National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY
VINCENNES QUADRANGLE
INDIANA, ILLINOIS, AND KENTUCKY

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

March 1981

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PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
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 Vincennes quadrangle covers 7,000 square miles of Indiana, Illinois, and Kentucky within the southeastern Midwestern Physiographic Province. The region contains a moderate to thick section of Paleozoic sediments, which are covered by surficial Quaternary glacial deposits in the western half of the area.

A search of available literature revealed no known uranium deposits.

A total of eighty-eight (88) uranium anomalies were detected and are discussed briefly in this report. The average concentrations of potassium, uranium, and thorium are moderate at best. All anomalies appear culturally induced, and none appear to represent significant concentrations of uranium.

The magnetic data appears to principally reflect the depth and complexities of the Precambrian basement.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

General

The Vincennes quadrangle covers 7,000 square miles in southwestern Indiana, southeastern Illinois, and northern Kentucky (see Figure 1).

Several geologic references were used in the interpretation. The base map was compiled by ESKA-TECH Incorporated in 1980, using the 1:250,000 scale Indiana State Geologic map of the region as their primary reference (also used in the interpretation). Outlined units on the two maps do not register together properly, which casts some doubt on the accuracy of the digitized units used in the interpretation. Map unit descriptions, found in Appendix C, were taken from both these maps as appropriate. Some glacial geologic information was taken from Flint (1959 and 1971). Physiographic descriptions were taken in part from Fairbridge (1972). Structural information came largely from Cohee (1972) and the Indiana State Geologic Map series (Gray and others, 1970). Cultural and physiographic information were taken from the 1:250,000 scale Vincennes topographic sheet (1969 version).

Data for the Vincennes quadrangle was acquired in November and December of 1980, and processed in January of 1981. A detailed summary of the data acquisition, processing, interpretation, and presentation methods appears in Appendix A. Appendix B contains a detailed flight summary for the Vincennes quadrangle.

Physiography

The Vincennes quadrangle comprises an irregular to mountainous region intermediate between the Midwestern and the Gulf Coastal Physiographic Provinces. The western half of the quadrangle is dominated by agricultural activity, as are portions of the more mountainous eastern half.

The region is drained by the Ohio River and several of its main tributaries. The Ohio River itself meanders through the extreme southeastern region. The White River watershed covers the largest percentage of the total quadrangle, including the entire northeastern quadrant. This river flows southwesterly into the Wabash, which flows SSW along the western border. The Wabash River drains the western border region directly. South and east of these two watersheds, small tributaries flow southward directly into the Ohio. All major river systems appear to be antecedent to present topography, with entrenched meanders throughout most of their length.

Elevations range from approximately 350 feet at the lowest base level of the Wabash River (at the extreme southwestern corner), to over 800 feet atop several mountains throughout the eastern half of the quadrangle. The quadrangle contains moderate amounts of cultural influence. The largest city in the area is Evansville (pop. 132,000) at the

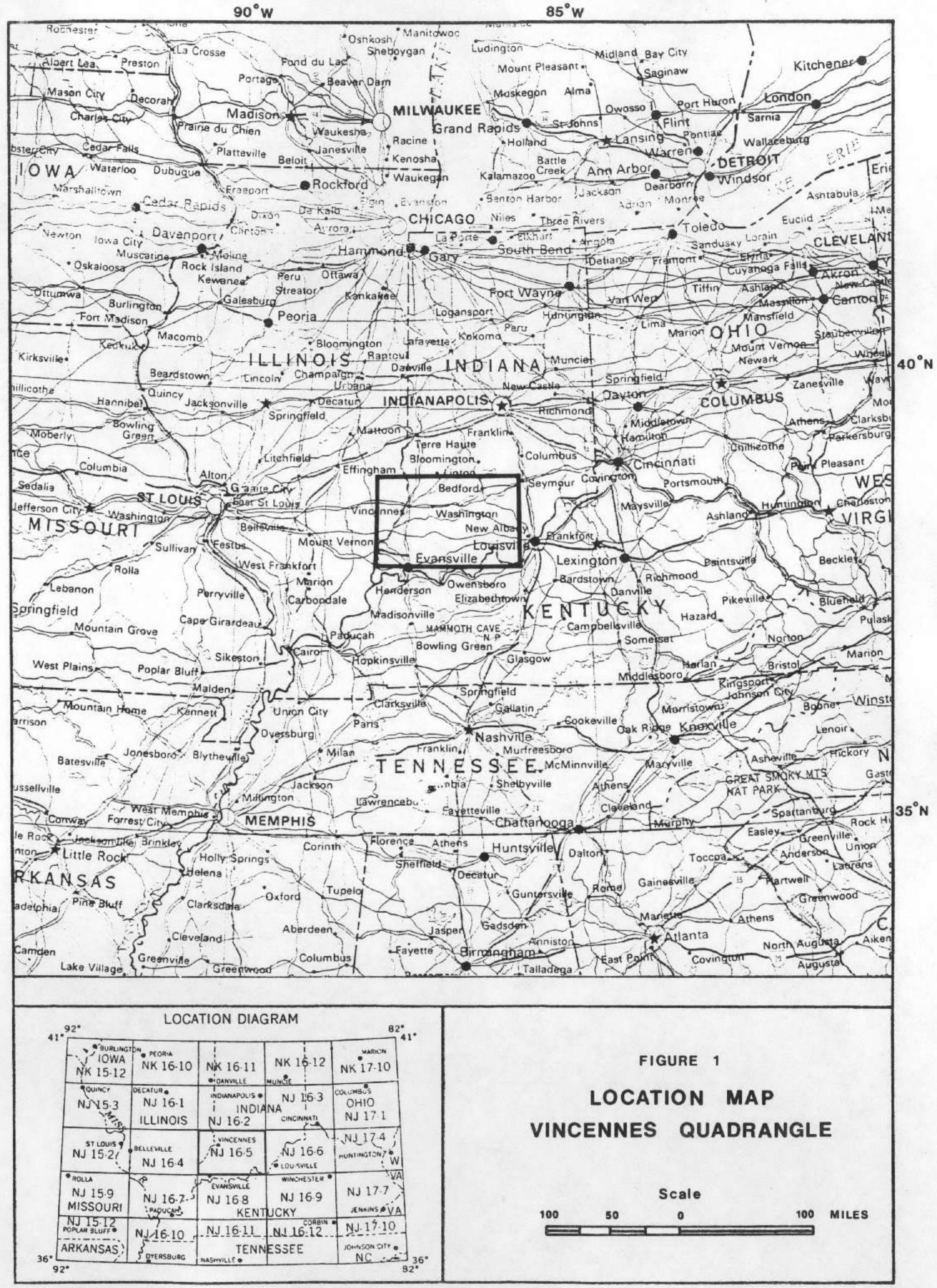


FIGURE 1

LOCATION MAP
VINCENNES QUADRANGLE

western south edge of the quadrangle. The quadrangle contains a moderate to dense rectangular grid of roads and highways, and several railroad lines. Strip mining occurs throughout the region but is concentrated north of Evansville. Numerous oil fields are present in the west.

GEOLOGY

Structure

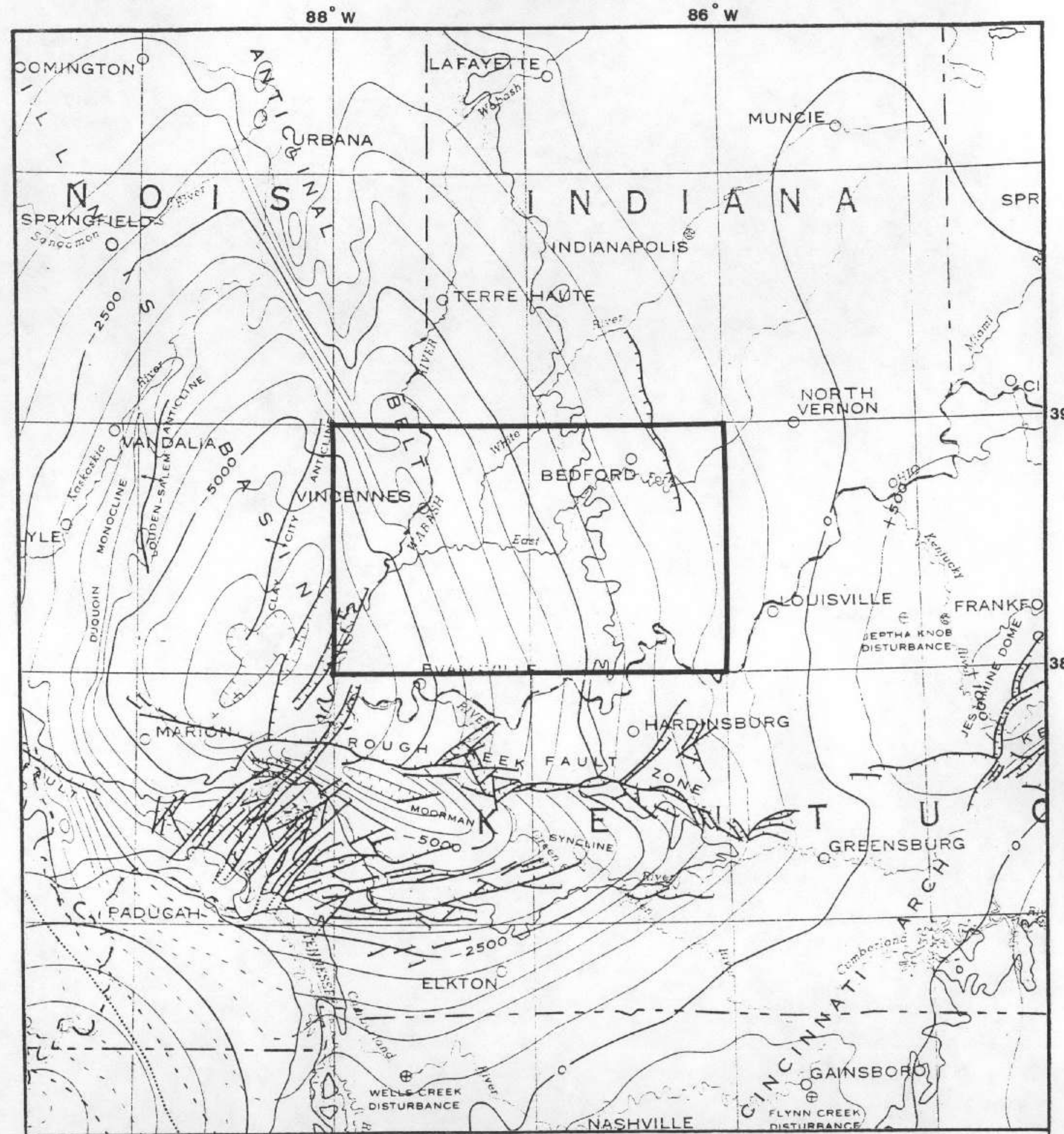
The region defined by the Vincennes quadrangle lies on the eastern edge of the Illinois Sedimentary Basin. Sediments of Paleozoic age shoal from 12,000 feet at the southwestern corner, to less than 4,500 feet in the extreme northeast (on the southwestern limb of the Kankakee Arch). The Illinois Basin is a roughly circular structure that is complicated by several secondary structural features. The LaSalle Anticlinal belt strikes SSE through the central portion of the basin (in the western half of the Vincennes quadrangle). Several dip slip faults have been mapped in this area by Cohee and others (1962), some of which appear associated with the anticlinal belt. Though these faults are largely subsurface, they have been mapped in detail by Gray and others (1970), and also appear on the ESKA-TECH map.

Surface Geology

Though Paleozoic sediments dominate the subsurface structure, they are, to a large extent, masked by overlying glacial, periglacial, and post-glacial sediments of Illinoian through Post-Wisconsinan (Quaternary). The quadrangle is essentially divided in half by a north-south trending line, with exposed Paleozoics in the east, and extensive Quaternary cover in the west. Some exposures of Paleozoics exist west of this line, primarily in the south. The eastern half has some localized regions containing thick Quaternary sections, particularly the extreme northeastern corner. In all, mapped Quaternary units cover 55 percent of the surface.

The Quaternary section is composed of a combination of glacially related deposits of Pleistocene age, and Recent deposits along the flood plains of the major rivers (alluvial, colluvial, fluvial, paludal, and related sedimentary processes). Of the mapped Quaternary section, Recent deposits cover 25 percent.

Till of Illinoian age is mapped in the northeastern corner and throughout the northwestern quadrant away from the flood plain areas. These sediments account for approximately 20 percent of the Pleistocene section. Large areas of drainage systems that were blocked by the glaciers contain lacustrine sediments. These sediments are quite extensive, covering 25 percent of the represented Pleistocene. The most extensive glacially-related deposits are eolian sands and silts (loess) of interglacial and post-glacial age. These amount for 45



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

FIGURE 2

TECTONIC STRUCTURE MAP
VINCENNES QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

percent of the Pleistocene surface deposits and are exposed throughout the western half of the quadrangle. The remaining 10 percent of the Pleistocene is covered with a combination of glacial outwash and miscellaneous alluvial, colluvial, and paludal deposits of glacial or interglacial age that largely occur adjacent to major rivers.

The Paleozoic section is completely dominated by Pennsylvanian age (in the western exposures) and Mississippian age (to the east) sediments. Mississippian limestones, shales and sandstones cover 60 percent of the Paleozoic surface. The remainder of the exposures compose thick sandstone and shales of Pennsylvanian age primarily of the Pottsuillian and Alleganian epochs, that contain some limestones and numerous coal beds. The Pennsylvanian - Mississippian boundary is marked by a significant unconformity that represents a major erosional period between the Kaskaskia and the Absaroka transgressive phases.

Uranium

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

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 88 groups of uranium (Bi214) samples meet the minimum statistical requirements for anomaly definitions as 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 the entire 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 data by the sensitivities calculated for the detection system and as such cannot be taken as directly determined geochemical values.

The Vincennes quadrangle contains moderately low concentrations of potassium, uranium, and thorium. All three elements appear to be distributed somewhat uniformly throughout the quadrangle. Potassium has a quadrangle mean of 1.0 percent. Uranium averages 2.0 ppmeU, and thorium has a mean of 5.9 ppmeT.

Uranium concentrations vary considerably over short distances, but through a narrow range centered around the quadrangle mean. The highest peak uranium concentration is 6.8 ppmeU in map unit QC (Holocene colluvium), whereas map unit QM (modified land; coal and strip mines, quarries) contains the highest average uranium concentration at 2.6 ppmeU. In general, the northern third of the quadrangle shows slightly lower concentrations, this is mainly attributed to the Wabash and White River floodplains, along with the slightly lower concentration values in the Illinoian glacial till.

Potassium exhibits relatively narrow concentration ranges, and tends to vary only over long distances. In general, concentrations appear to define two populations (see Appendix H). The eastern half contains values that range around 0.875 percent, while the western half averages about 1.25 percent. The lower concentrations may represent the pre-Quaternary bedrock exposures. The highest peak and average potassium concentrations both occur in map unit Ql (Quaternary loess) at 2.0 and 1.15 percent, respectively.

Thorium also exhibits relatively narrow concentration ranges, with significant variations occurring only over long distances. Only the floodplains of the Wabash and White Rivers in the northwest, and the White River (East Fork) floodplain in the northeast corner (see Appendix H) exhibit significantly lower thorium concentrations. The peak thorium concentration occurs in map unit QL, at 10.74 ppmeT, while the highest average concentration of 6.9 ppmeT occurs in map unit PMC (Pennsylvanian McLeansboro Group).

Generally speaking, the concentrations of the three radioactive elements within those areas of mapped exposed bedrock are very similar to those in the overlying Quaternary materials. This suggests that glacial material may in part be of local origin.

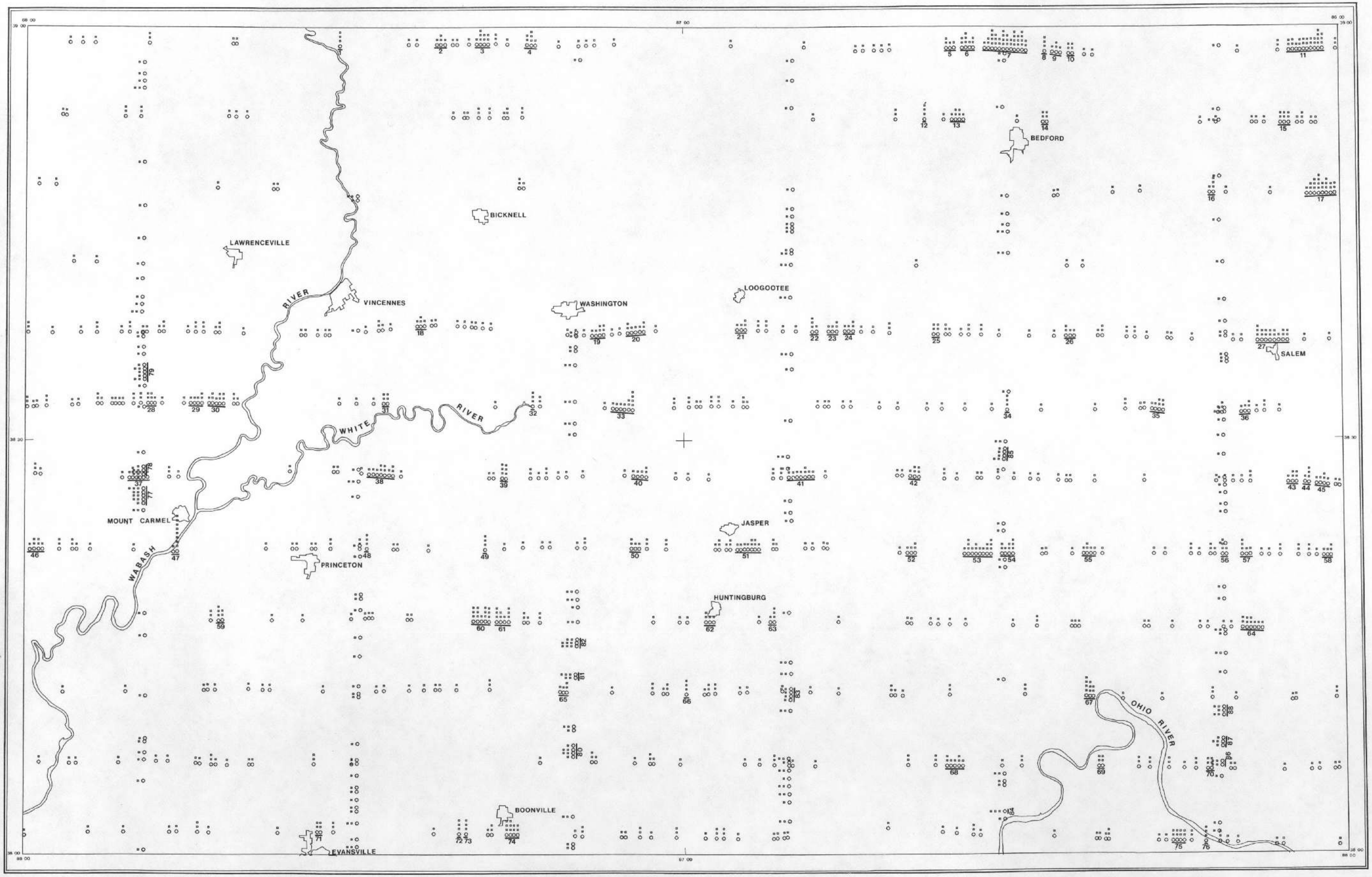
Anomalies occur mainly in the southeast quadrant, and an area just east of the Wabash River. All these anomalies appear to have cultural origins (such as roads, railroads, quarries, oil fields, etc.). These anomalies range in peak concentrations from 2.5 to 6.1 ppmeU. Anomaly 47 has the highest peak uranium concentration, and occurs within a partially flooded oxbow over cultural activity of an unknown sort. Otherwise, the cultural associations, coupled with the low concentration levels, indicates that none of the anomalies have any significance.

Magnetic Data

The pseudo-contour map of the magnetic data appears in the Appendix H.

The quadrangle is mainly dominated by moderate to long wavelengths of very low amplitude, with the exception of the eastern border area which shows strikingly higher gradients that define isolated structures. The resulting picture suggests a large complex structural pattern at depth. Though gradients slightly decrease away from the axis of the LaSalle Anticline, the resulting picture appears to depict complexities in lithology and/or structure in the underlying Precambrian basement rather than in the Paleozoic sediments.

VINCENNES



URANIUM ANOMALY/ INTERPRETATION MAP

VINCENNES 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

Figure 3 - Uranium Anomaly/Interpretation Map - Vincennes Quadrangle

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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.

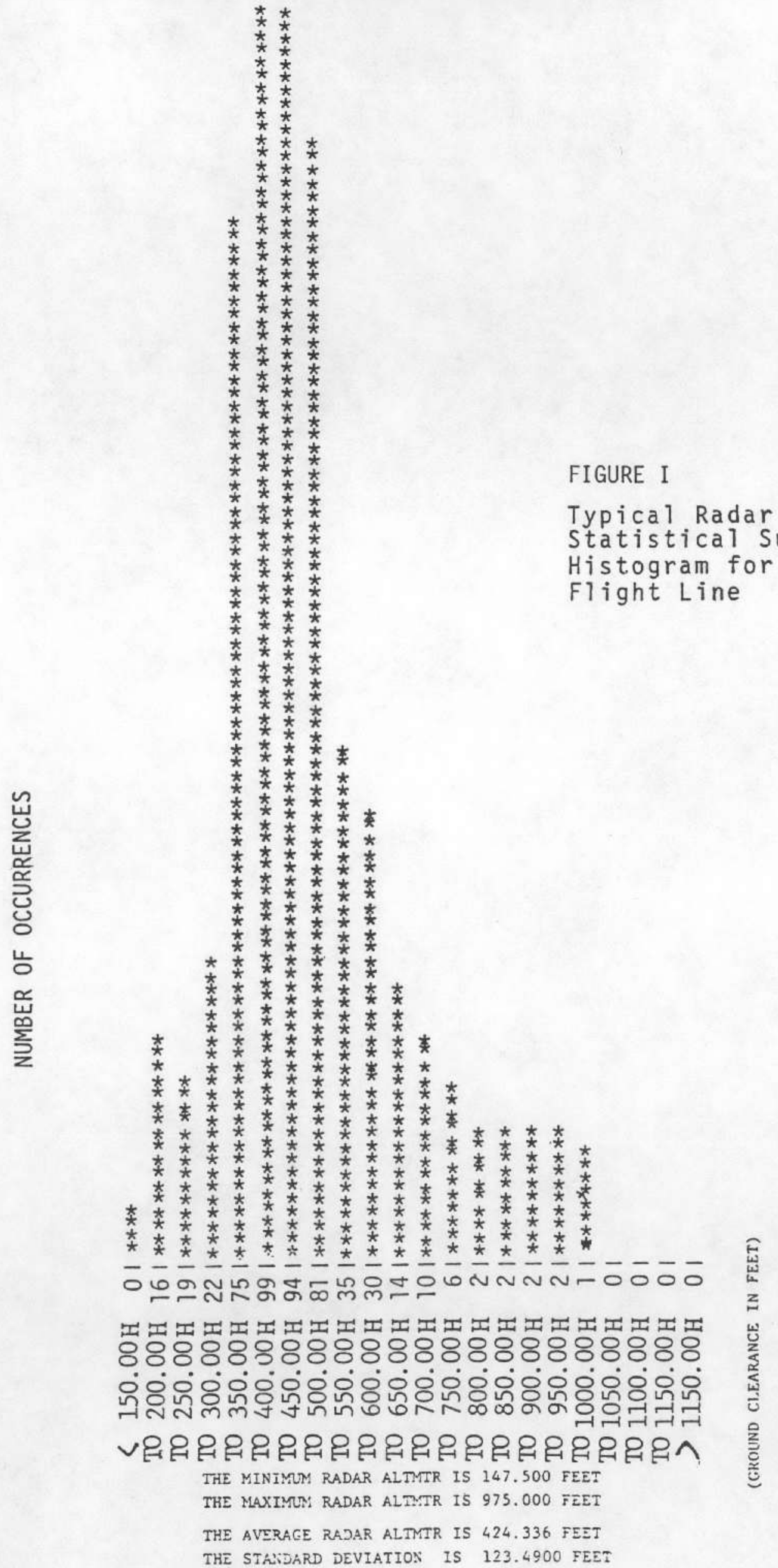


FIGURE I

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.

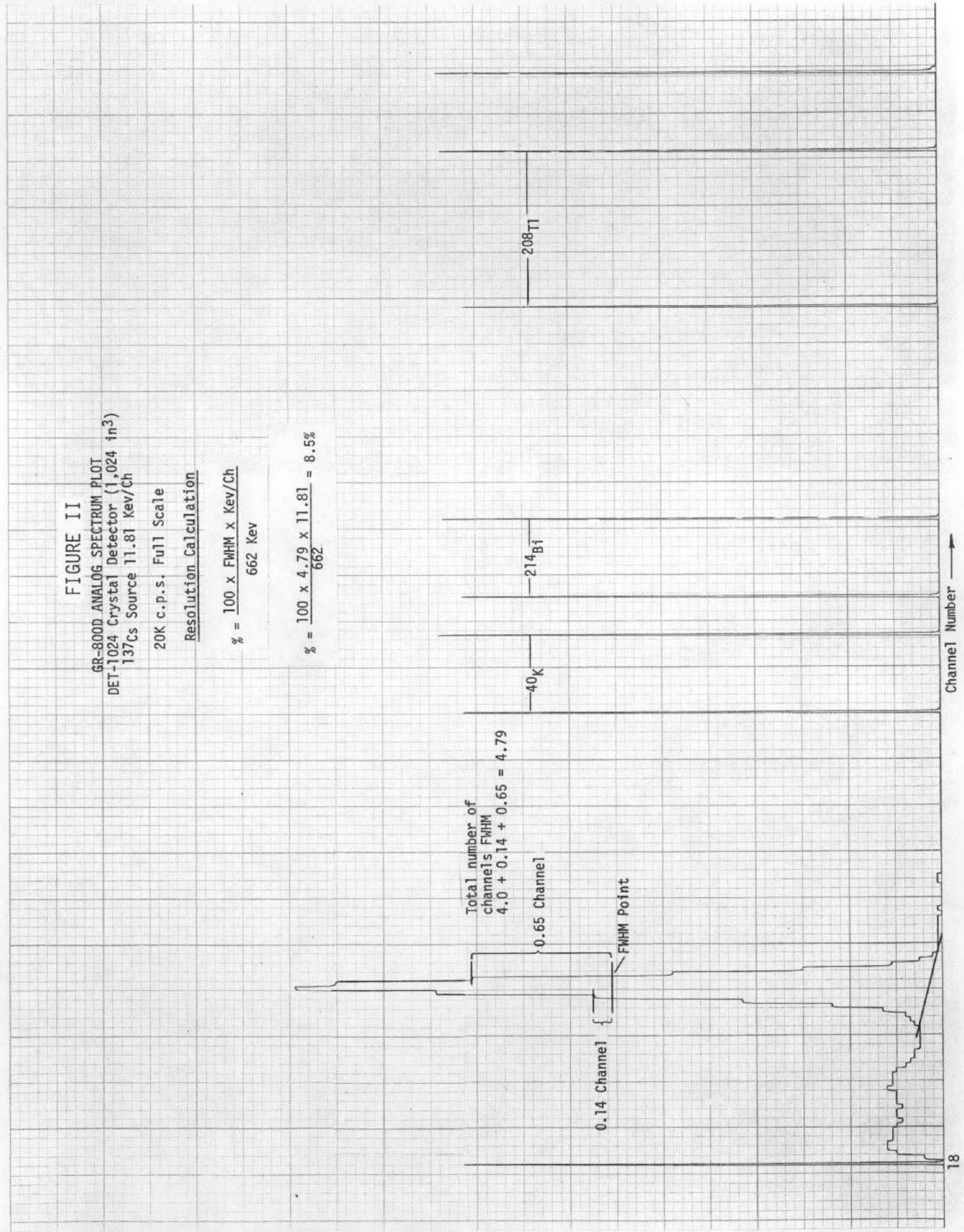
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.

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)		
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.

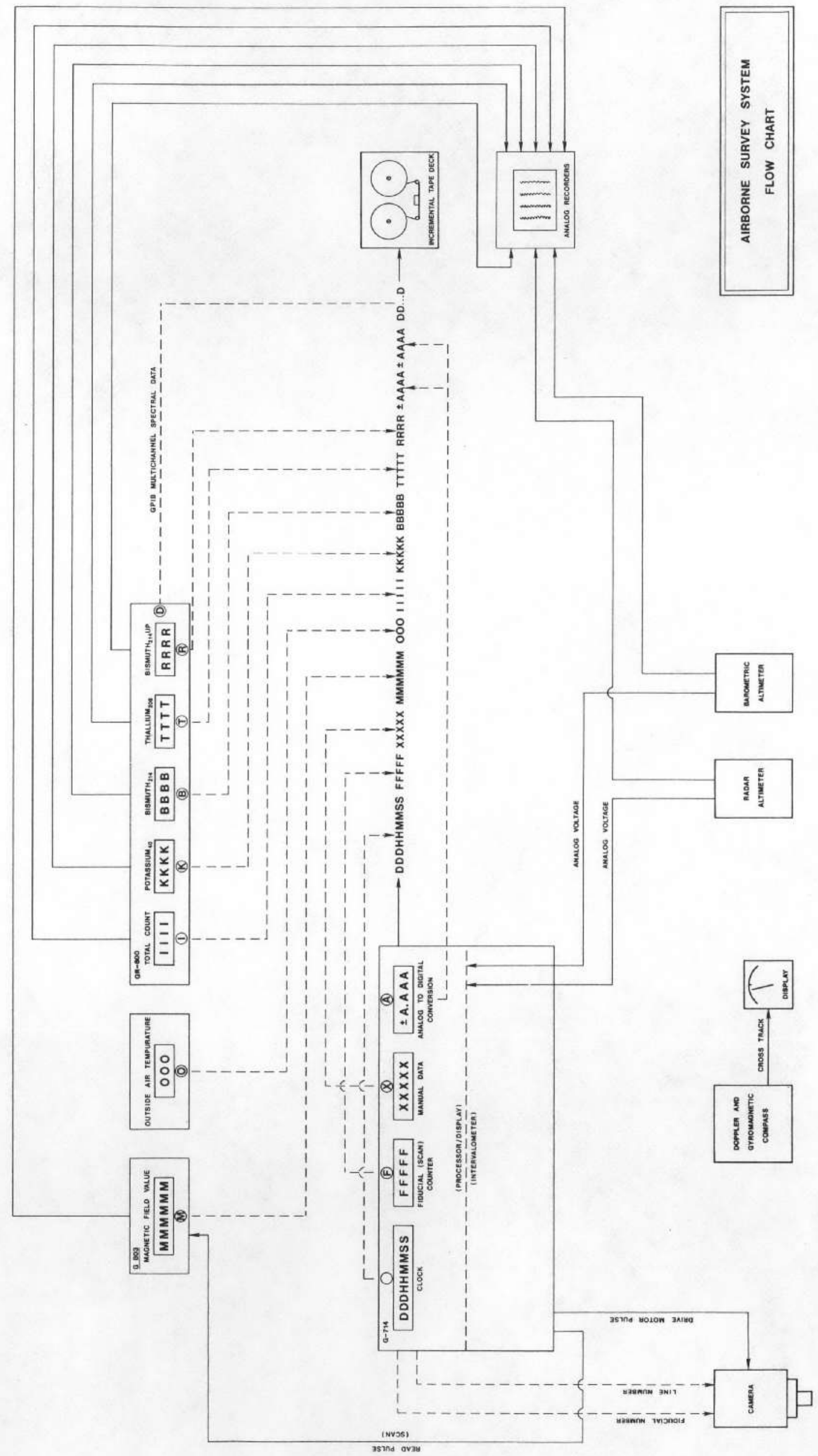


FIGURE III

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:

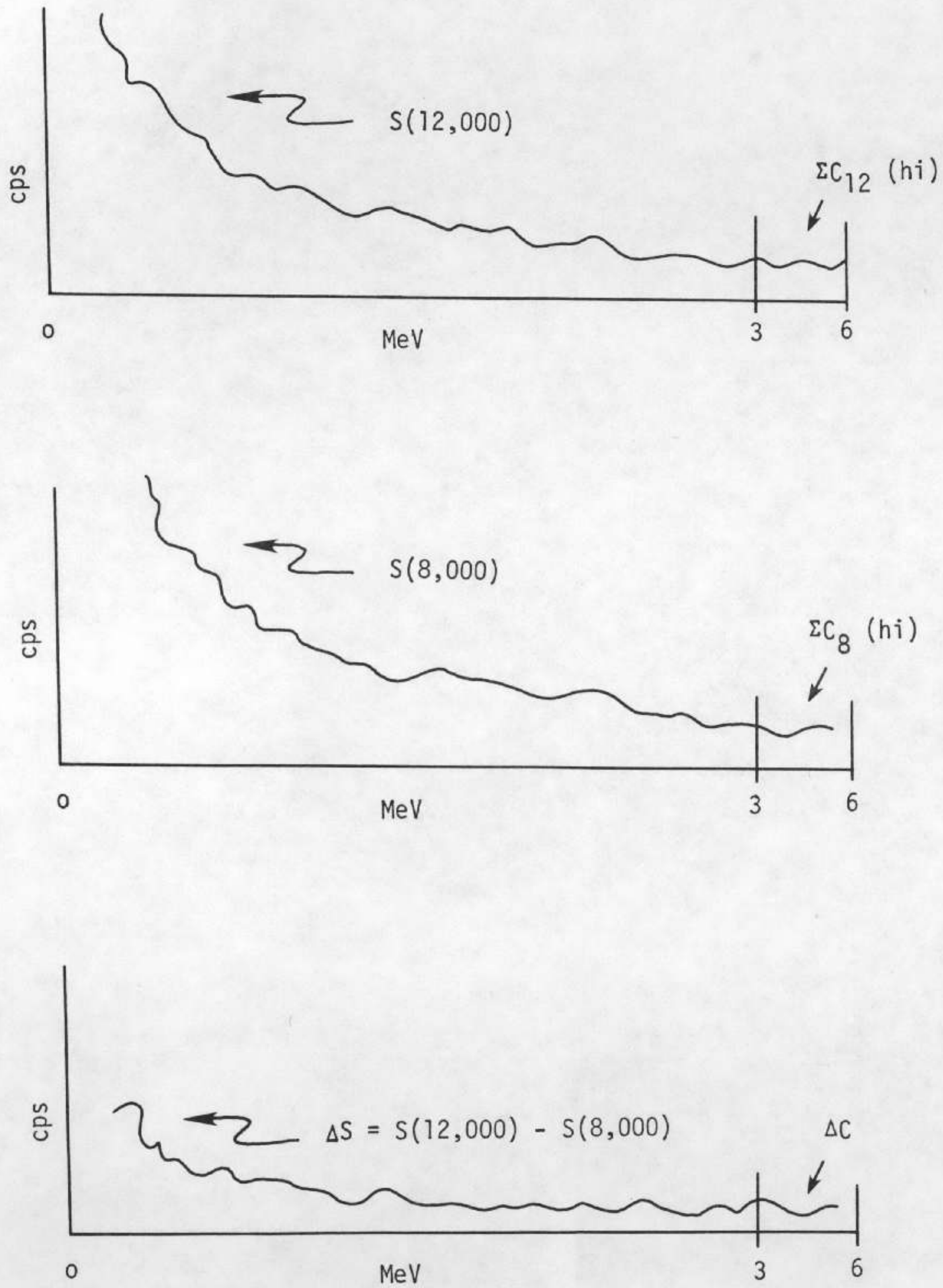


FIGURE IV - Multiple altitude spectra schematic

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).

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

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

CH 0	(0.000 MEV)	0.000 CPS	x	
CH 1	(0.012 MEV)	0.000 CPS	x	
CH 2	(0.024 MEV)	0.000 CPS	x	
CH 3	(0.035 MEV)	0.000 CPS	x	
CH 4	(0.047 MEV)	0.000 CPS	x	
CH 5	(0.059 MEV)	0.000 CPS	x	
CH 6	(0.071 MEV)	0.000 CPS	x	
CH 7	(0.083 MEV)	0.000 CPS	x	
CH 8	(0.095 MEV)	0.000 CPS	x	
CH 9	(0.106 MEV)	0.000 CPS	x	
CH 10	(0.118 MEV)	0.000 CPS	x	
CH 11	(0.130 MEV)	0.000 CPS	x	
CH 12	(0.142 MEV)	0.000 CPS	x	
CH 13	(0.154 MEV)	0.000 CPS	x	
CH 14	(0.165 MEV)	0.000 CPS	x	
CH 15	(0.177 MEV)	0.000 CPS	x	
CH 16	(0.189 MEV)	0.000 CPS	x	
CH 17	(0.201 MEV)	0.000 CPS	x	
CH 18	(0.213 MEV)	-0.025 CPS	x	
CH 19	(0.225 MEV)	-0.020 CPS	x	
CH 20	(0.236 MEV)	0.080 CPS	x	
CH 21	(0.248 MEV)	1.401 CPS	xxxxx	
CH 22	(0.260 MEV)	3.792 CPS	xxxxxxxxxxxxx	
CH 23	(0.272 MEV)	4.280 CPS	xxxxxxxxxxxxxxx	
CH 24	(0.284 MEV)	4.334 CPS	xxxxxxxxxxxxxxx	
CH 25	(0.295 MEV)	3.748 CPS	xxxxxxxxxxxxx	
CH 26	(0.307 MEV)	3.897 CPS	xxxxxxxxxxxxxx	
CH 27	(0.319 MEV)	3.818 CPS	xxxxxxxxxxxxx	
CH 28	(0.331 MEV)	4.236 CPS	xxxxxxxxxxxxxxx	
CH 29	(0.343 MEV)	3.433 CPS	xxxxxxxxxxxx	
CH 30	(0.355 MEV)	2.996 CPS	xxxxxxxxxxx	
CH 31	(0.366 MEV)	2.559 CPS	xxxxxxxxxx	
CH 32	(0.378 MEV)	2.269 CPS	xxxxxxxxx	
CH 33	(0.390 MEV)	2.102 CPS	xxxxxxxx	
CH 34	(0.402 MEV)	2.081 CPS	xxxxxxxx	TOTAL COUNT
CH 35	(0.414 MEV)	2.121 CPS	xxxxxxxx	
CH 36	(0.426 MEV)	2.114 CPS	xxxxxxxx	
CH 37	(0.437 MEV)	1.976 CPS	xxxxxxxx	
CH 38	(0.449 MEV)	2.290 CPS	xxxxxxxxx	
CH 39	(0.461 MEV)	2.188 CPS	xxxxxxxxx	
CH 40	(0.473 MEV)	2.226 CPS	xxxxxxxxx	
CH 41	(0.485 MEV)	1.983 CPS	xxxxxxxx	
CH 42	(0.496 MEV)	2.165 CPS	xxxxxxxx	
CH 43	(0.508 MEV)	2.158 CPS	xxxxxxxx	
CH 44	(0.520 MEV)	2.267 CPS	xxxxxxxxx	
CH 45	(0.532 MEV)	2.217 CPS	xxxxxxxxx	
CH 46	(0.544 MEV)	1.997 CPS	xxxxxxxx	
CH 47	(0.556 MEV)	2.447 CPS	xxxxxxxxx	
CH 48	(0.567 MEV)	2.540 CPS	xxxxxxxxxx	
CH 49	(0.579 MEV)	2.586 CPS	xxxxxxxxxx	
CH 50	(0.591 MEV)	2.708 CPS	xxxxxxxxxx	
CH 51	(0.603 MEV)	2.481 CPS	xxxxxxxxx	
CH 52	(0.615 MEV)	2.372 CPS	xxxxxxxxx	
CH 53	(0.626 MEV)	1.866 CPS	xxxxxxx	
CH 54	(0.638 MEV)	1.682 CPS	xxxxxx	
CH 55	(0.650 MEV)	1.661 CPS	xxxxxx	
CH 56	(0.662 MEV)	1.480 CPS	xxxxx	
CH 57	(0.674 MEV)	1.474 CPS	xxxxx	
CH 58	(0.686 MEV)	1.447 CPS	xxxxx	
CH 59	(0.697 MEV)	1.431 CPS	xxxxx	
CH 60	(0.709 MEV)	1.476 CPS	xxxxx	
CH 61	(0.721 MEV)	1.453 CPS	xxxxx	
CH 62	(0.733 MEV)	1.467 CPS	xxxxx	
CH 63	(0.745 MEV)	1.579 CPS	xxxxxx	
CH 64	(0.756 MEV)	1.497 CPS	xxxxx	
CH 65	(0.768 MEV)	1.548 CPS	xxxxxx	
CH 66	(0.780 MEV)	1.421 CPS	xxxxx	
CH 67	(0.792 MEV)	1.282 CPS	xxxxx	
CH 68	(0.804 MEV)	1.155 CPS	xxxx	
CH 69	(0.816 MEV)	1.246 CPS	xxxxx	
CH 70	(0.827 MEV)	1.245 CPS	xxxxx	
CH 71	(0.839 MEV)	1.161 CPS	xxxx	
CH 72	(0.851 MEV)	1.253 CPS	xxxxx	
CH 73	(0.863 MEV)	1.231 CPS	xxxxx	
CH 74	(0.875 MEV)	1.425 CPS	xxxxx	
CH 75	(0.887 MEV)	1.452 CPS	xxxxx	
CH 76	(0.898 MEV)	1.543 CPS	xxxxxx	
CH 77	(0.910 MEV)	1.444 CPS	xxxxx	
CH 78	(0.922 MEV)	1.364 CPS	xxxxx	
CH 79	(0.934 MEV)	1.289 CPS	xxxxx	
CH 80	(0.946 MEV)	1.150 CPS	xxxx	
CH 81	(0.957 MEV)	1.144 CPS	xxxx	
CH 82	(0.969 MEV)	1.085 CPS	xxxx	
CH 83	(0.981 MEV)	1.061 CPS	xxxx	
CH 84	(0.993 MEV)	0.941 CPS	xxxx	
CH 85	(1.005 MEV)	0.919 CPS	xxxx	
CH 86	(1.017 MEV)	0.822 CPS	xxx	
CH 87	(1.028 MEV)	0.816 CPS	xxx	
CH 88	(1.040 MEV)	0.853 CPS	xxxx	
CH 89	(1.052 MEV)	0.901 CPS	xxxx	BISMUTH 214
CH 90	(1.064 MEV)	0.822 CPS	xxx	
CH 91	(1.076 MEV)	0.867 CPS	xxxx	
CH 92	(1.087 MEV)	0.968 CPS	xxxx	
CH 93	(1.099 MEV)	0.851 CPS	xxxx	
CH 94	(1.111 MEV)	0.905 CPS	xxxx	
CH 95	(1.123 MEV)	0.847 CPS	xxxx	
CH 96	(1.135 MEV)	0.861 CPS	xxxx	
CH 97	(1.147 MEV)	0.800 CPS	xxx	
CH 98	(1.158 MEV)	0.727 CPS	xxx	
CH 99	(1.170 MEV)	0.751 CPS	xxx	
CH 100	(1.182 MEV)	0.607 CPS	xxx	BISMUTH 214
CH 101	(1.194 MEV)	0.663 CPS	xxx	
CH 102	(1.206 MEV)	0.657 CPS	xxx	
CH 103	(1.217 MEV)	0.633 CPS	xxx	
CH 104	(1.229 MEV)	0.719 CPS	xxx	
CH 105	(1.241 MEV)	0.671 CPS	xxx	
CH 106	(1.253 MEV)	0.475 CPS	xx	
CH 107	(1.265 MEV)	0.601 CPS	xxx	
CH 108	(1.277 MEV)	0.661 CPS	xxx	
CH 109	(1.288 MEV)	0.669 CPS	xxx	
CH 110	(1.300 MEV)	0.606 CPS	xxx	
CH 111	(1.312 MEV)	0.630 CPS	xxx	
CH 112	(1.324 MEV)	0.652 CPS	xxx	
CH 113	(1.336 MEV)	0.644 CPS	xxx	
CH 114	(1.347 MEV)	0.652 CPS	xxx	
CH 115	(1.359 MEV)	0.791 CPS	xxx	
CH 116	(1.371 MEV)	0.787 CPS	xxx	POTASSIUM 40
CH 117	(1.383 MEV)	0.834 CPS	xxxx	
CH 118	(1.395 MEV)	0.984 CPS	xxxx	
CH 119	(1.407 MEV)	1.072 CPS	xxxx	
CH 120	(1.418 MEV)	1.124 CPS	xxxx	
CH 121	(1.430 MEV)	1.088 CPS	xxxx	
CH 122	(1.442 MEV)	1.210 CPS	xxxxx	
CH 123	(1.454 MEV)	1.231 CPS	xxxxx	
CH 124	(1.466 MEV)	1.207 CPS	xxxxx	
CH 125	(1.477 MEV)	0.995 CPS	xxxx	
CH 126	(1.489 MEV)	0.967 CPS	xxxx	
CH 127	(1.501 MEV)	0.624 CPS	xxx	
CH 128	(1.513 MEV)	0.635 CPS	xxx	
CH 129	(1.525 MEV)	0.512 CPS	xxx	
CH 130	(1.537 MEV)	0.488 CPS	xx	
CH 131	(1.548 MEV)	0.409 CPS	xx	
CH 132	(1.560 MEV)	0.369 CPS	xx	POTASSIUM 40
CH 133	(1.572 MEV)	0.339 CPS	xx	
CH 134	(1.584 MEV)	0.438 CPS	xx	
CH 135	(1.596 MEV)	0.310 CPS	xx	
CH 136	(1.608 MEV)	0.259 CPS	xx	
CH 137	(1.619 MEV)	0.250 CPS	xx	
CH 138	(1.631 MEV)	0.353 CPS	xx	
CH 139	(1.643 MEV)	0.323 CPS	xx	
CH 140	(1.655 MEV)	0.332 CPS	xx	
CH 141	(1.667 MEV)	0.326 CPS	xx	BISMUTH 214
CH 142	(1.678 MEV)	0.267 CPS	xx	
CH 143	(1.690 MEV)	0.275 CPS	xx	
CH 144	(1.702 MEV)	0.245 CPS	xx	
CH 145	(1.714 MEV)	0.347 CPS	xx	
CH 146	(1.726 MEV)	0.352 CPS	xx	
CH 147	(1.738 MEV)	0.293 CPS	xx	
CH 148	(1.749 MEV)	0.359 CPS	xx	
CH 149	(1.761 MEV)	0.270 CPS	xx	
CH 150	(1.773 MEV)	0.334 CPS	xx	
CH 151	(1.785 MEV)	0.245 CPS	xx	
CH 152	(1.797 MEV)	0.255 CPS	xx	
CH 153	(1.808 MEV)	0.174 CPS	xx	
CH 154	(1.820 MEV)	0.228 CPS	xx	
CH 155	(1.832 MEV)	0.188 CPS	xx	
CH 156	(1.844 MEV)	0.115 CPS	x	
CH 157	(1.856 MEV)	0.084 CPS	x	BISMUTH 214
CH 158	(1.868 MEV)	0.147 CPS	x	
CH 159	(1.879 MEV)	0.147 CPS	x	
CH 160	(1.891 MEV)	0.139 CPS	x	
CH 161	(1.903 MEV)	0.109 CPS	x	
CH 162	(1.915 MEV)	0.091 CPS	x	
CH 163	(1.927 MEV)	0.151 CPS	x	
CH 164	(1.938 MEV)	0.088 CPS	x	
CH 165	(1.950 MEV)	0.136 CPS	x	
CH 166	(1.962 MEV)	0.157 CPS	x	
CH 167	(1.974 MEV)	0.119 CPS	x	
CH 168	(1.986 MEV)	0.109 CPS	x	
CH 169	(1.998 MEV)	0.113 CPS	x	
CH 170	(2.009 MEV)	0.106 CPS	x	
CH 171	(2.021 MEV)	0.147 CPS	x	
CH 172	(2.033 MEV)	0.137 CPS	x	
CH 173	(2.045 MEV)	0.171 CPS	xx	
CH 174	(2.057 MEV)	0.154 CPS	x	
CH 175	(2.068 MEV)	0.108 CPS	x	
CH 176	(2.080 MEV)	0.162 CPS	x	
CH 177	(2.092 MEV)	0.104 CPS	x	
CH 178	(2.104 MEV)	0.138 CPS	x	
CH 179	(2.116 MEV)	0.137 CPS	x	
CH 180	(2.128 MEV)	0.119 CPS	x	
CH 181	(2.139 MEV)	0.169 CPS	xx	
CH 182	(2.151 MEV)	0.148 CPS	x	
CH 183	(2.163 MEV)	0.101 CPS	x	
CH 184	(2.175 MEV)	0.114 CPS	x	
CH 185	(2.187 MEV)	0.088 CPS	x	
CH 186	(2.199 MEV)	0.101 CPS	x	
CH 187	(2.210 MEV)	0.085 CPS	x	
CH 188	(2.222 MEV)	0.130 CPS	x	
CH 189	(2.234 MEV)	0.117 CPS	x	
CH 190	(2.246 MEV)	0.113 CPS	x	
CH 191	(2.258 MEV)	0.116 CPS	x	
CH 192	(2.269 MEV)	0.088 CPS	x	
CH 193	(2.281 MEV)	0.097 CPS	x	
CH 194	(2.293 MEV)	0.095 CPS	x	
CH 195	(2.305 MEV)	0.087 CPS	x	
CH 196	(2.317 MEV)	0.059 CPS	x	
CH 197	(2.329 MEV)	0.015 CPS	x	
CH 198	(2.340 MEV)	0.041 CPS	x	
CH 199	(2.352 MEV)	0.070 CPS	x	
CH 200	(2.364 MEV)	0.087 CPS	x	
CH 201	(2.376 MEV)	0.085 CPS	x	
CH 202	(2.388 MEV)	0.084 CPS	x	
CH 203	(2.399 MEV)	0.064 CPS	x	
CH 204	(2.411 MEV)	0.123 CPS	x	THALLIUM 208
CH 205	(2.423 MEV)	0.076 CPS	x	
CH 206	(2.435 MEV)	0.116 CPS	x	
CH 207	(2.447 MEV)	0.147 CPS	x	
CH 208	(2.459 MEV)	0.108 CPS	x	
CH 209	(2.470 MEV)	0.120 CPS	x	
CH 210	(2.482 MEV)	0.092 CPS	x	
CH 211	(2.494 MEV)	0.127 CPS	x	
CH 212	(2.506 MEV)	0.169 CPS	xx	
CH 213	(2.518 MEV)	0.206 CPS	xx	
CH 214	(2.529 MEV)	0.262 CPS	xx	
CH 215	(2.541 MEV)	0.184 CPS	xx	
CH 216	(2.553 MEV)	0.206 CPS	xx	
CH 217	(2.565 MEV)	0.195 CPS	xx	
CH 218	(2.577 MEV)	0.173 CPS	xx	
CH 219	(2.589 MEV)	0.201 CPS	xx	
CH 220	(2.600 MEV)	0.329 CPS	xx	
CH 221	(2.612 MEV)	0.232 CPS	xx	
CH 222	(2.624 MEV)	0.187 CPS	xx	
CH 223	(2.636 MEV)	0.171 CPS	xx	
CH 224	(2.648 MEV)	0.177 CPS	xx	
CH 225	(2.660 MEV)	0.089 CPS	x	
CH 226	(2.671 MEV)	0.122 CPS	x	
CH 227	(2.683 MEV)	0.124 CPS	x	
CH 228	(2.695 MEV)	0.131 CPS	x	
CH 229	(2.707 MEV)	0.090 CPS	x	
CH 230	(2.719 MEV)	0.027 CPS	x	
CH 231	(2.730 MEV)	0.012 CPS	x	
CH 232	(2.742 MEV)	-0.026 CPS	x	
CH 233	(2.754 MEV)	-0.024 CPS	x	
CH 234	(2.766 MEV)	0.038 CPS	x	
CH 235	(2.778 MEV)	0.003 CPS	x	
CH 236	(2.790 MEV)	0.003 CPS	x	
CH 237	(2.801 MEV)	0.038 CPS	x	THALLIUM 208
CH 238	(2.813 MEV)	0.023 CPS	x	
CH 239	(2.825 MEV)	0.003 CPS	x	
CH 240	(2.837 MEV)	0.078 CPS	x	
CH 241	(2.849 MEV)	0.027 CPS	x	
CH 242	(2.860 MEV)	0.047 CPS	x	
CH 243	(2.872 MEV)	0.039 CPS	x	
CH 244	(2.884 MEV)	0.084 CPS	x	
CH 245	(2.896 MEV)	0.025 CPS	x	
CH 246	(2.908 MEV)	-0.025 CPS	x	
CH 247	(2.920 MEV)	-0.015 CPS	x	
CH 248	(2.931 MEV)	-0.037 CPS	x	
CH 249	(2.943 MEV)	-0.005 CPS	x	
CH 250	(2.955 MEV)	0.042 CPS	x	
CH 251	(2.967 MEV)	0.056 CPS	x	
CH 252	(2.979 MEV)	-0.018 CPS	x	
CH 253	(2.990 MEV)	0.031 CPS	x	
CH 254	(3.002 MEV)	-0.106 CPS	x	TOTAL COUNT
CH 255	(3.014 MEV)	0.000 CPS	x	

FIGURE V

DERIVED COSMIC SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE COSMIC, DATED 072577

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

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

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

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)

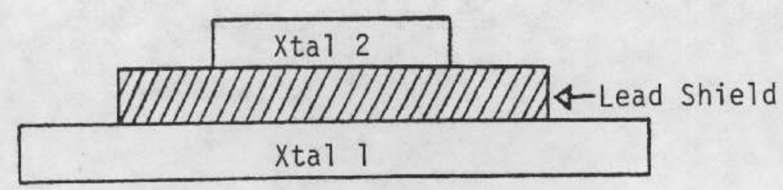
$S_{tu} = \frac{\Delta_{tu}}{\Delta_{tt}}$ (effect of uranium on thorium)

$S_{tk} = \frac{\Delta_{tk}}{\Delta_{tt}}$ (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)

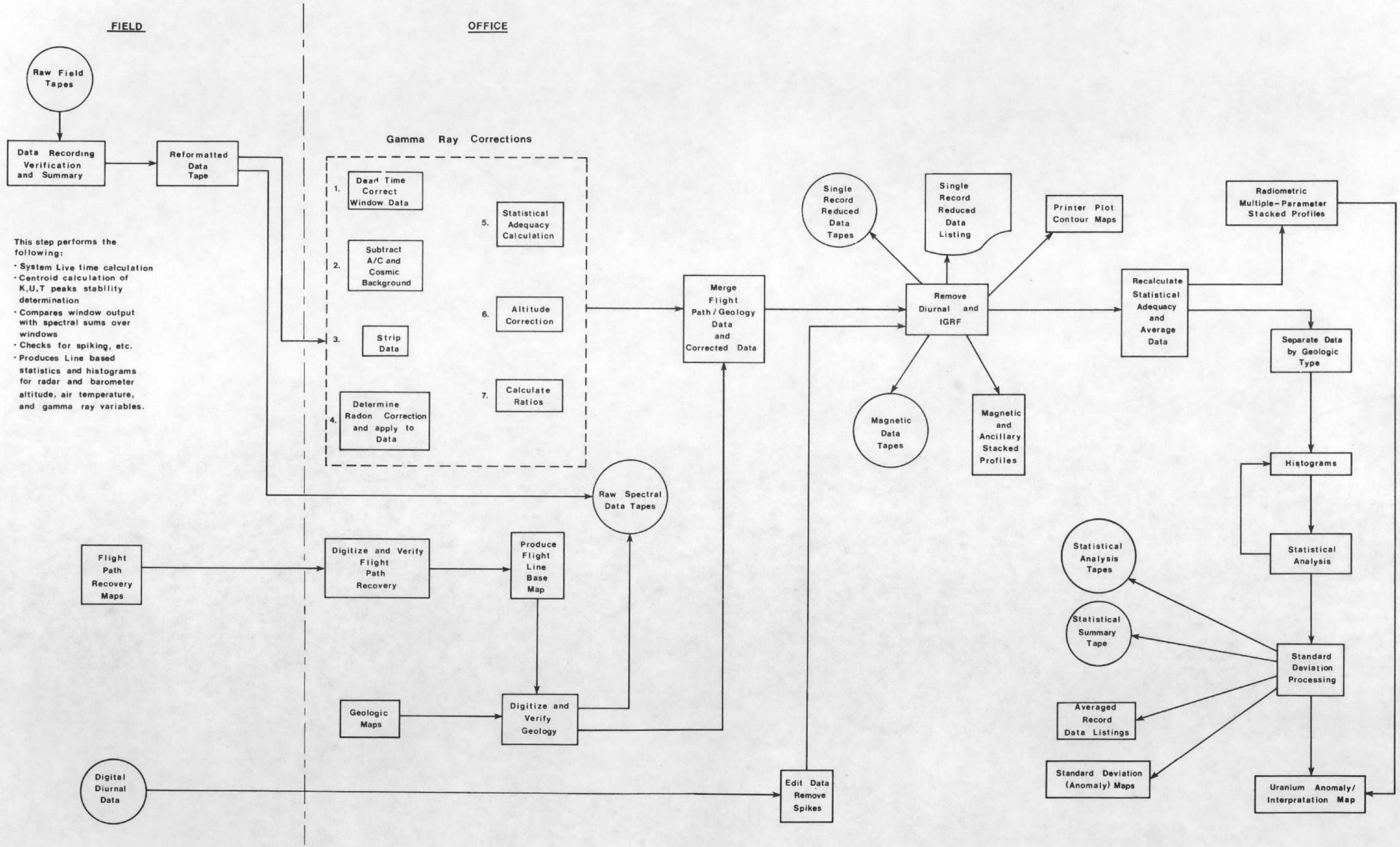
Aircraft and Cosmic background for the Queen Air/Aero Commander over these windows are as follows:

	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:

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

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 ascribed 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 distribution. 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 distribution.

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 corrections 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.

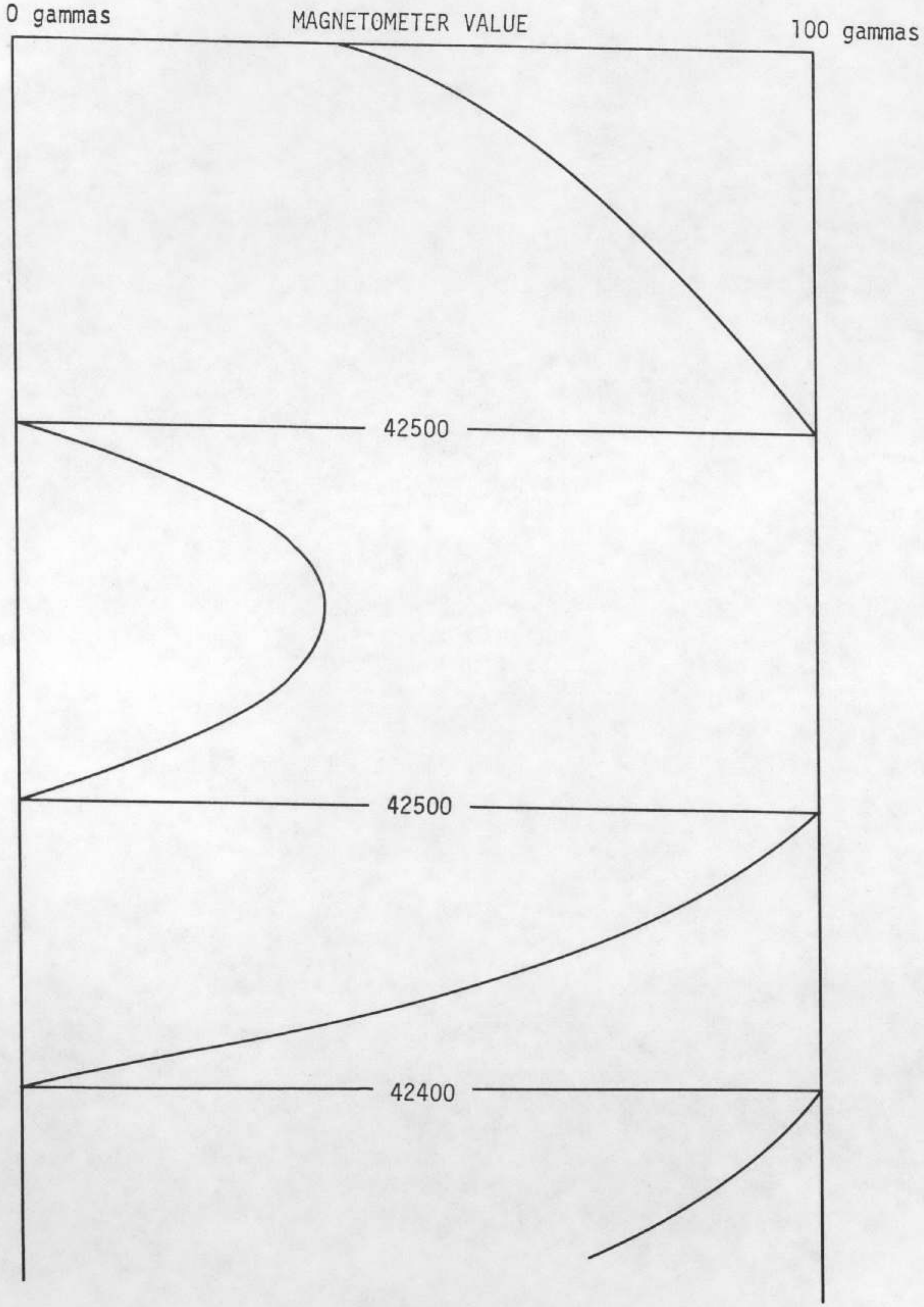


FIGURE VIII Plotter Step Value Labeling

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.

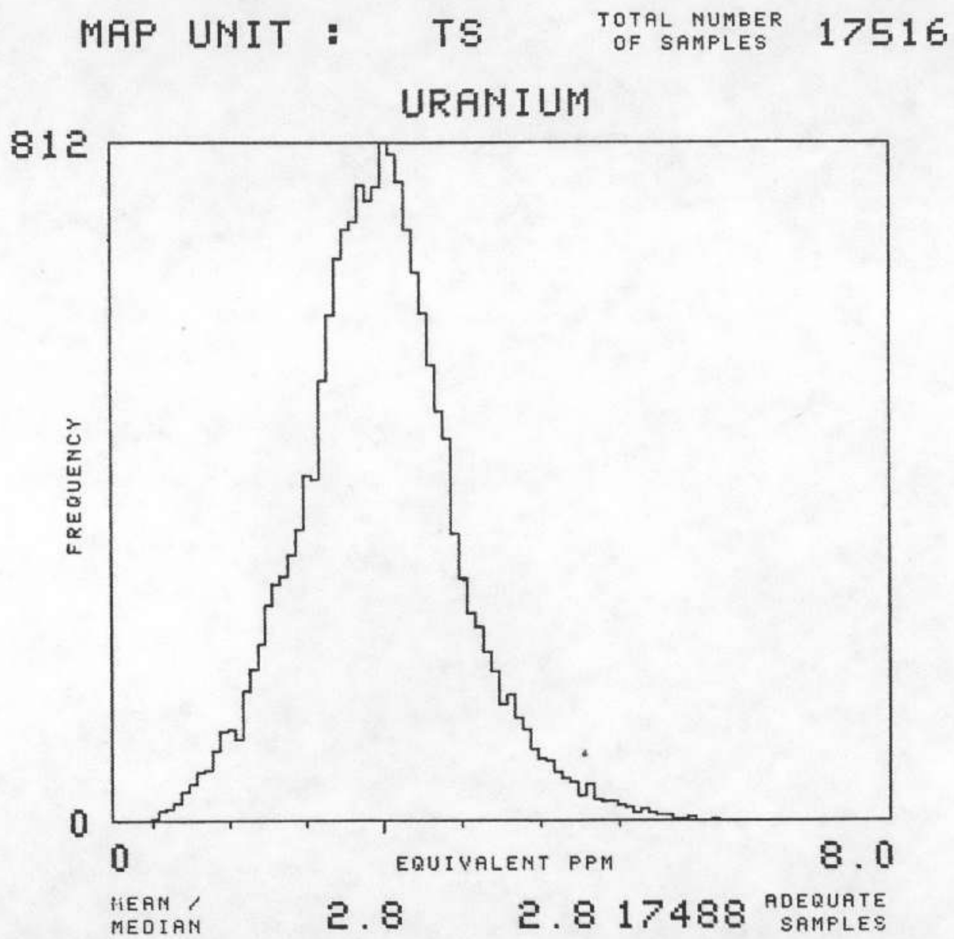


FIGURE IX Sample Computer Map Unit Histogram

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 (Tl208) 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
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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Adams, J. A. S., and Gasparini, P., 1970, Gamma-Ray Spectrometry of Rocks; Elsevier Publishing Co.

Burson, Z. G., 1974, Airborne Surveys of Terrestrial Gamma Radiation in Environmental Research; IEEE Trans. Nucl. Sci., NS-21, No. 1, p. 558-571.

Currie, L. A., 1968, Limits for Qualitative Detection and Quantitative Determination; Analytical Chemistry, Vol. 40, No. 3, p. 586-593.

Grasty, R. L., Uranium Measurement by Airborne Gamma-Ray Spectrometry; Geophysics, Vol. 40, No. 3, June 1975, p. 503-519.

Gregory, A. F., and Horwood, J. L., 1963, A Spectrometric Study of the Attenuation in Air of Gamma Rays from Mineral Resources; U.S. Atomic Energy Commission Report CEX-60-3, Washington, D.C.

