National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY
CINCINNATI QUADRANGLE
INDIANA, OHIO, AND KENTUCKY

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

March 1981

PREPARED FOR U.S. DEPARTMENT OF ENERGY

Grand Junction Office, Colorado

This report is a result of work performed by EG&G geoMetrics through a Bendix Field Engineering Corporation Subcontract, as part of the National Uranium Resource Evaluation. NURE is a program of the U.S. Department of Energy's Grand Junction, Colorado, Office to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States.

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Under Contract No. DE-AC13-76GJ01664
and Bendix Field Engineering Corporation
Subcontract No. 80-479-L

ABSTRACT

The Cincinnati quadrangle of Indiana, Ohio, and Kentucky covers 7,100 square miles of largely agricultural land in the easternmost Midwestern Physiographic Province. Thin Paleozoic strata overlie Precambrian basement in this area. The Paleozoic units are largely masked by Quaternary glacial deposits that thicken to the northwest and northeast.

No uranium deposits are known within the quadrangle.

The interpretation process defined 86 anomalies, all of which appeared to be culturally induced. None contain significant measured quantities of uranium.

Magnetic data appear to be largely in agreement with present structural interpretations, though some other small structures are suggested that could represent complexities in the Precambrian basement.

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INTRODUCTION

General

The Cincinnati quadrangle covers 7,100 square miles in southeastern Indiana, southwestern Ohio, and northernmost Kentucky (See Figure 1.).

The geologic map used in the interpretation was compiled at 1:250,000 scale by Fremont Geologic Consultants in 1980. The map was compiled primarily from an Indiana State Geological Survey map at 1:250,000 scale (Gray and others, 1971). Geologic unit descriptions were taken from the Fremont map legend. Supplementary geologic information was taken from Fairbridge (ed.), 1972, Gray and others (1971), and Cohee and others (1962). Physiographic and cultural information was taken from the 1:250,000 scale Cincinnati topographic map (1974 version).

Radiometric and magnetic data were acquired in November and December of 1980, and were processed in February of 1981. A detailed summary of data acquisition, processing, interpretation, and presentation methods is contained in Appendix A. Appendix B contains a detailed flight summary from the Cincinnati quadrangle.

Physiography

The Cincinnati quadrangle lies at the southeastern boundary of the Midwestern Physiographic Province. The region is largely agricultural, but contains several major population centers. Flat, nearly featureless plains in the north and west gradually give way to moderately dissected topography in the central and southeastern areas. The region is drained by tributaries of the Ohio River (which meanders along the eastern south edge). Though the tributaries show youthful features, the Ohio itself appears antecedent.

Elevations range from below 500 feet at the Ohio River base level, to over 1200 feet in the central northern plains. The plains themselves slope gently upward to the north from 700 feet to the maximum along the central northern edge. Irregularities in the landscape are the result of extensive glaciation in the area during the Pleistocene. The most obvious features are the end moraines of the Wisconsinan, which form low but continuous ridges in the plains, and outline the furthest extents of local glacial advances.

The quadrangle is well developed culturally. The largest cities comprise the Cincinnati and Dayton metropolitan areas (pop. 404,000 and 219,000 respectively). Though largely an agricultural region, the quadrangle contains several other large cities, and an extensive network of roads, freeways and railroads.

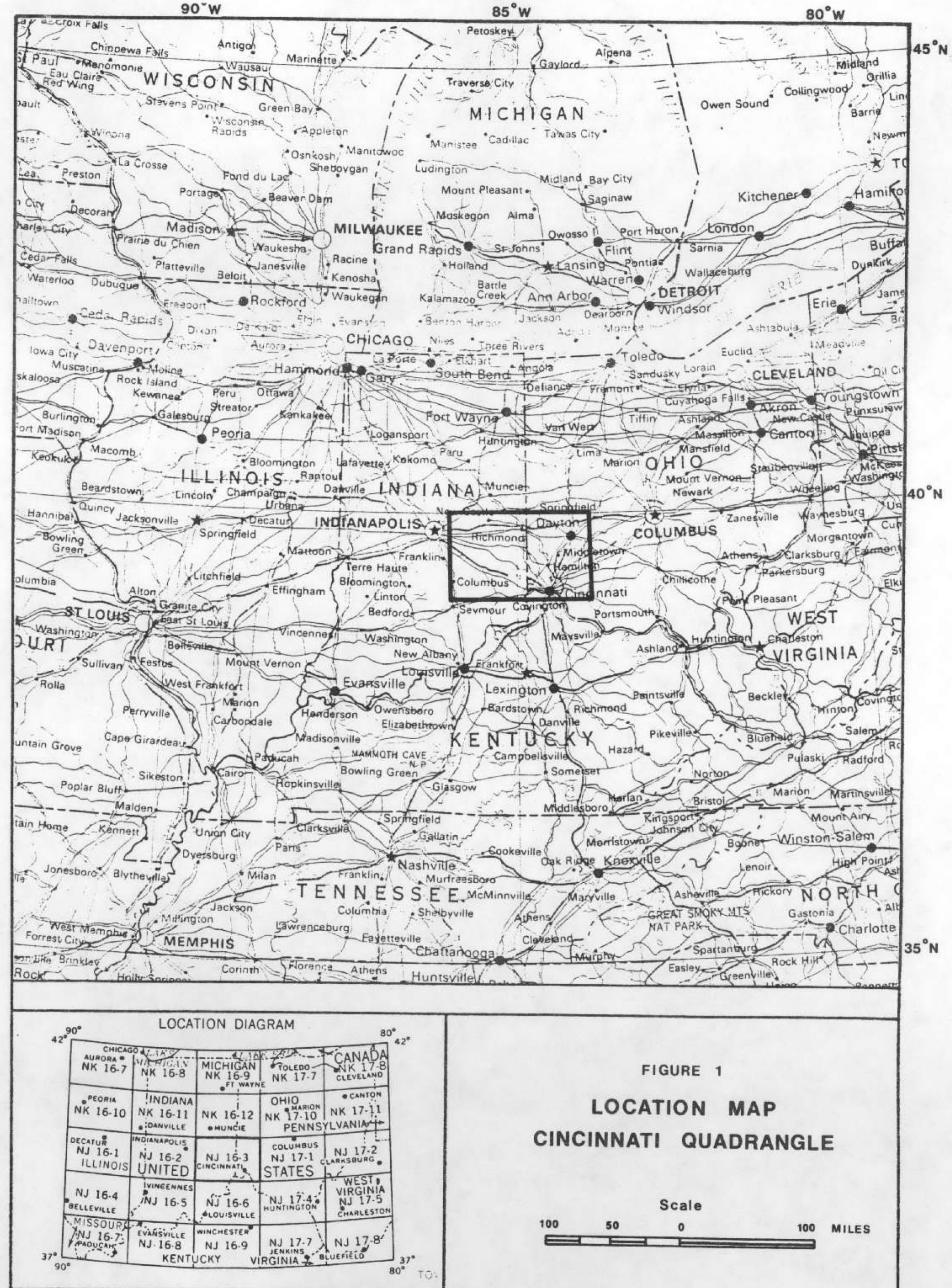


FIGURE 1

LOCATION MAP
CINCINNATI QUADRANGLE

GEOLOGY

Structure

The Cincinnati quadrangle overlies the axis of the Cincinnati Arch, which strikes NNE through the east-central area of the quadrangle (see Figure 2). Sedimentary cover over basement is thinnest in the south-central portion of the quadrangle, where the Paleozoics are approximately 500 feet. Sedimentary material thickens to the southwest toward the Illinois Basin (to over 1700 feet), and to the northeast on the extreme edge of the Michigan Basin (approaching 1000 feet).

No faults disturb surficial units as mapped by Gray and others (1972). Cohee and others (1962) show no structural complexities in the Paleozoics that could be interpreted as faults.

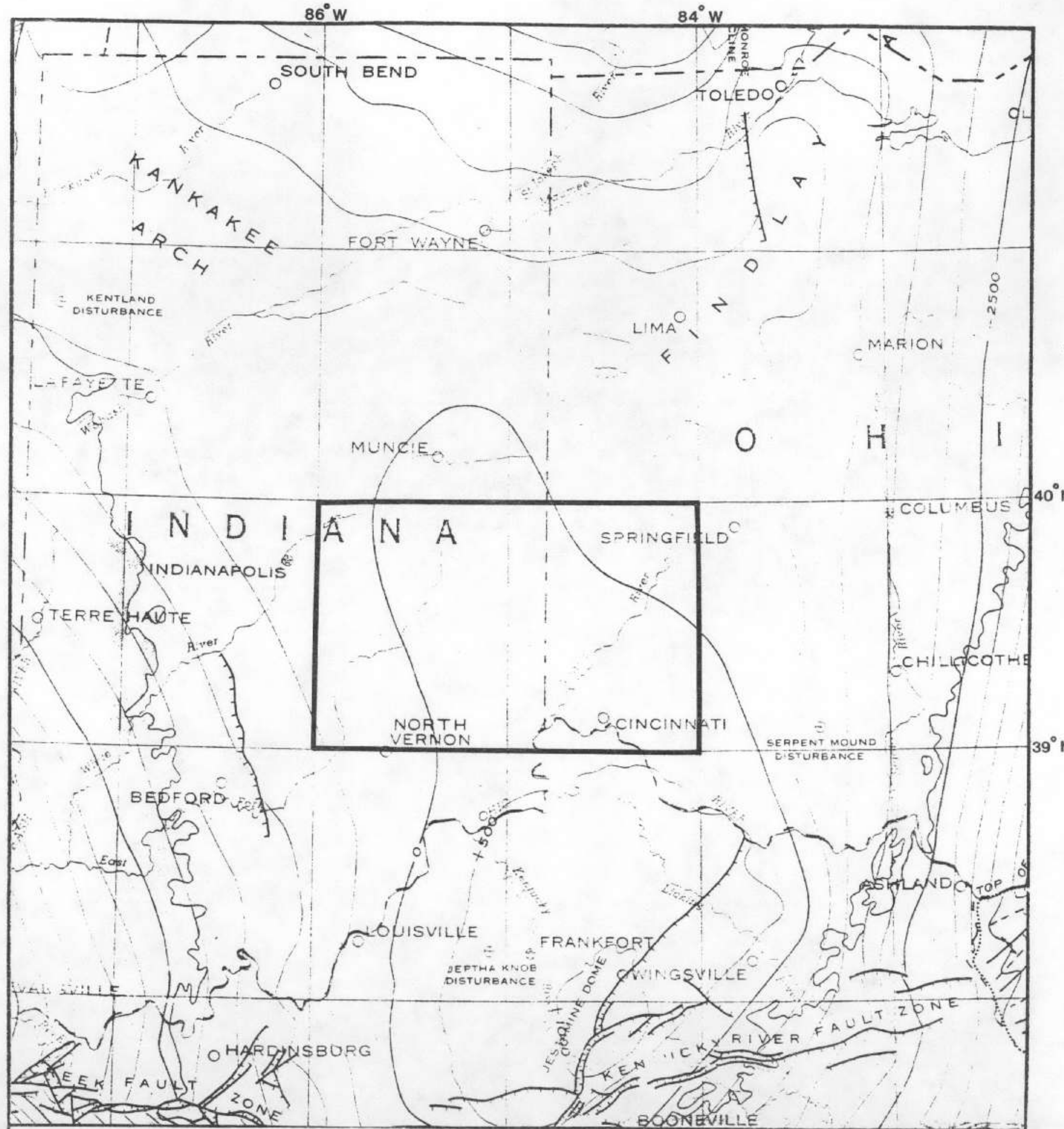
Surface Geology

The primary surface exposures are those of the Pleistocene glacial deposits which cover in excess of 90 percent of the surface. Wisconsinan glacial material alone covers 70 percent, largely in the north and west (the plains regions). The Wisconsinan consists almost entirely of till (93 percent of the Wisconsinan - including kames, eskers, and other stratified drift). Associated outwash deposits cover 6 percent. Local lacustrine deposits account for 1 percent. Small but mappable eolian deposits are scattered throughout the map, covering less than 1 percent of the Wisconsinan surface.

The Illinoian glacial surface covers 20 percent of the quadrangle in an irregular belt along the southern edge. As mapped, the deposits consist largely of till (99 percent), with some lacustrine sediments associated with the drift near the major tributaries.

As mapped by Fremont Geologic Consultants, the Paleozoic crops out over approximately 8 percent of the quadrangle. These outcrops occur in deeply eroded river channels throughout the quadrangle, and in a single large area along the central southern edge (south and west of Cincinnati). In fact much of this large Paleozoic exposure is covered by a thin irregular layer of Kansan glacial debris (Flint, 1959). The contrasts between the Kansan drift and the underlying Paleozoics are not well defined on any available map. This Kansan debris will be largely ignored in this report, but should be kept in the mind of any person using data from this survey.

The Paleozoic exposures as mapped are dominated by the Ordovician, which ranges in lithology from argillaceous limestone to calcareous shale. Small exposures in the river channels range in age from Ordovician to Mississippian, and have a wide range of sedimentary lithologies (mostly limestones and shales). These exposures are narrow and discontinuous.



After
USGS and AAPG
Tectonic Map of the United States
by
Cohee and others (1962)

FIGURE 2

TECTONIC STRUCTURE MAP
CINCINNATI QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

The remaining 2 percent of the quadrangle is mapped as Recent alluvium (with associated colluvial, paludal and lacustrine deposits) in and around the major river channels. These deposits grade downward into the Pleistocene, and are difficult to distinguish in many cases.

It is of some note that the geologic base map and its major reference, though of the same scale, do not register properly. Since the geologic contact lines form the basis for a large portion of the interpretation results, some reservations should be held as to the accuracy of the numerical results by the user.

Uranium

According to available resources, there are no known uranium deposits in the Cincinnati quadrangle.

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 86 groups of uranium (Bi214) samples meet the minimum statistical requirements set forth in the data interpretation section of Appendix A. These are displayed, along with all other anomalous samples and pertinent data, on Figure 3. The anomalies are summarized in a table in Appendix G. The potassium, uranium, thorium, and ratio pseudo-contour maps, which reflect radiometric responses for each quadrangle, are found in Appendix H. Discussion of the abundances of potassium, uranium, and thorium are in terms of apparent equivalent percent and apparent equivalent ppm. These equivalent units are derived from scaling of counts per second by the sensitivities calculated for the detection system and as such cannot be taken as directly determined geochemical values.

Concentrations of potassium, uranium, and thorium are both uniform and low. Uranium has an average concentration of 2.1 ppmeU. Potassium and thorium have average concentrations of 1.1 percent and 5.4 percent respectively. In general, the relative concentrations of these elements remain uniform between exposed glacial and pre-glacial units. Only the post-glacial fluviatile materials appear anomalous, and these concentration values are even lower.

Highest average and peak potassium are found in map unit OK (Ordovician Kope Formation - calcareous shale and argillaceous limestone) at 1.3 and 1.85 percent respectively. Highest average thorium (6.1 ppmeT) occurs in map unit OD (Ordovician Dillsboro Formation - argillaceous limestone and minor calcareous shale). Average uranium reaches 2.3 ppmeU in map unit QM (Wisconsinan end and lateral moraines). Peak uranium and thorium concentrations are highest in map unit QGM (Wisconsinan ground moraines) at 4.14 ppmeU and 8.86 ppmeT respectively. In general, the Quaternary has higher uranium and lower thorium than the Paleozoics. Potassium is highest in the Quaternary and Ordovician. Devonian, Silurian, and upper Ordovician sediments show lower potassium values.

Anomalies can be found throughout the quadrangle, but tend to concentrate in the northeast corner. Peak concentrations in the anomalies range near 3.0 ppmeU, and all are culturally induced (by roads, railroads, etc.). The low uranium concentrations, coupled with the obvious cultural associations, indicate a lack of significant concentrations of naturally-occurring uranium.

Magnetic Data

The structural picture of the Cincinnati quadrangle is one of thin sedimentary units gradually increasing in thickness to the west and northeast.

This picture is, for the most part, duplicated in the magnetic field pseudo-contour map (Appendix H). The central portion of the quadrangle is dominated by relatively high gradients. Wavelengths are longer and have lower amplitudes in the west and northeast. Some isolated structures and linear features suggest lithologic and/or structural complexities in the underlying Precambrian basement.

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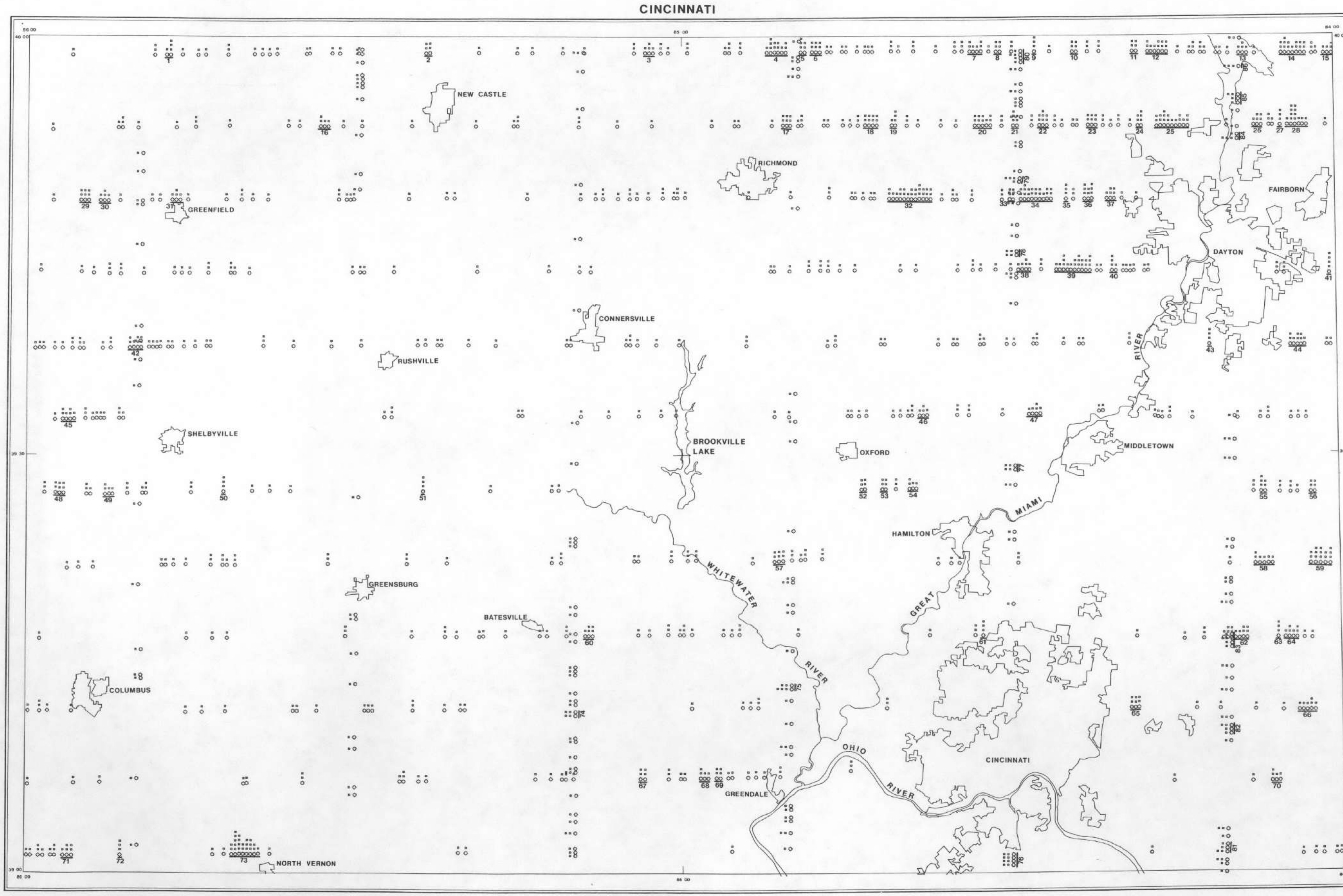

Figure 3 - Uranium Anomaly/Interpretation Map - Cincinnati Quadrangle

URANIUM ANOMALY/ INTERPRETATION MAP

CINCINNATI QUADRANGLE

U.S. DEPARTMENT OF ENERGY

APPROXIMATE SCALE 1:500,000

EXPLANATION

□ - CITY OR TOWN

- URANIUM SAMPLE MEETING FOLLOWING CRITERIA:
  - (1) $1.0 \leq U \leq \infty$
  - (2) $-1.0 \leq T \leq \infty$
  - (3) $1.0 \leq U/T \leq \infty$

  IN STANDARD DEVIATION UNITS.
  EACH SQUARE REPRESENTS 1 STANDARD DEVIATION.

- URANIUM ANOMALY:

  A SINGLE SAMPLE OF 3 OR MORE STANDARD DEVIATIONS OR GROUP OF ADJOINING SAMPLES WHICH TOGETHER TOTAL 4 OR MORE STANDARD DEVIATIONS, $4.0 \leq \text{sum} \leq \infty$, WITH AT LEAST ONE SAMPLE OF 2 OR MORE STANDARD DEVIATIONS.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

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APPENDIX A - Data Acquisition, Processing, and Interpretation Methods

INTRODUCTION

General

Under the U.S. Department of Energy's (DoE), National Uranium Resource Evaluation (NURE) Program, geoMetrics, Inc., conducted a high sensitivity airborne radiometric and magnetic survey. The data collection and processing were conducted under requirements set forth in Bendix Field Engineering Corporation specification 1200-C, dated February, 1979. The objectives of the (DoE)/NURE program, of which this project is a small part, may be summarized as follows:

> "To develop and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States." (DoE)

As an integral part of the DoE/NURE Program, the National Airborne Radiometric Program is designed to provide cost effective, semiquantitative reconnaissance radio element distribution information to aid in the assessment of regional distribution of uraniferous materials within the United States.

All Airborne data collected by geoMetrics during the course of this project were done so utilizing a Beechcraft B65 Queen Air Airplane (U.S. Registry No. N9AG) and a Rockwell Aero Commander (Registry No. N1213B). Both aircraft used 3584 cubic inches of NaI crystal and a high sensitivity proton magnetometer (0.25 gamma).

Each report contains a detailed geologic summary, interpretation report, reduced scale copies of all maps and profiles, histograms, and statistical tables for each quadrangle contained within the project. In addition, each report contains an appendix detailing the survey description, specifications, data collection and processing methods, and interpretation methods.

All data processing, statistical analyses, and interpretation were performed at the geoMetrics computer facility, Sunnyvale, California. After processing, the corrected data were statistically evaluated to define those areas which were radiometrically anomalous relative to other areas within each computer map unit. Standard deviation maps and radiometric and magnetic profile data were first evaluated individually and then integrated into a final interpretation map for each NTMS quadrangle.

Corrected profiles of all radiometric variables (total count, potassium, uranium, thorium, uranium/thorium, uranium/potassium, and thorium /potassium, ratios), magnetic data, radar altimeter data, barometric altimeter data, air temperature, and airborne bismuth contributions are presented as profiles in this report. Single record and averaged data are presented on microfiche in report. These data are given at 1.0 second sample intervals, corrected for Compton Scatter, referenced to 400 foot mean terrain clearance as Standard Temperature and Pressure and corrected for atmospheric bismuth. Digital magnetic tapes are available containing raw spectral data, single record data, magnetic data, and statistical analysis results.

OPERATIONS

PRODUCTION SUMMARY

The production summary presented below describes the general procedures involved in gathering data for the entire project. The detailed daily production summary in Appendix B describes a portion of the total project.

Prior to the start of the survey operations, the airplanes were calibrated at the DoE test pads and Dynamic Test Range (the Queen Air in April 1980, and the Aero Commander in October 1980). Requirements for system calibrations are listed in the 1250-A specifications from BFEC.

Throughout the course of the overall project, the average ground speed maintained by the Queen Air was 140 mph. The Aero Commander averaged 150 mph.

Nearly 100% of the data collected were within the specification limits of 200-700 feet. Several deviations over short distances were required to meet military regulations, FAA safety requirements, and to ensure that livestock were not endangered due to low flying aircraft. A sample altitude statistical distribution is shown in Figure I.

DATA COLLECTION PROCEDURES

Operating Parameters/Sampling Procedures

This survey was conducted using data collection parameters summarized below:

1. Data sampling was performed by a time-base system using 1.0 second sample intervals. All sensor data with analog output were digitally sampled at each scan based upon the clock timing rate of 1.0 seconds. The data so collected are the instantaneous values of the altimeter, temperature, pressure, and magnetometer parameters determined at the time of the data scan, but represent a count time of 1.0 seconds for the gamma ray spectrometer data.

2. The airplanes' objective ground speeds, mentioned previously, were not exceeded unless dictated by safety.

3. The airplane's downward looking crystal volume was 3,072 cubic inches providing an objective V/V (crystal volume in cubic inches divided by ground speed in miles per hour) of 22.0 at 140 m.p.h.

4. The upward looking crystal volume was 512 cubic inches.

FIGURE I

Typical Radar Altimeter Statistical Summary Histogram for Single Flight Line

Navigation/Flight Path Recovery

For all of the quadrangles, profiles were flown east-west at 6 mile (9.6 km) spacing. North-south tie lines were flown at 18 mile (28.8 km) spacing.

Navigation was accomplished using visual navigation techniques. Flight lines were drawn on 1:250,000 quadrangles and the pilot/navigator utilized these maps to provide visual navigation features.

Simultaneously, a 35 mm tracking camera was used to record actual flight position. This camera's fiducial numbering system was directly synchronized to the digital recording system such that a one-to-one correlation between position and data could be made. Upon completion of a data collection flight, the 35 mm film was processed and actual flight path positions located on the appropriate scale map sheets.

Infield System Calibration

Due to the complex nature of both the system and the required data interpretation, much emphasis was placed on infield calibration of the data collection system. The objective of this calibration was to ensure continuous high quality of the data collected. The daily calibration procedures used are summarized below:

A. Pre Flight

1. Use cesium sources (same positioning on crystals every day), peak each Photomultiplier tube/crystal using the digital split-window detector of the GR-800. Then using thallium sources, repeat the tuning of the individual crystals.

2. Run full cesium spectrum on analog recorder for both down and up looking crystals. Calculate the cesium resolution (see sample in Figure II). Run spectrum out past the K40 peak on down crystals for evaluation of system tuning.

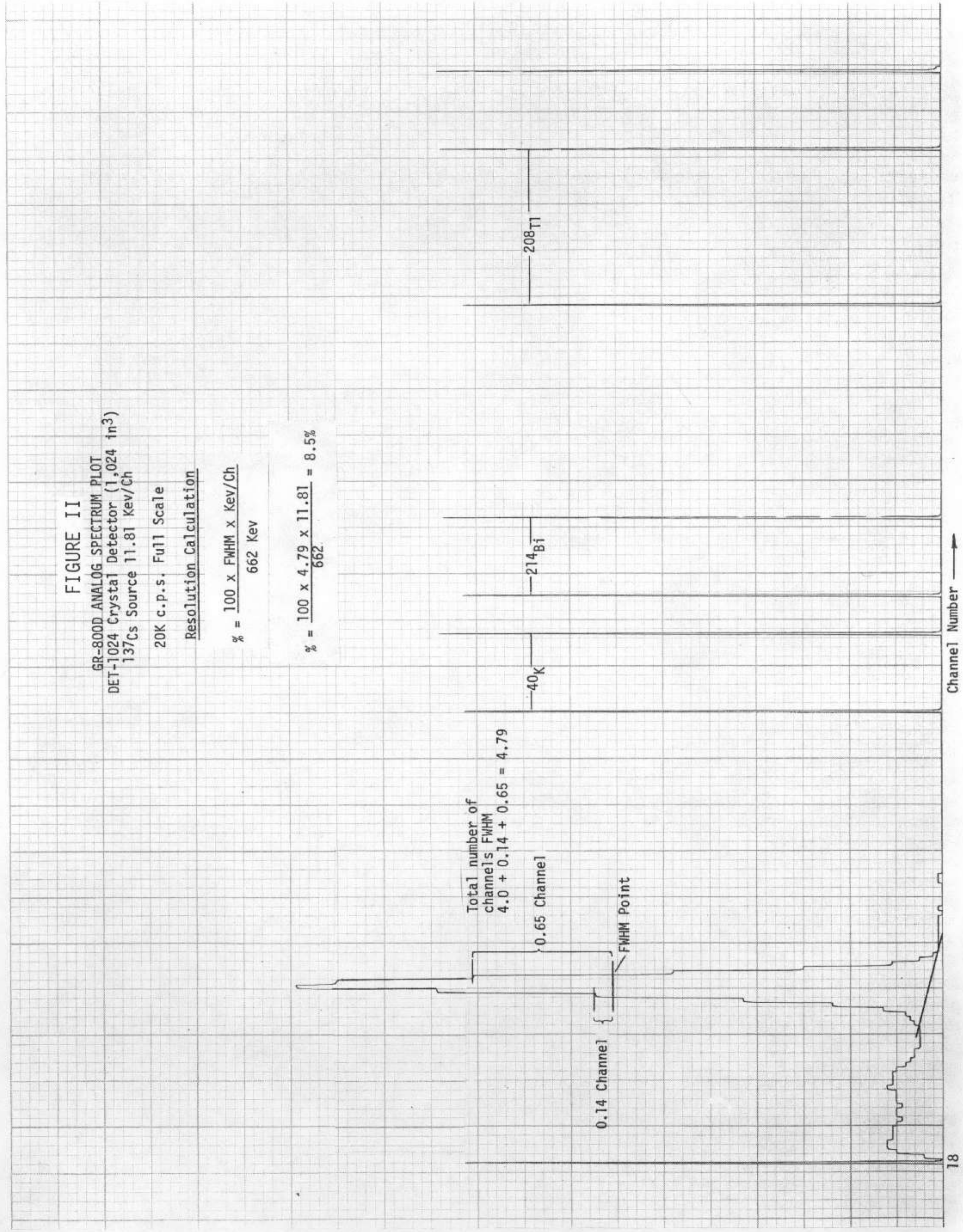
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.

4. Repeat 1-3 until system is within contract specifications.

B. During Flight

1. Fly test line at survey altitude (400 ft), for approximately five miles, prior to production data collection (record both analog and digital).

2. Prior to production data collection, the above data are evaluated to ensure ±20% limits on total count compared to average of all test flights from that base of operations.



3. During production data collection, monitor radon analog data for unusual increases. Visually correlate these with temperature and barometric pressure.

4. Upon completion of production data collection, refly test line at survey altitude (400 ft). Record both analog and digital.

C. Post Flight

1. Verify test line total count within 20% of average for all test lines at that base of operations.

2. Using cesium sources (same position as pre-flight), run full cesium spectrum for both down and up crystals (allow it to record through the K40 peak in the down crystals). Repeat the procedure using thallium sources and examine the Tl208 window.

3. Calculate the resolution of down and up crystal pack.

4. Determine shift, if any, in Tl208 peak position.

Field Digital Data Verification

At the completion of each flight, the raw digital data tapes were checked for data quality and completeness on geoMetrics' G-725. The G-725 system is a totally portable mini computer (and peripherals) consisting of; an Interdata 516, two 9 track tape drives, a CRT, a line printer, and two floppy discs. Any digital problems encountered were immediately evaluated by the electronics operator and data man, thus assuring optimum data quality. In addition, histogram information for each measured variable was generated. Thus a summary display of altitude, etc., is available for immediate evaluation.

DATA COLLECTION SYSTEM

AIRCRAFT

Two aircraft were used for this survey: (1) a Beechcraft Queen Air - Model 65 (U.S. Reg. No. N9AG), and (2) a Rockwell Aero Commander 680F (U.S. Reg. No. N1213B). Both these aircraft, being medium size with twin engines, possess overall performance and safety features which make them ideal for low level, fixed-wing airborne geophysical surveys in areas of up to moderately high topographic relief. They can carry adequate payloads at low constant airspeeds, while maintaining economy and a wide envelope of safety. Performance data for the two craft in their present survey configuration are given below.

	QUEEN AIR	AERO COMMANDER
Maximum Aircraft Gross Weight	7,700 lbs.	8,500 lbs.
Aircraft Empty (dry)	4,640 lbs.	5,200 lbs.
Max. useful load including fuel	3,060 lbs.	3,300 lbs
Geophysical Package	1,110 lbs.	1,110 lbs.
Navigation Equipment	125 lbs.	125 lbs.
Fuel Tanks Full	528 lbs.	1,338 lbs
Pilot & Electronics Operator	350 lbs.	350 lbs.
Total	2,113 lbs.	2,923 lbs.
Min. Control Speed at G.W. (IAS)	95 mph	NG
Safe Single Eng. Speed @ G.W. (IAS)	105 mph	NG
Rate of Climb 2 engines @ gross (FPM)	1,300	1,500
Rate of climb 1 engine @ gross (FPM)	210	250
Avgas consumption (ga/hr) at 75% power	36	38
Endurance (75% power)	6 hrs/6 mins.	5 hrs/30 mins.
Range (75% power - 45 min. reserve)	1,200 miles	1,100 miles

Cruise Configuration stalling speed at gross weight (IAS)

	QUEEN AIR	AERO COMMANDER
0° bank	80 mph	80 mph
45° bank	95 mph	NG

Electronics

The major components of the airborne data collection system are summarized below (shown schematically in Figure III):

1. Gamma Ray Spectrometer, geoMetrics GR-800, utilizing a dual 256 channel capability to provide spectral data in the 0.4 to 3.0 MeV range for both the downward looking and the upward looking crystal packages and coverage in the 3.0 to 6.0 MeV range for cosmic background.

2. Crystal Detector, geoMetrics Model DET-3072/512R consisting of 3072 cubic inches in the downward looking configuration and 512 cubic inches appropriately shielded in an upward looking configuration.

3. A geoMetrics Digital Data Acquisition System, Model G-714 with "read-after-write" data verification, recording the following on magnetic tape:

   a. 512 channels of gamma ray spectrometer data

   b. Total magnetic intensity

   c. Fiducial number from data system/camera

   d. Manually inserted information, i.e. date, survey area, and flight line number

   e. Altitude from radar altimeter and barometric altimeter (by analog-to-digital conversion)

   f. Time in days, hours, minutes and seconds

   g. Outside air temperature

4. Magnetometer, geoMetrics Airborne Model G-803, capable of 0.125 gamma sensitivity, but operated at 0.25 gamma sensitivity.

5. Radar Altimeter, Bonzer Model Mark 10 with recording output and display operating over an altitude range of 0 to 2,500 feet.

6. Rosemont Barometric Altimeter with recording output and display.

7. Recording Thermometer for monitoring outside air temperature.

8. Tracking Camera. Automax 35 mm framing camera with wide angle lens and 10 character fiducial/line number display to provide flight path recovery data.

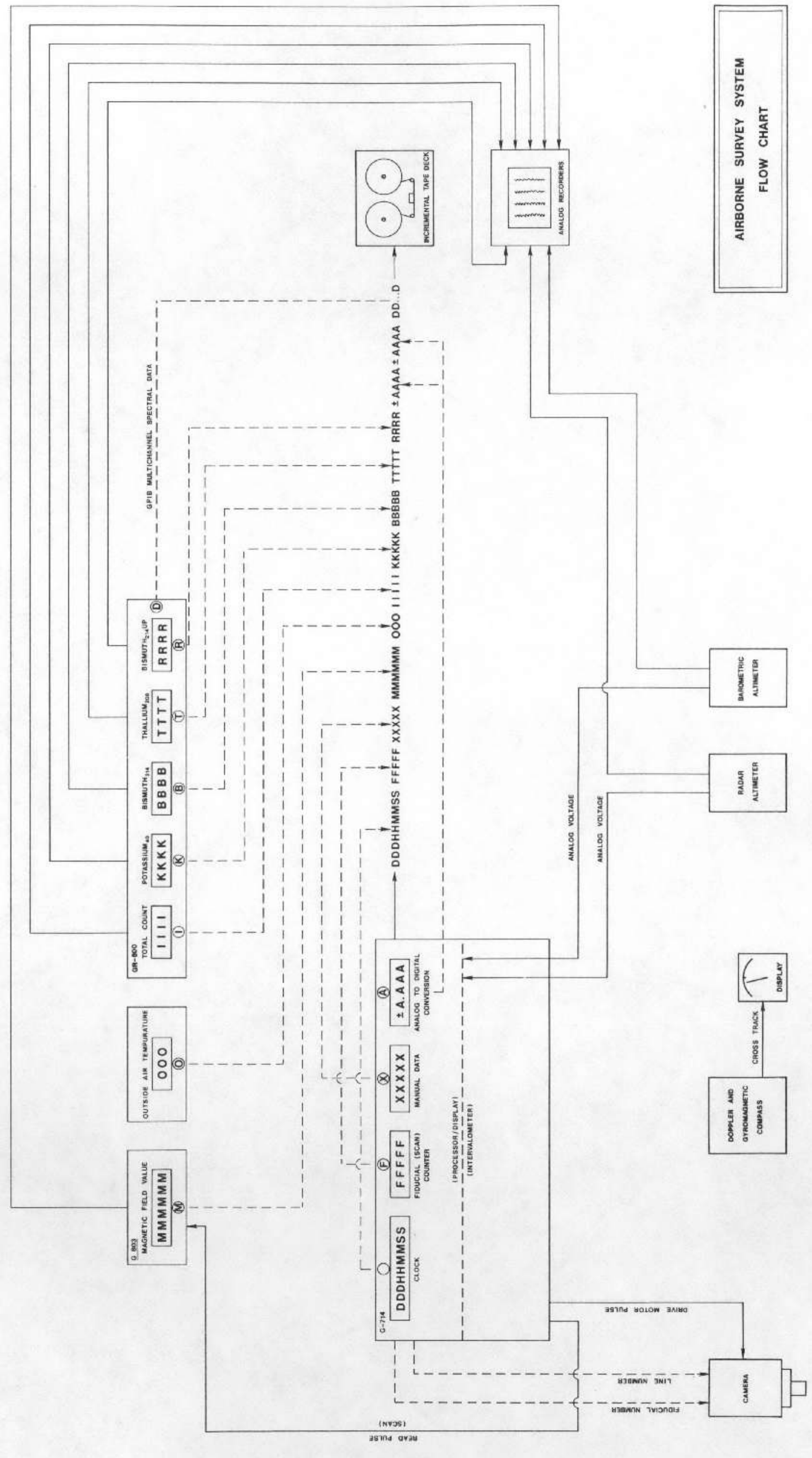


FIGURE III

9. Analog Recorder geoMetrics (MARS 6)to record the following data:

   a. Bi214 using a window about the 1.76 MeV peak from the downward looking system.

   b. Bi air background from the upward looking system.

   c. Magnetometer

   d. Radar Altitude

   e. Total count for downward looking system (0.4 to 3.0 MeV)

   f. Barometric Altitude

   g. Time markers

10. HP 7155 single channel analog recorder during pre and post flight calibrations, this recorder is used to plot a full analog spectra for both the down and up crystal systems via the GR-800. Thus, a hard copy record of the data used for resolution, drift, etc., checks are available at all times. This approach provides instant verification of system parameters (refer to Figure II).

SYSTEM CALIBRATION

AIRCRAFT AND COSMIC BACKGROUND

Full spectral data are collected at five (5) altitudes over water (14,000 feet, 12,000 feet; 10,000 feet; 8,000 feet and 6,000 feet) in an area where the existence of no airborne Bi214 can be assured (off shore over the Pacific Ocean). This results in separate spectra as shown schematically in Figure 10. We define S(12,000) to be the spectra at 12,000 feet from 0.4 MeV to 3.0 MeV with S(8,000) the same spectra at a lower altitude (8,000) and $C_i(h)$ the total count between 3.0 and 6.0 MeV at respective altitudes.[1] Since the aircraft background is constant, the difference between any two altitudes separated sufficiently - typically, 2,000 feet - yields the cosmic spectral curve shape as shown schematically in Figure VI. Thus

$$S(12{,}000) - S(8{,}000) = \Delta S$$

and

$$\Sigma C_{12}(h_i) - \Sigma C_8(h_i) = \Delta C$$

This cosmic spectral curve is scaled back to 12,000 feet as follows:

$$\frac{C_{12}(h_i)}{\Delta C} \times \Delta S = \Delta C\ (12{,}000)$$ the Cosmic Spectrum (shape and magnitude at 12,000 feet)

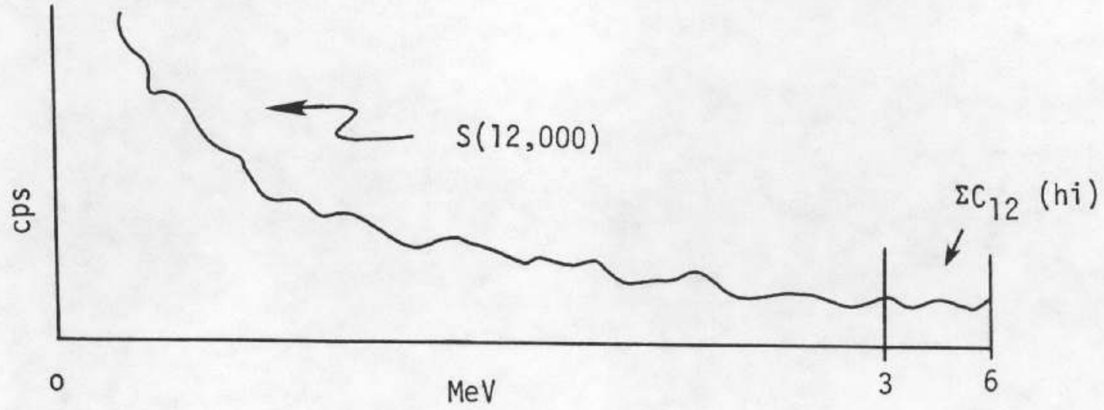
The aircraft background is derived as follows:

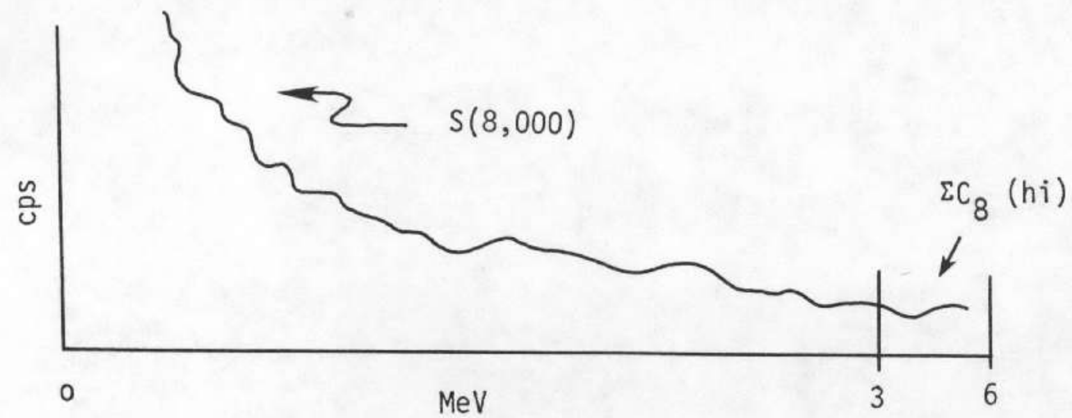
$$S(12{,}000) - C(12{,}000) = \text{A/C Background}$$

Since data were collected at five altitudes, this procedure was repeated for each combination of altitudes and results averaged. Typical aircraft and cosmic spectra are shown in Figures V, AND VI respectively.

SYSTEM CONSTANTS

System constants were determined by occupation of the DoE Walker Field Test Pads. (See Ward, 1978, and Stromswold, 1978, for complete descriptions of the building and monitoring of the pads). The five test pads contained varying concentrations of K, U, and T as presented by BFEC:





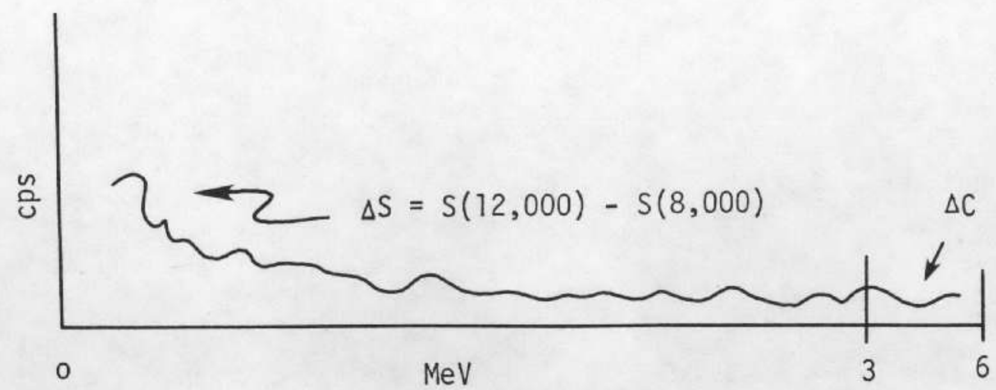


FIGURE IV - Multiple altitude spectra schematic

PAD	K	U	T
Matrix	1.45%	2.19 ppm	6.26 ppm
K	5.14%	5.09 ppm	8.48 ppm
U	2.03%	30.29 ppm	9.19 ppm
T	2.01%	5.14 ppm	45.33 ppm
Mixed	4.11%	20.39 ppm	17.52 ppm

Since the measurements were taken over a relatively short time period (a few hours), it was assumed that the matrix pad measurements contain not only the effects of the matrix pad itself, but also aircraft background (which is a constant), cosmic background (constant over the time period of interest), and all other local background (e.g. BiAir, etc.) effects. (The matrix pad is constructed with only the basic concrete mix without the additional elemental minerals). Thus, by subtracting the matrix pad count rates from the count rates in the four pads, we have eliminated aircraft and cosmic background and BiAir effects for the four pads. The pad concentrations are then modified in a similar fashion by the subtraction of the matrix pad concentrations. The differential concentrations in the pads are given in the table below.

PAD	K	U	T
K-Matrix	3.7%	2.9 ppm	2.2 ppm
U-Matrix	0.6%	28.5 ppm	2.9 ppm
T-Matrix	0.6%	3.0 ppm	39.0 ppm
Mixed-Matrix	2.7%	18.8 ppm	11.3 ppm

Considering the above, we can define a functional relationship between the differential concentrations and the residual count rates which will provide a method of determining the calibration constants for the spectrometer system. These calibration constants are the six (6) stripping coefficients which account for the interactions occuring between the elemental channels in the system (Compton scatter coefficients, etc.).

On the basis of an ideal situation, one would anticipate that some of these interactions should be negligible. This is not totally the case, since we are dealing with a system which has less than infinite resolving power (i.e. the energies are smeared to some extent).

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DERIVED AIRCRAFT BACKGROUND SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE AC BGD, DATED 072577

TC (0-6 MEV)  184.07 TC (0.4-3.0 MEV)  141.17 COSMIC (3-6 MEV)     0.00
U (1.12 MEV)     9.91 K (1.46 MEV)   14.54 U (1.76 MEV)     4.36 T (2.62 MEV)     4.29

CH   0 (0.000 MEV)   0.000 CPS *
CH   1 (0.012 MEV)   0.000 CPS *
CH   2 (0.024 MEV)   0.000 CPS *
CH   3 (0.035 MEV)   0.000 CPS *
CH   4 (0.047 MEV)   0.000 CPS *
CH   5 (0.059 MEV)   0.000 CPS *
CH   6 (0.071 MEV)   0.000 CPS *
CH   7 (0.083 MEV)   0.000 CPS *
CH   8 (0.095 MEV)   0.000 CPS *
CH   9 (0.106 MEV)   0.000 CPS *
CH  10 (0.118 MEV)   0.000 CPS *
CH  11 (0.130 MEV)   0.000 CPS *
CH  12 (0.142 MEV)   0.000 CPS *
CH  13 (0.154 MEV)   0.000 CPS *
CH  14 (0.165 MEV)   0.000 CPS *
CH  15 (0.177 MEV)   0.000 CPS *
CH  16 (0.189 MEV)   0.000 CPS *
CH  17 (0.201 MEV)   0.000 CPS *
CH  18 (0.213 MEV)  -0.025 CPS *
CH  19 (0.225 MEV)  -0.020 CPS *
CH  20 (0.236 MEV)   0.080 CPS *
CH  21 (0.248 MEV)   1.401 CPS *****
CH  22 (0.260 MEV)   3.792 CPS *************
CH  23 (0.272 MEV)   4.280 CPS ***************
CH  24 (0.284 MEV)   4.334 CPS ***************
CH  25 (0.295 MEV)   3.748 CPS *************
CH  26 (0.307 MEV)   3.897 CPS **************
CH  27 (0.319 MEV)   3.818 CPS *************
CH  28 (0.331 MEV)   4.236 CPS ***************
CH  29 (0.343 MEV)   3.433 CPS ************
CH  30 (0.355 MEV)   2.996 CPS ***********
CH  31 (0.366 MEV)   2.559 CPS **********
CH  32 (0.378 MEV)   2.269 CPS *********
CH  33 (0.390 MEV)   2.102 CPS ********
CH  34 (0.402 MEV)   2.081 CPS ******** TOTAL COUNT
CH  35 (0.414 MEV)   2.121 CPS ********
CH  36 (0.426 MEV)   2.114 CPS ********
CH  37 (0.437 MEV)   1.976 CPS *******
CH  38 (0.449 MEV)   2.290 CPS *********
CH  39 (0.461 MEV)   2.188 CPS ********
CH  40 (0.473 MEV)   2.226 CPS ********
CH  41 (0.485 MEV)   1.983 CPS *******
CH  42 (0.496 MEV)   2.165 CPS ********
CH  43 (0.508 MEV)   2.158 CPS ********
CH  44 (0.520 MEV)   2.267 CPS *********
CH  45 (0.532 MEV)   2.217 CPS ********
CH  46 (0.544 MEV)   1.997 CPS *******
CH  47 (0.556 MEV)   2.447 CPS *********
CH  48 (0.567 MEV)   2.540 CPS **********
CH  49 (0.579 MEV)   2.586 CPS **********
CH  50 (0.591 MEV)   2.708 CPS **********
CH  51 (0.603 MEV)   2.481 CPS *********
CH  52 (0.615 MEV)   2.372 CPS *********
CH  53 (0.626 MEV)   1.866 CPS *******
CH  54 (0.638 MEV)   1.682 CPS ******
CH  55 (0.650 MEV)   1.661 CPS ******
CH  56 (0.662 MEV)   1.480 CPS *****
CH  57 (0.674 MEV)   1.474 CPS *****
CH  58 (0.686 MEV)   1.447 CPS *****
CH  59 (0.697 MEV)   1.431 CPS *****
CH  60 (0.709 MEV)   1.476 CPS *****
CH  61 (0.721 MEV)   1.453 CPS *****
CH  62 (0.733 MEV)   1.467 CPS *****
CH  63 (0.745 MEV)   1.579 CPS ******
CH  64 (0.756 MEV)   1.497 CPS *****
CH  65 (0.768 MEV)   1.548 CPS ******
CH  66 (0.780 MEV)   1.421 CPS *****
CH  67 (0.792 MEV)   1.282 CPS *****
CH  68 (0.804 MEV)   1.155 CPS ****
CH  69 (0.816 MEV)   1.246 CPS *****
CH  70 (0.827 MEV)   1.245 CPS *****
CH  71 (0.839 MEV)   1.161 CPS ****
CH  72 (0.851 MEV)   1.253 CPS *****
CH  73 (0.863 MEV)   1.231 CPS *****
CH  74 (0.875 MEV)   1.425 CPS *****
CH  75 (0.887 MEV)   1.452 CPS *****
CH  76 (0.898 MEV)   1.543 CPS ******
CH  77 (0.910 MEV)   1.444 CPS *****
CH  78 (0.922 MEV)   1.364 CPS *****
CH  79 (0.934 MEV)   1.289 CPS *****
CH  80 (0.946 MEV)   1.150 CPS ****
CH  81 (0.957 MEV)   1.144 CPS ****
CH  82 (0.969 MEV)   1.085 CPS ****
CH  83 (0.981 MEV)   1.061 CPS ****
CH  84 (0.993 MEV)   0.941 CPS ****
CH  85 (1.005 MEV)   0.919 CPS ****
CH  86 (1.017 MEV)   0.822 CPS ***
CH  87 (1.028 MEV)   0.816 CPS ***
CH  88 (1.040 MEV)   0.853 CPS ****
CH  89 (1.052 MEV)   0.901 CPS **** BISMUTH 214
CH  90 (1.064 MEV)   0.822 CPS ***
CH  91 (1.076 MEV)   0.867 CPS ****
CH  92 (1.087 MEV)   0.968 CPS ****
CH  93 (1.099 MEV)   0.851 CPS ****
CH  94 (1.111 MEV)   0.905 CPS ****
CH  95 (1.123 MEV)   0.847 CPS ****
CH  96 (1.135 MEV)   0.861 CPS ****
CH  97 (1.147 MEV)   0.800 CPS ***
CH  98 (1.158 MEV)   0.727 CPS ***
CH  99 (1.170 MEV)   0.751 CPS ***
CH 100 (1.182 MEV)   0.607 CPS *** BISMUTH 214
CH 101 (1.194 MEV)   0.663 CPS ***
CH 102 (1.206 MEV)   0.657 CPS ***
CH 103 (1.217 MEV)   0.633 CPS ***
CH 104 (1.229 MEV)   0.719 CPS ***
CH 105 (1.241 MEV)   0.671 CPS ***
CH 106 (1.253 MEV)   0.475 CPS **
CH 107 (1.265 MEV)   0.601 CPS ***
CH 108 (1.277 MEV)   0.661 CPS ***
CH 109 (1.288 MEV)   0.669 CPS ***
CH 110 (1.300 MEV)   0.606 CPS ***
CH 111 (1.312 MEV)   0.630 CPS ***
CH 112 (1.324 MEV)   0.652 CPS ***
CH 113 (1.336 MEV)   0.644 CPS ***
CH 114 (1.347 MEV)   0.652 CPS ***
CH 115 (1.359 MEV)   0.791 CPS ***
CH 116 (1.371 MEV)   0.787 CPS *** POTASSIUM 40
CH 117 (1.383 MEV)   0.834 CPS ****
CH 118 (1.395 MEV)   0.984 CPS ****
CH 119 (1.407 MEV)   1.072 CPS ****
CH 120 (1.418 MEV)   1.124 CPS ****
CH 121 (1.430 MEV)   1.088 CPS ****
CH 122 (1.442 MEV)   1.210 CPS *****
CH 123 (1.454 MEV)   1.231 CPS *****
CH 124 (1.466 MEV)   1.207 CPS *****
CH 125 (1.477 MEV)   0.995 CPS ****
CH 126 (1.489 MEV)   0.967 CPS ****
CH 127 (1.501 MEV)   0.624 CPS ***
CH 128 (1.513 MEV)   0.635 CPS ***
CH 129 (1.525 MEV)   0.512 CPS ***
CH 130 (1.537 MEV)   0.488 CPS **
CH 131 (1.548 MEV)   0.409 CPS **
CH 132 (1.560 MEV)   0.369 CPS ** POTASSIUM 40
CH 133 (1.572 MEV)   0.339 CPS **
CH 134 (1.584 MEV)   0.438 CPS **
CH 135 (1.596 MEV)   0.310 CPS **
CH 136 (1.608 MEV)   0.259 CPS **
CH 137 (1.619 MEV)   0.250 CPS **
CH 138 (1.631 MEV)   0.353 CPS **
CH 139 (1.643 MEV)   0.323 CPS **
CH 140 (1.655 MEV)   0.332 CPS **
CH 141 (1.667 MEV)   0.326 CPS ** BISMUTH 214
CH 142 (1.678 MEV)   0.267 CPS **
CH 143 (1.690 MEV)   0.275 CPS **
CH 144 (1.702 MEV)   0.245 CPS **
CH 145 (1.714 MEV)   0.347 CPS **
CH 146 (1.726 MEV)   0.352 CPS **
CH 147 (1.738 MEV)   0.293 CPS **
CH 148 (1.749 MEV)   0.359 CPS **
CH 149 (1.761 MEV)   0.270 CPS **
CH 150 (1.773 MEV)   0.334 CPS **
CH 151 (1.785 MEV)   0.245 CPS **
CH 152 (1.797 MEV)   0.255 CPS **
CH 153 (1.808 MEV)   0.174 CPS **
CH 154 (1.820 MEV)   0.228 CPS **
CH 155 (1.832 MEV)   0.188 CPS **
CH 156 (1.844 MEV)   0.115 CPS *
CH 157 (1.856 MEV)   0.084 CPS * BISMUTH 214
CH 158 (1.868 MEV)   0.147 CPS *
CH 159 (1.879 MEV)   0.147 CPS *
CH 160 (1.891 MEV)   0.139 CPS *
CH 161 (1.903 MEV)   0.109 CPS *
CH 162 (1.915 MEV)   0.091 CPS *
CH 163 (1.927 MEV)   0.151 CPS *
CH 164 (1.938 MEV)   0.088 CPS *
CH 165 (1.950 MEV)   0.136 CPS *
CH 166 (1.962 MEV)   0.157 CPS *
CH 167 (1.974 MEV)   0.119 CPS *
CH 168 (1.986 MEV)   0.109 CPS *
CH 169 (1.998 MEV)   0.113 CPS *
CH 170 (2.009 MEV)   0.106 CPS *
CH 171 (2.021 MEV)   0.147 CPS *
CH 172 (2.033 MEV)   0.137 CPS *
CH 173 (2.045 MEV)   0.171 CPS **
CH 174 (2.057 MEV)   0.154 CPS *
CH 175 (2.068 MEV)   0.108 CPS *
CH 176 (2.080 MEV)   0.162 CPS *
CH 177 (2.092 MEV)   0.104 CPS *
CH 178 (2.104 MEV)   0.138 CPS *
CH 179 (2.116 MEV)   0.137 CPS *
CH 180 (2.128 MEV)   0.119 CPS *
CH 181 (2.139 MEV)   0.169 CPS **
CH 182 (2.151 MEV)   0.148 CPS *
CH 183 (2.163 MEV)   0.101 CPS *
CH 184 (2.175 MEV)   0.114 CPS *
CH 185 (2.187 MEV)   0.088 CPS *
CH 186 (2.199 MEV)   0.101 CPS *
CH 187 (2.210 MEV)   0.085 CPS *
CH 188 (2.222 MEV)   0.130 CPS *
CH 189 (2.234 MEV)   0.117 CPS *
CH 190 (2.246 MEV)   0.113 CPS *
CH 191 (2.258 MEV)   0.116 CPS *
CH 192 (2.269 MEV)   0.088 CPS *
CH 193 (2.281 MEV)   0.097 CPS *
CH 194 (2.293 MEV)   0.095 CPS *
CH 195 (2.305 MEV)   0.087 CPS *
CH 196 (2.317 MEV)   0.059 CPS *
CH 197 (2.329 MEV)   0.015 CPS *
CH 198 (2.340 MEV)   0.041 CPS *
CH 199 (2.352 MEV)   0.070 CPS *
CH 200 (2.364 MEV)   0.087 CPS *
CH 201 (2.376 MEV)   0.085 CPS *
CH 202 (2.388 MEV)   0.084 CPS *
CH 203 (2.399 MEV)   0.064 CPS *
CH 204 (2.411 MEV)   0.123 CPS * THALLIUM 208
CH 205 (2.423 MEV)   0.076 CPS *
CH 206 (2.435 MEV)   0.116 CPS *
CH 207 (2.447 MEV)   0.147 CPS *
CH 208 (2.459 MEV)   0.108 CPS *
CH 209 (2.470 MEV)   0.120 CPS *
CH 210 (2.482 MEV)   0.092 CPS *
CH 211 (2.494 MEV)   0.127 CPS *
CH 212 (2.506 MEV)   0.169 CPS **
CH 213 (2.518 MEV)   0.206 CPS **
CH 214 (2.529 MEV)   0.262 CPS **
CH 215 (2.541 MEV)   0.184 CPS **
CH 216 (2.553 MEV)   0.206 CPS **
CH 217 (2.565 MEV)   0.195 CPS **
CH 218 (2.577 MEV)   0.173 CPS **
CH 219 (2.589 MEV)   0.201 CPS **
CH 220 (2.600 MEV)   0.329 CPS **
CH 221 (2.612 MEV)   0.232 CPS **
CH 222 (2.624 MEV)   0.187 CPS **
CH 223 (2.636 MEV)   0.171 CPS **
CH 224 (2.648 MEV)   0.177 CPS **
CH 225 (2.660 MEV)   0.089 CPS *
CH 226 (2.671 MEV)   0.122 CPS *
CH 227 (2.683 MEV)   0.124 CPS *
CH 228 (2.695 MEV)   0.131 CPS *
CH 229 (2.707 MEV)   0.090 CPS *
CH 230 (2.719 MEV)   0.027 CPS *
CH 231 (2.730 MEV)   0.012 CPS *
CH 232 (2.742 MEV)  -0.026 CPS *
CH 233 (2.754 MEV)  -0.024 CPS *
CH 234 (2.766 MEV)   0.038 CPS *
CH 235 (2.778 MEV)   0.003 CPS *
CH 236 (2.790 MEV)   0.060 CPS *
CH 237 (2.801 MEV)   0.038 CPS * THALLIUM 208
CH 238 (2.813 MEV)   0.023 CPS *
CH 239 (2.825 MEV)   0.008 CPS *
CH 240 (2.837 MEV)   0.078 CPS *
CH 241 (2.849 MEV)   0.027 CPS *
CH 242 (2.860 MEV)   0.047 CPS *
CH 243 (2.872 MEV)   0.039 CPS *
CH 244 (2.884 MEV)   0.084 CPS *
CH 245 (2.896 MEV)   0.025 CPS *
CH 246 (2.908 MEV)   0.025 CPS *
CH 247 (2.920 MEV)  -0.015 CPS *
CH 248 (2.931 MEV)   0.037 CPS *
CH 249 (2.943 MEV)  -0.005 CPS *
CH 250 (2.955 MEV)   0.042 CPS *
CH 251 (2.967 MEV)   0.002 CPS *
CH 252 (2.979 MEV)  -0.018 CPS *
CH 253 (2.990 MEV)   0.031 CPS *
CH 254 (3.002 MEV)  -0.106 CPS * TOTAL COUNT
CH 255 (3.014 MEV)   0.000 CPS *
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AIRCRAFT BACKGROUND
ROTARY WING AIRCRAFT
DOWNWARD LOOKING CRYSTAL
2048 CUBIC INCHES
DATE: 25 JULY 1977

FIGURE V

DERIVED COSMIC SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE COSMIC, DATED 072577

TC (0-6 MEV) 5275.09 TC (0.4-3.0 MEV) 3245.27 COSMIC (3-6 MEV) 1000.00
U (1.12 MEV) 165.91 K (1.46 MEV) 181.83 U (1.76 MEV) 157.56 T (2.62 MEV) 213.66

COSMIC SPECTRUM
ROTARY WING AIRCRAFT
DOWNWARD LOOKING CRYSTAL
2048 CUBIC INCHES
DATE: 25 JULY 1977

CH	MEV	CPS	
0	0.000	0.000	
1	0.012	0.000	
2	0.024	0.000	
3	0.035	0.000	
4	0.047	0.000	
5	0.059	0.000	
6	0.071	0.000	
7	0.083	0.000	
8	0.095	0.000	
9	0.106	0.000	
10	0.118	0.000	
11	0.130	0.000	
12	0.142	0.000	
13	0.154	0.000	
14	0.165	0.000	
15	0.177	0.000	
16	0.189	0.000	
17	0.201	0.000	
18	0.213	1.091	
19	0.225	1.313	
20	0.236	2.226	
21	0.248	26.345	
22	0.260	89.243	
23	0.272	100.516	
24	0.284	103.036	
25	0.295	94.423	
26	0.307	88.893	
27	0.319	85.032	
28	0.331	80.528	
29	0.343	78.271	
30	0.355	72.498	
31	0.366	74.934	
32	0.378	65.560	
33	0.390	65.966	
34	0.402	63.189	TOTAL COUNT
35	0.414	62.880	
36	0.426	64.078	
37	0.437	67.602	
38	0.449	69.116	
39	0.461	76.972	
40	0.473	84.879	
41	0.485	96.049	
42	0.496	94.167	
43	0.508	86.706	
44	0.520	68.016	
45	0.532	48.444	
46	0.544	40.965	
47	0.556	30.512	
48	0.567	33.160	
49	0.579	31.892	
50	0.591	25.907	
51	0.603	30.781	
52	0.615	27.055	
53	0.626	27.982	
54	0.638	25.776	
55	0.650	22.988	
56	0.662	27.787	
57	0.674	25.274	
58	0.686	25.240	
59	0.697	23.489	
60	0.709	24.769	
61	0.721	22.350	
62	0.733	22.242	
63	0.745	22.424	
64	0.756	22.234	
65	0.768	20.332	
66	0.780	18.821	
67	0.792	20.493	
68	0.804	19.339	
69	0.816	19.021	
70	0.827	17.949	
71	0.839	20.235	
72	0.851	17.491	
73	0.863	18.370	
74	0.875	16.244	
75	0.887	16.331	
76	0.898	17.519	
77	0.910	16.689	
78	0.922	17.150	
79	0.934	19.230	
80	0.946	17.111	
81	0.957	16.248	
82	0.969	14.954	
83	0.981	17.324	
84	0.993	16.276	
85	1.005	14.813	
86	1.017	15.703	
87	1.028	13.767	
88	1.040	16.414	
89	1.052	13.642	BISMUTH 214
90	1.064	13.624	
91	1.076	13.517	
92	1.087	13.700	
93	1.099	14.633	
94	1.111	14.303	
95	1.123	13.766	
96	1.135	14.949	
97	1.147	13.503	
98	1.158	13.481	
99	1.170	13.189	
100	1.182	13.602	BISMUTH 214
101	1.194	12.965	
102	1.206	12.538	
103	1.217	14.001	
104	1.229	11.346	
105	1.241	11.113	
106	1.253	13.669	
107	1.265	11.910	
108	1.277	12.345	
109	1.288	10.736	
110	1.300	11.444	
111	1.312	11.433	
112	1.324	11.927	
113	1.336	11.846	
114	1.347	11.896	
115	1.359	11.470	
116	1.371	11.864	POTASSIUM 40
117	1.383	10.286	
118	1.395	12.084	
119	1.407	9.642	
120	1.418	11.778	
121	1.430	12.635	
122	1.442	10.601	
123	1.454	9.140	
124	1.466	11.144	
125	1.477	10.766	
126	1.489	9.250	
127	1.501	11.961	
128	1.513	10.296	
129	1.525	10.900	
130	1.537	9.022	
131	1.548	10.311	
132	1.560	10.151	POTASSIUM 40
133	1.572	9.361	
134	1.584	8.753	
135	1.596	11.176	
136	1.608	10.130	
137	1.619	10.551	
138	1.631	9.204	
139	1.643	9.159	
140	1.655	8.738	
141	1.667	8.679	BISMUTH 214
142	1.678	10.154	
143	1.690	9.743	
144	1.702	9.453	
145	1.714	9.418	
146	1.726	8.425	
147	1.738	9.263	
148	1.749	9.653	
149	1.761	9.412	
150	1.773	9.019	
151	1.785	9.329	
152	1.797	10.232	
153	1.808	9.686	
154	1.820	7.911	
155	1.832	8.104	
156	1.844	9.602	
157	1.856	9.473	BISMUTH 214
158	1.868	8.568	
159	1.879	8.105	
160	1.891	8.014	
161	1.903	8.365	
162	1.915	8.759	
163	1.927	6.994	
164	1.938	8.477	
165	1.950	8.144	
166	1.962	7.798	
167	1.974	8.214	
168	1.986	9.240	
169	1.998	7.945	
170	2.009	7.615	
171	2.021	6.816	
172	2.033	8.408	
173	2.045	7.196	
174	2.057	7.231	
175	2.068	7.473	
176	2.080	9.062	
177	2.092	8.116	
178	2.104	8.235	
179	2.116	7.653	
180	2.128	8.338	
181	2.139	7.237	
182	2.151	7.528	
183	2.163	8.039	
184	2.175	8.536	
185	2.187	8.888	
186	2.199	7.485	
187	2.210	8.211	
188	2.222	8.233	
189	2.234	8.055	
190	2.246	7.825	
191	2.258	7.062	
192	2.269	8.435	
193	2.281	7.440	
194	2.293	7.686	
195	2.305	7.110	
196	2.317	7.329	
197	2.329	7.890	
198	2.340	7.771	
199	2.352	7.147	
200	2.364	6.729	
201	2.376	6.264	
202	2.388	6.318	
203	2.399	7.050	
204	2.411	6.506	THALLIUM 208
205	2.423	6.486	
206	2.435	6.589	
207	2.447	7.033	
208	2.459	6.515	
209	2.470	6.852	
210	2.482	6.871	
211	2.494	6.573	
212	2.506	6.417	
213	2.518	5.845	
214	2.529	6.127	
215	2.541	6.355	
216	2.553	6.964	
217	2.565	6.820	
218	2.577	6.670	
219	2.589	6.808	
220	2.600	5.940	
221	2.612	6.177	
222	2.624	6.176	
223	2.636	6.109	
224	2.648	6.347	
225	2.660	7.049	
226	2.671	5.757	
227	2.683	5.645	
228	2.695	5.229	
229	2.707	5.415	
230	2.719	6.190	
231	2.730	6.092	
232	2.742	6.466	
233	2.754	7.032	
234	2.766	5.533	
235	2.778	6.309	
236	2.790	5.559	
237	2.801	5.206	THALLIUM 208
238	2.813	6.045	
239	2.825	5.257	
240	2.837	5.640	
241	2.849	5.835	
242	2.860	5.348	
243	2.872	4.804	
244	2.884	4.742	
245	2.896	5.304	
246	2.908	5.248	
247	2.920	6.036	
248	2.931	5.711	
249	2.943	5.513	
250	2.955	5.010	
251	2.967	5.579	
252	2.979	6.256	
253	2.990	5.207	
254	3.002	9.302	TOTAL COUNT
255	3.014	1000.000	

FIGURE VI

Thus, energy peaks within a spectrum of a given element are Gaussian shaped rather than pure line spectra. Additionally, we are dealing with finite spectral windows, multiple peaked spectra, and pulse pileup; all tend to couple each window's response to the other.

