National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY
INDIANAPOLIS QUADRANGLE
INDIANA AND ILLINOIS

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

March 1981

DEPARTMENT OF ENERGY · UNITED STATES OF AMERICA

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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and Bendix Field Engineering Corporation
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ABSTRACT

The Indianapolis quadrangle of Indiana and Illinois covers 7,500 square miles of largely agricultural land within the eastern Midwestern Physiographic Province. Moderate to thick sections of Paleozoic rocks are largely masked by overlying Quaternary glacial deposits that represent several Pleistocene glacial advances.

No uranium deposits are known in the quadrangle.

Though 99 anomalies were defined by the interpretation process, all appeared to be culturally induced. One small group of anomalies overlying strip mines in Pennsylvanian coal deposits have unusually high uranium concentration levels and are thus noteworthy.

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

TABLE OF CONTENTS

		Page Nos.
I.	INTRODUCTION	1
	General	1
	Physiography	1
II.	GEOLOGY	2
	Structure	2
	Surface Geology	2
	Uranium	3
III.	INTERPRETATION OF GEOPHYSICAL DATA	3
	Radiometric Data	3
	Magnetic Data	3
IV.	BIBLIOGRAPHY	5
V.	APPENDICES	
	Appendix A - Data Acquisition, Processing, and Interpretation Methods	
	Appendix B - Flight Summary	
	Appendix C - Flight Path and Geologic Map	
	Appendix D - Profiles	
	Appendix E - Standard Deviation Maps	
	Appendix F - Histograms and Map Unit Conversion Table	
	Appendix G - Uranium Anomaly Summary and Statistical Tables	
	Appendix H - Pseudo-Contour Maps	

LIST OF FIGURES

		Page Nos.
Figure 1	Location Map	1
Figure 2	Tectonic Structure Map	2
Figure 3	Uranium Anomaly/Interpretation Map	4

INTRODUCTION

General

The Indianapolis quadrangle covers 7,500 square miles in southwestern Indiana, and southeastern Illinois, (see Figure 1).

The principal source of geologic information is the 1:250,000 scale geologic map of the Indianapolis quadrangle by Gray and others (1969). This map also served as the geologic base used in the interpretation (see Appendix C). Unit descriptions were taken directly from this map. Some glacial information was taken from Flint (1959 and 1971). Physiographic and cultural information were taken from Fairbridge (1972), and the 1:250,000 scale Indianapolis topographic map (1974 version). Structural information came in part from Gray and others, but principally from Cohee and others (1962).

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

Physiography

The Indianapolis quadrangle covers a flat-lying to mountainous region at the southeastern border of the Midwestern Physiographic Province. Flat to gently-dipping, primarily agricultural land in the west and northeast grade into irregular to mountainous forested sections in the central and southeastern regions.

The region is drained by the White and Wabash Rivers. The watersheds of the two river systems occupy approximately equal areas, and the drainage divide strikes roughly NNE through the center of the quadrangle. The Wabash flows southward through the western half, and has a narrow but well developed flood plain. The White River flows southwesterly from the northeastern corner, and appears antecedent to the mountainous areas it flows through. Its narrow, discontinuous regions of flood plain in the northeast give way to entrenched meanders in the central mountainous areas. The White and Wabash Rivers join further south and eventually flow into the Ohio.

Elevations range from 400 feet at the Wabash River along the southern border, to over 1,000 feet atop some of the mountain peaks in the southeast and the higher plains of the northeast.

The region contains a substantial amount of cultural influence. The largest city in the quadrangle is Indianapolis (population 741,000) in the northeastern corner. The quadrangle contains several major population centers, a dense rectangular grid of roads and highways, major rail lines, and freeways. Strip mines occur within and adjacent to the mountainous areas, and numerous oilfields are present in the west.

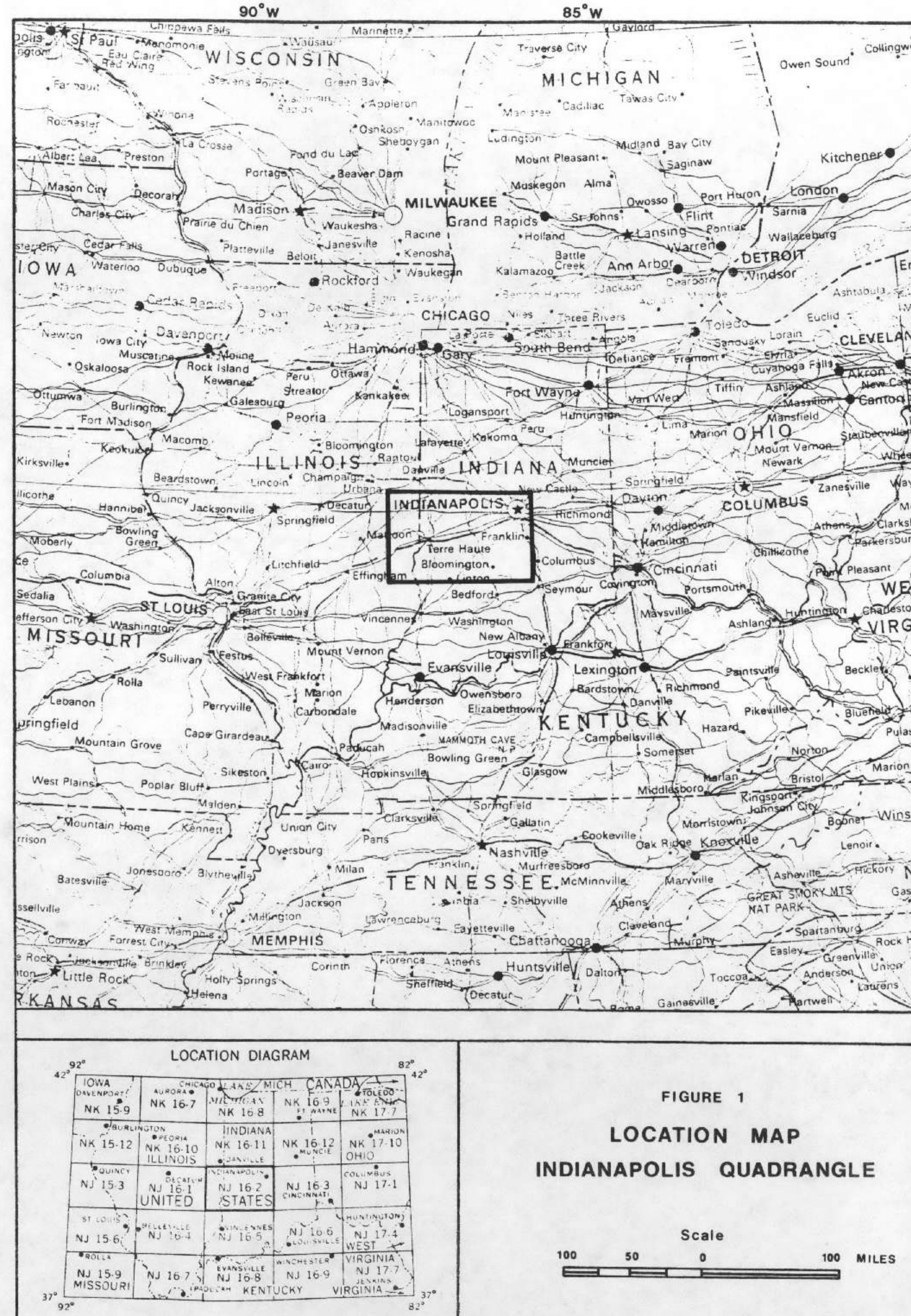


FIGURE 1

LOCATION MAP
INDIANAPOLIS QUADRANGLE

GEOLOGY

Structure

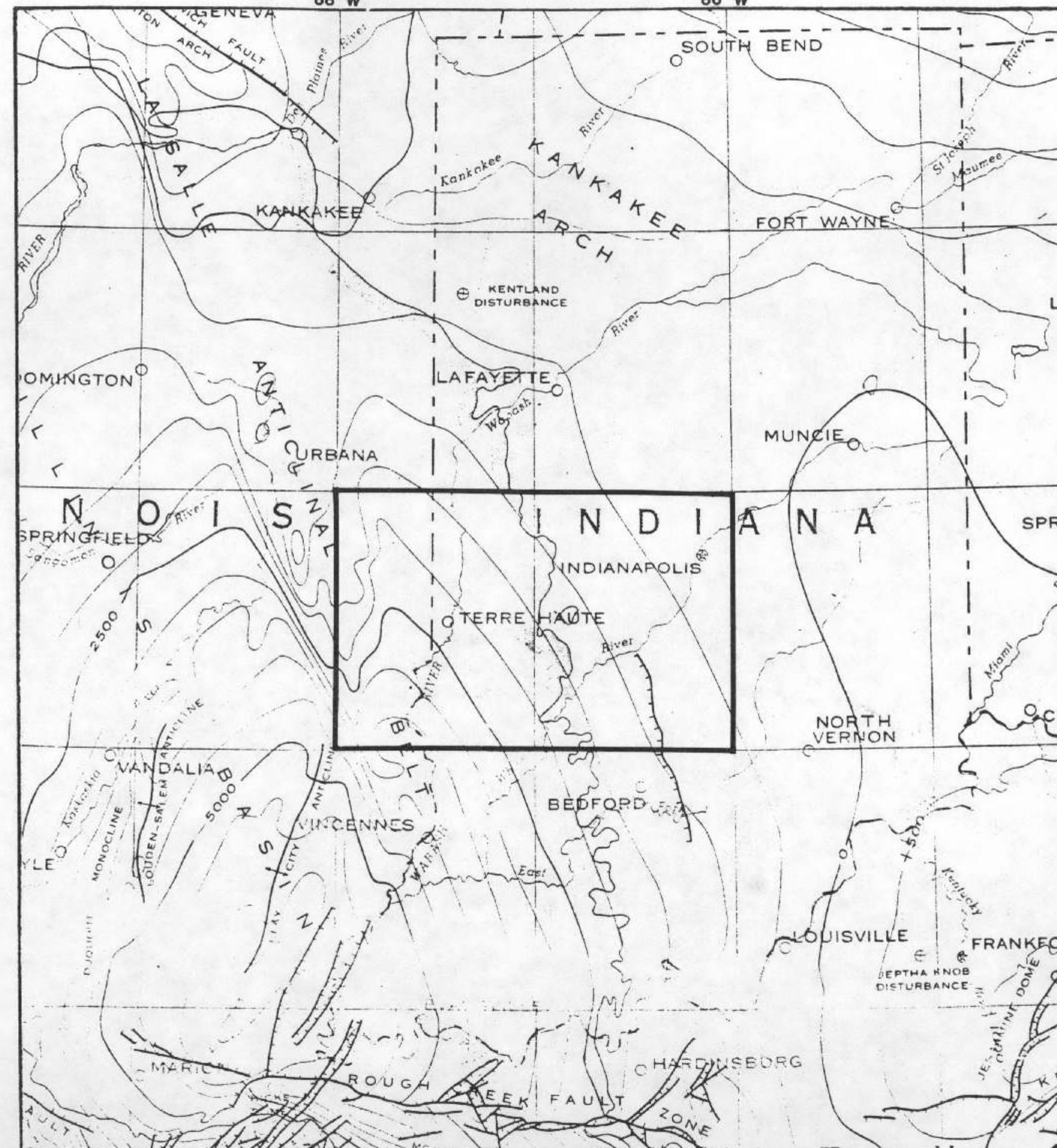
The region defined by the Indianapolis quadrangle lies at the northeastern edge of the Illinois Sedimentary Basin.(see Figure 2). Sediments of Paleozoic age shoal from 8,000 feet at the southwestern corner, to approximately 3,000 feet in the northeast (near the axis of the Kankakee Arch). The Illinois Basin is a roughly circular structure that is complicated by several secondary structural features. The La Salle Anticlinal Belt strikes SSE along the western edge through the central portion of the basin. The Carmel Fault (a dip slip fault) has been mapped by Cohee and others (1962), and Gray and others (1979), striking north approximately 25 miles from the eastern south edge. This fault displaces Paleozoic units only, though its exact age is unknown.

Surface Geology

The Paleozoic section that comprises the subsurface is for the most part, masked by overlying glacial, periglacial, and post-glacial sediments of Illinoian, Wisconsinan, and Recent age (Quaternary). The Paleozoics have major exposures only in the southeastern quadrant. Thick Quaternary deposits dominate the other three quadrants and portions of the southeast as well. In all, Quaternary units cover 80 percent of the surface as mapped.

The Quaternary section is composed of a combination of Pleistocene age glacially-related deposits, and younger sediments along the major river basins (resulting from alluvial, colluvial, puludal, and related sedimentary processes). Of the mapped Quaternary section, the post-glacial alluvium covers only 10 percent.

Till of Illinoian age is mapped bordering the Paleozoic outcrops, along the Wabash River flood plain and covers large areas in the central and southwestern regions (approximately 25 percent of the Quaternary exposures). Related outwash, alluvial, and lake deposits cover extremely small regions closely associated with the till (1 percent of the Wisconsinan). Wisconsinan age till, along with some stratified drift, covers almost the entire northern half of the quadrangle (exclusive of flood-plain areas) and accounts for 45 percent of the Quaternary surface exposures as mapped. Some areas of drainage systems that were blocked by the glaciers contain lacustrine deposits. These sediments comprise 2 percent of the total Quaternary system in or near present drainage patterns. Eolian deposits are extensive in the southwest along the Wabash flood plain and account for 10 percent of the quadrangle's Quaternary exposures. Finally, outwash gravel, sand, and silt of Wisconsinan age covers 7 percent of the Quaternary, but is almost exclusively confined to the present drainage systems.



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

FIGURE 2

TECTONIC STRUCTURE MAP
INDIANAPOLIS QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

The Paleozoic system is almost completely dominated by Mississippian age sediments. Some Pennsylvanian is exposed to the west. Mississippian shales, limestones, and occasional sandstones cover 90 percent of the Paleozoic surface. The Pennsylvanian section exposed consists of Raccoon Creek shales and sandstones, with some limestones, and numerous coal beds. Minor exposures of younger Pennsylvanian materials are exposed in natural or man-made (strip mine) windows through the glacial drift to the west and northwest, but their lithology is much the same as the older, more extensively exposed Pennsylvanian units. The Pennsylvanian - Mississippian boundary is marked by a significant unconformity that represents a major erosional period between the Kaskaskia and Absaroka transgressive phases.

Uranium

According to available resources, there are no known uranium deposits within the Indianapolis quadrangle.

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 99 groups of uranium (Bi214) samples meet the minimum statistical requirements, set forth in the data interpretation section of Appendix A, used to define anomalies. 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. They do not directly correspond to real geochemical data.

Concentrations of potassium, uranium, and thorium within the Indianapolis quadrangle are both uniform and low. Potassium and thorium have average concentrations of 1.1 percent and 5.7 ppmeT respectively. Uranium has an average concentration of 2.0 ppmeU. In general, the relative concentrations of these elements remain uniform between glacial and pre-glacial units exposed. Only the post-glacial fluvial materials appear anomalous, and these concentration values are even lower.