McSharry, P. J. and Emerson, D. W., The Collection and Processing of Gamma Ray Spectrometer Data; 2nd International Conference on Geophysics of the Earth and Oceans, Sydney, Australia, January 1973.

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

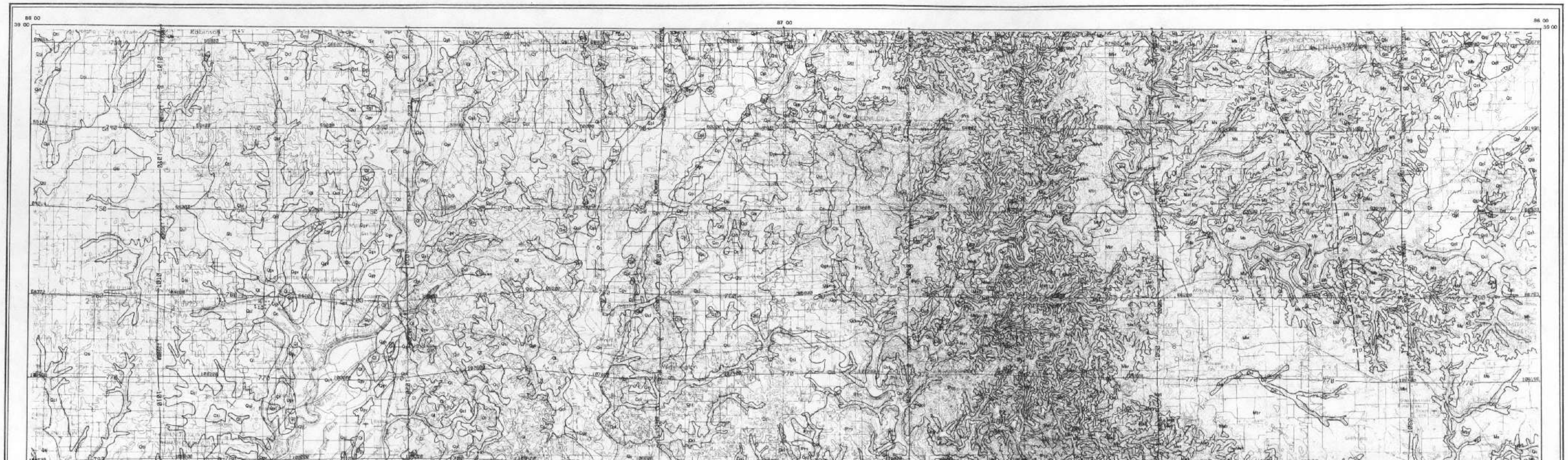
Nov. 21	200 line miles Cincinnati
22	480 " " Vincennes
23-25	Weather - nil production
26	480 line miles Vincennes
27-30	Weather - nil production
Dec. 1	448 line miles Cincinnati, Vincennes
2	Weather - nil production
3	528 line miles Vincennes, Indianapolis
4	368 " " Indianapolis
5	206 " " "
6	206 " " "
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

VINCENNES



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

FIDUCIAL NUMBER

123400 — 053-0 — 123800

LINE NUMBER

FLIGHT LINE SPACING .... 6.0 MILE(S)

FLIGHT ALTITUDE .... 400 FEET AMT

FLOWN AND COMPILED 1980

N

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

LOCATION DIAGRAM

FLIGHT PATH RECOVERY

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

VINCENNES QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

UNCONSOLIDATED DEPOSITS

CENOZOIC — QUATERNARY

HOLOCENE

Qm
Modified land
Coal strip mines, rock quarries, and gravel pits

Qc
Cahokia Alluvium
Poorly sorted sand, silt or clay conglomerate

PLEISTOCENE

Qpl
Parkland Sand
Well sorted, medium grained sand

Ql
Eolian silt
Silt, fine sand and clay

Qcl
Equality Formation
Well-bedded silt and clay

Qgv\Qgp
Qgv, valley-plain deposits
Qgp, outwash-plains deposits

Qsi
Alluvium, colluvial and lacustrine
Silt, sand and gravel

Qgk
Ice-contact stratified drift
Gravel, sand and some silt

Qti
Glasford Formation
Silty till with little gravel

BEDROCK UNITS

PALEOZOIC

PENNSYLVANIAN

IPmc
McLeansboro group
Shale, sandstone, limestone, clay and coal

IPc
Carbondale group
Shale, sandstone, limestone, clay and coal

IPrc
Raccoon Creek group
Shale, sandstone, limestone, clay, and coal

MISSISSIPPIAN

Mc
Menard Formation
Varicolored shale, sandstone and limestone

Mst
Stephensport group
Limestone, sandstone and shale

Mwb
West Baden group
Shale, sandstone and limestone

Mbr
Blue River group
Fine-grained limestone

Ms
Sanders group
Coarse-grained fossiliferous limestone

Mb
Borden group
Siltstone, shale, sandstone and some limestone

GEOLOGIC SYMBOLS

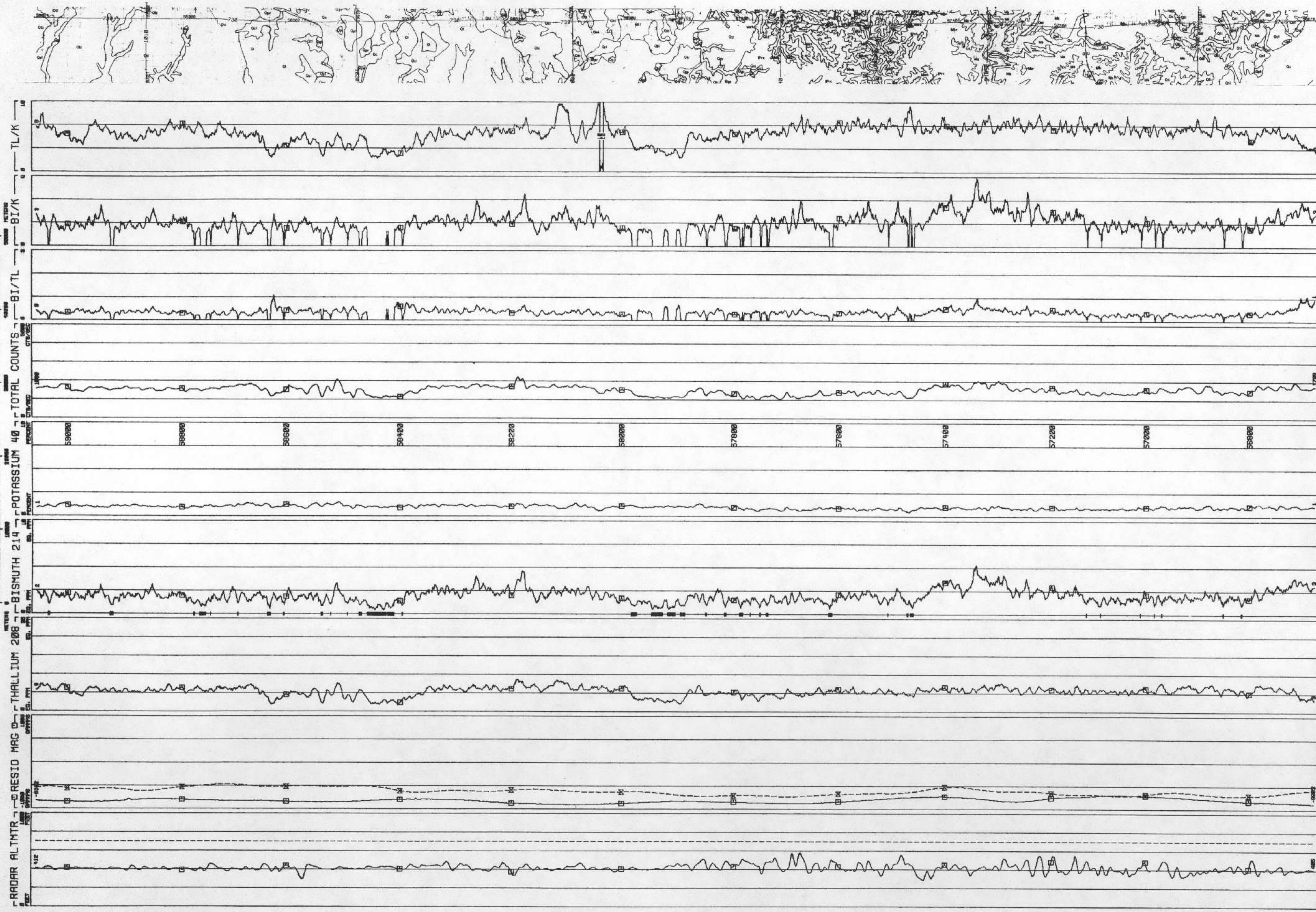
CONTACT

FAULTS, dashed where approximate

wa WATER BODIES

APPENDIX D - Profiles

LINE 730
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



TL/K
MIN 1.891
MAX 11.22
MEAN 5.622
STD DEV 1.353

BI/K
MIN .0000
MAX 5.947
MEAN 1.958
STD DEV .8931

BI/TL
MIN .0000
MAX 1.080
MEAN .3472
STD DEV .1573

TOTAL COUNTS CTS/SEC
MIN 1016
MAX 2205
MEAN 1514
STD DEV 212.2

POTASSIUM 40 PERCENT
MIN .4651
MAX 1.519
MEAN .9938
STD DEV .1560

BISMUTH 214 EQ. PPM
MIN .9499
MAX 5.314
MEAN 2.084
STD DEV .6612

THALLIUM 208 EQ. PPM
MIN 1.841
MAX 8.681
MEAN 5.490
STD DEV 1.207

BI AIR CORR EQ. PPM
MIN 1.350
MAX 2.662
MEAN 1.917
STD DEV .3475

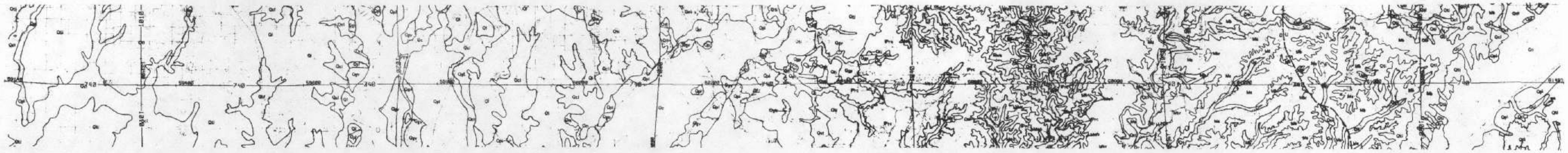
RESID MAG GAMMAS
MIN -907.4
MAX -689.2
MEAN -817.8
STD DEV 54.02

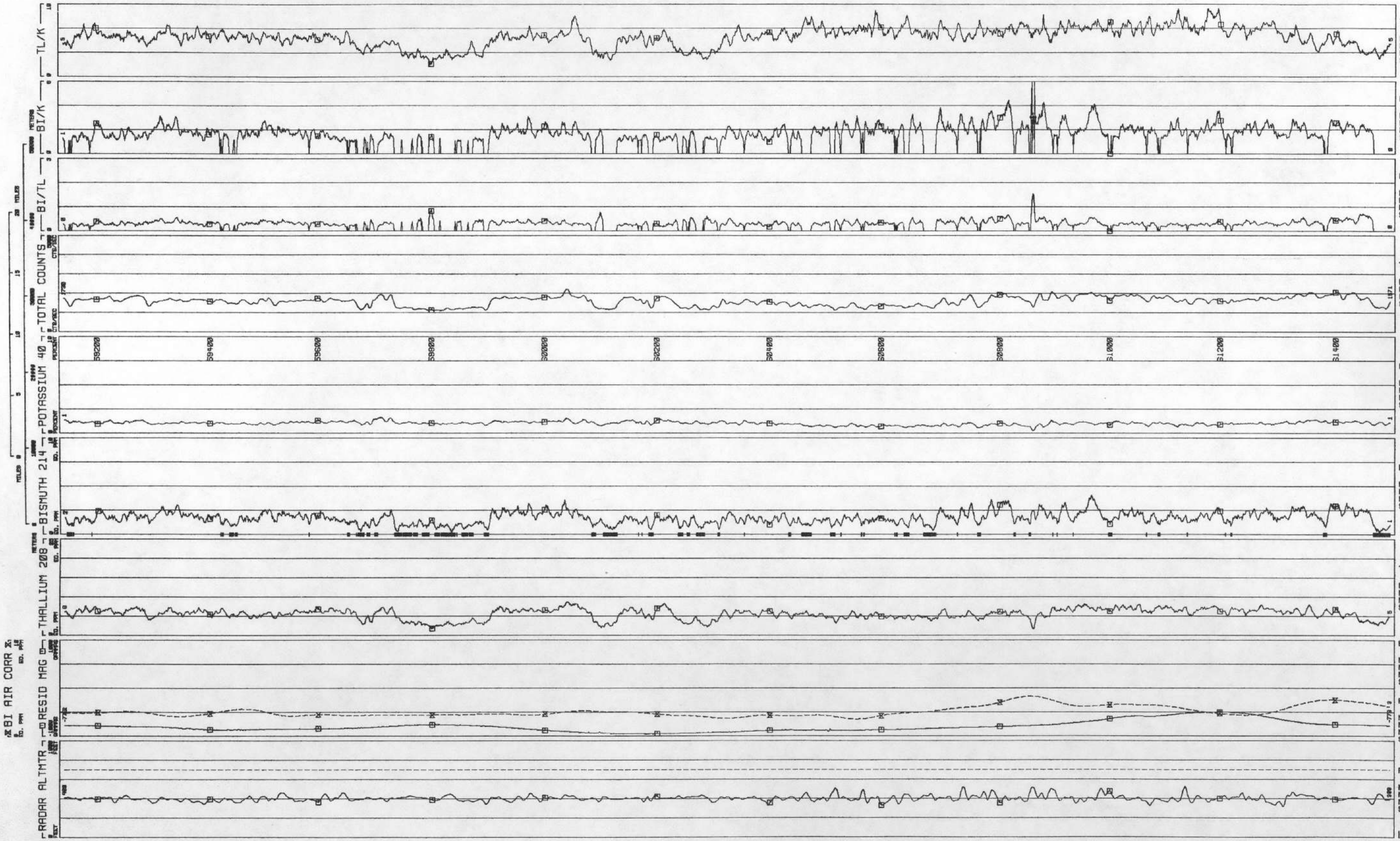
RADAR ALTMTR FEET
MIN 287.1
MAX 578.2
MEAN 416.6
STD DEV 38.94

LINE 730

D2

LINE 740
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



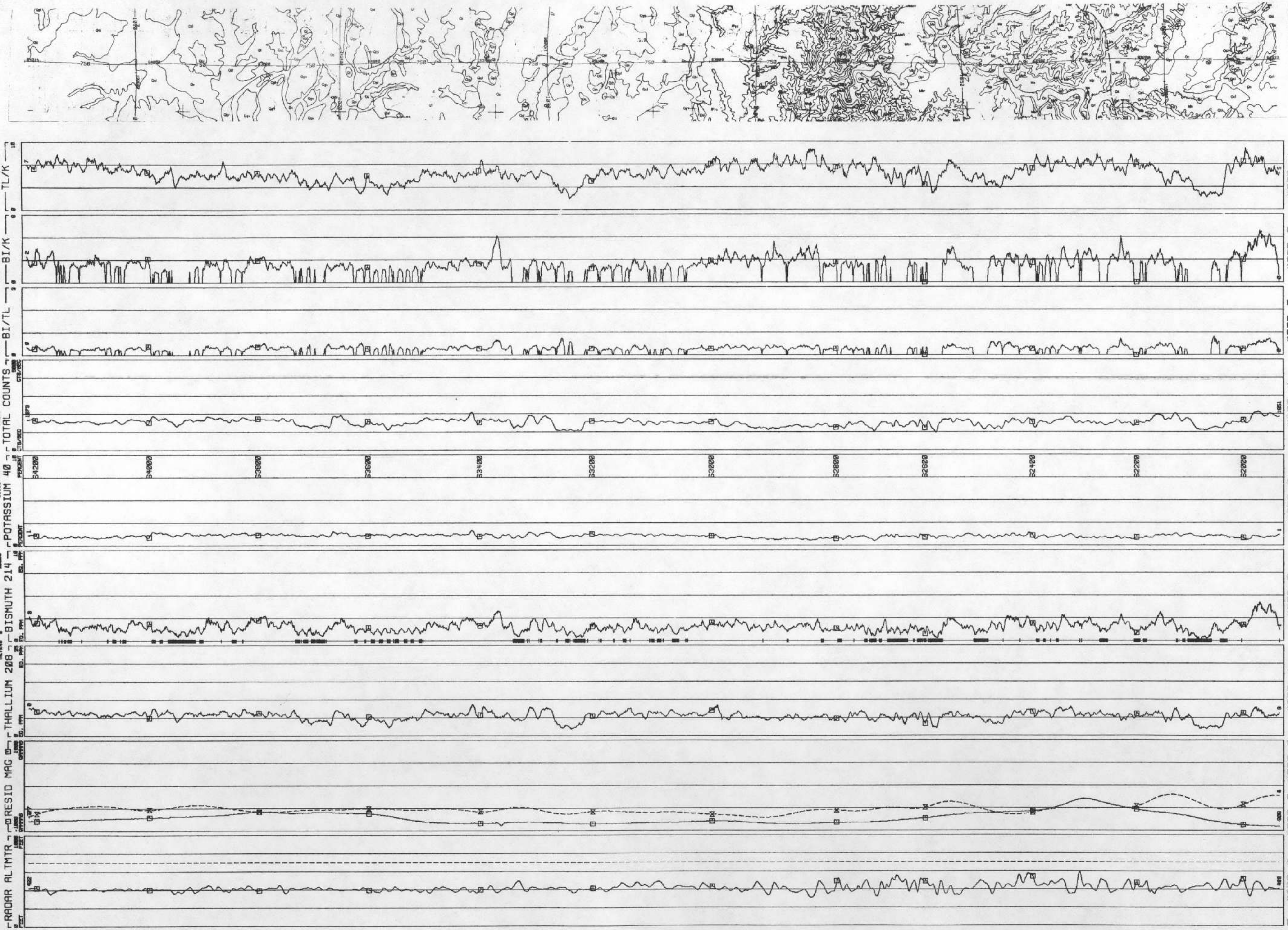


	MIN	MAX	MEAN	STD DEV
TL/K	1.675	9.382	5.530	1.332
BI/K	.0000	9.409	1.568	.9064
BI/TL	.0000	1.532	.2787	.1586
TOTAL COUNTS CTS/SEC	1106	2203	1588	231.3
POTASSIUM 40 PERCENT	.2668	1.657	1.024	.1777
BISMUTH 214 EQ. PPM	1.000	4.040	1.881	.5140
THALLIUM 208 EQ. PPM	1.639	8.686	5.574	1.332
BI AIR CORR EQ. PPM	1.768	4.135	2.571	.5421
RESID MAG GAMMAS	-955.8	-499.8	-796.4	112.7
RADAR ALTMTR FEET	319.2	522.7	403.0	28.17

LINE 740

D3

LINE 750
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



TL/K

MIN	1.594
MAX	9.015
MEAN	5.403
STD DEV	1.297

BI/K

MIN	.0000
MAX	4.567
MEAN	1.297
STD DEV	.9344

BI/TL

MIN	.0000
MAX	.8198
MEAN	.2345
STD DEV	.1642

TOTAL COUNTS
CTS/SEC

MIN	975.6
MAX	2115
MEAN	1522
STD DEV	198.0

POTASSIUM 40
PERCENT

MIN	.4863
MAX	1.672
MEAN	1.033
STD DEV	.1821

BISMUTH 214
EQ. PPM

MIN	.8195
MAX	4.221
MEAN	1.756
STD DEV	.5040

THALLIUM 208
EQ. PPM

MIN	1.766
MAX	8.590
MEAN	5.466
STD DEV	1.192

BI AIR CORR
EQ. PPM

MIN	1.450
MAX	3.963
MEAN	2.412
STD DEV	.4699

RESID MAG
GAMMAS

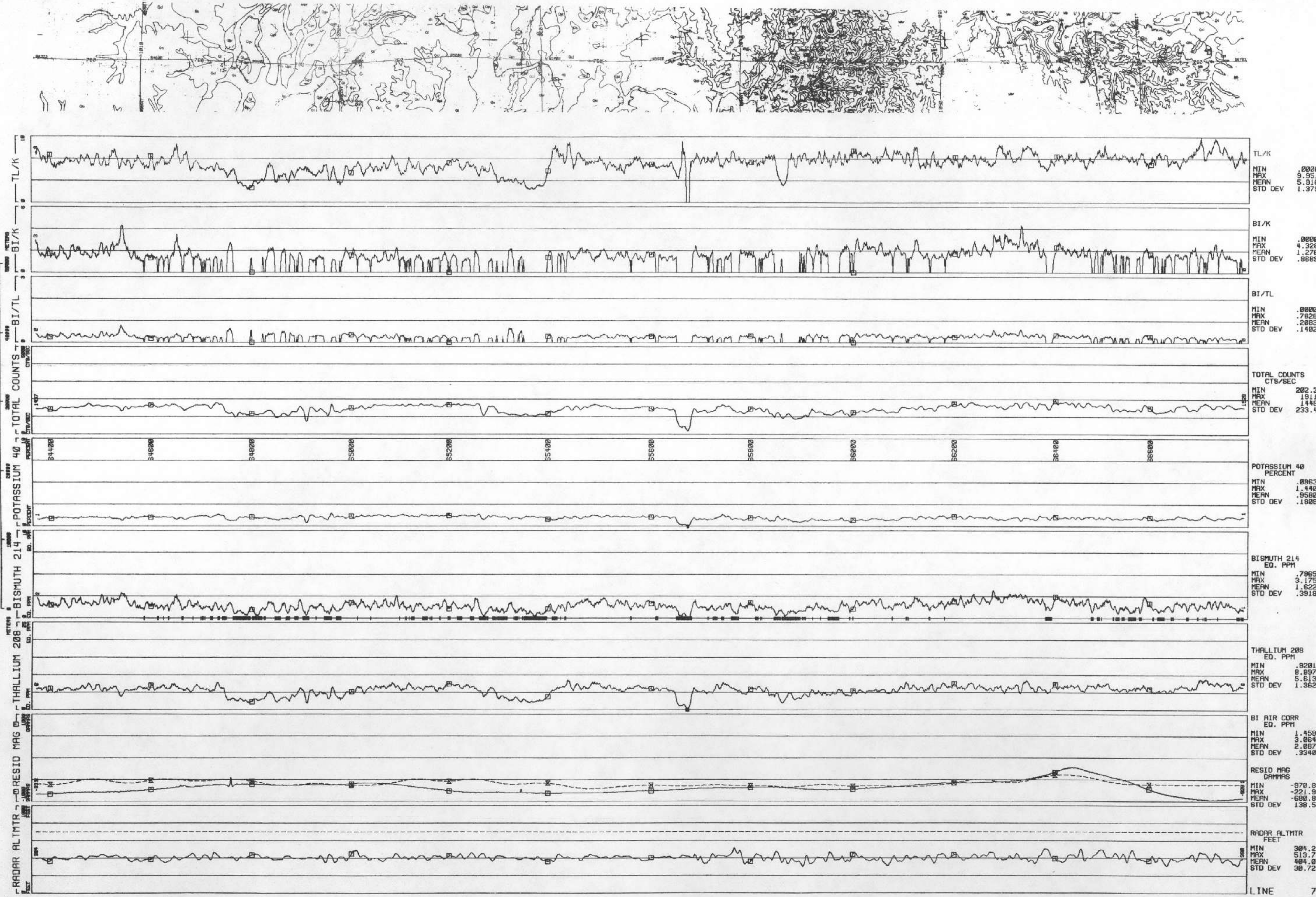
MIN	-909.9
MAX	-294.4
MEAN	-714.5
STD DEV	129.6

RADAR ALTMTR
FEET

MIN	308.5
MAX	590.1
MEAN	419.0
STD DEV	39.49

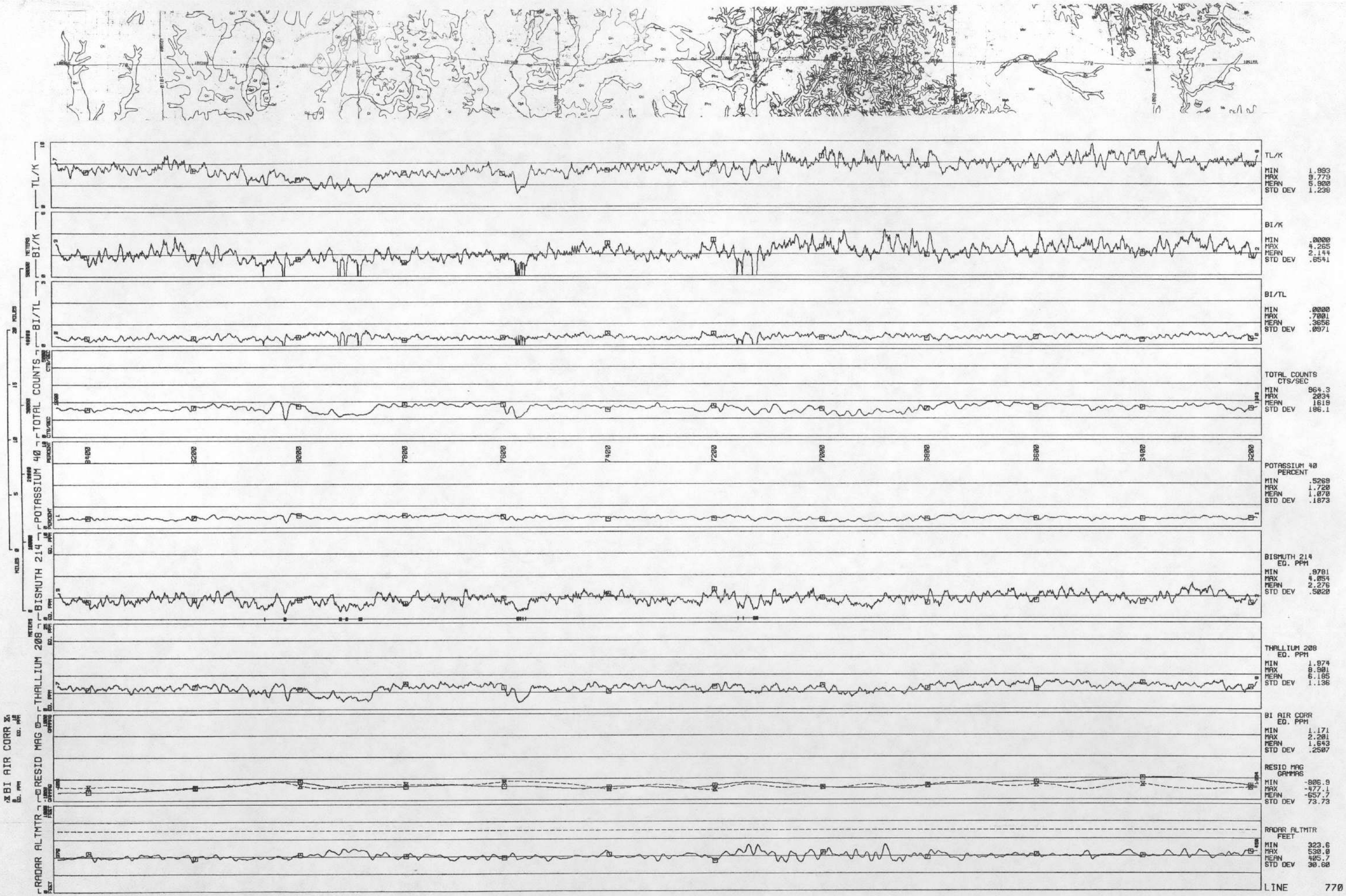
LINE 750

LINE 760
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



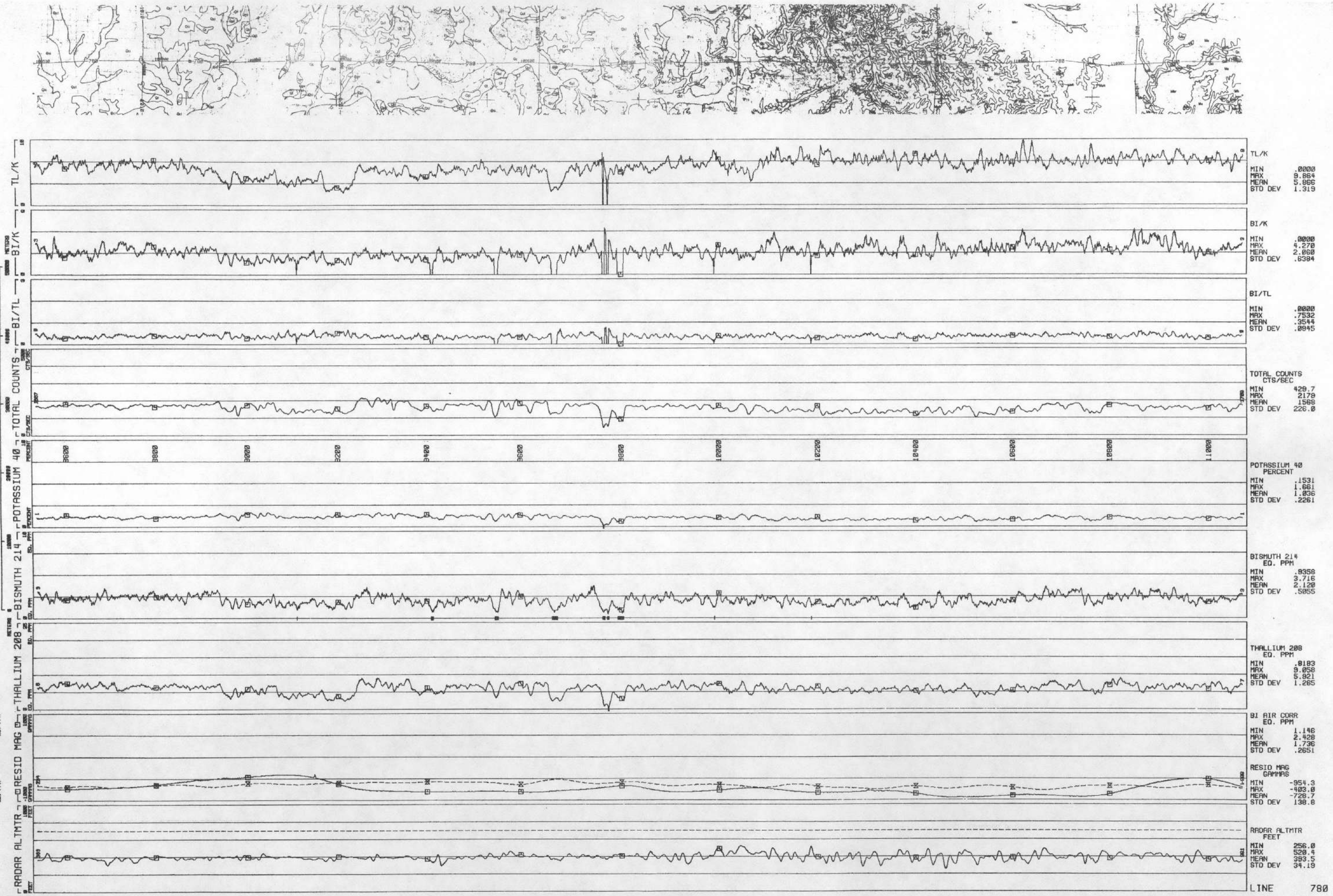
LINE 760

D5
v

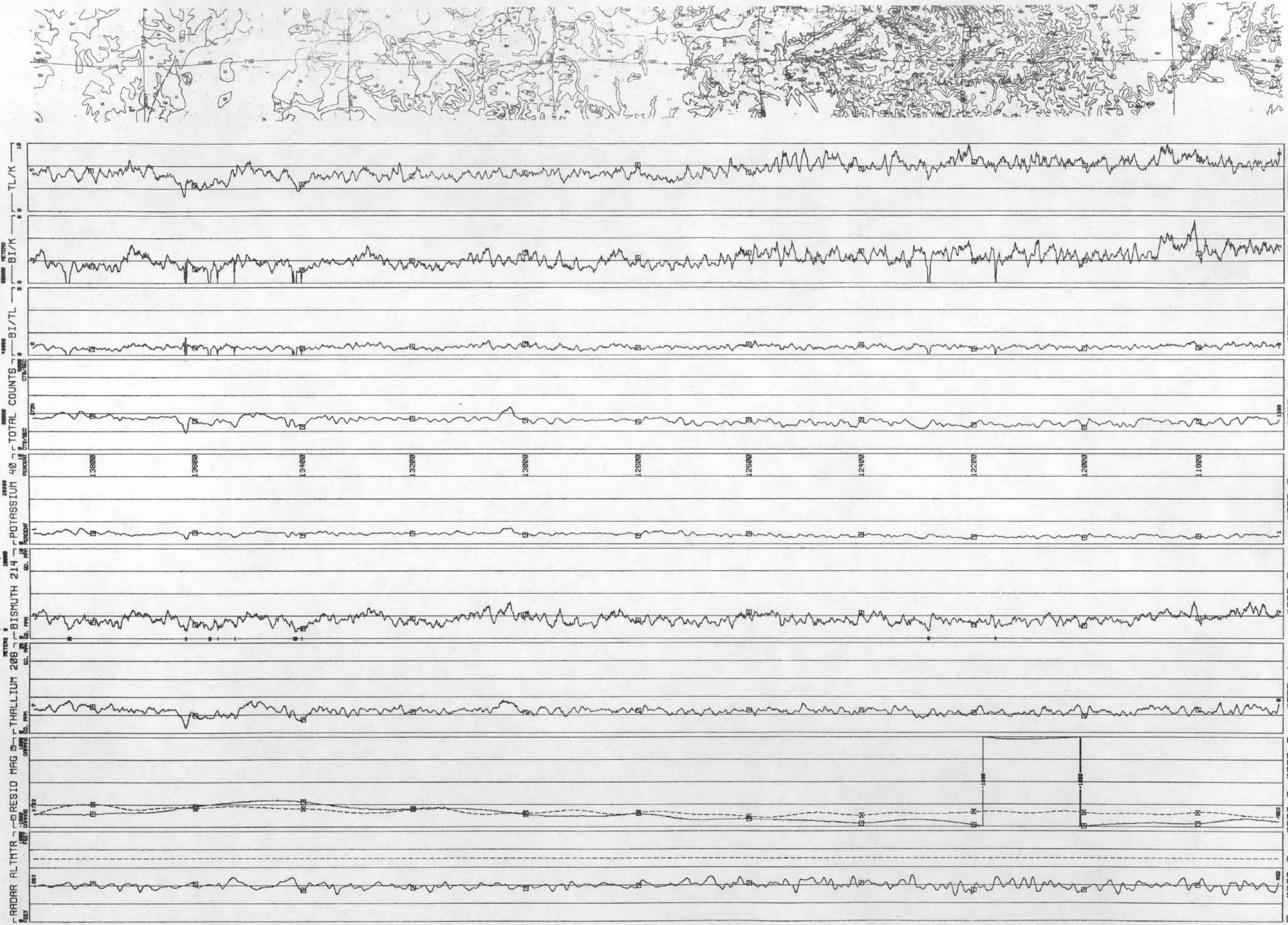

LINE 770
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331
TL/K
MIN 1.893
MAX 9.779
MEAN 5.900
STD DEV 1.238
BI/K
MIN .0000
MAX 4.265
MEAN 2.144
STD DEV .6541
BI/TL
MIN .0000
MAX .7001
MEAN .3656
STD DEV .0971
TOTAL COUNTS CTS/SEC
MIN 964.3
MAX 2034
MEAN 1619
STD DEV 186.1
POTASSIUM 40 PERCENT
MIN .5269
MAX 1.720
MEAN 1.070
STD DEV .1873
BISMUTH 214 EQ. PPM
MIN .0701
MAX 4.054
MEAN 2.276
STD DEV .5020
THALLIUM 208 EQ. PPM
MIN 1.974
MAX 8.801
MEAN 6.105
STD DEV 1.136
BI AIR CORR EQ. PPM
MIN 1.171
MAX 2.201
MEAN 1.643
STD DEV .2507
RESID MAG GAMMAS
MIN -806.9
MAX -477.1
MEAN -657.7
STD DEV 73.73
RADAR ALTMTR FEET
MIN 323.6
MAX 530.0
MEAN 405.7
STD DEV 30.60
LINE 770

D6

LINE 780
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331



LINE 790
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331



TL/K

MIN	2.148
MAX	9.997
MEAN	6.097
STD DEV	1.203

BI/K

MIN	.0000
MAX	5.620
MEAN	2.159
STD DEV	.7094

BI/TL

MIN	.0000
MAX	.7960
MEAN	.3528
STD DEV	.0896

TOTAL COUNTS
CTS/SEC

MIN	888.7
MAX	2358
MEAN	1577
STD DEV	191.6

POTASSIUM 40
PERCENT

MIN	.5073
MAX	1.787
MEAN	1.023
STD DEV	.2175

BISMUTH 214
EQ. PPM

MIN	.9514
MAX	4.084
MEAN	2.146
STD DEV	.5179

THALLIUM 208
EQ. PPM

MIN	1.374
MAX	8.187
MEAN	6.052
STD DEV	.9463

BI AIR CORR
EQ. PPM

MIN	1.047
MAX	2.575
MEAN	1.678
STD DEV	.3413

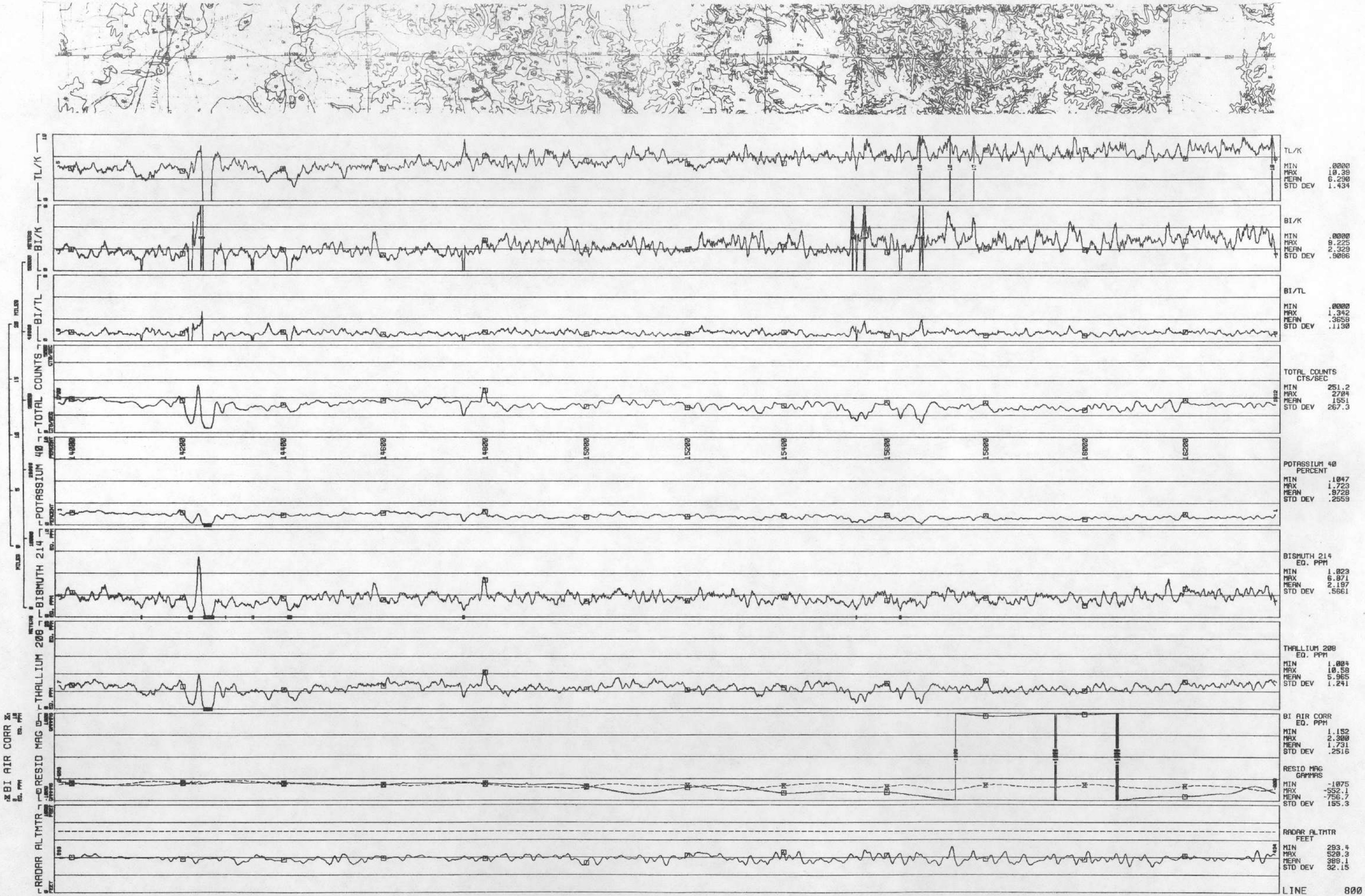
RESID MAG
GAMMAS

MIN	-1053
MAX	-404.8
MEAN	-760.6
STD DEV	171.4

RADAR ALTMTR
FEET

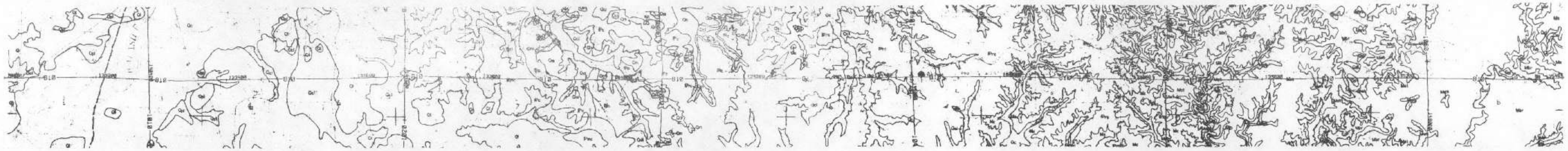
MIN	279.8
MAX	510.8
MEAN	398.5
STD DEV	34.91

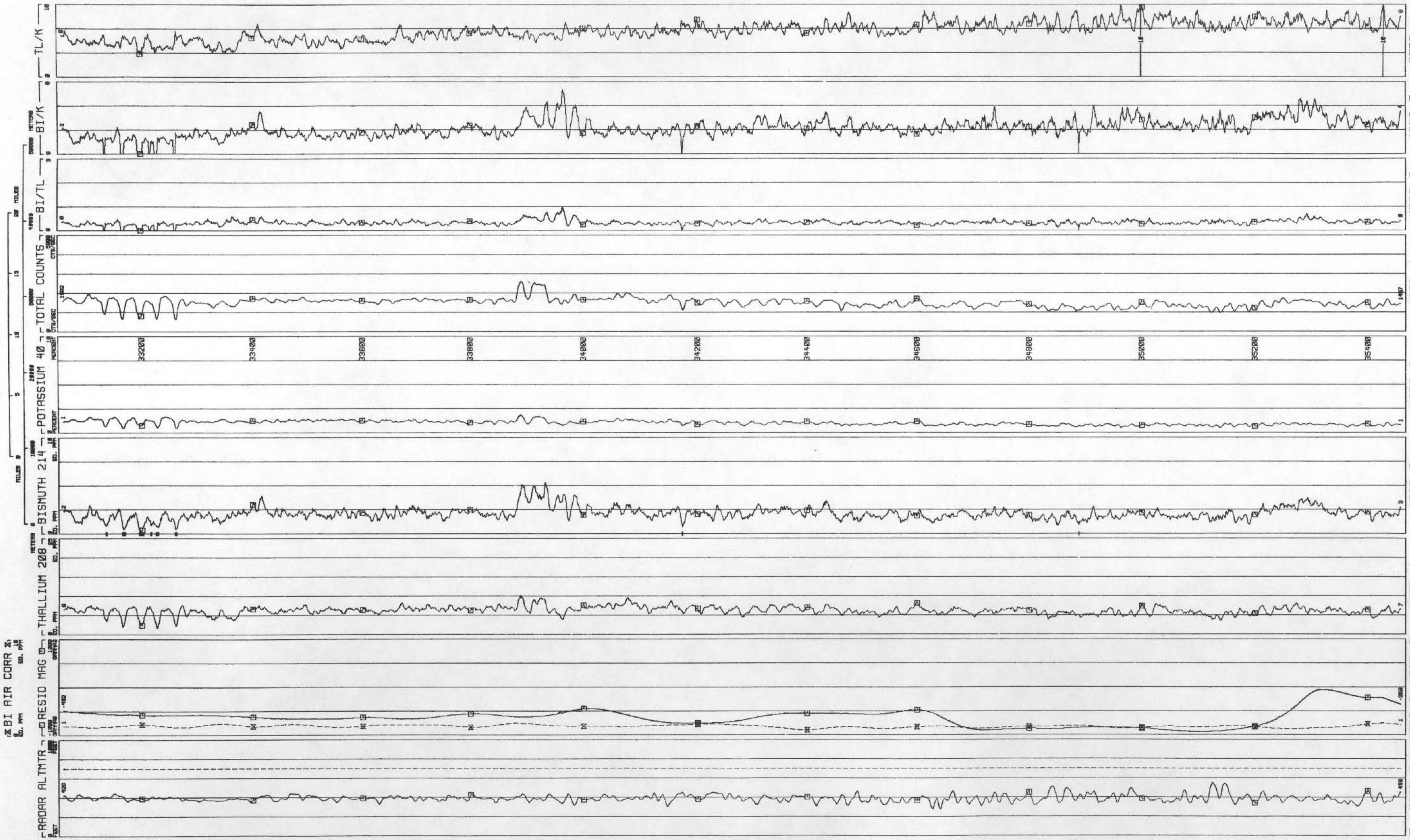
LINE 790


LINE 800
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331
TL/K
MIN .0000
MAX 10.39
MEAN 6.290
STD DEV 1.434
BI/K
MIN .0000
MAX 9.225
MEAN 2.329
STD DEV .9086
BI/TL
MIN .0000
MAX 1.342
MEAN .3658
STD DEV .1130
TOTAL COUNTS CTS/SEC
MIN 251.2
MAX 2704
MEAN 1551
STD DEV 267.3
14000
14200
14400
14600
14800
15000
15200
15400
15600
15800
16000
16200
POTASSIUM 40 PERCENT
MIN .1047
MAX 1.723
MEAN .9728
STD DEV .2559
BISMUTH 214 EQ. PPM
MIN 1.023
MAX 6.871
MEAN 2.197
STD DEV .5661
THALLIUM 208 EQ. PPM
MIN 1.004
MAX 10.58
MEAN 5.965
STD DEV 1.241
BI AIR CORR EQ. PPM
MIN 1.152
MAX 2.300
MEAN 1.731
STD DEV .2516
RESID MAG GAMMAS
MIN -1075
MAX -552.1
MEAN -756.7
STD DEV 155.3
RADAR ALTMTR FEET
MIN 293.4
MAX 520.3
MEAN 388.1
STD DEV 32.15
LINE 800

D9 v

LINE 810
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336





TL/K
MIN 3.140
MAX 10.29
MEAN 6.353
STD DEV 1.225

BI/K
MIN .0000
MAX 5.329
MEAN 2.129
STD DEV .7063

BI/TL
MIN .0000
MAX .9956
MEAN .3345
STD DEV .0960

TOTAL COUNTS CTS/SEC
MIN 634.7
MAX 2609
MEAN 1498
STD DEV 231.1

POTASSIUM 40 PERCENT
MIN .4853
MAX 1.848
MEAN 1.006
STD DEV .2418

BISMUTH 214 EQ. PPM
MIN .0601
MAX 5.300
MEAN 2.098
STD DEV .5926

THALLIUM 208 EQ. PPM
MIN 1.775
MAX 10.07
MEAN 6.181
STD DEV 1.025

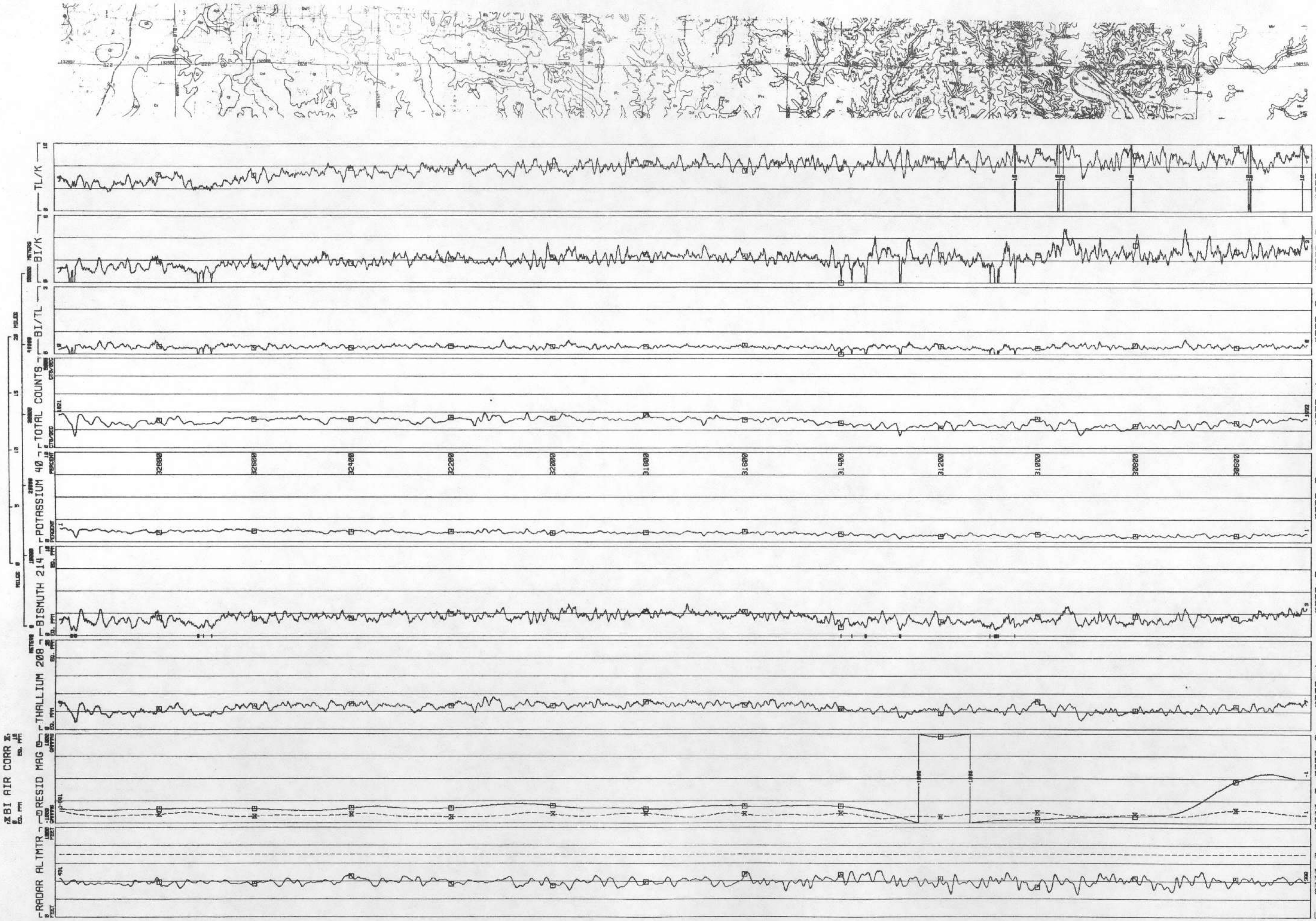
BI AIR CORR EQ. PPM
MIN .4889
MAX 1.240
MEAN .8950
STD DEV .1586

RESID MAG GAMMAS
MIN -942.4
MAX -56.94
MEAN -632.9
STD DEV 186.5

RADAR ALTMTR FEET
MIN 281.4
MAX 548.0
MEAN 389.3
STD DEV 33.84

LINE 810

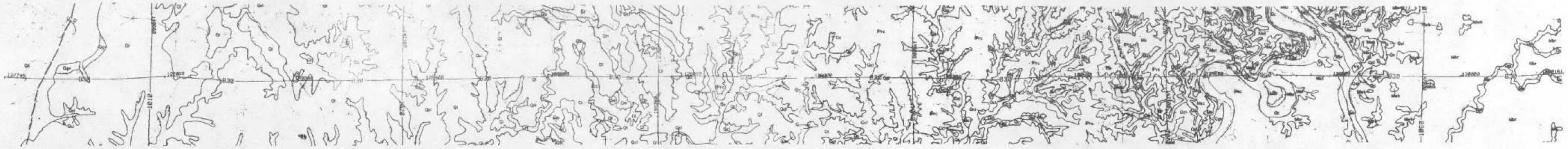
LINE 820
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336

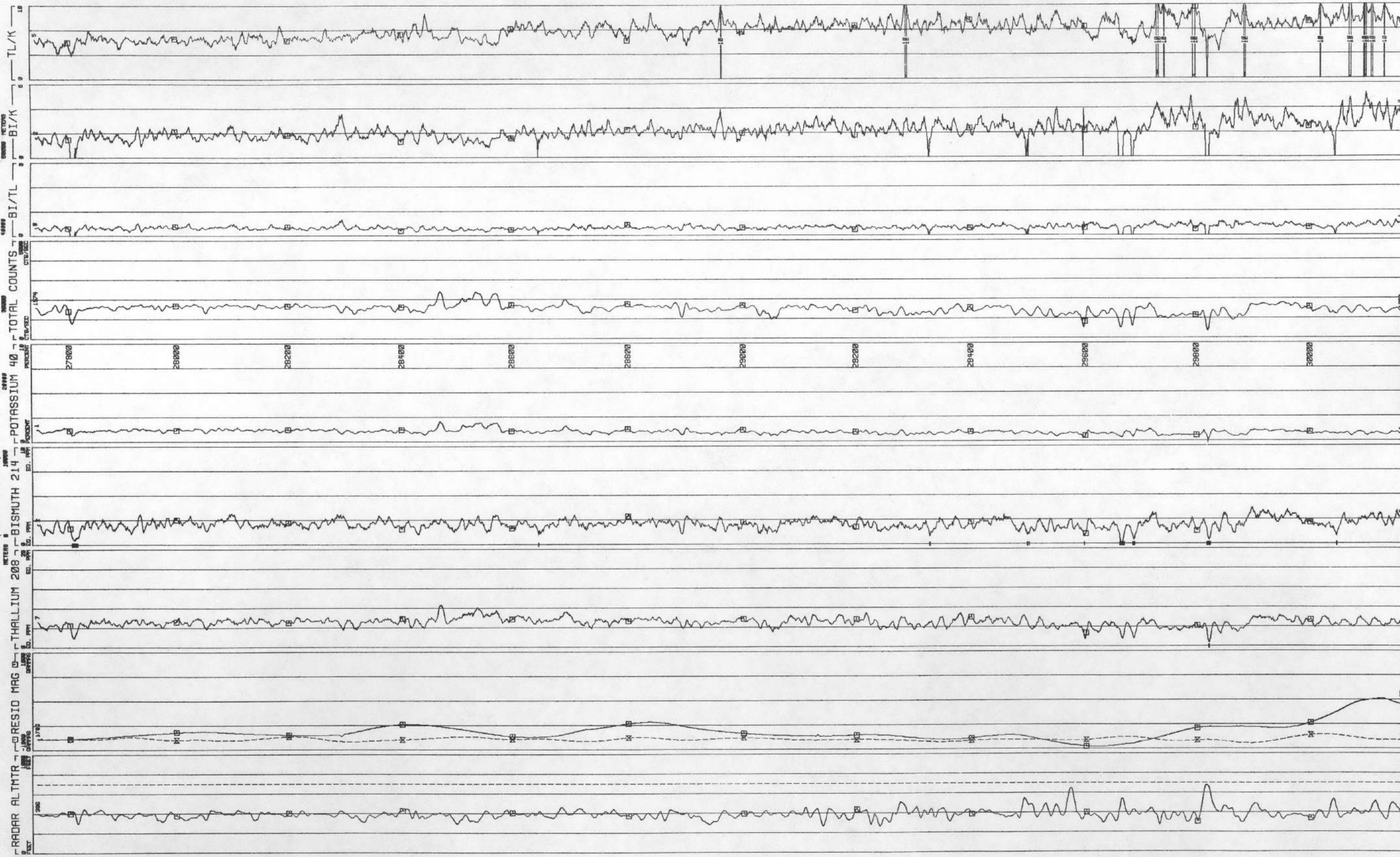


	MIN	MAX	MEAN	STD DEV
TL/K	2.884	11.15	6.585	1.423
BI/K	.0000	4.936	2.157	.6795
BI/TL	.0000	.6867	.3281	.0806
TOTAL COUNTS CTS/SEC	644.1	1966	1468	208.4
POTASSIUM 40 PERCENT	.3591	1.571	.9684	.2299
BISMUTH 214 EQ. PPM	.8187	3.618	2.027	.4871
THALLIUM 208 EQ. PPM	1.876	9.165	6.123	1.119
BI AIR CORR EQ. PPM	.5089	1.452	.9316	.1900
RESID MAG GAMMAS	-1065	109.5	-666.1	228.8
RADAR ALTMTR FEET	248.5	516.2	393.9	38.81

LINE 820

LINE 830
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336





TL/K
MIN .0000
MAX 11.01
MEAN 6.655
STD DEV 1.249

BI/K
MIN .0000
MAX 5.208
MEAN 2.195
STD DEV .7180

BI/TL
MIN .0000
MAX .6501
MEAN .3283
STD DEV .0845

TOTAL COUNTS
CTS/SEC
MIN 340.4
MAX 2410
MEAN 1497
STD DEV 244.2

POTASSIUM 40
PERCENT
MIN .1559
MAX 2.032
MEAN .9693
STD DEV .2595

BISMUTH 214
EQ. PPM
MIN .7594
MAX 3.636
MEAN 2.070
STD DEV .4558

THALLIUM 208
EQ. PPM
MIN 1.234
MAX 10.75
MEAN 6.236
STD DEV 1.144

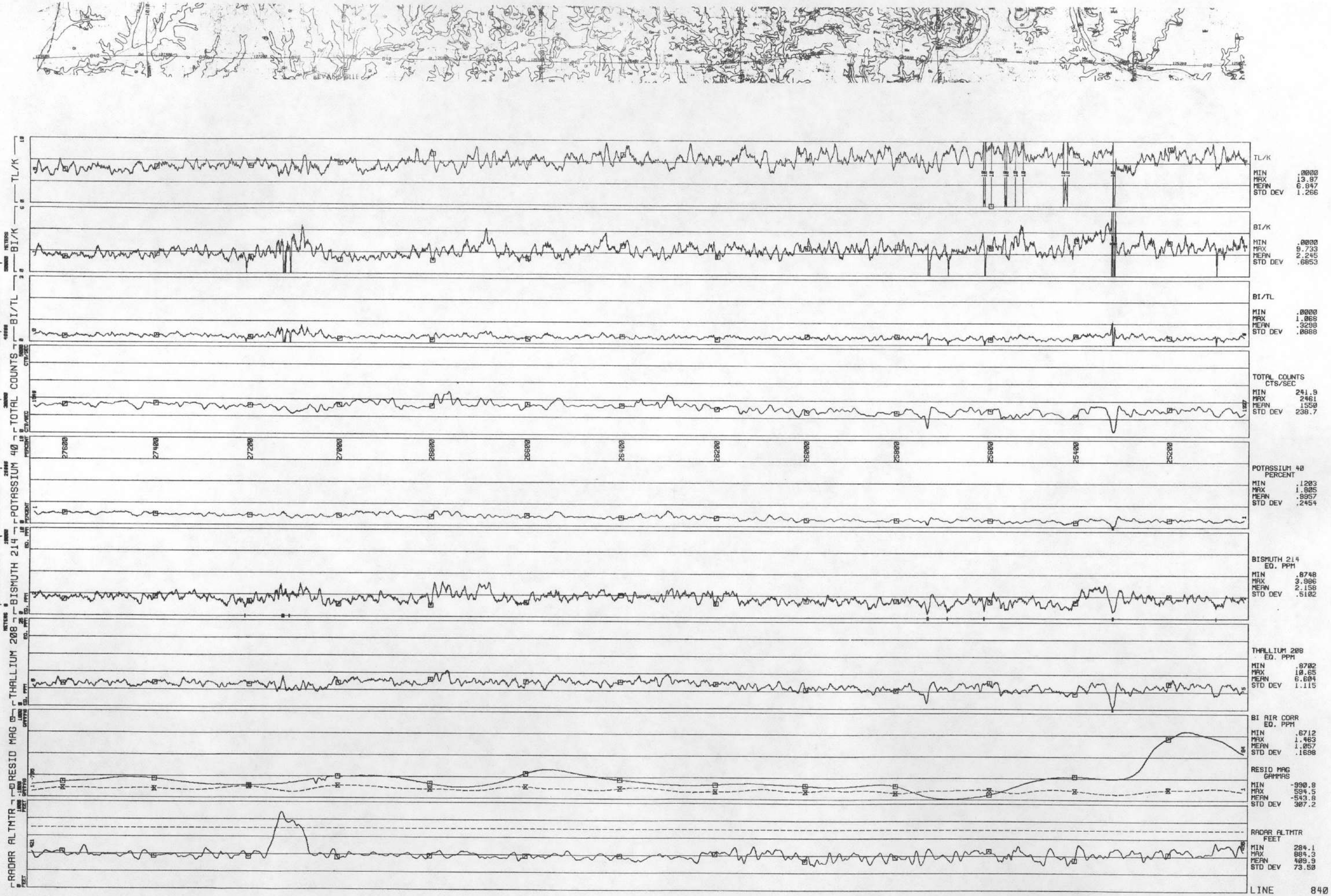
BI AIR CORR
EQ. PPM
MIN .5186
MAX 1.465
MEAN 1.015
STD DEV .1742

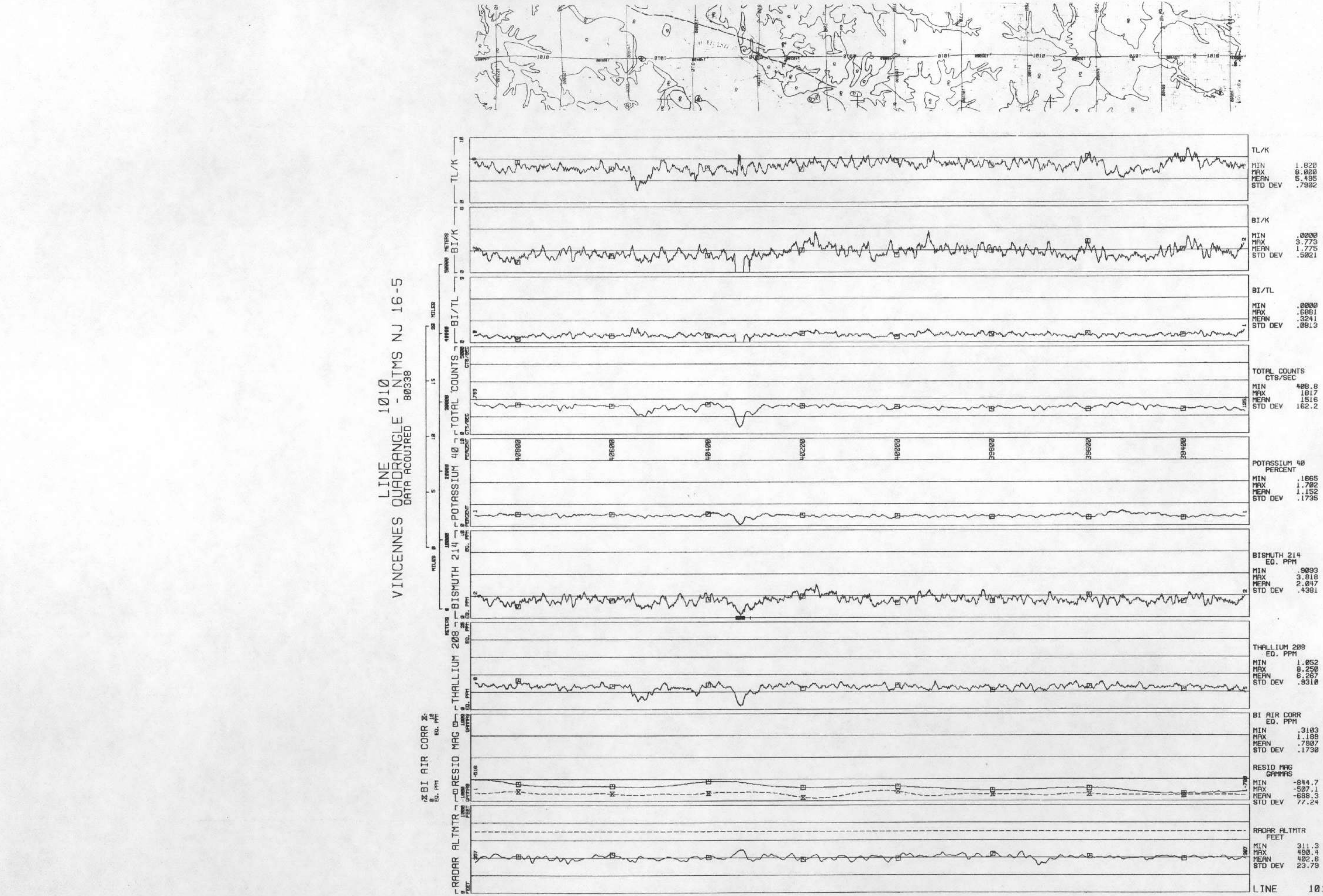
RESID MAG
GAMMAS
MIN -964.8
MAX 22.63
MEAN -641.5
STD DEV 177.8