Keeping in mind that we are dealing with the count rates corresponding to the concentrations presented in the last table, we define the following:

KC_i = uncorrected system count rate for the K channel

UC_i = uncorrected system count rate for the U channel

TC_i = uncorrected system count rate for the T channel

K_i = the percent differential concentration of potassium

U_i = ppm differential concentration of uranium

T_i = ppm differential concentration of thorium

where "i" refers to the ith pad.

We also define the following:

ζ_{kk} = sensitivity of KC_i to concentrations of K_i

ζ_{ku} = sensitivity of KC_i to concentrations of U_i

ζ_{kt} = sensitivity of KC_i to concentrations of T_i

ζ_{uk} = sensitivity of UC_i to concentrations of K_i

ζ_{uu} = sensitivity of UC_i to concentrations of U_i

ζ_{ut} = sensitivity of UC_i to concentrations of T_i

ζ_{tk} = sensitivity of TC_i to concentrations of K_i

ζ_{tu} = sensitivity of TC_i to concentrations of U_i

ζ_{tt} = sensitivity of TC_i to concentrations of T_i

Using the above definitions, we now construct the functional relationship by means of the following nine (9) equations in sets of three (3) per pad.

<u>K pad</u>

$$KC_k = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$
$$UC_k = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$
$$TC_k = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

<u>U pad</u>

$$KC_u = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$
$$UC_u = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$
$$TC_u = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

<u>T pad</u>

$$KC_t = \zeta_{kk}K + \zeta_{ku}U + \zeta_{kt}T$$
$$UC_t = \zeta_{uk}K + \zeta_{uu}U + \zeta_{ut}T$$
$$TC_t = \zeta_{tk}K + \zeta_{tu}U + \zeta_{tt}T$$

Separating these equation into consistent groups, we get for the uncorrected count rates in the K channel

(K pad) $KC_k = \zeta_{kk}K_k + \zeta_{ku}U_k + \zeta_{kt}T_k$

(U pad) $KC_u = \zeta_{kk}K_u + \zeta_{ku}U_u + \zeta_{kt}T_u$

(T pad) $KC_t = \zeta_{kk}K_t + \zeta_{ku}U_t + \zeta_{kt}T_t$

The equations can be expressed in matrix notation

$$\begin{bmatrix} KC_k \\ KC_u \\ KC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{kk} \\ \zeta_{ku} \\ \zeta_{kt} \end{bmatrix}$$

Where the k, u and t subscripts represent the K, U and T pads.

In a similar manner we can write two other matrix equations for UC_i and TC_i respectively.

$$\begin{bmatrix} UC_k \\ UC_u \\ UC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{uk} \\ \zeta_{uu} \\ \zeta_{ut} \end{bmatrix}$$

$$\begin{bmatrix} TC_k \\ TC_u \\ TC_t \end{bmatrix} = \begin{bmatrix} K_k & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{tk} \\ \zeta_{tu} \\ \zeta_{tt} \end{bmatrix}$$

Collecting the above, these equations can be expressed in matrix form as

$$\begin{bmatrix} KC_k & UC_k & TC_k \\ KC_u & UC_u & TC_u \\ KC_t & UC_t & TC_t \end{bmatrix} = \begin{bmatrix} K_t & U_k & T_k \\ K_u & U_u & T_u \\ K_t & U_t & T_t \end{bmatrix} \cdot \begin{bmatrix} \zeta_{kk} & \zeta_{uk} & \zeta_{tk} \\ \zeta_{ku} & \zeta_{uu} & \zeta_{tu} \\ \zeta_{kt} & \zeta_{ut} & \zeta_{tt} \end{bmatrix}$$

or

$$\bar{A} = \bar{B} \cdot \bar{\zeta}$$

where $\bar{A}$ is the residual count rate matrix, $\bar{B}$ is the matrix of the known differential concentrations and $\bar{\zeta}$ the sensitivity matrix.

Rearranging the above equations we have

$$\bar{B} = \bar{A} \cdot \bar{\zeta}^{-1}$$

We now define

$$\bar{\zeta}^{-1} = \bar{\Delta}$$

Eliminating $\bar{\zeta}$, we get

$$\bar{B} = \bar{A} \cdot \bar{\Delta}$$

We can now solve for $\bar{\Delta}$ by matrix inversion.

Therefore, the differential concentrations in the mixed pad can be derived from the k,u,t pads to check the computed $\bar{\Delta}$.

$$\begin{bmatrix} K_m \\ U_m \\ T_m \end{bmatrix} = \begin{bmatrix} \Delta_{kk} & \Delta_{ku} & \Delta_{kt} \\ \Delta_{uk} & \Delta_{uu} & \Delta_{ut} \\ \Delta_{tk} & \Delta_{tu} & \Delta_{tt} \end{bmatrix} \cdot \begin{bmatrix} KC_m \\ UC_m \\ TC_m \end{bmatrix}$$

where the subscript m refers to the mixed pad. Expanding this in algebraic form we obtain the following set of equations:

$$K_m = \Delta_{kk}\left(KC_m + \frac{\Delta_{ku}}{\Delta_{kk}}UC_m + \frac{\Delta_{kt}}{\Delta_{kk}}TC_m\right)$$

$$U_m = \Delta_{uu}\left(UC_m + \frac{\Delta_{ut}}{\Delta_{kk}}TC_m + \frac{\Delta_{uk}}{\Delta_{uu}}KC_m\right)$$

$$T_m = \Delta_{tt}\left(TC_m + \frac{\Delta_{tu}}{\Delta_{tt}}UC_m + \frac{\Delta_{tk}}{\Delta_{tt}}KC^m\right)$$

The terms in parentheses in the above 3 equations are the "corrected stripped count rates" for the system, and the stripping coefficients are as follows:

$S_{ku} = \frac{\Delta_{ku}}{\Delta_{kk}}$ (effect of uranium on potassium)

$S_{kt} = \frac{\Delta_{kt}}{\Delta_{kk}}$ (effect of thorium on potassium)

$S_{ut} = \frac{\Delta_{ut}}{\Delta_{uu}}$ (effect of thorium on uranium)

$S_{uk} = \frac{\Delta_{uk}}{\Delta_{uu}}$ (effect of potassium on uranium)

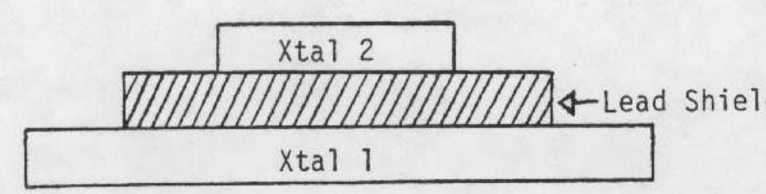
$S_{tu} = \frac{\Delta_{tu}}{\Delta_{tt}}$ (effect of uranium on thorium)

$S_{tk} = \frac{\Delta_{tk}}{\Delta_{tt}}$ (effect of potassium on thorium)

These stripping coefficients are defined in terms of S_{ij} in order to eliminate confusion with α, β, and γ, which are sometimes defined slightly differently.

ATMOSPHERIC RADON CORRECTION

Consider the crystal configuration shown below:



Let 1 and 2 designate the down and up crystal respectively. The down crystal sees radiation rates of I_1 composed of the air signal I_a and the ground signal I_g plus aircraft and cosmic background.

Therefore $$I_1 = I_g + I_a + A_1 + C_1$$

Similarly, the up crystal sees the air signal and ground signal (both somewhat attenuated) plus an aircraft and cosmic background.

Therefore $$I_2 = \ell I_g + mI_a + A_2 + C_2$$

Where m is the response to the air signal and is the % of the ground signal getting through to the up detector.

Using the test pad data, the factor can be determined. Consider the two previous equations. When we subtract the matrix pad data from the K, U, and T pad data, we have essentially set A_1, A_2, C_1, and C_2 and I_a equal to zero.

Therefore $$I_1 = I_g$$

$$I_2 = \ell I_g$$

$$= \left(\frac{I_2}{I_1}\right)$$

Instead of using the count rates we can use the resultant sensitivities $1/\Delta_{uu}$ to determine ℓ for the elemental channel U.

$$= \frac{1/\Delta_{uu}\ (up)}{1/\Delta_{uu}\ (down)}$$

It should be noted that due to "shine around" (since the shielding is not an infinite plane, the upward looking crystal responds to the surrounding terrain) on the test pads, as altitude increases, should decrease, thus $\ell = f(h)$.

Only the factor m remains to be determined. This unfortunately cannot be determined from test pad data. It can however be determined by flying over water (e.g. use of the Lake Mead over-water data).

Consider the equations for I_1 and I_2 again

$$I_1 = I_g + I_a + A_1 + C_1$$

$$I_2 = \ell I_g + mI_a + A_2 + C_2$$

Over water $I_g = 0$

We have A_1, A_2, C_1, and C_2 defined.

Removing the aircraft and cosmic background from the over water data and we are left with

$$I_1 = I_a$$

$$I_2 = mI_a$$

Since m is the shielding factor response to the air signal, we should have an air signal to "shield". Thus m is best determined if there is radon present.

Both up and down counting rates are corrected for aircraft and cosmic background and so we can solve the following two equations for I_a.

$$I_1 = I_g + I_a$$

$$I_2 = \ell I_g + mI_a$$

$$mI_a = I_2 - \ell I_g$$

but $$I_g = I_1 - I_a$$

then $$I_a\,(m-\ell) = I_2 - \ell I_1$$

or $$I_a = \frac{I_2 - \ell I_1}{m - \ell} = \text{Bi Air}$$

and I_a is then the Bi Air contribution from the surrounding air. This is then subtracted from the down looking U count resulting in corrected data.

DATA PROCESSING

DATA PREPARATION

The following sections summarize the techniques used for reduction and processing of the airborne data collected by geoMetrics.

Field Tape Verification and Edit

The field data tapes containing the airborne data are read on a computer to verify the recording and data quality. Data recovery is essentially 100% from the field tapes. During this phase, statistics are generated summarizing all the variables recorded for each flight line. Simultaneously, the spectral peaks are evaluated for shifts using a centroid calculation and the particular window's peak channel. The data are also checked for correct scan lengths and proper justification of data fields within each scan and and live time calculations are made. During this process, the desired window data fields are extracted from each spectrum and rewritten as a reformatted copy tape. (Portions of this operation were performed in the field using the G-725 field computer system.)

The reformatted raw data for each flight line (with aborted or unnecessary flight line data edited out) are then checked for consistency, data spikes, gradients, etc. Every correction suggested by the computer is evaluated by the data processing personnel prior to implementation. Upon completion of the phase, the data on the output tape are "clean" and ready for subsequent correction of the radiometrics and tieing of the magnetics.

Flight Line Location

A single frame 35 mm camera is used for obtaining position recovery information. The photo locations are spotted or transferred to a suitable base map and are digitized. The fiducial numbers of the spotted points along each line are entered during the digitying process. A computer program is used to check the consistency of these data using calculated intersections from tie line to tie line and from traverse to traverse. This program allows easy detection of entry errors as well as potential flight path recovery errors.

A computer program then calculates the map location for each intersection and the beginning and end of each line based on the fiducial numbers and the control line/tie grid. A computer plot is made of these locations to check against the field plot and correct editing information. These flight lines are then overlain on the geologic base map and each map unit is digitized such that each sample falls within a single unit. This resulting location information is then merged with the geophysicial data using the fiducial numbers as common reference.

RADIOMETRIC DATA REDUCTION

Reduction of the raw window data was carried out utilizing system calibration constants as derived from high altitude over water flights, Lake Mead Dynamic Test Range, and the Walker Field Test Pads. The data reduction sequence used is summarized in Figure VII. Processing of the data was performed using the window energies given below:

Total count - 0.4 to 3.0 MeV

K - 1.37 to 1.57 MeV

U - 1.66 to 1.87 MeV (downward looking system)

U_{up} - 1.04 to 1.21 MeV and 1.65 to 2.42 MeV (upward looking system)

T - 2.41 to 2.81 MeV

Cosmic - 3 to 6 MeV (downward and upward looking system)

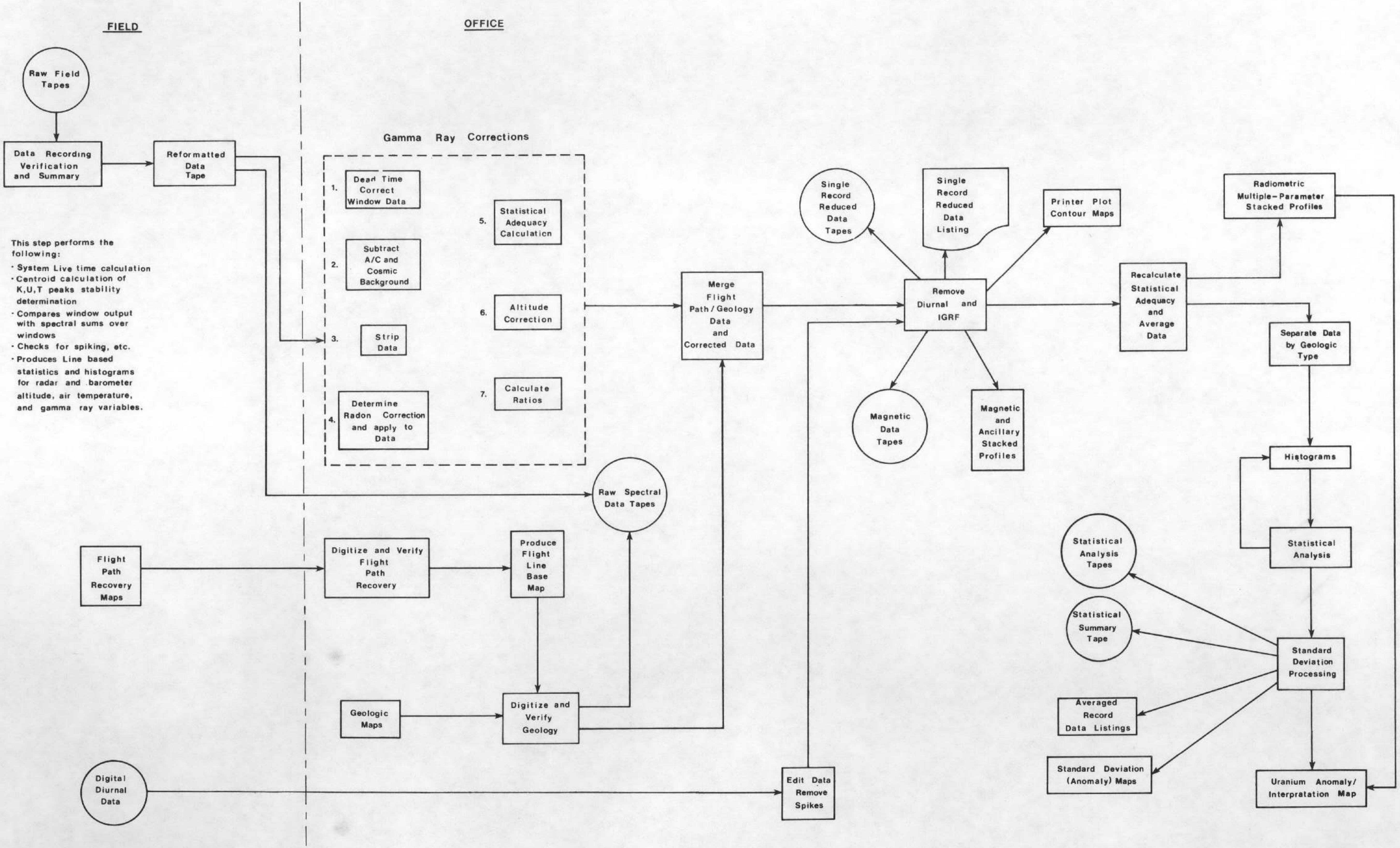
Aircraft and Cosmic background for the Queen Air/Aero Commander over these windows are as follows:

	QUEEN AIR		AERO COMMANDER	
	Aircraft	Cosmic*	Aircraft	Cosmic*
TC (cps)	152.04	2.3833	220.37	2.3915
K (cps)	16.06	0.1322	18.82	0.1334
U_{dn}(cps)	6.50	0.1098	10.85	0.1082
U_{up}(cps)	3.17	0.5540	5.35	0.5915
T (cps)	3.42	0.1503	4.35	0.1513

*Cosmic background values are in cps per 1.0 cps in the 3-6 MeV window.

DATA PROCESSING FLOW DIAGRAM

FIGURE VII



Compton corrections to the down data were made using the following constants:

Sij	QUEEN AIR	AERO COMMANDER
S_{ku}	0.8437	0.8717
S_{kt}	0.1584	0.1408
S_{ut}	0.2703	0.2877
S_{uk}	0.0	0.0
S_{tu}	0.05614	0.09453
S_{tk}	0.0	0.0

The ij subscripts represent the influence of the j^{th} window on the i^{th} window.

All parameters except for S_{ut} are considered constants. S_{ut} was considered an altitude dependent paramenter utilizing the following expression (after Grasty, 1975).

$$S_{ut} = S_{ut_o} + 0.0076h,$$ where h is the altitude in hundreds of feet.

Altitude attenuation coefficients used are defined as follows:

ALTITUDE ATTENUATION COEFFICIENTS

	QUEEN AIR	AERO COMMANDER
TC (per foot)	0.002011	0.001688
K (per foot)	0.002740	0.002800
U (per foot)	0.002479	0.002536
T (per foot)	0.002048	0.002102

All radiometric data presented in the strip charts have been normalized to 400 feet mean terrain clearance at STP using the expression:

$$\exp - u_i \frac{273.15}{760} \times \frac{P}{T} (h - 400)$$

where h is the height in feet, $_i$ is the appropriate altitude attenuation coefficient, P is in mm of Hg, and T is in degrees Kelvin. In cases where the altitude exceeds 1,000 feet, the correction coefficients were limited to the 1,000 foot value.

Bi Air calculations are made using the following expressions:

$$Bi_{Air} = \frac{U_{up} - (R_{us} + \frac{C'uk}{C'uu} R_{ks} + \frac{C'ut}{C'uu} R_{ts})\ell}{m - \ell}$$

Where U_{up} = count rate from upward detectors

ℓ = crystal coupling constant

m = crystal geometric factor

C'_{uk}, C'_{ut}, C'_{uu}, = stripping coefficients relating down data to up data

R_{us} = stripped uranium count rate - down system

R_{ks} = stripped potassium count rate - down system

R_{ts} = stripped thorium count rate - down system

The numerical values for the constants ℓ, m, C'_{uk}, and C'_{uu} are given below:

	QUEEN AIR	AERO COMMANDER
ℓ	0.1101	0.0890
m	0.596	0.445
C'_{uk}	0.00947	0.00964
C'_{uu}	0.07136	0.08562
C'_{ut}	0.04636	0.05644
$\mu\ell$	-0.000032	-0.00019
μm	-0.000192	-0.000112

$\mu \ell$ & μm are altitude dependent as follows:

$$\ell = \ell - \mu \ell \times h, \text{ where h is in feet}$$

$$m = m - \mu m \times h, \text{ where h is in feet}$$

These Bi Air data are filtered and the filtered results are then removed on a point by point basis from the corrected uranium window data.

The window data are then evaluated for statistical adequacy prior to altitude correction to ensure they are significant within the context of the anticipated errors in count statistics.

Statistical Adequacy Test

The statistical adequacy test is made to determine whether the corrected data sample is sufficiently greater than the "noise" to represent the "signal" of interest.

We can define three separate criteria for detection thresholds (ref. Currie, Analytical Chemistry, Volume 40, No. 3, March 1968) of which only one is directly applicable to our case; this is the "critical level". This is the level at which the decision is made that a signal is "detected". We thus define this critical level as that level at which the data are statistically adequate.

Setting the actual levels in counts per second, "a priori " for each elemental window is difficult at best since the full effect of all parameters affecting the counts is not known to a sufficient degree of certainty. If the corrections to the data are a significant portion of the count rate, most of the error (exclusive of systematic errors due to electronics, etc.) in the corrected data can be ascrib-ed to random errors within the applied corrections. The corrections are basically the results of counting radioactive decay products (gamma rays) and are therefore assumed to follow the classical Poisson distri-bution. The following assumptions concerning these corrections are:

1. In the best case, the error in each correction is additive.

2. The sum of these corrections also follows a Poisson distribu-tion.

3. The uncertainty in the correction itself is equal to the square root of the correction applied.

4. This uncertainty is directly reflected in the corrected single record count rate.

With these assumptions in mind, the criterion for determining the statistical adequacy of a given data sample is defined as follows:

> "If a corrected single record data sample exceeds 1.5 times the square root of the summed correction applied to that data sample, then that data sample is statistically adequate."

Since any calculation using statistically inadequate data (such as ratios) is also inadequate, the adequacy of each element of the single sample record data is tested prior to the calculation. This is done during the course of the processing by retaining all correc-tions applied to each data sample and determining its adequacy as explained above.

Not only are the results of this statistical adequacy test used to insure that calculated ratios will be meaningful but they are also utilized to determine the optimum interval over which the data should be averaged (e.g. 5 seconds or 7 seconds, etc.) to improve the overall data statistical adequacy In the case of this project, the resulting averaging sample interval was 7 seconds.

Conversion to Equivalent ppm and Percent

At this point the data are single record corrected samples in units of counts per second. These data are then converted to equivalent ppm (parts per million) uranium, thorium and percent potassium. The conversion factors are the sensitivities derived from the Lake Mead Dynamic Test Range data at 400 feet mean terrain clearance.

Radioelement	Equivalent Percent/ppm	Queen Air Counts/Second	Aero Commander Counts/Second
K	1%K	91.5	96.3
U	1 ppmeu	10.4	9.2
T	1 ppmeT	6.4	6.7

MAGNETIC DATA REDUCTION

The magnetic data reduction processes are: correction for diurnal variation, tieing to a common magnetic datum, and subtraction of the regional magnetic field as defined by the International Geomagnetic Reference Field (IGRF). During data acquisition, the magnetic field is monitored by a ground-based diurnal magnetometer that samples every four seconds at a sensitivity of one-quarter gamma. These data are recorded on magnetic tape along with the time for synchronization with the airborne data.

The diurnal data are edited to keep only samples taken during flight time and remove spikes and man-made magnetic events. After editing, these data are displayed in profile form to ensure that all corrections necessary have been made. Next, the data are synchronized in time with the airborne data, interpolated, and subtracted from the airborne magnetic data.

The diurnally corrected magnetic data are then processed by a tieing program that compares the magnetic differences at intersections of flight lines and tie lines. This program calculates individual magnetic field biases for each flight tie line based on tie line intersections. This allows miss-ties to be minimized throughout the survey. These biases usually represent, after diurnal correction, systematic magnetic changes caused by such things as heading error, changes in location of the ground-based magnetometer, or changes in the airborne equipment. The biases are manually evaluated and selectively applied.

DATA PRESENTATION

General

The majority of the data products are presented in this report. These include the uranium anomaly/interpretation maps and pseudo-contour maps of potassium, uranium, thorium, and magnetic data which are integrated as part of the text in the interpretation section. In addition to these data, this report contains data presented in the form of radiometric profiles, flight path recovery maps, standard deviation maps, and histograms. Microfiche data are contained in the back cover of each report. Data tapes are available separately.

Radiometric Profiles

Stacked profiles were prepared from the averaged data for each traverse and tie line. These stacked profiles, plotted at a linear scale of 1:250,000, contain the following parameters: corrected Total Count, percent potassium, equivalent ppm uranium, equivalent ppm thorium, eU/eT, eU/%K, and eT/%K ratios, equivalent ppm Bi Air, radar altimeter, and magnetometer data. Each of the stacked profile sheets contains a plot of the flight path superimposed on a geologic strip map. Included along these profiles are the fiducial numbers which correspond to flight path position as displayed on the flight path recovery maps. Each of the stacked profiles represents the data contained on the specific flight line within the boundaries of the specified NTMS Quadrangle sheet.

Radiometric traces on the stacked profiles contain an indicator showing those data which are statistically inadequate. These statistically inadequate data are marked by a small vertical tick at the sample location. The altitude profile has been limited in display to 1,000 feet. A dashed line at the 700 foot level is presented to show those data which do not meet the altitude specifications. The vertical scale of each variable remains constant on all stacked profiles. When overranging occurs, the trace is stepped and the step labeled showing the actual value. A pictorial representation of such a stepping profile is shown in Figure VIII. At the end of each stacked profile, a statistical summary of the minimum value, maximum value, mean, and standard deviation for that variable is presented.

This report contains an equivalent set of stacked profiles for each quadrangle, photographically reduced to an approximate scale of 1:500,000.

MAGNETIC PROFILES

A set of profiles containing the magnetic data (corrected, with IGRF removed), barometric altimeter data, radar altimeter data, diurnal monitor data, and temperature data are available at a linear scale of 1:250,000. Each of the stacked profiles contains a plot of the flight path superimposed on the geology over which the aircraft flew. Reduced scale (1:500,000) copies of these are presented in of this report.

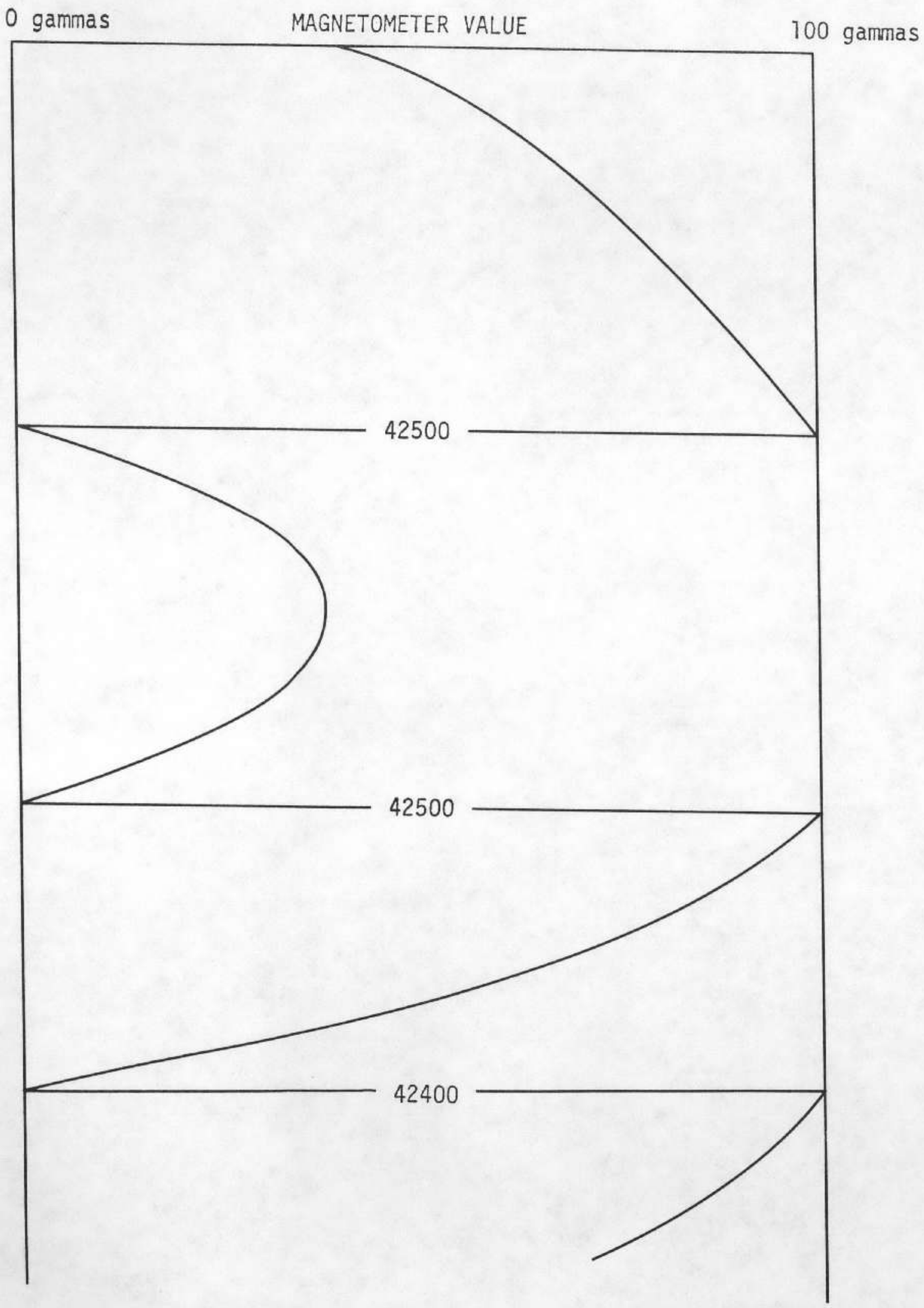


FIGURE VIII Plotter Step Value Labeling

FLIGHT PATH MAPS

For each of the NTMS quadrangle sheets covered by this survey, a flight path position map is available at a scale of 1:250,000. The actual flight path has been superimposed on the geologic quadrangle maps. Flight lines and tie lines are annotated along with fiducial numbers of located positions. Reduced scale (1:500,000) copies of these can be found in this report.

STANDARD DEVIATION MAPS

Gamma ray standard deviation maps have been prepared for each NTMS quadrangle included in this survey. The six maps generated represent the following parameters: percent potassium, equivalent ppm uranium, equivalent ppm thorium, and eU/eT, eU/%K and eT/%K ratios. The data contained in each map represent only those data which are considered statistically adequate. This automatically excludes all data collected over water or data which falls outside of altitude specifications (i.e. altitude greater than 700 and less than 200 feet). The symbolism of each of the six maps is identical. The center of each circle represents the central averaged sample since the data had been averaged over a 7 second interval. The small boxes adjacent to each of the circles represents one standard deviation from the mean for that specific data sample. In order to determine whether the data shown are represented by positive or negative standard deviations, consider each map with north pointing away from the viewer. For east/west lines (traverse lines) positive standard deviations lie above or to the north of the traverse line with negative standard deviation below or to the south. On the north/south lines (tie lines) positive standard deviations are to the left of the viewer (west) with negative standard deviations to the right (east).

These maps were generated at a scale of 1:250,000 for each NTMS sheet and in addition, are presented in each report at a reduced scale of approximately 1:500,000.

HISTOGRAMS

Computer generated histograms, showing the equivalent ppm and percent distributions for the three gamma ray emitters and their ratios measured and calculated as a function of computer map unit are presented in this report (See Figure IX). Information contained on these histograms includes the standard deviation as calculated about the arithmetic mean (or median), and the total number of samples from which the statistics were derived.

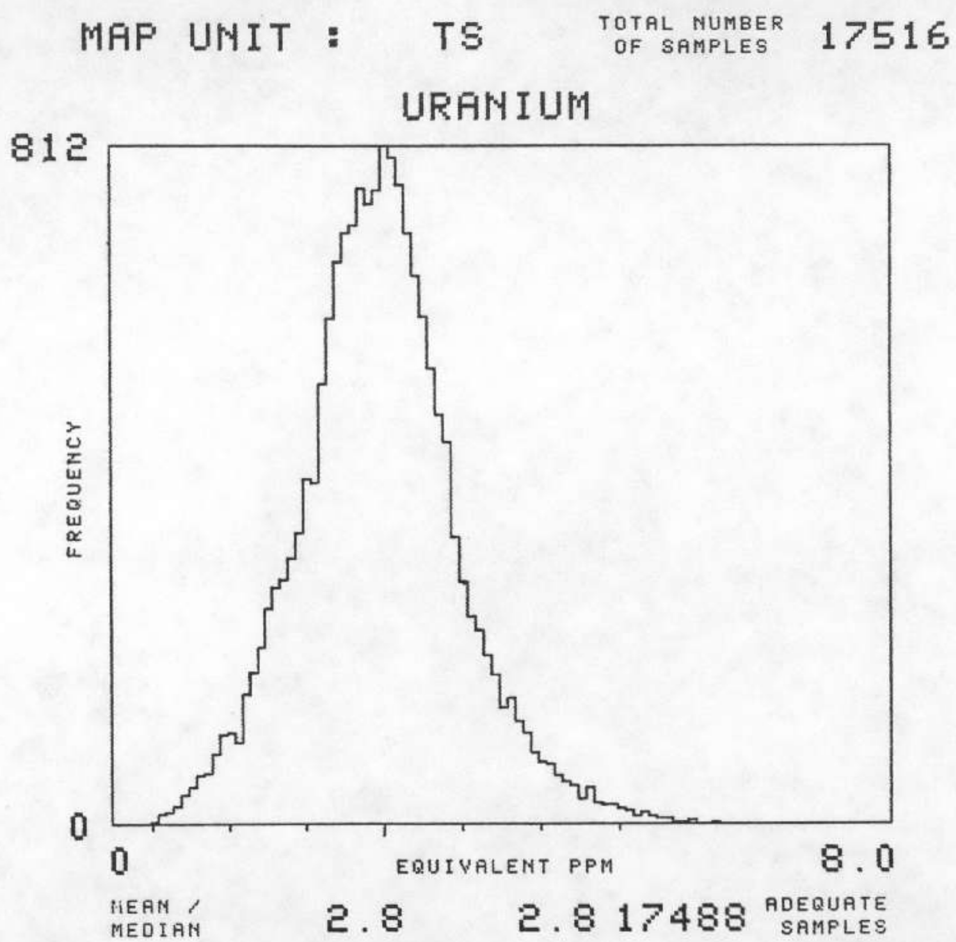


FIGURE IX Sample Computer Map Unit Histogram

DATA LISTINGS

Single record reduced and averaged record (statistical analysis) data listings have been prepared on microfiche. The microfiche are contained in each report. Each of the single record and averaged record data listings are presented for the data contained in a single quadrangle. The data contained in the single record data listings are summarized below:

1. Fiducial number

2. System/Quality (SAKUT) - The first digit identifies the system used to collect the sample. The remaining digits define the results of statistical adequacy testing for altitude, potassium, uranium, and thorium. A value of 0 indicated that the data are statistically adequate. A value of 1 indicates that the data are statistically inadequate. All data collected in excess of 700 feet and less than 200 feet are considered statistically inadequate.

3. Time - time presented in hours, minutes, and seconds

4. Altitude - altitude presented in feet above terrain

5. LAT/LONG - Latitude and Longitude presented in terms of decimal degrees

6. Magnetic field expressed in residual gammas

7. Geology - code representing geologic units

8. %K, eU, eT - percent potassium, equivalent ppm of uranium and thorium

9. eU/eTH, eU/%K, eTH/%K - calculated ratios of the three parameters

10. Total count - corrected total count data (0.4 to 3.0 MeV)

11. COS - downward looking cosmic count rate in the 3-6 MeV channel

12. Uair - atmospheric Bi-214 equivalent ppm

13. Temperature - outside air temperature in degrees centigrade

14. Press - barometric pressure in mm of mercury

The averaged record (statistical analysis) data listings are summarized below:

1. Fiducial number

2. System/Quality (SAKUT) - The first digit identifies the system used to collect the sample. The remaining digits define the results of statistical adequacy testing for altitude, potassium, uranium, and thorium. A value of 0 indicated that the data are statistically adequate. A value of 1 indicates that the data are statistically inadequate. All data collected in excess of 700 feet and less than 200 feet are considered statistically inadequate.

3. LAT/LONG - Latitude and longitude presented in terms of decimal degrees

4. Magnetic field expressed in residual gammas

5. Geology - code representing geologic formations

6. %K, eU, eT - percent potassium, equivalent ppm of uranium and thorium data and the number of ($\pm$) standard deviations from the mean

7. eU/eTH, eU/%K, eTh/%K - calculated ratios of the three parameters, and the number of ($\pm$) standard deviations from the mean

8. Total count - corrected total count data (0.4 to 3.0 MeV)

9. COS - downward looking cosmic count rate in the 3-6 MeV channel

10. Uair - atmospheric Bi-214 in equivalent ppm

DATA TAPES

Data tape files have been generated for each of the 1:250,000 NTMS quadrangle sheets. The tapes are IBM compatible and recorded on 9 track EBCDIC at 800 bpi. Five separate types of data tapes are presented: raw spectral data tapes, single record reduced data tapes, statistical analysis tapes, magnetic data tapes and a statistical analysis summary tape. Detailed descriptions of the data tape formats follow this discussion.

DATA INTERPRETATION METHODS

General

The stated objective of the NURE Program is the evaluation of the uranium potential of the United States. In support of this goal, high sensitivity airborne radiometric and magnetic surveys have been implemented to obtain reconnaissance information pertaining to regional distribution of uraniferous materials. Within this context, data interpretation has been oriented toward regional detection and description of anomalously high concentrations of uranium.

By far the most significant natural sources of gamma radiation in the geologic environment are the radioactive decay series of potassium 40 (K40), thorium 232 (Th232) and uranium 238 (U238) of which 0.7% is uranium 235. Potassium 40 is the largest contributor to natural radioactivity, accounting for nearly 98%, as it is the most abundant gamma ray emitter-.012% of all potassium in nature. (Refer to GSA Memoir 97 for abundances of uranium, thorium, and potassium).

Potassium 40 is directly identified by the airborne spectrometer from a single clear peak at 1.46 mev (million electron volts) in its gamma ray spectrum. However, thorium 232 and uranium 238 do not have any clear, distinct peaks at sufficiently high energies to allow direct detection from airborne systems. Instead, daughter products which do have distinct peaks are measured as representing the abundance of the parent element. For thorium 232, the daughter nuclide thallium 208 (T1208) has a distinct peak at 2.62 meV while uranium 238 has a daughter, bismuth 214 (Bi214) possessing a clear peak at 1.76 meV (see Figure 7 for a composite decay series spectrum). Consequently the fundamental assumption implicit to airborne uranium and thorium measurements is that the measured daughter products are in radioactive equilibrium - the number of atoms of disintegrating daughter nuclides are equal to the number being formed (see Adams and Gasparini, 1970).

An airborne gamma ray measurement is the sum of photons counted during a specified time interval from a multitude of gamma ray sources which include the three geologic emitters that are being sought plus other interfering sources. These others include, but are not limited to higher energy cosmic rays, aircraft and instruments, contributions from overlapping decay series and airborne radon 222. (See Burson, 1974 and McSharry, 1973 for a more complete discussion of airborne radiometric measurements, and Radiometric Data Reduction in this volume for a complete description of data correction procedures).

When correlating ground data (geochemical, geological, etc.) with the corrected data derived from raw airborne measurements, the interpreter must remember what an individual airborne gamma ray sample physically measures. First, the terrestrial component of the gamma radiation measured by the airborne detector emanated primarily from the upper 18 inches of material on the earth's surface (Gregory and

Horwood, 1963). The airborne measurement cannot "see" any deeper into the underlying rock material and is essentially a measurement of the soil's or exposed (weathered) rock's radioactivity. Secondly, since each airborne sample is an accumulation of gamma rays measured on a moving platform over a fixed period of time, the individual sample represents a large areal extent of surficial material. For this survey, with specifications of 400 feet mean terrain clearance and an average ground speed of 140 miles per hour, a one second sample corresponds to an oval approximately 750 feet long by 600 feet wide (assuming an infinite, uniformly distributed source). Accordingly, averaged samples represent tremendous volumes of surficial materials.

Methodology

As described previously, the gamma ray data were located by computer map units, histograms were produced and statistical analyses performed. The basic unit for interpretation then is the averaged sample and its attendant deviations about a particular map unit's mean.

The uranium anomaly/interpretation map displays each individual averaged sample that meets the following criteria:

1. The averaged uranium sample must be greater than or equal to 1 standard deviation above its map unit mean.

2. The sample must have a U/T ratio greater than or equal to 1 standard deviation above its unit mean.

3. Each U/T ratio defined in (2) must have a corresponding thorium value lying at least greater than minus one (-1) standard deviation below the mean. If the thorium sample is less than one standard deviation below the mean, the U/T ratio is considered questionable.

All the possible anomalies displayed on the map are then examined for clusters, trends, and comparisons with all other available data.

Minimum requirements in the subsequent interpretation discussions of each quadrangle for anomalies listed in the uranium anomaly summary are defined as follows:

> Two (2) consecutive averaged U samples lying two or more standard deviations above the mean or three (3) consecutive averaged U samples, two of which are one (1) or more standard deviations and the third of which is two (2) or more standard deviations above the mean.

Statistical anomalies which meet the above criteria can result from several factors or circumstances including: (1) true concentration of uraniferous minerals, (2) differential surface cover (soils and/or vegetation) within a lithologic unit, (3) local weather conditions such as rain and snow, (4) extreme facies variation within a mapped unit, and (5) differential weathering of rocks within mapped units. Obviously an averaged sample which lies on the boundary between two map units is not truly reflecting either one, but is rather an average of both. Thus, for two markedly different units, such a sample would be anomalous relative to one of the units and not be a true indication of radioactive differences within the unit.

The percent potassium, equivalent ppm thorium and uranium, the three ratios and residual magnetic data were plotted as separate pseudo-contour maps and overlain on the geologic base map and standard deviation maps. Regional trends of each variable and average valves could thus be easily and quickly determined and compared with the associated geological, magnetic, and statistical trends. Only the long wavelengths within each variable would show any line-to-line continuity on the pseudo-contour maps and thus, only regional trends will appear.

Each quadrangle's stacked profiles were also overlain on the corresponding geologic and standard deviation maps and anomaly map to further delineate trends and to allow a more detailed analysis of individual anomalies. Since the interpretation was concentrated on detection of anomalous uranium, subtle trends present in the potassium and thorium channels and ratios were only examined in a cursory manner. Even during such a brief examination of the profiles, it was evident that the spectrometer system was highly sensitive to changes in surface materials even in areas of low counting rates such as glacial drift. Thus radiometrics have a real potential for performing general surficial mapping "geochemical analysis" on a geologic unit (or soils) basis in addition to merely radioactive mineral "anomaly hunting".

TAPE FORMATS

SINGLE RECORD REDUCED DATA TAPE

REFERENCE: Paragraphs 4.7.6 and 6.1.6, BFEC 1200-C

The Single Record Tape is an unlabeled, nine track, 800 BPI, NRZI. All data are recorded as EBCDIC characters. Each tape contains but one file of format, header, data, and trailer records for no more than one quadrangle. The tape is divided into 6900-character blocks containing the following information.

Block 1 - Format Data

This block contains 6768 characters in 94 consecutive lines of 72 characters containing the following literal description.

02 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

SINGLE RECORD REDUCED DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1.	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2.	A20	NAME OF SUBCONTRACTOR
3.	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4.	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
5.	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
6.	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
7.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN CPS PER PERCENT K
8.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
9.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH

ITEM	FORMAT	DESCRIPTION
13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM
15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
*	*	*
*	*	*
*	*	*
85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
99-101	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
390-392	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR SINGLE RECORD REDUCED DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
16	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH

ITEM	FORMAT	DESCRIPTION
17	F6.1	URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
18	F6.1	URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
19	F5.1	THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
24	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
25	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG

This description serves to identify the format of data on subsequent blocks on the tape. The remaining 132 characters on this block are blanks.

Block 2 - Single Record Reduced Identification Data

The second block contains the identifier information for the data contained in subsequent blocks. The identification information is written according to the format description in the first half of the first block. The remaining 4978 characters on this block are blanks.

Block 3 - Single Record Reduced Data

These blocks contain data written according to the format description in the second half of the first block. There will be 50 logical records per physical block. As of August 1979, the method for determining uncertainties specified in the data blocks remains undefined, and those values are filled with 9's under format control.

STATISTICAL ANALYSIS TAPE

REFERENCE: Paragraphs 4.7.7 and 6.1.6, BFEC 1200-C

The statistical analysis data tape is an unlabeled, nine track, 800 BPI, NRZI. All data is recorded as EBCDIC characters. The block length is 8000 characters long. Each tape contains one file of data for no more than one quadrangle.

Block 1 - Format Description Data

The first physical block on this tape contains a format description for data on subsequent blocks. The first 7560 characters on this block contains 105 lines of 72 characters exactly as written below:

03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

STATISTICAL ANALYSIS DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN CPS PER PERCENT K
8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH
10	I6	BLANK FIELD (99999)
11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM

ITEM	FORMAT	DESCRIPTION
15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
*	*	*
*	*	*
*	*	*
85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
99-101	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
390-392	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR STATISTICAL ANALYSIS DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF Removed) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRIACALLY SIGNED.
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DEICMAL PLACE IN PPM EQUIVALENT U
24	F4.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
27	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
D8	F6.1	AVERÁGED THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
29	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED

The remaining 440 characters in this block are blanks.

Block 2 - Statistical Analysis Identification Data

The second block contains the identifier information for the data contained in subsequent blocks according to the format specification in the first part of Block 1. The final 6078 characters on this block are blanks.

Block 3 - Statistical Analysis Data

The third and subsequent blocks contain statistical analysis data in the format specified by the second part of the Block 1. Fifty logical records are allowed per block. The method for determining uncertainty values shown, as of August 1979, remains undefined. These values are filled with 9's under format control.

MAGNETIC DATA TAPE

REFERENCE: Paragraphs 4.7.8 and 6.1.6, BFEC 1200-C

The Magentic Data Tape is an unlabeled, nine track, 800 BPI, NRZI. All data are recorded as EBCDIC characters. Each tape contains data for no more than one quadrangle and are divided into 8000-character blocks as described below.

Block 1 - Tape Format Description

The first block contains 3384 characters of format information in exactly the following format:

04 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)

MAGNETIC DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH., YEAR
4	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
5	I4	FIRST FLIGHT LINE ON THIS TAPE
6	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
7	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
8	F8.4	LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE
9	F8.4	LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL PLACES IN DEGREES FOR FIRST FLIGHT LINE
10-14	(SAME)	REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
495-499	(SAME)	REPEAT OF ITEMS 5-9 FOR 99th FLIGHT LINE ON THIS TAPE

FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	F7.1	TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
11	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
12	F7.1	DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL PLACE IN GAMMAS
13	F7.1	MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE IN METERS (IF REQUIRED)

The remaining 4616 characters in this block are blanks.

Block 2 - Magnetic Tape Identification Data

This block contains information about the data in subsequent blocks organized according to the format specification in the first half of Block 1.

Block 3 - Magnetic Data

This block and subsequent block contains magnetic data for the quadrangle organized according to the format specifications in the second half of Block 1. There will be 100 logical records per physical block.

STATISTIC ANALYSIS SUMMARY TAPE

REFERENCE: Paragraphs 4.7.9, BFEC 1200-C

The statistical analysis summary tape is an unlabeled, nine track, 800 BPI, NRZI. All data is recorded as EBCDIC characters. The block length is 700 characters long. Each tape contains one file of data for no more than one quadrangle.

Block 1 - Format Description Data

The first physical block on this tape contains a format description for data on subsequent blocks. The first 4320 characters on this block contains 60 lines of 72 characters exactly as written below:

05 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)

STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2	A20	NAME OF SUBCONTRACTOR
3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4	I6	NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS QUADRANGLE

FORMAT FOR STATISTICAL ANALYSIS SUMMARY DATA RECORD (THIRD THRU LAST BLOCK)

ITEM	FORMAT	DESCRIPTION
1	A8	SURFACE GEOLOGIC MAP UNIT IDENTIFYING CODE
2	I6	TOTAL RECORDS FOR GEOLOGIC MAP UNIT
3	I6	NUMBER OF POTASSIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
4	F6.1	POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PERCENT K
5	F6.1	POTASSIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PERCENT K
6	A3	POTASSIUM CONCENTRATION DISTRIBUTION CODE
7	I6	NUMBER OF URANIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
8	F6.1	URANIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
9	F6.1	URANIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
10	A3	URANIUM CONCENTRATION DISTRIBUTION CODE
11	I6	NUMBER OF THORIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
12	F6.1	THORIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
13	F6.1	THORIUM CONCENTRATION STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
14	A3	THORIUM CONCENTRATION DISTRIBUTION CODE
15	I6	NUMBER OF URANIUM-TO-THORIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
16	F6.1	URANIUM-TO-THORIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT U PER PPM EQUIVALENT TH
17	F6.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVA-LENT TH
18	A3	URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE
19	I6	NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
20	F6.1	URANIUM -TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
21	F6.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT
22	A3	URANIUM-TO-POTASSIUM RATIO DISTRIBUTION
23	I6	NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
24	F6.1	THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
25	F6.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
26	A3	THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE

The remaining 2680 characters on this block shall be blanks.

Block 2 - Statistical Analysis Identification Data

The second block contains the identifier information for the data contained in subsequent blocks according to the format specification in the first part of Block 1. The final 6930 characters on this block are blanks.

Block 3 - Statistical Analysis Summary Data

The third and subsequent blocks contain statistical analysis data in the format specified by the second part of the Block 1. Fifty logical records are allowed per block.

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APPENDIX B - Flight Summary

APPENDIX B

DAILY PRODUCTION SUMMARY

NOVEMBER, DECEMBER, 1980

QUEEN AIR N9AG

Nov. 27-30	Aircraft Maintenance
Dec. 1-3	Base Mobilization
4	434 line mines Louisville, Huntington
5	434 " " " "
6	868 " " " "
7	Weather - nil production
8	848 line miles Louisville, Huntington
9	Weather - nil production
10	848 line miles Louisville, Huntington
11	Weather - nil production
12	630 line miles Marion
13	630 " " Marion
14	671 " " Marion, Toledo
15	Weather - nil production
16	" " "
17	1055 line miles Cincinnati

AERO COMMANDER

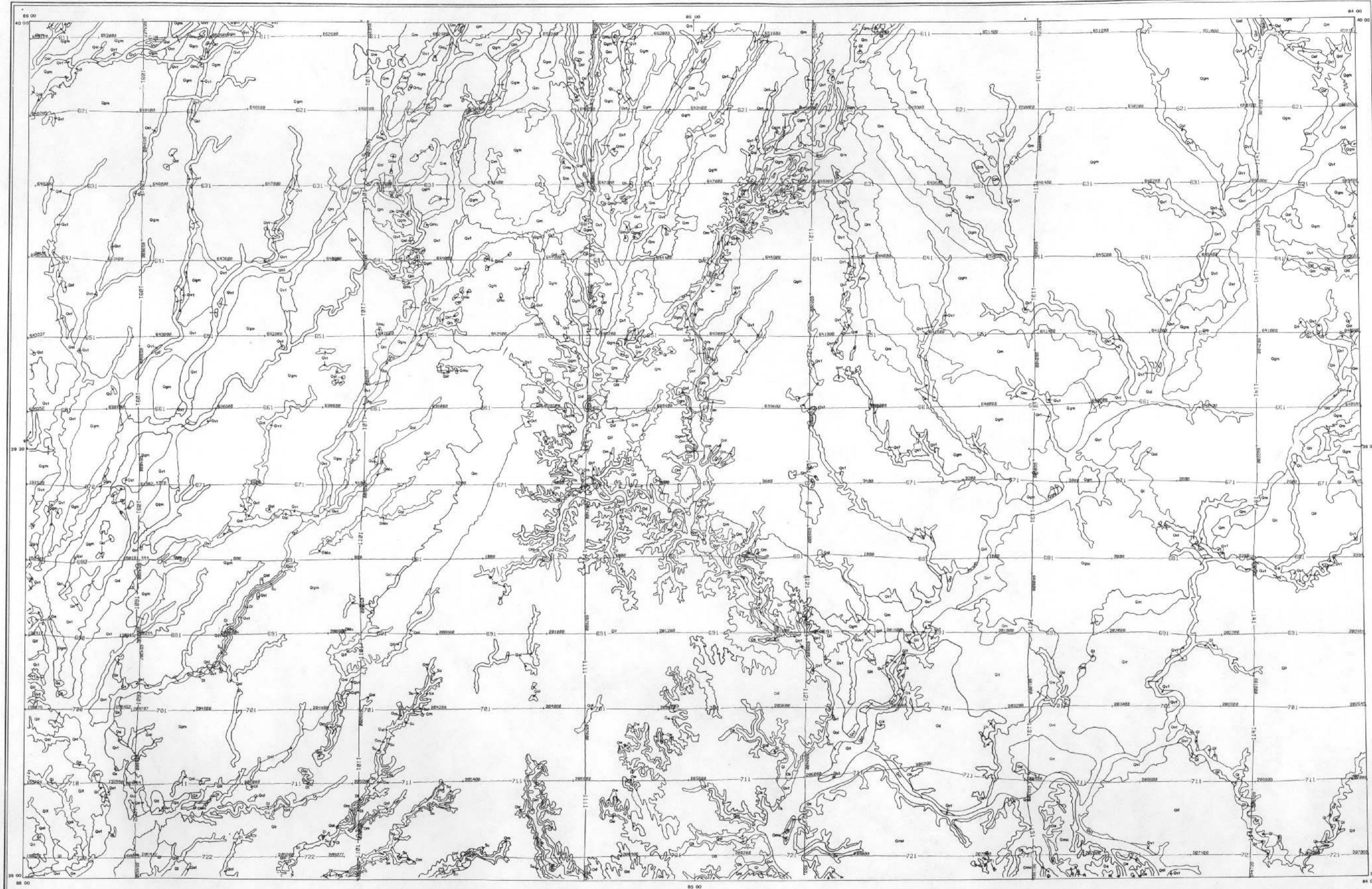
Nov. 21	200 line miles Cincinnati
22	480 " " Vincennes
23-25	Weather - nil production
26	480 line miles Vincennes
27-30	Weather - nil production
Dec. 1	448 line miles Cincinnati, Vincennes
2	Weather - nil production
3	528 line miles Vincennes, Indianapolis
4	368 " " Indianapolis
5	206 " " "
6	206 " " "
7	Weather - nil production
8	Equipment problem
9	Weather - nil production
10	" " "
11	" " "
12	300 line miles Indianapolis
13	Weather - nil production
14	434 line miles Indianapolis
15	Weather - nil production
16	" " "
17	399 line miles Cincinnati

Total miles for the above period = 10,467 line miles.
Total miles for the included quadrangles:

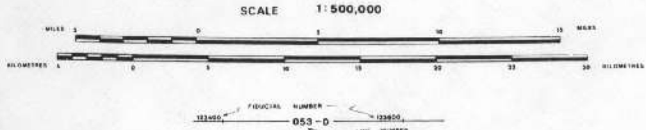
Louisville	1716.0
Huntington	1716.0
Indianapolis	1693.8
Cincinnati	1693.8
Vincennes	1716.0
Toledo	Unfinished
Marion	Unfinished

APPENDIX C - Flight Path and Geologic Map

CINCINNATI

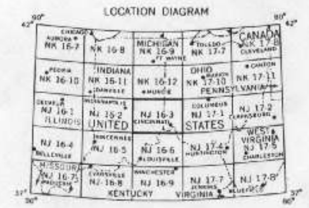


SCALE 1:500,000



FLIGHT LINE SPACING .... 6.0 MILE(S)
FLIGHT ALTITUDE .... 400 FEET AMT
FLOWN AND COMPILED 1980–1981

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

FLIGHT PATH RECOVERY

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

CINCINNATI QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

Cenozoic

Qal Alluvium

Includes some colluvial, paludal, & lacustrine deposits. Martinsville & Prospect Fms in Indiana.

Qmu Muck, peat, & marl

Martinsville Formation in Indiana

Qe Eolian sand

Dune facies of Atherton Formation in Indiana

Ql Lacustrine deposits

Sand & clay Lacustrine facies of Atherton Formation in Indiana

Qvt | Qo Qvt: Valley-train deposits

Outwash facies of Atherton Formation in Indiana

Qo: Outwash

Outwash facies of Atherton Formation in Indiana

Qst Ice-contact stratified drift

Kame & esker facies of Trafalgar Formation in Indiana

Qgm Ground moraine

Trafalgar Formation in Indiana

Qm End & lateral moraines

Trafalgar Formation in Indiana.

Qit Illinoian till

Includes some ice-contact stratified drift & in Ohio, large areas of bedrock Jessup Fm in Indiana

(Qal through Qit: Pleistocene & Holocene; Quaternary)

QTi Irvine Formation

Glacial sand, locally calcareous, & limestone conglomerate, & upland sand deposits

(Tertiary)

Paleozoic

DMn New Albany Shale

Black shale with some greenish-gray shale.

(Devonian / Mississippian)

Dl Middle Devonian limestones

Includes Geneva Dolomite & Jeffersonville & North Vernon Limestones

(Devonian)

Su Silurian rocks, undifferentiated

Limestone, dolomite, & shale.

(Silurian)

Ow	Om	
Od		Oma
Ok		Oe

(Ordovician)

Ow: Whitewater Formation

Shale with limestone. Includes lower part of Brassfield Formation.