Highest average potassium occurs in map unit QGK (Pre-Wisconsinan stratified drift) at 1.27 percent. Map unit QM (culturally modified land) contains the highest average uranium concentrations (2.31 ppmeU). Average thorium concentrations are highest in map unit QTE (Wisconsinan end moraine deposits) at 6.19 ppmeT. Peak potassium and thorium values occur in map unit QT (Wisconsinan ground moraine) at 2.04 percent and 9.29 ppmeT respectively. Maximum concentrations of uranium are found in map unit QTI (Pre-Wisconsinan till). Uranium concentrations of 5.0 or above have been rare in the Great Lakes Survey and are of note. Samples of this description occur in map units QM, OTI (Quaternary Illinoion till) and with peak uranium concentrations of 6.38 and 6.7 ppmeU respectively.

In general it can be said that anomalies are scattered without recognizable pattern throughout the quadrangle. Peak concentrations in the anomalies average around 3.0 ppmeU, and all are culturally induced (by roads, railraods, etc.). A small group of anomalies, representing a variety of Paleozoic and Quaternary map units, are situated over coal strip mines (or tailings piles). This group, defined by anomalies 54, 61, 62, 67, and 87, have peak uranium concentrations that range from 4.4 to 5.2 ppmeU. Nearby anomalies also situated over strip mines, have lower peak uranium concentrations. Though associated with obvious cultural features, these anomalies may represent significant concentrations of uranium within or stratigraphically adjacent to the coal seams. If any radiometric response deserves further investigation, it is from this region (see Figure 3). Otherwise the low uranium concentrations, coupled with the obvious cultural associations, indicate a lack of significant concentrations of naturally occurring uranium.

Magnetic Data

The structural picture of the Indianapolis quadrangle is one of a basin gradually deepening to the south and west, and complicated near the western edge by an anticlinal zone.

This picture is, for the most part, duplicated in the magnetic field pseudo contour map (Appendix H). Gradients do generally decrease toward the southwest. The La Salle Anticlinal Belt appears to be expressed in this area as a large isolated structure with no obvious linear extensions. Other minor isolated or linear structures occur throughout the quadrangle that do not appear on any referenced structural interpretation. The Paleozoic and Quaternary cover are not extremely thick, and given that these sediments are relatively nonmagnetic, the magnetic field may be largely controlled by the underlying Precambrian. The magnetic field may be defining a combination of lithologic and/or structural patterns in the Precambrian, and structure in the Paleozoics (some of which may be genetically related to Precambrian structure), with only the latter having surficial expression.

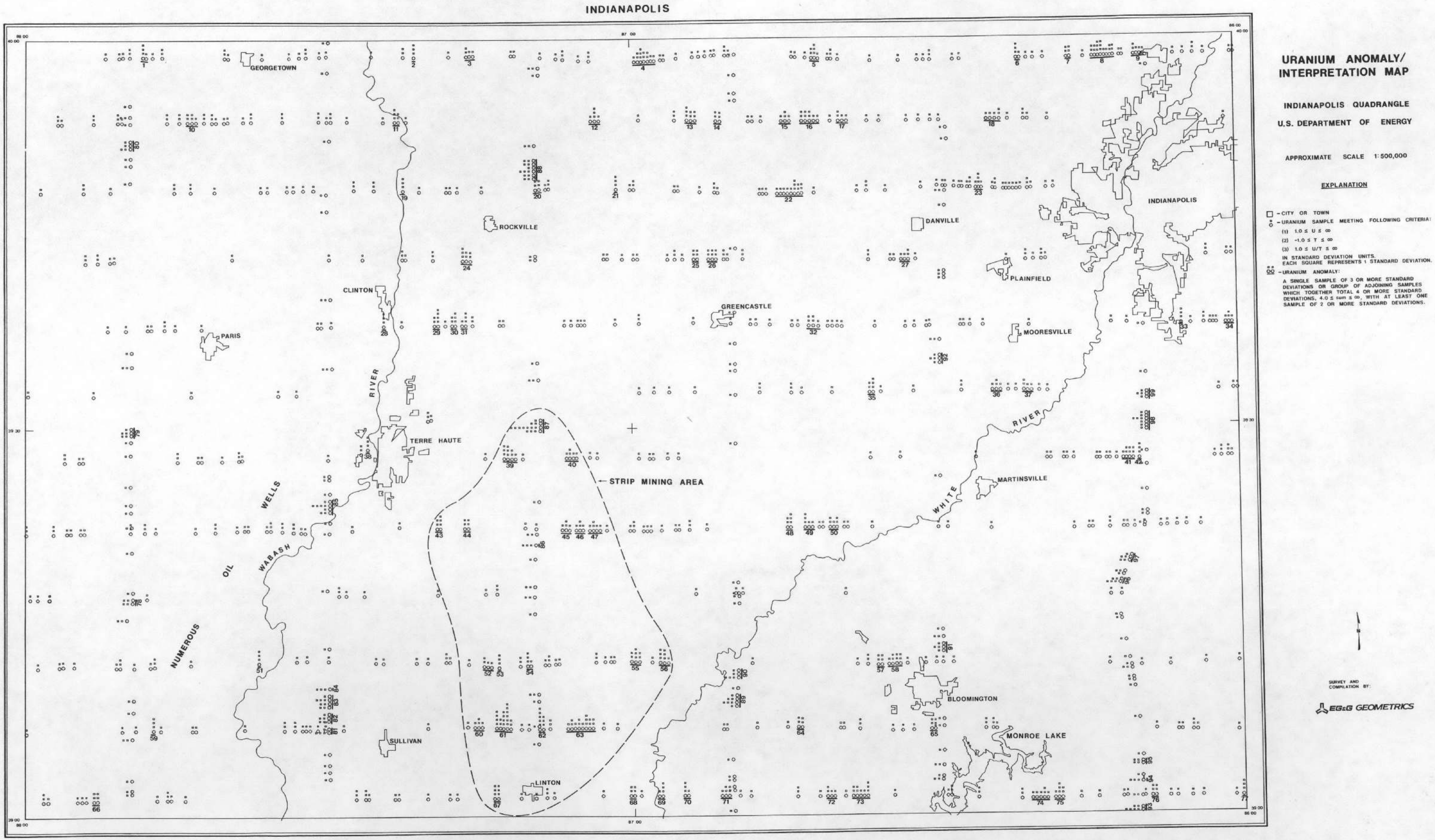


Figure 3 - Uranium Anomaly/Interpretation Map - Indianapolis Quadrangle

BIBLIOGRAPHY

Butler, A.P., Jr., Finch, W. I., and Twenhofel, E. S., 1962, Epigenetic Uranium Deposits in the United States: U.S. Geological Survey Mineral Resources Map MR-21, scale 1:3,000,000.

Flint, R.F., 1959, Glacial Map of North America East of the Rocky Mountains. New York: Geological Society of America, scale 1:4,550,000.

Flint, R.F., 1971, Glacial and Quaternary Geology: New York: Wiley, 892 p.

Gray, H.G., and others, 1979, Geologic Map of the 1° x 2° Indianapolis Quadrangle, Indiana and Illinois, showing Bedrock and Unconsolidated deposits: Indiana Geological Survey regional geologic map No. 1.

Schnabel, R.W., 1955, The Uranium Deposits of the United States: U.S. Geological Survey Mineral Resources Appraisals Map MR2, scale 1:5,000,000.

United States Geological Survey and American Association of Petroleum Geologists, 1962, Tectonic Map of the United States: scale 1:2,500,000.

Weller, J.M., 1975, United States - Midwestern Region: in the Encyclopedia of World Regional Geology Part 1: R.W. Fairbirdge, editor.

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.

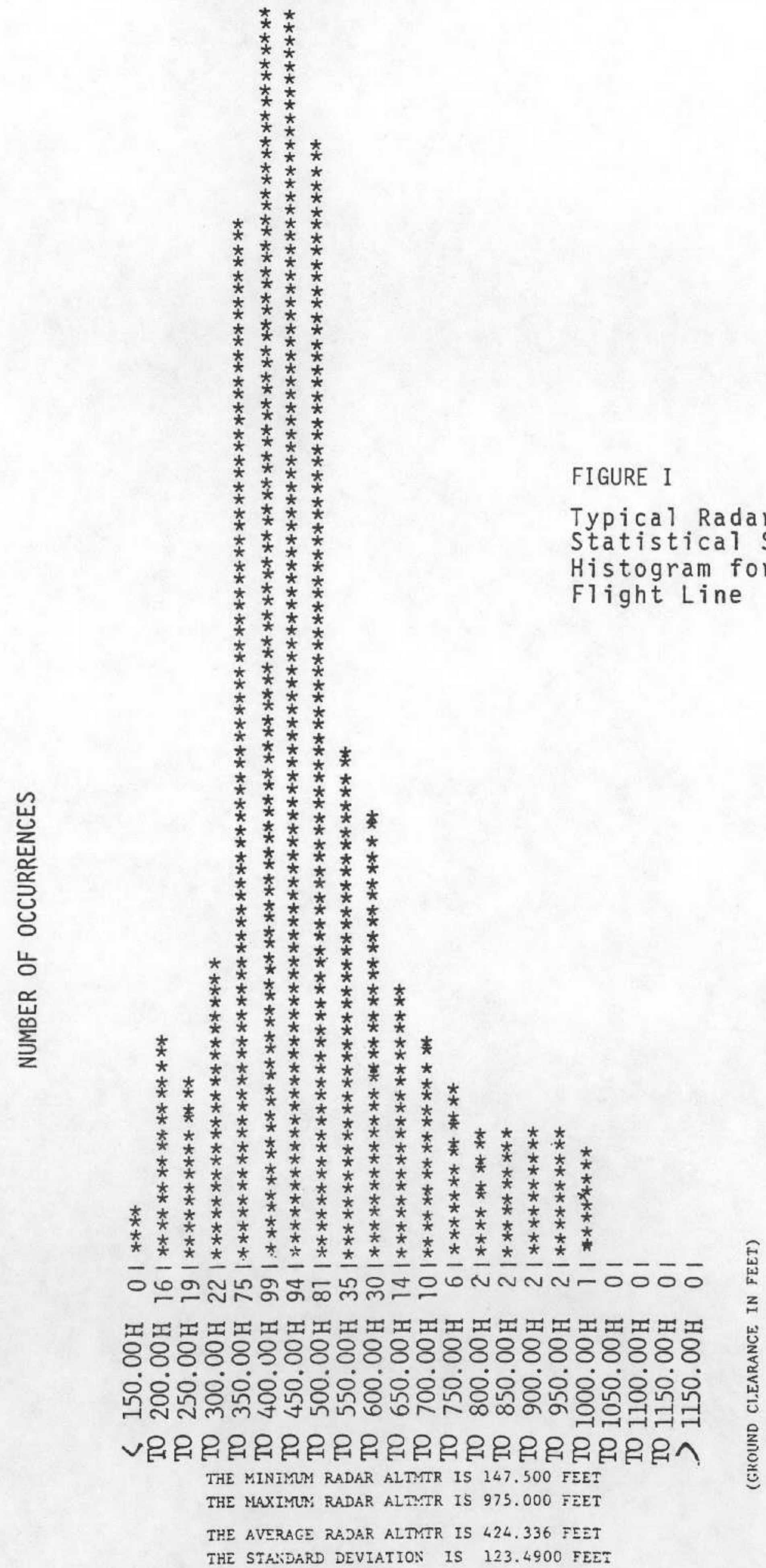


FIGURE I

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.

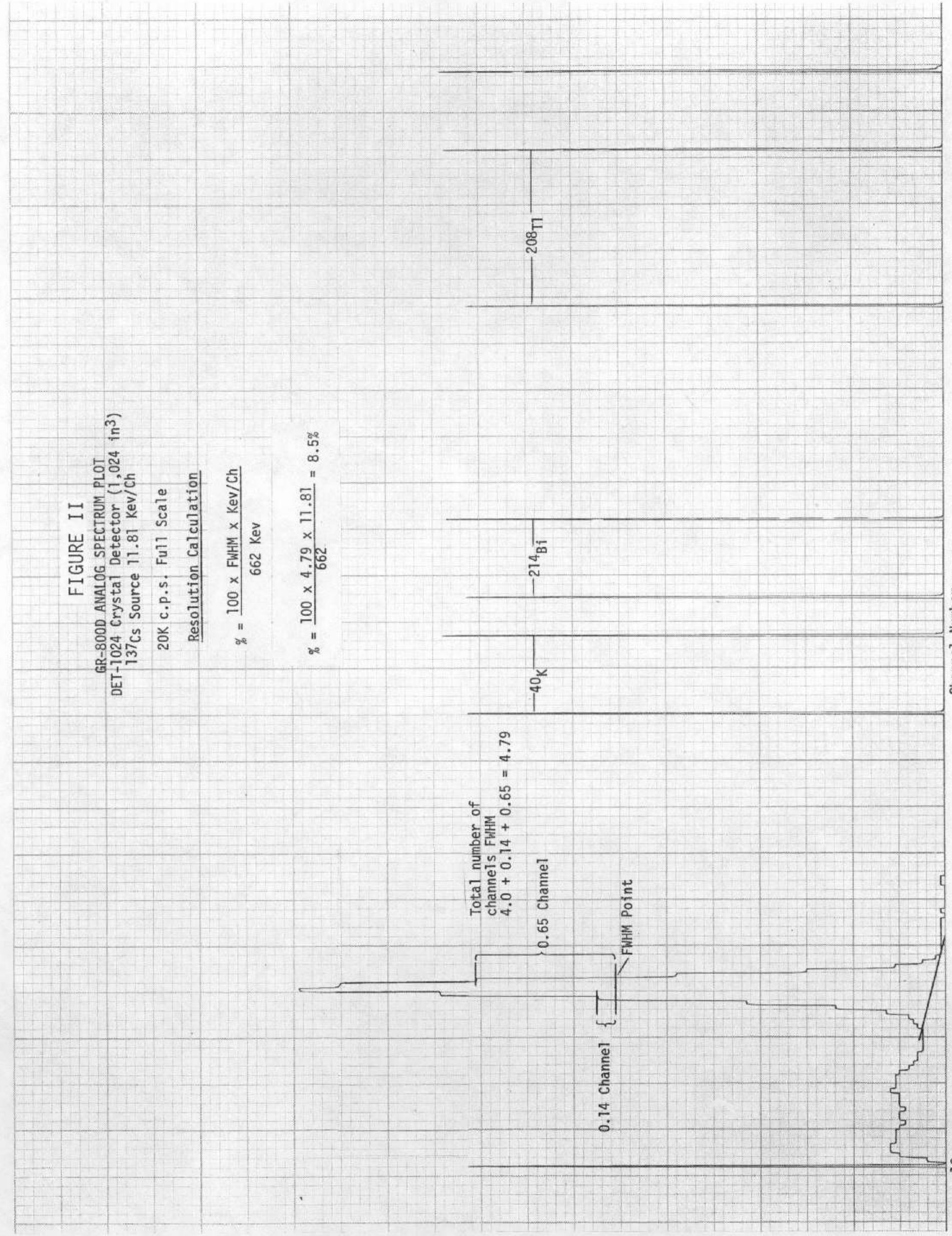
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.

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.

