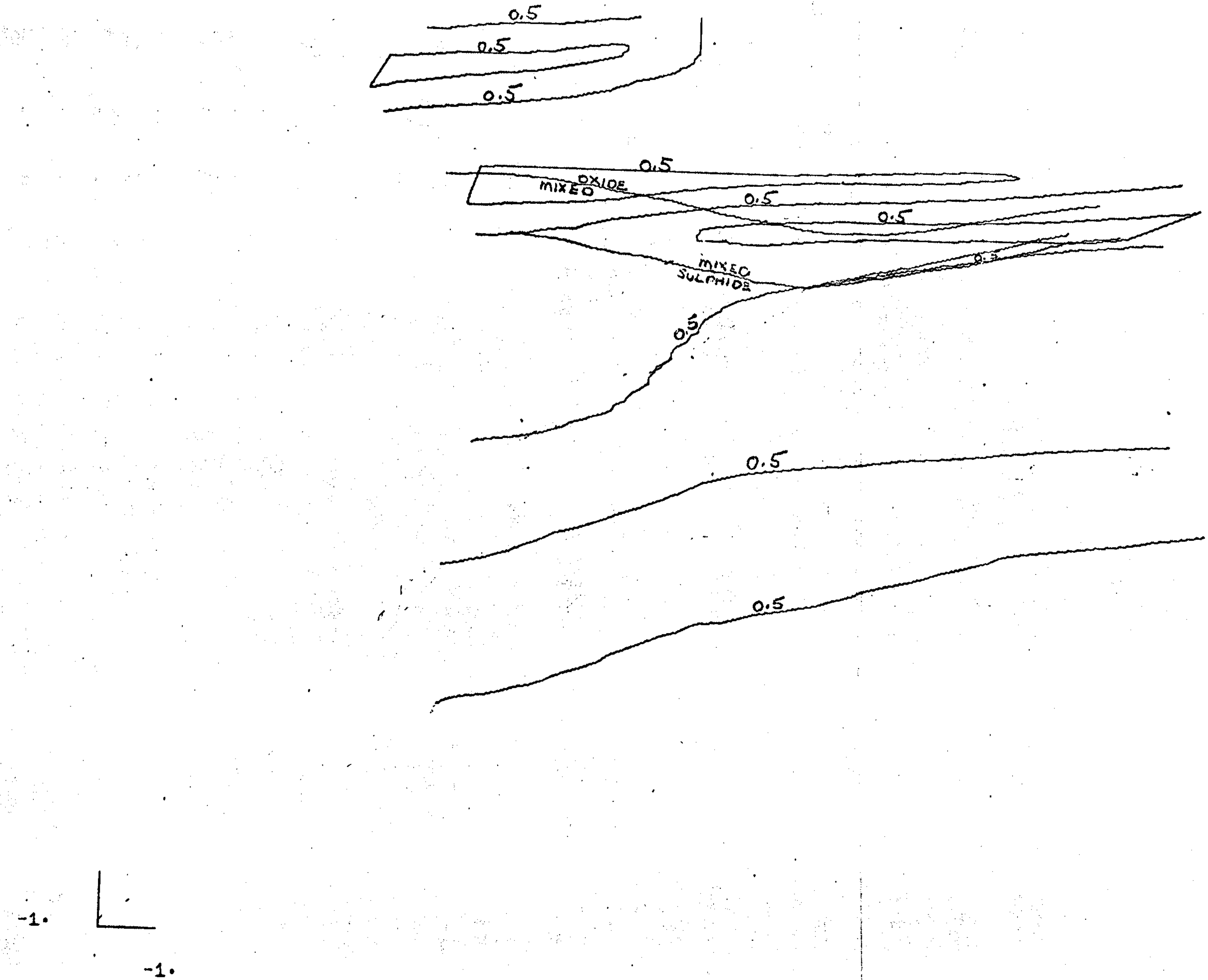


GRADE CONTOURS FOR 0.50 CU 4/20/68 (SULPHIDE) - CONTOURS IN X.XX % CU



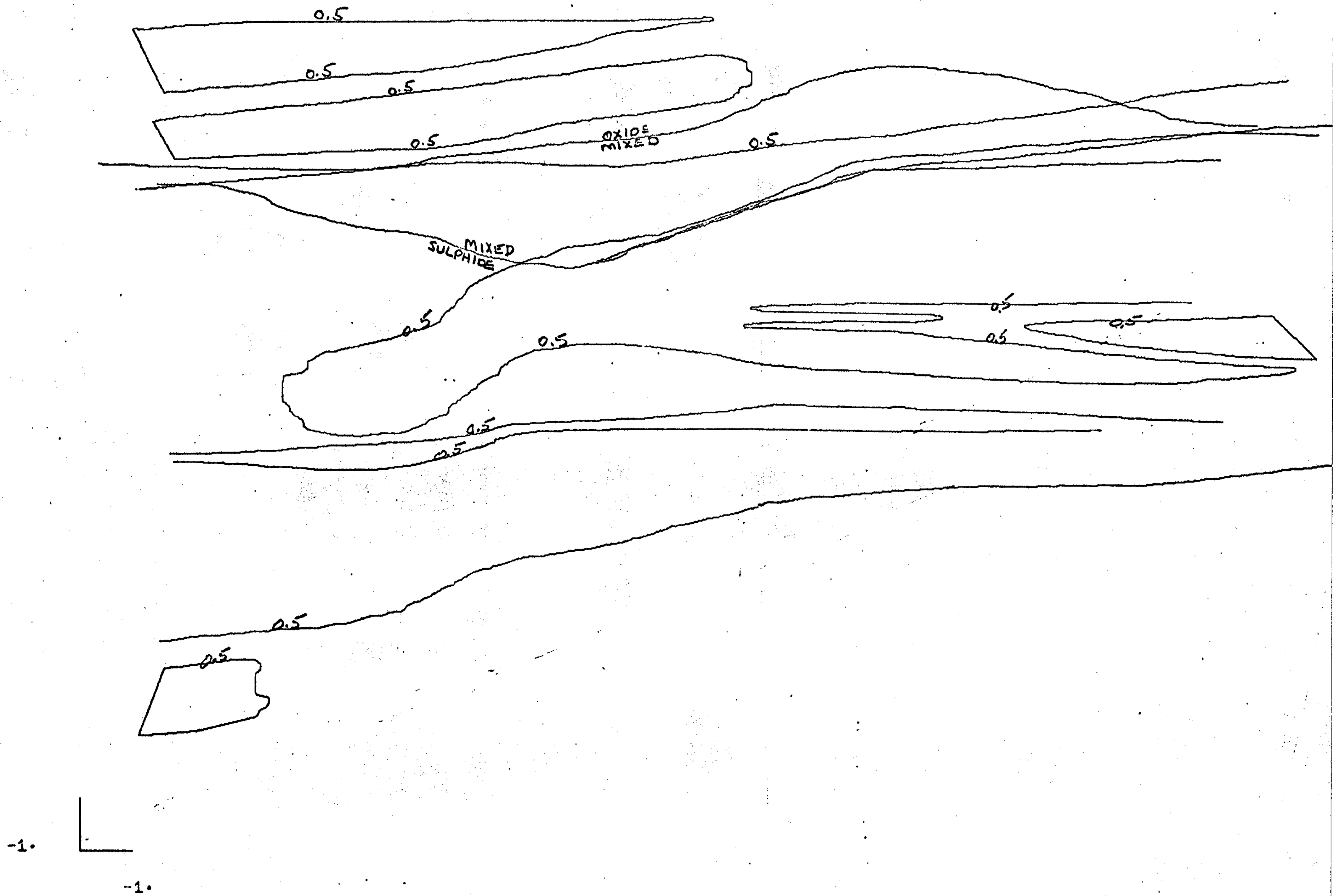
LAKE SHORE CROSS SECTIONS N 5/2/68

100

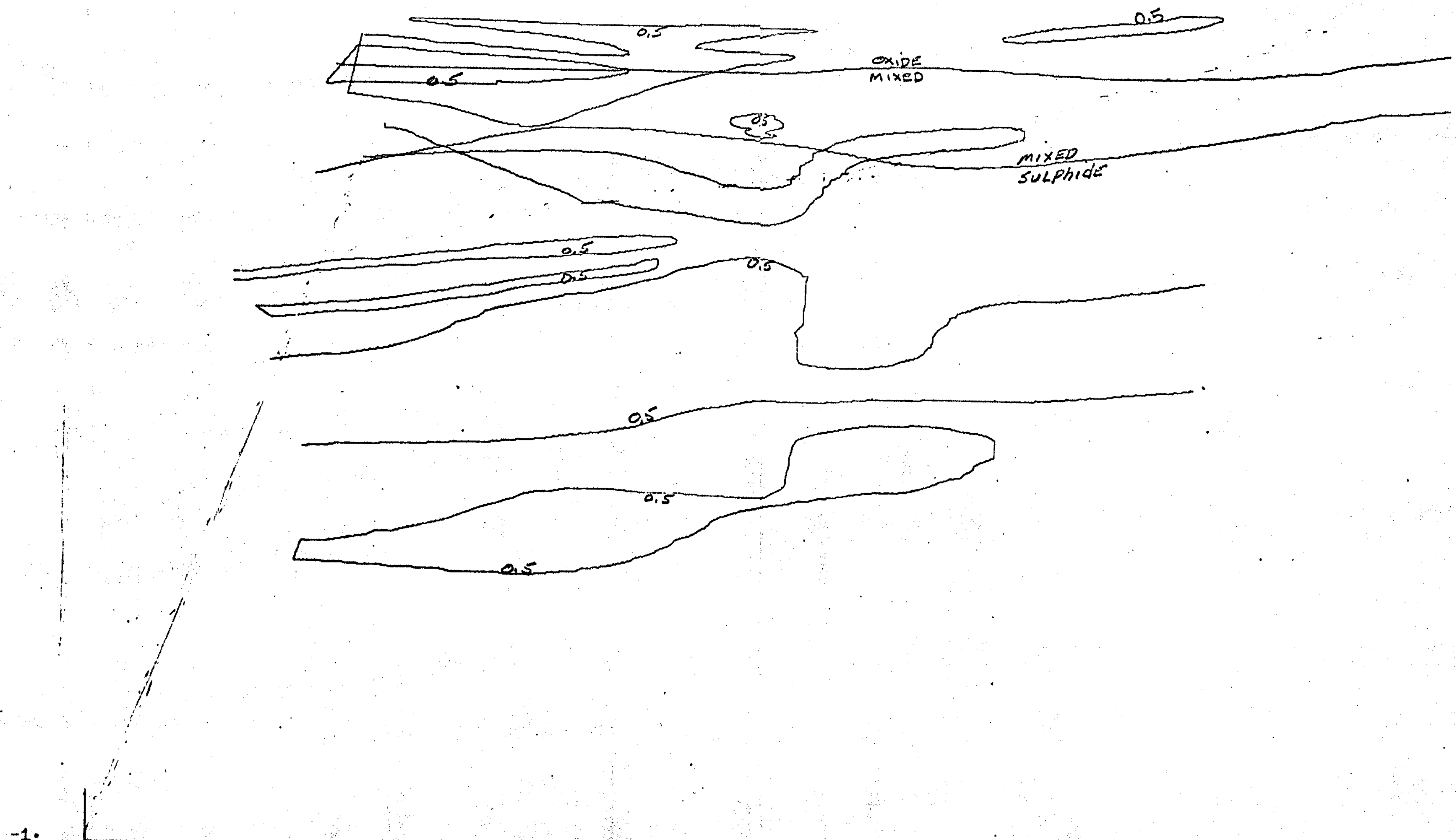


LAKE SHORE CROSS SECTIONS P 5/2/68

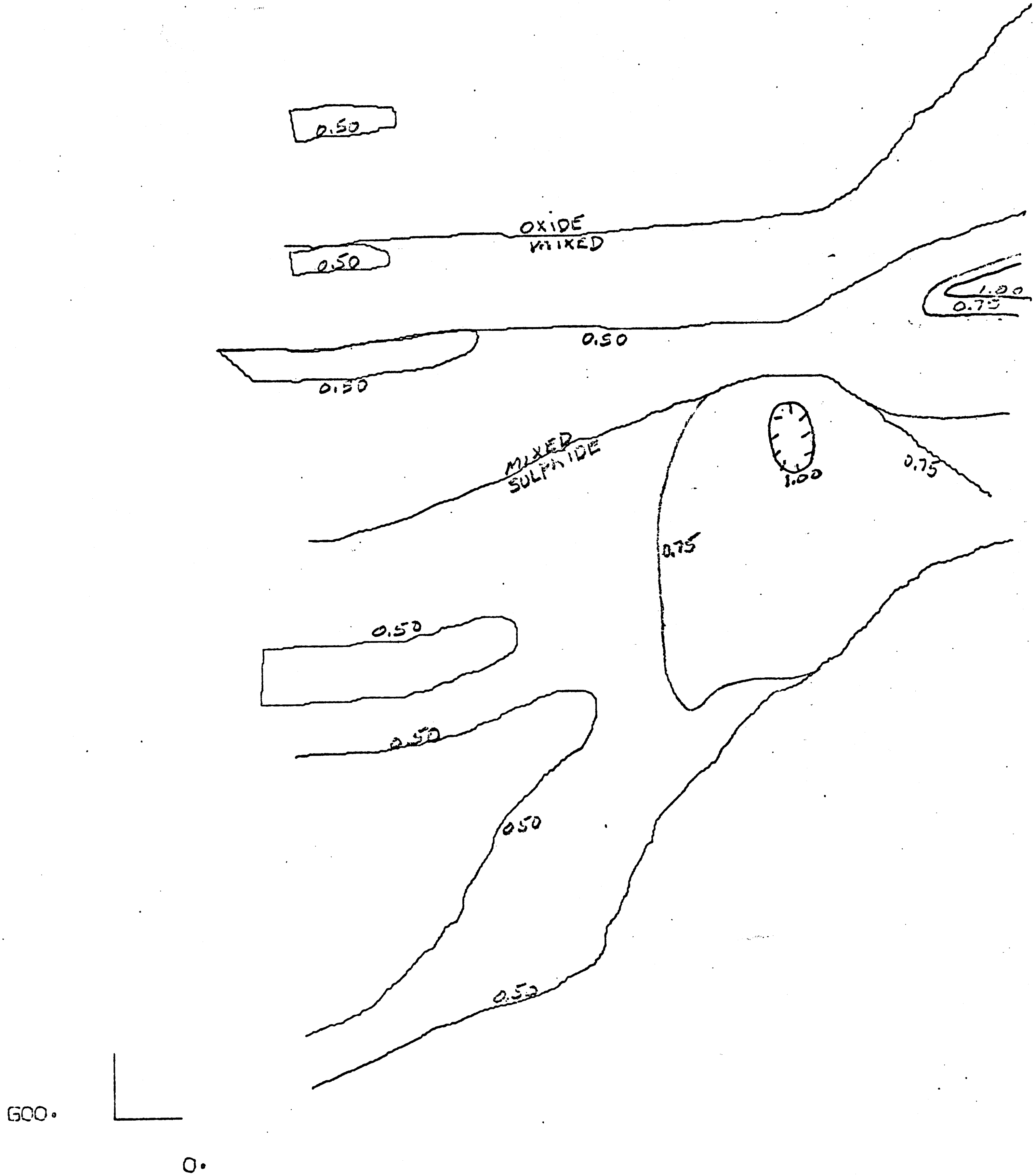
161



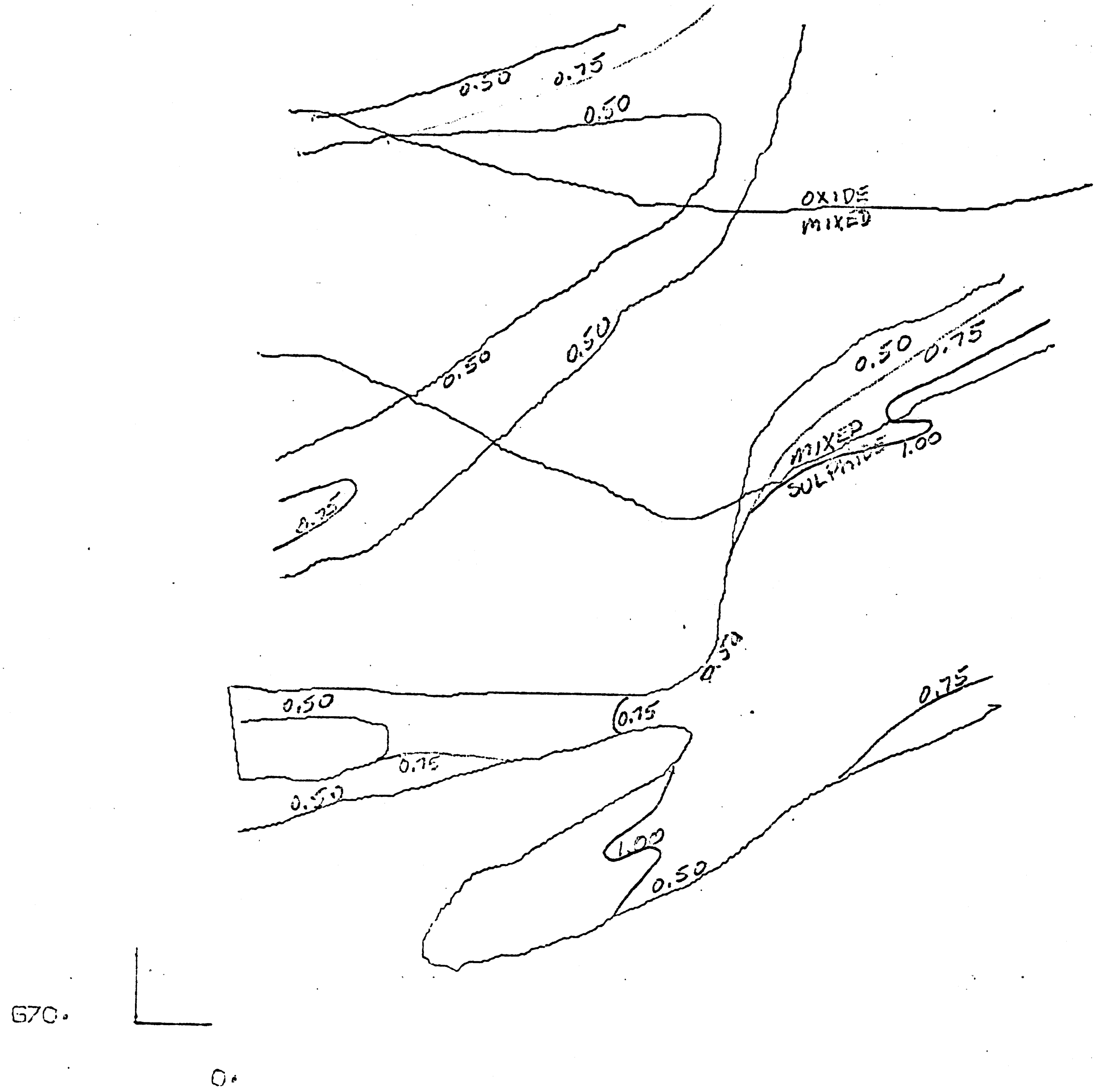
LAKE SHORE CROSS SECTIONS Q 5/2/68



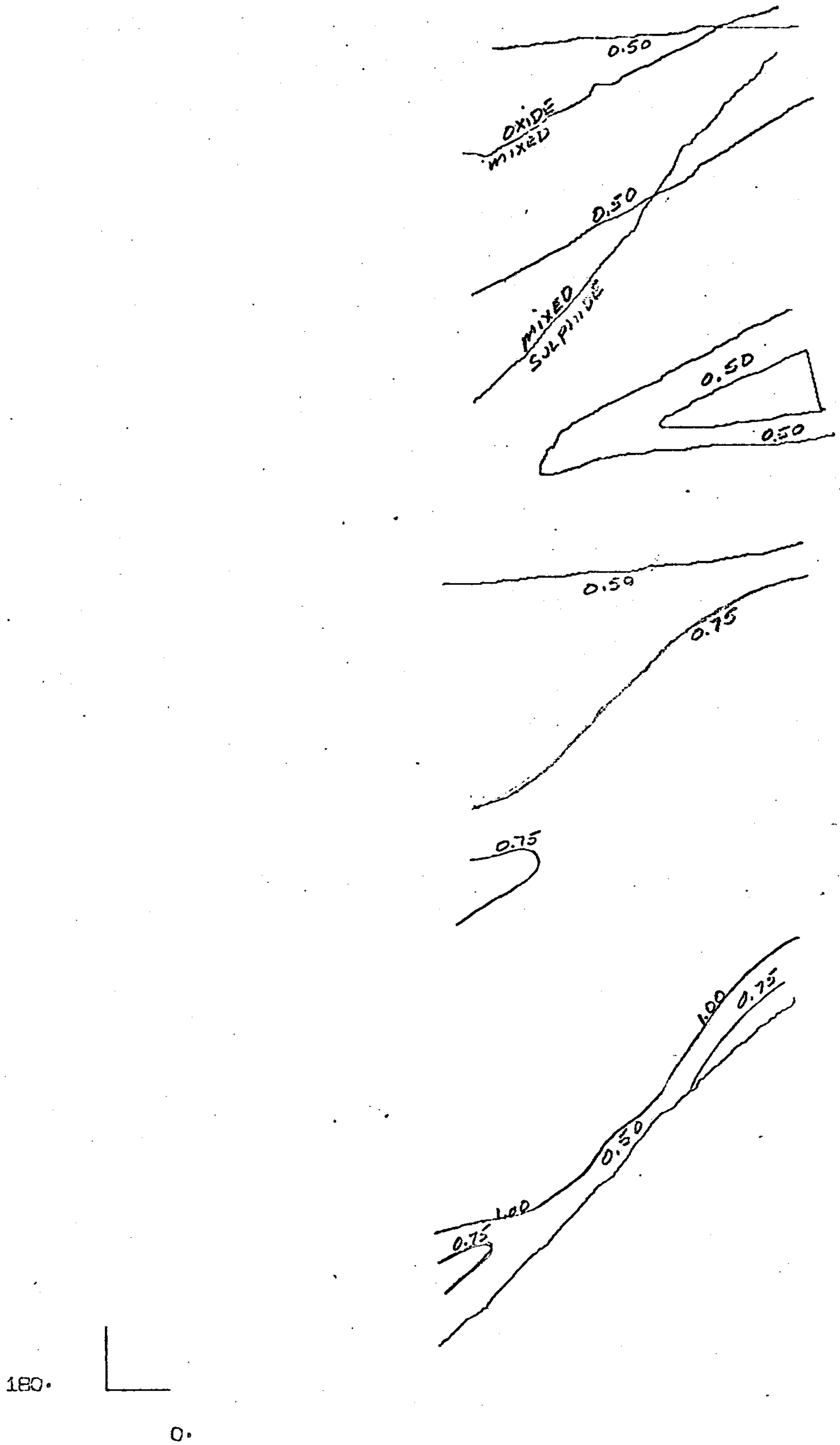
LAKE SHORE CROSS SECTIONS   R 5/2/68



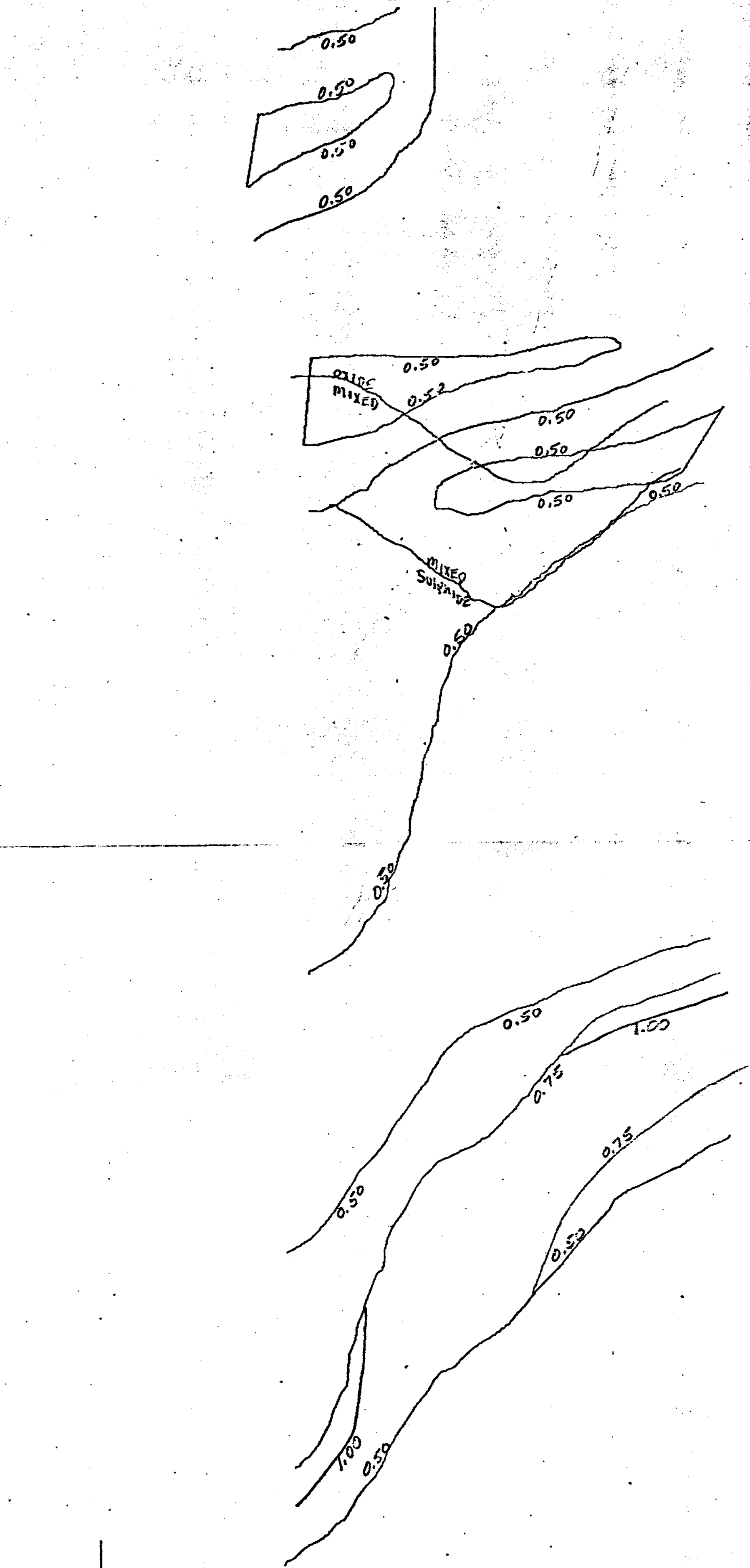
LAKE SHORE CROSS SECTIONS S 5/2/68