Od: Dillsboro Formation

Argillaceous limestone & calcareous shale

Ok: Kope Formation

Calcareous shale with some argillaceous limestone

Om: Maquoketa Group

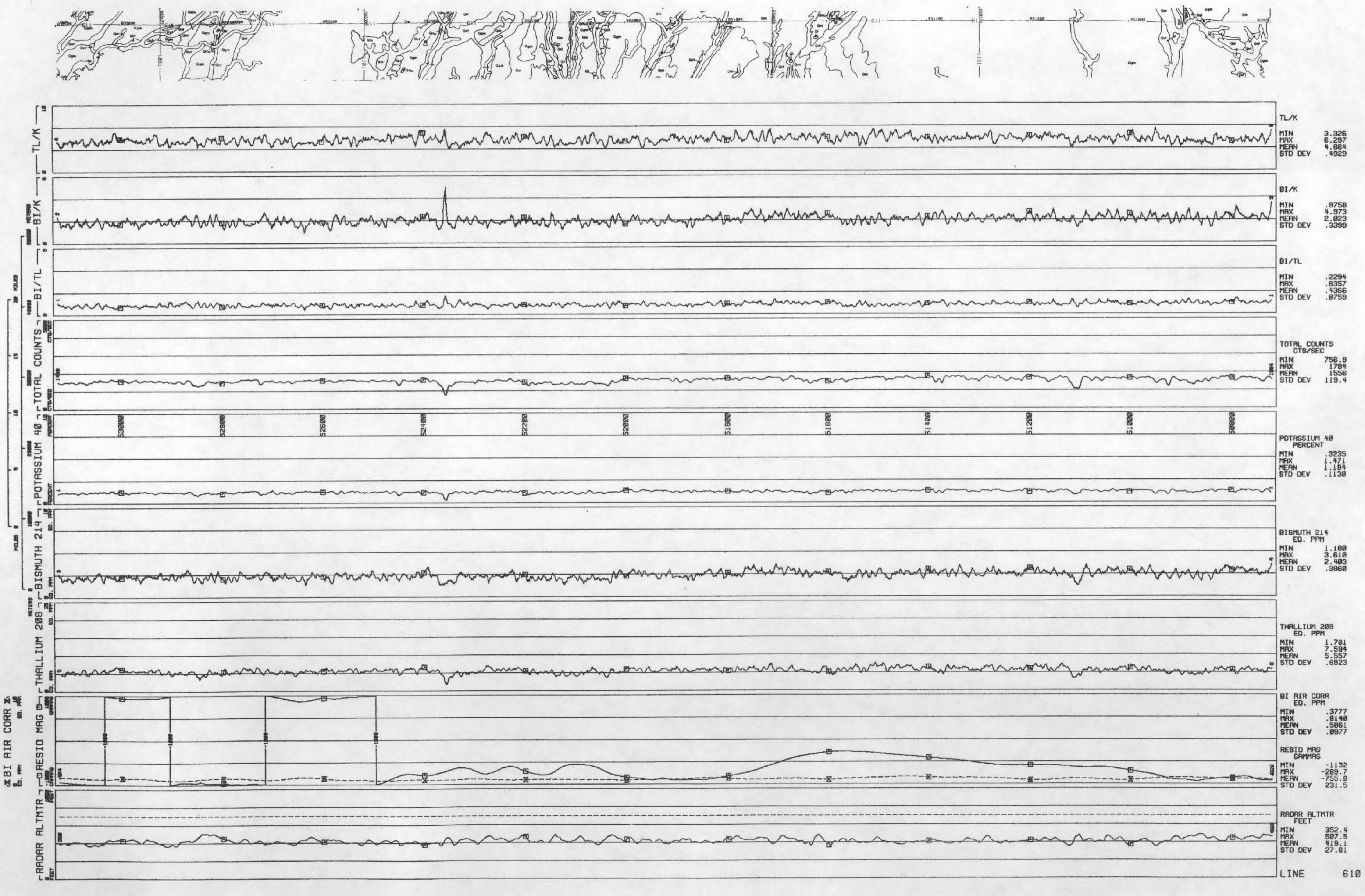
Oma: Maysville Group

Thin- to medium-bedded argillaceous limestone with interbedded bluish to gray, lumpy, calcareous shale.

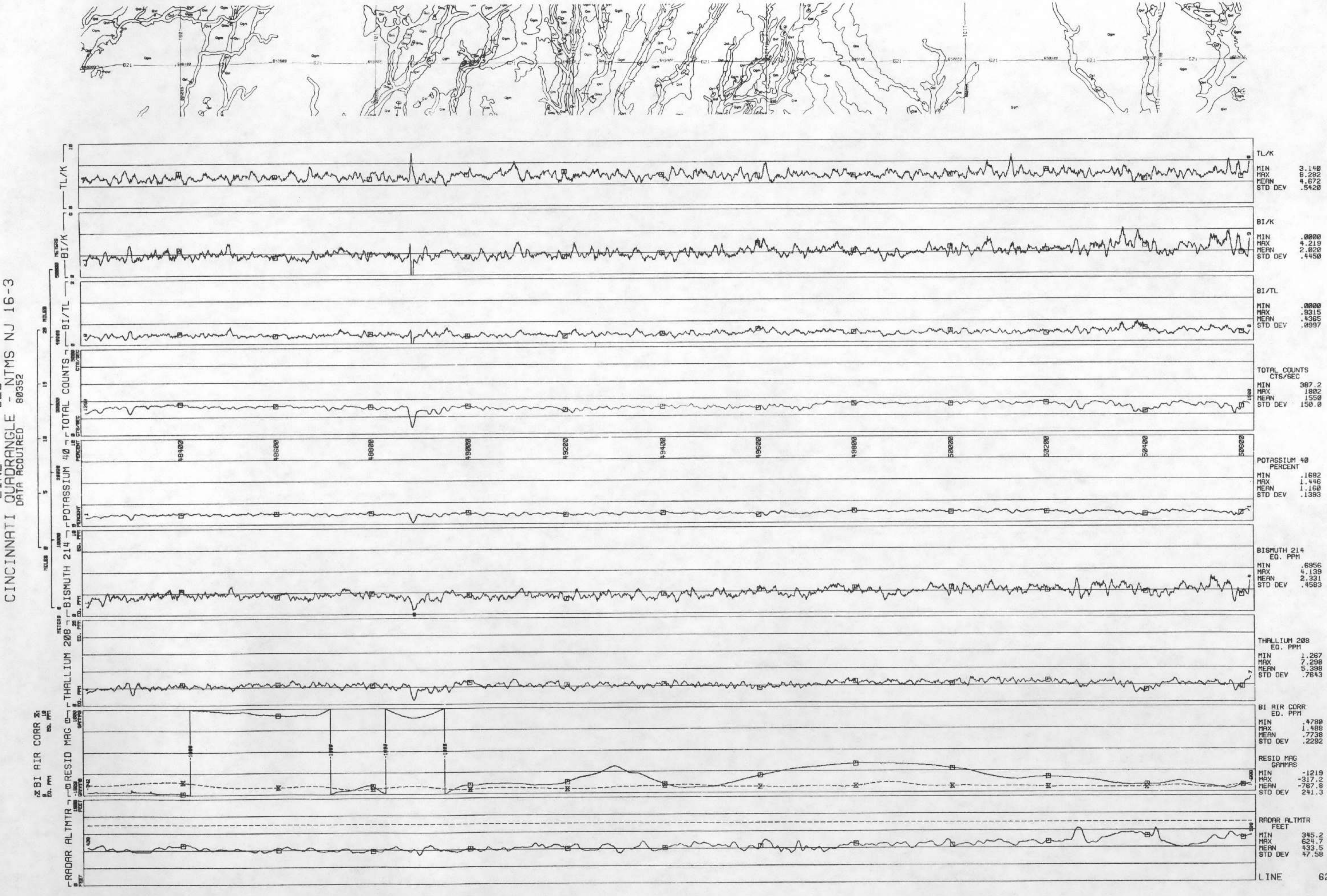
Oe: Eden Formation

Lumpy blue calcareous shale & mudstone. Contains thinly bedded argillaceous limestone increasing toward base.

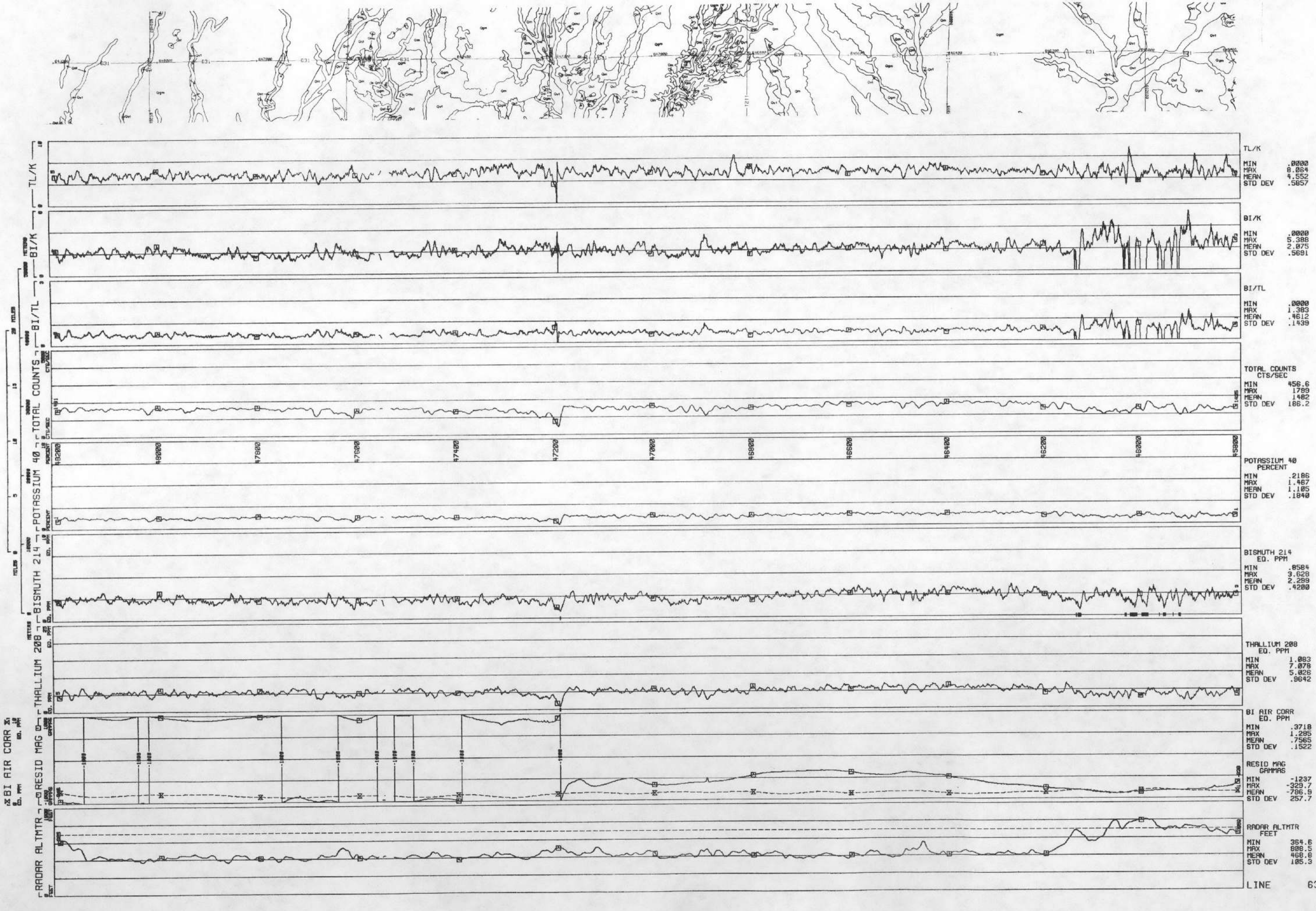
APPENDIX D - Profiles


LINE 610
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
BI AIR CORR
RESID MAG
RADAR ALTMTR
53000
52800
52600
52400
52200
52000
51800
51600
51400
51200
51000
50800
TL/K
MIN 3.326
MAX 6.297
MEAN 4.664
STD DEV .4929
BI/K
MIN .8758
MAX 4.973
MEAN 2.023
STD DEV .3399
BI/TL
MIN .2294
MAX .8357
MEAN .4366
STD DEV .0759
TOTAL COUNTS CTS/SEC
MIN 756.9
MAX 1784
MEAN 1556
STD DEV 119.4
POTASSIUM 40 PERCENT
MIN .3235
MAX 1.471
MEAN 1.184
STD DEV .1130
BISMUTH 214 EQ. PPM
MIN 1.180
MAX 3.610
MEAN 2.403
STD DEV .3860
THALLIUM 208 EQ. PPM
MIN 1.781
MAX 7.594
MEAN 5.557
STD DEV .6823
BI AIR CORR EQ. PPM
MIN .3777
MAX .8140
MEAN .5861
STD DEV .0977
RESID MAG GAMMAS
MIN -1132
MAX -269.7
MEAN -755.0
STD DEV 231.5
RADAR ALTMTR FEET
MIN 352.4
MAX 507.5
MEAN 419.1
STD DEV 27.61
LINE 610

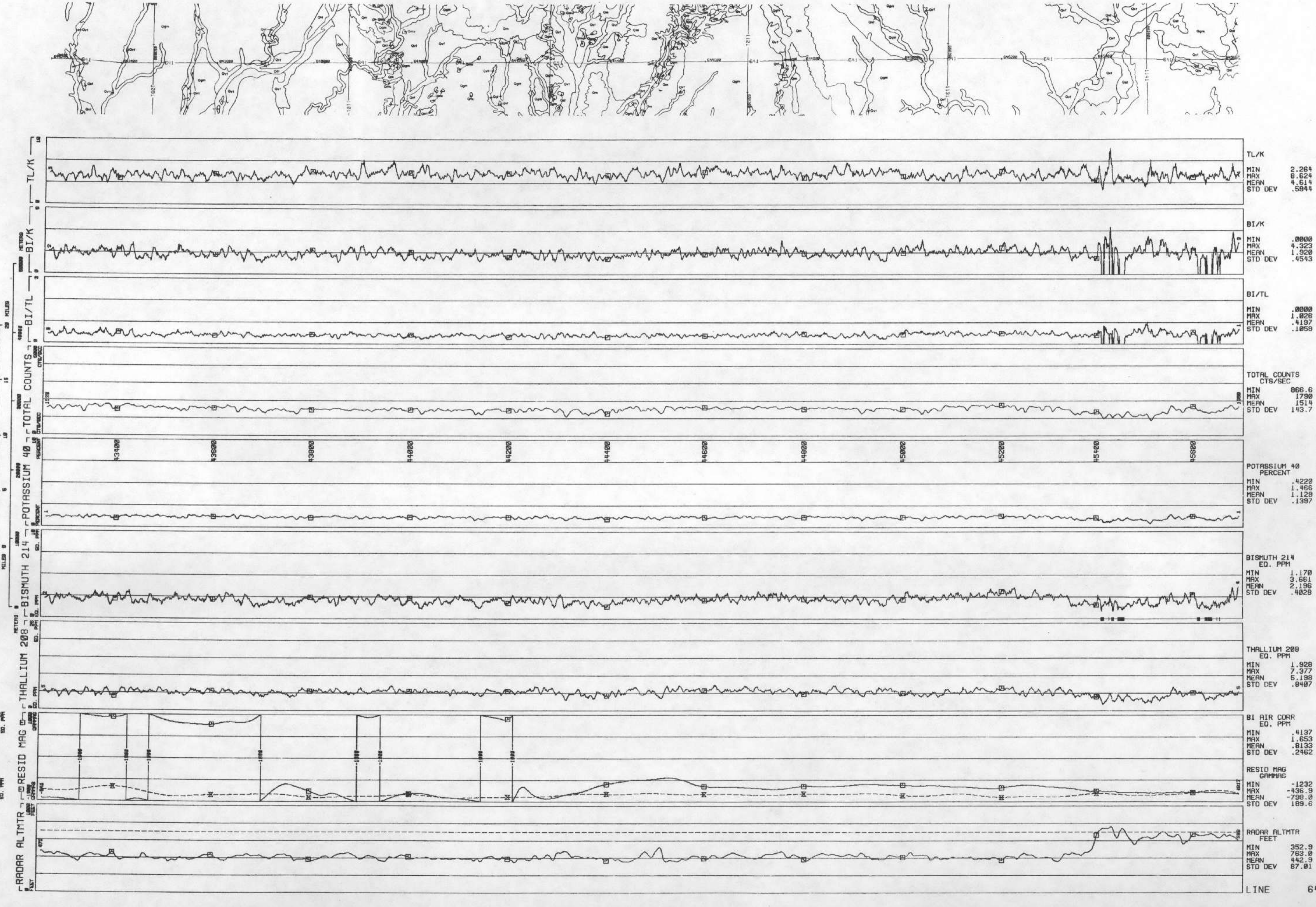
D2 ci


LINE 620
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
MIN 3.140
MAX 8.282
MEAN 4.672
STD DEV .5420
BI/K
MIN .0000
MAX 4.219
MEAN 2.020
STD DEV .4450
BI/TL
MIN .0000
MAX .8315
MEAN .4365
STD DEV .0997
TOTAL COUNTS CTS/SEC
MIN 387.2
MAX 1802
MEAN 1550
STD DEV 150.0
POTASSIUM 40 PERCENT
MIN .1692
MAX 1.446
MEAN 1.160
STD DEV .1393
BISMUTH 214 EQ. PPM
MIN .6956
MAX 4.139
MEAN 2.331
STD DEV .4583
THALLIUM 208 EQ. PPM
MIN 1.267
MAX 7.298
MEAN 5.398
STD DEV .7643
BI AIR CORR EQ. PPM
MIN .4780
MAX 1.488
MEAN .7738
STD DEV .2292
RESID MAG GAMMAS
MIN -1219
MAX -317.2
MEAN -767.8
STD DEV 241.3
RADAR ALTMTR FEET
MIN 345.2
MAX 624.7
MEAN 433.5
STD DEV 47.58
LINE 620

LINE 630
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352

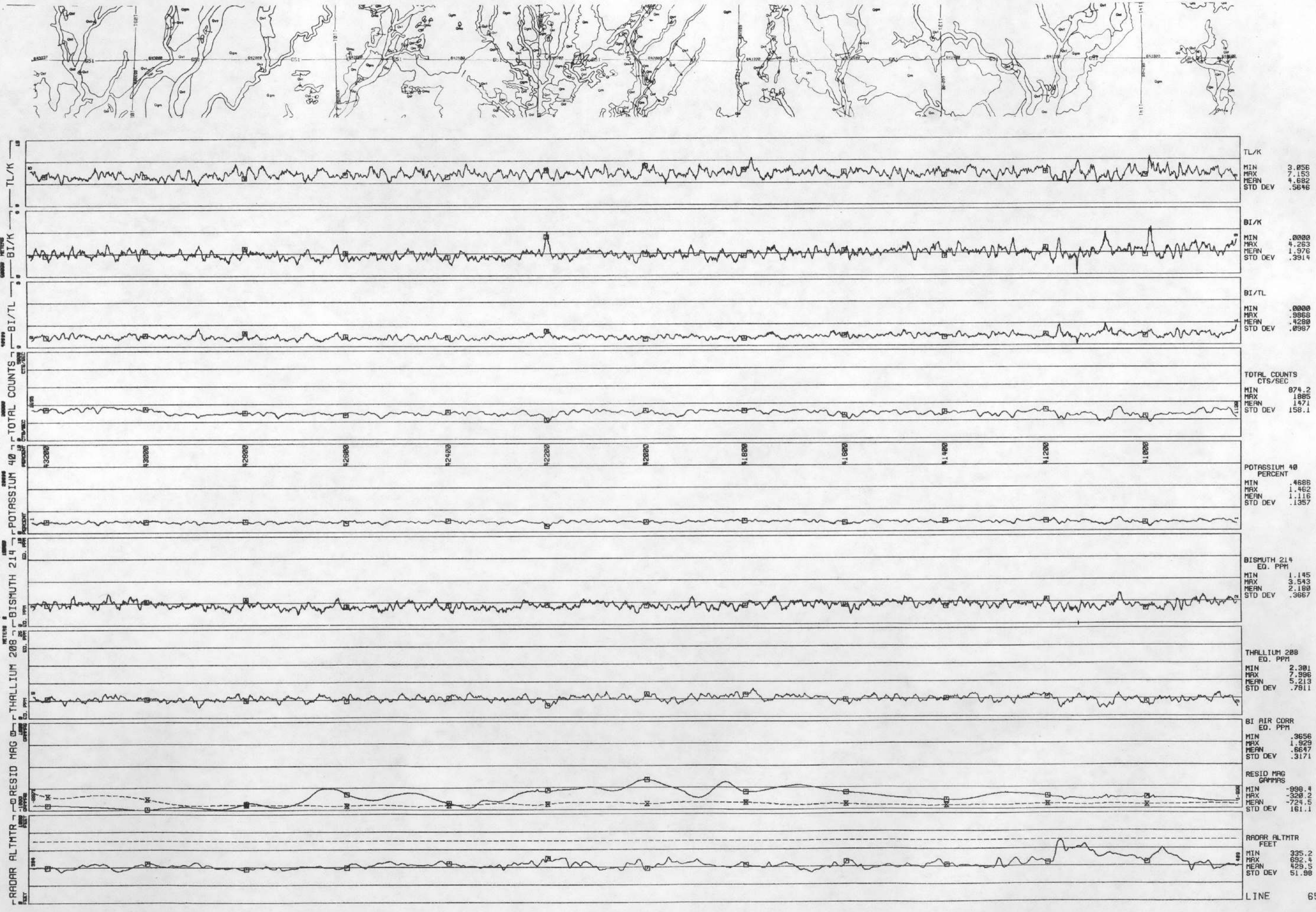


LINE 640
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352

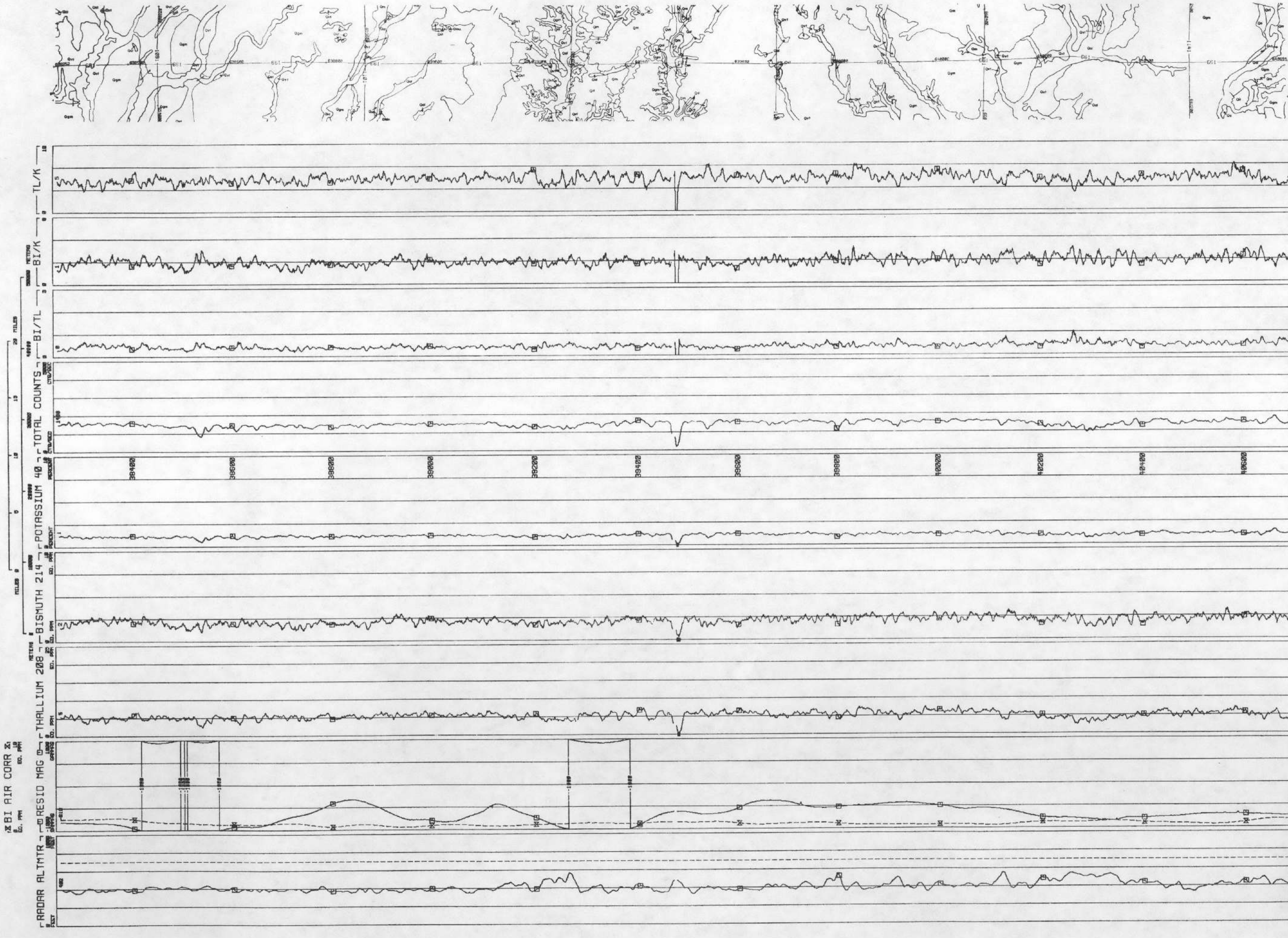


D5 ci

LINE 650
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



LINE 660
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



TL/K
MIN .0000
MAX 6.903
MEAN 4.762
STD DEV .6460

BI/K
MIN .0000
MAX 3.194
MEAN 1.938
STD DEV .3580

BI/TL
MIN .0000
MAX 1.013
MEAN .4119
STD DEV .0913

TOTAL COUNTS CTS/SEC
MIN 210.8
MAX 1760
MEAN 1447
STD DEV 147.0

POTASSIUM 40 PERCENT
MIN .1434
MAX 1.519
MEAN 1.100
STD DEV .1292

BISMUTH 214 EQ. PPM
MIN .8640
MAX 3.229
MEAN 2.123
STD DEV .3515

THALLIUM 208 EQ. PPM
MIN .9982
MAX 7.619
MEAN 5.249
STD DEV .8050

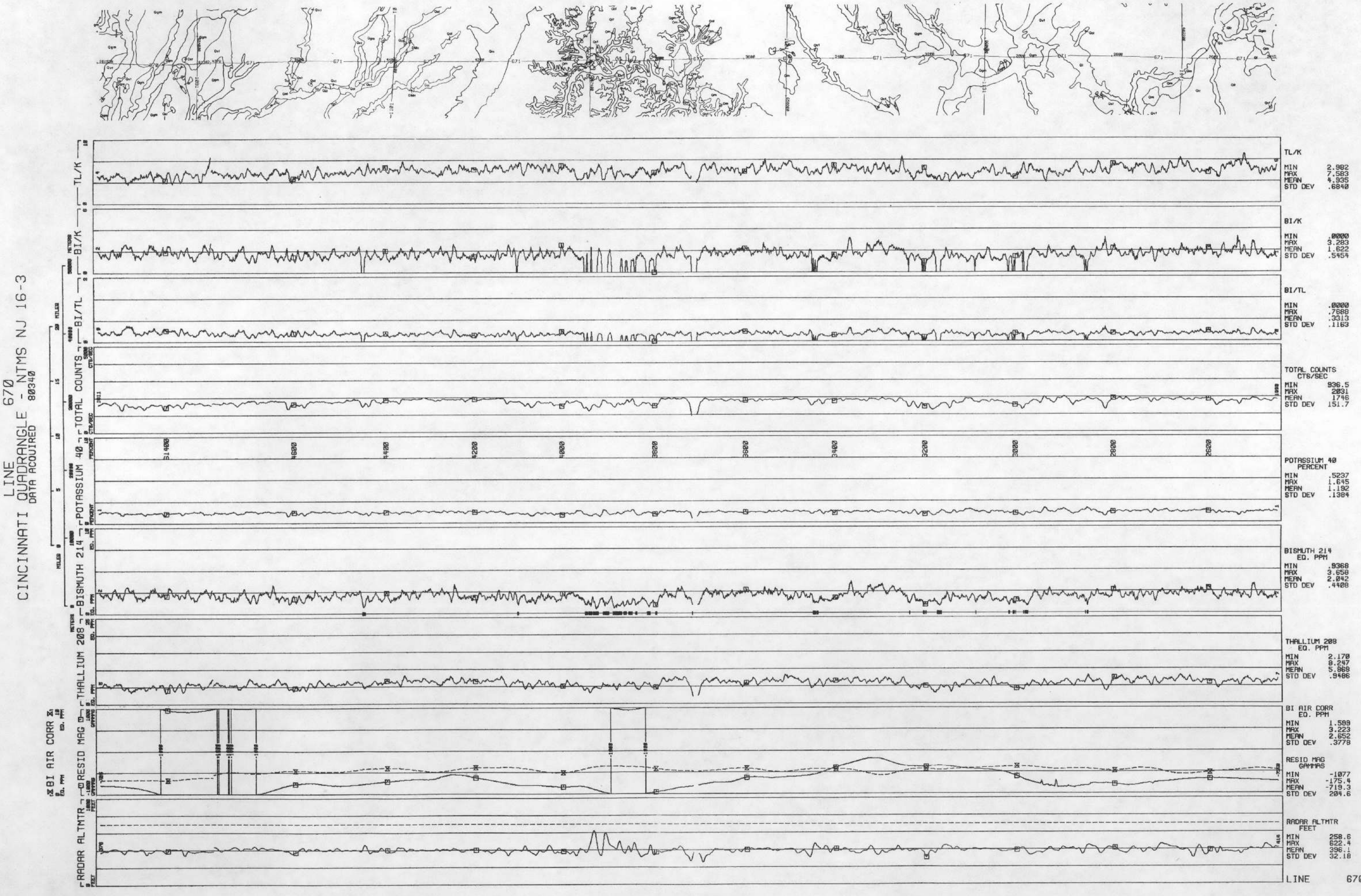
BI AIR CORR EQ. PPM
MIN .2872
MAX 1.355
MEAN .6098
STD DEV .2313

RESID MAG GAMMAS
MIN -1086
MAX -316.2
MEAN -710.8
STD DEV 195.5

RADAR ALTMTR FEET
MIN 334.8
MAX 569.9
MEAN 411.3
STD DEV 42.90

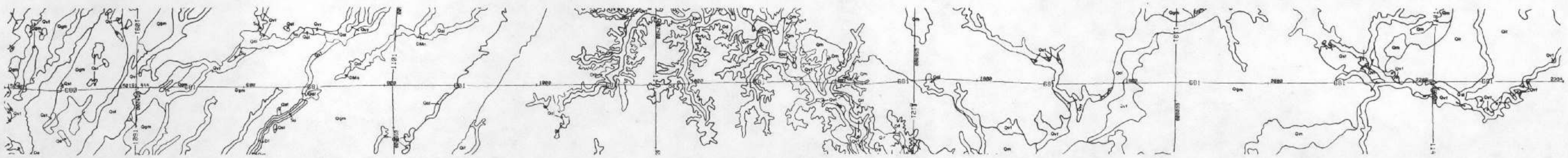
LINE 660

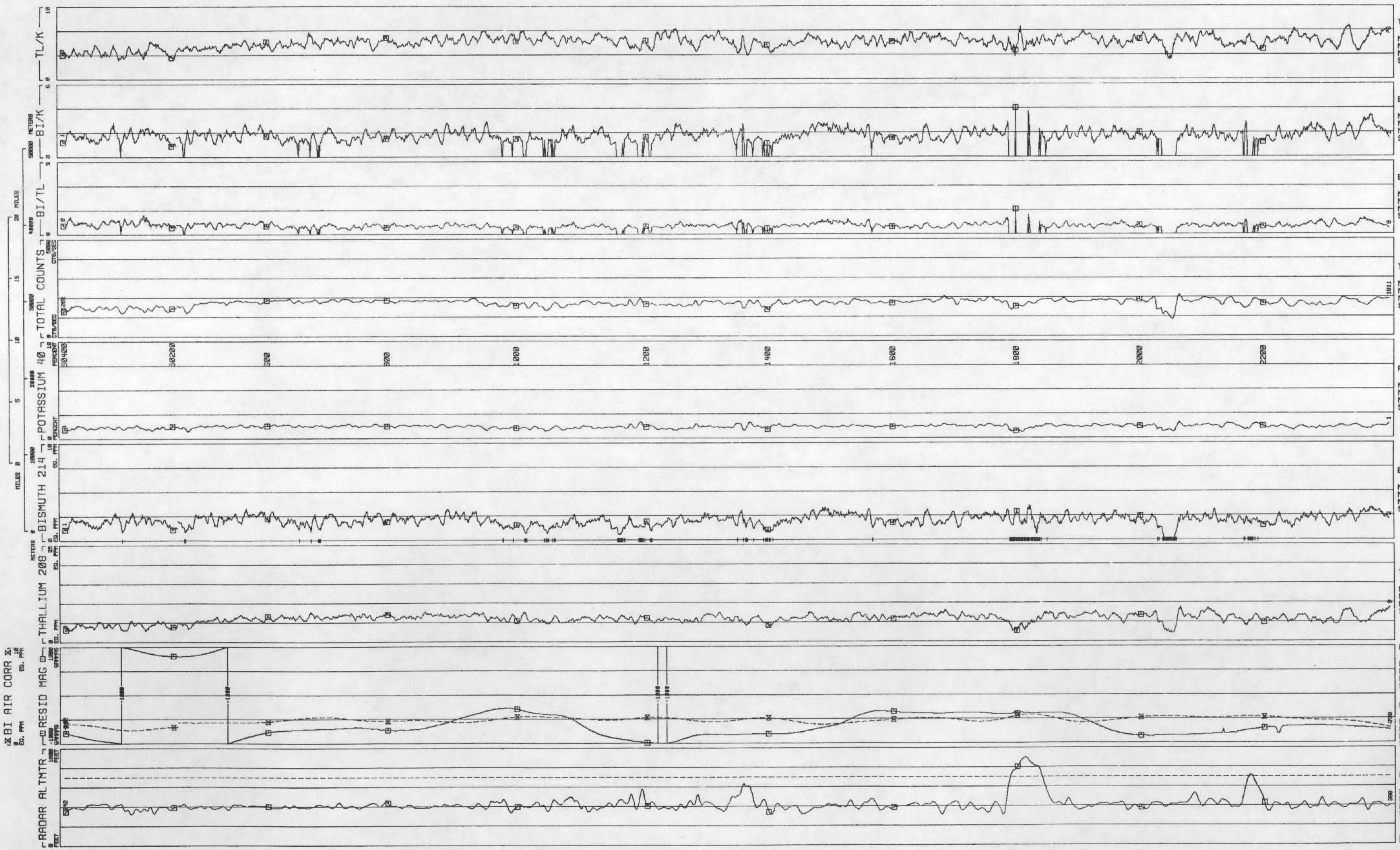
D7ci


LINE 670
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80340
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
BI AIR CORR
RESID MAG
RADAR ALTMTR
TL/K
MIN 2.982
MAX 7.583
MEAN 4.935
STD DEV .6840
BI/K
MIN .0000
MAX 3.283
MEAN 1.622
STD DEV .5454
BI/TL
MIN .0000
MAX .7688
MEAN .3313
STD DEV .1163
TOTAL COUNTS CTS/SEC
MIN 936.5
MAX 2031
MEAN 1746
STD DEV 151.7
POTASSIUM 40 PERCENT
MIN .5237
MAX 1.645
MEAN 1.192
STD DEV .1384
BISMUTH 214 EQ. PPM
MIN .9368
MAX 3.658
MEAN 2.042
STD DEV .4408
THALLIUM 208 EQ. PPM
MIN 2.170
MAX 8.247
MEAN 5.868
STD DEV .9486
BI AIR CORR EQ. PPM
MIN 1.589
MAX 3.223
MEAN 2.652
STD DEV .3778
RESID MAG GAMMAS
MIN -1077
MAX -175.4
MEAN -719.3
STD DEV 204.6
RADAR ALTMTR FEET
MIN 258.6
MAX 622.4
MEAN 396.1
STD DEV 32.18
LINE 670

D8 ci

LINE 680
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80339





TL/K
MIN 2.605
MAX 7.310
MEAN 5.012
STD DEV .7928

BI/K
MIN .0000
MAX 4.057
MEAN 1.640
STD DEV .6185

BI/TL
MIN .0000
MAX 1.045
MEAN .3319
STD DEV .1309

TOTAL COUNTS CTS/SEC
MIN 850.1
MAX 2126
MEAN 1704
STD DEV 165.8

POTASSIUM 40 PERCENT
MIN .5856
MAX 1.646
MEAN 1.173
STD DEV .1585

BISMUTH 214 EQ. PPM
MIN .9354
MAX 3.485
MEAN 2.082
STD DEV .4634

THALLIUM 208 EQ. PPM
MIN 1.958
MAX 8.856
MEAN 5.857
STD DEV 1.068

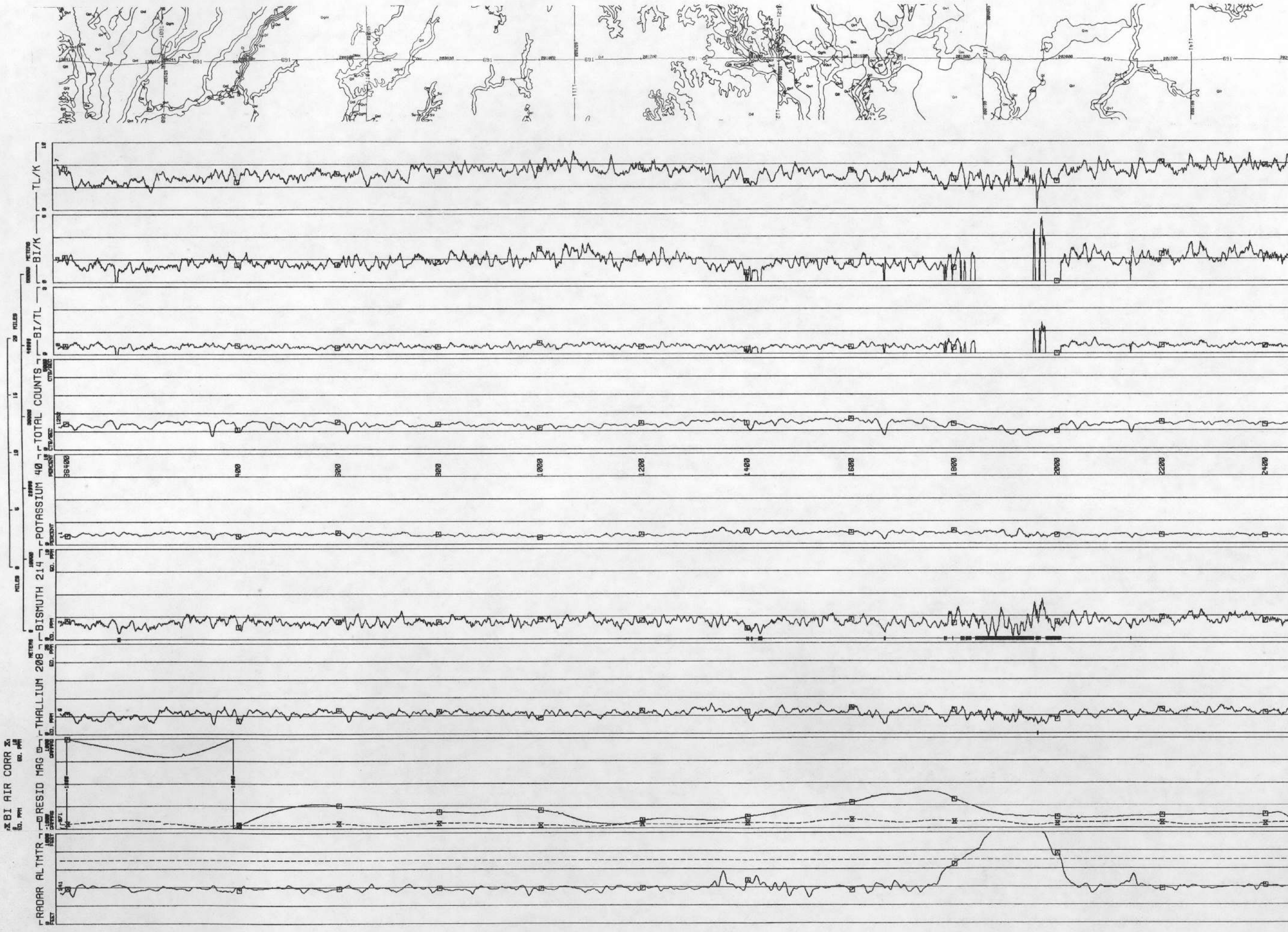
BI AIR CORR EQ. PPM
MIN 1.353
MAX 2.913
MEAN 2.322
STD DEV .3258

RESID MAG GAMMAS
MIN -1196
MAX -268.6
MEAN -705.8
STD DEV 233.9

RADAR ALTMTR FEET
MIN 309.8
MAX 900.4
MEAN 421.2
STD DEV 80.54

LINE 680

LINE 690
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



TL/K
MIN .0000
MAX 8.611
MEAN 5.315
STD DEV 1.016

BI/K
MIN .0000
MAX 5.660
MEAN 1.712
STD DEV .7203

BI/TL
MIN .0000
MAX 1.379
MEAN .3191
STD DEV .1302

TOTAL COUNTS CTS/SEC
MIN 679.9
MAX 1705
MEAN 1354
STD DEV 171.6

POTASSIUM 40 PERCENT
MIN .4997
MAX 1.823
MEAN 1.072
STD DEV .1765

BISMUTH 214 EQ. PPM
MIN .8512
MAX 4.377
MEAN 1.937
STD DEV .4176

THALLIUM 208 EQ. PPM
MIN 2.526
MAX 8.337
MEAN 5.605
STD DEV .9032

BI AIR CORR EQ. PPM
MIN .1653
MAX .9698
MEAN .5340
STD DEV .1807

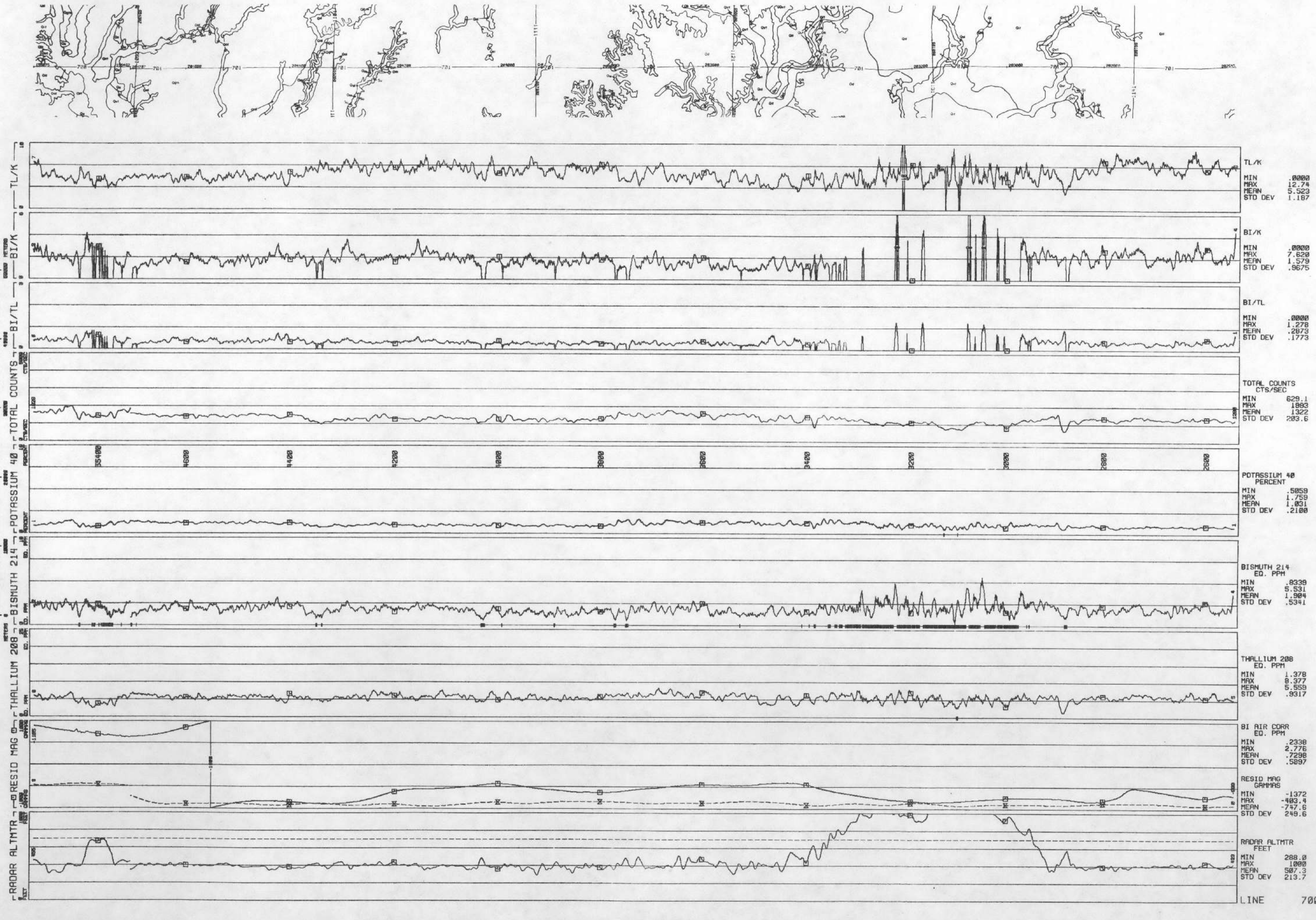
RESID MAG GAMMAS
MIN -1410
MAX -184.7
MEAN -726.9
STD DEV 264.4

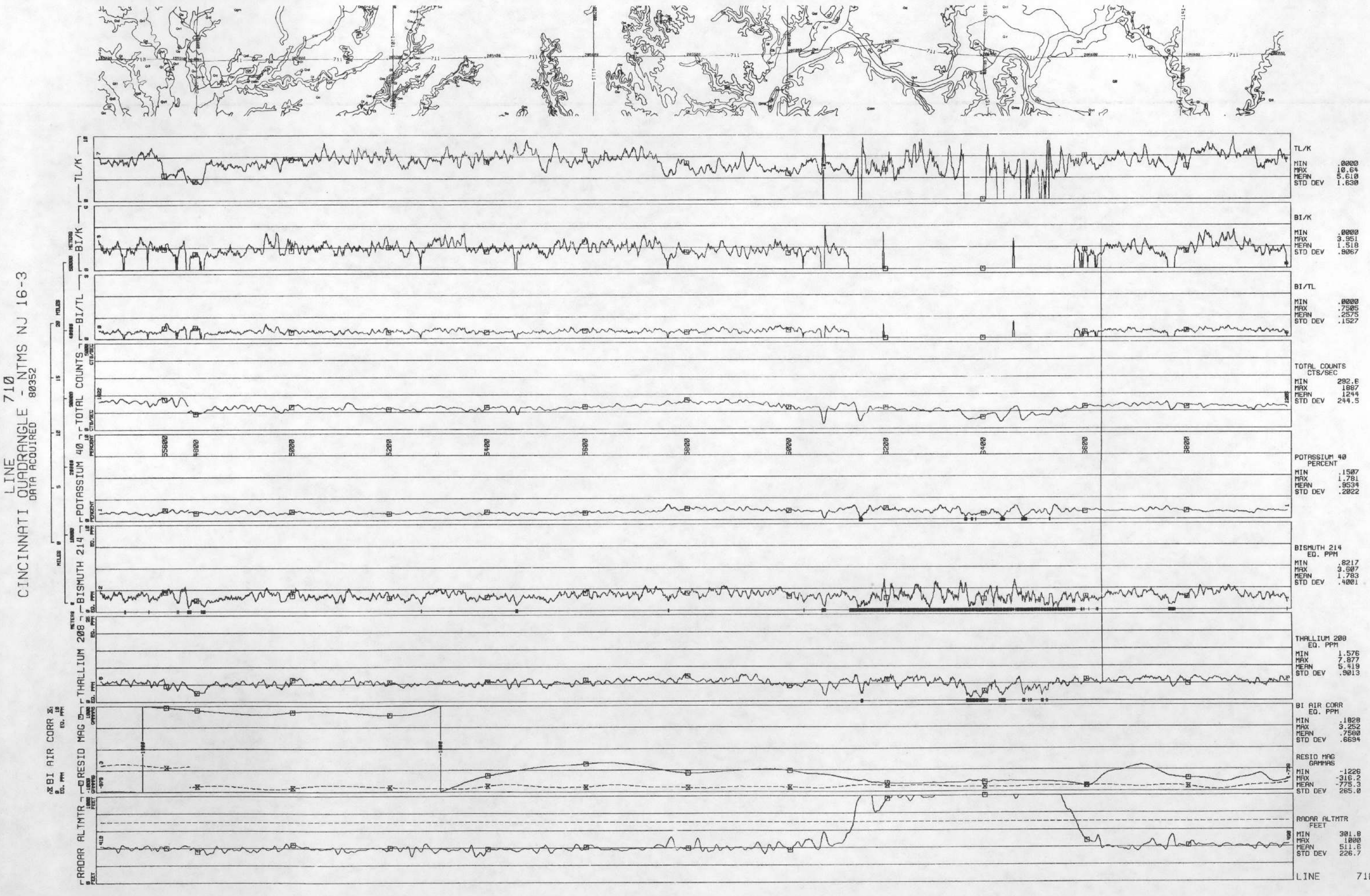
RADAR ALTMTR FEET
MIN 284.1
MAX 1000
MEAN 438.9
STD DEV 150.9

LINE 690

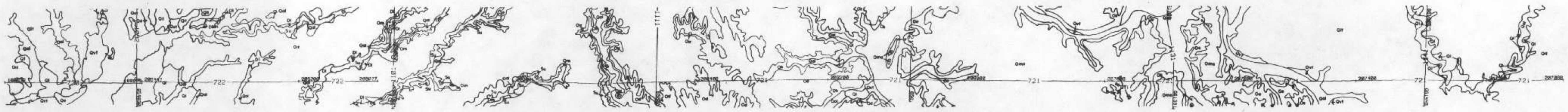
D10

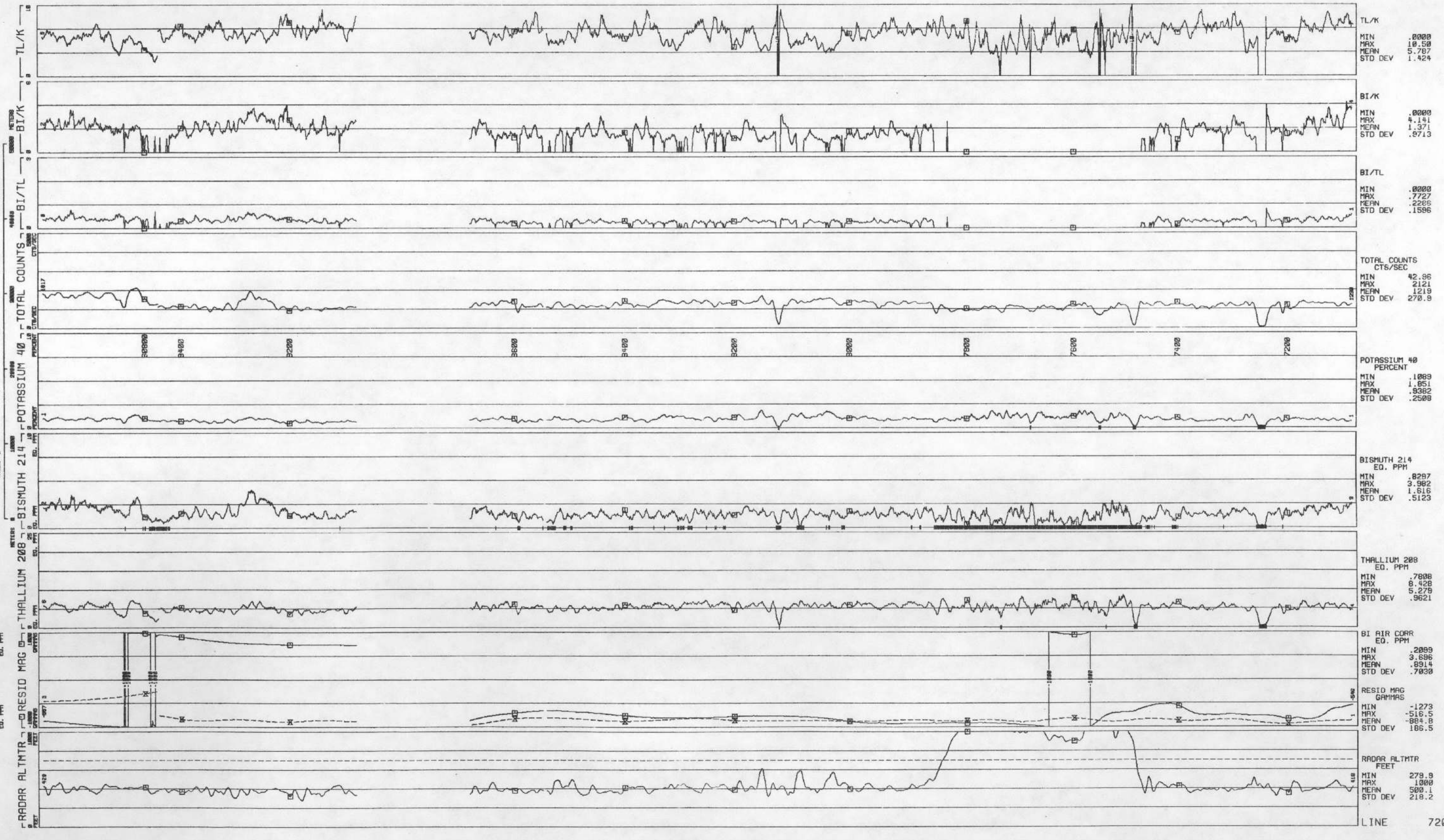
LINE 700
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



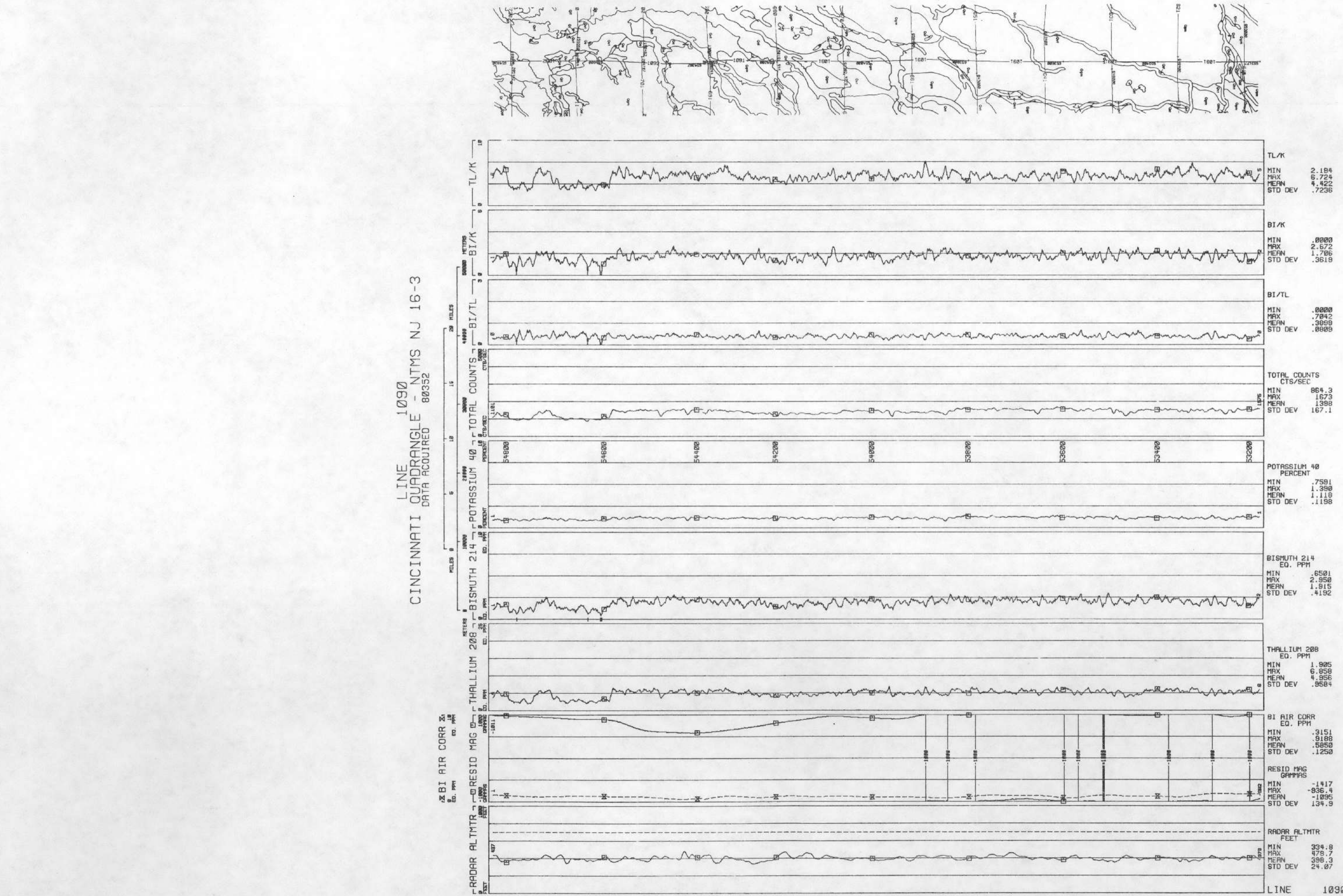

LINE 710
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
BI AIR CORR
RESID MAG
RADAR ALTMTR
4800
5000
5200
5400
5600
5800
6000
6200
6400
6600
6800
TL/K
MIN .0000
MAX 10.64
MEAN 5.610
STD DEV 1.630
BI/K
MIN .0000
MAX 3.951
MEAN 1.518
STD DEV .9067
BI/TL
MIN .0000
MAX .7505
MEAN .2575
STD DEV .1527
TOTAL COUNTS CTS/SEC
MIN 292.6
MAX 1887
MEAN 1244
STD DEV 244.5
POTASSIUM 40 PERCENT
MIN .1507
MAX 1.781
MEAN .9534
STD DEV .2022
BISMUTH 214 EQ. PPM
MIN .8217
MAX 3.607
MEAN 1.783
STD DEV .4001
THALLIUM 208 EQ. PPM
MIN 1.576
MAX 7.877
MEAN 5.419
STD DEV .9013
BI AIR CORR EQ. PPM
MIN .1828
MAX 3.252
MEAN .7580
STD DEV .6694
RESID MAG GAMMAS
MIN -1226
MAX -316.2
MEAN -775.3
STD DEV 265.0
RADAR ALTMTR FEET
MIN 301.8
MAX 1000
MEAN 511.6
STD DEV 226.7
LINE 710

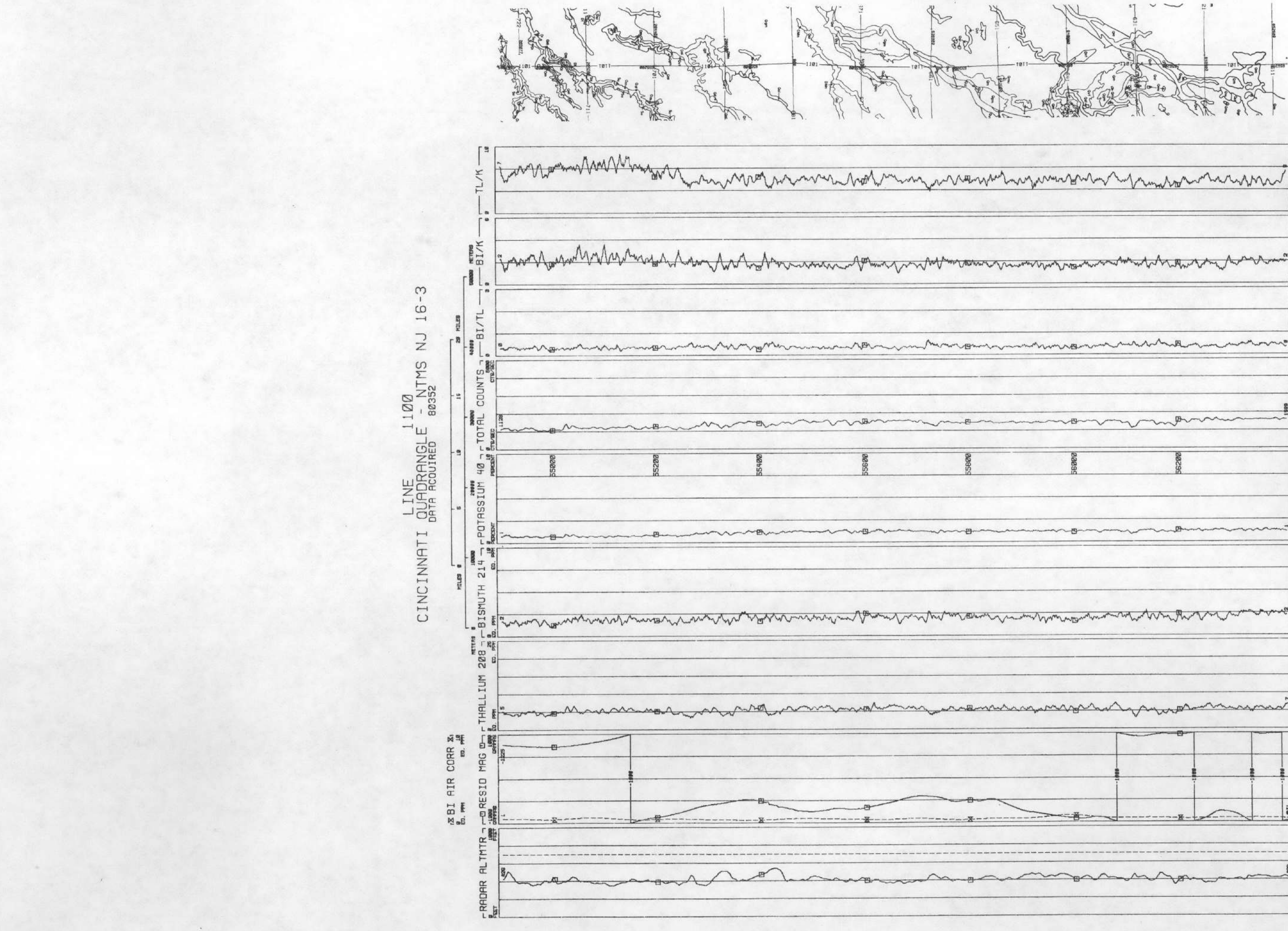
LINE 720
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



