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Arizona Department of Mines and Mineral Resources Mining Collection

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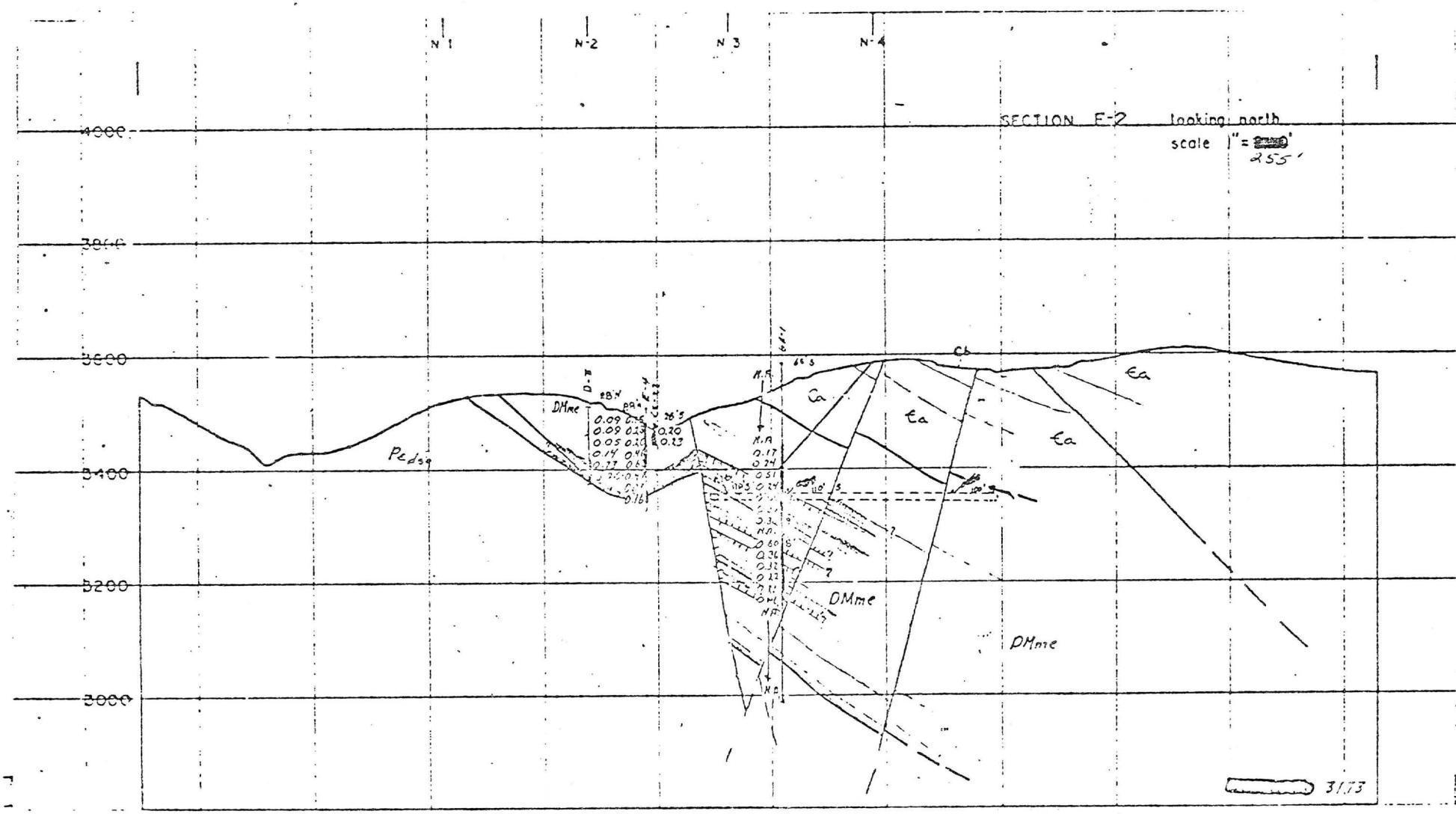
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N-2
N 3
N-4
SECTION E-2 looking north
scale 1" = [redacted]'
255'
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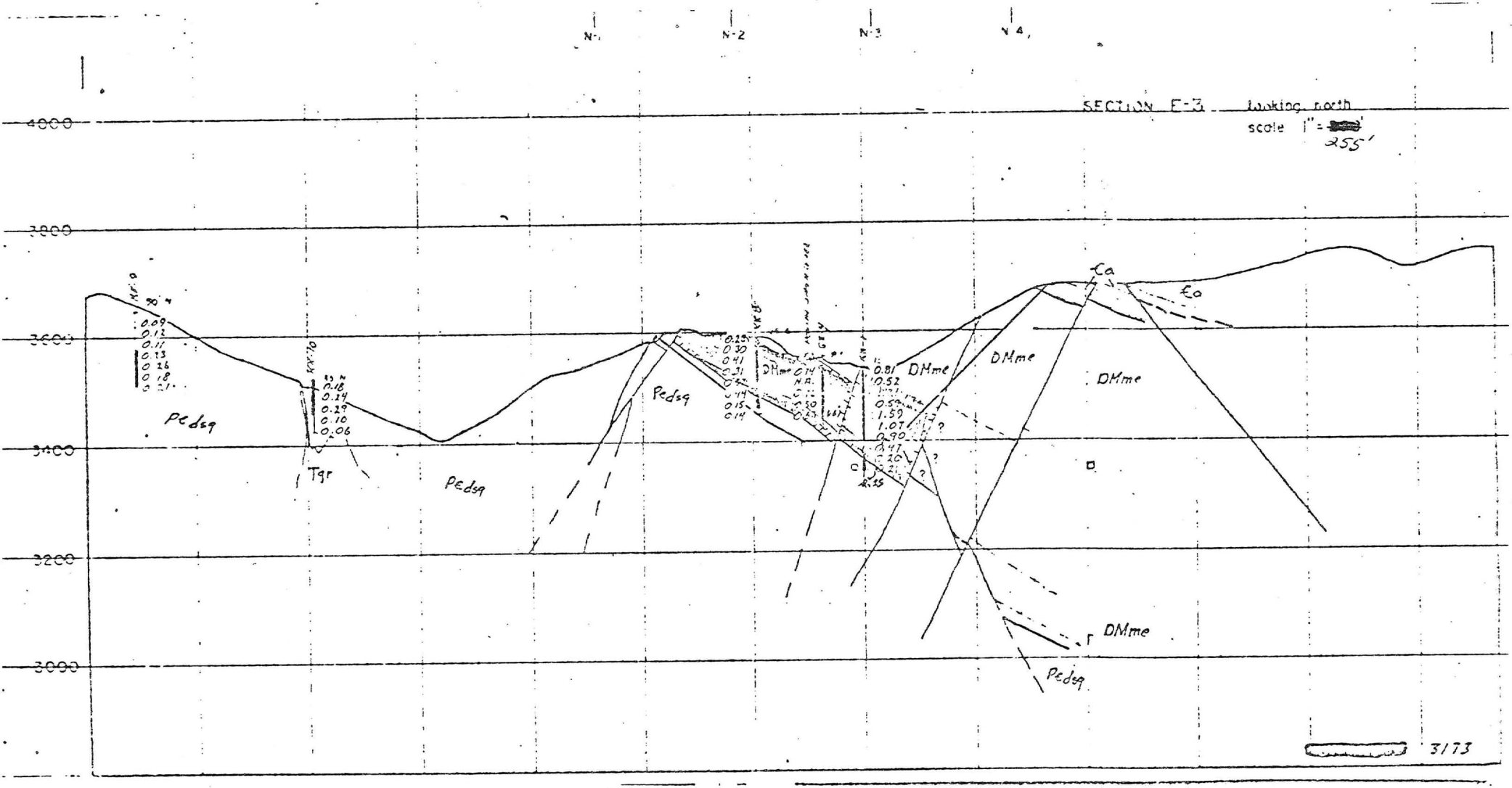
3800
3600
3400
3200
3000
Pedsq
DMme
Ca
Ca
Ca
Ca
DMme
DMme
3173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N-2
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N-4
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DMme
DMme
DMme
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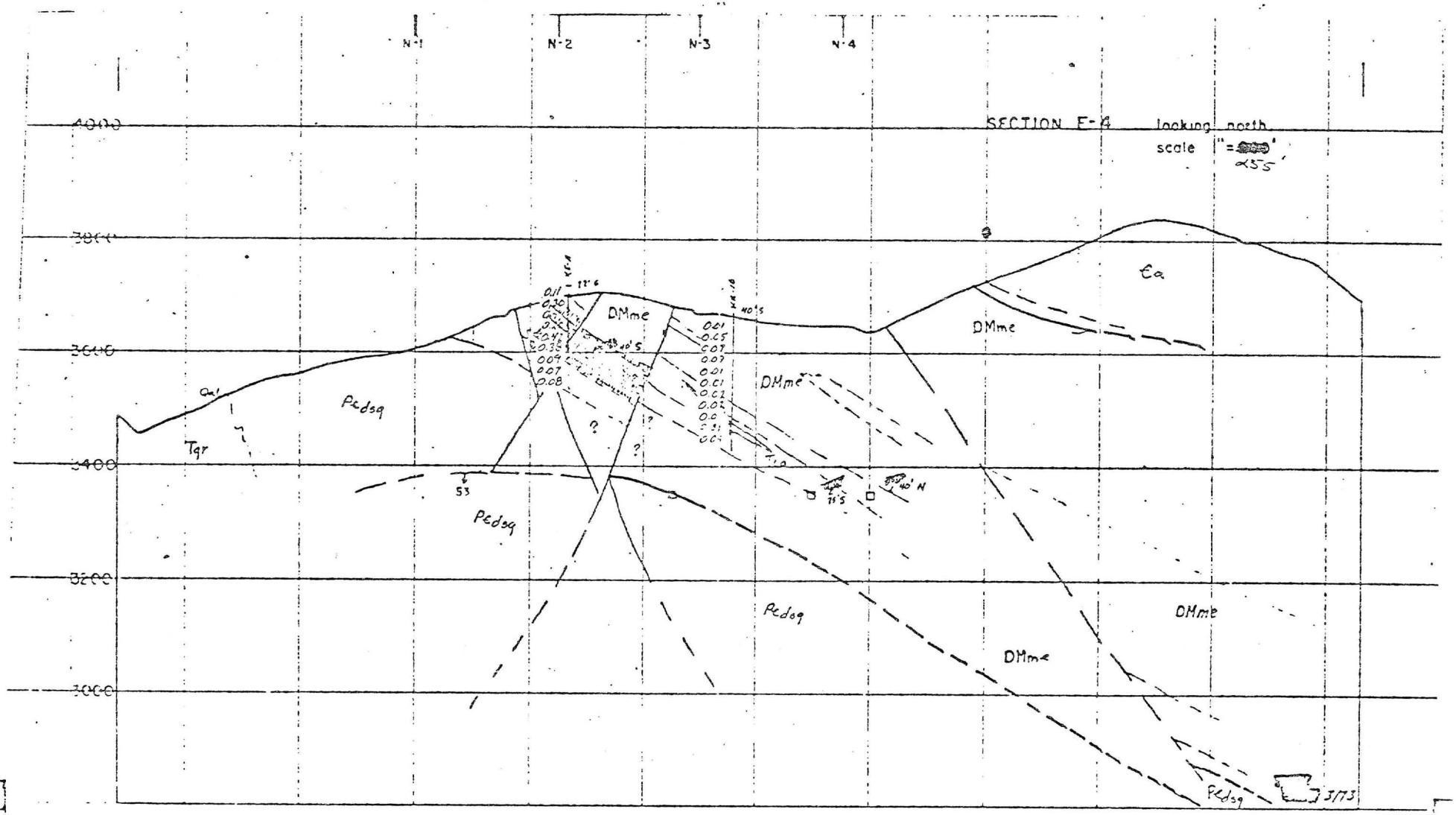
Ca
Eo
3173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looking north
scale
N-1
N-2
N-3
N-4
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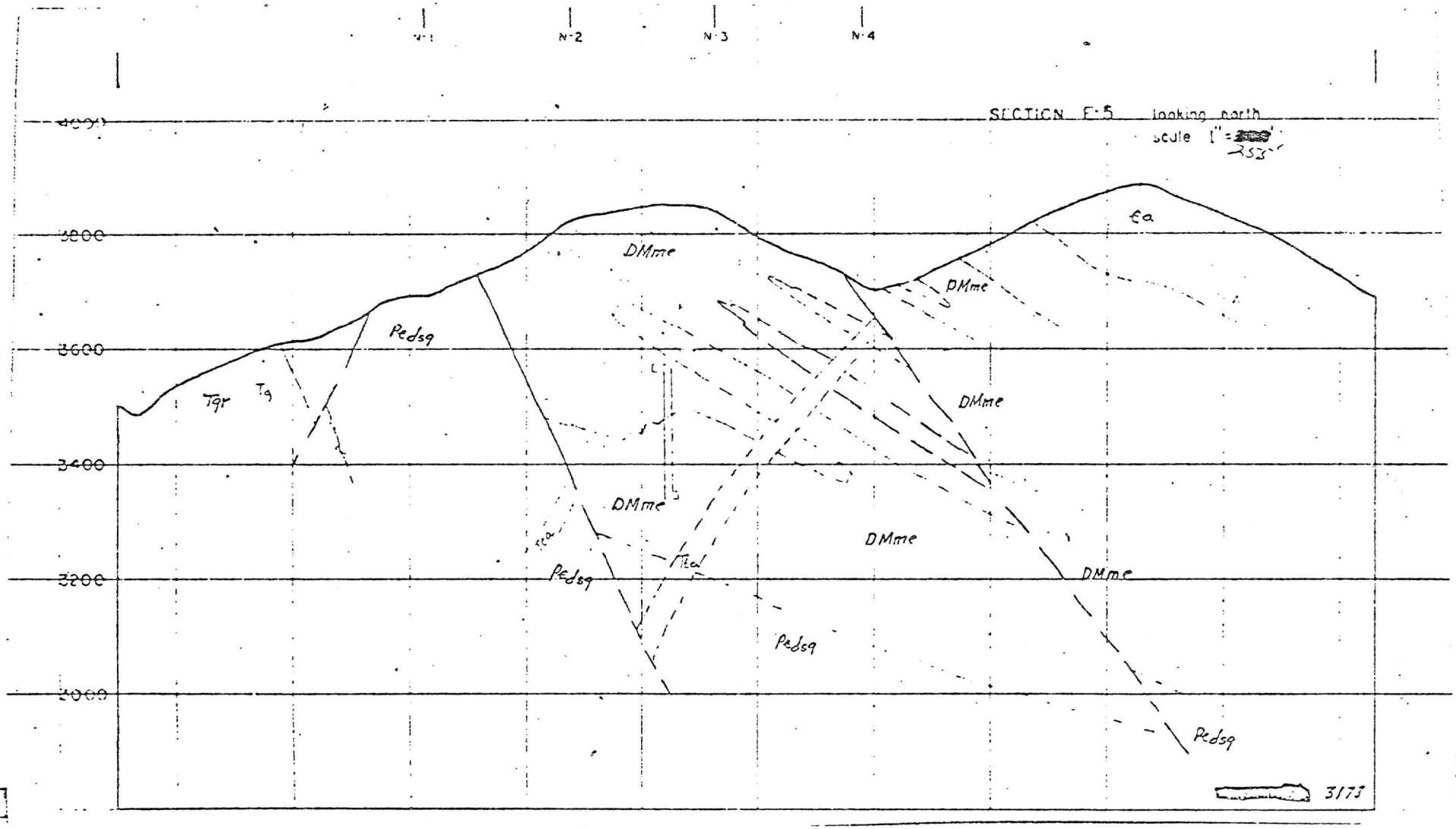
3800
3600
3400
3200
3000
DMme
Pedsq
Tqr
Qal
Ca
53
3/73


N-1
N-2
N-3
N-4
SECTION E-5 looking north
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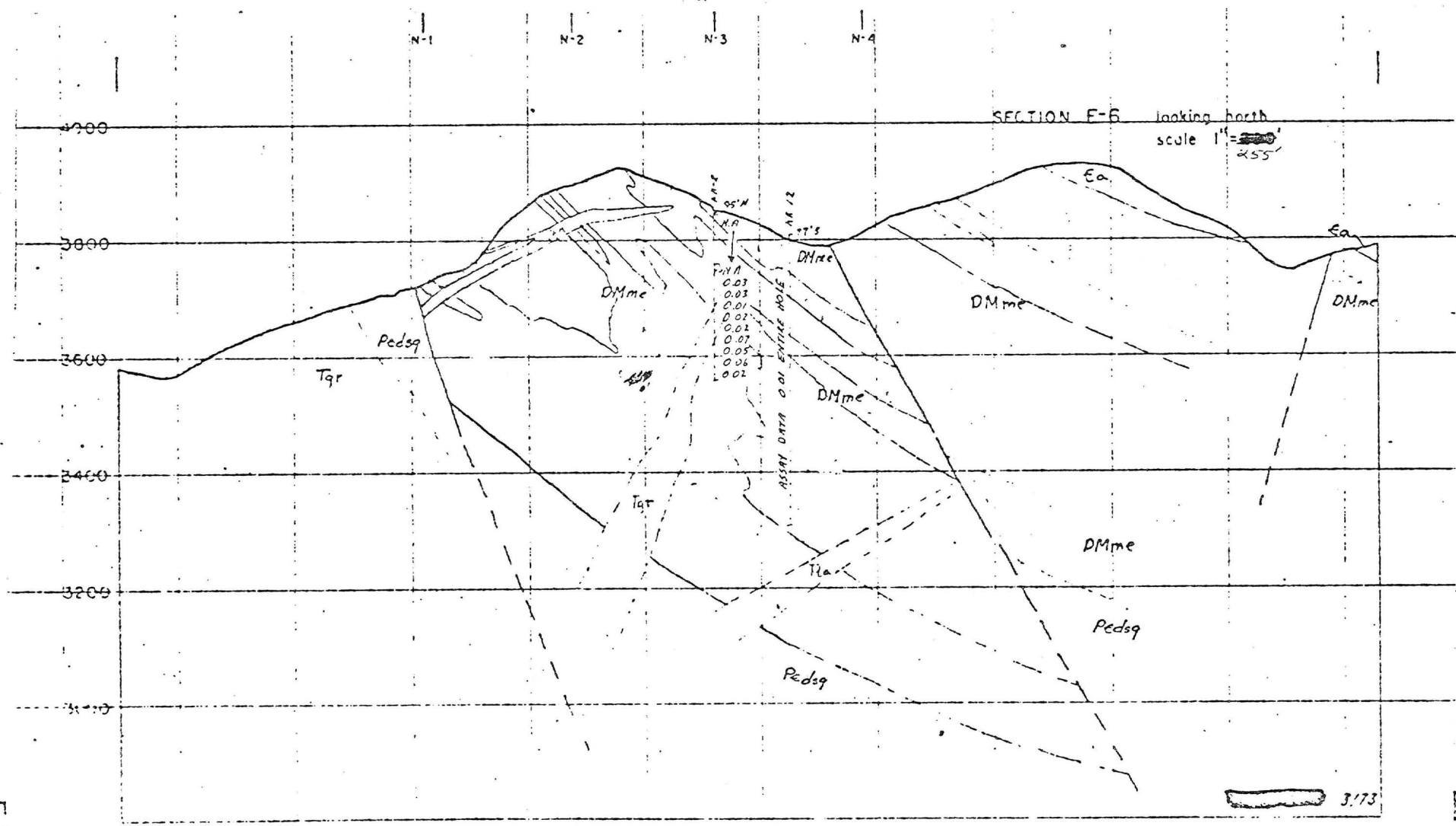
3600
3400
3200
3000
DMme
Pedsq
Tqr
Tq
Ea
Tlcl
3173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N-2
N-3
N-4
3800
3600
3400
3200
Ea
DMme
Pedsq
Tqr
Tla
95'N
95'S
N.A.
0.03
0.03
0.01
0.02
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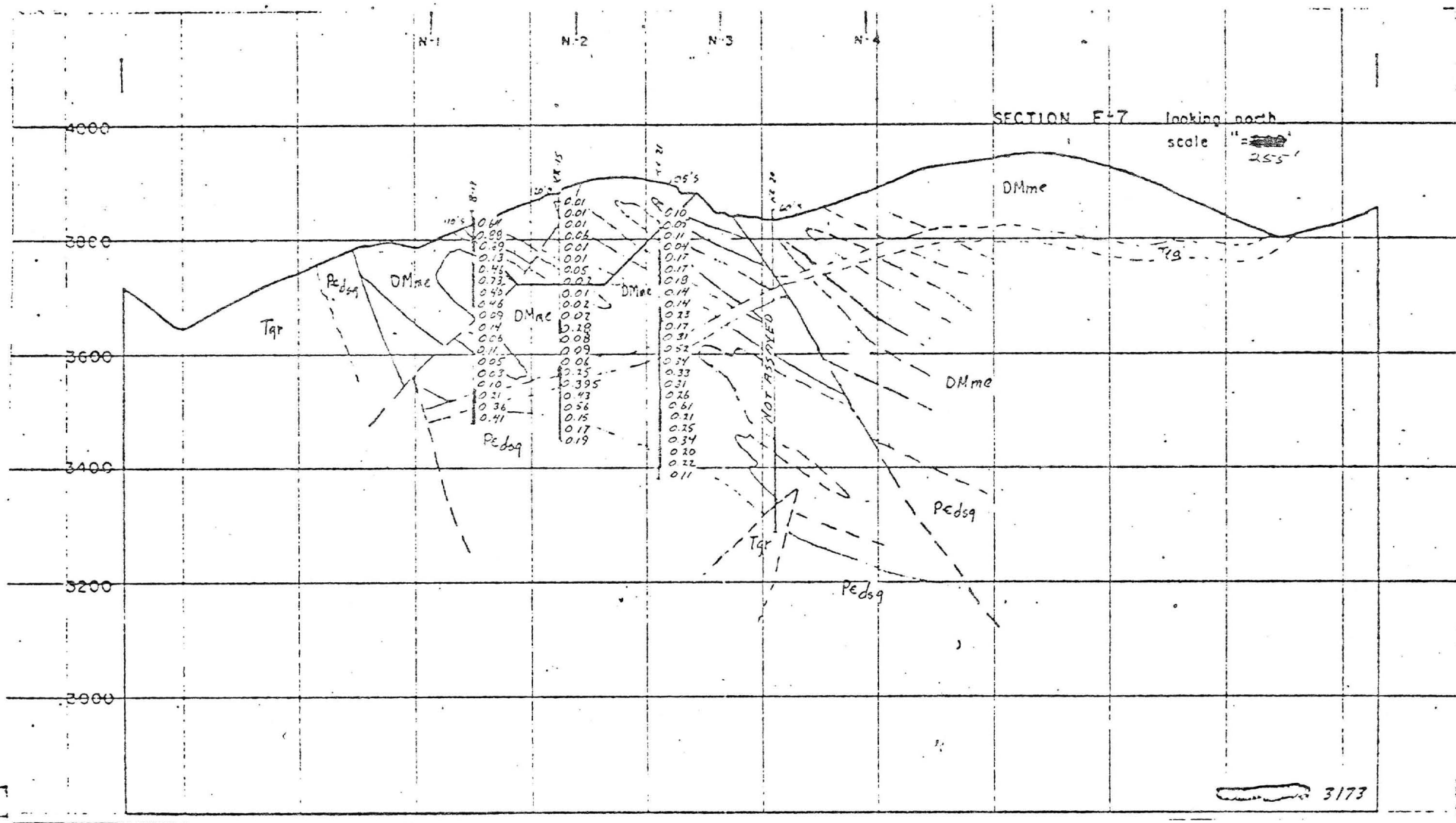
0.07
0.05
0.06
0.02
ASSAY DATA OF ENTIRE HOLE
3.173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scale "= 25'
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N-2
N-3
N-4
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3200
3000
DMme
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Tqr
Tqg
NOT ASSAYED
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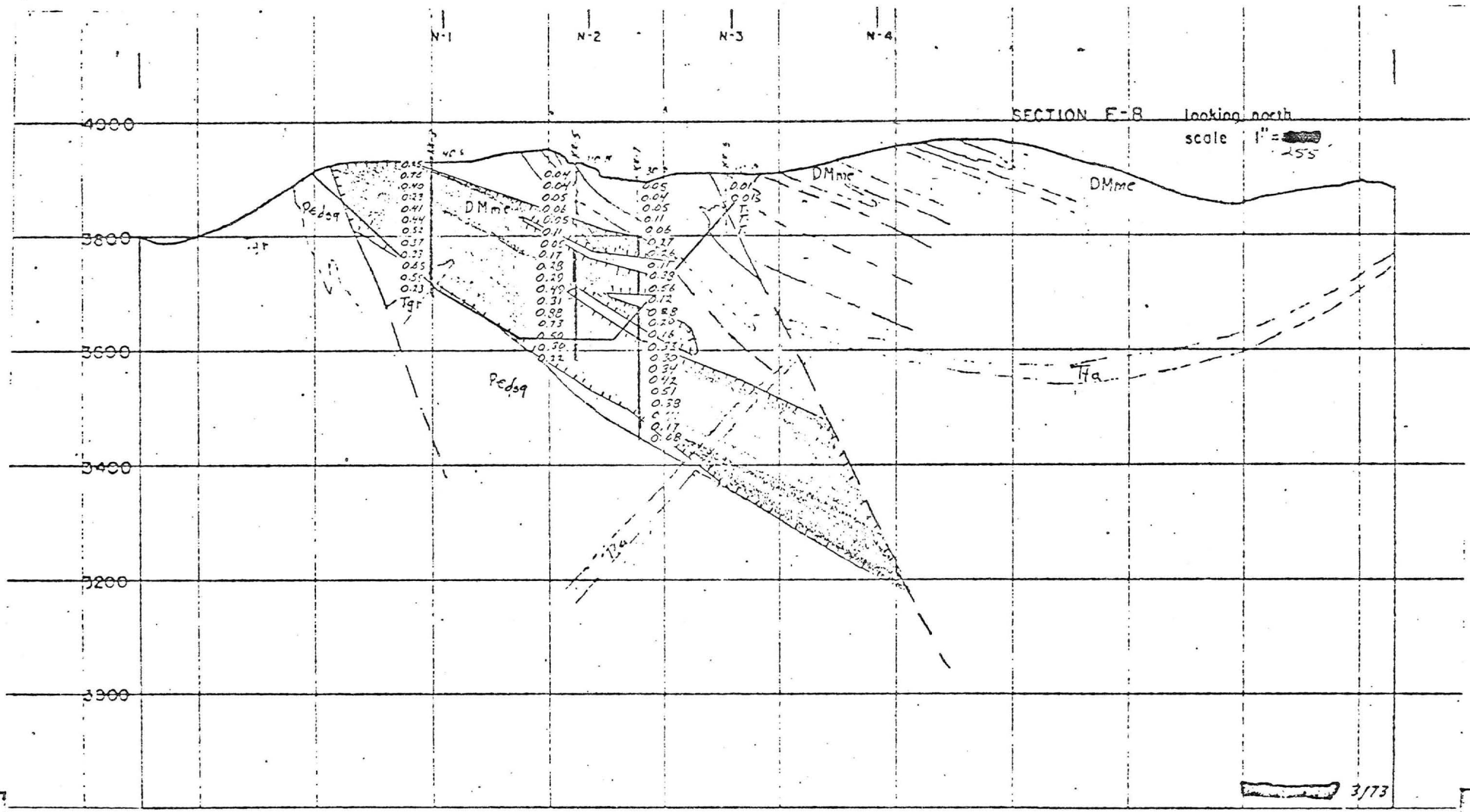
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N-2
N-3
N-4
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3200
3000
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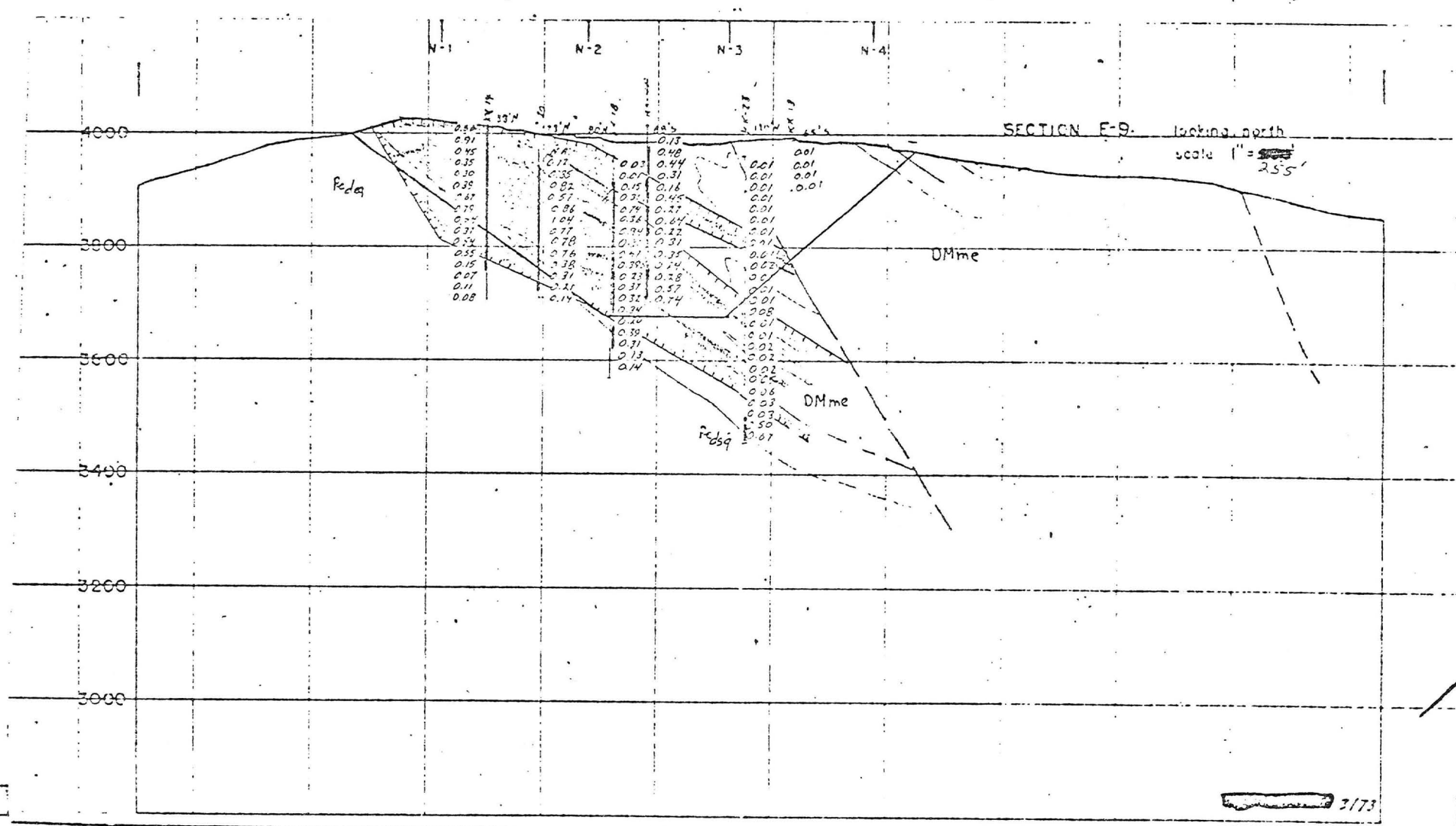
DMme
Pedog
Pedog
Tgr
Ha
Ha
3/73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N-1
N-2
N-3
N-4
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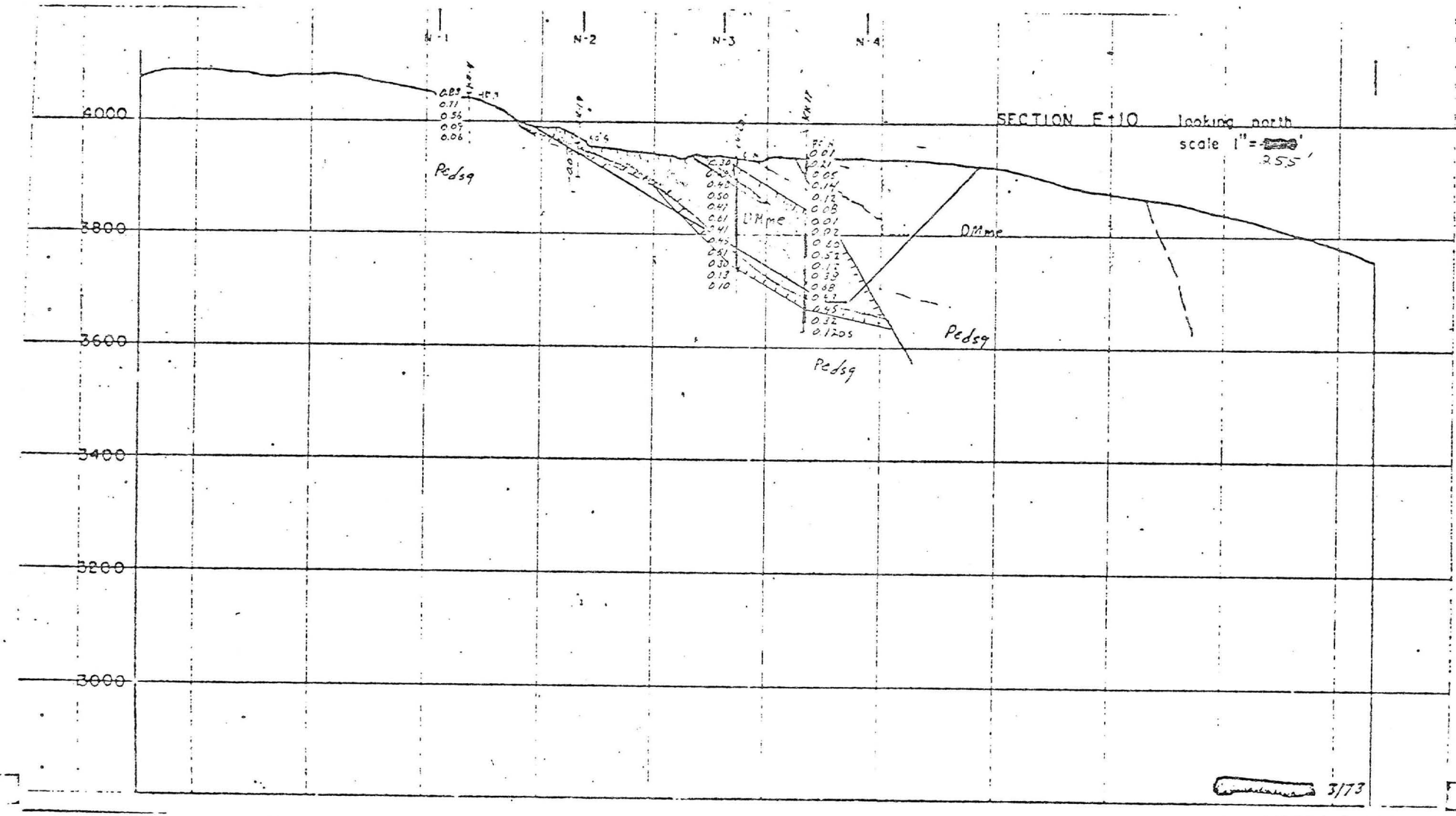
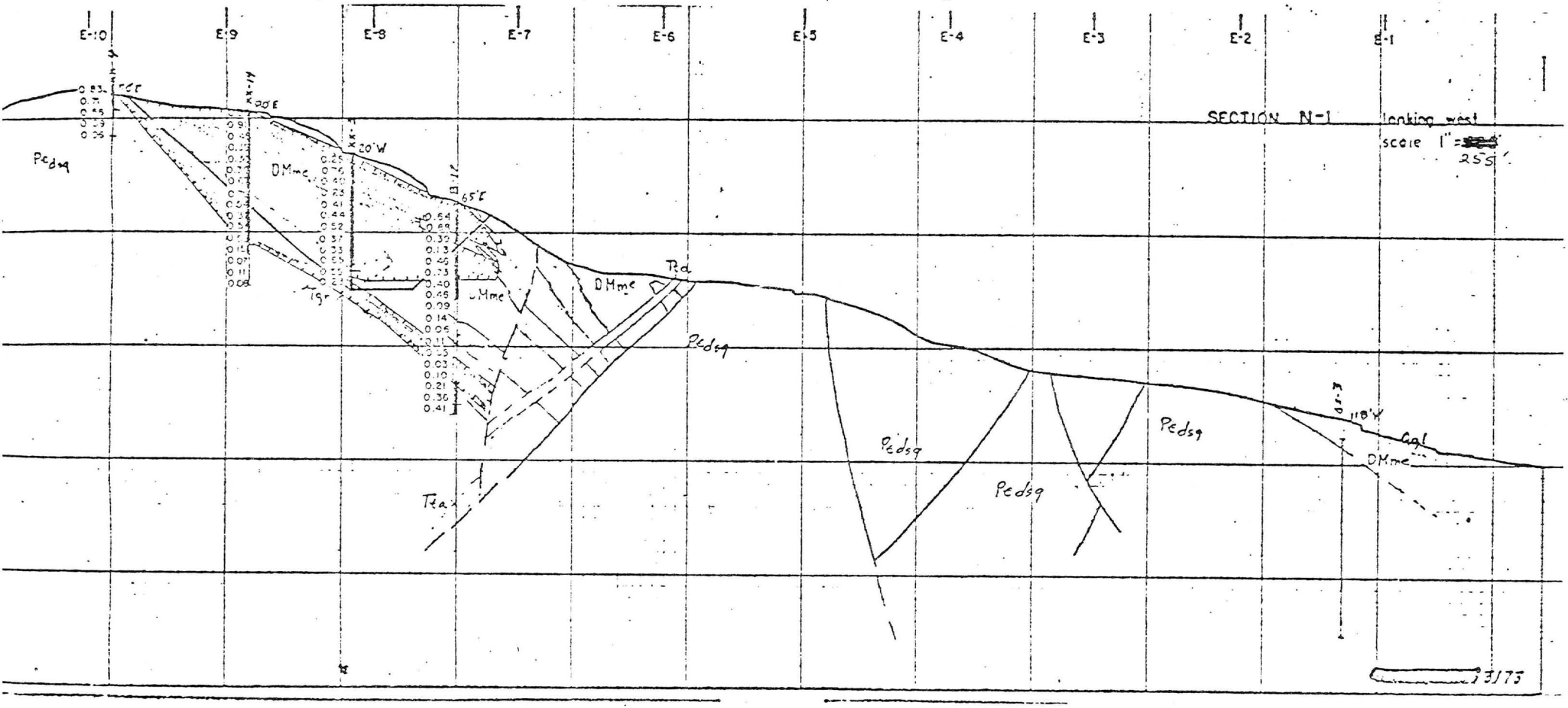
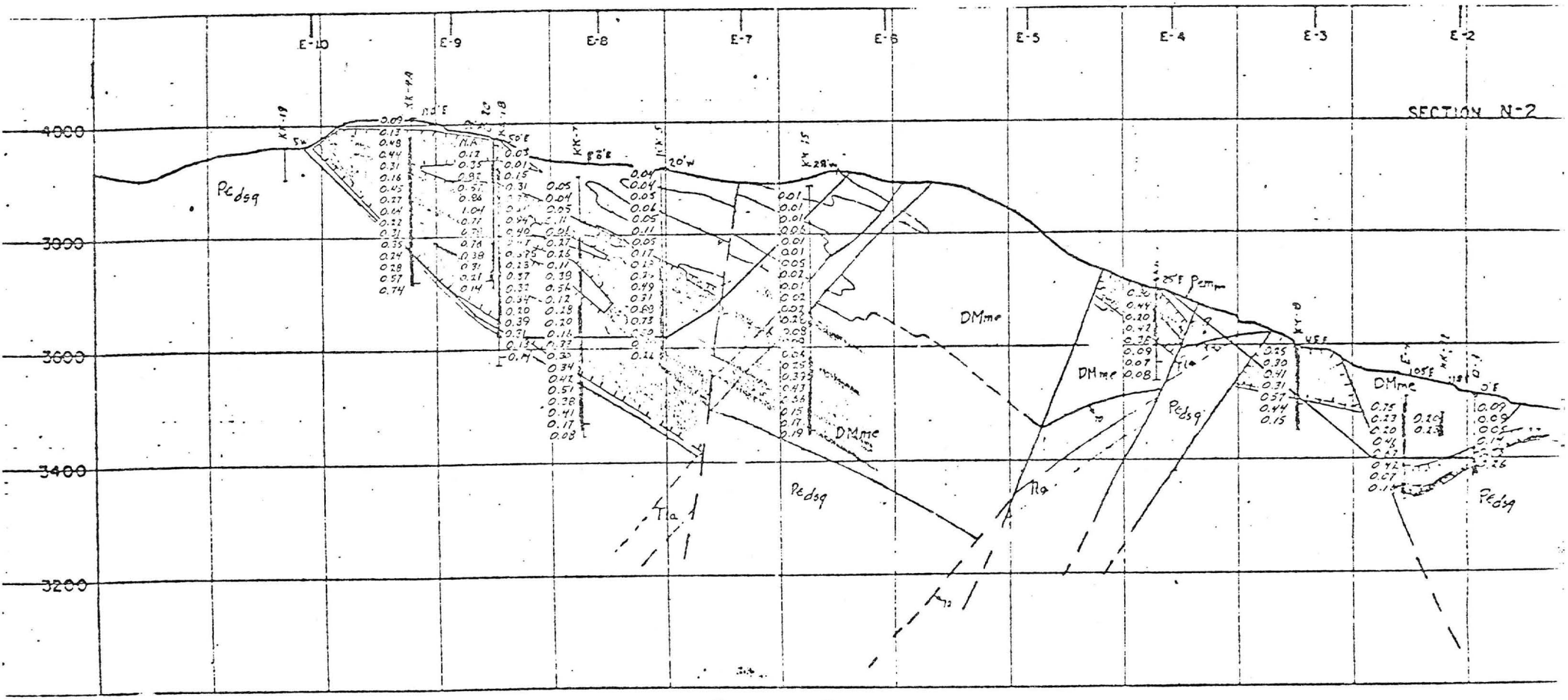
3400
3200
3000
Fedq
DMme
DMme
Fedsq
3/73


