

HIGH-PRECISION MULTILEVEL AEROMAGNETIC SURVEY

over

DIXIE VALLEY, NEVADA

PART 2

Townships 21 North to 24 North
Ranges 35 East to 38 East
In Churchill County, Nevada

June, 1978

Senturion Sciences, Inc., has performed the field work, analyzed the data, and interpreted the results for this task. All the data and information resulting from this survey are the property of Southland Royalty Company.

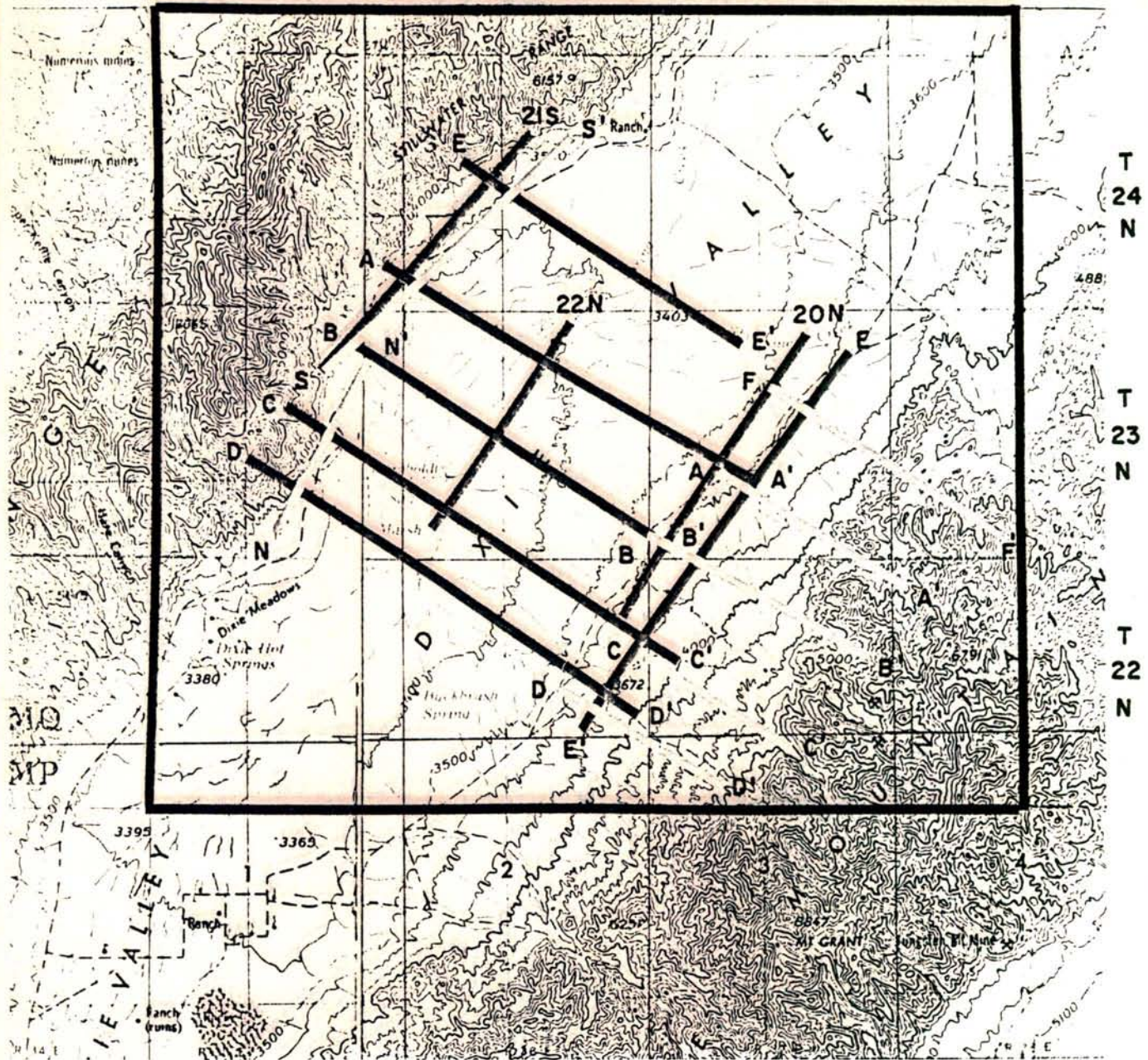
SURVEY SPECIFICATIONS

LOCATION:	Dixie Valley, Nevada
AREA COVERED:	Approximately 50 square miles
ACQUISITION DATE:	May, 1978
CREW:	Senturion Sciences #8
CODE:	South Dixie #2, 243
NUMBER OF PROFILES:	MultiLevel - seven Single-level - one
NUMBER OF CONGRUENT LEVELS PER PROFILE:	Five
MULTILEVEL GROUND MILES:	40
SINGLE-LEVEL GROUND MILES:	15
GEOPHYSICIST:	M.D. Quigley

R 35 E

R 36 E

R 37 E



SINGLE LEVEL
MULTILEVEL

DIXIE NO. 1

DIXIE NO. 2



**SOUTH DIXIE VALLEY, NEV.
AEROMAGNETIC SURVEY**

SOUTHLAND ROYALTY COMPANY'S
SOUTH DIXIE #2, NEVADA
MULTILEVEL AEROMAGNETIC SURVEY REPORT

INTRODUCTION

The original South Dixie, Nevada report of October, 1977, developed extraordinary gradients which were indicative of heat. Scalar magnetotelluric data interpreted by Mr. Will Czimer of Senturion Sciences, Inc., (See South Dixie Scalar Magnetotelluric Report, February, 1978) detected two separate heat source anomalies within the original area of abnormal magnetic gradients. Based on these surveys, additional MultiLevel aeromagnetics (shown on Figure 1 and Plate 1) verified the existence of two separate heat source anomalies. Two additional tensor magnetotelluric stations were also programmed. But, after 16 days of unsuccessful recording due to the completely saturated ground conditions at the sites, it was necessary to discontinue the surface program.

SUMMARY

All MultiLevel profiles were flown at five (5) altitudes while the single level was flown at 7,000 feet ASL. On the east side, the significance of the magnetic low east of Mud Fault was negated by extended Profiles A through D. However, a new area of interest was revealed at the intersection of Section 19 and 30, T38N, R23E; Sec, 24, 25, T37N, R23E, by Profile F. On the western border, Profile S delineated the abnormal gradients previously reported.

DATA ACQUISITION

Senturion flew seven (7) MultiLevel profiles with each profile consisting of five congruent flight lines. On the western portion, elevations were at 5000, 5500, 6000, 6500, and 7500 feet above sea level. On the eastern portion, the profiles were flown at 6000, 6500, 7000, 7500 and 8500 feet above sea level since these extensions carried over the Clan Alpine Mountain Range on the eastern border of the valley.

The survey area did include an aircraft restriction zone (Naval Target Range), which hampered and delayed data acquisition.

The high-precision survey used Senturion's Aztec N5176Y, which is equipped with Doppler navigation and optically-pumped helium magnetometer. The data was acquired at the rate of 18 magnetic readings per flight mile with a photograph of the ground position below each sample; both the magnetic reading and photograph were triggered by the Doppler navigation system. The magnetic readings were recorded digitally on magnetic tape concurrently with clock times and Doppler down-track and off-track information.

A base line at a constant elevation was reflown after each pass along the profiles to record diurnal variations in the earth's magnetic field, Figure 2.

DATA PROCESSING

After diurnal corrections were computed and applied, each line for each elevation was plotted along with its first and second horizontal derivatives. Next, the MultiLevel total field readings were plotted to graphically show the total field changes at consecutive 1000 foot intervals (Plates 10-16). Finally, the MultiLevel gradients (derivatives) were computed and plotted.

The MultiLevel 1000-foot gradient profiles were interpreted in terms of subsurface geology, and this interpretation is presented on the profiles (Plates 2-9), which are in the pocket of this report.

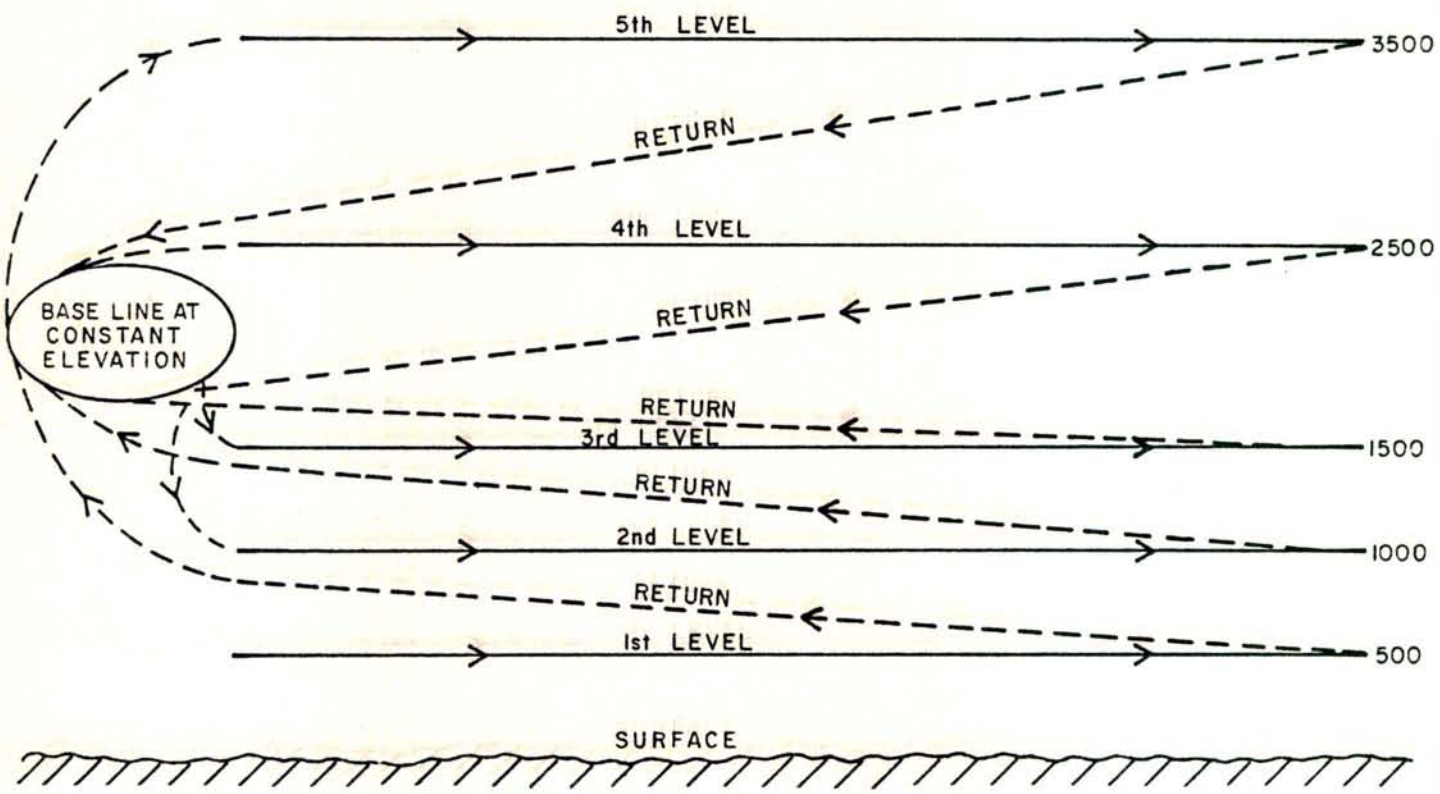
- . 6500' - 7500' = 1000-foot gradient
- . 7500' - 8500' = 1000-foot gradient
- . (6500' - 7500') - (7500' - 8500') = Second 1000-foot difference