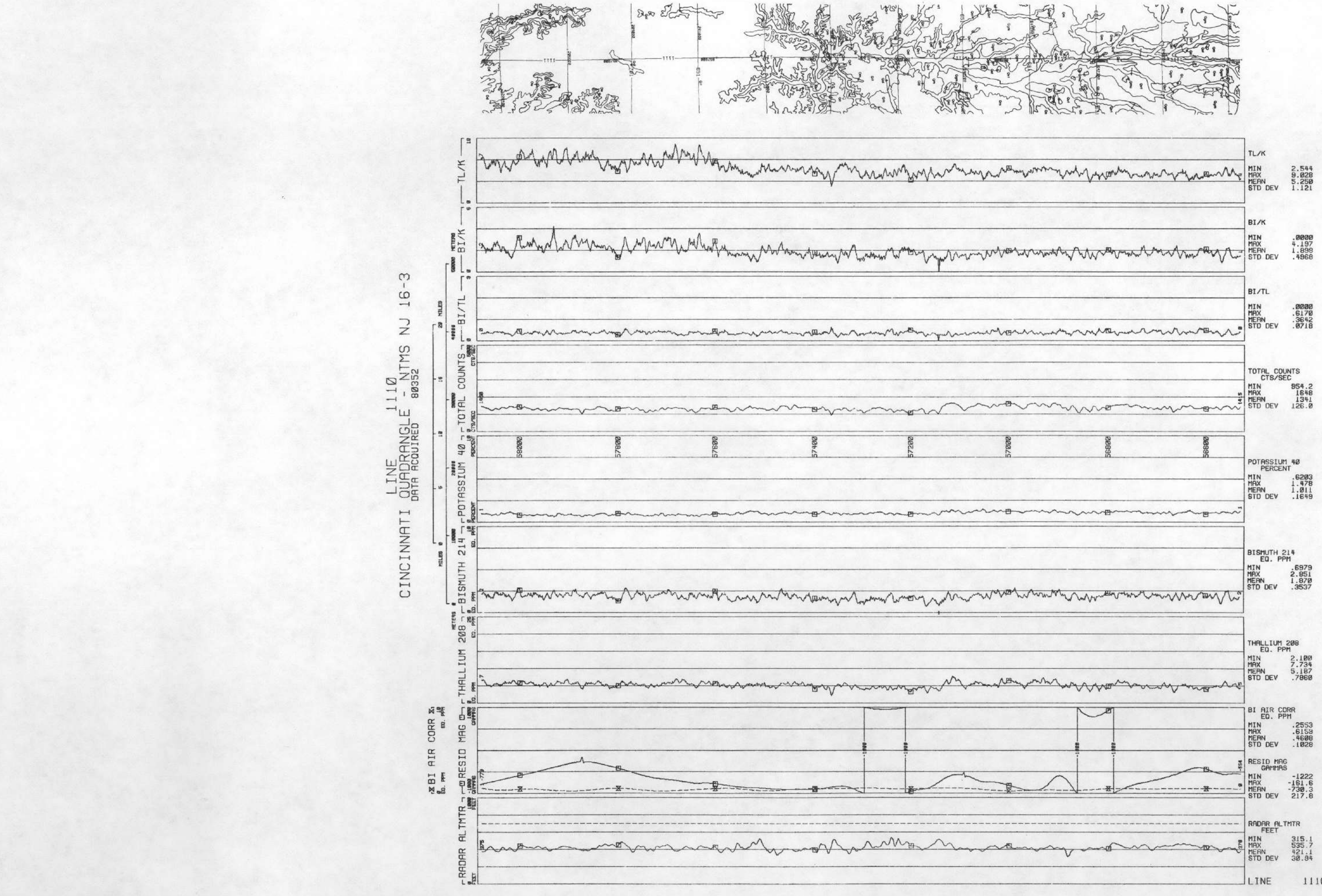


LINE 1090
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352

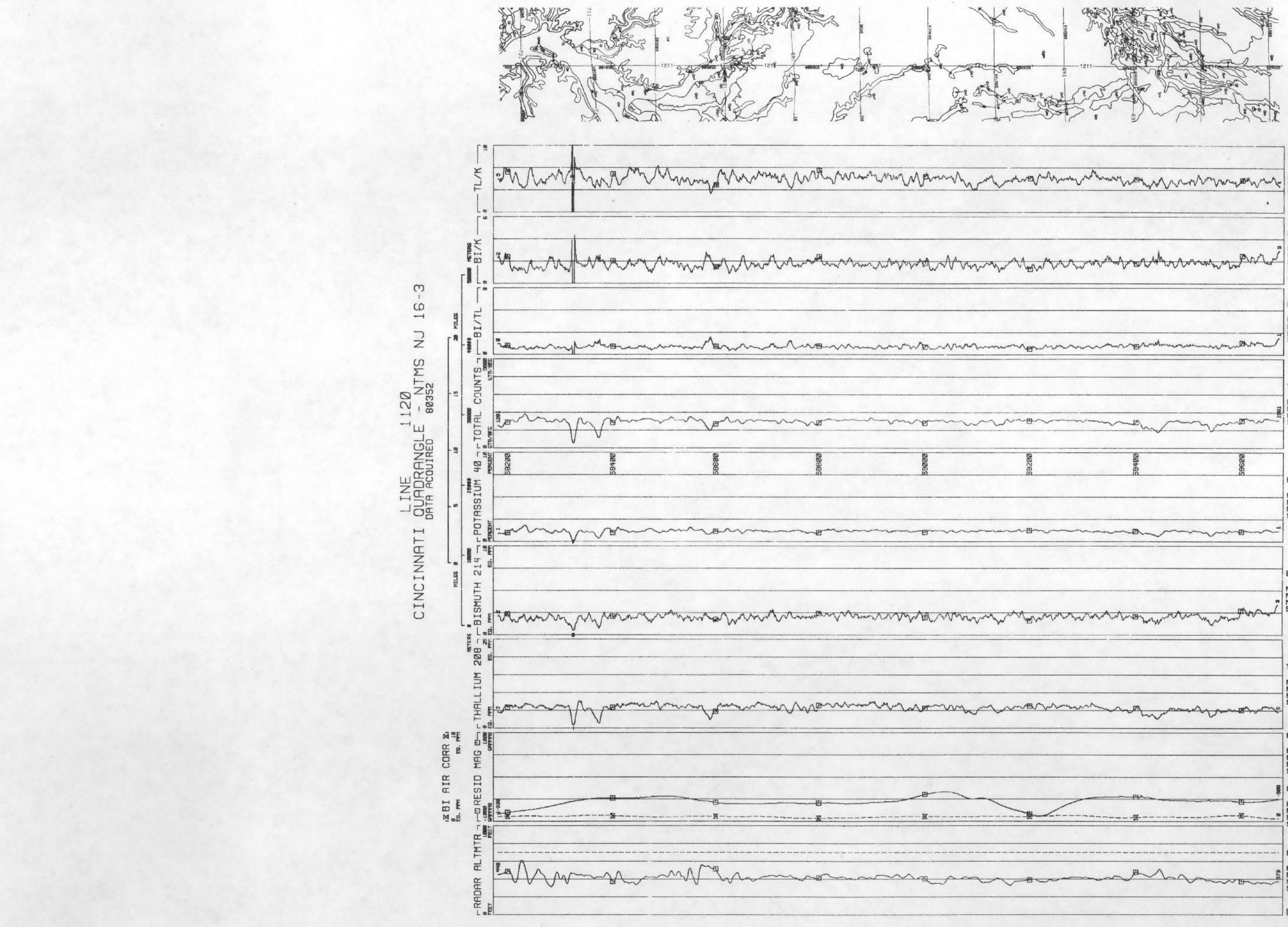



LINE 1100
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
MIN 3.150
MAX 8.812
MEAN 5.149
STD DEV 1.009
BI/K
MIN .9581
MAX 3.614
MEAN 1.856
STD DEV .3755
BI/TL
MIN .1944
MAX .6559
MEAN .3661
STD DEV .0690
TOTAL COUNTS CTS/SEC
MIN 1022
MAX 1663
MEAN 1396
STD DEV 154.1
POTASSIUM 40 PERCENT
MIN .5971
MAX 1.432
MEAN 1.079
STD DEV .1998
BISMUTH 214 EQ. PPM
MIN 1.027
MAX 2.776
MEAN 1.853
STD DEV .3162
THALLIUM 208 EQ. PPM
MIN 3.180
MAX 7.417
MEAN 5.403
STD DEV .7009
BI AIR CORR EQ. PPM
MIN .2675
MAX .7466
MEAN .4376
STD DEV .0908
RESID MAG GAMMAS
MIN -1283
MAX +408.8
MEAN -826.5
STD DEV 251.2
RADAR ALTMTR FEET
MIN 350.5
MAX 541.0
MEAN 412.9
STD DEV 34.02
LINE 1100

D15


LINE 1110
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
MIN 2.544
MAX 9.028
MEAN 5.250
STD DEV 1.121
BI/K
MIN .0000
MAX 4.197
MEAN 1.899
STD DEV .4868
BI/TL
MIN .0000
MAX .6170
MEAN .3642
STD DEV .0718
TOTAL COUNTS CTS/SEC
MIN 854.2
MAX 1648
MEAN 1341
STD DEV 126.0
POTASSIUM 40 PERCENT
MIN .6203
MAX 1.478
MEAN 1.011
STD DEV .1649
BISMUTH 214 EQ. PPM
MIN .6979
MAX 2.851
MEAN 1.870
STD DEV .3537
THALLIUM 208 EQ. PPM
MIN 2.100
MAX 7.734
MEAN 5.187
STD DEV .7860
BI AIR CORR EQ. PPM
MIN .2553
MAX .6159
MEAN .4608
STD DEV .1028
RESID MAG GAMMAS
MIN -1222
MAX -161.6
MEAN -730.3
STD DEV 217.8
RADAR ALTMTR FEET
MIN 315.1
MAX 535.7
MEAN 421.1
STD DEV 30.84
LINE 1110

D16 ci



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MAX 11.95
MEAN 4.967
STD DEV .7275

BI/K
MIN .0000
MAX 4.275
MEAN 1.769
STD DEV .3687

BI/TL
MIN .0000
MAX .8013
MEAN .3609
STD DEV .0832

TOTAL COUNTS
CTS/SEC
MIN 280.1
MAX 1909
MEAN 1476
STD DEV 174.0

POTASSIUM 40
PERCENT
MIN .1148
MAX 1.827
MEAN 1.152
STD DEV .1698

BISMUTH 214
EQ. PPM
MIN .6980
MAX 3.386
MEAN 2.010
STD DEV .3448

THALLIUM 208
EQ. PPM
MIN .9184
MAX 7.705
MEAN 5.689
STD DEV .9685

BI AIR CORR
EQ. PPM
MIN .3142
MAX .6708
MEAN .5157
STD DEV .0794

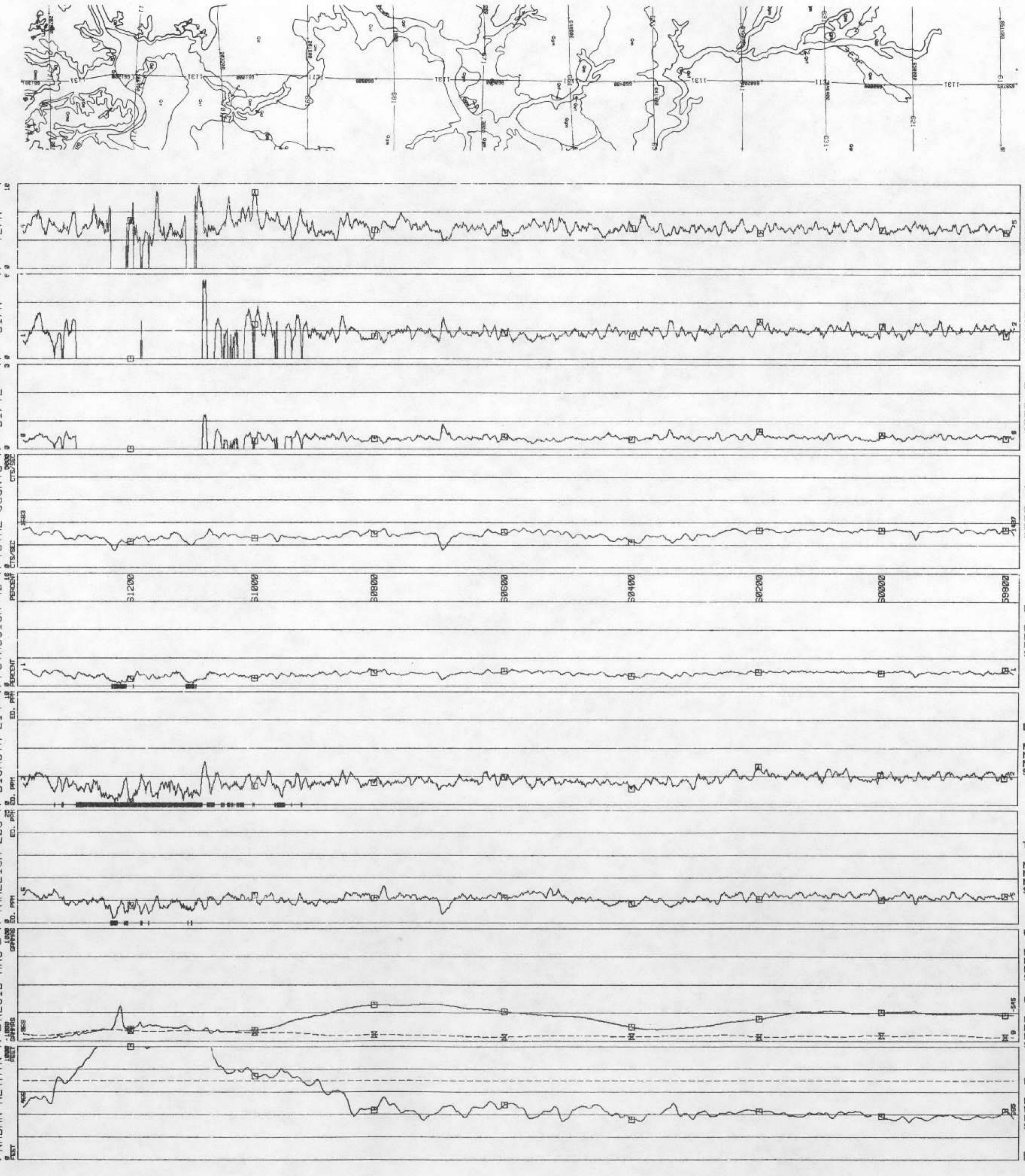
RESID MAG
GAMMAS
MIN -882.3
MAX -327.5
MEAN -560.6
STD DEV 111.5

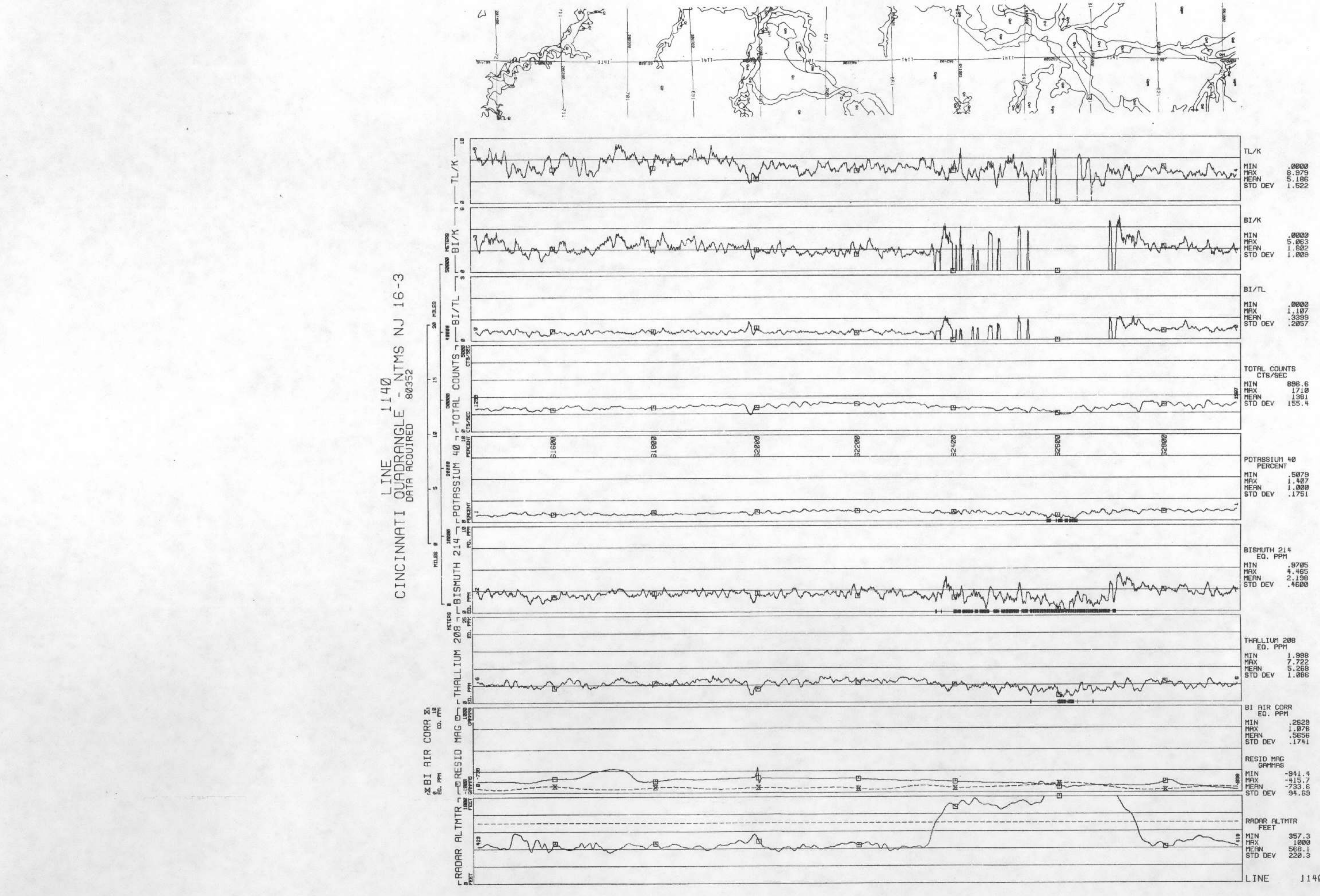
RADAR ALTMTR
FEET
MIN 316.4
MAX 611.3
MEAN 414.2
STD DEV 42.12

LINE 1120

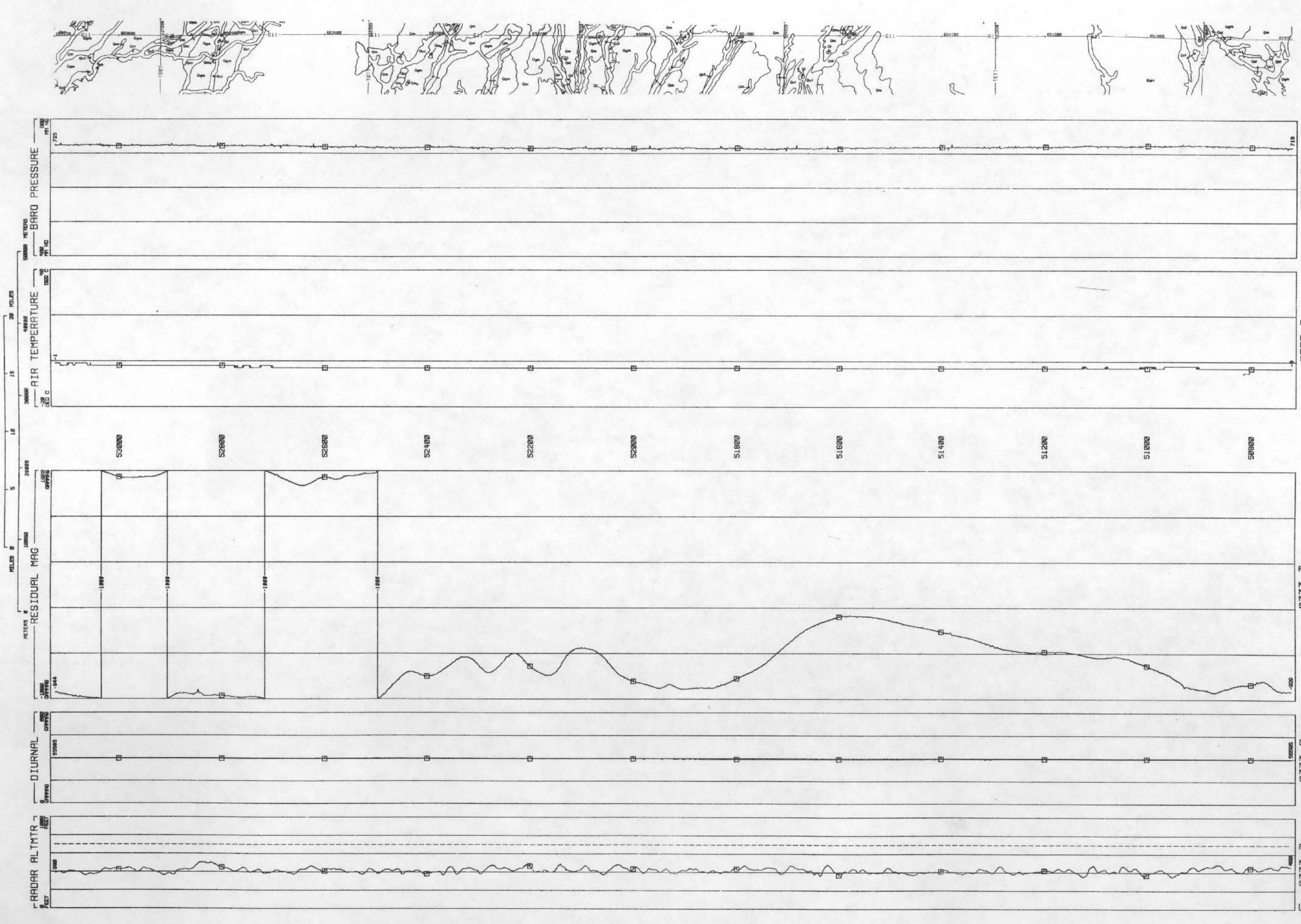
D17 ci

LINE 1130
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352




LINE 1140
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
TL/K
MIN .0000
MAX 8.979
MEAN 5.186
STD DEV 1.522
BI/K
MIN .0000
MAX 5.063
MEAN 1.802
STD DEV 1.009
BI/TL
MIN .0000
MAX 1.107
MEAN .3399
STD DEV .2057
TOTAL COUNTS CTS/SEC
MIN 896.6
MAX 1710
MEAN 1381
STD DEV 155.4
POTASSIUM 40 PERCENT
MIN .5079
MAX 1.407
MEAN 1.000
STD DEV .1751
BISMUTH 214 EQ. PPM
MIN .9705
MAX 4.465
MEAN 2.198
STD DEV .4600
THALLIUM 208 EQ. PPM
MIN 1.988
MAX 7.722
MEAN 5.268
STD DEV 1.086
BI AIR CORR EQ. PPM
MIN .2629
MAX 1.076
MEAN .5656
STD DEV .1741
RESID MAG GAMMAS
MIN -941.4
MAX -415.7
MEAN -733.6
STD DEV 94.69
RADAR ALTMTR FEET
MIN 357.3
MAX 1000
MEAN 568.1
STD DEV 220.3
LINE 1140

LINE 610
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG

MIN	708.3
MAX	730.7
MEAN	718.8
STD DEV	3.406

AIR TEMPERATURE
DEG C

MIN	-3.000
MAX	-1.000
MEAN	-2.784
STD DEV	.4521

RESIDUAL MAG
GAMMAS

MIN	-1132
MAX	-269.7
MEAN	-755.0
STD DEV	231.5

DIURNAL
GAMMAS

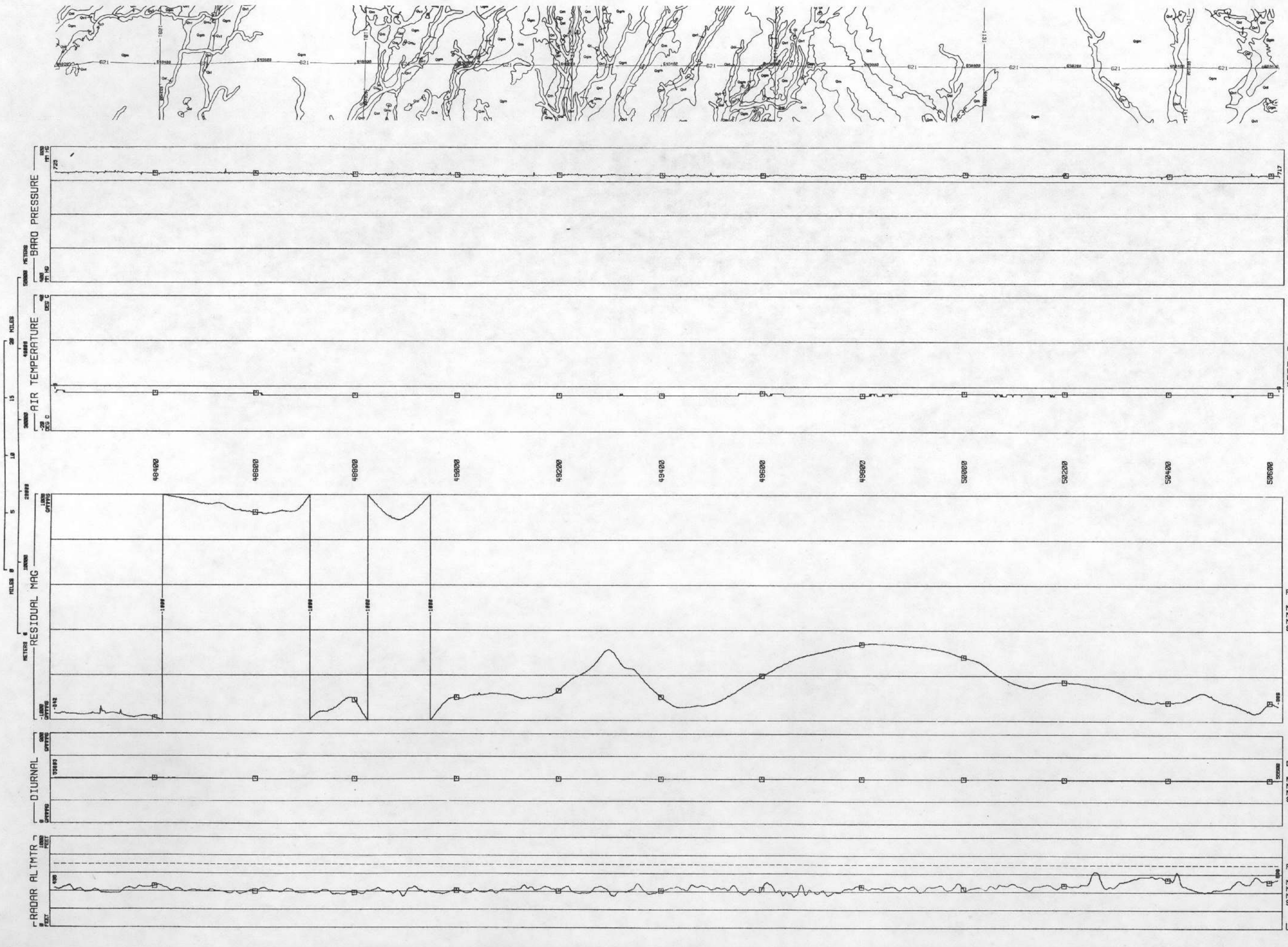
MIN	55583
MAX	55596
MEAN	55588
STD DEV	6.277

RADAR ALTMTR
FEET

MIN	352.4
MAX	507.5
MEAN	419.1
STD DEV	27.61

LINE 610

LINE 620
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG
MIN 710.9
MAX 734.5
MEAN 719.5
STD DEV 2.683

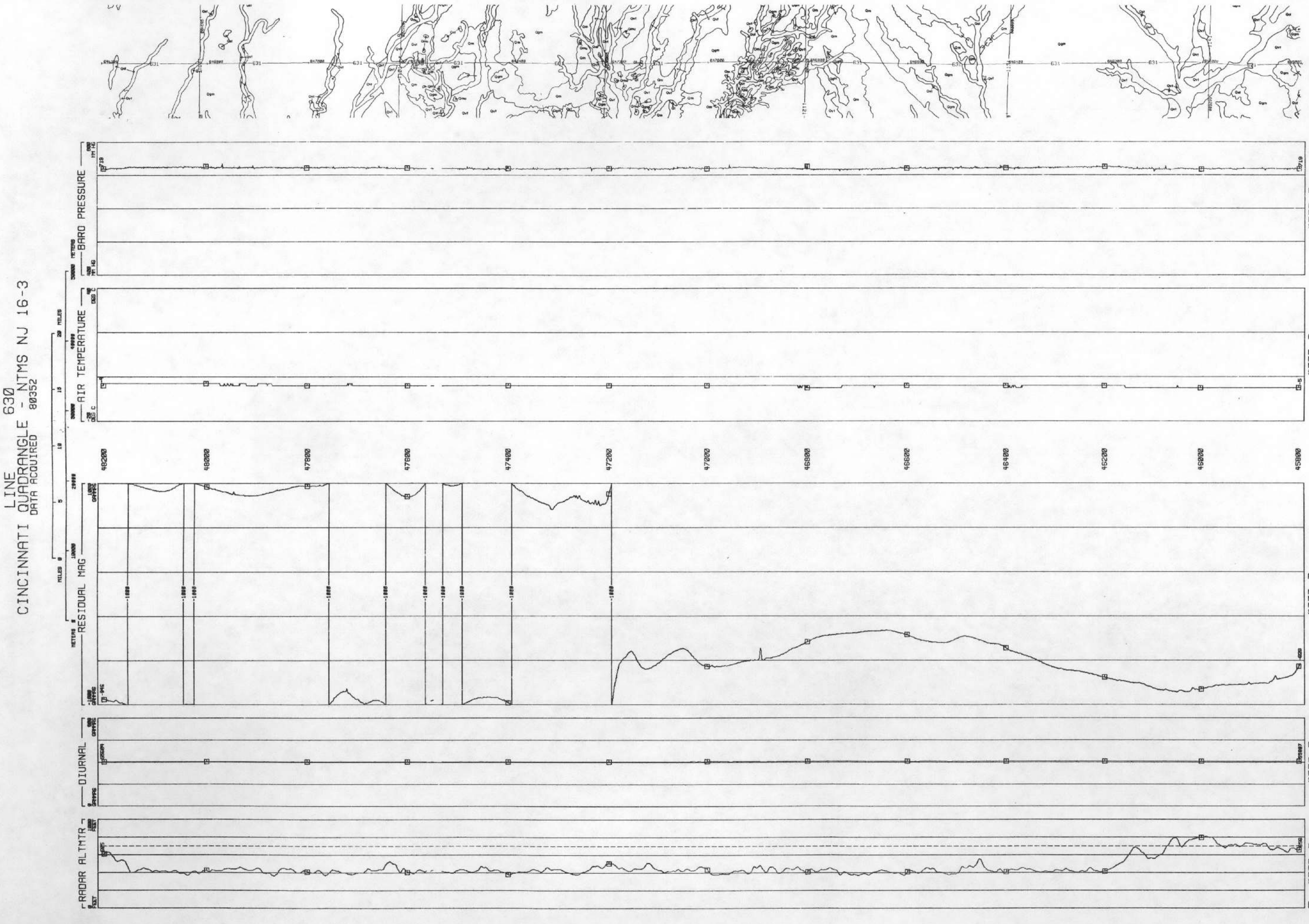
AIR TEMPERATURE
DEG C
MIN -4.000
MAX -2.000
MEAN -3.477
STD DEV .5893

RESIDUAL MAG
GAMMAS
MIN -1219
MAX -317.2
MEAN -767.8
STD DEV 241.3

DIURNAL
GAMMAS
MIN 55596
MAX 55603
MEAN 55591
STD DEV 8.373

RADAR ALTMTR
FEET
MIN 345.2
MAX 624.7
MEAN 433.5
STD DEV 47.58

LINE 620



BARO PRESSURE
MM HG
MIN 710.9
MAX 735.0
MEAN 720.6
STD DEV 2.347

AIR TEMPERATURE
DEG C
MIN -5.000
MAX -3.000
MEAN -4.072
STD DEV .5509

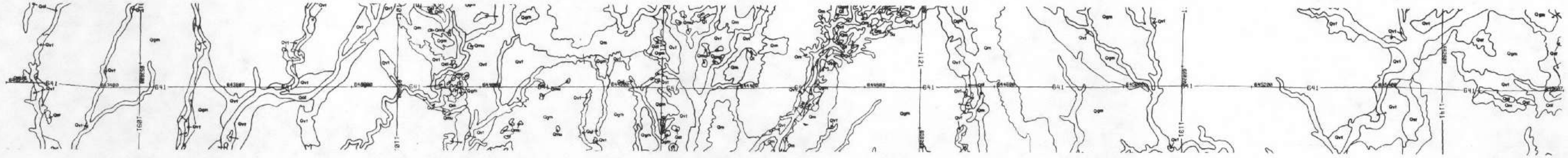
RESIDUAL MAG
GAMMAS
MIN -1237
MAX -329.7
MEAN -786.9
STD DEV 257.7

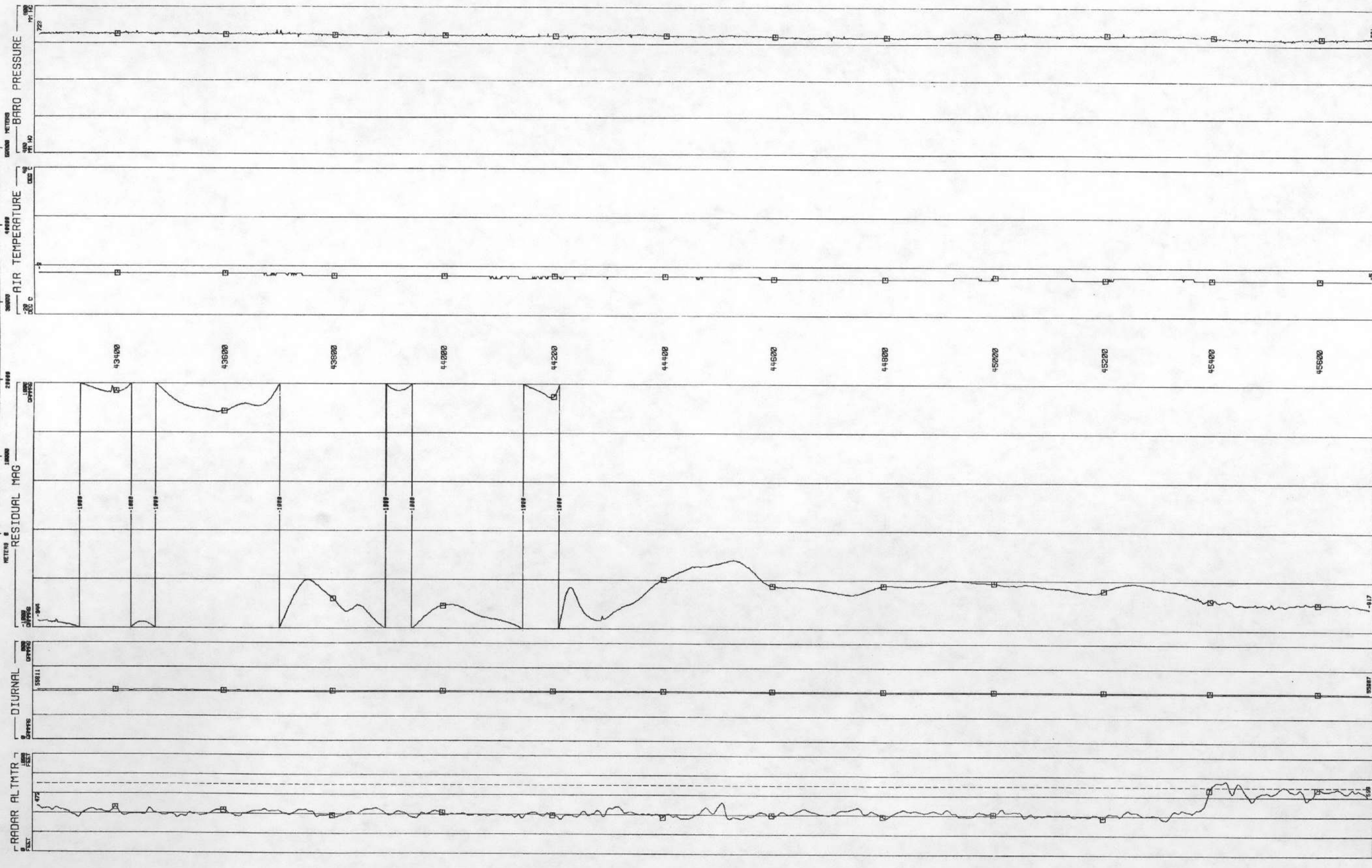
DIURNAL
GAMMAS
MIN 55604
MAX 55608
MEAN 55601
STD DEV 5.002

RADAR ALTMTR
FEET
MIN 364.6
MAX 808.5
MEAN 468.8
STD DEV 105.3

LINE 630

LINE 640
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352





BARO PRESSURE MM HG
MIN 712.5
MAX 736.1
MEAN 722.4
STD DEV 3.128

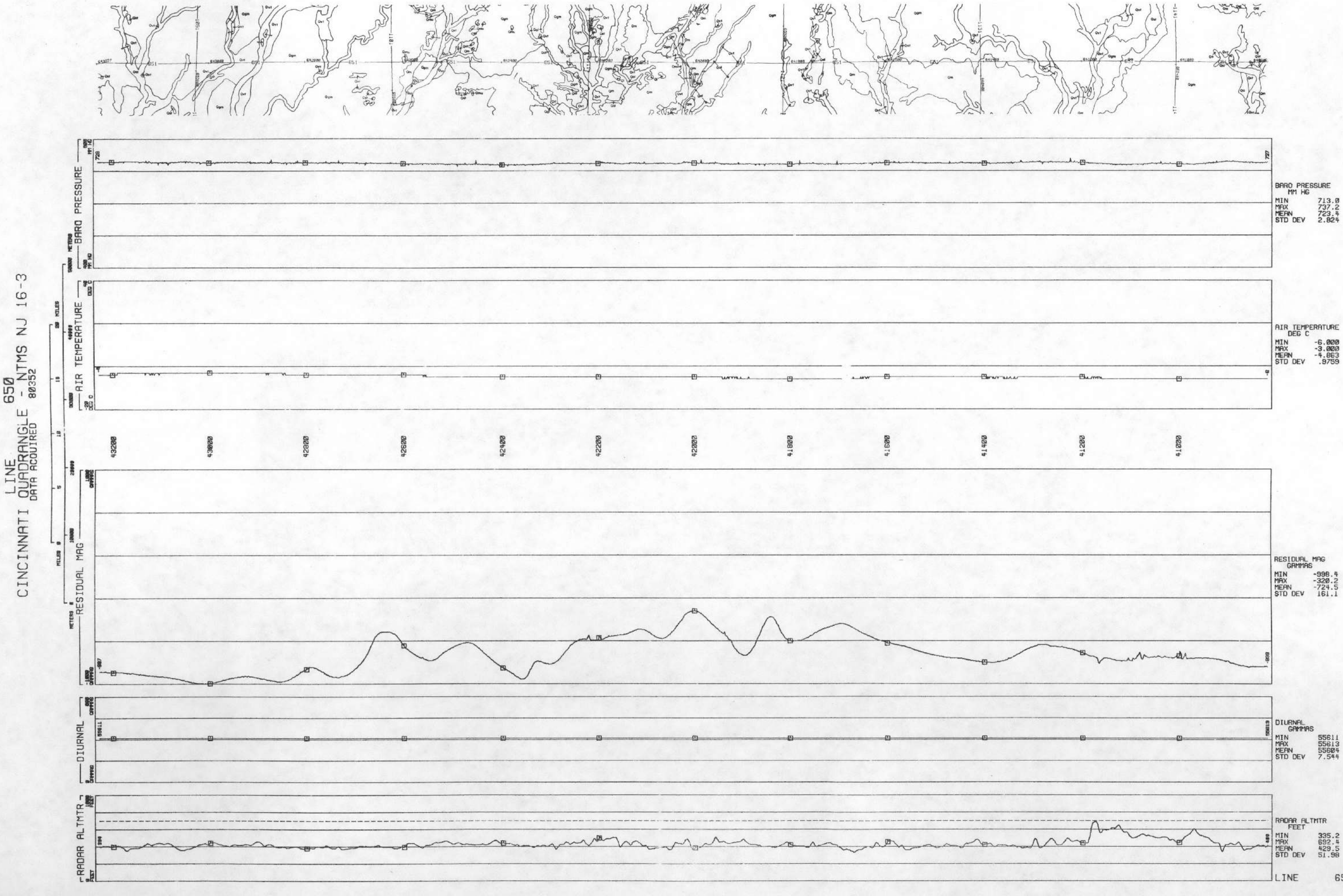
AIR TEMPERATURE DEG C
MIN -5.000
MAX -3.000
MEAN -4.158
STD DEV .7170

RESIDUAL MAG GAMMAS
MIN -1232
MAX -436.9
MEAN -796.0
STD DEV 189.6

DIURNAL GAMMAS
MIN 55606
MAX 55611
MEAN 55603
STD DEV 5.129

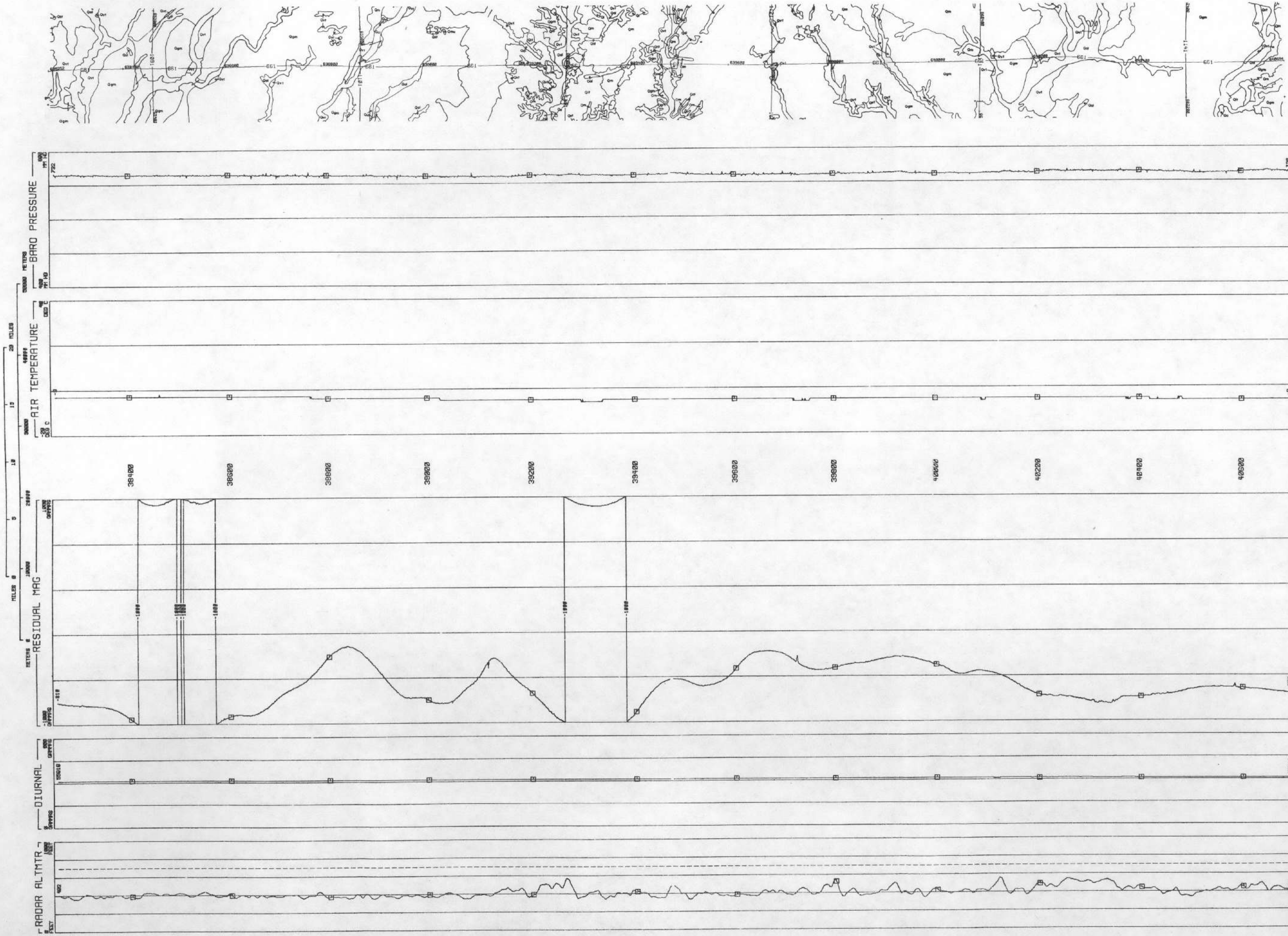
RADAR ALTMTR FEET
MIN 352.9
MAX 763.0
MEAN 442.9
STD DEV 87.01

LINE 640



LINE 650
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
43200
43000
42800
42600
42400
42200
42000
41800
41600
41400
41200
41000
BARO PRESSURE MM HG
MIN 713.0
MAX 737.2
MEAN 723.4
STD DEV 2.824
AIR TEMPERATURE DEG C
MIN -6.000
MAX -3.000
MEAN -4.863
STD DEV .9759
RESIDUAL MAG GAMMAS
MIN -998.4
MAX -320.2
MEAN -724.5
STD DEV 161.1
DIURNAL GAMMAS
MIN 55611
MAX 55613
MEAN 55604
STD DEV 7.544
RADAR ALTMTR FEET
MIN 335.2
MAX 692.4
MEAN 429.5
STD DEV 51.98
LINE 650

LINE 660
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG
MIN 713.5
MAX 734.0
MEAN 724.8
STD DEV 2.790

AIR TEMPERATURE
DEG C
MIN -6.000
MAX -2.000
MEAN -4.614
STD DEV .9719

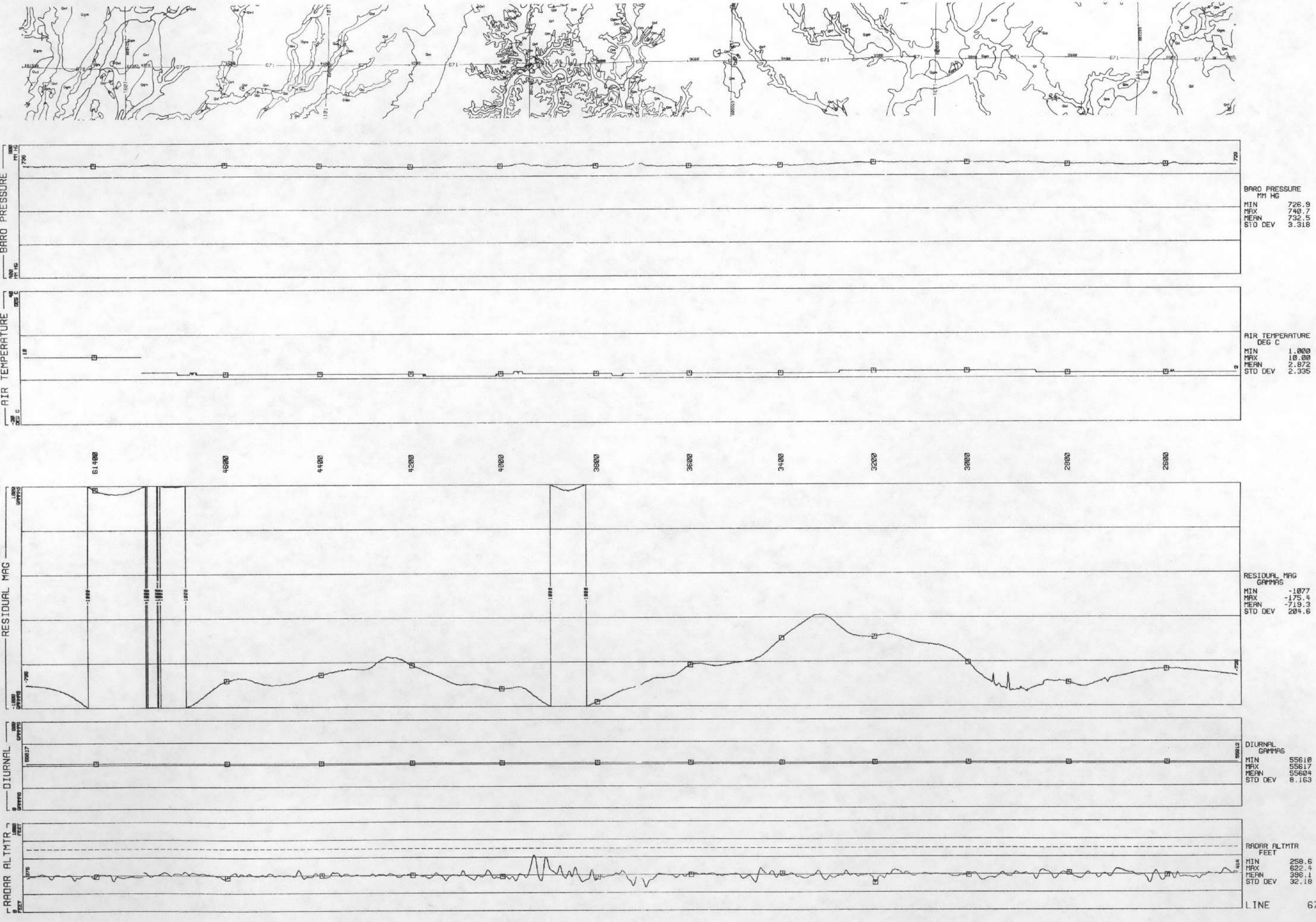
RESIDUAL MAG
GAMMAS
MIN -1066
MAX -316.2
MEAN -710.8
STD DEV 195.5

DIURNAL
GAMMAS
MIN 55613
MAX 55617
MEAN 55606
STD DEV 9.295

RADAR ALTMTR
FEET
MIN 334.8
MAX 569.9
MEAN 411.3
STD DEV 42.90

LINE 660

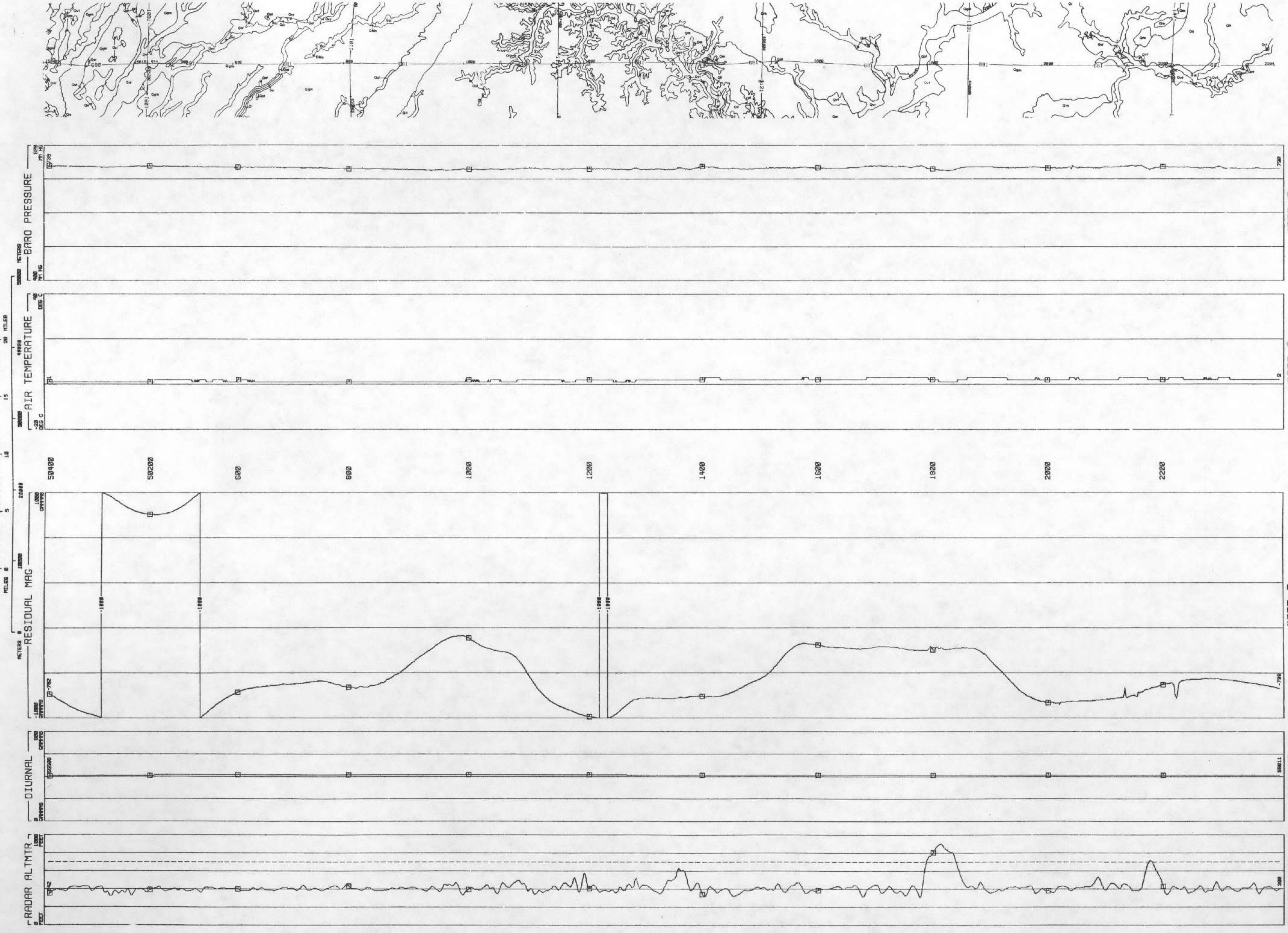
LINE 670
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80340



LINE 670

D26

LINE 680
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80339



BARO PRESSURE
MM HG
MIN 723.8
MAX 739.9
MEAN 732.8
STD DEV 3.176

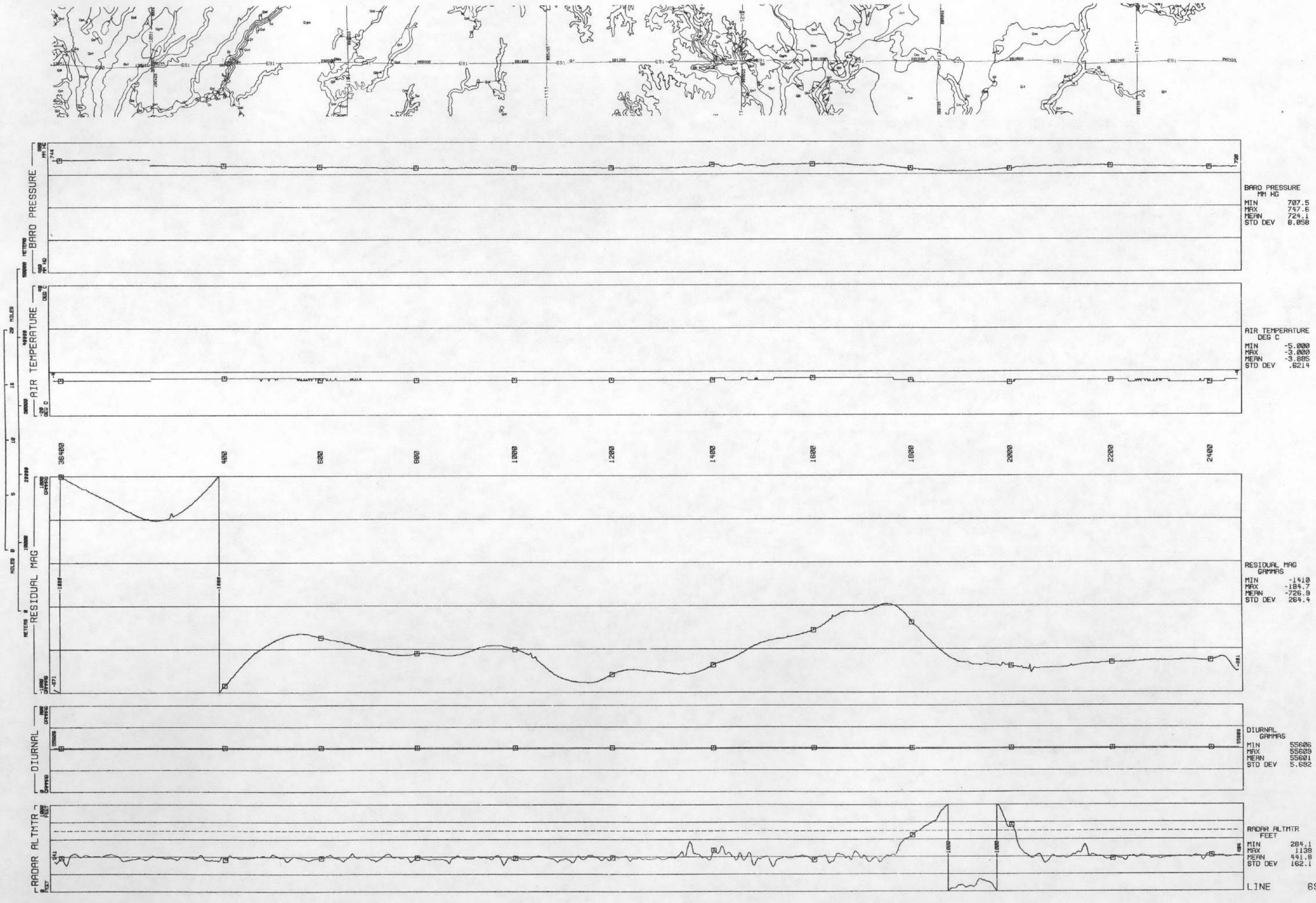
AIR TEMPERATURE
DEG C
MIN 1.000
MAX 3.000
MEAN 1.799
STD DEV .6840

RESIDUAL MAG
GAMMAS
MIN -1196
MAX -268.6
MEAN -705.6
STD DEV 233.9

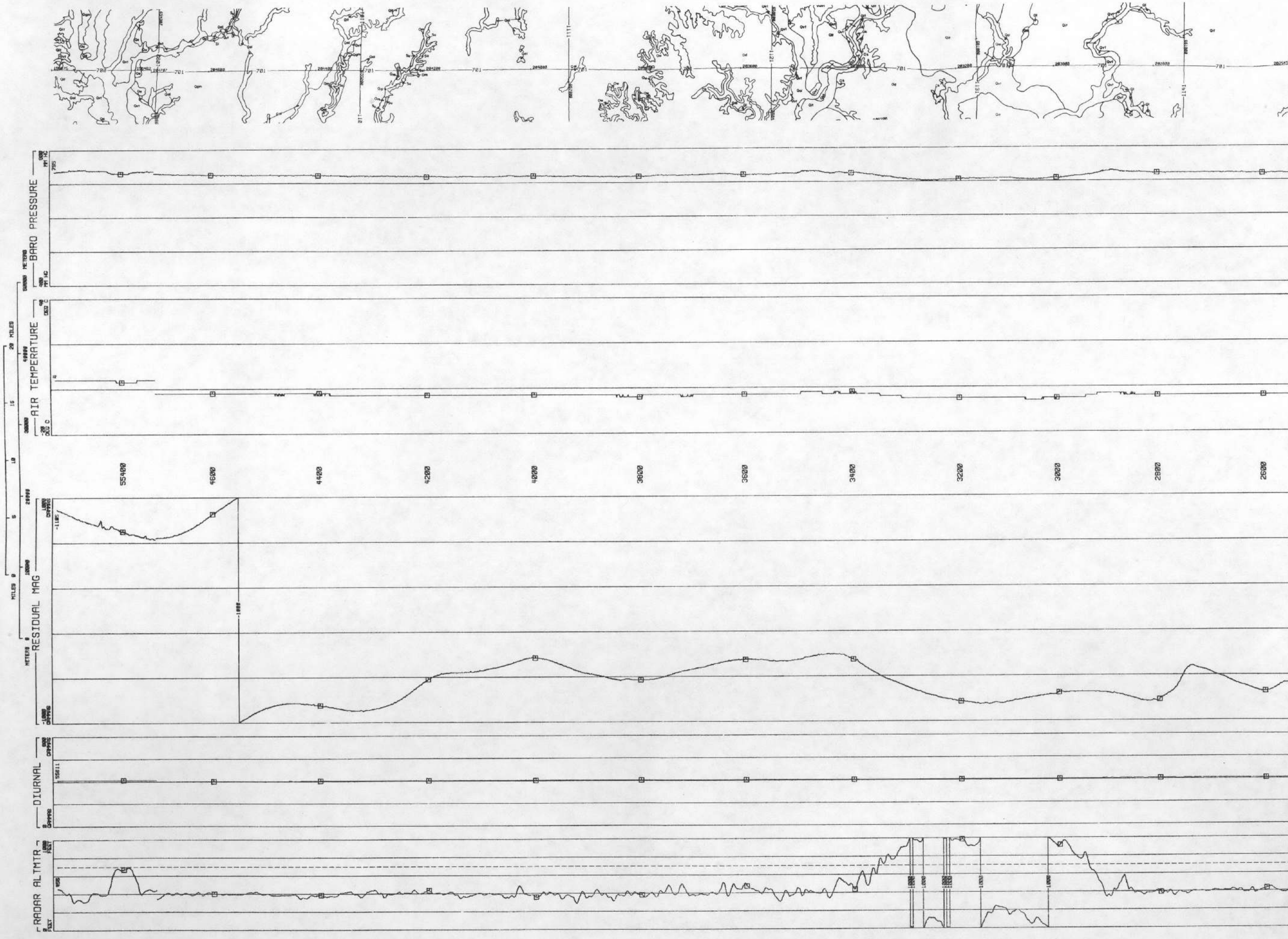
DIURNAL
GAMMAS
MIN 55606
MAX 55617
MEAN 55606
STD DEV 7.554

RADAR ALTMTR
FEET
MIN 309.8
MAX 900.4
MEAN 421.2
STD DEV 80.54

LINE 680


LINE
690
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
BARO PRESSURE MM HG
MIN 707.5
MAX 747.6
MEAN 724.1
STD DEV 8.058
AIR TEMPERATURE DEG C
MIN -5.000
MAX -3.000
MEAN -3.885
STD DEV .6214
RESIDUAL MAG GAMMAS
MIN -1410
MAX -184.7
MEAN -726.9
STD DEV 264.4
DIURNAL GAMMAS
MIN 55606
MAX 55609
MEAN 55601
STD DEV 5.692
RADAR ALTMTR FEET
MIN 284.1
MAX 1138
MEAN 441.8
STD DEV 162.1
LINE 690