N-1
N-2
N-3
N-4
4000
3800
3600
3400
3200
3000
SECTION E+10 looking north
scale 1" = 25.5'
Pedsq
UMme
DMme
Pedsq
Pedsq
3/73


E-10
E-9
E-8
E-7
E-6
E-5
E-4
E-3
E-2
E-1
SECTION N-1
looking west
scale 1" = 255'
Pedsq
DMme
Tgr
Tra
Pedsq
Pedsq
Pedsq
Pedsq
Qal
DMme
3/75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E-10
E-9
E-8
E-7
E-6
E-5
E-4
E-3
E-2
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3800
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3400
3200
Pedsq
DMme
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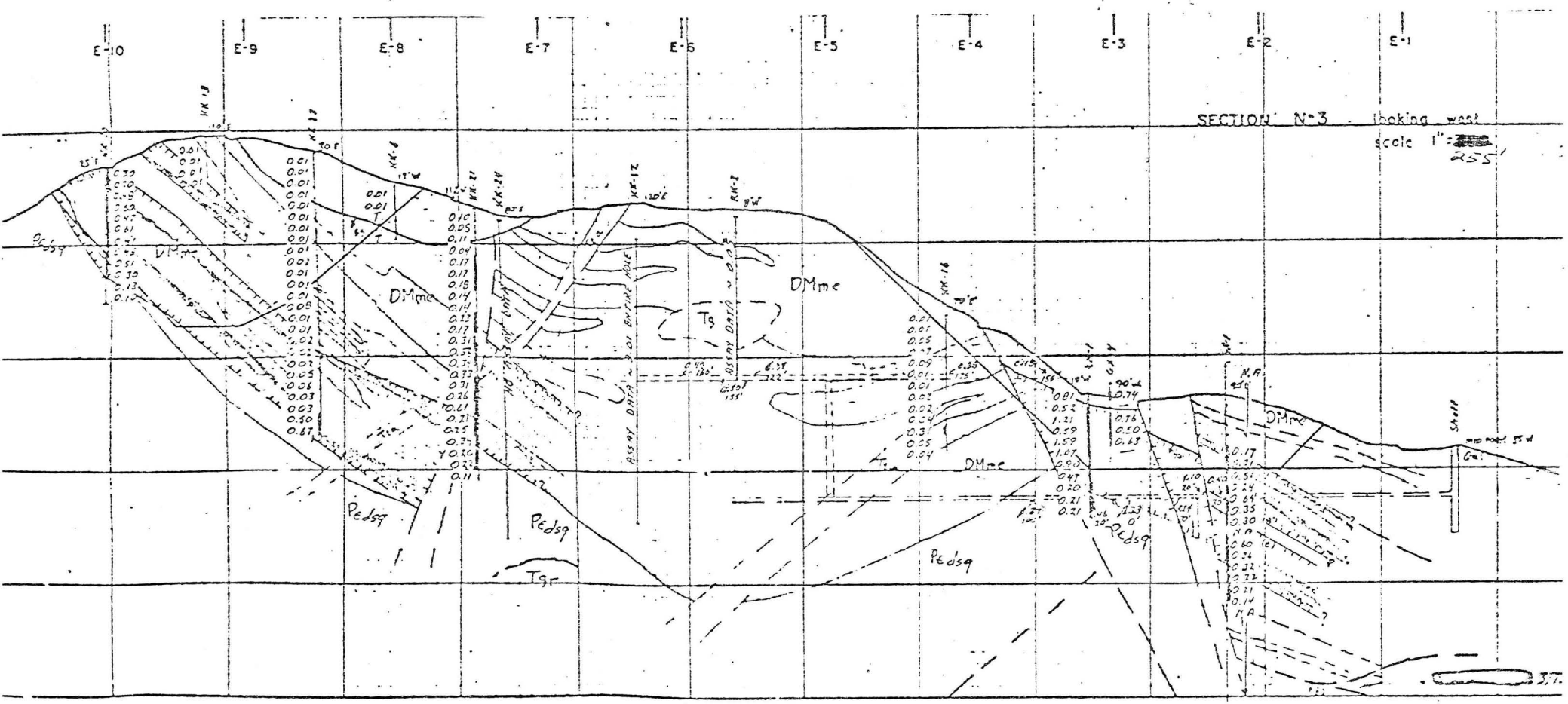
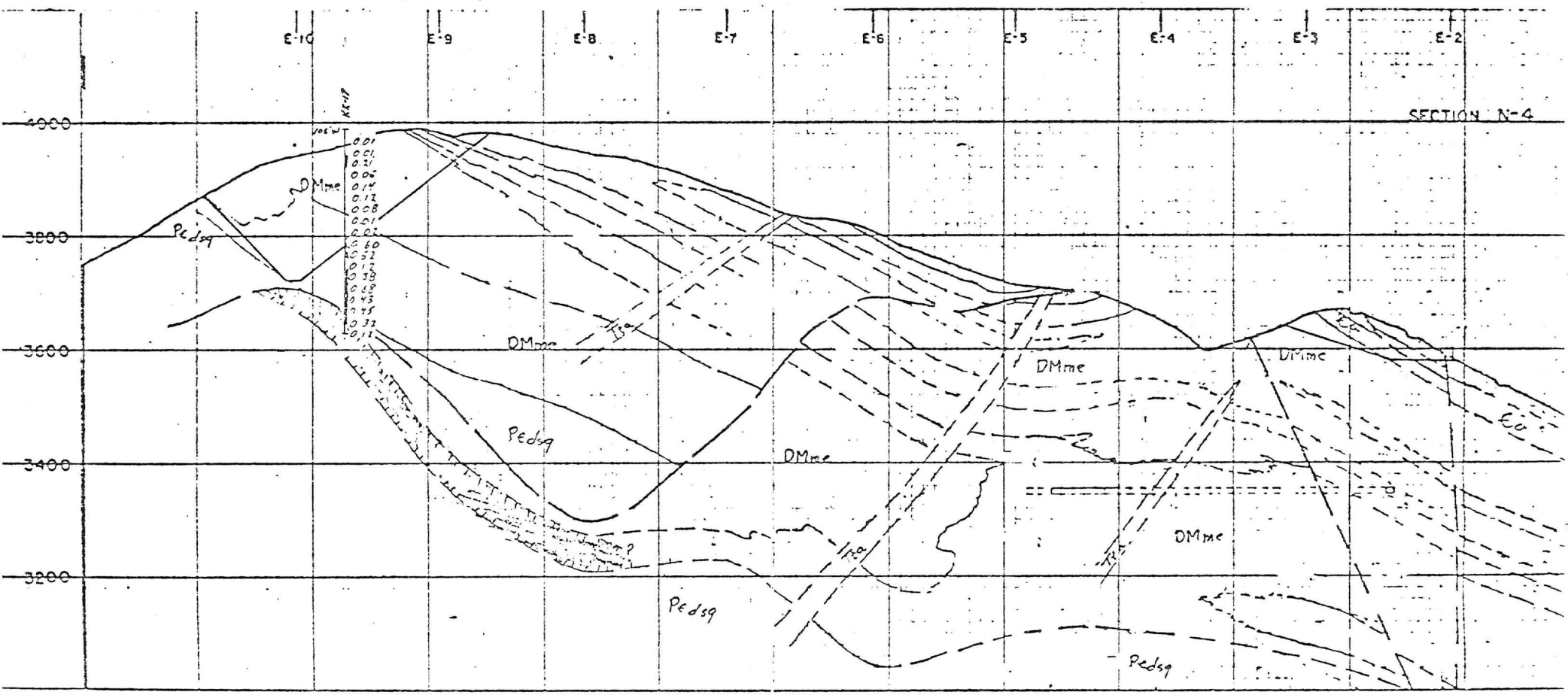
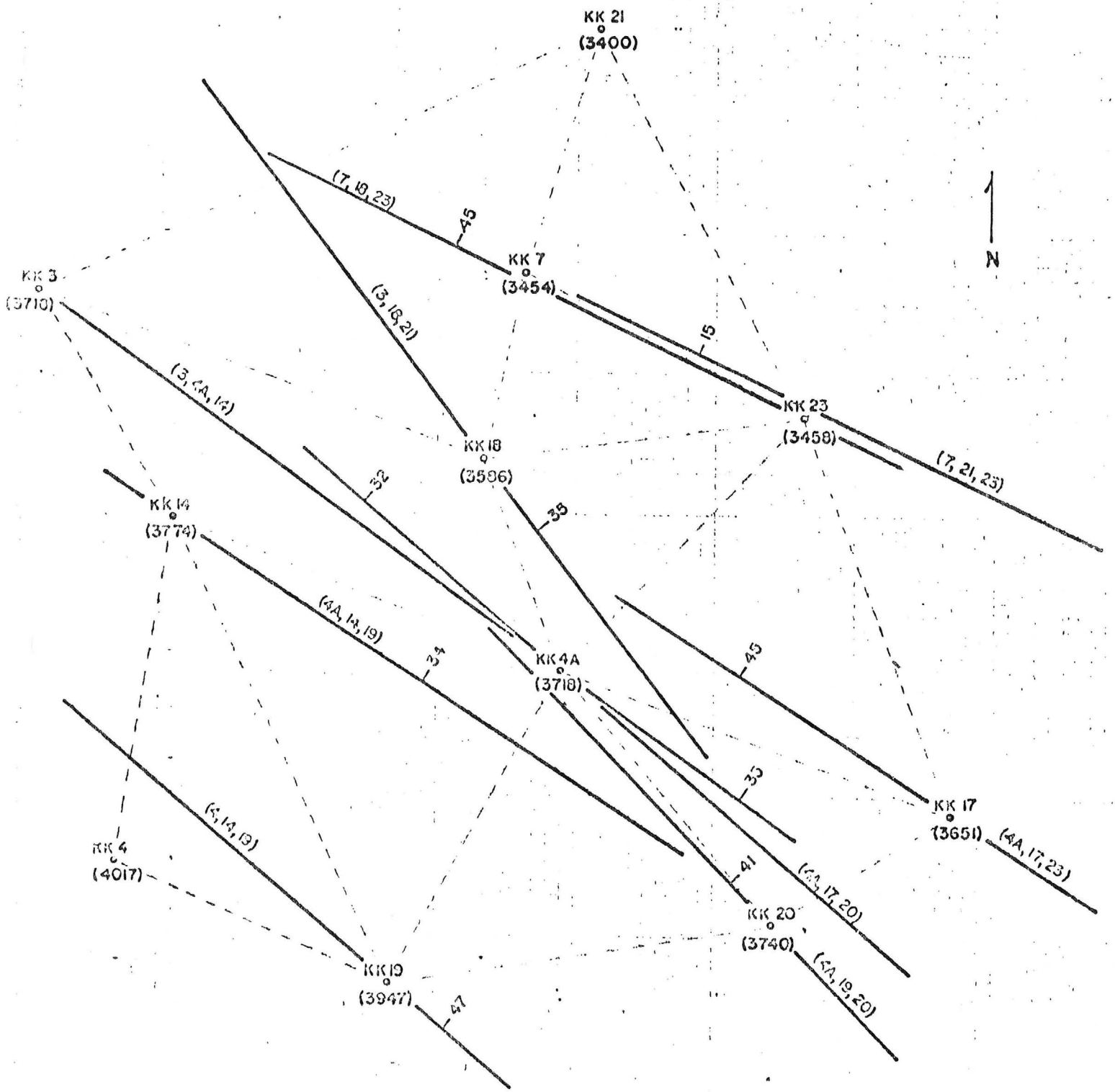
DMme
DMme
Pedsq
DMme
Pedsq


E-10
E-9
E-8
E-7
E-6
E-5
E-4
E-3
E-2
E-1
SECTION N°3 looking west
scale 1" = [redacted]
25'
DMme
Pedsq
Tg
Tgr
N.A.


E-10
E-9
E-8
E-7
E-6
E-5
E-4
E-3
E-2
SECTION N-4
4000
3800
3600
3400
3200
DMme
Pedsq
DMme
Pedsq
DMme
Pedsq
DMme
DMme
DMme
Pedsq
Pedsq
Eo
Eo

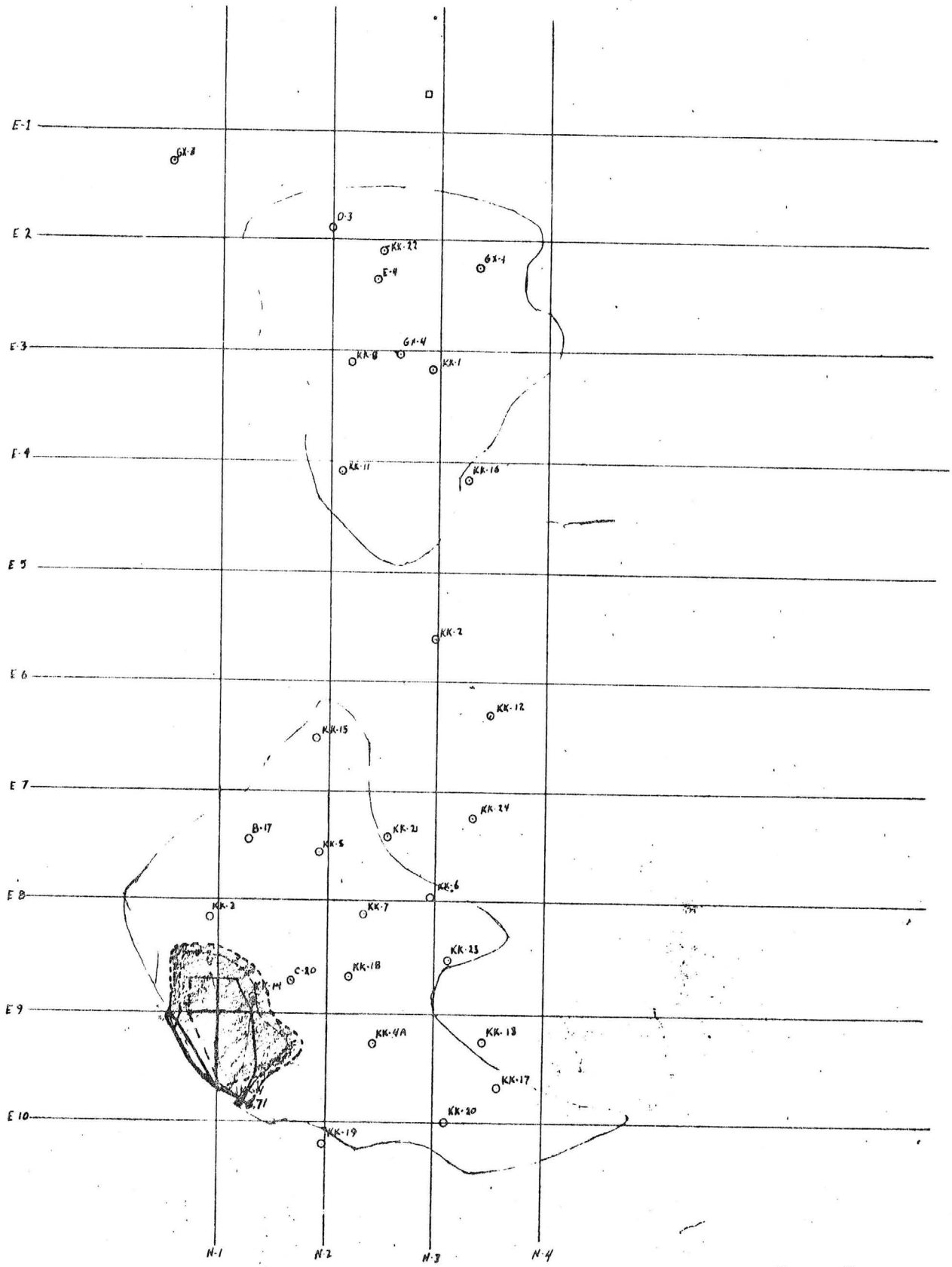



THREE POINT STRIKE AND DIP CALCULATIONS FOR BOTTOM OF ORE ZONE BASED O
INFORMATION FROM HOLES KK 3, 4, 4A, 7, 14, 17, 18, 19, 20, 21, & 23.

AVERAGE STRIKE N-50-W,
15-47 NE.

HEINRICHS
GEOEXPLORATION COMPANY
POST OFFICE BOX 8071, TUCSON, ARIZONA, 85703
Phone: 602/623-0570 Cable: GEOEX, Tucson
geophysical engineers
vancouver
sydney

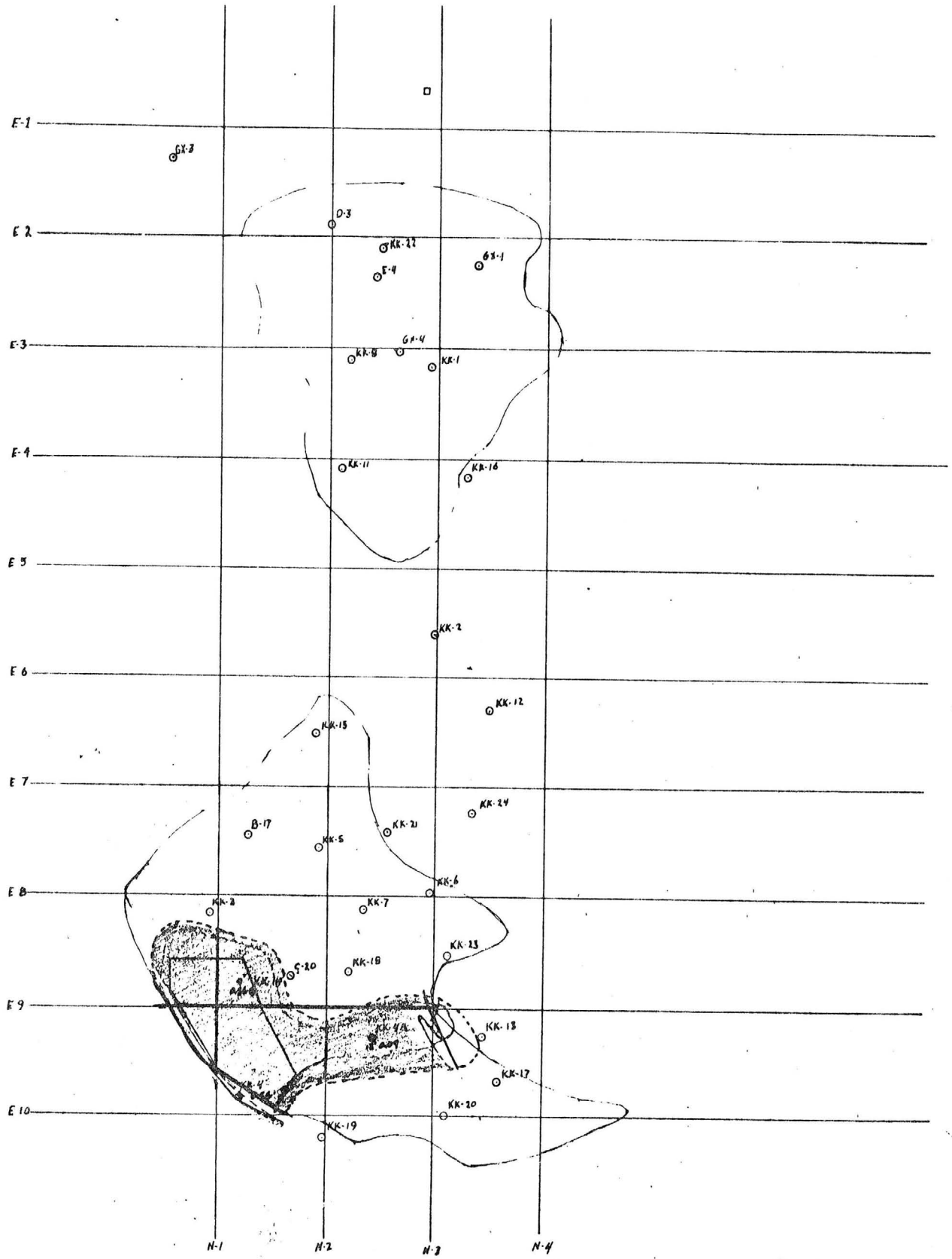
JOB 575 JAN. 1971




Bench 4020

elevation at base of bench

SCALE 1" = 33.3'

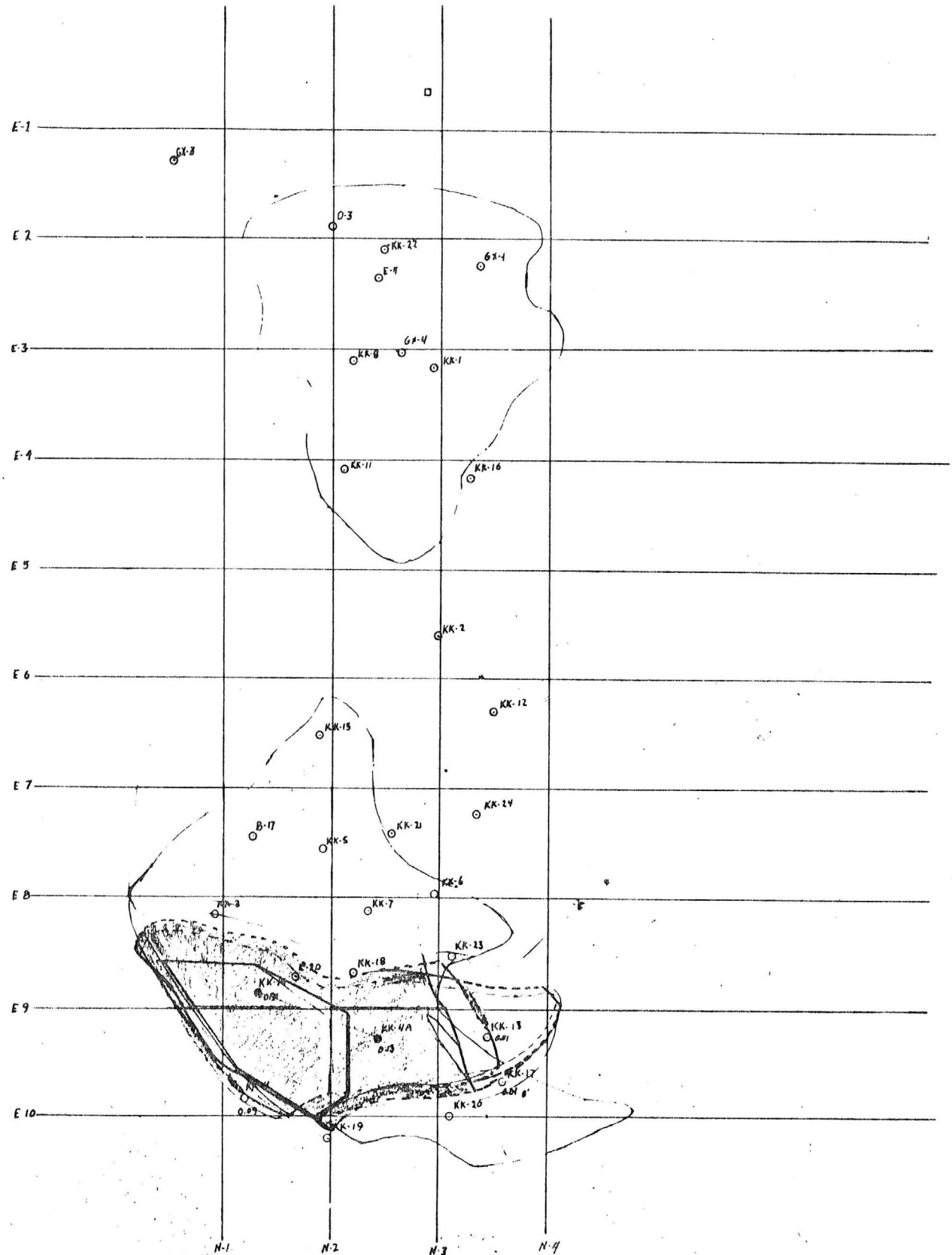



Bench #4000

elevation at base of bench

SCALE 1" = 333.3'

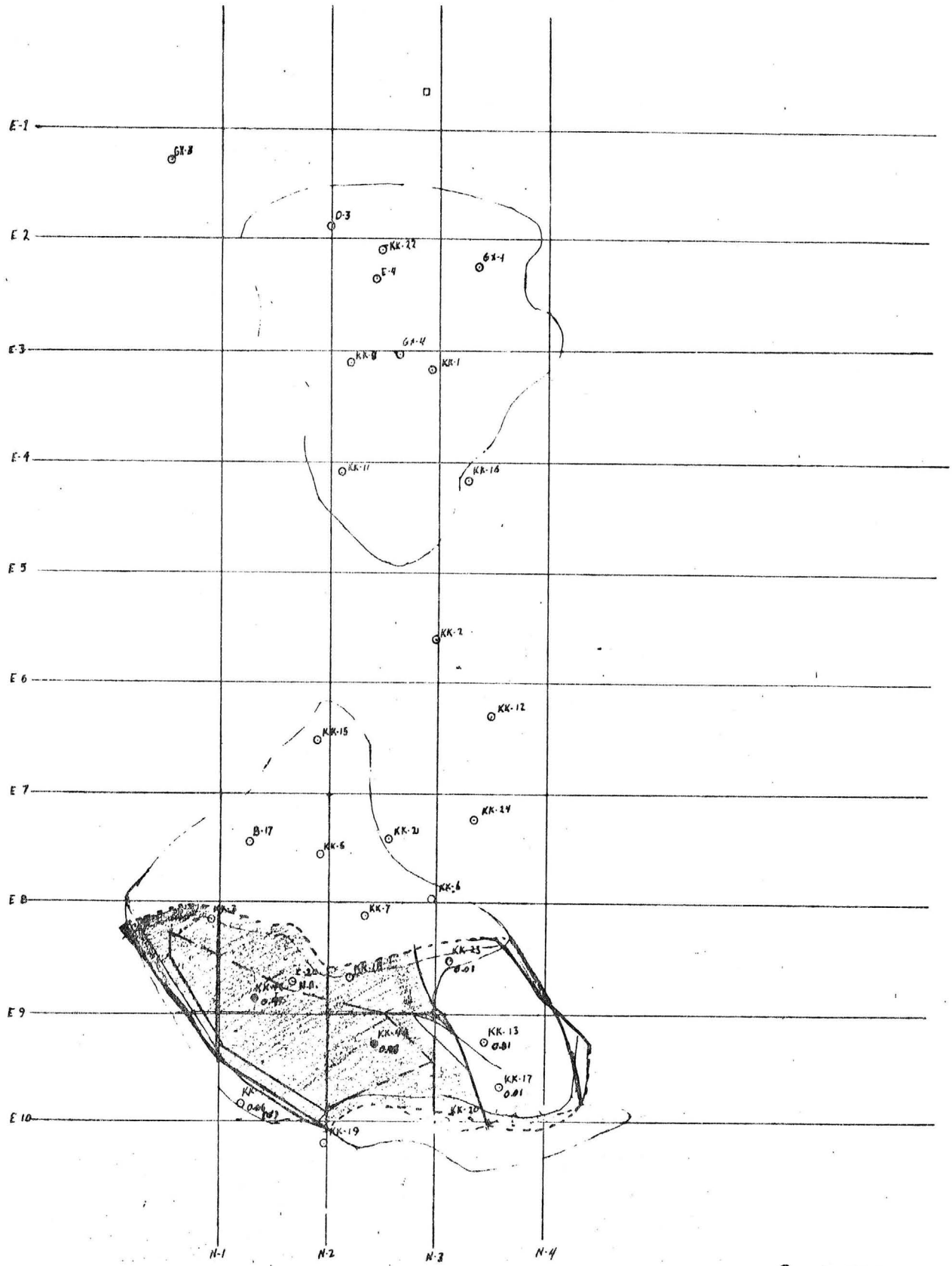
N




Bench 3980

elevation at base of bench

SCALE 1" = 33.3'