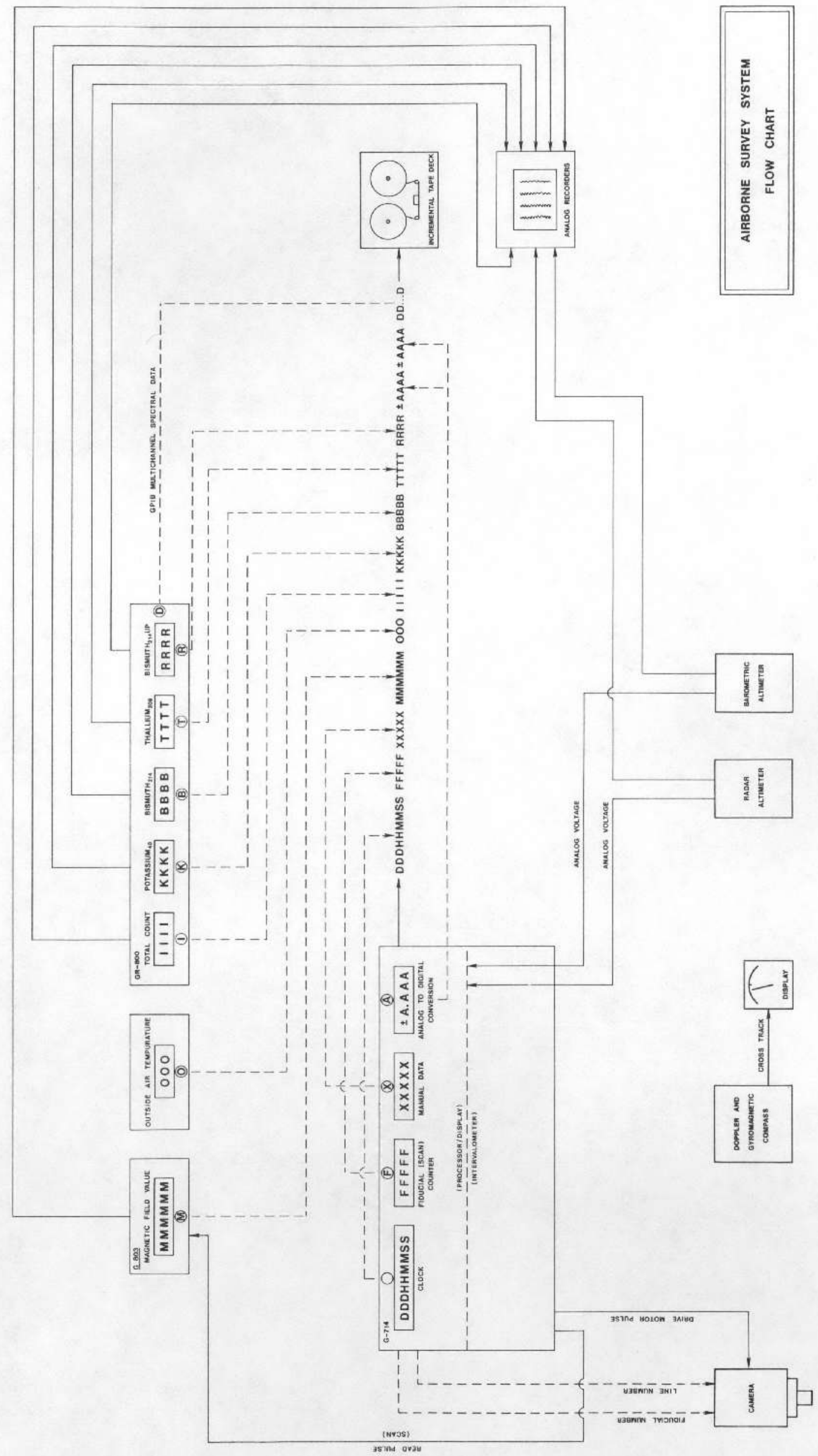


FIGURE III

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. 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:

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

The aircraft background is derived as follows:

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

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

SYSTEM CONSTANTS

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

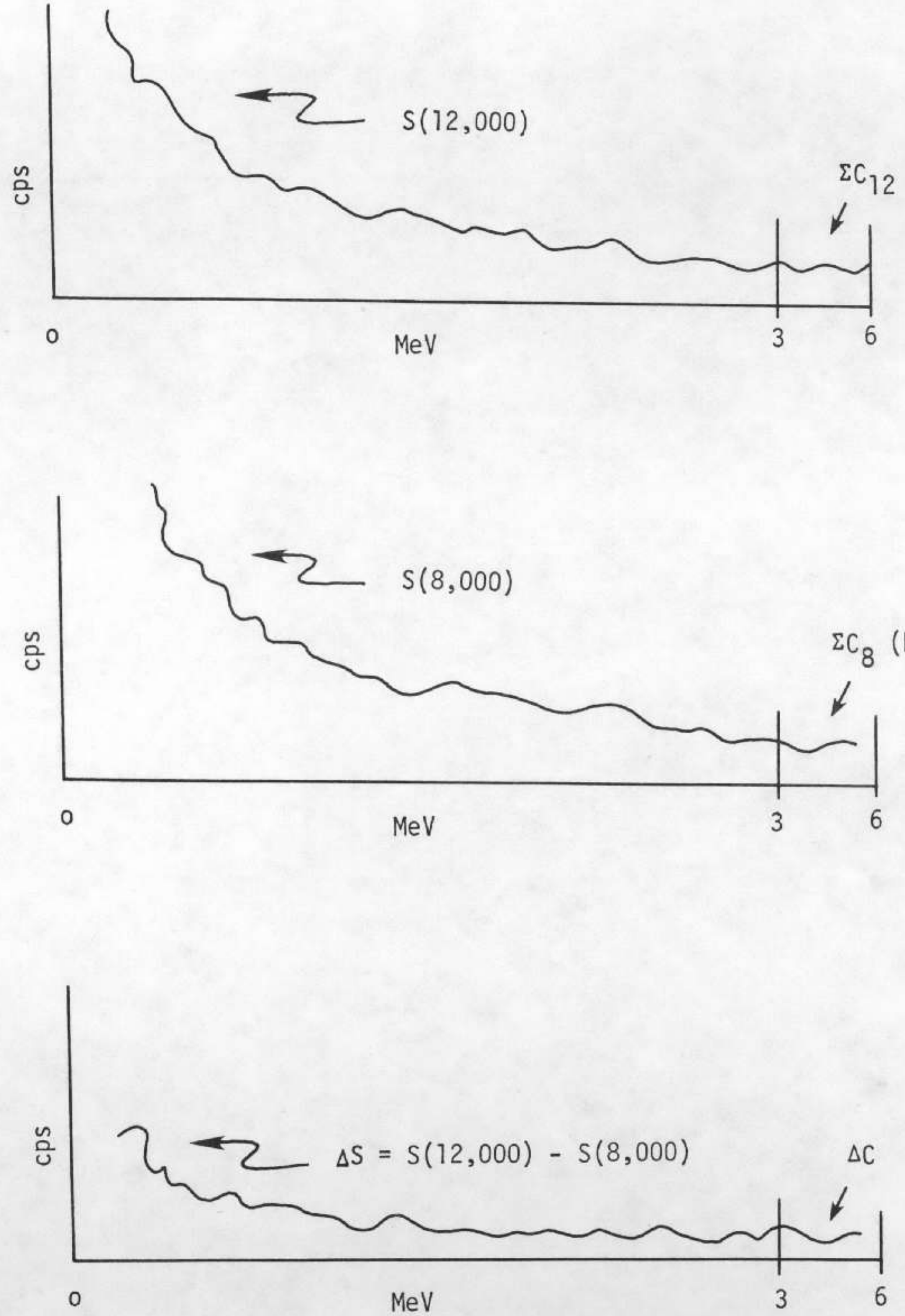


FIGURE IV - Multiple altitude spectra schematic

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

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

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

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

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

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DERIVED AIRCRAFT BACKGROUND SPECTRUM FROM PACIFIC OCEAN DATA

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

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

CH    0 (0.000 MEV)    0.000 CPS *
CH    1 (0.012 MEV)    0.000 CPS *
CH    2 (0.024 MEV)    0.000 CPS *
CH    3 (0.035 MEV)    0.000 CPS *
CH    4 (0.047 MEV)    0.000 CPS *
CH    5 (0.059 MEV)    0.000 CPS *
CH    6 (0.071 MEV)    0.000 CPS *
CH    7 (0.083 MEV)    0.000 CPS *
CH    8 (0.095 MEV)    0.000 CPS *
CH    9 (0.106 MEV)    0.000 CPS *
CH   10 (0.118 MEV)    0.000 CPS *
CH   11 (0.130 MEV)    0.000 CPS *
CH   12 (0.142 MEV)    0.000 CPS *
CH   13 (0.154 MEV)    0.000 CPS *
CH   14 (0.165 MEV)    0.000 CPS *
CH   15 (0.177 MEV)    0.000 CPS *
CH   16 (0.189 MEV)    0.000 CPS *
CH   17 (0.201 MEV)    0.000 CPS *
CH   18 (0.213 MEV)   -0.025 CPS *
CH   19 (0.225 MEV)   -0.020 CPS *
CH   20 (0.236 MEV)    0.080 CPS *
CH   21 (0.248 MEV)    1.401 CPS *****
CH   22 (0.260 MEV)    3.792 CPS *************
CH   23 (0.272 MEV)    4.280 CPS ***************
CH   24 (0.284 MEV)    4.334 CPS ***************
CH   25 (0.295 MEV)    3.748 CPS *************
CH   26 (0.307 MEV)    3.897 CPS **************
CH   27 (0.319 MEV)    3.818 CPS *************
CH   28 (0.331 MEV)    4.236 CPS ***************
CH   29 (0.343 MEV)    3.433 CPS ************
CH   30 (0.355 MEV)    2.996 CPS ***********
CH   31 (0.366 MEV)    2.559 CPS **********
CH   32 (0.378 MEV)    2.269 CPS *********
CH   33 (0.390 MEV)    2.102 CPS ********
CH   34 (0.402 MEV)    2.081 CPS ******** TOTAL COUNT
CH   35 (0.414 MEV)    2.121 CPS ********
CH   36 (0.426 MEV)    2.114 CPS ********
CH   37 (0.437 MEV)    1.976 CPS ********
CH   38 (0.449 MEV)    2.290 CPS *********
CH   39 (0.461 MEV)    2.188 CPS *********
CH   40 (0.473 MEV)    2.226 CPS *********
CH   41 (0.485 MEV)    1.983 CPS ********
CH   42 (0.496 MEV)    2.165 CPS ********
CH   43 (0.508 MEV)    2.158 CPS ********
CH   44 (0.520 MEV)    2.267 CPS *********
CH   45 (0.532 MEV)    2.217 CPS *********
CH   46 (0.544 MEV)    1.997 CPS ********
CH   47 (0.556 MEV)    2.447 CPS *********
CH   48 (0.567 MEV)    2.540 CPS **********
CH   49 (0.579 MEV)    2.586 CPS **********
CH   50 (0.591 MEV)    2.708 CPS **********
CH   51 (0.603 MEV)    2.481 CPS *********
CH   52 (0.615 MEV)    2.372 CPS *********
CH   53 (0.626 MEV)    1.866 CPS ********
CH   54 (0.638 MEV)    1.682 CPS *******
CH   55 (0.650 MEV)    1.661 CPS *******
CH   56 (0.662 MEV)    1.480 CPS *****
CH   57 (0.674 MEV)    1.474 CPS *****
CH   58 (0.686 MEV)    1.447 CPS *****
CH   59 (0.697 MEV)    1.431 CPS *****
CH   60 (0.709 MEV)    1.476 CPS *****
CH   61 (0.721 MEV)    1.453 CPS *****
CH   62 (0.733 MEV)    1.467 CPS *****
CH   63 (0.745 MEV)    1.579 CPS ******
CH   64 (0.756 MEV)    1.497 CPS *****
CH   65 (0.768 MEV)    1.548 CPS ******
CH   66 (0.780 MEV)    1.421 CPS *****
CH   67 (0.792 MEV)    1.282 CPS *****
CH   68 (0.804 MEV)    1.155 CPS ****
CH   69 (0.816 MEV)    1.246 CPS *****
CH   70 (0.827 MEV)    1.245 CPS *****
CH   71 (0.839 MEV)    1.161 CPS ****
CH   72 (0.851 MEV)    1.253 CPS *****
CH   73 (0.863 MEV)    1.231 CPS *****
CH   74 (0.875 MEV)    1.425 CPS *****
CH   75 (0.887 MEV)    1.452 CPS *****
CH   76 (0.898 MEV)    1.543 CPS ******
CH   77 (0.910 MEV)    1.444 CPS *****
CH   78 (0.922 MEV)    1.364 CPS *****
CH   79 (0.934 MEV)    1.289 CPS *****
CH   80 (0.946 MEV)    1.150 CPS ****
CH   81 (0.957 MEV)    1.144 CPS ****
CH   82 (0.969 MEV)    1.085 CPS ****
CH   83 (0.981 MEV)    1.061 CPS ****
CH   84 (0.993 MEV)    0.941 CPS ****
CH   85 (1.005 MEV)    0.919 CPS ****
CH   86 (1.017 MEV)    0.822 CPS ***
CH   87 (1.028 MEV)    0.816 CPS ***
CH   88 (1.040 MEV)    0.853 CPS ****
CH   89 (1.052 MEV)    0.901 CPS **** BISMUTH 214
CH   90 (1.064 MEV)    0.822 CPS ***
CH   91 (1.076 MEV)    0.867 CPS ****
CH   92 (1.087 MEV)    0.968 CPS ****
CH   93 (1.099 MEV)    0.851 CPS ****
CH   94 (1.111 MEV)    0.906 CPS ****
CH   95 (1.123 MEV)    0.847 CPS ****
CH   96 (1.135 MEV)    0.861 CPS ****
CH   97 (1.147 MEV)    0.800 CPS ***
CH   98 (1.158 MEV)    0.727 CPS ***