LINE 700
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG

MIN	701.9
MAX	741.3
MEAN	720.9
STD DEV	7.712

AIR TEMPERATURE
DEG C

MIN	-6.000
MAX	4.000
MEAN	-2.825
STD DEV	2.165

RESIDUAL MAG
GAMMAS

MIN	-1372
MAX	-403.4
MEAN	-747.6
STD DEV	249.6

DIURNAL
GAMMAS

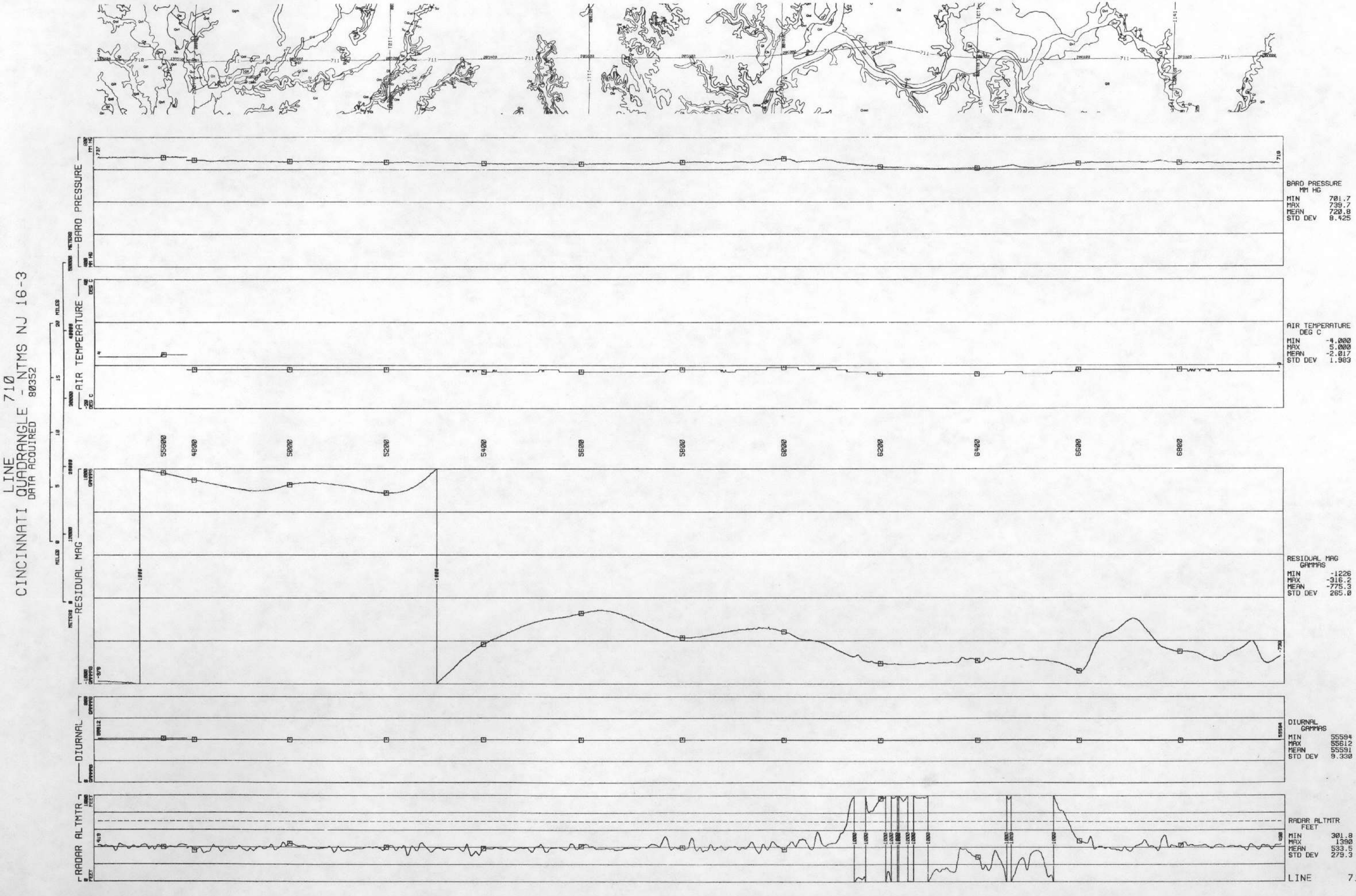
MIN	55601
MAX	55611
MEAN	55601
STD DEV	4.787

RADAR ALTMTR
FEET

MIN	288.0
MAX	1246
MEAN	516.8
STD DEV	237.6

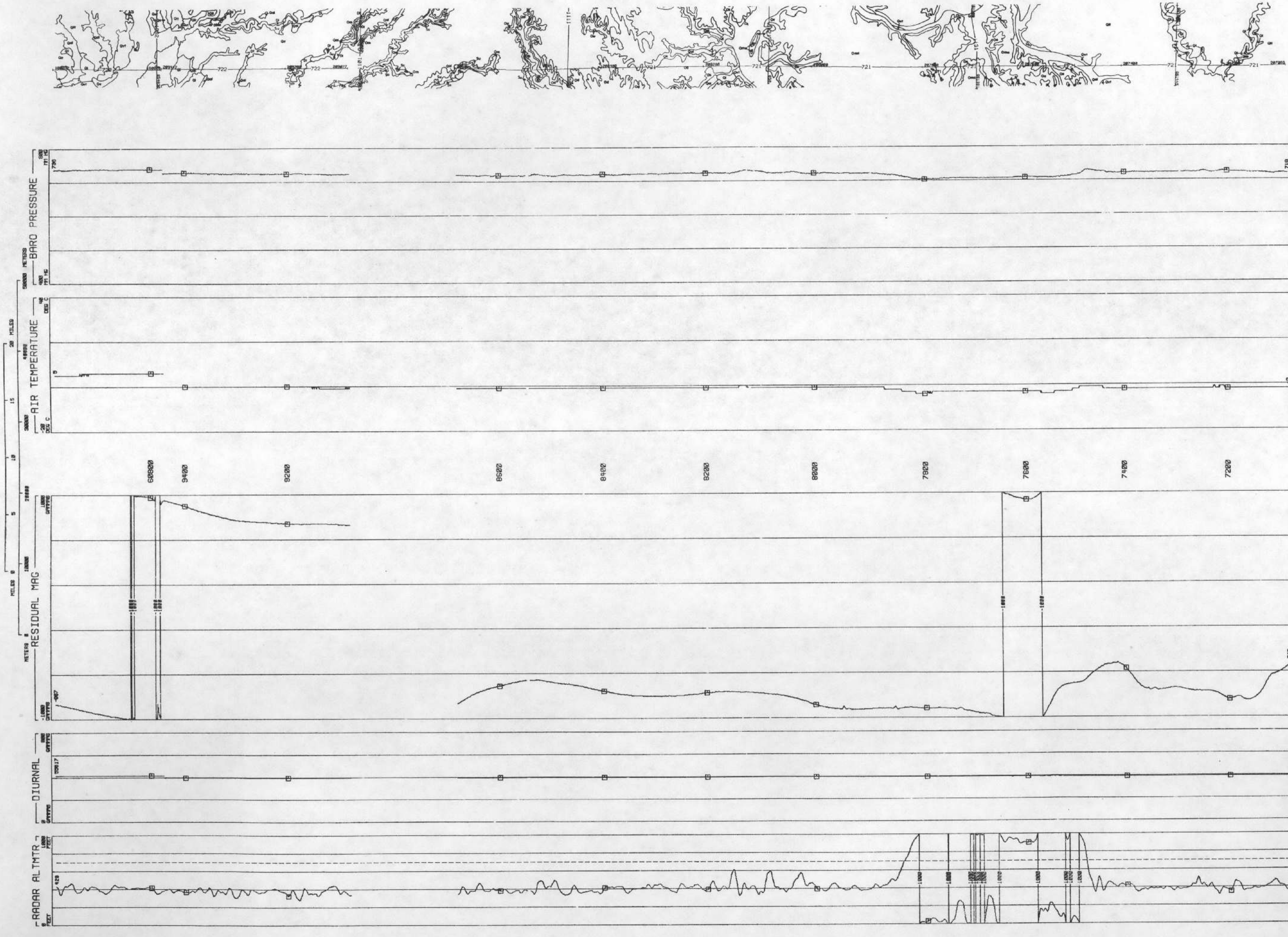
LINE 700

D29 ci



LINE 710
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
5500
4800
5000
5200
5400
5600
5800
6000
6200
6400
6600
6800
BARO PRESSURE
MM HG
MIN 701.7
MAX 739.7
MEAN 720.8
STD DEV 8.425
AIR TEMPERATURE
DEG C
MIN -4.000
MAX 5.000
MEAN -2.017
STD DEV 1.983
RESIDUAL MAG
GAMMAS
MIN -1226
MAX -316.2
MEAN -775.3
STD DEV 265.0
DIURNAL
GAMMAS
MIN 55594
MAX 55612
MEAN 55591
STD DEV 9.330
RADAR ALTMTR
FEET
MIN 301.8
MAX 1390
MEAN 533.5
STD DEV 279.3
LINE 710

LINE 720
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG
MIN 702.4
MAX 735.7
MEAN 721.2
STD DEV 8.204

AIR TEMPERATURE
DEG C
MIN -4.000
MAX 6.000
MEAN -.7776
STD DEV 2.258

RESIDUAL MAG
GAMMAS
MIN -1273
MAX -516.5
MEAN -884.8
STD DEV 186.5

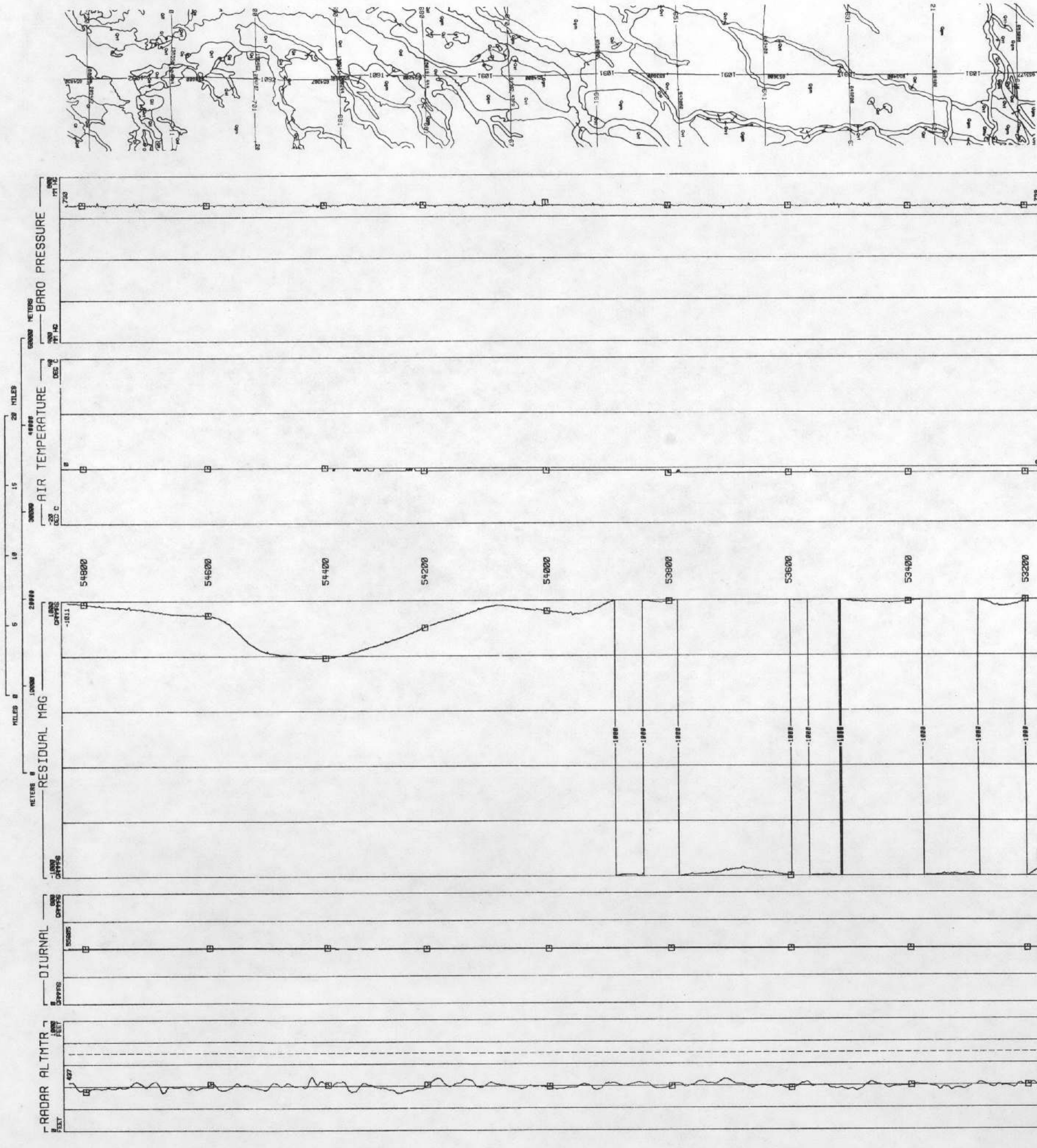
DIURNAL
GAMMAS
MIN 55593
MAX 55618
MEAN 55591
STD DEV 8.702

RADAR ALTMTR
FEET
MIN 279.9
MAX 1310
MEAN 509.4
STD DEV 241.7

LINE 720

D31 ci

LINE 1090
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG

MIN	716.7
MAX	737.2
MEAN	726.2
STD DEV	2.870

AIR TEMPERATURE
DEG C

MIN	-2.000
MAX	.0000
MEAN	-1.070
STD DEV	.8300

RESIDUAL MAG
GAMMAS

MIN	-1417
MAX	-936.4
MEAN	-1095
STD DEV	134.9

DIURNAL
GAMMAS

MIN	55585
MAX	55605
MEAN	55593
STD DEV	6.270

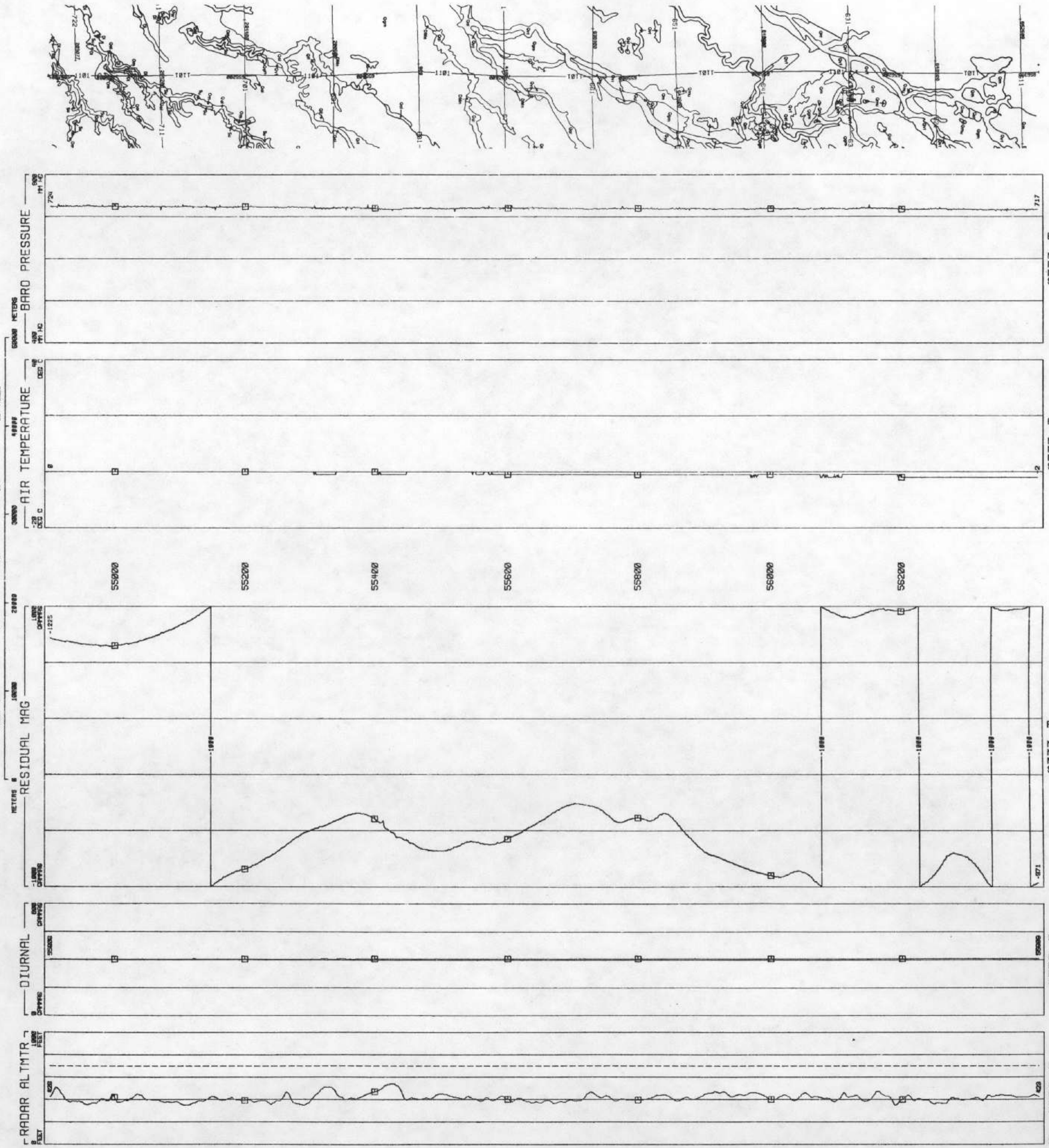
RADAR ALTMTR
FEET

MIN	334.8
MAX	478.7
MEAN	398.3
STD DEV	24.07

LINE 1090

D32 ci

LINE 1100
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



BARO PRESSURE
MM HG
MIN 713.5
MAX 729.1
MEAN 720.2
STD DEV 2.515

AIR TEMPERATURE
DEG C
MIN -2.000
MAX .0000
MEAN -.7647
STD DEV .7014

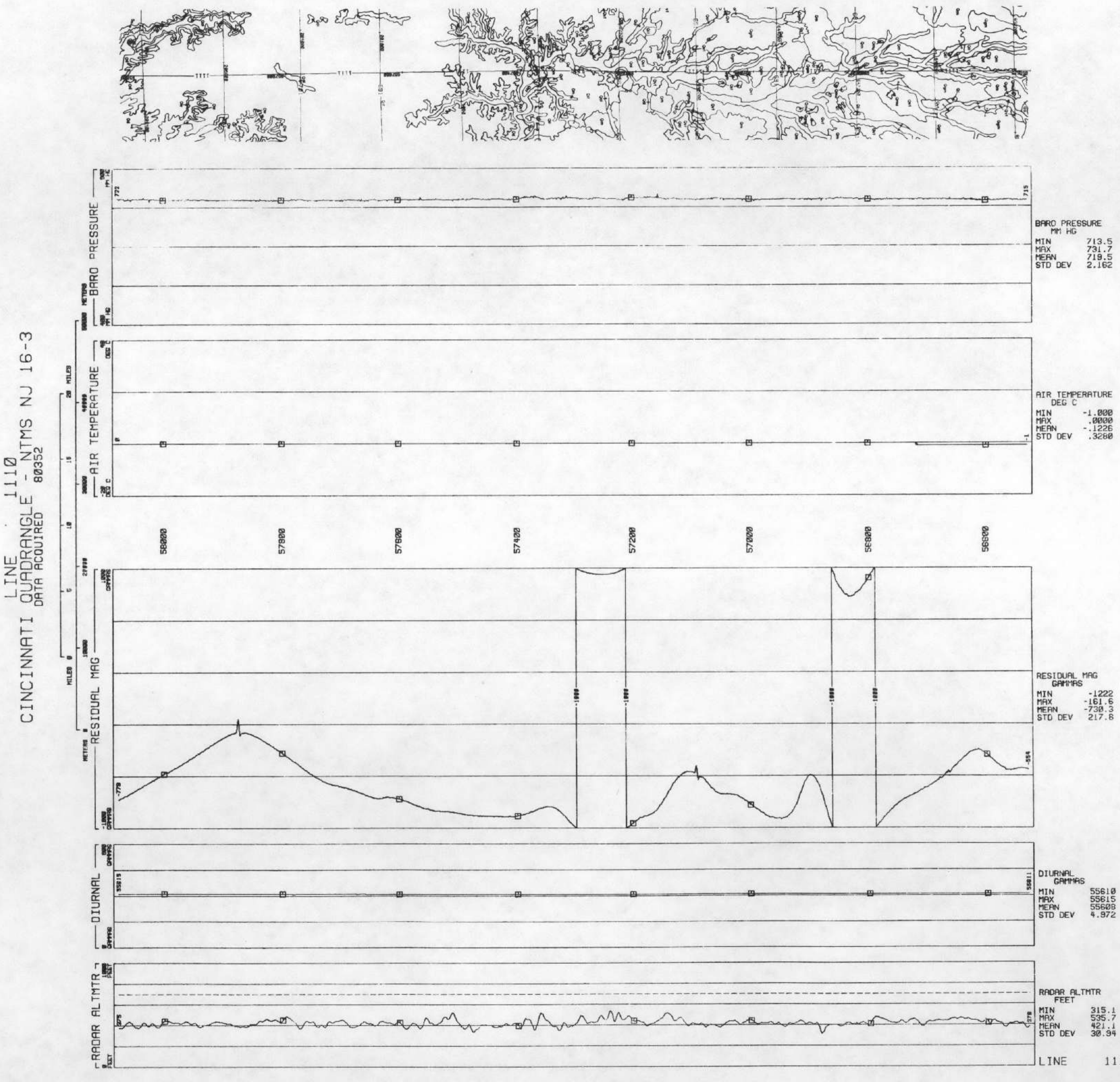
RESIDUAL MAG
GAMMAS
MIN -1283
MAX -408.8
MEAN -826.5
STD DEV 251.2

DIURNAL
GAMMAS
MIN 55605
MAX 55609
MEAN 55602
STD DEV 4.919

RADAR ALTMTR
FEET
MIN 350.5
MAX 541.0
MEAN 412.9
STD DEV 34.02

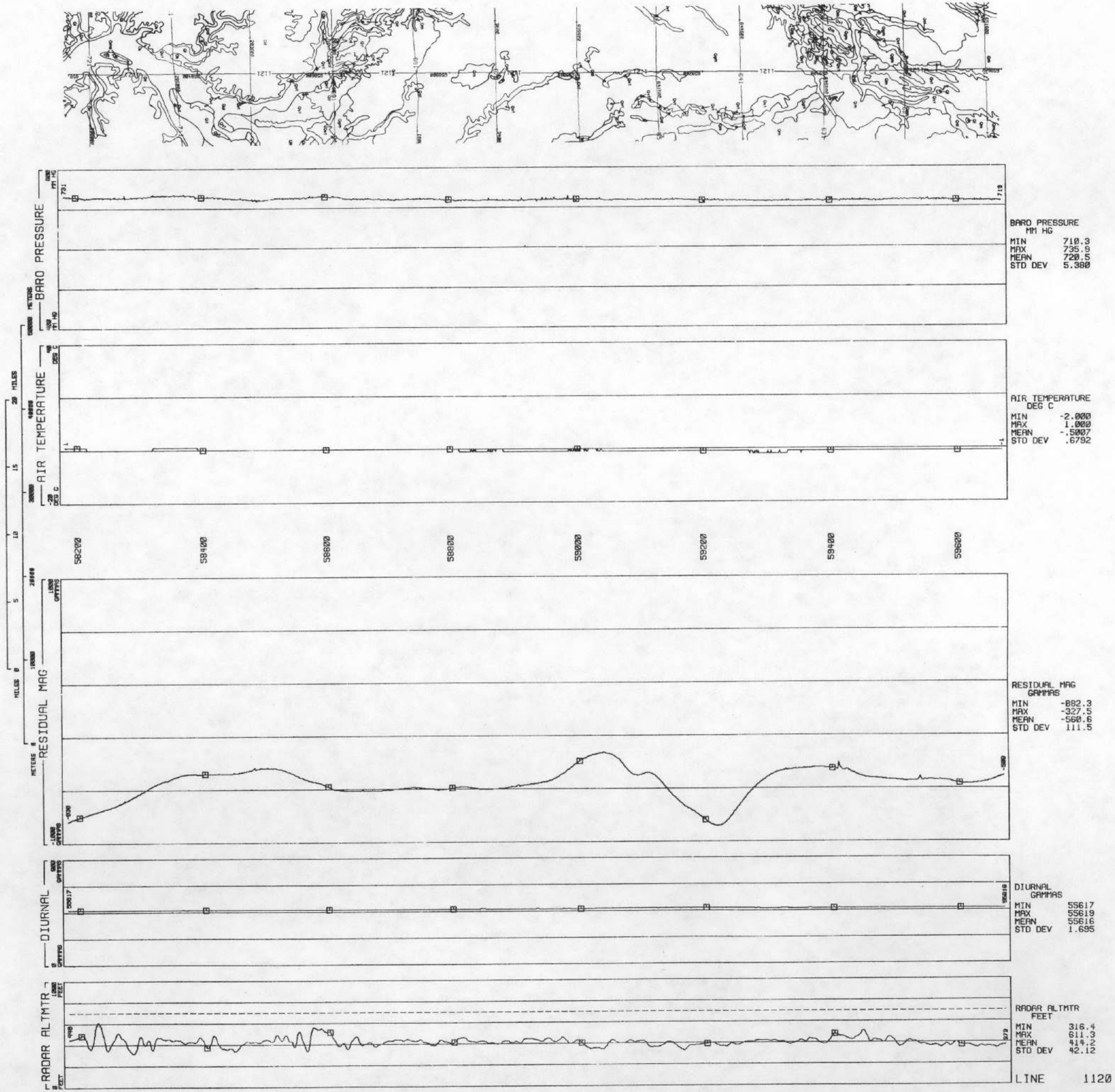
LINE 1100

D33 ci

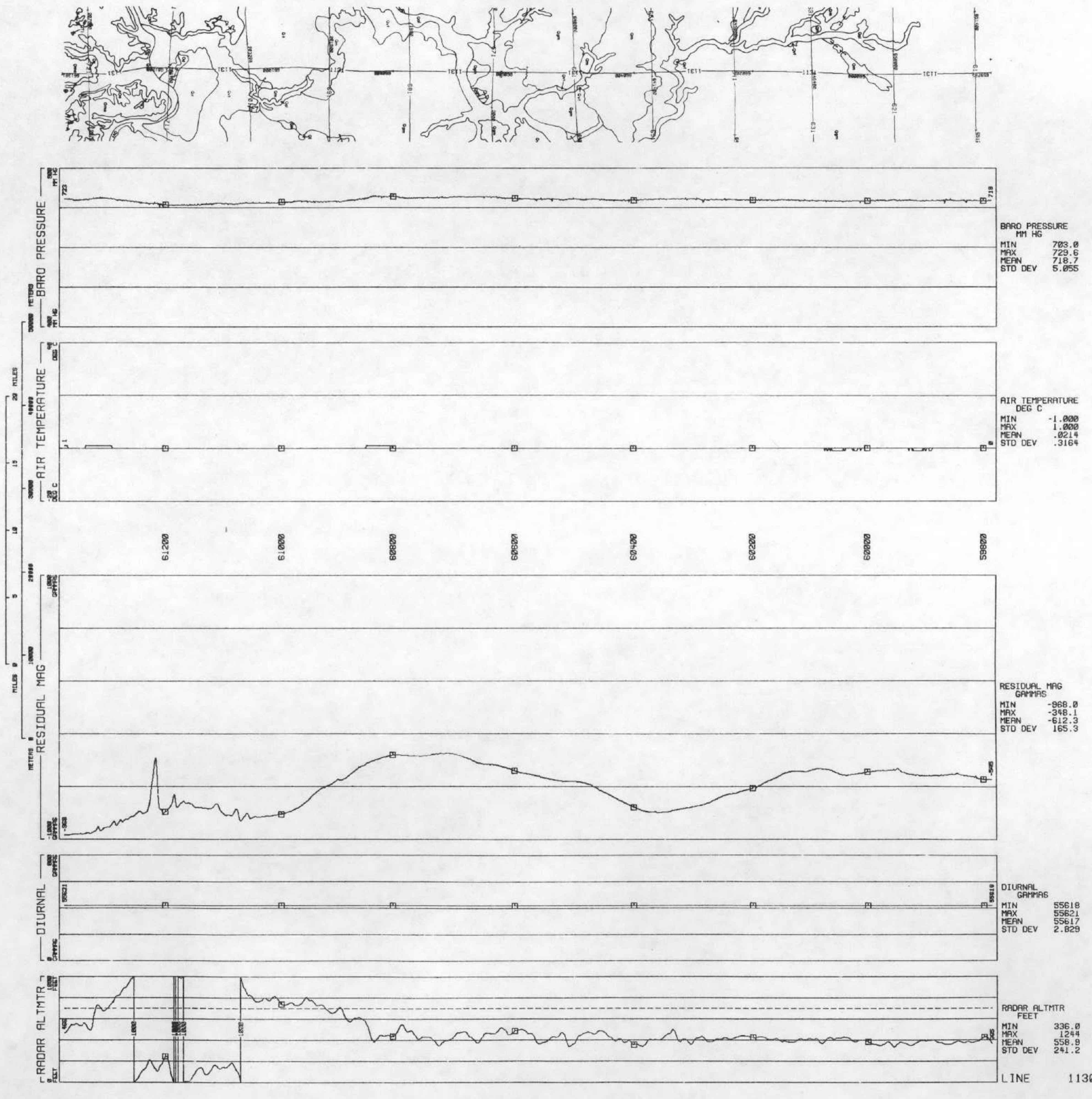


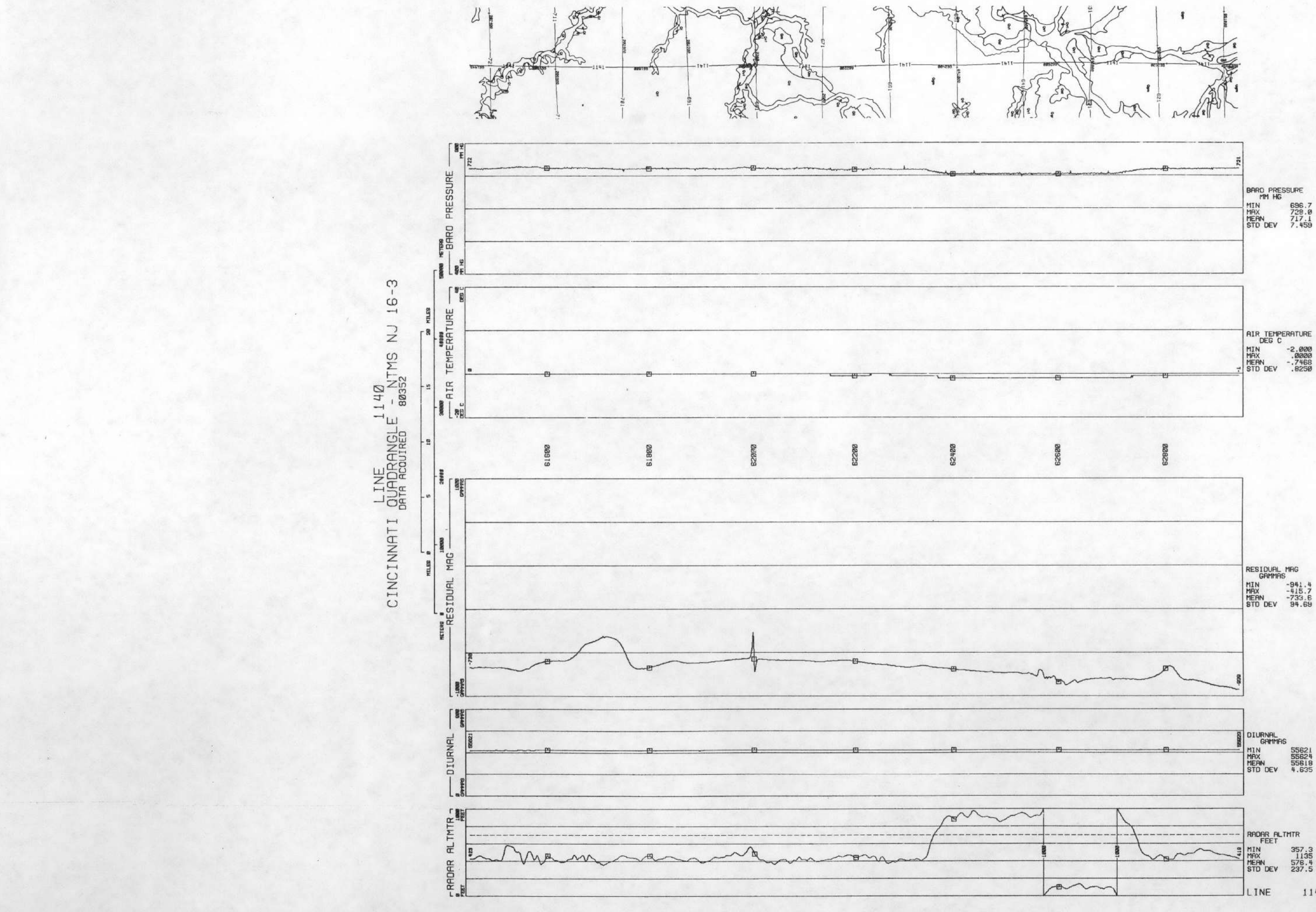
LINE 1110
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
58000
57800
57600
57400
57200
57000
56800
56600
BARO PRESSURE MM HG
MIN 713.5
MAX 731.7
MEAN 719.5
STD DEV 2.162
AIR TEMPERATURE DEG C
MIN -1.000
MAX .0000
MEAN -.1226
STD DEV .3280
RESIDUAL MAG GAMMAS
MIN -1222
MAX -161.6
MEAN -730.3
STD DEV 217.8
DIURNAL GAMMAS
MIN 55610
MAX 55615
MEAN 55608
STD DEV 4.972
RADAR ALTMTR FEET
MIN 315.1
MAX 535.7
MEAN 421.1
STD DEV 30.94
LINE 1110

LINE 1120
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352



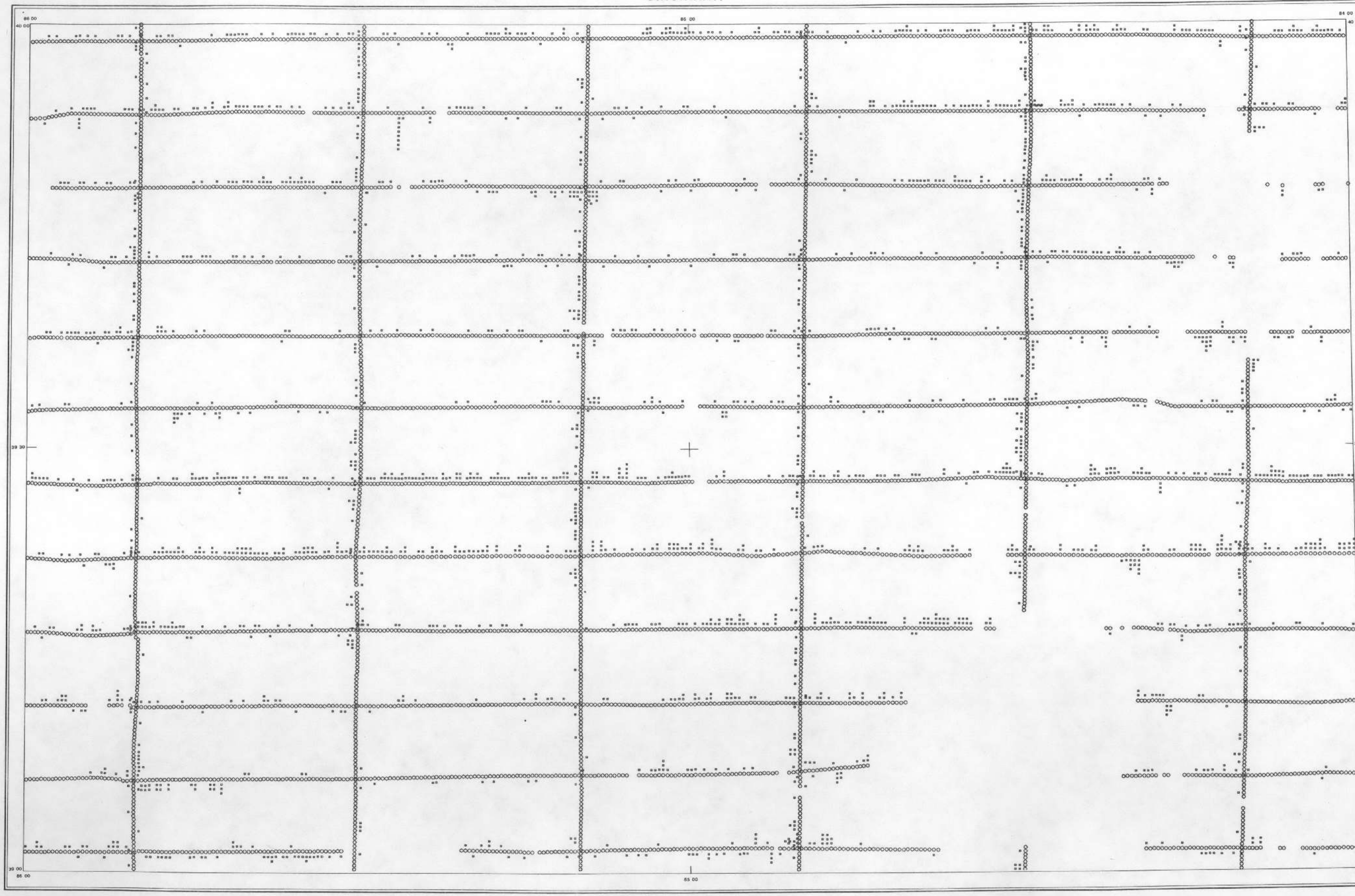
LINE 1130
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352




LINE 1140
CINCINNATI QUADRANGLE - NTMS NJ 16-3
DATA ACQUIRED 80352
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
61600
61800
62000
62200
62400
62600
62800
BARO PRESSURE MM HG
MIN 696.7
MAX 728.0
MEAN 717.1
STD DEV 7.459
AIR TEMPERATURE DEG C
MIN -2.000
MAX .0000
MEAN -.7468
STD DEV .8250
RESIDUAL MAG GAMMAS
MIN -941.4
MAX -415.7
MEAN -733.6
STD DEV 94.69
DIURNAL GAMMAS
MIN 55621
MAX 55624
MEAN 55618
STD DEV 4.635
RADAR ALTMTR FEET
MIN 357.3
MAX 1135
MEAN 576.4
STD DEV 237.5
LINE 1140

APPENDIX E - Standard Deviation Maps

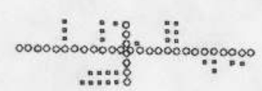
CINCINNATI



SCALE 1:500,000

MILES 1 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

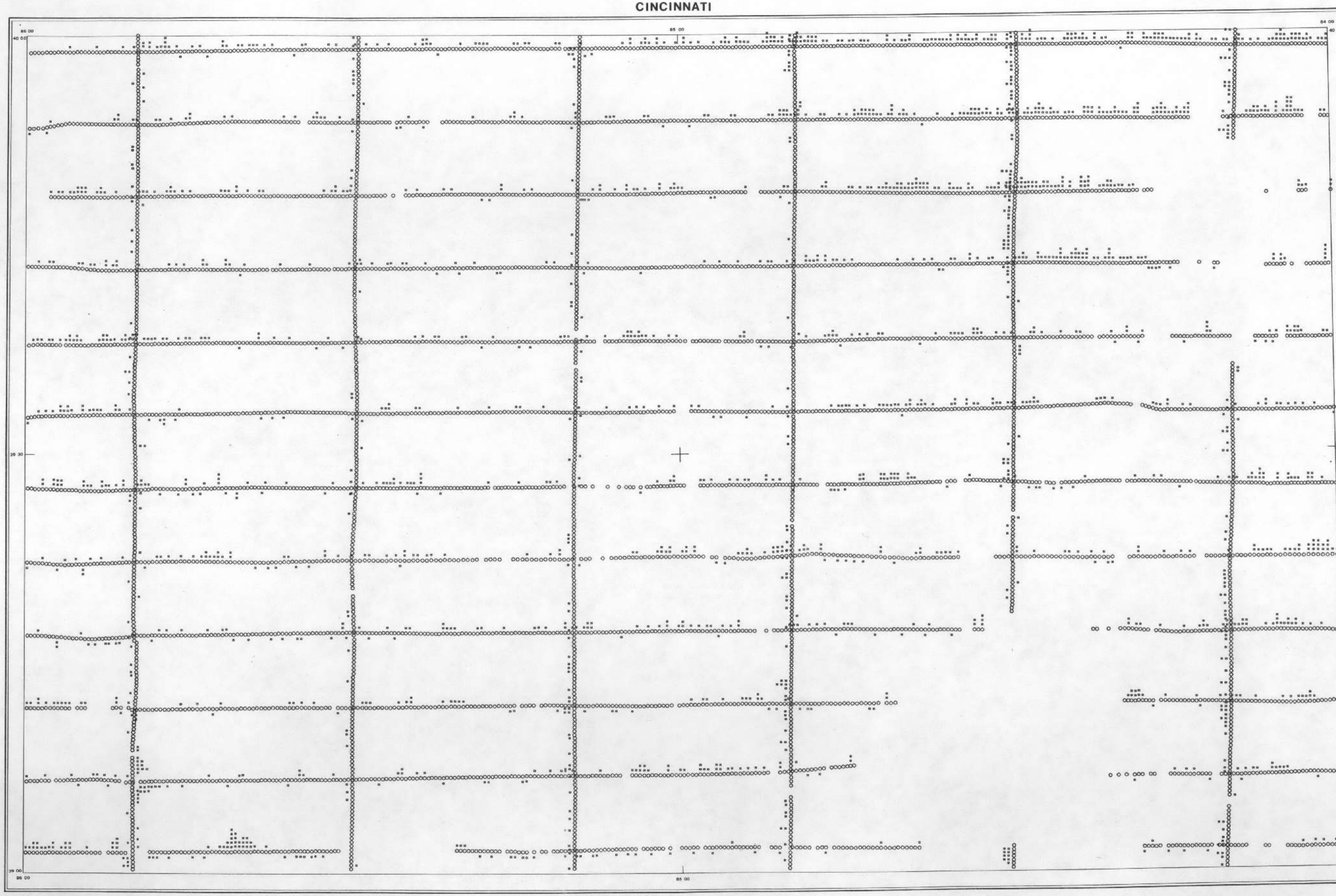
LOCATION DIAGRAM

POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

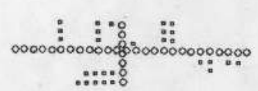
CINCINNATI



SCALE 1:500,000

SURVEY AND COMPILATION BY:

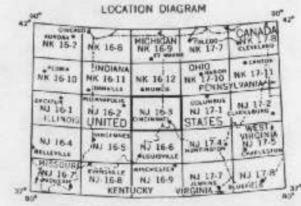
EG&G GEOMETRICS



○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, $+\sigma$ TO NORTH, $-\sigma$ TO SOUTH.
ON N-S LINES, $+\sigma$ TO WEST, $-\sigma$ TO EAST.

LOCATION DIAGRAM

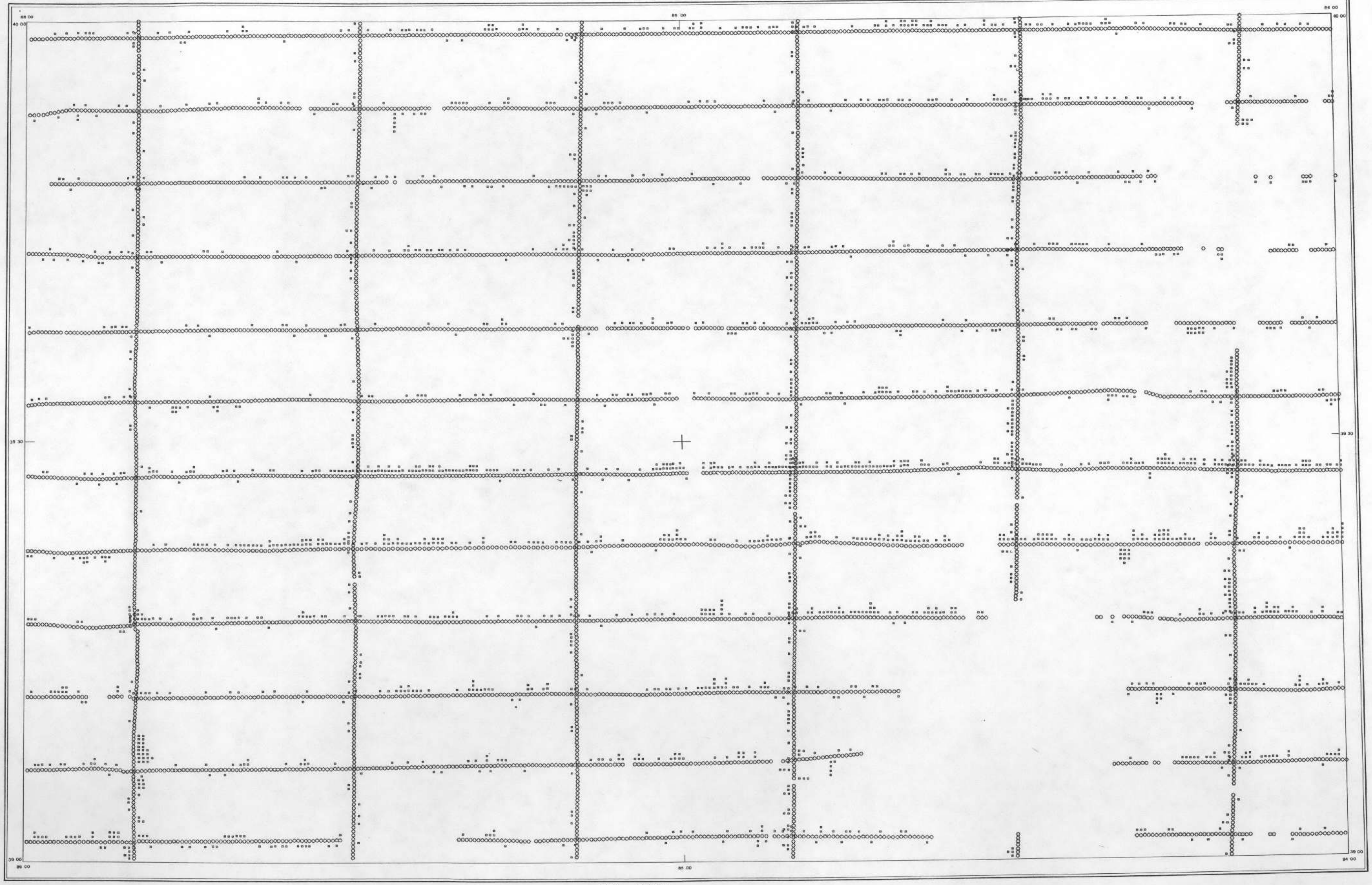


URANIUM STANDARD DEVIATION MAP

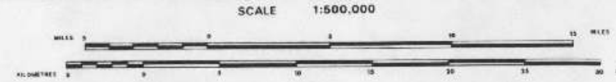
GREAT LAKES PROJECT

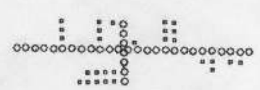
U. S. DEPARTMENT OF ENERGY

CINCINNATI



SCALE 1:500,000



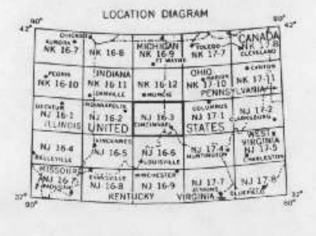


○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH. ON N-S LINES, +σ TO WEST, -σ TO EAST.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

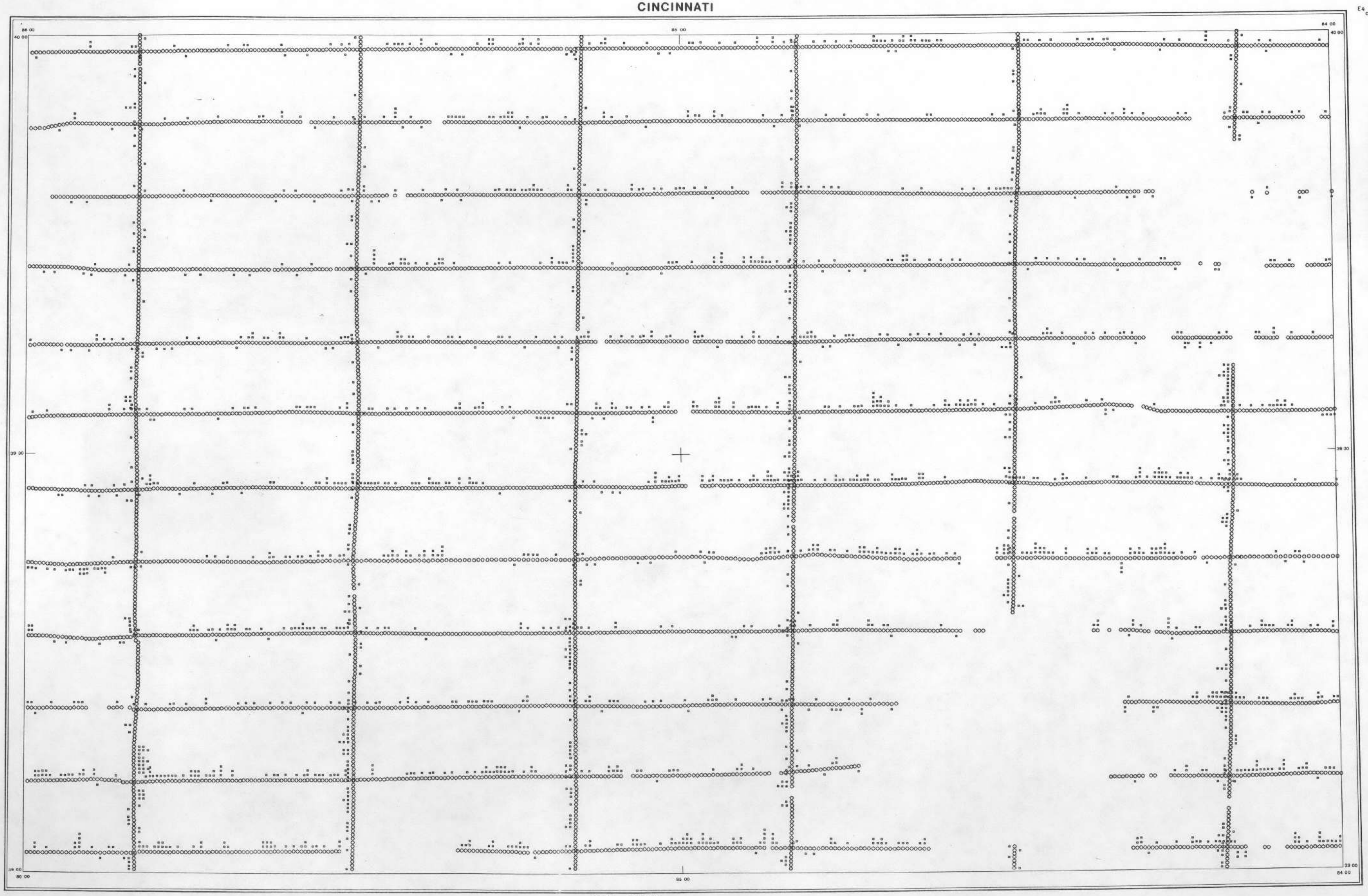


THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

CINCINNATI

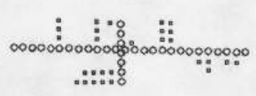


SCALE 1:500,000

MILES · KILOMETRES

SURVEY AND COMPILATION BY:

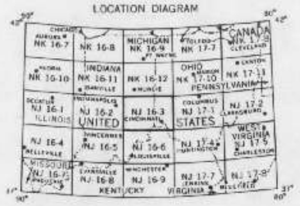
EG&G GEOMETRICS



O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

LOCATION DIAGRAM

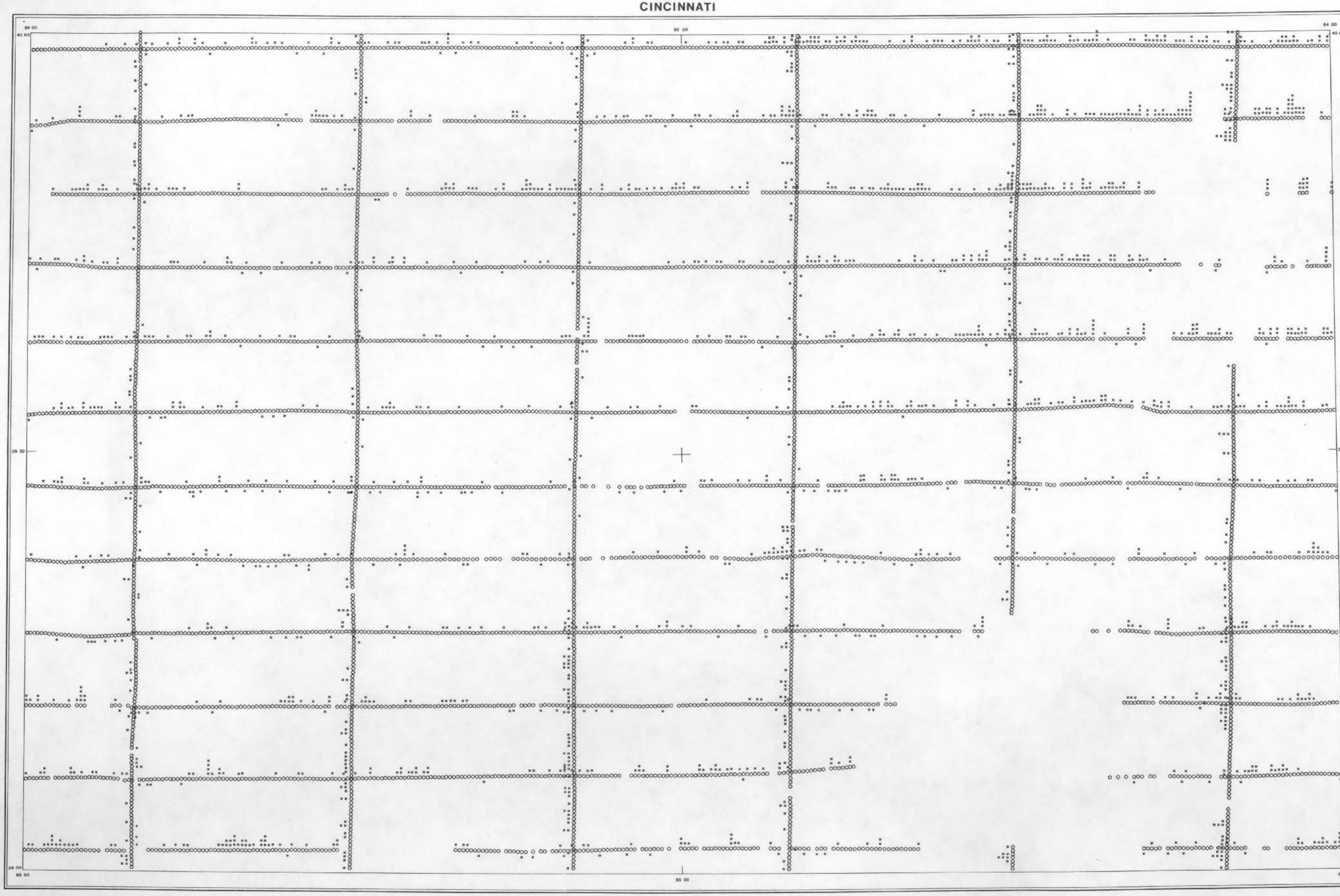


THORIUM / POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

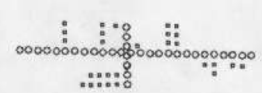
U. S. DEPARTMENT OF ENERGY

CINCINNATI



SCALE 1:500,000

MILES — KILOMETRES



○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH. ON N-S LINES, +σ TO WEST, -σ TO EAST.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

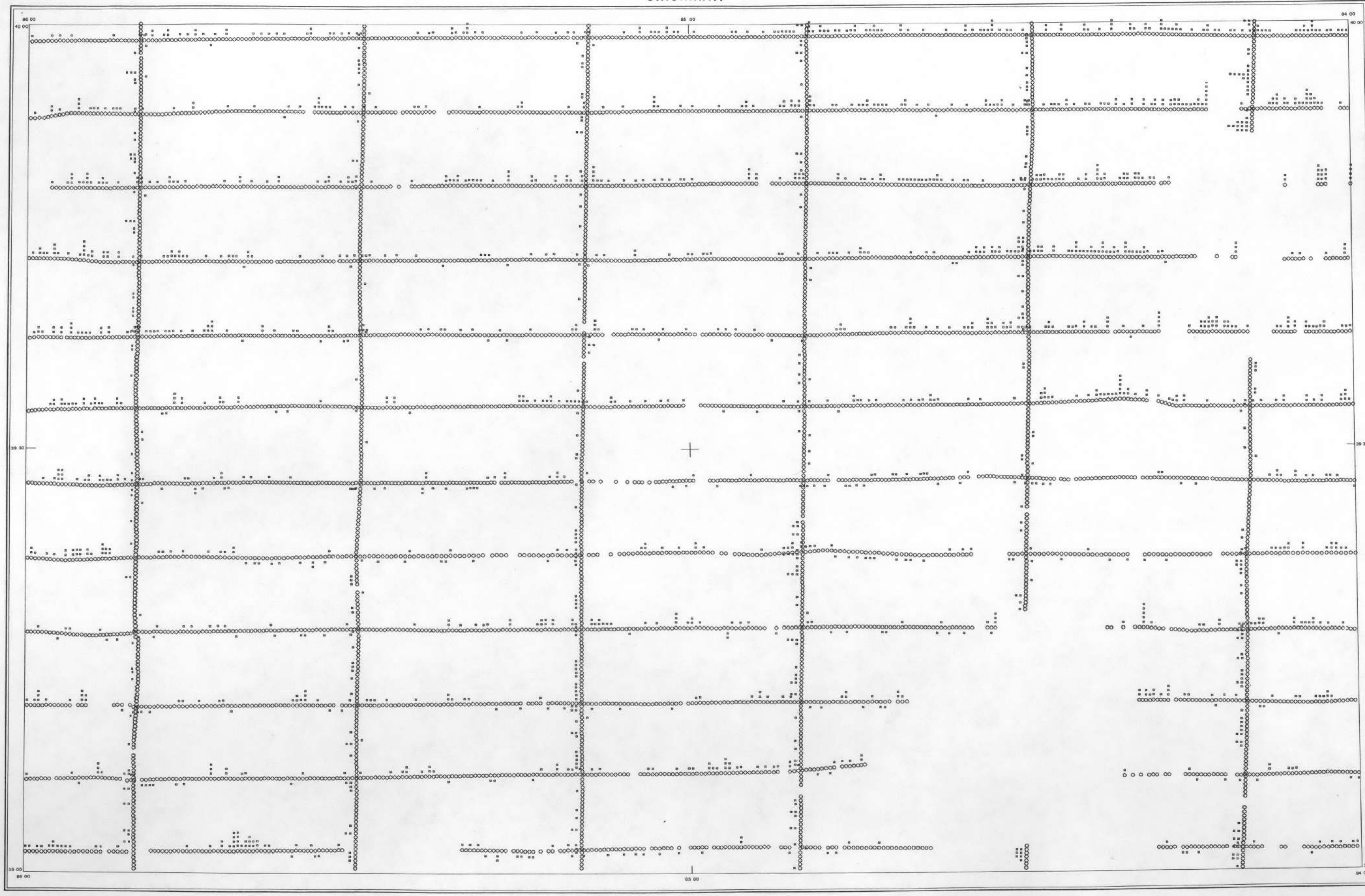
LOCATION DIAGRAM

URANIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

CINCINNATI



SCALE 1:500,000

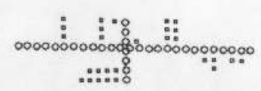
MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

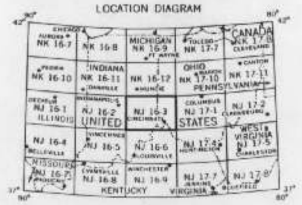
N



○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

LOCATION DIAGRAM



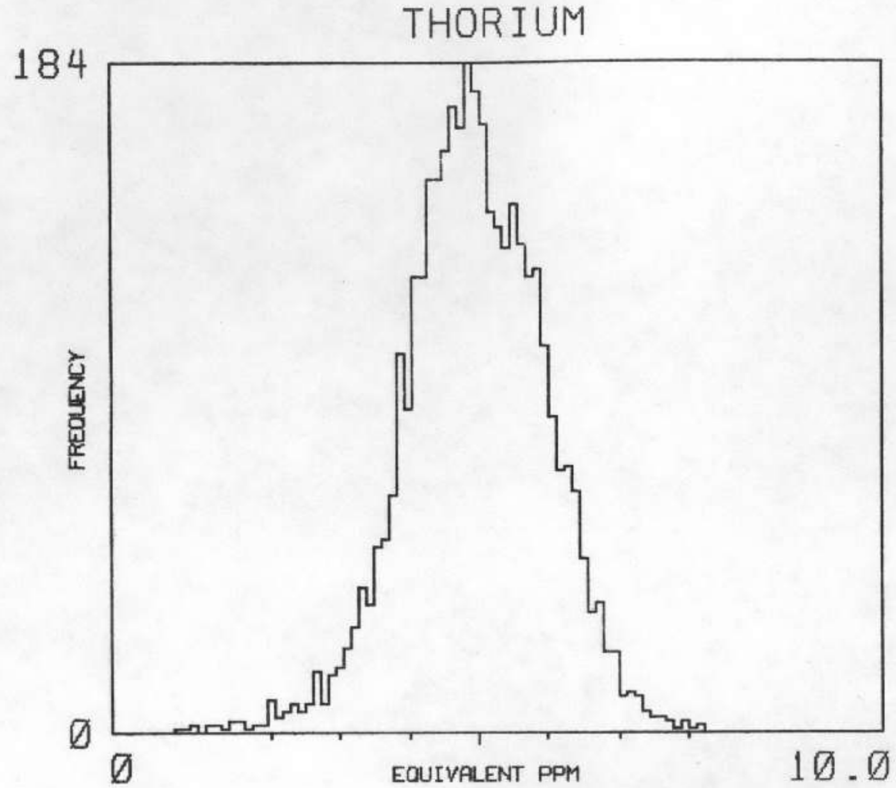
URANIUM/THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