For the western portion of the survey, 1000' must be subtracted from the above elevations

RESULTS

Eastern Part

The extension profiles, A through D (Plates 2-5), eliminated any real significance of the magnetic low east of the Mud Fault as mapped by the previous survey. However, Profile F, (Plate 6), revealed evidence of a new area of geothermal interest. It crosses a magnetic high of exceptionally sharp relief at the intersection of Section 19, 30, T38N, R23E; Sec. 24, 25, T37N, R23E. The anomaly has a range of 557.5 gammas in three miles. This amplitude compares with the relief of 664 gammas in five miles over the known intrusive of Profile D. Unlike Profile D, which exhibits very normal gradients east of the intrusive, Profile F shows gradient falloff rate east of the magnetic apex that is one-and-one half times greater than the falloff rate over the apex. The unusual falloff rate in Section 25, T37N, R23E, indicates an abnormal loss of magnetism at depth. This loss can most reasonably be explained by a sudden increase in temperature at relatively shallow depths.



MULTILEVEL AEROMAGNETIC PROFILING WITH
 BASE LINE FLOWN TO ELIMINATE HEADING EFFECTS

As indicated on the map (Plate 1), the intrusive is probably 100 feet to 300 feet below the surface. Some alteration of surface rocks should be evident confirming the existence of the intrusive. Certainly, the abnormal gradient area east of the intrusive should be tested by drill-hole to determine the temperature gradient.

One other magnetic axis occurs on Profile F and Profile A. This magnetic high is not expected to have geothermal significance since the gradients are seen to be normal. Correlations from profile to profile are arbitrary due to the distances involved.

Western Part

Profile S (Plate 8) was flown along the long axis of the abnormal gradient area indicated by the previous survey. Indeed, the gradients are abnormal as shown in the plots of several of the data stations (Figures 3 to 7). Aside from the fact that all the plots indicate reverse polarities in the shallow volcanics, stations 1303 and 1409 are most abnormal. Upper level gradients as well as lower level gradients are reversed. This suggests mineralization at depth possibly associated with the existence of hot mineralizing fluids.

The Stillwater Fault was crossed at the South end of this profile. As true previously, the evidence is consistent that the fault hades to the west. The inflection point on the flight lines moves 1500 feet to the southwest with a 2500 foot change in elevation.

Profile N (Plate 7) adds little new information. The profile nearly parallels the Stillwater Fault at the southwest end and obliquely crosses a magnetic low at the northeast end of the profile.

CONCLUSION

Profile S verifies the abnormal gradients previously mapped and also indicates a westward hade to the Stillwater Fault.

Profile F added valuable, new information concerning an area of geothermal interest in Section 19 and 30 of T23N, R38E. This is probably the most significant result of the survey.

The magnetic low east of the Mud Fault does not appear to be significant as determined by the extended Profiles A through D.

Aside from this new development, the survey shows rather clearly that flying MultiLevel profiles at random prior to a controlled, closely gridded single-level survey is a questionable procedure.

ADDENDUM

I have reviewed the results from the additional MultiLevel aeromagnetics May 31, 1978.

Profile S-S' indicates:

1. Two zones of abnormal magnetic gradients exist and are directly associated with the heat source anomalies identified by the Dixie Valley Magnetotelluric Survey, February, 1978.
2. Faulted scalar MT station #11 should now be included in the heat source anomaly associated with the Stillwater geothermal anomaly.
3. Abnormal magnetic gradients, associated with the Stillwater heat source anomaly are stronger than those associated with the Mine anomaly because:
 - a. The environment is hotter
 - b. The environment is hotter and closer to the surface
 - c. The environment is cooler, but closer to the surface

Magnetotelluric data (ρ_o at $T=30,100$ seconds) supports the "a" theory and one-dimensional modeling suggests the conductive zone associated with the Stillwater anomaly is up to 2Km closer to the surface.

At this time, I still feel the Stillwater heat source anomaly reflects the "b" theory, and the Stillwater MT anomaly presents the greatest geothermal potential.

William J. Czimer

SENTURION SCIENCES, INC.

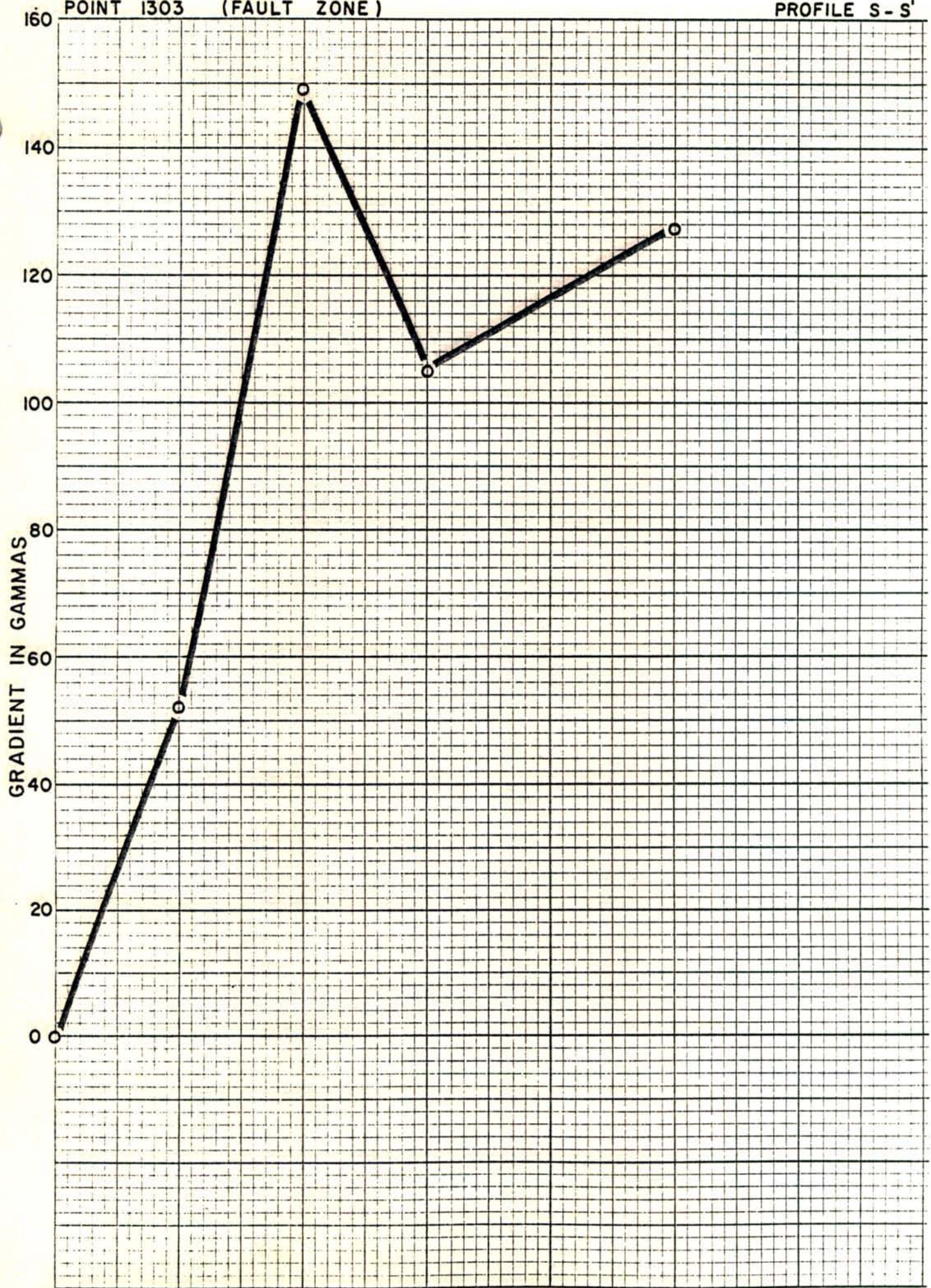
May 31, 1978

Sec 1-23N-35E

Sec 21-T24N-R36E

47 0780

K&E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



50 55 60 65 70 75
FLIGHT ELEVATION IN HUNDREDS OF FEET

FIGURE 3
SENTURION SCIENCES, INC.