CH   99 (1.170 MEV)    0.751 CPS ***
CH  100 (1.182 MEV)    0.607 CPS *** BISMUTH 214
CH  101 (1.194 MEV)    0.663 CPS ***
CH  102 (1.206 MEV)    0.657 CPS ***
CH  103 (1.217 MEV)    0.633 CPS ***
CH  104 (1.229 MEV)    0.719 CPS ***
CH  105 (1.241 MEV)    0.671 CPS ***
CH  106 (1.253 MEV)    0.475 CPS **
CH  107 (1.265 MEV)    0.601 CPS ***
CH  108 (1.277 MEV)    0.661 CPS ***
CH  109 (1.288 MEV)    0.669 CPS ***
CH  110 (1.300 MEV)    0.606 CPS ***
CH  111 (1.312 MEV)    0.630 CPS ***
CH  112 (1.324 MEV)    0.652 CPS ***
CH  113 (1.336 MEV)    0.644 CPS ***
CH  114 (1.347 MEV)    0.652 CPS ***
CH  115 (1.359 MEV)    0.791 CPS ***
CH  116 (1.371 MEV)    0.787 CPS *** POTASSIUM 40
CH  117 (1.383 MEV)    0.834 CPS ****
CH  118 (1.395 MEV)    0.984 CPS ****
CH  119 (1.407 MEV)    1.072 CPS ****
CH  120 (1.418 MEV)    1.124 CPS ****
CH  121 (1.430 MEV)    1.088 CPS ****
CH  122 (1.442 MEV)    1.210 CPS *****
CH  123 (1.454 MEV)    1.231 CPS *****
CH  124 (1.466 MEV)    1.207 CPS *****
CH  125 (1.477 MEV)    0.995 CPS ****
CH  126 (1.489 MEV)    0.967 CPS ****
CH  127 (1.501 MEV)    0.624 CPS ***
CH  128 (1.513 MEV)    0.635 CPS ***
CH  129 (1.525 MEV)    0.512 CPS ***
CH  130 (1.537 MEV)    0.488 CPS **
CH  131 (1.548 MEV)    0.409 CPS **
CH  132 (1.560 MEV)    0.369 CPS ** POTASSIUM 40
CH  133 (1.572 MEV)    0.339 CPS **
CH  134 (1.584 MEV)    0.438 CPS **
CH  135 (1.596 MEV)    0.310 CPS **
CH  136 (1.608 MEV)    0.259 CPS **
CH  137 (1.619 MEV)    0.250 CPS **
CH  138 (1.631 MEV)    0.353 CPS **
CH  139 (1.643 MEV)    0.323 CPS **
CH  140 (1.655 MEV)    0.332 CPS **
CH  141 (1.667 MEV)    0.326 CPS ** BISMUTH 214
CH  142 (1.678 MEV)    0.267 CPS **
CH  143 (1.690 MEV)    0.275 CPS **
CH  144 (1.702 MEV)    0.245 CPS **
CH  145 (1.714 MEV)    0.347 CPS **
CH  146 (1.726 MEV)    0.352 CPS **
CH  147 (1.738 MEV)    0.293 CPS **
CH  148 (1.749 MEV)    0.359 CPS **
CH  149 (1.761 MEV)    0.270 CPS **
CH  150 (1.773 MEV)    0.334 CPS **
CH  151 (1.785 MEV)    0.245 CPS **
CH  152 (1.797 MEV)    0.255 CPS **
CH  153 (1.808 MEV)    0.174 CPS **
CH  154 (1.820 MEV)    0.228 CPS **
CH  155 (1.832 MEV)    0.188 CPS **
CH  156 (1.844 MEV)    0.115 CPS *
CH  157 (1.856 MEV)    0.084 CPS * BISMUTH 214
CH  158 (1.868 MEV)    0.147 CPS *
CH  159 (1.879 MEV)    0.147 CPS *
CH  160 (1.891 MEV)    0.139 CPS *
CH  161 (1.903 MEV)    0.109 CPS *
CH  162 (1.915 MEV)    0.091 CPS *
CH  163 (1.927 MEV)    0.151 CPS *
CH  164 (1.938 MEV)    0.088 CPS *
CH  165 (1.950 MEV)    0.136 CPS *
CH  166 (1.962 MEV)    0.157 CPS *
CH  167 (1.974 MEV)    0.119 CPS *
CH  168 (1.986 MEV)    0.109 CPS *
CH  169 (1.998 MEV)    0.113 CPS *
CH  170 (2.009 MEV)    0.106 CPS *
CH  171 (2.021 MEV)    0.147 CPS *
CH  172 (2.033 MEV)    0.137 CPS *
CH  173 (2.045 MEV)    0.171 CPS **
CH  174 (2.057 MEV)    0.154 CPS *
CH  175 (2.068 MEV)    0.108 CPS *
CH  176 (2.080 MEV)    0.162 CPS *
CH  177 (2.092 MEV)    0.104 CPS *
CH  178 (2.104 MEV)    0.138 CPS *
CH  179 (2.116 MEV)    0.137 CPS *
CH  180 (2.128 MEV)    0.119 CPS *
CH  181 (2.139 MEV)    0.169 CPS **
CH  182 (2.151 MEV)    0.148 CPS *
CH  183 (2.163 MEV)    0.101 CPS *
CH  184 (2.175 MEV)    0.114 CPS *
CH  185 (2.187 MEV)    0.088 CPS *
CH  186 (2.199 MEV)    0.101 CPS *
CH  187 (2.210 MEV)    0.085 CPS *
CH  188 (2.222 MEV)    0.130 CPS *
CH  189 (2.234 MEV)    0.117 CPS *
CH  190 (2.246 MEV)    0.113 CPS *
CH  191 (2.258 MEV)    0.116 CPS *
CH  192 (2.269 MEV)    0.088 CPS *
CH  193 (2.281 MEV)    0.097 CPS *
CH  194 (2.293 MEV)    0.095 CPS *
CH  195 (2.305 MEV)    0.087 CPS *
CH  196 (2.317 MEV)    0.059 CPS *
CH  197 (2.329 MEV)    0.015 CPS *
CH  198 (2.340 MEV)    0.041 CPS *
CH  199 (2.352 MEV)    0.070 CPS *
CH  200 (2.364 MEV)    0.087 CPS *
CH  201 (2.376 MEV)    0.085 CPS *
CH  202 (2.388 MEV)    0.084 CPS *
CH  203 (2.399 MEV)    0.064 CPS *
CH  204 (2.411 MEV)    0.123 CPS * THALLIUM 208
CH  205 (2.423 MEV)    0.076 CPS *
CH  206 (2.435 MEV)    0.116 CPS *
CH  207 (2.447 MEV)    0.147 CPS *
CH  208 (2.459 MEV)    0.108 CPS *
CH  209 (2.470 MEV)    0.120 CPS *
CH  210 (2.482 MEV)    0.092 CPS *
CH  211 (2.494 MEV)    0.127 CPS *
CH  212 (2.506 MEV)    0.169 CPS **
CH  213 (2.518 MEV)    0.206 CPS **
CH  214 (2.529 MEV)    0.262 CPS **
CH  215 (2.541 MEV)    0.184 CPS **
CH  216 (2.553 MEV)    0.206 CPS **
CH  217 (2.565 MEV)    0.195 CPS **
CH  218 (2.577 MEV)    0.173 CPS **
CH  219 (2.589 MEV)    0.201 CPS **
CH  220 (2.600 MEV)    0.329 CPS **
CH  221 (2.612 MEV)    0.232 CPS **
CH  222 (2.624 MEV)    0.187 CPS **
CH  223 (2.636 MEV)    0.171 CPS **
CH  224 (2.648 MEV)    0.177 CPS **
CH  225 (2.660 MEV)    0.089 CPS *
CH  226 (2.671 MEV)    0.122 CPS *
CH  227 (2.683 MEV)    0.124 CPS *
CH  228 (2.695 MEV)    0.131 CPS *