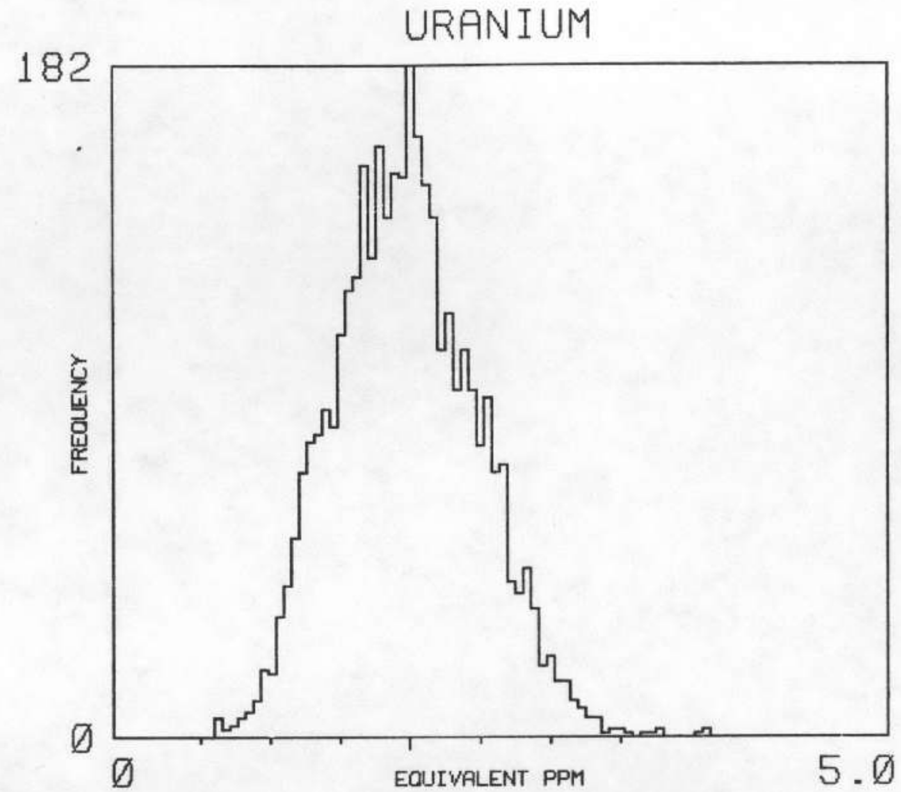
U. S. DEPARTMENT OF ENERGY

APPENDIX F – Histograms and Map Unit Conversion Table

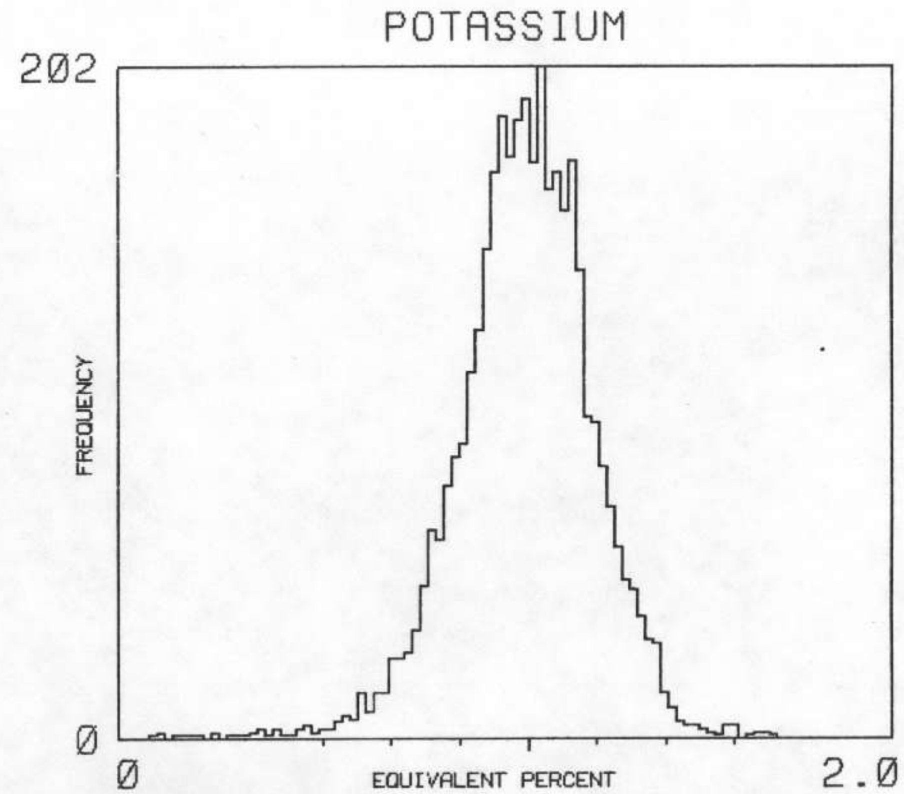
NJ 16-3 CINCINNATI MAP UNIT : QAL TOTAL NUMBER OF SAMPLES 3918



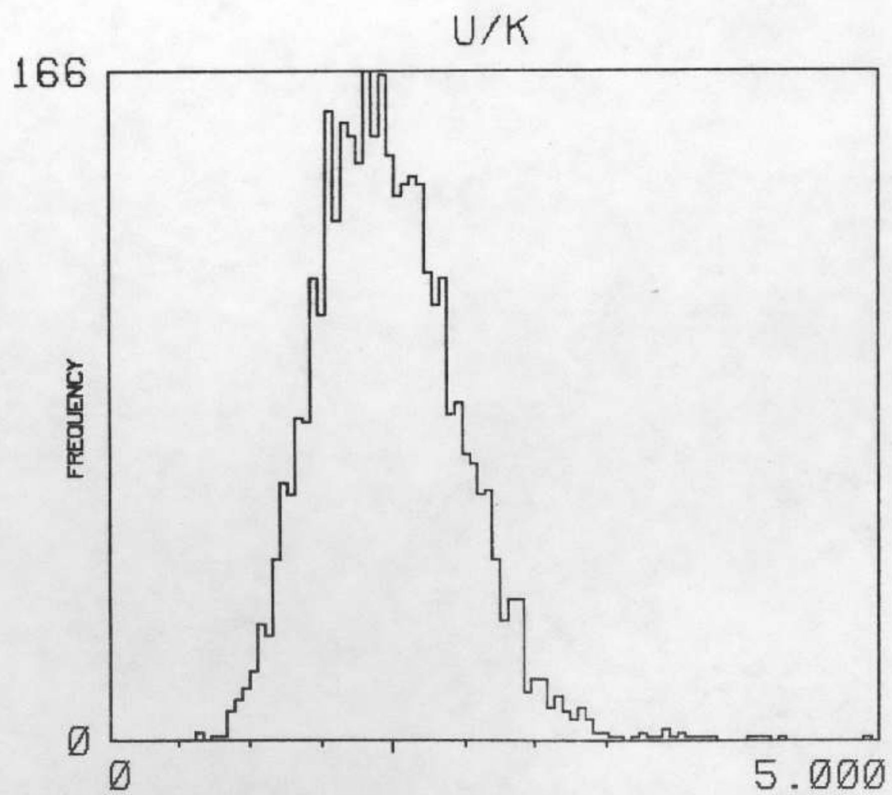
MEAN / MEDIAN 4.8 4.8 3754 ADEQUATE SAMPLES



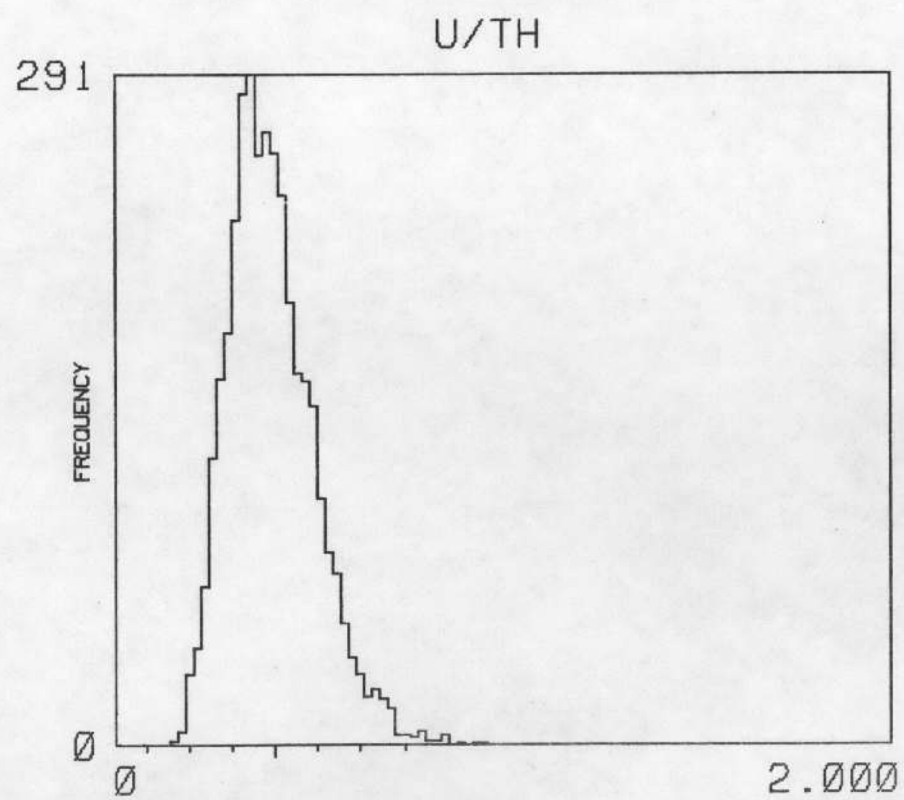
MEAN / MEDIAN 1.9 1.9 3588 ADEQUATE SAMPLES



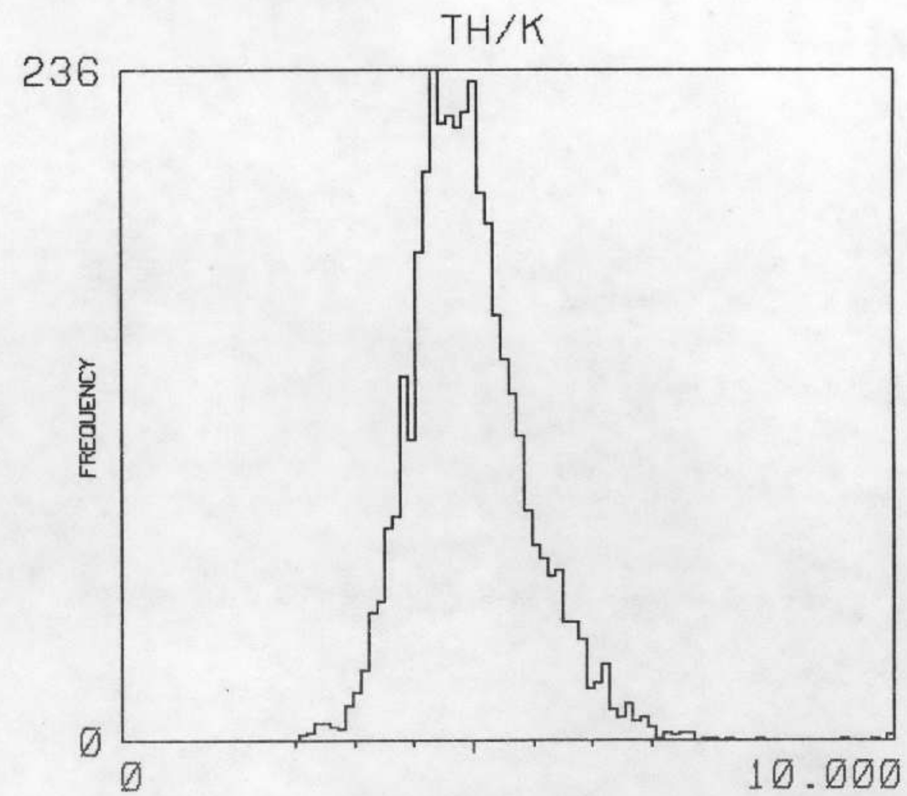
MEAN / MEDIAN 1.1 1.1 3753 ADEQUATE SAMPLES



MEAN / MEDIAN 1.840 1.800 3588 ADEQUATE SAMPLES



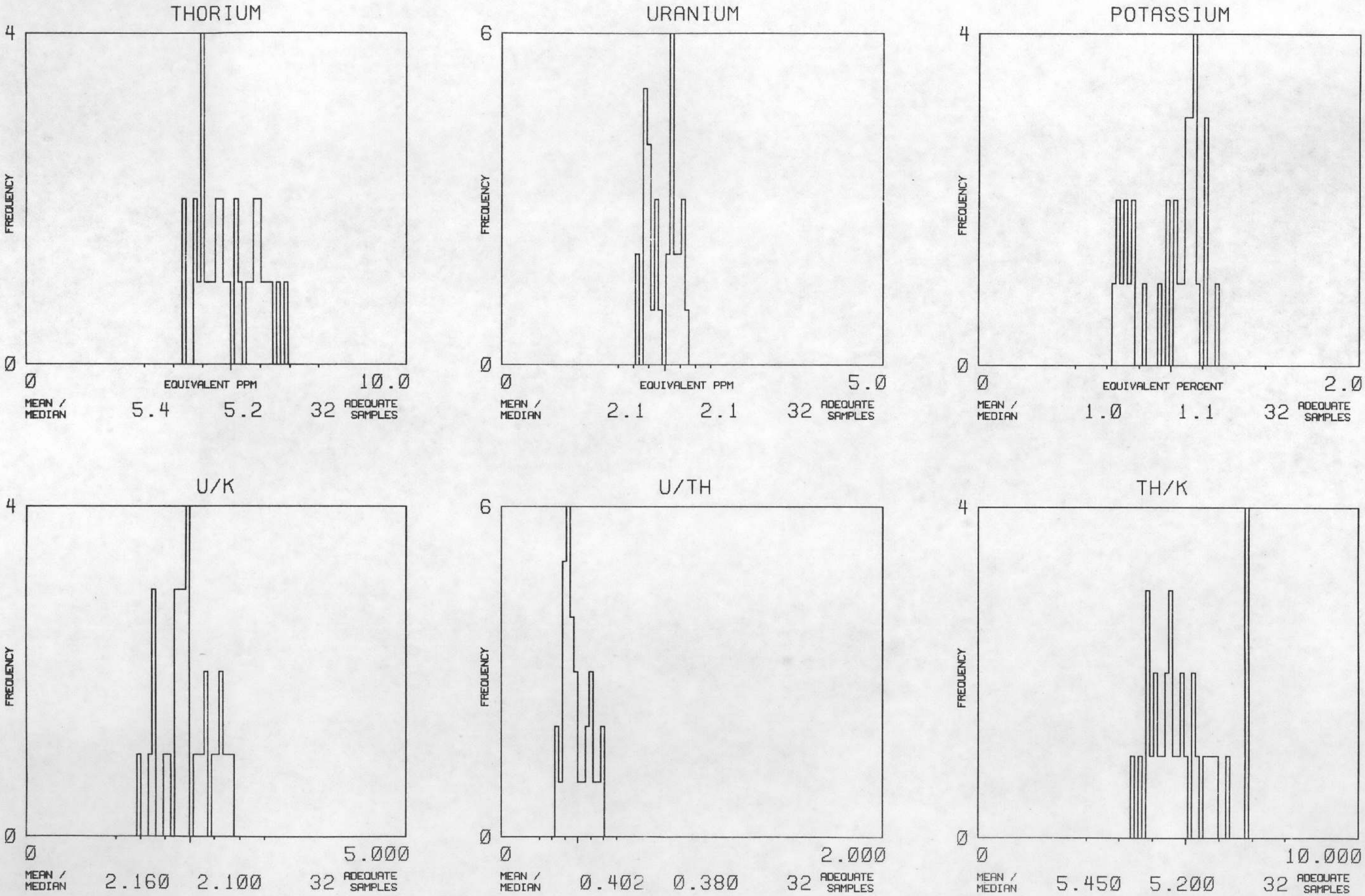
MEAN / MEDIAN 0.412 0.400 3588 ADEQUATE SAMPLES



MEAN / MEDIAN 4.552 4.500 3753 ADEQUATE SAMPLES

F2ci

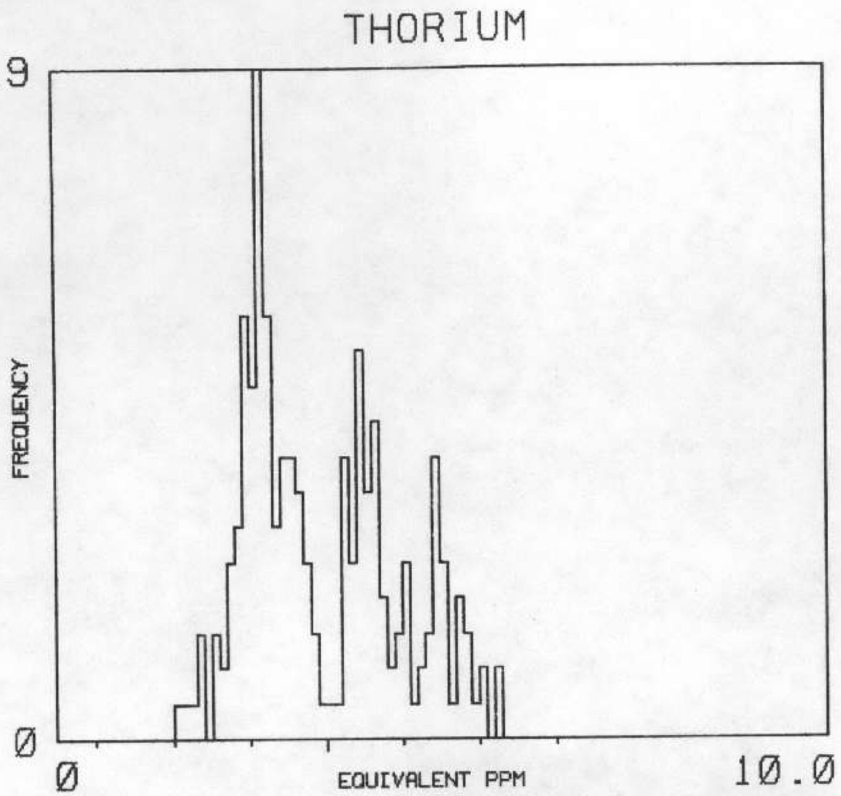
NJ 16-3 CINCINNATI MAP UNIT : QMU TOTAL NUMBER OF SAMPLES 32



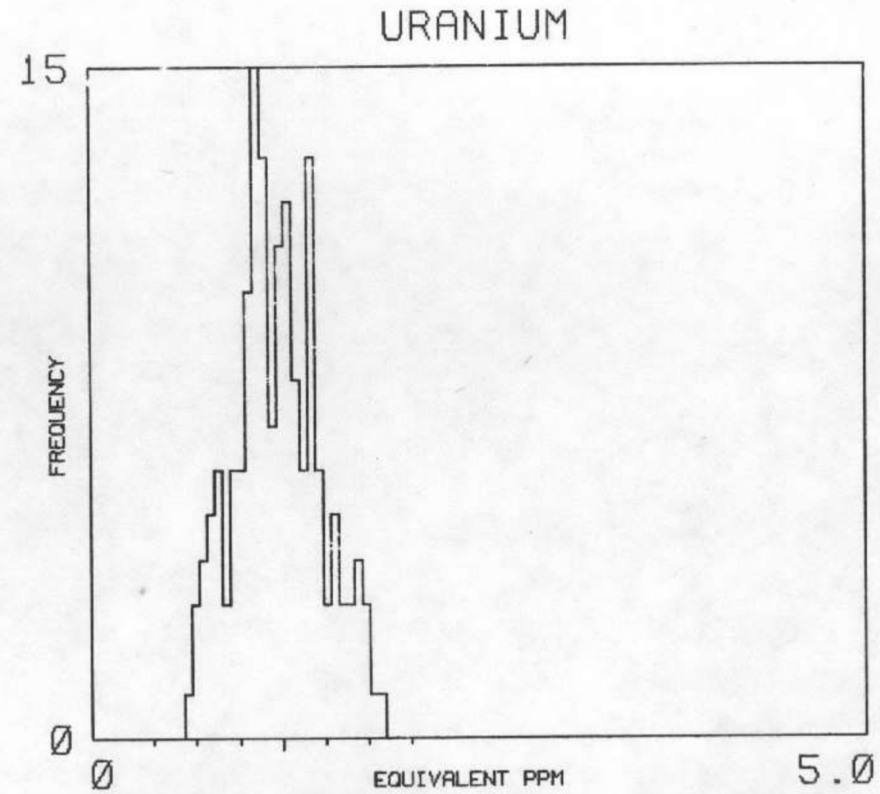
F3 ci

NJ 16-3 CINCINNATI

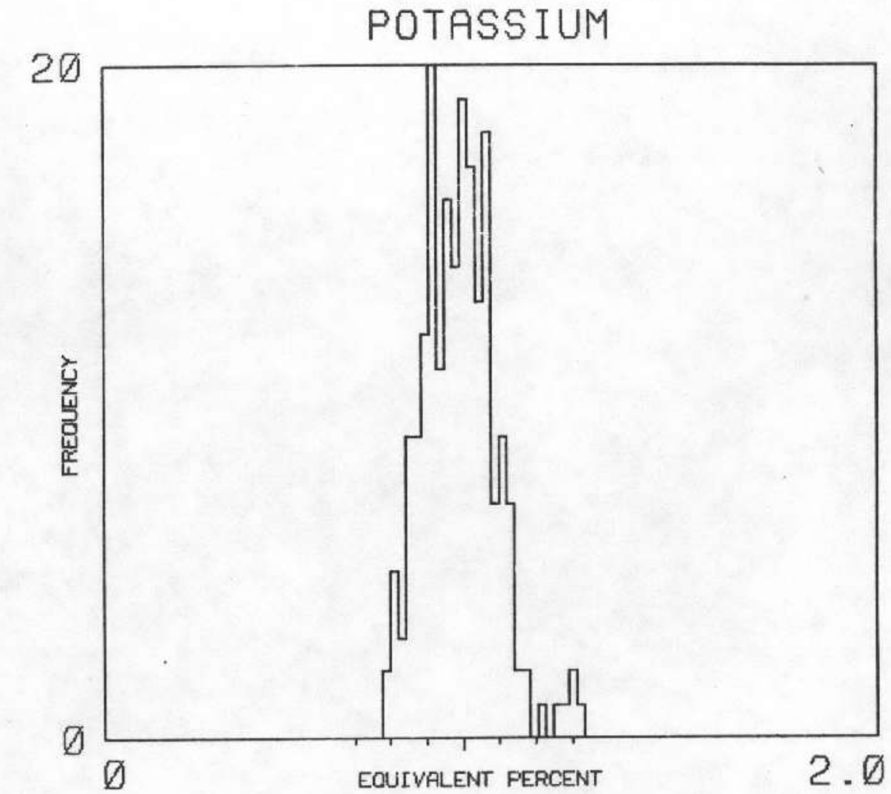
MAP UNIT : QE TOTAL NUMBER OF SAMPLES 201



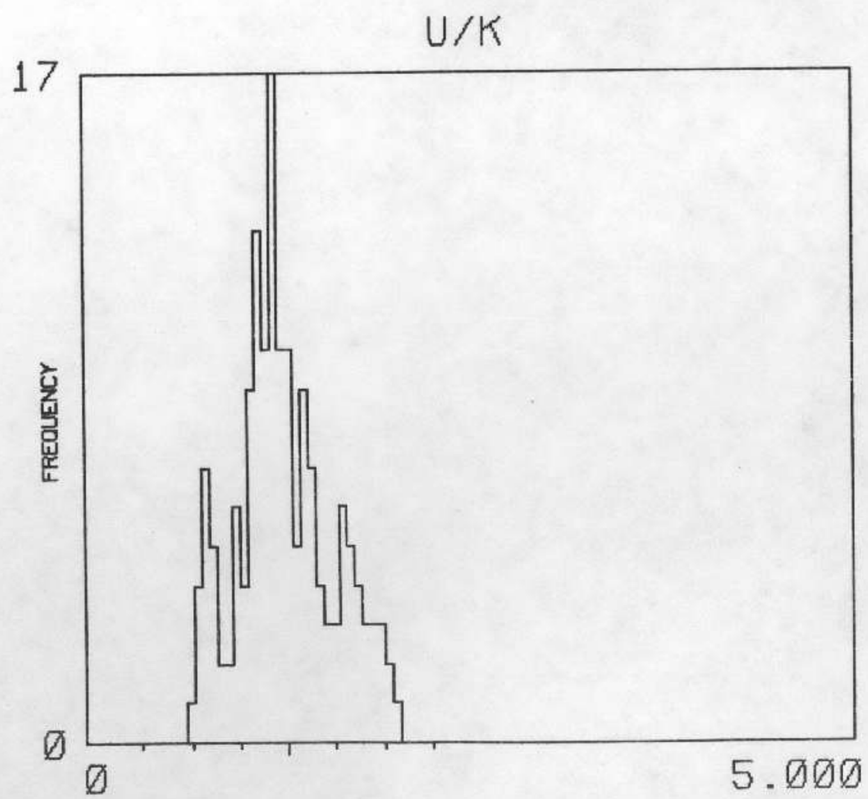
MEAN / MEDIAN 3.5 3.2 201 ADEQUATE SAMPLES



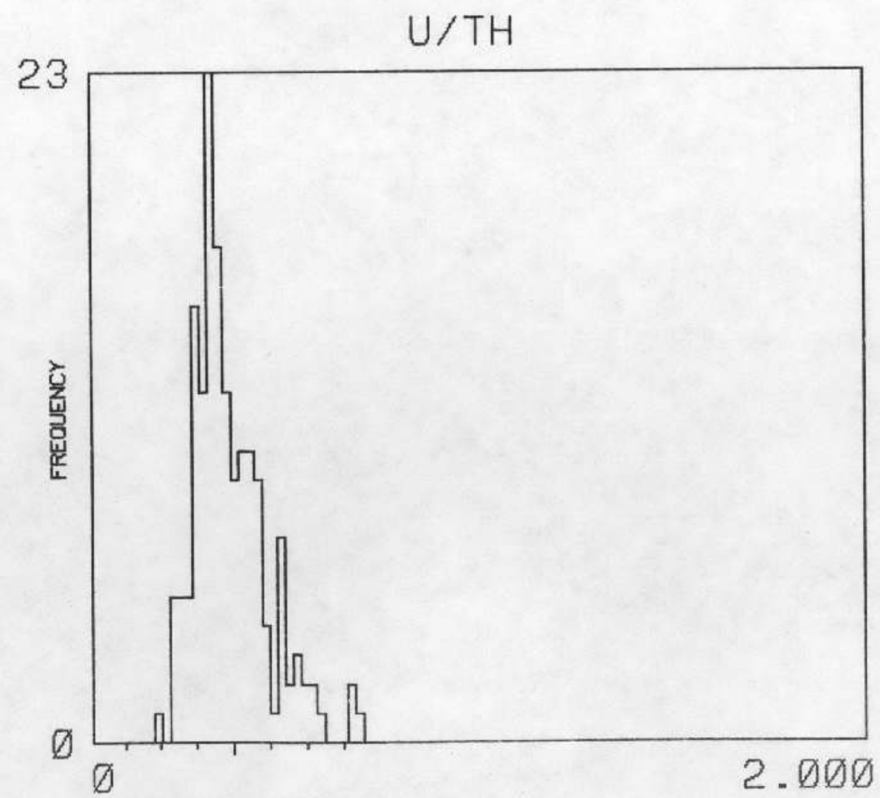
MEAN / MEDIAN 1.2 1.2 158 ADEQUATE SAMPLES



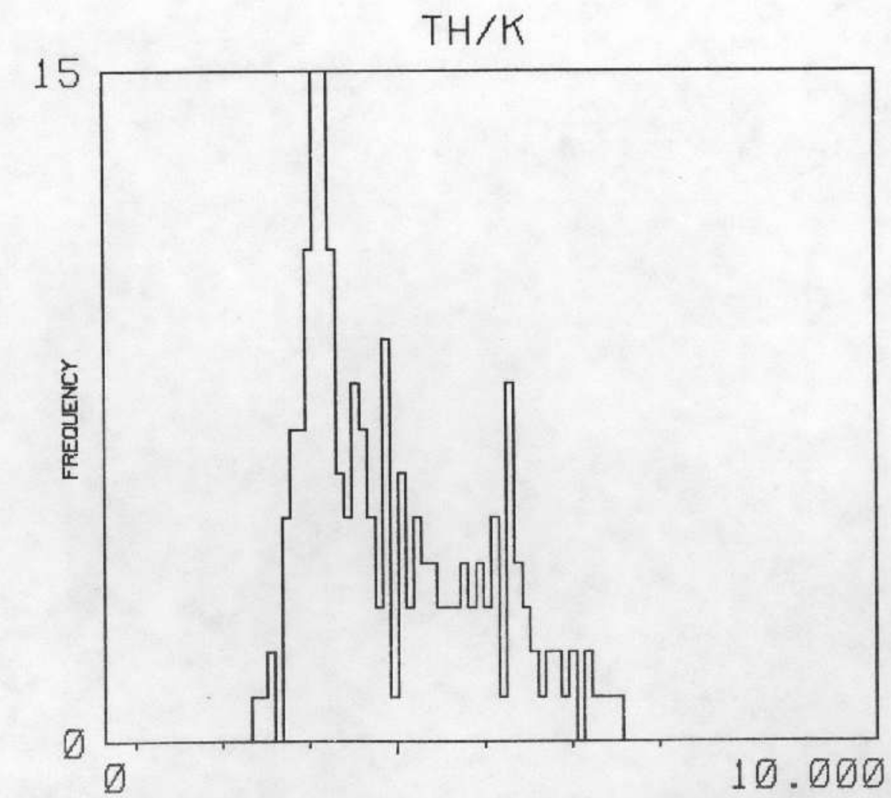
MEAN / MEDIAN 0.9 0.9 201 ADEQUATE SAMPLES



MEAN / MEDIAN 1.314 1.250 158 ADEQUATE SAMPLES



MEAN / MEDIAN 0.367 0.340 158 ADEQUATE SAMPLES

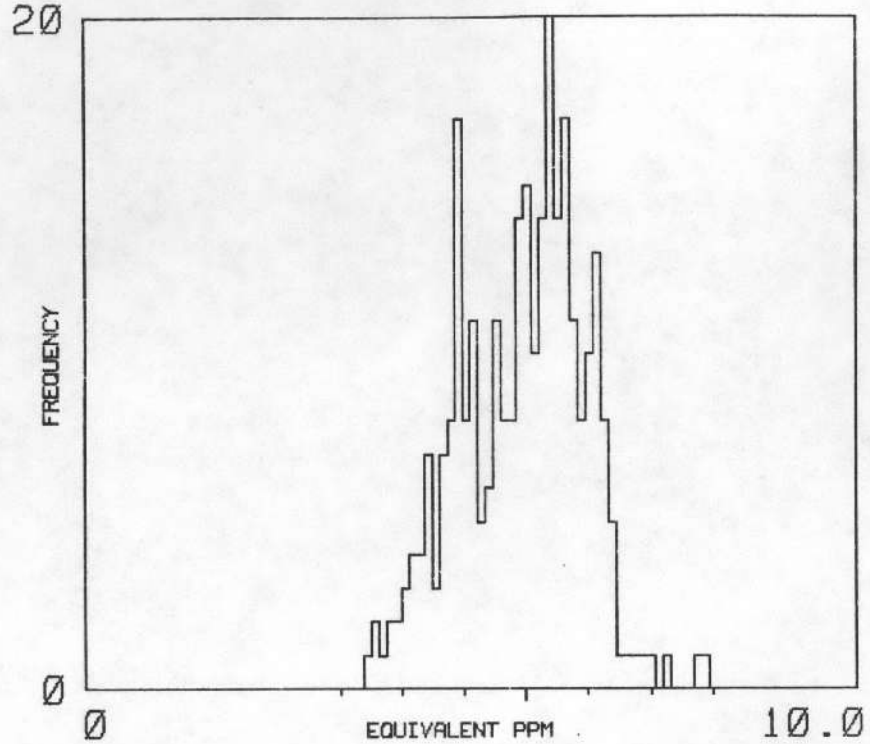


MEAN / MEDIAN 3.787 3.400 201 ADEQUATE SAMPLES

NJ 16-3 CINCINNATI MAP UNIT : QL TOTAL NUMBER OF SAMPLES 285

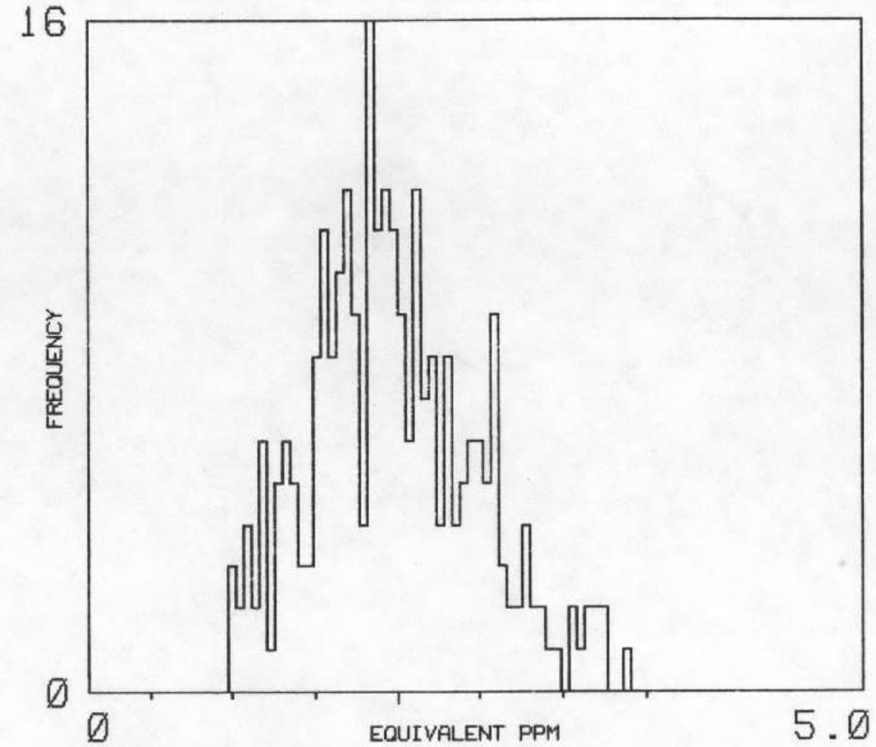
F4ci

THORIUM



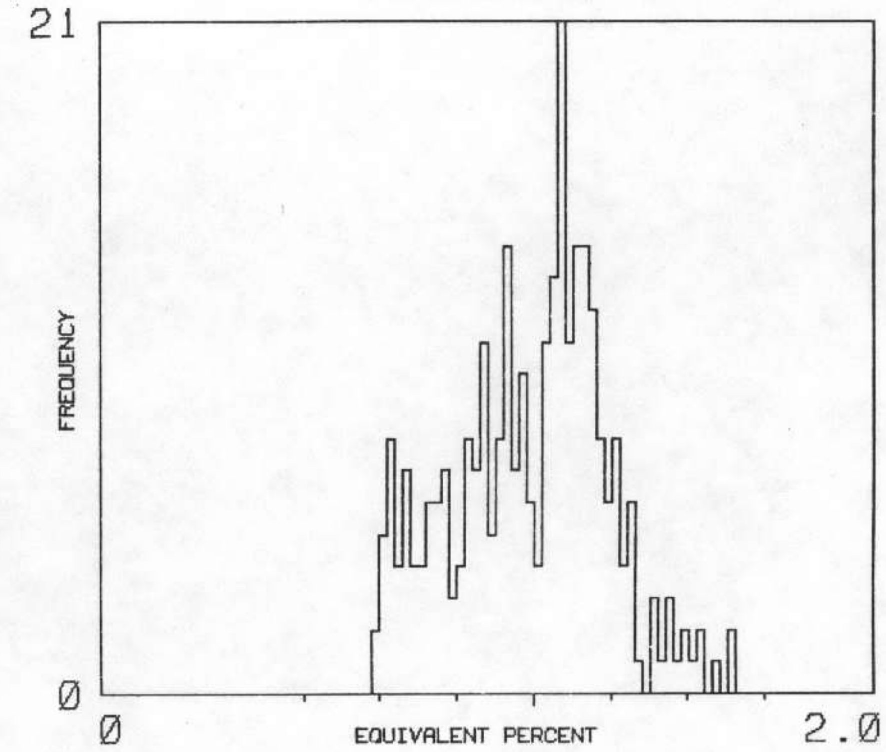
MEAN / MEDIAN 5.7 5.8 285 ADEQUATE SAMPLES

URANIUM



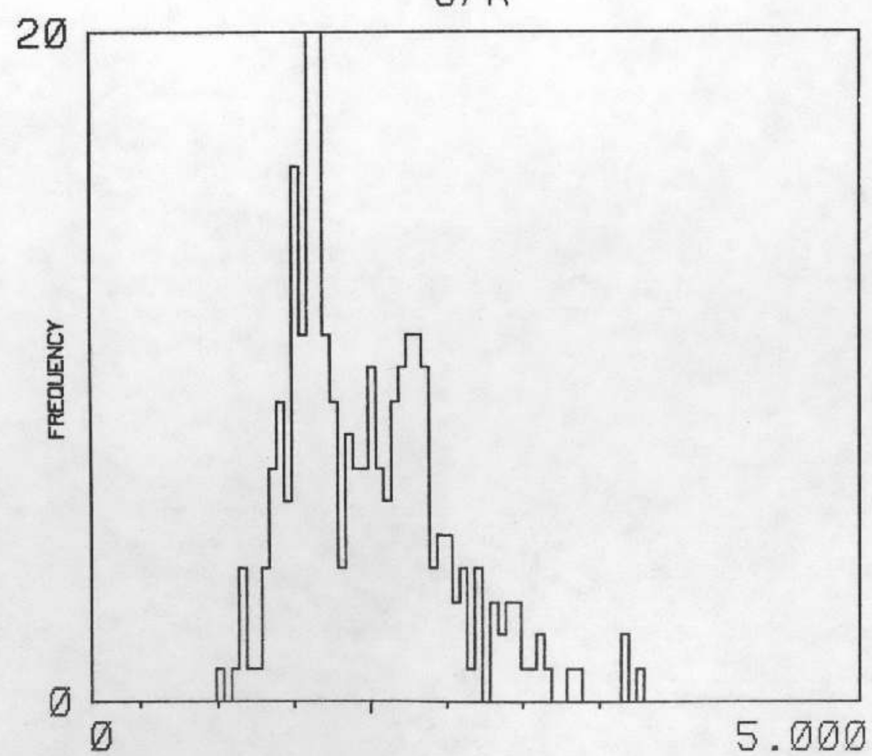
MEAN / MEDIAN 2.0 1.9 268 ADEQUATE SAMPLES

POTASSIUM



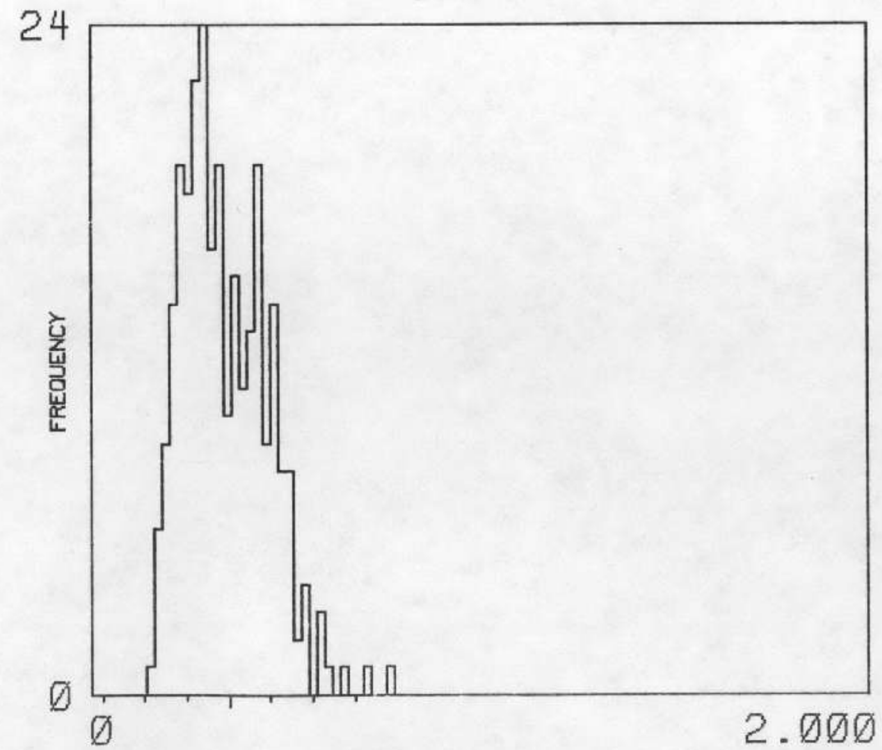
MEAN / MEDIAN 1.1 1.2 285 ADEQUATE SAMPLES

U/K



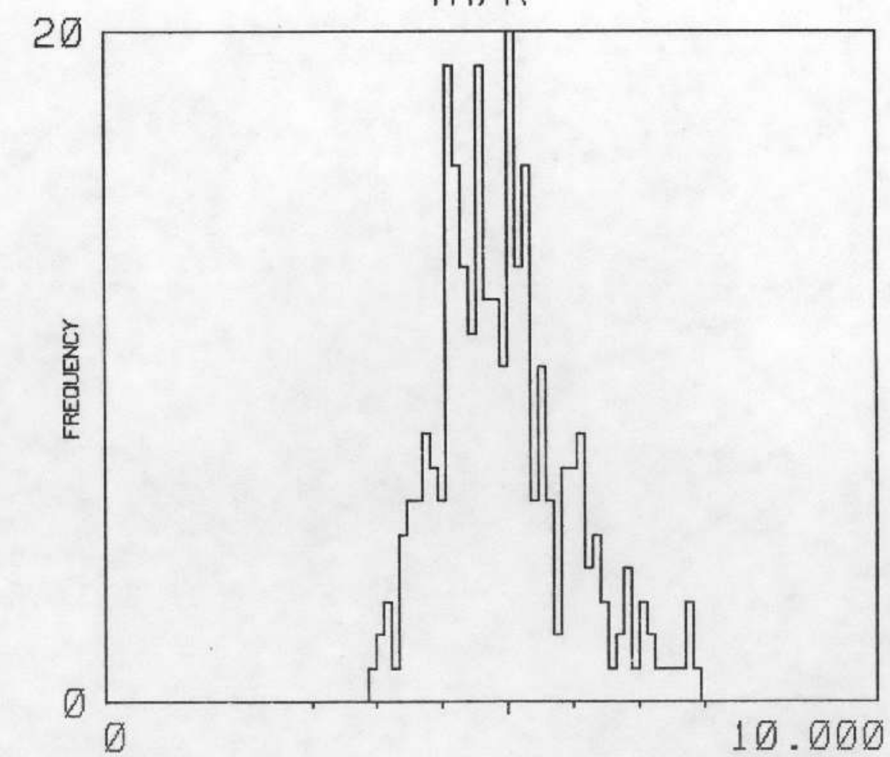
MEAN / MEDIAN 1.816 1.750 268 ADEQUATE SAMPLES

U/TH



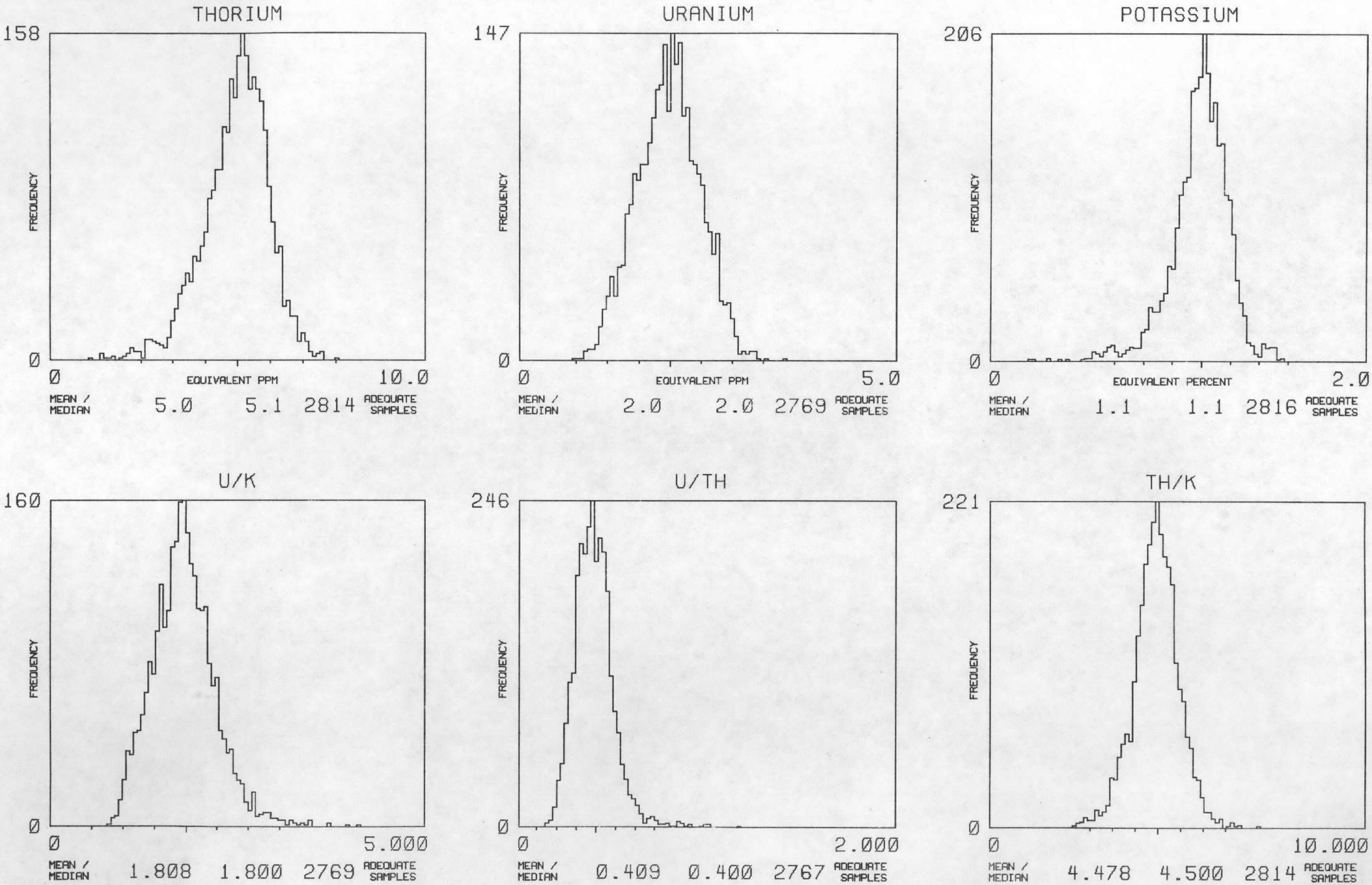
MEAN / MEDIAN 0.353 0.340 268 ADEQUATE SAMPLES

TH/K

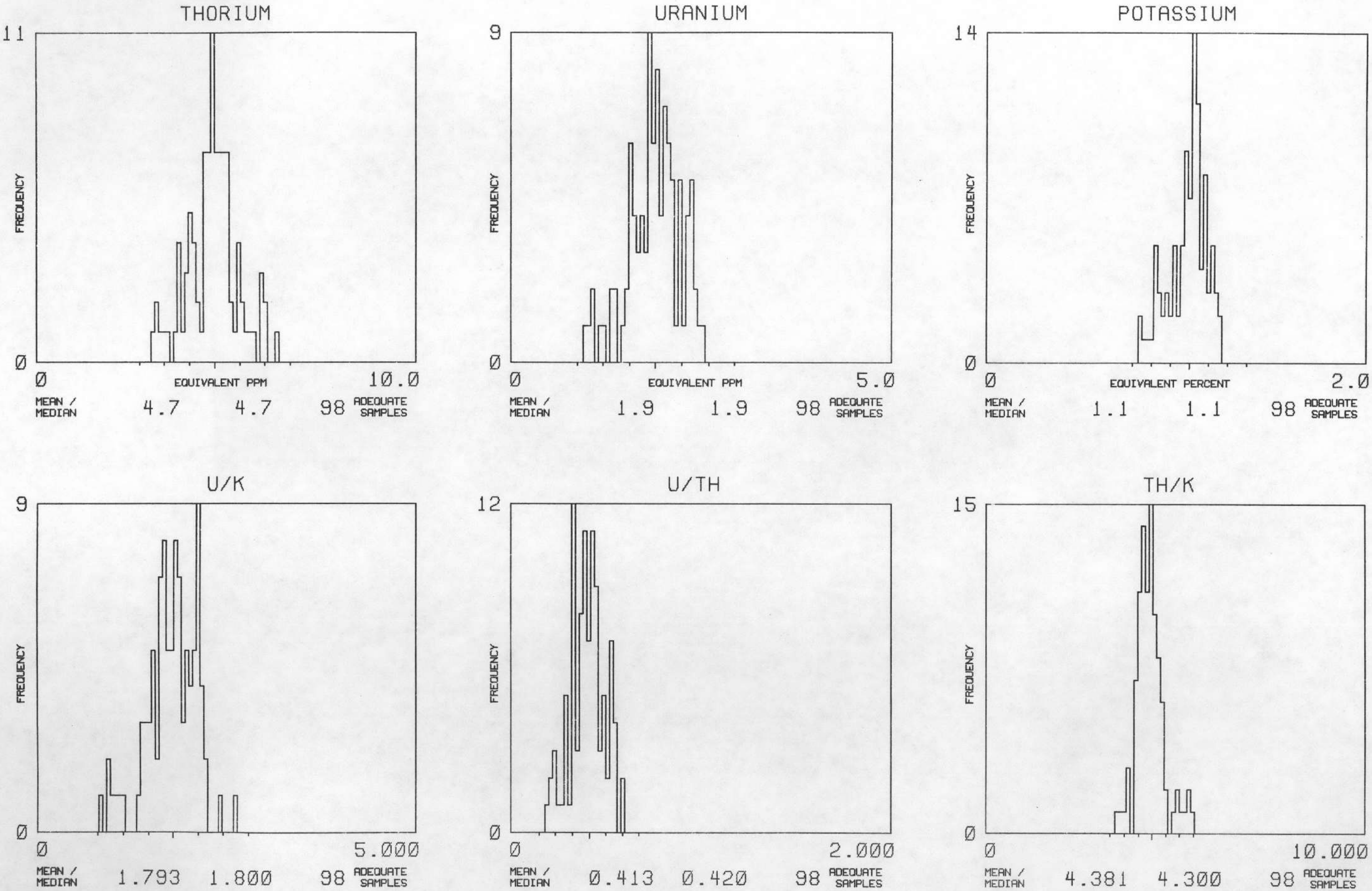


MEAN / MEDIAN 5.208 5.100 285 ADEQUATE SAMPLES

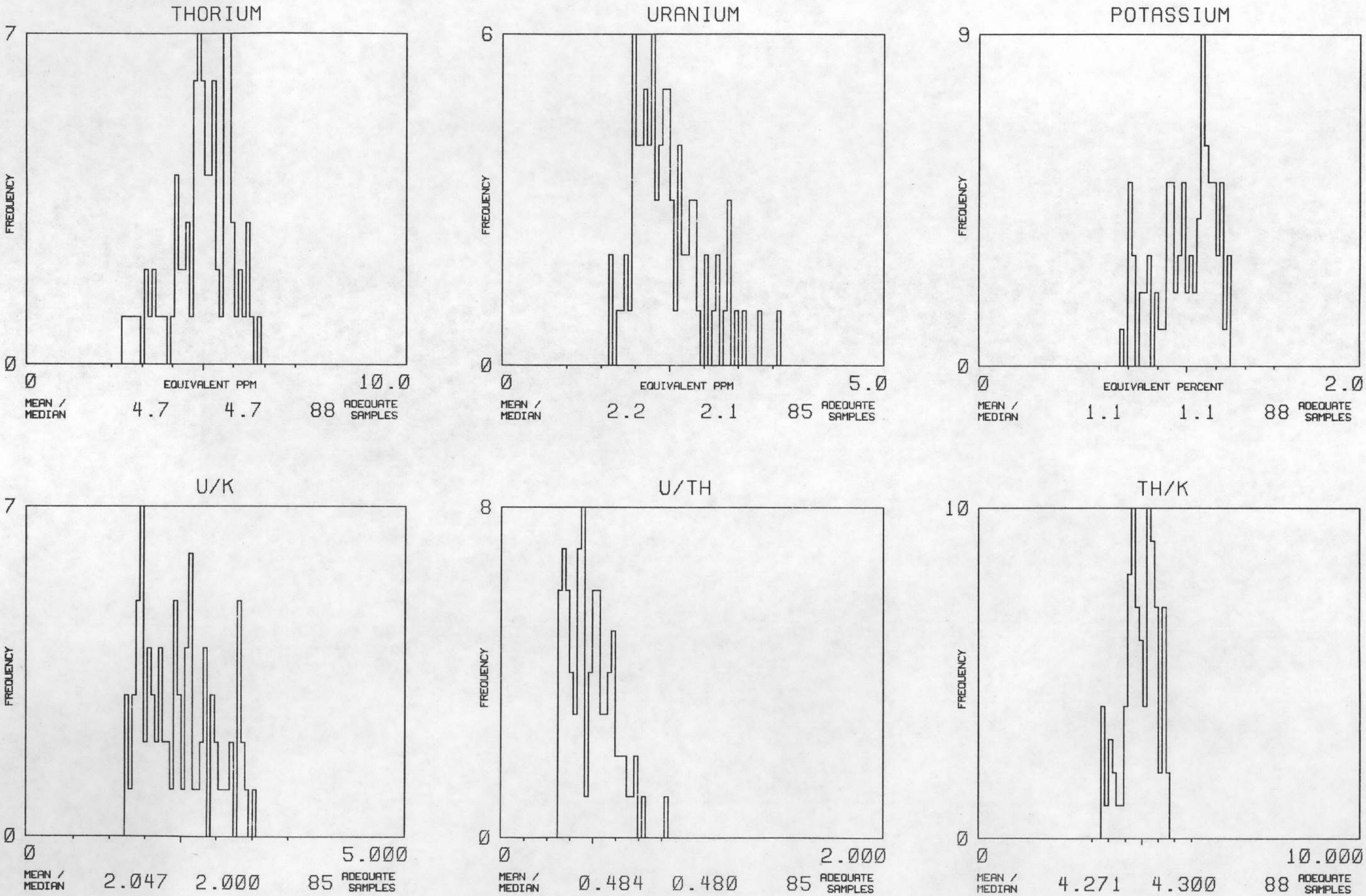
NJ 16-3 CINCINNATI MAP UNIT : QVT TOTAL NUMBER OF SAMPLES 2974



NJ 16-3 CINCINNATI MAP UNIT : QO TOTAL NUMBER OF SAMPLES 98



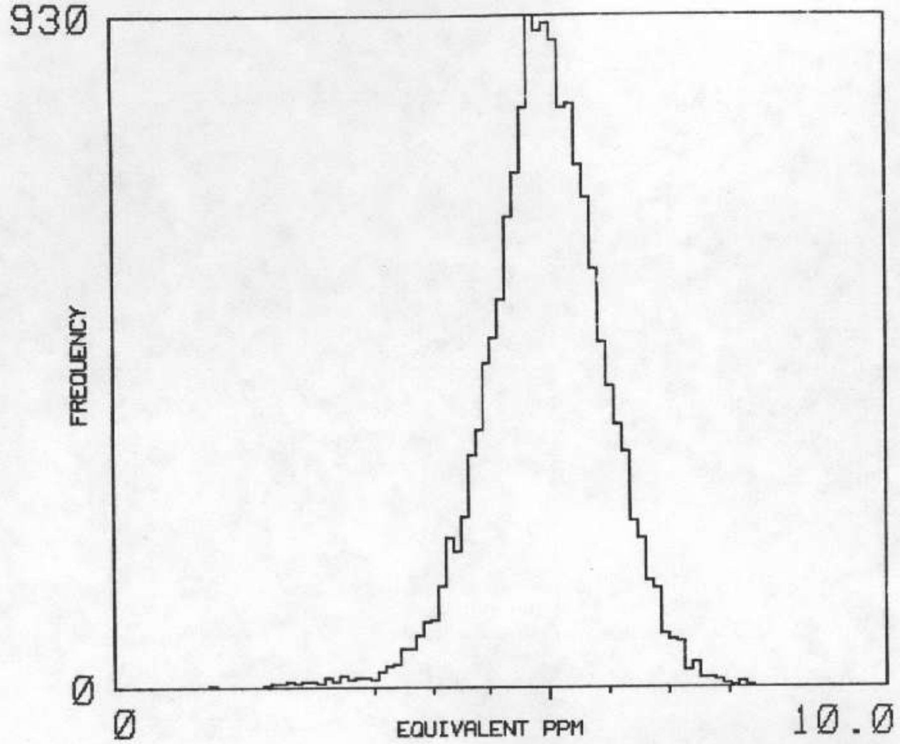
NJ 16-3 CINCINNATI MAP UNIT : QST TOTAL NUMBER OF SAMPLES 100



NJ 16-3 CINCINNATI

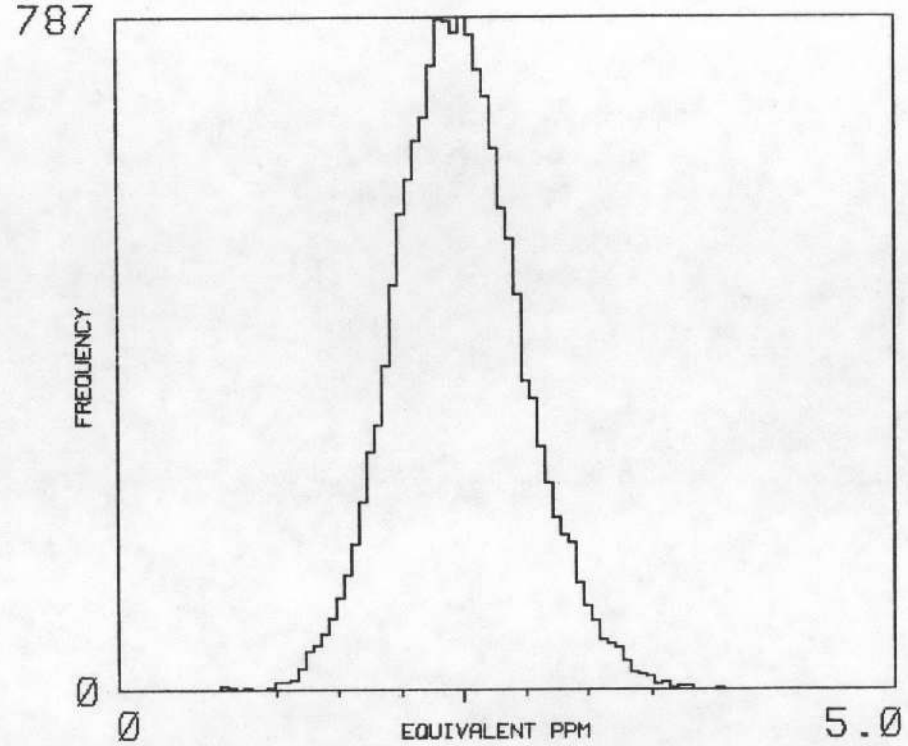
MAP UNIT : QGM TOTAL NUMBER OF SAMPLES 15640

THORIUM



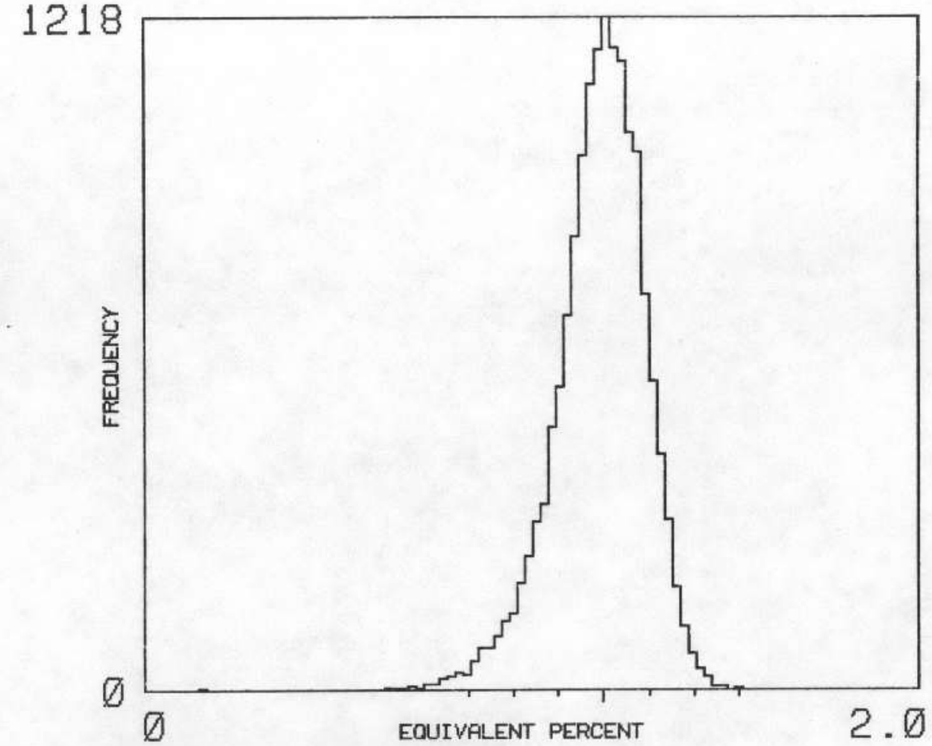
MEAN / MEDIAN 5.7 5.7 15528 ADEQUATE SAMPLES

URANIUM



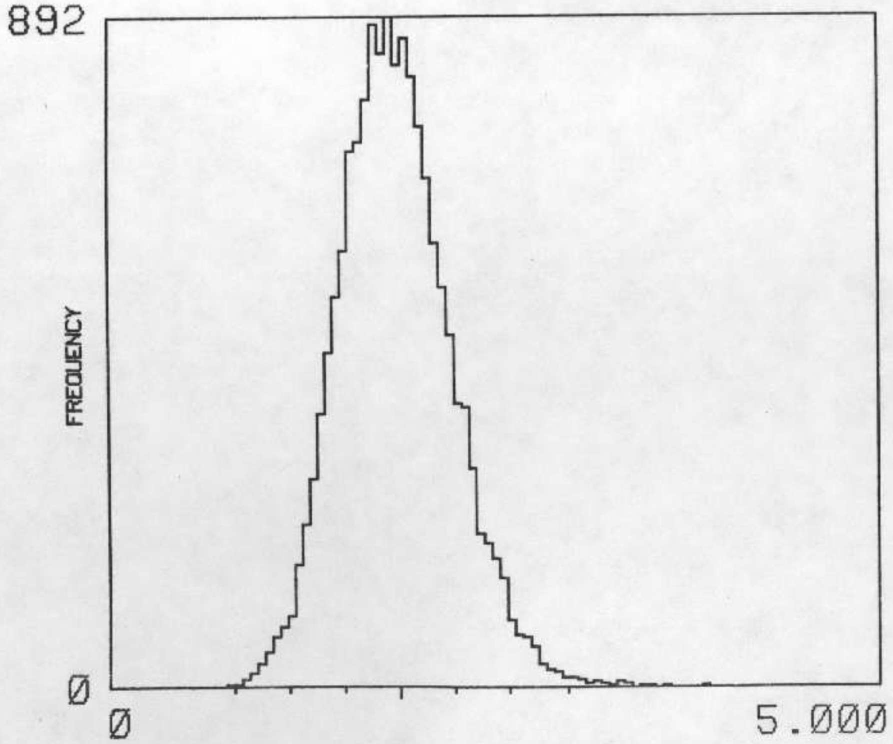
MEAN / MEDIAN 2.2 2.2 15470 ADEQUATE SAMPLES