47 0780

K&E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



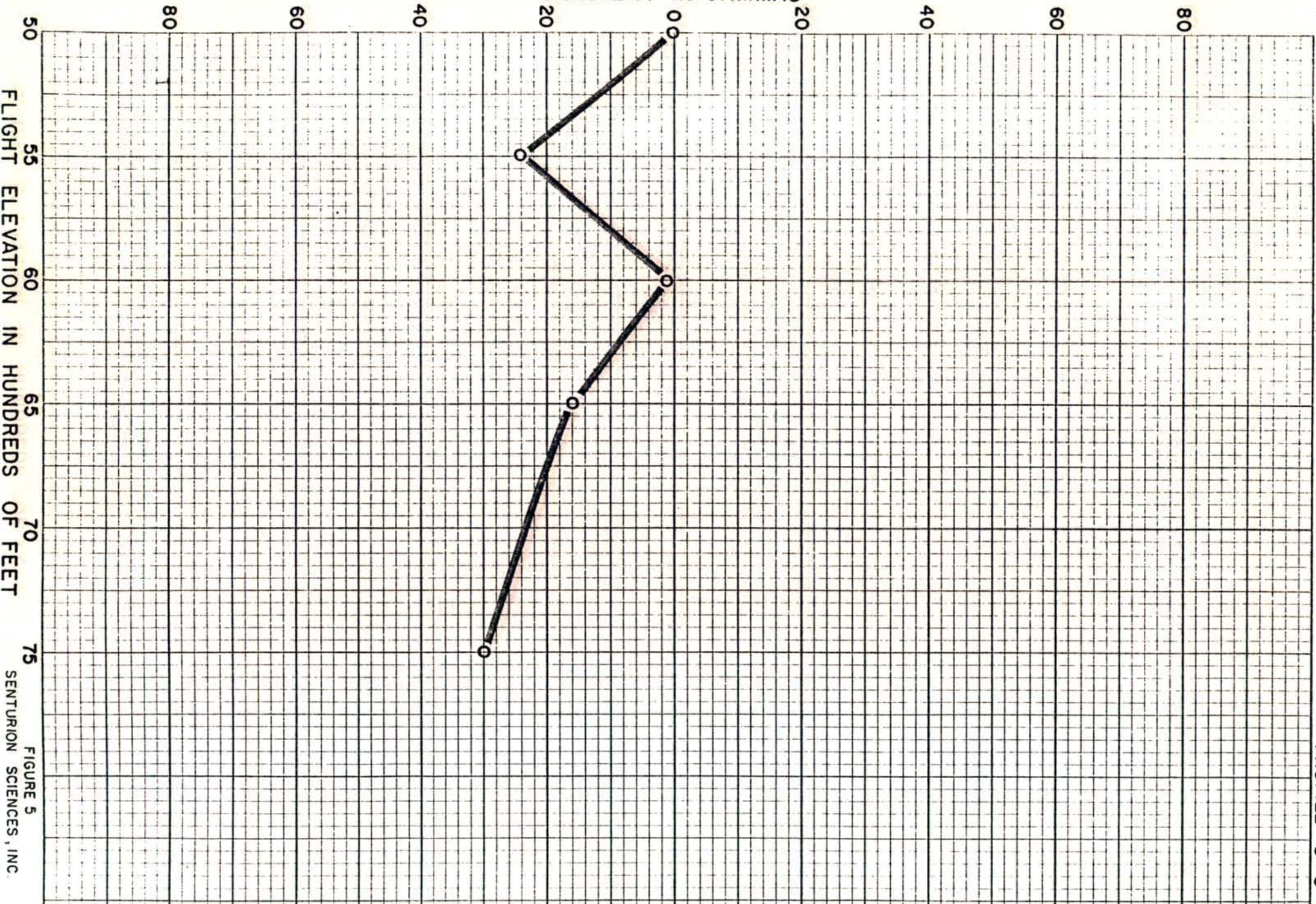
50 55 60 65 70 75
FLIGHT ELEVATION IN HUNDREDS OF FEET

FIGURE 4
SENTURION SCIENCES, INC.

POINT 1366
(MAG HIGH)

PROFILE S-S'

GRADIENT IN GAMMAS

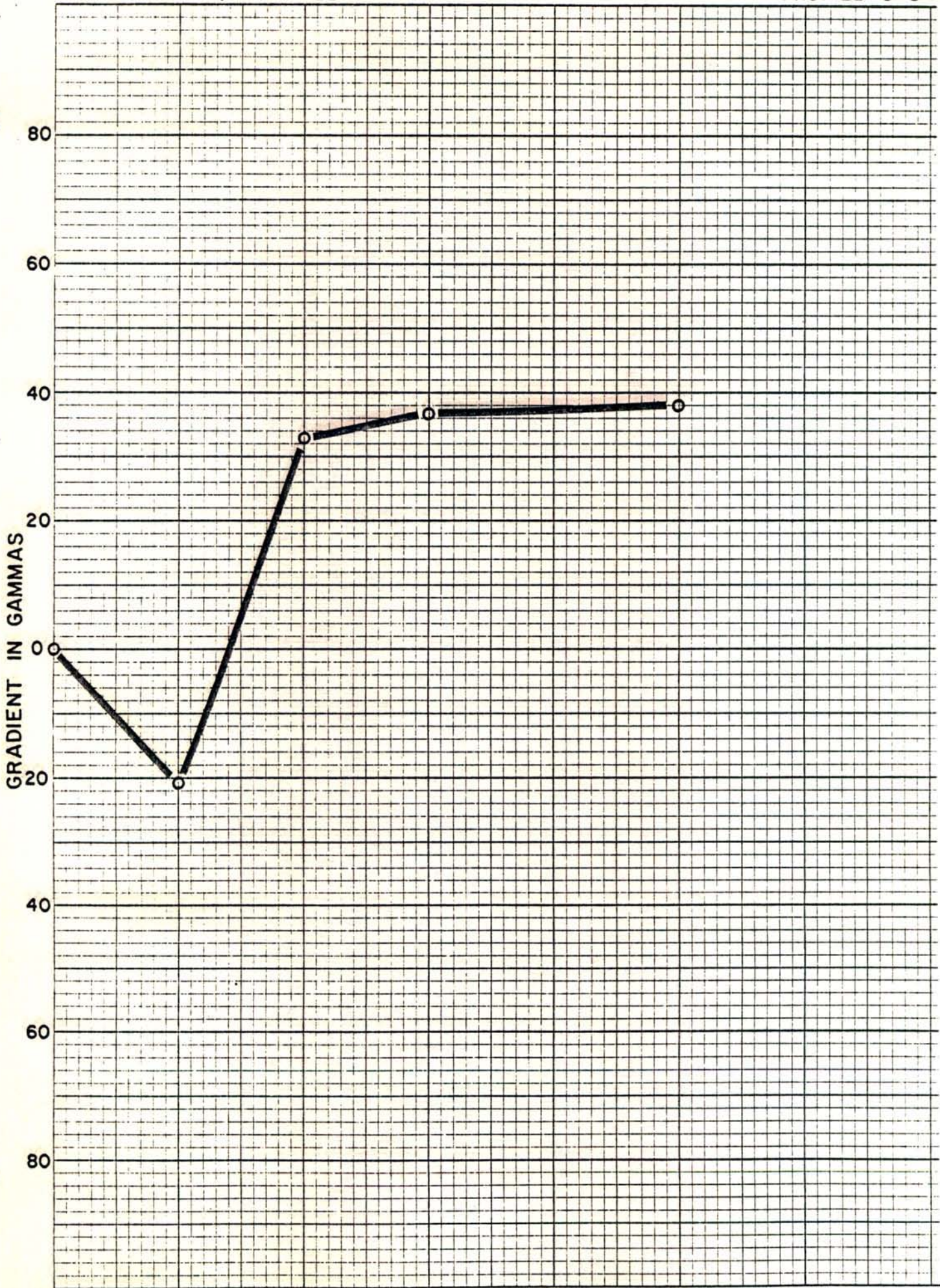


FLIGHT ELEVATION IN HUNDREDS OF FEET

FIGURE 5
SENTURION SCIENCES, INC

47 0780

K₀Σ 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.



50 55 60 65 70 75
FLIGHT ELEVATION IN HUNDREDS OF FEET

FIGURE 6
SENTURION SCIENCES, INC

47 0780

K&E 10 X 10 TO THE INCH • 10 X 15 INCHES
KEUFFEL & ESSER CO. MADE IN U.S.A.