CH  229 (2.707 MEV)    0.090 CPS *
CH  230 (2.719 MEV)    0.027 CPS *
CH  231 (2.730 MEV)    0.012 CPS *
CH  232 (2.742 MEV)   -0.026 CPS *
CH  233 (2.754 MEV)   -0.024 CPS *
CH  234 (2.766 MEV)    0.038 CPS *
CH  235 (2.778 MEV)    0.003 CPS *
CH  236 (2.790 MEV)    0.060 CPS *
CH  237 (2.801 MEV)    0.038 CPS * THALLIUM 208
CH  238 (2.813 MEV)    0.023 CPS *
CH  239 (2.825 MEV)    0.008 CPS *
CH  240 (2.837 MEV)    0.078 CPS *
CH  241 (2.849 MEV)    0.027 CPS *
CH  242 (2.860 MEV)    0.047 CPS *
CH  243 (2.872 MEV)    0.039 CPS *
CH  244 (2.884 MEV)    0.084 CPS *
CH  245 (2.896 MEV)    0.025 CPS *
CH  246 (2.908 MEV)    0.025 CPS *
CH  247 (2.920 MEV)   -0.015 CPS *
CH  248 (2.931 MEV)    0.037 CPS *
CH  249 (2.943 MEV)   -0.005 CPS *
CH  250 (2.955 MEV)    0.042 CPS *
CH  251 (2.967 MEV)    0.002 CPS *
CH  252 (2.979 MEV)   -0.018 CPS *
CH  253 (2.990 MEV)    0.031 CPS *
CH  254 (3.002 MEV)   -0.106 CPS * TOTAL COUNT
CH  255 (3.014 MEV)    0.000 CPS *
```

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

FIGURE V

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:

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

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

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

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

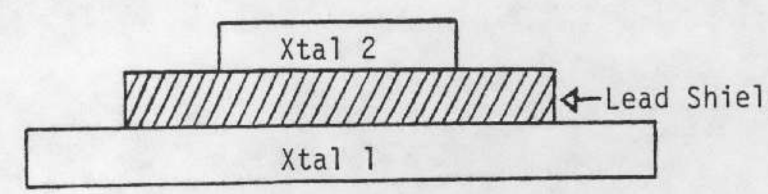
$S_{tu} = \dfrac{\Delta_{tu}}{\Delta_{tt}}$ (effect of uranium on thorium)

$S_{tk} = \dfrac{\Delta_{tk}}{\Delta_{tt}}$ (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 $I_a = \dfrac{I_2 - \ell I_1}{m - \ell}$ = Bi Air

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

DATA PROCESSING

DATA PREPARATION

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

Field Tape Verification and Edit

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

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

Flight Line Location

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

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

RADIOMETRIC DATA REDUCTION

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

Total count - 0.4 to 3.0 MeV

K - 1.37 to 1.57 MeV

U - 1.66 to 1.87 MeV (downward looking system)

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

T - 2.41 to 2.81 MeV

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

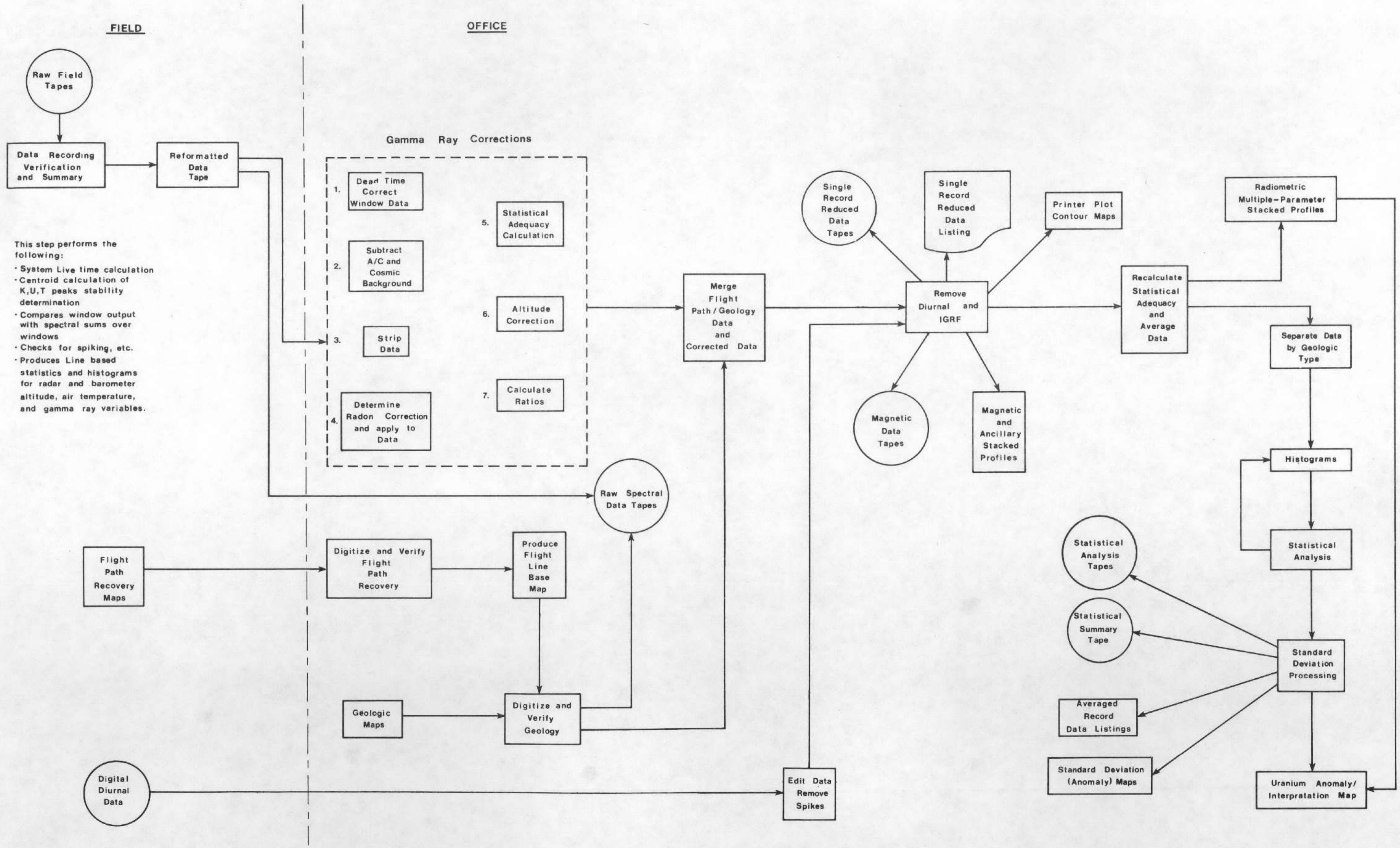
Aircraft and Cosmic background for the Queen Air/Aero Commander over these windows are as follows:

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

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

DATA PROCESSING FLOW DIAGRAM

FIGURE VII



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

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

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

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

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

Altitude attenuation coefficients used are defined as follows:

ALTITUDE ATTENUATION COEFFICIENTS

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

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

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

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

Bi Air calculations are made using the following expressions:

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

Where U_{up} = count rate from upward detectors

ℓ = crystal coupling constant

m = crystal geometric factor

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

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

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

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

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

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

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

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

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

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

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

Statistical Adequacy Test

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

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

Setting the actual levels in counts per second, "a priori " for each elemental window is difficult at best since the full effect of all parameters affecting the counts is not known to a sufficient degree of certainty. If the corrections to the data are a significant portion of the count rate, most of the error (exclusive of systematic errors due to electronics, etc.) in the corrected data can be 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.

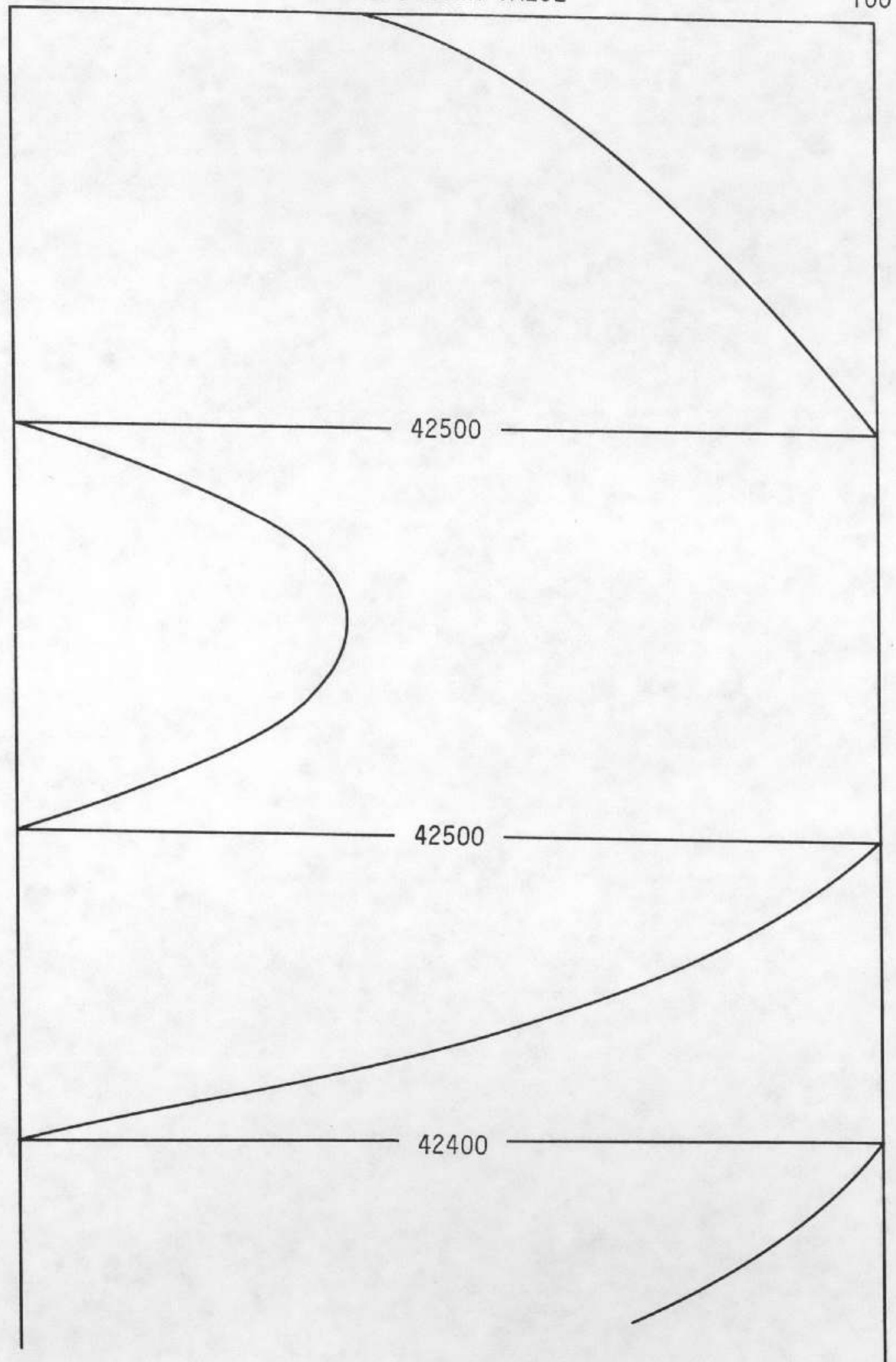


FIGURE VIII Plotter Step Value Labeling