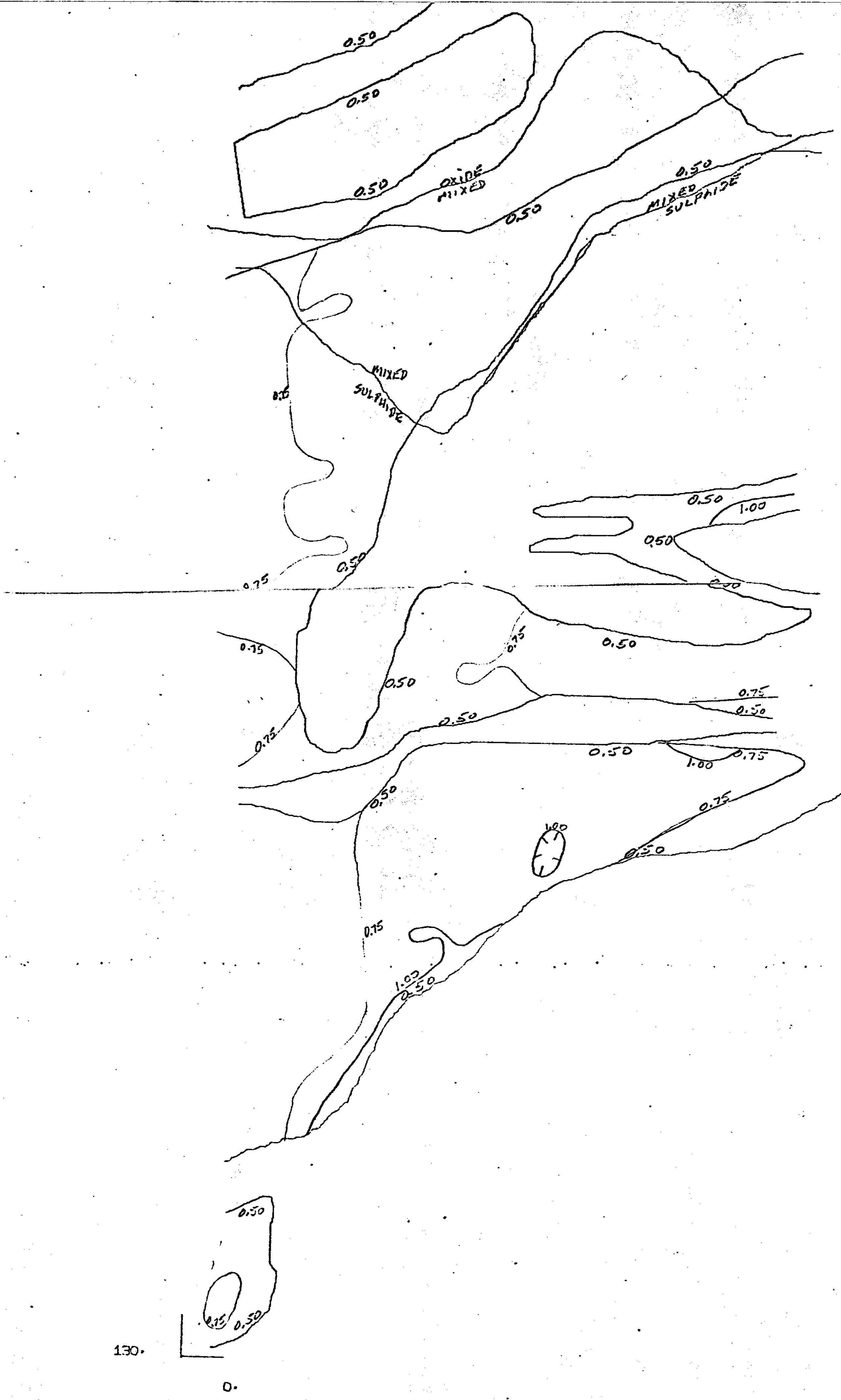
LAKE SHORE CROSS SECTIONS T 5/2/68



LAKE SHORE CROSS SECTIONS N 5/2/68



LAKE SHORE CROSS SECTIONS P 5/2/69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0.50
0.50
OXIDE
MIXED
0.50
0.50
MIXED
SULPHIDE
MIXED
SULPHIDE
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1.00
0.50
0.75
0.50
0.75
0.75
0.50
0.50
0.50
0.75
0.50
0.75
0.50
1.00
0.75
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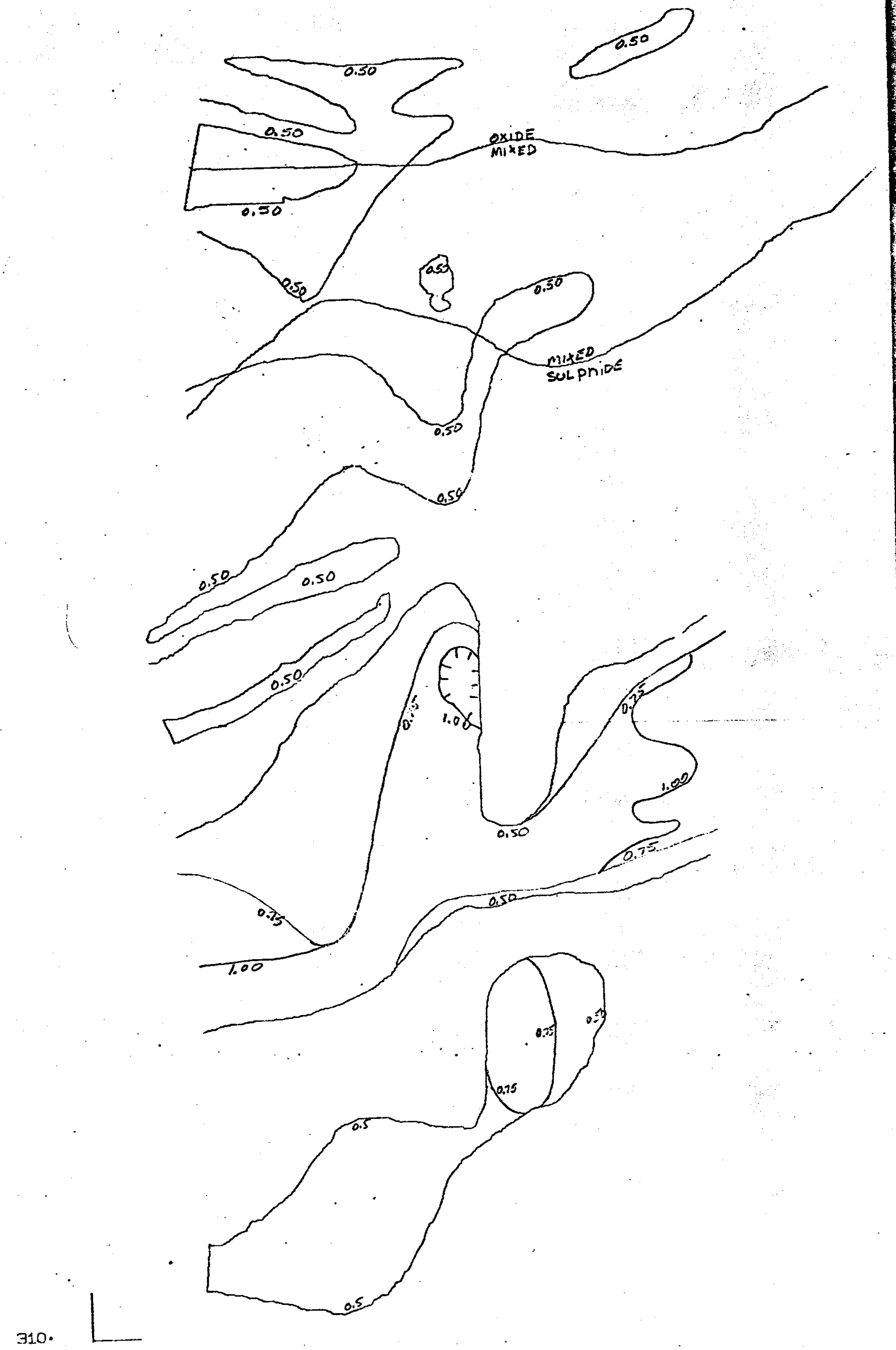
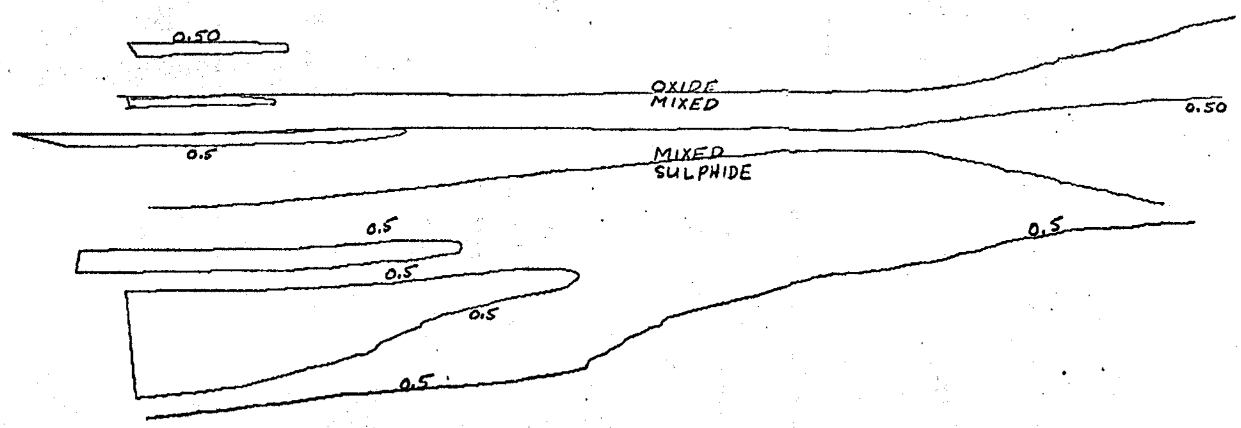
0.50
130.
0.