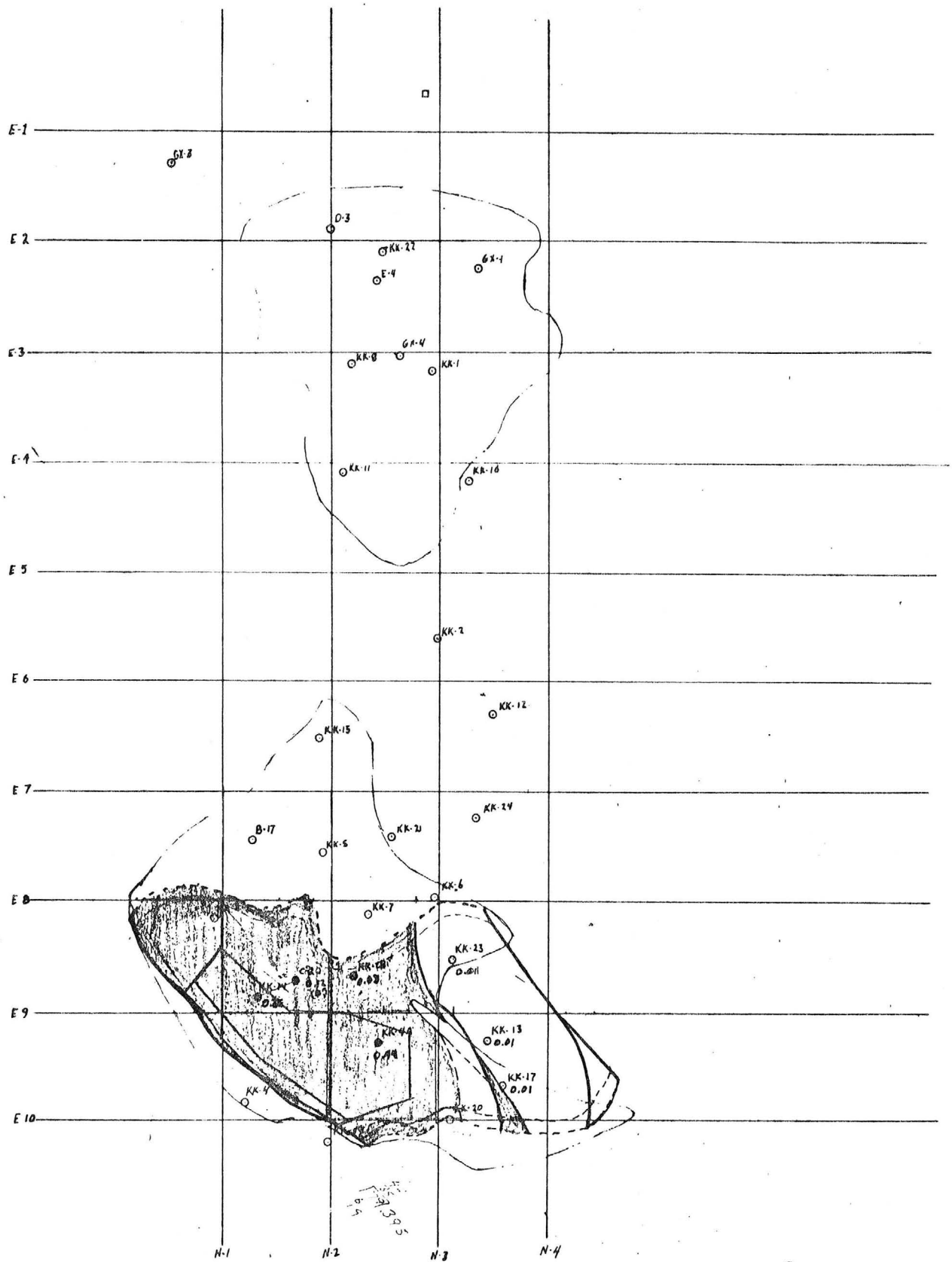



Bench 3960

elevation at base of bench

SCALE 1" = 3-3.5'

N

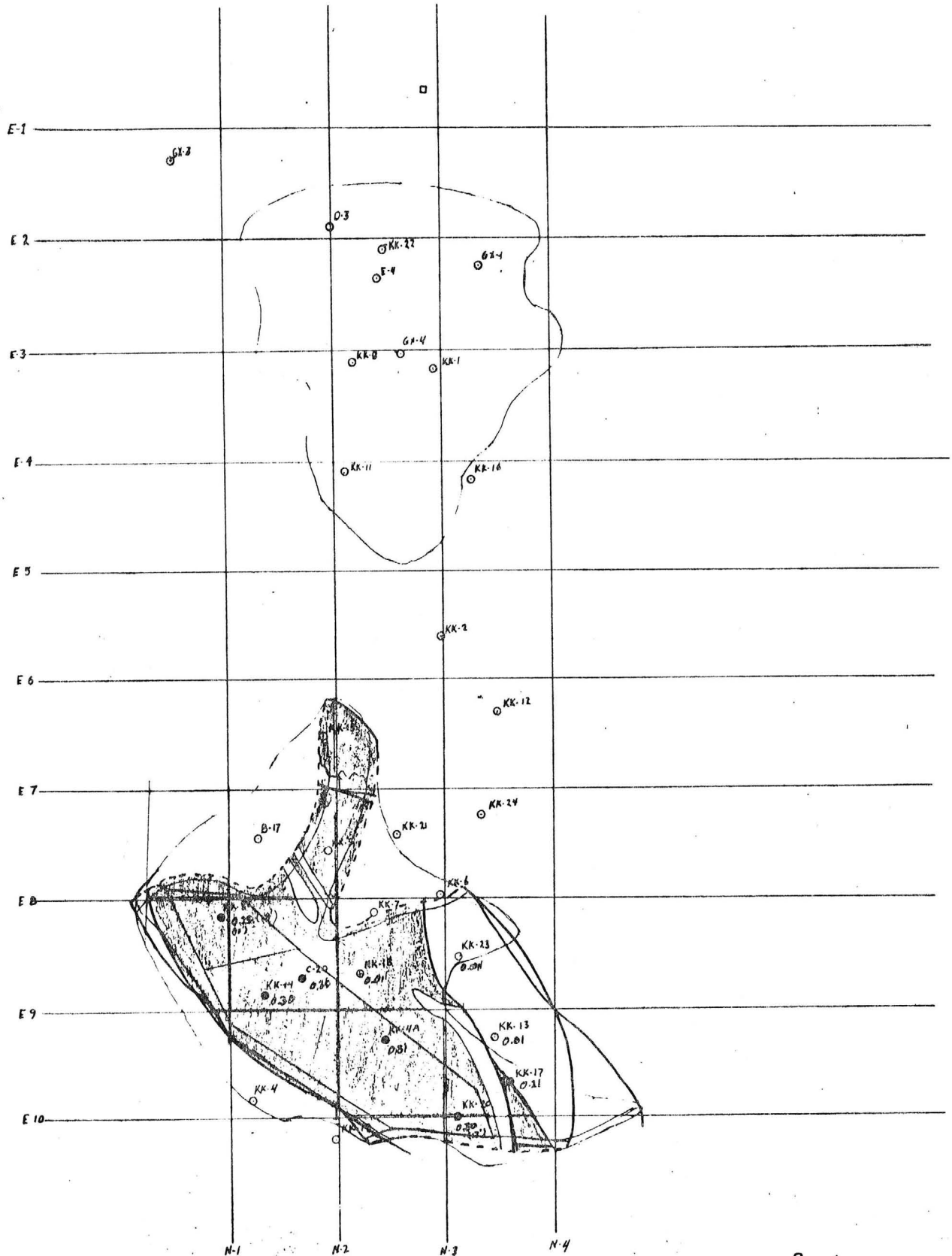



Bench 3940

elevation at base of bench

SCALE 1" = 333.3'

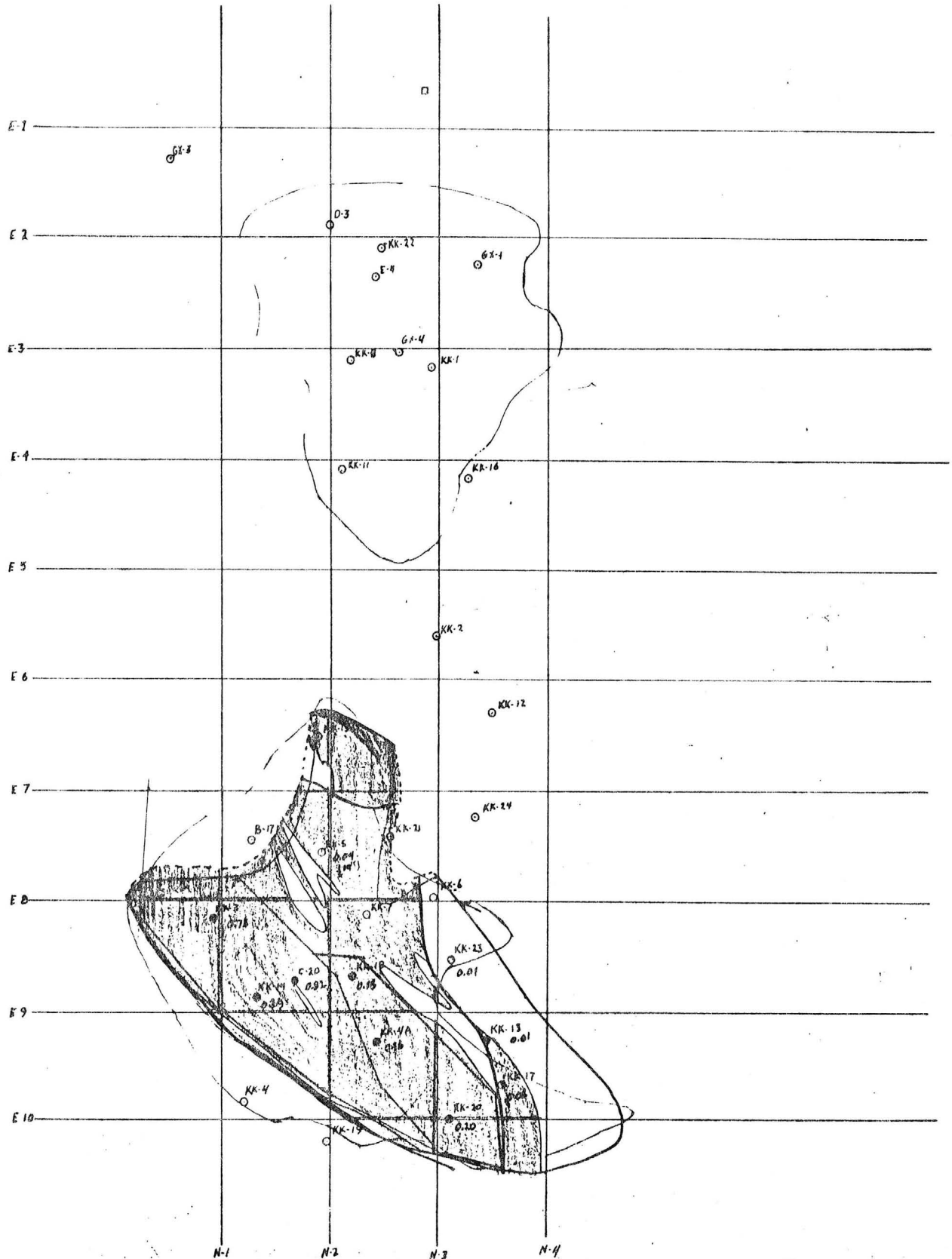
N




Bench 3970

elevation at base of bench

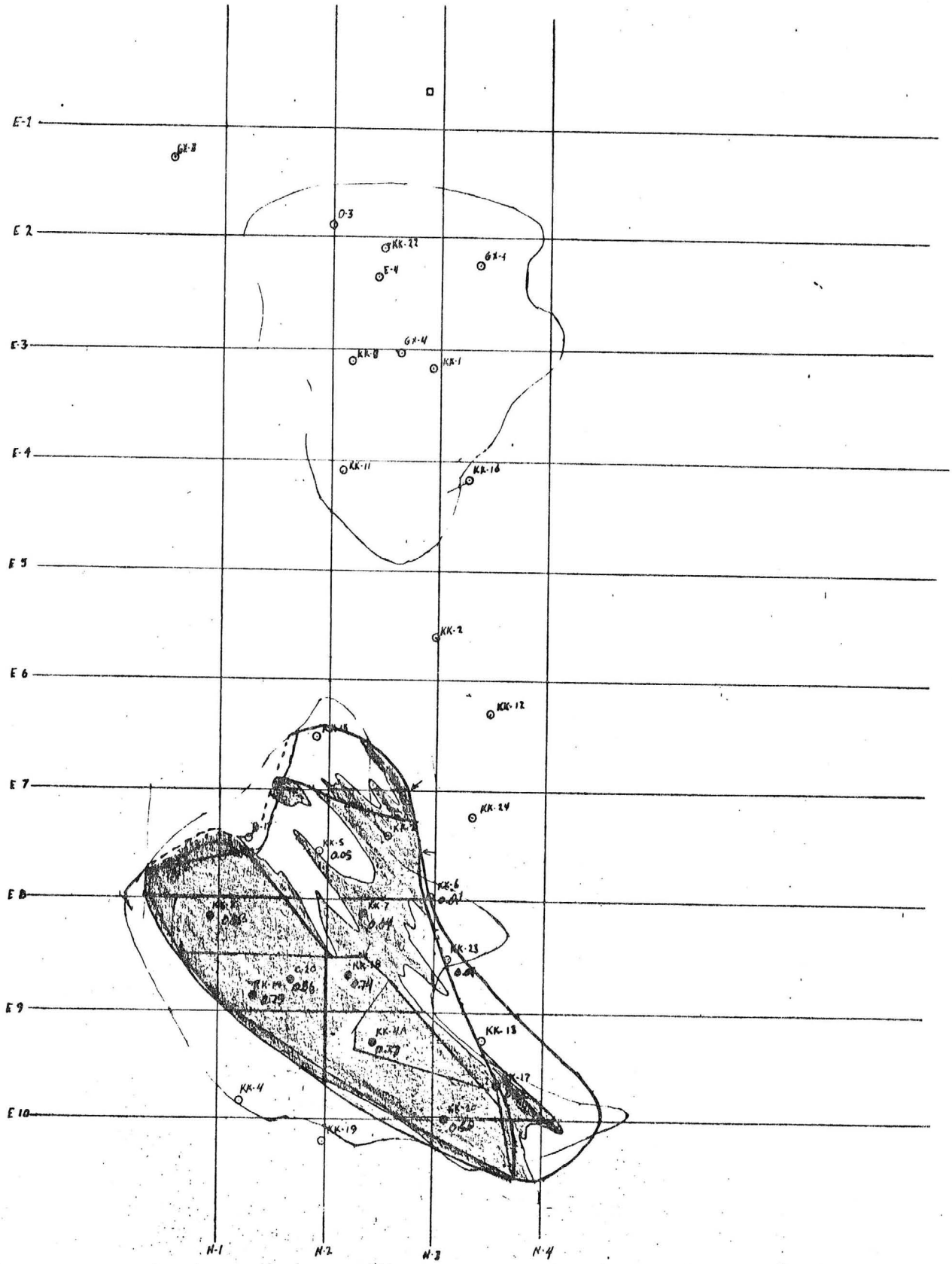
SCALE 1" = 333.3'




Bench 3900

elevation at base of bench

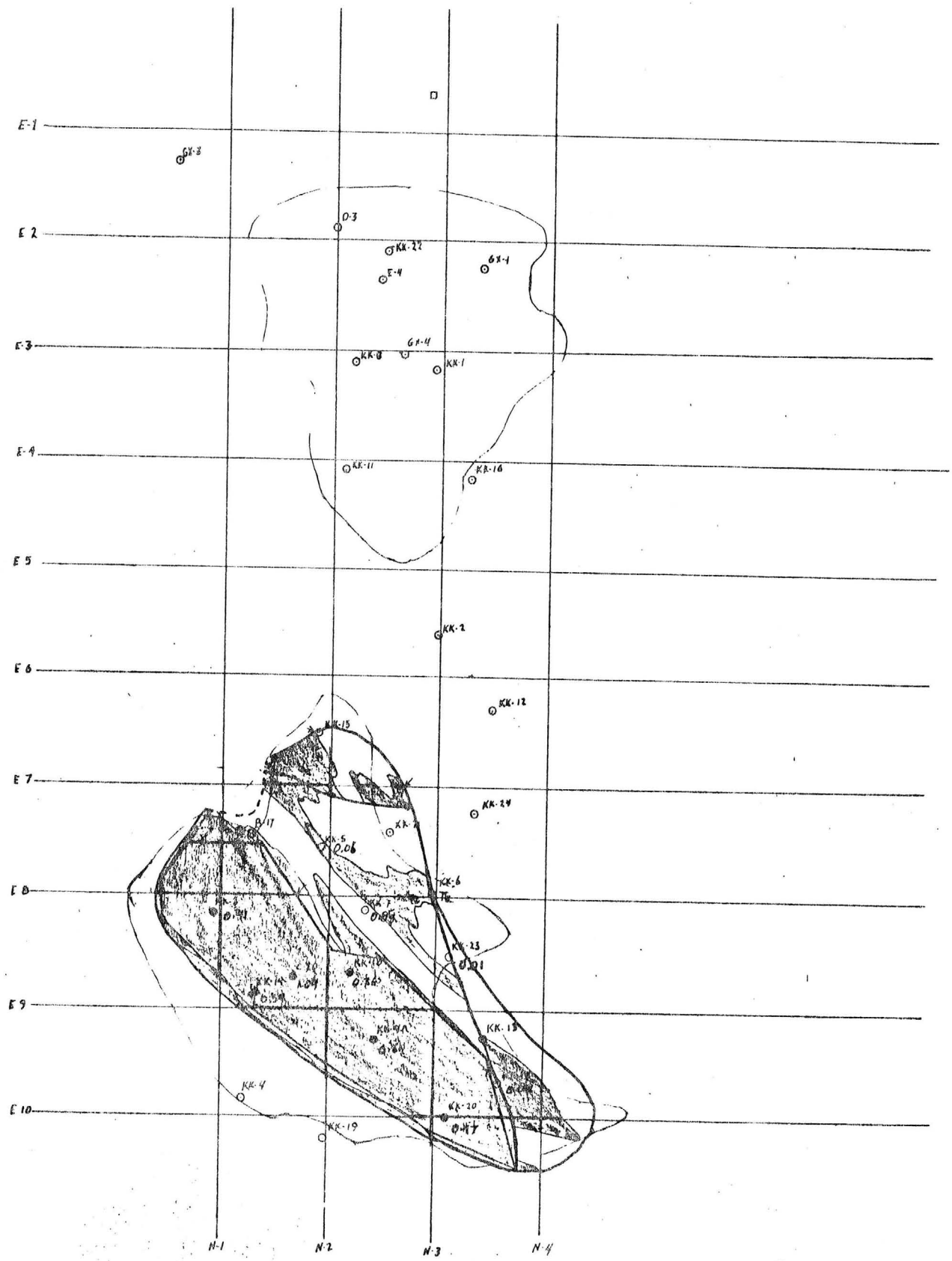
SCALE 1" = 333.3'




Bench 3860

elevation at base of bench

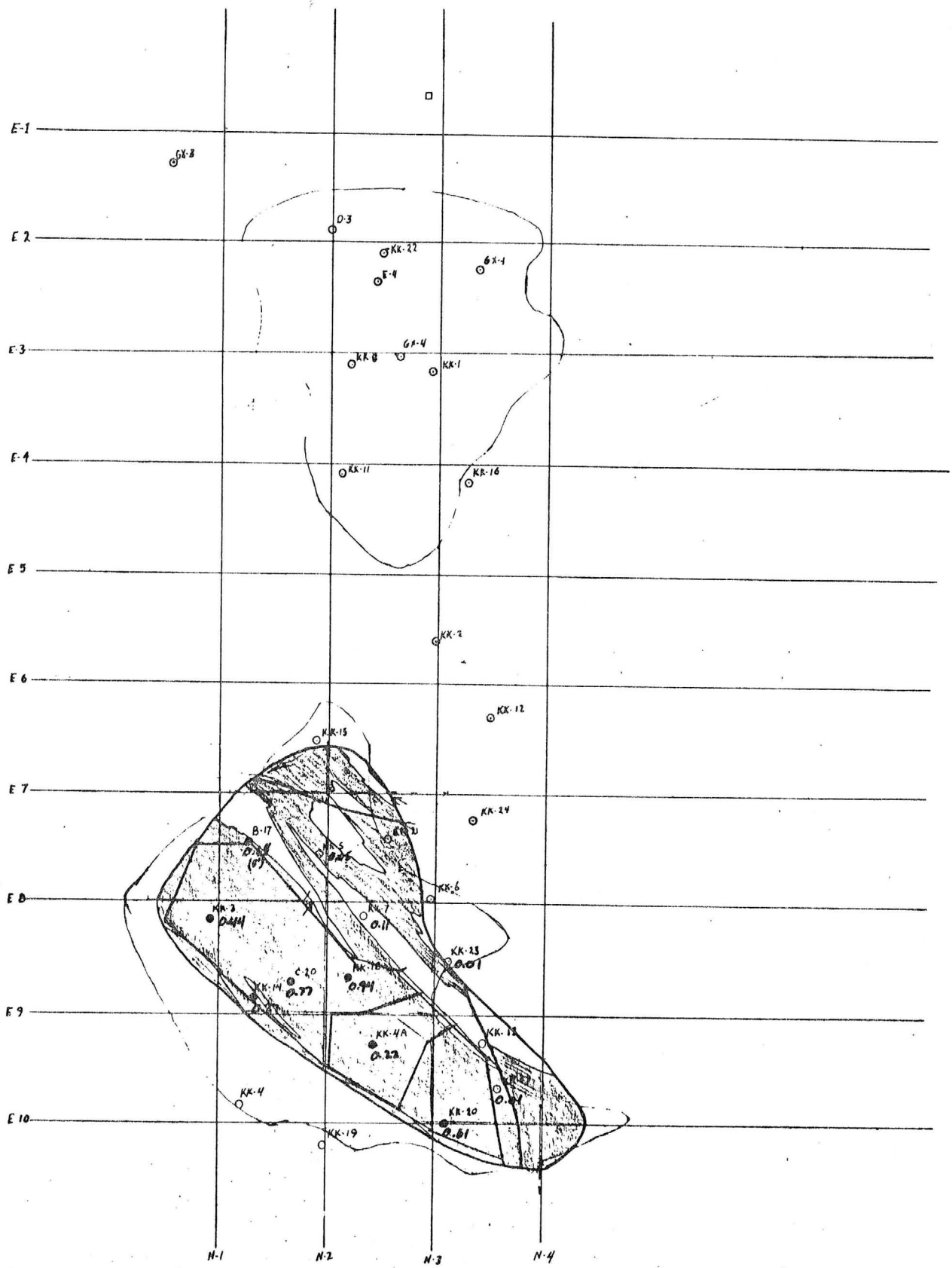
SCALE 1" = 33.33'




Bench 3840

elevation at base of bench

SCALE 1" = 33 3'

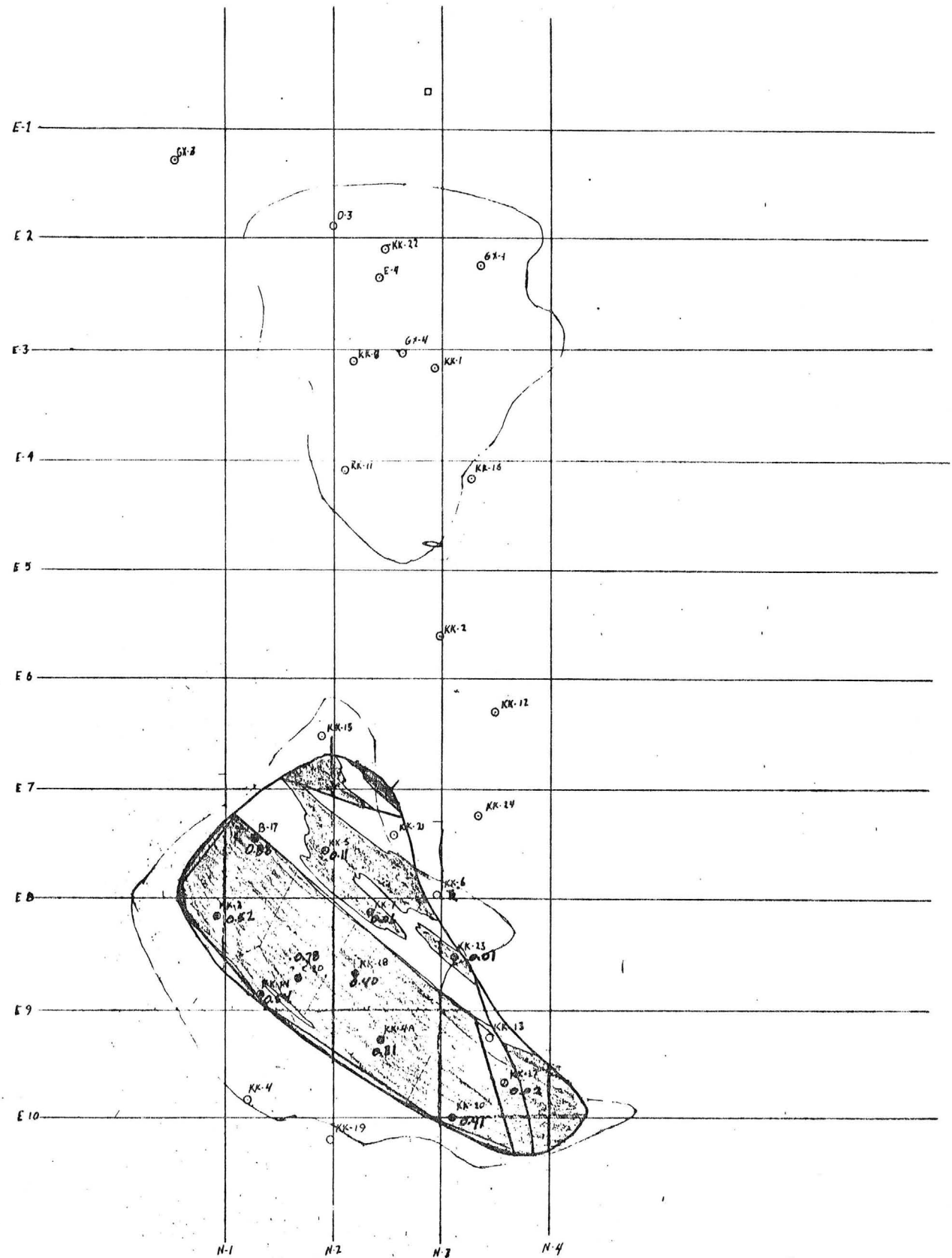



Bench 3810

elevation at base of bench

SCALE 1" = [illegible]'

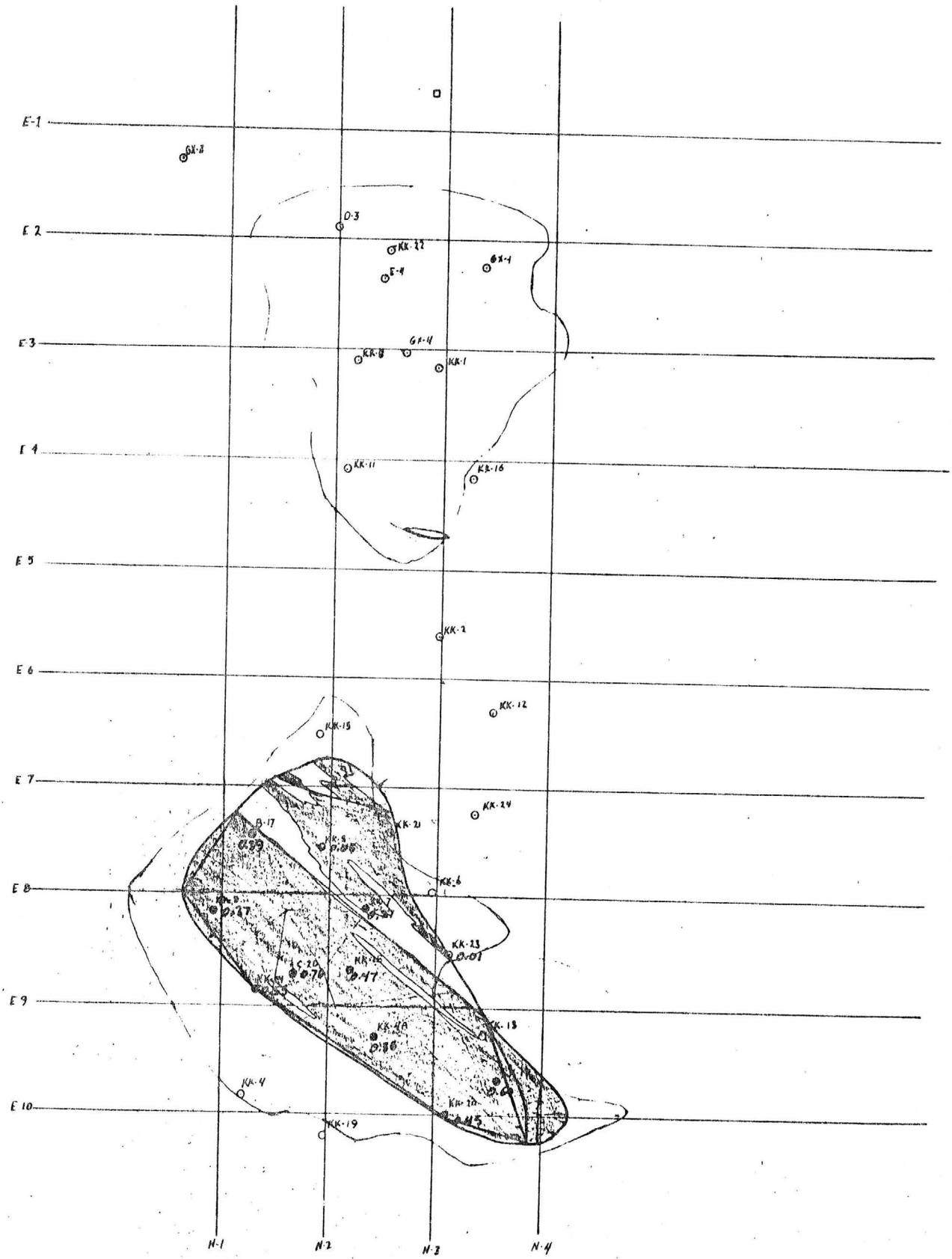
N



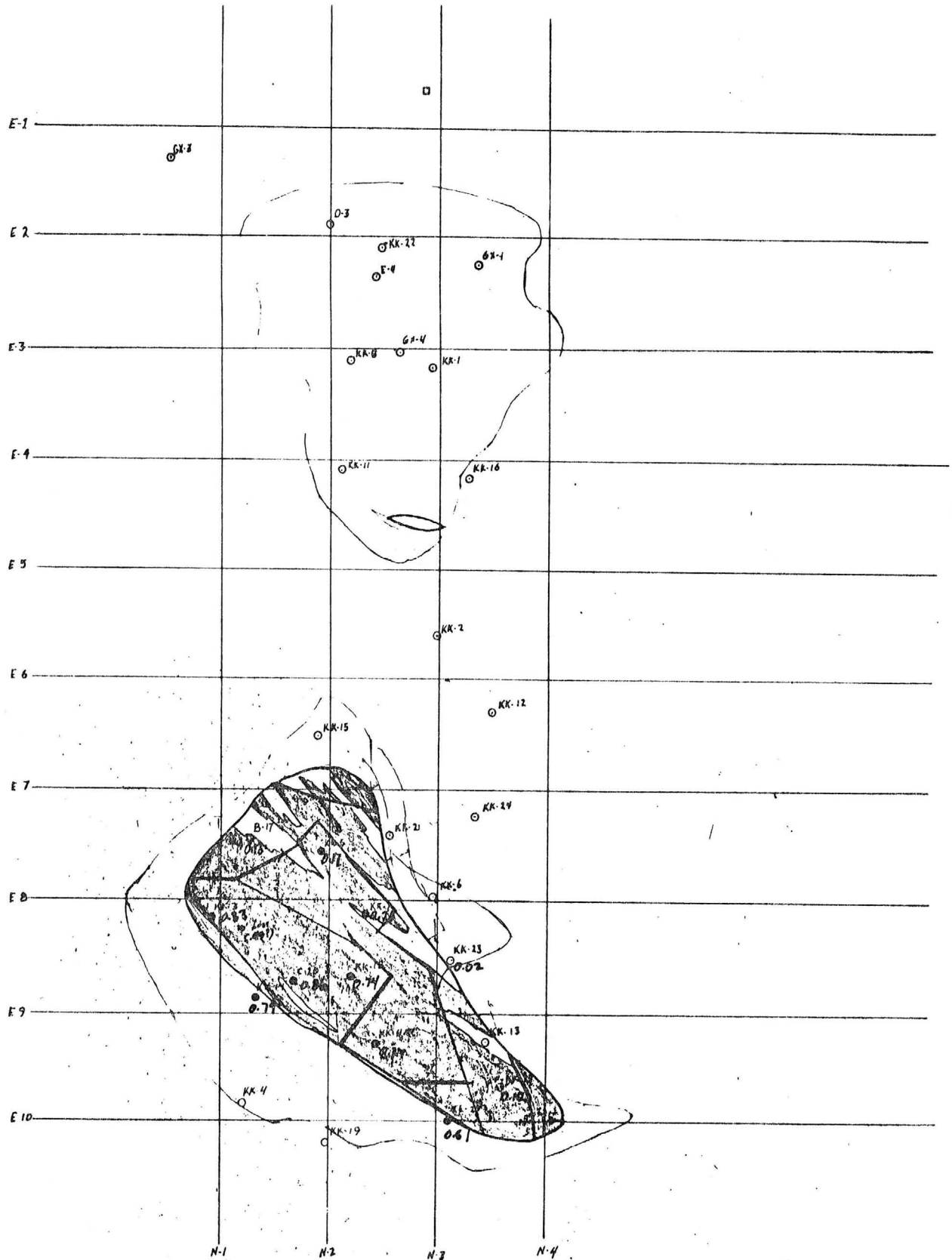

Bench 3800

elevation at base of bench

SCALE 1" = [illegible]'