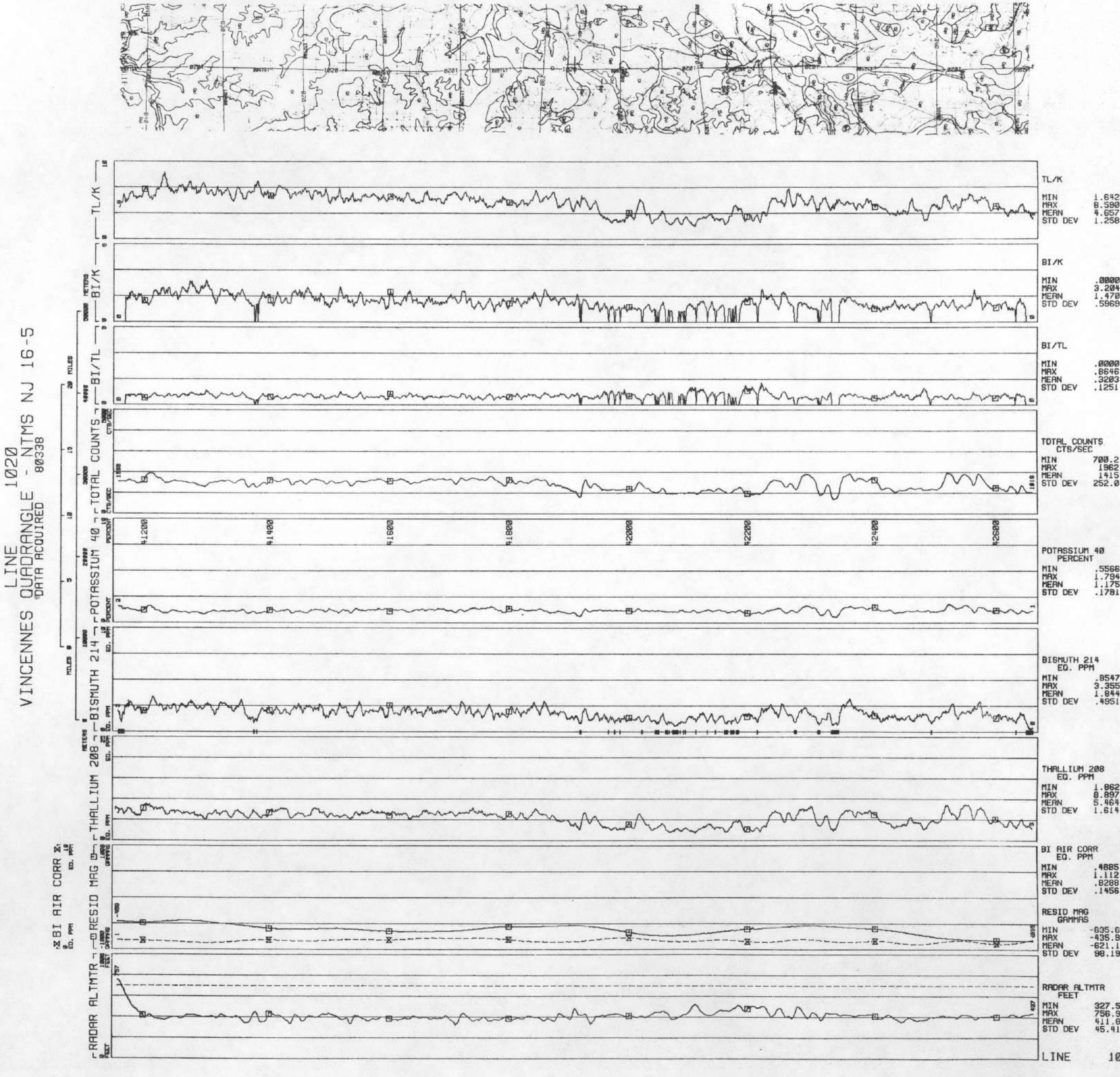
RADAR ALTMTR
FEET
MIN 266.0
MAX 675.7
MEAN 390.7
STD DEV 47.59

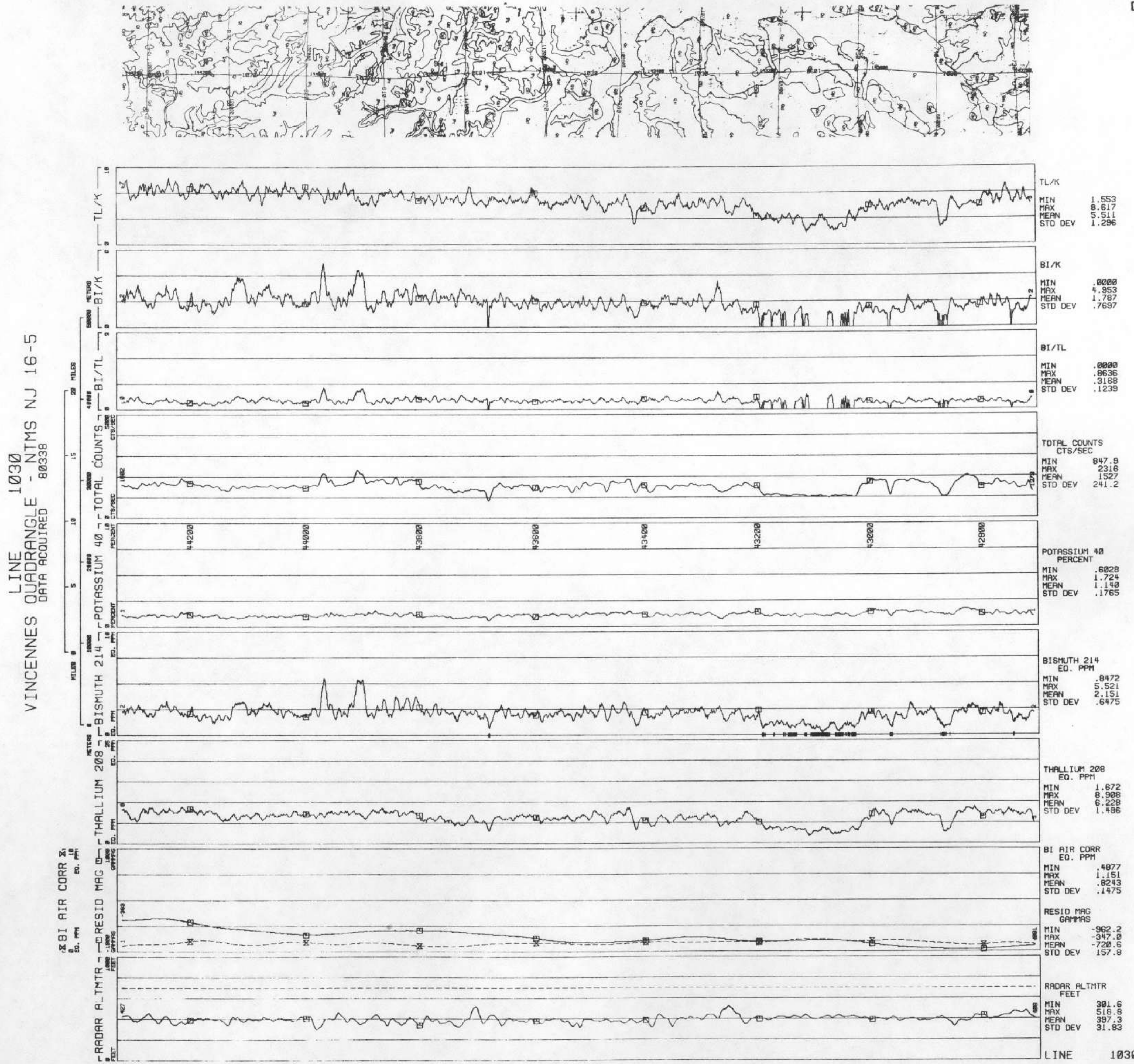
LINE 830

VINCENNES QUADRANGLE - NTMS NJ 16-5
LINE 840
DATA ACQUIRED 80336



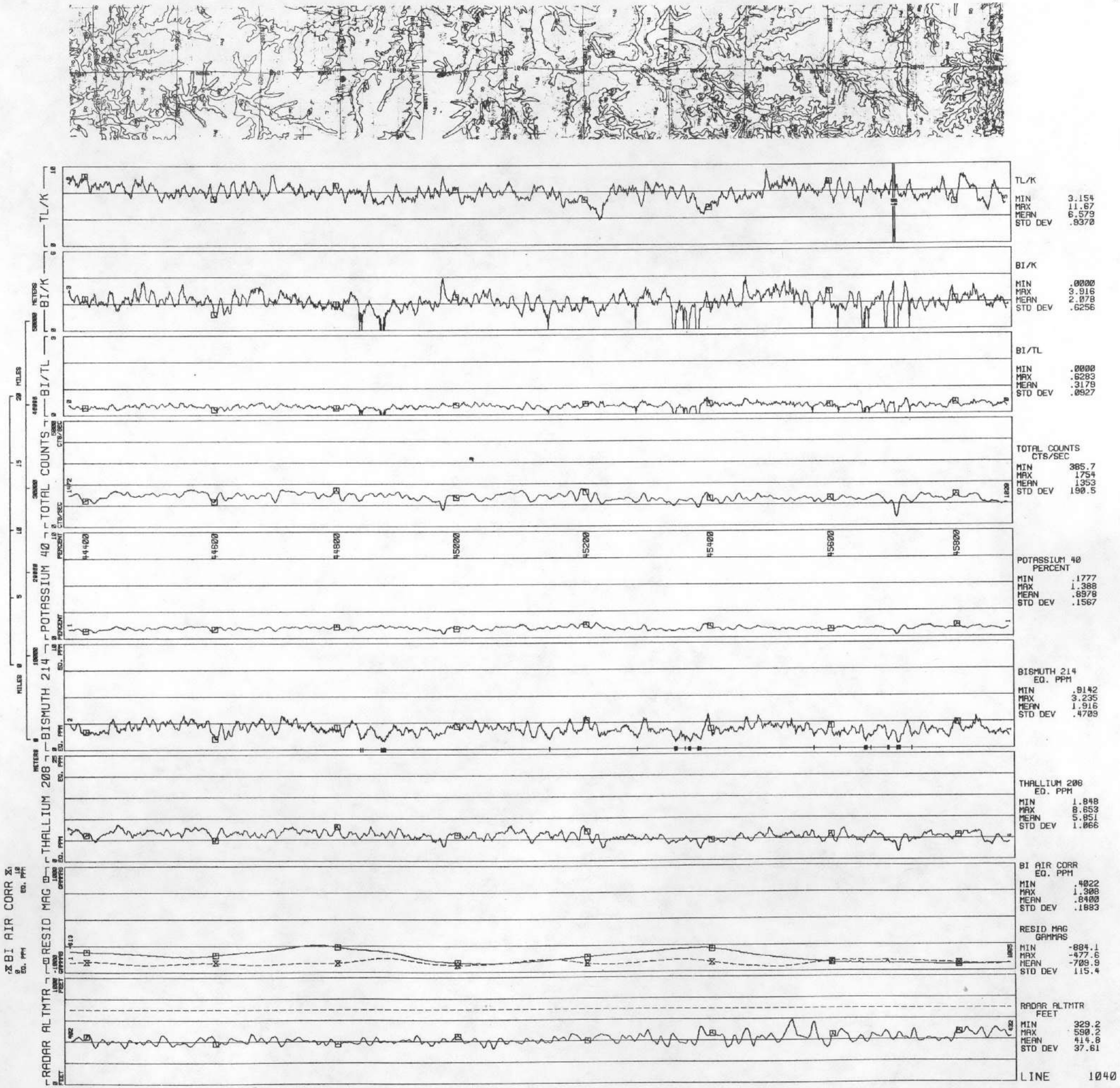

LINE 1010
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
TL/K
MIN 1.820
MAX 8.000
MEAN 5.495
STD DEV .7902
BI/K
MIN .0000
MAX 3.773
MEAN 1.775
STD DEV .5021
BI/TL
MIN .0000
MAX .6881
MEAN .3241
STD DEV .0813
TOTAL COUNTS CTS/SEC
MIN 408.8
MAX 1817
MEAN 1516
STD DEV 162.2
POTASSIUM 40 PERCENT
MIN .1665
MAX 1.702
MEAN 1.152
STD DEV .1735
BISMUTH 214 EQ. PPM
MIN .9093
MAX 3.818
MEAN 2.047
STD DEV .4381
THALLIUM 208 EQ. PPM
MIN 1.052
MAX 8.250
MEAN 6.267
STD DEV .9310
BI AIR CORR EQ. PPM
MIN .3103
MAX 1.188
MEAN .7907
STD DEV .1730
RESID MAG GAMMAS
MIN -844.7
MAX -507.1
MEAN -688.3
STD DEV 77.24
RADAR ALTMTR FEET
MIN 311.3
MAX 480.4
MEAN 402.6
STD DEV 23.79
LINE 1010

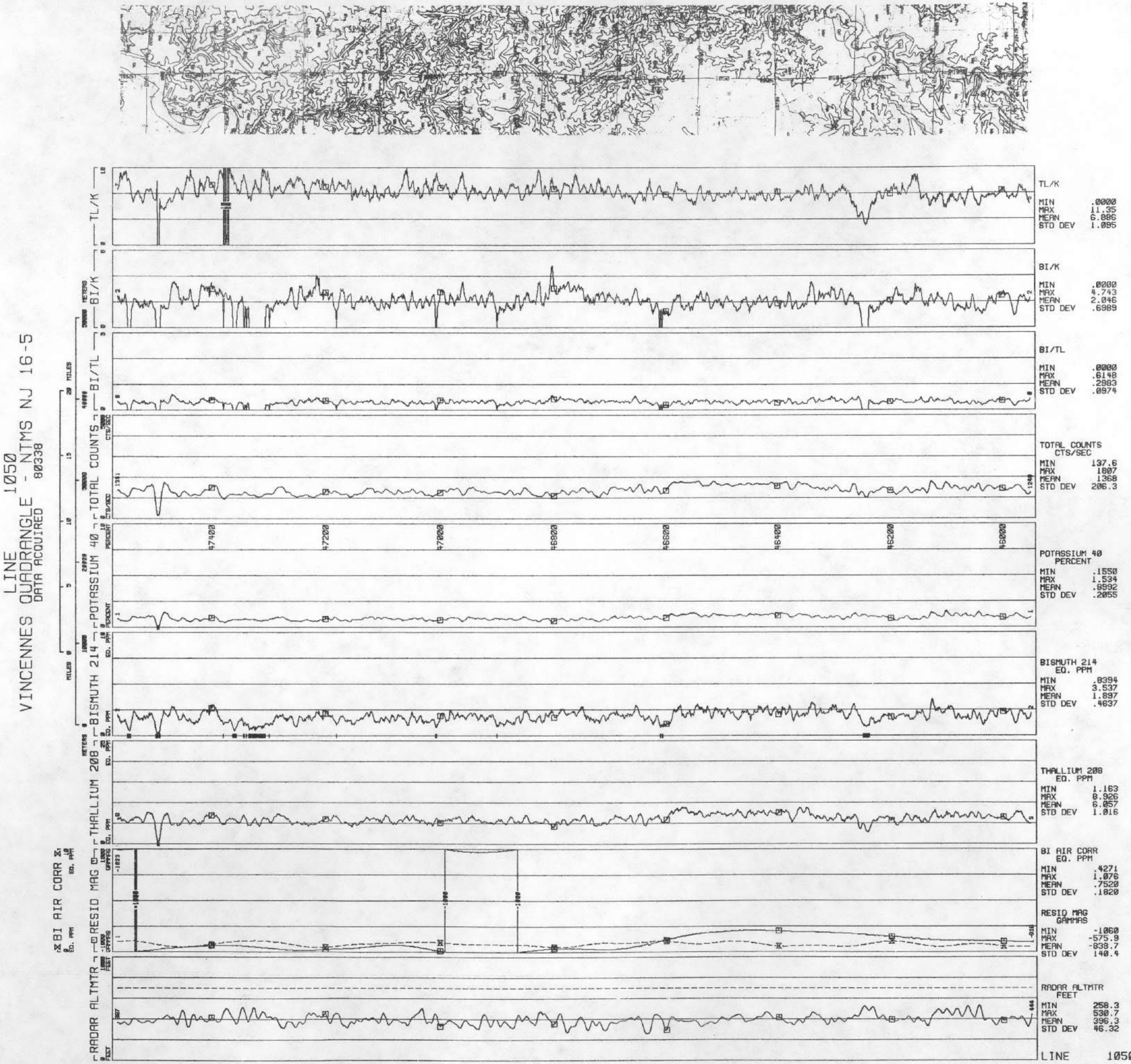

LINE 1020
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
TL/K
MIN 1.642
MAX 8.590
MEAN 4.657
STD DEV 1.258
BI/K
MIN .0000
MAX 3.204
MEAN 1.470
STD DEV .5969
BI/TL
MIN .0000
MAX .8646
MEAN .3203
STD DEV .1251
TOTAL COUNTS CTS/SEC
MIN 700.2
MAX 1962
MEAN 1415
STD DEV 252.0
POTASSIUM 40 PERCENT
MIN .5566
MAX 1.794
MEAN 1.175
STD DEV .1781
BISMUTH 214 EQ. PPM
MIN .8547
MAX 3.355
MEAN 1.844
STD DEV .4951
THALLIUM 208 EQ. PPM
MIN 1.862
MAX 8.897
MEAN 5.464
STD DEV 1.614
BI AIR CORR EQ. PPM
MIN .4885
MAX 1.112
MEAN .8288
STD DEV .1456
RESID MAG GAMMAS
MIN -835.6
MAX -435.9
MEAN -621.1
STD DEV 98.19
RADAR ALTMTR FEET
MIN 327.5
MAX 756.9
MEAN 411.8
STD DEV 45.41
41200
41400
41600
41800
42000
42200
42400
42600
LINE 1020



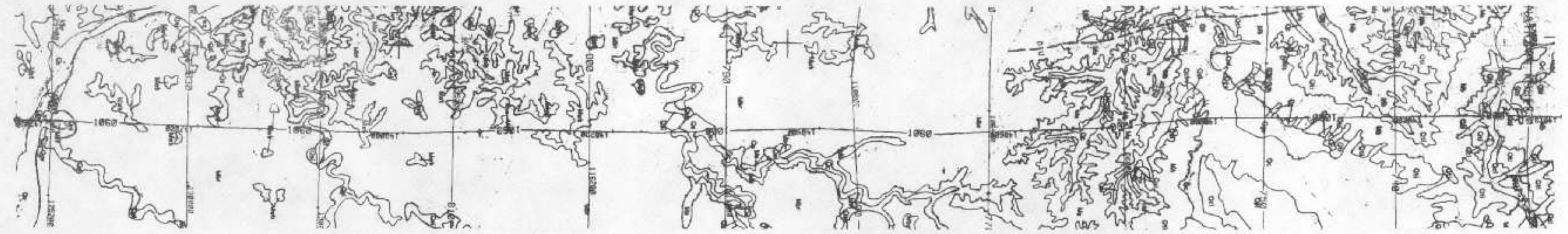
LINE 1030
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
TL/K
MIN 1.553
MAX 8.617
MEAN 5.511
STD DEV 1.296
BI/K
MIN .0000
MAX 4.953
MEAN 1.787
STD DEV .7697
BI/TL
MIN .0000
MAX .8636
MEAN .3168
STD DEV .1239
TOTAL COUNTS CTS/SEC
MIN 847.9
MAX 2316
MEAN 1527
STD DEV 241.2
POTASSIUM 40 PERCENT
MIN .6028
MAX 1.724
MEAN 1.140
STD DEV .1765
BISMUTH 214 EQ. PPM
MIN .8472
MAX 5.521
MEAN 2.151
STD DEV .6475
THALLIUM 208 EQ. PPM
MIN 1.672
MAX 8.908
MEAN 6.228
STD DEV 1.496
BI AIR CORR EQ. PPM
MIN .4877
MAX 1.151
MEAN .8243
STD DEV .1475
RESID MAG GAMMAS
MIN -962.2
MAX -347.0
MEAN -720.6
STD DEV 157.8
RADAR ALTMTR FEET
MIN 301.6
MAX 518.8
MEAN 397.3
STD DEV 31.83
44200
44000
43800
43600
43400
43200
43000
42800
LINE 1030

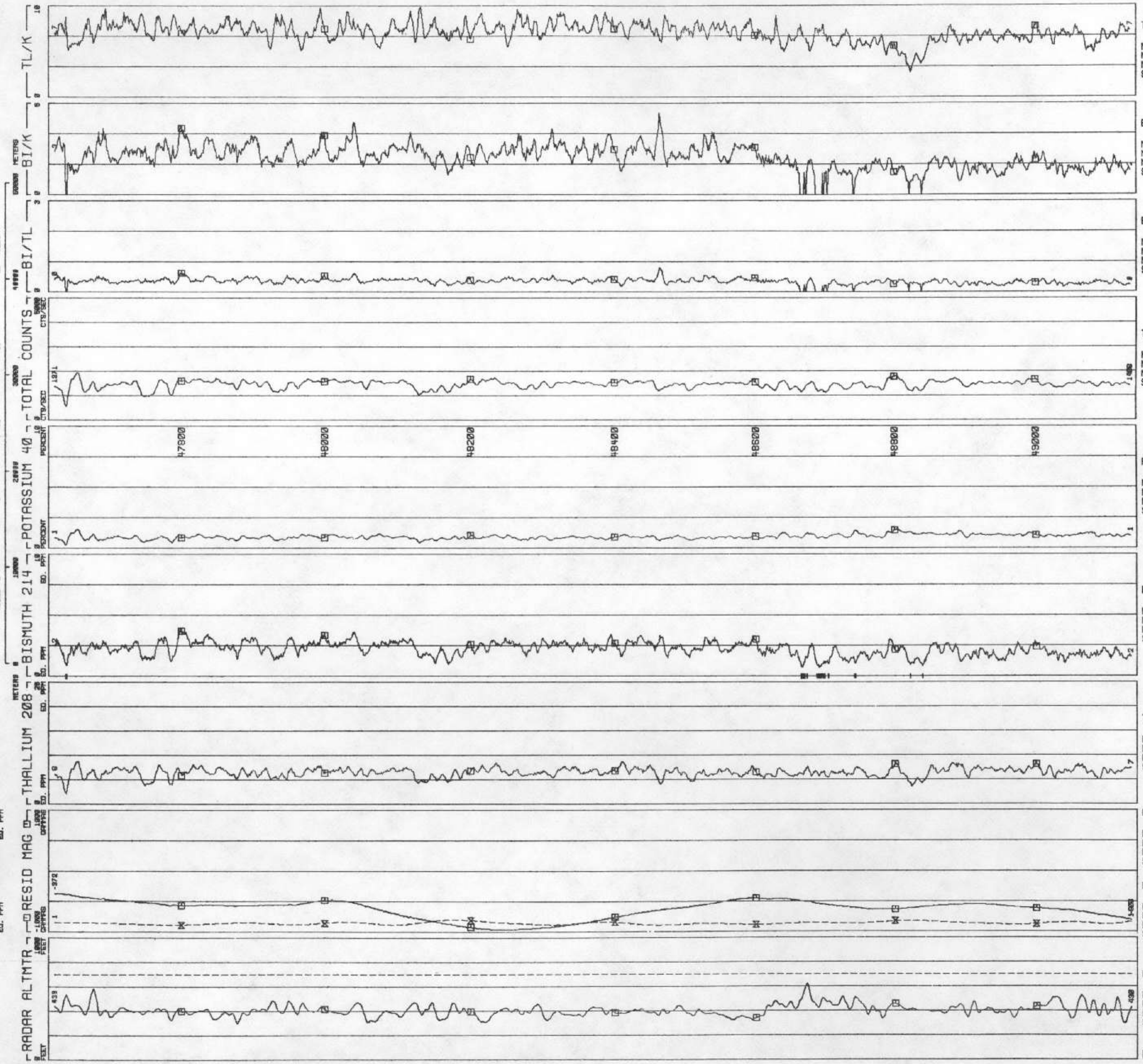
LINE 1040
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338



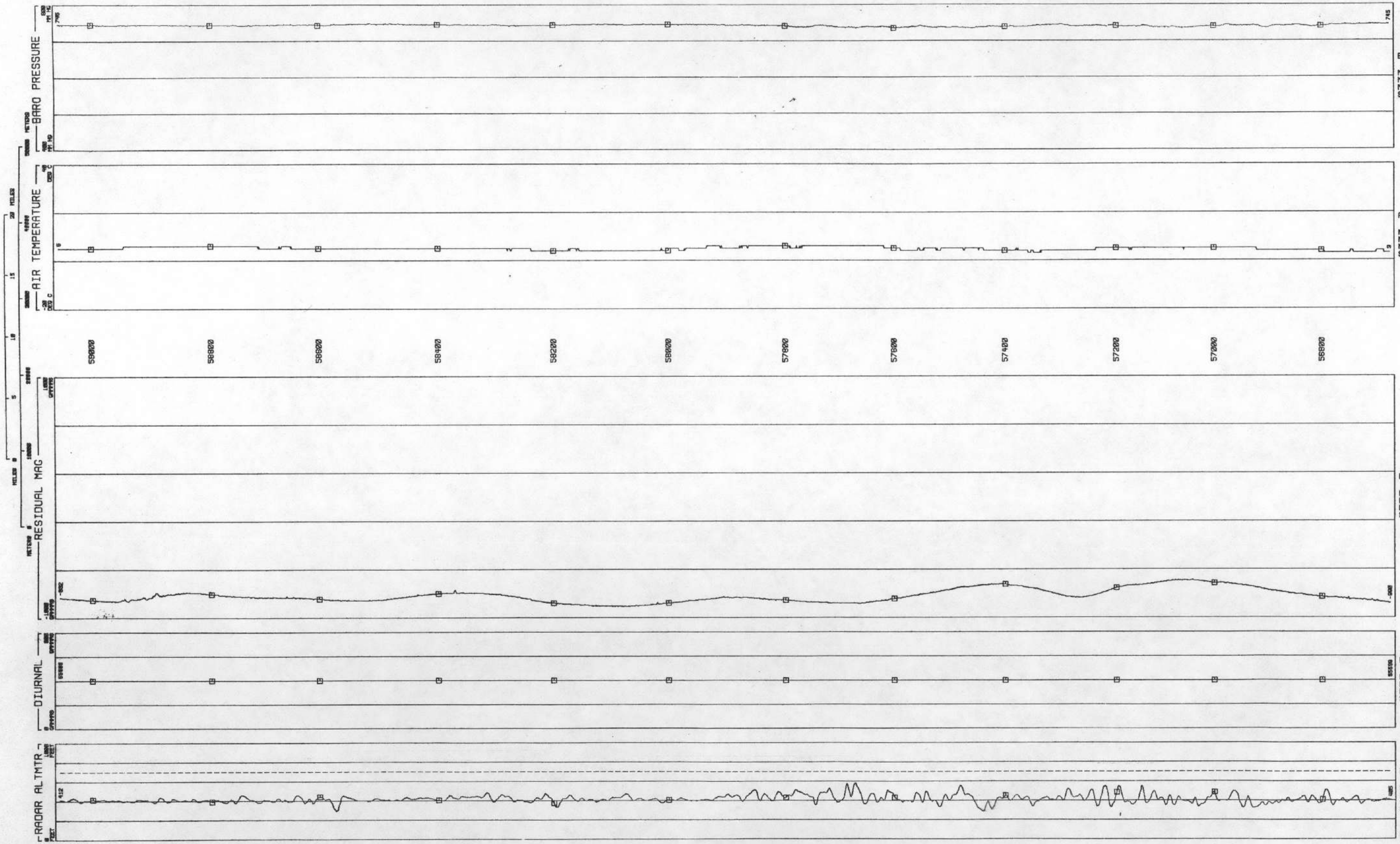

LINE 1050
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
TL/K
MIN .0000
MAX 11.35
MEAN 6.886
STD DEV 1.095
BI/K
MIN .0000
MAX 4.743
MEAN 2.046
STD DEV .6989
BI/TL
MIN .0000
MAX .6148
MEAN .2983
STD DEV .0974
TOTAL COUNTS CTS/SEC
MIN 137.6
MAX 1807
MEAN 1368
STD DEV 206.3
POTASSIUM 40 PERCENT
MIN .1550
MAX 1.534
MEAN .8992
STD DEV .2055
BISMUTH 214 EQ. PPM
MIN .8394
MAX 3.537
MEAN 1.897
STD DEV .4637
THALLIUM 208 EQ. PPM
MIN 1.163
MAX 8.926
MEAN 6.057
STD DEV 1.016
BI AIR CORR EQ. PPM
MIN .4271
MAX 1.076
MEAN .7520
STD DEV .1820
RESID MAG GAMMAS
MIN -1060
MAX -575.9
MEAN -838.7
STD DEV 140.4
RADAR ALTMTR FEET
MIN 258.3
MAX 530.7
MEAN 396.3
STD DEV 46.32
47400
47200
47000
46800
46600
46400
46200
46000
LINE 1050

LINE 1060
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338





LINE 730
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



BARO PRESSURE
MM HG

MIN	733.7
MAX	748.1
MEAN	742.1
STD DEV	3.238

AIR TEMPERATURE
DEG C

MIN	3.000
MAX	6.000
MEAN	4.659
STD DEV	.8078

RESIDUAL MAG
GAMMAS

MIN	-907.4
MAX	-689.2
MEAN	-817.8
STD DEV	54.02

DIURNAL
GAMMAS

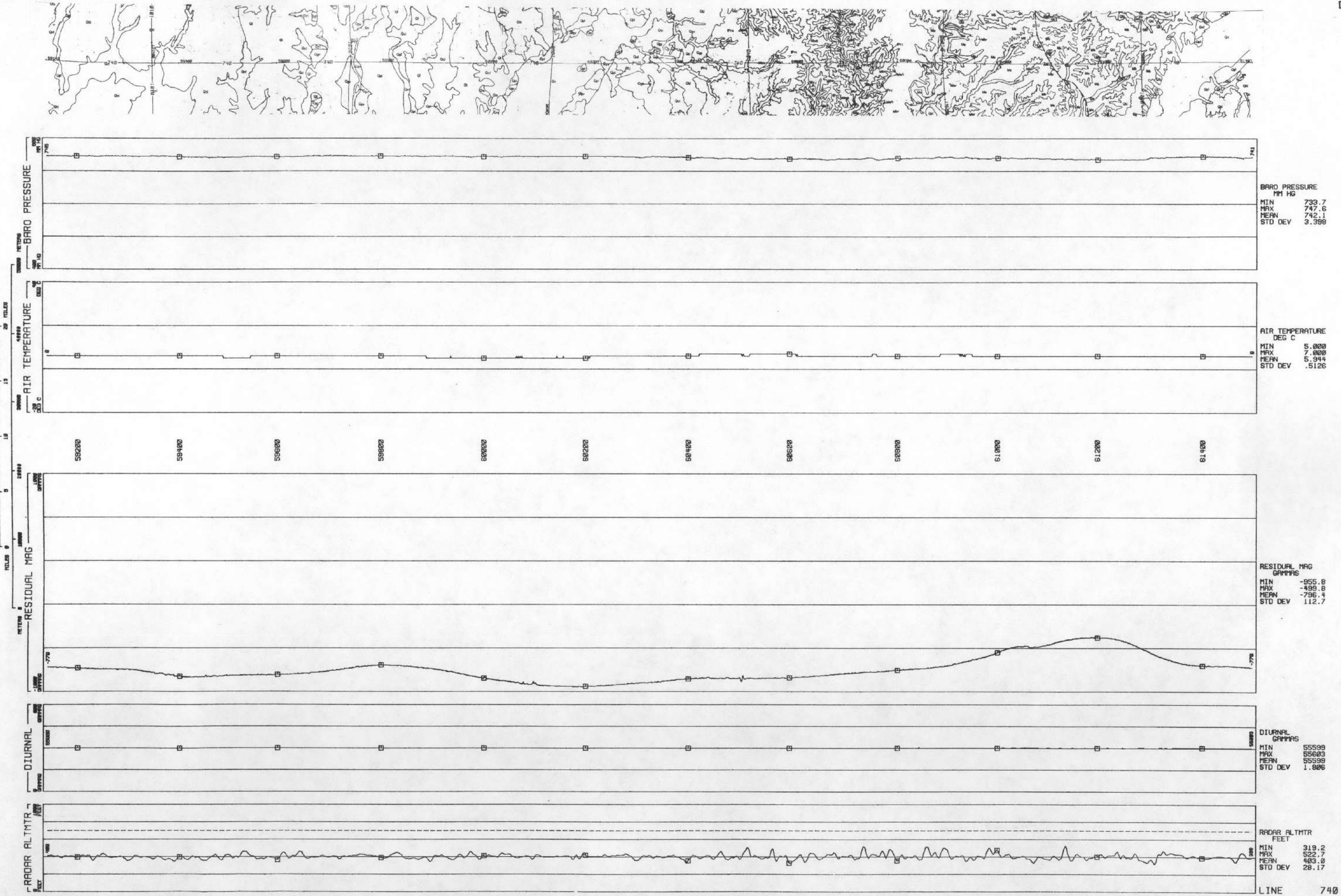
MIN	55598
MAX	55600
MEAN	55589
STD DEV	9.758

RADAR ALTMTR
FEET

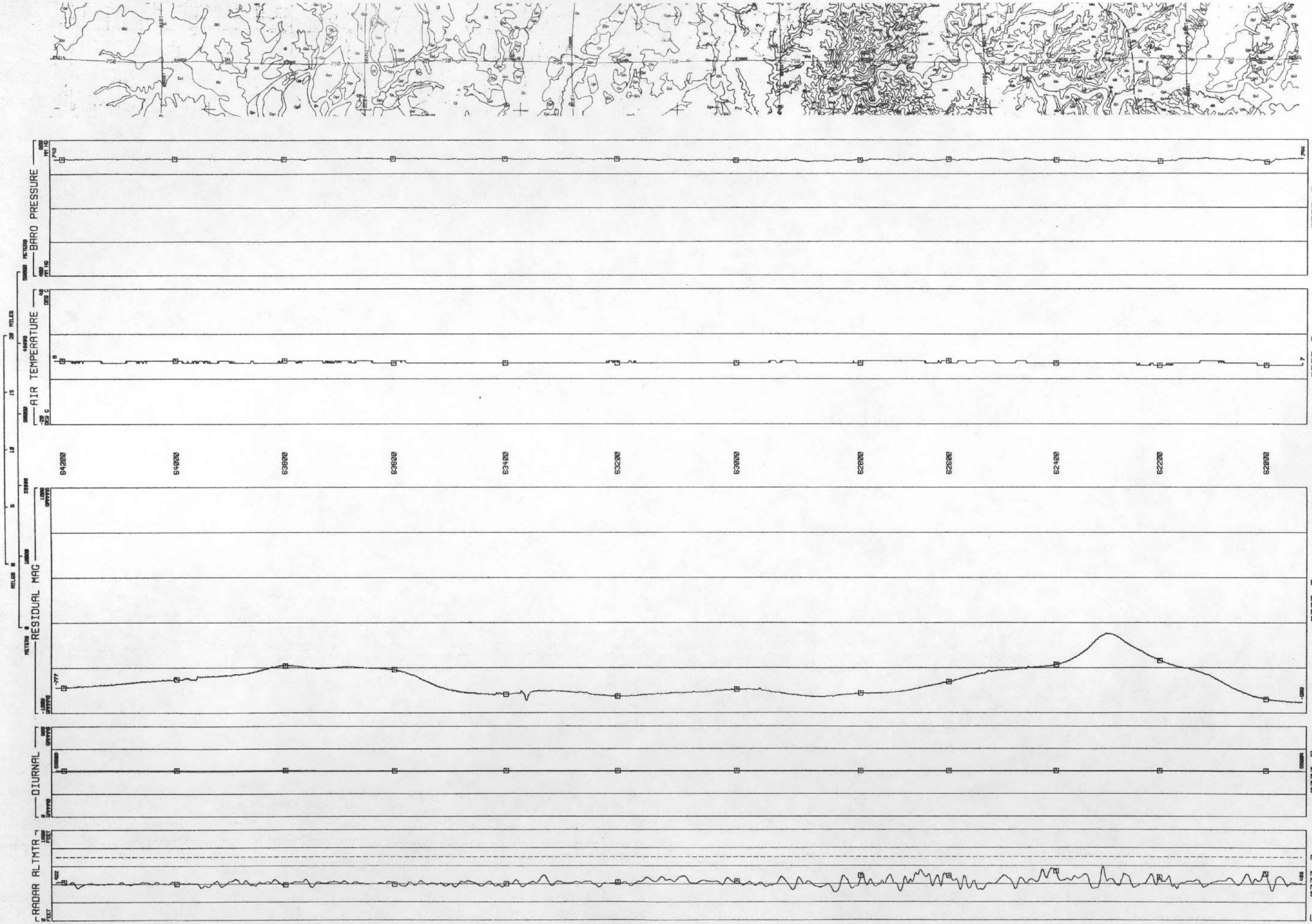
MIN	287.1
MAX	578.2
MEAN	416.6
STD DEV	38.94

LINE 730

LINE 740
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



LINE 750
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327



BARO PRESSURE
MM HG
MIN 732.4
MAX 747.1
MEAN 742.0
STD DEV 2.756

AIR TEMPERATURE
DEG C
MIN 6.000
MAX 8.000
MEAN 7.243
STD DEV .5583

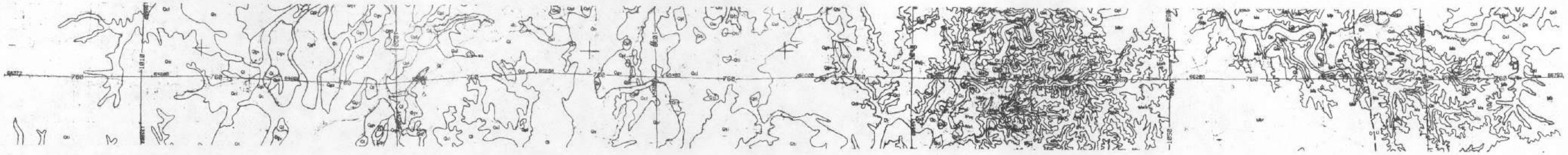
RESIDUAL MAG
GAMMAS
MIN -909.9
MAX -294.4
MEAN -714.5
STD DEV 129.6

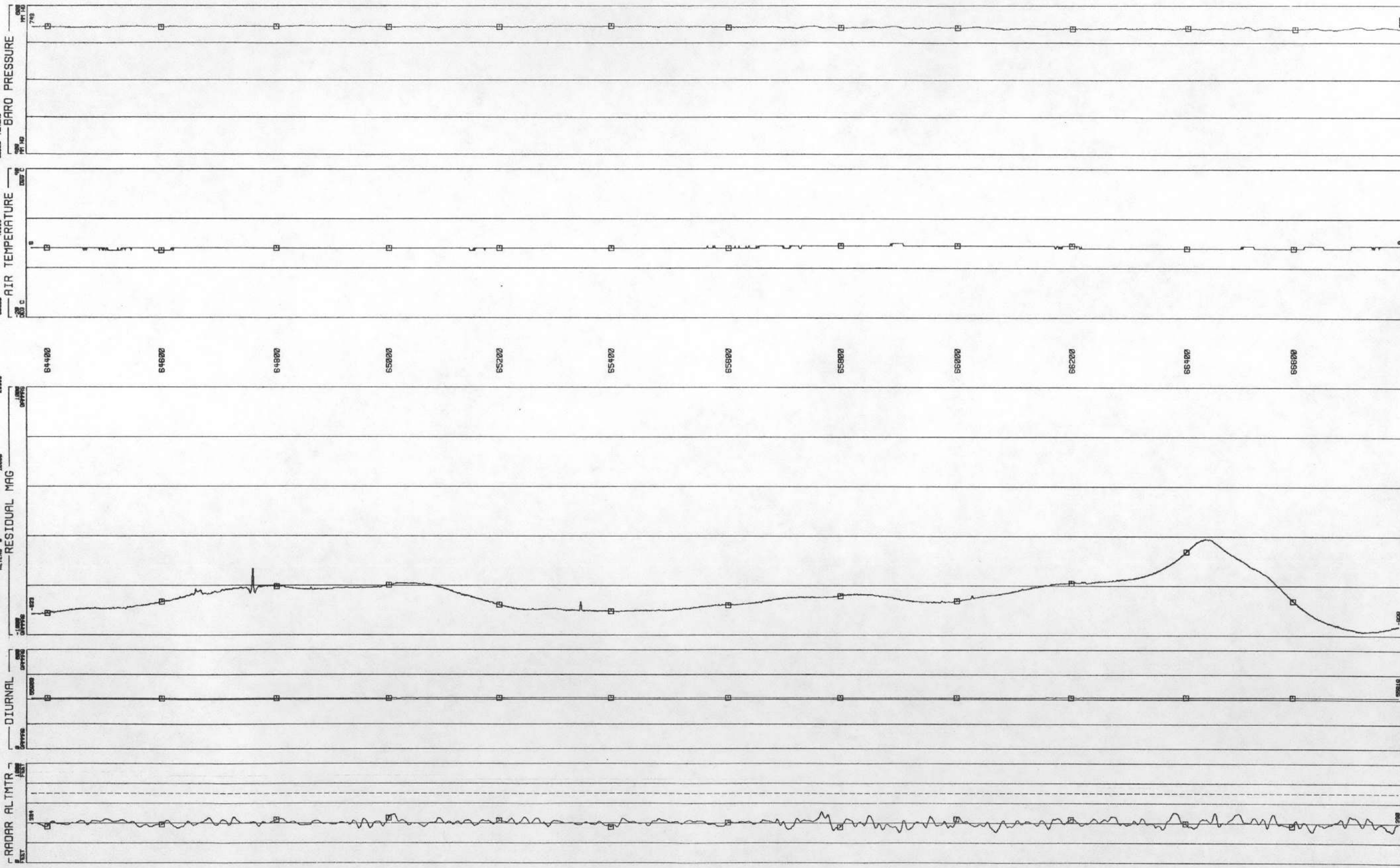
DIURNAL
GAMMAS
MIN 55603
MAX 55608
MEAN 55601
STD DEV 3.761

RADAR ALTMTR
FEET
MIN 308.5
MAX 590.1
MEAN 418.0
STD DEV 39.49

LINE 750

LINE 760
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80327





BARO PRESSURE
MM HG
MIN 733.7
MAX 746.5
MEAN 741.2
STD DEV 2.842

AIR TEMPERATURE
DEG C
MIN 7.000
MAX 10.00
MEAN 8.262
STD DEV .5194

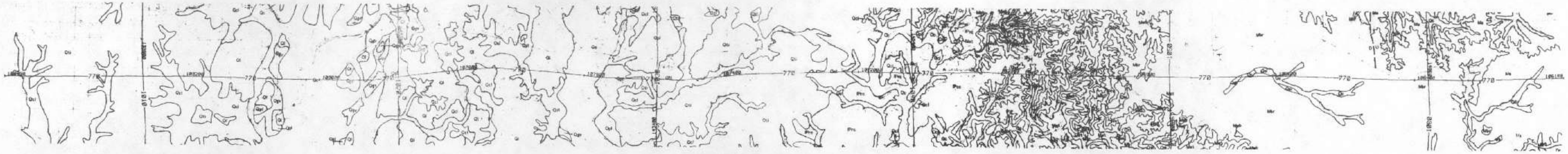
RESIDUAL MAG
GAMMAS
MIN -970.8
MAX -221.9
MEAN -680.8
STD DEV 138.5

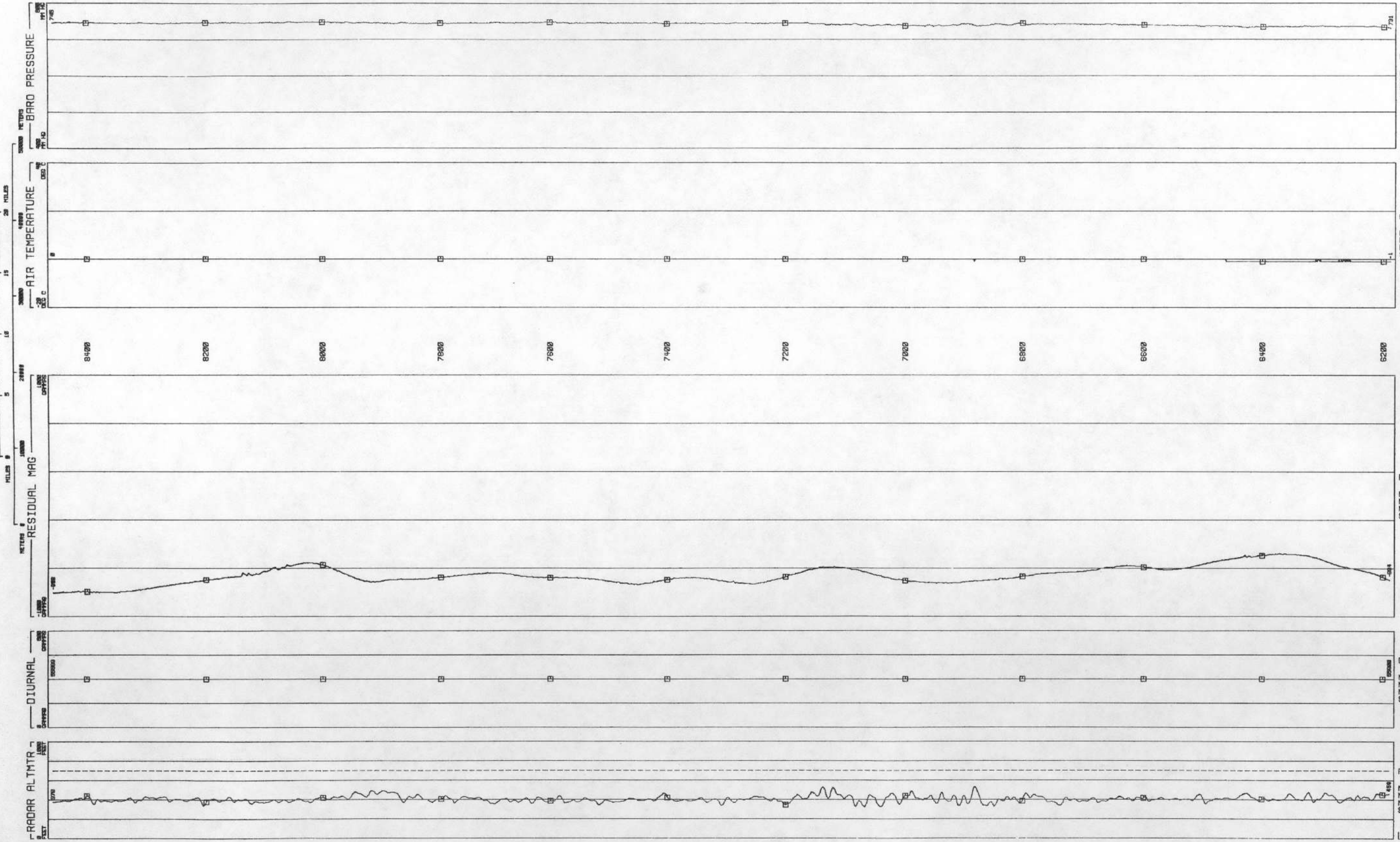
DIURNAL
GAMMAS
MIN 55608
MAX 55616
MEAN 55604
STD DEV 7.680

RADAR ALTMTR
FEET
MIN 304.2
MAX 513.7
MEAN 404.0
STD DEV 30.72

LINE 760

LINE 770
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331





BARO PRESSURE
MM HG

MIN	731.0
MAX	749.7
MEAN	742.9
STD DEV	4.154

AIR TEMPERATURE
DEG C

MIN	-1.000
MAX	.0000
MEAN	-.1154
STD DEV	.3195

RESIDUAL MAG
GAMMAS

MIN	-806.9
MAX	-477.1
MEAN	-657.7
STD DEV	73.73

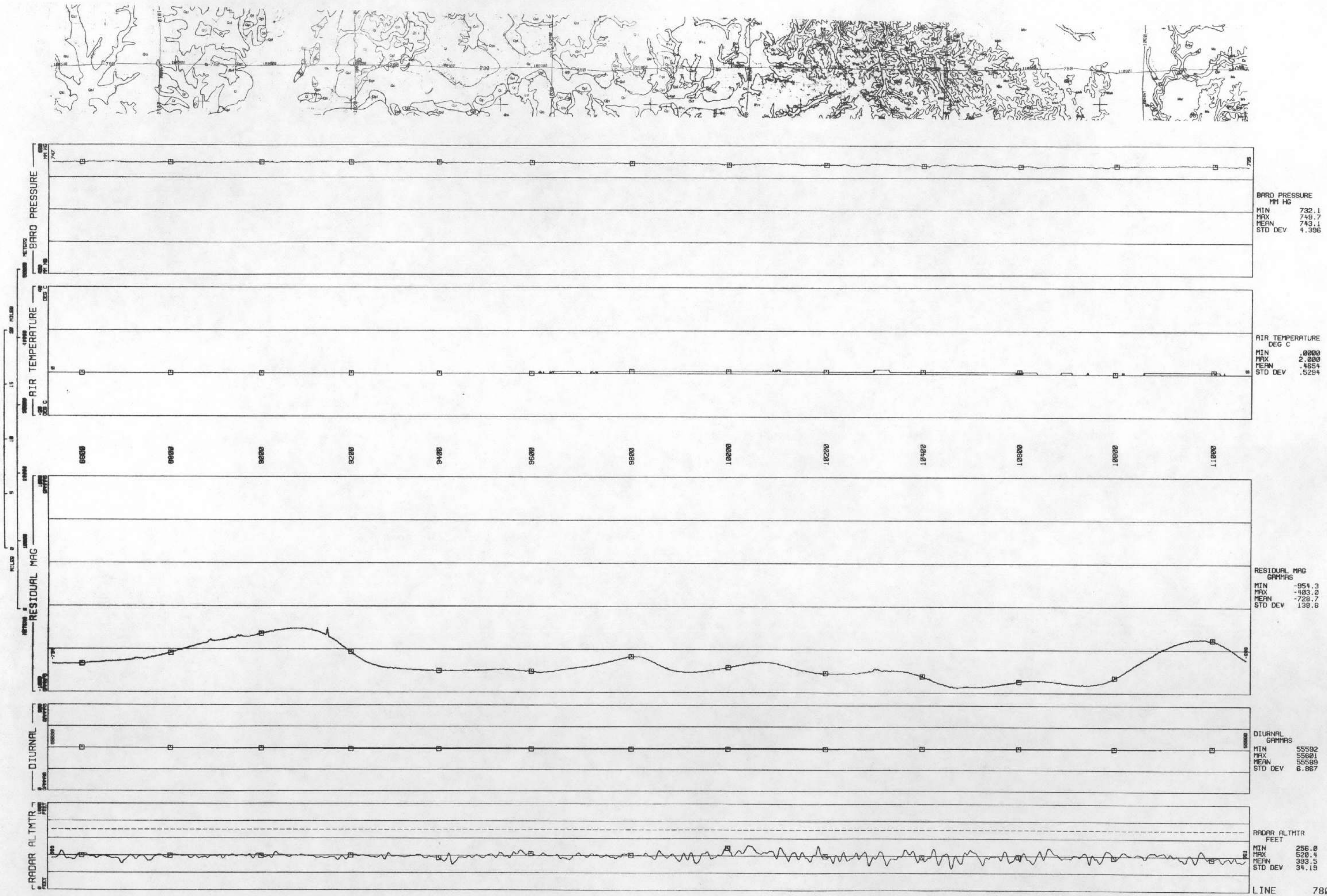
DIURNAL
GAMMAS

MIN	55598
MAX	55601
MEAN	55591
STD DEV	8.493

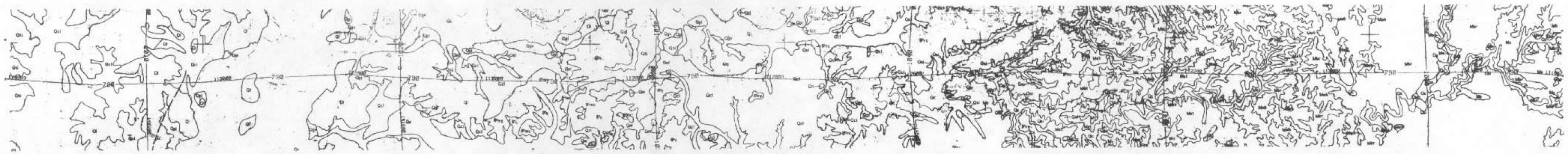
RADAR ALTMTR
FEET

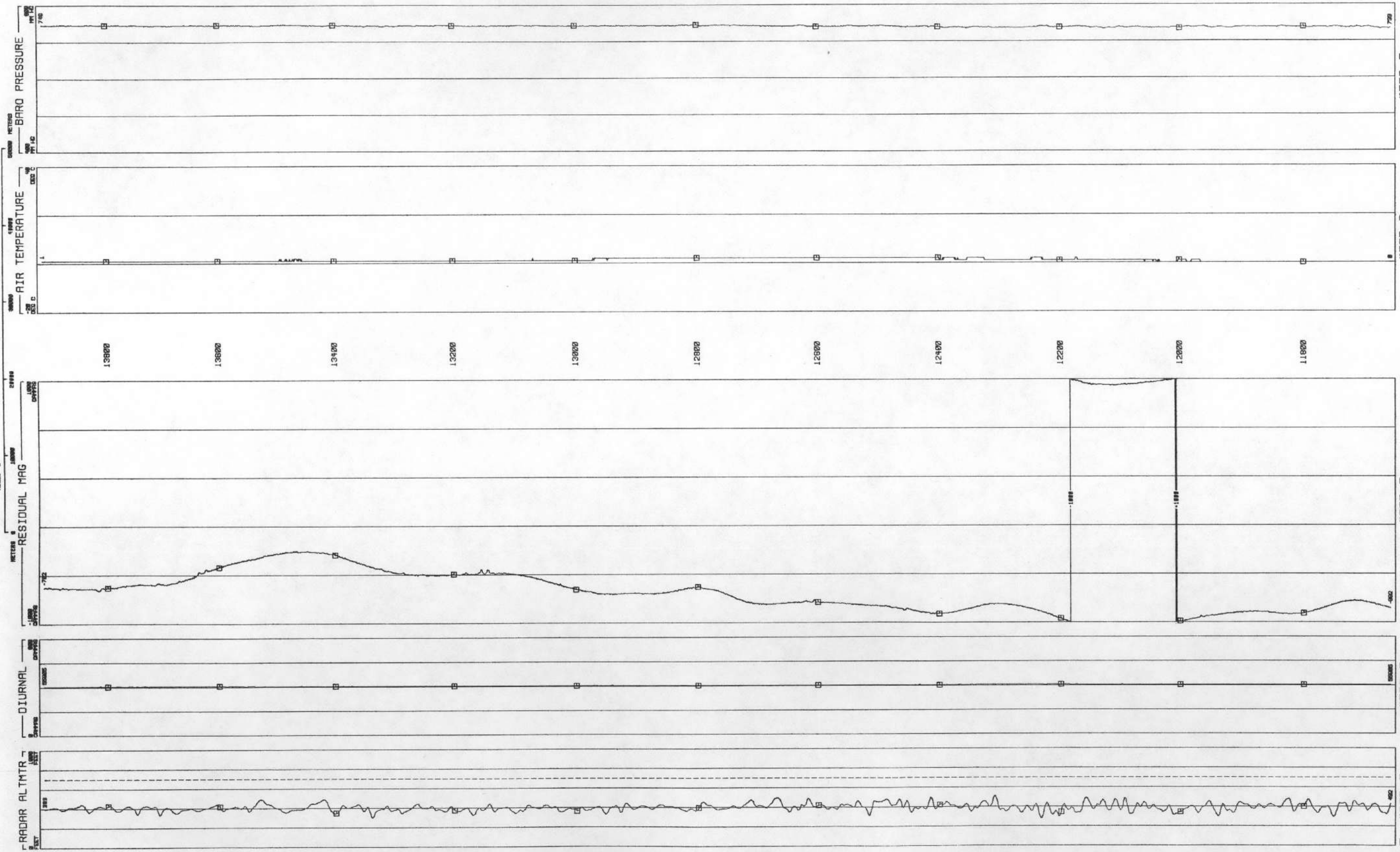
MIN	323.6
MAX	530.0
MEAN	405.7
STD DEV	30.60

LINE 770


LINE 780
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
8600
8800
9000
9200
9400
9600
9800
10000
10200
10400
10600
10800
11000
BARO PRESSURE MM HG
MIN 732.1
MAX 749.7
MEAN 743.1
STD DEV 4.396
AIR TEMPERATURE DEG C
MIN .0000
MAX 2.000
MEAN .4654
STD DEV .5294
RESIDUAL MAG GAMMAS
MIN -954.3
MAX -403.0
MEAN -728.7
STD DEV 138.8
DIURNAL GAMMAS
MIN 55592
MAX 55601
MEAN 55589
STD DEV 6.867
RADAR ALTMTR FEET
MIN 256.0
MAX 520.4
MEAN 393.5
STD DEV 34.19
LINE 780

LINE 790
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331





BARO PRESSURE
MM HG
MIN 731.5
MAX 748.1
MEAN 741.4
STD DEV 3.645

AIR TEMPERATURE
DEG C
MIN .0000
MAX 2.000
MEAN 1.134
STD DEV .6594

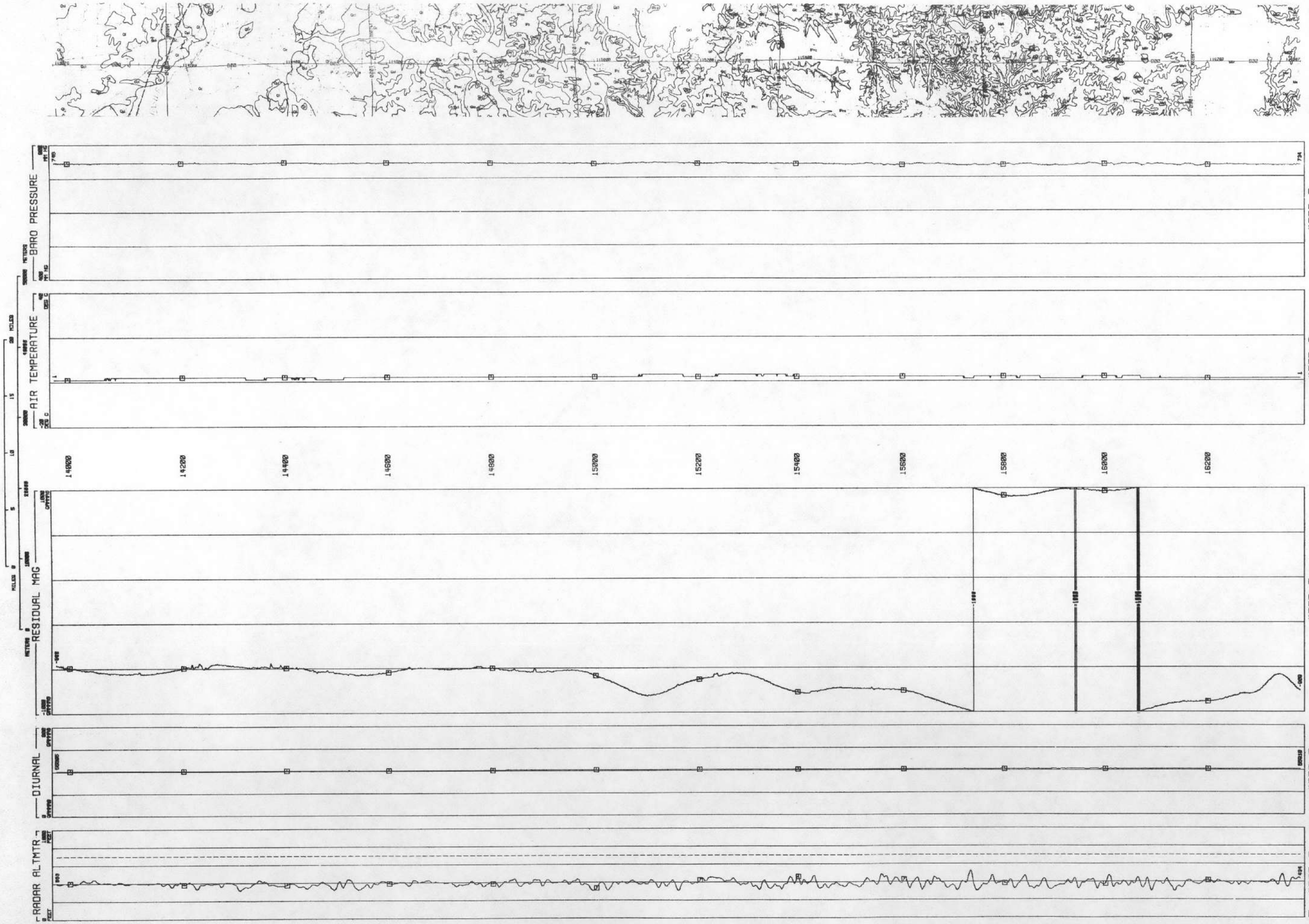
RESIDUAL MAG
GAMMAS
MIN -1053
MAX -404.8
MEAN -760.6
STD DEV 171.4

DIURNAL
GAMMAS
MIN 55604
MAX 55607
MEAN 55601
STD DEV 4.227

RADAR ALTMTR
FEET
MIN 279.8
MAX 510.8
MEAN 398.5
STD DEV 34.91

LINE 790

LINE 800
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80331



BARO PRESSURE
MM HG

MIN	731.0
MAX	747.6
MEAN	740.8
STD DEV	4.182

AIR TEMPERATURE
DEG C

MIN	1.000
MAX	3.000
MEAN	1.829
STD DEV	.5693

RESIDUAL MAG
GAMMAS

MIN	-1075
MAX	-552.1
MEAN	-750.7
STD DEV	155.3

DIURNAL
GAMMAS

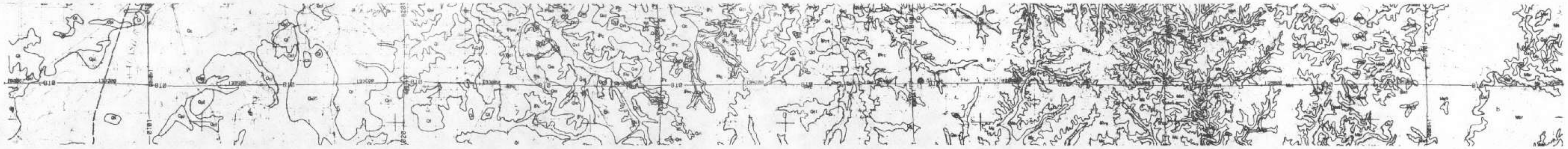
MIN	55604
MAX	55610
MEAN	55601
STD DEV	6.323