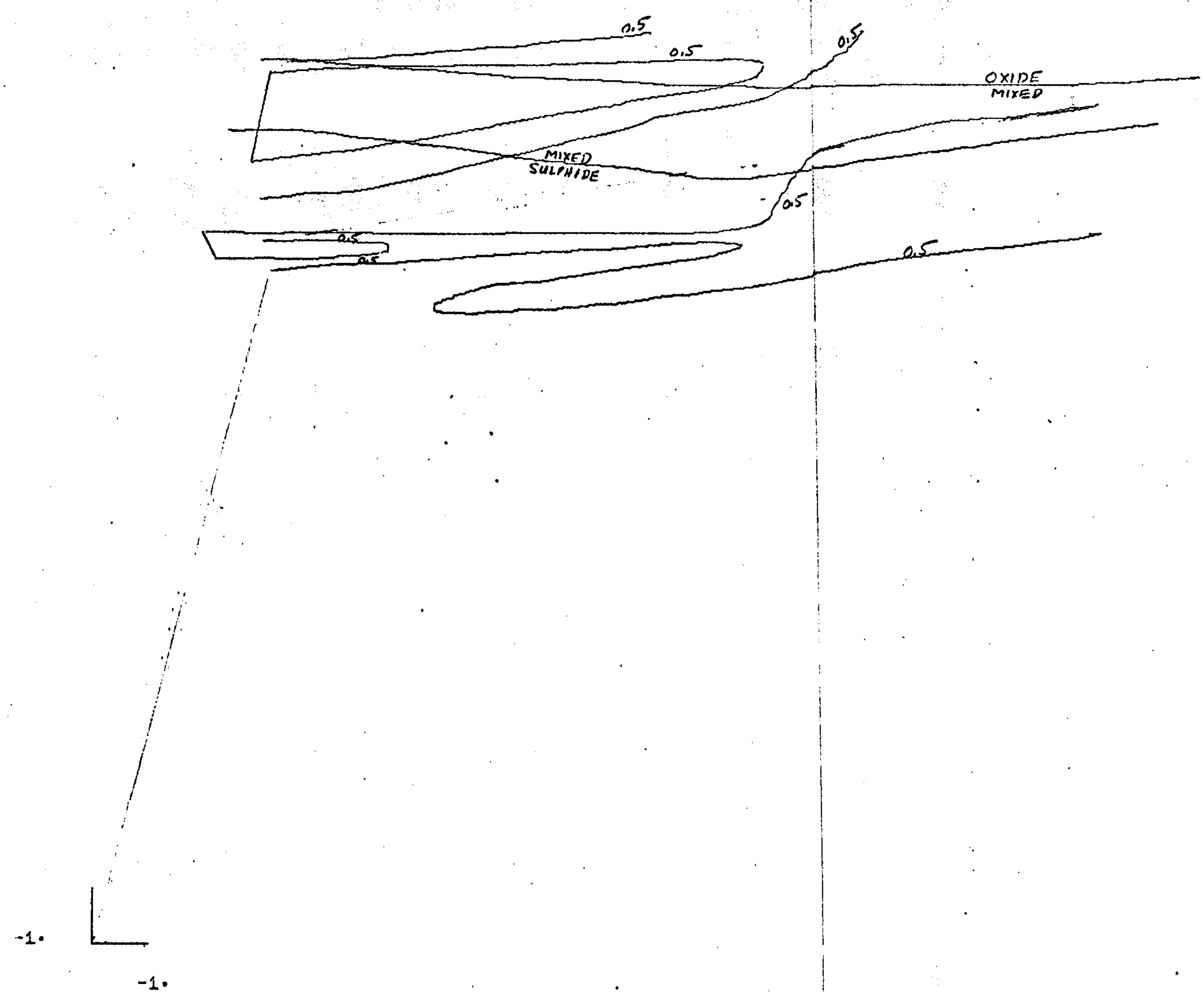


LAKE SHORE CROSS SECTIONS R 5/2/68



-1.

LAKE SHORE CROSS SECTIONS S 5/2/68



LAKE SHORE CROSS SECTIONS T 5/2/68

COMPUTECH RESEARCH, LTD.
Subsidiary of GFI Computer Industries
1019 WEST PRINCE ROAD
TUCSON, ARIZONA 85705
887-2220, AREA CODE 602

September 24, 1968

Mr. C. L. Perkins
El Paso Natural Gas Company
24th Floor
American General Building
2727 Allen Parkway
Houston, Texas

Dear Mr. Perkins:

Enclosed please find the summary of the updated ore reserves for the Lake Shore project.

Mr. John R. Reynolds requested that this summary be sent to you. Twelve copies of the summary with supporting documentation are provided.

Sincerely,

William L. Meyer

William L. Meyer
Systems Development Division

WLM/rcm
Enclosures
Registered Mail, Return Receipt Requested
Special Delivery

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******************************************
*                                        *
*                                        *
*     EL PASO NATURAL GAS COMPANY        *
*                                        *
*                                        *
*      SUMMARY OF ORE RESERVES           *
*                                        *
*                FOR                     *
*                                        *
*        LAKE SHORE PROJECT              *
*                                        *
*        SEPTEMBER 22, 1968              *
*                                        *
*                                        *
*                                        *
*            PREPARED BY                 *
*                                        *
*        SYSTEMS DEVELOPMENT             *
*                                        *
*            DIVISION OF                 *
*                                        *
*     COMPUTECH RESEARCH, LTD.           *
*                                        *
*          TUCSON, ARIZONA               *
*                                        *
*                                        *
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September 24, 1968

NOTES ON THE LAKE SHORE SUMMARY OF ORE RESERVES:

1. The computer analysis was performed on all data received through Tuesday, September 17, 1968.

2. 'PROVEN ORE' is defined as that material totally within the boundary of the actual drilling.

3. 'PROBABLE ORE' is defined as that material outside the immediate boundary of the drilling, within a distance consistent with established valuation practices.

4. The top of the porphyry zone was taken as the bottom of the mixed oxide-sulfide zone, as specified on the geologic summary sheets received from Claude Barren. Some difference of opinion exists as to the actual top of the porphyry zone, which could add a considerable tonnage to that shown under Item 1 on the summary.

5. Tactite reserves are included within the porphyry reserves shown under Item 1 on the summary.

William L. Meyer

William L. Meyer
Director
Systems Development Division

WLM/rcm

LAKE SHORE PROJECT SUMMARY OF ORE RESERVES AS OF SEPT. 22, 1968.

1. PORPHYRY RESERVES FOR ORE GREATER THAN 200 FEET THICK
CUT-OFF GRADE FOR PORPHYRY = 0.50

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	0.819	71,231,250
PROBABLE ORE	0.754	14,665,400
TOTAL ORE	0.808	85,896,650

2. TACTITE RESERVES FOR THE ENTIRE ORE BODY
CUT-OFF GRADE = 1.00

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	1.752	16,675,000
PROBABLE ORE	1.967	2,606,400
TOTAL ORE	1.781	19,281,400

3. TACTITE RESERVES OUTSIDE THE PORPHYRY AREA
CUT-OFF GRADE = 1.00

ORE CLASS	GRADE	TONNAGE
PROVEN ORE	1.663	7,894,100
PROBABLE ORE	1.967	2,128,600
TOTAL ORE	1.728	10,022,700

4. OXIDE RESERVES

CUT-OFF GRADE	GRADE	TONNAGE
0.20	0.458	185,280,600
0.75	1.085	21,182,900
1.00	1.400	10,826,700

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +0.20 OXIDE, 9/20/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1285	0.458	185280608.	50.
2	1284	0.458	185261248.	100.
3	1281	0.458	185183744.	150.
4	1271	0.457	184809568.	200.
5	1257	0.456	184157920.	250.
6	1244	0.455	183416256.	300.
7	1227	0.454	182258112.	350.
8	1213	0.453	181162496.	400.
9	1176	0.454	177845824.	450.
10	1137	0.455	173980640.	500.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +0.75 OXIDE, 9/20/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1113	1.085	21182916.	10.
2	966	1.088	20745416.	20.
3	851	1.093	20166044.	30.
4	776	1.096	19639584.	40.
5	705	1.098	18986460.	50.
6	649	1.099	18355000.	60.
7	594	1.103	17616876.	70.
8	532	1.104	16652500.	80.
9	469	1.098	15546042.	90.
10	377	1.078	13726250.	100.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +1.00 OXIDE, 9/20/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	891	1.400	10826668.	10.
2	721	1.405	10324584.	20.
3	593	1.410	9680626.	30.
4	499	1.417	9013958.	40.
5	430	1.423	8377292.	50.
6	363	1.428	7612084.	60.
7	292	1.430	6659584.	70.
8	222	1.431	5569584.	80.
9	178	1.416	4798334.	90.
10	138	1.380	4010208.	100.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +0.50 PORPHYRY, 9/20/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1159	0.860	83948128.	50.
2	1077	0.858	82648752.	100.
3	866	0.834	77033952.	150.
4	706	0.819	71231248.	200.
5	609	0.811	66770416.	250.
6	548	0.803	63310208.	300.
7	472	0.793	58181872.	350.
8	417	0.782	53907288.	400.
9	352	0.768	48180416.	450.
10	310	0.766	44042504.	500.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +0.75 PORPHYRY, 9/20/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1047	1.076	47401456.	50.
2	741	1.043	42141872.	100.
3	513	1.000	36537088.	150.
4	325	0.906	29530416.	200.
5	244	0.875	25876248.	250.
6	213	0.871	24143960.	300.
7	201	0.869	23320416.	350.
8	185	0.866	22078124.	400.
9	172	0.863	20925624.	450.
10	137	0.866	17464168.	500.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +0.75 TACTITE, 9/22/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1146	1.542	22078224.	10.
2	1112	1.544	21950500.	20.
3	1029	1.538	21428964.	30.
4	877	1.518	20119560.	40.
5	793	1.514	19209412.	50.
6	730	1.514	18358916.	60.
7	675	1.512	17432184.	70.
8	596	1.511	16020796.	80.
9	468	1.518	13330448.	90.
10	299	1.519	9381934.	100.

EL PASO NATURAL GAS *LAKE SHORE* RESERVES AT +1.00 TACTITE, 9/22/68.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	1049	1.752	16674946.	10.
2	967	1.755	16349380.	20.
3	831	1.753	15513324.	30.
4	729	1.749	14646966.	40.
5	636	1.745	13616400.	50.
6	528	1.757	12137520.	60.
7	426	1.768	10497848.	70.
8	332	1.781	8755454.	80.
9	214	1.789	6284005.	90.
10	144	1.829	4650099.	100.

EL PASO NATURAL GAS *LAKE SHORE* +1.00 TACTITE OUTSIDE PORPHYRY.

PROVEN RESERVES

I	NO.	AVERAGE	TONNAGE	THICKNESS CUT-OFF
1	517	1.663	7894092.	10.
2	472	1.667	7719168.	20.
3	431	1.671	7468896.	30.
4	394	1.669	7154193.	40.
5	352	1.672	6687140.	50.
6	275	1.697	5632861.	60.
7	211	1.713	4601699.	70.
8	153	1.740	3532221.	80.
9	76	1.683	1918042.	90.
10	31	1.741	864653.	100.

3 copies
Ken for your file
Grover

12/15/69
DBC

El Paso Natural Gas Company

El Paso, Texas 79999

November 28, 1969

HEINRICHS GEOEX
RECEIVED DEC 1969
BOX 5671 TUCSON, ARIZONA 85703
Phone: (AREA 602) 623-0578

Mr. E. Grover Heinrichs
Vice President
Heinrichs Geoexploration Company
P. O. Box 5671
Tucson, Arizona 85703

Dear Mr. Heinrichs:

In answer to your request I am enclosing a copy of the paper on exploration at Lakeshore that I prepared for the annual meeting of the New Mexico Mining Association which was held in El Paso on November 16 - 19, 1969.

Thank you.

Sincerely,

Claude E. Barron

Claude E. Barron
Senior Mining Geologist
Mining Division

CEB:mp

EXPLORATION AT LAKESHORE MINE

Pinal County, Arizona

By

Claude E. Barron
Senior Mining Geologist
El Paso Natural Gas Company

ABSTRACT

As the result of a general reconnaissance of the Slate Mountain area, an interpretation of the geology was made that assumed (1) the oxide tactite ore body in the Lakeshore Pit had been overturned by tilting to the northwest, (2) that these metasediments would be in place underlying the andesite west of the pit and would trend generally northwest parallel to the trend of the Slate Mountains, and (3) that the strong northwest and north-south fault and fracture system which was exposed in the pit would offer channels for migrating mineralized solutions permitting the deposition of sulphides at depth.

A proposed correlation of this interpretation with Induced Polarization anomalies involved an area that extended to the south and northwest of the Lakeshore Pit. This area was recommended for deep drilling to test the weak I. P. anomalies for sulphide mineralization.

Contour maps based on assay and geological data from gyroscopically surveyed drill holes offered control for delineation and computer evaluation of the discovered ore body.

EXPLORATION AT LAKESHORE MINE

Pinal County, Arizona

Claude E. Barron

Senior Mining Geologist

El Paso Natural Gas Company

INTRODUCTION

The Lakeshore mineral deposit outcrops on the southwest piedmont of the Slate Mountains in Section 25, T10S, R4E, Pinal County, Arizona. This location is in the Papago Indian Reservation, approximately 30 miles south of Casa Grande, Arizona.

In the Basin and Range Province of southwest Arizona, the Slate Mountains form an arcing outcrop that trends from northwest to north, and reaches an elevation of 3330 feet at Prieta Peak near the center of the range. The Lakeshore Mine, about 2 miles south of Prieta Peak, is at an elevation of approximately 1800 feet. Vegetation in the valley is of the desert variety, capable of surviving in the hot summer temperature and the few inches of annual precipitation.

PREVIOUS WORK

Rocks in the Slate Mountains were described in an unpublished thesis by Hogue (1) in 1940. The Lakeshore copper deposits were investigated by the U. S. Bureau of Mines (2) in 1950. Precambrian and Paleozoic sedimentary rocks of the area were described by McClymonds (3) in 1959. Geologic maps prepared by the Arizona Bureau of Mines (4) in 1960 show rocks in the Slate Mountain area range in age from Precambrian to Quaternary. Sedimentary rocks of the northern Slate Mountains have been described in detail in an unpublished thesis by Hammer (5) in 1961. Other work describing surface geology and sub-surface data obtained from shallow drilling is contained in several unpublished reports made by consultants for Transarizona.

HISTORY

The mineral outcrop, consisting primarily of copper silicates and iron oxides, was located by Trout and Atchison in the early 1880's. Abandoned in 1884, the property was relocated by B. S. Wilson in 1905. In 1914 Wilson sold the property to Frank M. and Charles Leonard.

The Leonards, who developed the ore body on three levels while working through a 225 foot vertical shaft, leased the property in 1917. This lease was terminated in 1919. The next noteworthy work to be conducted was an examination of the property by the U. S. Bureau of Mines in 1942 which initiated an investigation that started in 1948 and concluded with a report in 1950.

In November 1955, the three patented claims of the Lakeshore property and the Drake claims, consisting of three patented and 19 unpatented claims, were obtained by George Freeman under a lease-option agreement from Treasure State Mining Company. In 1956, a 580 acre lease surrounding these claims was obtained from the Bureau of Indian Affairs by Dwight McClure and George Freeman. In 1960 the Bureau of Indian Affairs approved an assignment of the lease to Transarizona Resources Inc.

El Paso Natural Gas Company's interest in the property was initiated by an invitation to examine the property in September 1962. At that time, the writer made an examination of the mine and plant. Transarizona had developed the mine as a small open pit. Exploration drilling on a closely-spaced drill pattern indicated $\pm$ 1.5 million tons of $\pm$ 1.75% copper oxide. Level maps and cross-sections prepared from the drill data indicated the mineral deposit formed a V-shaped trough that plunged to the southwest, and was controlled by faults.

The Plant had been designed for a copper segregation process that was followed by flotation.

As a result of the examination, a recommendation for a more complete evaluation of the property was made but the request was not approved. However, in June 1963, a limited amount of drilling was conducted in the open pit and a feasibility study of the segregation process was made.

In August 1966, under the direction of the Mining Division of El Paso Natural Gas Company, an induced Polarization survey was conducted on the Lakeshore property by McPhar Geophysical Limited and, at the same time, the writer began a general geological survey of the area.

In September 1966 a core drilling program was initiated to investigate the I. P. anomalies that were discovered on the property.

In February 1969, El Paso Natural Gas Company announced an agreement with Hecla Mining Company for development of a major new copper discovery made by the Mining Division on the Lakeshore property.

GENERAL GEOLOGY

Reconnaissance of the Slate Mountain Area

The Slate Mountains (Fig. 1), composed primarily of the Pinal Schist formation of Precambrian age (4), strike N ± 45W and dip ± 50° NE. Near the center of the mountains, an elongated mass of quartz diorite has intruded the schist. This intrusive mass tends to parallel the foliation of the schist and was identified as being Precambrian in age (4). However, recent work by P. E. Damon and R. L. Mauger (6) has dated this intrusive by the potassium-argon process as Laramide (Cretaceous-Tertiary). Along the northeast slopes of the mountains, the schist dips under the alluvium and fanglomerates at the edge of the valley.

At the north end of the Slate Mountains, the Pioneer Shale, the Dripping Springs Quartzite, and the Mescal Limestone of the Precambrian Apache Group (4) strike N ± 40° E and dip ± 45° NW. These northwest dipping metasediments overlie the northwest trending Pinal Schist with angular unconformity. Overlying the Apache Group is the Abrigo Limestone and Troy Quartzite of Early Cambrian age (4) and the limestone, quartzite and shales of Devonian and Carboniferous age (4). Along the southwest slope of the Slate Mountains and to the southeast, outcrops of these formations generally dip to the southwest and strike parallel with the trend of the mountains.