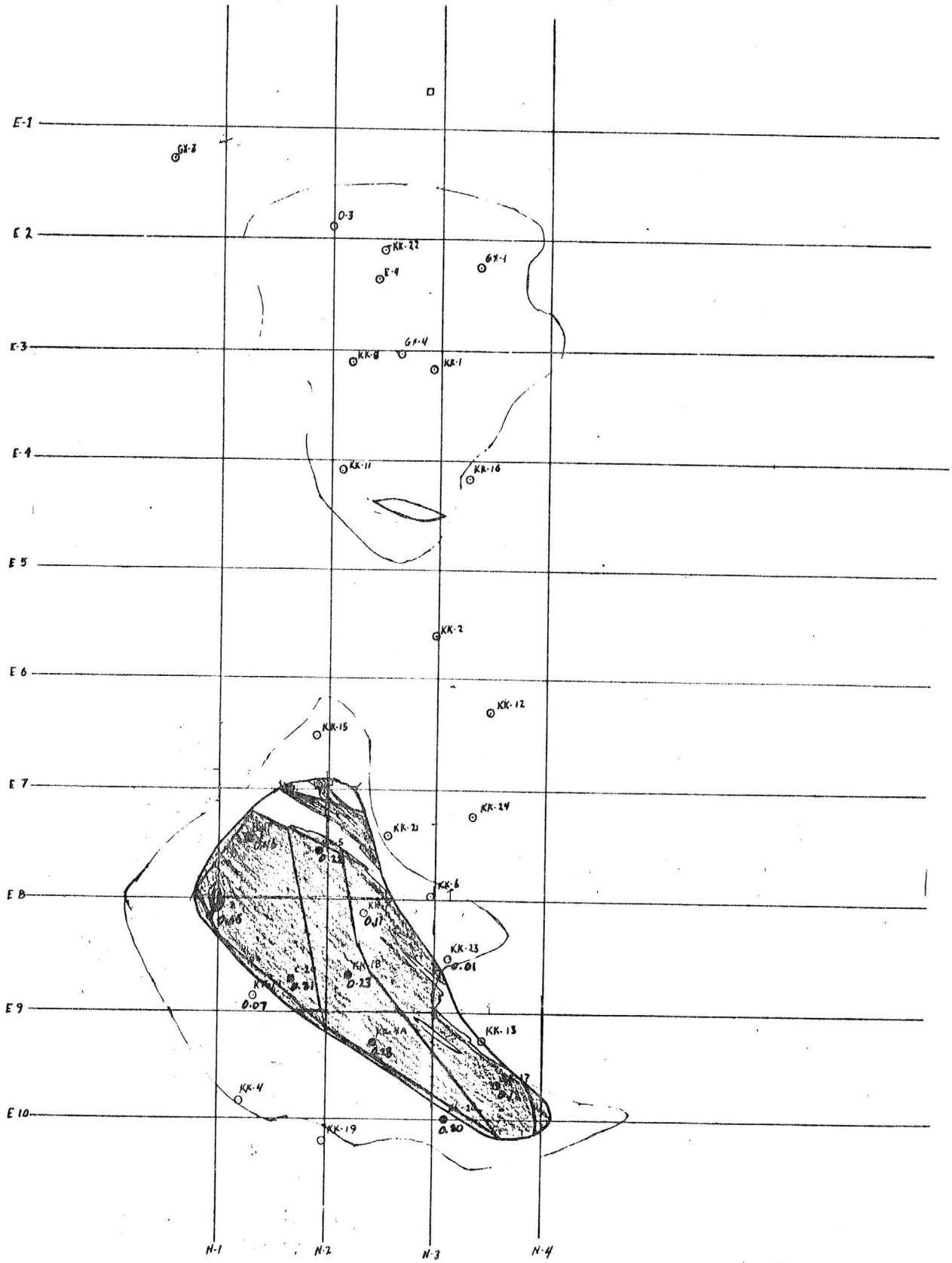

Bench 3780
elevation at base of bench
SCALE 1" = 333.3'




Bench 3760

elevation at base of bench

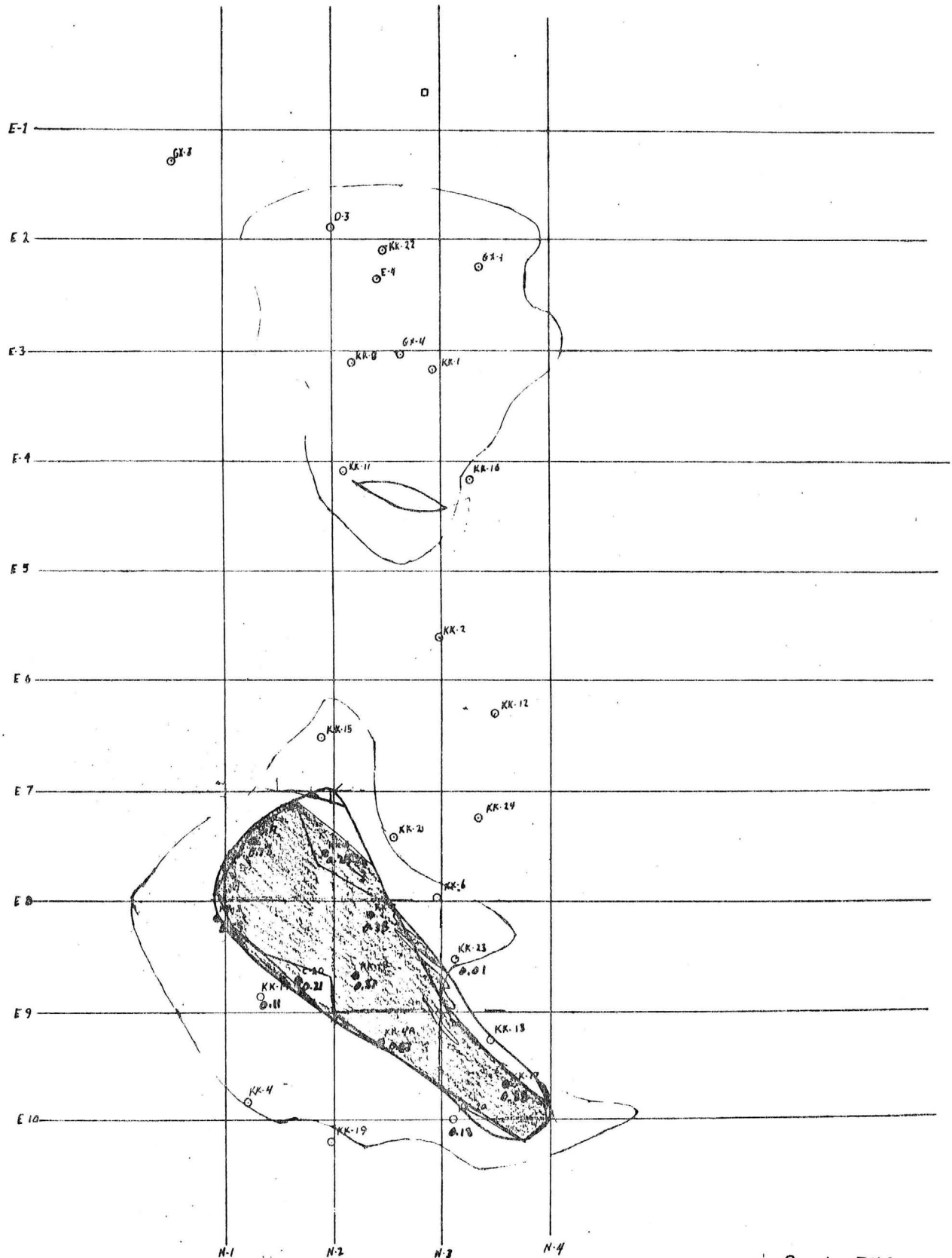
SCALE 1" = 333.3'




Bench 3740

elevation at base of bench

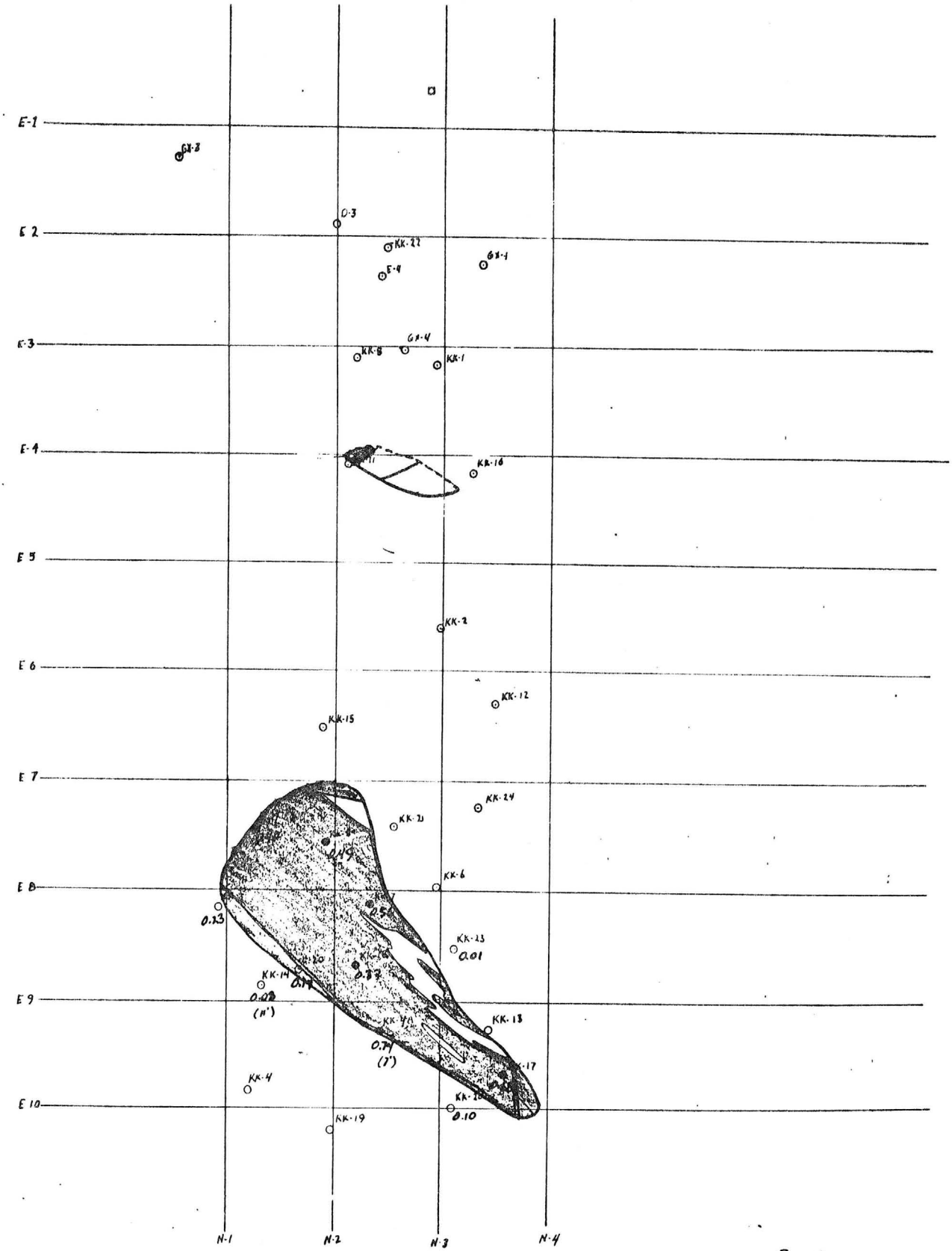
SCALE 1" = 333.3'




Bench 3720

elevation at base of bench

SCALE 1" = 333.3'

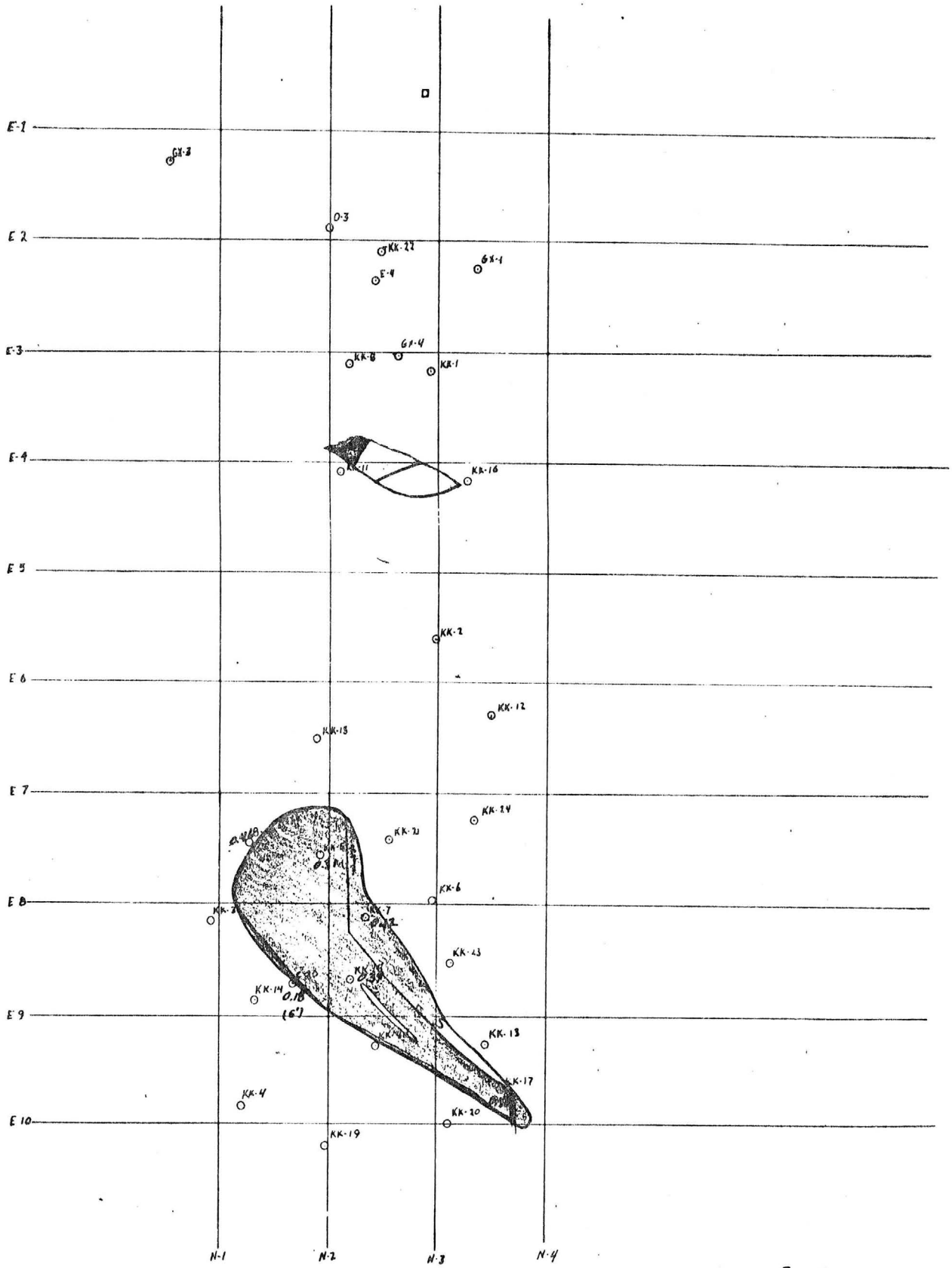



Bench 7100

elevation at base of bench

SCALE 1" = 333.3'

N

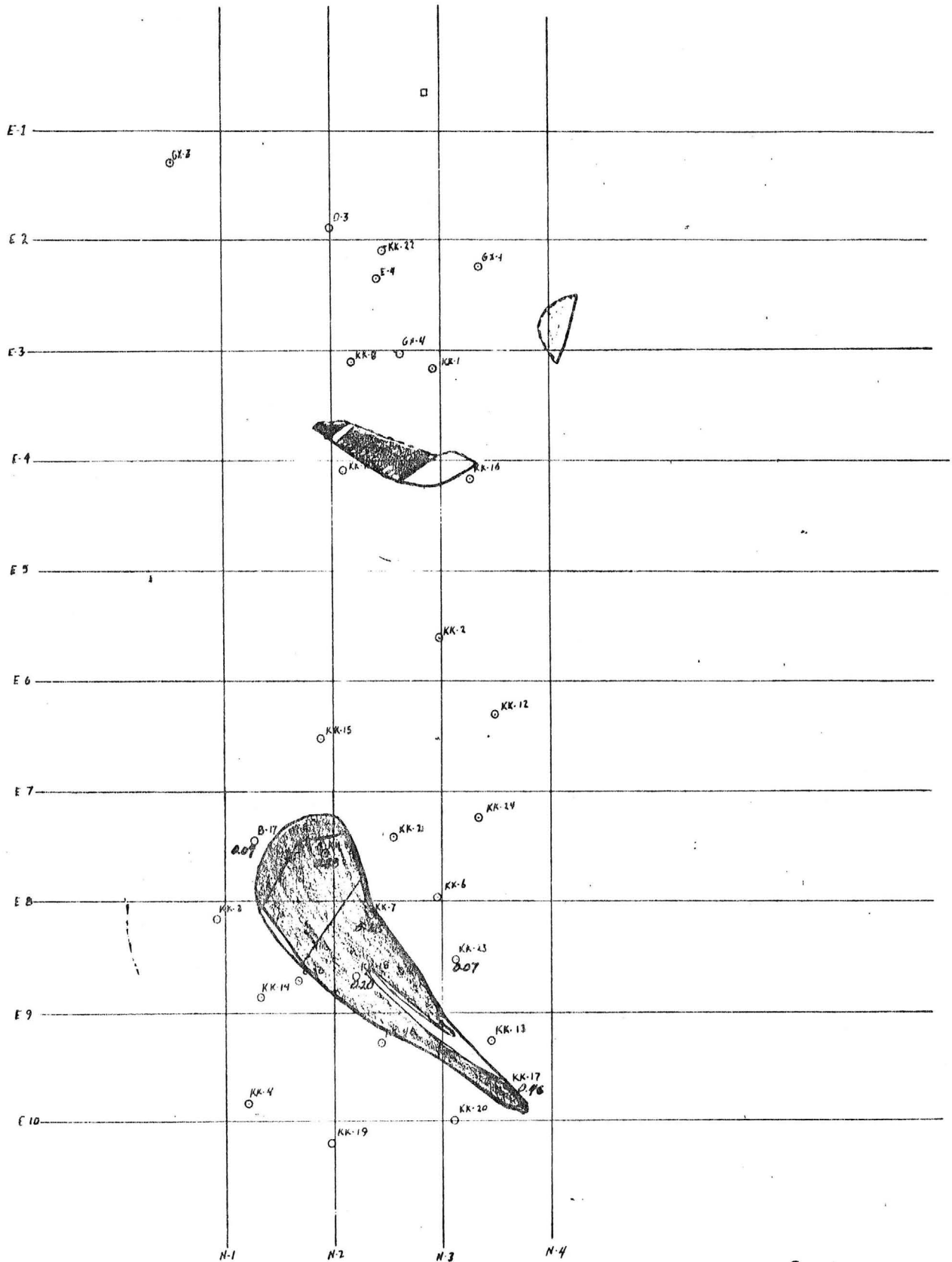



Bench ~~[illegible]~~

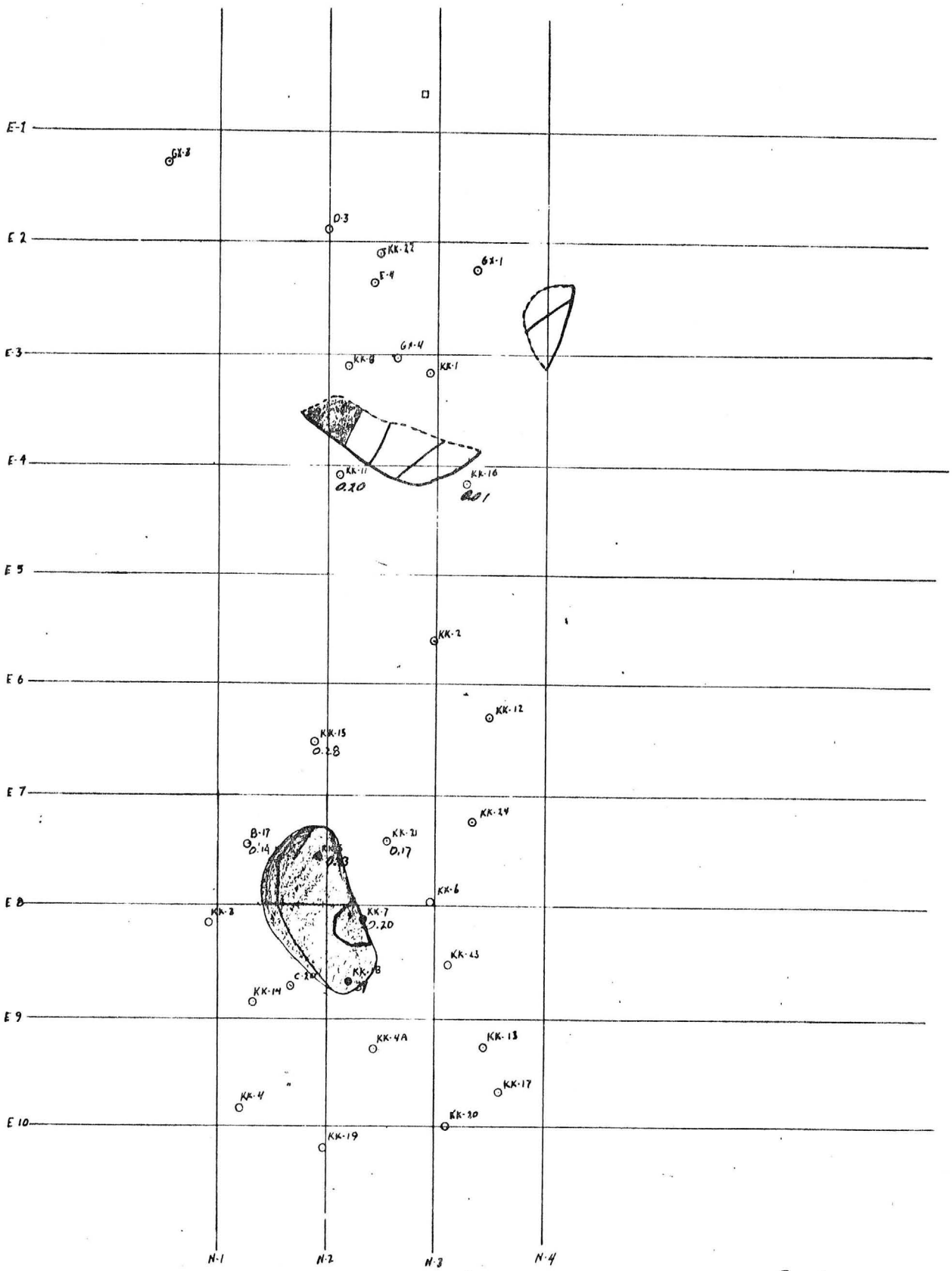
elevation at base of bench

SCALE 1" = 353.3'

N

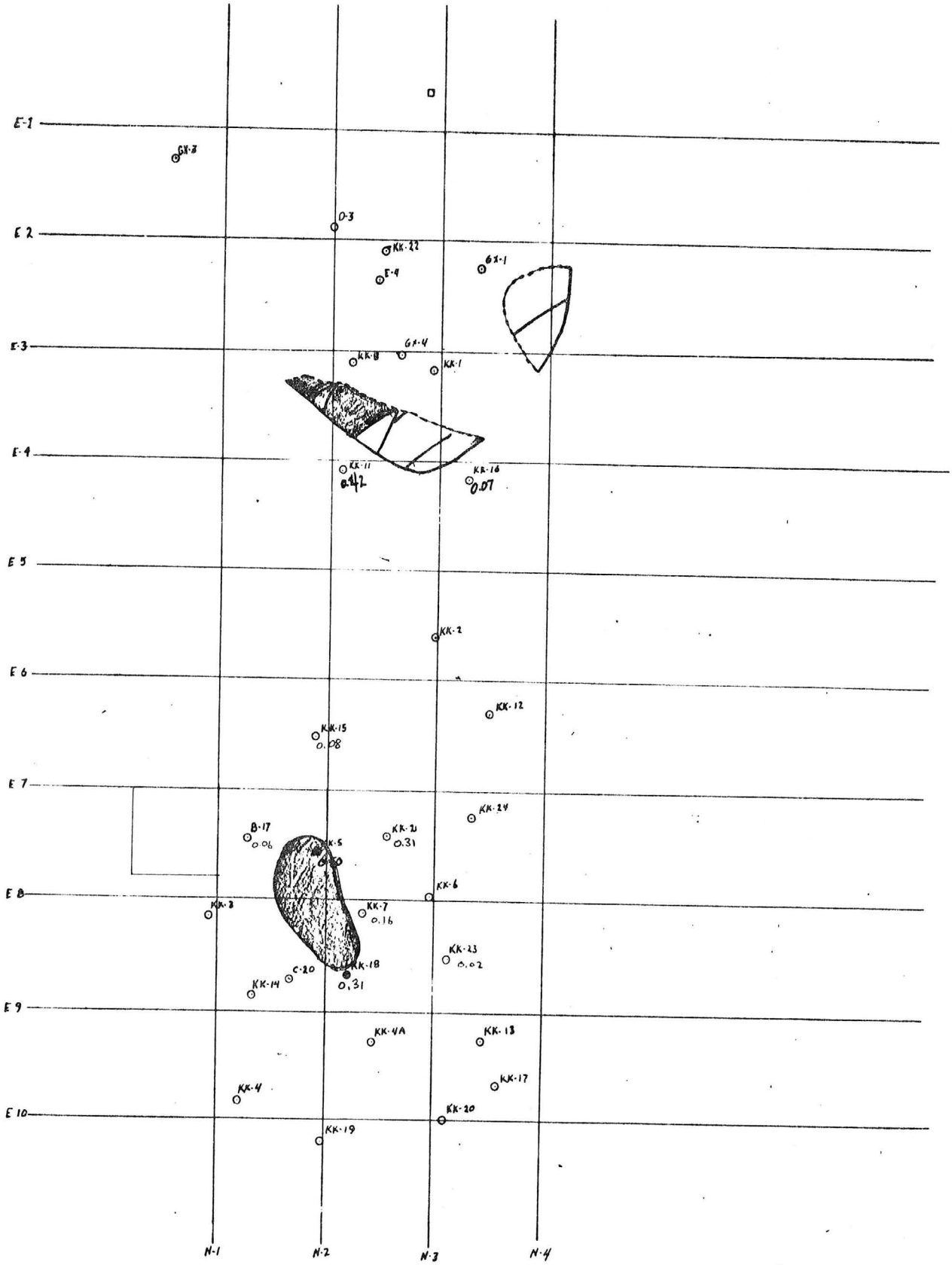



Bench 3460
elevation at base of bench
SCALE 1" = 333.3'




Bench 7640
elevation at base of bench
SCALE 1" = 333.3'

N

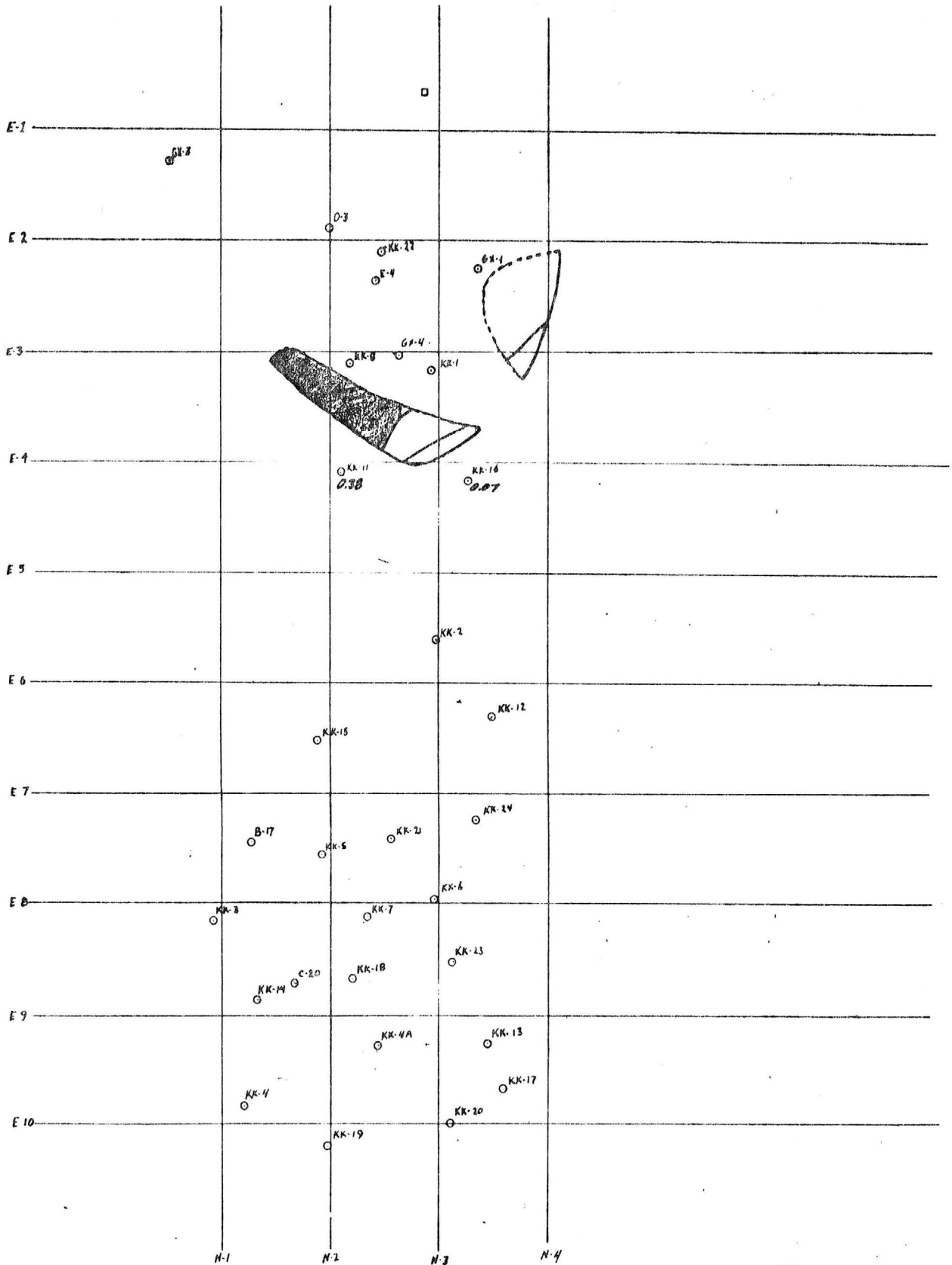



Bench 3620

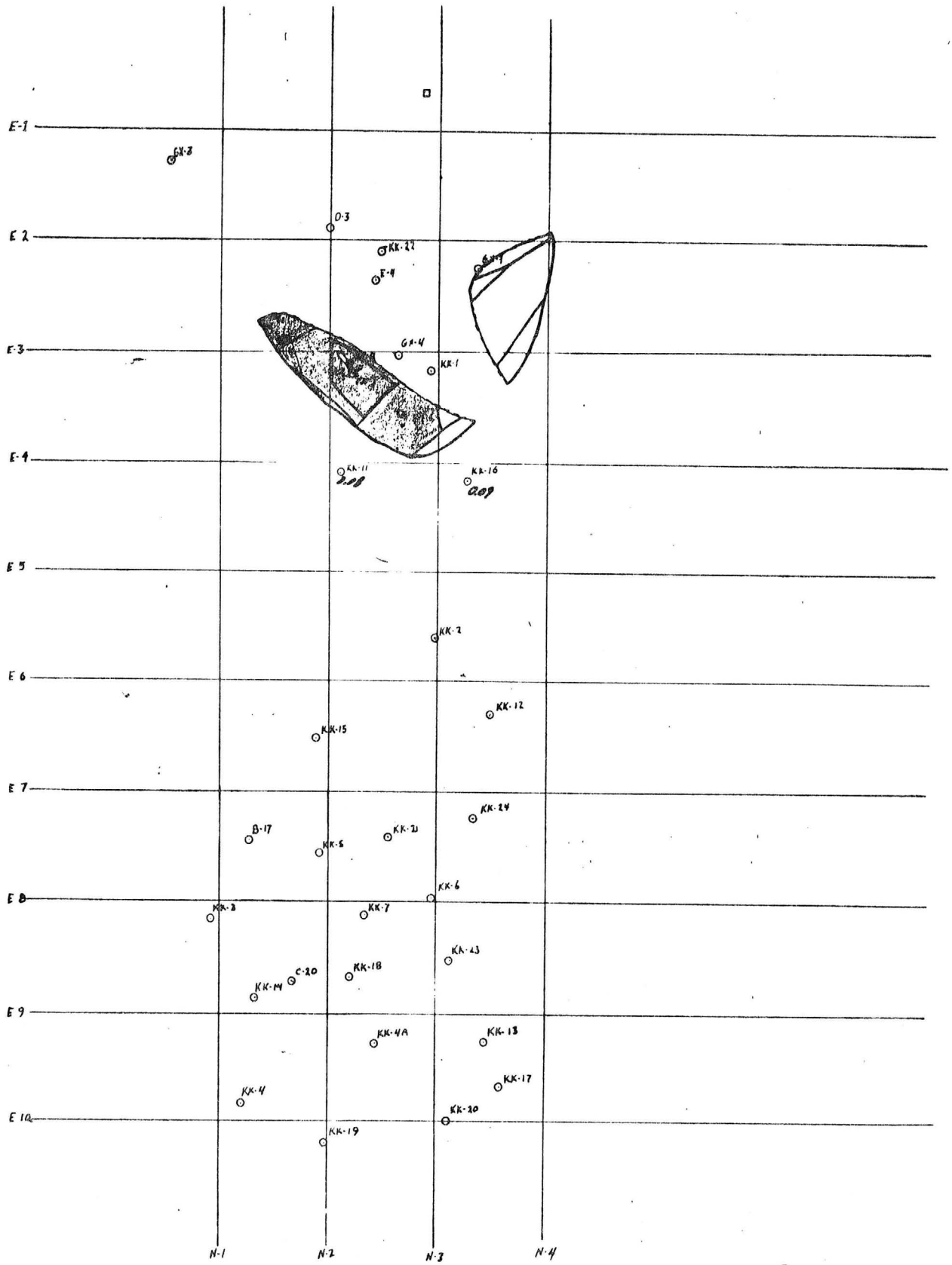
elevation at base of bench

SCALE 1" = 333.3'

N




Bench 2600
elevation at base of bench
SCALE 1" = 3333'