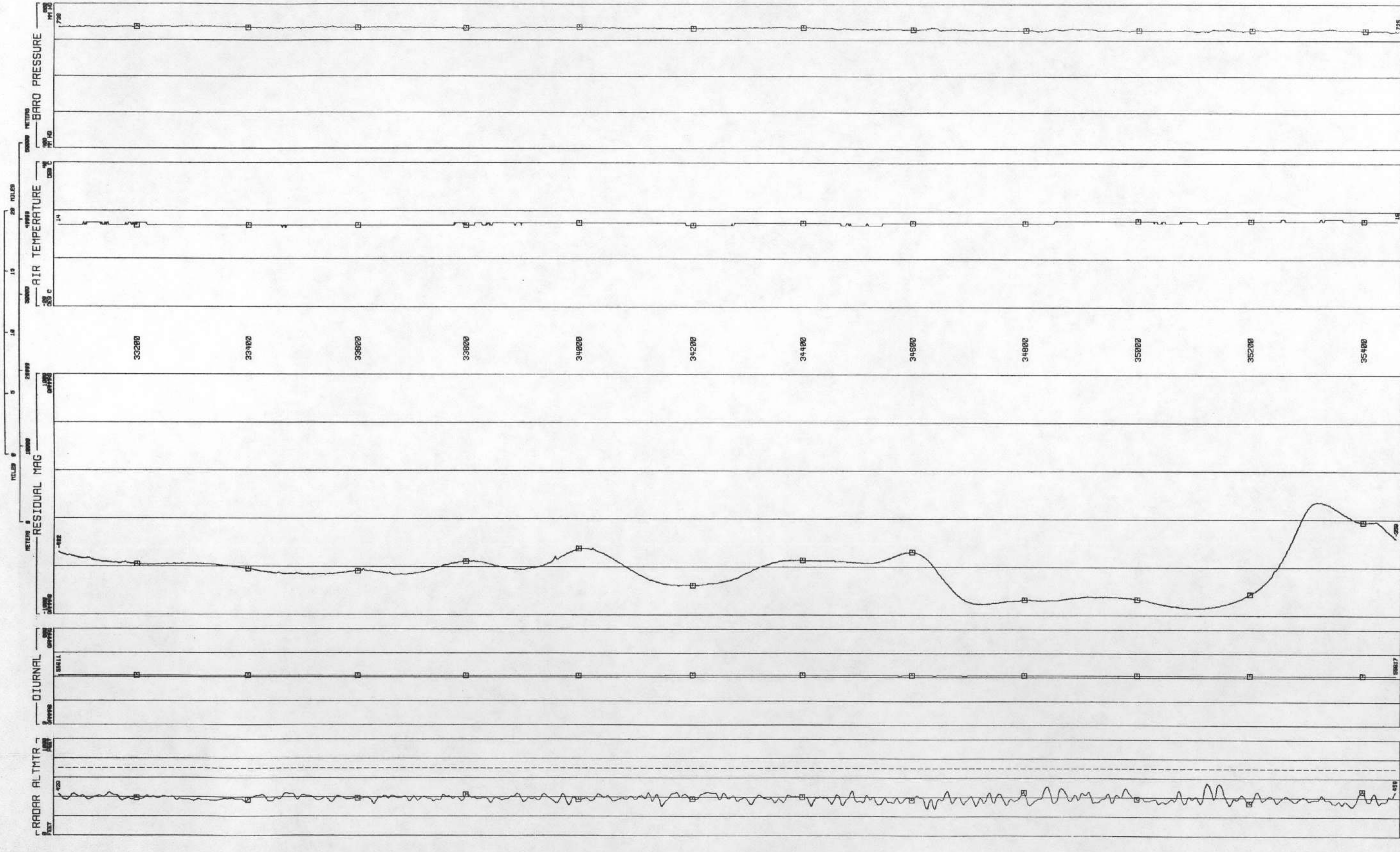
RADAR ALTMTR
FEET

MIN	293.4
MAX	520.3
MEAN	388.1
STD DEV	32.15

LINE 800

LINE 810
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336





BARO PRESSURE
MM HG
MIN 723.3
MAX 738.1
MEAN 732.3
STD DEV 3.421

AIR TEMPERATURE
DEG C
MIN 13.00
MAX 17.00
MEAN 14.90
STD DEV .7935

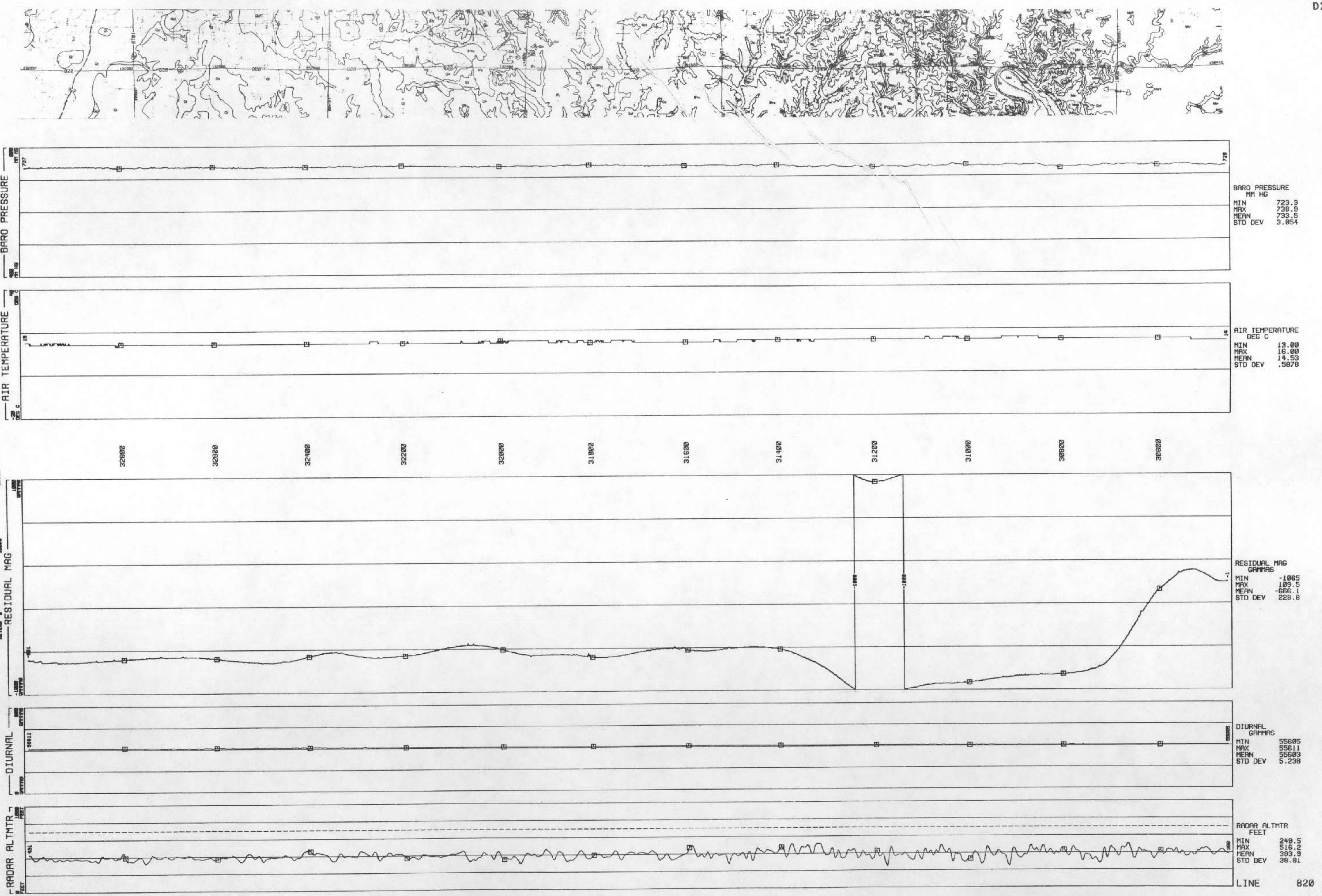
RESIDUAL MAG
GAMMAS
MIN -942.4
MAX -56.94
MEAN -632.9
STD DEV 186.5

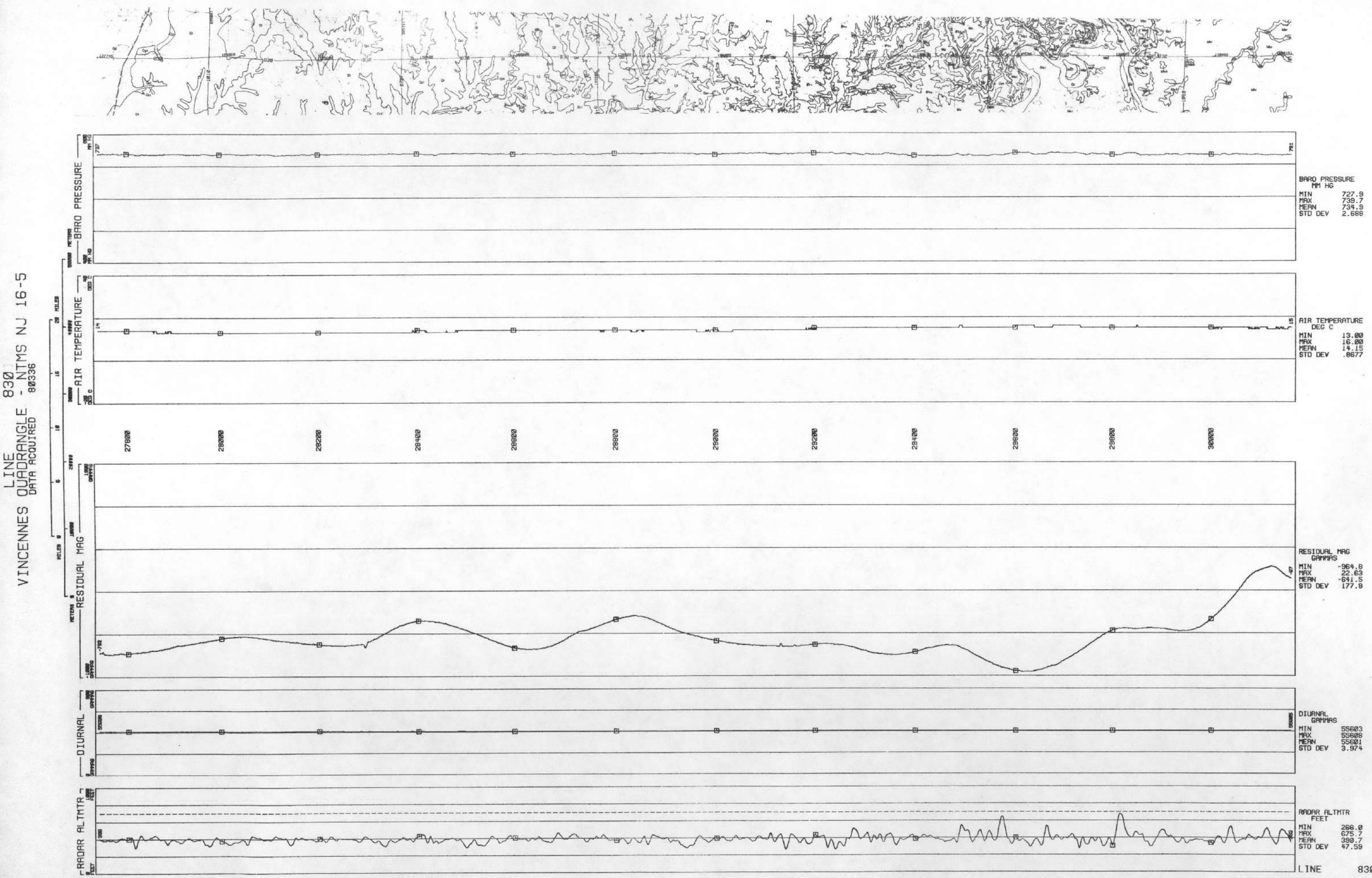
DIURNAL
GAMMAS
MIN 55611
MAX 55617
MEAN 55607
STD DEV 7.461

RADAR ALTMTR
FEET
MIN 281.4
MAX 548.0
MEAN 389.3
STD DEV 33.84

LINE 810

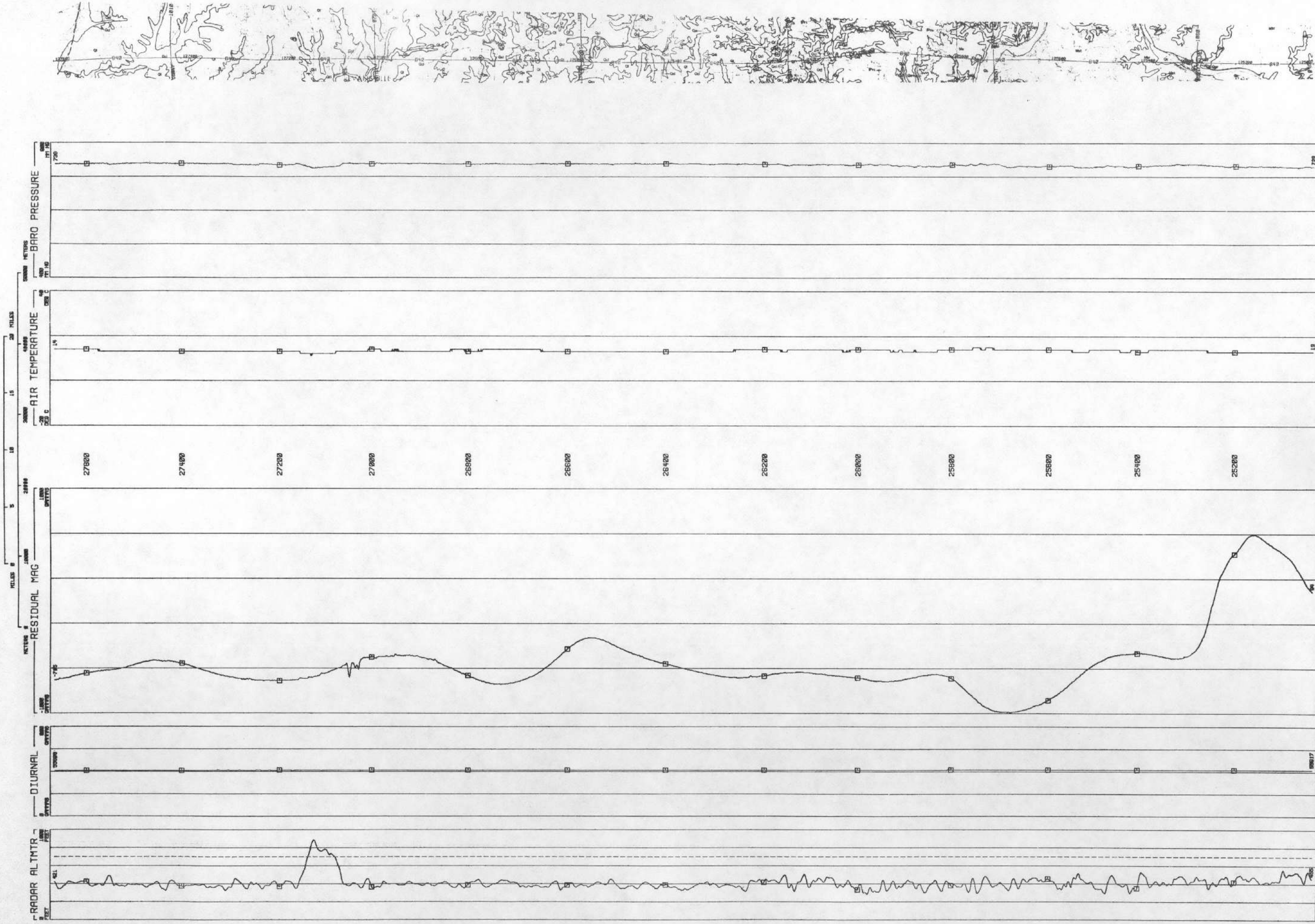
LINE 820
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336




LINE 830
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
27800
28000
28200
28400
28600
28800
29000
29200
29400
29600
29800
30000
BARO PRESSURE
MM HG
MIN 727.9
MAX 739.7
MEAN 734.9
STD DEV 2.688
AIR TEMPERATURE
DEG C
MIN 13.00
MAX 16.00
MEAN 14.15
STD DEV .8677
RESIDUAL MAG
GAMMAS
MIN -964.8
MAX -22.63
MEAN -641.5
STD DEV 177.8
DIURNAL
GAMMAS
MIN 55603
MAX 55608
MEAN 55601
STD DEV 3.974
RADAR ALTMTR
FEET
MIN 266.0
MAX 675.7
MEAN 390.7
STD DEV 47.59
LINE 830

D30

LINE 840
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80336



BARO PRESSURE
MM HG
MIN 725.3
MAX 740.7
MEAN 735.4
STD DEV 3.296

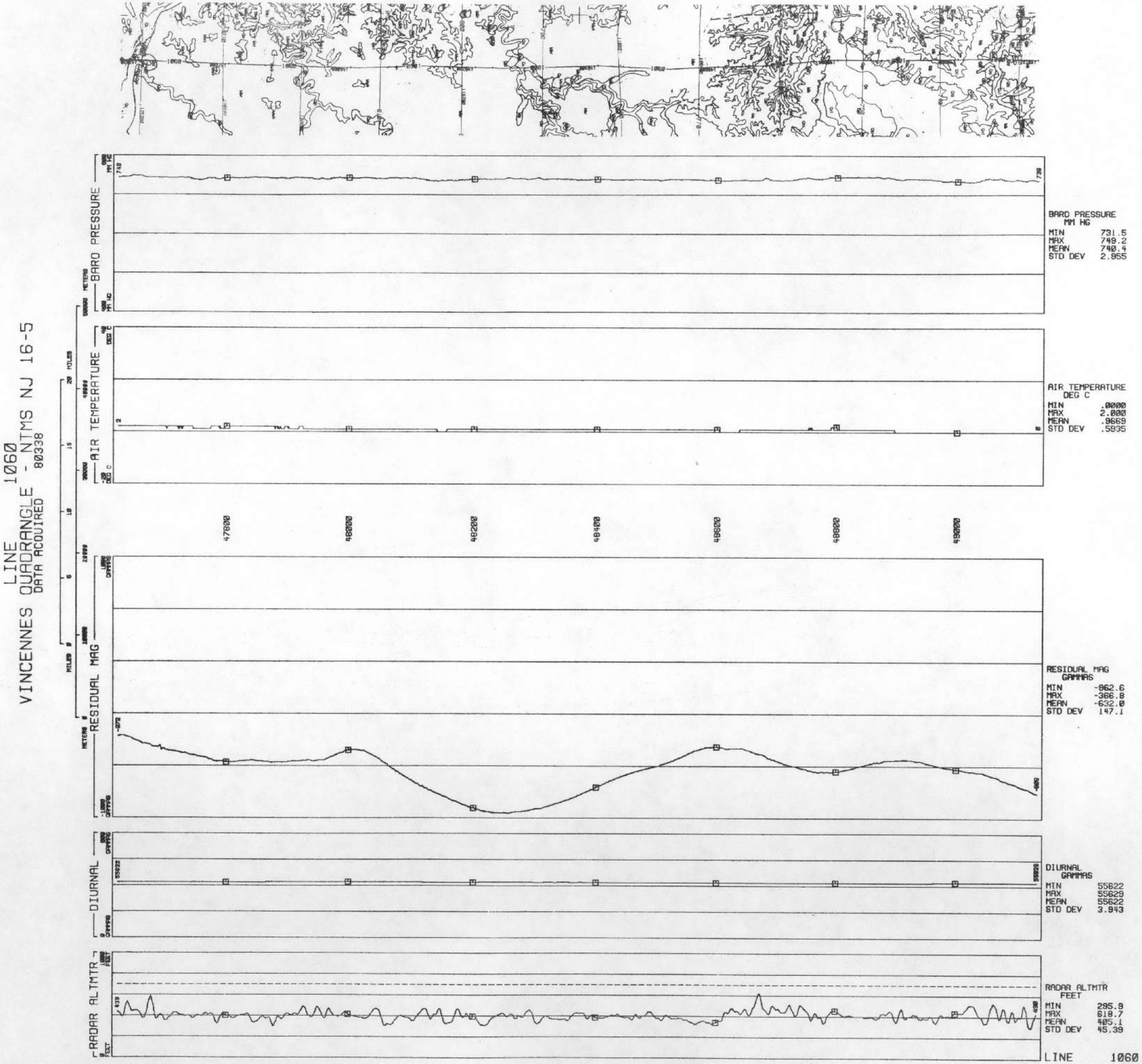
AIR TEMPERATURE
DEG C
MIN 11.00
MAX 15.00
MEAN 13.39
STD DEV .5710

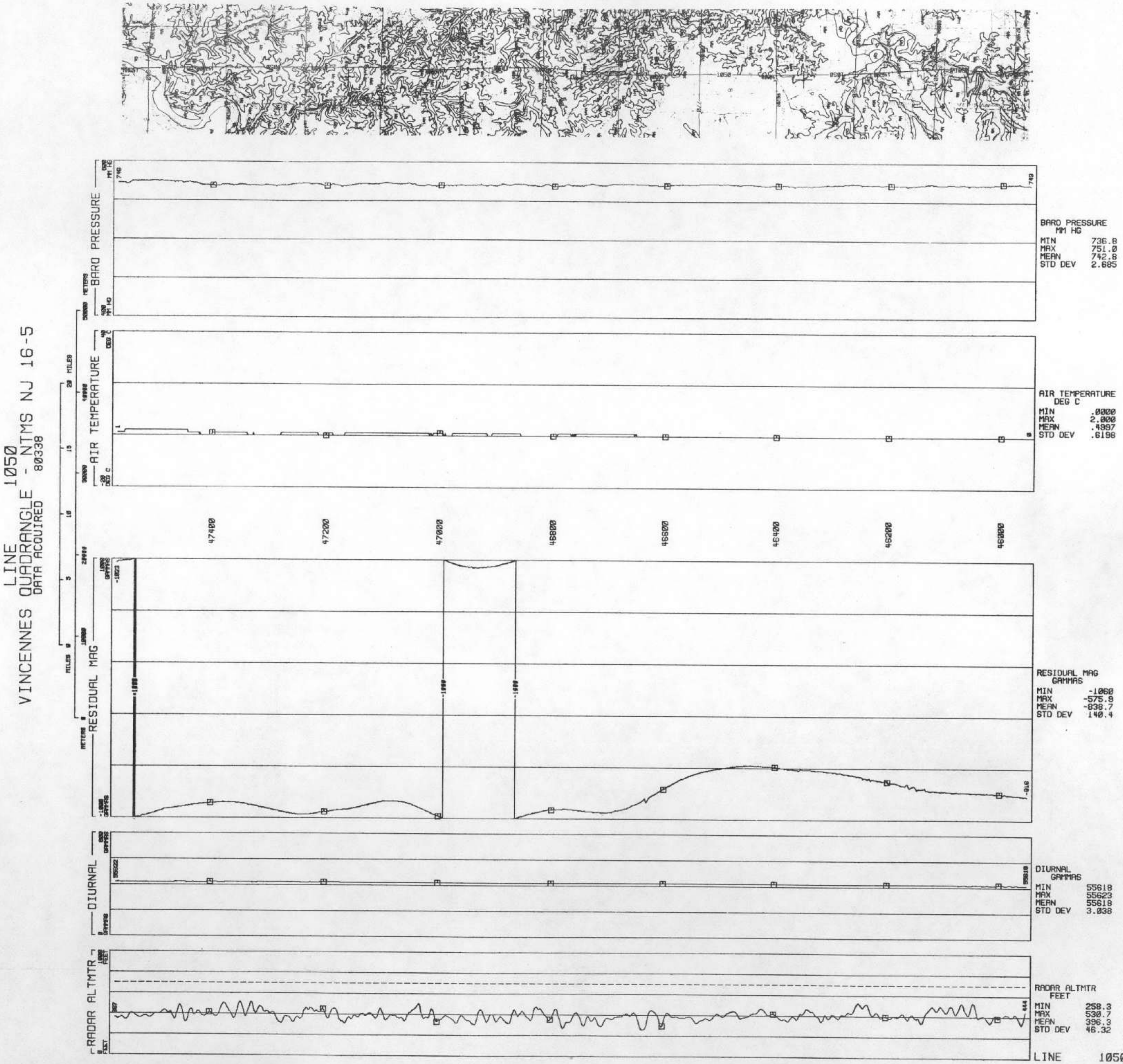
RESIDUAL MAG
GAMMAS
MIN -990.8
MAX 584.5
MEAN -543.8
STD DEV 307.2

DIURNAL
GAMMAS
MIN 55608
MAX 55617
MEAN 55604
STD DEV 8.658

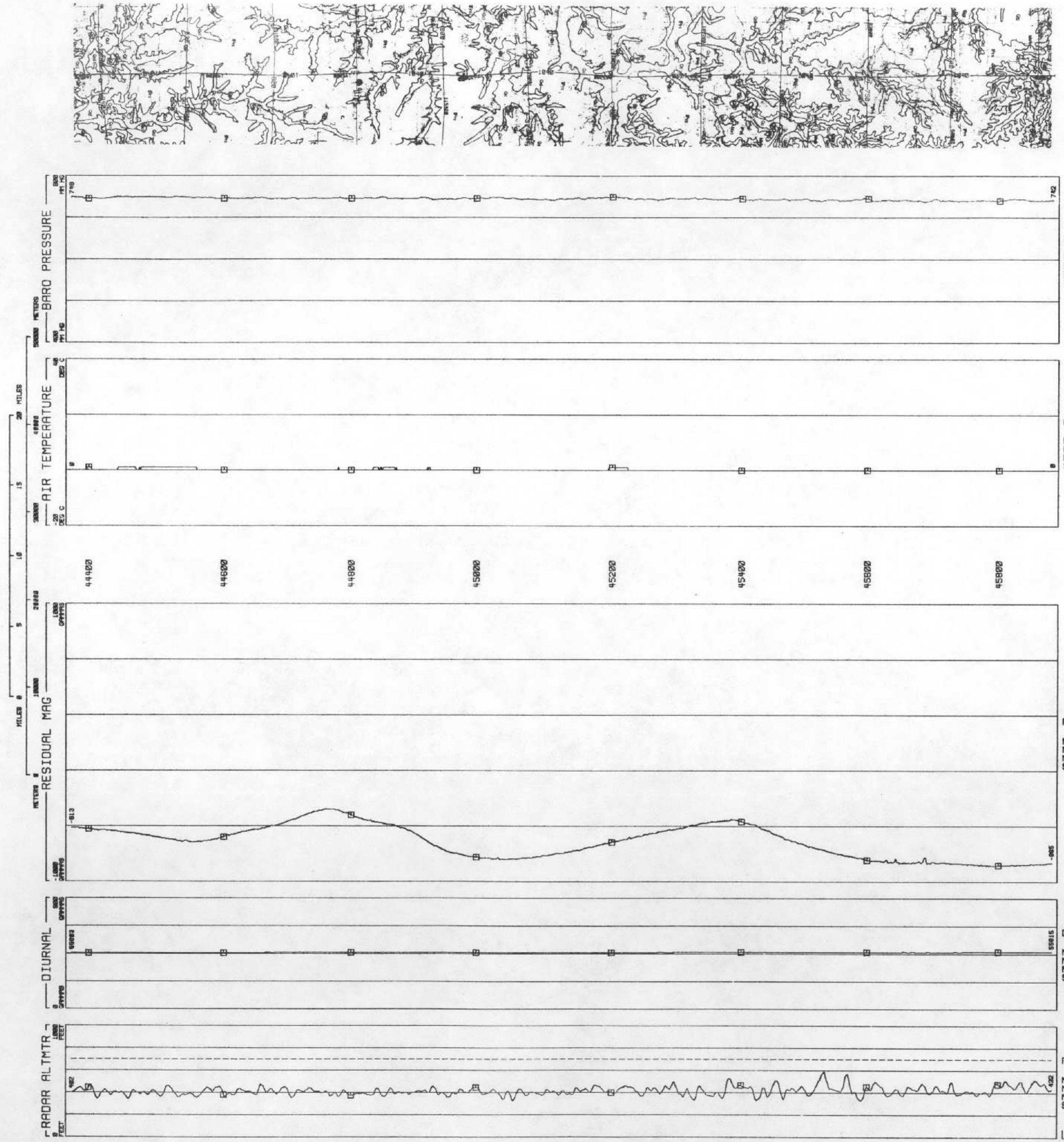
RADAR ALTMTR
FEET
MIN 284.1
MAX 884.3
MEAN 409.9
STD DEV 73.50

LINE 840


LINE 1060
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
47800
48000
48200
48400
48600
48800
49000
BARO PRESSURE MM HG
MIN 731.5
MAX 749.2
MEAN 740.4
STD DEV 2.855
AIR TEMPERATURE DEG C
MIN .0000
MAX 2.000
MEAN .9669
STD DEV .5935
RESIDUAL MAG GAMMAS
MIN -862.6
MAX -366.8
MEAN -632.0
STD DEV 147.1
DIURNAL GAMMAS
MIN 55622
MAX 55629
MEAN 55622
STD DEV 3.943
RADAR ALTMTR FEET
MIN 295.9
MAX 610.7
MEAN 405.1
STD DEV 45.39
LINE 1060


LINE 1050
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338
BARO PRESSURE
BARO PRESSURE MM HG
MIN 736.8
MAX 751.0
MEAN 742.8
STD DEV 2.685
AIR TEMPERATURE
AIR TEMPERATURE DEG C
MIN .0000
MAX 2.000
MEAN .4997
STD DEV .6198
47400
47200
47000
46800
46600
46400
46200
46000
RESIDUAL MAG
RESIDUAL MAG GAMMAS
MIN -1060
MAX -575.9
MEAN -838.7
STD DEV 140.4
DIURNAL
DIURNAL GAMMAS
MIN 55618
MAX 55623
MEAN 55618
STD DEV 3.038
RADAR ALTMTR
RADAR ALTMTR FEET
MIN 258.3
MAX 530.7
MEAN 396.3
STD DEV 46.32
LINE 1050

LINE 1040
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338



BARO PRESSURE
MM HG
MIN 737.4
MAX 750.7
MEAN 744.6
STD DEV 2.761

AIR TEMPERATURE
DEG C
MIN .0000
MAX 1.000
MEAN .1213
STD DEV .3265

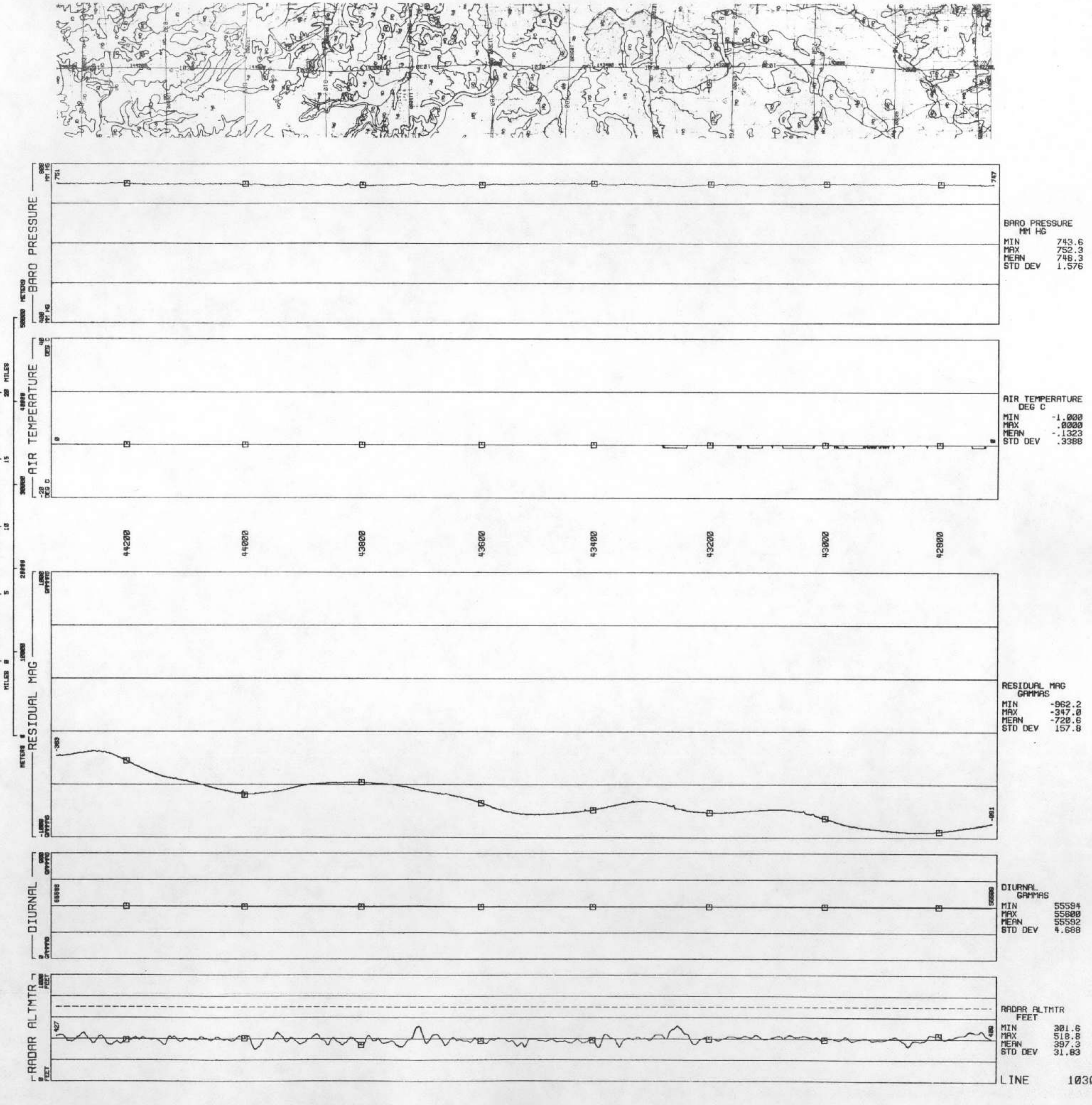
RESIDUAL MAG
GAMMAS
MIN -884.1
MAX -477.6
MEAN -709.9
STD DEV 115.4

DIURNAL
GAMMAS
MIN 55603
MAX 55615
MEAN 55605
STD DEV 5.590

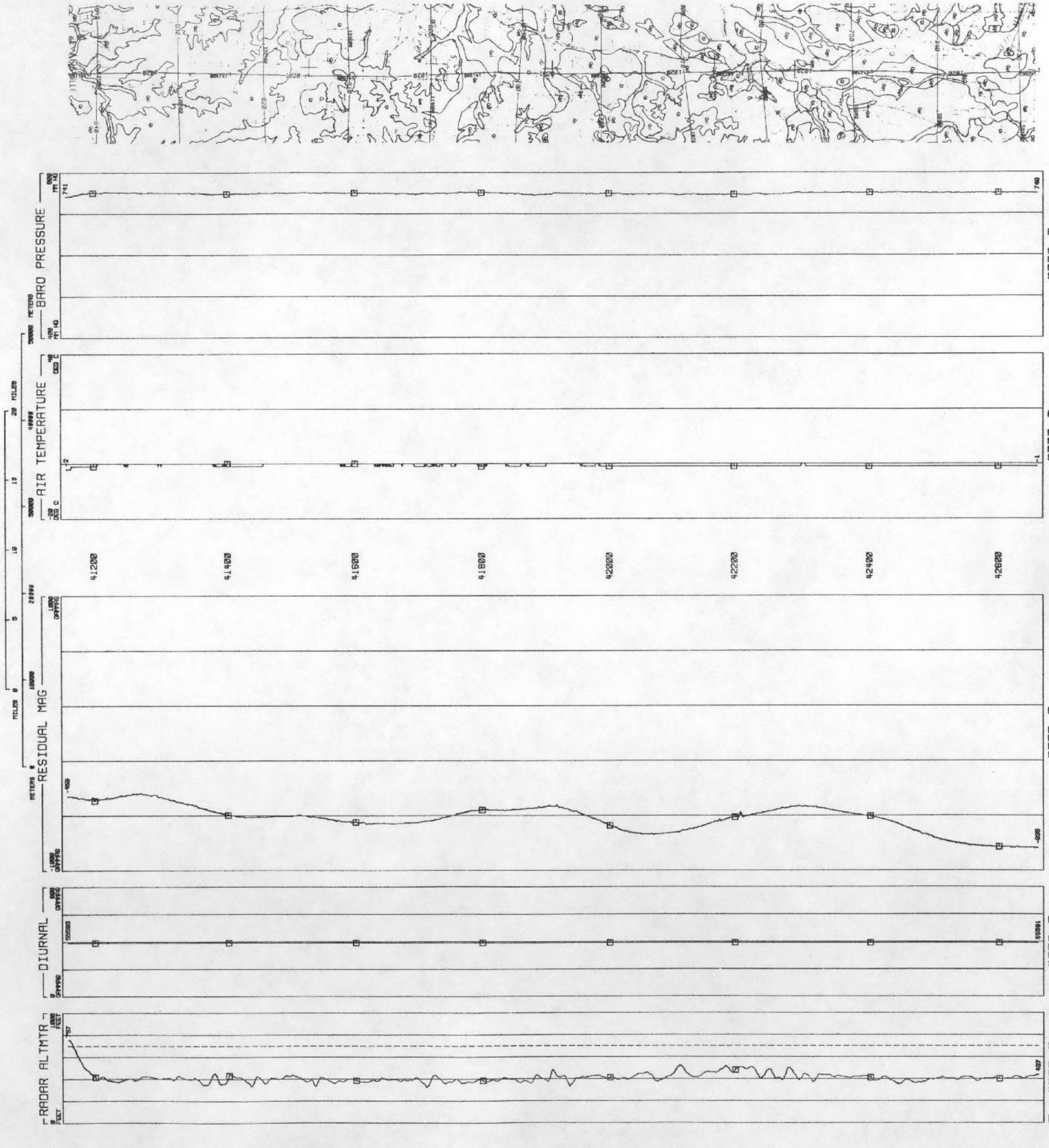
RADAR ALTMTR
FEET
MIN 329.2
MAX 590.2
MEAN 414.8
STD DEV 37.61

LINE 1040

LINE 1030
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338



LINE 1020
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338



BARO PRESSURE
MM HG
MIN 740.7
MAX 753.4
MEAN 749.3
STD DEV 1.688

AIR TEMPERATURE
DEG C
MIN -2.000
MAX .0000
MEAN -.6354
STD DEV .4922

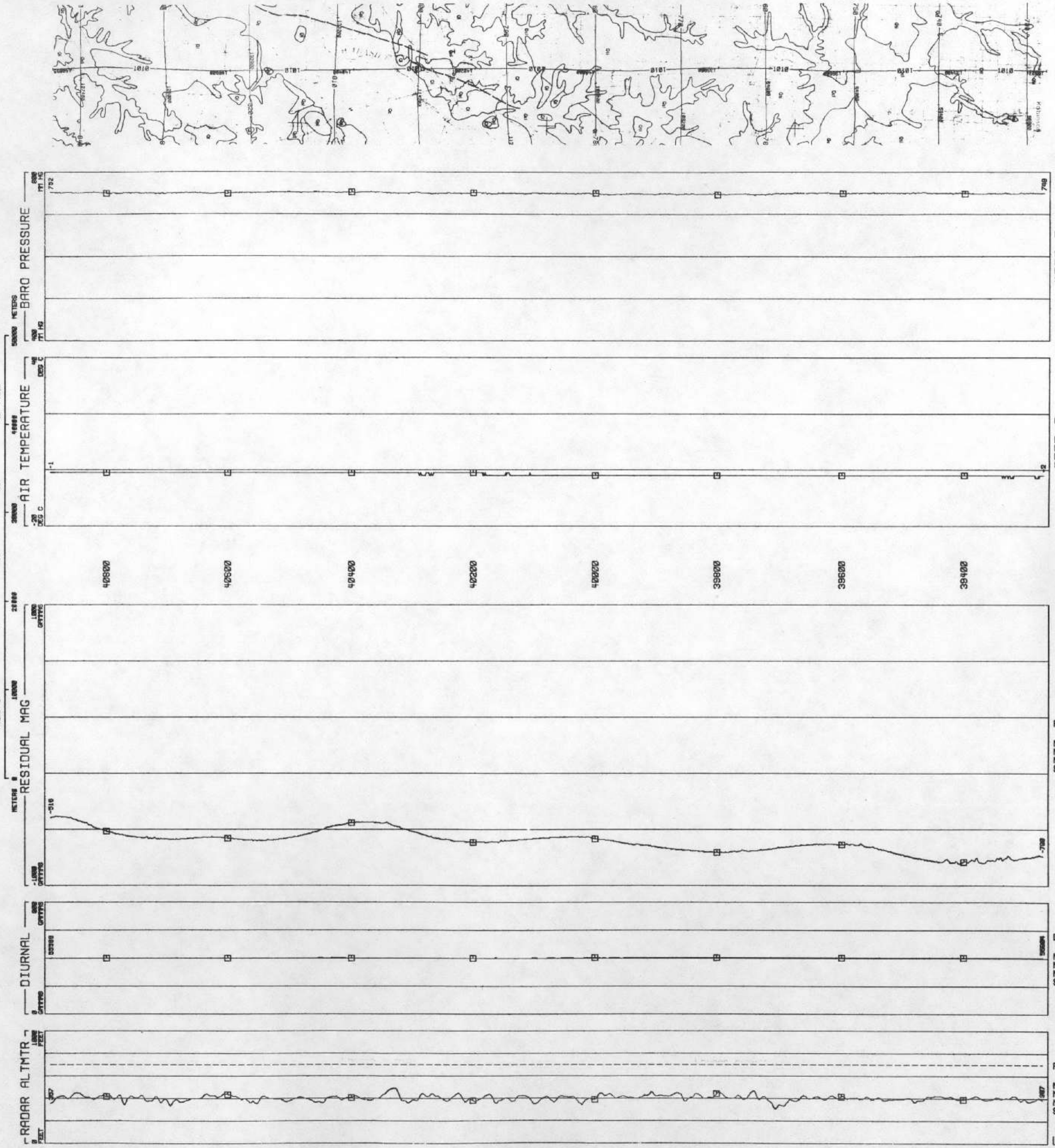
RESIDUAL MAG
GAMMAS
MIN -835.6
MAX -435.9
MEAN -621.1
STD DEV 98.19

DIURNAL
GAMMAS
MIN 55591
MAX 55594
MEAN 55589
STD DEV 3.210

RADAR ALTMTR
FEET
MIN 327.5
MAX 756.9
MEAN 411.8
STD DEV 45.41

LINE 1020

LINE 1010
VINCENNES QUADRANGLE - NTMS NJ 16-5
DATA ACQUIRED 80338



BARO PRESSURE
MM HG
MIN 745.8
MAX 753.4
MEAN 748.7
STD DEV 1.349

AIR TEMPERATURE
DEG C
MIN -3.000
MAX -1.000
MEAN -1.574
STD DEV .5104

RESIDUAL MAG
GAMMAS
MIN -844.7
MAX -507.1
MEAN -688.3
STD DEV 77.24

DIURNAL
GAMMAS
MIN 55599
MAX 55604
MEAN 55600
STD DEV 2.322

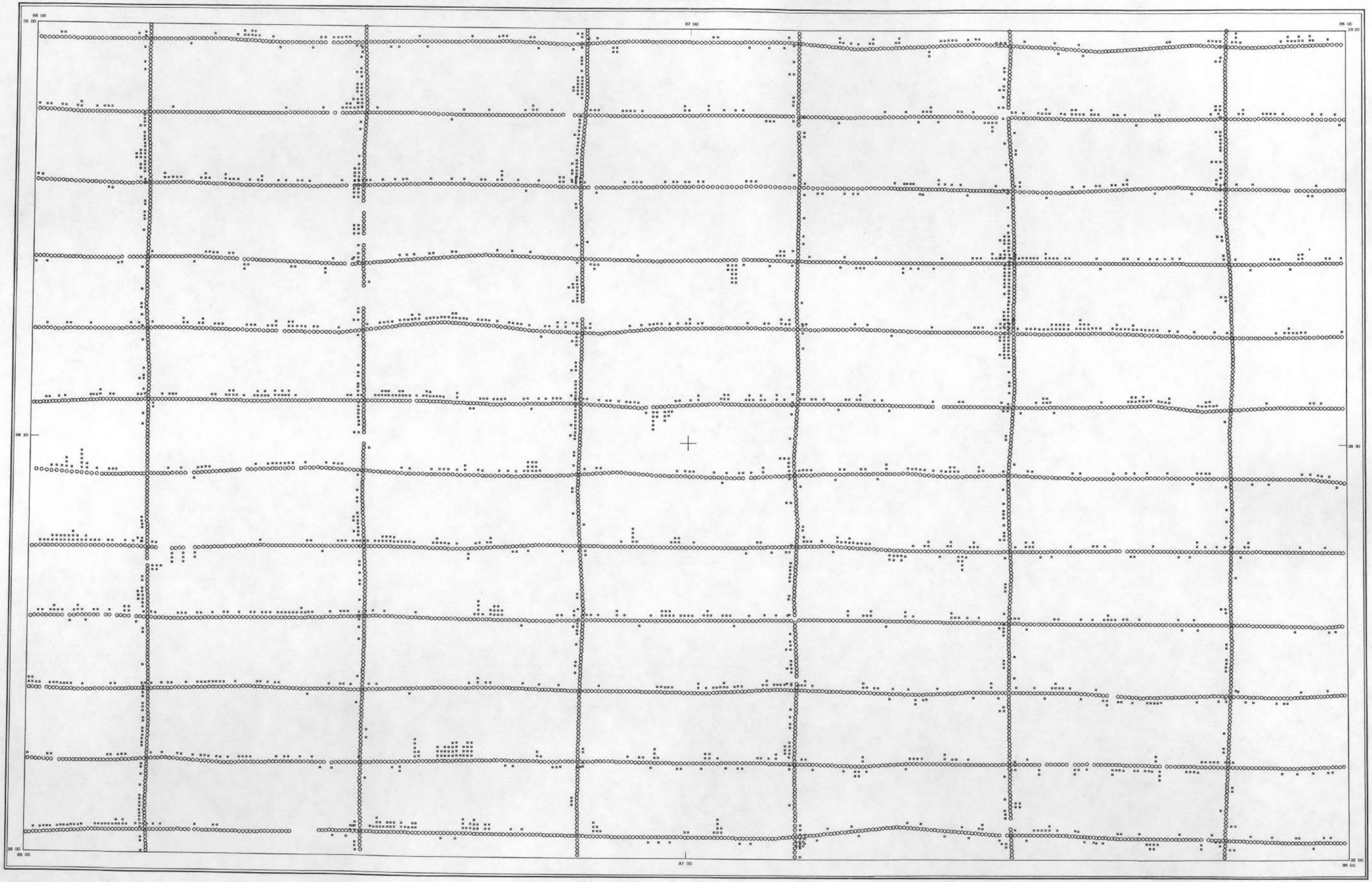
RADAR ALTMTR
FEET
MIN 311.3
MAX 490.4
MEAN 402.6
STD DEV 23.79

LINE 1010

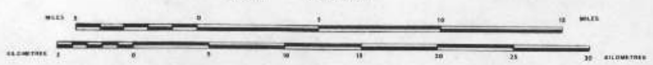
APPENDIX E – Standard Deviation Maps

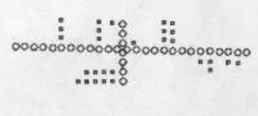
VINCENNES

E1



SCALE 1:500,000

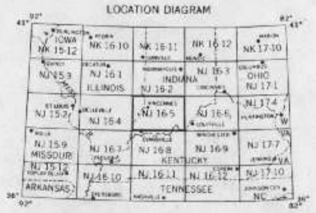




○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

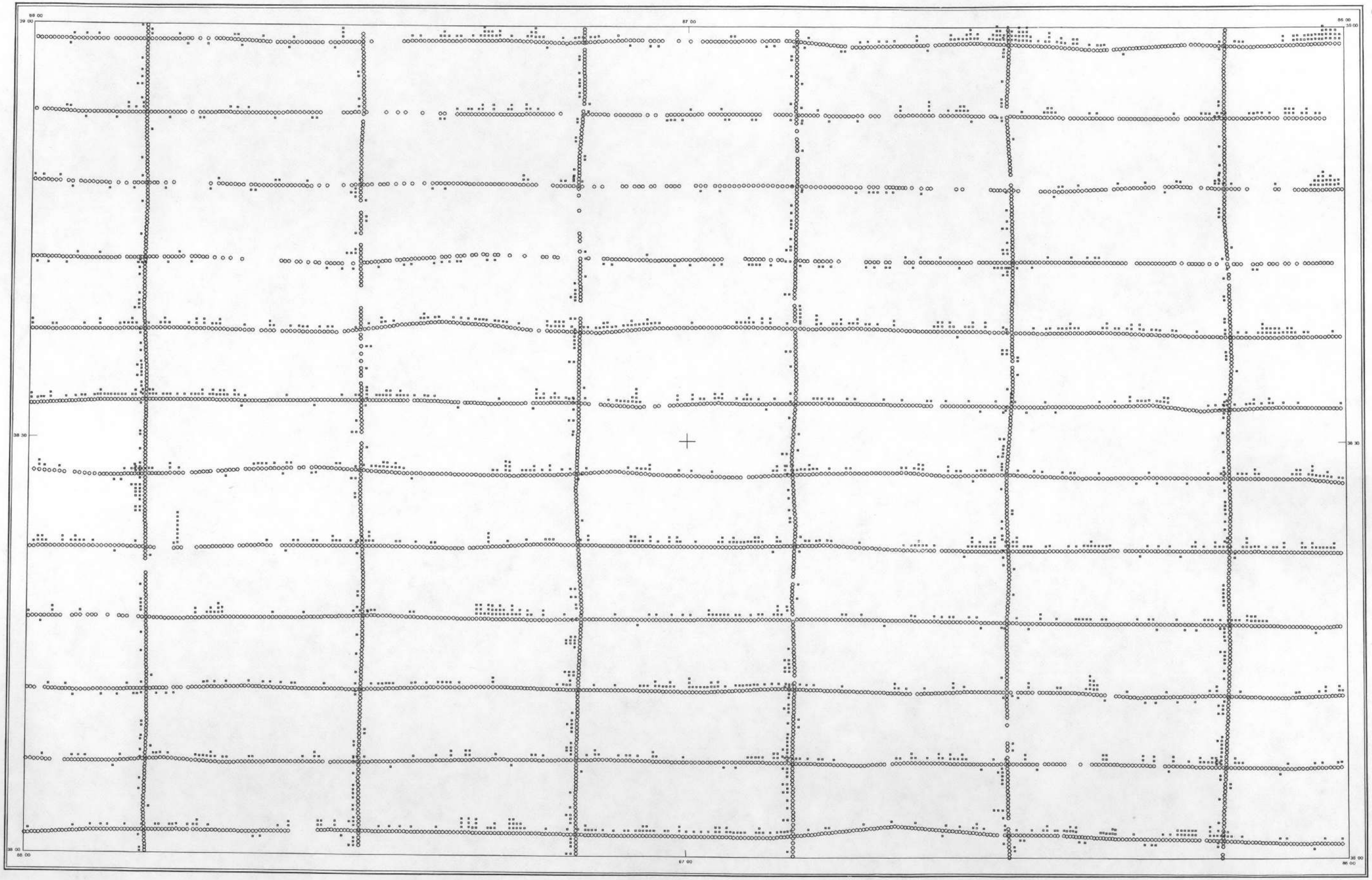
EG&G GEOMETRICS

POTASSIUM STANDARD DEVIATION MAP

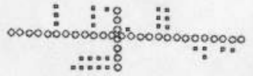
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

VINCENNES



SCALE 1:500,000



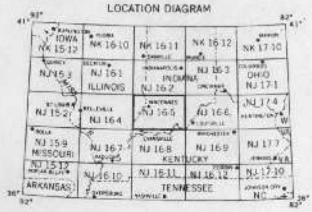
O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

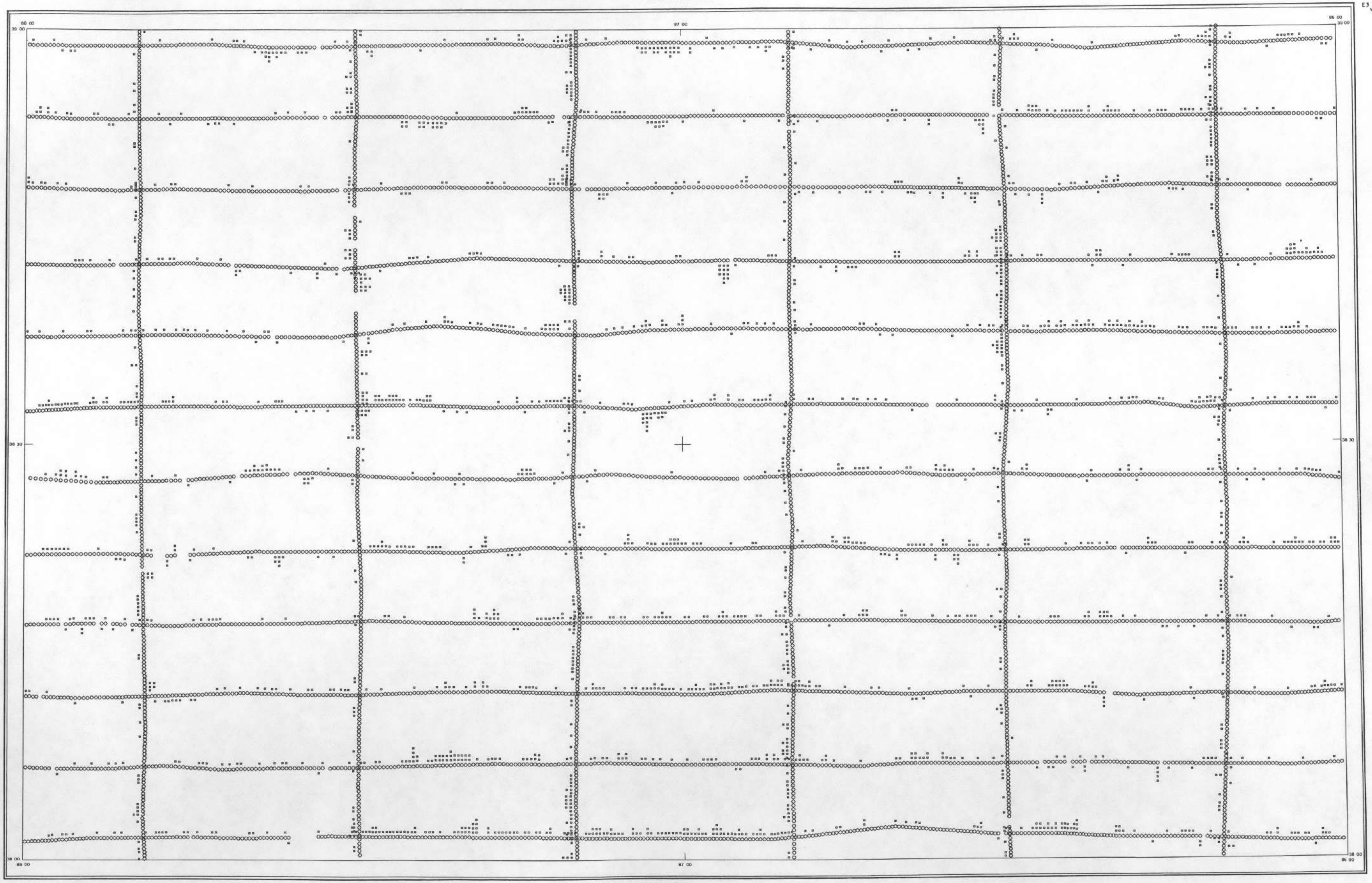


URANIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

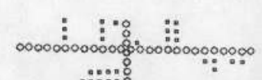
VINCENNES



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

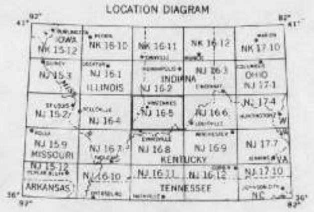
KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



○ - 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.

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

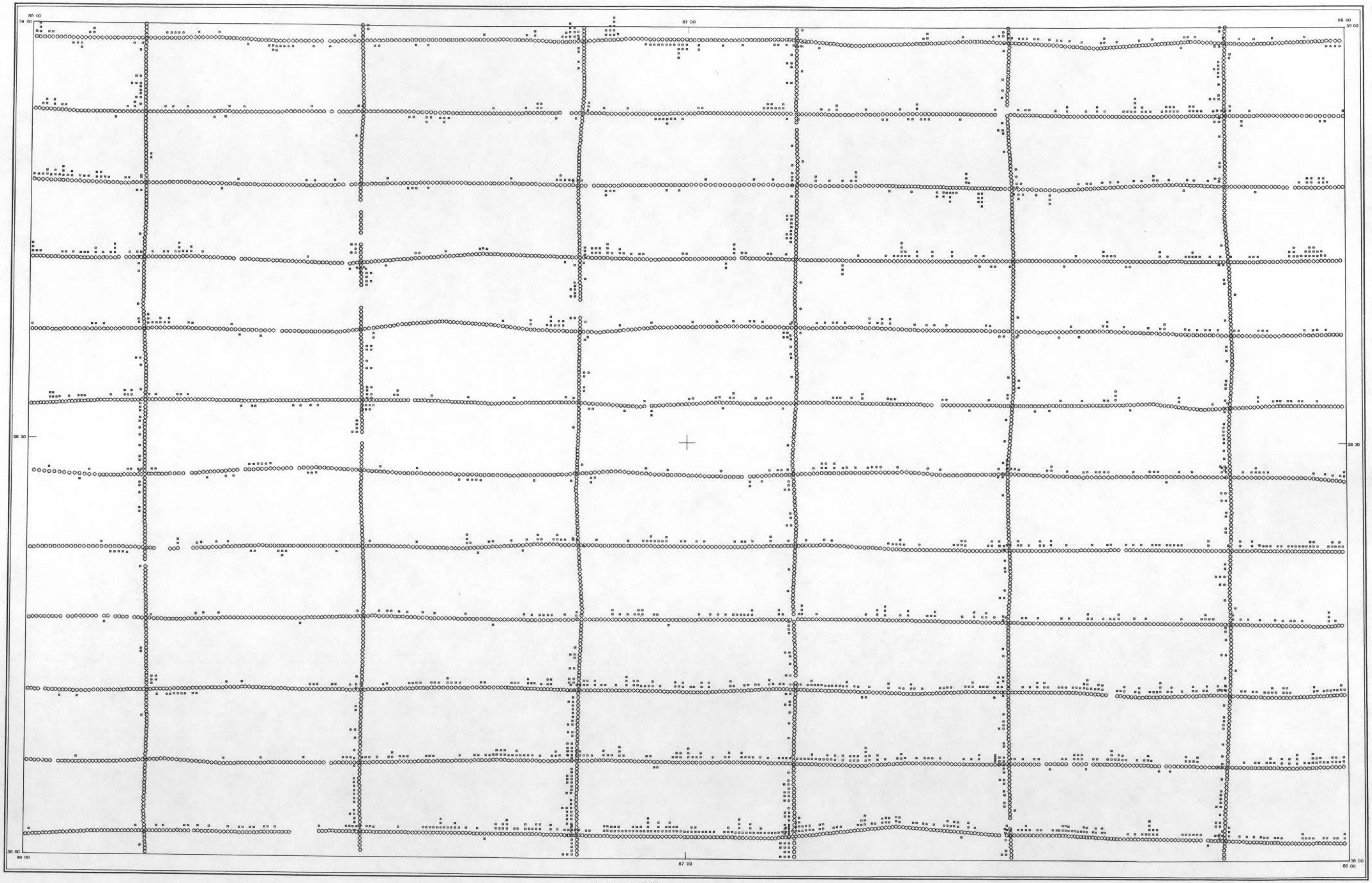
EG&G GEOMETRICS

THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

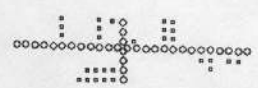
VINCENNES



SCALE 1:500,000

SURVEY AND COMPILATION BY:

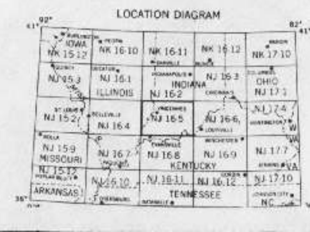
EG&G GEOMETRICS



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

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

LOCATION DIAGRAM

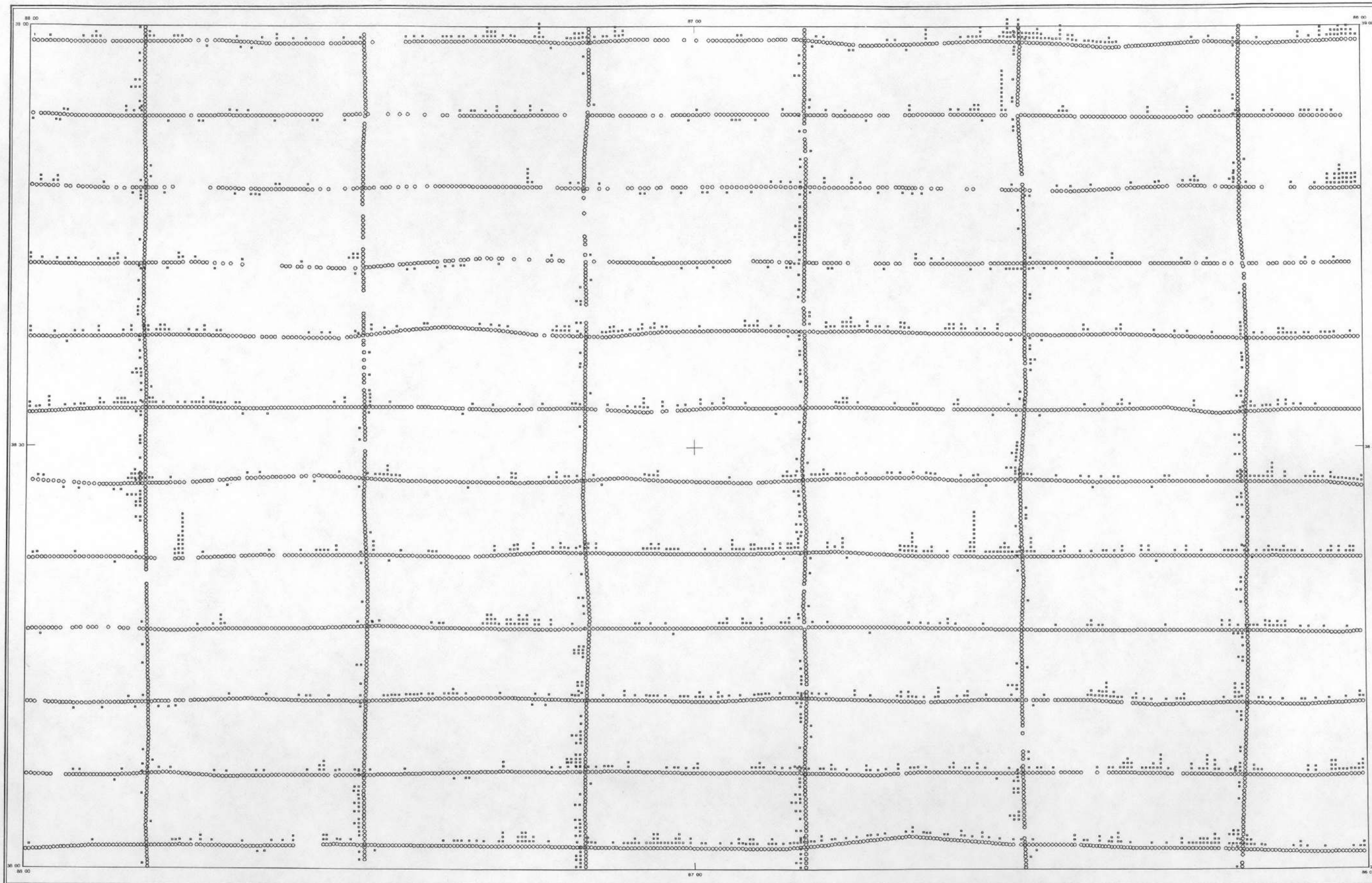


THORIUM / POTASSIUM STANDARD DEVIATION MAP

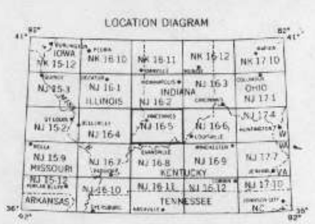
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

VINCENNES



SCALE 1:500,000



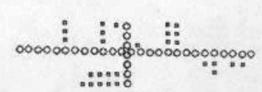
URANIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

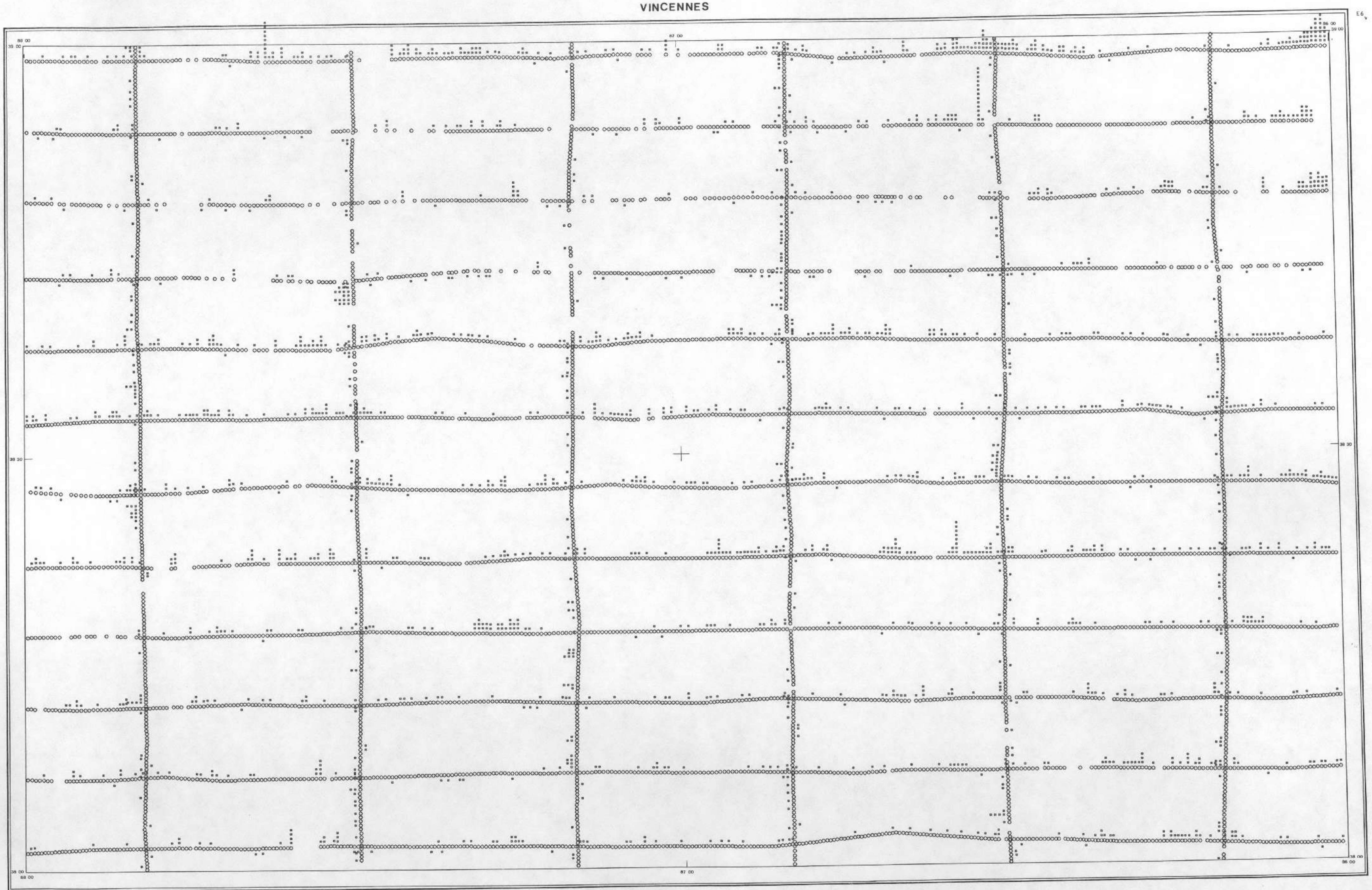
EG&G GEOMETRICS



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.