Around the southwest periphery of the Slate Mountains and protruding through the valley fill, are outlying hills of Devonian and Carboniferous limestone, Cretaceous volcanic and sedimentary rocks and Tertiary andesite and breccia (4). The Devonian

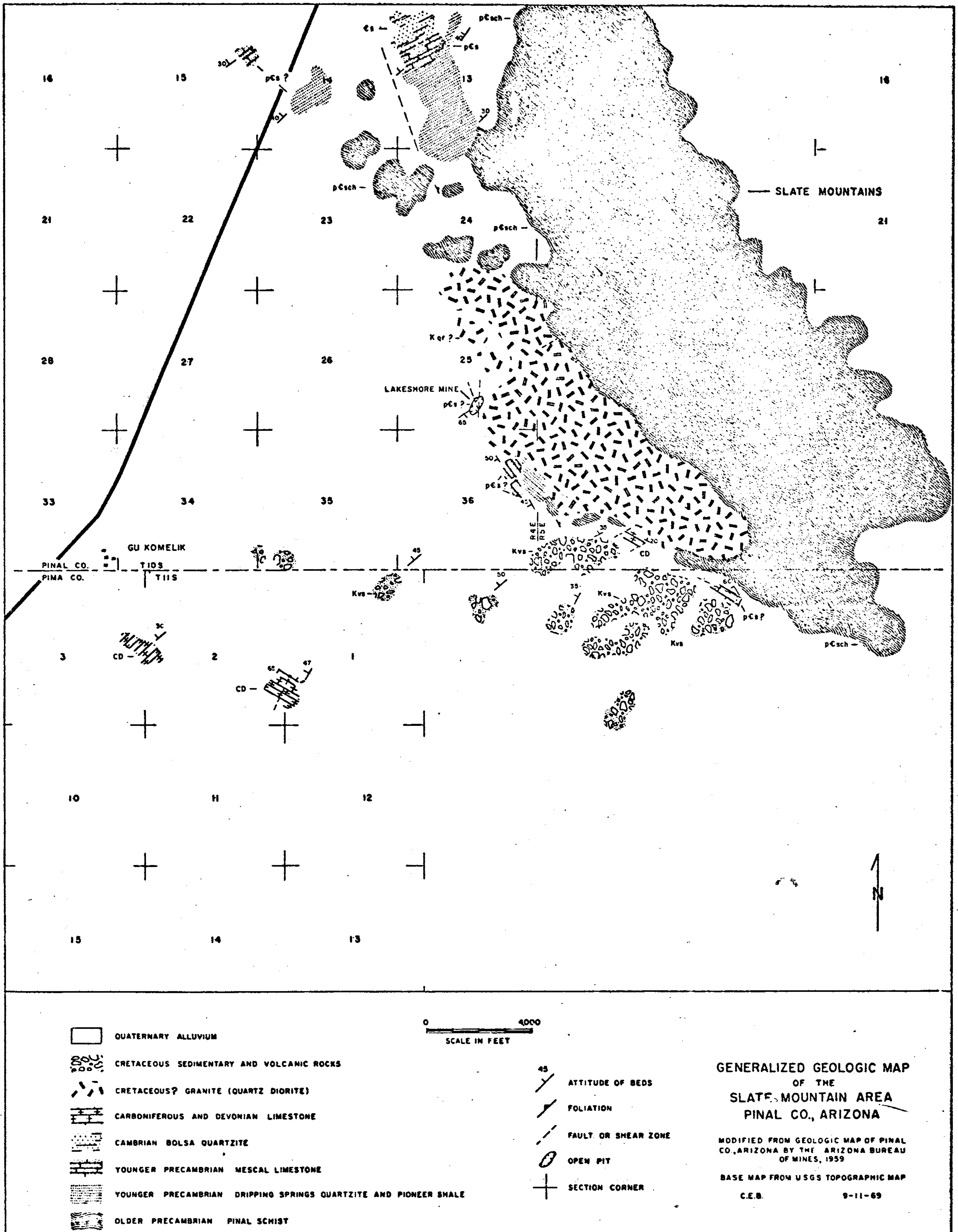

SLATE MOUNTAINS
LAKESHORE MINE
GU KOMELIK
PINAL CO.
PIMA CO.
T10S
T11S
R4E
R5E
p€sch
p€s
€s
Kqr ?
Kvs
CD
0 4000
SCALE IN FEET
N
QUATERNARY ALLUVIUM
CRETACEOUS SEDIMENTARY AND VOLCANIC ROCKS
CRETACEOUS? GRANITE (QUARTZ DIORITE)
CARBONIFEROUS AND DEVONIAN LIMESTONE
CAMBRIAN BOLSA QUARTZITE
YOUNGER PRECAMBRIAN MESCAL LIMESTONE
YOUNGER PRECAMBRIAN DRIPPING SPRINGS QUARTZITE AND PIONEER SHALE
OLDER PRECAMBRIAN PINAL SCHIST
ATTITUDE OF BEDS
FOLIATION
FAULT OR SHEAR ZONE
OPEN PIT
SECTION CORNER
GENERALIZED GEOLOGIC MAP
OF THE
SLATE MOUNTAIN AREA
PINAL CO., ARIZONA
MODIFIED FROM GEOLOGIC MAP OF PINAL CO., ARIZONA BY THE ARIZONA BUREAU OF MINES, 1959
BASE MAP FROM U.S.G.S. TOPOGRAPHIC MAP
C.E.B. 9-11-69

Fig. 1

and Carboniferous limestone and dolomite have been folded along an apparent north-west trending axis and then tilted to the northwest. In the area southwest of the Lakeshore mine, the breccia and the underlying Cretaceous volcanic and sedimentary rock strikes N $\pm$ 50° E and dips $\pm$ 45° NW.

Small faults have apparently displaced sedimentary bedding and igneous and sedimentary contacts in these outlying hills. However, any evidence of large faults has been covered by the alluvium. The poles of the measured attitudes of joints and fractures, plotted on a stereographic projection, indicates a preferred orientation of N 30° E with 45° SE dip, N 40° E with 45° NW dip, and N 65° E with 66° SE dip.

Geology of the Lakeshore Pit

At the Lakeshore Mine, a small open pit was excavated by Transarizona (Fig. 2). Near the center of the pit, mineralized banded tactite overlaid by a fine-grained quartzite, striking N $\pm$ 50 E and dipping $\pm$ 60° SE, was exposed. These metasediments terminate on the east side of the pit where they are in contact with diorite along a very strong oblique slip dip fault that strikes NW and dips 65° SW. Merging with this fault is a strong north-south fault that dips 74° W.

Along the west wall of the pit, altered and fractured andesite occurs on the footwall of an andesite and metasediment contact which shows slickensides. This contact, striking N $\pm$ 40° E and dipping $\pm$ 50° SE,forms the footwall of the oxide ore body.

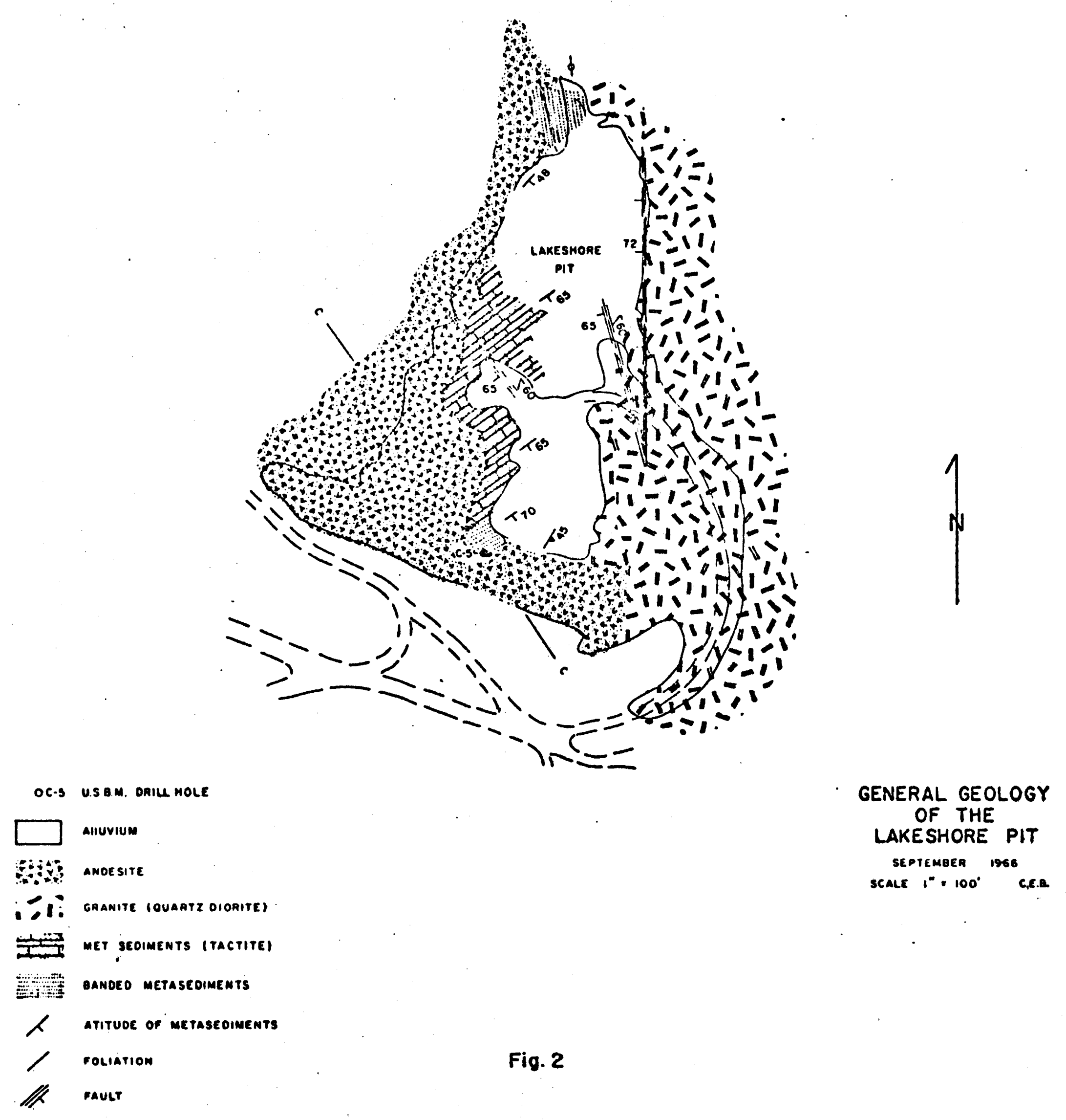

LAKESHORE PIT
72
65
60
70
48
N
OC-5 U.S.B.M. DRILL HOLE
AIIUVIUM
ANDESITE
GRANITE (QUARTZ DIORITE)
MET SEDIMENTS (TACTITE)
BANDED METASEDIMENTS
ATITUDE OF METASEDIMENTS
FOLIATION
FAULT
GENERAL GEOLOGY
OF THE
LAKESHORE PIT
SEPTEMBER 1966
SCALE 1" = 100' C.E.B.

Fig. 2

At the north end of the pit, a fine-grained, banded quartzite, striking N $\pm$ 10° W with vertical dip, has been exposed in contact with the diorite on the footwall side of the NW striking fault zone.

The south end of the pit has been cut through highly altered and fractured andesite with foliation striking N $\pm$ 30° E and dipping $\pm$ 45° SE. This andesite overlays the metasedimentary rock and forms the hanging wall of the oxide ore body.

Drill hole data from close space drilling, conducted by Transarizona, indicated that the northeast end of the ore body had been offset to the northwest on the footwall side of the NW striking fault zone.

Drilling conducted by the U. S. Bureau of Mines (2) in 1948 had encountered quartzite underlying andesite at 460 feet in hole C-2, and at 270 feet in hole C-4. In hole C-5, from 455 feet to 545 feet, copper oxides were encountered in a section described by the Bureau as a shear zone (Fig. 3).

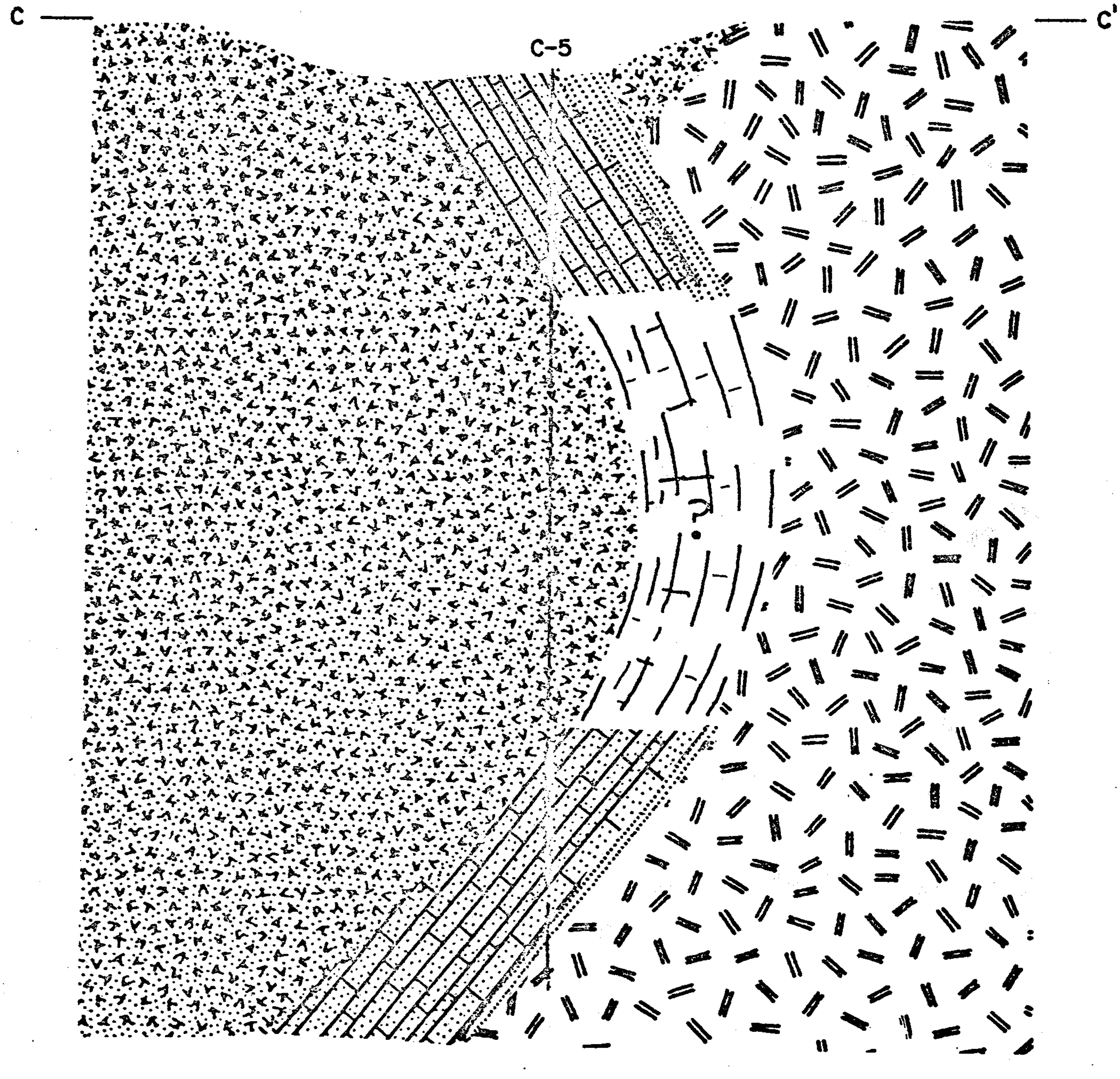
GEOPHYSICAL SURVEY

Induced Polarization Survey

During August and September of 1966, a combined resistivity and induced polarization survey was conducted on the mineral lease and the claims southwest of the Slate Mountains (Fig. 4).

A dipole-dipole electrode configuration, with 500 foot electrode spread length, was used to apply current and measure potential along parallel north-south lines, with $\pm$ 1200 foot east-west separations. Alternating current of 0. 3 and 5 cycles per second were used to determine the I. P. effect. In addition to the north-south survey, an east-west survey, using shorter electrode spread lengths, was made over the Lakeshore fault system.

Fig. 3



CROSS-SECTION C-C'
LOOKING N 55 E
SCALE 1" = 100'

INTERPRETATION, BY THE WRITER, OF THE MINERALIZATION ENCOUNTERED BY THE U.S.B.M. IN CHURN DRILL HOLE No. C-5

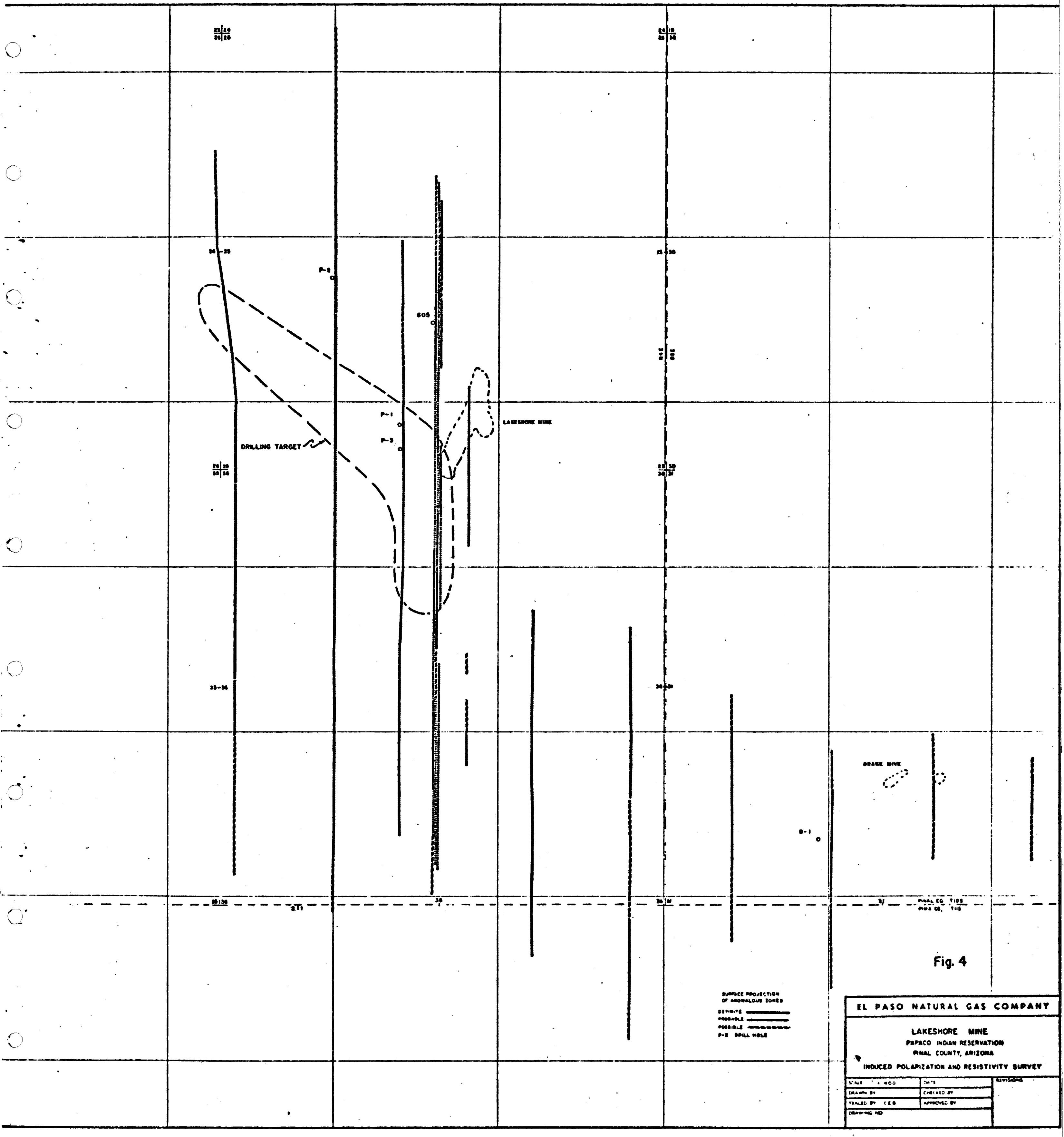

DRILLING TARGET
LAKESHORE MINE
DRAKE MINE
P-1
P-2
P-3
608
D-1
SURFACE PROJECTION
OF ANOMALOUS ZONES
DEFINITE
PROBABLE
POSSIBLE
P-2 DRILL HOLE
EL PASO NATURAL GAS COMPANY
LAKESHORE MINE
PAPACO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
INDUCED POLARIZATION AND RESISTIVITY SURVEY
DATE
DRAWN BY
CHECKED BY
TRACED BY C.E.B.
APPROVED BY
DRAWING NO
REVISIONS

Fig. 4

Testing I. P. Anomalies

Several I. P. anomalies were recorded along the north-south survey lines. To test the anomalies, core drilling began at locations D-1 and 605 (Fig. 4). Core hole D-1 was located in the area of a reported anomaly ± 1200 feet southwest of the Drake oxide pit. This test hole was cored for 500 feet through andesite breccia without encountering sulphide mineralization and then abandoned. Hole 605 was an old rotary drill hole which had been terminated in a weakly mineralized porphyry at a drill depth of ± 288 feet. This location was on an I. P. anomaly ± 750 feet north of the Lakeshore pit. Core drilling began at 288 feet and copper oxide mineralization was encountered along fractures in an altered biotite porphyry and in and near the contacts of the biotite porphyry and sections of altered andesite of varying thickness. This hole was anandoned at 790 feet because of drilling conditions without encountering sulphide mineralization.