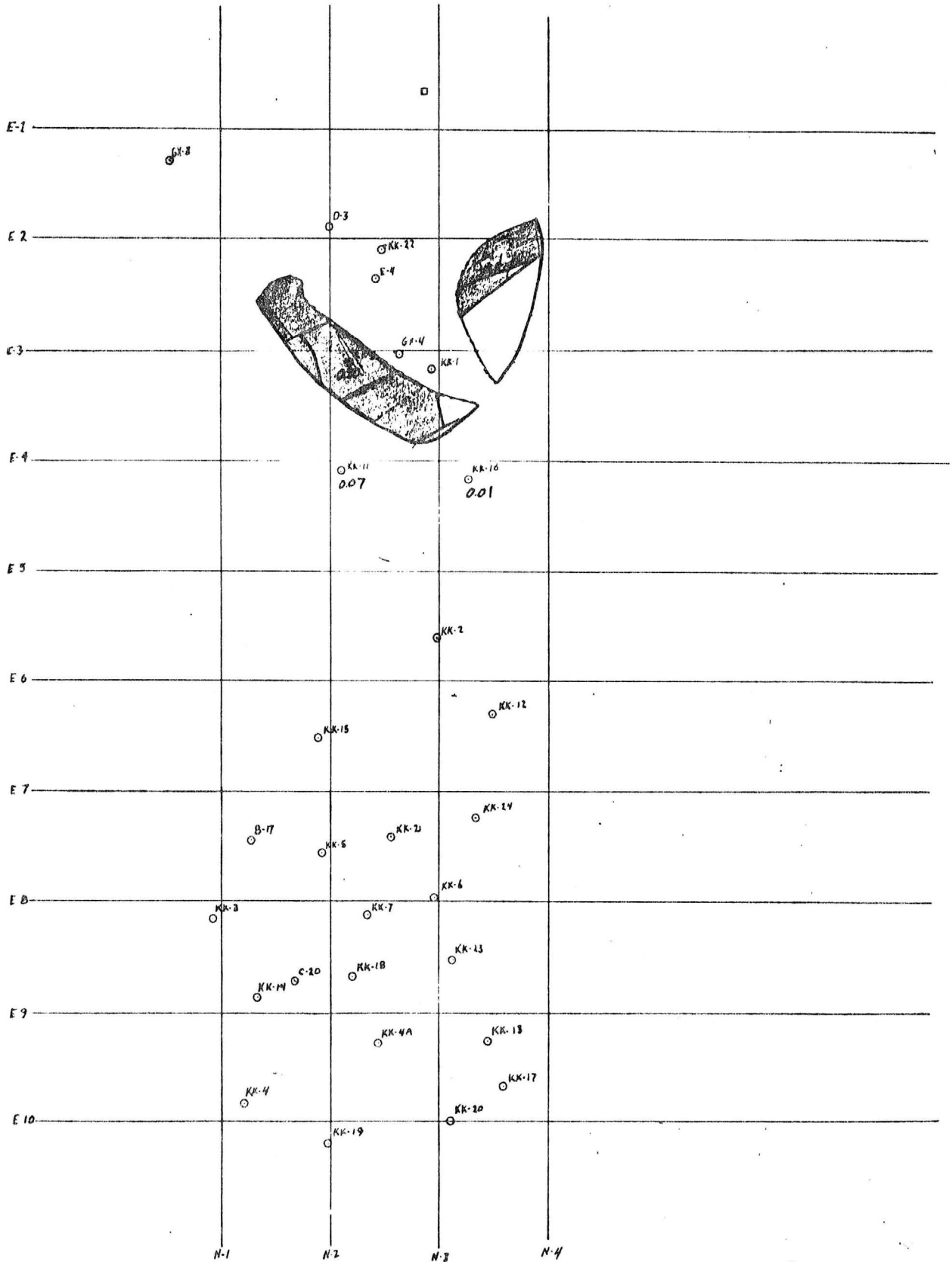



Bench 3580

elevation at base of bench

SCALE 1" = 333.3'

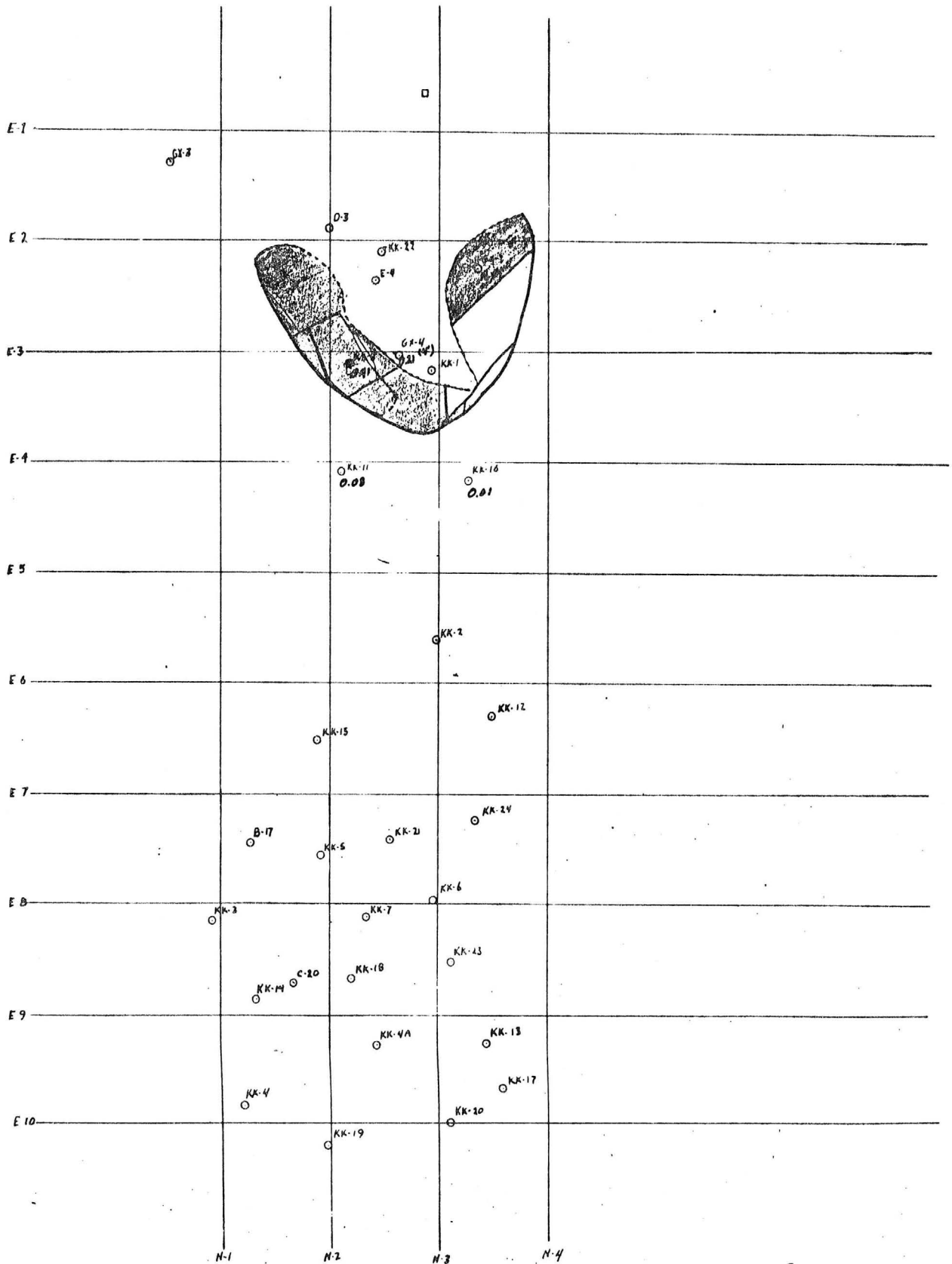
N




Bench ~~XS60~~

elevation at base of bench

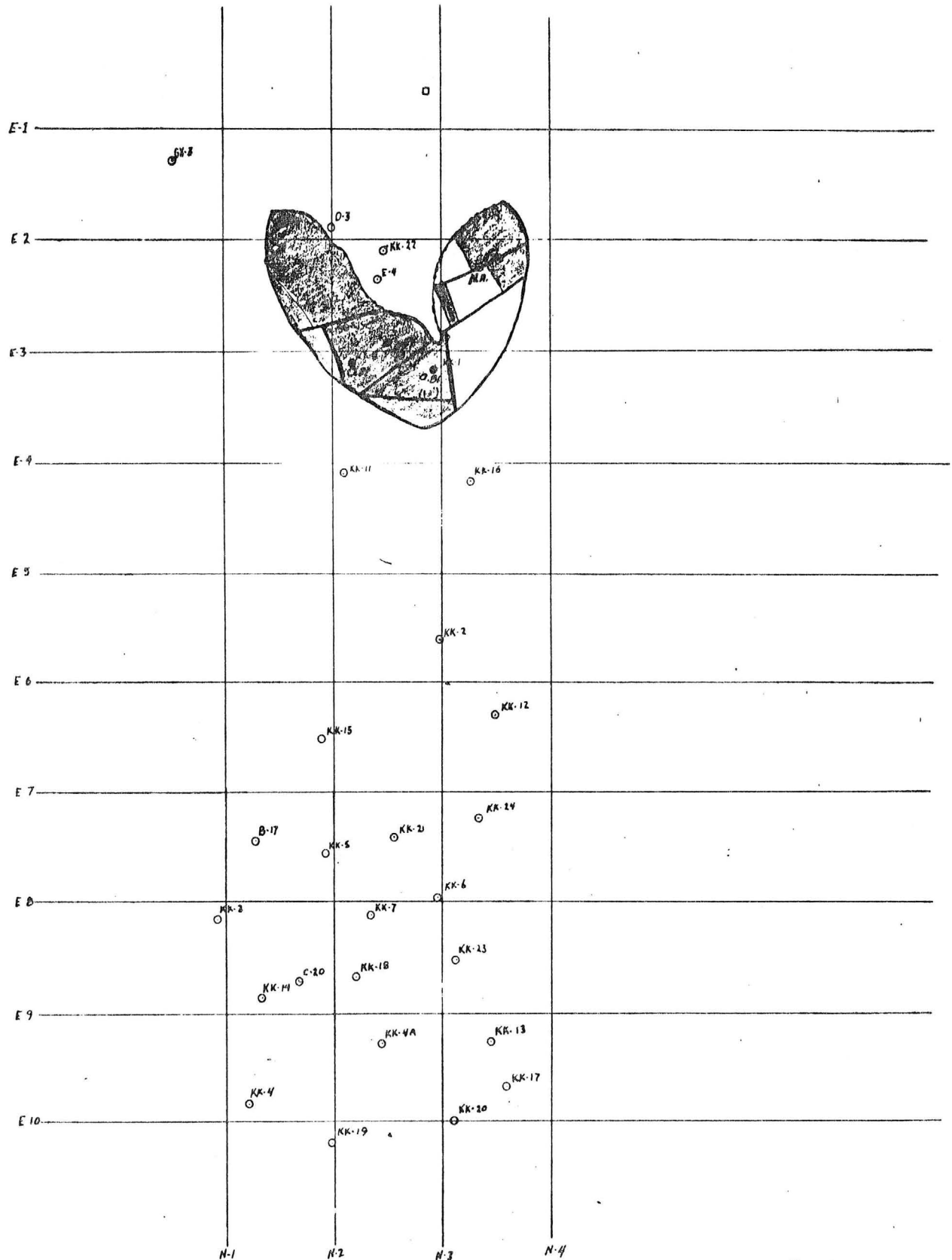
SCALE 1" = 3333'




Bench [redacted]

elevation at base of bench

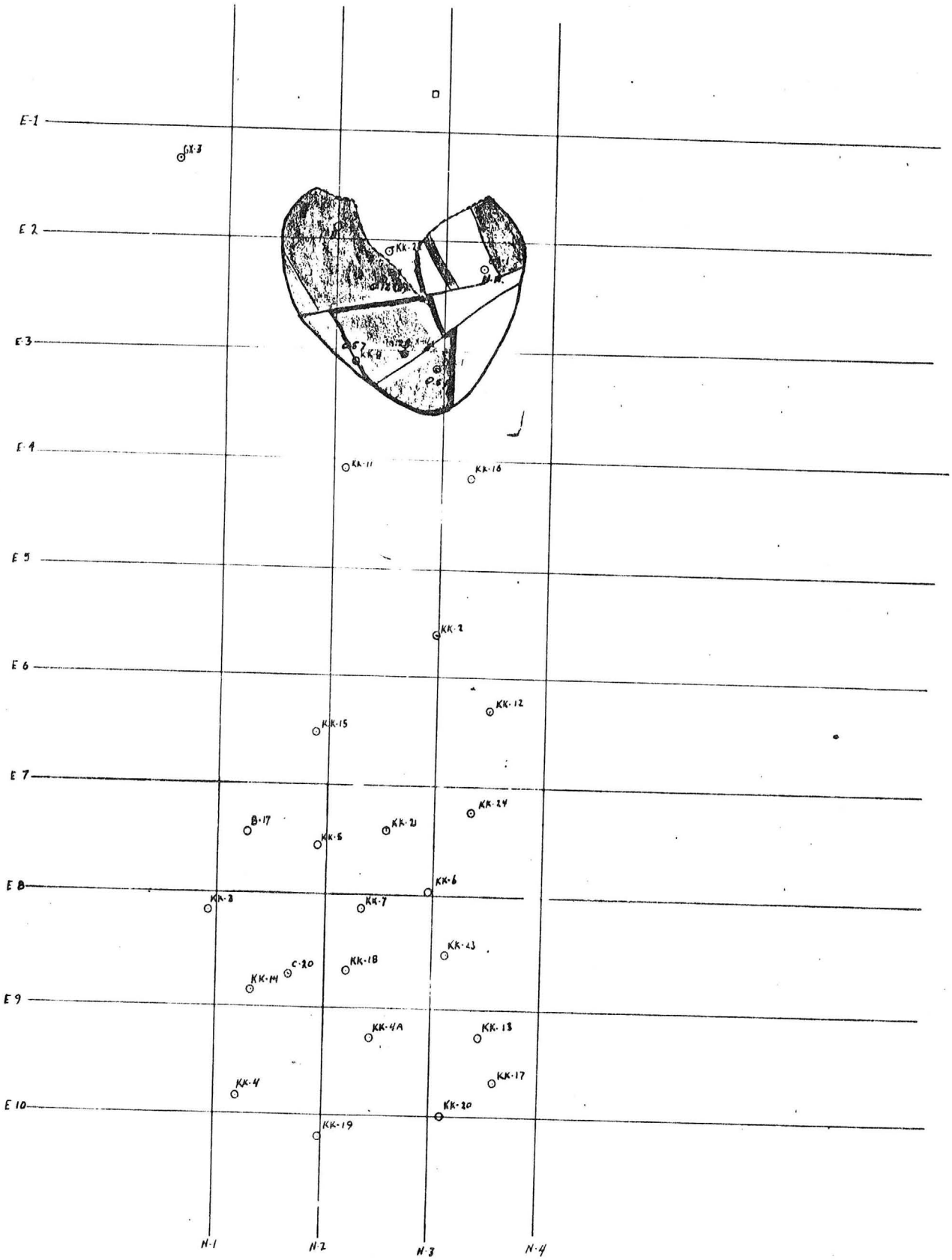
SCALE 1" = 335.3'




Bench 2520

elevation at base of bench

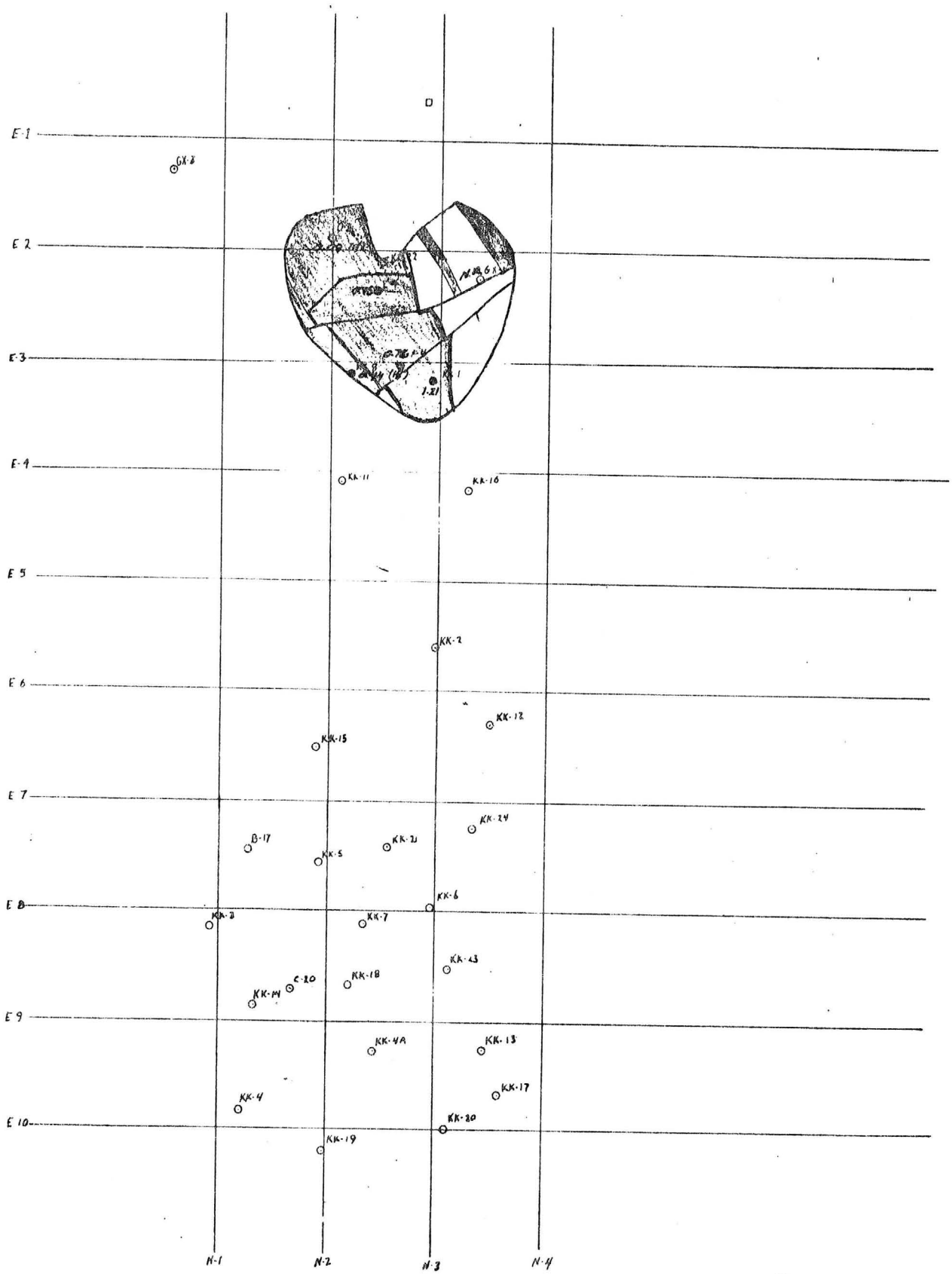
SCALE 1" = 333.3'




Bench [redacted]

elevation at base of bench

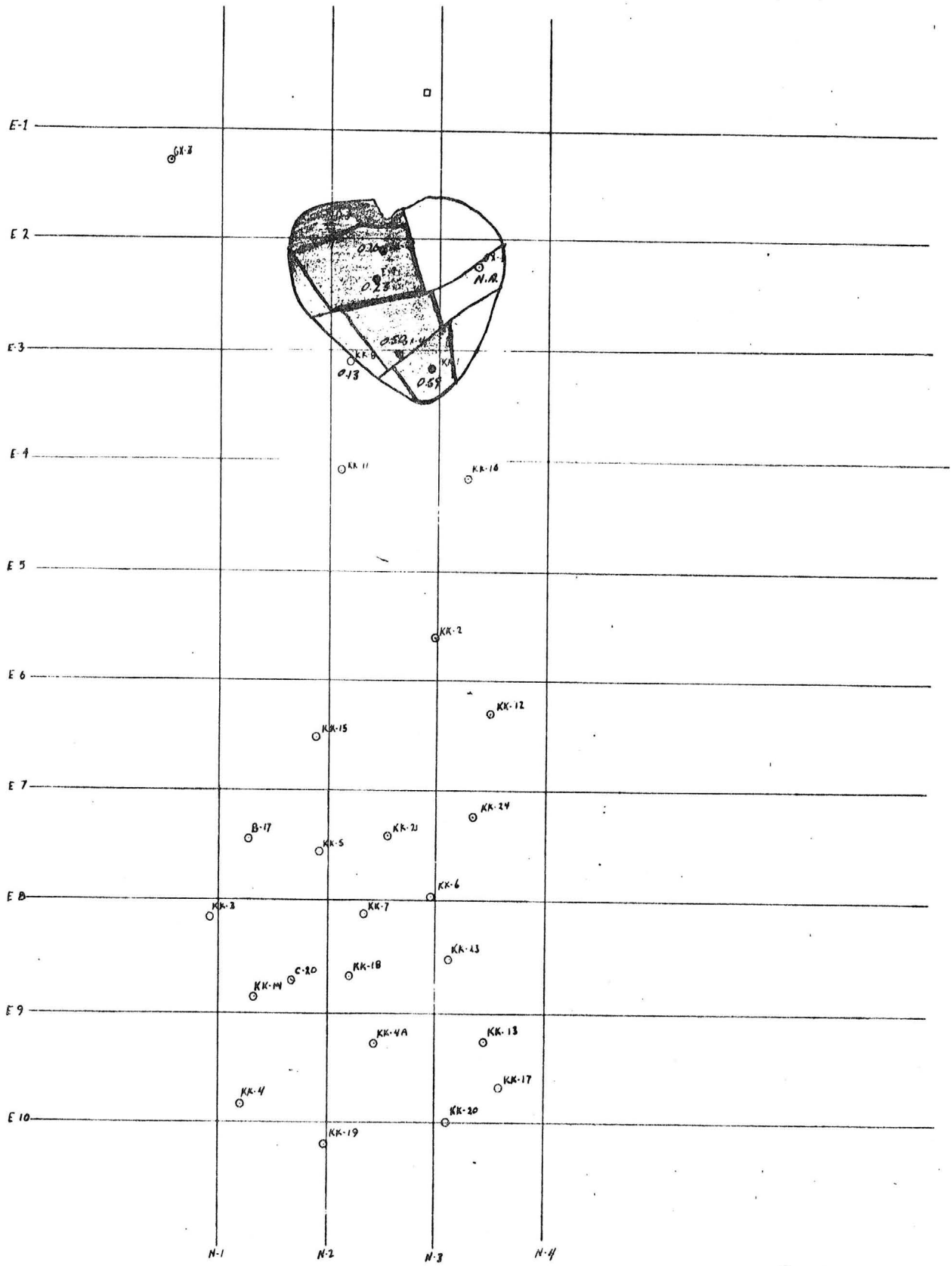
SCALE 1" = 333.3'




Bench [redacted]

elevation at base of bench

SCALE 1" = 3333'

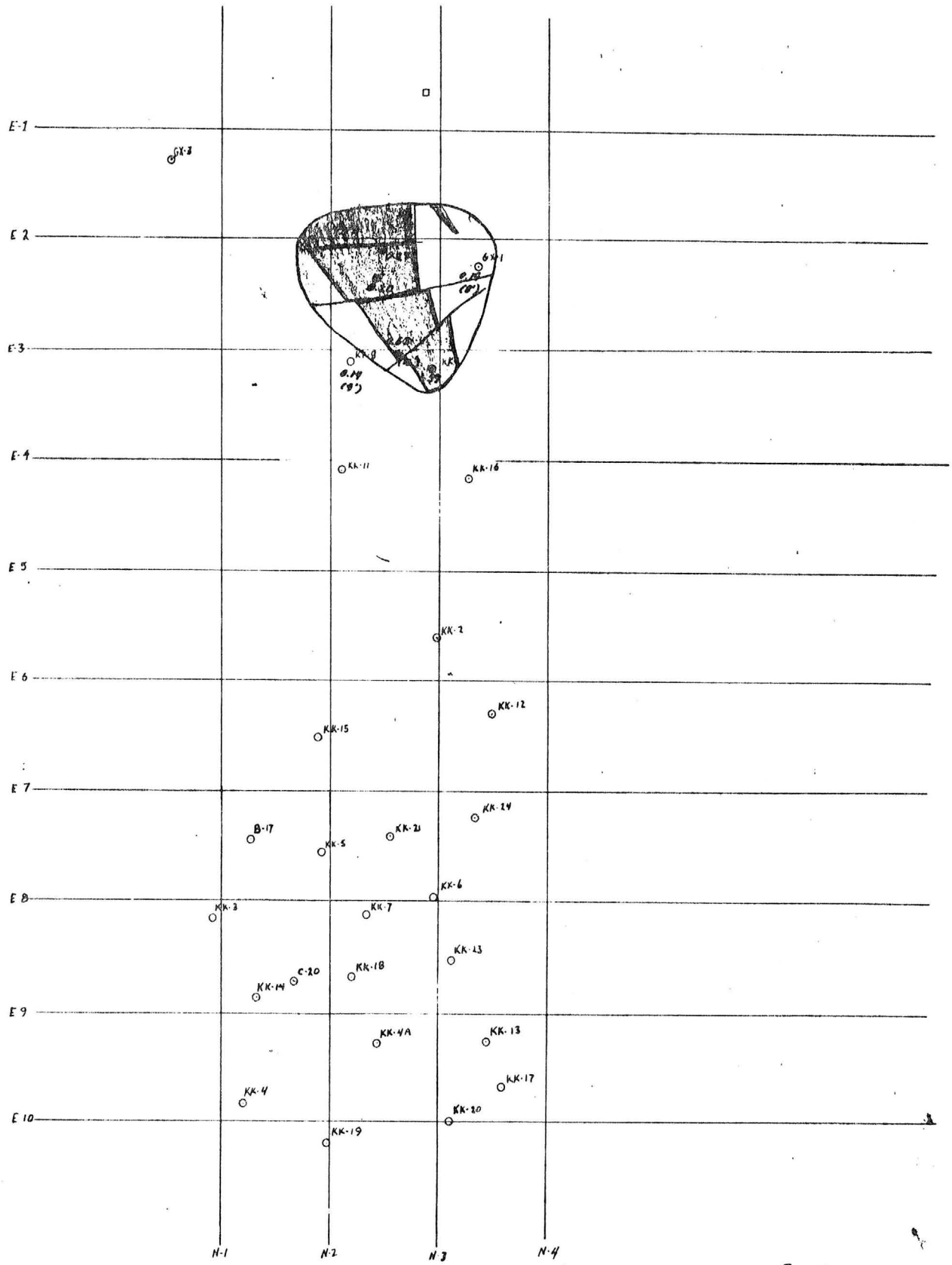



Bench 3960

elevation at base of bench

SCALE 1" = 3333'

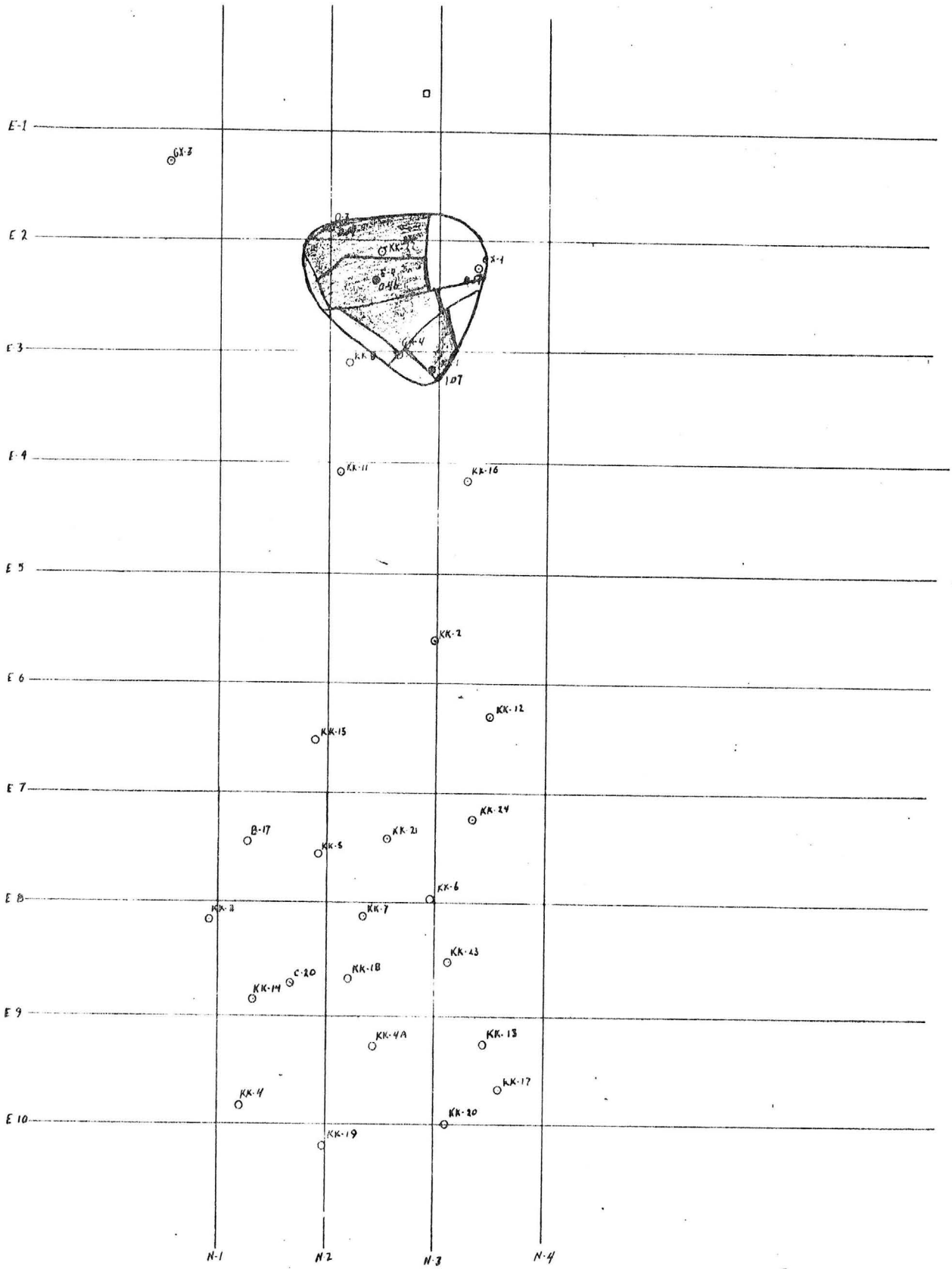
N




Bench _____

elevation at base of bench

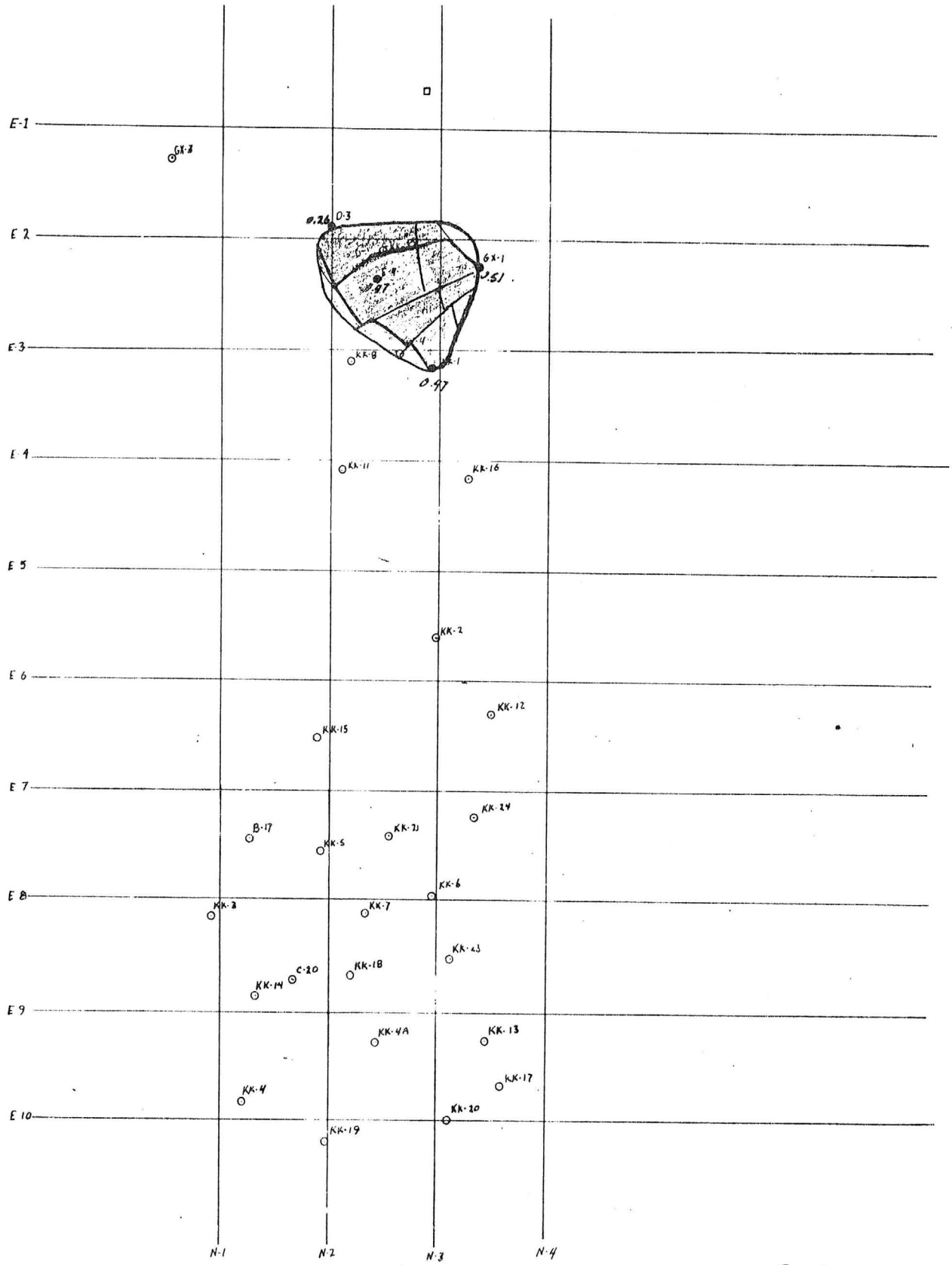
SCALE 1" = 333.3'




Bench 3910

elevation at base of bench

SCALE 1" = 5'-2.5'