POTASSIUM



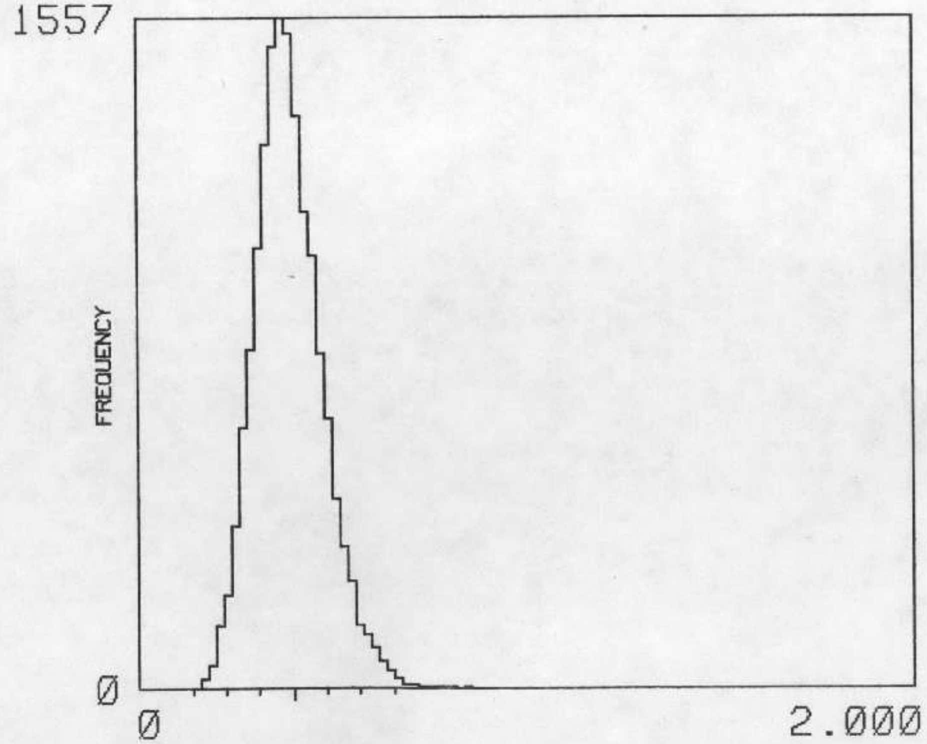
MEAN / MEDIAN 1.2 1.2 15528 ADEQUATE SAMPLES

U/K



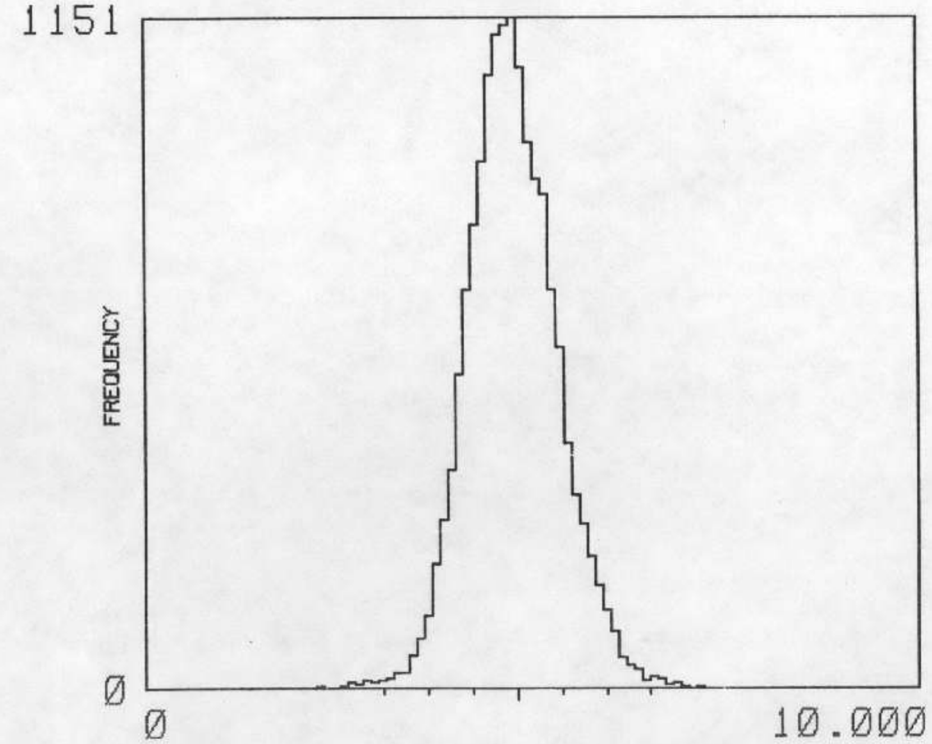
MEAN / MEDIAN 1.891 1.850 15470 ADEQUATE SAMPLES

U/TH

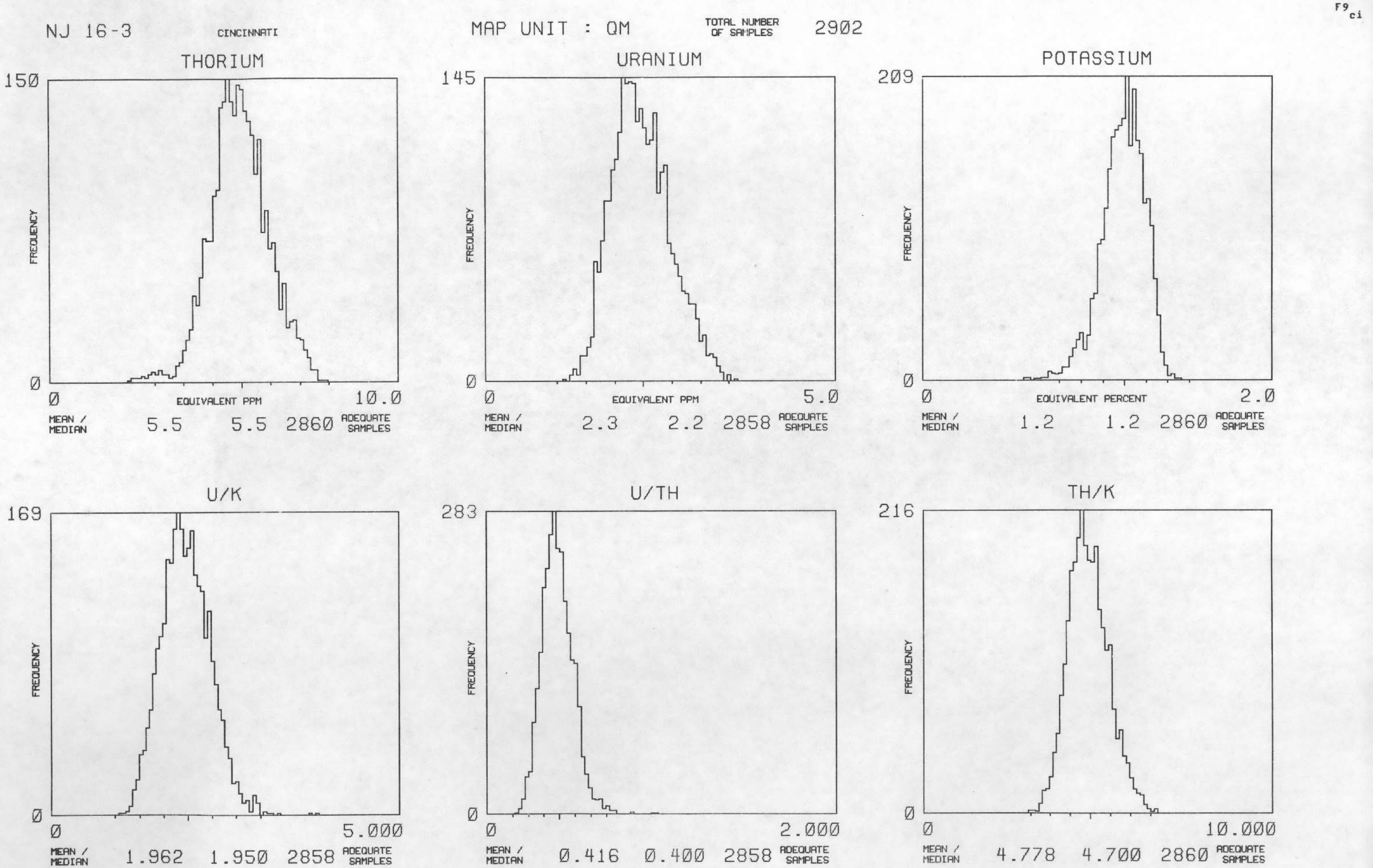


MEAN / MEDIAN 0.399 0.400 15470 ADEQUATE SAMPLES

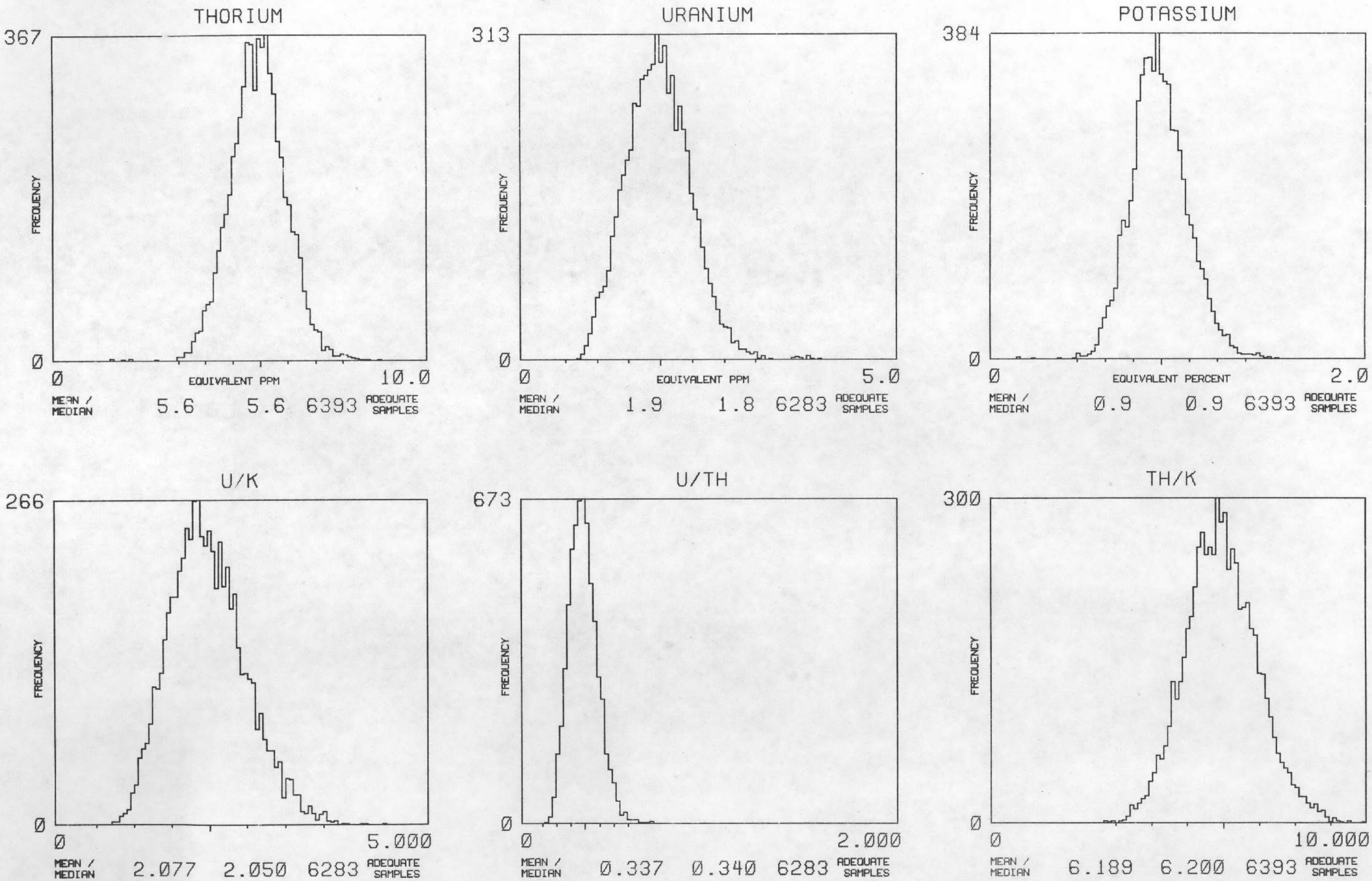
TH/K



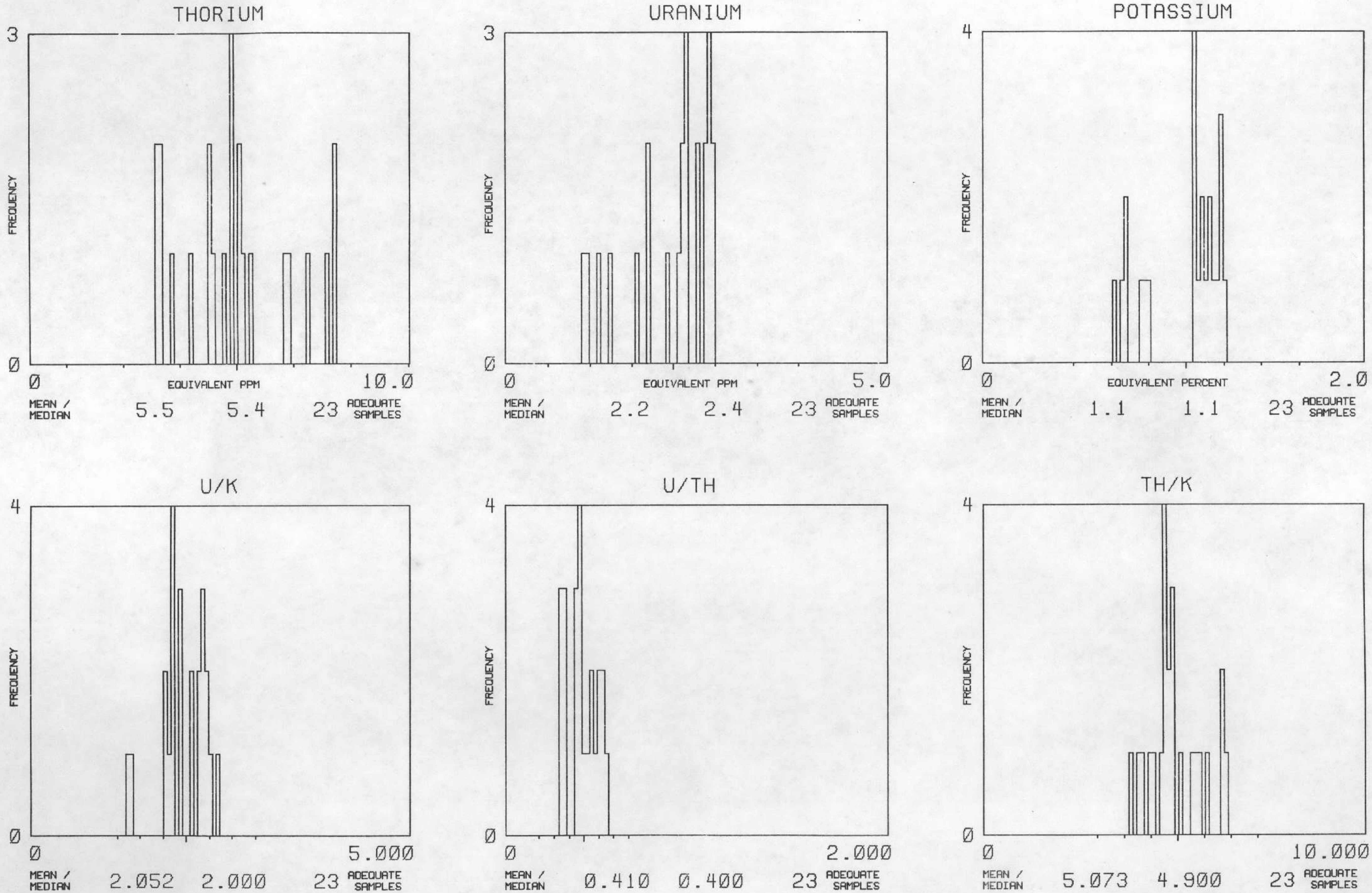
MEAN / MEDIAN 4.793 4.800 15528 ADEQUATE SAMPLES


F9ci
NJ 16-3
CINCINNATI
MAP UNIT : QM
TOTAL NUMBER OF SAMPLES 2902
THORIUM
150
0
FREQUENCY
0
EQUIVALENT PPM
10.0
MEAN / MEDIAN 5.5 5.5 2860 ADEQUATE SAMPLES
URANIUM
145
0
FREQUENCY
0
EQUIVALENT PPM
5.0
MEAN / MEDIAN 2.3 2.2 2858 ADEQUATE SAMPLES
POTASSIUM
209
0
FREQUENCY
0
EQUIVALENT PERCENT
2.0
MEAN / MEDIAN 1.2 1.2 2860 ADEQUATE SAMPLES
U/K
169
0
FREQUENCY
0
5.000
MEAN / MEDIAN 1.962 1.950 2858 ADEQUATE SAMPLES
U/TH
283
0
FREQUENCY
0
2.000
MEAN / MEDIAN 0.416 0.400 2858 ADEQUATE SAMPLES
TH/K
216
0
FREQUENCY
0
10.000
MEAN / MEDIAN 4.778 4.700 2860 ADEQUATE SAMPLES

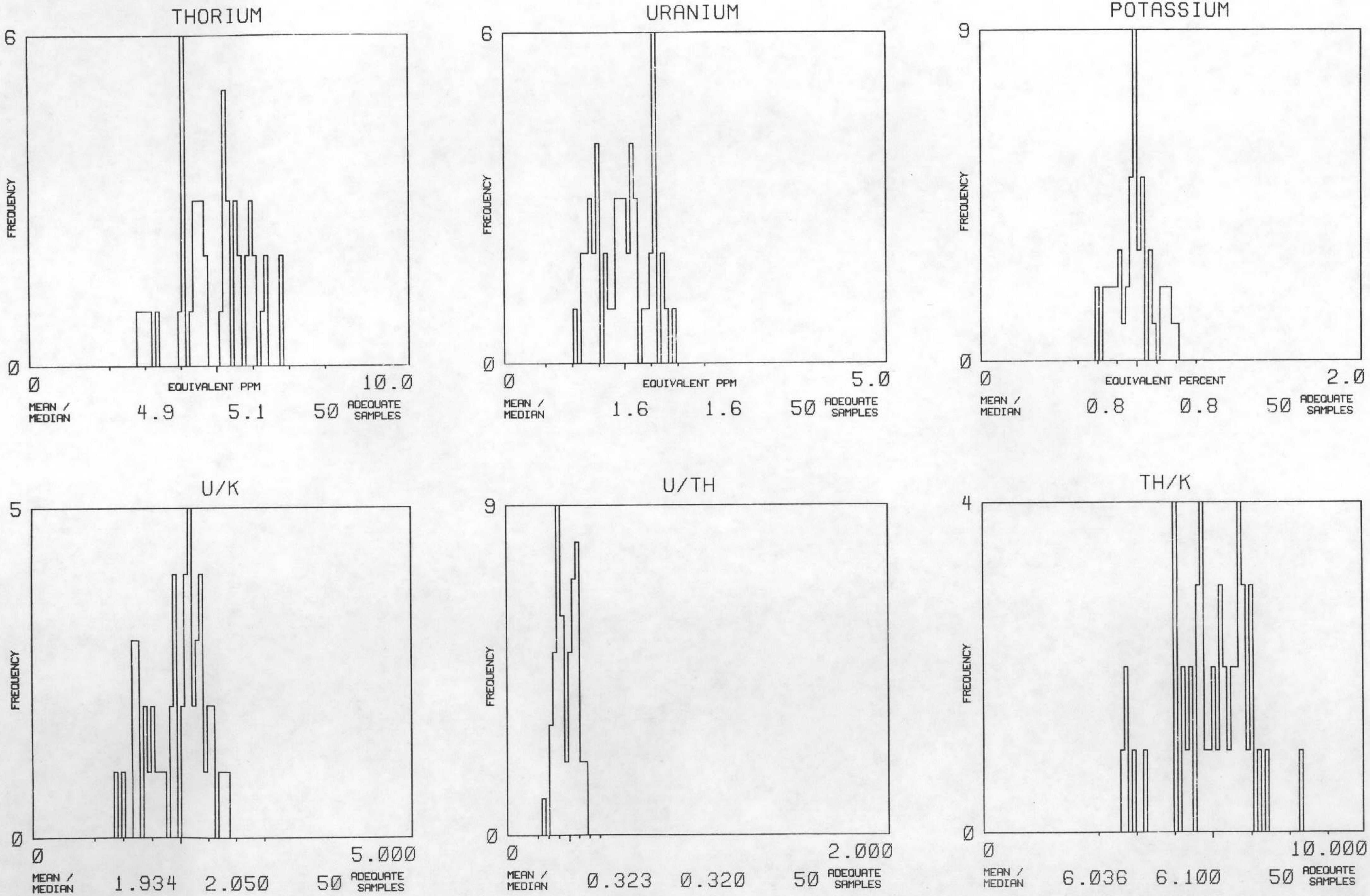
NJ 16-3 CINCINNATI MAP UNIT : QIT TOTAL NUMBER OF SAMPLES 6458



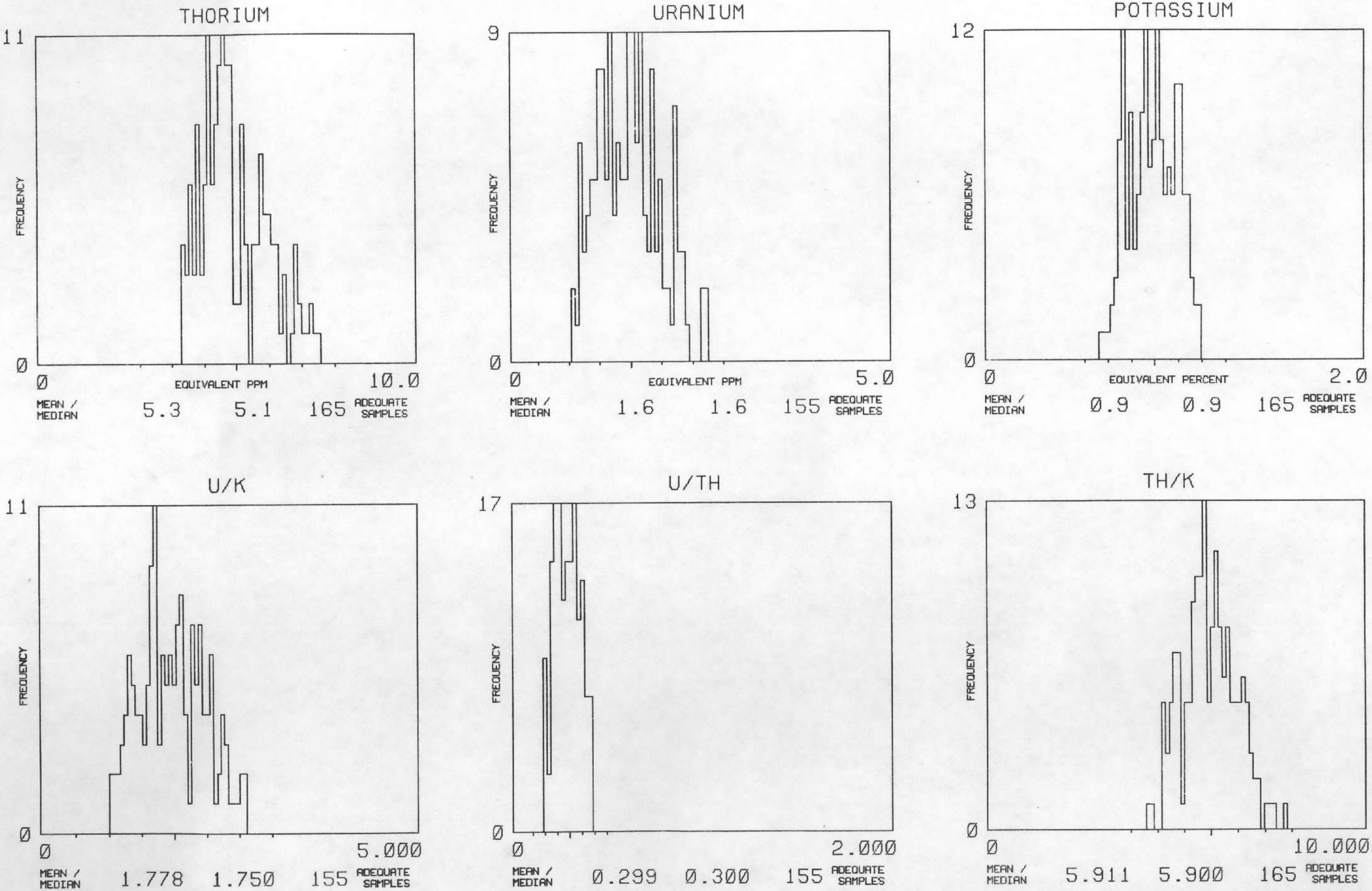
NJ 16-3 CINCINNATI MAP UNIT : DMN TOTAL NUMBER OF SAMPLES 23



NJ 16-3 CINCINNATI MAP UNIT : DL TOTAL NUMBER OF SAMPLES 50



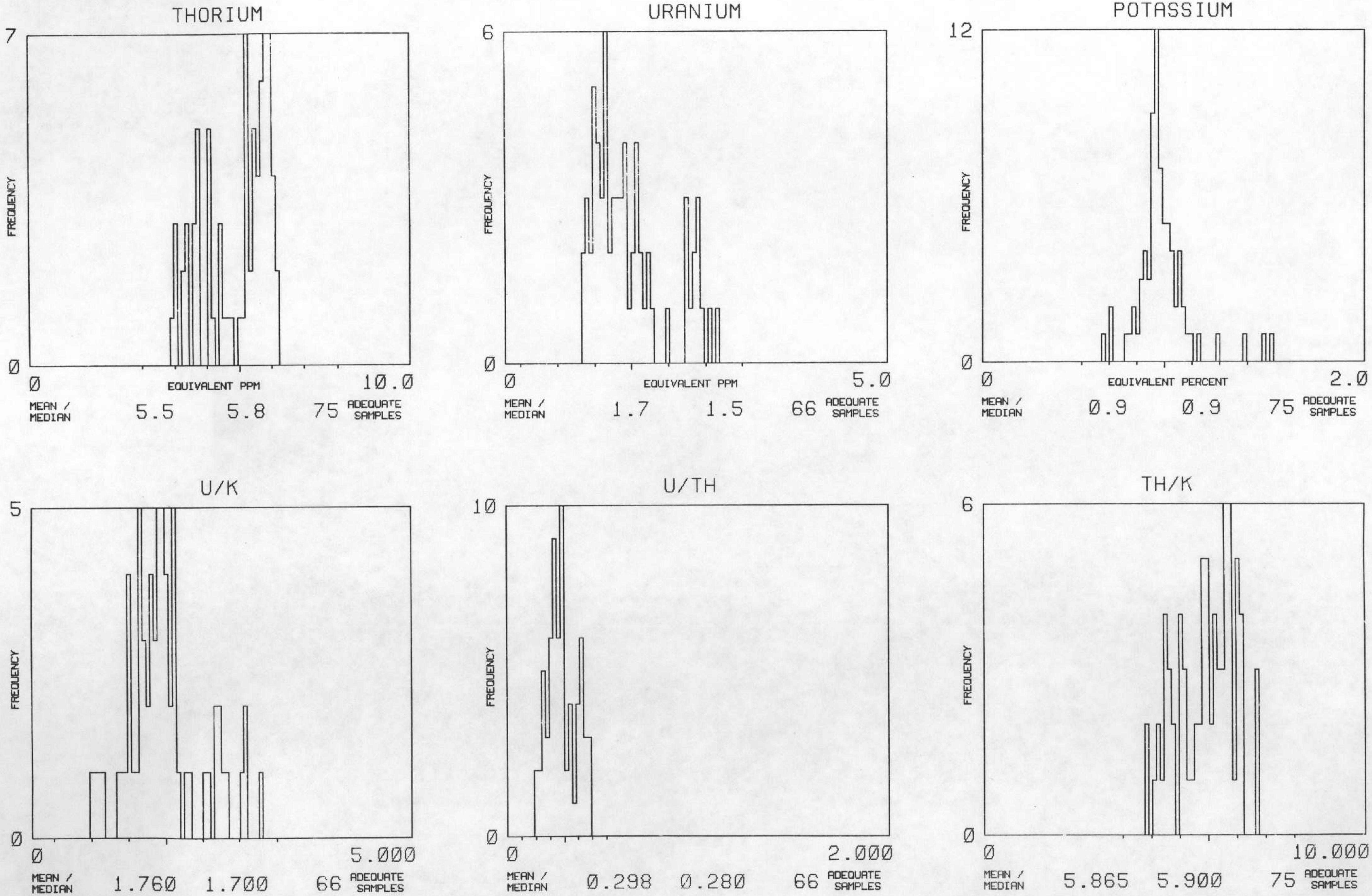
NJ 16-3 CINCINNATI MAP UNIT : SU TOTAL NUMBER OF SAMPLES 165



NJ 16-3 CINCINNATI

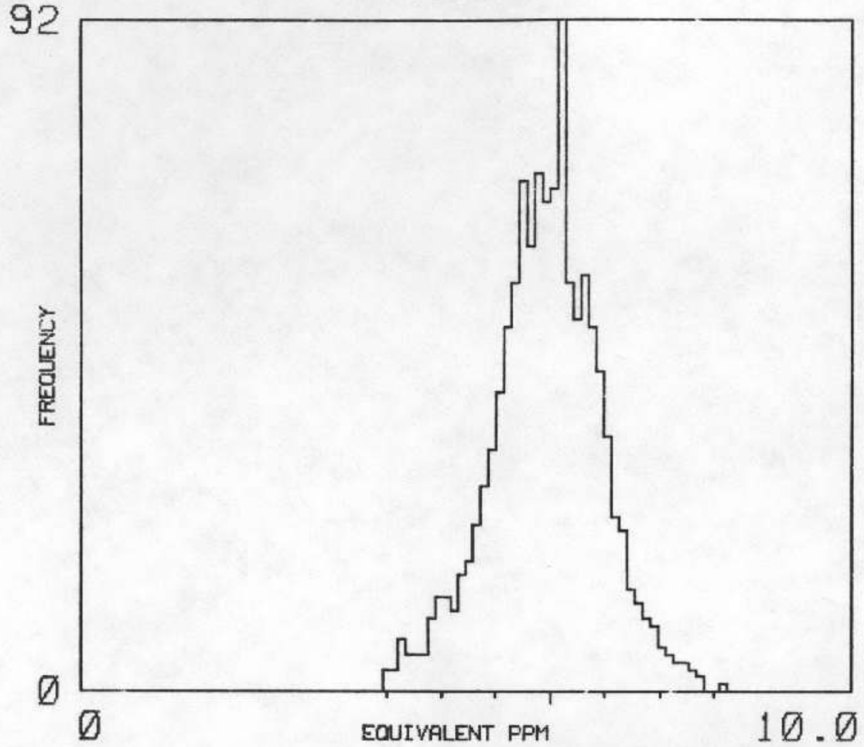
MAP UNIT : OW

TOTAL NUMBER OF SAMPLES 75



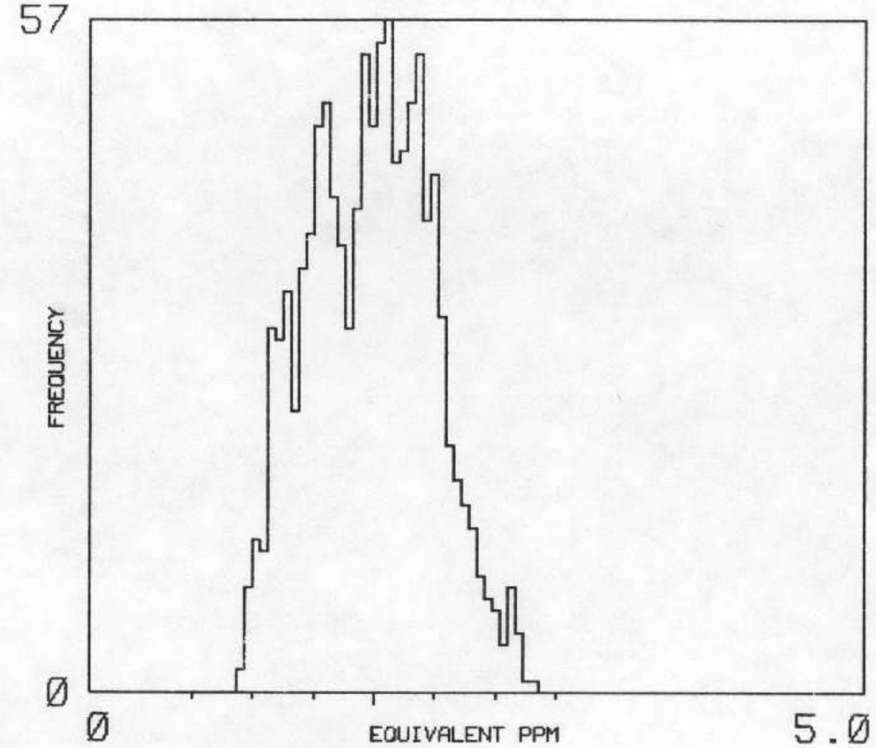
NJ 16-3 CINCINNATI MAP UNIT : OD TOTAL NUMBER OF SAMPLES 1321

THORIUM



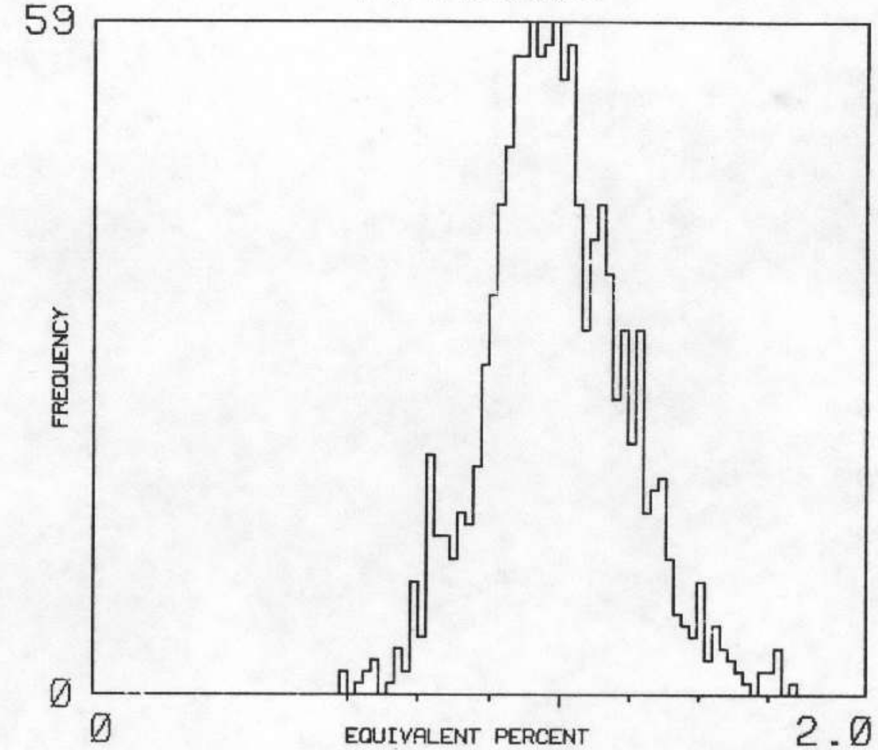
MEAN / MEDIAN 6.1 6.1 1179 ADEQUATE SAMPLES

URANIUM



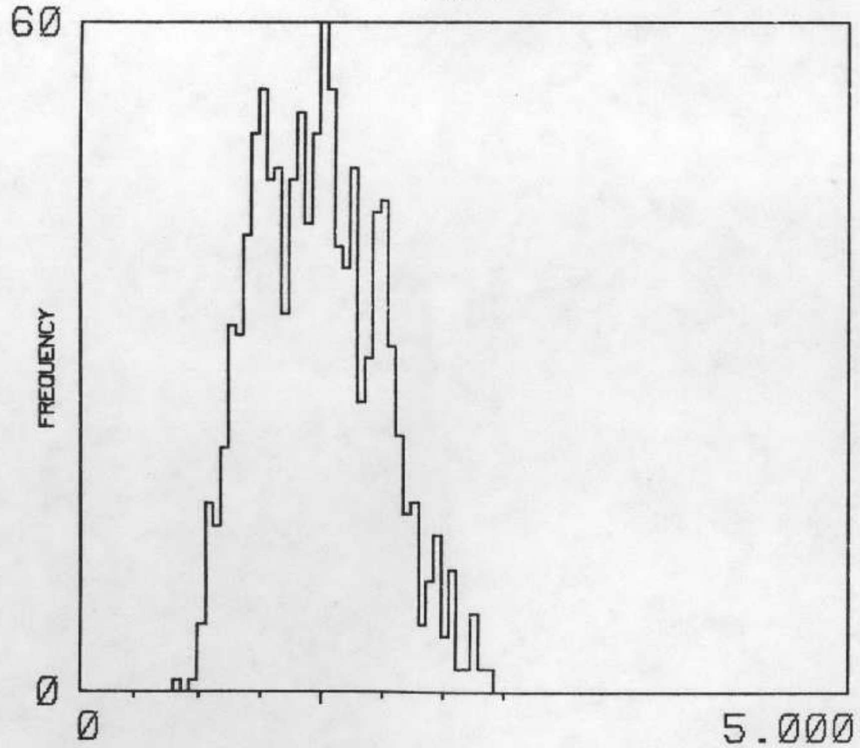
MEAN / MEDIAN 1.8 1.8 1119 ADEQUATE SAMPLES

POTASSIUM



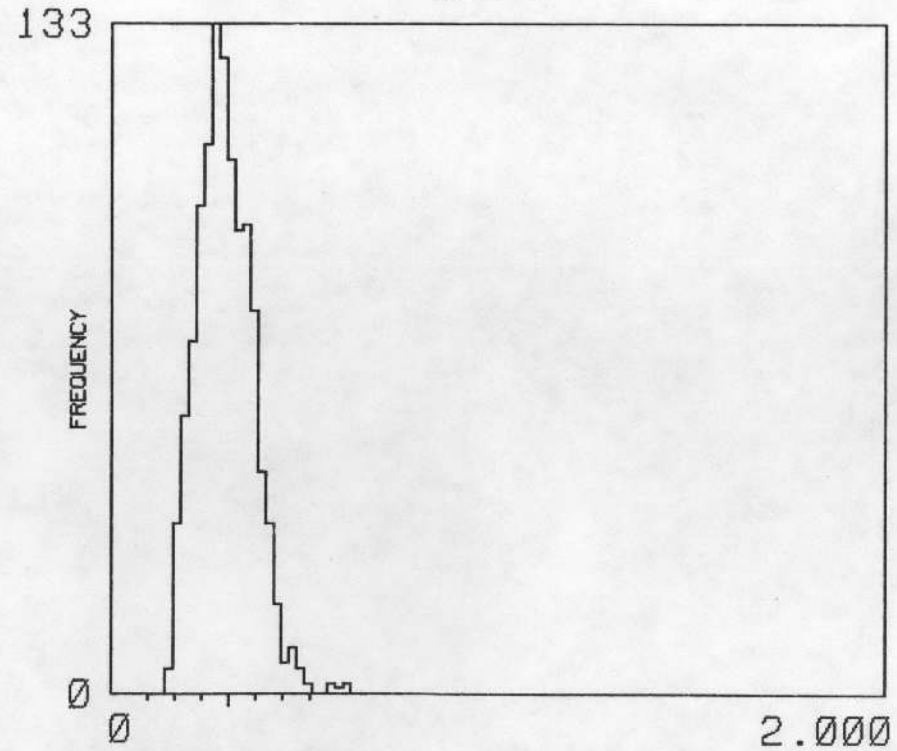
MEAN / MEDIAN 1.2 1.2 1179 ADEQUATE SAMPLES

U/K



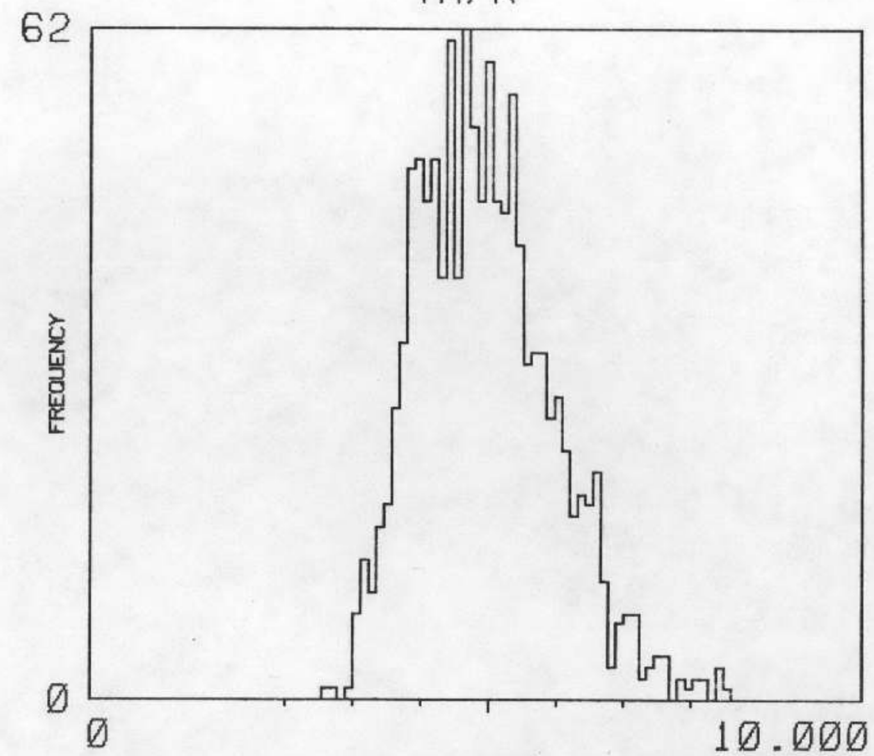
MEAN / MEDIAN 1.560 1.550 1119 ADEQUATE SAMPLES

U/TH

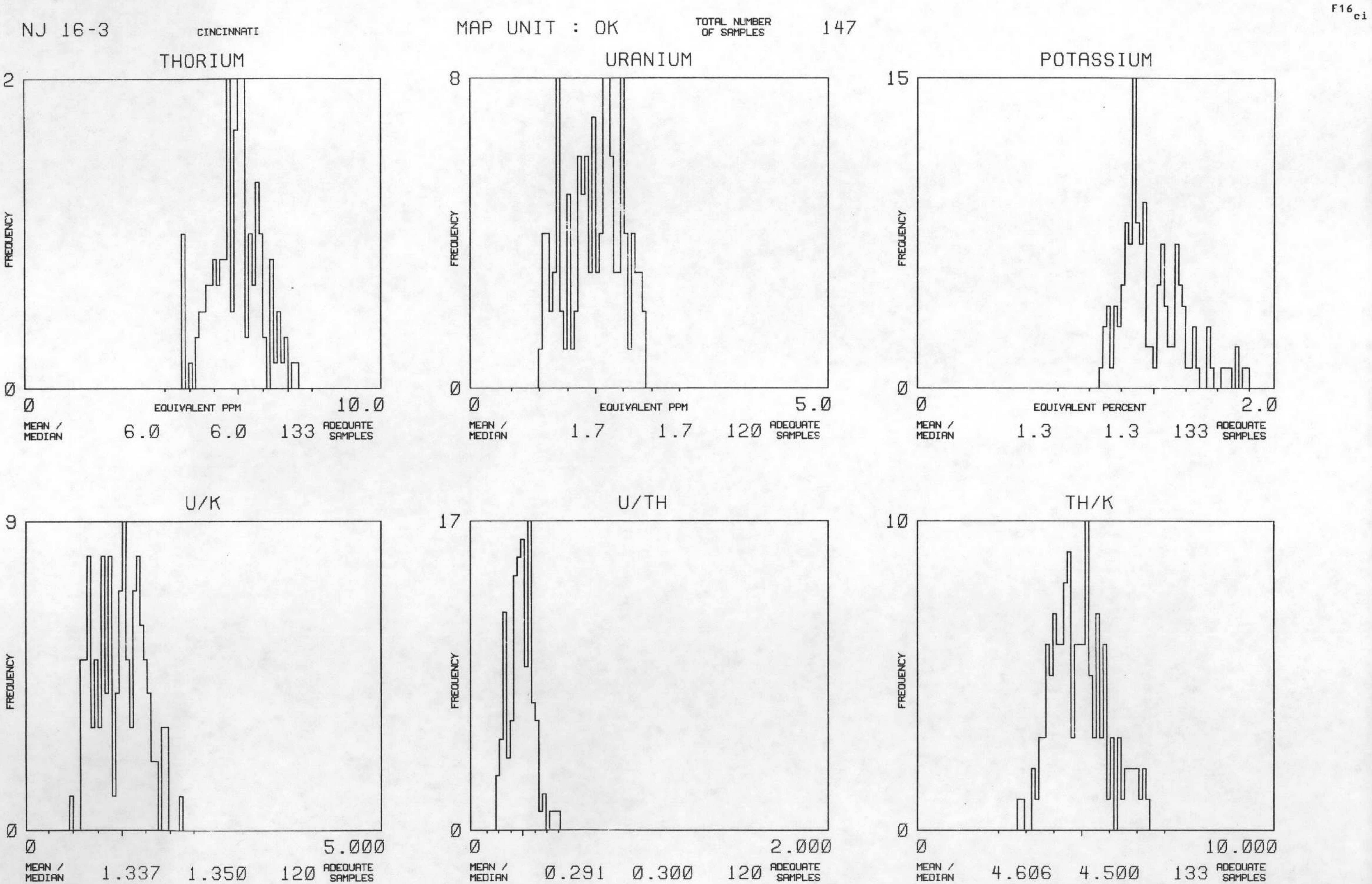


MEAN / MEDIAN 0.305 0.300 1119 ADEQUATE SAMPLES

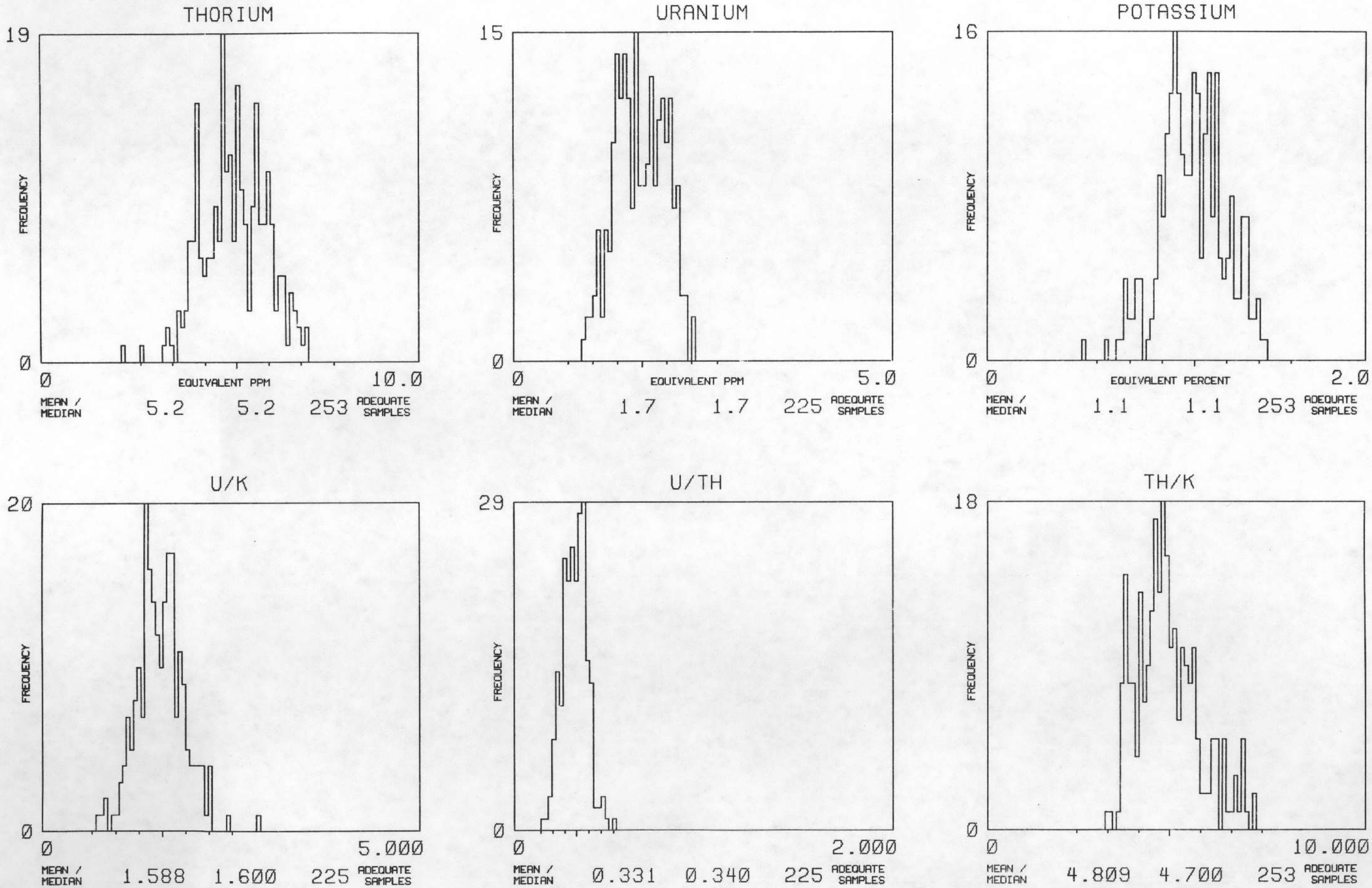
TH/K



MEAN / MEDIAN 5.158 5.100 1179 ADEQUATE SAMPLES


F16ci
NJ 16-3
CINCINNATI
MAP UNIT : OK
TOTAL NUMBER OF SAMPLES 147
THORIUM
12
0
FREQUENCY
0
EQUIVALENT PPM
10.0
MEAN / MEDIAN 6.0 6.0 133 ADEQUATE SAMPLES
URANIUM
8
0
FREQUENCY
0
EQUIVALENT PPM
5.0
MEAN / MEDIAN 1.7 1.7 120 ADEQUATE SAMPLES
POTASSIUM
15
0
FREQUENCY
0
EQUIVALENT PERCENT
2.0
MEAN / MEDIAN 1.3 1.3 133 ADEQUATE SAMPLES
U/K
9
0
FREQUENCY
0
5.000
MEAN / MEDIAN 1.337 1.350 120 ADEQUATE SAMPLES
U/TH
17
0
FREQUENCY
0
2.000
MEAN / MEDIAN 0.291 0.300 120 ADEQUATE SAMPLES
TH/K
10
0
FREQUENCY
0
10.000
MEAN / MEDIAN 4.606 4.500 133 ADEQUATE SAMPLES

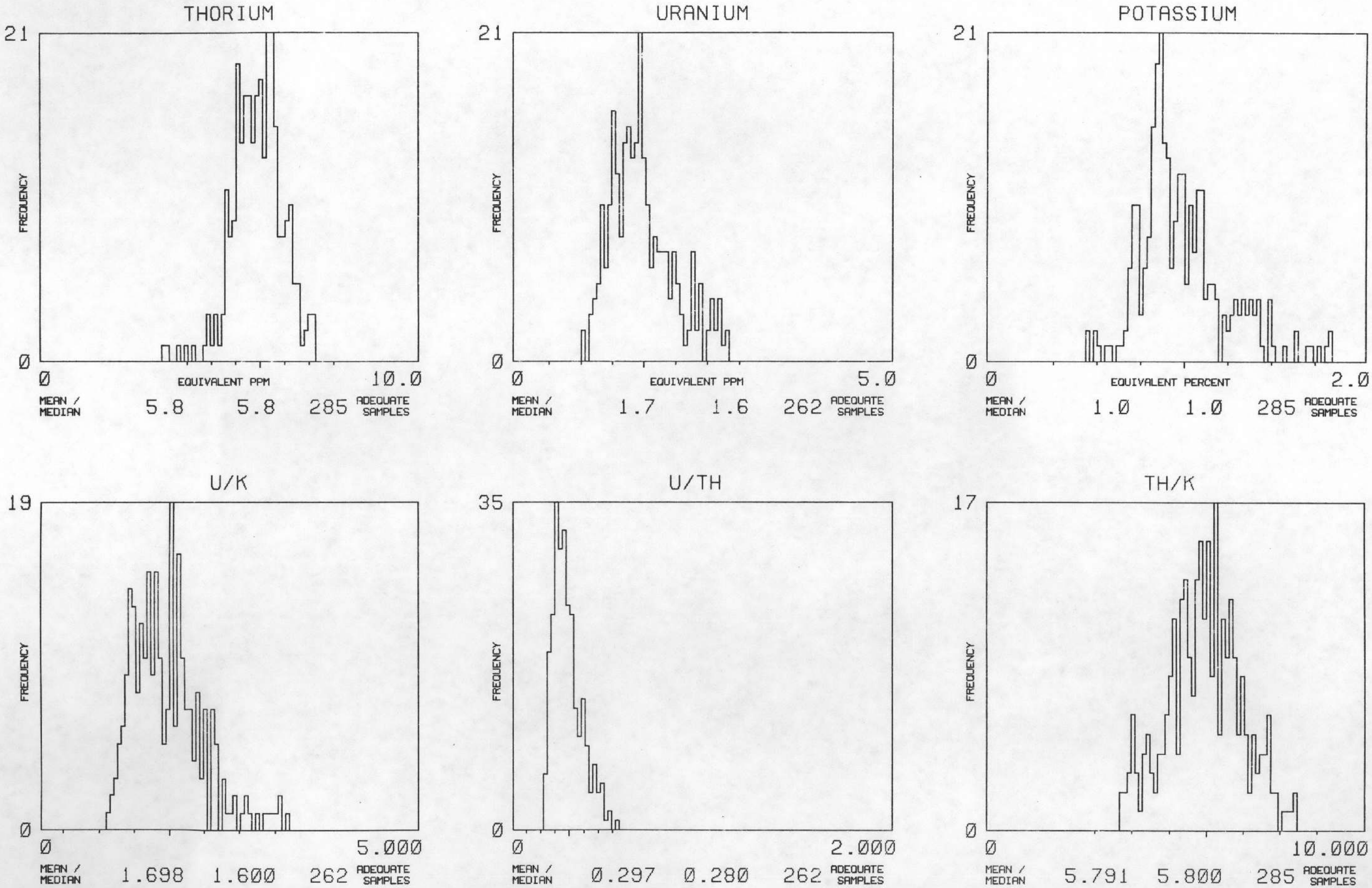
NJ 16-3 CINCINNATI MAP UNIT : OM TOTAL NUMBER OF SAMPLES 253



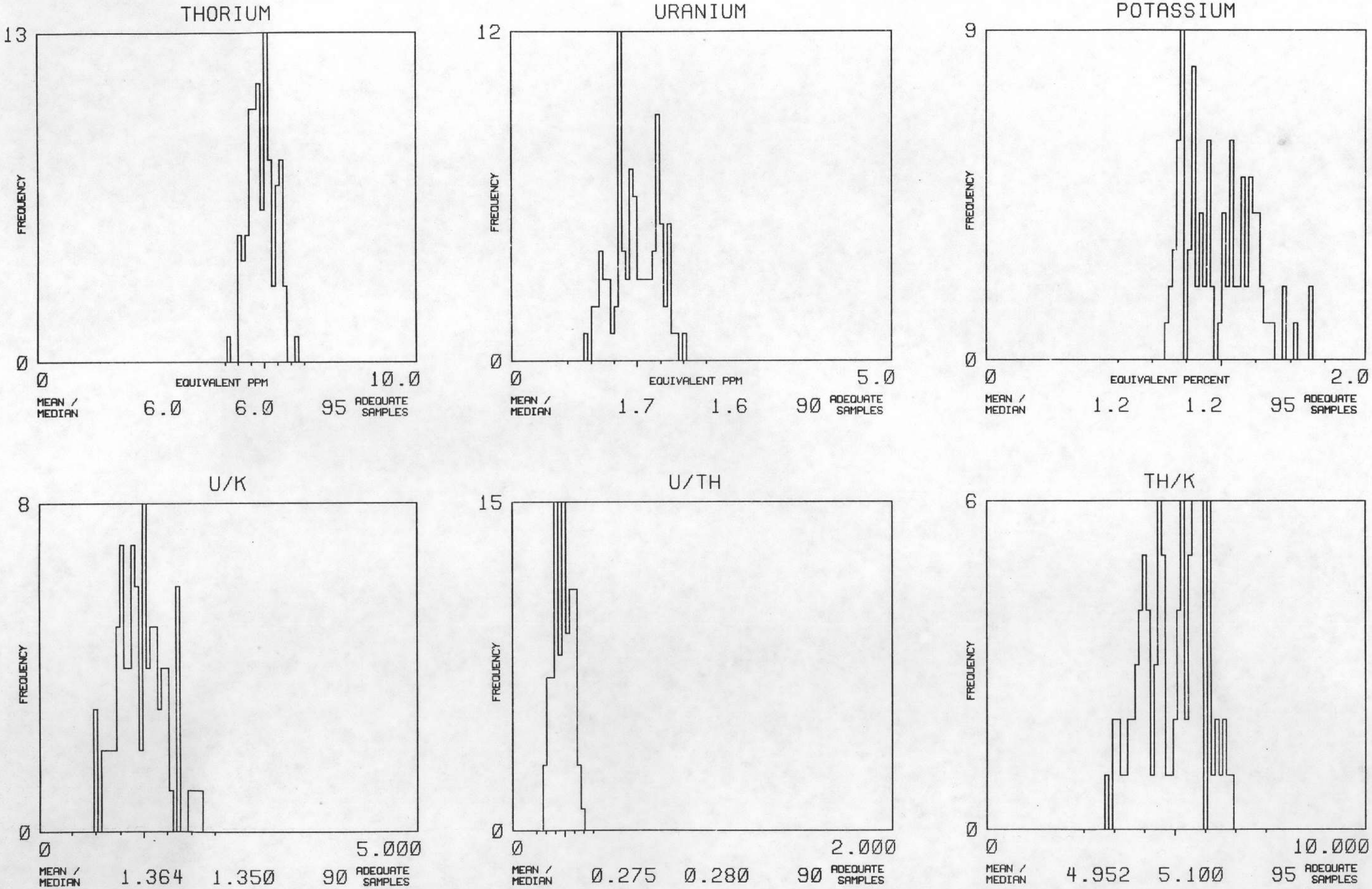
F18ci

NJ 16-3 CINCINNATI

MAP UNIT : OMA TOTAL NUMBER OF SAMPLES 422



NJ 16-3 CINCINNATI MAP UNIT : OE TOTAL NUMBER OF SAMPLES 233 F19ci



CINCINNATI QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
QAL	Qal
QMU	Qmu
QE	Qe
QL	Ql
QVT	Qvt
QO	Qo
QST	Qst
QGM	Qgm
QM	Qm
QIT	Qit
*QTI	Qti
DMN	Dmn
DL	Dl
SU	Su
OW	Ow
OD	Od
OK	Ok
OM	Om
OMA	Oma
OE	Oe

NOTES:

On the following pages, histograms for each computer map unit are included in the same order as they appear on the above list.

Geologic descriptions of original geologic map units are in Appendix A.

Areas over water or cultural features were assigned separate map unit symbols and were removed from the data block during processing.

*Statistical analysis was not performed on these units due to there being an inadaquate number of samples.