With the completion of D-1 and 605, the testing of two additional I. P. anomalies began at locations P-1 and P-2 (Fig. 4). Drill hole P-2 was located on an I. P. anomaly ± 1500 feet northwest of hole 605. Core drilling was conducted through 800 feet of fanglomerate without encountering oxide or sulphide mineralization, and the hole was abandoned. The fanglomerate consisted of angular to sub-angular fragments of sedimentary and volcanic rock that was weakly cemented but did not display the prominent high-angle slickenside fracture system that had been encountered in hole 605.

At Hole P-1, located on an I. P. anomaly ± 700 feet west of the Lakeshore pit, low grade copper oxide mineralization was encountered in a fractured and altered andesite and andesite breccia. These andesites had been intruded by a few thin sill-like masses of biotite porphyry. At a drill depth of 750 feet where the drill was still in oxides, a re-evaluation of the I. P. data and a review of the geology was made.

INTERPRETATION OF GEOLOGY

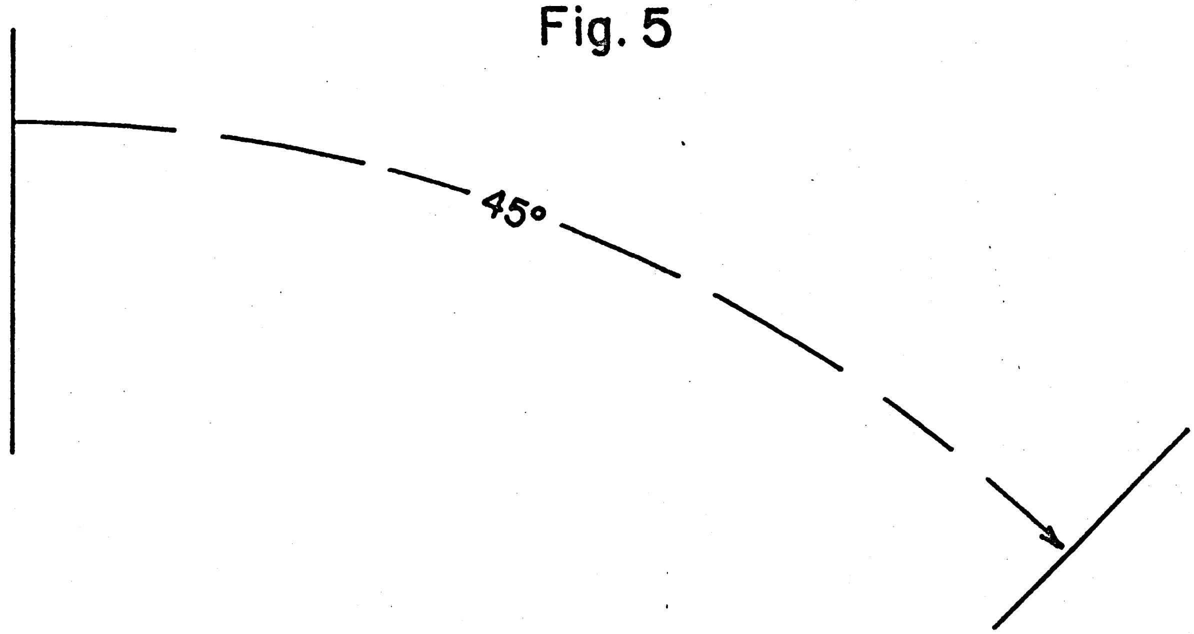
In an attempt to correlate surface geology with subsurface data obtained from core holes, the writer assumed:

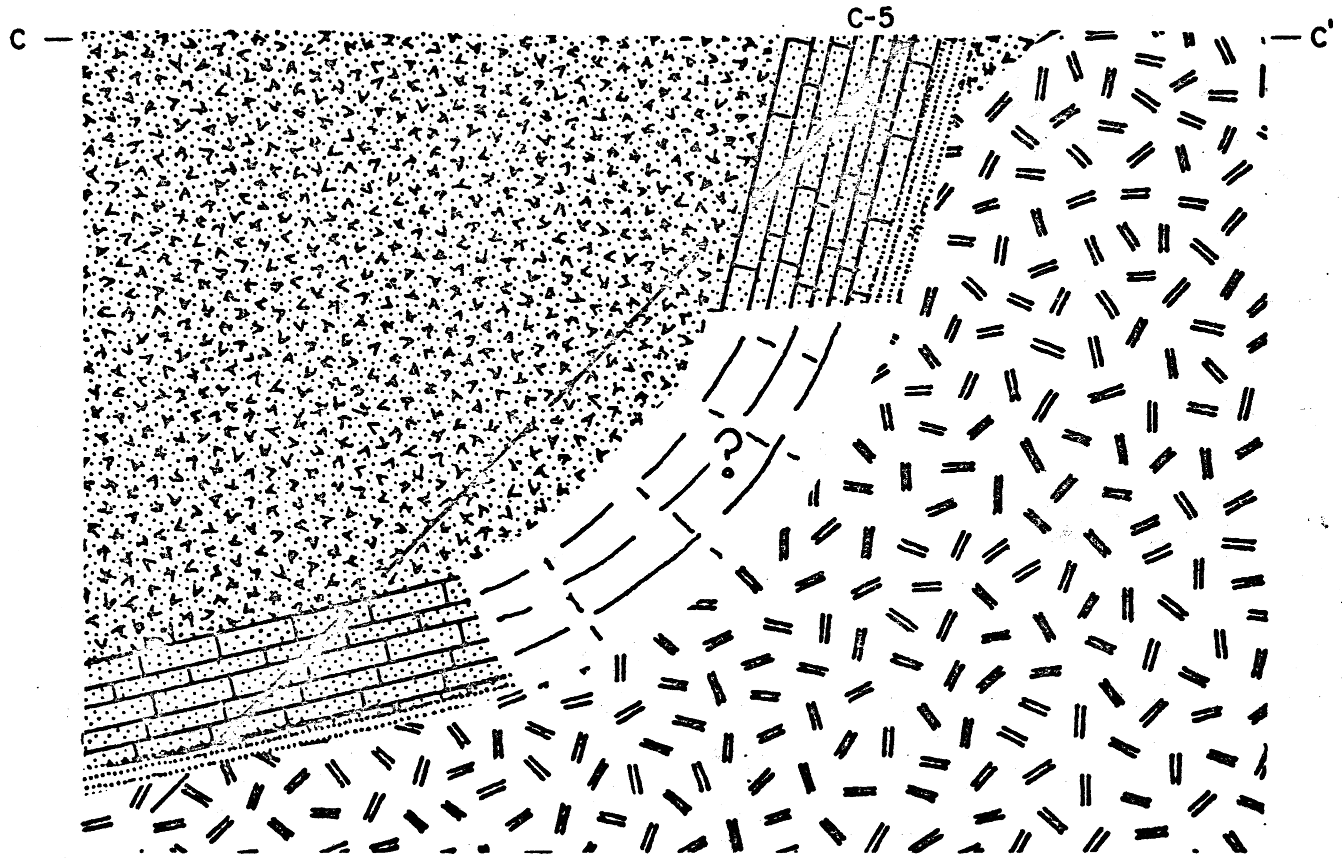
(1) The andesite and breccia encountered in drill hole P-1 are extrusive and the biotite porphyry encountered in hole 605 and P-1 is younger than the andesite and younger than the biotite hornblende porphyry that has intruded the Pinal Schist to the east;

(2) The high angle slickenside fracture system encountered in hole P-1 and 605 is parallel to the fault and fracture system observed in the Lakeshore pit;

(3) The present attitude of the Cretaceous volcanic and sedimentary rocks cropping out southwest of the Slate Mountains represents the youngest structural trend in the area, and that this trend, striking N ± 50° E and dipping ± 45° NW, has been superimposed on the older structural system in the area;

Fig. 5





CROSS-SECTION C-C'
LOOKING N55E
SCALE 1" = 100'

ASSUMED ATITUDE OF THE METASEDIMENTS
PRIOR TO TILTING TO THE NORTHWEST

contin
south
coppe
andesi
drill v
depth
hole P
but co
coppe
ture p
brecci
sectio
altere
was e
sedim
had an

(4) If the metasediments outcropping in the Lakeshore pit were rotated about a horizontal axis trending N 50° E to a pre-45° tilt attitude, the metasediments would then be dipping steeply to the northwest and be overlaid by the andesite (Fig. 5).

(5) The mineralization, encountered by the U. S. Bureau of Mines (2) in churn drill hole C-5 at a drill depth of 455 feet to 545 feet, is the continuation down dip of the mineralized metasediments and these metasediments woul continue to the northwest to underlie the andesite (Fig. 3).

In summation then, this interpretation requires that the metased tend down dip from the oxide outcrop and lie under the andesite to the no The trend of the metasediments is controlled by the northwest trend of t Mountains, the strong northwest and north-south fault and fracture syst intrusive. Movement of mineralized solutions were controlled by this p vironment and sulphide mineralization should be encountered at depth.

RECOMMENDED DRILLING TARGET

To try to correlate this interpretation with the indicated I. P. and plotted anomalies extending to the south of the Lakeshore pit and the an echelon to the northwest of the pit were encircled. This enclosed an ar wide extending from near the center of Section 36 north to Section 25, t to the west line of Section 25 (Fig. 4). This area offered the best possi of projected geology and plotted I. P. anomalies. The enclosed area was as the drilling target for the Lakeshore project.

DELINEATION OF MINERALIZATION

Drilling and Recording of Data

With the encounter of sulphide mineralization in metasediments, an accelerated drilling program began. Rotary drilling was used to penetrate the andesites and breccias. When the rotary hole was completed to a pre-determined depth, casing was set and a wire line diamond drill was then moved onto the prepared location. NX size tools (2-1/8 inch core diameter) were used until drill depth or drilling conditions required the hole diameter to be reduced; then BX size tools (1-5/8 inch core diameter) were used. Average recovery of core was over 90%.

From the recovered core, the following data and observations were recorded and sketched on the logs: rock type, alterations, mineralization, amount of fracturing, angle of fracturing and pitch of the slickensides, fault breccia and gouge, and contacts of major rock type changes.

When core holes were completed, they were surveyed for drift and inclination with a multiple-shot gyroscopic survey instrument. Degree of inclination and bearing of drift were recorded on 100 foot intervals and at major contacts.

With this drill hole survey data, the assay and geological data could be plotted in both vertical and horizontal positions with a high degree of accuracy (Fig. 6).

Subsurface Mapping

To maintain control of drilling and indicate attitude and limits of assay and geological data, the following subsurface contour maps were prepared:

(1) The andesite-tactite contact

(2) The tactite-quartzite contact

(3) The quartzite-diorite contact

(4) The top and bottom of mineralization within the tactite

(5) The upper contact of the mineralized biotite porphyry

(6) The top and the lower drilling cut off of sulphide

(7) The top and bottom of oxide

(8) Base of the fanglomerate

With the above contoured data, isopach maps were drawn indicating direction and thickness of high grade oxides, sulphides, tactite, and mineralization within the tactite.

With the same contour maps, cross-sections could be drawn in any direction without regard to drift or alignment of core holes.

Interpretation of Subsurface Data

From the subsurface data, the following interpretations were made:

(1) The contours of the andesite-tactite contact form a subsurface that strikes $\pm$ north and dips $\pm$ 30° W (Fig. 7).

(2) The contours at the tactite-quartzite contact form a subsurface that strikes N $\pm$ 20° W and dips $\pm$ 20° SW, then turns to the northeast and dips to the northwest (Fig. 8). The curving contours

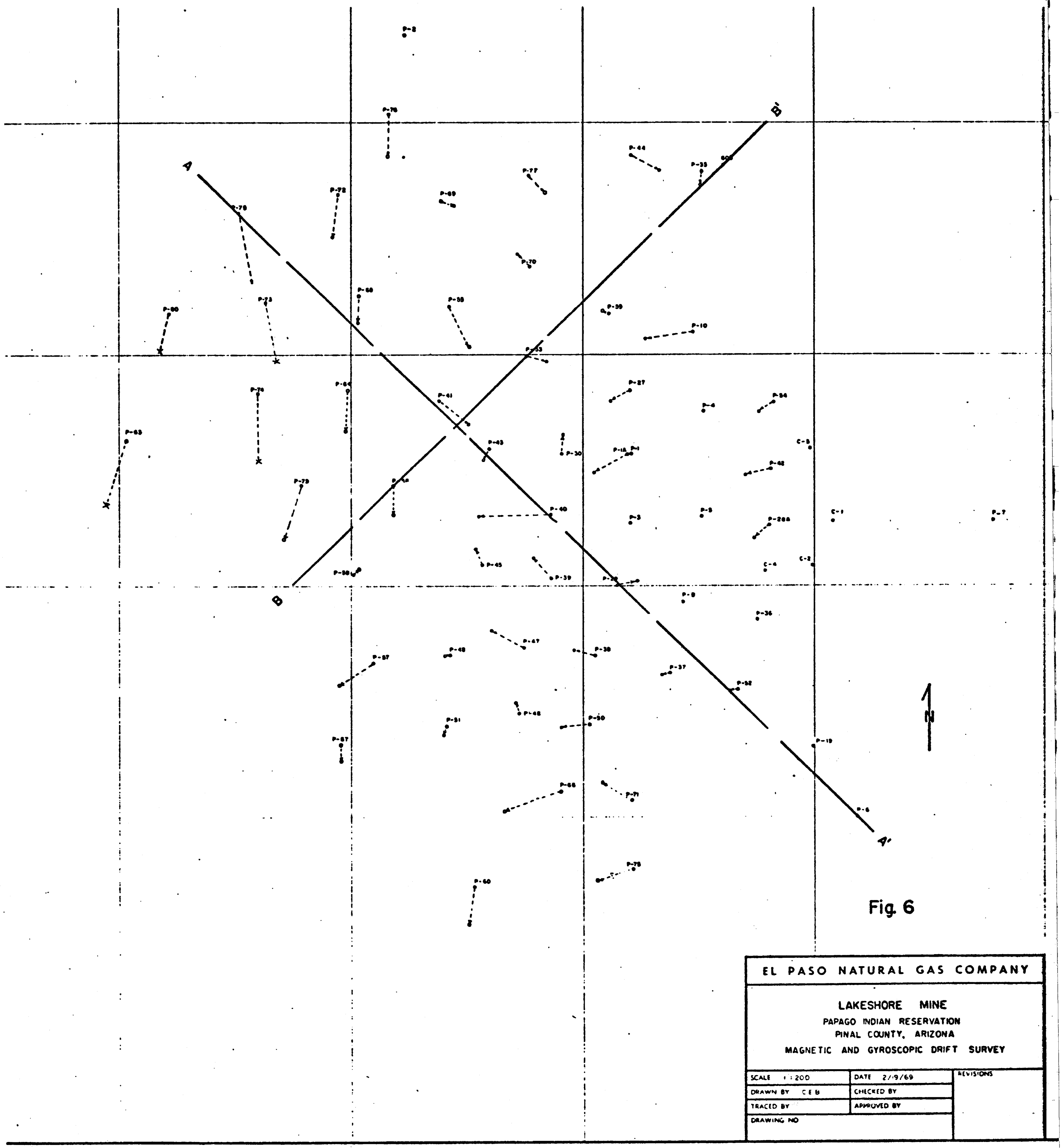


Fig. 6

EL PASO NATURAL GAS COMPANY		
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA MAGNETIC AND GYROSCOPIC DRIFT SURVEY		
SCALE 1 : 200	DATE 2/9/69	REVISIONS
DRAWN BY CEB	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		

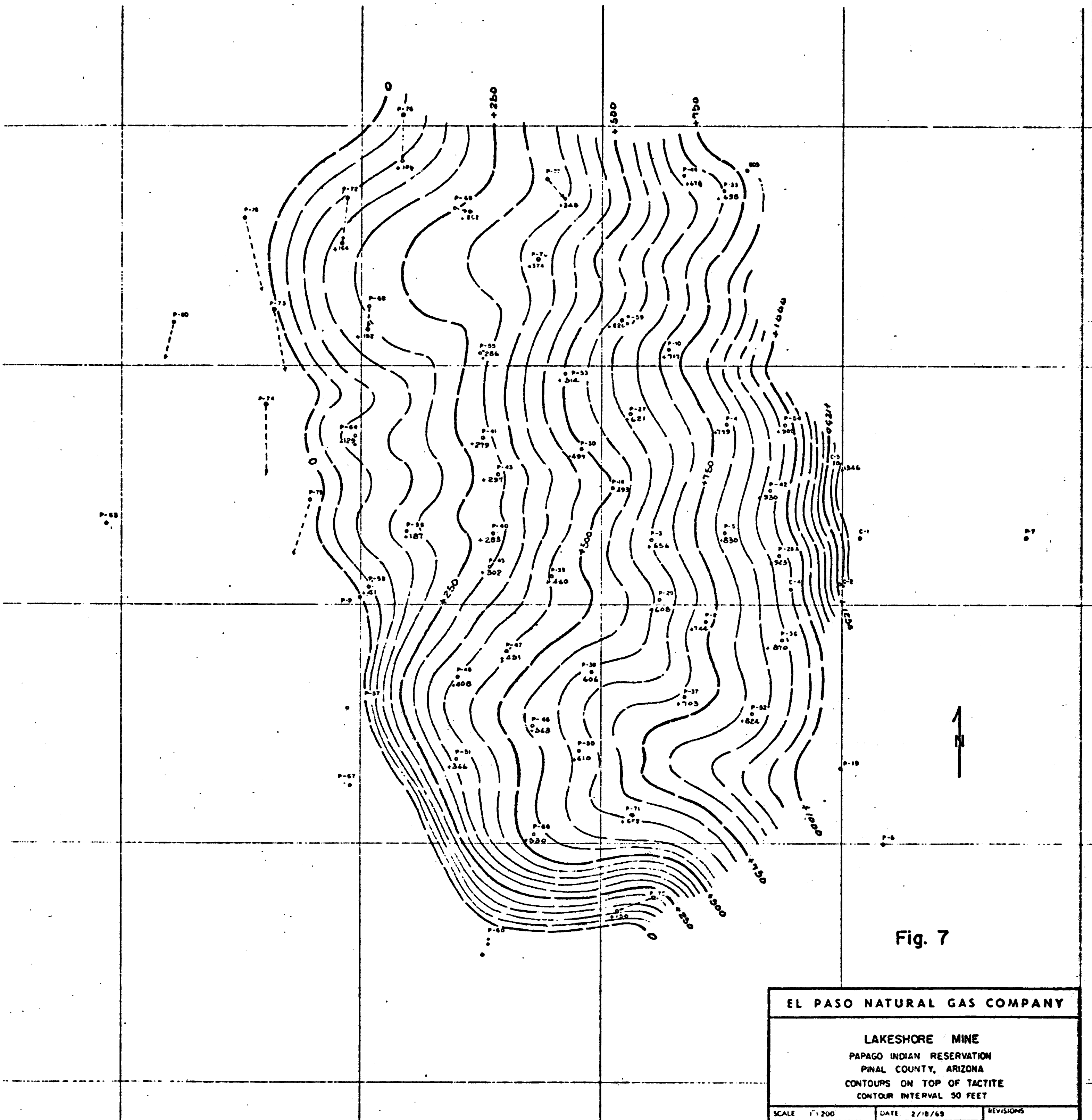


Fig. 7

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE

PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS ON TOP OF TACTITE
CONTOUR INTERVAL 50 FEET