VINCENNES



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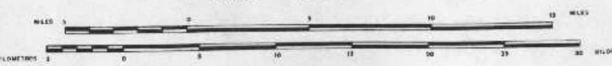
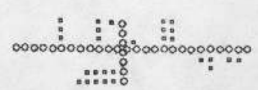
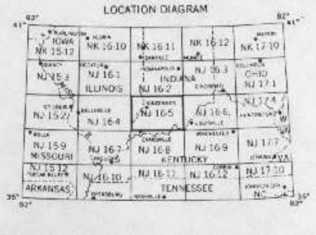




O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

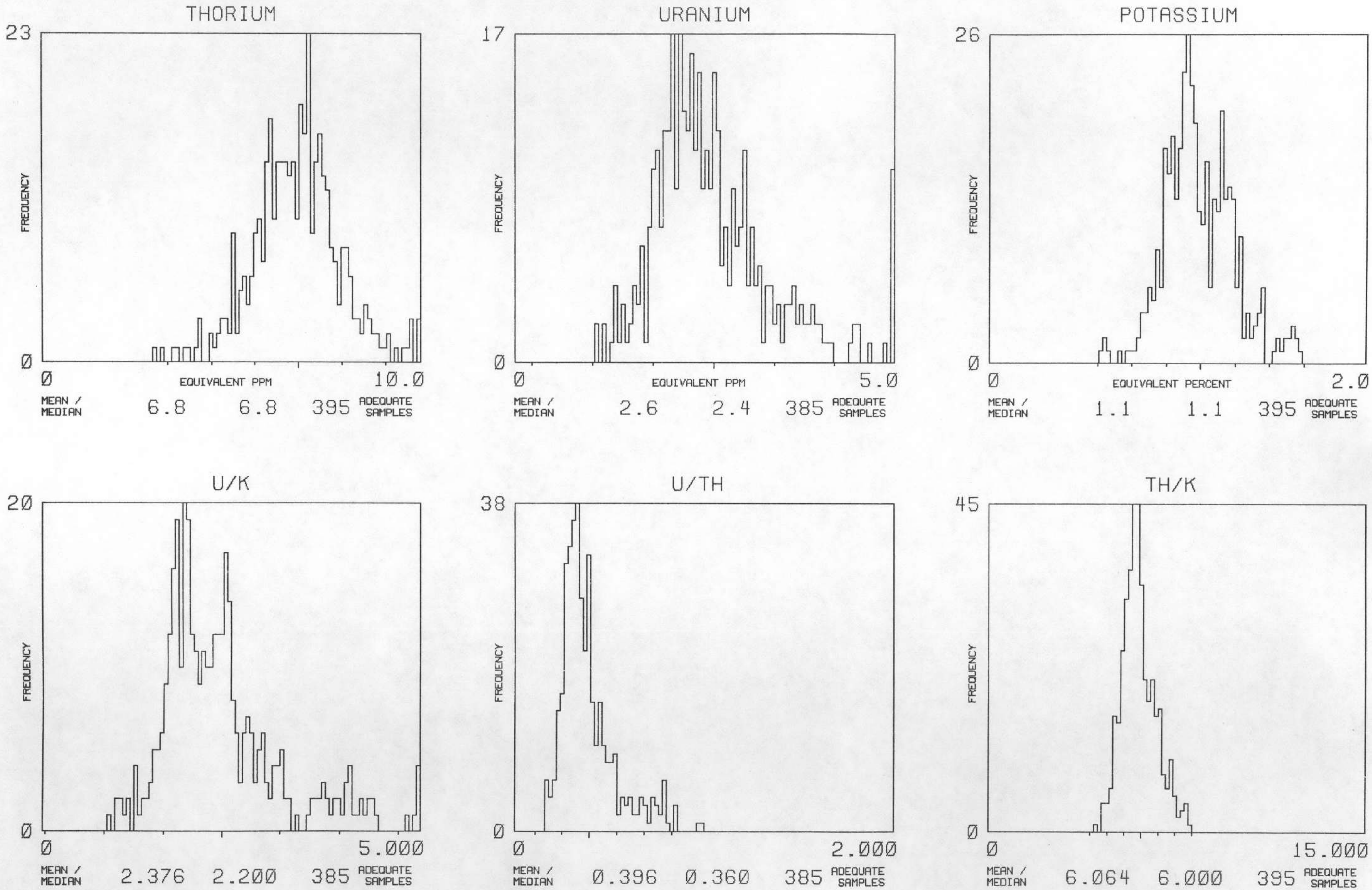
URANIUM/THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

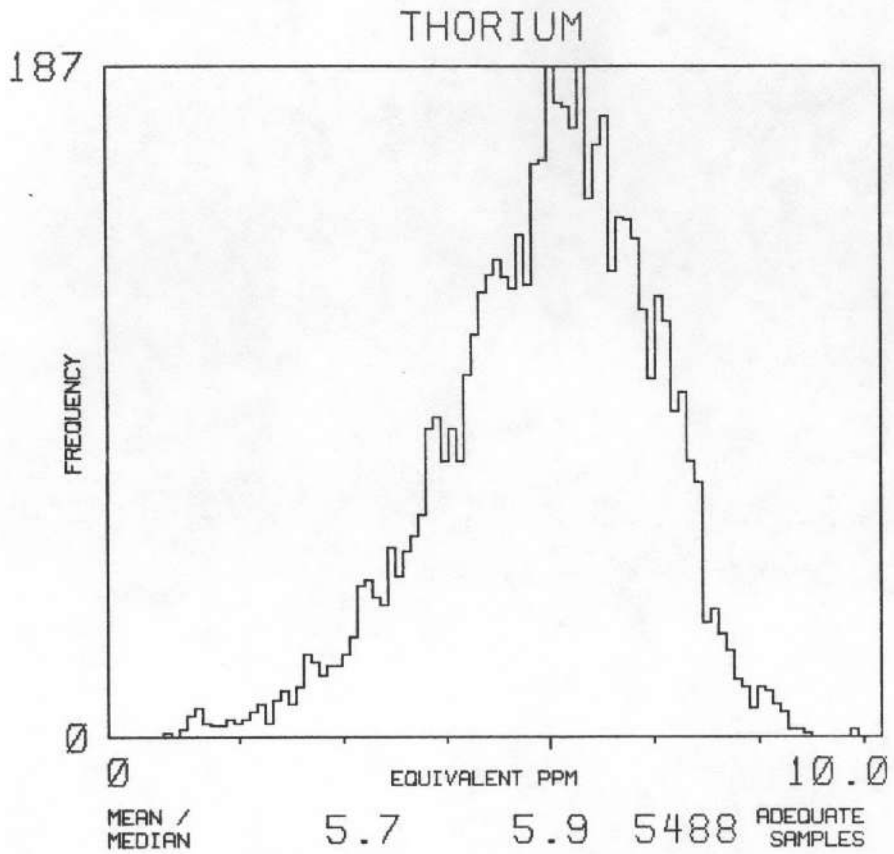
U. S. DEPARTMENT OF ENERGY

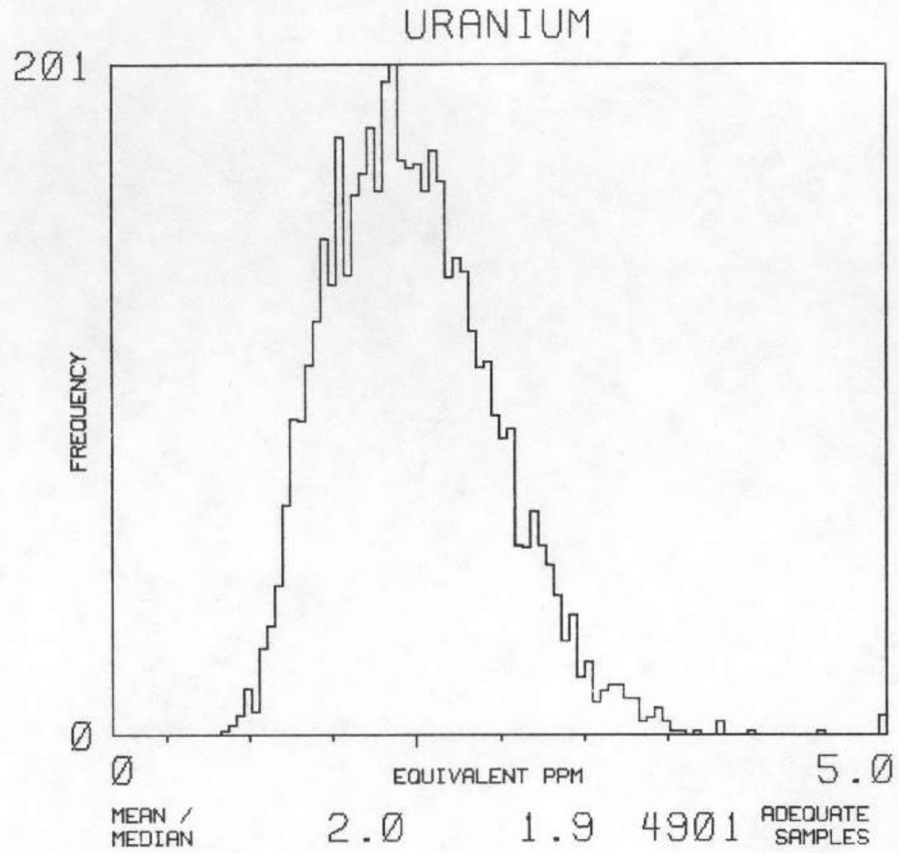
APPENDIX F - Histograms and Map Unit Conversion Table

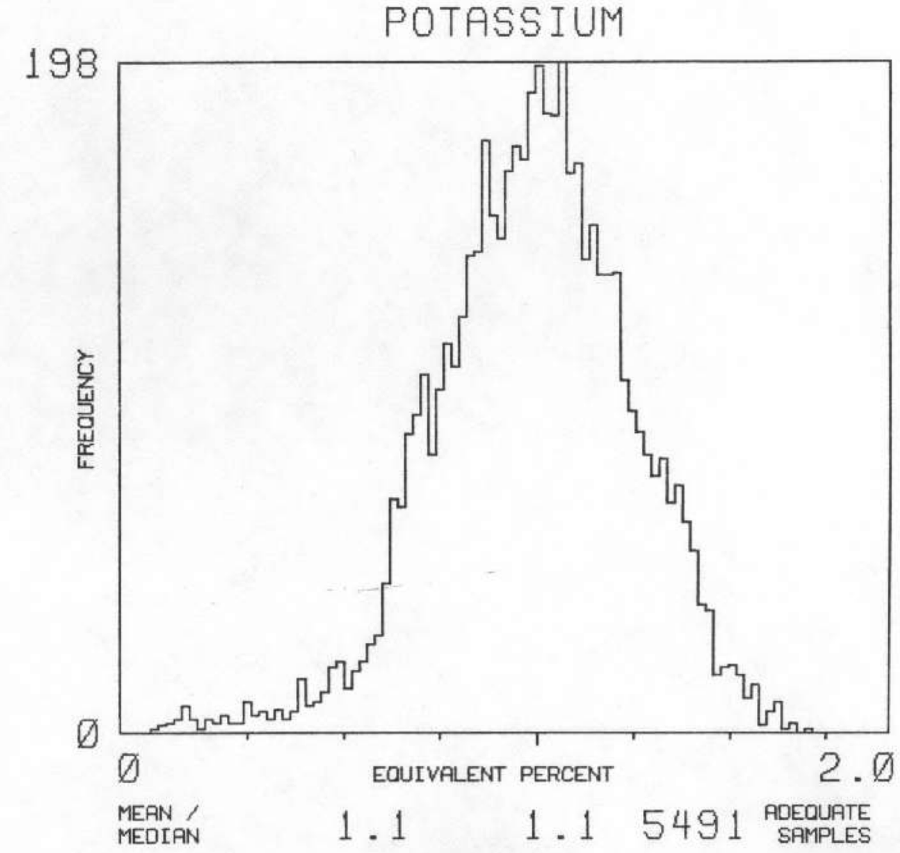
NJ 16-5 VINCENNES MAP UNIT : QM TOTAL NUMBER OF SAMPLES 395

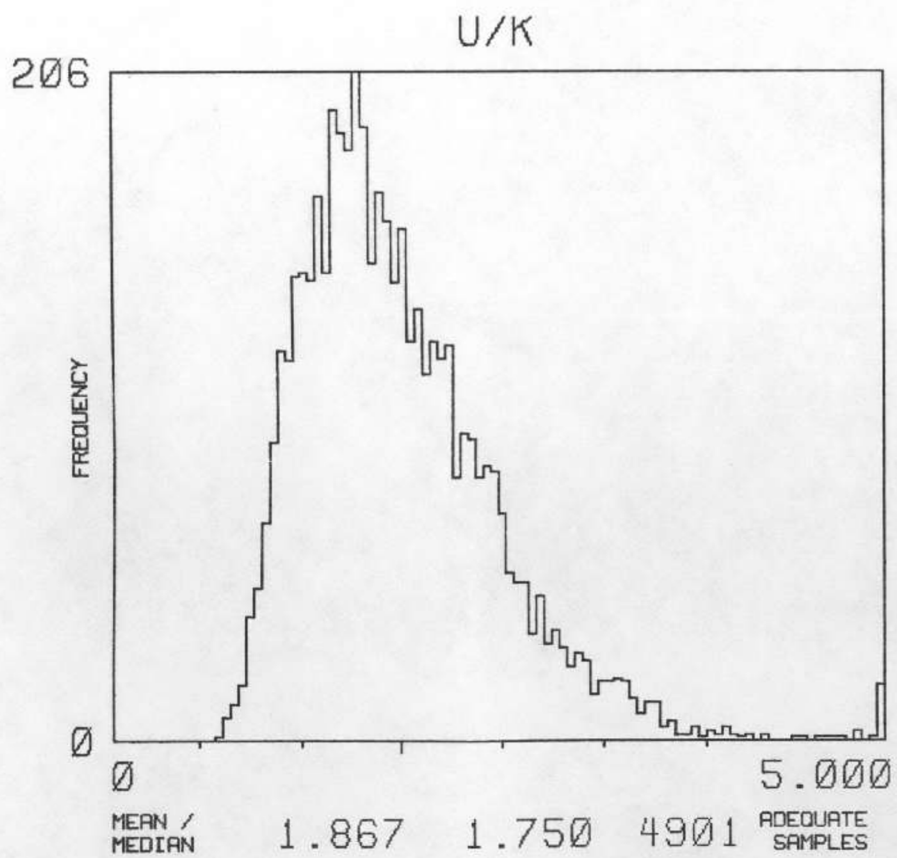


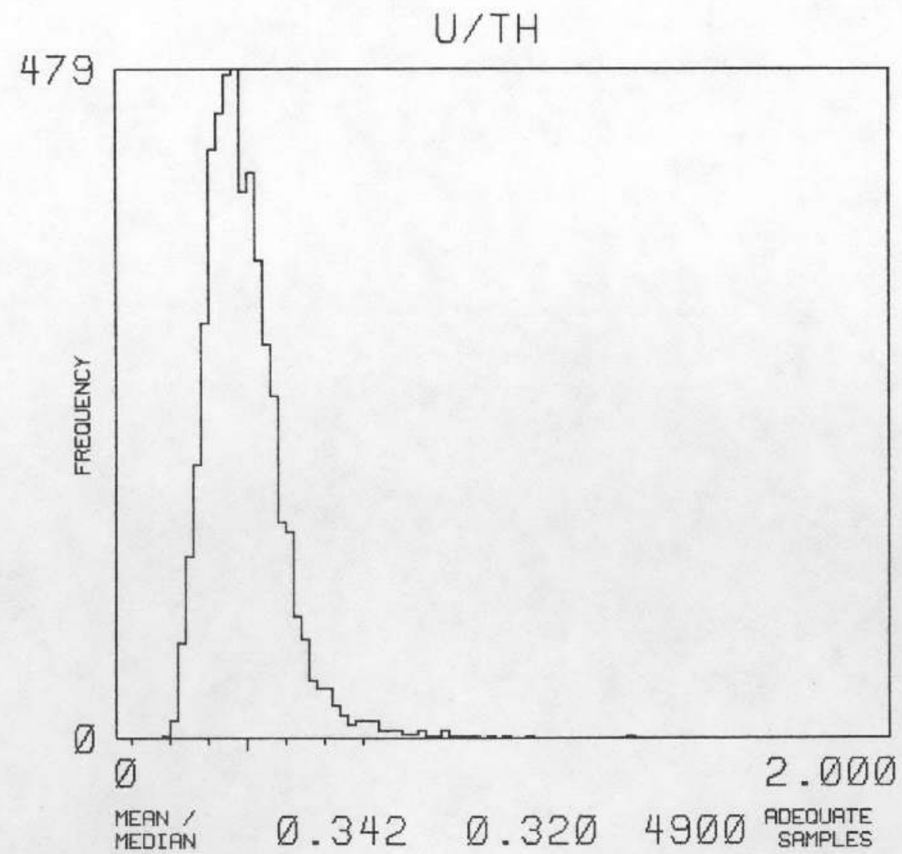
NJ 16-5 VINCENNES MAP UNIT : QC TOTAL NUMBER OF SAMPLES 5509

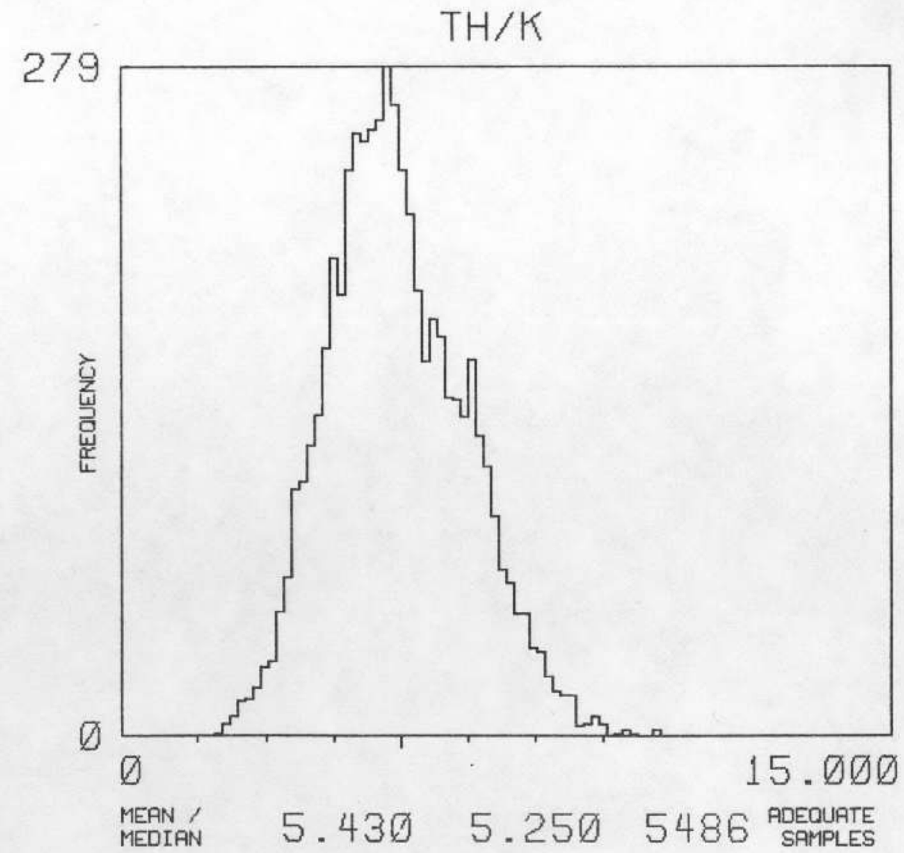






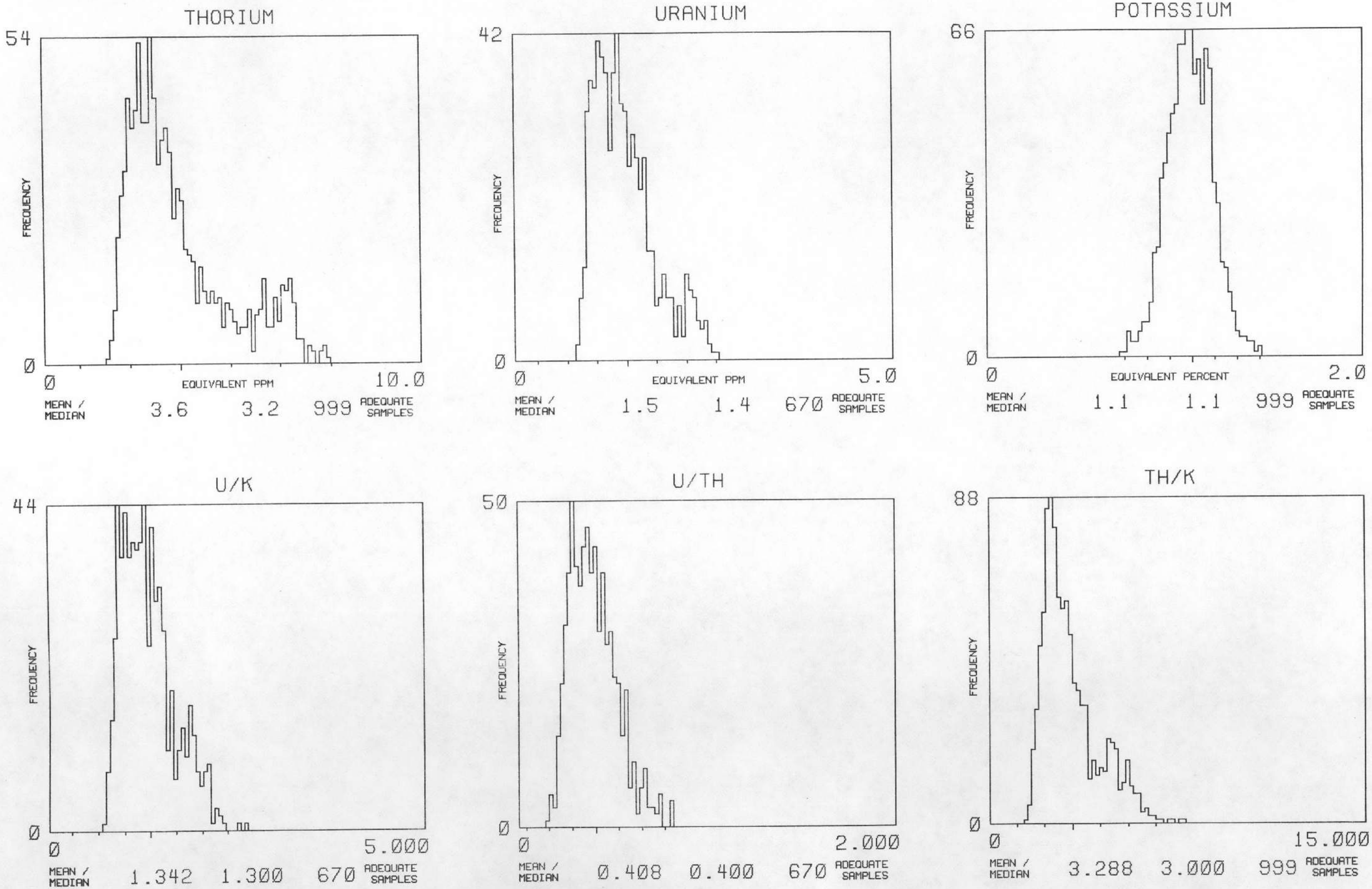






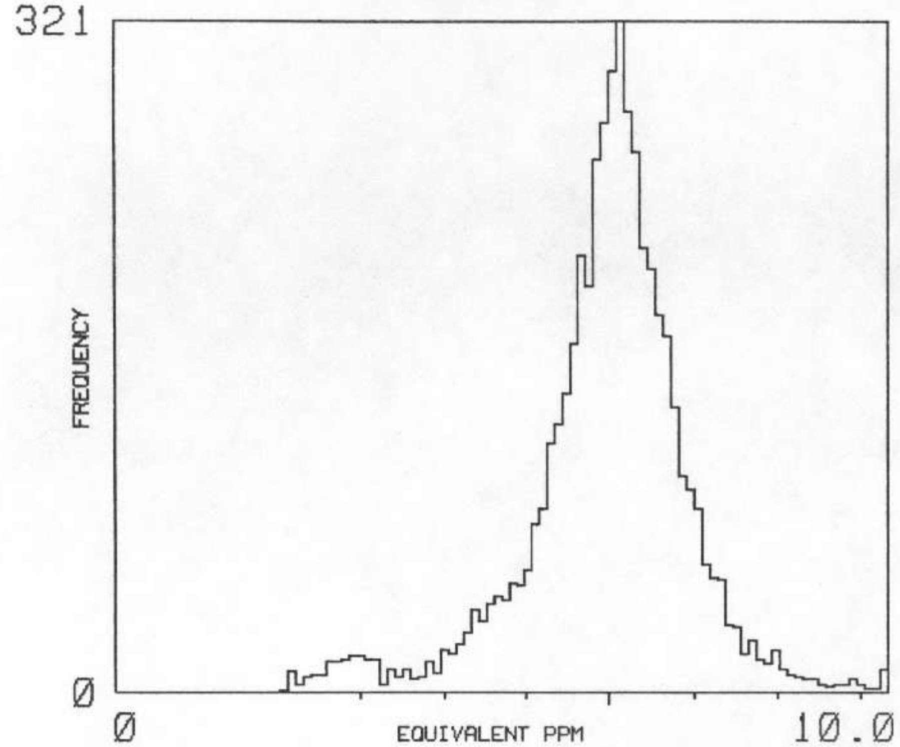
F3

NJ 16-5 VINCENNES MAP UNIT : QPL TOTAL NUMBER OF SAMPLES 999



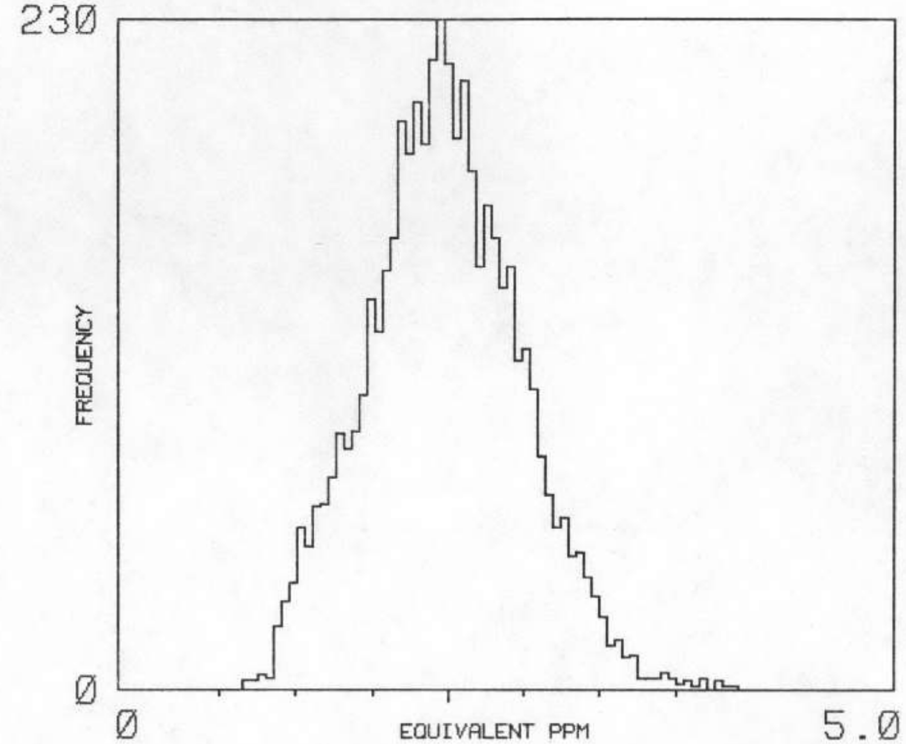
NJ 16-5 VINCENNES MAP UNIT : QL TOTAL NUMBER OF SAMPLES 5109

THORIUM



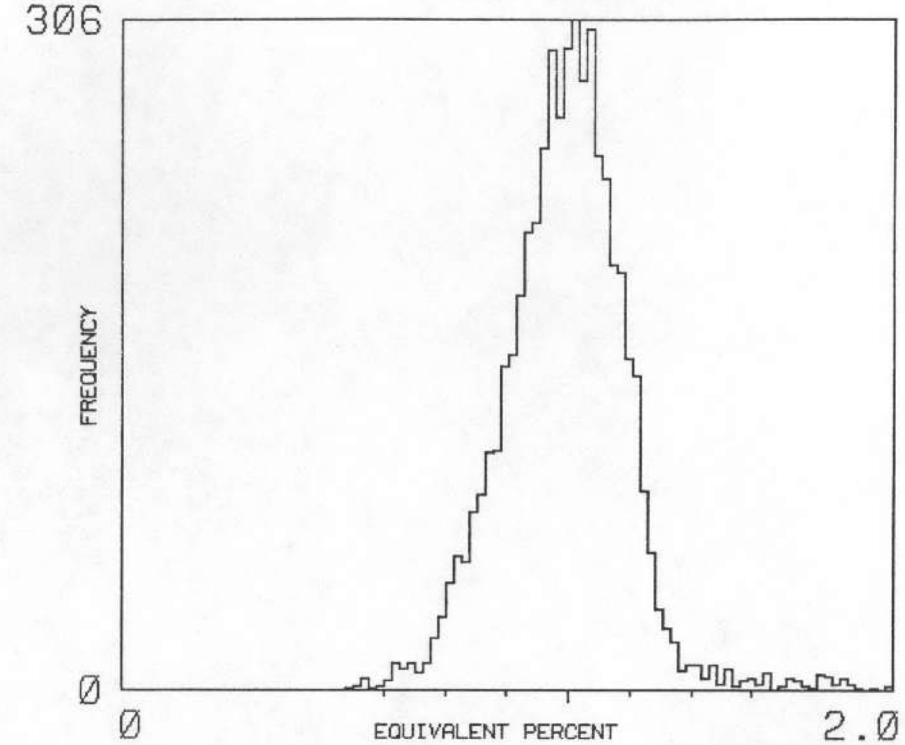
MEAN / MEDIAN 6.4 6.5 5085 ADEQUATE SAMPLES

URANIUM



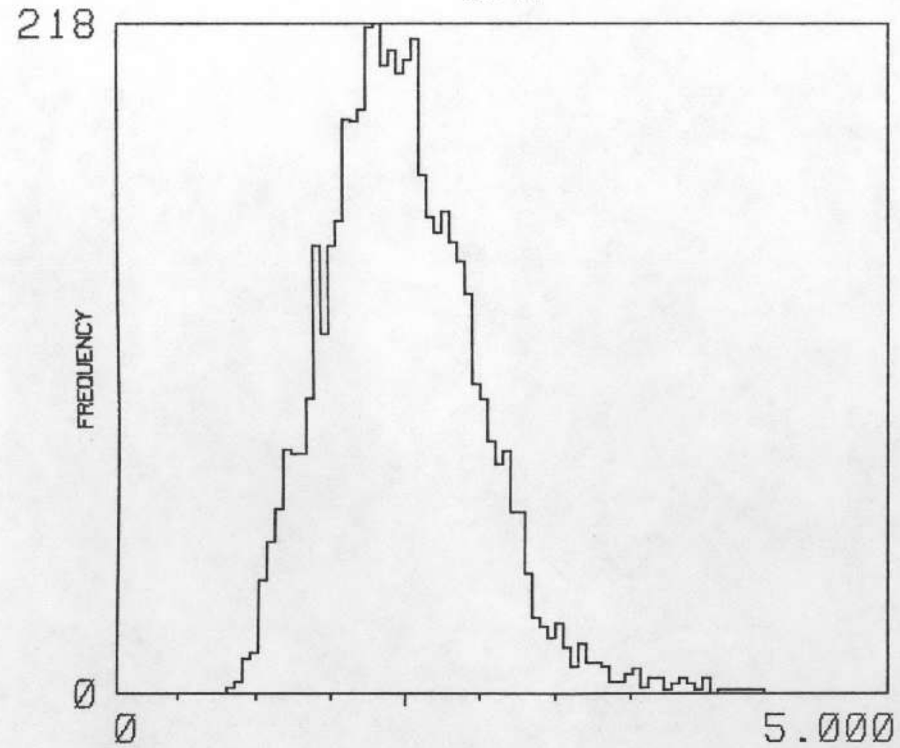
MEAN / MEDIAN 2.1 2.1 4956 ADEQUATE SAMPLES

POTASSIUM



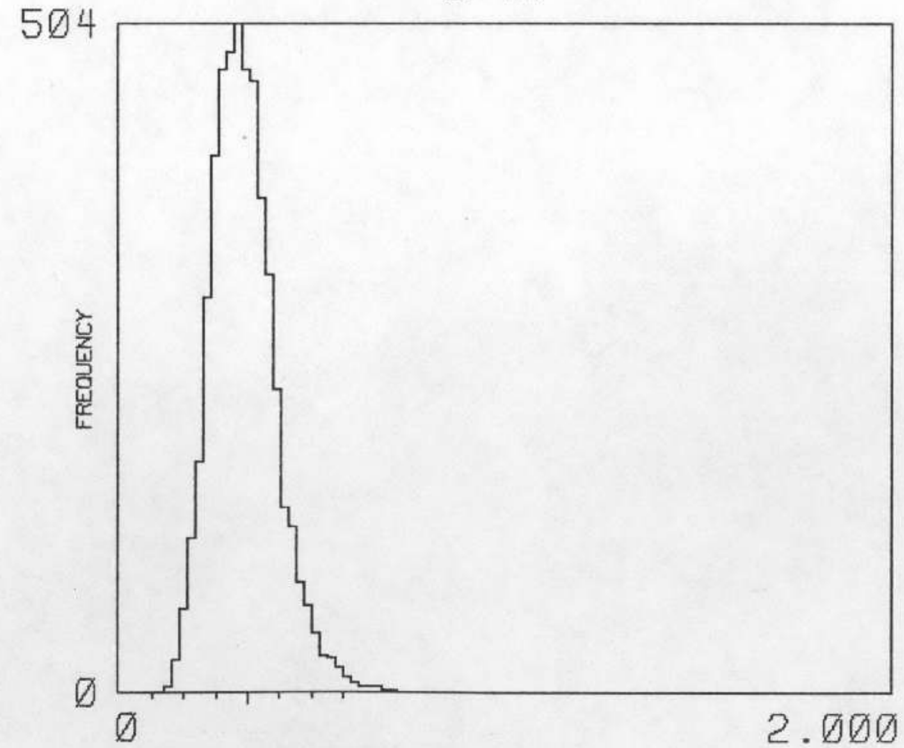
MEAN / MEDIAN 1.2 1.2 5085 ADEQUATE SAMPLES

U/K



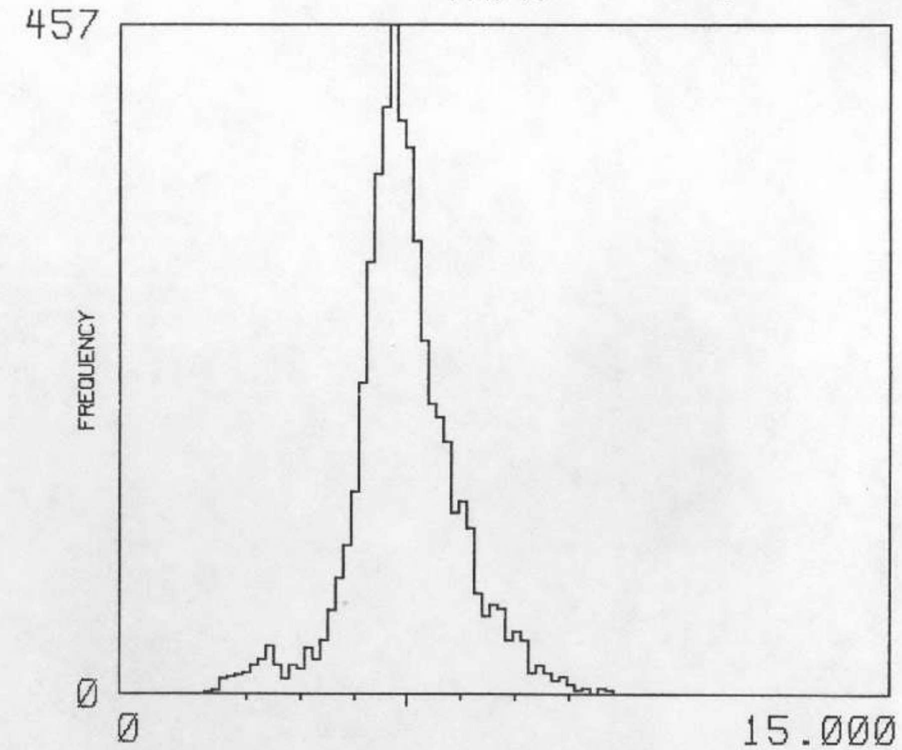
MEAN / MEDIAN 1.865 1.800 4956 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.335 0.320 4956 ADEQUATE SAMPLES

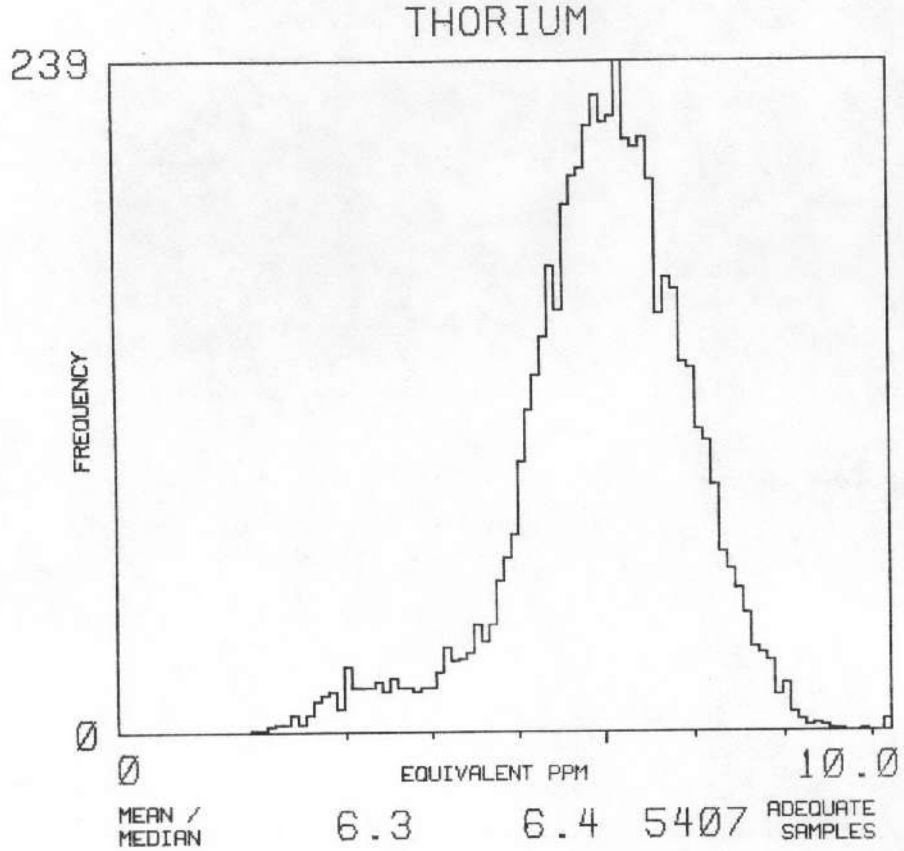
TH/K

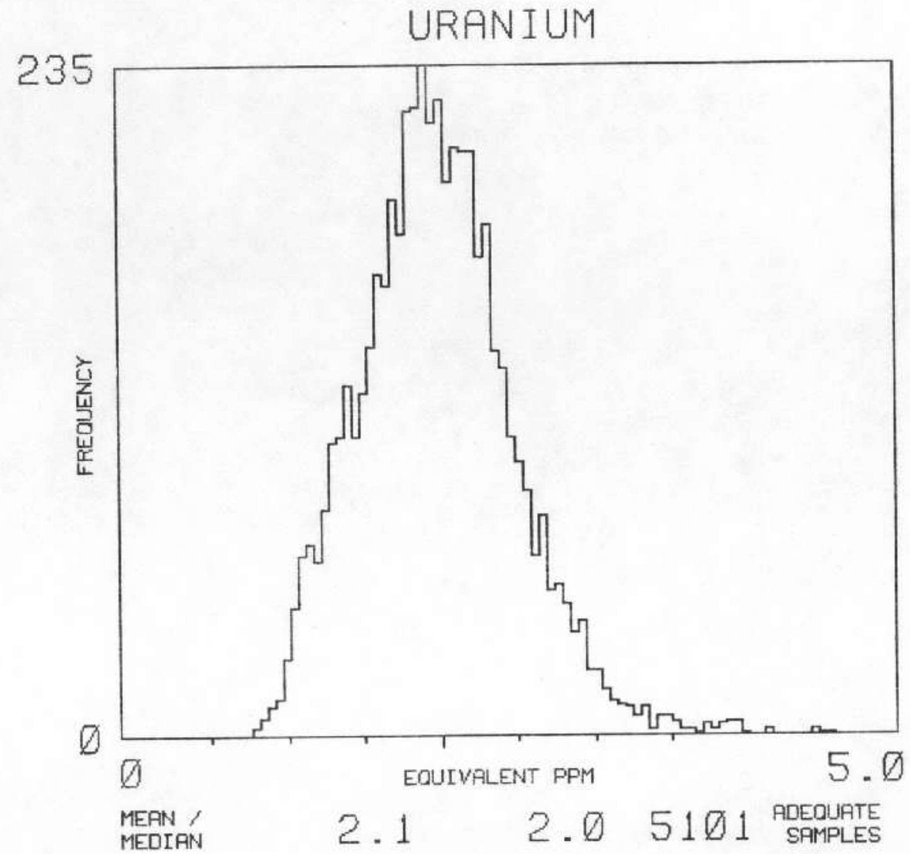


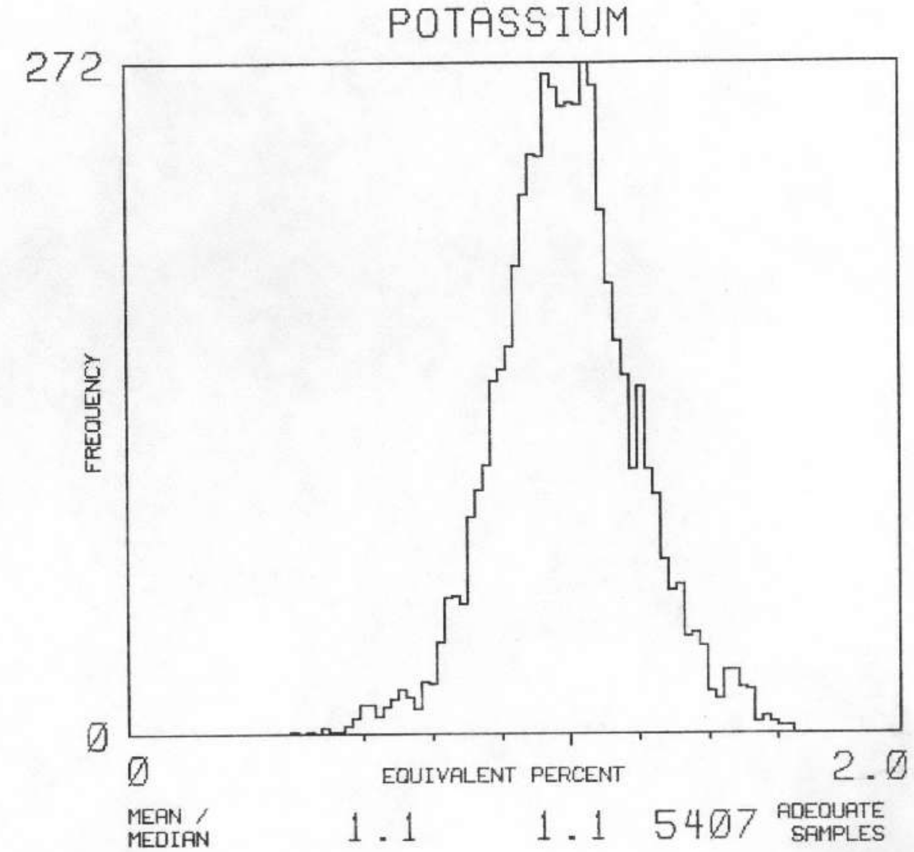
MEAN / MEDIAN 5.605 5.550 5085 ADEQUATE SAMPLES

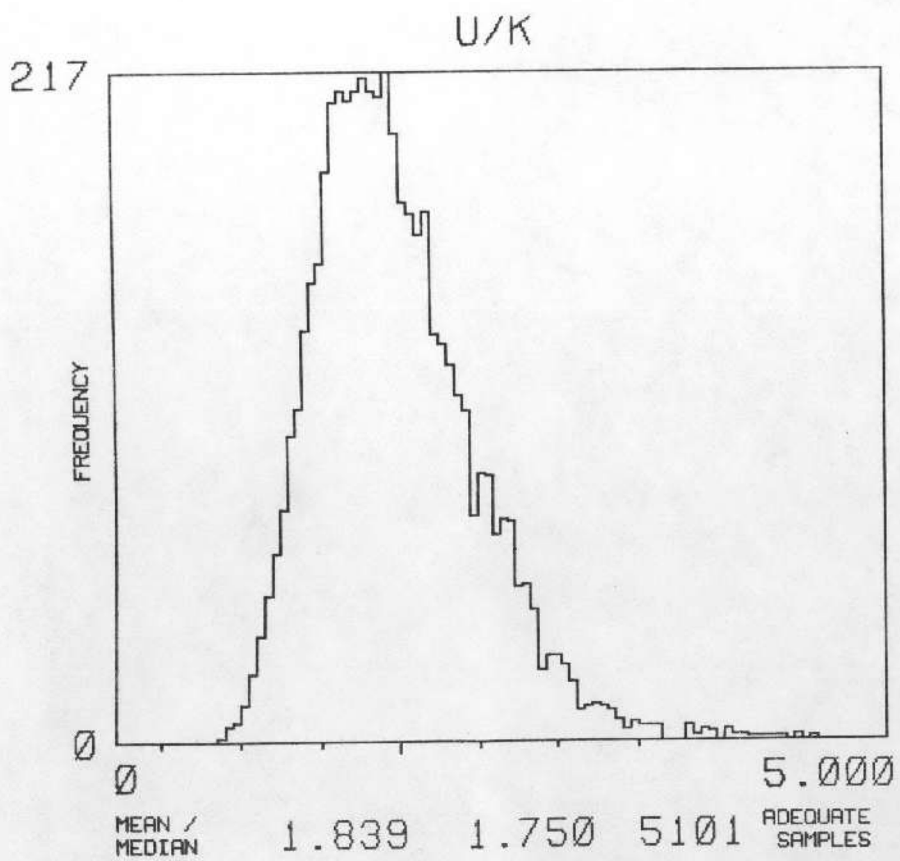
F5 v

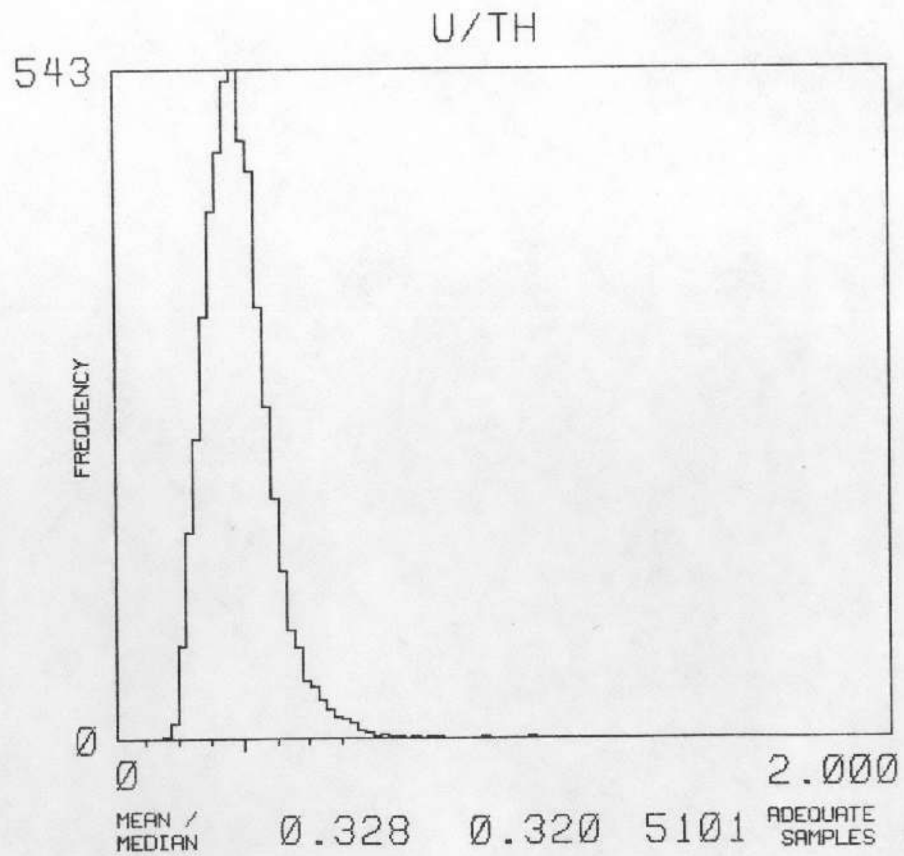
NJ 16-5 VINCENNES MAP UNIT : QCL TOTAL NUMBER OF SAMPLES 5439

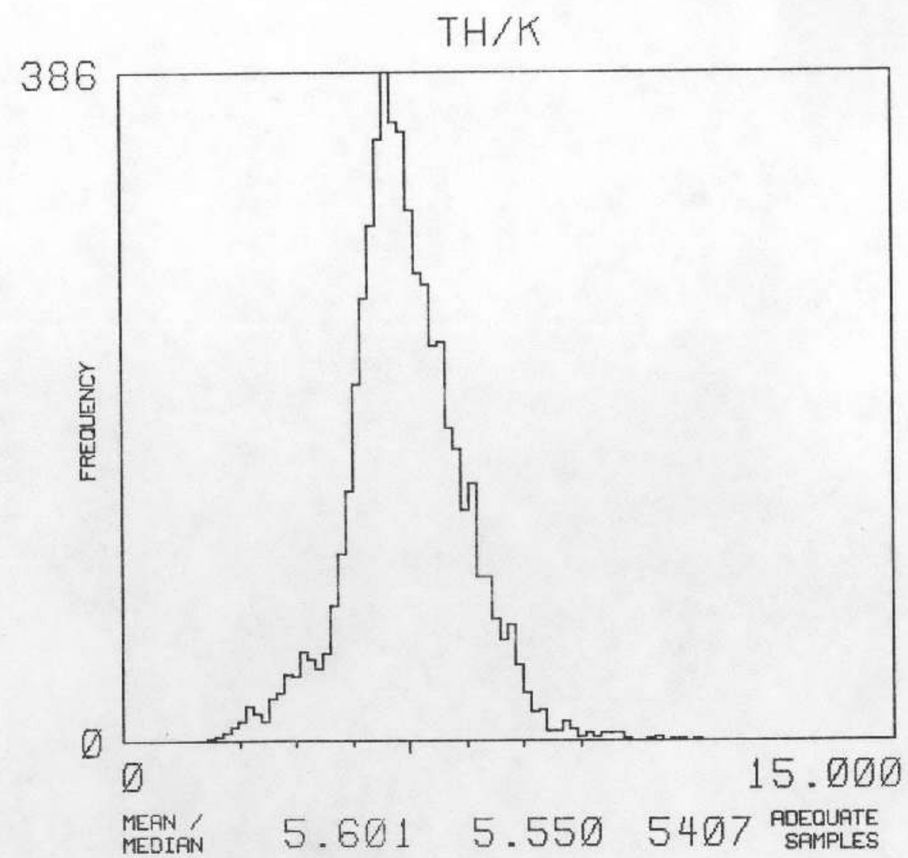






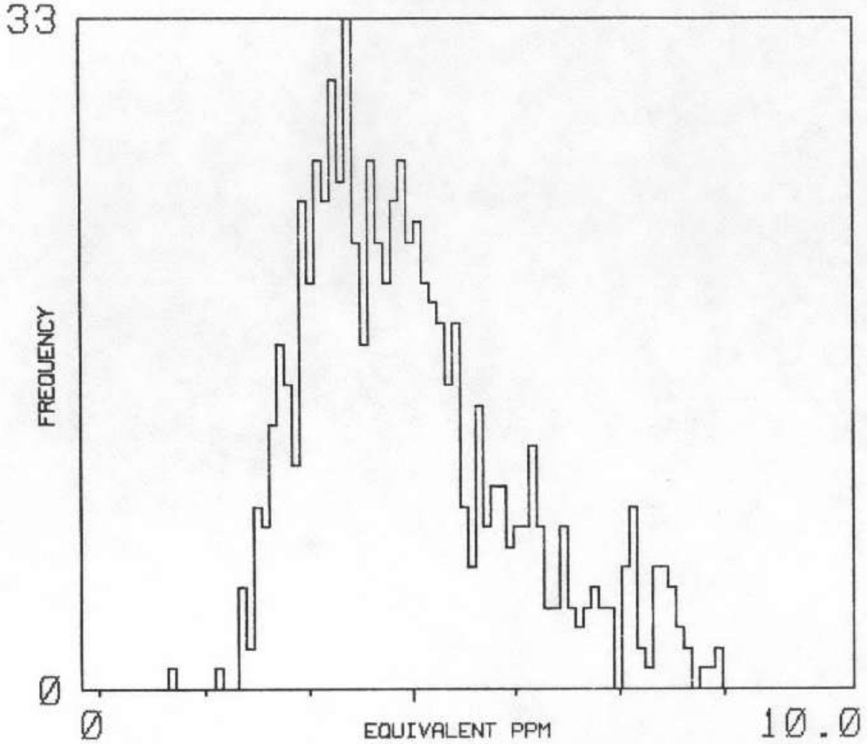






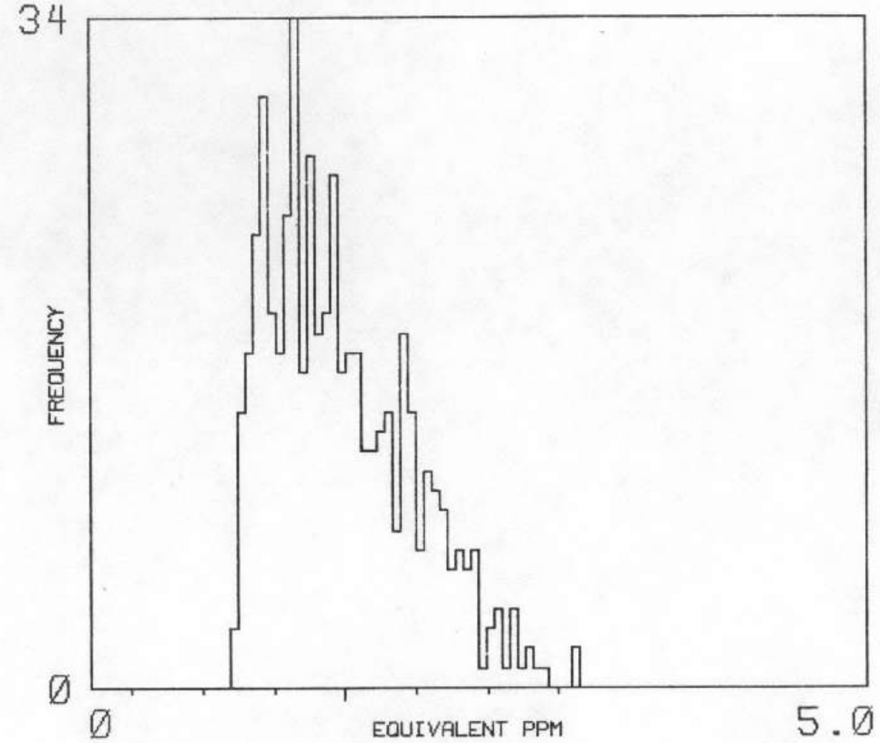
NJ 16-5 VINCENNES MAP UNIT : QGV TOTAL NUMBER OF SAMPLES 746

THORIUM



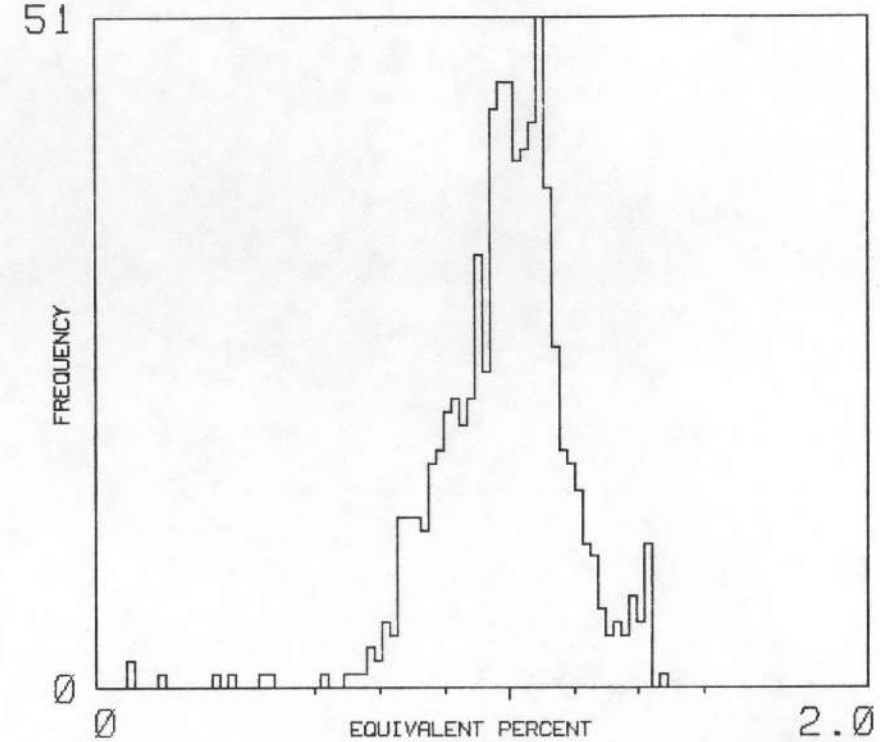
MEAN / MEDIAN 4.3 4.0 740 ADEQUATE SAMPLES

URANIUM



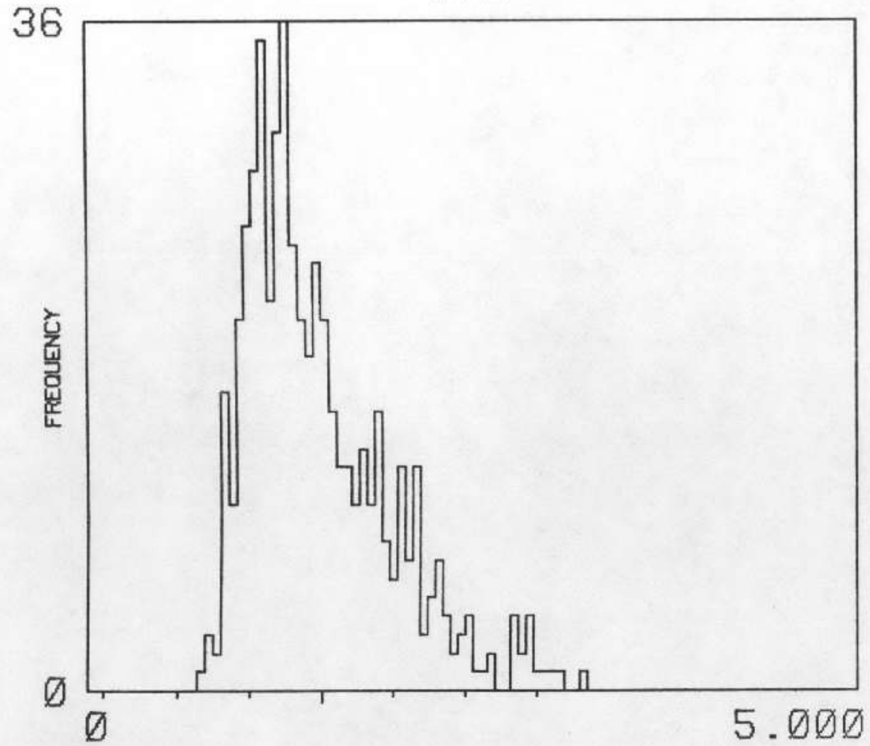
MEAN / MEDIAN 1.6 1.5 511 ADEQUATE SAMPLES

POTASSIUM



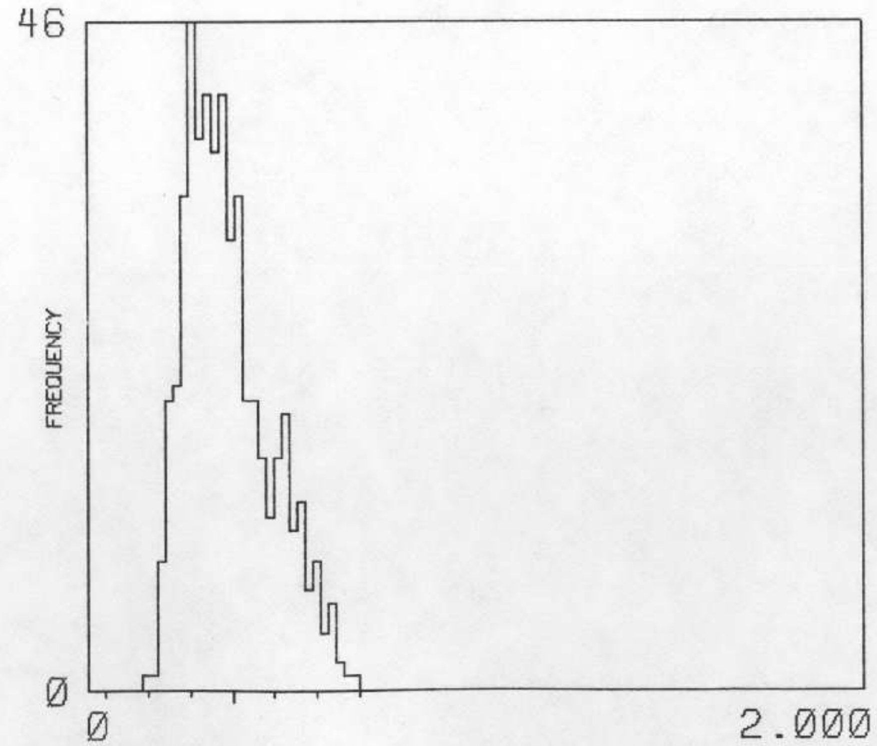
MEAN / MEDIAN 1.1 1.1 742 ADEQUATE SAMPLES

U/K



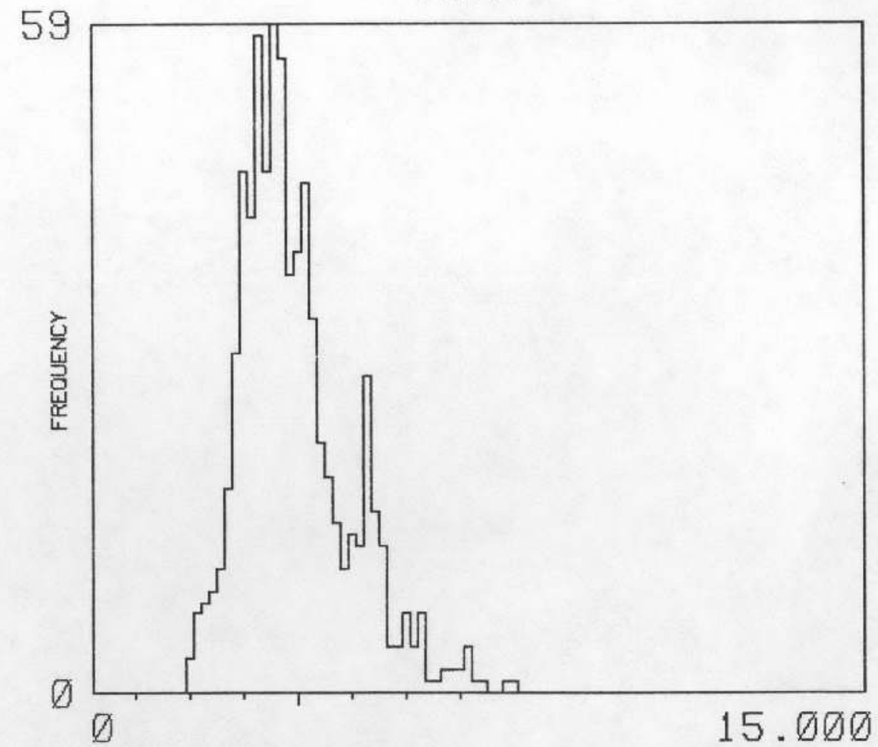
MEAN / MEDIAN 1.511 1.400 511 ADEQUATE SAMPLES