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.

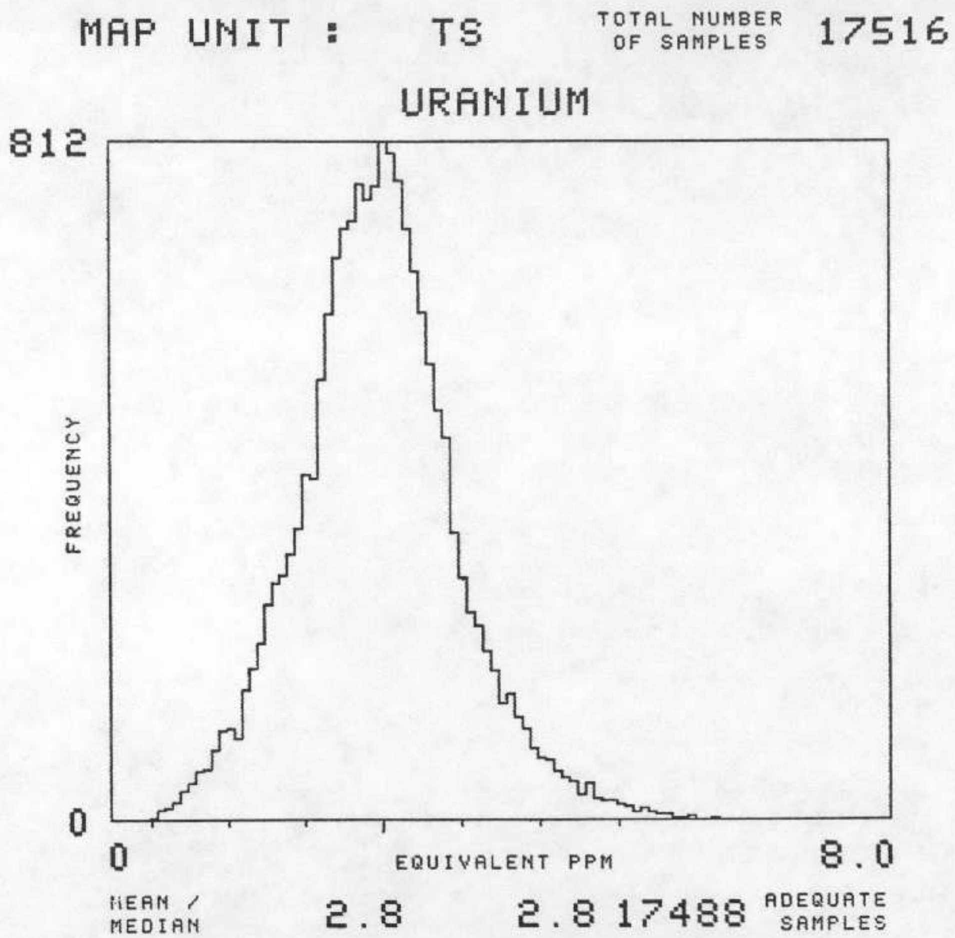


FIGURE IX Sample Computer Map Unit Histogram

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.

BIBLIOGRAPHY

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

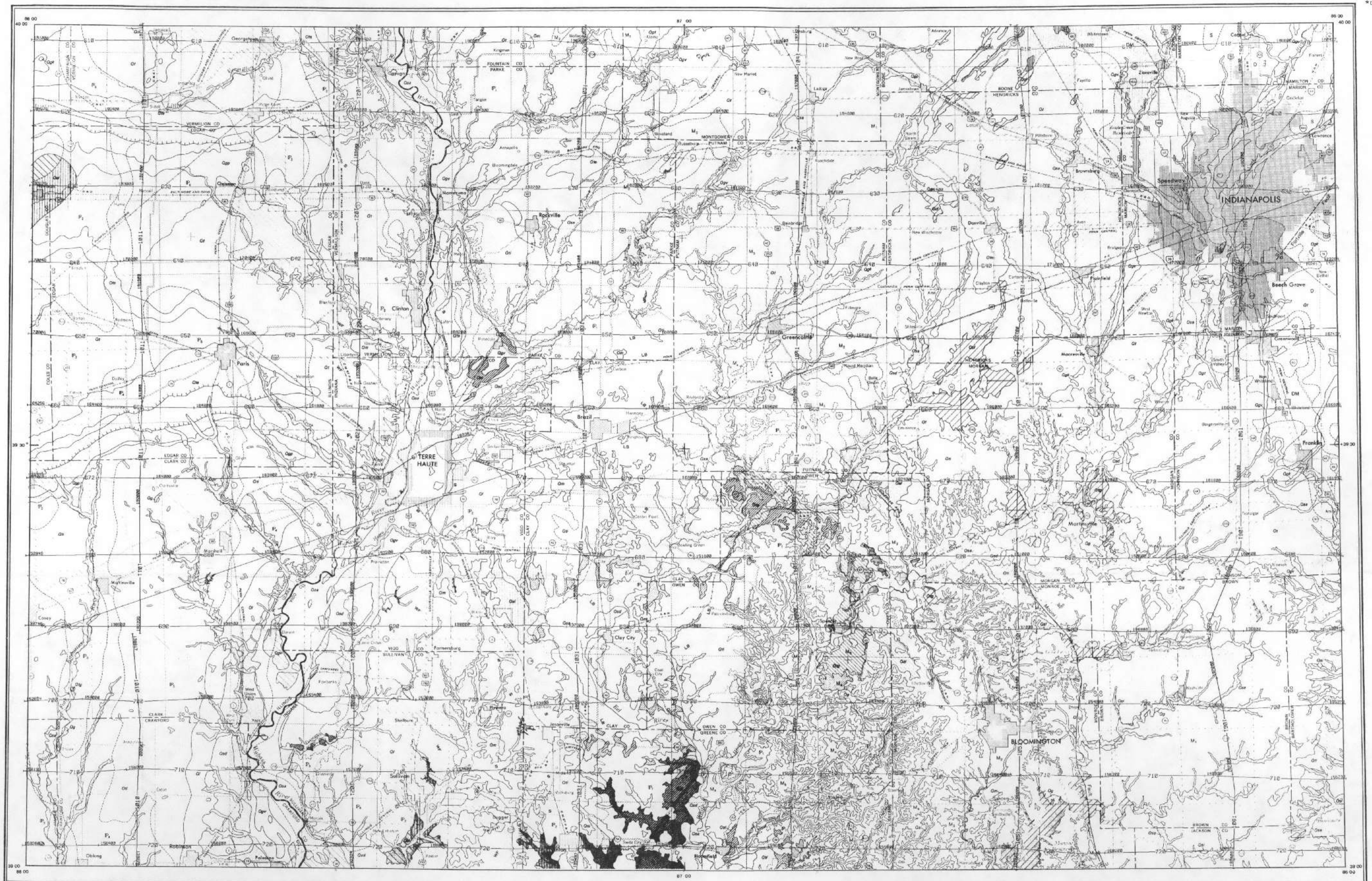
AERO COMMANDER

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
Marion	Unfinished
Toledo	Unfinished

APPENDIX C - Flight Path and Geologic Map



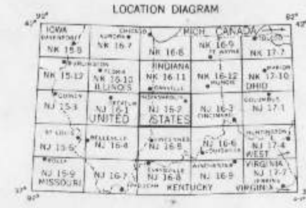
SCALE 1:500,000

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

SURVEY AND COMPILATION BY

EG&G GEOMETRICS

LOCATION DIAGRAM



FLIGHT PATH RECOVERY

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

UNCONSOLIDATED DEPOSITS

QUATERNARY (PLEISTOCENE)

Holocene

Qm

Modified land

Land extensively modified by excavation for coal, limestone, or gravel. Small areas not shown

Wisconsinan and Holocene

Qsa

Silt, sand, and gravel

Deposits of present streams; includes associated slopewash and swamp deposits. Martinsville Formation in Indiana; Cahokia Alluvium in Illinois

Qsd

Sand and some silt

Windblown sand, mostly in dune patches along valley walls. Parkland Sand in Illinois

Wisconsinan

Ql

Silt, fine sand, and clay

Windblown silt in blanket form on low hills. Principally Peoria Loess in Illinois

Qcl

Clay, silt, and sand

Lake deposits, mostly as partial valley fill. Equality Formation in Illinois

Qgv / Qgp

Gravel, sand, and silt

Deposits of meltwater streams. Qgv, valley-train deposits as partial valley fill; Qgp, outwash-plain deposits in blanket form on uplands. Atherton Formation in Indiana, Mackinaw Member and Batavia Member, respectively, of Henry Formation in Illinois

Qgk

Gravel, sand, and some silt

Hummocky patches of ice-contact stratified drift. Kame and esker facies of Trafalgar Formation in Indiana; Wasco Member of Henry Formation in Illinois

Qgt

Sand, gravel, and till

Undifferentiated ice-contact stratified drift and till with hummocky topography. Part of Trafalgar Formation (deposit of the Erie Lobe) in Indiana

Qt / Qte

Till

Mostly loam till. Qt, till sheets of low relief; Qte, end moraine with hummocky topography. Trafalgar Formation (deposit of the Erie Lobe) in eastern areas; Fairgrange and Batestown Till Members of Wedron Formation (deposits of the Michigan Lobe) in western areas

Illinoian and Wisconsinan

Qsi

Silt, sand, and gravel

Older stream deposits comprised of mostly local materials; includes associated slopewash. Prospect Formation; recognized mainly in nonglaciated areas in Indiana

Illinoian and older

Qsl

Silt, clay, and fine sand

Older lake deposits as partial valley fill and as broad basin fill in upland areas

Qg

Gravel and sand

Deposits of older meltwater streams, mostly as isolated intermediate-level remnants. Pearl Formation in Illinois

Qti / Qtg

Till: till, sand, and gravel

Mostly loam till as extensive blankets (Qti); in local areas a till-outwash complex (Qtg). Jessup Formation in most of Indiana; Glasford Formation in Illinois and parts of western Indiana

BEDROCK UNITS

PENNSYLVANIAN

$\mathbb{P}_5$

Mattoon Formation
Shale, sandstone, and thin coal

$\mathbb{P}_4$

Bond Formation
Shale, sandstone, limestone, and thin coal

$\mathbb{P}_3$ WF

Lower part of McLeansboro Group
Shale, sandstone, limestone, and thin coal
WF, top of West Franklin Limestone Member

$\mathbb{P}_2$ S

Carbondale Group
Shale, sandstone, limestone, clay, and coal.
S, top of Springfield Coal Member (V)

$\mathbb{P}_1$ LB

Raccoon Creek Group
Shale, sandstone, limestone, clay, and coal.
LB, base of Lower Block Coal Member

MISSISSIPPIAN

M_5

Stephensport Group
Limestone, sandstone, and shale

M_4

West Baden Group
Shale, sandstone, and limestone

M_3

Blue River Group
Mostly micritic, skeletal, and oolitic limestone

M_2

Sanders Group
Mostly coarse-grained limestone

M_1

Borden Group and Rockford Limestone
Siltstone, shale, sandstone, and thin limestone

DEVONIAN AND MISSISSIPPIAN

DM

New Albany Shale
Black and greenish-gray shale

DEVONIAN

D

Muscatatuck Group
Mostly limestone and dolomite of Middle Devonian age.
Includes some Early Devonian rocks on cross section

SILURIAN

S

Rocks of Silurian age
Limestone, dolomite, and shale

Boundary of mapped unit
Bedrock boundaries dashed where covered by unconsolidated deposits

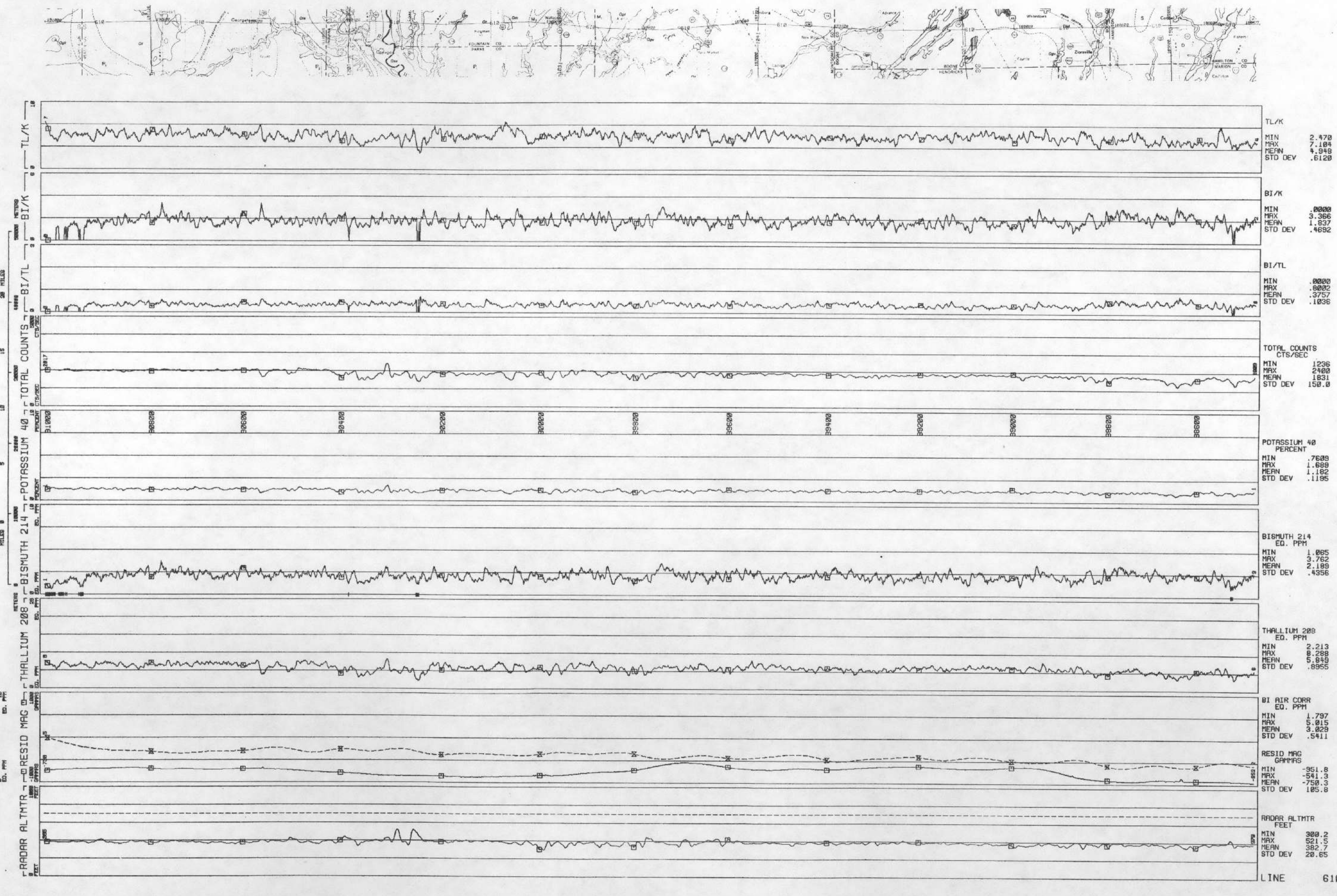
Significant ice-marginal position
Marked by stratigraphic or topographic break

U
D
Fault
U, upthrown side; D, downthrown side

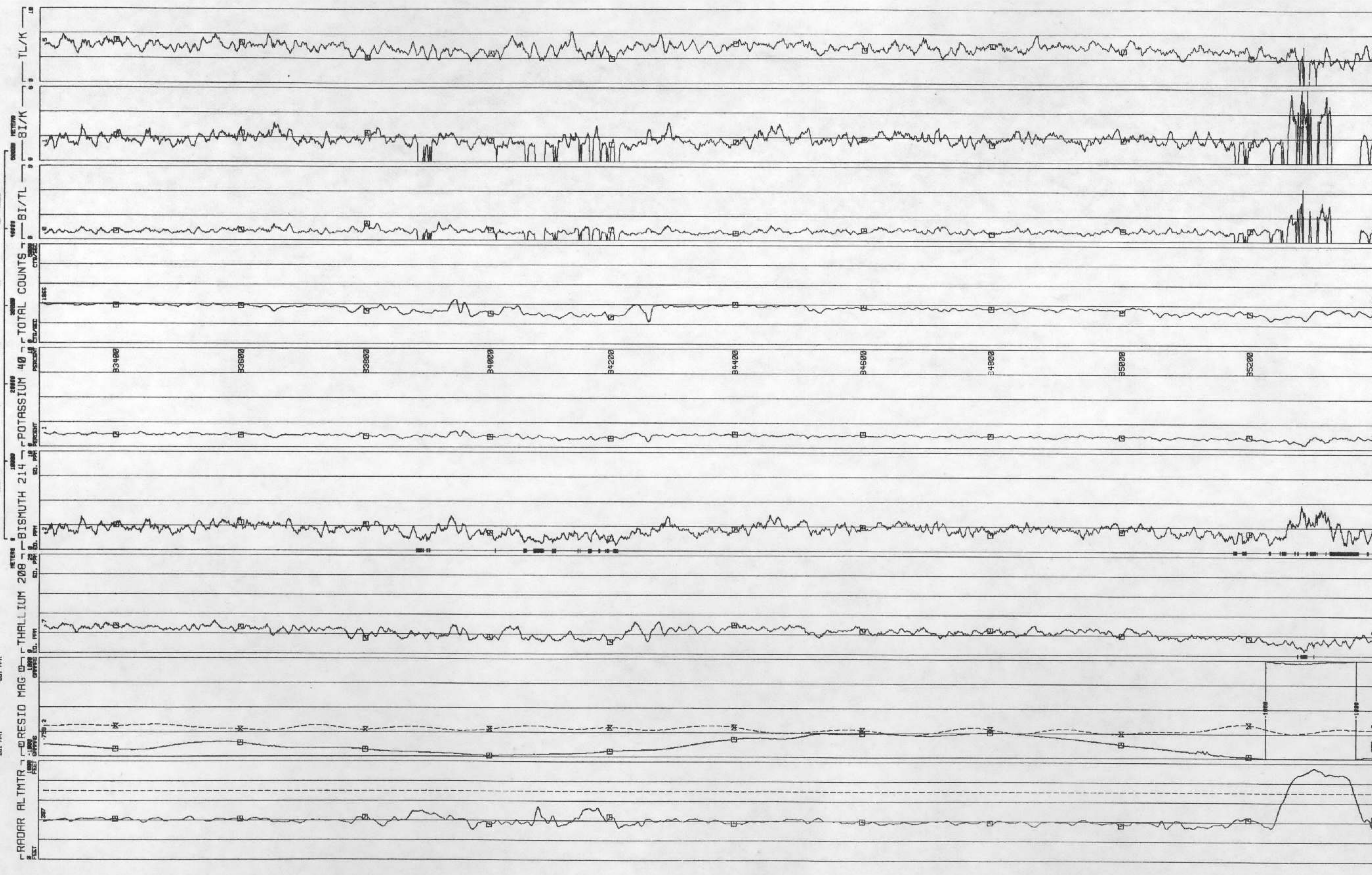
APPENDIX D - Profiles

D1 i

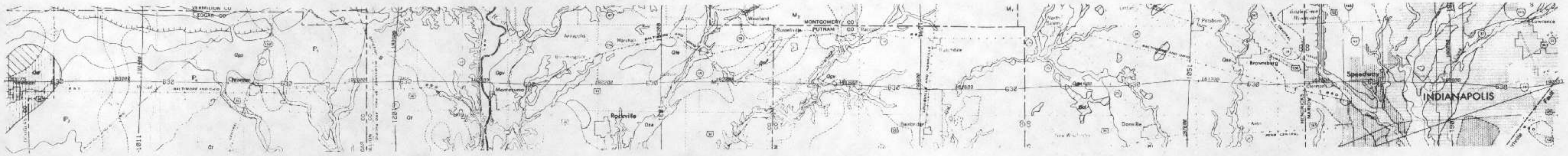
LINE 610
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349

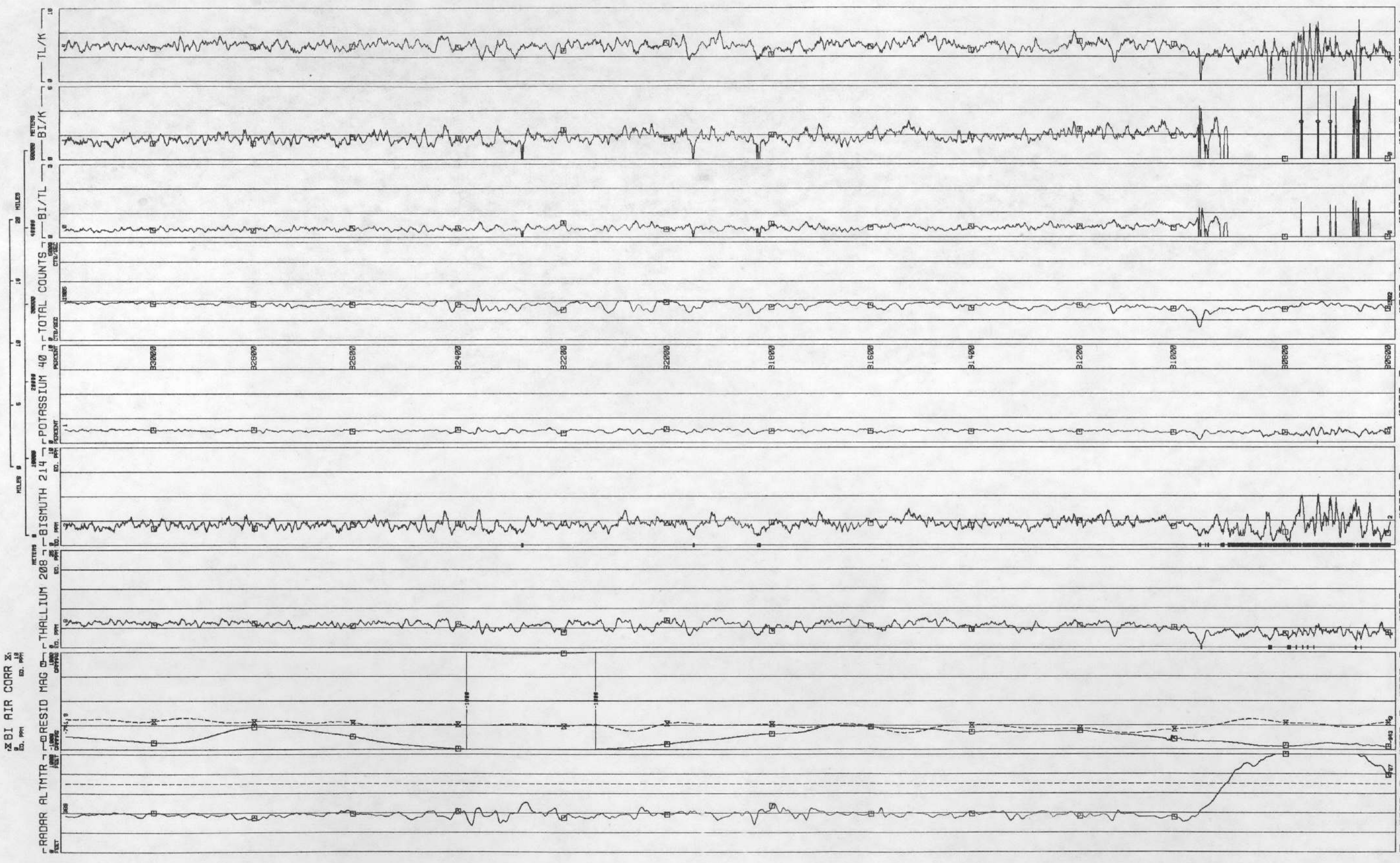


LINE 620