SCALE 1" = 200	DATE 2/18/69	REVISIONS
DRAWN BY C E B	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO.		
GEOLOGY BY C E BARRON		

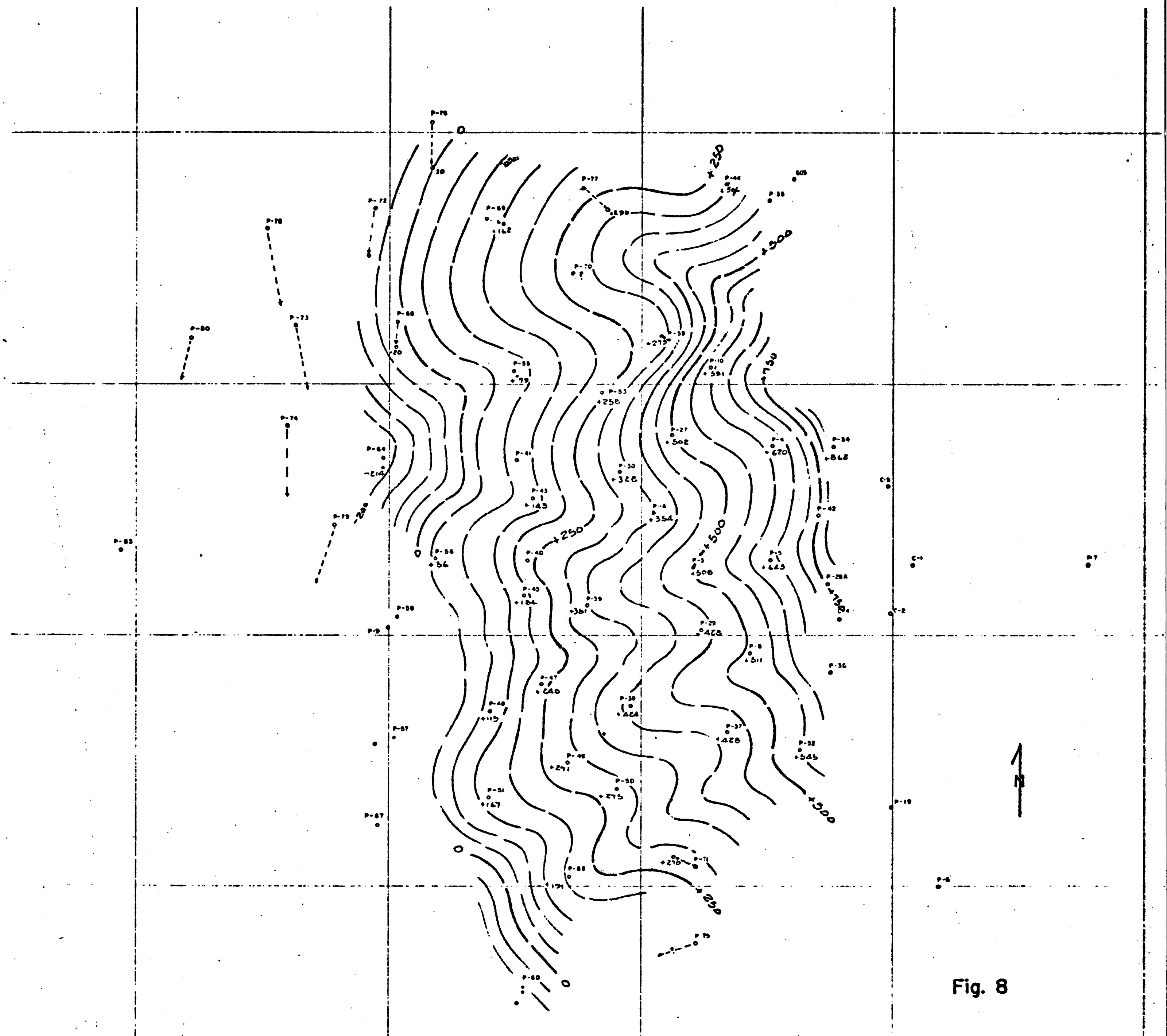


Fig. 8

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS ON TOP OF QUARTZITE
CONTOUR INTERVAL 50 FEET

SCALE	DATE 2/9/69	REVISIONS
DRAWN BY C E B	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C E BARRON		

form a weakly nosing subsurface structure that plunges to the southwest. As the overlying andesite-tactite contact approaches this plunging structure, a thinning of the tactite occurs along a northeast trend and wedge-like thicknesses of tactite occur to the northwest and southeast of this zone of thinning. This thickening and thinning is best illustrated by an isopach of the tactite (Fig. 15).

(3) The more consistent thickness of mineralization, within the tactite, occurs in the wedge-like thickness southeast of the zone of thinning. Contours on the top and bottom of this mineralized thickness conform with the N 20 W strike and 20° SW dip of the underlying quartzite. The line of intersection of this mineralization with the overlying andesite trends NE and plunges SW, and terminates this thickness of mineralization in the zone of thinning. To the south and southeast of the zone of thinning, an increasing thickness of massive garnet and epidote occurs over the mineralization, and the mineralized horizon is divided into an upper and lower mineral thickness by an interbedded, fine-grained quartzite. Underlying this sulphide mineralization, a black and gray banded tactite is in contact with the underlying quartzite. This sequence of metasediments, which has been intruded by diabase and biotite porphyry, continues to the south and southeast until it has apparently been displaced by a major fault that trends N $\pm$ 20 W.

(4) To the east the metasediments are in contact with the diorite. Contours on this contact form a north trending subsurface that dips $\pm$ 60° W (Fig. 9).

(5) To the west the metasediments have been intruded by the biotite porphyry along a northeast trending contact zone. Along this contact zone the intrusive forms sills of irregular masses that occur in both the metasediments and the andesite. Better grade mineralization occurs along this zone of multiple sills (Fig. 16).

(6) Northwest of this contact zone the stock-like intrusive forms a more homogenous emplacement within the andesite but continues to form sills within the metasediments. Further to the northwest, the intrusive again forms a contact zone of multiple sills within the andesite (Fig. 16).

(7) Contours on top of the oxidized intrusive trend N 55 E and form a $\pm$ 40° slope along the northwest side (Fig. 10). On the southeast side the contours indicate a much steeper slope, and to the southwest, the intrusive apparently has been displaced in this horizon by a high angle normal fault that strikes $\pm$ N 20 W. Limits of the intrusive have not been determined to the north and northeast.

(8) Contours on top of the oxide mineralization form an irregular horizon in the subsurface west of the Lakeshore pit; then this horizon forms a northwestern dip and passes through the top of the mineralized intrusive. As the oxide zone passes through the

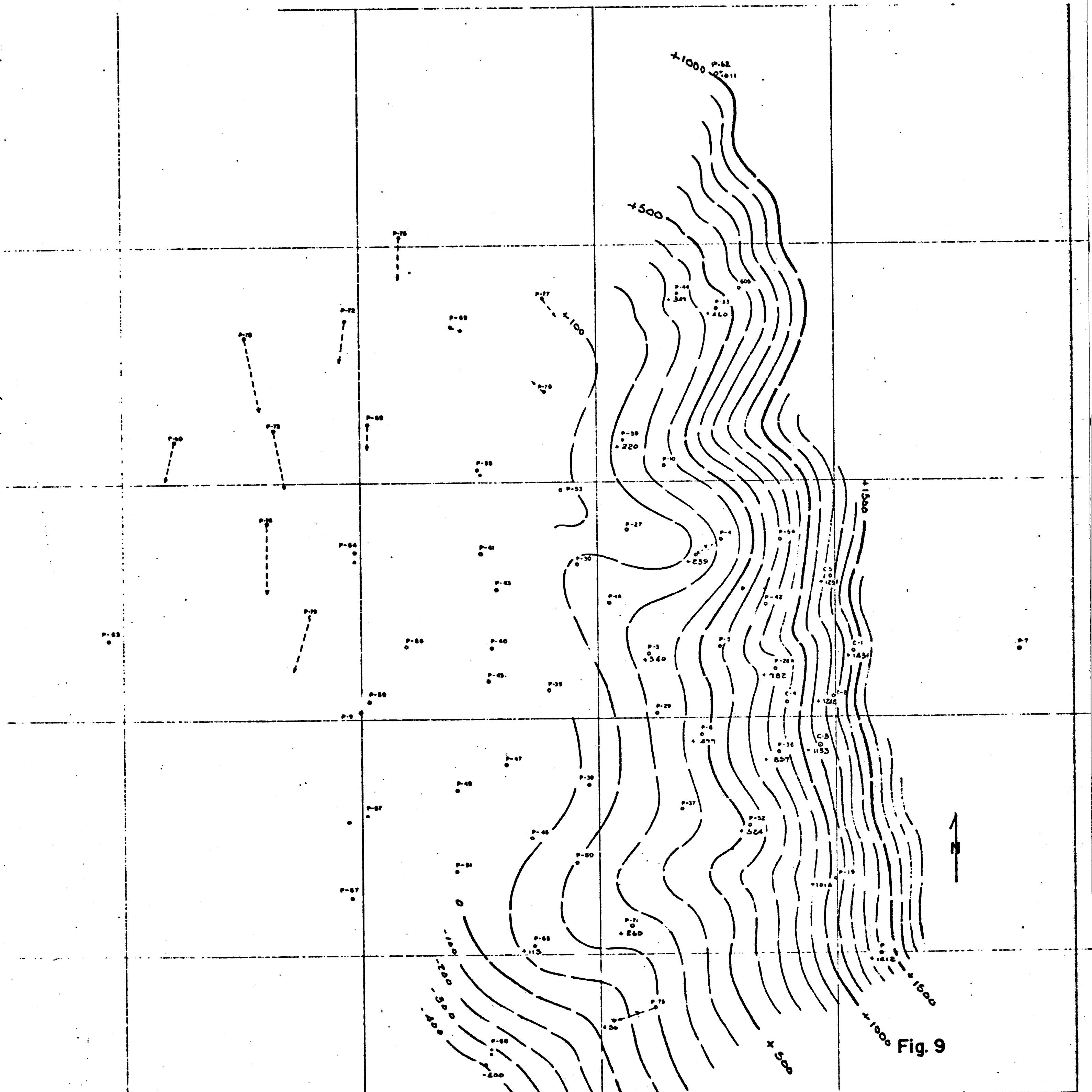


Fig. 9

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS ON TOP OF GRANITE
CONTOUR INTERVAL 100 FEET

SCALE 1":200'	DATE 2/19/69	REVISIONS
DRAWN BY C E B	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C E BARRON		

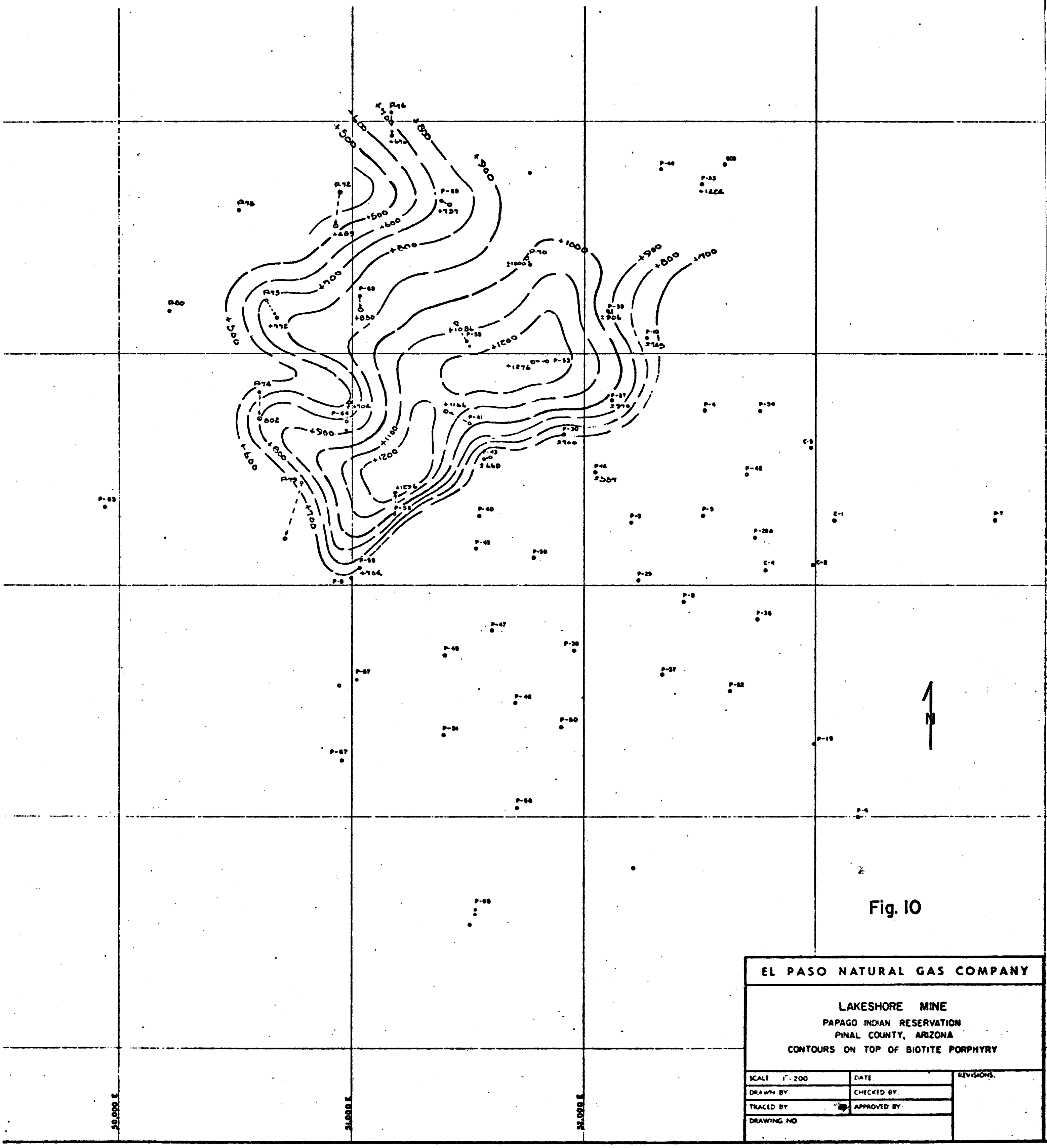

EL PASO NATURAL GAS COMPANY
LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
CONTOURS ON TOP OF BIOTITE PORPHYRY
SCALE 1" : 200
DATE
REVISIONS
DRAWN BY
CHECKED BY
TRACED BY
APPROVED BY
DRAWING NO
50,000 E
51,000 E
52,000 E
N

Fig. 10

upper part of the intrusive, a ± 100 foot thick blanket of ± 1.5% copper oxide mineralization occurs at the base of the oxides. This mineralization trends to the northeast along the top of the intrusive and dips to the northwest. As the dip of the oxide mineralization increases to the northwest, the high grade oxide mineralization thins and a zone of chalcocite has formed an enriched upper thickness of sulphide mineralization (Fig. 11).

(9) Contours at the top of sulphide mineralization form a low trough that plunges to the southwest along the southeast flank of the biotite porphyry intrusive. This oxide-sulphide transition horizon then climbs to its highest elevation within the top of the intrusive and forms a northeast trend that dips to the NW. To the southwest the contours turn sharply to the northwest or southeast and form a N ± 20° W trending horizon that dips ± 70° SW (Fig. 12).

(10) The isopach of the sulphides indicates a wedge-like thickness of mineralization. The thin edge, ± 300 feet thick, occurs along the northeast trending contact zone of the intrusive and the metasediments. To the northwest of this contact zone and along the apparent fault zone, the mineralized zone thickens to over 1000 feet. Some core holes in this zone have an average assay value of .85% copper for 1000 feet of recovered core. The limits of mineralization to the northwest and north of this area have not been determined (Fig. 14).