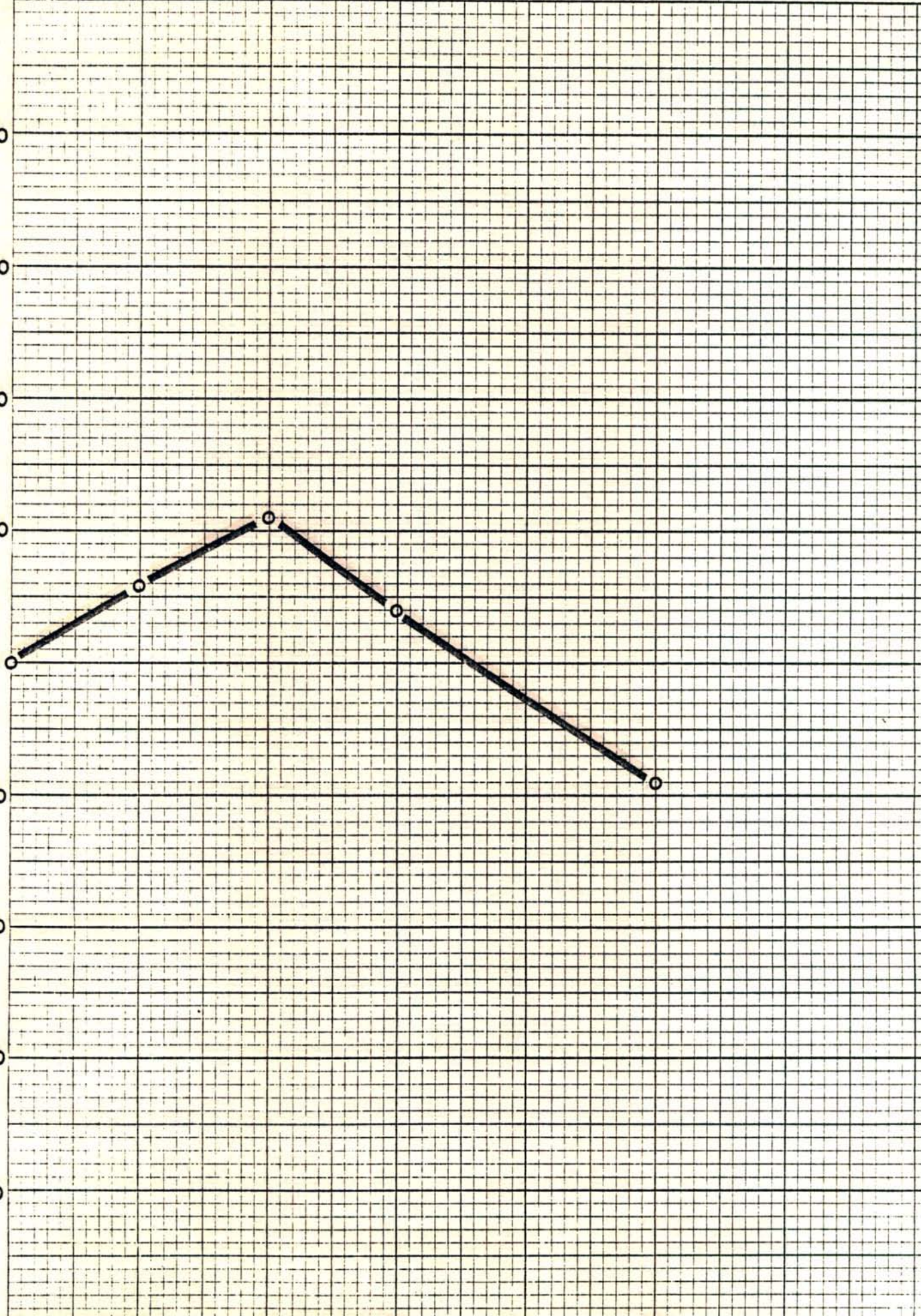
GRADIENT IN GAMMAS

80
60
40
20
0
20
40
60
80

50 55 60 65 70 75

FLIGHT ELEVATION IN HUNDREDS OF FEET

FIGURE 7
SENTURION SCIENCES, INC.



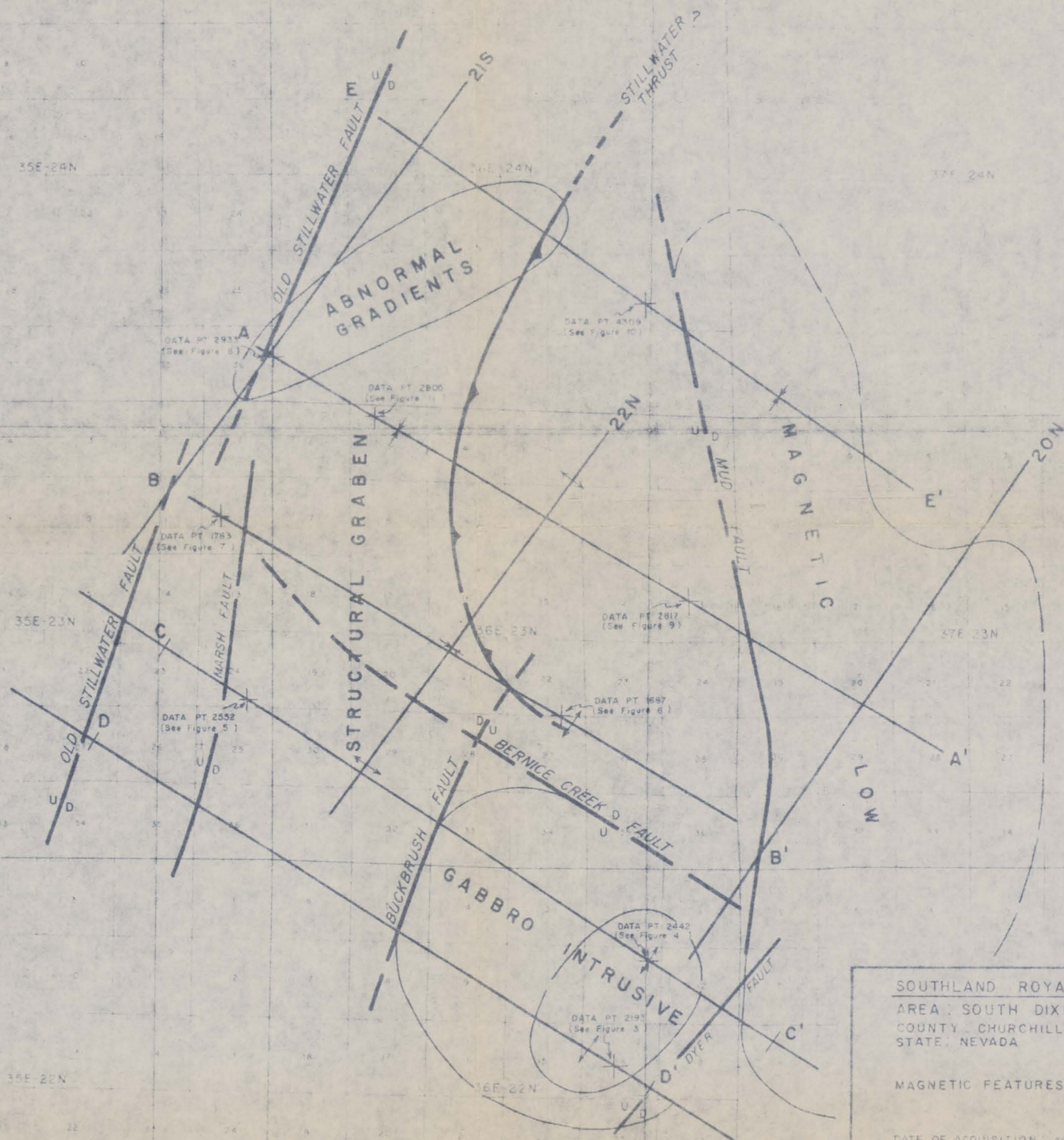
LEGEND

- 20 N
- 21 S
- 22 N
- A-A
- B-B
- C-C'
- D-D'
- E-E'

SINGLE LEVEL TIE LINES

MULTILEVEL CONGRUENT PROFILES

- FAULT
- STRUCTURAL HIGH
- STRUCTURAL LOW
- THRUST FAULT



SOUTHLAND ROYALTY CO
 AREA: SOUTH DIXIE
 COUNTY, CHURCHILL
 STATE, NEVADA

MAGNETIC FEATURES MAP

DATE OF ACQUISITION: AUGUST 25, 1977

0 1 2 3
 MILES

PLATE 1 GEOPHYSICAL SCIENCE 102

PROJECT: SOUTH DIXIE "D" MULTI

VERTICAL GRADIENT MULTILEVEL AEROMAGNETIC PROFILES

COUNTY: CHURCHILL
STATE: NEVADA

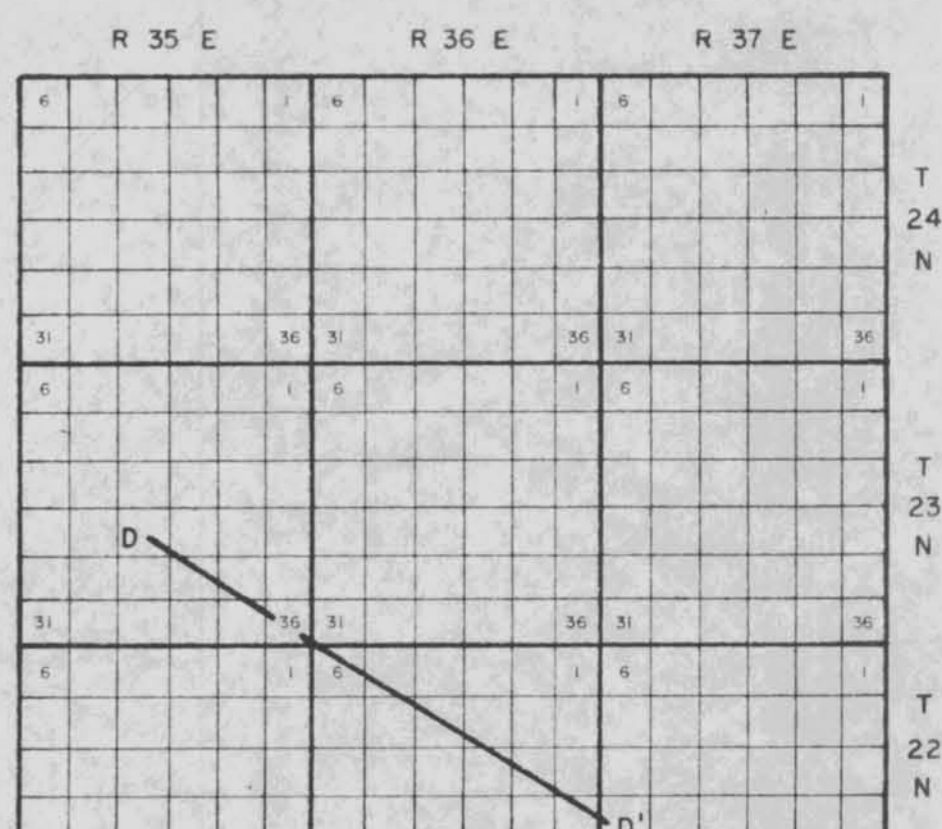
DATE OF ACQUISITION: 9/25/77

CROSS SECTION

SCALES: HORIZONTAL - 3 INCHES EQUAL 1 MILE MAP SCALE
VERTICAL - 1 INCH EQUALS 1000 FEET GEOLOGIC INTERPRETATION
0.5 GAMMA PER PLOT POSITION MAGNETIC SCALE