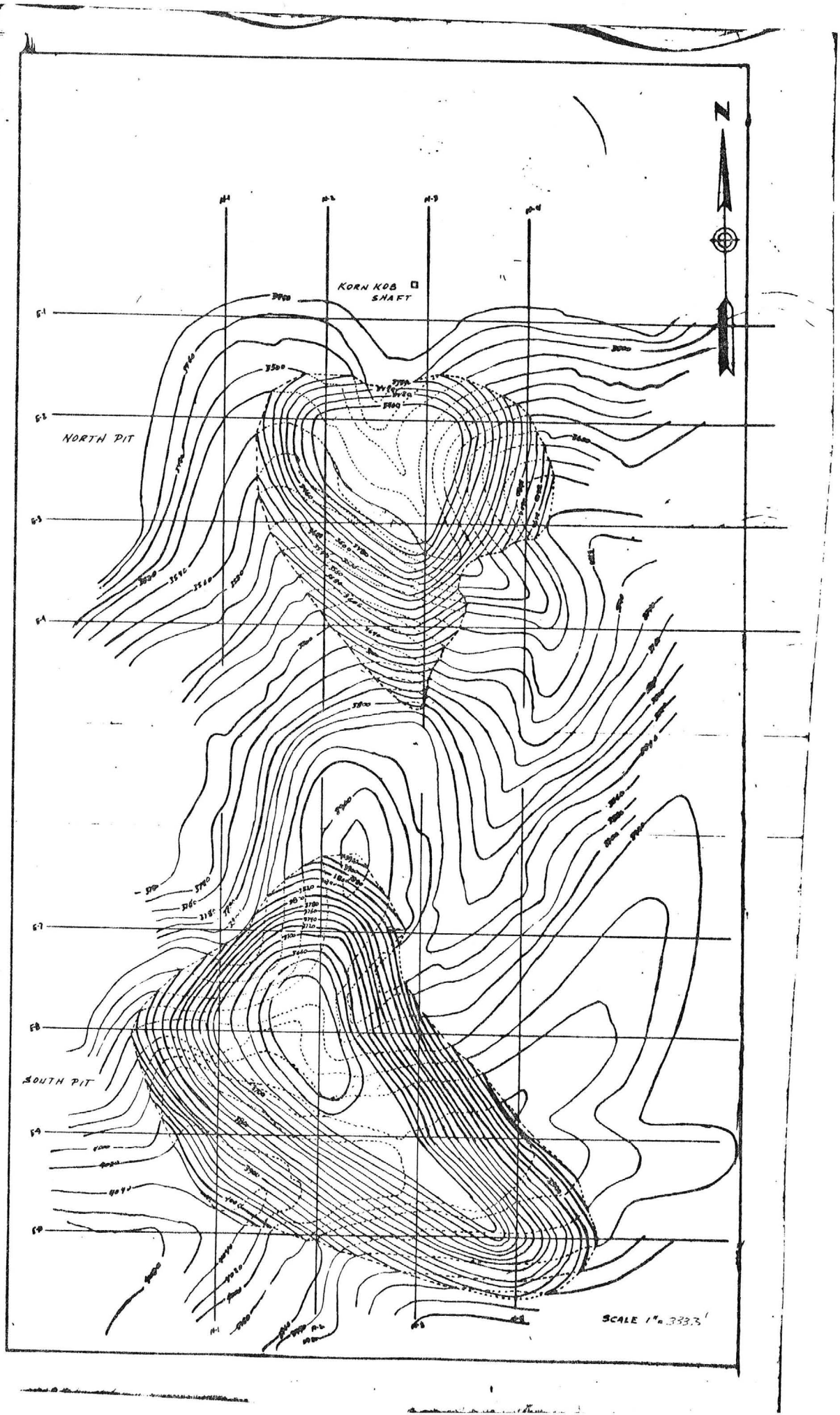


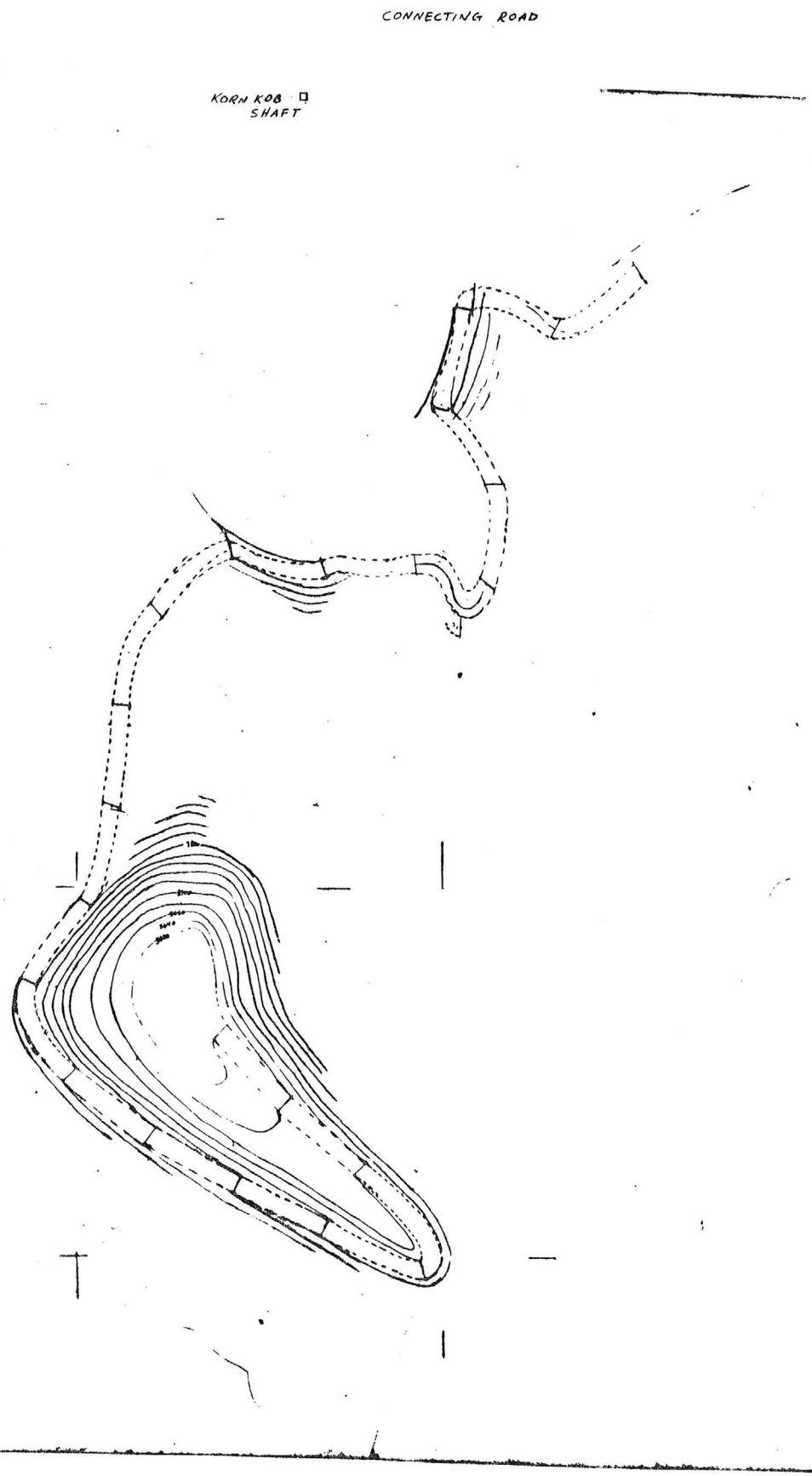

Bench ~~[illegible]~~

elevation at base of bench

SCALE 1" = ~~[illegible]~~ 3'

N


N
KORN KOB SHAFT
NORTH PIT
SOUTH PIT
SCALE 1" = 333.3'


CONNECTING ROAD
KORN KOB
SHAFT

pE.

February 23, 1971

TO: H. Lanier

FROM: C.K. Chase

SUBJECT: REPORT NO. MET. 71-2-3
Accuracy of Atomic Absorption as Compared to the Copper Assays by Long Iodide Method - Korn Kob Project

Conclusion: Due to probable calibration errors, the atomic absorption copper assays run on the Korn Kob rotary drill chip sample are in the range of 8-10% low on the average, as compared to long iodide wet chemical assays run on every tenth intercept. The number of samples compared were 120, with the following results:

All Assays:

Atomic absorption $\frac{27.98}{120} = 0.233\%$ Cu

Wet Chemical $\frac{30.70}{120} = 0.256\%$ Cu

$$\frac{0.256 \times 100}{0.233} = 109.9\%$$

In a second calculation, wet chemical assays above 0.24% Cu were averaged and compared to the corresponding atomic absorption assays, some of which were under 0.24% Cu, with the following results:

Wet Chemical Assays Above 0.24% Cu:

Atomic absorption $\frac{23.43}{50} = 0.469\%$ Cu

Wet chemical $\frac{25.40}{50} = 0.508\%$ Cu

$$\frac{.508 \times 100}{.469} = 108.3\%$$

A statistical analysis was run on the fifty comparative assays immediately above. At 50 degrees of freedom, t = 2.008 at the 95% confidence level. The calculated value of t was 7.54 which indicates a significant difference in the two assay procedures.

Recommendation:

Since the price and promptness of the wet chemical assay is the same as the atomic absorption assay, I recommend that we stick to the wet chemical method to avoid the calibration errors of atomic absorption.

Korn Kob assays should be adjusted 8 to 10% higher to compensate for this bias.

These findings are very similar to the results of the study of assay comparisons on the BYU and Banner drill cores from Morenci.

Discussion:

The check assays are attached. Assays of <.01% Cu and "trace" were counted as zero % Cu.

C.K. Chase

CKC:td
attachments

3226 East 46th Street

Phone 624-0[illegible]

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

Korn Kob Proj.

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 8[illegible]

SAMPLE SUBMITTED BY Essex International, Inc.

Proj. # A023-P3970 P3-03

DATE Feb. 13, 197

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON |
|---|---|---|---|---|---|---|---|
| KK-1 45-50 | [illegible] | .73 | 0.75 | | | | |
| 95-100 | [illegible] | .93 | 0.97 | | | | |
| 145-150 | [illegible] | .27 | 0.32 | | | | |
| 1239 | | .21 | 0.25 | | | | |
| KK-2 1168 | | .01 | 0.06 | | | | |
| 1178 | | .02 | 0.07 | | | | |
| 1188 | | .06 | 0.10 | | | | |
| KK-3 1251 | | .20 | 0.35 | | | | |
| 1261 | | .55 | 0.59 | | | | |
| 1271 | | .63 | 0.68 | | | | |
| 1281 | | .41 | 0.44 | | | | |
| 1292 | | .75 | 0.77 | | | | |
| KK-4 1354 | | .47 | 0.49 | | | | |
| 1364 | | .09 | 0.12 | | | | |
| KK-4A 1308 | | .78 | 0.93 | | | | |
| 1319 | | .62 | 0.71 | | | | |
| 1369 | | .14 | 0.14 | | | | |
| 1379 | | .28 | 0.29 | | | | |
| 1389 | | .32 | 0.32 | | | | |
| 1399 | | .29 | 0.28 | | | | |
| K-5 1337 | | .48 | 0.49 | | | | |
| 1406 | | .02 | 0.03 | | | | |
| 1416 | | .03 | 0.03 | | | | |
| 1426 | | .04 | 0.04 | | | | |
| 1436 | | [illegible] | 0.23 | | | | |

Invoice # 5946

CHARGES $ 50.00

2/13/71

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-00

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

Korn Kob Proj.

ASSAYERS - CHEMISTS - METALLURGISTS

TUCSON, ARIZONA 85713

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 13, 19

Proj. # A023-P3970 P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | |
|---|---|---|---|---|---|---|---|---|
| KK-5 1446 | | 0.13 | 0.14 | | | | | |
| KK-6 4 | | 0.01 | 0.02 | | | | | |
| 14 | | [illegible] | 0.01 | | | | | |
| KK-7 804 | | .01 | 0.02 | | | | | |
| 814 | | .15 | 0.16 | | | | | |
| 824 | | .50 | 0.52 | | | | | |
| 834 | | .11 | 0.11 | | | | | |
| 844 | | .13 | 0.14 | | | | | |
| 1804 | | .17 | 0.17 | | | | | |
| 1814 | | .22 | 0.23 | | | | | |
| 1824 | | .41 | 0.44 | | | | | |
| 1834 | | .49 | 0.54 | | | | | |
| KK-8 1845 | | .64 | 0.67 | | | | | |
| 1905 | | .29 | 0.30 | | | | | |
| 1915 | | .24 | 0.28 | | | | | |
| KK-9 1798 | | .07 | 0.08 | | | | | |
| 1958 | | .13 | 0.14 | | | | | |
| 1968 | | .23 | 0.25 | | | | | |
| KK-10 1978 | | .16 | 0.23 | | | | | |
| 1988 | | .07 | 0.08 | | | | | |
| KK-11 3757 | | .13 | 0.13 | | | | | |
| 3767 | | .36 | 0.37 | | | | | |
| 3777 | | .08 | 0.10 | | | | | |
| KK-12 3847 | | .01 | 0.01 | | | | | |
| 3858 | | .01 | 0.01 | | | | | |

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CHARGES $ 50.00

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Phone 624-0

AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS - CHEMISTS - METALLURGISTS

TUCSON ARIZONA 8571

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 13, 197

Project # A023-P3970 P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON |
|---|---|---|---|---|---|---|---|
| KK-12 3868 | | <.01 | 0.01 | | | | |
| 3878 | | <.01 | 0.01 | | | | |
| 3888 | | .03 | 0.05 | | | | |
| 35-40 | | .01 | 0.01 | | | | |
| 85-90 | | .01 | 0.01 | | | | |
| 135-140 | | .01 | 0.01 | | | | |
| 190-195 | | .01 | 0.02 | | | | |
| 240-245 | | .01 | 0.01 | | | | |
| KK-13 5-10 | | .01 | Trace | | | | |
| 55-60 | | .01 | 0.01 | | | | |
| KK-14 20-25 | | 1.39 | 1.39 | | | | |
| 70-75 | | .31 | 0.35 | | | | |
| 120-125 | | 1.06 | 1.08 | | | | |
| 170-175 | | .44 | 0.45 | | | | |
| 225-230 | | .35 | 0.40 | | | | |
| 227-280 | | .25 | 0.27 | | | | |
| KK-15 30-35 | | .01 | 0.04 | | | | |
| 80-85 | | .01 | 0.03 | | | | |
| 130-135 | | .01 | 0.02 | | | | |
| 180-185 | | .03 | 0.06 | | | | |
| 230-235 | | .54 | 0.57 | | | | |
| 280-285 | | .08 | 0.09 | | | | |
| 330-335 | | .19 | 0.19 | | | | |
| 380-385 | | .46 | 0.51 | | | | |
| 430-435 | | .20 | 0.19 | | | | |

Invoice # 5946

CHARGES $ 50.00

REGISTERED ASSAYER ARIZONA 2/13/71

ASSAYER - CHEMIST

3226 East 46th Street

Phone 624-06

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 85713

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 13, 197

Project # A023-P3970 P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | |
|---|---|---|---|---|---|---|---|---|
| | | Silver | Copper | | | | | |
| KK-16 40-45 | | .04 | 0.06 | | | | | |
| 90-95 | | .01 | 0.03 | | | | | |
| 140-145 | | .03 | 0.04 | | | | | |
| 200-205 | | .14 | 0.16 | | | | | |
| KK-17 3252 | | .44. | 0.46 | | | | | |
| 3262 | | .40. | 0.42 | | | | | |
| 3272 | | .07 | 0.08 | | | | | |
| 3294 | | .01? | 0.15 | | | | | |
| 3700 | | .18? | 0.02 | | | | | |
| 3711 | | .05 | 0.06 | | | | | |
| 3721 | | .01 | 0.02 | | | | | |

Invoice # 5946

CHARGES $ 22.00

2/13/71

ASSAYER · CHEMIST

3226 East 46th Street

Phone 624-00-

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 14, 1971

Project # A023-P3970-P3-03

| SAMPLE MARKED | | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON |
|---|---|---|---|---|---|---|---|---|
| KK-18 | 3453 | | .95 | 0.99 | | | | |
| | 3463 | | .54 | 0.61 | | | | |
| | 3473 | | .41 | 0.46 | | | | |
| | 3483 | | .54 | 0.61 | | | | |
| | 3493 | | .26 | 0.29 | | | | |
| | 3504 | | .11 | 0.12 | | | | |
| | 3736 | | .01 | 0.02 | | | | |
| | 3746 | | .32 | 0.34 | | | | |
| KK-19 | 3511 | | .03 | 0.04 | | | | |
| KK-20 | 3521 | | .81 | 0.88 | | | | |
| | 3531 | | .20 | 0.20 | | | | |
| | 3541 | | .49 | 0.54 | | | | |
| | 3551 | | [illegible] | 0.40 | | | | |
| | 3561 | | [illegible] | 0.24 | | | | |
| KK-21 | 3307 | | .17 | 0.19 | | | | |
| | 3317 | | .41 | 0.45 | | | | |
| | 3327 | | .23 | 0.25 | | | | |
| | 3337 | | .34 | 0.36 | | | | |
| | 3347 | | .28 | 0.30 | | | | |
| | 3357 | | .17 | 0.19 | | | | |
| | 3571 | | .25 | 0.25 | | | | |
| | 3581 | | .10 | 0.12 | | | | |
| | 3591 | | .23 | 0.26 | | | | |
| KK-22 | 3365 | | .13 | 0.15 | | | | |
| KK-23 | 3276 | | .07 | 0.14 | | | | |

Invoice # 5954

CHARGES $ 50.00

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-0

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 85711

SAMPLE SUBMITTED BY Essex International, Inc.

Project # A023-P3970-P3-03

DATE Feb. 14, 19

| SAMPLE MARKED | GOLD OZ/TON | SILVER OZ/TON | PERCENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON |
|---|---|---|---|---|---|---|---|
| KK-23 3286 | | [illegible] | 0.10 | | | | |
| 3296 | | [illegible] | 0.02 | | | | |
| 3407 | | .01 | 0.04 | | | | |
| 3417 | | .01 | 0.04 | | | | |
| 3427 | | .01 | 0.03 | | | | |
| 3437 | | .01 | 0.02 | | | | |
| 3447 | | [illegible] | 0.02 | | | | |
| 420-425 | | [illegible] | 0.01 | | | | |
| 470-475 | | [illegible] | 0.51 | | | | |

0.256 % Cu

27.98 / 120 — 30.70 / 120

0.233 % Cu

0.469 % Cu (only +0.24 % Cu samples)

25.40 / 50 = 0.508 %

Invoice # 5954

CHARGES $ 18.00

ASSAYER-CHEMIST

KEYSTONE MINERALS INC. - KORN KOB MINE
SUMMARY OF TONNAGE, OXIDIZED COPPER MINERALIZATION
INDICATED BY DRILLING THROUGH 1972

| | Plus 0.30% Cu | | | | Plus 0.15% to 0.29% Cu | | Total - Plus 0.15% Cu | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Location | Tons (1000's) | % Cu | Waste Tons (1000's) | Strip.Ratio Waste/Ore | Tons (1000's) | % T. Cu | Total Tons | Waste Tons (1000's) | Strip.Ratio Waste/Ore | Ave.% T. Cu |
| South Pit | 6,137 | 0.52 | 7,197 | 1.173:1 | 1,205 | 0.24 | 7,342 | 6,000 | 0:874:1 | 0.48 |
| North Pit | 927 | 0.66 | 2,684 | 2.895:1 | 228 | 0.23 | 1,155 | 2,456 | 2.126:1 | 0.58 |
| Total | 7,064 | 0.54 | 9,881 | 1.440:1 | 1,433 | 0.24 | 8,497 | 8,456 | 1.020:1 | 0.49 |

Incl. 1.433,000 Tons of +0.15-0.29% Cu.

only -0.15 % Cu

6

# LABORATORY TESTS CONDUCTED ON KORN KOB ORES USING TL LEACHING TECHNIQUES

by

Paul H. Johnson, Ph.D.

Hydrometallurgist

February 8, 1974

HOLMES & NARVER, INC.

A Resource Sciences company

Advanced Technology / Engineering / Construction / Management / Maintenance & Operations

400 EAST ORANGETHORPE AVENUE • ANAHEIM, CALIFORNIA 92801

## Introduction

A series of leach tests have been conducted on various ore samples from the Korn Kob Mine property, near Tucson, Arizona, using the new TL Leaching concept.

TL Leaching, because of its proprietary nature, may only be described in this report as a highly modified form of percolation leaching wherein crushed ore is very effectively leached in a short period of time with a minimum usage of acid leaching reagent and in a plant having low capital and operating costs. Numerous small and large scale tests on other ores have shown that this technique is far superior to any of the present methods used in leaching ores. It is not unusual to achieve above 95% recovery on an unsized, crushed oxide copper ore that would normally yield about 80% recovery by means of a complicated and expensive vat leach.

Percolation and agitation leach tests that have previously been run on finely ground or crushed Korn Kob ores at ambient temperatures have yielded recoveries in the range of 15 to 75% with most results in the 60 to 70% range (see Essex reports). In the Essex tests, acid consumptions were generally about 7#/# Cu. for tests run on the North Pit ores and 11#/# Cu. for tests conducted on the South Pit ores.

## Ore Samples

Four separate run-of-mine ore samples with a combined weight of about 400# were submitted by Mr. Dirk Den-Baars of Keystone Minerals, Inc. As of this date, only two of these samples have been used in testing, viz; KKHS1 representing the tactite ore from the North Pit and KKHS2 representing the tactite (skarn) ore of the South Pit.

These ores have a high hematite and magnitite content and are relatively heavy and impermeable to downward percolated leach solutions.

## Results

The test conditions and results are tabulated in Table I.

## Conclusions

The Korn Kob ores responded quite well to leaching by means of TL Leaching techniques. Recoveries were generally high, acid consumptions were relatively low, the total leaching period was short, and the pregnant leach liquors were of high quality.

Recoveries of copper varied somewhat with the grade and type of ore treated. High grade ores (.917 and 1.20% Cu) crushed to minus 1/2 inch from the North pit yielded recoveries in the 90 to 97% range; whereas, a more average pit grade ore (.527% Cu) from the South pit gave recoveries in the 86 to 87% range when crushed to either minus 1/2 inch or minus 3/8 inch.

Gross acid consumptions were 5-6.2#/#Cu recovered on the high-grade North pit ores and about 10#/# Cu in those tests run on the South pit ores under low-acid conditions. The net acid consumptions, wherein credit is given for the acid generated in the solvent extraction-electrowinning circuit and for the acid equivalent ferric iron that results from leaching, are about 3 to 5#/# Cu less that the above-mentioned gross acid consumptions. Hence, the net acid consumptions would be about 2#/#Cu and 6#/#Cu for the North and South Pit ores tested in this study, respectively.

The total loading, leaching, rinsing, and discharging times were four days in each of these tests.

The pregnant leach liquors in most of these tests could be adjusted with recycled rinse liquors to give an overall feed liquor for the solvent extraction plant of about 3.5 gpl Cu and 2 gpl $H_2SO_4$. Under these conditions, most of the regenerated acid and ferric iron would be profitably used.

Additional testwork would probably improve the recovery, lower the acid consumptions and lower the acid content of the pregnant leach liquors.

| Test No. | Ore No. | Grams Ore Used | Ore Assay % Cu | Ore Size | Total Leaching Period* | Copper Recovery % | ⁷ Gross Acid Consumption #/#Cu Rec |
|---|---|---|---|---|---|---|---|
| TLKK 1 | KKHS 1 | 11,800 | 1.20 | -1/2" | 4 Days | 94 S&T** <br> 94 H&T | 5.0 |
| TLKK 2 | KKHS 2 | 9,500 | .527 | -1/2" | 4 Days | 86 H&T <br> 86 S&T | 10.1 |
| TLKK 3 | KKHS 1 W/Hi-Grade Removed | 9,500 | .914 | -1/2" | 4 Days | 90 S&T <br> 90 H&T | 6.2 |
| TLKK 4 | KKHS 2 | 6,200 | .527 | -1/2" | 4 Days | 86 H&T | 14.5*** |
| TLKK 5 | KKHS 2 | 6,200 | .527 | -3/8" | 4 Days | 85-87 S&T <br> 85-87 H&T | 14.5*** |
| TLKK 6 | KKHS 2 | 3,385 | .527 | -3/8" | 4 Days | 86 S&T <br> 87 H&T | 10.0 |

* Includes loading, leaching, rinsing and waste removal times.

** S&T indicates calculated based on solution assays and tails and H&T indicates recovery based on head and tails assays.

***Tests run under strong acid conditions.

⁷ Does not give credit to acid generated in SX-EW (1.67#/# Cu) or $Fe^{+++}$ equivalent acid (~2 - 3# $H_2SO_4$/# Cu).

TABLE 1. Conditions and Results of TL Leach Tests on Korn Kob Ores

7

**HAZEN RESEARCH, INC.**

4601 INDIANA STREET
GOLDEN, COLORADO • 80401
TELEPHONE 303/279-4501

HRI Project 781
Copy No. 4

# COPPER ORE LEACHING STUDIES

KORN KOB
ORE

for

Essex International, Inc.
1704 West Grand Road
Tucson, Arizona 85719

December 29, 1970

By:

T. K. Miyoshi
Research Engineer

V. J. Hoffmann
Senior Research Engineer

Approved by:

A. W. Lankenau
Vice President

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## INTRODUCTION AND SUMMARY

KURN KCB

Samples of drill cuttings from a copper ore body were submitted by Essex International, Inc., for leaching studies. The grade of the samples varied from 0.32 to 0.69% copper. Mineralogical examination indicated that the copper was associated with iron oxides. Separating the strongly magnetic fraction, however, did not concentrate the copper values. Neither did screening the minus 1/4-inch drill cuttings received on 100-mesh.

Most of the tests were conducted on the sample of Hole 4A which analyzed 0.32% copper. A few tests were conducted on Composite A, an equal weight composite of Holes 3, 5, and 7 which analyzed 0.42% copper. The following techniques were tested:

1. Agitation acid leaching.
2. Percolation leaching.
3. Acid ferric sulfate leaching.
4. Ammonia leaching.

The best results were obtained by agitation acid leaching and percolation leaching and are summarized as follows:

| Type Test | Sample | Grind | $H_2SO_4$ Addition, lb/ton | % Cu Extraction |
|---|---|---|---|---|
| Agitation leach | Hole 4A | -1/4 inch | 70.5 | 55.1 |
| Agitation leach | Hole 4A | -20 mesh | 70.8 | 61.6 |
| Agitation leach | Hole 4A | -28 mesh | 100.0 | 72.5 |
| Percolation leach | Hole 4A | -1/4 inch | 86.4 | 64.6 |
| Agitation leach | Composite A* | -28 mesh | 127.4 | 66.8 |
| Agitation leach | Composite A | -28 mesh | 195.5 | 70.2 |

*Composed of equal weights from Holes 3, 5, and 7.

The reagent consumptions per pound of copper extracted are high because of the relatively low grades of the samples treated. Even higher copper extractions, 80-82%, were obtained by agitation leaching of minus 100-mesh ore with relatively large amounts of sulfuric acid or sulfuric acid and ferric sulfate.

## ORE SAMPLES

Composite samples of drill cuttings from six holes were received on October 29, 1970 via Greyhound bus from Essex International, Inc., Tucson, Arizona. The identifications and analyses of these samples were as follows:

Table 1

Analysis of Ore Samples

| HRI No. | Hole No. | Total | +100 Mesh | -100 Mesh | % Acid Soluble Cu | % $P_2O_5$ |
|---|---|---|---|---|---|---|
| 3216-1 | 1 | 0.69 | 0.53 | 0.87 | | |
| 3216-2 | 3 | 0.44 | 0.33 | 0.58 | | |
| 3216-3 | 4 | 0.43 | 0.36 | 0.57 | | |
| 3216-4 | 4A | 0.32 | 0.23 | 0.49 | 0.27 | 0.75 |
| 3216-5 | 5 | 0.41 | 0.34 | 0.59 | | |
| 3216-6 | 7 | 0.38 | 0.29 | 0.49 | | |
| Composite A (3216-2-5-6) | (3,5,7) | 0.42 | | | | |

The samples as received were minus 1/4-inch in size. The analyses of the plus and minus 200-mesh fractions were made to determine if a concentration by sizing could be achieved. The results are not encouraging.

A semi-quantitative x-ray fluorescence scan of Composite A is shown in Table 2.

Table 2

Semi-Quantitative X-ray Fluorescence Analysis
Composite A Head Sample

| | | | |
|---|---|---|---|
| Copper | 0.36 | Zirconium | 0.003 |
| Silver | | Hafnium | |
| Gold | | Thorium | |
| Zinc | 0.13 | Vanadium | |
| Cadmium | | Columbium | 0.003 |
| Mercury | | Tantalum | |
| Gallium | | Chromium | |
| Indium | | Molybdenum | 0.009 |
| Thallium | | Tungsten | |
| Germanium | | Uranium | |
| Tin | | Manganese | 1.8 |
| Lead | 0.033 | Lanthanum | |
| Arsenic | 0.002 | Cerium | |
| Antimony | | Praseodymium | |
| Bismuth | | Neodymium | |
| Selenium | | Samarium | |
| Tellurium | | Europium | |
| Bromine | | Gadolinium | |
| Iodine | | Terbium | |
| Iron | 9.1 | Dysprosium | |
| Cobalt | | Holmium | |
| Nickel | 0.004 | Erbium | |
| Cesium | | Thulium | |
| Rubidium | | Ytterbium | |
| Barium | | Lutetium | |
| Strontium | 0.007 | Yttrium | |
| Titanium | 0.047 | | |

Note: The values above are estimated percentages for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

## MINERALOGY

Samples from six composites were submitted by Essex International for mineralogical analysis. The samples were designated HRI numbers 3216-1 through 6. Polished sections and thin sections were prepared of the individual samples by impregnating the granular composites with epoxy.

From this examination it appears that the composites are composed of two distinct rock types. The predominant type is a garnet-chlorite schist or tactite with considerable amounts of magnetite-hematite. The other rock type is a phyllitic schist. The principal copper mineralization seems to be associated mostly with the garnet-chlorite schist or tactite.

The copper mineralization occurs primarily as cupriferous iron oxide and chrysocolla. Traces of malachite, tenorite, and delafossite (?) were noted but comprised less than one percent of the copper present. Sulfides were almost totally lacking but a few grains of pyrite and chalcopyrite were noted.

Some consideration has been given to the possibility of copper occurring as a phosphate. Most of the known copper phosphates are either shades of green or blue and fairly easily recognizable. None were noted in any of the samples. The only phosphate mineral detected was apatite, the calcium phosphate.

The calcite content of the samples varied considerably. Samples 1 and 3 contained almost no calcite whereas several percent of calcite was noted in the other samples.

The magnetic fraction of the samples also varied. Magnetic concentrations were made with a hand magnet. The results of the magnetic separations are shown in the following table.

Table 3

Magnetic Separation Results

| | Sample No. | Composite Hole # | Total Cu | Weight % Magnetic | Weight % Non-magnetic |
|---|---|---|---|---|---|
| North ORE | 3216-1 | 1 | 0.69 | 8 | 92 |
| | 3216-2 | 3 | 0.44 | 20 | 80 |
| South ORE | 3216-3 | 4 | 0.43 | 30 | 70 |
| | 3216-4 | 4A | 0.32 | 33 | 67 |
| | 3216-5 | 5 | 0.41 | 13 | 87 |
| | 3216-6 | 7 | 0.38 | 17 | 83 |
| | Average | | | 20 | 80 |

The magnetic fraction was composed primarily of magnetite, which was partially altered to hematite, and a high-iron garnet. Minor amounts of amphibole and chlorite were also present.

Following the magnetic separation of the individual samples, using a hand magnet, a wet magnetic separation of a sample of Composite A ground to minus 100-mesh was made in the Dings Davis Tube. The magnetic and non-magnetic fractions were analyzed for copper with the following results.

Table 4

Dings Davis Tube Magnetic Separation
Composite A Ground to -100 Mesh

| Sample | Weight % | % Cu | % Cu Distribution |
|---|---|---|---|
| Magnetic | 6.5 | 0.141 | 2.3 |
| Non-magnetic | 93.5 | 0.426 | 97.7 |
| Calculated heads | 100.0 | 0.41 | 100.0 |
| Assayed heads | | 0.42 | |

The results of semi-quantitative x-ray fluorescence analyses of the magnetic and non-magnetic fractions are shown in Table 5.

The strong magnetic concentrate contained only 2.3% of the copper in the test feed. A magnetic separation at a much higher intensity would

probably be required to concentrate the copper and iron values in the sample.

Trace amounts of zircon and a mineral which might be monazite were noted in all samples along with apatite. A few grains of fluorite were also noted.

The samples have a tan to brownish color due to the alteration and oxidation of some of the iron-bearing minerals. The phyllitic schist, which contains few iron-bearing minerals, lends a grayish color to the samples depending on the amount of this rock type present.

The identification of rock types is difficult in this type of sample since few particles are large enough to ascertain textural and mineralogical associations.

The locking of grains is not important in this type of sample since liberation of copper-bearing minerals from gangue is not required. The examination, however, indicates that the copper-bearing minerals are generally coarse and where chrysocolla is present with other minerals, it occurs as a surface coating. A few grains of pale blue quartz which probably contain a minor amount of the total copper mineralization were noted in the study. This copper would be difficult to recover because little of the copper would be present at the surface but the amount of this type of mineralization is small and is not important.

Table 5

Semi-Quantitative X-ray Fluorescence Analysis
Composite A, Magnetic and Non-magnetic

Magnetic Fraction - M
Non-magnetic Fraction - NM

| | M | NM | | M | NM |
|---|---|---|---|---|---|
| Copper | 0.16 | 0.59 | Zirconium | | 0.012 |
| Silver | | | Hafnium | | |
| Gold | | | Thorium | | |
| Zinc | 0.033 | 0.13 | Vanadium | | |
| Cadmium | | | Columbium | | 0.003 |
| Mercury | | | Tantalum | | |
| Gallium | | | Chromium | 0.15 | |
| Indium | | | Molybdenum | | 0.004 |
| Thallium | | | Tungsten | | |
| Germanium | | | Uranium | | |
| Tin | | | Manganese | 0.81 | 1.8 |
| Lead | 0.055 | 0.019 | Lanthanum | | |
| Arsenic | | | Cerium | | |
| Antimony | | | Praseodymium | | |
| Bismuth | | | Neodymium | | |
| Selenium | | | Samarium | | |
| Tellurium | | | Europium | | |
| Bromine | | | Gadolinium | | |
| Iodine | | | Terbium | | |
| Iron | 44 | 5.6 | Dysprosium | | |
| Cobalt | | | Holmium | | |
| Nickel | 0.013 | 0.008 | Erbium | | |
| Cesium | | 0.019 | Thulium | | |
| Rubidium | | | Ytterbium | | |
| Barium | | | Lutetium | | |
| Strontium | | 0.006 | Yttrium | | 0.008 |
| Titanium | 0.067 | 0.068 | | | |

Note: The values above are estimated percentages for the metal equivalent of the indicated elements. No check was made for elements with atomic numbers less than 22 (below titanium).

## TEST PROCEDURES AND RESULTS

Agitation leaching with sulfuric acid was tested first. The initial testing was on the sample from Hole 4A, HRI 3216-4, because this was the largest sample. If a procedure could be developed which was economic, it would be tested on the other samples. Later, Composite A was made by blending equal weights of the samples of Holes 3, 5, and 7 in order to provide sufficient additional material for testing.

Other leaching methods tested were acid percolation leaching, acid ferric sulfate leaching, and ammonia leaching.