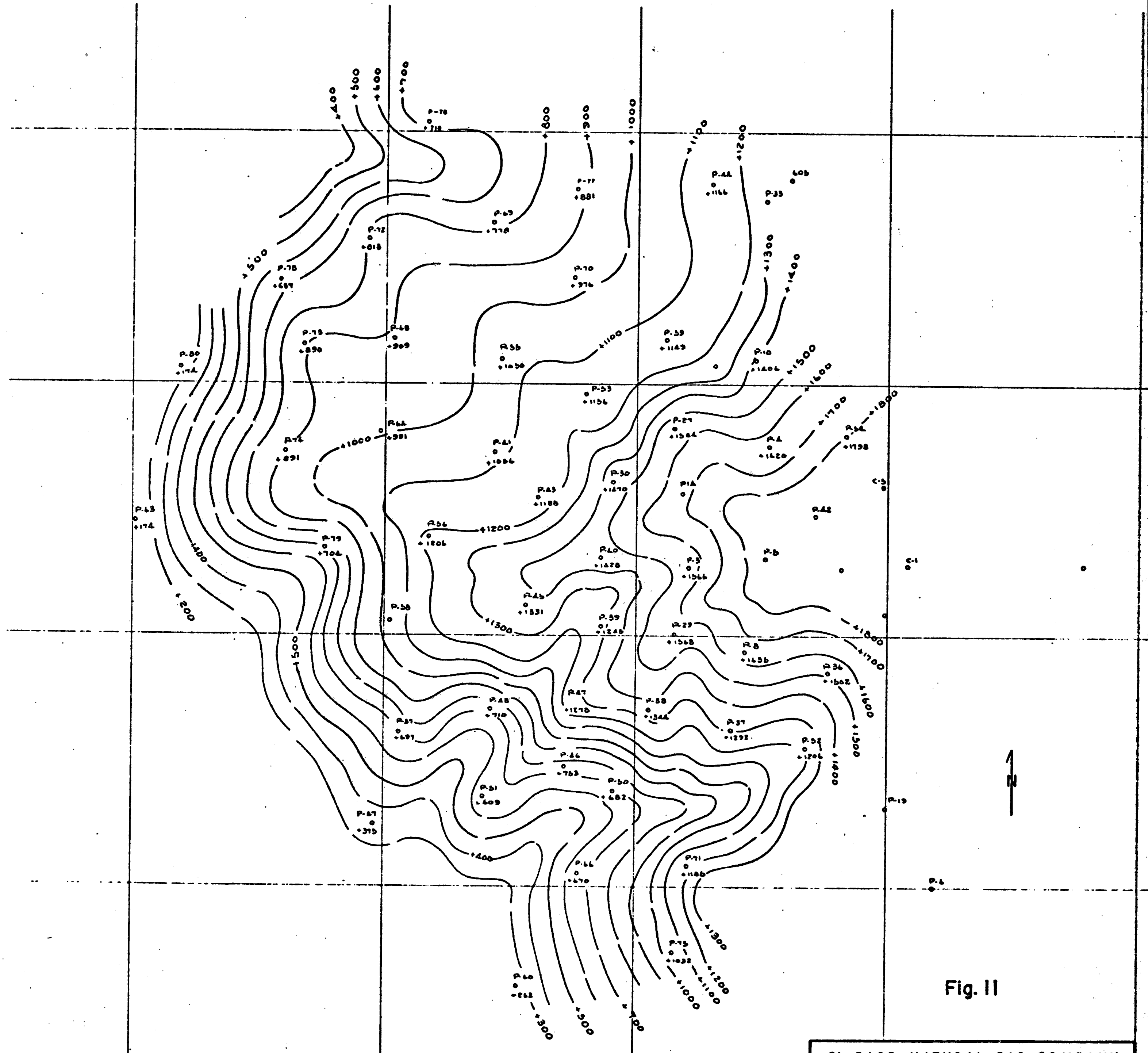


Fig. II

EL PASO NATURAL GAS COMPANY	
LAKESHORE MINE PAPAGO INDIAN RESERVATION PINAL COUNTY, ARIZONA CONTOURS ON TOP OF OXIDES CONTOUR INTERVAL 100 FEET	
SCALE 1" = 200'	DATE 2/19/69
DRAWN BY C.E.B.	CHECKED BY
TRACED BY	APPROVED BY
DRAWING NO	
GEOLOGY BY C.E.BARRON	