GRADIENT IDENTIFICATION SYMBOL
5500 MSL MINUS 6500 MSL XXXXX
6500 MSL MINUS 7500 MSL OOOOO
(5500 MINUS 6500) MINUS (6500 MINUS 7500) *****

AVERAGE SURFACE ELEVATION BENEATH PROFILE 3500 FT. MSL



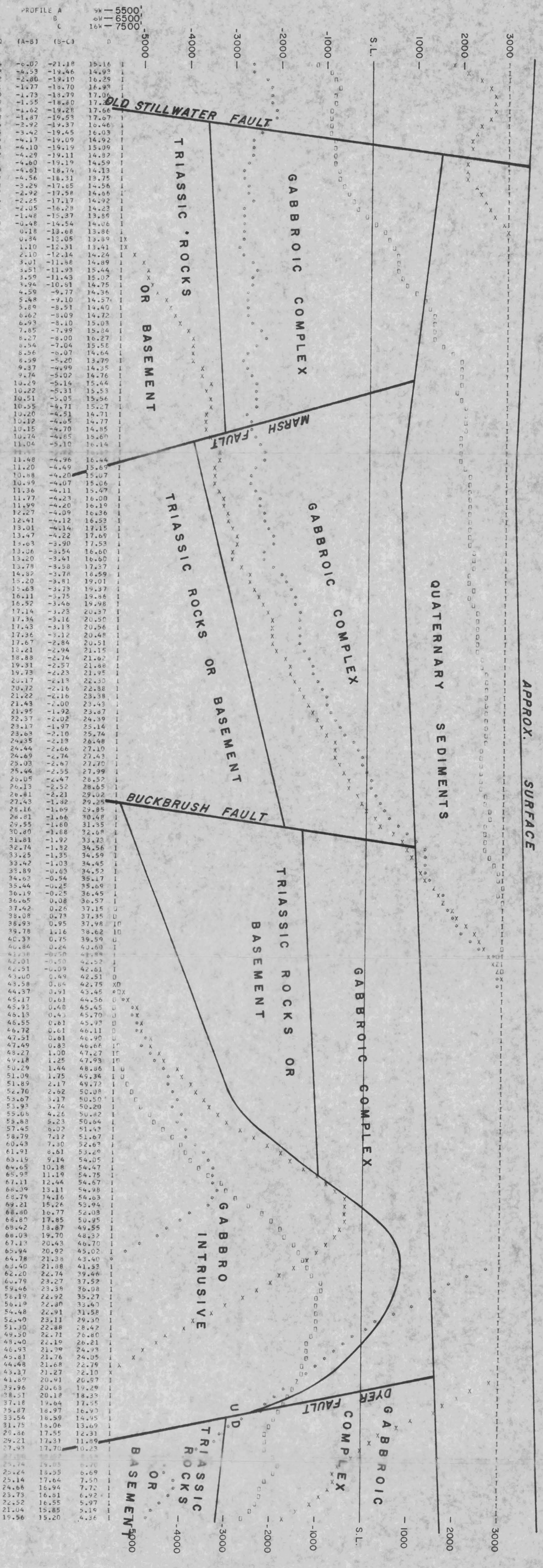
SOUTHLAND ROYALTY CO.
PLATE 2 SENTURION SCIENCES, INC.

PROFILE	ELEVATION	NO. OF POINTS	SCALE GAMMAS / PLOT POS.
9W	5500	192	0.500
6W	6500	192	0.500
16W	7500	192	0.500
0??	0	0	0.000

VALUES SHOWN ARE GAMMAS

SOUTH DIXIE
D = (A - B) - (B - C)

LENGTH 192 POINTS



NORTHWEST
D
35E - 23N
31
6
5
8
9
10
14
13
24
SOUTHEAST

DEPTH CALCULATION
(SEE FIGURE 3)

D

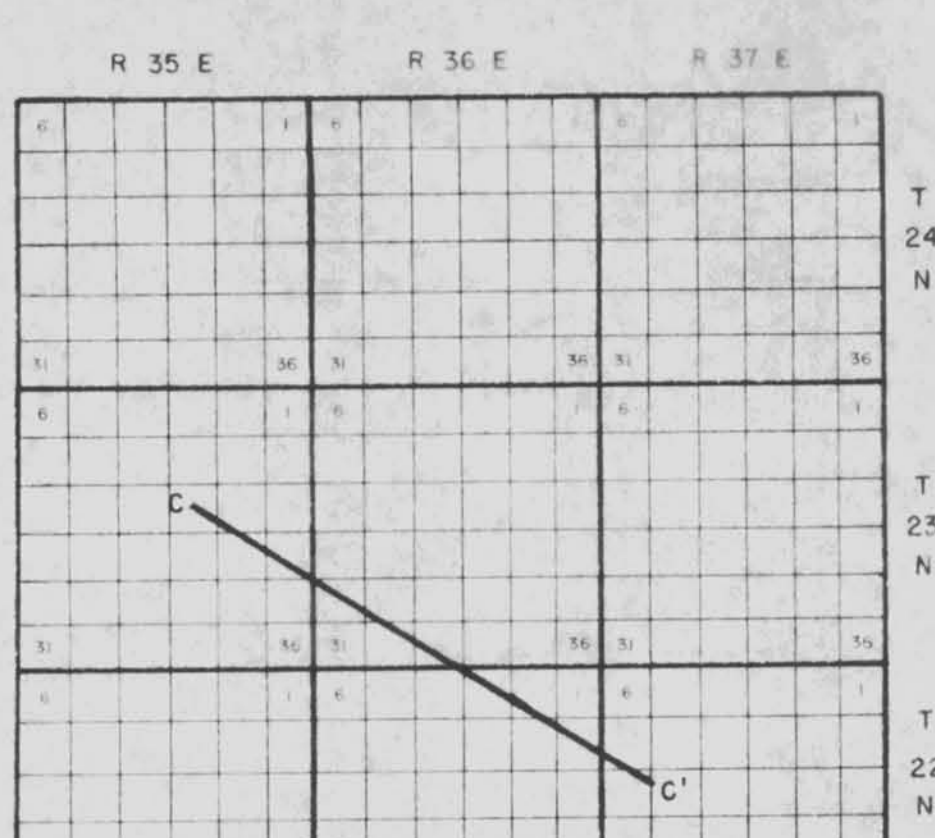
PROJECT: SOUTH DIXIE "C" MULTI
VERTICAL GRADIENT MULTILEVEL AEROMAGNETIC PROFILES

COUNTY: CHURCHILL
STATE: NEVADA

DATE OF ACQUISITION: 9/25/77

CROSS SECTION
SCALES: HORIZONTAL - 3 INCHES EQUAL 1 MILE
VERTICAL - 1 INCH EQUALS 1000 FEET
0.5 GAMMA PER PLOT POSITION
MAP SCALE GEOLOGIC INTERPRETATION
MAGNETIC SCALE

GRADIENT IDENTIFICATION SYMBOL
5500 MSL MINUS 6500 XXXXX
6500 MSL MINUS 7500 00000
(5500 MINUS 6500) MINUS (6500 MINUS 7500) *****
AVERAGE SURFACE ELEVATION BENEATH PROFILE 3500 FT. MSL



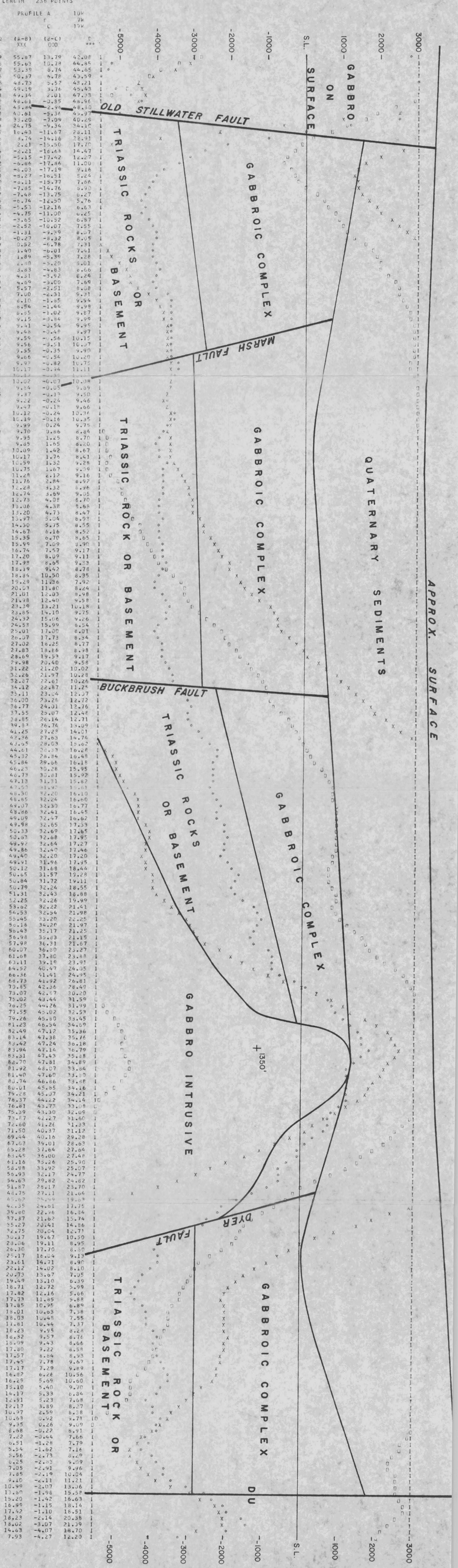
SOUTHLAND ROYALTY CO.
PLATE 3 SENTURION SCIENCES, INC.