### ACID AGITATION LEACHING

In the first series of tests on the minus 1/4-inch ore, the extractions were compared at pH 1.0, 1.5, and 2.0 with the following results:

| | Leach Conditions | | | | | |
|---|---|---|---|---|---|---|
| Sample | Grind | Time Hours | Temp °C | pH | $H_2SO_4$ lb/ton | % Cu Extraction |
| 3216-4 | -1/4 inch | 1 | 24 | 1.0 | 70.5 | 55.1 |
| | -1/4 inch | 1 | 24 | 1.5 | 50.6 | 43.7 |
| | -1/4 inch | 1 | 23 | 2.0 | 40.4 | 14.6 |

As expected, the results at pH 1.0 were best, but acid consumption was also greatest. The extraction at pH 2.0 was poor. Tests were then run on minus 6 and minus 20-mesh ore at pH 1.5 to determine the effect of grind on extraction.

| | Leach Conditions | | | | | |
|---|---|---|---|---|---|---|
| Sample | Grind | Time Hours | Temp °C | pH | $H_2SO_4$ lb/ton | % Cu Extraction |
| 3216-4 | -6 mesh | 1 | 22 | 1.5 | 53.8 | 41.9 |
| | -20 mesh | 1 | 22 | 1.5 | 58.1 | 42.4 |

These results show very little improvement in copper extraction as the ore size decreases.

Two series of tests were then run on minus 20 and minus 28-mesh ore with varying leach times. The results of these tests plus those of several leaches on Composite A, consisting of equal weights from Holes 3, 5, and 7 are shown in the following table:

Table 6

Agitation Leach Test Results

| | Leach Conditions | | | | | |
|---|---|---|---|---|---|---|
| Sample | Grind | Time Hours | Temp °C | pH | $H_2SO_4$ lb/ton | % Cu Extraction |
| 3216-4 | -20 mesh | 2 | 23 | 1.5 | 65.5 | 56.6 |
| | -20 mesh | 3 | 22 | 1.5 | 70.8 | 61.6 |
| | -20 mesh | 4 | 23 | 1.5 | 58.8 | 56.0 |
| | -28 mesh | 2 | 23 | 1.5 | 71.7 | 58.5 |
| | -28 mesh | 3 | 22 | 1.5 | 74.3 | 60.1 |
| | -28 mesh | 4 | 23 | 1.5 | 64.4 | 54.8 |
| | -28 mesh | 4 | 22 | 1.4* | 100.0* | 72.5 |
| Composite A | -28 mesh | 4 | 24 | 1.5 | 127.4 | 66.8 |
| | -28 mesh | 4 | 22 | 1.55* | 195.5* | 70.2 |

* Slurry made up with 5% weight/volume $H_2SO_4$ solution and sufficient 5% acid added if necessary to maintain pH.

Note that acid consumption increased greatly when higher concentrations of acid were added at the beginning of the leach such as in the tests in which a 5% acid solution was used to make up the slurry. Copper extraction also increased in these tests.

## PERCOLATION LEACHING

The results of percolation leaching tests on samples from Hole 4A and Composite A using upflow leaching are shown in Table 7. Note that although the acid consumed on Composite A is less than on 3216-4, the pH of the effluent is higher. If sufficient acid were added to hold the pH of the column discharge the same as from sample 3216-4, it is likely that acid consumption and copper extraction from this sample would increase.

Table 7

Percolation Leaching Tests

| | | |
|---|---|---|
| Ore, HRI No. | 3216-4 | Composite A |
| % Cu | 0.328 | 0.42 |
| Weight, g | 2000 | 1500 |
| Grind | -1/4 inch | -1/4 inch |
| Column diameter, inches | 2-31/32 | 2-3/4 |
| Ore depth, inches | 10 | 8 |
| Solution, ml | 6000 | 4500 |
| $H_2SO_4$, g/l | 14.4 | 14.4 |
| Flow rate, ml/min | 81 | 74 |
| $H_2SO_4$ added, lb/ton | 86.4 | 64.8 |
| Cu extraction, % | 64.6 | 41.9 |
| Column Discharge: | | |

| | HRI No. 3216-4 | | | Composite A | | |
|---|---|---|---|---|---|---|
| Time Hours | pH | Free Acid g/l | Cu g/l | pH | Free Acid g/l | Cu g/l |
| 1 | 1.5 | 2.94 | 0.654 | 1.2 | 6.75 | 0.397 |
| 2 | 1.3 | 6.00 | 0.544 | 1.25 | 6.40 | 0.427 |
| 3 | 1.3 | 5.39 | 0.561 | 2.5 | - | 0.479 |
| 4 | 1.3 | 5.11 | 0.582 | 2.1 | 0.52 | 0.569 |
| 5 | 1.35 | 4.76 | 0.605 | 2.0 | 0.65 | 0.605 |
| 6 | 1.4 | 4.40 | 0.620 | 2.1 | 0.50 | 0.627 |
| 7 | 1.45 | 4.07 | 0.637 | | | |
| 8 | 1.45 | 3.85 | 0.638 | | | |
| 9 | 1.4 | 3.77 | 0.662 | | | |

## ACID FERRIC SULFATE LEACHING

Agitation leaches of minus 100-mesh samples of Composite A were performed with and without the addition of 100 lb/ton of ferric sulfate. The leaches were conducted at pH 1.0 and 50% solids for three hours with the following results:

| Test No. | Reagent Additions, lb/ton $H_2SO_4$ | $Fe_2(SO_4)_3$ | % Cu Extraction |
|---|---|---|---|
| 1 | 195 | 100 | 80.4 |
| 2 | 258.5 | - | 82.5 |

Although good extractions were obtained, the reagent additions are large.

## AMMONIA LEACHING TESTS

A minus 100-mesh sample of Composite A was leached at 20% solids in a solution 2 Molar each in ammonium hydroxide and ammonium carbonate. The leach was conducted in a bottle with a small opening in the lid. The bottle was agitated on rollers for 24 hours. At the end of this time, the leach solution was removed by filtration, fresh solution added, and the sample agitated another 12 hours. The total copper extraction at the end of the second stage of leaching was 25.0%. No attempt was made to determine the ammonia consumption which is likely to be very high using high strength ammonia solutions and atmospheric leaching.

## DISCUSSION

Although reasonable copper extraction can be obtained by acid leaching, the reagent consumption is high. The relatively high acid consumption is probably a function of the ore grade. If the ore grade could be upgraded by selective mining or concentration, more intense conditions could be applied during the extraction step.

Although the mineralogical examination indicated that most of the copper was associated with iron oxides, the strongly magnetic fraction contained only a small amount of the copper. However, if all of the iron oxides could be concentrated by flotation or high intensity magnets, perhaps the copper could also be concentrated.

There is some evidence that fine grinding and/or ferric sulfate addition to the acid leach will improve copper extraction as shown by the following comparison:

| Sample | Grind mesh | $H_2SO_4$ lb/ton | $Fe_2(SO_4)_3$ lb/ton | Leach Time hours | % Cu Extraction |
|---|---|---|---|---|---|
| Composite A | -28 | 195 | - | 4 | 70.2 |
| Composite A | -100 | 195 | 100 | 3 | 80.4 |

If ferric sulfate is effective in leaching the coppper, recycling of sulfuric acid leach solutions will result in an increase of ferric iron in the solution. Perhaps the addition of sodium chloride to the acid leach would be helpful in attacking the iron-copper minerals. This has not been tested in the laboratory.

July 22, 1971

TO: H. Lanier

FROM: C.K. Chase

SUBJECT: REPORT NO. MET. 71-7-7
Summary of Korn Kob
Acid Leach Tests

General: A series of 50 separate bench-scale acid leach tests have been run on various samples of Korn Kob ore. The results of all of these tests are presented in detail on the accompanying recap sheets, Table I. The first of these tests, on a single very amenable sample, was run by KCC. Others were performed by Hazen Research, Inc., Metcon Research, Inc., and by Essex on several different Korn Kob samples which are identified in the tabulation. One ammonia leach test was run, with poor results.

Conclusions: In general, standard acid leaching techniques dissolve only 2/3 of the copper present.

Fine grinding of the entire ore helps extraction moderately.

Longer leach times (24 hours) do not improve results much over those obtained in 6 hours.

Two variations in leach technique, however, do provide substantially increased extractions, and will have to be used to obtain sufficient leached copper to support an economic operation. It will be helpful to the economics if an increase in the price of copper can be counted on. These two variations are: leaching with heated solutions ($\pm 50^{\circ}C$) and the use of very strong acid in contact with the ore at some stage in the leach. In effect, we should arrange a counter-current leach in regard to the flow of solution and ore, insofar as possible, with a strong concentration of acid at the end of the system farthest removed from the entering ore. This is simple in the vat leach portion but more difficult in the mechanical leach part of the system.

Figure 1 shows the effect of acid concentration as evidenced by pH on the copper extraction from the two pit composite samples. It is apparent that pH 1.5 is necessary for any effective leaching and that stronger acid results in additional leaching.

Figure II shows the effect on extraction of increase in leach solution temperatures coupled with high acid levels on these same samples. The combination of these two factors can increase leach extractions by twenty percent.

Test Procedure: Most of the tests reported in Table I were run on 100 gram samples at 33% solids in a beaker agitated with an electric stirrer. After the leach, the pulp was filtered and washed with $pH_2$ water. Accountability is calculated by dividing the grams of copper in the products by the grams of copper in the heads.

Discussion and Comparison of Tests:

Test No. 1 was on a sample from the dump around the old shaft and is higher in copper and of better processing quality than any samples since obtained. It is not apparently very representative of the general ore body but it may indicate some good ore intersected by the shaft and associated drifts.

Effect of Leach Retention Time, pH, and Grind on Extraction, Composite Sample of Drill Hole 4A

Tests No. 2 through 13, performed by Hazen, show that a leach pH of 1.5 is necessary for leaching and that a finer grind together with longer retention time improves extraction from 40% up into the 70% range. These tests were on the composite of Drill Hole 4A, which falls short of representation of the orebody. In addition, the sample was low grade.

Percolation Leaches

Tests 14 and 15 are percolation leaches on two different samples, the 4A composite and another composite (A) of Holes 3, 5, and 7. Number 14 shows reasonable percolation leach extraction in a laboratory column, but extraction in a deep heap can hardly be this good. Composite 4 is less extractable under these conditions.

Test 16 compared with Test 19 shows that increasing grind from -78 mesh to -100 mesh and increasing acid from pH 1.5 to 1.0 results in a 15.7% increase in extraction, from 66.8% to 82.5% at 4 and 3 hours of leaching, respectively.

Test 18 compared with Test 19 shows no extraction advantage for presence of ferric sulfate in the leach, which is evidence of lack of cuprite or chalcocite in Composite A. This conclusion was corroborated on another more representative sample: data from Tests 21 and 23 show essentially the same result on the Trial Pit composite.

## Ammonia Leach

Test 20 demonstrates the poor extraction obtained on Composite A with ammonia leach.

## Fine Grind

Tests 21 and 22 show a considerable extraction advantage for fine grind as compared to -10 mesh grind in work done by Metcon. Metcon tests were #21 through #27.

## North Pit Composite Drill Hole Sample

The effect of varying amounts of acid, method of adding acid, temperature of leach fine grind, and a 24 hour leach were investigated in Tests 28 through 35 by Essex, 36 and 37 by Metcon, and 38 and 39 by Essex. Test #25 used $SO_2$ in the leach to determine whether any extracting advantage might be obtained by running a reducing leach to break apart any possible copper-manganese minerals. Comparison of Tests 35 and 29 show little effect on leach extraction resulting from use of a reducing agent.

Effects of leach temperature plus strong acid are demonstrated by comparing Test #32 at 25°C with #37 at 50° under otherwise identical conditions. Extraction increases from 70.6% to 80.9%. These results are graphed in Fig. 2 and represent acid addition of three times that necessary for maintaining pH 1.5 in all tests.

## South Pit Composite Drill Hole Sample

The same parameters that were investigated on the North Pit were compared in the South Pit, with comparable results. The effect of temperature and acidity increased extractions from the 70's to 90%. The South Pit is more leachable than the North Pit but acid consumption is higher per lb. of copper leached.

Tests 45 and 46 compare fine grind and longer leach. Longer leach is more effective.

In general, the higher the acid level in the leach, the higher the overall acid consumption, but still within reason.

## Acid Consumption

The North Pit has varying acid consumptions according to individual test variations but in general a level of 7 lb. acid per lb. of copper dissolved is associated with extractions in the range of 70-80%.

The South Pit leaches best with acid consumptions of the order of 11 lb. per lb. of copper dissolved. Extractions are in the range of 80-90%.

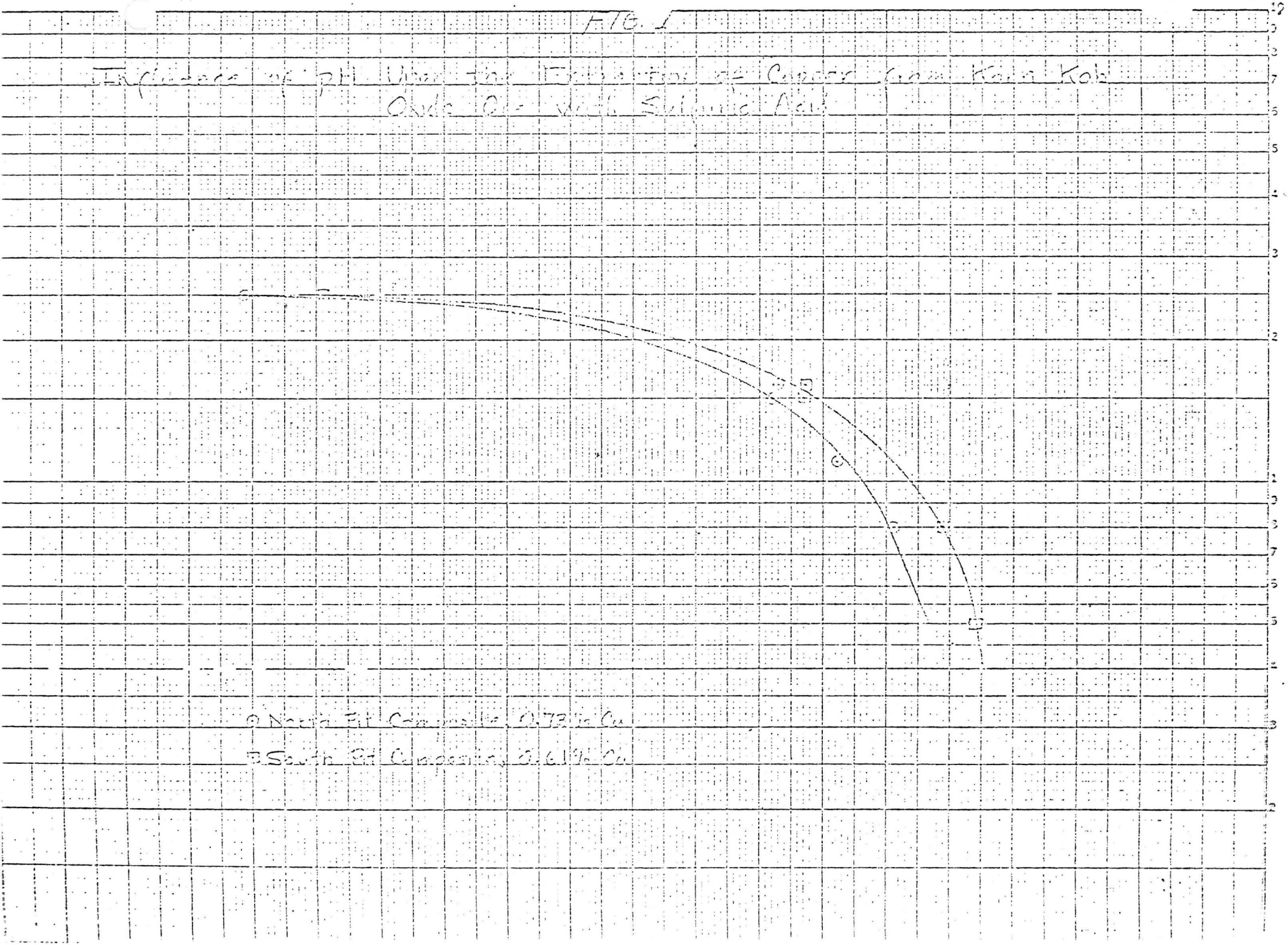
C.K. Chase

C.K. Chase

CKC:td

FIG. 1

Influence of pH Upon the Solubility of Copper from Kalin Kob Oxide Ore with Sulfuric Acid



K+E 10 X 10 INCHES MADE IN U.S.A.
FOLD 3 CO.

# FIG. 2
## EFFECT OF HIGH TEMPERATURE ON LEACH EXTRACTION FROM KORAMKOL ORE

CKC 7/8/71

TABLE I

KUCAP – KORN KOB LEACH TESTS, MAR. 12, 1958 TO MAY 26, 1971

| TEST NUMBER | SAMPLE DESCRIPTION | TEST PERFORMED BY | HEAD ASSAY, % Cu | SAMPLE MESH | LEACH PH | LEACH TEMP. °C. | LEACH TIME, HOURS | ACID CONSUMED, #/TON ORE | ACID CONSUMED #/#COPPER | EXTRACTION % | EXTRACTION #/TON OF ORE | ACCOUNTABILITY | LEACH METHOD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | COMP AT SHAFT | KCC | 2.04 | -1/4" | — | AMBIENT | 7 | 45 | 7.2 | 93.8 | 38.3 | — | PERCOLATION LEACH |
| 2 | COMPO. DRILL HOLE 4A | MRI | 0.32 | -1/4" | 1.0 | 24° | 1 | 70.5 | 20.1 | 55.1 | 5.5 | — | AGITATION LEACH |
| 3 | " | " | " | -1/4" | 1.5 | 24° | 1 | 50.6 | 18.1 | 43.7 | 2.8 | — | " |
| 4 | " | " | " | -1/4" | 2.0 | 23° | 1 | 40.4 | 44.9 | 14.6 | 0.9 | — | " |
| 5 | " | " | " | -6 | 1.5 | 22° | 1 | 53.8 | 19.9 | 41.9 | 2.7 | — | " |
| 6 | " | " | " | -20 | 1.5 | 22° | 1 | 58.1 | 21.5 | 42.4 | 2.7 | — | " |
| 7 | " | " | " | -20 | 1.5 | 23° | 2 | 65.5 | 17.2 | 56.6 | 3.6 | — | " |
| 8 | " | " | " | -20 | 1.5 | 22° | 3 | 70.8 | 18.2 | 61.6 | 3.9 | — | " |
| 9 | " | " | " | -20 | 1.5 | 23° | 4 | 58.8 | 16.3 | 56.0 | 3.6 | — | " |
| 10 | " | " | " | -28 | 1.5 | 22° | 2 | 71.7 | 19.4 | 53.5 | 3.7 | — | " |
| 11 | " | " | " | -28 | 1.5 | 22° | 3 | 74.3 | 19.6 | 63.1 | 3.8 | — | " |
| 12 | " | " | " | -28 | 1.5 | 23° | 4 | 64.4 | 18.4 | 54.8 | 3.5 | — | " |
| 13 | " | " | " | -28 | 1.4 | 23° | 4 | 100.0 | 21.7 | 72.5 | 4.6 | — | " |
| 14 | " | " | " | -1/4" | — | AMBIENT | 9 | 86.4 | 21.1 | 64.6 | 4.1 | — | PERCOLATION LEACH |
| 15 | COMPO. A, HOLES 3, 5, & 7 | " | 0.42 | -1/4" | — | " | 6 | 64.8 | 18.5 | 44.9 | 3.5 | — | " |
| 16 | " | " | " | -28 | 1.5 | 24° | 4 | 122.4 | 28.8 | 68.8 | 5.6 | — | AGITATION LEACH |
| 17 | " | " | " | -28 | 1.6 | 22° | 4 | 194.5 | 33.1 | 79.2 | 5.9 | — | " |
| 18 | " | " | " | -100 | 1.0 | AMBIENT | 3 | 145.0 | 26.7 | 83.4 | 6.8 | — | AGITATION LEACH |
| 19 | " | " | " | -100 | 1.0 | " | 3 | 250.5 | 37.5 | 82.5 | 6.9 | — | AGITATION LEACH |
| 20 | " | " | " | -100 | 1.4 H3 | " | 24 | — | — | 25.0 | 2.1 | — | AGITATION LEACH |
| 21 | TRIAL PIT (SOUTH), DRILL COMPO. | MRI | 0.50 | -10 | 1-2 | 25° | 6 | 142.0 | 25.5 | 54.6 | 5.5 | 101.2 | AGITATION LEACH |
| 22 | " | " | " | 18.7-325 | 1.5 | " | " | 197.0 | 24.4 | 74.8 | 7.2 | 110.0 | AGIT. & FILTRATION |
| 23 | " | " | " | -10 | — | " | " | 174.0 | 23.0 | 53.7 | 5.4 | 92.4 | AGIT. & FILTRATION |
| 24 | COMPO., #1 DRILL HOLE | " | 0.37 | -20 | 1.5 | " | " | 92.0 | 9.8 | 62.5 | 10.5 | 100.9 | PERCOLATION LEACH |
| 25 | COMPO., #4 DRILL HOLE | " | 0.66 | " | 1.5 | " | " | 74.0 | 10.6 | 52.8 | 7.0 | 94.2 | " |
| 26 | COMPLETE ADIT COMPO. | " | 0.16 | " | 1.5 | " | 2 | 56.0 | 9.3 | 65.7 | 6.0 | 94.6 | " |
| 27 | SELECTED ADIT COMPO. | " | 0.64 | " | 1.5 | " | " | 80.0 | 9.3 | 67.0 | 8.6 | 103.0 | " |
| 28 | NORTH PIT COMPO. | SX | 0.73 | " | 2.5* | " | " | 17.7 | 6.3 | 18.3 | 2.8 | 94.8 | " |
| 29 | " | " | " | " | 1.5* | " | 4 | 26.0 | 9.2 | 64.0 | 8.9 | 138.2 | " |
| 30 | " | " | " | " | 1.6** | " | 4 | 22.3 | 8.5 | 64.5 | 8.0 | 145.7 | " |
| 31 | " | " | " | " | 1.1*** | " | 4 | 34.4 | 5.9 | 64.1 | 9.7 | 152.4 | " |
| 32 | " | " | " | " | 0.8**** | " | 4 | 53.3 | 5.2 | 70.6 | 10.3 | 102.2 | " |
| 33 | " | " | " | " | 2.2** | " | 24 | 12.1 | 1.9 | 66.0 | 9.6 | 102.3 | " |
| 34 | " | " | " | -325 | 2.3** | " | 6 | 20.4 | 3.2 | 64.7 | 9.0 | 102.2 | " |
| 35 | " | " | " | -20 | 3.8 | " | " | 10.1 | 11.3 | 62.3 | 9.1 | 95.9 | AGITATION LEACH |
| 36 | " | MRI | " | " | 0.8* | 40° | 2 | [illegible] | 1.1 | [illegible] | 11.0 | [illegible] | [illegible] |
| 37 | " | " | " | " | 1.4** | 50° | 4 | 45.8 | [illegible] | 77.1 | 11.3 | [illegible] | " |
| 38 | " | SX | " | " | 1.8** | " | " | 62.5 | 6.1 | [illegible] | 11.0 | [illegible] | " |
| 39 | " | " | " | " | 1.5** | " | " | 72.6 | 6.7 | [illegible] | [illegible] | [illegible] | " |

TABLE I

RECAP - KORKOB LEACH TESTS

| TEST NUMBER | SAMPLE DESCRIPTION | TEST PERFORMED BY | HEAD ASSAY % Cu | SAMPLE MESH | LEACH pH | LEACH TEMP. °C. | LEACH TIME, HOURS | ACID CONSUMED #/TON ORE | ACID CONSUMED #/# Cu | EXTRACTION % | EXTRACTION #/TON OF ORE | ACCOUNTABILITY | LEACH METHOD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 40 | SOUTH PIT COMPO. | SX | 0.61 | -20 | 2.5* | 25° | 6 | 53.3 | 18.6 | 25.6 | 3.1 | 101.6 | AGITATION, 2 EACH |
| 41 | " | " | " | " | 1.5* | " | " | 64.9 | 8.4 | 63.4 | 7.7 | 102.0 | " |
| 42 | " | " | " | " | 1.6** | " | " | 66.4 | 8.6 | 63.6 | 7.7 | 99.6 | " |
| 43 | " | " | " | " | 0.8** | " | " | 83.5 | 9.3 | 74.4 | 9.1 | 99.2 | " |
| 44 | " | " | " | " | 0.5**++ | " | " | 95.4 | 16.1 | 76.9 | 9.4 | 99.4 | " |
| 45 | " | " | " | " | 2.2 | " | 24 | 73.9 | 9.2 | 65.7 | 8.0 | 104.0 | " |
| 46 | " | " | " | -325 | 2.2 | " | 6 | 75.2 | 10.7 | 52.2 | 7.0 | 101.4 | " |
| 47 | " | MRI | 1 | -20 | 1.0** | 40° | 4 | 120.0 | 14.2 | 79.3 | 9.7 | 102.0 | " |
| 48 | " | " | 1 | " | 0.9** | 50° | " | 122.0 | 11.6 | 90.7 | 10.1 | 104.9 | " |
| 49 | " | SX | " | " | 1.3**+ | " | " | 122.9 | 11.8 | 85.0 | 10.4 | 95.4 | " |
| 50 | " | " | " | " | 0.9**++ | " | " | 153.3 | 13.7 | 90.0 | 11.0 | 94.5 | " |

NOTES -

* ACID WAS ADDED OVER LENGTH OF TEST TO MAINTAIN INDICATED pH.

** ENTIRE AMOUNT OF ACID WAS ADDED DURING FIRST 20 MINUTES OF TEST RESULTING IN FINAL pH AS INDICATED.

\+ DOUBLE THE AMOUNT OF ACID TO MAINTAIN pH OF 1.5 WAS ADDED, IN FIRST TEN MINUTES

++ TRIPLE, AS ABOVE.

PULP DENSITY IN AGITATION LEACHES WAS 33% SOLIDS.

LEFT-OVER ACID IN PREGNANT SOLUTION WAS TITRATED AND SUBTRACTED TO ARRIVE AT ACID CONSUMPTION FIGURES.

PROJECT NO. EI - 114.4

AGITATION LEACH TEST

FOR

ESSEX INTERNATIONAL, INC.

KORN KOB ORE

July 22, 1977

METCON Research, Inc.
1796 West Grant Road
Post Office Box 50225
Tucson, Arizona 85703

Project No. EI - 114.4

Agitation Leach Test

Composite KKC - 4 - North Pit

June 22, 1971

Test No. RF-1

| | | |
|---|---|---|
| Ore Charge | - | 100.0 grams |
| Tap Water | - | 200.0 ml |
| $H_2SO_4$ | - | 4.95 ml |
| Temperature | - | 50°C |

Results

| Assay No. | Product | Volume | Cu Assay (gpl) | Cu Content |
|---|---|---|---|---|
| 7078 | Strong Preg. Solution | 99.0 ml | 2.83 | 0.2801 |
| 7079 | Wash Solution | 445.0 ml | 0.69 | 0.3070 |
| 7081 | Tailing | 96.4 gms | 0.18% | 0.1735 |
| | Calculated Head | | | 0.7606 |

Recovery $\frac{H - T}{H} \times 100$ $\frac{.7606 - .1735}{.7606} \times 100 = 77.18\%$

Recovery by Assay Head $\frac{.7300 - .1735}{.7300} \times 100 = 76.23\%$

Accountability $\frac{.7606}{.7300} \times 100 = 104.2\%$

Project No. EI - 114.4 June 22, 1971

Agitation Leach Test Test No. RF-1

Composite KKC - 4 - North Pit

Volume of Strong Preg Solution = 99.0 ml

Volume of Weak Solution = 445.0 ml

| Time | pH | Temperature ( °C) |
|---|---|---|
| 11:10 | 0.70 | 57 at $H_2SO_4$ addition |
| 11:20 | 0.70 | 55 |
| 11:30 | 0.80 | 54 |
| 11:40 | 0.95 | 50.50 |
| 11:50 | 1.00 | 50.50 |
| 12:25 | 1.15 | 49.50 |
| 12:55 | 1.25 | 50.00 |
| 1:25 | 1.30 | 50.00 |
| 1:50 | 1.35 | 49.50 |
| 2:25 | 1.40 | 49.75 |
| 2:55 | 1.45 | 49.75 |
| 3:25 | 1.50 | 49.75 |
| 3:55 | 1.50 | 49.50 |
| 4:25 | 1.55 | 49.50 |
| 5:10 | 1.60 | 49.50 |

Project No. EI - 114.4 June 23, 1971

Agitation Leach Test Test No. RF-2

Composite KKC - 4 - South Pit

| | | |
|---|---|---|
| Ore Charge | - | 100.00 grams |
| Tap Water | - | 200.00 ml |
| $H_2SO_4$ | - | 8.85 ml |
| Temperature | - | 40°C |

Results

| Assay No. | Product | Volume | Cu Assay | Cu Content |
|---|---|---|---|---|
| 7082 | Strong Preg. Solution | 100.00 ml | 2.58 gpl | 0.2580 |
| 7083 | Wash Solution | 390.00 ml | 0.83 gpl | 0.3237 |
| 7092 | Tailing | 96.5 gms | 0.06 gpl | 0.0579 |
| | Calculated Head | | | 0.6396 |

Recovery by Calculated Head $\frac{.6396 - .0579}{.6396} \times 100 = 90.94\%$

Recovery by Assay Head $\frac{.6100 - .0579}{.6100} \times 100 = 90.50\%$

Accountability $\frac{.6396}{.6100} \times 100 = 104.9\%$

Project No. EI - 114.4

June 23, 1971

Agitation Leach Test

Test No. RF-2

Composite KKC - 5 - South Pit

| Time | pH | Temperature (°C) | |
|---|---|---|---|
| 9:30 | 0.60 | 59.00 | Addition of $H_2SO_4$ |
| 9:40 | 0.80 | 56.00 | |
| 9:50 | 1.15 | 53.00 | |
| 9:58 | 1.30 | 52.00 | |
| 10:10 | 1.40 | 51.00 | |
| 10:20 | 1.55 | 51.75 | |
| 10:30 | 1.60 | 51.50 | |
| 10:45 | 1.70 | 49.25 | |
| 11:00 | 1.75 | 49.00 | |
| 11:15 | 1.80 | 49.75 | |
| 11:30 | 1.85 | 50.00 | |
| 12:00 | 1.90 | 50.50 | |
| 12:30 | 2.00 | 50.00 | |
| 1:00 | 2.05 | 50.00 | |
| 1:30 | 2.10 | 49.00 | |
| 2:00 | 2.10 | 49.50 | |
| 2:30 | 2.15 | 50.00 | |
| 3:00 | 2.18 | 49.00 | |
| 3:37 | 2.20 | 49.00 | |

Project No. EI - 114.4 June 24, 1971

Agitation Leach Test Test No. RF-3

Composite KKC - 4 - North Pit

| | | |
|---|---|---|
| Ore Charge | - | 100.00 grams |
| Tap Water | - | 200.00 ml |
| $H_2SO_4$ | - | 4.95 ml |
| Temperature | - | 40°C |

Results

| Assay No. | Product | Volume | Cu Assay | Cu Content |
|---|---|---|---|---|
| 7085 | Strong Preg Solution | 100.00 ml | 2.44 gpl | 0.2440 |
| 7086 | Wash Solution | 400.00 ml | 0.78 gpl | 0.3120 |
| 7093 | Tailing | 96.10 gms | 0.19% | 0.1825 |
| | Calculated Head | | | 0.7385 |

Recovery by Calculated Head $\frac{.7385 - .1825}{.7385} \times 100 = 75.29\%$

Recovery by Assay Head $\frac{.7300 - .1825}{.7300} \times 100 = 75.00\%$

Accountability $\frac{.7385}{.7300} \times 100 = 101.2\%$

Project No. EI - 114.4 June 24, 1971

Agitation Leach Test Test No. KF-3

Composite KKC - 4 - North Pit

| Time | pH | Temperature (°C) | |
|---|---|---|---|
| 9:55 | 0.70 | 45.00 | Addition of $H_2SO_4$ |
| 10:05 | 0.75 | 41.50 | |
| 10:15 | 0.80 | 41.00 | |
| 10:25 | 0.90 | 40.00 | |
| 10:35 | 1.00 | 39.25 | |
| 10:45 | 1.05 | 40.00 | |
| 10:55 | 1.05 | 40.00 | |
| 11:05 | 1.10 | 40.00 | |
| 11:15 | 1.15 | 40.0 | |
| 11:30 | 1.20 | 40.50 | |
| 11:45 | 1.20 | 40.25 | |
| 12:00 | 1.25 | 38.25 | |
| 12:15 | 1.25 | 41.00 | |
| 12:30 | 1.30 | 39.00 | |
| 12:45 | 1.30 | 40.00 | |
| 1:00 | 1.30 | 40.00 | |
| 1:15 | 1.40 | 39.50 | (caused by spillage on hotplate) |
| 1:30 | 1.40 | 40.00 | |
| 1:45 | 1.40 | 40.50 | |
| 2:00 | 1.40 | 40.50 | |

Project No. EI - 114.4

June 24, 1971

Agitation Leach Test

Test No. RF-3 Cont'd.