U/TH



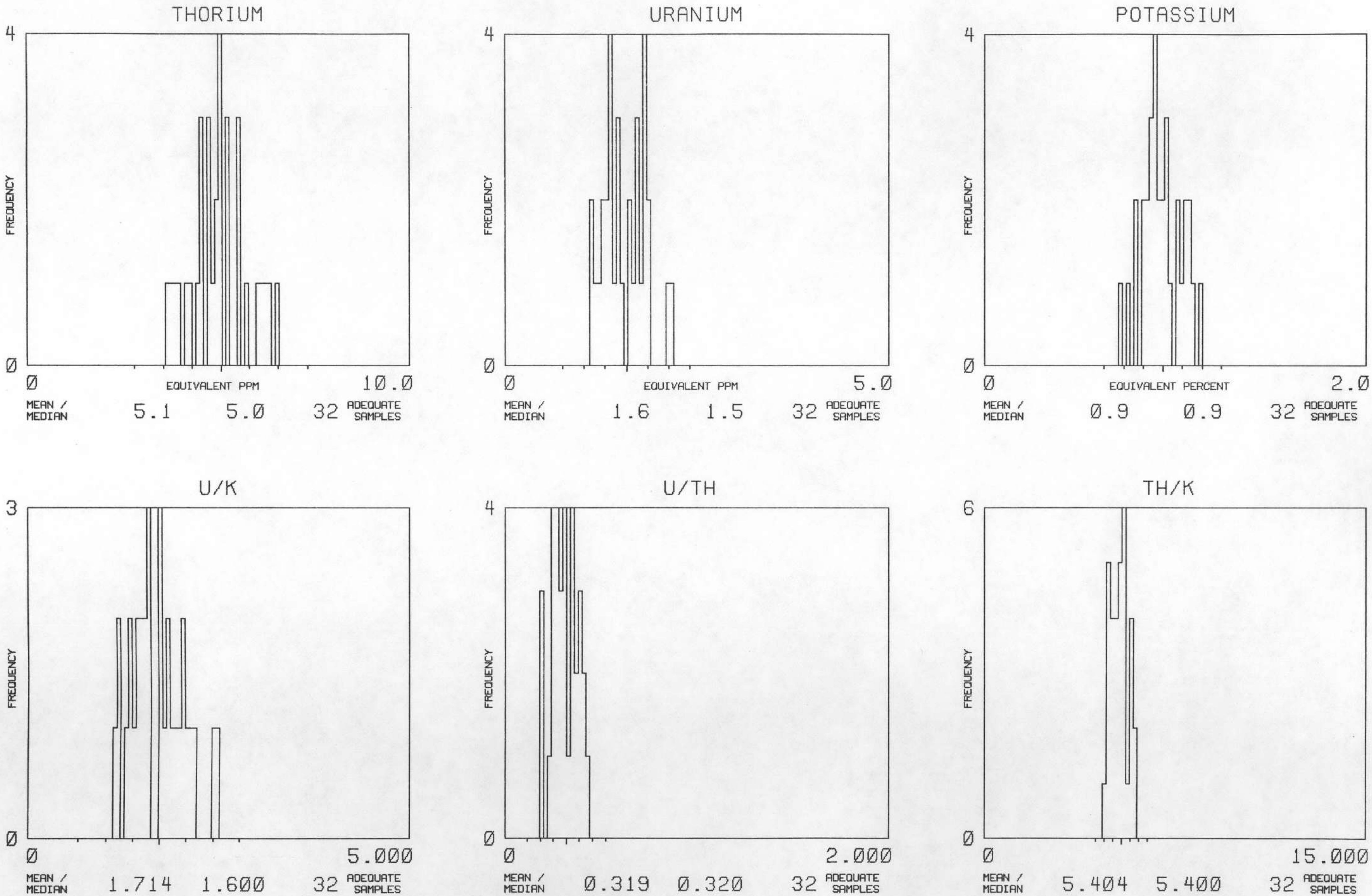
MEAN / MEDIAN 0.373 0.360 511 ADEQUATE SAMPLES

TH/K



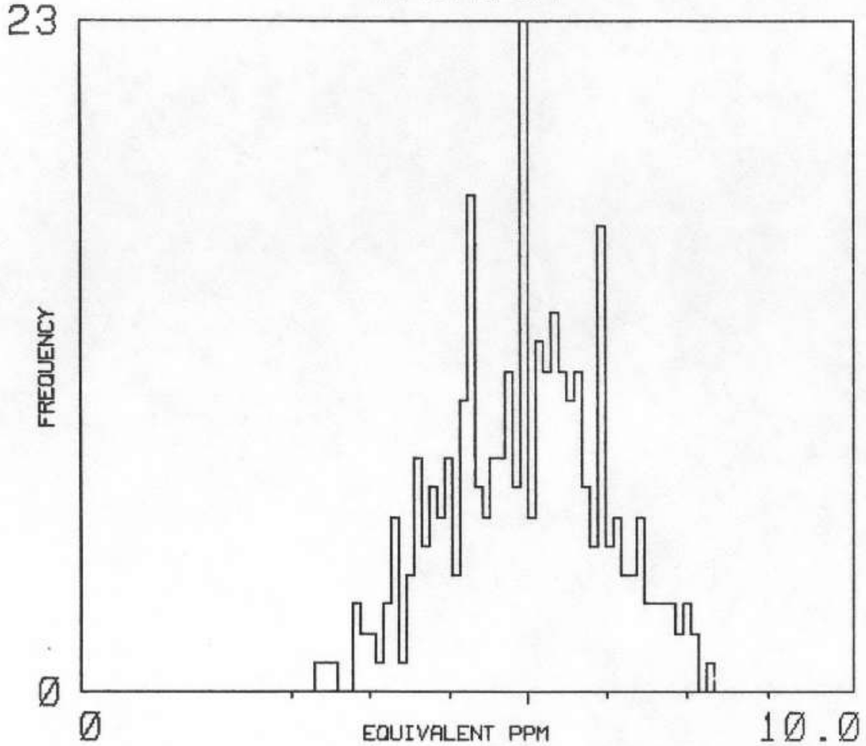
MEAN / MEDIAN 3.979 3.750 740 ADEQUATE SAMPLES

NJ 16-5 VINCENNES MAP UNIT : QGP TOTAL NUMBER OF SAMPLES 32



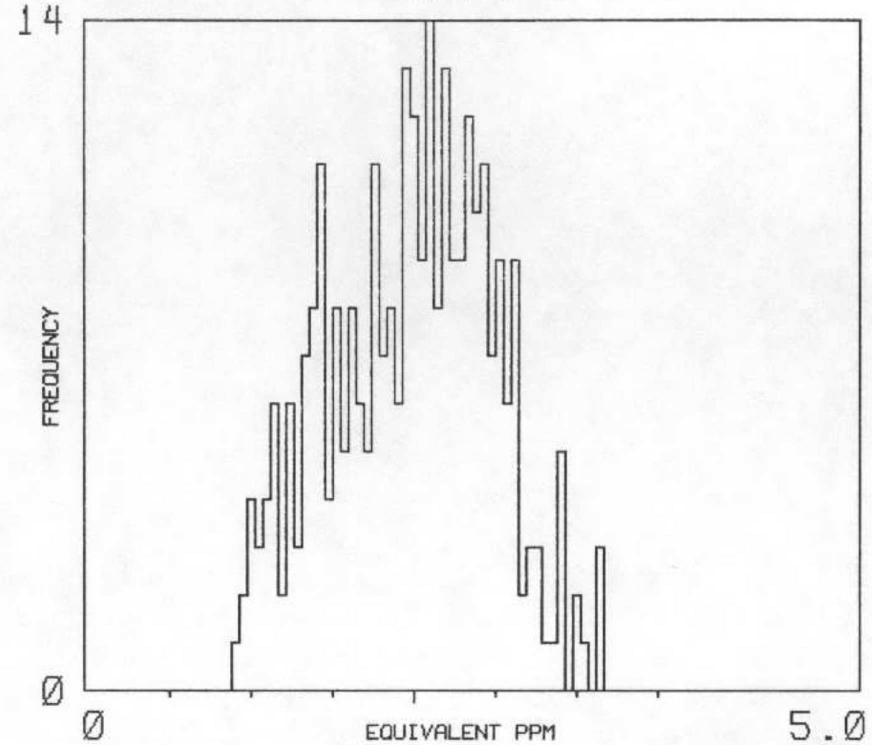
NJ 16-5 VINCENNES MAP UNIT : QSI TOTAL NUMBER OF SAMPLES 307

THORIUM



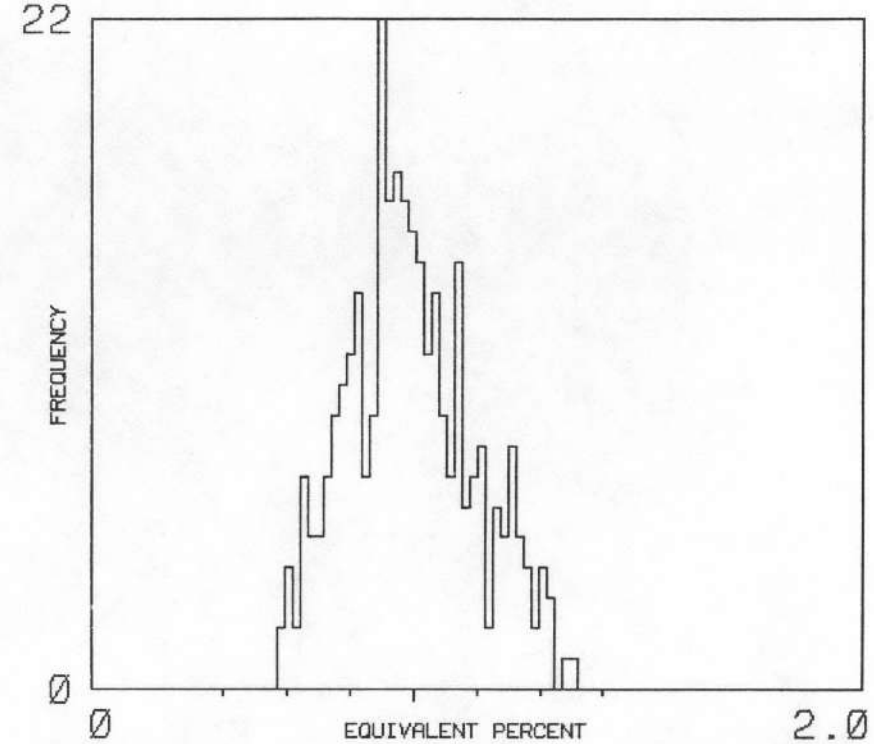
MEAN / MEDIAN 5.8 5.8 307 ADEQUATE SAMPLES

URANIUM



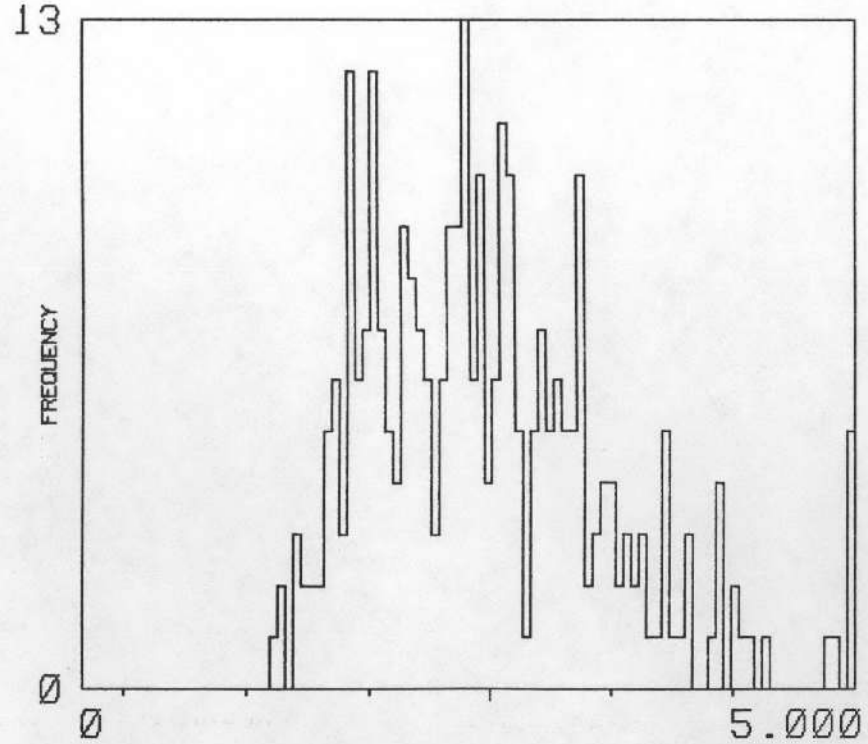
MEAN / MEDIAN 2.1 2.1 297 ADEQUATE SAMPLES

POTASSIUM



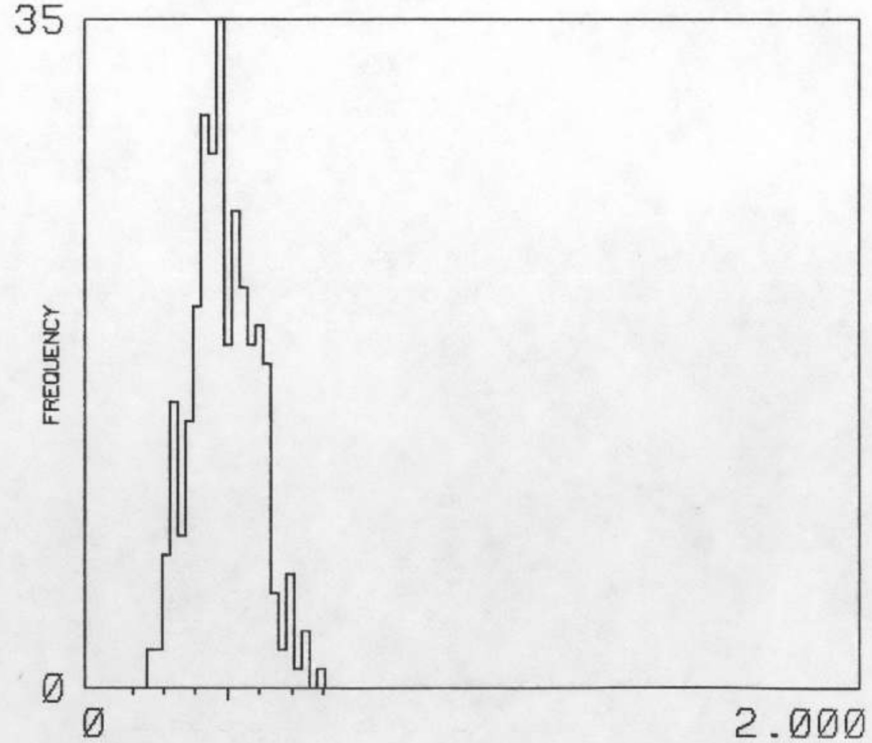
MEAN / MEDIAN 0.8 0.8 307 ADEQUATE SAMPLES

U/K



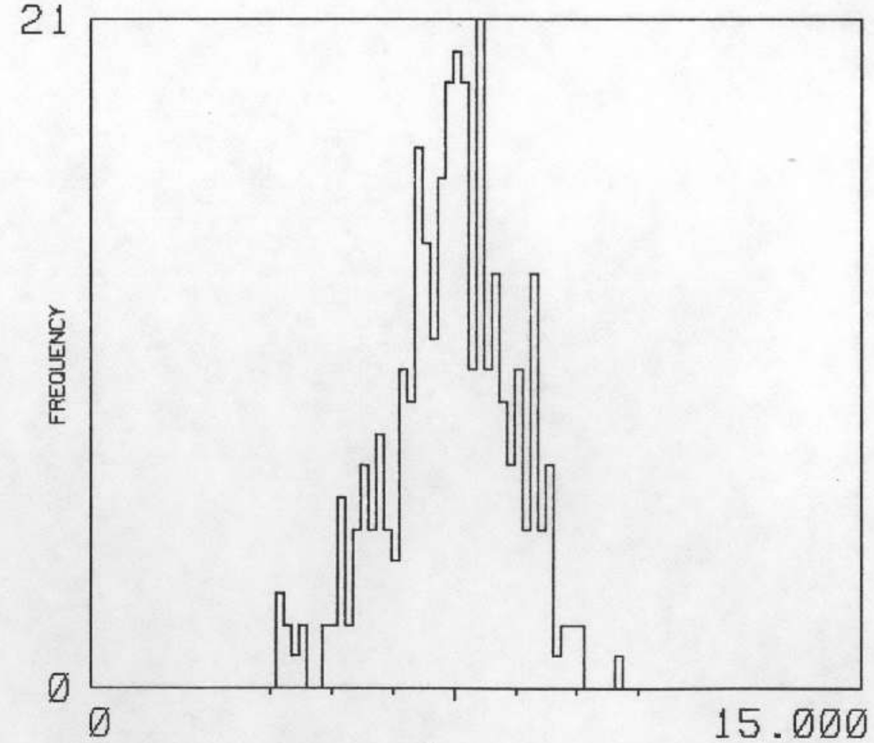
MEAN / MEDIAN 2.635 2.500 297 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.369 0.360 297 ADEQUATE SAMPLES

TH/K



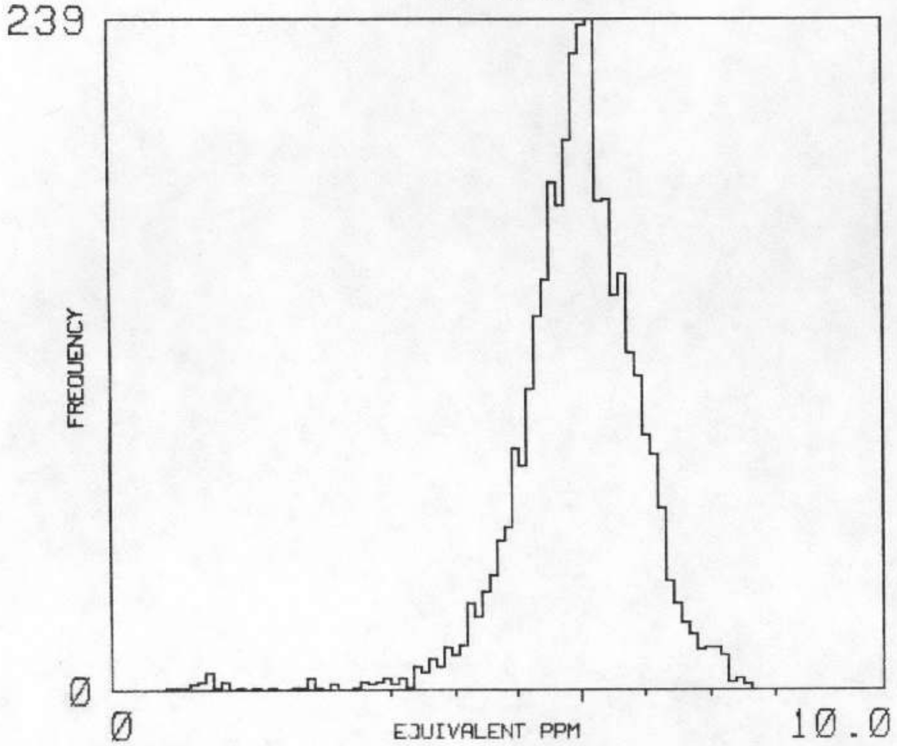
MEAN / MEDIAN 7.080 7.200 307 ADEQUATE SAMPLES

F9

NJ 16-5 VINCENNES

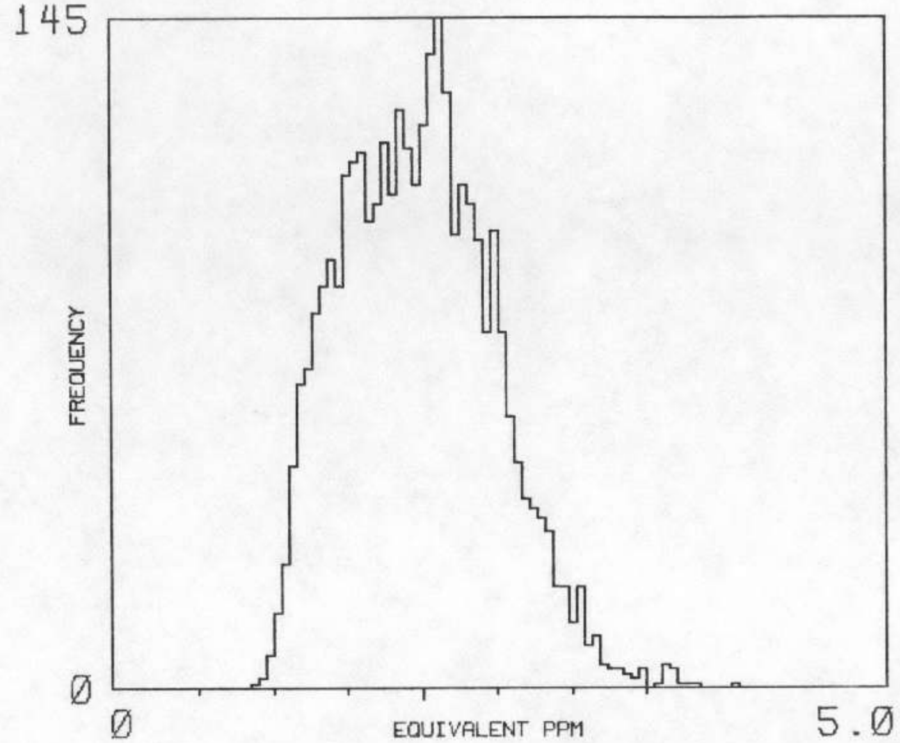
MAP UNIT : QTI   TOTAL NUMBER OF SAMPLES 3467

THORIUM



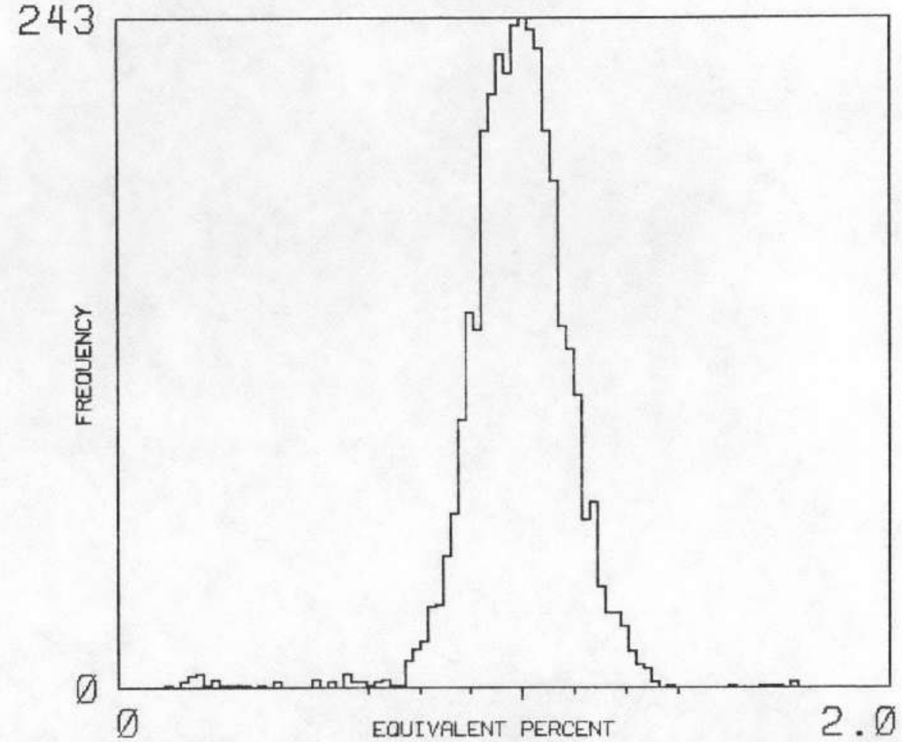
MEAN / MEDIAN 6.1 6.2 3464 ADEQUATE SAMPLES

URANIUM



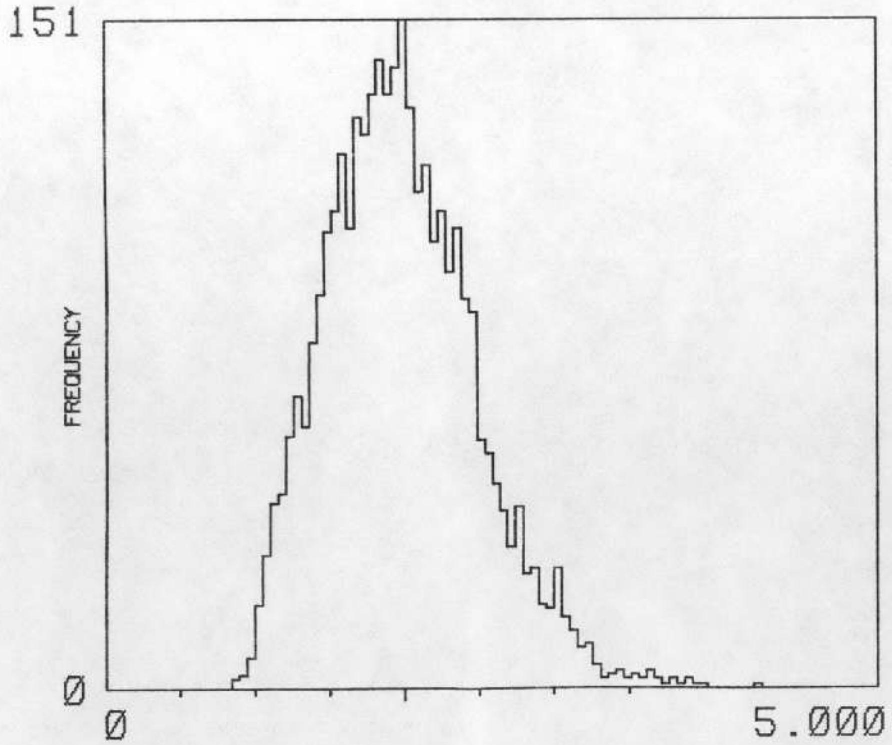
MEAN / MEDIAN 2.0 2.0 3297 ADEQUATE SAMPLES

POTASSIUM



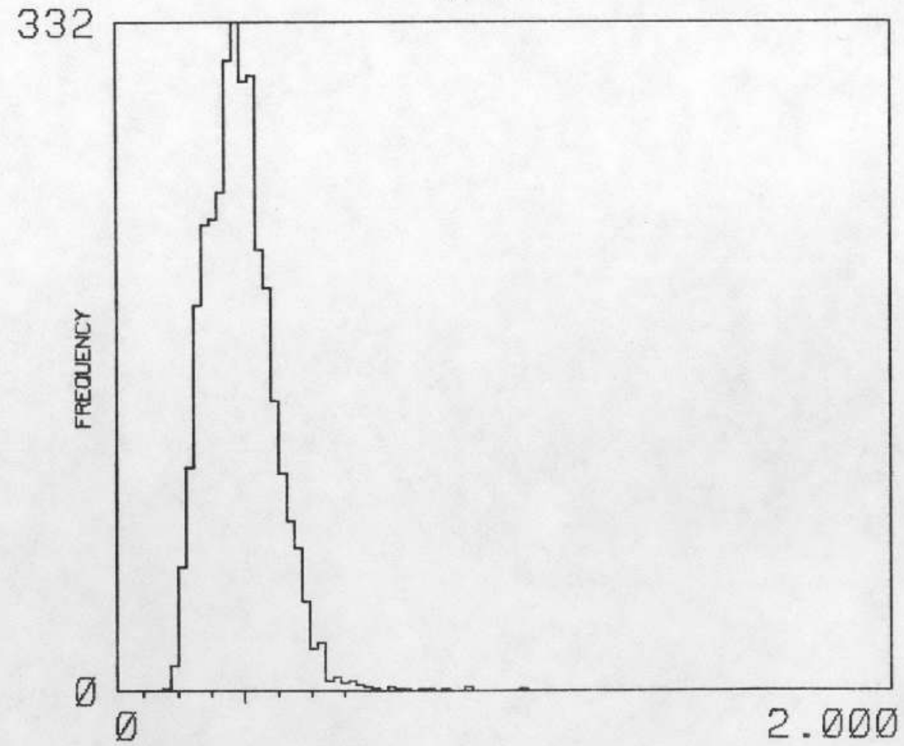
MEAN / MEDIAN 1.0 1.1 3467 ADEQUATE SAMPLES

U/K



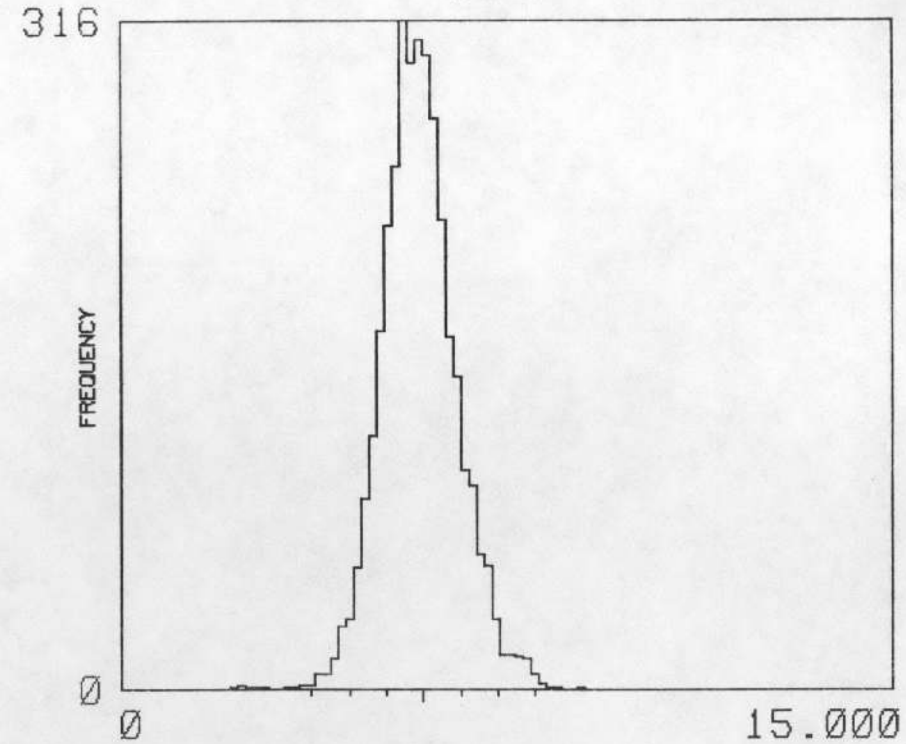
MEAN / MEDIAN 1.927 1.900 3297 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.331 0.320 3297 ADEQUATE SAMPLES

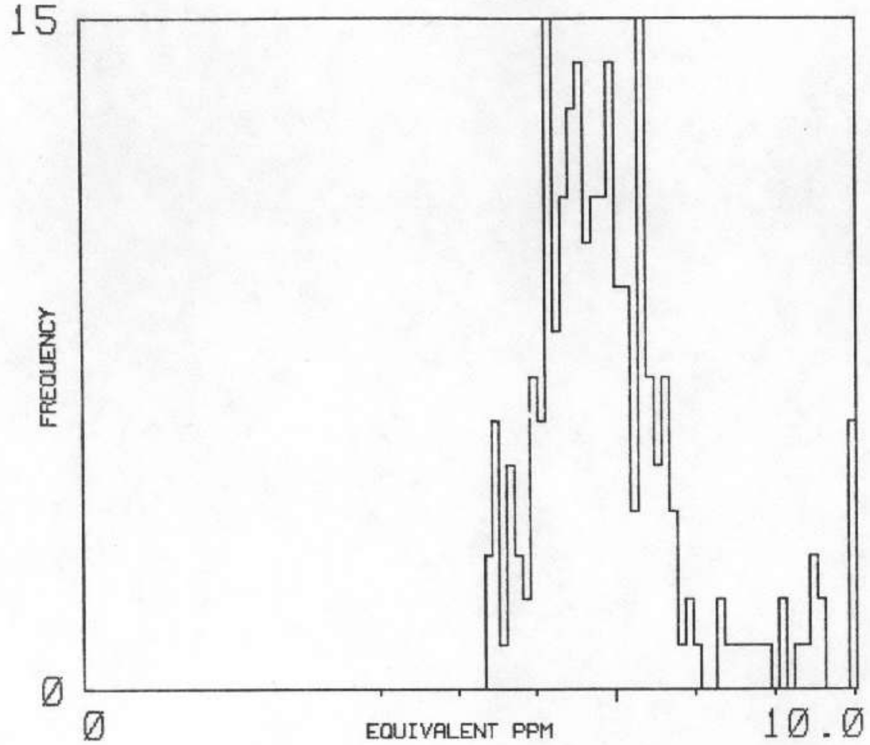
TH/K



MEAN / MEDIAN 5.857 5.850 3464 ADEQUATE SAMPLES

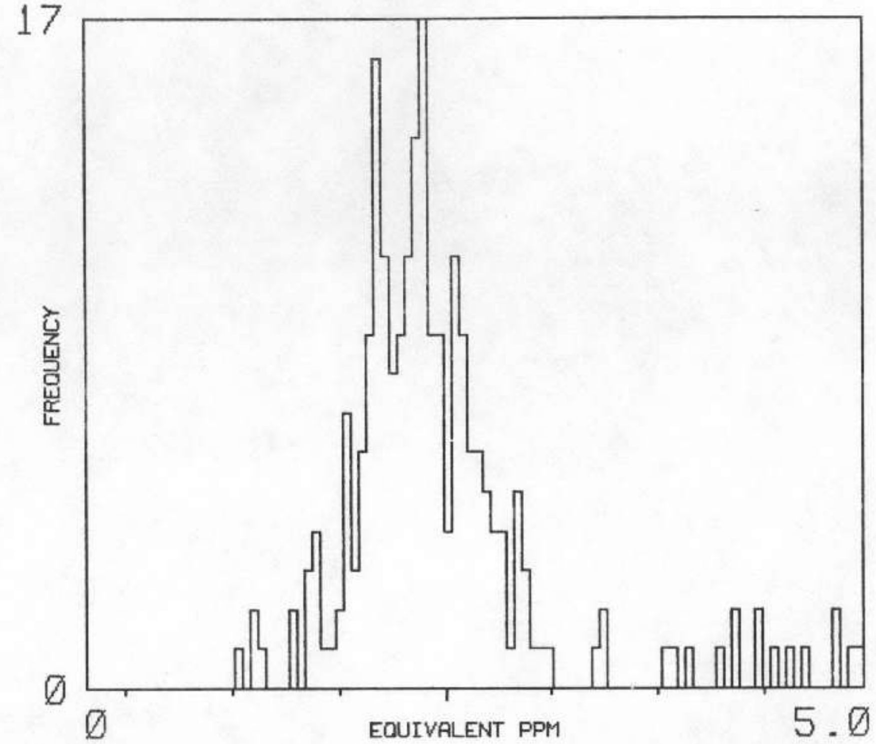
NJ 16-5 VINCENNES MAP UNIT : PMC TOTAL NUMBER OF SAMPLES 227

THORIUM



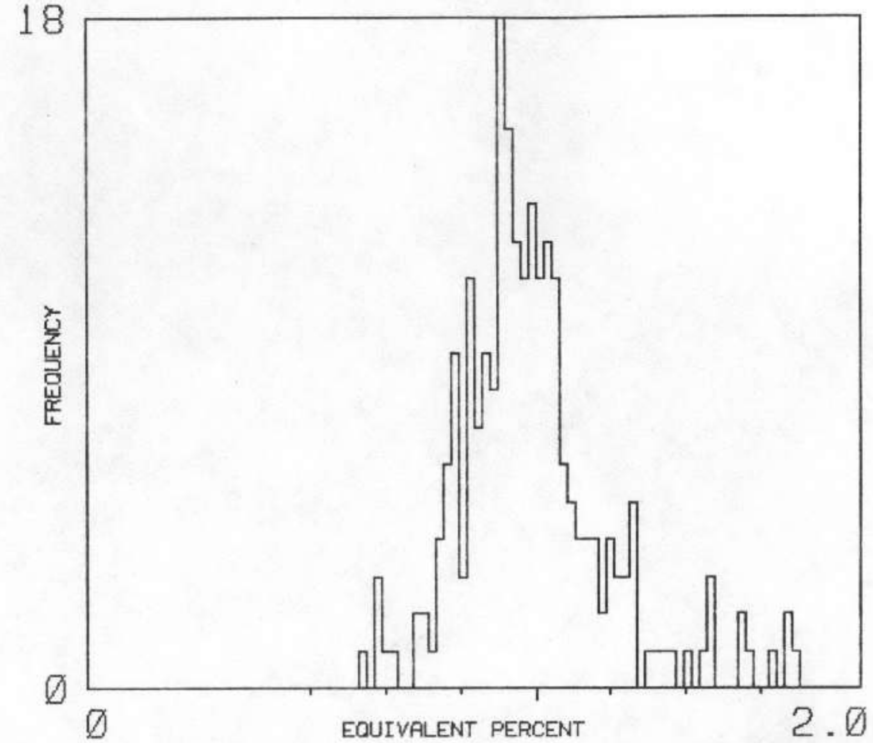
MEAN / MEDIAN 6.9 6.7 227 ADEQUATE SAMPLES

URANIUM



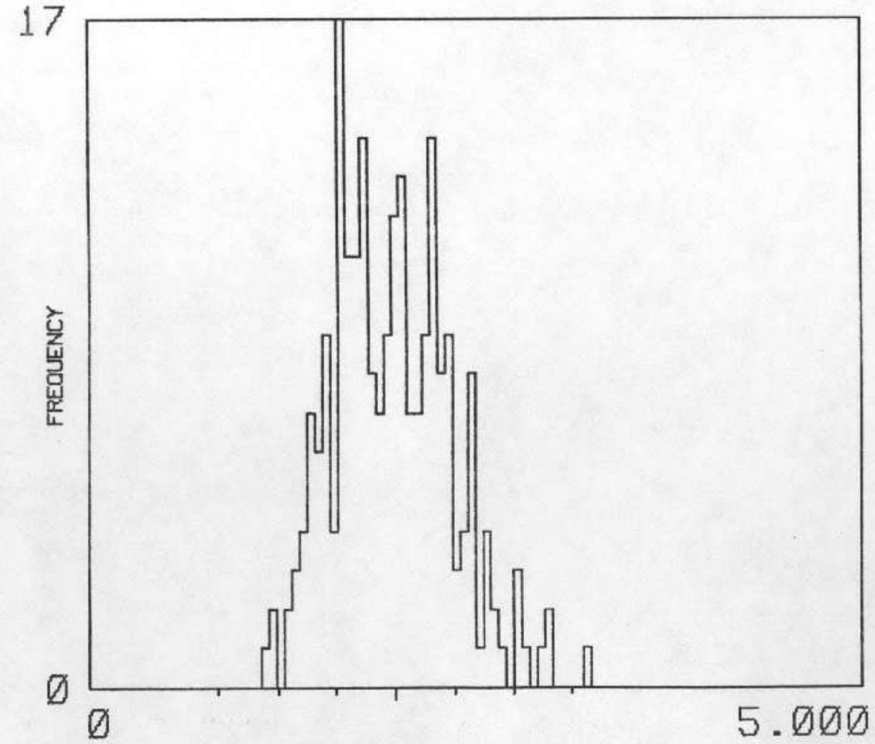
MEAN / MEDIAN 2.3 2.2 225 ADEQUATE SAMPLES

POTASSIUM



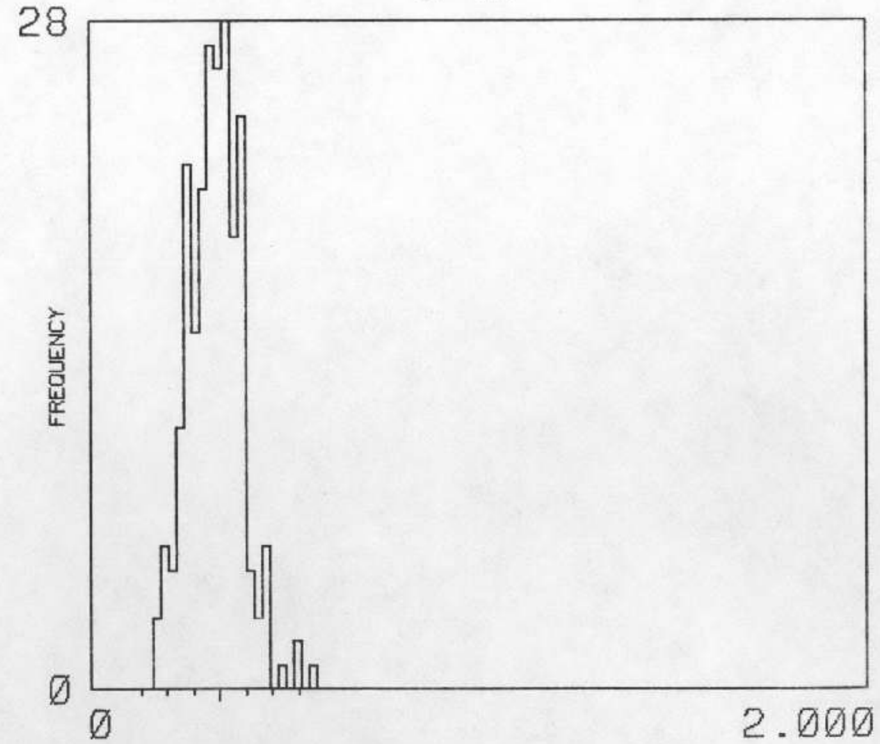
MEAN / MEDIAN 1.2 1.1 227 ADEQUATE SAMPLES

U/K



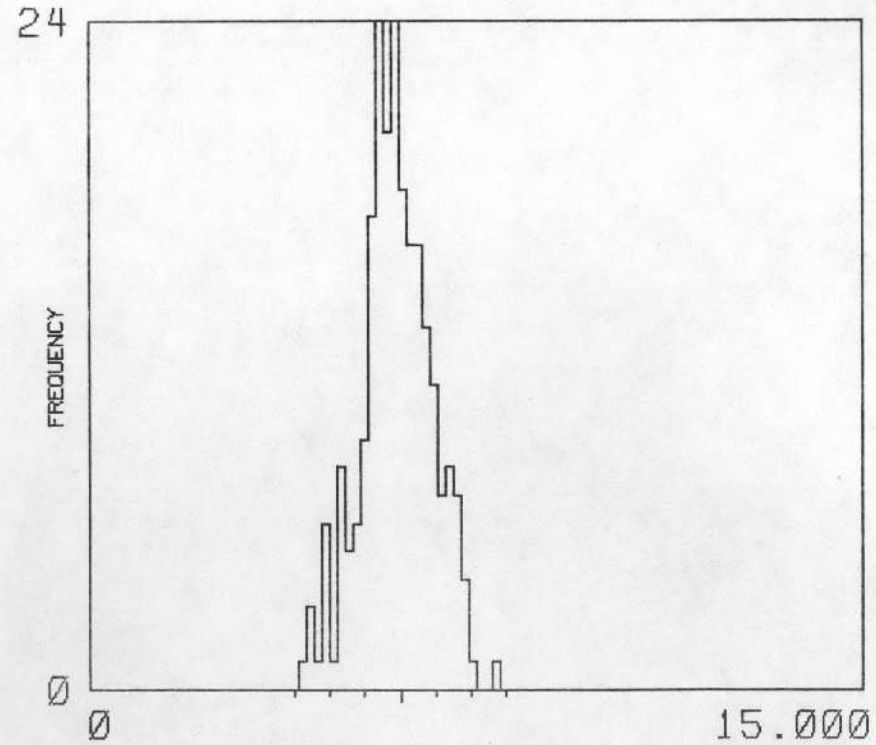
MEAN / MEDIAN 1.976 1.950 225 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.332 0.340 225 ADEQUATE SAMPLES

TH/K



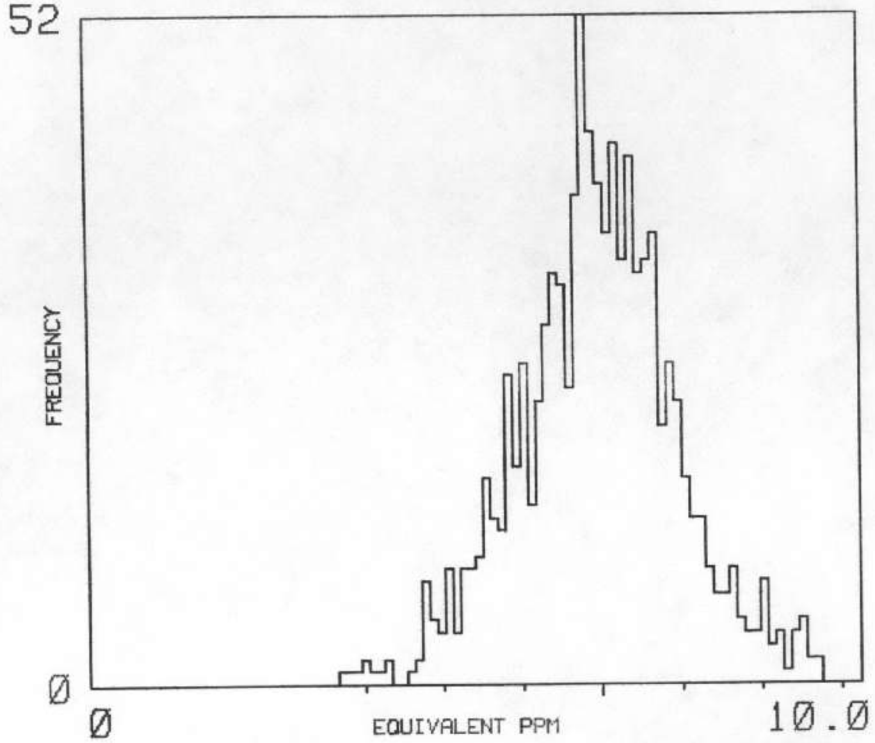
MEAN / MEDIAN 6.022 6.000 227 ADEQUATE SAMPLES

NJ 16-5 VINCENNES

MAP UNIT : PC

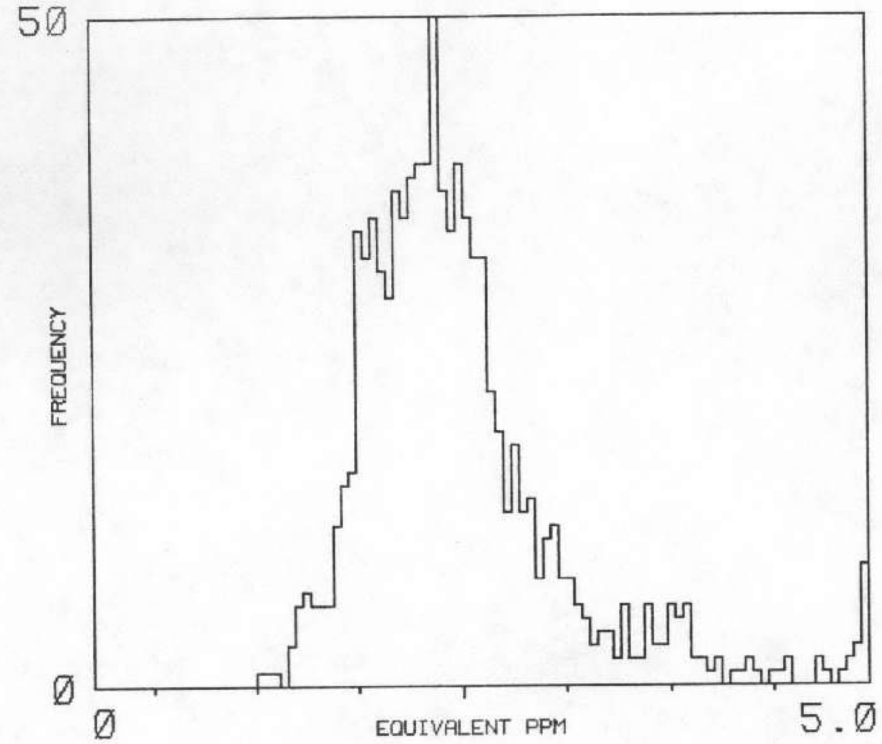
TOTAL NUMBER OF SAMPLES 933

THORIUM



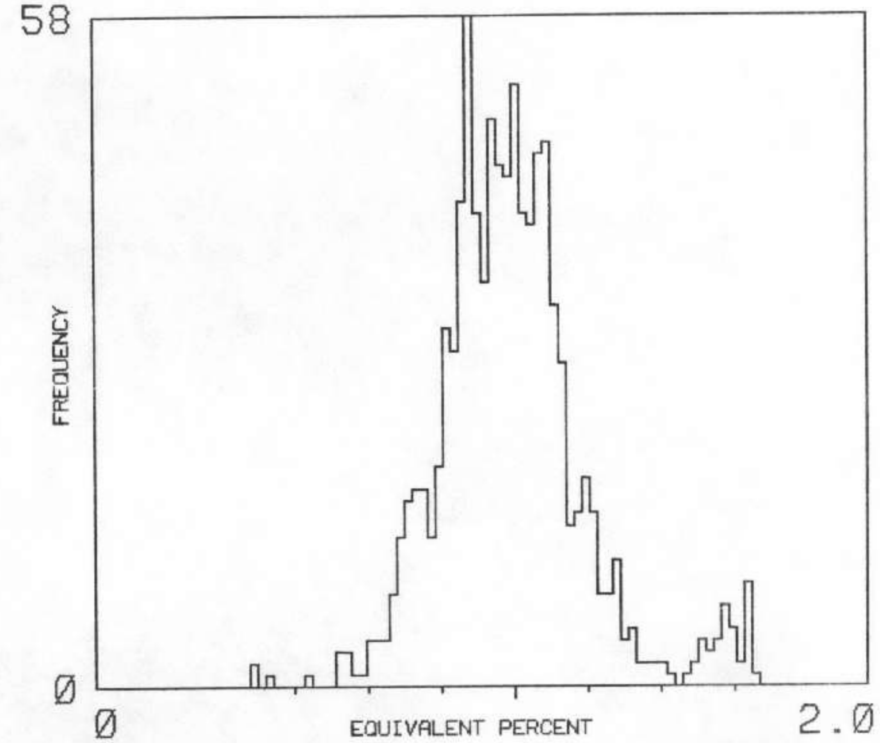
MEAN / MEDIAN 6.7 6.7 933 ADEQUATE SAMPLES

URANIUM



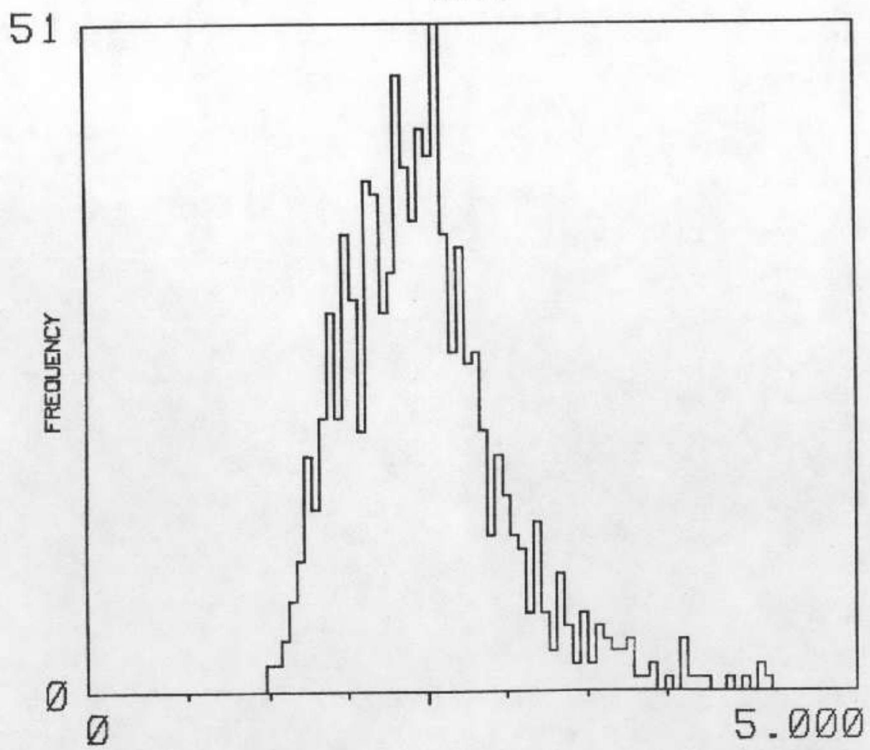
MEAN / MEDIAN 2.4 2.2 931 ADEQUATE SAMPLES

POTASSIUM



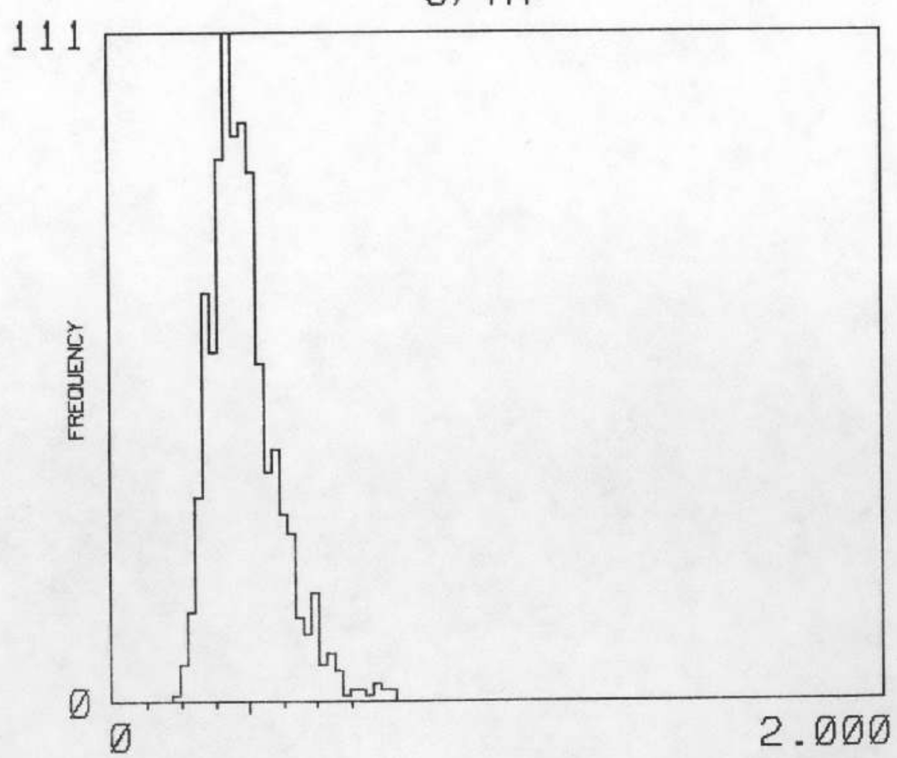
MEAN / MEDIAN 1.1 1.1 933 ADEQUATE SAMPLES

U/K



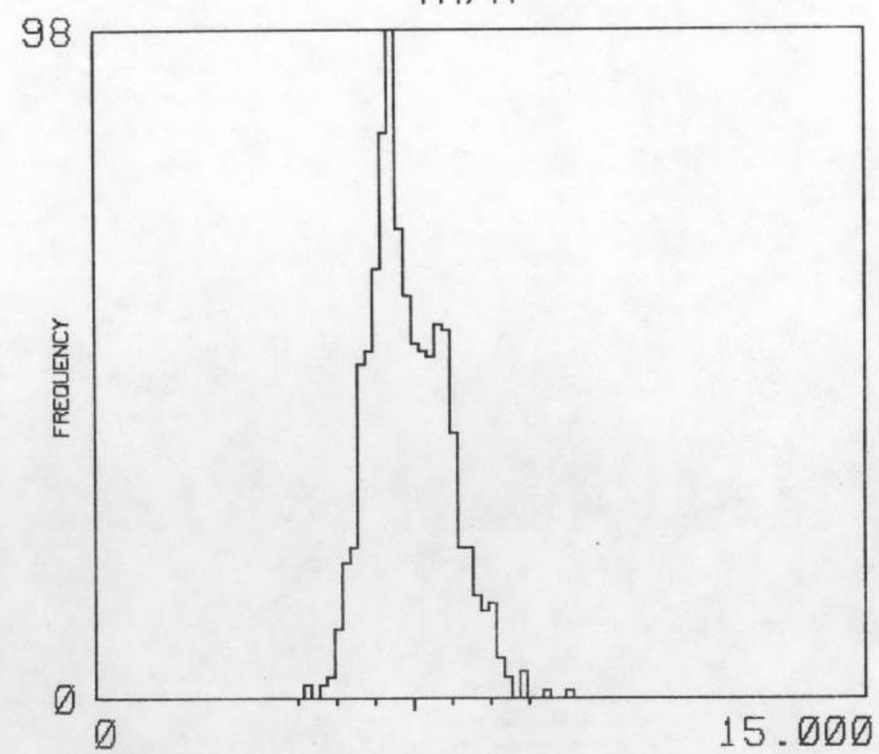
MEAN / MEDIAN 2.209 2.150 931 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.361 0.340 931 ADEQUATE SAMPLES

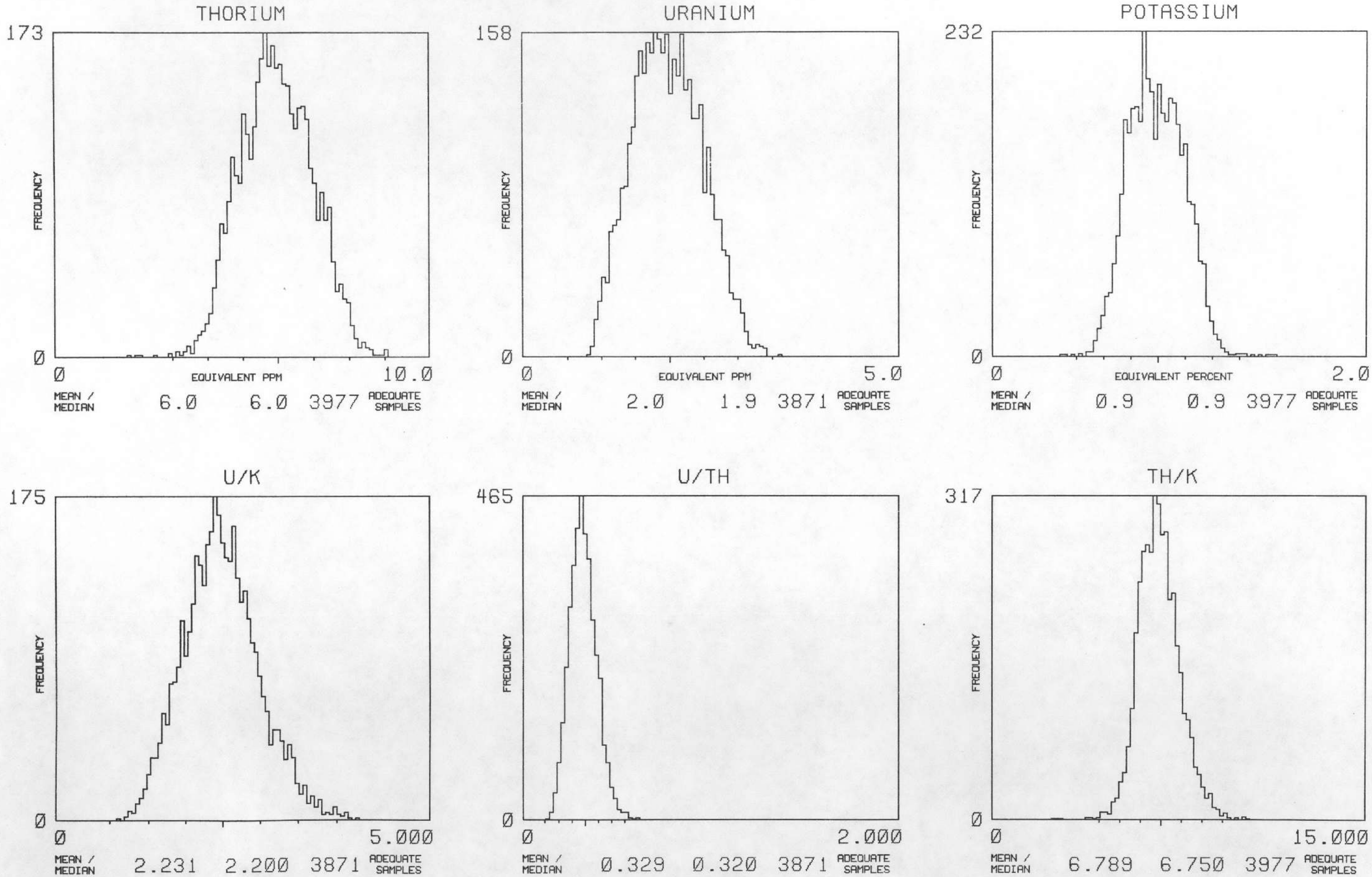
TH/K



MEAN / MEDIAN 6.182 6.000 933 ADEQUATE SAMPLES

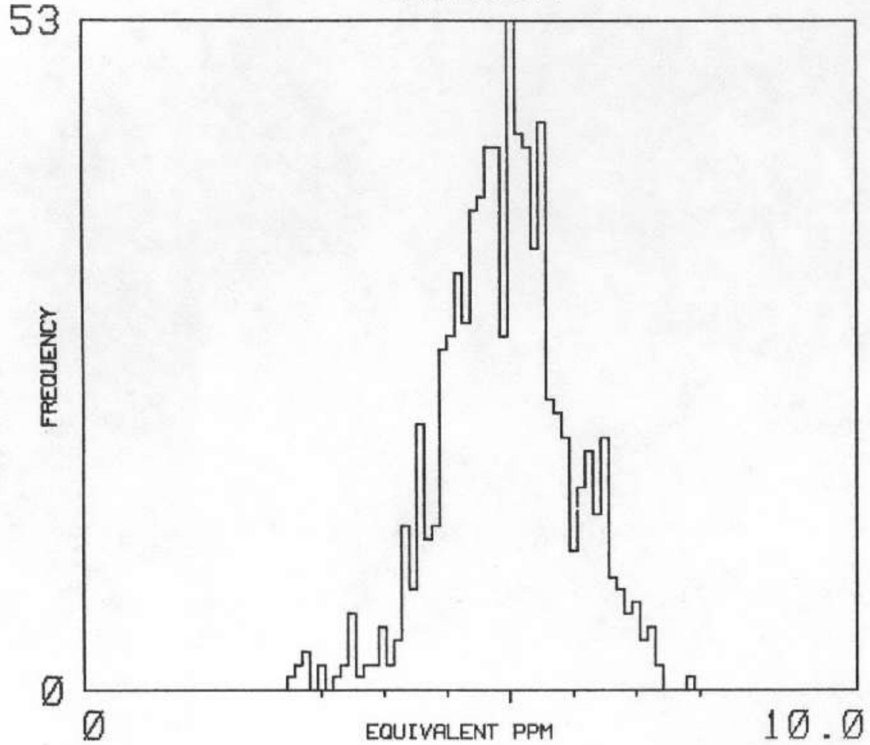
F12 v

NJ 16-5 VINCENNES MAP UNIT : PRC TOTAL NUMBER OF SAMPLES 3977



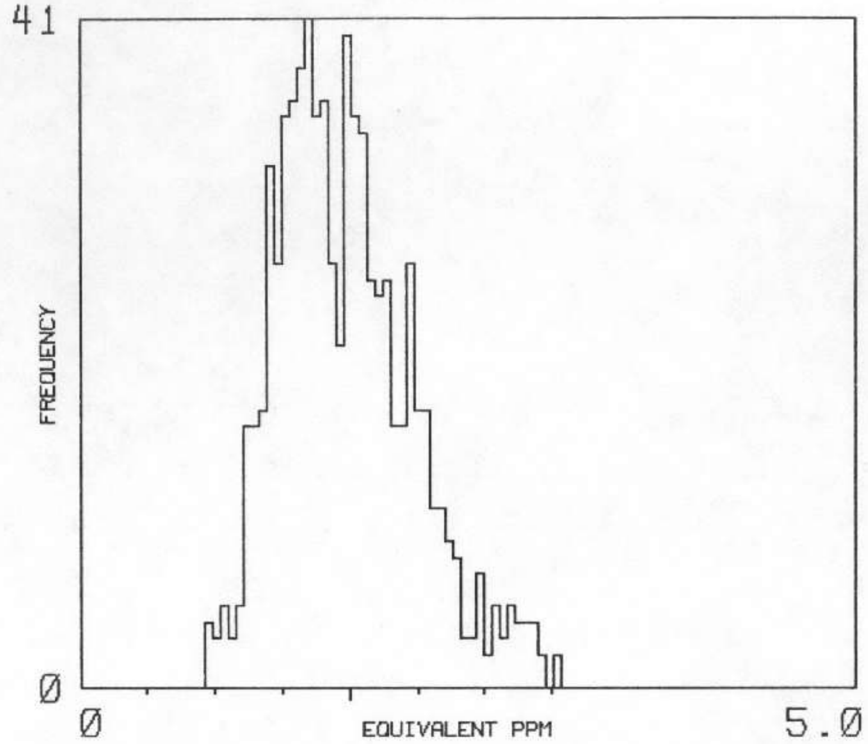
NJ 16-5 VINCENNES MAP UNIT : MC TOTAL NUMBER OF SAMPLES 815

THORIUM



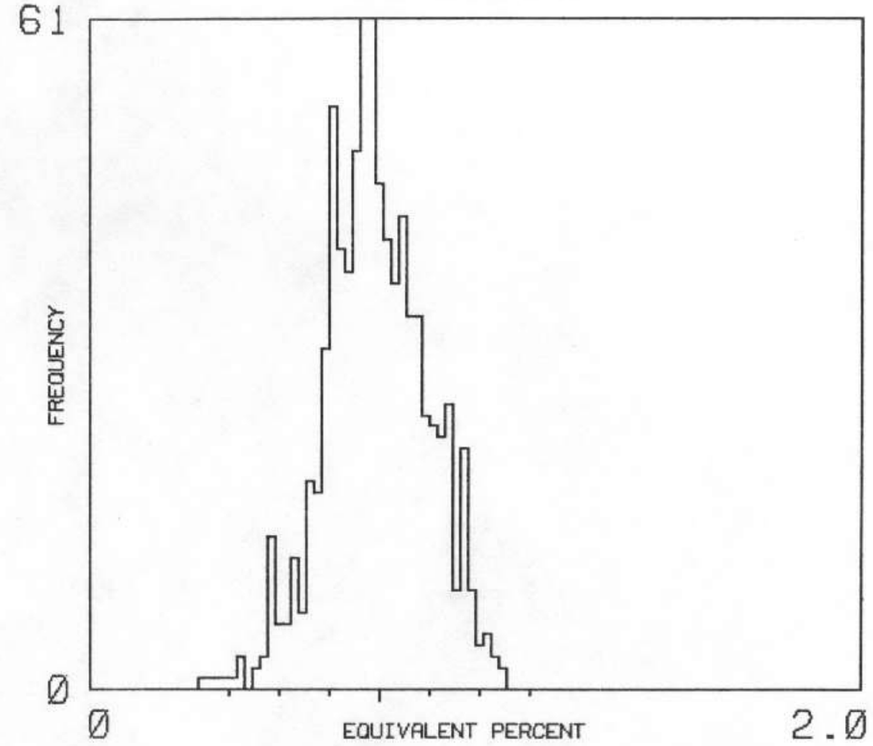
MEAN / MEDIAN 5.5 5.5 815 ADEQUATE SAMPLES