PROFILE	ELEVATION	NO. OF POINTS	SCALE GAMMAS / PLOT POS.
10W	5500	238	0.500
7W	6500	238	0.500
17W	7500	238	0.500
077	0	0	0.000

VALUES SHOWN ARE GAMMAS

SOUTH DIXIE
*** D = (A - B) - (B - C)

LENGTH 238 POINTS



SEC. 13
SEC. 14
SEC. 23
SEC. 24
SEC. 25
SEC. 29
SEC. 30
SEC. 32
SEC. 33
SEC. 3
SEC. 11
SEC. 12
SEC. 18
SEC. 19

DEPTH CALCULATION (SEE FIGURE 4)

GRADIENT CALCULATION (SEE FIGURE 6)

35E-23N
36E-23N
36E-22N
37E-22N

3000
2000
1000
S.L.
-1000
-2000
-3000
-4000
-5000

SEQ. 2599 55.87 13.79 42.08
2598 55.63 13.78 44.85
2597 53.39 8.74 44.65
2596 50.37 6.78 43.59
2595 48.73 5.52 43.21
2594 49.19 3.76 45.43
2593 49.34 2.01 47.33
2592 48.61 -0.35 48.96
2591 45.84 -2.96 48.80
2590 40.81 -5.36 49.97
2589 38.20 -7.09 40.25
2588 24.75 -5.34 34.15
2587 16.43 -11.67 28.11
2586 8.74 -14.16 22.91
2585 2.21 -15.50 17.70
2584 -2.21 -16.68 14.47
2583 -5.15 -17.42 12.27
2582 -6.86 -17.86 11.00
2581 -6.03 -17.19 9.16
2580 -8.27 -16.51 8.24
2579 -8.11 -15.77 7.66
2578 -7.85 -14.76 6.90
2577 -7.48 -13.75 6.27
2576 -6.74 -12.50 5.76
2575 -5.53 -11.16 6.63
2574 -4.75 -11.00 6.25
2573 -3.65 -10.52 6.87
2572 -2.52 -10.07 7.55
2571 -1.31 -9.59 8.07
2570 -0.27 -8.32 8.05
2569 0.52 -6.78 7.31
2568 1.40 -6.01 7.41
2567 1.89 -5.36 7.28
2566 2.80 -5.20 8.01
2565 3.83 -4.83 6.66
2564 4.31 -3.92 8.24
2563 4.69 -3.00 7.69
2562 5.37 -2.51 8.08
2561 7.00 -2.31 9.31
2560 8.10 -1.95 9.94
2559 8.54 -1.44 9.99
2558 8.85 -1.02 9.87
2557 9.15 -0.84 9.99
2556 9.41 -0.54 9.95
2555 9.48 -0.46 9.97
2554 9.59 -0.56 10.15
2553 9.56 -0.51 10.07
2552 9.55 -0.35 9.90
2551 9.66 -0.54 10.20
2550 9.92 -0.82 10.75
2549 10.17 -0.94 11.11
2548 10.02 -0.67 10.08
2547 9.84 -0.05 9.89
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2545 9.22 -0.24 9.46
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2543 10.12 -0.24 10.34
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2541 9.99 0.24 9.75
2540 9.70 0.86 8.84
2539 9.95 1.25 8.70
2538 9.85 1.65 8.20
2537 10.09 1.42 8.67
2536 10.37 1.74 8.41
2535 10.59 1.32 9.28
2534 10.75 1.67 9.19
2533 11.28 2.12 9.16
2532 11.76 2.84 8.97
2531 12.28 3.32 8.96
2530 12.74 3.69 9.05
2529 12.73 4.08 8.70
2528 13.06 4.38 8.68
2527 13.20 4.73 8.47
2526 13.97 5.04 8.93
2525 14.30 5.75 8.55
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2523 15.35 6.70 8.65
2522 15.99 7.09 8.90
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2514 21.01 12.03 8.98
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2511 23.85 14.10 9.75
2510 24.37 15.06 9.66
2509 24.32 15.99 9.54
2508 25.01 17.00 8.01
2507 26.37 17.73 8.54
2506 27.02 18.25 8.77
2505 27.83 18.86 8.98
2504 28.69 19.53 9.17
2503 29.98 20.40 9.58
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2489 44.61 28.33 16.28
2488 45.32 28.84 16.48
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2484 47.13 31.31 15.82
2483 47.53 31.92 15.60
2482 48.30 32.60 16.00
2481 48.85 32.24 16.60
2480 49.07 32.30 16.77
2479 48.86 32.41 16.45
2478 49.09 32.47 16.62
2477 49.98 32.65 17.53
2476 50.33 32.69 17.65
2475 50.63 32.68 17.95
2474 49.92 32.64 17.27
2473 49.86 32.40 17.46
2472 49.40 32.20 17.20
2471 49.41 31.96 17.95
2470 50.12 31.88 18.44
2469 50.45 31.57 19.28
2468 50.84 31.72 19.11
2467 50.79 32.24 18.55
2466 51.31 32.43 18.88
2465 52.25 32.26 19.99
2464 53.02 32.22 21.41
2463 54.53 32.54 21.98
2462 55.45 33.20 22.25
2461 56.18 34.26 21.97
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2458 57.98 36.31 21.67
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2456 61.68 37.80 23.88
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2448 76.25 44.26 31.99
2447 77.55 45.02 32.53
2446 79.26 45.80 33.45
2445 81.23 46.54 34.69
2444 82.49 47.12 35.36
2443 83.14 47.38 35.76
2442 83.62 47.24 36.18
2441 83.94 47.16 36.79
2440 83.31 47.43 35.38
2439 82.70 47.81 34.89
2438 81.92 48.07 33.84
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2434 79.28 44.22 34.14
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2432 75.39 43.30 32.09
2431 73.87 42.27 31.60
2430 72.60 41.26 31.33
2429 71.50 40.37 31.12
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2427 67.63 39.01 28.63
2426 65.28 37.64 27.64
2425 63.49 36.00 27.48
2424 61.16 35.26 25.90
2423 58.98 33.92 25.07
2422 56.93 32.17 24.77
2421 54.63 29.82 24.82
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2407 20.73 13.67 7.05
2406 18.71 12.72 5.99
2405 17.82 12.16 5.66
2404 17.73 11.85 5.88
2403 17.85 10.95 6.88
2402 18.01 10.63 7.38
2401 18.03 10.48 7.55
2400 18.23 9.95 8.28
2399 18.32 9.57 8.76
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2397 17.80 9.22 8.58
2396 17.57 8.64 8.93
2395 17.45 7.78 9.67
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2391 15.11 5.46 9.70
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2382 5.54 -1.62 7.16
2381 5.56 -2.73 8.00
2380 6.25 -2.83 9.09
2379 7.05 -2.91 9.96
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2376 10.99 -2.07 13.06
2375 13.50 -1.96 15.58
2374 15.20 -1.42 16.63
2373 16.99 -1.15 18.14
2372 17.42 -1.10 18.51
2371 18.23 -2.14 20.38
2370 18.02 -3.07 21.39
2369 14.63 -4.07 18.70
2368 7.93 -4.27 12.20