REVISIONS

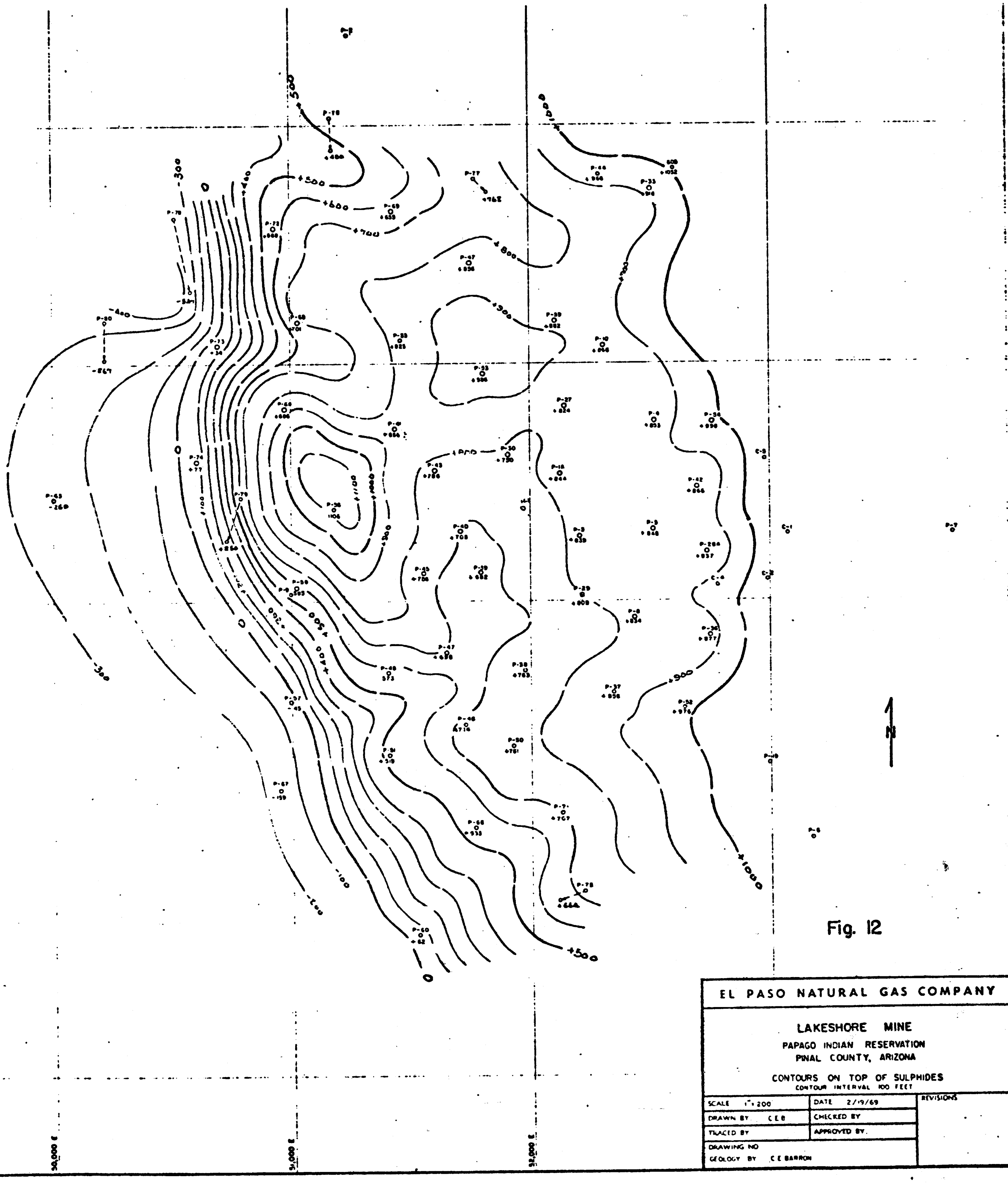


Fig. 12

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE

PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA

CONTOURS ON TOP OF SULPHIDES
CONTOUR INTERVAL 100 FEET

SCALE 1" = 200	DATE 2/19/69	REVISIONS
DRAWN BY C E B	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C E BARRON		

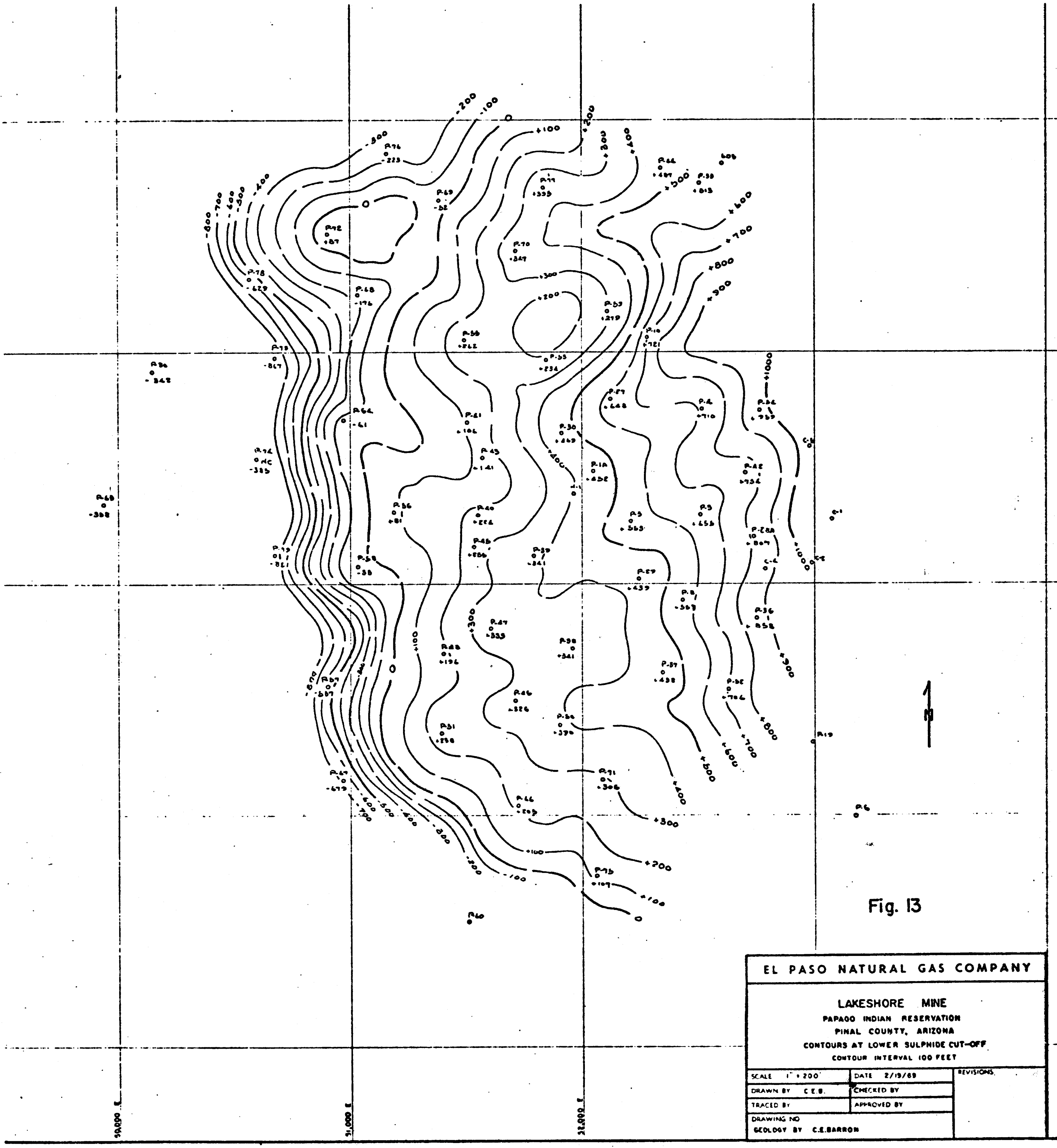


Fig. 13

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE

PAPAGO INDIAN RESERVATION

PINAL COUNTY, ARIZONA

CONTOURS AT LOWER SULPHIDE CUT-OFF

CONTOUR INTERVAL 100 FEET

SCALE 1" = 200'	DATE 2/19/69	REVISIONS
DRAWN BY C.E.B.	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C.E.BARRON		

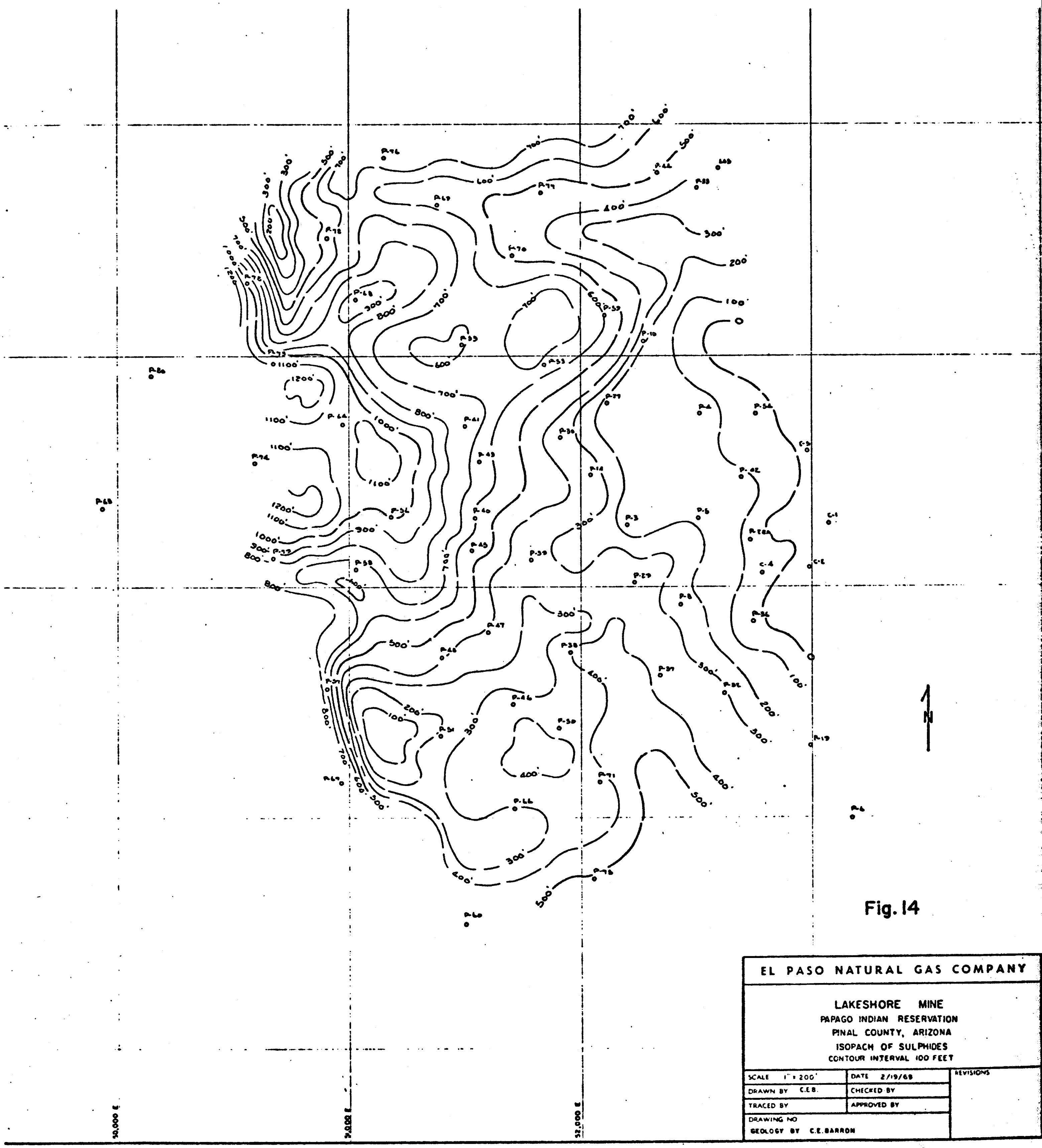


Fig. 14

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
ISOPACH OF SULPHIDES
CONTOUR INTERVAL 100 FEET

SCALE 1" = 200'	DATE 2/19/68	REVISIONS
DRAWN BY C.E.B.	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C.E. BARRON		

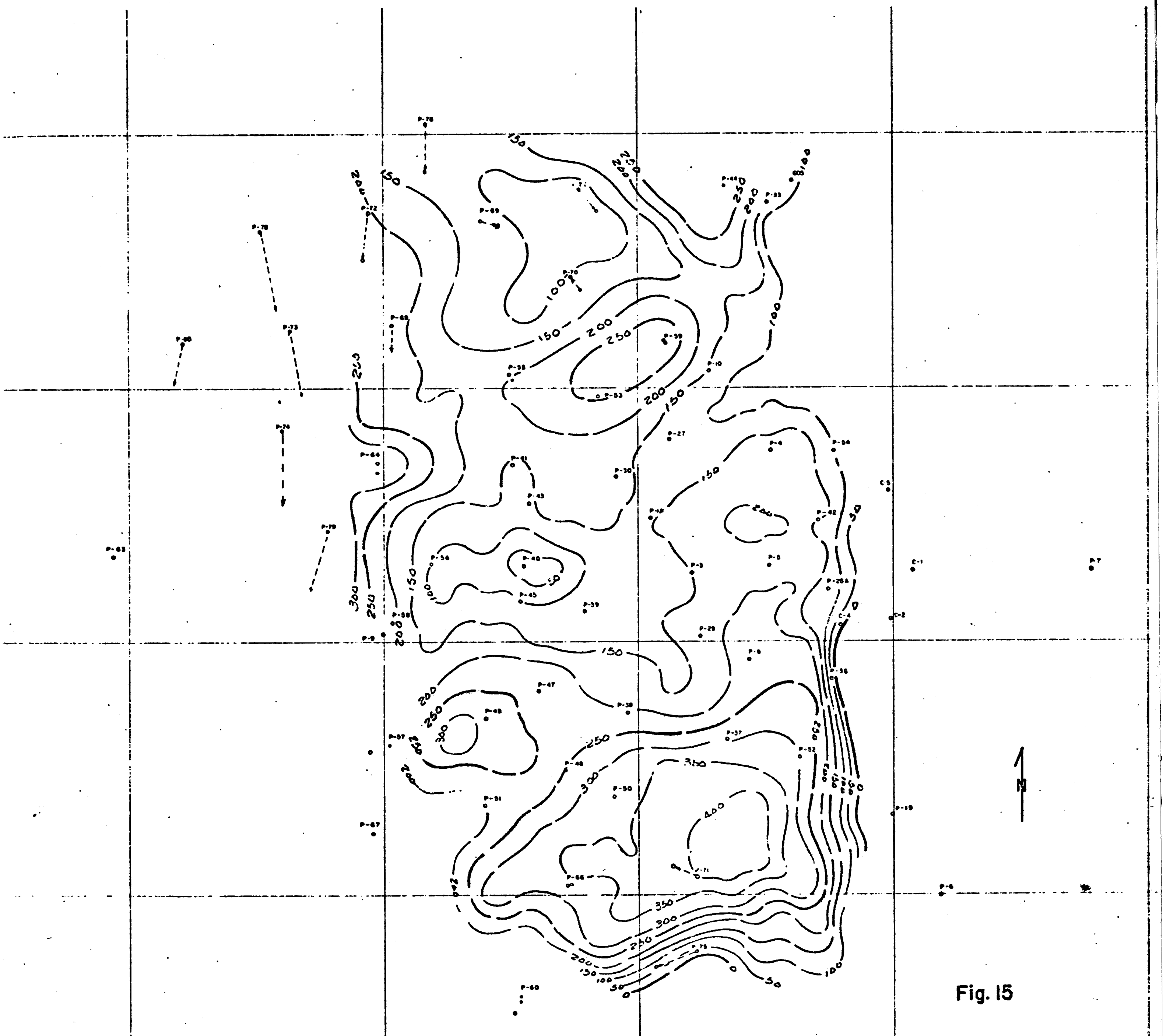
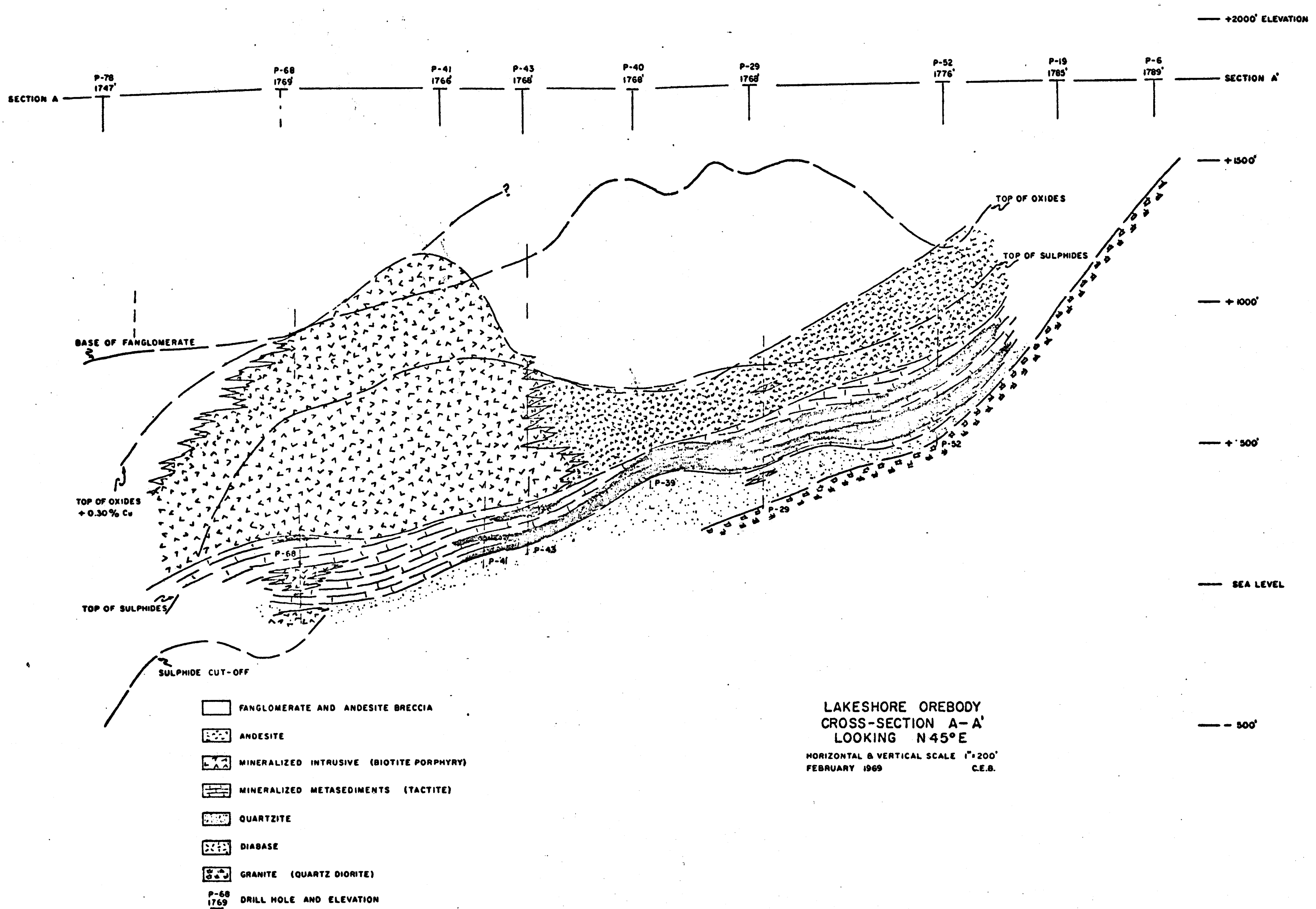


Fig. 15

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
ISOPACH OF TACTITE
CONTOUR INTERVAL 50 FEET

SCALE 1" = 200	DATE 2/19/69	REVISIONS
DRAWN BY C E B	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		
GEOLOGY BY C E BARRON		



+2000' ELEVATION
SECTION A
SECTION A'
P-78 1747'
P-68 1769'
P-41 1766'
P-43 1768'
P-40 1768'
P-29 1768'
P-52 1776'
P-19 1785'
P-6 1789'
+1500'
+1000'
+500'
SEA LEVEL
-500'
TOP OF OXIDES
TOP OF SULPHIDES
BASE OF FANGLOMERATE
TOP OF OXIDES +0.30% Cu
TOP OF SULPHIDES
SULPHIDE CUT-OFF
P-39
P-43
P-41
P-68
P-29
P-52
FANGLOMERATE AND ANDESITE BRECCIA
ANDESITE
MINERALIZED INTRUSIVE (BIOTITE PORPHYRY)
MINERALIZED METASEDIMENTS (TACTITE)
QUARTZITE
DIABASE
GRANITE (QUARTZ DIORITE)
P-68 1769 DRILL HOLE AND ELEVATION
LAKESHORE OREBODY
CROSS-SECTION A-A'
LOOKING N45°E
HORIZONTAL & VERTICAL SCALE 1"=200'
FEBRUARY 1969
C.E.B.

Fig. 16

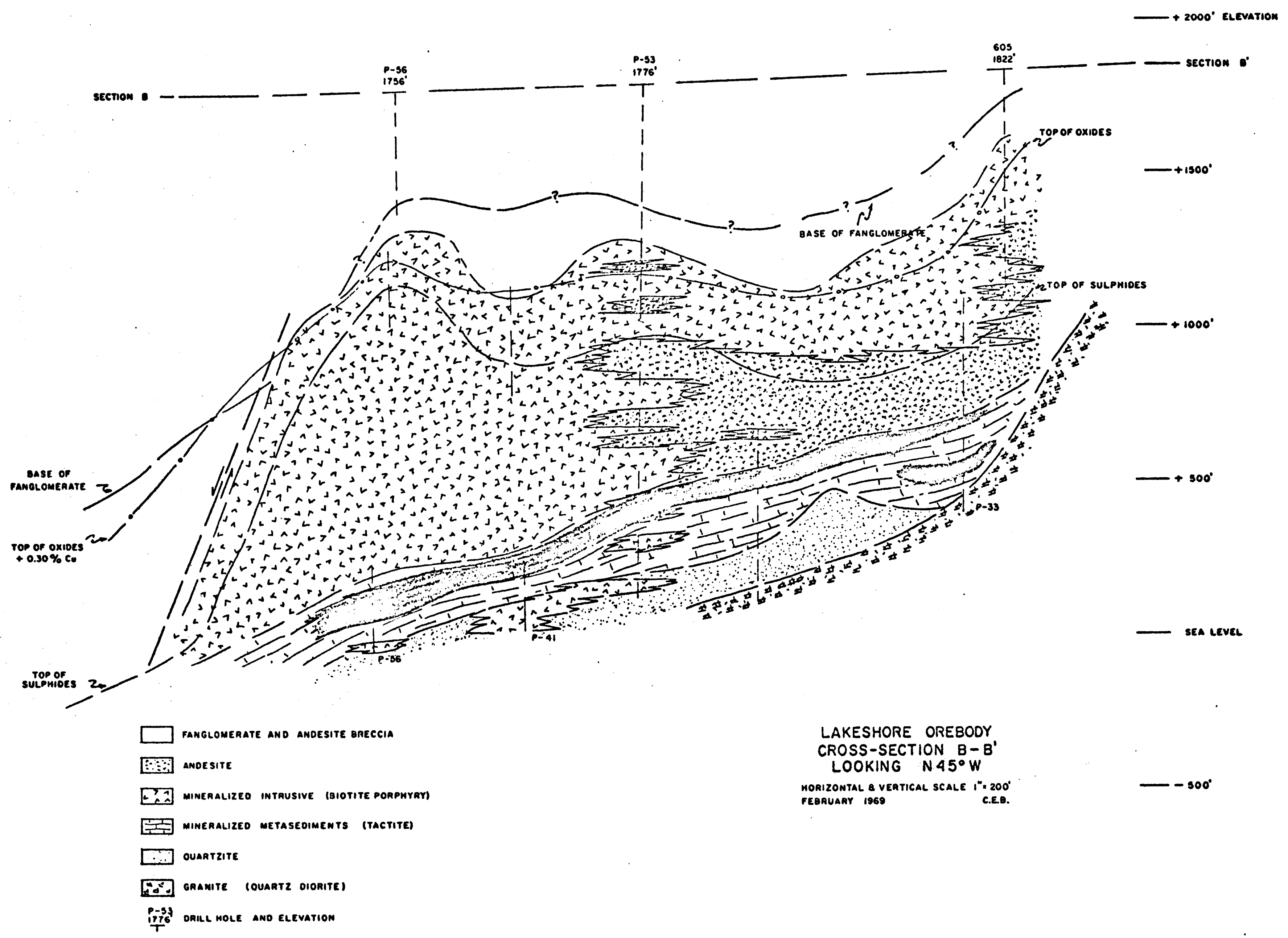

+ 2000' ELEVATION
SECTION B'
+1500'
+ 1000'
+ 500'
SEA LEVEL
- 500'
SECTION B
P-56
1756'
P-53
1776'
605
1822'
TOP OF OXIDES
BASE OF FANGLOMERATE
TOP OF SULPHIDES
P-33
P-41
P-56
BASE OF FANGLOMERATE
TOP OF OXIDES + 0.30% Cu
TOP OF SULPHIDES
FANGLOMERATE AND ANDESITE BRECCIA
ANDESITE
MINERALIZED INTRUSIVE (BIOTITE PORPHYRY)
MINERALIZED METASEDIMENTS (TACTITE)
QUARTZITE
GRANITE (QUARTZ DIORITE)
P-53 1776 DRILL HOLE AND ELEVATION
LAKESHORE OREBODY
CROSS-SECTION B-B'
LOOKING N45°W
HORIZONTAL & VERTICAL SCALE 1" = 200'
FEBRUARY 1969
C.E.B.

Fig. 17

(11) Overlying the highly fractured and altered andesite, biotite porphyry and tactite is a relatively unfractured, weakly cemented fanglomerate that thickens from ± 100 feet at the edge of the valley to ± 1500 feet around the southwest end of the biotite porphyry and is apparently in contact with the altered and oxidized top of this intrusive.

In summation, the geological data indicates the occurrence of mineralization at Lakeshore to be the result of the emplacement of a weakly mineralized biotite porphyry. This stock-like mass formed a multiple sill contact with eroded and deformed metasediments and the overlying andesites and breccia. The processes of contact metamorphism formed tactite or skarn in the metasediments and a higher grade of sulphide mineralization was deposited in the more favorable carbonates. Post-mineral faulting and fracturing formed channels for erosion, leaching, and enrichment of mineralization. This mineral deposit was tilted to the northwest and underwent a second period of erosion and oxidization. This oxidized and fractured surface was then buried by the present overlying fanglomerate (Fig. 17).

COMPUTER EVALUATION

During March and April of 1968, a computer evaluation of the assay and geological data from 23 core holes was performed by an independent consultant (7). This evaluation provided the following information:

(1) Ore reserves, tonnage and grade of the sulphide and oxide mineralization for various cut-off grades and thicknesses;

(2) Level plans at various vertical intervals showing contours of sulphide copper values;

(3) Vertical cross-sections of the sulphide copper values;

(4) A confidence interval analysis to determine future drilling requirements; and

(5) A financial analysis based on ore reserves of varying cut off grades, and the following parameters - mining cost and mining methods, concentrator capacity and recovery, metal prices, capital requirements and financing, royalty, sales agreements, and taxation.

In May 1968, ore reserves based on assay and geological data from 23 holes was reported as follows:

1. Tactite reserves, based on a cut-off grade of 0.75% copper, were 13.7 million tons with an average grade of 1.84% copper.

2. Porphyry reserves including tactite, based on a cut-off grade of 0.50% copper, were 59 million tons with an average grade of 0.99% copper.

During September 1968, the assay and geological data was again submitted to an independent consultant (8) for computer evaluation. The following reserves were reported:

1. Porphyry reserves based on mineralization with a thickness greater than 200 feet and a cut-off grade of 0.50% copper were 86 million tons with an average grade of 0.81% copper. This included tactite material lying under the porphyry.

2. Tactite reserves, outside the porphyry area and with a cut-off grade of 1.00% copper, were 10 million tons with an average grade of 1.73% copper.

In November 1968, with the data from 42 core holes, the following up-dated ore reserves, classified as a total of proved and probable, were reported:

1. Porphyry reserves based on mineralization with a thickness greater than 200 feet and a cut-off grade of 0.50% copper, were 132.0 million tons with an average grade of 0.81% copper. This included 9 million tons of tactite material lying under the porphyry.

2. Tactite reserves, outside the porphyry area and with a cut-off grade of 1.00% copper, were 10 million tons with an average grade of 1.73% copper.

3. Oxide reserves, based on a cut-off grade of 0.50% copper, were 85 million tons with an average grade of 0.81% copper.

On February 7, 1969, with data from 51 core holes, the following ore reserves classified as a total of proved and probable, were reported:

1. Porphyry reserves, based on a cut-off grade of 0.40% copper, were 241 million tons with an average grade of 0.70% copper.

2. Tactite reserves, based on a cut-off grade of 1.00% copper, were 24 million tons with an average grade of 1.69% copper.

3. Oxide reserves, based on a cut-off grade of 0.40% copper, were 207 million tons with an average grade of 0.71% copper.

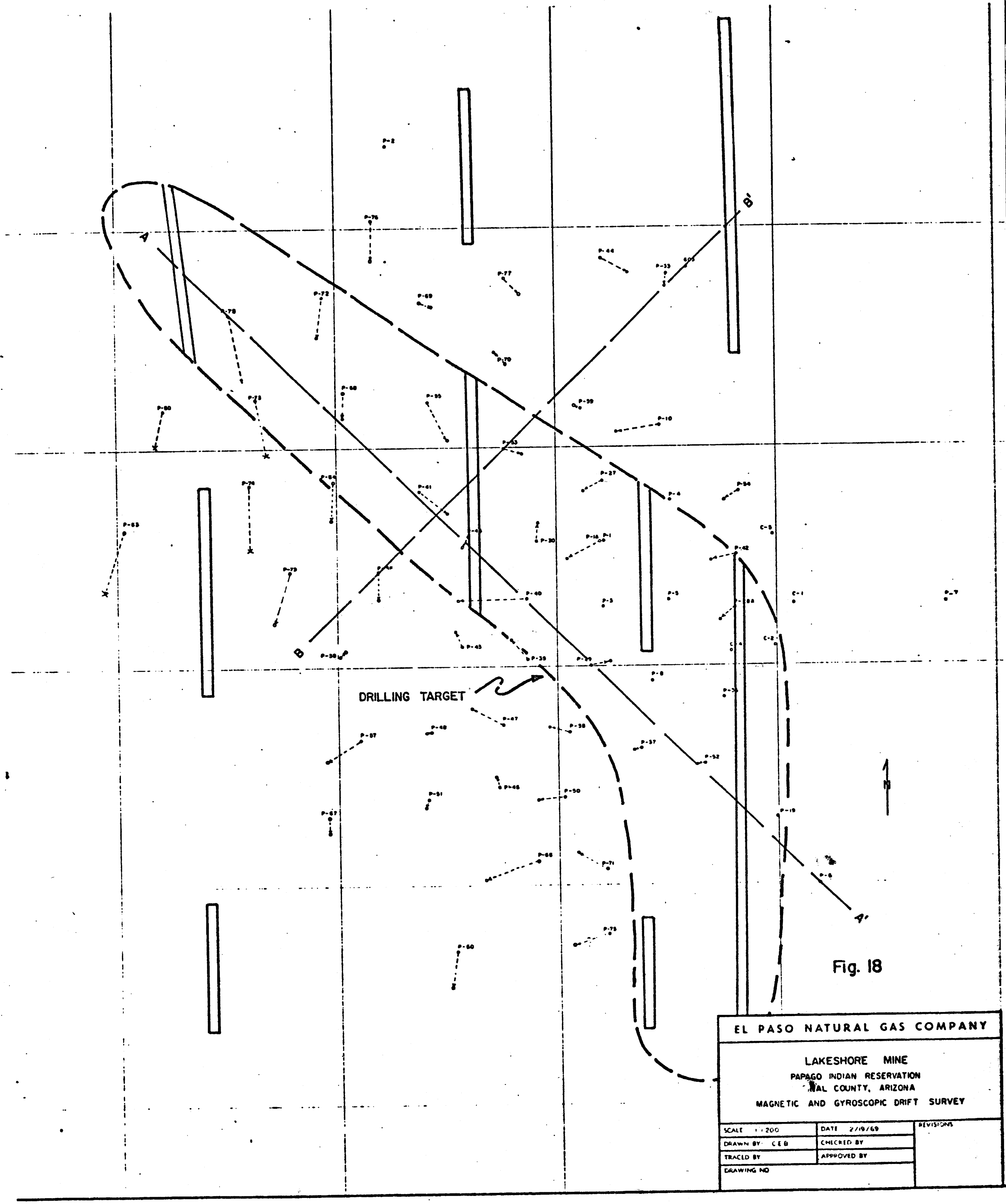


Fig. 18

EL PASO NATURAL GAS COMPANY

LAKESHORE MINE
PAPAGO INDIAN RESERVATION
PINAL COUNTY, ARIZONA
MAGNETIC AND GYROSCOPIC DRIFT SURVEY

SCALE 1:200	DATE 2/19/69	REVISIONS
DRAWN BY: CEB	CHECKED BY	
TRACED BY	APPROVED BY	
DRAWING NO		

CONCLUSION

In the opinion of the writer, the discovery of sulphide mineralization at Lakeshore was the result of a successful interpretation of combined geologic and geophysical data. The rotation of the mineralized metasediments to an assumed pre-tilt attitude gave a reason for projecting these metasediments to the northwest. The I. P. anomalies were correlated with this assumed northwest projection.

At the end of this phase of the exploration program, the majority of mineralized core holes have been collared within or near the limits of the proposed drilling target (Fig. 18). The interpretation that assumed overturning of metasediments by tilting to the northwest has been strengthened by three core holes which were collared in the oxide ore body and again entered mineralized metasediments at depth after penetrating the andesites. The discovery of the mineralized tactite led to the discovery of sulphide mineralization in the biotite porphyry intrusive and a "porphyry copper" deposit.

The gyroscopic drift survey of drill holes accurately located the subsurface position of the assay and geologic data that was obtained from the diamond drill cores, and gave the necessary vertical and horizontal control for the preparation of subsurface maps and cross sections and for computer evaluation of the mineral deposit.

Computer evaluation proved to be an efficient and rapid method of obtaining and updating grade and tonnage estimates during the exploration program.