URANIUM



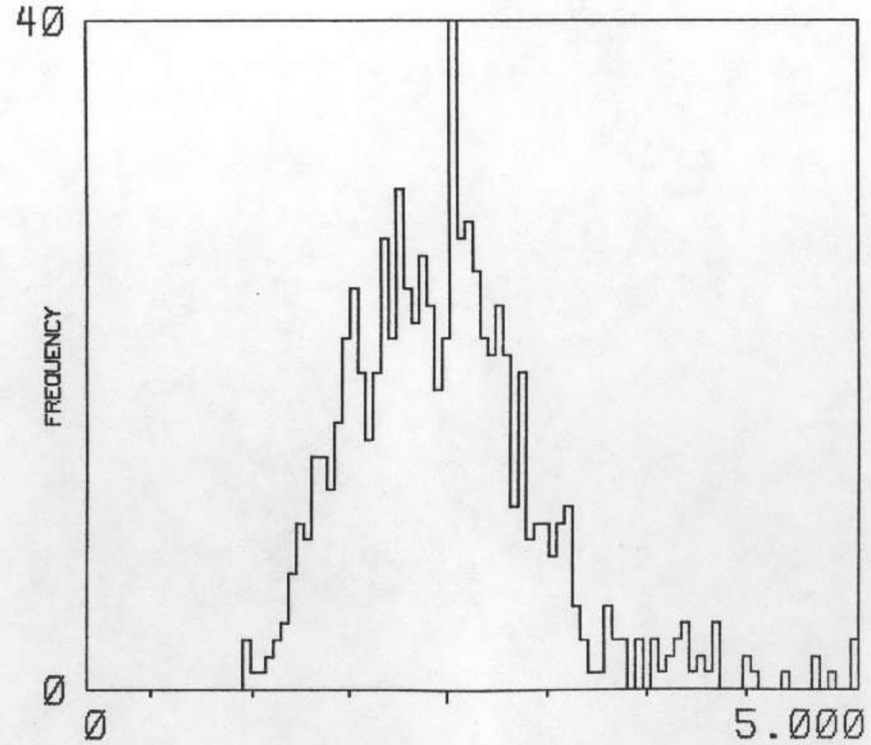
MEAN / MEDIAN 1.7 1.7 753 ADEQUATE SAMPLES

POTASSIUM



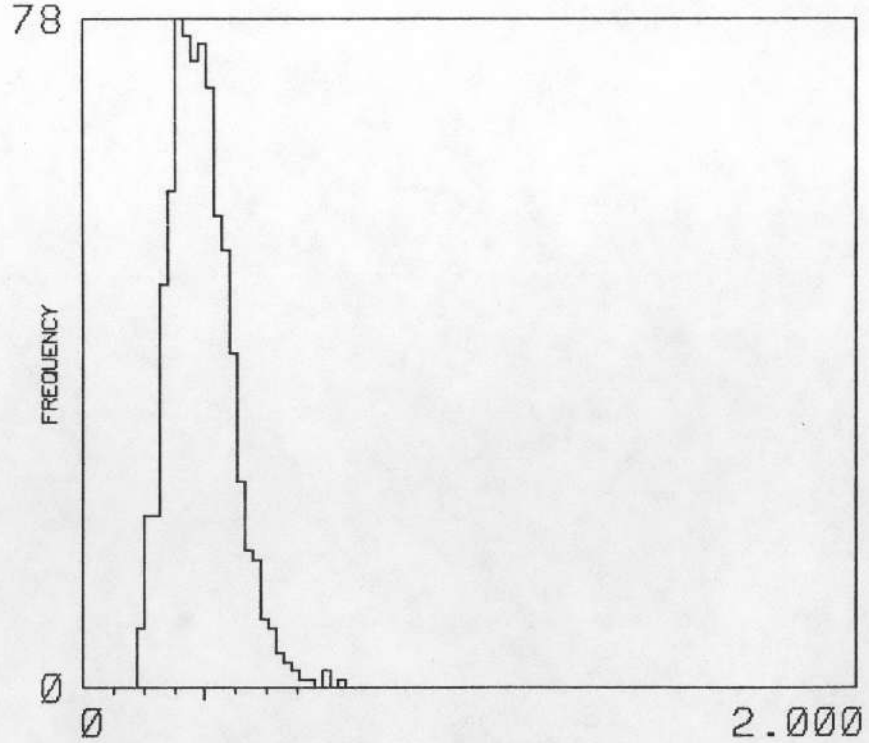
MEAN / MEDIAN 0.8 0.7 815 ADEQUATE SAMPLES

U/K



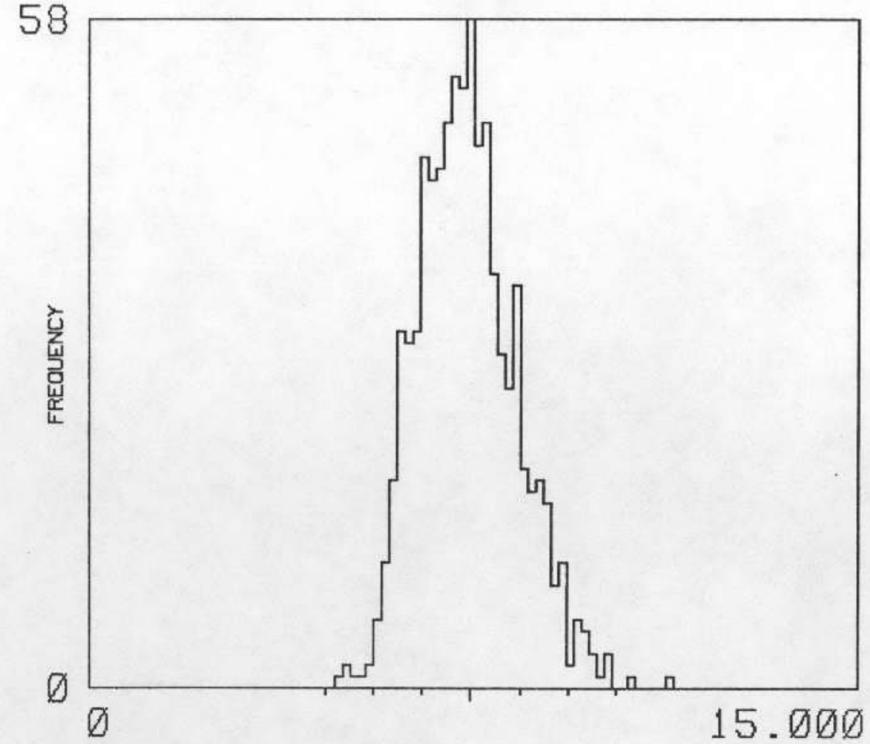
MEAN / MEDIAN 2.343 2.300 753 ADEQUATE SAMPLES

U/TH



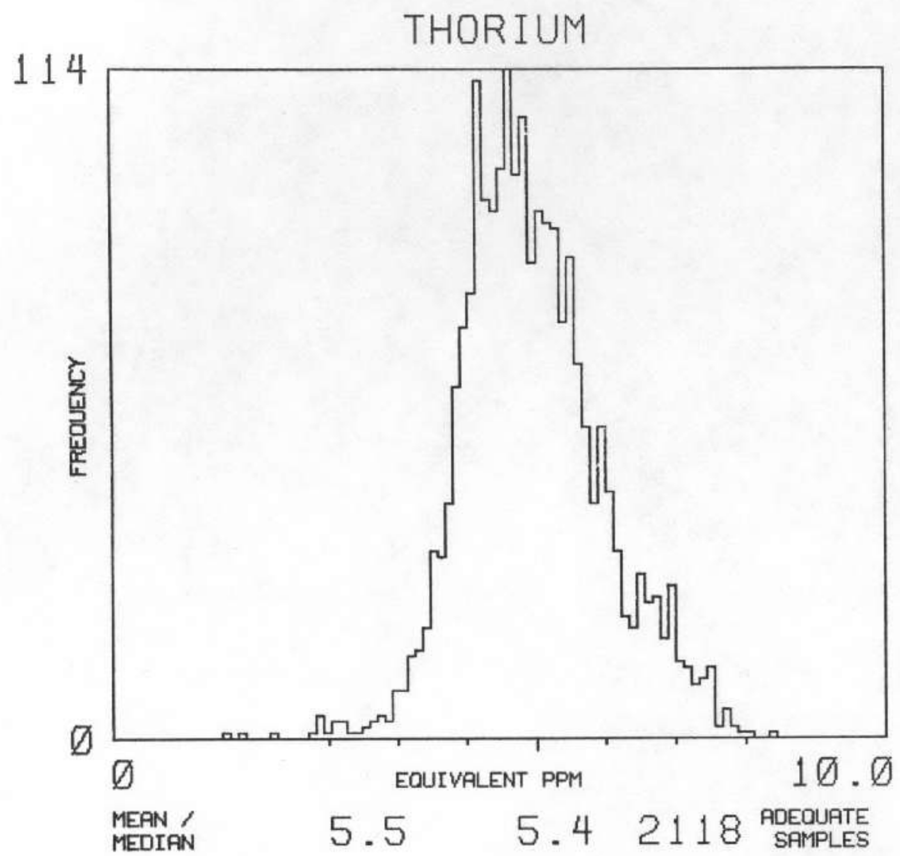
MEAN / MEDIAN 0.317 0.300 753 ADEQUATE SAMPLES

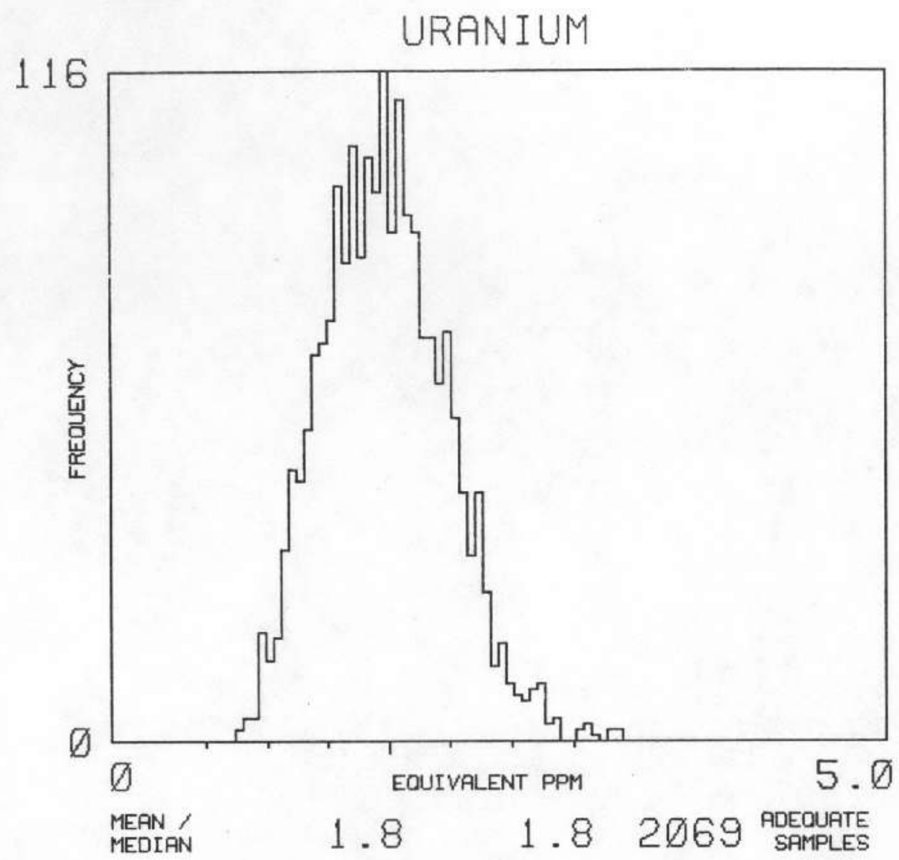
TH/K

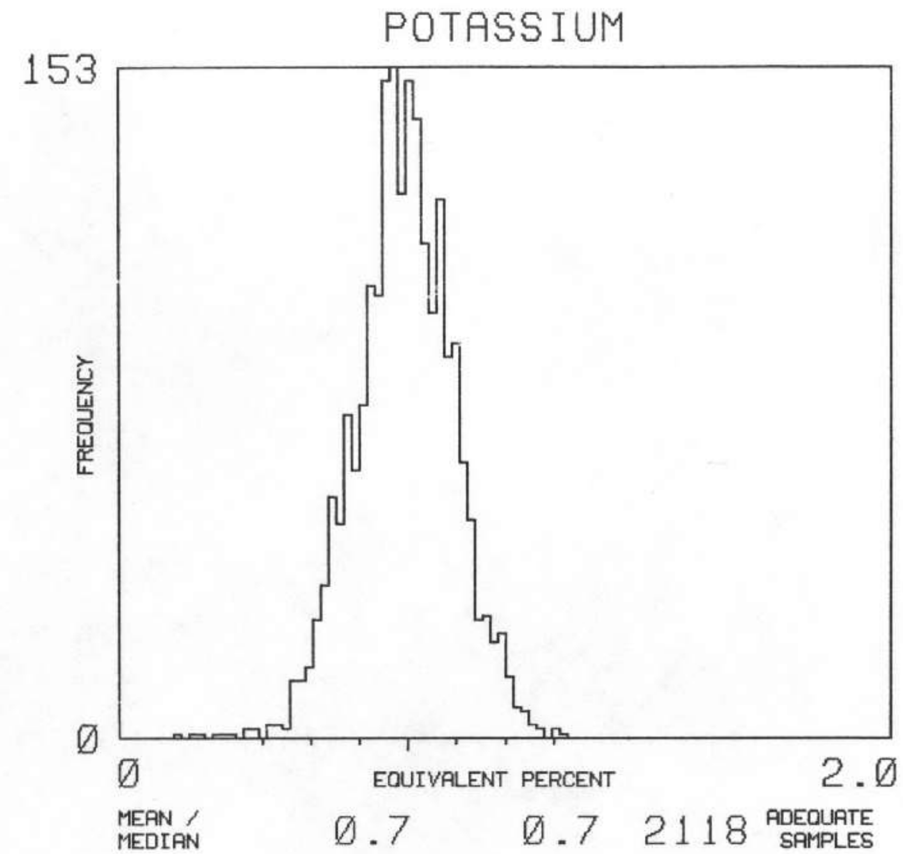


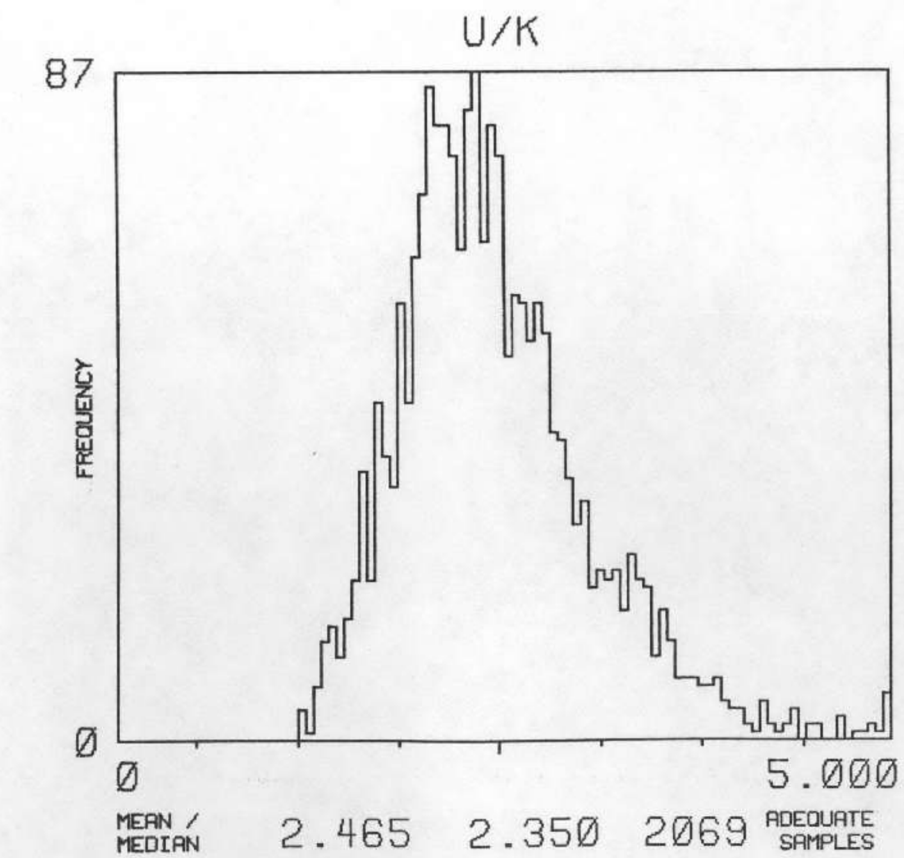
MEAN / MEDIAN 7.442 7.350 815 ADEQUATE SAMPLES

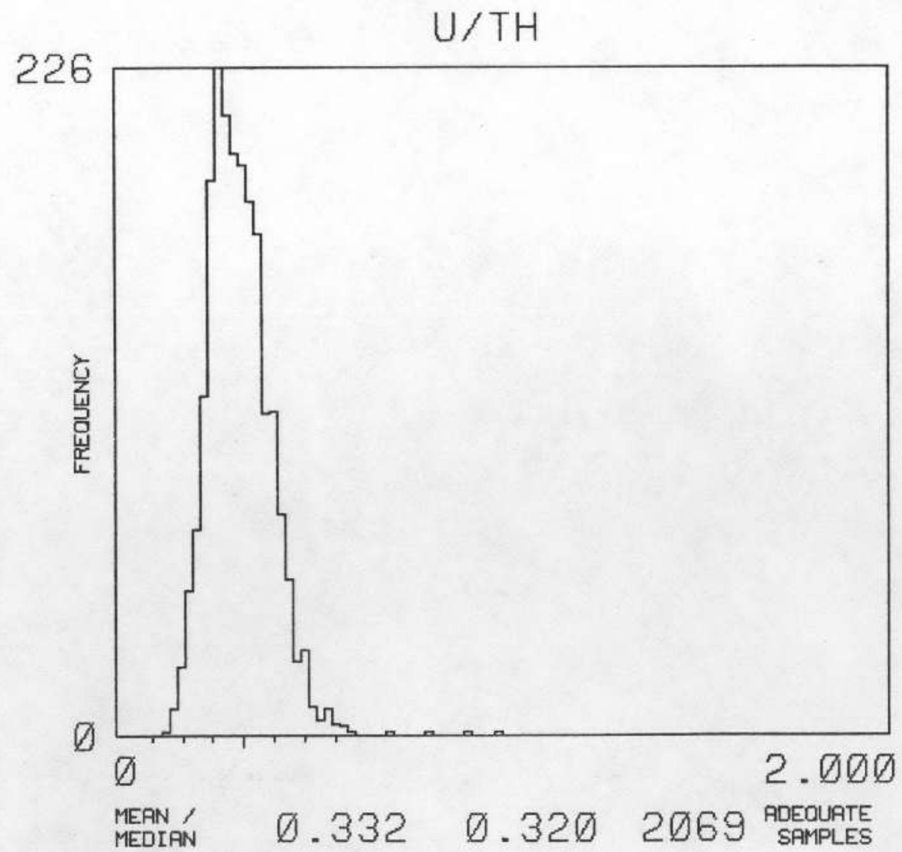
NJ 16-5 VINCENNES MAP UNIT : MST TOTAL NUMBER OF SAMPLES 2118

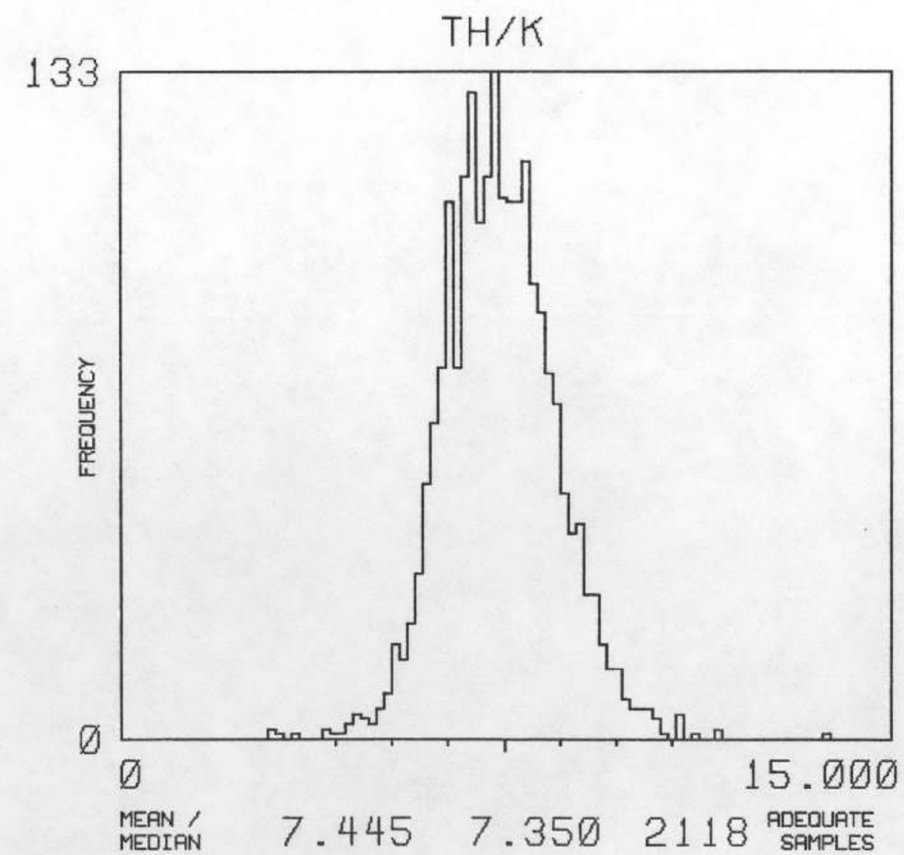




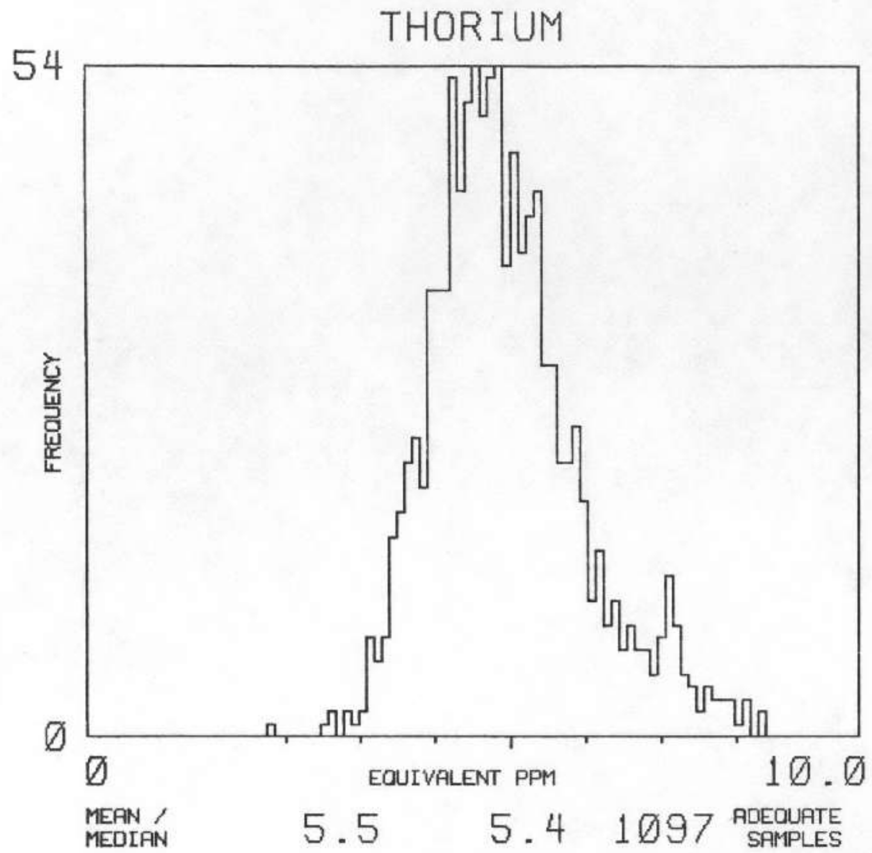


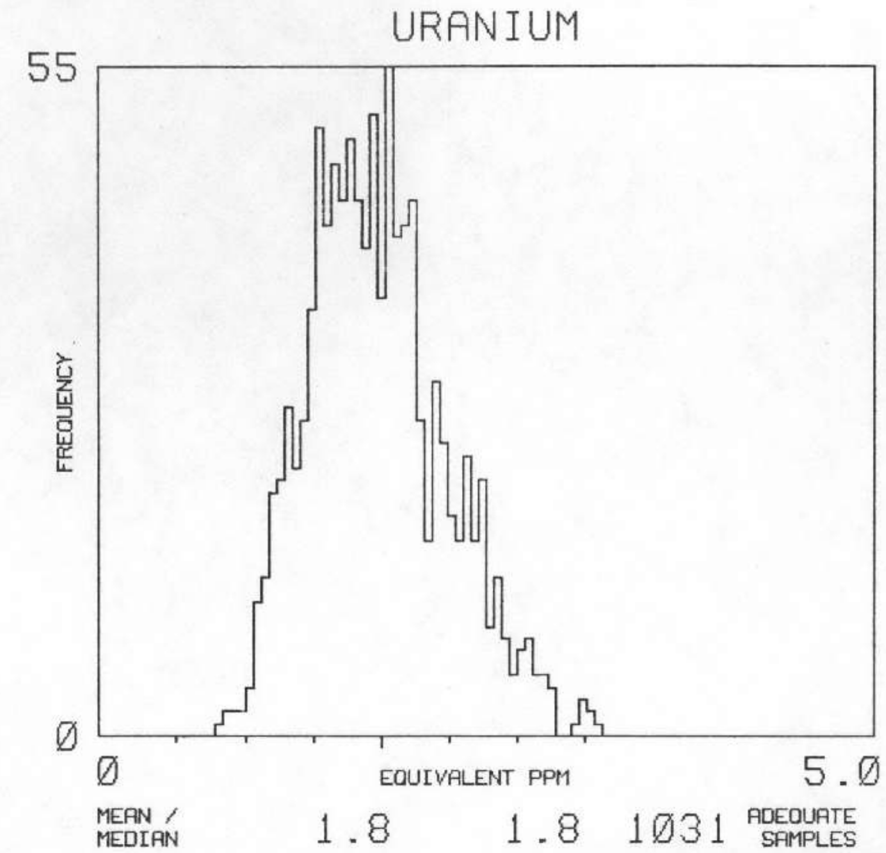


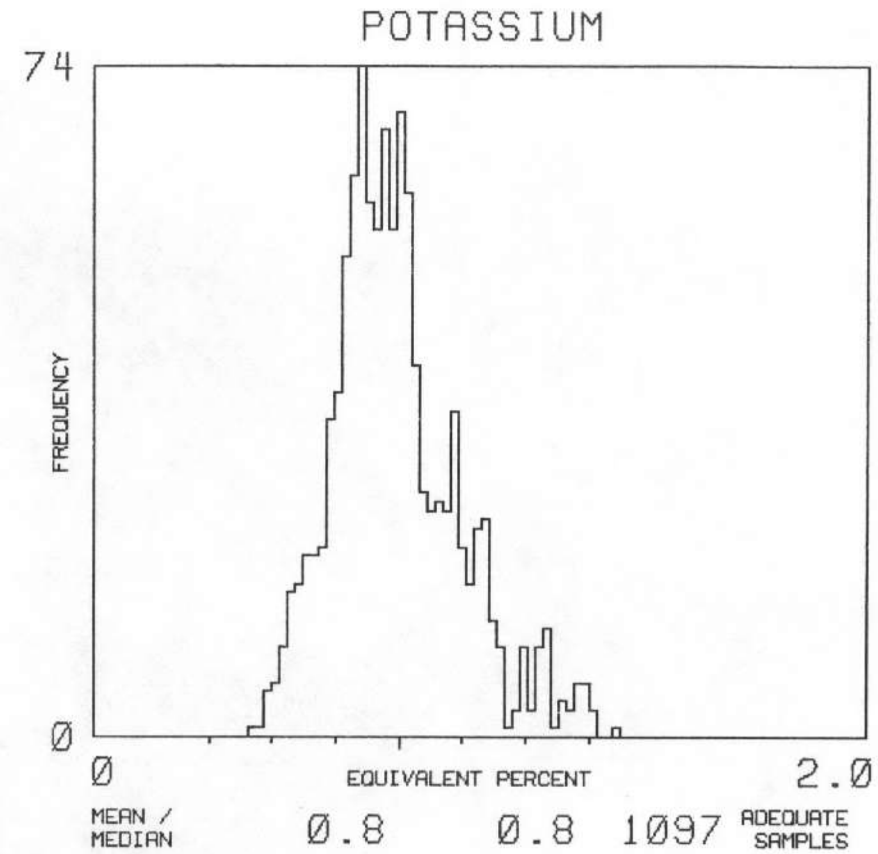


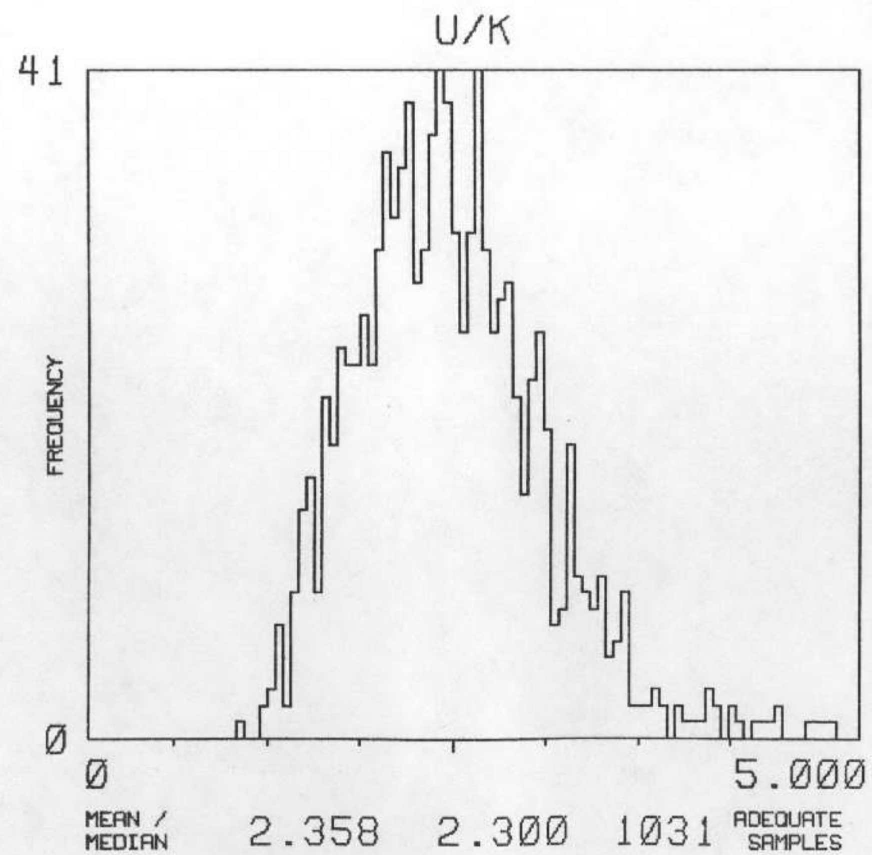


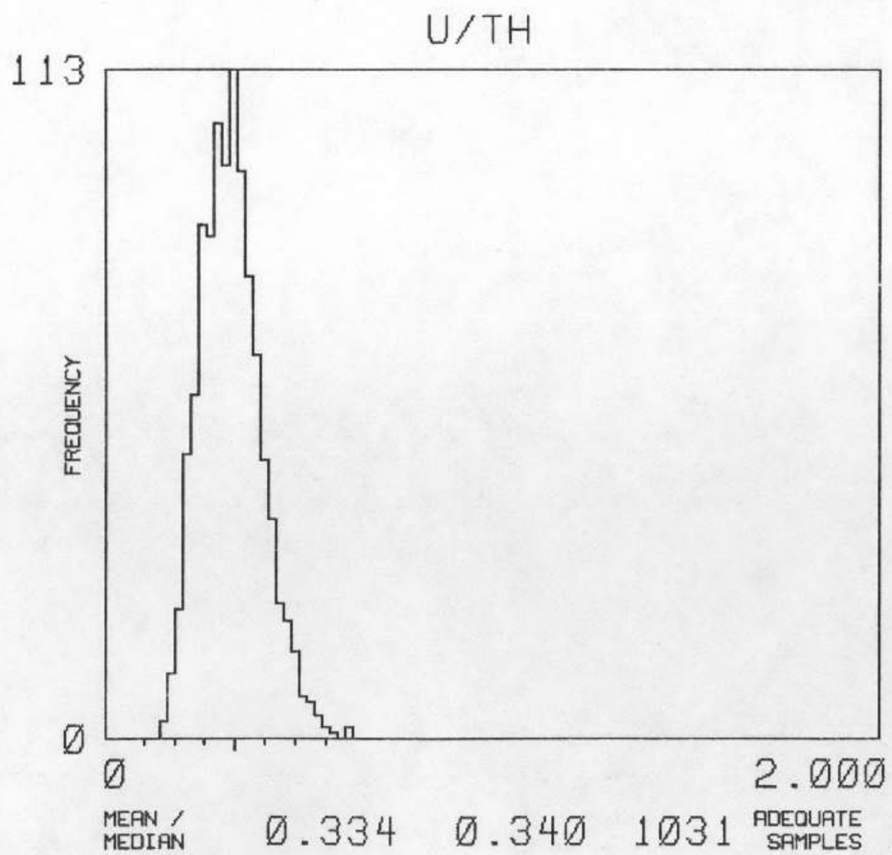
NJ 16-5 VINCENNES MAP UNIT : MWB TOTAL NUMBER OF SAMPLES 1097

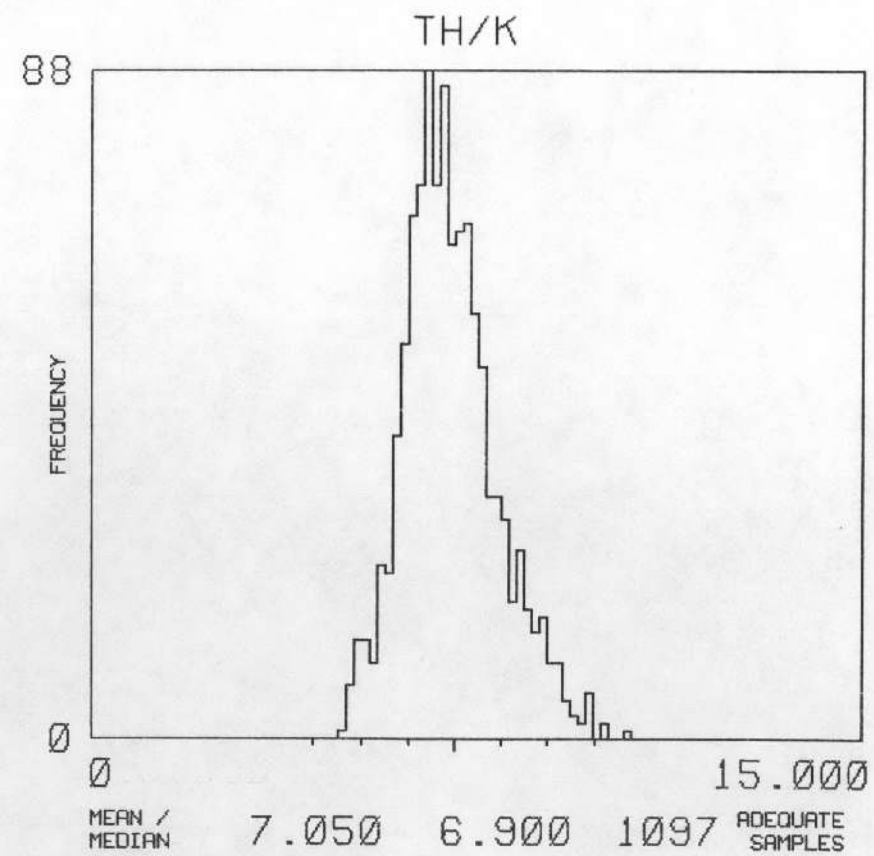






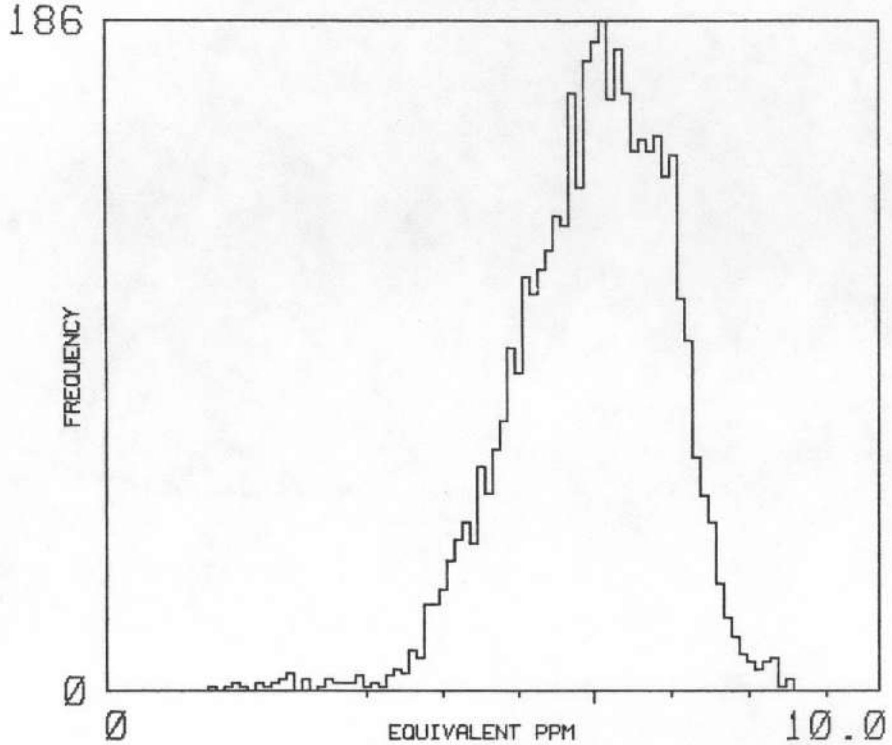






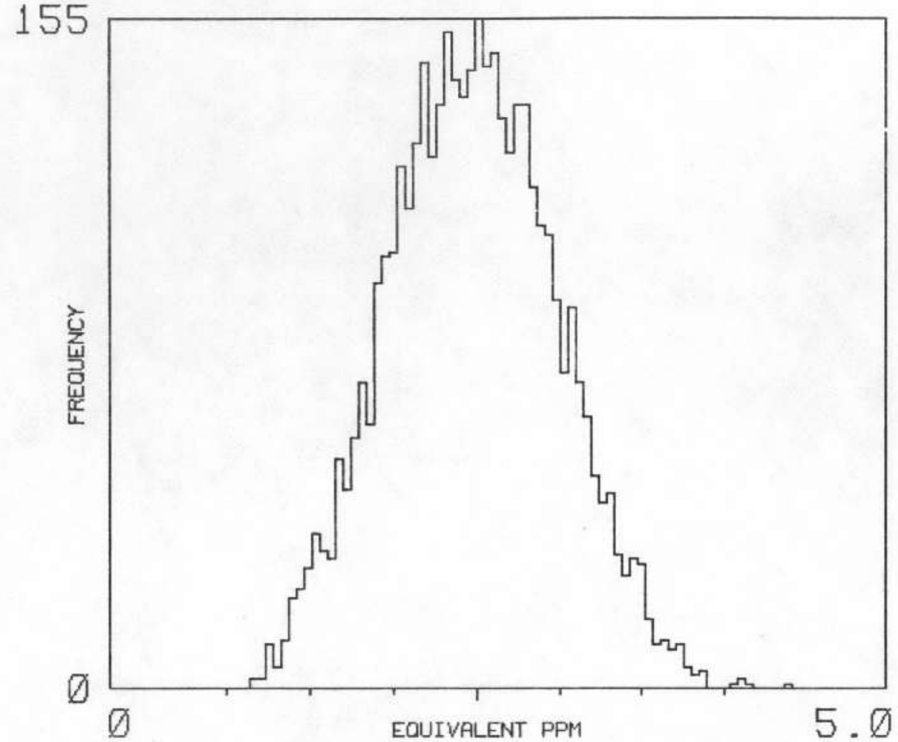
NJ 16-5 VINCENNES MAP UNIT : MBR TOTAL NUMBER OF SAMPLES 4219

THORIUM



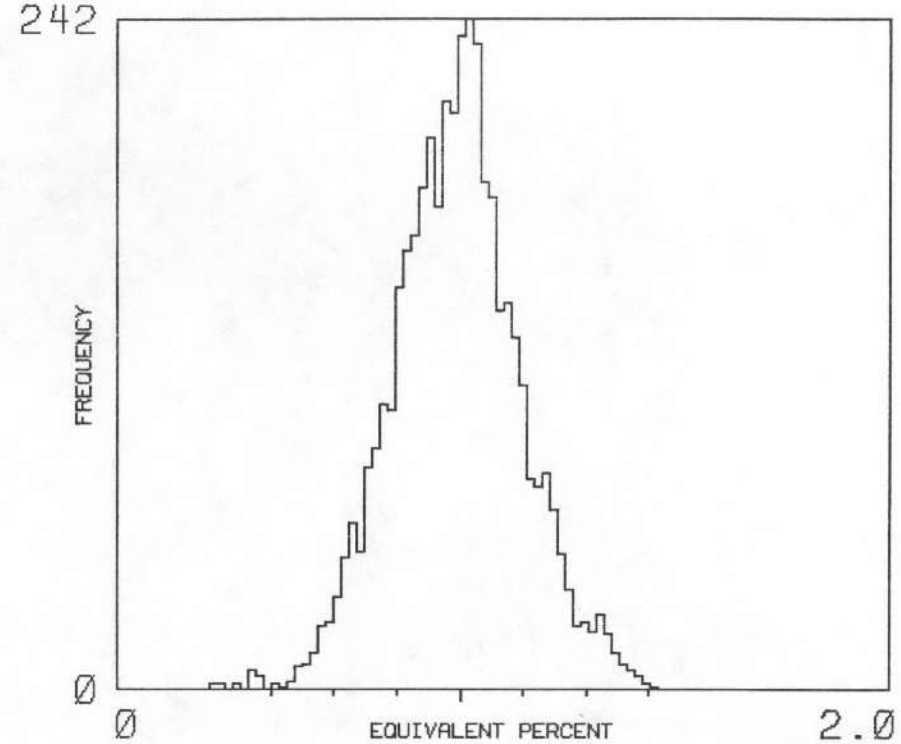
MEAN / MEDIAN 6.3 6.4 4219 ADEQUATE SAMPLES

URANIUM



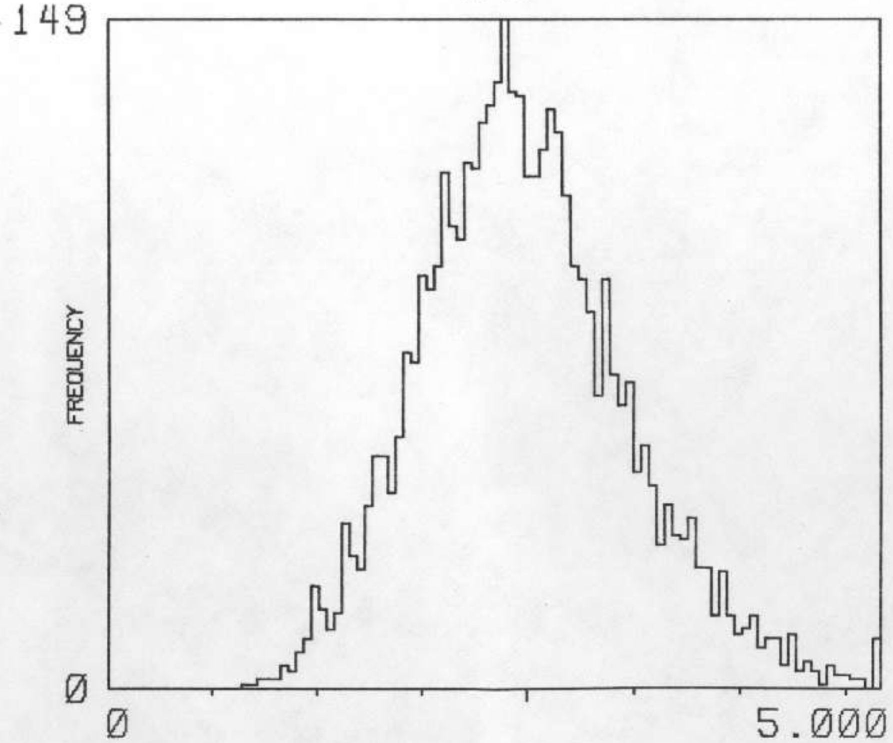
MEAN / MEDIAN 2.4 2.3 4129 ADEQUATE SAMPLES

POTASSIUM



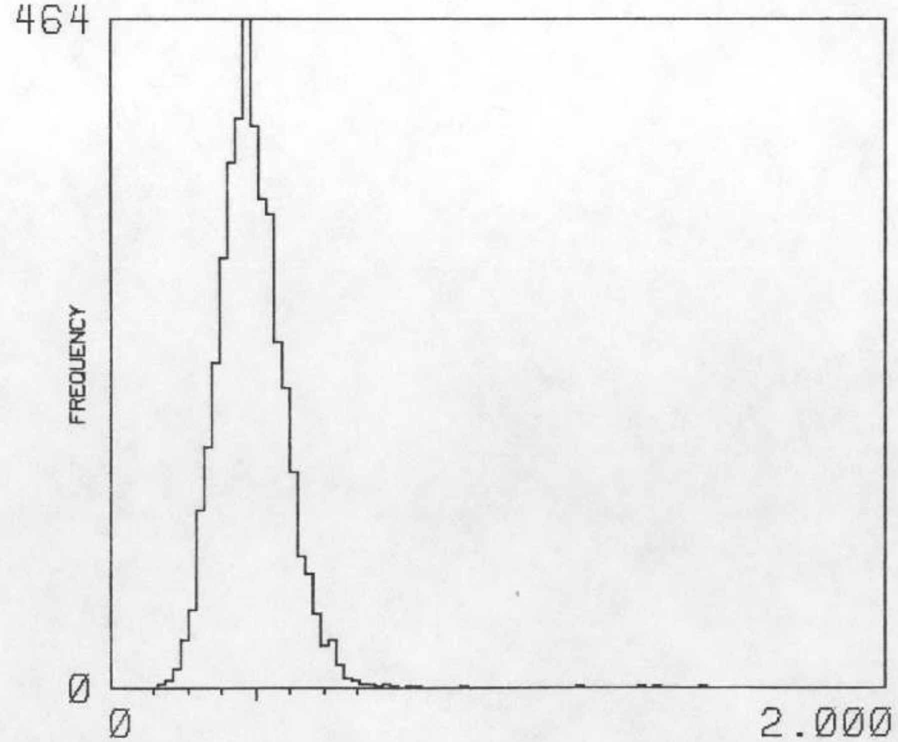
MEAN / MEDIAN 0.9 0.9 4219 ADEQUATE SAMPLES

U/K



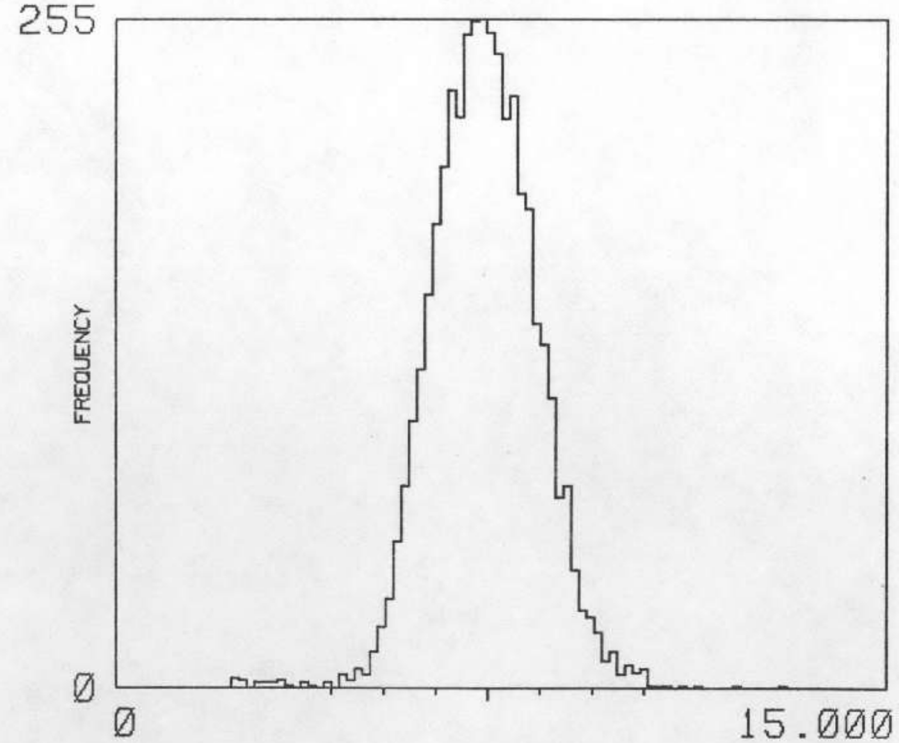
MEAN / MEDIAN 2.713 2.650 4129 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.374 0.360 4129 ADEQUATE SAMPLES

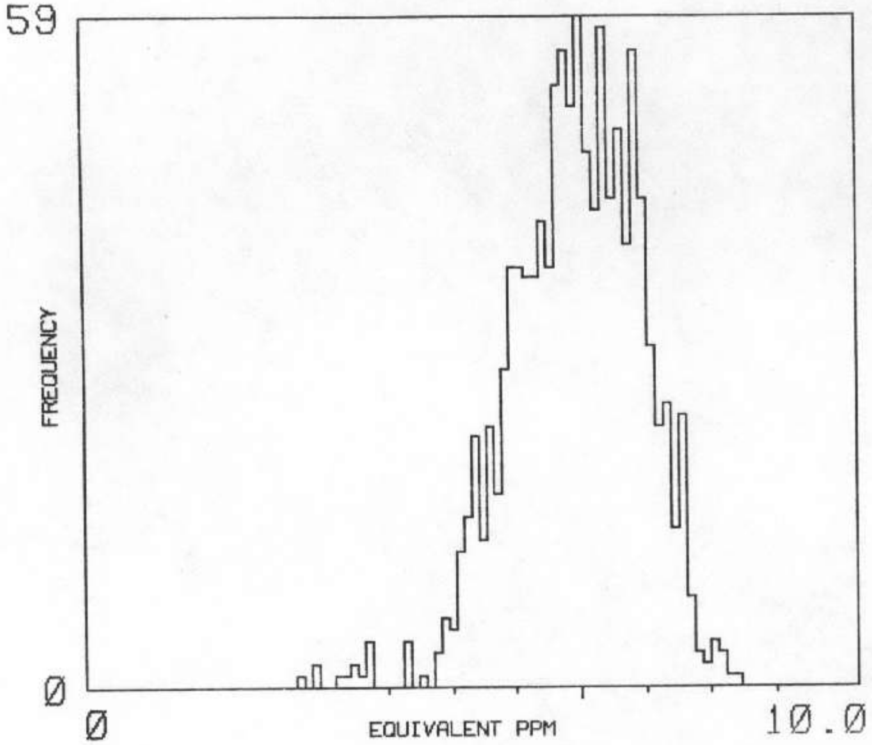
TH/K



MEAN / MEDIAN 7.239 7.200 4219 ADEQUATE SAMPLES

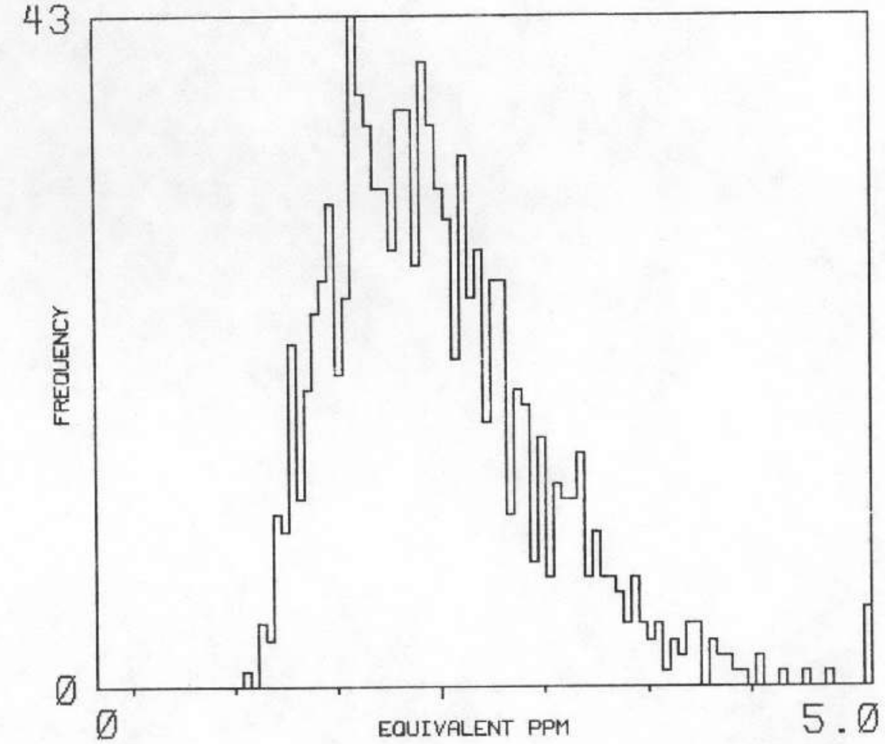
NJ 16-5 VINCENNES MAP UNIT : MS TOTAL NUMBER OF SAMPLES 1119

THORIUM



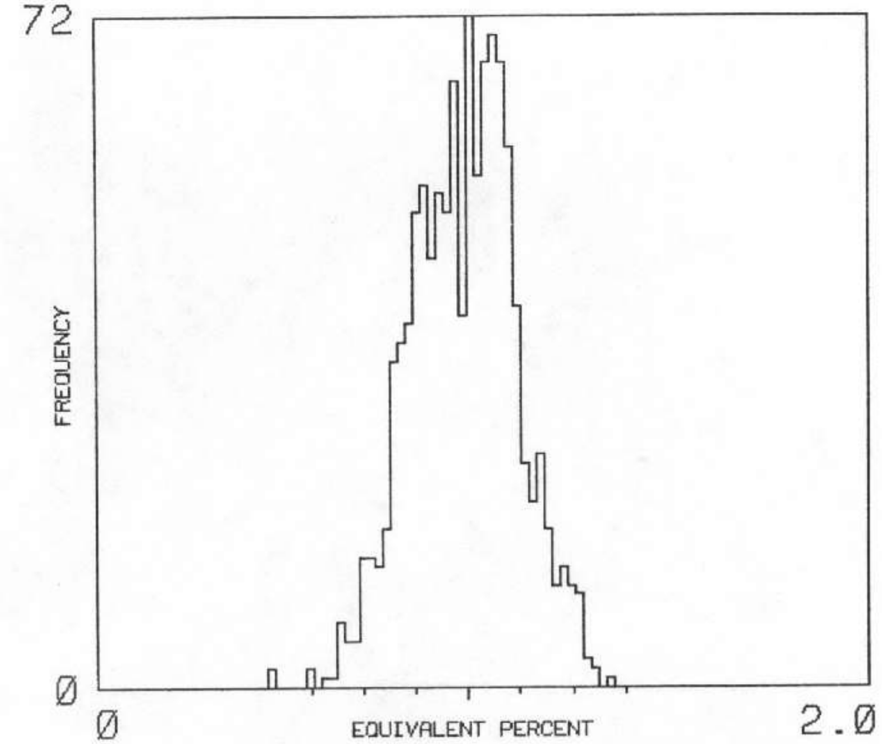
MEAN / MEDIAN 6.4 6.5 1119 ADEQUATE SAMPLES

URANIUM



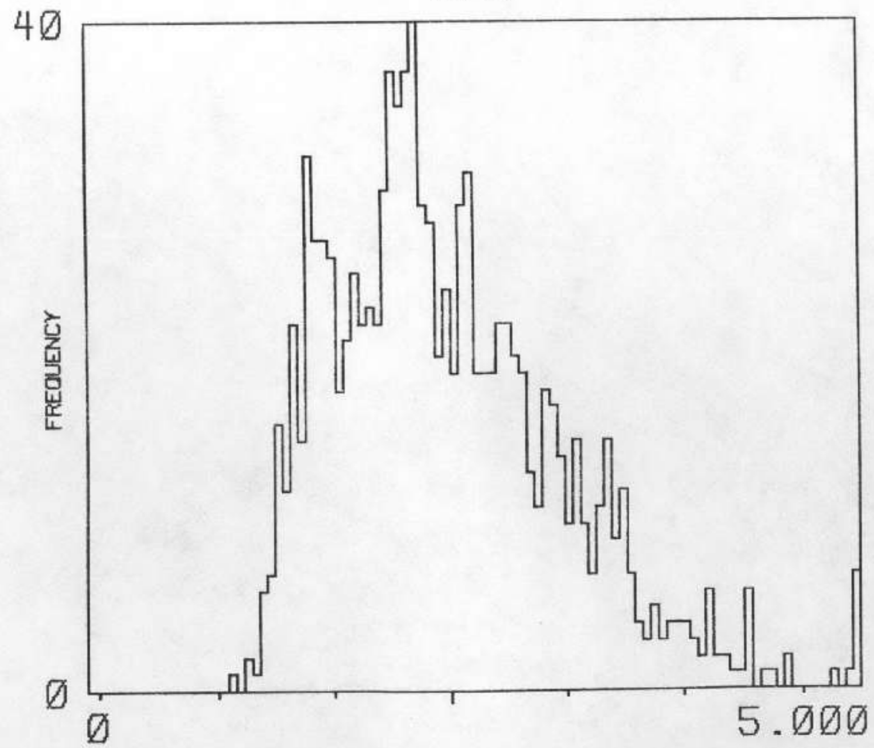
MEAN / MEDIAN 2.2 2.1 1Ø56 ADEQUATE SAMPLES

POTASSIUM



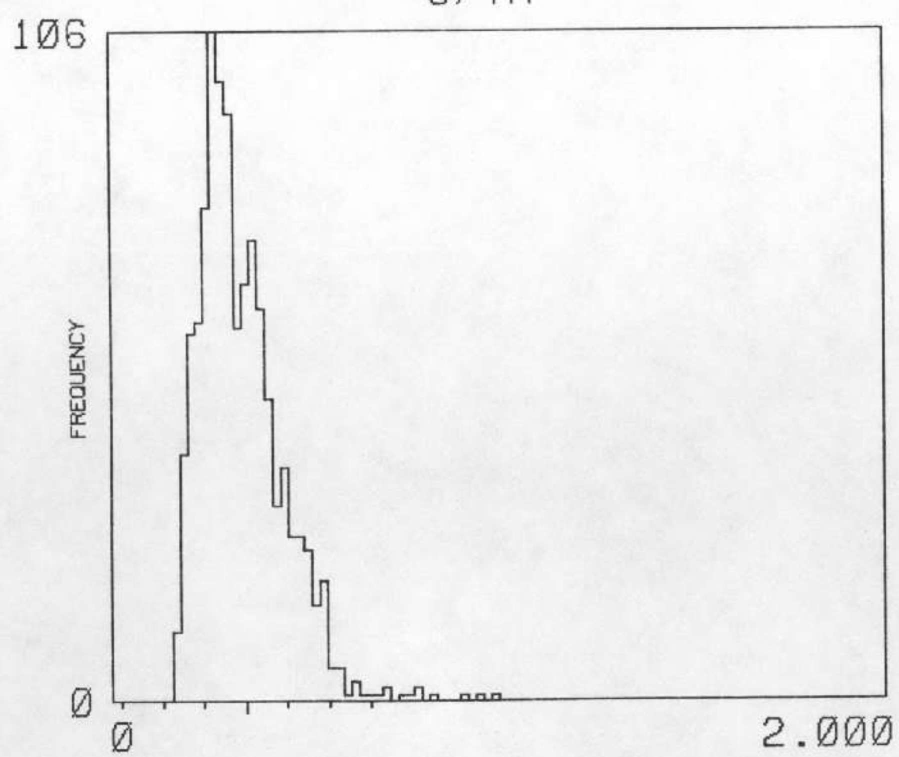
MEAN / MEDIAN 1.Ø 1.Ø 1119 ADEQUATE SAMPLES

U/K



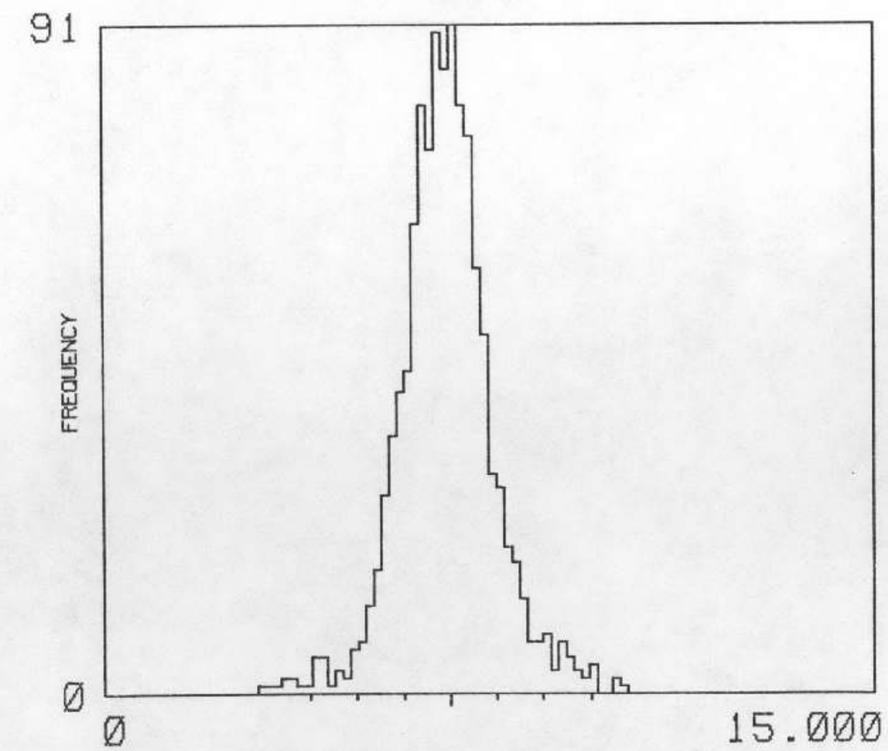
MEAN / MEDIAN 2.35Ø 2.2ØØ 1Ø56 ADEQUATE SAMPLES