PROJECT: SO. DIXIE "B" MULTI

*****VERTICAL GRADIENT MULTILEVEL AEROMAGNETIC PROFILES*****

COUNTY: CHURCHILL

STATE: NEVADA

DATE OF ACQUISITION: 9/24/77

SCALES: HORIZONTAL - 3 INCH EQUALS 1 MILES
VERTICAL - 1 INCH EQUALS 1000 FEET

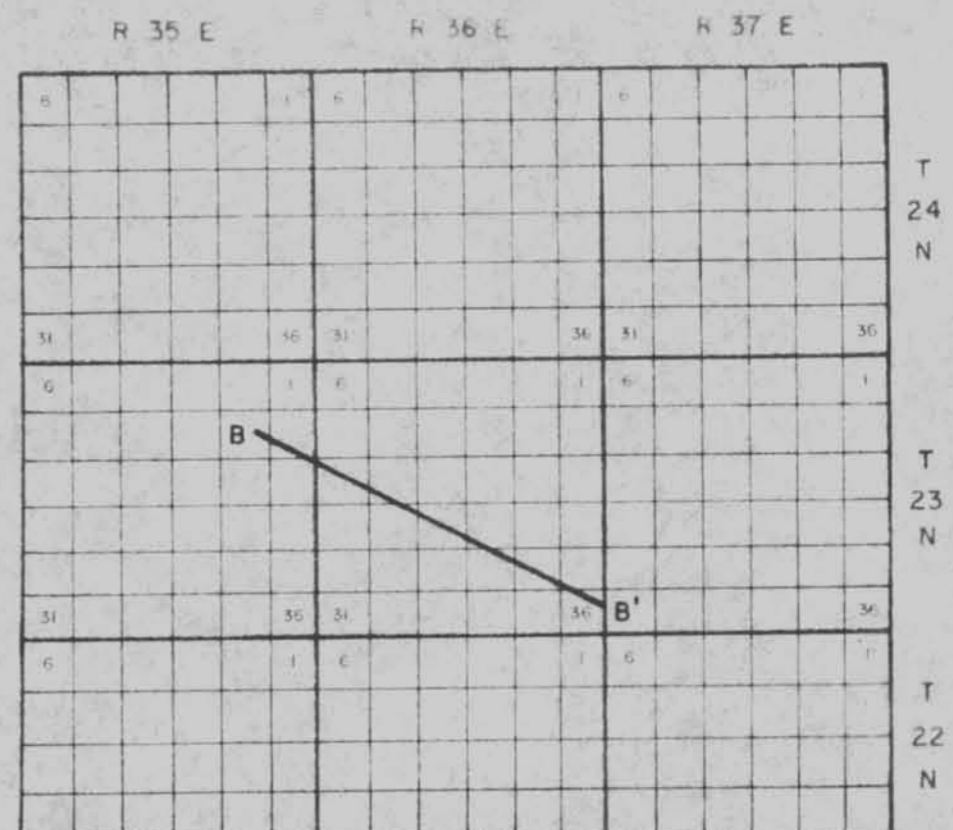
GRADIENT IDENTIFICATION

5500 MSL MINUS 6500 MSL
6500 MSL MINUS 7500 MSL
(5500 MINUS 6500) MINUS (6500 MINUS 7500)

SYMBOL

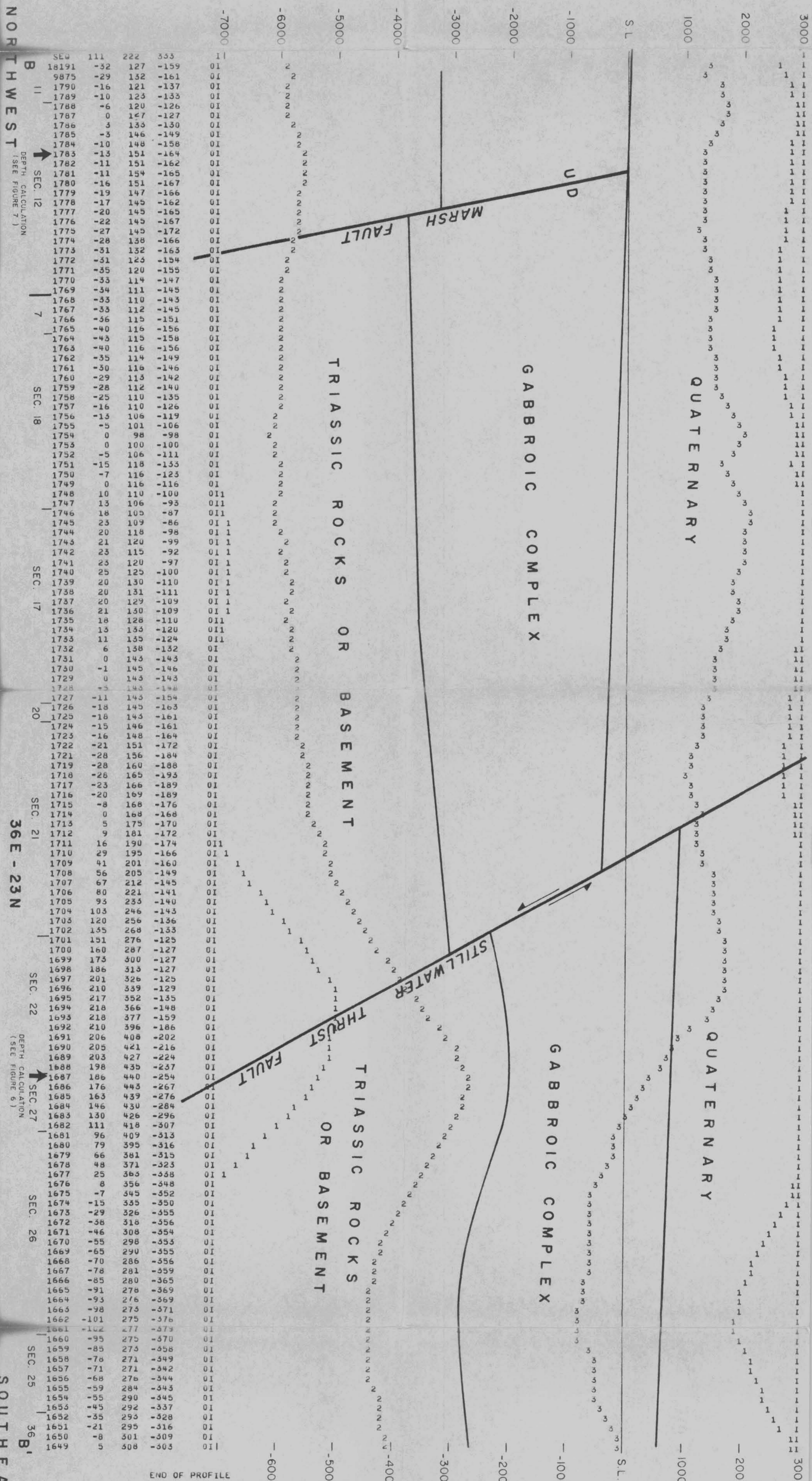
11111
22222
33333

AVERAGE SURFACE ELEVATION BENEATH PROFILE 4000 FT. MSL



SOUTHLAND ROYALTY CO.
PLATE 4 SENTURION SCIENCES, INC.

VALUES SHOWN ARE GAMMAS X 10



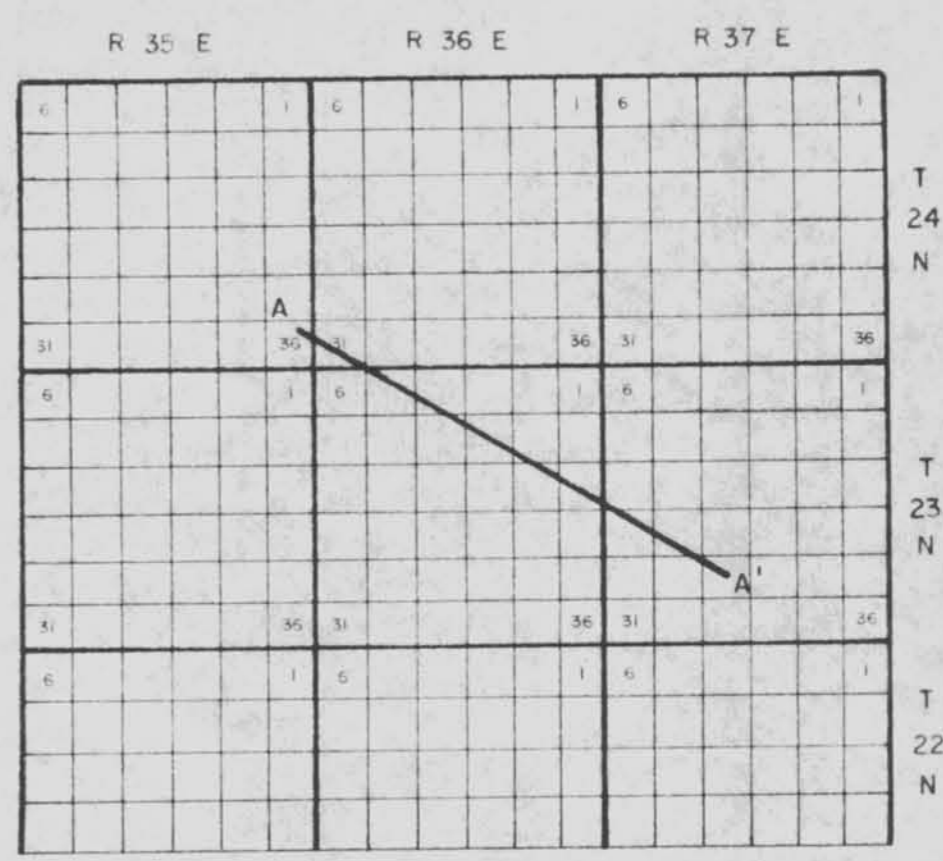
NORTH WEST
DEPTH CALCULATION (SEE FIGURE 7)
SEC. 12
7
SEC. 18
SEC. 17
20
SEC. 21
36E - 23N
SEC. 22
DEPTH CALCULATION (SEE FIGURE 6)
SEC. 27
SEC. 26
SEC. 25
SOUTH EAST