Composite KKC - 4 - North Pit

| Time | pH | Temperature ($^{o}C$) |
|---|---|---|
| 2:30 | 1.40 | 39.00 |
| 3:00 | 1.45 | 39.00 |
| 3:15 | 1.45 | 41.00 |
| 3:45 | 1.50 | 40.00 |
| 3:55 | 1.50 | 39.50 |

Project No. EI - 114.4 June 25, 1971

Agitation Leach Test Test No. RF-4

Composite KKC - 5 - South Pit

| | | |
|---|---|---|
| Ore Charge | - | 100.00 grams |
| Tap Water | - | 200.00 ml |
| $H_2SO_4$ | - | 8.85 ml |
| Temperature | - | 40°C |

Results

| Assay No. | Product | Volume | Cu Assay | Cu Content |
|---|---|---|---|---|
| 7088 | Strong Preg. Solution | 100.00 ml | 2.38 gpl | 0.2380 |
| 7089 | Wash Solution | 455.00 ml | 0.56 gpl | 0.2548 |
| 7094 | Tailing | 96.85 gms | 0.13% | 0.1259 |
| | Calculated Head | | | 0.6187 |

Recovery by Calculated Head $\frac{.6187 - .1259}{.6187} \times 100 = 79.65\%$

Recovery by Assay Head $\frac{.6100 - .1259}{.6100} \times 100 = 79.36\%$

Accountability $\frac{.6187}{.6100} \times 100 = 101.4\%$

Project No. EI - 114.4 June 25, 1971

Agitation Leach Test Test No. RF-4

Composite KKC - 5 - South Pit

| Time | pH | Temperature (°C) | |
|---|---|---|---|
| 9:15 | 0.60 | 47.00 | Addition of $H_2SO_4$ |
| 9:25 | 0.70 | 43.00 | |
| 9:35 | 0.90 | 39.25 | |
| 9:45 | 1.00 | 39.75 | |
| 9:55 | 1.05 | 40.00 | |
| 10:05 | 1.15 | 39.25 | |
| 10:15 | 1.20 | 40.00 | |
| 10:30 | 1.30 | 38.00 | |
| 10:45 | 1.35 | 40.25 | |
| 11:00 | 1.40 | 37.75 | |
| 11:15 | 1.50 | 40.00 | |
| 11:30 | 1.55 | 40.00 | |
| 11:45 | 1.60 | 36.00 | |
| 12:00 | 1.60 | 34.00 | |
| 12:15 | 1.65 | 46.00 | |
| 12:30 | 1.70 | 40.00 | |
| 12:45 | 1.70 | 36.00 | |
| 1:00 | 1.75 | 39.00 | |
| 1:20 | 1.80 | 41.00 | |
| 1:30 | 1.80 | 39.00 | |
| 1:45 | 1.80 | 39.50 | |
| 2:00 | 1.85 | 41.00 | |

Project No. EI - 114.4

Agitation Leach Test

Composite KKC - 5 - South Pit

June 25, 1971

Test No. RF-4 Cont'd.

| Time | pH | Temperature (°C) |
|---|---|---|
| 2:15 | 1.90 | 39.00 |
| 2:30 | 1.90 | 40.00 |
| 2:45 | 1.95 | 40.00 |
| 3:15 | 2.00 | 39.25 |

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

~~EO-114-3~~
EI-114.4

SAMPLE SUBMITTED BY Metcon Research Incorporated

DATE June 30, 1971

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ. / TON | PER CENT COPPER | G/L Cu | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | G/L Free Acid |
|---|---|---|---|---|---|---|---|---|
| ~~Solutions~~ | | | | | | | | |
| 7078 | | | | 2.83 | | | | 26.81 |
| 7079 | | | | 0.69 | | | | |
| 7082 | | | | 2.58 | | | | 46.3 |
| 7083 | | | | 0.83 | | | | |
| | | | | | | | | |
| ~~Pulps~~ | | | | | | | | |
| 7081 | | | 0.18 | | | | | |

Invoice # 6463

CHARGES $ 11.75

REGISTERED ASSAYER
ARIZONA U. S. A.
7/30/71

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

00-000

SAMPLE SUBMITTED BY Metcon Research Incorporated

DATE June 30, 1971

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ. / TON | PER CENT COPPER | G/L Cu | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | G/L Free Acid |
|---|---|---|---|---|---|---|---|---|
| ~~Solutions~~ 7078 | | | | 2.83 | | | | 26.81 |
| 7079 | | | | 0.69 | | | | |
| 7082 | | | | 2.58 | | | | 46.3 |
| 7083 Called in Barry 7/9/71 | | | | 0.83 | | | | |
| ~~Pulps~~ 7081 | | | 0.18 | | | | | |

Invoice # 6463

CHARGES $ 11.75

REGISTERED ASSAYER Pete S. Flores 7/30/71 Arizona U. S. A.

ASSAYER - CHEMIST

3220 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

EI-114.4

SAMPLE SUBMITTED BY Metcon Research Laboratories

DATE June 30, 1971

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ. / TON | PER CENT COPPER | G/L Cu | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | Free Acid |
|---|---|---|---|---|---|---|---|---|
| Solutions 7085 | | | | 2.44 | | | | 23.70 |
| 7086 | | | | 0.78 | | | | |
| 7088 | | | | 2.38 | | | | 45.51 |
| 7089 | | | | 0.56 | | | | |
| | | | | | | | | |
| Pulps 114.4 7092 Called for Recovery 7/8/71 | | | 0.11 | | | | | |
| 7093 | | | 0.19 | | | | | |
| 7094 | | | 0.13 | | | | | |

REGISTERED ASSAYER
Certificate No. 6852
Arizona U. S. A.
6/30/71

Invoice # 6461

CHARGES $ 13.50

ASSAYER-CHEMIST

3226 East 40th Street

to be bill 2 ch 7/13/71

EI-114.4

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

SAMPLE SUBMITTED BY Metcon Research Laboratories

DATE June 30, 1971

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | G/L Cu | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | Free Acid |
|---|---|---|---|---|---|---|---|---|
| Solutions 7085 | | | | 2.44 | | | | 23.70 |
| 7086 | | | | 0.78 | | | | |
| 7088 | | | | 2.38 | | | | 45.51 |
| 7089 | | | | 0.56 | | | | |
| | | | | | | | | |
| Pulps 114.4 7092 | | | 0.11 | | | | | |
| 7093 | | | 0.19 | | | | | |
| 7094 | | | 0.13 | | | | | |

Invoice # 6461

CHARGES $ 13.50

REGISTERED ASSAYER Peter Gerhardt 6/30/71 U.S.A.

ASSAYER-CHEMIST

Copies to:
H. Lanier
C. Osborn

TO: Paul Eimon

MET REPORT 72-5: Acid Consumption Tests on Korn Kob Drill Intercepts and Bench Composites

BY: C.K. Chase

DATE: April 23, 1972

The acid consumption tests were performed by American Analytical & Research Laboratories in accordance with the appended copy of their procedure which is used at other assay offices in the same or somewhat modified form.

This method uses pulverized samples and an excess of acid which is then back-titrated with caustic to determine acid consumption. Since the strength of the acid attack on the rock itself is in inverse proportion to the amount of acid consumers present, many rock constituents tend to go into solution; this is a further disadvantage of the method. Since the previous Korn Kob acid consumption tests had been run by this method, it was continued in the latest bench composite tests for the sake of consistent data.

Better acid consumption tests exist that follow plant practice in regard to grind and acid concentration and should be used when possible.

The attached log sheets show the amount of sulfuric acid consumed per pound of copper dissolved (on an average leach extraction of 80% as demonstrated in test work) on all available drill intercepts and bench composites for the two proposed Korn Kob pits. These data are significant only when computed into a mining plan for the ore bodies. It is evident that much of the Korn Kob is very calcareous and cannot be processed at a profit unless low cost acid is available. However, the Korn Kob could be an efficient acid sink for the predicted surplus of sulfuric acid in Arizona.

The acid consumption figures reported here are for the average 80% copper extraction possible with heated solutions.

C.K. Chase

Attachments:
- Assay Reports
- Acid Consumption Method
- Nevada Mining Assoc'n. Newsletter
- Section on Magma Copper Company

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 85713

COMPOSITES

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3M70P3-03

| SAMPLE MARKED | GOLD OZ/TON | SILVER OZ/TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | * A con: |
|---|---|---|---|---|---|---|---|---|
| Hole # 4 A 110-130 | | 24.57 | 0.44 | | | | | 173 |
| 130-150 | | 21.52 | 0.29 | | | | | 99 |
| 150-170 | | 16.25 | 0.65 | | | | | 169 |
| 170-200 | | 23.58 | 0.22 | | | | | 83 |
| 200-220 | | 11.11 | 0.36 | | | | | 64 |
| 220-240 | | 11.64 | 0.29 | | | | | 54 |
| 240-260 | | 12.14 | 0.35 | | | | | 68 |
| 260-280 | | 24.06 | 0.20 | | | | | 77 |
| 280-300 | | 9.84 | 0.79 | | | | | 124 |
| Hole # 5 195-215 | | 19.61 | 0.51 | | | | | 160 |
| 215-235 | | 59.48 | 0.31 | | | | | 295 |
| 235-255 | | 15.14 | 0.90 | | | | | 218 |
| 255-275 | | 7.31 | 0.88 | | | | | 103 |
| 275-295 | | 10.50 | 0.50 | | | | | 84 |
| 295-315 | | 15.30 | 0.29 | | | | | 71 |
| Hole # 7 165-185 | | 8.14 | 0.43 | | | | | 56 |
| 185-205 | | 11.05 | 0.56 | | | | | 99 |
| 285-305 | | 51.91 | 0.35 | | | | | 299 |
| 305-325 | | 12.30 | 0.34 | | | | | 105 |
| 325-345 | | 22.17 | 0.32 | | | | | 154 |
| 345-365 | | 10.24 | 0.47 | | | | | 77 |
| 365-385 | | 9.70 | 0.58 | | | | | 90 |
| 385-405 | | 8.89 | 0.45 | | | | | 64 |
| 405-425 | | 7.78 | 0.45 | | | | | 90 |
| Hole # 8 10-30 | | 6.82 | 0.33 | | | | | 36 |

Invoice # 5940

* Acid Consumption

CHARGES $ 102.00

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

COMPOSITES

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3170P3-03 80%

| SAMPLE MARKED | GOLD OZ/TON | ~~SILVER~~ OZ/TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | * A cons |
|---|---|---|---|---|---|---|---|---|
| Hole # 8 30-50 | | 5.69 | 0.45 | | | | | 41 |
| 50-70 | | 8.06 | 0.38 | | | | | 49 |
| 70-90 | | 5.93 | 0.59 | | | | | 56 |
| 90-110 | | 4.93 | 0.5[illegible] | | | | | 41 |
| Hole # 11 40-60 | | 57.53 | 0.39 | | | | | 359 |
| 60-80 | | 119.41 | 0.19 | | | | | 363 |
| 80-100 | | 26.09 | 0.46 | | | | | 192 |
| 100-120 | | 7.03 | 0.36 | | | | | 52 |
| Hole # 14 0-10 | | 6.15 | 0.61 | | | | | 60 |
| 10-30 | | 5.36 | 0.98 | | | | | 84 |
| 30-50 | | 17.11 | 0.42 | | | | | 115 |
| 50-70 | | 38.18 | 0.37 | | | | | 226 |
| 70-90 | | 15.52 | 0.31 | | | | | 77 |
| 90-110 | | 49.85 | 0.42 | | | | | 335 |
| 110-130 | | 17.25 | 0.75 | | | | | 207 |
| 130-150 | | 8.21 | 0.86 | | | | | 113 |
| 150-170 | | 8.47 | 0.62 | | | | | 84 |
| 170-190 | | 48.01 | 0.44 | | | | | 338 |
| 190-210 | | 37.20 | 0.62 | | | | | 309 |
| 210-230 | | 11.27 | 0.56 | | | | | 101 |
| Hole # 15 325-34[illegible] | | 54.32 | 0.42 | | | | | 365 |
| 345-365 | | 13.99 | 0.46 | | | | | 103 |
| 365-385 | | | | | | | | 276 |
| Hole # 16 190-210 | | 18.57 | 0.34 | | | | | 101 |
| Hole # 17 A 190-210 | | 5.43 | 0.70 | | | | | 66 |

Invoice # 5940

*Acid Consumption

CHARGES $ 100.00

ASSAYER-CHEMIST

3226 East 40th Street

Phone 624-00

COMPOSITES AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA

Korn Kob Project = Au = Cu

Project SAMPLE SUBMITTED BY Asco International, Inc.

DATE Feb. 10, 197

(NOTE: RETURN 20%)

| SAMPLE MARKED | GOLD OZ/TON | SILVER OZ/T | PER CENT COPPER | PER CENT LEAD | PER CENT ZINC | PER CENT MOLYBDENUM | PER CENT IRON | % CONS |
|---|---|---|---|---|---|---|---|---|
| Hole # 1 | | | | | | | | |
| 0-15 | 23.50 | 19.68 | 0.74 | | | | | 233 |
| 15-35 | 10.15 | 6.88 | 0.60 | | | | | 162 |
| 35-55 | 4.90 | 4.10 | 1.31 | | | | | 86 |
| 55-75 | 5.57 | 4.66 | 0.83 | | | | | 62 |
| 75-95 | 3.28 | 2.75 | 1.50 | | | | | 56 |
| 95-115 | 7.35 | 6.16 | 0.69 | | | | | 68 |
| 115-135 | 6.59 | 5.52 | 1.11 | | | | | 93 |
| 135-155 | 11.37 | 9.54 | 0.38 | | | | | 53 |
| Hole # 3 | | | | | | | | |
| 20-40 | 6.22 | 4.37 | 0.80 | | | | | 56 |
| 40-60 | 20.07 | 16.83 | 0.39 | | | | | 105 |
| 60-80 | 50.23 | 42.07 | 0.26 | | | | | 175 |
| 80-100 | 15.65 | 13.11 | 0.41 | | | | | 86 |
| 100-120 | 33.33 | 27.91 | 0.45 | | | | | 201 |
| 120-140 | 10.48 | 8.78 | 0.52 | | | | | 73 |
| 140-160 | 21.54 | 18.04 | 0.35 | | | | | 101 |
| 160-180 | 8.17 | 6.84 | 0.53 | | | | | 58 |
| 180-200 | 7.05 | 5.90 | 0.72 | | | | | 66 |
| 200-220 | 34.64 | 29.01 | 0.53 | | | | | 240 |
| Hole # 4 | | | | | | | | |
| 0-10 | 6.27 | 5.25 | 0.69 | | | | | 58 |
| 10-30 | 6.48 | 5.43 | 0.76 | | | | | 66 |
| 30-50 | 8.17 | 6.84 | 0.53 | | | | | 58 |
| Hole # 4 A | | | | | | | | |
| 30-50 | 6.93 | 5.80 | 0.42 | | | | | 39 |
| 50-70 | 7.17 | 6.00 | 0.51 | | | | | 49 |
| 70-90 | 13.65 | 11.43 | 0.32 | | | | | 64 |
| 90-110 | 46.77 | 39.17 | 0.15 | | | | | 24 |

Invoice # 5940 * Acid Consumption

CHARGES $ 100.00

2/10/77

ASSAYER CHEMIST

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 8[illegible]

COMPOSITES

Korn Kob Project

#Ag / #Cu dissolved

SAMPLE SUBMITTED BY [illegible] International, Inc.

DATE Feb. 10, 1971

Project # [illegible]-1327OP3-[illegible] 80%

| SAMPLE MARKED | GOLD OZ/TON | SILVER OZ/TON | PERCENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | * % CONC |
|---|---|---|---|---|---|---|---|---|
| Hole # 20 180-200 | | 22.22 | 0.31 | | | | | 135 |
| Hole # 21 260-280 | | 10.47 | 0.37 | | | | | 62 |
| 280-300 | | 18.92 | 0.36 | | | | | 109 |
| 300-320 | | 21.40 | 0.33 | | | | | 113 |
| 340-360 | | 4.90 | 0.62 | | | | | 51 |
| 400-420 | | 17.28 | 0.34 | | | | | 94 |
| Hole # 23 460-480 | | 22.96 | 0.49 | | | | | 180 |
| 480-500 | | 16.20 | 0.76 | | | | | 197 |

Invoice # 5940

CHARGES $ [illegible].00

2/10/71

ASSAYER-CHEMIST

3236 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON ARIZONA 85713

COMPOSITES

Form Fob Project

SAMPLE SUBMITTED BY Pacific Copper International, Inc.

DATE Feb. 10, 1971

Project # A023-297013-33

| SAMPLE MARKED | GOLD OZ/TON | SILVER OZ/TON | PERCENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | % A CONC. |
|---|---|---|---|---|---|---|---|---|
| Hole # 17A 210-230 | | 8.97 | 0.46 | | | | | 66 |
| 250-270 | | 14.94 | 0.41 | | | | | 98 |
| 270-290 | | 5.80 | 0.33 | | | | | 77 |
| 290-310 | | 35.28 | 0.45 | | | | | 254 |
| 310-330 | | 33.13 | 0.50 | | | | | 265 |
| 330-350 | | 21.17 | 0.31 | | | | | 105 |
| Hole # 18 60-80 | | 11.49 | 0.37 | | | | | 68 |
| 80-100 | | 27.38 | 0.21 | | | | | 92 |
| 100-120 | | 3.99 | 1.08 | | | | | 69 |
| 120-140 | | 11.54 | 0.52 | | | | | 96 |
| 140-160 | | 8.88 | 0.57 | | | | | 81 |
| 160-180 | | 16.74 | 0.56 | | | | | 150 |
| 180-200 | | 20.96 | 0.51 | | | | | 171 |
| 220-240 | | 25.14 | 0.44 | | | | | 177 |
| 240-260 | | 24.46 | 0.35 | | | | | 137 |
| 260-280 | | 8.88 | 0.38 | | | | | 54 |
| 300-320 | | 7.85 | 0.43 | | | | | 54 |
| 320-340 | | 6.80 | 0.34 | | | | | 37 |
| Hole # 20 40-60 | | 5.73 | 0.60 | | | | | 55 |
| 60-80 | | 4.89 | 0.55 | | | | | 43 |
| 80-100 | | 4.89 | 0.55 | | | | | 43 |
| 100-120 | | 4.27 | 0.63 | | | | | 43 |
| 120-140 | | 43.87 | 0.52 | | | | | 265 |
| 140-160 | | 29.48 | 0.53 | | | | | 250 |
| 160-180 | | 27.04 | 0.51 | | | | | 237 |

Invoice # 5240

* Acid Consumption

CHARGES $ 10.00

ASSAYER-CHEMIST

3226 East 49th Street

AMERICAN [illegible] and RESE[illegible]

# acid/# Cu

| | 67% #A/#Cu | 80% | |
|---|---|---|---|
| | [illegible] | 7.75 | .46 |
| | [illegible] | 5.45 | .78 |
| | [illegible] | 11.48 | .80 |
| | 7.38 | 7.86 | 1.01 |
| | [illegible] | 7.60 | 1.20 |
| | 24.85 | 20.81 | .82 |
| | 27.67 | 23.12 | .80 |
| | 13.84 | 11.57 | .07 |
| | 21.53 | 20.38 | .50 |
| | [illegible] | 7.61 | .55 |
| | [illegible] | 6.34 | .70 |
| | [illegible] | 5.14 | .79 |
| | [illegible] | 7.00 | .93 |
| | [illegible] | 10.33 | .69 |
| | [illegible] | 16.54 | .48 |
| | [illegible] | 16.85 | .56 |
| | [illegible] | 13.21 | .53 |
| | 25.21 | 23.63 | .41 |
| | [illegible] | 8.46 | .65 |
| | [illegible] | 15.46 | .38 |
| | [illegible] | 19.21 | .27 |

AMERICAN ANALYTICAL and RESEARCH LABORATORIES

3226 East 46th Street
Tucson, Arizona 85713

Phone 624-0049

ASSAYERS - CHEMISTS
METALLURGICAL RESEARCH

ORE TESTING
FLOTATION LEACHING
ELECTROLYSIS

## ACID CONSUMERS ASSAY

1. Weigh 7.50 grams of sample into a 250 milliliter Erlenmeyer (beaker) flask.

2. Add 50 milliliters $H_2O$ and pipette 25 milliliters of standard 0.5 N $H_2SO_4$ into the flask.

3. Swirl occasionally. After 1.0 hour of acid contact, transfer to a 250 milliliter beaker. Keep tht total volume to approximately 100 milliliters.

4. Add 15 grams $K_2C_2O_4 \cdot H_2O$ and stir on a magnetic stirrer to dissolve the oxalate.

5. Titrate with standard 0.2N NaOH to pH 7.25.

Calculations

a. ml standard acid x N = meg $H_2SO_4$

b. ml standard base x N = meg NaOH

c. meg $H_2SO_4$ - meg NaOH = $H_2SO_4$ consumed

d. meg acid consumed x 49 mg/meg = milligrams $H_2SO_4$ consumed

e. $\frac{\text{milligrams } H_2SO_4}{\text{grams of sample}} \times 2 = \frac{\text{pounds } H_2SO_4}{\text{per ton of ore}}$

When the consumption is in excess of 100 pounds per ton, we suggest that the sample be rerun using the same standard solution volume, but 4.0 rather than 7.5 grams of sample.

KORN

1-6-92
G.J.

COMPOSITE SAMPLES FOR ASSAY INVESTIGATION

HOLE No. 6 — 6051 – 6116

| Sample # | Bench | Sample No. |
|---|---|---|
| 6258 | 3940 | 6057, 6058, 6059, 6060, 6061 — |
| 6259 | 3920 | 6060, 6062, 6063, 6064, 6065 — |
| 6260 | 3900 | 6065, 6066, 6067, 6068, 6069 |
| 6261 | 3880 | 6071, 6072, 6073, 6074, 6075, 6076, 6077 — |
| 6262 | 3860 | 6078, 6079, 6080, 6081, 6082 — |
| 6263 | 3840 | 6083, 6084, 6085, 6086, 6087, 6088 — |
| 6264 | 3820 | 6089, 6090, 6091, 6092 — |
| 6265 | 3800 | 6092, 6093, 6094, 6095, 6096, 6097 — |

NOTE: MISSING SAMPLE (6068)

6054
6097

HOLE No. 5 — 6223-6257

| Sample # | Bench | Sample No. |
|---|---|---|
| 6266 | 3460 | 6224 |
| 6267 | 3390 | 6238, 6239, 6240 |
| 6268 | 3360 | 6243, 6245, 6244 |

6223
6241

HOLE No. 3 — 6196-6222

| Sample # | Bench | Sample No. |
|---|---|---|
| 6269 | 3740 | 6213, 6214, 6215, 6216, 6217 |

6213
6217

4-6-77
DJ

Kor[illegible] B

Composite [illegible] for Acid Consumption

Hole No. [illegible]P-17 6117-6195

| Sample # | Bracket | Sample Nos |
|---|---|---|
| 6270 | 3820 | 6117, [illegible] |
| 6271 | 3800 | 611[illegible], [illegible], 6121, 6122 |
| 6272 | 3740 | 61[illegible], [illegible], 6133, 6134, 6135, 6136 |
| 6273 | 3720 | 6137, [illegible], 6139, 6140 |
| 6274 | 3700 | 614[illegible], [illegible]2, 6143, 61[illegible], 6145 |
| 6275 | 3540 | 6176, [illegible] 6178, 6179 |
| 6276 | 3520 | 6177, [illegible]80, 6181, 6[illegible], 6182 |
| 6277 | 3500 | 6184, [illegible] 6186, 6187, 6188 |
| 6278 | 3480 | 6187, [illegible] 6191, 6192, 6193 |

# HAWLEY & HAWLEY

ASSAYERS AND CHEMISTS, INC.

1700 WEST GRANT ROAD - TELEPHONE 622-4836 - POST OFFICE BOX 5934

TUCSON, ARIZONA 85703

Registered Assayers

THE SOUTHWEST'S LEADING ASSAYERS AND REPRESENTATIVES

Branch Representatives at Buyer's Plants:
Phelps Dodge Corp., Douglas, Arizona; ASARCO, El Paso, Amarillo, Texas and Hayden, Arizona


| IDENTIFICATION | Gold ozs. | Silver ozs. | Lead % | Copper % | Zinc % | Mo. % | $CaCO_3$ % | Fe % | |
|---|---|---|---|---|---|---|---|---|---|
| 2051 | | | | 0.65 | | | 3.57 | 7.99 | |
| 2052 | | | | 0.10 | | | 14.93 | 5.82 | |
| 2053 | | | | 1.09 | | | 3.48 | 18.03 | |
| 2054 | | | | 0.89 | | | 9.01 | 21.23 | |
| 2057 | | | | 0.58 | | | 27.50 | 9.13 | |
| 2058 | | | | 0.62 | | | 28.32 | 23.74 | |
| 2059 | | | | 1.06 | | | 21.63 | 14.61 | |
| 2060 | | | | 0.47 | | | 13.58 | 8.10 | |
| 2061 | | | | 0.15 | | | 4.58 | 9.82 | |
| 2062 | | | | 1.68 | | | 9.90 | 11.19 | |
| 2063 | | | | 0.49 | | | 6.88 | 9.58 | |
| 2064 | | | | 0.33 | | | 13.58 | 7.76 | |
| 2055 | | | | 0.54 | | | 10.03 | 10.27 | |

Korn Kob
SURFACE SAMPLES
on the 3590 ft bench
(KK 8)

K.K.

13 Cu, single @ $1.75 $ 22.
13 Fe, verified @ $4.75 61.
13 $CaCO_3$, verified @ $8.25 107.
191.
Plus 5% air pollution surcharge 9,
201.

CC: Essex International, Inc.
ADD: 2030 Speedway, Tucson, Arizona
CITY: cc: Essex International, Three Rivers
ADD: Attn: Howard Lanier
CITY: cc: Heinrichs Geoexploration

REMARKS:

Analysis Cert. By

REGISTERED ASSAYER CERTIFICATE No. 6731 H. C. RICHARD ARIZONA

Preparation $ 13.
Analysis $ 201.
$ 214.

ACC: ESSEX INTERNATIONAL INC | Date Spl. 5/12/70 | Date 5/19/70 | THP 244276

Ti

SKYLINE LABS, INC.
SPECIALISTS IN GEOCHEMICAL EXPLORATION
12090 WEST 50TH PLACE, WHEAT RIDGE, COLORADO 80033 TEL.: (303) 424-7718

# REPORT OF ANALYSIS

Job No. 12093
May 20, 1970

The Golden Cycle Corporation
P.O. Box 4576
Colorado Springs, Colorado 80909

1 Pulp Sample

A. W. Tipton (Gen Exp)

| Item | Sample No. | Fe (%) | Mg (%) |
|---|---|---|---|
| 1. | 787 DX-2896 | 13.6 | 1.2 |

Charles E. Thompson
Chief Chemist

70 [illegible] COMPOSITES - [illegible]

32[illegible] t 46th Street Phone 624-0049

# COMPOSITES AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3970P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | *A Cons. |
|---|---|---|---|---|---|---|---|---|
| Hole # 1 | | | | | | | | |
| 0-15 | | | 0.74 | | | | | 233 |
| 15-35 | | | 0.60 | | | | | 162 |
| 35-55 | | | 1.31 | | | | | 86 |
| 55-75 | | | 0.83 | | | | | 62 |
| 75-95 | | | 1.50 | | | | | 66 |
| 95-115 | | | 0.69 | | | | | 68 |
| 115-135 | | | 1.11 | | | | | 98 |
| 135-155 | | | 0.38 | | | | | 58 |
| Hole # 3 | | | | | | | | |
| 20-40 | | | 0.80 | | | | | 56 |
| 40-60 | | | 0.39 | | | | | 105 |
| 60-80 | | | 0.26 | | | | | 175 |
| 80-100 | | | 0.41 | | | | | 86 |
| 100-120 | | | 0.45 | | | | | 201 |
| 120-140 | | | 0.52 | | | | | 73 |
| 140-160 | | | 0.35 | | | | | 101 |
| 160-180 | | | 0.53 | | | | | 58 |
| 180-200 | | | 0.72 | | | | | 68 |
| 200-220 | | | 0.53 | | | | | 246 |
| Hole # 4 | | | | | | | | |
| 0-10 | | | 0.69 | | | | | 58 |
| 10-30 | | | 0.76 | | | | | 66 |
| 30-50 | | | 0.53 | | | | | 58 |
| Hole # 4 A | | | | | | | | |
| 30-50 | | | 0.42 | | | | | 39 |
| 50-70 | | | 0.51 | | | | | 49 |
| 70-90 | | | 0.35 | | | | | 64 |
| 90-110 | | | 0.15 | | | | | 94 |

Invoice # 5940

* Acid Consumption

CHARGES $ 100.00

REGISTERED ASSAYER 2/10/71 U.S.A.

ASSAYER · CHEMIST

32_ t 46th Street

Phone 624-004

COMPOSITES

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

Korn Kob Project

Hole 4-A

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 12, 1971

Proj. # A023-P3970 P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | Lb/T A. Co |
|---|---|---|---|---|---|---|---|---|
| Hole 4-A 170--190 | | | 0.23 | | | | | 77 |
| 190--210 | | | 0.28 | | | | | 96 |
| 210--230 | | | 0.47 | | | | | 79 |
| 230--250 | | | 0.25 | | | | | 73 |
| 250--270 | | | 0.34 | | | | | 94 |
| 270--290 | | | 0.53 | | | | | 115 |
| 290--300 | | | 0.77 | | | | | 205 |

Invoice # 5945

CHARGES $ 28.00

2/12/71

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-0049

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

COMPOSITES

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3970P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | * A Con. lb/a |
|---|---|---|---|---|---|---|---|---|
| Hole # 4 A 110-130 | | | 0.44 | | | | | 173 |
| 130-150 | | | 0.29 | | | | | 99 |
| 150-170 | | | 0.65 | | | | | 169 |
| 170-200 | | | 0.22 | | | | | 83 |
| 200-220 | | | 0.36 | | | | | 64 |
| 220-240 | | | 0.29 | | | | | 54 |
| 240-260 | | | 0.35 | | | | | 68 |
| 260-280 | | | 0.20 | | | | | 77 |
| 280-300 | | | 0.79 | | | | | 124 |
| Hole # 5 195-215 | | | 0.51 | | | | | 16[illegible] |
| 215-235 | | | 0.31 | | | | | 295 |
| 235-255 | | | 0.90 | | | | | 218 |
| 255-275 | | | 0.88 | | | | | 103 |
| 275-295 | | | 0.50 | | | | | 84 |
| 295-315 | | | 0.29 | | | | | 71 |
| Hole # 7 165-185 | | | 0.43 | | | | | 56 |
| 185-205 | | | 0.56 | | | | | 99 |
| 285-305 | | | 0.36 | | | | | 299 |
| 305-325 | | | 0.34 | | | | | 105 |
| 325-345 | | | 0.33 | | | | | 154 |
| 345-365 | | | 0.47 | | | | | 77 |
| 365-385 | | | 0.58 | | | | | 90 |
| 385-405 | | | 0.45 | | | | | 64 |
| 405-425 | | | 0.45 | | | | | 56 |
| Hole # 8 10-30 | | | 0.33 | | | | | 36 |

Invoice # 5940 * Acid Consumption

CHARGES 100.00

REGISTERED ASSAYER FEB 24 1971 ARIZONA U.S.A.

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-004

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

COMPOSITES

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3970P3-03

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | lb/a * A Con |
|---|---|---|---|---|---|---|---|---|
| Hole # 8 30-50 | | | 0.45 | | | | | 41 |
| 50-70 | | | 0.38 | | | | | 49 |
| 70-90 | | | 0.59 | | | | | 56 |
| 90-110 | | | 0.52 | | | | | 41 |
| Hole # 11 40-60 | | | 0.39 | | | | | 359 |
| 60-80 | | | 0.19 | | | | | 363 |
| 80-100 | | | 0.46 | | | | | 192 |
| 100-120 | | | 0.36 | | | | | 52 |
| Hole # 14 0-10 | | | 0.61 | | | | | 60 |
| 10-30 | | | 0.98 | | | | | 84 |
| 30-50 | | | 0.42 | | | | | 115 |
| 50-70 | | | 0.37 | | | | | 226 |
| 70-90 | | | 0.31 | | | | | 77 |
| 90-110 | | | 0.42 | | | | | 335 |
| 110-130 | | | 0.75 | | | | | 207 |
| 130-150 | | | 0.86 | | | | | 113 |
| 150-170 | | | 0.62 | | | | | 84 |
| 170-190 | | | 0.44 | | | | | 338 |
| 190-210 | | | 0.62 | | | | | 369 |
| 210-230 | | | 0.56 | | | | | 101 |
| Hole # 15 325-345 | | | 0.42 | | | | | 365 |
| 345-365 | | | 0.46 | | | | | 103 |
| 365-385 | | | 0.60 | | | | | 276 |
| Hole # 16 190-210 | | | 0.34 | | | | | 101 |
| Hole # 17 A 190-210 | | | 0.76 | | | | | 66 |

Invoice # 5940

*Acid Consumption

CHARGES $ 100.00

REGISTERED ASSAYER ILLINOIS 2/8/71 ARIZONA U.S.A.

ASSAYER · CHEMIST

3226 East 46th Street

Phone 624-004[illegible]

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

COMPOSITES

Korn Kob Project

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3970P3-03

Job/P

| SAMPLE MARKED | GOLD OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | * A Con |
|---|---|---|---|---|---|---|---|---|
| Hole # 17A 210-230 | | | 0.46 | | | | | 66 |
| 250-270 | | | 0.41 | | | | | 98 |
| 270-290 | | | 0.83 | | | | | 77 |
| 290-310 | | | 0.45 | | | | | 254 |
| 310-330 | | | 0.50 | | | | | 265 |
| 330-350 | | | 0.31 | | | | | 105 |
| Hole # 18 60-80 | | | 0.37 | | | | | 68 |
| 80-100 | | | 0.21 | | | | | 92 |
| 100-120 | | | 1.08 | | | | | 69 |
| 120-140 | | | 0.52 | | | | | 96 |
| 140-160 | | | 0.57 | | | | | 81 |
| 160-180 | | | 0.56 | | | | | 150 |
| 180-200 | | | 0.51 | | | | | 171 |
| 220-240 | | | 0.44 | | | | | 177 |
| 240-260 | | | 0.35 | | | | | 137 |
| 260-280 | | | 0.38 | | | | | 54 |
| 300-320 | | | 0.43 | | | | | 54 |
| 320-340 | | | 0.34 | | | | | 37 |
| Hole # 20 40-60 | | | 0.60 | | | | | 55 |
| 60-80 | | | 0.5[illegible] | | | | | 43 |
| 80-100 | | | 0.55 | | | | | 43 |
| 100-120 | | | 0.63 | | | | | 43 |
| 120-140 | | | 0.52 | | | | | 265 |
| 140-160 | | | 0.53 | | | | | 250 |
| 160-180 | | | 0.51 | | | | | 237 |

Invoice # 5940

* Acid Consumption

CHARGES $ 100.00

REGISTERED ASSAYER FLOYD S. 3/10/71 Arizona U. S. A.

ASSAYER-CHEMIST

3226 East 46th Street

Phone 624-004[illegible]

COMPOSITES

# AMERICAN ANALYTICAL and RESEARCH LABORATORIES

Korn Kob Project

ASSAYERS · CHEMISTS · METALLURGISTS

TUCSON, ARIZONA 85713

SAMPLE SUBMITTED BY Essex International, Inc.

DATE Feb. 10, 1971

Project # A023-P3970P3-03

| SAMPLE MARKED | GOLD, OZ / TON | SILVER OZ / TON | PER CENT COPPER | PERCENT LEAD | PERCENT ZINC | PERCENT MOLYBDENUM | PERCENT IRON | lb/ton * A Con |
|---|---|---|---|---|---|---|---|---|
| Hole # 20 180-200 | | | 0.31 | | | | | 135 |
| Hole # 21 260-280 | | | 0.37 | | | | | 62 |
| 280-300 | | | 0.36 | | | | | 109 |
| 300-320 | | | 0.33 | | | | | 113 |
| 340-360 | | | 0.65 | | | | | 51 |
| 400-420 | | | 0.34 | | | | | 94 |
| Hole # 23 460-480 | | | 0.49 | | | | | 180 |
| 480-500 | | | 0.76 | | | | | 197 |

Invoice # 5940

CHARGES $ 32.00

REGISTERED ASSAYER ... Arizona U. S. A. 3/10/71

ASSAYER-CHEMIST