APPENDIX G - Uranium Anomaly Summary and Statistical Tables

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT				PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF :							
							1	2	3	4	5	6	7	GT7
1 C	610	QAL	/ 2	/ 0	/ 0	3.1	1	0	1	0	0	0	0	0
2 C	610	QM	/ 1QVT	/ 1	/ 0	3.1	0	2	0	0	0	0	0	0
3 C	610	QGM	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
4 C	610	QM	/ 6	/ 0	/ 0	3.3	2	3	1	0	0	0	0	0
5 C	610	QM	/ 2	/ 0	/ 0	3.6	0	1	1	0	0	0	0	0
6 C	610	QM	/ 3	/ 0	/ 0	3.1	0	3	0	0	0	0	0	0
7 C	610	QGM	/ 4	/ 0	/ 0	2.9	2	2	0	0	0	0	0	0
8 C	610	QGM	/ 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
9 C	610	QGM	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
10 C	610	QGM	/ 2	/ 0	/ 0	3.2	0	2	0	0	0	0	0	0
11 C	610	QGM	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
12 C	610	QGM	/ 6	/ 0	/ 0	3.0	2	4	0	0	0	0	0	0
13 C	610	QVT	/ 2QAL	/ 1	/ 0	2.8	2	1	0	0	0	0	0	0
14 C	610	QM	/ 7	/ 0	/ 0	3.3	1	5	1	0	0	0	0	0
15 C	610	QM	/ 2QGM	/ 1	/ 0	3.0	2	1	0	0	0	0	0	0
16 C	620	QGM	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
17 C	620	QVT	/ 1QAL	/ 2	/ 0	2.9	0	3	0	0	0	0	0	0
18 C	620	QM	/ 4	/ 0	/ 0	3.2	0	4	0	0	0	0	0	0
19 C	620	QGM	/ 2	/ 0	/ 0	3.2	1	0	1	0	0	0	0	0
20 C	620	QGM	/ 5	/ 0	/ 0	3.2	1	4	0	0	0	0	0	0
21 C	620	QGM	/ 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
22 C	620	QGM	/ 3	/ 0	/ 0	3.5	0	2	1	0	0	0	0	0
23 C	620	QGM	/ 3	/ 0	/ 0	3.1	0	3	0	0	0	0	0	0
24 C	620	QAL	/ 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
25 C	620	QGM	/ 9	/ 0	/ 0	3.2	3	5	1	0	0	0	0	0
26 C	620	QGM	/ 3	/ 0	/ 0	3.2	1	2	0	0	0	0	0	0
27 C	620	QGM	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
28 C	620	QGM	/ 6	/ 0	/ 0	4.0	4	0	0	2	0	0	0	0
29 C	630	QAL	/ 2QGM	/ 1	/ 0	3.0	0	3	0	0	0	0	0	0
30 C	630	QGM	/ 3	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
31 C	630	QGM	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
32 C	630	QM	/ 4QGM	/ 8	/ 0	3.3	3	8	1	0	0	0	0	0
33 C	630	QGM	/ 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
34 C	630	QGM	/ 9	/ 0	/ 0	3.3	1	7	1	0	0	0	0	0
35 C	630	QGM	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
36 C	630	QGM	/ 3	/ 0	/ 0	3.3	0	1	2	0	0	0	0	0
37 C	630	QGM	/ 3	/ 0	/ 0	3.2	1	2	0	0	0	0	0	0
38 C	640	QGM	/ 4	/ 0	/ 0	2.8	3	1	0	0	0	0	0	0
39 C	640	QGM	/10	/ 0	/ 0	3.5	4	3	3	0	0	0	0	0
40 C	640	QGM	/ 2	/ 0	/ 0	3.3	1	0	1	0	0	0	0	0
41 C	640	QAL	/ 1	/ 0	/ 0	3.6	0	0	0	1	0	0	0	0
42 C	650	QVT	/ 1QGM	/ 3	/ 0	3.1	1	3	0	0	0	0	0	0
43 C	650	QGM	/ 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
44 C	650	QAL	/ 4QVT	/ 1	/ 0	3.0	2	3	0	0	0	0	0	0
45 C	660	QAL	/ 3QVT	/ 1	/ 0	2.7	2	2	0	0	0	0	0	0
46 C	660	QAL	/ 2QGM	/ 1	/ 0	2.8	2	1	0	0	0	0	0	0
47 C	660	QAL	/ 2QGM	/ 2	/ 0	2.9	3	1	0	0	0	0	0	0
48 C	670	QAL	/ 2QVT	/ 1	/ 0	2.8	0	3	0	0	0	0	0	0
49 C	670	QAL	/ 2QVT	/ 1	/ 0	3.0	2	1	0	0	0	0	0	0
50 C	670	QGM	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT				PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF : 1	2	3	4	5	6	7	GT7
51 C	670	QGM	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
52 C	670	QGM	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
53 C	670	QGM	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
54 C	670	QGM	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
55 C	670	QIT	/ 2	/ 0	/ 0	3.0	0	1	1	0	0	0	0	0
56 C	670	QL	/ 2	/ 0	/ 0	2.9	0	2	0	0	0	0	0	0
57 C	680	QM	/ 3	/ 0	/ 0	3.0	0	3	0	0	0	0	0	0
58 C	680	QIT	/ 4QAL	/ 1	/ 0	2.6	4	1	0	0	0	0	0	0
59 C	680	QAL	/ 2QIT	/ 3	/ 0	3.1	0	2	3	0	0	0	0	0
60 C	690	QIT	/ 3	/ 0	/ 0	2.7	1	2	0	0	0	0	0	0
61 C	690	QM	/ 1	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
62 C	690	QIT	/ 7	/ 0	/ 0	2.9	3	4	0	0	0	0	0	0
63 C	690	QIT	/ 1	/ 0	/ 0	2.9	0	0	1	0	0	0	0	0
64 C	690	QIT	/ 4	/ 0	/ 0	2.8	2	2	0	0	0	0	0	0
65 C	700	QIT	/ 3	/ 0	/ 0	2.9	0	3	0	0	0	0	0	0
66 C	700	QIT	/ 5	/ 0	/ 0	2.7	4	1	0	0	0	0	0	0
67 C	710	OW	/ 2	/ 0	/ 0	2.5	0	2	0	0	0	0	0	0
68 C	710	OD	/ 3	/ 0	/ 0	2.5	2	1	0	0	0	0	0	0
69 C	710	OD	/ 2	/ 0	/ 0	2.8	0	2	0	0	0	0	0	0
70 C	710	QIT	/ 3	/ 0	/ 0	2.6	2	1	0	0	0	0	0	0
71 C	720	QL	/ 1QIT	/ 2	/ 0	2.7	1	2	0	0	0	0	0	0
72 C	720	QAL	/ 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
73 C	720	QAL	/ 1QIT	/ 7	/ 0	3.9	1	3	2	1	1	0	0	0
74 C	1110	QIT	/ 2	/ 0	/ 0	2.7	0	2	0	0	0	0	0	0
75 C	1120	OD	/ 1OK	/ 1	/ 0	2.8	0	1	1	0	0	0	0	0
76 C	1130	OMA	/ 4	/ 0	/ 0	2.8	0	4	0	0	0	0	0	0
77 C	1130	QVT	/ 2	/ 0	/ 0	2.7	0	2	0	0	0	0	0	0
78 C	1130	QGM	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
79 C	1130	QGM	/ 2	/ 0	/ 0	3.3	1	0	1	0	0	0	0	0
80 C	1130	QGM	/ 4	/ 0	/ 0	2.9	3	1	0	0	0	0	0	0
81 C	1140	QIT	/ 3	/ 0	/ 0	2.5	2	1	0	0	0	0	0	0
82 C	1140	QIT	/ 3	/ 0	/ 0	2.5	2	1	0	0	0	0	0	0
83 C	1140	QIT	/ 4	/ 0	/ 0	2.6	3	1	0	0	0	0	0	0
84 C	1140	QGM	/ 2	/ 0	/ 0	3.3	1	0	1	0	0	0	0	0
85 C	1140	QGM	/ 3	/ 0	/ 0	2.8	2	1	0	0	0	0	0	0
86 C	1140	QAL	/ 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0

NOTES: M INDICATES THAT THE ANOMALY LIES OVER A URANIUM MINE OR PROSPECT.

C INDICATES THAT THE ANOMALY LIES OVER A CULTURAL FEATURE.

W INDICATES POSSIBLE INTERFERENCE BY WEATHER PHENOMENA.

MAP UNIT QAL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5301	0.7066	0.8831	1.0596	1.2361	1.4126	1.5891
URANIUM DIST NORMAL	0.5609	1.0135	1.4661	1.9187	2.3713	2.8239	3.2765
THORIUM DIST NORMAL	2.0525	2.9598	3.8671	4.7744	5.6817	6.5890	7.4963
U/K DIST NORMAL	0.4373	0.9048	1.3723	1.8398	2.3073	2.7748	3.2423
U/TH DIST NORMAL	0.0807	0.1910	0.3013	0.4116	0.5219	0.6322	0.7425
TH/K DIST NORMAL	2.2522	3.0187	3.7852	4.5517	5.3182	6.0847	6.8512

MAP UNIT QMU

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5120	0.6774	0.8428	1.0082	1.1736	1.3390	1.5044
URANIUM DIST NORMAL	1.5286	1.7298	1.9310	2.1322	2.3334	2.5346	2.7358
THORIUM DIST NORMAL	3.1069	3.8733	4.6397	5.4061	6.1725	6.9389	7.7053
U/K DIST NORMAL	1.1727	1.5019	1.8311	2.1603	2.4895	2.8187	3.1479
U/TH DIST NORMAL	0.2001	0.2673	0.3345	0.4017	0.4689	0.5361	0.6033
TH/K DIST NORMAL	2.8405	3.7104	4.5803	5.4502	6.3201	7.1900	8.0599

MAP UNIT QE

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6481	0.7415	0.8349	0.9283	1.0217	1.1151	1.2085
URANIUM DIST NORMAL	0.4046	0.6809	0.9572	1.2335	1.5098	1.7861	2.0624
THORIUM DIST NORMAL	0.4909	1.4921	2.4933	3.4945	4.4957	5.4969	6.4981
U/K DIST NORMAL	0.3653	0.6817	0.9981	1.3145	1.6309	1.9473	2.2637
U/TH DIST NORMAL	0.0826	0.1773	0.2720	0.3667	0.4614	0.5561	0.6508
TH/K DIST NORMAL	0.4034	1.5314	2.6594	3.7874	4.9154	6.0434	7.1714

MAP UNIT QL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5225	0.7215	0.9205	1.1195	1.3185	1.5175	1.7165
URANIUM DIST NORMAL	0.3953	0.9284	1.4615	1.9946	2.5277	3.0608	3.5939
THORIUM DIST NORMAL	3.2960	4.1045	4.9130	5.7215	6.5300	7.3385	8.1470
U/K DIST NORMAL	0.3159	0.8158	1.3157	1.8156	2.3155	2.8154	3.3153
U/TH DIST NORMAL	0.0286	0.1368	0.2450	0.3532	0.4614	0.5696	0.6778
TH/K DIST NORMAL	2.6645	3.5124	4.3603	5.2082	6.0561	6.9040	7.7519

MAP UNIT QVT

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6602	0.8133	0.9664	1.1195	1.2726	1.4257	1.5788
URANIUM DIST NORMAL	0.7547	1.1685	1.5823	1.9961	2.4099	2.8237	3.2375
THORIUM DIST NORMAL	2.3885	3.2605	4.1325	5.0045	5.8765	6.7485	7.6205
U/K DIST NORMAL	0.5449	0.9660	1.3871	1.8082	2.2293	2.6504	3.0715
U/TH DIST NORMAL	0.0956	0.2000	0.3044	0.4088	0.5132	0.6176	0.7220
TH/K DIST NORMAL	2.6715	3.2736	3.8757	4.4778	5.0799	5.6820	6.2841

MAP UNIT QO

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7703	0.8700	0.9697	1.0694	1.1691	1.2688	1.3685
URANIUM DIST NORMAL	0.8726	1.2170	1.5614	1.9058	2.2502	2.5946	2.9390
THORIUM DIST NORMAL	2.6891	3.3585	4.0279	4.6973	5.3667	6.0361	6.7055
U/K DIST NORMAL	0.7920	1.1257	1.4594	1.7931	2.1268	2.4605	2.7942
U/TH DIST NORMAL	0.1478	0.2361	0.3244	0.4127	0.5010	0.5893	0.6776
TH/K DIST NORMAL	3.2841	3.6497	4.0153	4.3809	4.7465	5.1121	5.4777

MAP UNIT QST

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6306	0.7841	0.9376	1.0911	1.2446	1.3981	1.5516
URANIUM DIST NORMAL	0.8509	1.3007	1.7505	2.2003	2.6501	3.0999	3.5497
THORIUM DIST NORMAL	2.2309	3.0423	3.8537	4.6651	5.4765	6.2879	7.0993
U/K DIST NORMAL	0.6254	1.0993	1.5732	2.0471	2.5210	2.9949	3.4688
U/TH DIST NORMAL	0.1234	0.2435	0.3636	0.4837	0.6038	0.7239	0.8440
TH/K DIST NORMAL	2.9735	3.4059	3.8383	4.2707	4.7031	5.1355	5.5679

MAP UNIT QGM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.8342	0.9501	1.0660	1.1819	1.2978	1.4137	1.5296
URANIUM DIST NORMAL	1.0142	1.4173	1.8204	2.2235	2.6266	3.0297	3.4328
THORIUM DIST NORMAL	3.3486	4.1176	4.8866	5.6556	6.4246	7.1936	7.9626
U/K DIST NORMAL	0.7993	1.1631	1.5269	1.8907	2.2545	2.6183	2.9821
U/TH DIST NORMAL	0.1387	0.2254	0.3121	0.3988	0.4855	0.5722	0.6589
TH/K DIST NORMAL	3.0769	3.6491	4.2213	4.7935	5.3657	5.9379	6.5101

MAP UNIT QM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7873	0.9100	1.0327	1.1554	1.2781	1.4008	1.5235
URANIUM DIST NORMAL	1.0290	1.4373	1.8456	2.2539	2.6622	3.0705	3.4788
THORIUM DIST NORMAL	2.9967	3.8365	4.6763	5.5161	6.3559	7.1957	8.0355
U/K DIST NORMAL	0.9059	1.2580	1.6101	1.9622	2.3143	2.6664	3.0185
U/TH DIST NORMAL	0.1498	0.2386	0.3274	0.4162	0.5050	0.5938	0.6826
TH/K DIST NORMAL	3.0662	3.6368	4.2074	4.7780	5.3486	5.9192	6.4898

MAP UNIT QIT

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4645	0.6143	0.7641	0.9139	1.0637	1.2135	1.3633
URANIUM DIST NORMAL	0.6009	1.0220	1.4431	1.8642	2.2853	2.7064	3.1275
THORIUM DIST NORMAL	3.3461	4.0854	4.8247	5.5640	6.3033	7.0426	7.7819
U/K DIST NORMAL	0.5453	1.0560	1.5667	2.0774	2.5881	3.0988	3.6095
U/TH DIST NORMAL	0.1103	0.1859	0.2615	0.3371	0.4127	0.4883	0.5639
TH/K DIST NORMAL	3.3299	4.2828	5.2357	6.1886	7.1415	8.0944	9.0473

MAP UNIT DMN

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4753	0.6725	0.8697	1.0669	1.2641	1.4613	1.6585
URANIUM DIST NORMAL	0.5663	1.1123	1.6583	2.2043	2.7503	3.2963	3.8423
THORIUM DIST NORMAL	0.9563	2.4587	3.9611	5.4635	6.9659	8.4683	9.9707
U/K DIST NORMAL	1.1339	1.4398	1.7457	2.0516	2.3575	2.6634	2.9693
U/TH DIST NORMAL	0.1773	0.2550	0.3327	0.4104	0.4881	0.5658	0.6435
TH/K DIST NORMAL	2.9701	3.6711	4.3721	5.0731	5.7741	6.4751	7.1761

MAP UNIT DL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5117	0.6145	0.7173	0.8201	0.9229	1.0257	1.1285
URANIUM DIST NORMAL	0.5408	0.8874	1.2340	1.5806	1.9272	2.2738	2.6204
THORIUM DIST NORMAL	2.0750	3.0283	3.9816	4.9349	5.8882	6.8415	7.7948
U/K DIST NORMAL	0.8030	1.1800	1.5570	1.9340	2.3110	2.6880	3.0650
U/TH DIST NORMAL	0.1607	0.2149	0.2691	0.3233	0.3775	0.4317	0.4859
TH/K DIST NORMAL	3.0185	4.0243	5.0301	6.0359	7.0417	8.0475	9.0533

MAP UNIT SU

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5254	0.6491	0.7728	0.8965	1.0202	1.1439	1.2676
URANIUM DIST NORMAL	0.3637	0.7706	1.1775	1.5844	1.9913	2.3982	2.8051
THORIUM DIST NORMAL	2.6900	3.5529	4.4158	5.2787	6.1416	7.0045	7.8674
U/K DIST NORMAL	0.4641	0.9022	1.3403	1.7784	2.2165	2.6546	3.0927
U/TH DIST NORMAL	0.1043	0.1693	0.2343	0.2993	0.3643	0.4293	0.4943
TH/K DIST NORMAL	3.8086	4.5094	5.2102	5.9110	6.6118	7.3126	8.0134

MAP UNIT OW

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5161	0.6607	0.8053	0.9499	1.0945	1.2391	1.3837
URANIUM DIST NORMAL	0.2046	0.6880	1.1714	1.6548	2.1382	2.6216	3.1050
THORIUM DIST NORMAL	2.9574	3.8177	4.6780	5.5383	6.3986	7.2589	8.1192
U/K DIST NORMAL	0.2865	0.7776	1.2687	1.7598	2.2509	2.7420	3.2331
U/TH DIST NORMAL	0.0743	0.1488	0.2233	0.2978	0.3723	0.4468	0.5213
TH/K DIST NORMAL	3.6143	4.3645	5.1147	5.8649	6.6151	7.3653	8.1155

MAP UNIT GD

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6610	0.8418	1.0226	1.2034	1.3842	1.5650	1.7458
URANIUM DIST NORMAL	0.6593	1.0522	1.4451	1.8380	2.2309	2.6238	3.0167
THORIUM DIST NORMAL	3.9625	4.6731	5.3837	6.0943	6.8049	7.5155	8.2261
U/K DIST NORMAL	0.3548	0.7565	1.1582	1.5599	1.9616	2.3633	2.7650
U/TH DIST NORMAL	0.0930	0.1636	0.2342	0.3048	0.3754	0.4460	0.5166
TH/K DIST NORMAL	2.5349	3.4092	4.2835	5.1578	6.0321	6.9064	7.7807

MAP UNIT OK

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7885	0.9673	1.1461	1.3249	1.5037	1.6825	1.8613
URANIUM DIST NORMAL	0.5757	0.9671	1.3585	1.7499	2.1413	2.5327	2.9241
THORIUM DIST NORMAL	3.9290	4.6219	5.3148	6.0077	6.7006	7.3935	8.0864
U/K DIST NORMAL	0.3144	0.6553	0.9962	1.3371	1.6780	2.0189	2.3598
U/TH DIST NORMAL	0.0898	0.1569	0.2240	0.2911	0.3582	0.4253	0.4924
TH/K DIST NORMAL	2.2808	3.0559	3.8310	4.6061	5.3812	6.1563	6.9314

MAP UNIT OM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5820	0.7527	0.9234	1.0941	1.2648	1.4355	1.6062
URANIUM DIST NORMAL	0.7209	1.0478	1.3747	1.7016	2.0285	2.3554	2.6823
THORIUM DIST NORMAL	2.6288	3.4850	4.3412	5.1974	6.0536	6.9098	7.7660
U/K DIST NORMAL	0.6461	0.9601	1.2741	1.5881	1.9021	2.2161	2.5301
U/TH DIST NORMAL	0.1400	0.2038	0.2676	0.3314	0.3952	0.4590	0.5228
TH/K DIST NORMAL	2.3578	3.1749	3.9920	4.8091	5.6262	6.4433	7.2604

MAP UNIT OMA

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3480	0.5781	0.8082	1.0383	1.2684	1.4985	1.7286
URANIUM DIST NORMAL	0.4764	0.8945	1.3126	1.7307	2.1488	2.5669	2.9850
THORIUM DIST NORMAL	3.8761	4.5269	5.1777	5.8285	6.4793	7.1301	7.7809
U/K DIST NORMAL	0.2882	0.7582	1.2282	1.6982	2.1682	2.6382	3.1082
U/TH DIST NORMAL	0.0679	0.1441	0.2203	0.2965	0.3727	0.4489	0.5251
TH/K DIST NORMAL	2.8571	3.8351	4.8131	5.7911	6.7691	7.7471	8.7251

MAP UNIT OE

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6931	0.8750	1.0569	1.2388	1.4207	1.6026	1.7845
URANIUM DIST NORMAL	0.7389	1.0437	1.3485	1.6533	1.9581	2.2629	2.5677
THORIUM DIST NORMAL	4.9586	5.3052	5.6518	5.9984	6.3450	6.6916	7.0382
U/K DIST NORMAL	0.4120	0.7292	1.0464	1.3636	1.6808	1.9980	2.3152
U/TH DIST NORMAL	0.1259	0.1757	0.2255	0.2753	0.3251	0.3749	0.4247
TH/K DIST NORMAL	2.5426	3.3457	4.1488	4.9519	5.7550	6.5581	7.3612

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT QAL

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.088	1.042	1.040	1.087	1.055	1.019	1.098	1.114	1.116	1.080	0.988	1.054	1.064	1.043	1.004
URANIUM	2.194	2.163	2.134	2.031	2.161	2.048	1.814	1.870	1.703	1.836	1.738	1.900	1.808	1.826	1.659
THORIUM	4.907	4.700	4.474	4.822	4.619	4.391	4.749	4.757	5.203	4.899	5.072	5.339	4.673	4.755	4.347
U/K	2.057	2.067	2.090	1.884	2.074	2.028	1.633	1.704	1.554	1.772	1.799	1.868	1.714	1.776	1.652
U/TH	0.455	0.458	0.490	0.426	0.483	0.475	0.386	0.402	0.329	0.383	0.351	0.362	0.392	0.395	0.386
TH/K	4.537	4.536	4.339	4.457	4.380	4.330	4.349	4.299	4.719	4.626	5.229	5.245	4.397	4.598	4.352

	1120	1130	1140
POTASIUM	1.059	0.972	1.051
URANIUM	1.816	1.836	2.005
THORIUM	4.882	4.463	4.845
U/K	1.771	1.914	1.922
U/TH	0.386	0.428	0.423
TH/K	4.705	4.557	4.633

MAP UNIT QMU

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.141	0.000	0.893	1.146	1.089	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.368	0.000	2.114	2.198	1.985	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	6.196	0.000	4.854	6.219	5.536	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.078	0.000	2.400	1.925	1.837	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.382	0.000	0.440	0.354	0.364	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	5.437	0.000	5.594	5.449	5.074	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT QE

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.082	0.955	0.857	0.930	0.000	0.964
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.550	1.219	1.189	1.207	0.000	1.210
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.511	2.709	3.623	3.406	0.000	4.098
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.452	1.294	1.306	1.313	0.000	1.259
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.361	0.452	0.345	0.365	0.000	0.296
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.117	2.839	4.267	3.680	0.000	4.268

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT QL

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.216	0.000	1.231	0.000	1.267	0.000	1.251	0.000	0.000	0.000	1.096	0.866	0.000	0.000	0.000
URANIUM	2.462	0.000	2.239	0.000	2.751	0.000	2.028	0.000	0.000	0.000	1.677	1.876	0.000	0.000	0.000
THORIUM	5.492	0.000	5.010	0.000	5.787	0.000	6.266	0.000	0.000	0.000	5.619	5.270	0.000	0.000	0.000
U/K	2.032	0.000	1.818	0.000	2.175	0.000	1.662	0.000	0.000	0.000	1.531	2.125	0.000	0.000	0.000
U/TH	0.456	0.000	0.448	0.000	0.476	0.000	0.330	0.000	0.000	0.000	0.287	0.359	0.000	0.000	0.000
TH/K	4.519	0.000	4.071	0.000	4.577	0.000	5.043	0.000	0.000	0.000	5.164	6.133	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	1.000
URANIUM	0.000	0.000	1.827
THORIUM	0.000	0.000	4.711
U/K	0.000	0.000	1.833
U/TH	0.000	0.000	0.392
TH/K	0.000	0.000	4.750

MAP UNIT QVT

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.160	1.133	1.012	1.123	1.111	1.061	1.207	1.237	1.150	1.045	1.057	1.056	1.077	1.183	1.136
URANIUM	2.263	2.164	2.169	1.931	2.203	2.080	1.935	1.994	1.570	1.642	1.856	1.349	1.796	2.150	1.868
THORIUM	5.372	5.245	4.532	5.011	5.031	4.831	5.449	5.364	4.695	4.003	4.580	5.473	4.652	5.102	5.347
U/K	1.964	1.941	2.206	1.725	2.019	1.995	1.617	1.618	1.384	1.589	1.759	1.274	1.678	1.819	1.660
U/TH	0.430	0.419	0.501	0.389	0.445	0.443	0.364	0.381	0.342	0.448	0.399	0.251	0.395	0.424	0.355
TH/K	4.631	4.650	4.484	4.473	4.557	4.565	4.531	4.351	4.097	3.759	4.361	5.219	4.309	4.322	4.709

	1120	1130	1140
POTASIUM	1.043	1.256	1.133
URANIUM	1.936	2.300	2.161
THORIUM	4.853	5.780	4.479
U/K	1.870	1.842	1.916
U/TH	0.404	0.400	0.496
TH/K	4.666	4.640	3.927

MAP UNIT QU

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.167	0.956	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.061
URANIUM	2.177	2.156	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.861
THORIUM	5.006	3.791	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.689
U/K	1.878	2.261	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.765
U/TH	0.441	0.568	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.403
TH/K	4.285	3.972	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.408

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT QST

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.210	1.083	1.190	1.045	0.819	0.000	0.000	1.267	0.000	0.000	0.000	0.000	0.000	1.169	0.000
URANIUM	2.404	2.937	2.222	2.157	2.211	0.000	0.000	1.910	0.000	0.000	0.000	0.000	0.000	1.900	0.000
THORIUM	5.097	5.032	5.370	4.506	3.207	0.000	0.000	4.412	0.000	0.000	0.000	0.000	0.000	5.439	0.000
U/K	1.988	2.715	1.867	2.081	2.707	0.000	0.000	1.506	0.000	0.000	0.000	0.000	0.000	1.627	0.000
U/TH	0.474	0.588	0.414	0.487	0.699	0.000	0.000	0.433	0.000	0.000	0.000	0.000	0.000	0.351	0.000
TH/K	4.206	4.646	4.512	4.306	3.905	0.000	0.000	3.479	0.000	0.000	0.000	0.000	0.000	4.639	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT QGM

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.219	1.188	1.185	1.164	1.141	1.137	1.230	1.230	1.182	1.181	0.950	0.000	1.163	1.194	1.218
URANIUM	2.418	2.356	2.375	2.282	2.215	2.173	2.149	2.175	1.971	2.031	1.707	0.000	2.047	2.029	2.158
THORIUM	5.724	5.561	5.463	5.445	5.370	5.544	6.197	6.148	5.845	5.675	5.123	0.000	5.273	5.679	5.745
U/K	1.991	1.994	2.013	1.968	1.959	1.924	1.759	1.766	1.674	1.742	1.848	0.000	1.762	1.707	1.776
U/TH	0.426	0.427	0.438	0.423	0.420	0.397	0.352	0.359	0.340	0.365	0.337	0.000	0.392	0.361	0.380
TH/K	4.704	4.706	4.620	4.692	4.722	4.889	5.050	4.998	4.956	4.816	5.442	0.000	4.535	4.770	4.710

	1120	1130	1140
POTASIUM	1.194	1.217	1.159
URANIUM	2.081	2.345	2.236
THORIUM	6.089	5.851	5.855
U/K	1.756	1.937	1.952
U/TH	0.345	0.405	0.397
TH/K	5.109	4.824	5.055

MAP UNIT QM

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	1.188	1.169	1.114	1.140	1.112	1.116	1.262	1.194	1.185	0.000	0.000	0.903	0.000	1.129	1.156
URANIUM	2.501	2.328	2.278	2.287	2.156	2.133	2.098	2.442	2.091	0.000	0.000	2.019	0.000	2.187	1.860
THORIUM	5.505	5.382	5.161	5.320	5.257	5.507	6.654	6.407	5.766	0.000	0.000	5.509	0.000	5.386	5.206
U/K	2.111	1.990	2.058	2.021	1.960	1.916	1.671	2.056	1.782	0.000	0.000	2.244	0.000	1.941	1.627
U/TH	0.456	0.436	0.447	0.441	0.422	0.394	0.318	0.386	0.370	0.000	0.000	0.366	0.000	0.408	0.368
TH/K	4.652	4.614	4.639	4.653	4.722	4.934	5.276	5.373	4.892	0.000	0.000	6.113	0.000	4.774	4.498

	1120	1130	1140
POTASIUM	1.178	1.086	0.000
URANIUM	2.335	2.016	0.000
THORIUM	5.735	5.185	0.000
U/K	1.992	1.872	0.000
U/TH	0.416	0.396	0.000
TH/K	4.864	4.789	0.000

MAP UNIT QIT

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	1.028	1.079	1.077	0.978	0.903	0.861	0.802	0.000	0.791	0.900
URANIUM	0.000	0.000	0.000	0.000	0.000	1.931	1.927	1.960	1.988	1.826	1.755	1.632	0.000	1.752	1.938
THORIUM	0.000	0.000	0.000	0.000	0.000	4.793	5.789	5.994	5.849	5.667	5.531	5.075	0.000	5.119	5.407
U/K	0.000	0.000	0.000	0.000	0.000	1.899	1.814	1.835	2.070	2.045	2.057	2.062	0.000	2.256	2.200
U/TH	0.000	0.000	0.000	0.000	0.000	0.412	0.332	0.329	0.344	0.323	0.318	0.322	0.000	0.345	0.361
TH/K	0.000	0.000	0.000	0.000	0.000	4.675	5.406	5.597	6.027	6.334	6.499	6.475	0.000	6.579	6.112

	1120	1130	1140
POTASIUM	1.108	0.000	0.912
URANIUM	1.880	0.000	2.094
THORIUM	5.718	0.000	5.698
U/K	1.749	0.000	2.336
U/TH	0.338	0.000	0.372
TH/K	5.191	0.000	6.320

MAP UNIT DMN

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	1.224	0.000	0.788	0.000	0.000	0.000	0.000	1.154	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.444	0.000	1.482	0.000	0.000	0.000	0.000	2.597	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	7.081	0.000	3.799	0.000	0.000	0.000	0.000	5.302	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	1.999	0.000	1.879	0.000	0.000	0.000	0.000	2.256	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.350	0.000	0.387	0.000	0.000	0.000	0.000	0.491	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	5.768	0.000	4.814	0.000	0.000	0.000	0.000	4.605	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT DL

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.898	0.000	0.831	0.748	0.000	0.827	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.567	0.000	1.812	1.283	0.000	1.705	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.168	0.000	5.593	4.523	0.000	5.363	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.708	0.000	2.183	1.759	0.000	2.073	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.372	0.000	0.327	0.285	0.000	0.325	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.570	0.000	6.736	6.123	0.000	6.438	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT SU

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.924	0.000	0.000	0.000	0.000	0.000	0.000	0.957	0.958	0.919	0.000	0.744	0.000
URANIUM	0.000	0.000	1.992	0.000	0.000	0.000	0.000	0.000	0.000	1.696	1.729	1.432	0.000	1.502	0.000
THORIUM	0.000	0.000	5.294	0.000	0.000	0.000	0.000	0.000	0.000	5.782	5.628	5.218	0.000	4.555	0.000
U/K	0.000	0.000	2.173	0.000	0.000	0.000	0.000	0.000	0.000	1.740	1.787	1.568	0.000	2.030	0.000
U/TH	0.000	0.000	0.375	0.000	0.000	0.000	0.000	0.000	0.000	0.287	0.306	0.272	0.000	0.330	0.000
TH/K	0.000	0.000	5.761	0.000	0.000	0.000	0.000	0.000	0.000	6.032	5.862	5.704	0.000	6.156	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT OW

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.062	0.927	0.869	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.528	1.943	1.357	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.205	5.715	4.693	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.447	2.075	1.609	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.244	0.338	0.293	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.963	6.165	5.421	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT OD

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.240	1.305	1.285	1.243	1.032	0.000	0.000	1.112
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.845	1.872	1.769	1.983	1.487	0.000	0.000	1.540
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.900	6.253	6.323	6.173	5.799	0.000	0.000	5.145
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.541	1.446	1.417	1.636	1.483	0.000	0.000	1.412
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.320	0.300	0.283	0.325	0.261	0.000	0.000	0.301
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.806	4.881	4.985	5.042	5.775	0.000	0.000	4.672

	1120	1130	1140
POTASIUM	1.192	0.000	0.000
URANIUM	2.014	0.000	0.000
THORIUM	6.162	0.000	0.000
U/K	1.717	0.000	0.000
U/TH	0.332	0.000	0.000
TH/K	5.217	0.000	0.000

MAP UNIT OK

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.375	1.378	1.232	1.298	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.669	1.718	2.132	1.469	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.383	6.109	5.350	5.632	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.253	1.250	1.735	1.131	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.262	0.283	0.400	0.261	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.728	4.497	4.341	4.416	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.274	0.000	0.000
URANIUM	2.047	0.000	0.000
THORIUM	6.143	0.000	0.000
U/K	1.625	0.000	0.000
U/TH	0.334	0.000	0.000
TH/K	4.886	0.000	0.000

MAP UNIT OM

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	1.057	1.208	1.123	1.105	1.138	1.204	0.000	0.951	0.000	1.021	0.000	0.799	1.013
URANIUM	0.000	0.000	1.665	2.192	1.843	1.971	1.580	1.790	0.000	1.712	0.000	1.583	0.000	1.776	1.472
THORIUM	0.000	0.000	4.084	6.023	4.760	5.254	5.012	5.554	0.000	5.761	0.000	5.990	0.000	4.800	4.492
U/K	0.000	0.000	1.576	1.815	1.640	1.798	1.457	1.489	0.000	1.795	0.000	1.560	0.000	2.244	1.458
U/TH	0.000	0.000	0.415	0.369	0.388	0.379	0.326	0.318	0.000	0.297	0.000	0.269	0.000	0.381	0.330
TH/K	0.000	0.000	3.849	4.979	4.230	4.785	4.473	4.637	0.000	6.068	0.000	5.891	0.000	5.950	4.467

	1120	1130	1140
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT OMA

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.962	0.000	0.000	0.000	0.000	1.352	0.932	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	1.751	0.000	0.000	0.000	0.000	1.573	1.508	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	5.476	0.000	0.000	0.000	0.000	5.654	5.715	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	1.838	0.000	0.000	0.000	0.000	1.203	1.614	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.322	0.000	0.000	0.000	0.000	0.269	0.263	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	5.715	0.000	0.000	0.000	0.000	4.196	6.218	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.230	1.205	0.000
URANIUM	1.889	2.367	0.000
THORIUM	6.119	6.201	0.000
U/K	1.615	2.085	0.000
U/TH	0.313	0.389	0.000
TH/K	5.146	5.274	0.000

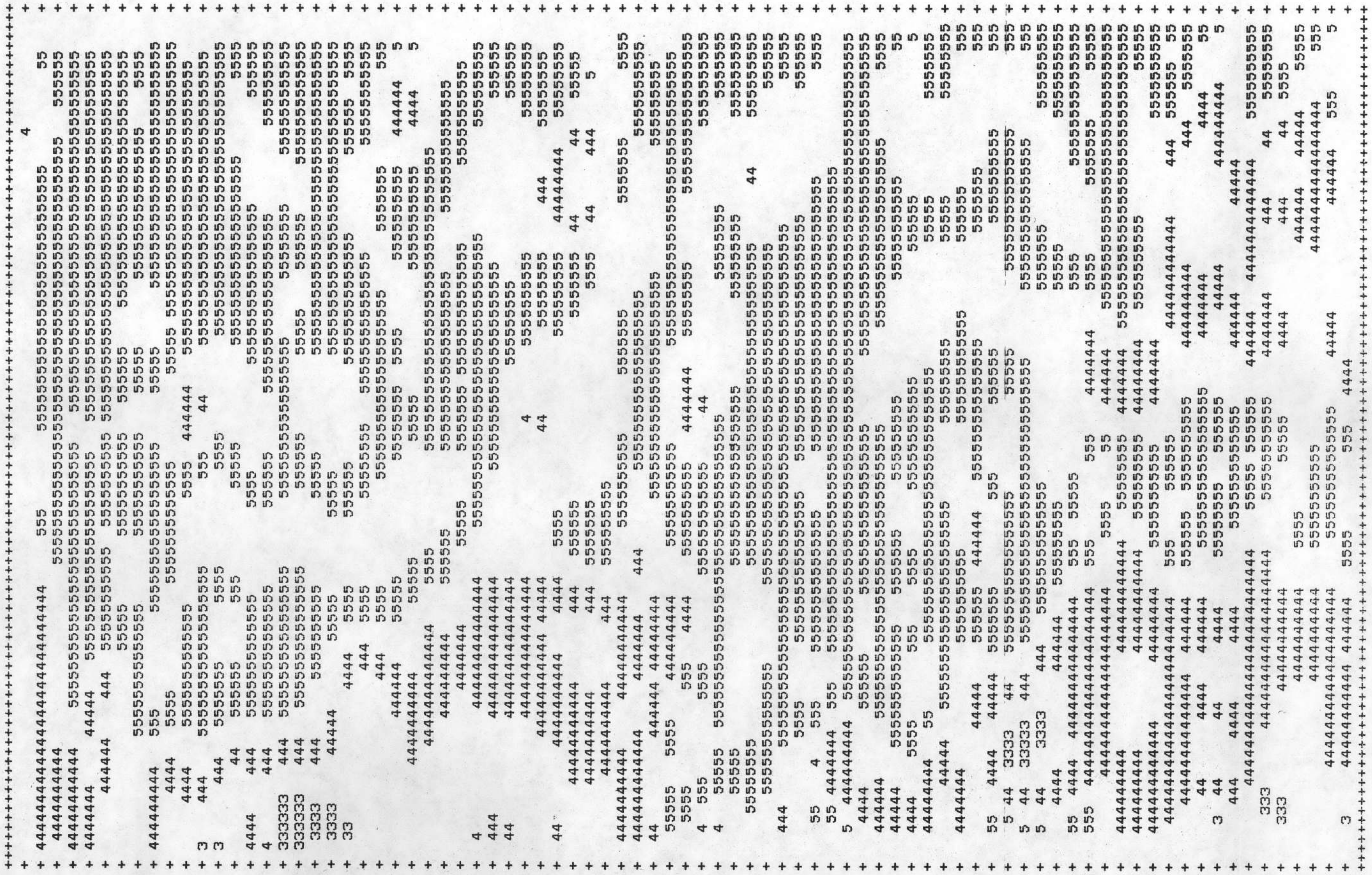
MAP UNIT OE

	610	620	630	640	650	660	670	680	690	700	710	720	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.198	1.223	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.987	1.403	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.220	5.802	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.667	1.191	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.320	0.242	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.207	4.908	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.279	1.178	0.000
URANIUM	1.809	1.646	0.000
THORIUM	6.070	6.316	0.000
U/K	1.440	1.417	0.000
U/TH	0.299	0.262	0.000
TH/K	4.831	5.379	0.000

APPENDIX H - Pseudo Contour Maps

CINCINNATI



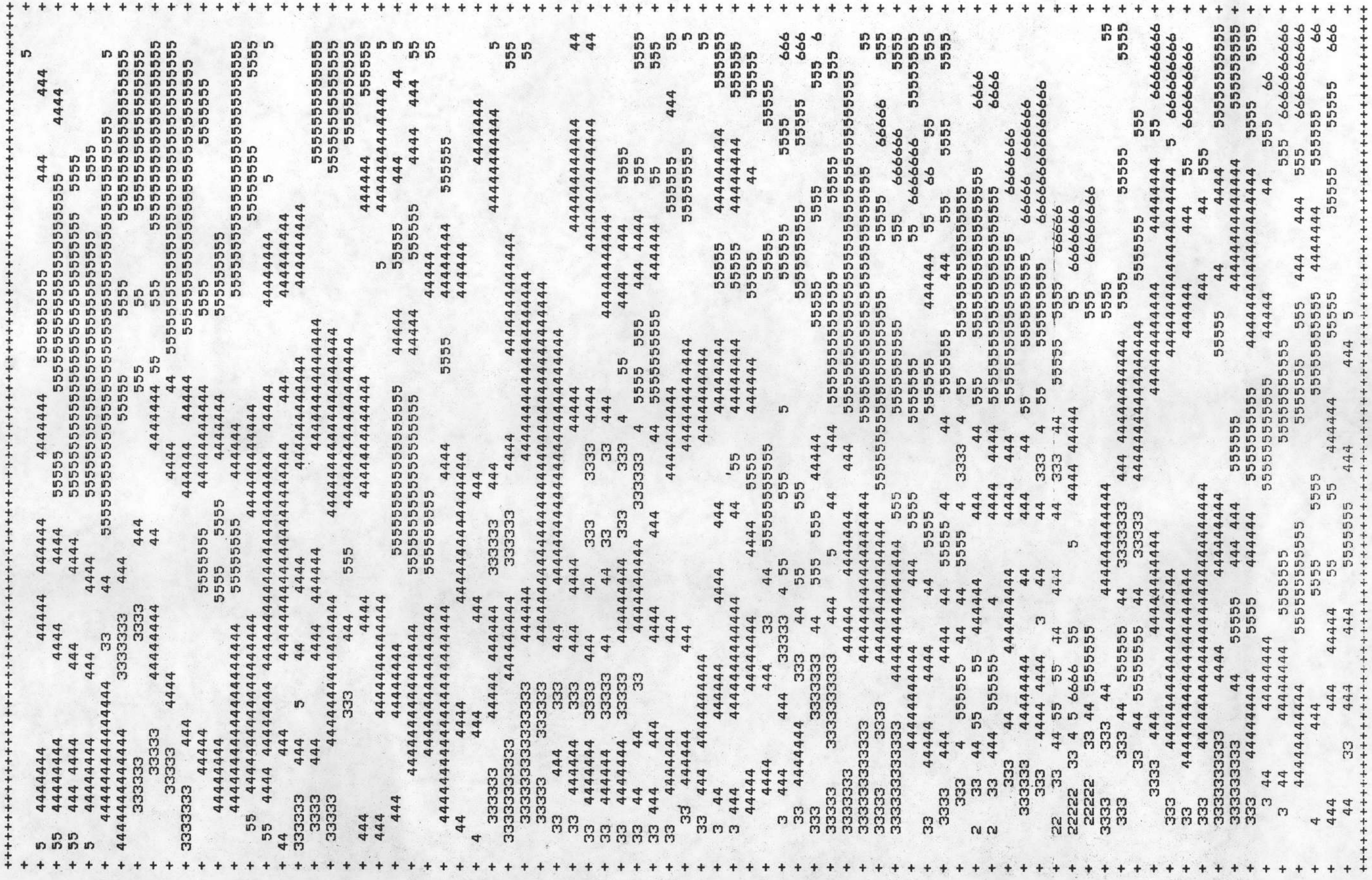
Potassium Pseudo-Contour Map - Cincinnati Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.1250
1	0.1250	0.2500
	0.2500	0.3750
2	0.3750	0.5000
	0.5000	0.6250
3	0.6250	0.7500
	0.7500	0.8750
4	0.8750	1.0000
	1.0000	1.1250
5	1.1250	1.2500
	1.2500	1.3750
6	1.3750	1.5000
	1.5000	1.6250
7	1.6250	1.7500
	1.7500	1.8750
8	1.8750	2.0000
	2.0000	2.1250
9	2.1250	2.2500
	GT	2.2500

SCALE IN EQUIVALENT PERCENT

CINCINNATI



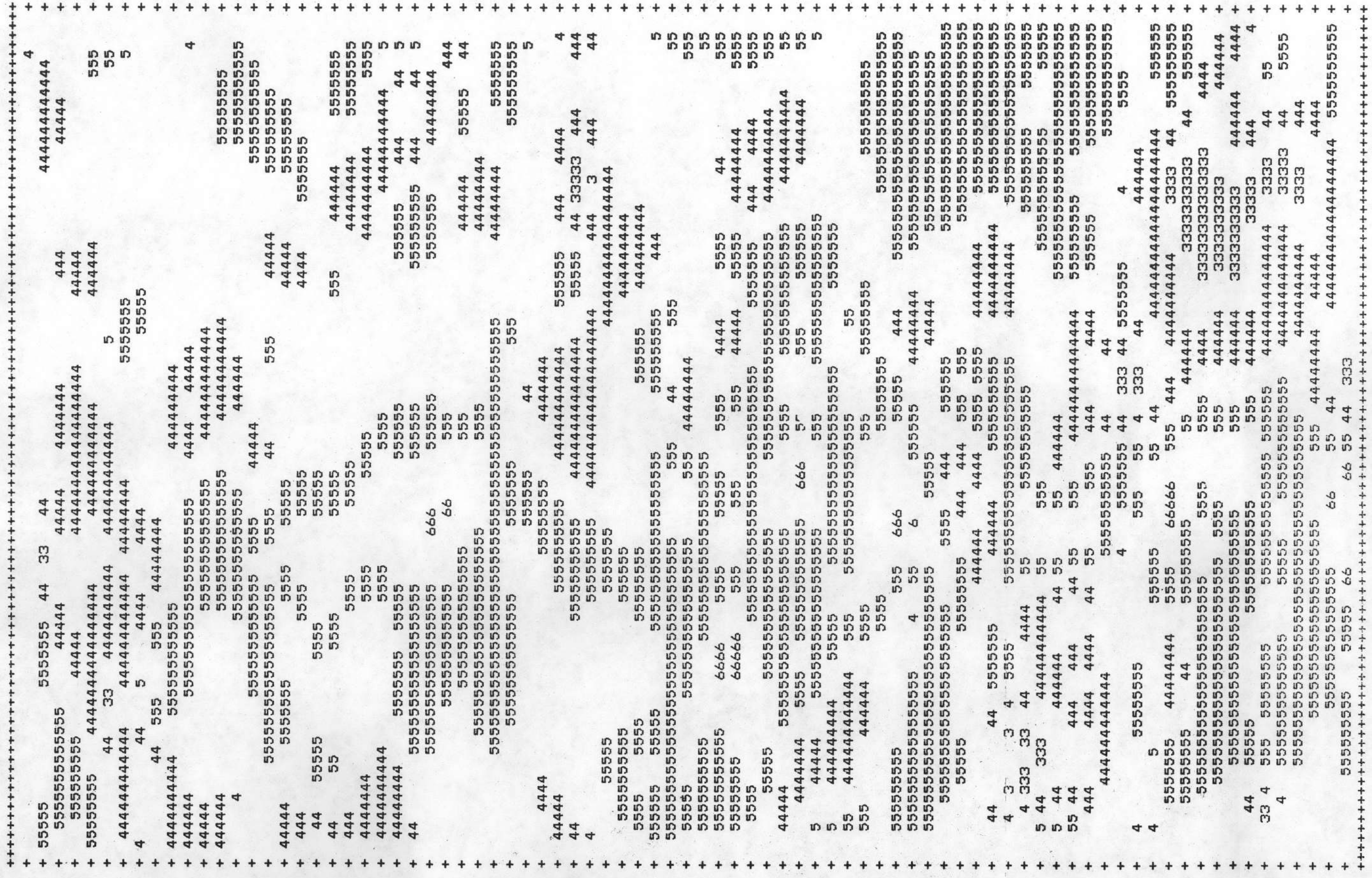
Uranium Pseudo-Contour Map - Cincinnati Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.2500
1	0.2500	0.5000
	0.5000	0.7500
2	0.7500	1.0000
	1.0000	1.2500
3	1.2500	1.5000
	1.5000	1.7500
4	1.7500	2.0000
	2.0000	2.2500
5	2.2500	2.5000
	2.5000	2.7500
6	2.7500	3.0000
	3.0000	3.2500
7	3.2500	3.5000
	3.5000	3.7500
8	3.7500	4.0000
	4.0000	4.2500
9	4.2500	4.5000
	GT	4.5000

SCALE IN EQUIVALENT PPM

CINCINNATI



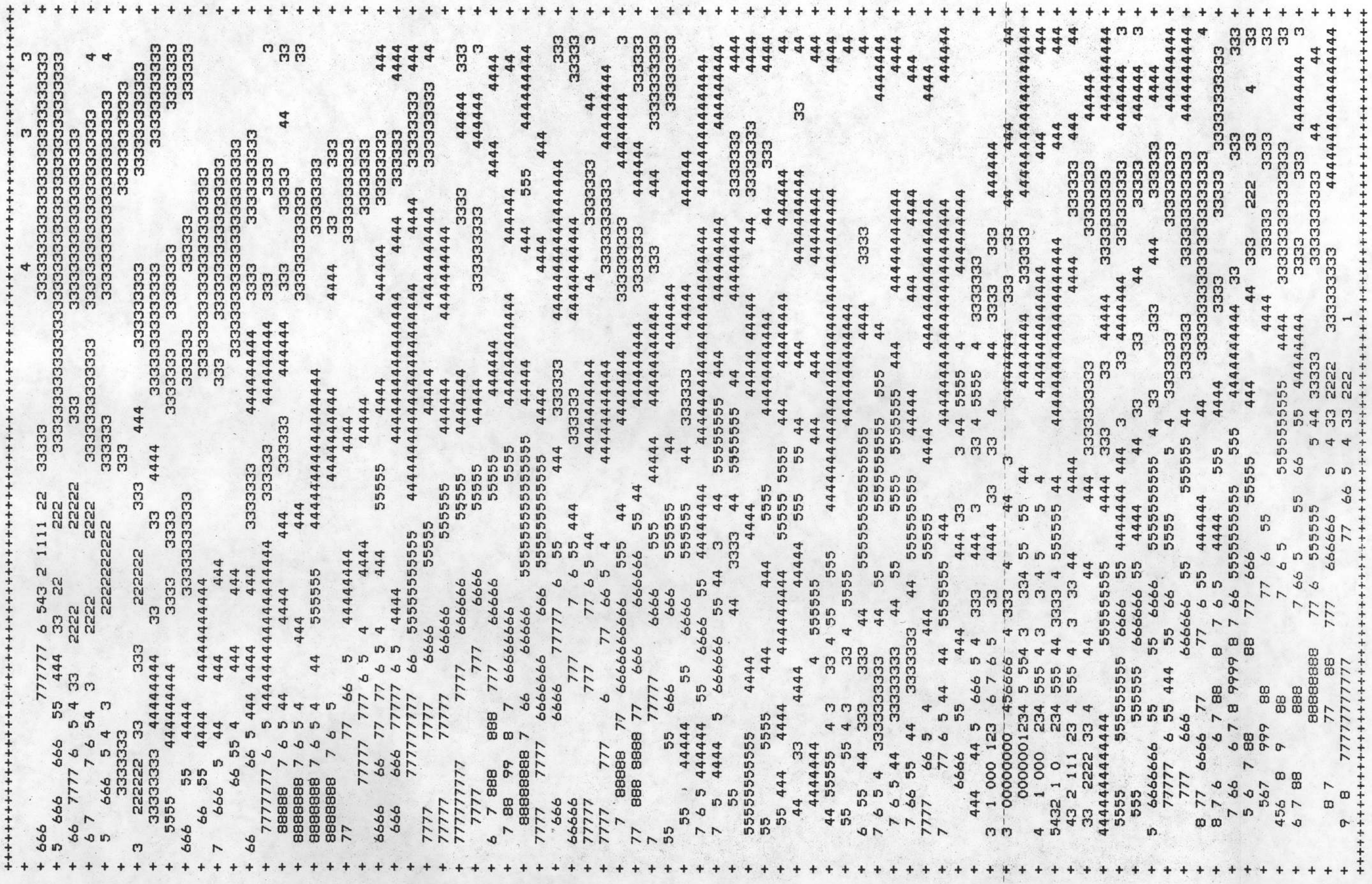
Thorium Pseudo-Contour Map - Cincinnati Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.6250
1	0.6250	1.2500
	1.2500	1.8750
2	1.8750	2.5000
	2.5000	3.1250
3	3.1250	3.7500
	3.7500	4.3750
4	4.3750	5.0000
	5.0000	5.6250
5	5.6250	6.2500
	6.2500	6.8750
6	6.8750	7.5000
	7.5000	8.1250
7	8.1250	8.7500
	8.7500	9.3750
8	9.3750	10.0000
	10.0000	10.6250
9	10.6250	11.2500
	GT	11.2500

SCALE IN EQUIVALENT PPM

CINCINNATI

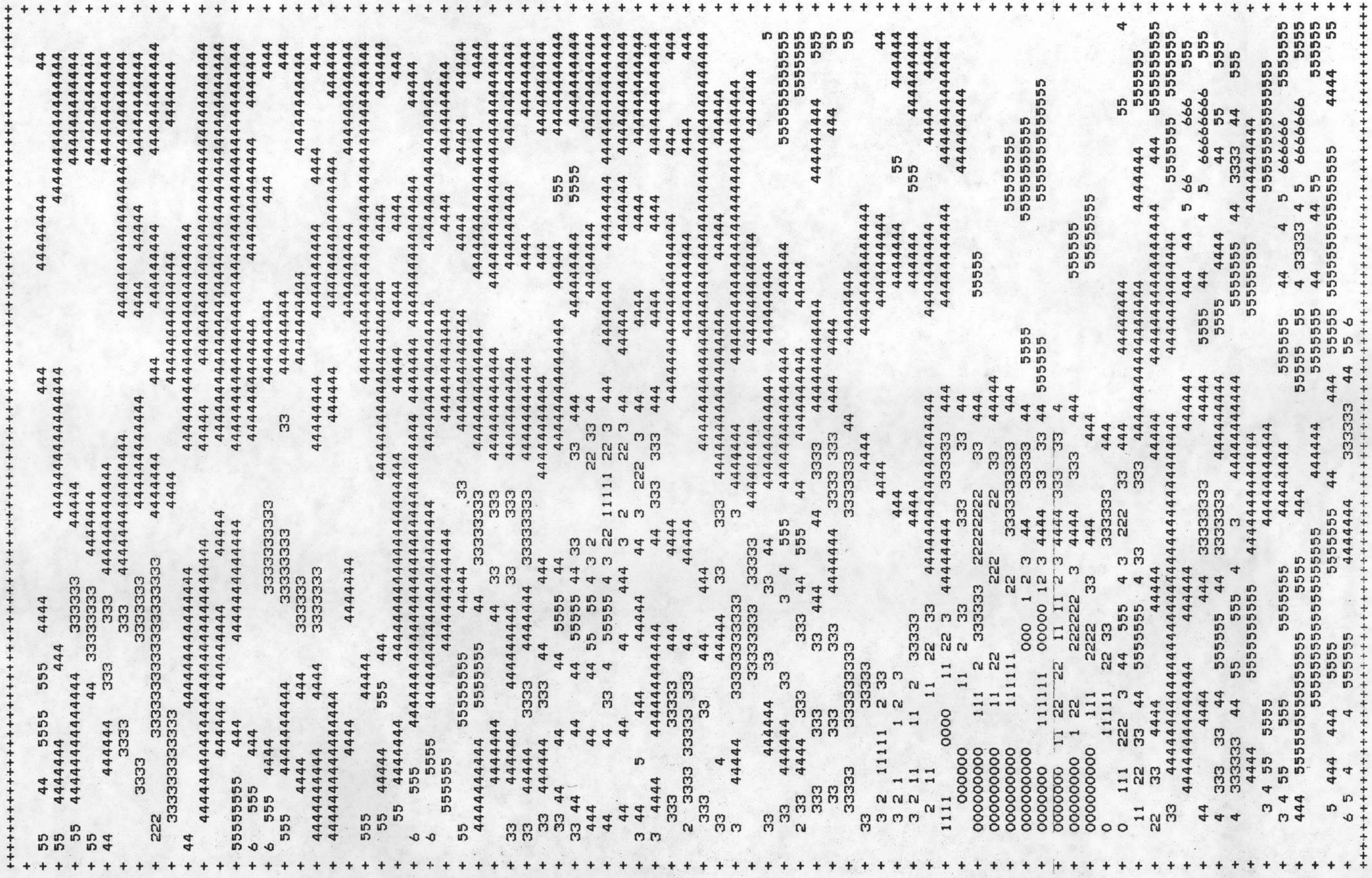


Thorium/Potassium Pseudo-Contour Map - Cincinnati Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	3.0000
	3.0000	3.2500
1	3.2500	3.5000
	3.5000	3.7500
2	3.7500	4.0000
	4.0000	4.2500
3	4.2500	4.5000
	4.5000	4.7500
4	4.7500	5.0000
	5.0000	5.2500
5	5.2500	5.5000
	5.5000	5.7500
6	5.7500	6.0000
	6.0000	6.2500
7	6.2500	6.5000
	6.5000	6.7500
8	6.7500	7.0000
	7.0000	7.2500
9	7.2500	7.5000
	GT	7.5000

CINCINNATI

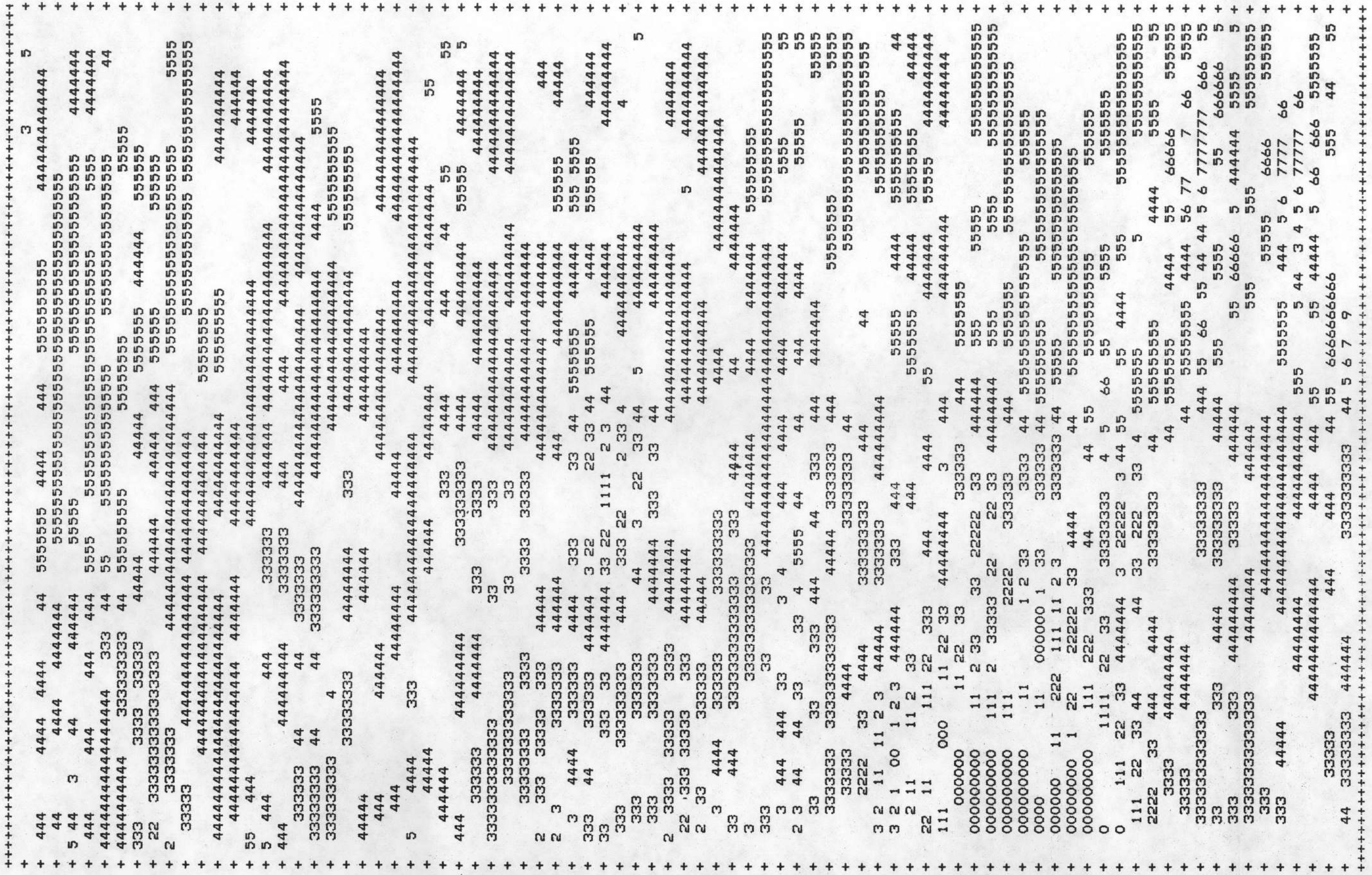


EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.2500
1	0.2500	0.5000
	0.5000	0.7500
2	0.7500	1.0000
	1.0000	1.2500
3	1.2500	1.5000
	1.5000	1.7500
4	1.7500	2.0000
	2.0000	2.2500
5	2.2500	2.5000
	2.5000	2.7500
6	2.7500	3.0000
	3.0000	3.2500
7	3.2500	3.5000
	3.5000	3.7500
8	3.7500	4.0000
	4.0000	4.2500
9	4.2500	4.5000
	GT	4.5000

Uranium/Potassium Pseudo-Contour Map - Cincinnati Quadrangle

CINCINNATI

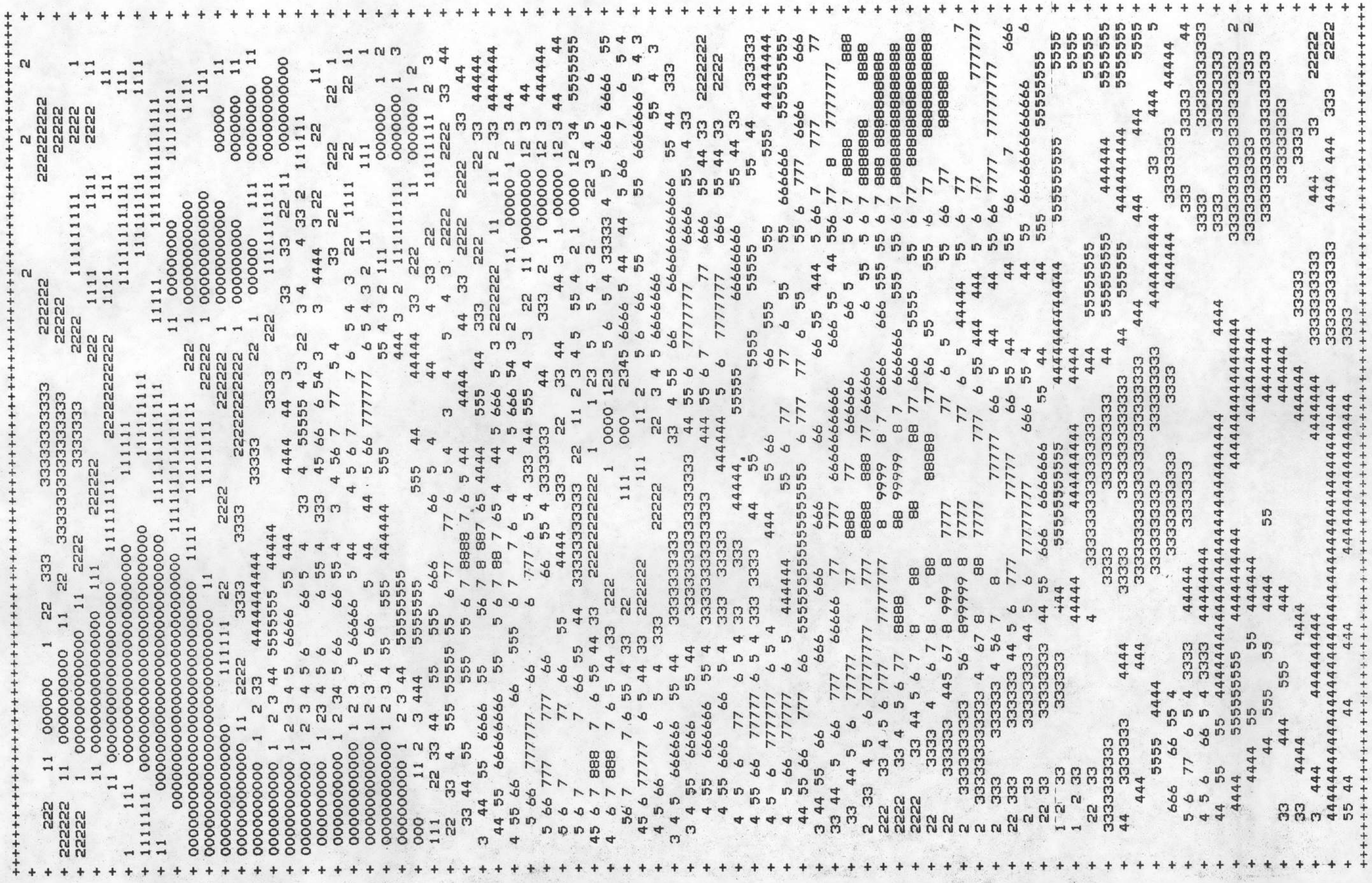


EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.0500
1	0.0500	0.1000
	0.1000	0.1500
2	0.1500	0.2000
	0.2000	0.2500
3	0.2500	0.3000
	0.3000	0.3500
4	0.3500	0.4000
	0.4000	0.4500
5	0.4500	0.5000
	0.5000	0.5500
6	0.5500	0.6000
	0.6000	0.6500
7	0.6500	0.7000
	0.7000	0.7500
8	0.7500	0.8000
	0.8000	0.8500
9	0.8500	0.9000
	GT	0.9000

Uranium/Thorium Pseudo-Contour Map - Cincinnati Quadrangle

CINCINNATI



Residual Magnetic Pseudo-Contour Map - Cincinnati Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE
0	LE-1100.0000
	-1100.0000-1050.0000
1	-1050.0000-1000.0000
	-1000.0000 -950.0000
2	-950.0000 -900.0000
	-900.0000 -850.0000
3	-850.0000 -800.0000
	-800.0000 -750.0000
4	-750.0000 -700.0000
	-700.0000 -650.0000
5	-650.0000 -600.0000
	-600.0000 -550.0000
6	-550.0000 -500.0000
	-500.0000 -450.0000
7	-450.0000 -400.0000
	-400.0000 -350.0000
8	-350.0000 -300.0000
	-300.0000 -250.0000
9	-250.0000 -200.0000
	GT -200.0000

SCALE IN GAMMAS