END OF PROFILE

PROJECT: SOUTH DIXIE "A" MULTI

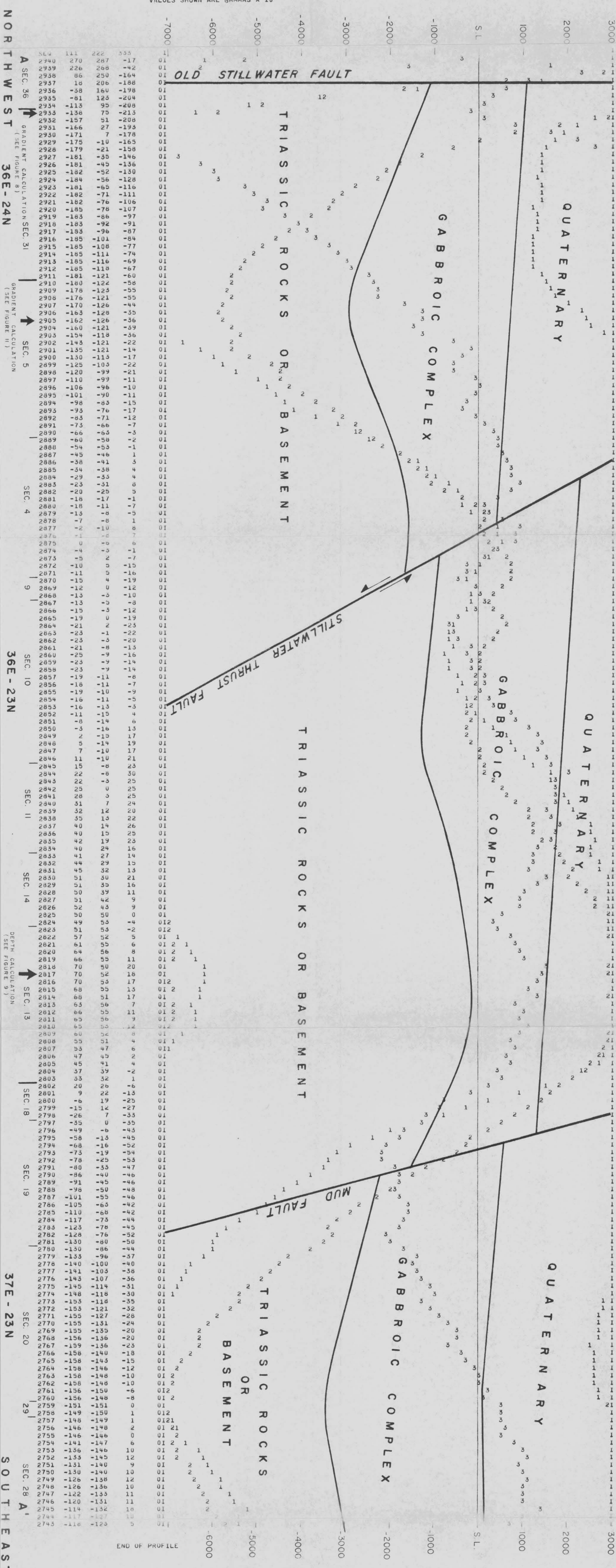
*****VERTICAL GRADIENT MULTILEVEL AEROMAGNETIC PROFILES*****

COUNTY: CHURCHILL
 STATE: NEVADA
 DATE OF ACQUISITION: 9/25/77
 CROSS SECTION SCALES: HORIZONTAL - 3 INCH EQUALS 1 MILES
 VERTICAL - 1 INCH EQUALS 1000 FEET
 GRADIENT IDENTIFICATION SYMBOL
 5500 MSL MINUS 6500 MSL 11111
 6500 MSL MINUS 7500 MSL 22222
 (5500 MINUS 6500) MINUS (6500 MINUS 7500) 33333
 AVERAGE SURFACE ELEVATION BENEATH PROFILE 4500 FT. MSL



SOUTHLAND ROYALTY CO.
 PLATE 5 SENTURION SCIENCES, INC.

VALUES SHOWN ARE GAMMAS X 10



NORTH WEST
 A SEC. 36
 GRADIENT CALCULATION SEC. 31
 SEC. 5
 GRADIENT CALCULATION
 SEC. 4
 SEC. 10
 SEC. 11
 SEC. 14
 SEC. 13
 SEC. 18
 SEC. 19
 SEC. 20
 SEC. 28 A
 SOUTH EAST

3000
2000
1000
S.L.
-1000
-2000
-3000
-4000
-5000
-6000
-7000

END OF PROFILE

PROJECT: SOUTH DIXIE "B" MULTI

*****VERTICAL GRADIENT MULTILEVEL AEROMAGNETIC PROFILES*****

COUNTY: CHURCHILL

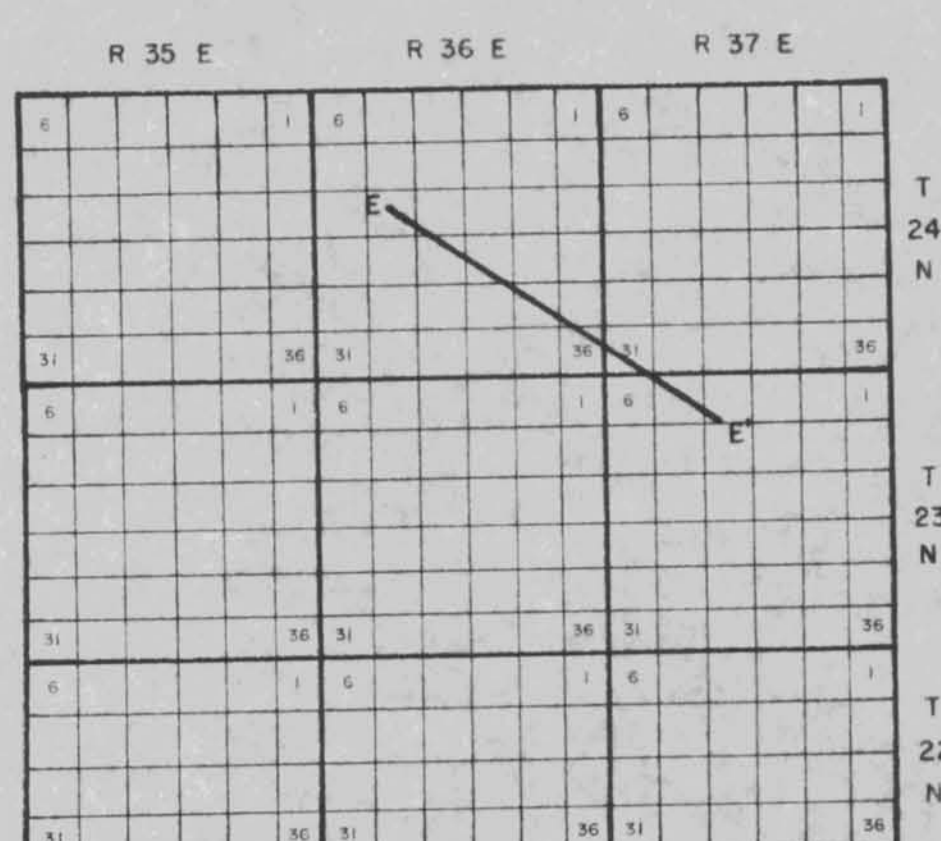
STATE: NEVADA

DATE OF ACQUISITION: 9/25/77

CROSS SECTION
 SCALES: HORIZONTAL - 3 INCH EQUALS 1 MILE
 VERTICAL - 1 INCH EQUALS 1000 FEET

GRADIENT IDENTIFICATION	SYMBOL
5500 MSL MINUS 6500 MSL	11111
6500 MSL MINUS 7500 MSL	22222
(5500 MINUS 6500) MINUS (6500 MINUS 7500)	33333

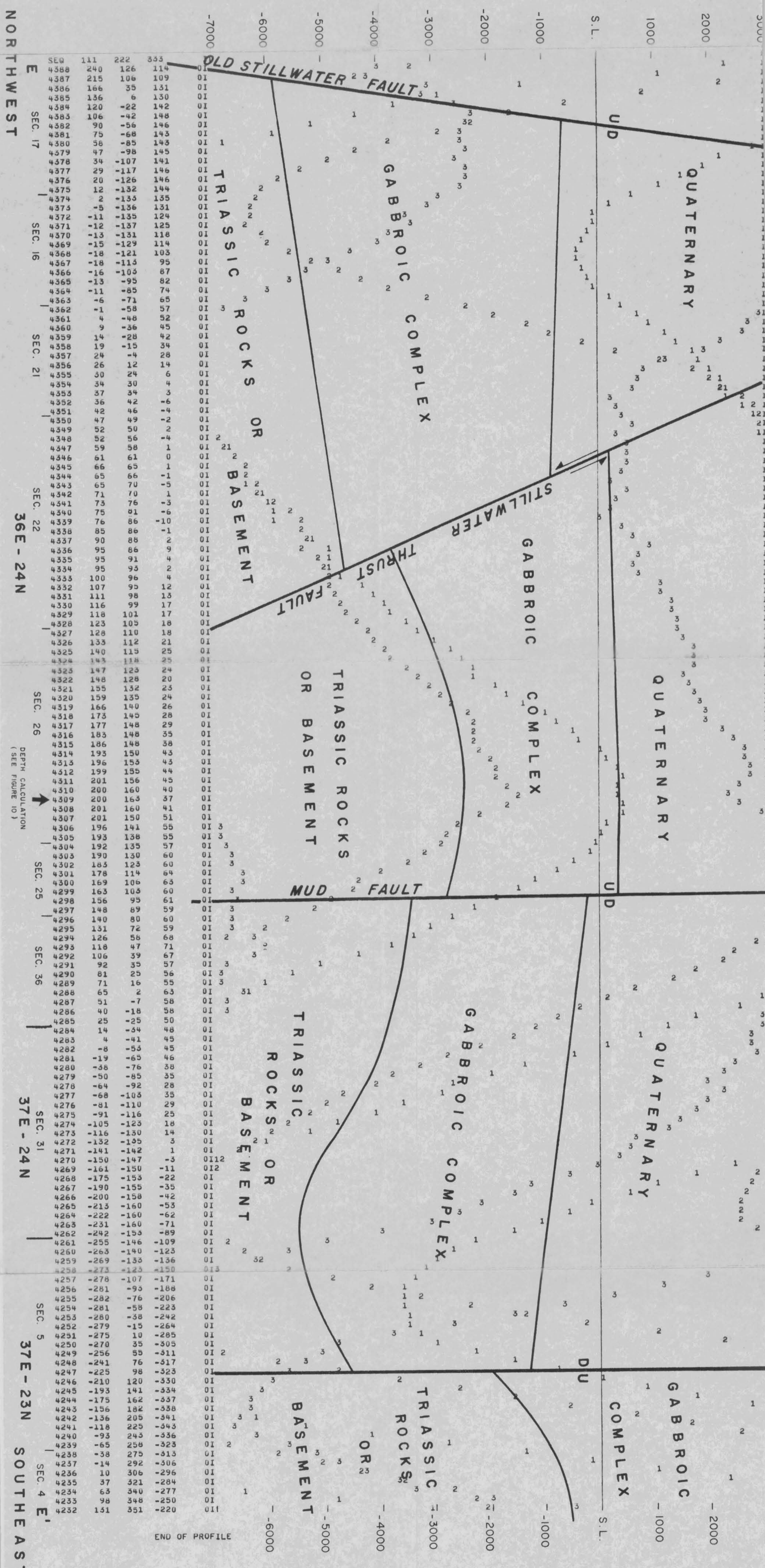
AVERAGE SURFACE ELEVATION BENEATH PROFILE 4500 FT. MSL



SOUTHLAND ROYALTY CO.
 PLATE 6 SENTURION SCIENCES, INC.

PROFILE	ELEVATION	NO. OF POINTS	SCALE GAMMAS / PLOT POS.	CORRECTIONS START	STOP
16NW	5500	157	0.200	8.4	8.0
12NW	6500	157	0.200	9.2	8.2
14NW	7500	159	0.200	7.5	8.0
077	0	0	0.000	0.0	0.0

VALUES SHOWN ARE GAMMAS X 10



END OF PROFILE