U/TH



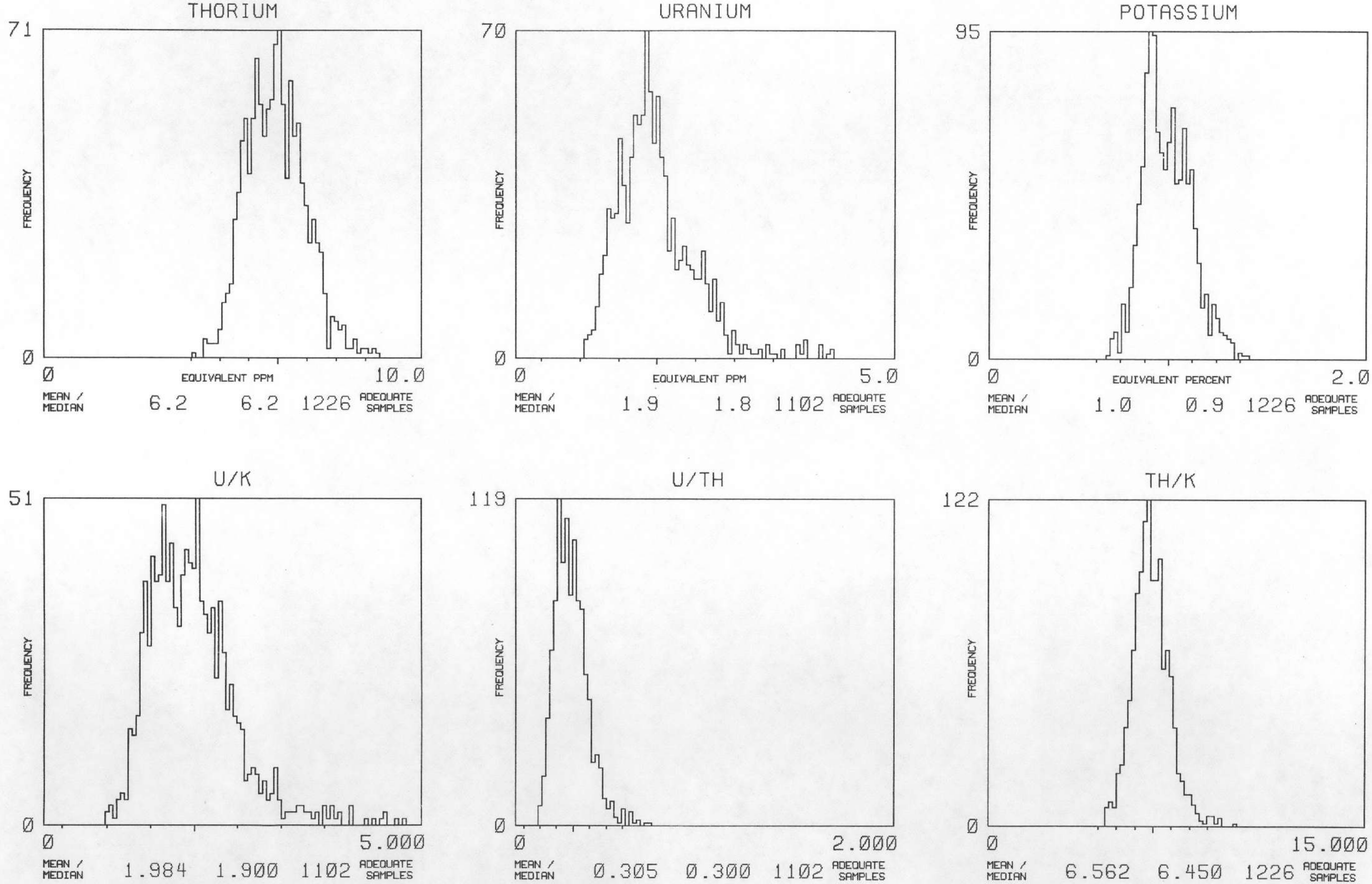
MEAN / MEDIAN Ø.349 Ø.32Ø 1Ø56 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 6.746 6.75Ø 1119 ADEQUATE SAMPLES

NJ 16-5 VINCENNES MAP UNIT : MB TOTAL NUMBER OF SAMPLES 1226



VINCENNES QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
QM	Qm
QC	QC
QPL	Qpl
QL	Ql
QCL	Qcl
QGV	Qgv
QGP	Qgp
QSI	Qsi
* QGK	Qgk
QTI	Qti
PMC	Pmc
PC	Pc
PRC	Prc
ME	Me
MST	Mst
MWB	Mwb
MBR	Mbr
MS	Ms
MB	Mb

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	730	QC	/ 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
2 C	730	QL	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
3 C	730	QL	/ 2QTI	/ 2	/ 0	3.6	1	2	1	0	0	0	0	0
4 C	730	QM	/ 1QCL	/ 2	/ 0	4.2	1	1	1	0	0	0	0	0
5 C	730	MWB	/ 1MBR	/ 2	/ 0	3.2	2	1	0	0	0	0	0	0
6 C	730	MBR	/ 4	/ 0	/ 0	3.7	1	2	1	0	0	0	0	0
7 C	730	MS	/ 5MB	/ 4QC	/ 3	5.1	1	4	3	4	0	0	0	0
8 C	730	MB	/ 1	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
9 C	730	MB	/ 3	/ 0	/ 0	2.7	2	1	0	0	0	0	0	0
10 C	730	MB	/ 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
11 C	730	MB	/ 3QCL	/ 4QTI	/ 3	3.9	1	7	1	1	0	0	0	0
12 C	740	MWB	/ 1	/ 0	/ 0	2.9	0	0	1	0	0	0	0	0
13 C	740	MWB	/ 1MBR	/ 3	/ 0	3.5	2	2	0	0	0	0	0	0
14 C	740	MS	/ 1MBR	/ 1	/ 0	3.7	0	2	0	0	0	0	0	0
15 C	740	QC	/ 3	/ 0	/ 0	3.1	0	3	0	0	0	0	0	0
16 C	750	MB	/ 1QGV	/ 1	/ 0	3.2	1	0	1	0	0	0	0	0
17 C	750	MB	/ 2QCL	/ 4QC	/ 2	4.2	1	4	2	1	0	0	0	0
18 C	770	QL	/ 1QCL	/ 2	/ 0	3.2	2	1	0	0	0	0	0	0
19 C	770	QCL	/ 4	/ 0	/ 0	3.2	2	2	0	0	0	0	0	0
20 C	770	QTI	/ 5	/ 0	/ 0	3.2	3	2	0	0	0	0	0	0
21 C	770	QC	/ 1QTI	/ 2	/ 0	3.2	2	1	0	0	0	0	0	0
22 C	770	QC	/ 2	/ 0	/ 0	3.3	1	0	1	0	0	0	0	0
23 C	770	PRC	/ 3	/ 0	/ 0	2.7	2	1	0	0	0	0	0	0
24 C	770	PRC	/ 3	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
25 C	770	MST	/ 2	/ 0	/ 0	2.5	0	2	0	0	0	0	0	0
26 C	770	QC	/ 1MBR	/ 2	/ 0	3.0	2	1	0	0	0	0	0	0
27 C	770	QC	/ 2MBR	/ 1MS	/ 5	3.6	1	6	1	0	0	0	0	0
28 C	780	QCL	/ 1QTI	/ 2	/ 0	3.1	1	2	0	0	0	0	0	0
29 C	780	QL	/ 4	/ 0	/ 0	3.0	3	1	0	0	0	0	0	0
30 C	780	QL	/ 3QCL	/ 2	/ 0	3.2	2	3	0	0	0	0	0	0
31 C	780	QL	/ 1QC	/ 1	/ 0	3.2	0	2	0	0	0	0	0	0
32 C	780	QC	/ 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
33 C	780	QTI	/ 6	/ 0	/ 0	3.7	4	1	0	1	0	0	0	0
34 C	780	MST	/ 1	/ 0	/ 0	2.9	0	0	1	0	0	0	0	0
35 C	780	MBR	/ 4	/ 0	/ 0	3.2	2	2	0	0	0	0	0	0
36 C	780	MBR	/ 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
37 C	790	QL	/ 6	/ 0	/ 0	3.1	5	1	0	0	0	0	0	0
38 C	790	QL	/ 7	/ 0	/ 0	3.3	4	3	0	0	0	0	0	0
39 C	790	QTI	/ 1QCL	/ 1	/ 0	3.4	0	0	2	0	0	0	0	0
40 C	790	QCL	/ 4	/ 0	/ 0	3.0	3	1	0	0	0	0	0	0
41 C	790	PRC	/ 5QC	/ 2	/ 0	3.1	5	2	0	0	0	0	0	0
42 C	790	PRC	/ 3	/ 0	/ 0	2.9	1	2	0	0	0	0	0	0
43 C	790	MBR	/ 2QC	/ 1	/ 0	3.3	1	2	0	0	0	0	0	0
44 C	790	MS	/ 2	/ 0	/ 0	3.9	1	0	1	0	0	0	0	0
45 C	790	MS	/ 4	/ 0	/ 0	3.5	3	1	0	0	0	0	0	0
46 C	800	QCL	/ 4	/ 0	/ 0	3.1	2	2	0	0	0	0	0	0
47 C	800	QC	/ 2	/ 0	/ 0	6.1	1	0	0	0	0	0	0	1
48 C	800	QL	/ 1	/ 0	/ 0	3.8	0	0	1	0	0	0	0	0
49 C	800	PMC	/ 1	/ 0	/ 0	4.2	0	0	1	0	0	0	0	0
50 C	800	QCL	/ 2QC	/ 1	/ 0	3.1	2	1	0	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	800	QC	/ 1QCL	/ 3PRC	/ 3	2.7	5	2	0	0	0	0	0	0
52	C	800	PRC	/ 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
53	C	800	MST	/ 1MC	/ 3PRC	/ 1QSI	3.2	4	2	2	0	0	0	0	0
54	C	800	PRC	/ 3MST	/ 1	/ 0	2.8	1	2	1	0	0	0	0	0
55	C	800	MST	/ 3MWB	/ 1	/ 0	2.8	3	1	0	0	0	0	0	0
56	C	800	MBR	/ 2	/ 0	/ 0	3.7	1	0	1	0	0	0	0	0
57	C	800	MWB	/ 1MBR	/ 2	/ 0	3.2	2	0	1	0	0	0	0	0
58	C	800	MS	/ 2MBR	/ 1	/ 0	3.6	2	1	0	0	0	0	0	0
59	C	810	QC	/ 1QL	/ 1	/ 0	3.7	0	1	1	0	0	0	0	0
60	C	810	PMC	/ 1PC	/ 4	/ 0	4.7	1	0	4	0	0	0	0	0
61	C	810	PC	/ 1QM	/ 1QCL	/ 2	4.5	1	1	2	0	0	0	0	0
62	C	810	PRC	/ 3	/ 0	/ 0	2.8	2	1	0	0	0	0	0	0
63	C	810	PRC	/ 1QC	/ 1	/ 0	3.4	1	0	1	0	0	0	0	0
64	C	810	MBR	/ 6	/ 0	/ 0	3.5	3	3	0	0	0	0	0	0
65	C	820	QM	/ 1PC	/ 1QCL	/ 1	3.2	2	1	0	0	0	0	0	0
66	C	820	QCL	/ 1	/ 0	/ 0	3.6	0	0	1	0	0	0	0	0
67	C	820	MST	/ 2MWB	/ 1	/ 0	3.2	0	1	1	1	0	0	0	0
68	C	830	PRC	/ 5	/ 0	/ 0	2.7	3	2	0	0	0	0	0	0
69	C	830	QC	/ 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
70	C	830	MBR	/ 2	/ 0	/ 0	3.3	0	2	0	0	0	0	0	0
71	C	840	QL	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
72	C	840	QL	/ 1	/ 0	/ 0	3.7	0	0	1	0	0	0	0	0
73	C	840	QL	/ 1	/ 0	/ 0	3.7	0	0	1	0	0	0	0	0
74	C	840	QL	/ 3QM	/ 1	/ 0	3.9	0	2	2	0	0	0	0	0
75	C	840	MBR	/ 4	/ 0	/ 0	3.5	0	4	0	0	0	0	0	0
76	C	840	QC	/ 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
77	C	1010	QL	/ 5	/ 0	/ 0	3.8	1	3	1	0	0	0	0	0
78	C	1010	QL	/ 4	/ 0	/ 0	2.9	2	2	0	0	0	0	0	0
79	C	1010	QTI	/ 5	/ 0	/ 0	3.0	3	2	0	0	0	0	0	0
80	C	1030	QL	/ 4	/ 0	/ 0	3.2	2	2	0	0	0	0	0	0
81	C	1030	PC	/ 1QM	/ 1	/ 0	5.1	0	1	1	0	0	0	0	0
82	C	1030	PC	/ 1QM	/ 2	/ 0	5.3	0	1	2	0	0	0	0	0
83	C	1040	PRC	/ 4	/ 0	/ 0	2.7	3	1	0	0	0	0	0	0
84	C	1050	MST	/ 1	/ 0	/ 0	2.8	0	0	1	0	0	0	0	0
85	C	1050	MST	/ 4	/ 0	/ 0	2.4	3	1	0	0	0	0	0	0
86	C	1060	MBR	/ 2	/ 0	/ 0	3.7	0	2	0	0	0	0	0	0
87	C	1060	MBR	/ 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
88	C	1060	MBR	/ 3	/ 0	/ 0	3.2	1	2	0	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 QM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5737	0.7561	0.9385	1.1209	1.3033	1.4857	1.6681
URANIUM DIST NORMAL	0.2309	1.0279	1.8249	2.6219	3.4189	4.2159	5.0129
THORIUM DIST NORMAL	3.3092	4.4630	5.6168	6.7706	7.9244	9.0782	10.2320
U/K DIST NORMAL	0.0390	0.8181	1.5972	2.3763	3.1554	3.9345	4.7136
U/TH DIST NORMAL	-0.0364	0.1079	0.2522	0.3965	0.5408	0.6851	0.8294
TH/K DIST NORMAL	4.0317	4.7092	5.3867	6.0642	6.7417	7.4192	8.0967

MAP UNIT QC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3313	0.5818	0.8323	1.0828	1.3333	1.5838	1.8343
URANIUM DIST NORMAL	0.3458	0.8867	1.4276	1.9685	2.5094	3.0503	3.5912
THORIUM DIST NORMAL	1.6745	3.0230	4.3715	5.7200	7.0685	8.4170	9.7655
U/K DIST NORMAL	-0.1137	0.5464	1.2065	1.8666	2.5267	3.1868	3.8469
U/TH DIST NORMAL	0.0424	0.1422	0.2420	0.3418	0.4416	0.5414	0.6412
TH/K DIST NORMAL	1.4801	2.7966	4.1131	5.4296	6.7461	8.0626	9.3791

MAP UNIT QPL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7296	0.8497	0.9698	1.0899	1.2100	1.3301	1.4502
URANIUM DIST NORMAL	0.2995	0.6942	1.0889	1.4836	1.8783	2.2730	2.6677
THORIUM DIST NORMAL	-0.4258	0.9162	2.2582	3.6002	4.9422	6.2842	7.6262
U/K DIST NORMAL	0.3029	0.6492	0.9955	1.3418	1.6881	2.0344	2.3807
U/TH DIST NORMAL	0.0392	0.1621	0.2850	0.4079	0.5308	0.6537	0.7766
TH/K DIST NORMAL	-0.0392	1.0700	2.1792	3.2884	4.3976	5.5068	6.6160

MAP UNIT QL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6802	0.8388	0.9974	1.1560	1.3146	1.4732	1.6318
URANIUM DIST NORMAL	0.6509	1.1418	1.6327	2.1236	2.6145	3.1054	3.5963
THORIUM DIST NORMAL	3.1554	4.2397	5.3240	6.4083	7.4926	8.5769	9.6612
U/K DIST NORMAL	0.3913	0.8824	1.3735	1.8646	2.3557	2.8468	3.3379
U/TH DIST NORMAL	0.0895	0.1713	0.2531	0.3349	0.4167	0.4985	0.5803
TH/K DIST NORMAL	2.4770	3.5196	4.5622	5.6048	6.6474	7.6900	8.7326

MAP UNIT QCL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6115	0.7899	0.9683	1.1467	1.3251	1.5035	1.6819
URANIUM DIST NORMAL	0.5927	1.0862	1.5797	2.0732	2.5667	3.0602	3.5537
THORIUM DIST NORMAL	2.9159	4.0559	5.1959	6.3359	7.4759	8.6159	9.7559
U/K DIST NORMAL	0.2827	0.8016	1.3205	1.8394	2.3583	2.8772	3.3961
U/TH DIST NORMAL	0.0744	0.1590	0.2436	0.3282	0.4128	0.4974	0.5820
TH/K DIST NORMAL	2.2894	3.3934	4.4974	5.6014	6.7054	7.8094	8.9134

MAP UNIT QGV

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5671	0.7348	0.9025	1.0702	1.2379	1.4056	1.5733
URANIUM DIST NORMAL	0.2689	0.7267	1.1845	1.6423	2.1001	2.5579	3.0157
THORIUM DIST NORMAL	0.2327	1.5804	2.9281	4.2758	5.6235	6.9712	8.3189
U/K DIST NORMAL	0.1020	0.5716	1.0412	1.5108	1.9804	2.4500	2.9196
U/TH DIST NORMAL	0.0462	0.1550	0.2638	0.3726	0.4814	0.5902	0.6990
TH/K DIST NORMAL	0.8306	1.6801	2.9296	3.9791	5.0286	6.0781	7.1276

MAP UNIT QGP

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6262	0.7288	0.8314	0.9340	1.0366	1.1392	1.2418
URANIUM DIST NORMAL	0.7489	1.0269	1.3049	1.5829	1.8609	2.1389	2.4169
THORIUM DIST NORMAL	2.7857	3.5450	4.3043	5.0636	5.8229	6.5822	7.3415
U/K DIST NORMAL	0.6562	1.0089	1.3616	1.7143	2.0670	2.4197	2.7724
U/TH DIST NORMAL	0.1144	0.1825	0.2506	0.3187	0.3868	0.4549	0.5230
TH/K DIST NORMAL	4.3839	4.7241	5.0643	5.4045	5.7447	6.0849	6.4251

MAP UNIT QSI

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3409	0.5053	0.6697	0.8341	0.9985	1.1629	1.3273
URANIUM DIST NORMAL	0.5557	1.0802	1.6047	2.1292	2.6537	3.1782	3.7027
THORIUM DIST NORMAL	2.7010	3.7332	4.7654	5.7976	6.8298	7.8620	8.8942
U/K DIST NORMAL	0.2652	1.0552	1.8452	2.6352	3.4252	4.2152	5.0052
U/TH DIST NORMAL	0.1228	0.2050	0.2872	0.3694	0.4516	0.5338	0.6160
TH/K DIST NORMAL	3.4985	4.6924	5.8863	7.0802	8.2741	9.4680	10.6619

MAP UNIT QTI

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6430	0.7777	0.9124	1.0471	1.1818	1.3165	1.4512
URANIUM DIST NORMAL	0.5623	1.0444	1.5265	2.0086	2.4907	2.9728	3.4549
THORIUM DIST NORMAL	3.6107	4.4423	5.2739	6.1055	6.9371	7.7687	8.6003
U/K DIST NORMAL	0.4709	0.9562	1.4415	1.9268	2.4121	2.8974	3.3827
U/TH DIST NORMAL	0.0707	0.1575	0.2443	0.3311	0.4179	0.5047	0.5915
TH/K DIST NORMAL	3.6818	4.4070	5.1322	5.8574	6.5826	7.3078	8.0330

MAP UNIT PMC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5762	0.7702	0.9642	1.1582	1.3522	1.5462	1.7402
URANIUM DIST NORMAL	0.2516	0.9368	1.6220	2.3072	2.9924	3.6776	4.3628
THORIUM DIST NORMAL	3.8336	4.8581	5.8826	6.9071	7.9316	8.9561	9.9806
U/K DIST NORMAL	0.8237	1.2079	1.5921	1.9763	2.3605	2.7447	3.1289
U/TH DIST NORMAL	0.1285	0.1963	0.2641	0.3319	0.3997	0.4675	0.5353
TH/K DIST NORMAL	3.9843	4.6635	5.3427	6.0219	6.7011	7.3803	8.0595

MAP UNIT PC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5173	0.7069	0.8965	1.0861	1.2757	1.4653	1.6549
URANIUM DIST NORMAL	0.3824	1.0503	1.7182	2.3861	3.0540	3.7219	4.3898
THORIUM DIST NORMAL	3.5424	4.5787	5.6150	6.6513	7.6876	8.7239	9.7602
U/K DIST NORMAL	0.6547	1.1728	1.6909	2.2090	2.7271	3.2452	3.7633
U/TH DIST NORMAL	0.0962	0.1844	0.2726	0.3608	0.4490	0.5372	0.6254
TH/K DIST NORMAL	3.9318	4.6820	5.4322	6.1824	6.9326	7.6828	8.4330

MAP UNIT PRC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4523	0.5971	0.7419	0.8867	1.0315	1.1763	1.3211
URANIUM DIST NORMAL	0.5970	1.0512	1.5054	1.9596	2.4138	2.8680	3.3222
THORIUM DIST NORMAL	3.1168	4.0691	5.0214	5.9737	6.9260	7.8783	8.8306
U/K DIST NORMAL	0.7148	1.2202	1.7256	2.2310	2.7364	3.2418	3.7472
U/TH DIST NORMAL	0.1169	0.1877	0.2585	0.3293	0.4001	0.4709	0.5417
TH/K DIST NORMAL	4.3166	5.1407	5.9648	6.7889	7.6130	8.4371	9.2612

MAP UNIT MC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3588	0.4893	0.6198	0.7503	0.8808	1.0113	1.1418
URANIUM DIST NORMAL	0.4306	0.8653	1.3000	1.7347	2.1694	2.6041	3.0388
THORIUM DIST NORMAL	3.0533	3.8744	4.6955	5.5166	6.3377	7.1588	7.9799
U/K DIST NORMAL	0.4165	1.0586	1.7007	2.3428	2.9849	3.6270	4.2691
U/TH DIST NORMAL	0.0792	0.1584	0.2376	0.3168	0.3960	0.4752	0.5544
TH/K DIST NORMAL	4.6228	5.5626	6.5024	7.4422	8.3820	9.3218	10.2616

MAP UNIT MST

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3701	0.4956	0.6211	0.7466	0.8721	0.9976	1.1231
URANIUM DIST NORMAL	0.6135	1.0083	1.4031	1.7979	2.1927	2.5875	2.9823
THORIUM DIST NORMAL	2.7789	3.6827	4.5865	5.4903	6.3941	7.2979	8.2017
U/K DIST NORMAL	0.4954	1.1520	1.8086	2.4652	3.1218	3.7784	4.4350
U/TH DIST NORMAL	0.0934	0.1729	0.2524	0.3319	0.4114	0.4909	0.5704
TH/K DIST NORMAL	4.1699	5.2617	6.3535	7.4453	8.5371	9.6289	10.7207

MAP UNIT MWB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.2980	0.4616	0.6252	0.7888	0.9524	1.1160	1.2796
URANIUM DIST NORMAL	0.5048	0.9446	1.3844	1.8242	2.2640	2.7038	3.1436
THORIUM DIST NORMAL	2.5478	3.5277	4.5076	5.4875	6.4674	7.4473	8.4272
U/K DIST NORMAL	0.5507	1.1531	1.7555	2.3579	2.9603	3.5627	4.1651
U/TH DIST NORMAL	0.1006	0.1785	0.2564	0.3343	0.4122	0.4901	0.5680
TH/K DIST NORMAL	4.3252	5.2335	6.1418	7.0501	7.9584	8.8667	9.7750

MAP UNIT MBR

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3989	0.5618	0.7247	0.8876	1.0505	1.2134	1.3763
URANIUM DIST NORMAL	0.7526	1.2882	1.8238	2.3594	2.8950	3.4306	3.9662
THORIUM DIST NORMAL	3.3522	4.3469	5.3416	6.3363	7.3310	8.3257	9.3204
U/K DIST NORMAL	0.6566	1.3421	2.0276	2.7131	3.3986	4.0841	4.7696
U/TH DIST NORMAL	0.1095	0.1975	0.2855	0.3735	0.4615	0.5495	0.6375
TH/K DIST NORMAL	4.2035	5.2153	6.2271	7.2389	8.2507	9.2625	10.2743

MAP UNIT MS

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5563	0.6916	0.8269	0.9622	1.0975	1.2328	1.3681
URANIUM DIST NORMAL	0.2372	0.9013	1.5654	2.2295	2.8936	3.5577	4.2218
THORIUM DIST NORMAL	3.9056	4.7449	5.5842	6.4235	7.2628	8.1021	8.9414
U/K DIST NORMAL	0.0745	0.8331	1.5917	2.3503	3.1089	3.8675	4.6261
U/TH DIST NORMAL	0.0257	0.1335	0.2413	0.3491	0.4569	0.5647	0.6725
TH/K DIST NORMAL	4.0192	4.9282	5.8372	6.7462	7.6552	8.5642	9.4732

MAP UNIT MB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5693	0.6963	0.8233	0.9503	1.0773	1.2043	1.3313
URANIUM DIST NORMAL	0.3381	0.8481	1.3581	1.8681	2.3781	2.8881	3.3981
THORIUM DIST NORMAL	3.8627	4.6394	5.4161	6.1928	6.9695	7.7462	8.5229
U/K DIST NORMAL	0.2416	0.8224	1.4032	1.9840	2.5648	3.1456	3.7264
U/TH DIST NORMAL	0.0430	0.1302	0.2174	0.3046	0.3918	0.4790	0.5662
TH/K DIST NORMAL	4.3908	5.1146	5.8384	6.5622	7.2860	8.0098	8.7336

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT QM

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.155	0.000	1.188	0.000	0.000	0.000	0.000	0.968	1.084	1.118	0.968	1.275	0.000	0.000	1.109
URANIUM	2.951	0.000	1.703	0.000	0.000	0.000	0.000	2.295	2.856	2.386	1.846	2.901	0.000	0.000	3.167
THORIUM	7.102	0.000	6.476	0.000	0.000	0.000	0.000	5.401	6.456	7.058	6.838	7.892	0.000	0.000	6.495
U/K	2.534	0.000	1.448	0.000	0.000	0.000	0.000	2.371	2.785	2.166	1.945	2.318	0.000	0.000	2.782
U/TH	0.414	0.000	0.271	0.000	0.000	0.000	0.000	0.430	0.473	0.344	0.272	0.371	0.000	0.000	0.481
TH/K	6.132	0.000	5.451	0.000	0.000	0.000	0.000	5.580	5.972	6.345	7.113	6.296	0.000	0.000	5.863

	1040	1050	1060
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 QC

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.078	1.133	1.078	0.880	1.138	1.210	1.040	0.925	1.169	1.008	0.926	0.975	1.123	1.285	1.304
URANIUM	2.239	1.887	1.748	1.573	2.264	2.037	2.049	1.946	1.985	1.728	2.018	2.219	1.835	1.827	2.039
THORIUM	5.265	5.622	5.248	5.140	5.862	5.803	5.896	5.296	6.010	5.384	5.594	6.343	5.617	5.741	6.582
U/K	2.109	1.668	1.665	1.741	2.056	1.692	2.052	2.261	1.695	1.858	2.158	2.307	1.559	1.418	1.578
U/TH	0.424	0.338	0.323	0.267	0.388	0.354	0.351	0.378	0.320	0.325	0.344	0.357	0.313	0.329	0.307
TH/K	4.959	5.045	4.935	6.008	5.276	4.861	5.832	5.860	5.223	5.742	6.157	6.570	5.056	4.420	5.055

	1040	1050	1060
POTASIUM	0.958	1.035	1.129
URANIUM	2.021	1.912	2.046
THORIUM	5.877	6.037	6.797
U/K	2.132	1.903	1.844
U/TH	0.347	0.311	0.304
TH/K	6.214	5.947	6.171

MAP UNIT QPL

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.009	1.052	1.067	0.958	1.096	1.154	0.000	0.000	1.213	0.000	0.000	0.000	1.018	1.154	1.117
URANIUM	1.506	1.347	1.293	1.427	1.741	1.540	0.000	0.000	2.073	0.000	0.000	0.000	1.303	1.409	1.516
THORIUM	2.900	3.446	3.239	3.157	4.212	3.423	0.000	0.000	5.002	0.000	0.000	0.000	3.169	3.754	3.995
U/K	1.477	1.256	1.219	1.646	1.564	1.363	0.000	0.000	1.708	0.000	0.000	0.000	1.289	1.223	1.340
U/TH	0.508	0.385	0.446	0.351	0.413	0.462	0.000	0.000	0.422	0.000	0.000	0.000	0.416	0.390	0.346
TH/K	2.869	3.238	3.023	3.459	3.789	3.026	0.000	0.000	4.110	0.000	0.000	0.000	3.101	3.244	3.535

	1040	1050	1060
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

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.108	1.152	1.161	1.154	1.279	1.176	1.138	1.214	1.208	1.143	1.178	1.110	1.227	1.139	1.003
URANIUM	2.241	1.961	1.941	1.518	2.371	2.091	2.249	2.275	2.098	2.086	2.117	2.219	2.246	1.986	2.321
THORIUM	5.454	5.932	5.780	6.039	6.563	5.886	6.052	6.019	6.458	6.230	6.792	7.057	6.651	5.882	6.977
U/K	2.027	1.684	1.726	1.327	1.869	1.787	1.999	1.887	1.744	1.844	1.839	2.033	1.857	1.765	2.351
U/TH	0.414	0.323	0.334	0.257	0.367	0.362	0.372	0.384	0.326	0.339	0.317	0.316	0.342	0.342	0.337
TH/K	4.920	5.112	5.012	5.232	5.144	5.045	5.349	4.949	5.369	5.469	5.853	6.472	5.444	5.199	6.978

	1040	1050	1060
POTASIUM	0.845	0.000	0.000
URANIUM	1.835	0.000	0.000
THORIUM	6.597	0.000	0.000
U/K	2.194	0.000	0.000
U/TH	0.281	0.000	0.000
TH/K	7.824	0.000	0.000

MAP UNIT QCL

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.052	1.090	1.145	1.042	1.156	1.133	1.189	1.215	1.188	1.146	1.063	1.173	1.266	1.195	1.179
URANIUM	2.045	1.826	1.990	1.599	2.303	2.239	2.090	2.217	2.169	2.147	2.059	2.167	1.878	2.159	2.044
THORIUM	5.458	5.612	5.925	6.003	6.386	6.555	6.356	6.299	6.461	6.440	6.573	7.081	6.384	6.580	6.693
U/K	1.991	1.642	1.804	1.567	2.017	1.959	1.779	1.873	1.872	1.913	1.982	1.888	1.514	1.839	1.755
U/TH	0.371	0.319	0.328	0.272	0.366	0.340	0.332	0.360	0.339	0.332	0.317	0.310	0.300	0.332	0.303
TH/K	5.297	5.176	5.228	5.819	5.558	5.793	5.368	5.256	5.530	5.714	6.320	6.128	5.112	5.556	5.740

	1040	1050	1060
POTASIUM	0.982	0.975	0.922
URANIUM	2.236	2.130	2.132
THORIUM	6.714	5.940	6.283
U/K	2.323	2.266	2.471
U/TH	0.337	0.362	0.354
TH/K	6.910	6.243	6.918

MAP UNIT QGV

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.000	1.070	1.140	0.921	1.110	1.186	0.000	0.000	0.000	0.000	0.765	0.861	0.000	1.120	1.126
URANIUM	0.000	1.593	1.815	1.320	1.713	1.774	0.000	0.000	0.000	0.000	1.709	2.301	0.000	1.397	1.760
THORIUM	0.000	4.153	5.142	3.156	3.699	4.358	0.000	0.000	0.000	0.000	4.671	5.217	0.000	4.190	4.902
U/K	0.000	1.460	1.581	1.486	1.538	1.498	0.000	0.000	0.000	0.000	1.910	2.676	0.000	1.248	1.500
U/TH	0.000	0.362	0.351	0.394	0.474	0.410	0.000	0.000	0.000	0.000	0.305	0.445	0.000	0.348	0.335
TH/K	0.000	3.882	4.455	3.435	3.322	3.629	0.000	0.000	0.000	0.000	6.068	6.070	0.000	3.737	4.352

	1040	1050	1060
POTASIUM	0.000	0.000	1.172
URANIUM	0.000	0.000	1.479
THORIUM	0.000	0.000	5.046
U/K	0.000	0.000	1.274
U/TH	0.000	0.000	0.283
TH/K	0.000	0.000	4.329

MAP UNIT QGP

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.000	0.969	0.000	0.000	0.000	0.948	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	1.581	0.000	0.000	0.000	1.745	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	5.283	0.000	0.000	0.000	5.259	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	0.000	1.646	0.000	0.000	0.000	1.873	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.306	0.000	0.000	0.000	0.334	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	5.433	0.000	0.000	0.000	5.574	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.780	0.000	0.000
URANIUM	1.332	0.000	0.000
THORIUM	3.916	0.000	0.000
U/K	1.720	0.000	0.000
U/TH	0.342	0.000	0.000
TH/K	5.025	0.000	0.000

MAP UNIT QSI

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.744	0.000	0.798	0.786	1.110	0.948	0.900	0.687	0.740	0.824	0.860	0.000	0.000	0.000	0.000
URANIUM	2.121	0.000	1.499	0.985	2.629	2.198	2.031	2.666	1.800	2.359	2.117	0.000	0.000	0.000	0.000
THORIUM	5.204	0.000	4.810	5.648	7.287	6.044	6.809	5.812	5.260	5.936	5.946	0.000	0.000	0.000	0.000
U/K	2.830	0.000	2.063	1.276	2.390	2.347	2.298	3.944	2.466	2.963	2.535	0.000	0.000	0.000	0.000
U/TH	0.406	0.000	0.321	0.176	0.363	0.365	0.307	0.461	0.347	0.403	0.368	0.000	0.000	0.000	0.000
TH/K	7.076	0.000	6.250	7.184	6.579	6.533	7.624	8.506	7.104	7.344	6.927	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.695	0.886
URANIUM	0.000	1.489	2.271
THORIUM	0.000	4.860	6.275
U/K	0.000	2.162	2.655
U/TH	0.000	0.309	0.361
TH/K	0.000	6.994	7.245

MAP UNIT QTI

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	1.027	1.028	1.052	0.960	1.088	1.051	1.157	0.000	0.000	0.000	0.000	0.000	1.053	0.000	1.154
URANIUM	1.995	1.841	1.666	1.605	2.251	2.410	2.013	0.000	0.000	0.000	0.000	0.000	2.089	0.000	2.091
THORIUM	5.722	5.912	6.175	5.917	6.370	6.362	6.100	0.000	0.000	0.000	0.000	0.000	6.254	0.000	6.231
U/K	1.954	1.807	1.617	1.664	2.091	2.285	1.775	0.000	0.000	0.000	0.000	0.000	2.002	0.000	1.824
U/TH	0.354	0.315	0.272	0.267	0.357	0.381	0.337	0.000	0.000	0.000	0.000	0.000	0.337	0.000	0.342
TH/K	5.605	5.764	5.948	6.179	5.877	6.014	5.302	0.000	0.000	0.000	0.000	0.000	5.961	0.000	5.407

	1040	1050	1060
POTASIUM	0.000	0.000	1.009
URANIUM	0.000	0.000	2.064
THORIUM	0.000	0.000	7.121
U/K	0.000	0.000	2.046
U/TH	0.000	0.000	0.289
TH/K	0.000	0.000	7.052

MAP UNIT PMC

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	1.186	1.296	1.132	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.223	3.137	2.216	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	6.047	7.793	7.021	0.000	0.000	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	1.891	2.403	1.941	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.367	0.401	0.313	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	5.140	5.980	6.269	0.000	0.000	0.000	0.000	0.000	0.000

	1040	1050	1060
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 PC

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	1.352	0.988	1.292	1.041	1.048	0.000	0.000	0.000	1.070
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.756	2.220	3.052	2.243	2.177	0.000	0.000	0.000	2.329
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	7.285	5.981	7.582	6.977	7.108	0.000	0.000	0.000	6.518
U/K	0.000	0.000	0.000	0.000	0.000	0.000	2.051	2.283	2.353	2.174	2.077	0.000	0.000	0.000	2.181
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.379	0.374	0.403	0.324	0.306	0.000	0.000	0.000	0.359
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	5.427	6.147	5.885	6.743	6.782	0.000	0.000	0.000	6.112

	1040	1050	1060
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 PRC

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.840	0.813	0.819	0.864	0.871	0.917	0.929	0.942	0.911	0.915	0.885	0.796	0.000	0.000	0.000
URANIUM	1.626	1.581	1.622	1.344	2.112	2.015	2.130	2.166	1.973	2.133	2.081	1.916	0.000	0.000	0.000
THORIUM	5.193	5.024	5.449	5.461	5.609	6.084	5.809	6.276	6.145	6.610	6.307	6.015	0.000	0.000	0.000
U/K	1.997	1.982	2.018	1.566	2.477	2.229	2.323	2.347	2.187	2.358	2.369	2.429	0.000	0.000	0.000
U/TH	0.324	0.318	0.304	0.247	0.380	0.335	0.367	0.352	0.323	0.325	0.331	0.321	0.000	0.000	0.000
TH/K	6.198	6.217	6.687	6.329	6.565	6.712	6.344	6.684	6.801	7.283	7.193	7.616	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.887	0.807	0.000
URANIUM	1.886	1.916	0.000
THORIUM	5.821	5.986	0.000
U/K	2.138	2.385	0.000
U/TH	0.324	0.316	0.000
TH/K	6.596	7.475	0.000

MAP UNIT MC

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.798	0.714	0.815	0.747	0.750	0.747	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.062	2.114	1.735	1.620	1.737	1.850	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	5.302	5.257	5.904	5.284	5.541	5.736	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	2.610	2.990	2.121	2.213	2.356	2.495	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.396	0.398	0.294	0.307	0.316	0.326	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	6.647	7.415	7.334	7.179	7.440	7.730	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.744	0.000
URANIUM	0.000	1.565	0.000
THORIUM	0.000	5.606	0.000
U/K	0.000	2.135	0.000
U/TH	0.000	0.282	0.000
TH/K	0.000	7.661	0.000

MAP UNIT MST

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.792	0.750	0.684	0.750	0.692	0.774	0.794	0.762	0.751	0.719	0.639	0.728	0.000	0.000	0.000
URANIUM	1.713	1.608	1.517	1.331	1.978	1.757	1.825	1.996	1.838	1.768	1.744	1.840	0.000	0.000	0.000
THORIUM	5.032	4.768	4.958	4.871	4.994	5.510	5.654	5.501	5.700	5.796	4.903	5.866	0.000	0.000	0.000
U/K	2.197	2.159	2.239	1.830	2.877	2.277	2.365	2.811	2.475	2.498	2.821	2.568	0.000	0.000	0.000
U/TH	0.345	0.344	0.309	0.264	0.399	0.320	0.327	0.379	0.327	0.307	0.362	0.317	0.000	0.000	0.000
TH/K	6.352	6.404	7.309	6.559	7.238	7.172	7.189	7.346	7.623	8.100	7.846	8.174	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.768	0.775	0.000
URANIUM	1.607	1.808	0.000
THORIUM	4.994	5.603	0.000
U/K	2.106	2.352	0.000
U/TH	0.330	0.325	0.000
TH/K	6.530	7.311	0.000

MAP UNIT MWB

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.833	0.796	0.864	0.747	0.779	0.751	0.787	0.821	0.728	0.649	0.566	0.000	0.000	0.000	0.000
URANIUM	1.835	2.084	1.401	1.532	2.049	1.715	1.862	2.080	1.784	1.823	1.623	0.000	0.000	0.000	0.000
THORIUM	5.405	4.988	5.569	5.153	5.516	5.172	5.646	5.917	5.226	5.171	4.148	0.000	0.000	0.000	0.000
U/K	2.192	2.450	1.652	2.026	2.676	2.308	2.407	2.554	2.478	2.827	2.972	0.000	0.000	0.000	0.000
U/TH	0.340	0.392	0.256	0.296	0.374	0.336	0.334	0.356	0.343	0.355	0.388	0.000	0.000	0.000	0.000
TH/K	6.534	6.319	6.462	6.920	7.134	6.917	7.213	7.253	7.247	8.024	7.545	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.967	0.723
URANIUM	0.000	1.911	1.763
THORIUM	0.000	6.530	5.079
U/K	0.000	2.001	2.507
U/TH	0.000	0.292	0.348
TH/K	0.000	6.865	7.317

MAP UNIT MBR

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.908	0.893	0.898	0.965	1.023	0.938	0.815	0.818	0.796	0.770	0.804	0.821	0.000	0.000	0.000
URANIUM	2.931	2.495	1.772	1.958	2.459	2.463	2.301	2.439	2.353	2.112	2.461	2.391	0.000	0.000	0.000
THORIUM	5.867	5.629	4.835	6.366	6.991	6.336	5.998	6.279	5.942	6.050	6.241	6.338	0.000	0.000	0.000
U/K	3.198	2.919	1.972	2.085	2.433	2.655	2.882	2.987	2.947	2.755	3.099	2.944	0.000	0.000	0.000
U/TH	0.495	0.468	0.313	0.311	0.354	0.392	0.386	0.388	0.395	0.350	0.393	0.381	0.000	0.000	0.000
TH/K	6.583	6.327	5.475	6.669	6.916	6.790	7.424	7.724	7.486	7.931	7.886	7.786	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	1.044	0.866
URANIUM	0.000	2.152	2.474
THORIUM	0.000	6.828	6.492
U/K	0.000	2.102	2.874
U/TH	0.000	0.319	0.383
TH/K	0.000	6.611	7.535

MAP UNIT MS

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.893	0.984	1.029	0.950	1.023	0.929	0.938	0.897	0.803	0.000	0.762	0.000	0.000	0.000	0.000
URANIUM	3.197	2.050	1.727	1.844	2.631	2.199	2.938	2.668	1.942	0.000	1.624	0.000	0.000	0.000	0.000
THORIUM	5.908	6.724	6.048	6.232	6.742	6.401	6.585	7.157	6.381	0.000	5.872	0.000	0.000	0.000	0.000
U/K	3.569	2.121	1.697	1.934	2.578	2.386	3.138	3.056	2.457	0.000	2.105	0.000	0.000	0.000	0.000
U/TH	0.543	0.309	0.291	0.294	0.392	0.348	0.446	0.377	0.305	0.000	0.275	0.000	0.000	0.000	0.000
TH/K	6.627	6.887	5.950	6.619	6.612	6.906	7.070	8.076	8.080	0.000	7.698	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	1.002	0.988
URANIUM	0.000	1.992	1.988
THORIUM	0.000	6.078	6.226
U/K	0.000	2.034	1.996
U/TH	0.000	0.334	0.317
TH/K	0.000	6.154	6.372

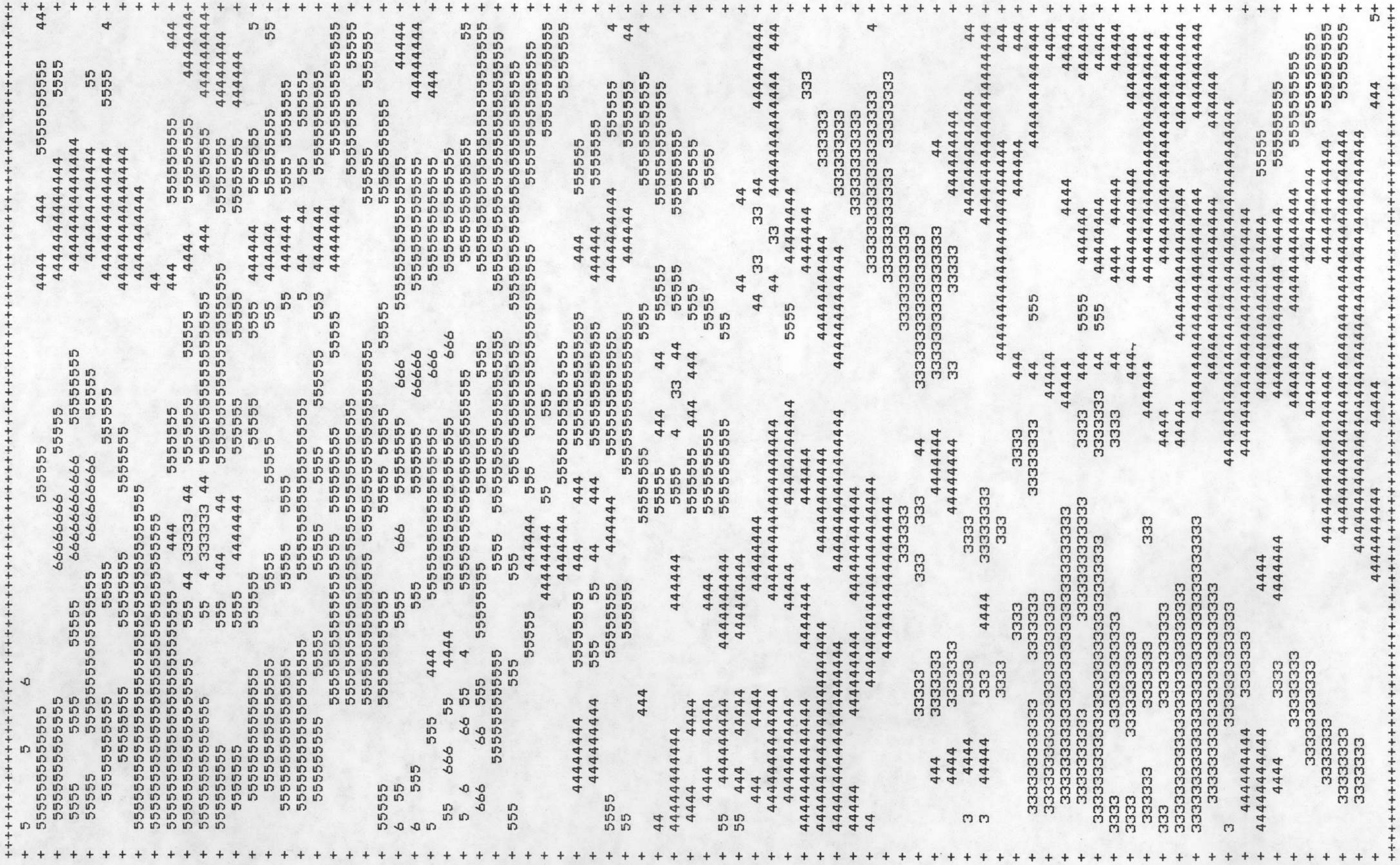
MAP UNIT MB

	730	740	750	760	770	780	790	800	810	820	830	840	1010	1020	1030
POTASIUM	0.938	0.970	0.868	0.949	0.000	0.000	0.864	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.037	1.815	1.894	1.443	0.000	0.000	2.634	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	6.025	6.410	5.672	6.392	0.000	0.000	6.706	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.188	1.886	2.228	1.505	0.000	0.000	3.055	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.338	0.283	0.341	0.223	0.000	0.000	0.401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	6.462	6.705	6.581	6.768	0.000	0.000	7.756	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	1.019	1.008
URANIUM	0.000	1.922	1.788
THORIUM	0.000	6.530	6.510
U/K	0.000	1.945	1.779
U/TH	0.000	0.299	0.278
TH/K	0.000	6.447	6.491

APPENDIX H - Pseudo Contour Maps

VINCENNES



Potassium Pseudo-Contour Map - Vincennes 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

VINCENNES

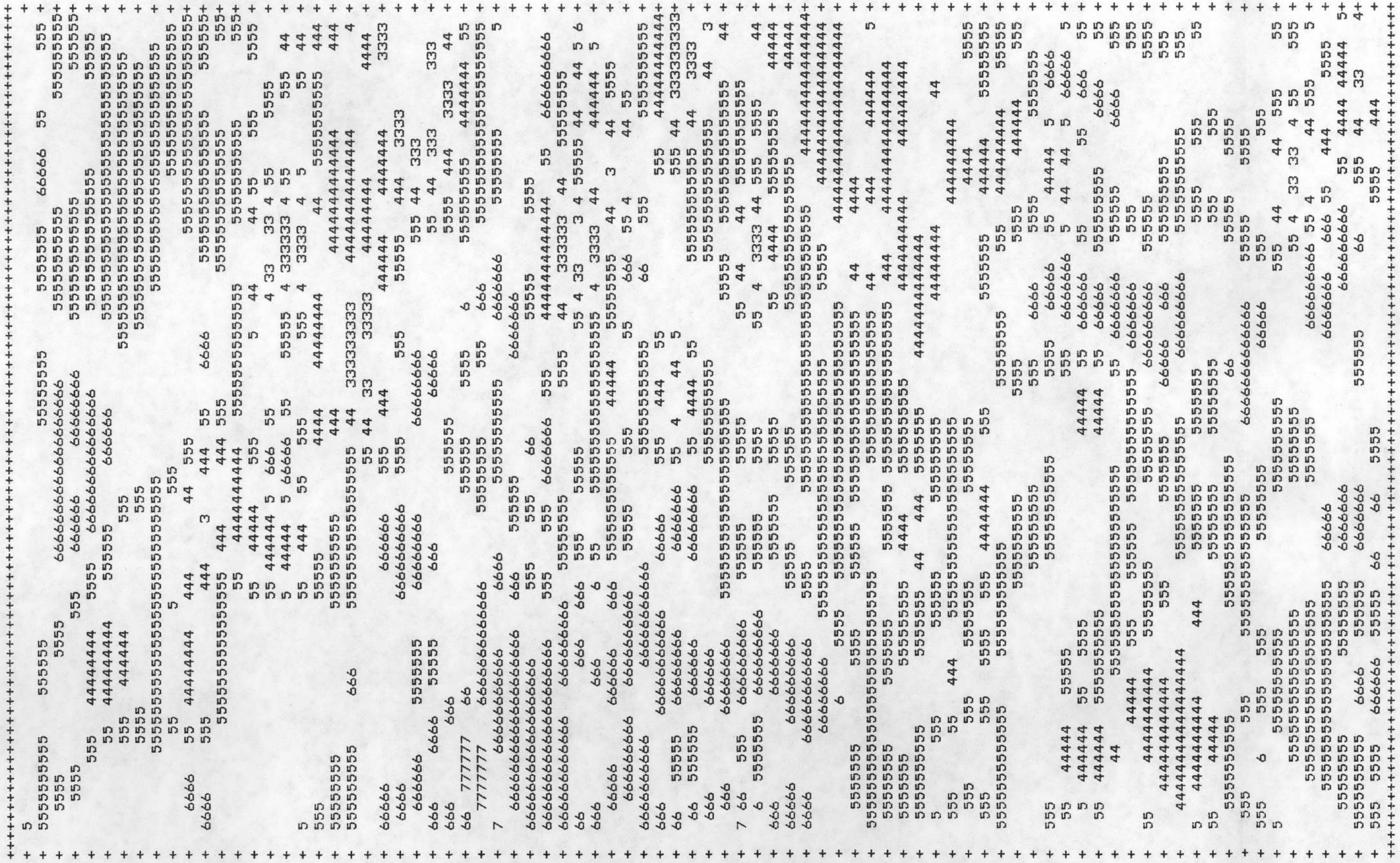
Uranium Pseudo-Contour Map - Vincennes Quadrangle

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

VINCENNES



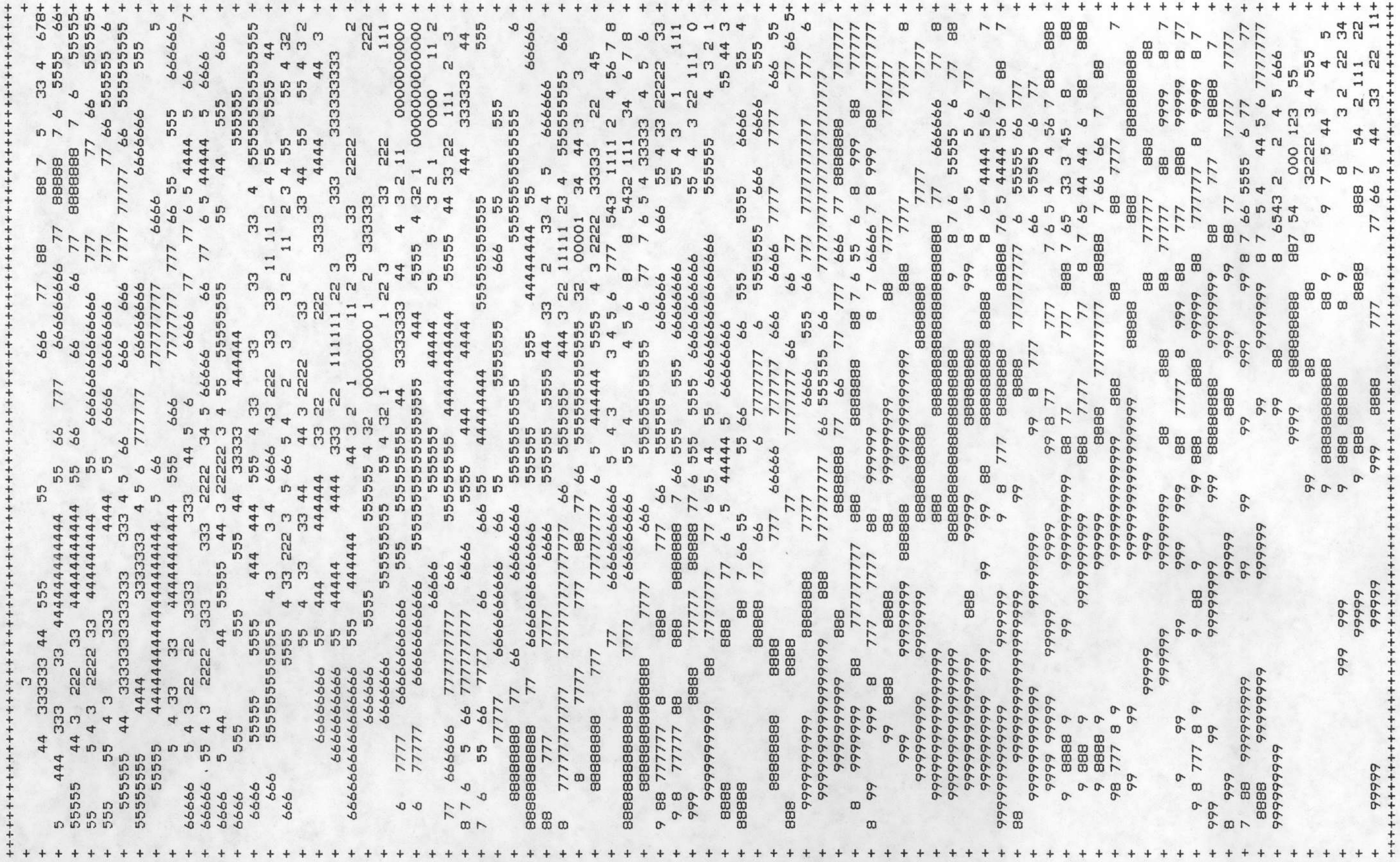
Thorium Pseudo-Contour Map - Vincennes Quadrangle

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

VINCENNES

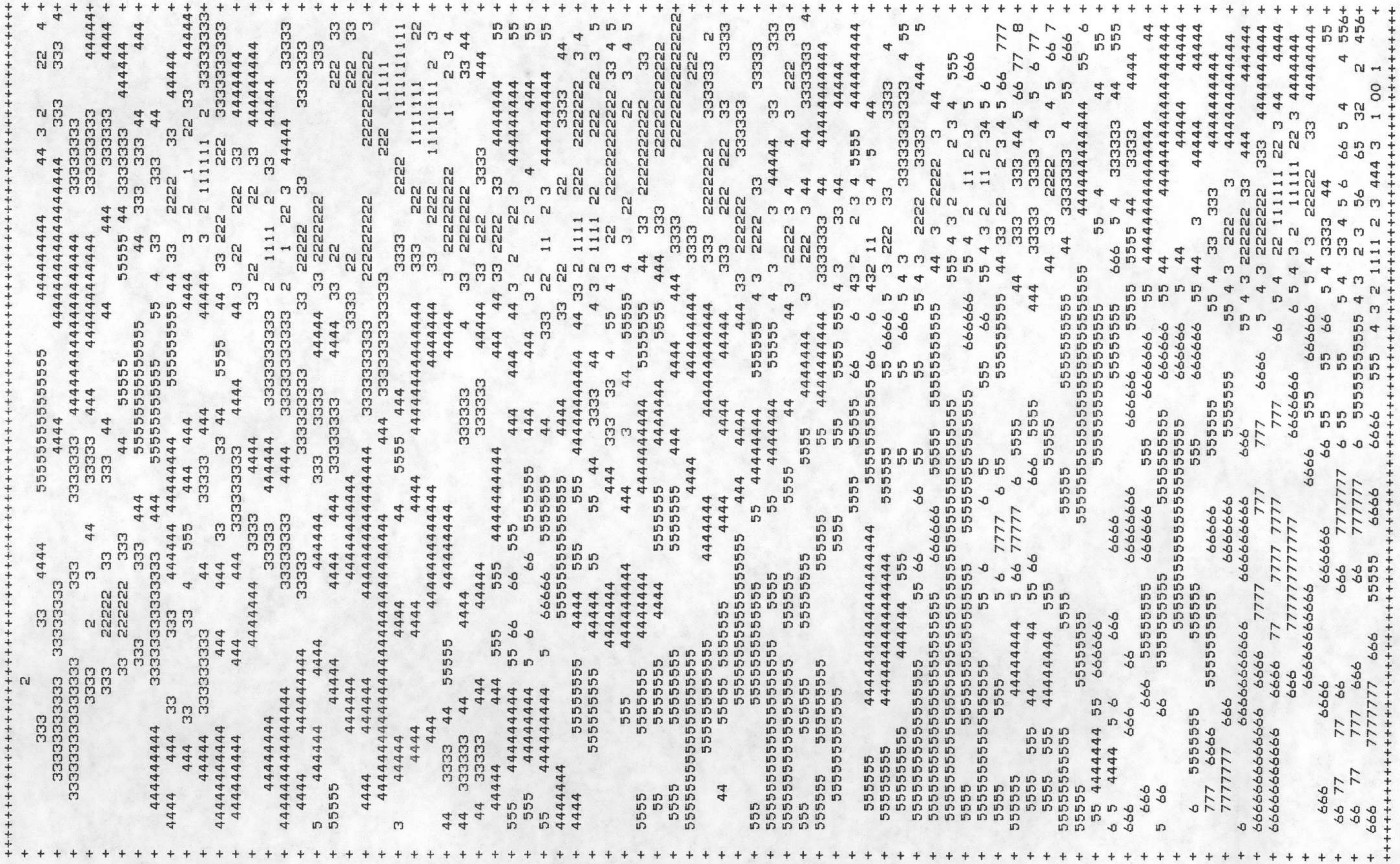


EXPLANATION

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

Thorium/Potassium Pseudo-Contour Map - Vincennes Quadrangle

VINCENNES

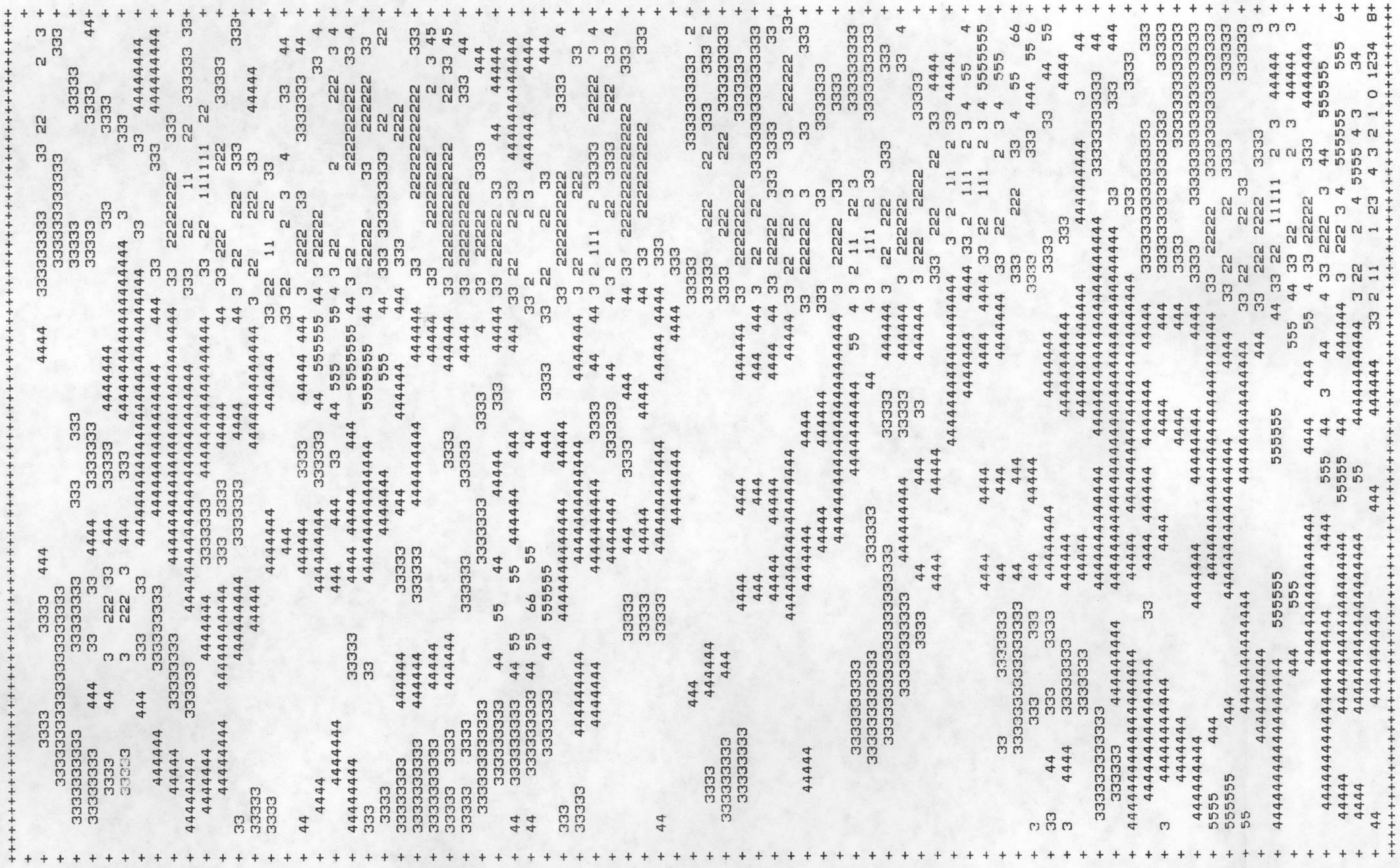


EXPLANATION

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 - Vincennes Quadrangle

VINCENNES

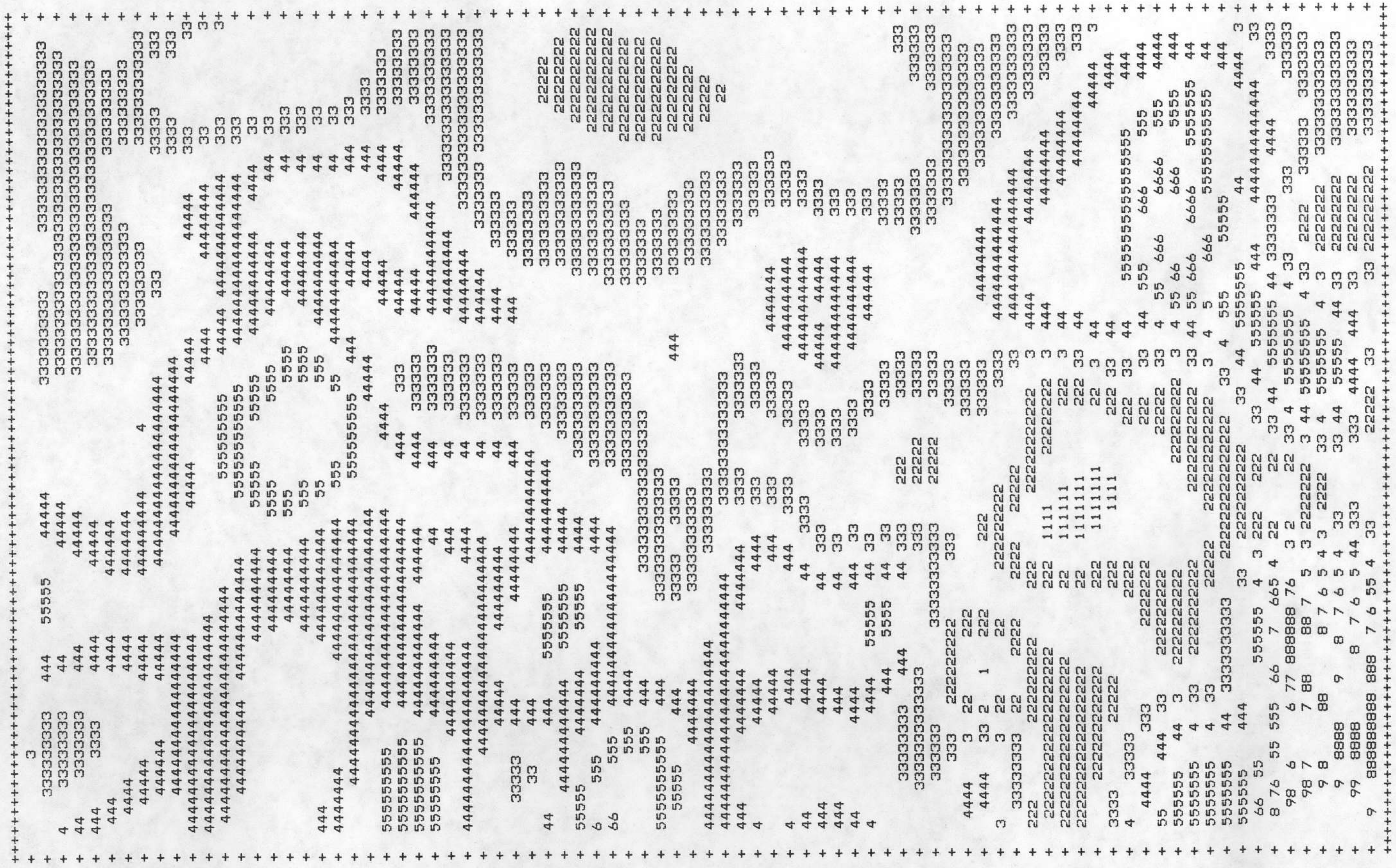


EXPLANATION

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 - Vincennes Quadrangle

VINCENNES



EXPLANATION

PRINT CHARACTER	VALUE
0	LE-1200.0000
	-1200.0000-1125.0000
1	-1125.0000-1050.0000
	-1050.0000 -975.0000
2	-975.0000 -900.0000
	-900.0000 -825.0000
3	-825.0000 -750.0000
	-750.0000 -675.0000
4	-675.0000 -600.0000
	-600.0000 -525.0000
5	-525.0000 -450.0000
	-450.0000 -375.0000
6	-375.0000 -300.0000
	-300.0000 -225.0000
7	-225.0000 -150.0000
	-150.0000 -75.0000
8	-75.0000 0.0000
	0.0000 75.0000
9	75.0000 150.0000
	GT 150.0000

SCALE IN GAMMAS

Residual Magntic Pseudo-Contour Map - Vincennes Quadrangle