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347

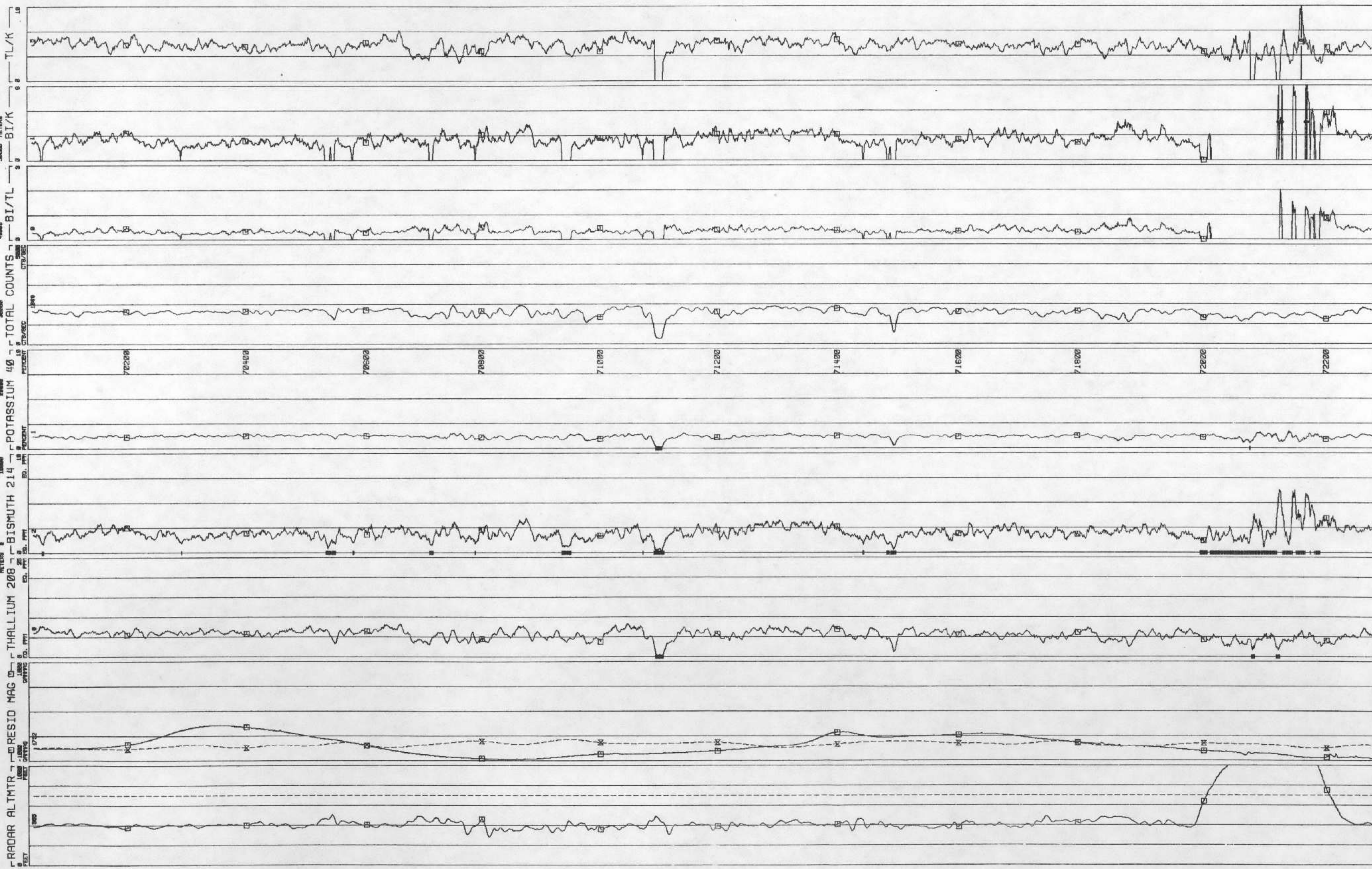


LINE 630
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347





LINE 640
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80341



TL/K
MIN .0000
MAX 10.95
MEAN 4.617
STD DEV .9291

BI/K
MIN .0000
MAX 9.399
MEAN 1.561
STD DEV .8137

BI/TL
MIN .0000
MAX 1.976
MEAN .3335
STD DEV .1832

TOTAL COUNTS CTS/SEC
MIN 266.2
MAX 1934
MEAN 1579
STD DEV 199.1

POTASSIUM 40 PERCENT
MIN .1273
MAX 1.725
MEAN 1.186
STD DEV .1719

BISMUTH 214 EQ. PPM
MIN .9905
MAX 6.312
MEAN 2.067
STD DEV .6059

THALLIUM 208 EQ. PPM
MIN .9282
MAX 8.275
MEAN 5.552
STD DEV 1.144

BI AIR CORR EQ. PPM
MIN 1.145
MAX 2.159
MEAN 1.616
STD DEV .2312

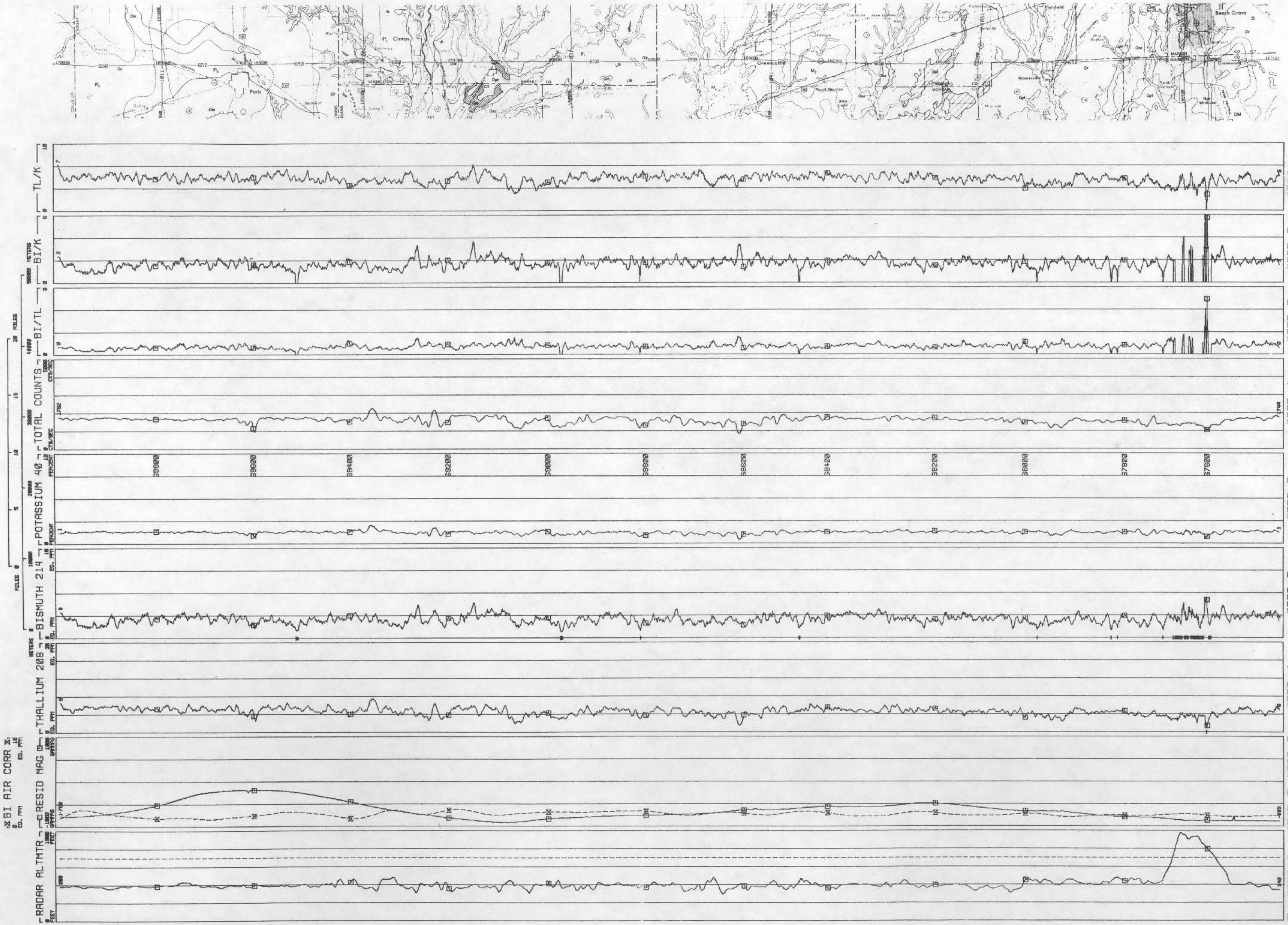
RESID MAG GAMMAS
MIN -980.9
MAX -285.3
MEAN -699.6
STD DEV 193.5

RADAR ALTMTR FEET
MIN 284.7
MAX 1000
MEAN 458.2
STD DEV 164.1

LINE 640

D5 i

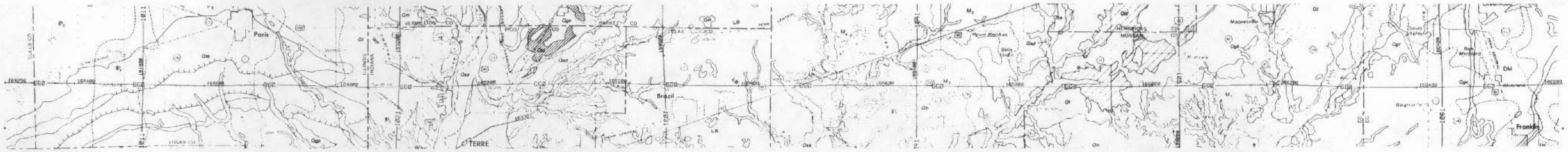
LINE 650
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80341

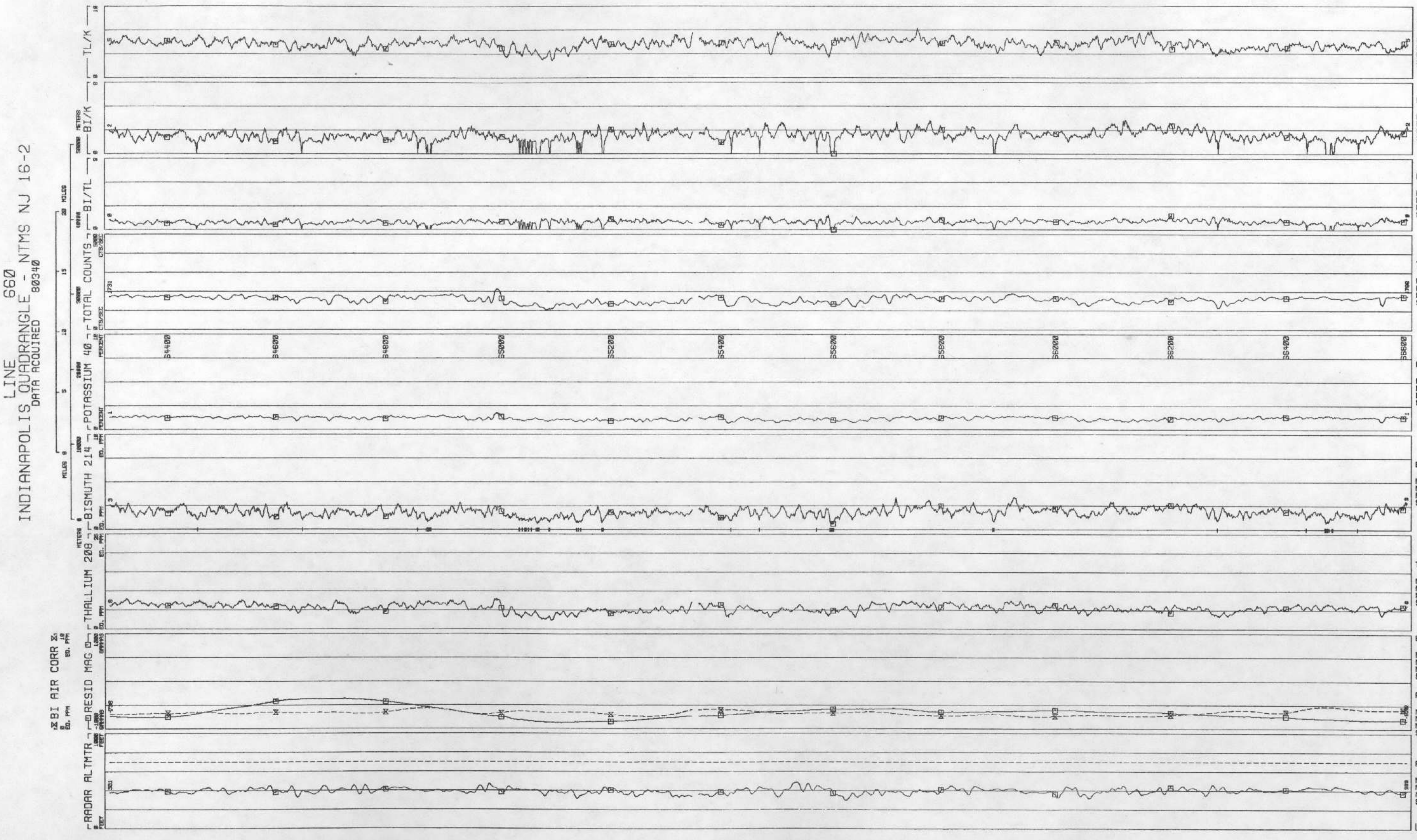


TL/K		
MIN	.0000	
MAX	6.873	
MEAN	4.661	
STD DEV	.6628	
BI/K		
MIN	.0000	
MAX	6.979	
MEAN	1.665	
STD DEV	.5580	
BI/TL		
MIN	.0000	
MAX	2.467	
MEAN	.3604	
STD DEV	.1379	
TOTAL COUNTS CTS/SEC		
MIN	838.6	
MAX	2258	
MEAN	1593	
STD DEV	177.3	
POTASSIUM 40 PERCENT		
MIN	.4407	
MAX	2.038	
MEAN	1.223	
STD DEV	.1656	
BISMUTH 214 EQ. PPM		
MIN	.9485	
MAX	4.585	
MEAN	2.083	
STD DEV	.4682	
THALLIUM 208 EQ. PPM		
MIN	1.712	
MAX	9.287	
MEAN	5.705	
STD DEV	1.084	
BI AIR CORR EQ. PPM		
MIN	.8024	
MAX	1.887	
MEAN	1.337	
STD DEV	.2458	
RESID MAG GAMMAS		
MIN	-918.6	
MAX	-178.7	
MEAN	-647.9	
STD DEV	197.2	
RADAR ALTMTR FEET		
MIN	293.0	
MAX	974.6	
MEAN	417.4	
STD DEV	106.2	

LINE 650

LINE 660
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80340





TL/K
MIN 2.457
MAX 6.927
MEAN 4.694
STD DEV .6396

BI/K
MIN .0000
MAX 2.832
MEAN 1.531
STD DEV .4588

BI/TL
MIN .0000
MAX .6145
MEAN .3278
STD DEV .0956

TOTAL COUNTS CTS/SEC
MIN 1037
MAX 2120
MEAN 1578
STD DEV 171.4

POTASSIUM 40 PERCENT
MIN .6918
MAX 1.764
MEAN 1.186
STD DEV .1654

BISMUTH 214 EQ. PPM
MIN .0087
MAX 3.373
MEAN 1.852
STD DEV .4225

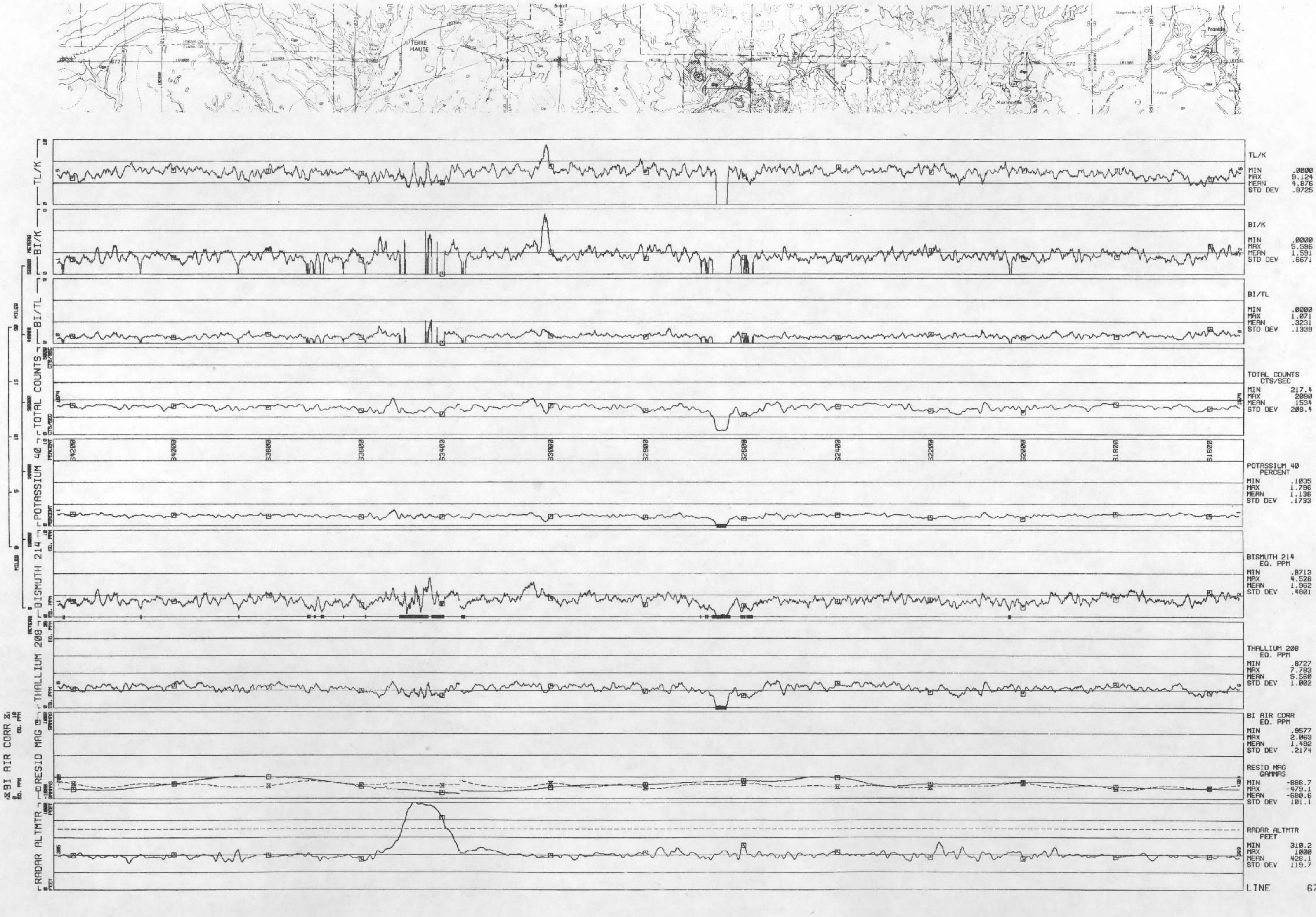
THALLIUM 208 EQ. PPM
MIN 2.420
MAX 7.994
MEAN 5.550
STD DEV .9860

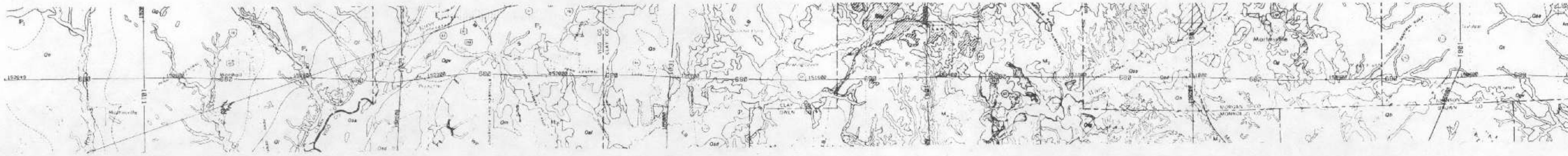
BI AIR CORR EQ. PPM
MIN 1.244
MAX 2.369
MEAN 1.674
STD DEV .2479

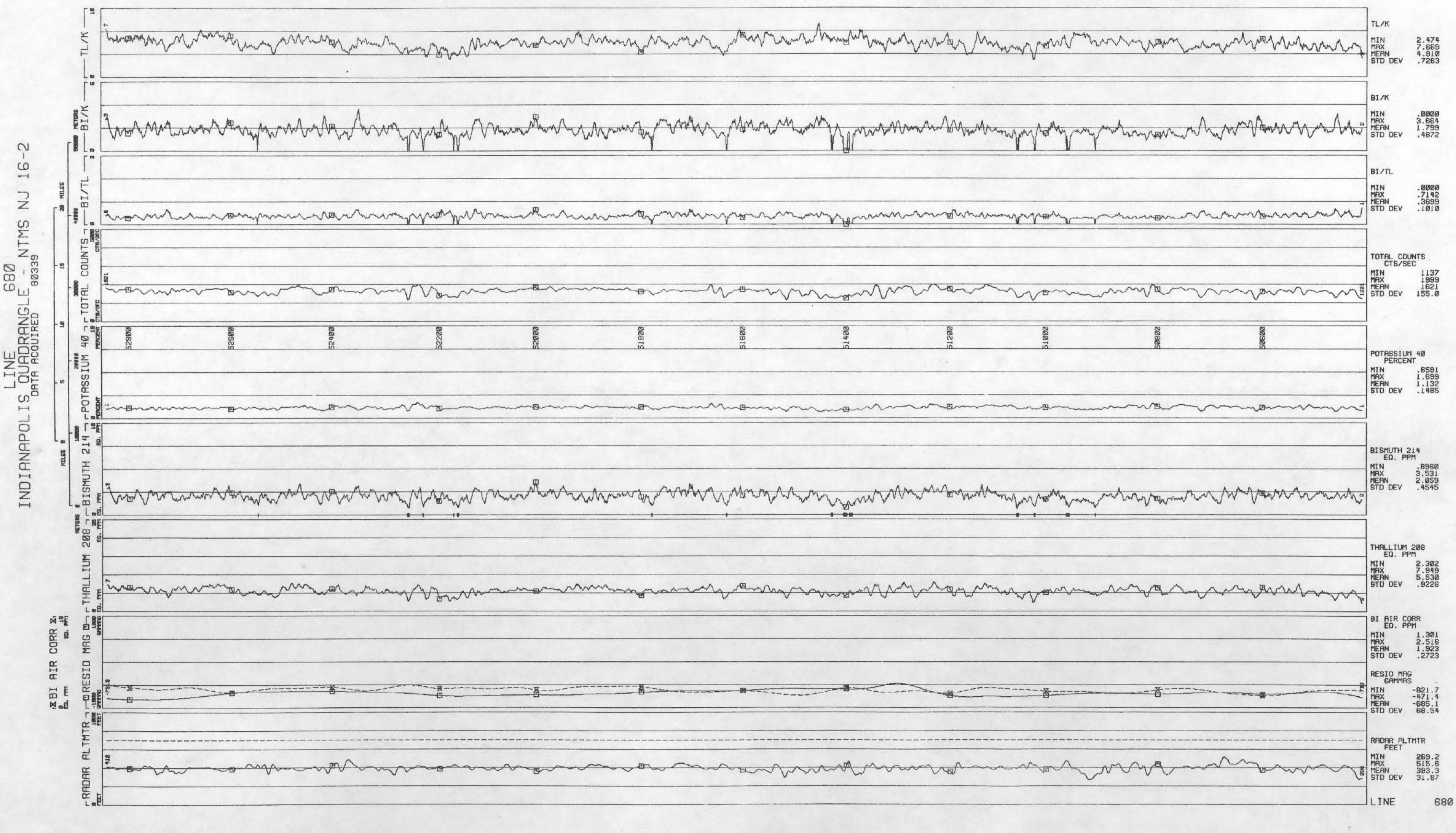
RESID MAG GAMMAS
MIN -876.1
MAX -362.0
MEAN -661.6
STD DEV 130.4

RADAR ALTMTR FEET
MIN 295.1
MAX 486.0
MEAN 395.7
STD DEV 28.11

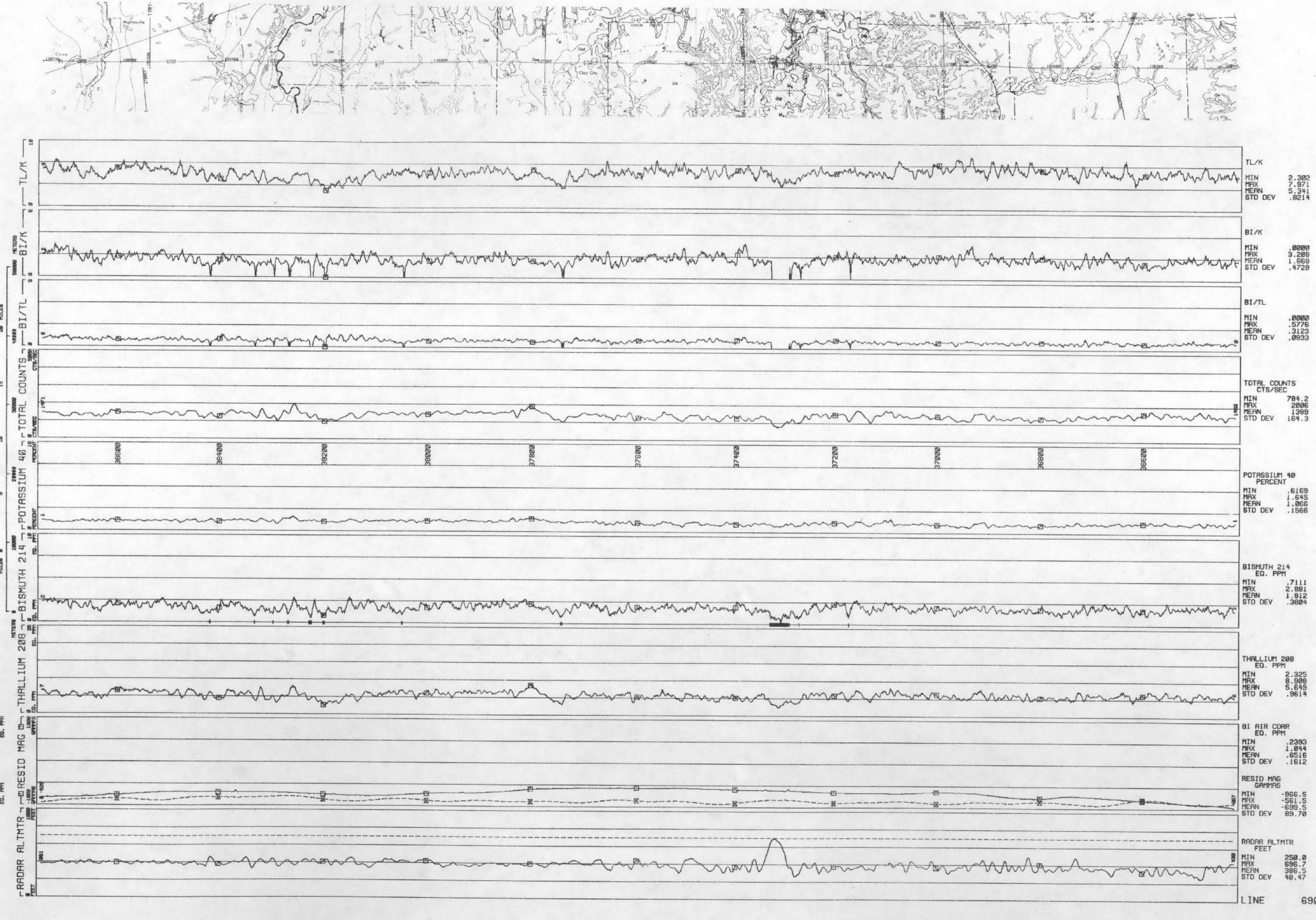
LINE 660


LINE 670
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80340
TERRE HAUTE
TL/K
MIN .0000
MAX 8.124
MEAN 4.876
STD DEV .8725
BI/K
MIN .0000
MAX 5.596
MEAN 1.591
STD DEV .6671
BI/TL
MIN .0000
MAX 1.071
MEAN .3231
STD DEV .1338
TOTAL COUNTS CTS/SEC
MIN 217.4
MAX 2090
MEAN 1534
STD DEV 208.4
POTASSIUM 40 PERCENT
MIN .1035
MAX 1.796
MEAN 1.136
STD DEV .1733
BISMUTH 214 EQ. PPM
MIN .0713
MAX 4.528
MEAN 1.962
STD DEV .4801
THALLIUM 208 EQ. PPM
MIN .0727
MAX 7.783
MEAN 5.560
STD DEV 1.002
BI AIR CORR EQ. PPM
MIN .8577
MAX 2.063
MEAN 1.492
STD DEV .2174
RESID MAG GAMMAS
MIN -886.7
MAX -479.1
MEAN -680.6
STD DEV 101.1
RADAR ALTMTR FEET
MIN 310.2
MAX 1000
MEAN 426.1
STD DEV 119.7
LINE 670

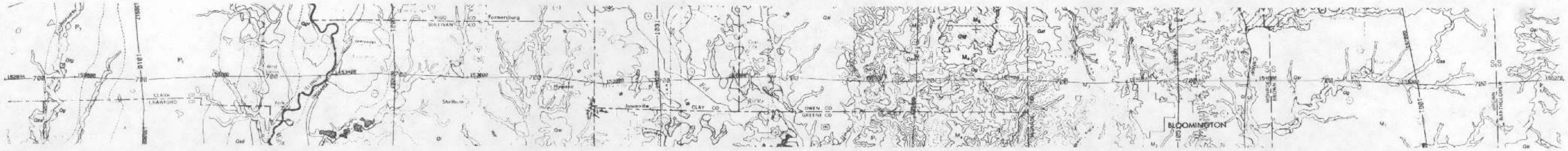


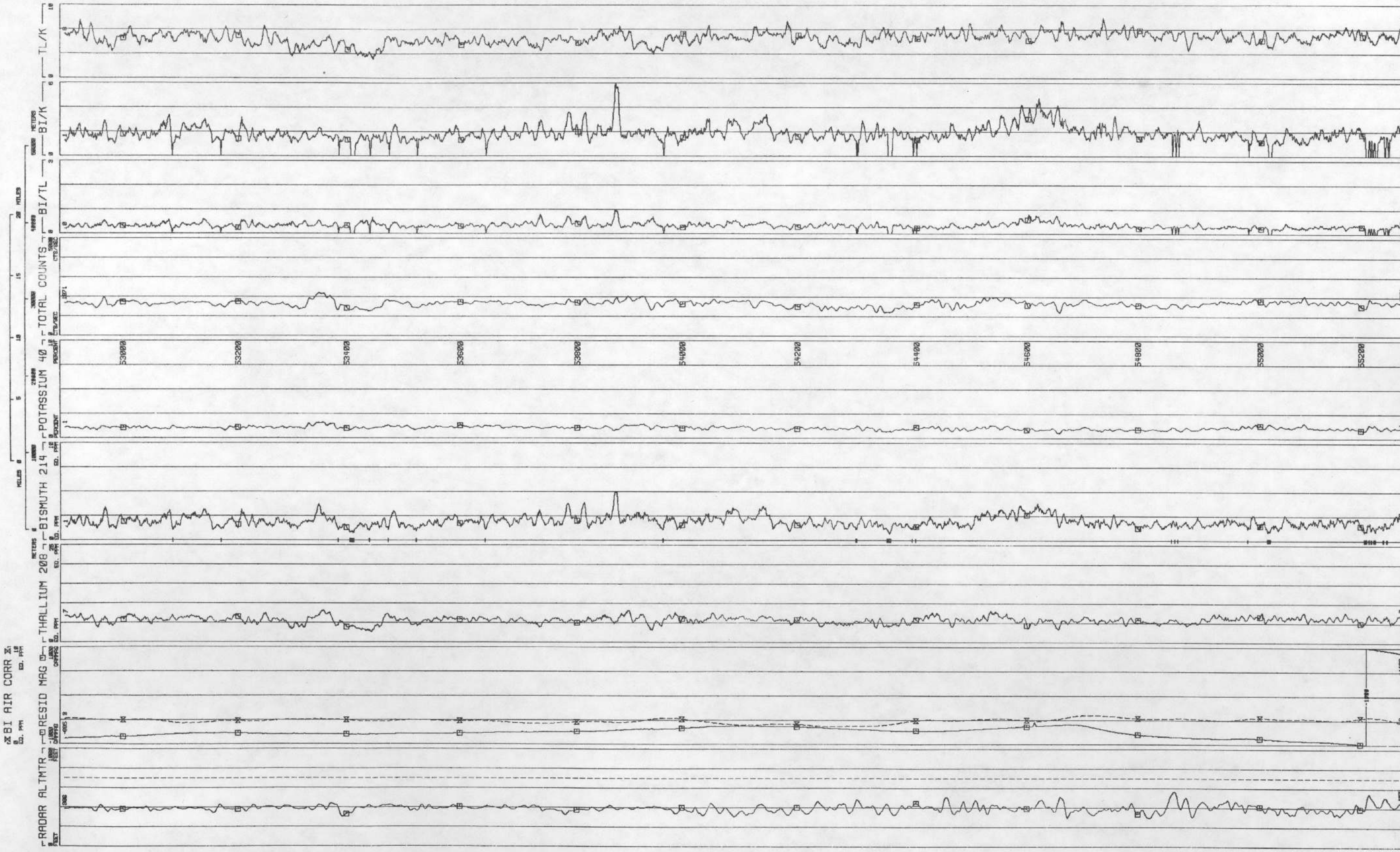

LINE 680
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
BI AIR CORR
RESID MAG
RADAR ALTMTR
52800
52600
52400
52200
52000
51800
51600
51400
51200
51000
50800
50600
TL/K
MIN 2.474
MAX 7.669
MEAN 4.910
STD DEV .7263
BI/K
MIN .0000
MAX 3.664
MEAN 1.799
STD DEV .4872
BI/TL
MIN .0000
MAX .7142
MEAN .3699
STD DEV .1010
TOTAL COUNTS
CTS/SEC
MIN 1137
MAX 1999
MEAN 1621
STD DEV 155.0
POTASSIUM 40
PERCENT
MIN .6591
MAX 1.699
MEAN 1.132
STD DEV .1485
BISMUTH 214
EQ. PPM
MIN .8960
MAX 3.531
MEAN 2.059
STD DEV .4545
THALLIUM 208
EQ. PPM
MIN 2.302
MAX 7.949
MEAN 5.530
STD DEV .9226
BI AIR CORR
EQ. PPM
MIN 1.301
MAX 2.516
MEAN 1.923
STD DEV .2723
RESID MAG
GAMMAS
MIN -821.7
MAX -471.4
MEAN -685.1
STD DEV 68.54
RADAR ALTMTR
FEET
MIN 269.2
MAX 515.6
MEAN 383.3
STD DEV 31.87
LINE 680

LINE 690
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80338



LINE 700
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339





TL/K
MIN 2.631
MAX 8.281
MEAN 5.474
STD DEV .8164

BI/K
MIN .0000
MAX 5.982
MEAN 1.845
STD DEV .6578

BI/TL
MIN .0000
MAX .9978
MEAN .3380
STD DEV .1144

TOTAL COUNTS
CTS/SEC
MIN 1201
MAX 2206
MEAN 1661
STD DEV 152.9

POTASSIUM 40
PERCENT
MIN .4934
MAX 1.609
MEAN 1.057
STD DEV .1523

BISMUTH 214
EQ. PPM
MIN .9235
MAX 5.001
MEAN 1.965
STD DEV .5273

THALLIUM 208
EQ. PPM
MIN 2.624
MAX 8.257
MEAN 5.733
STD DEV .8780

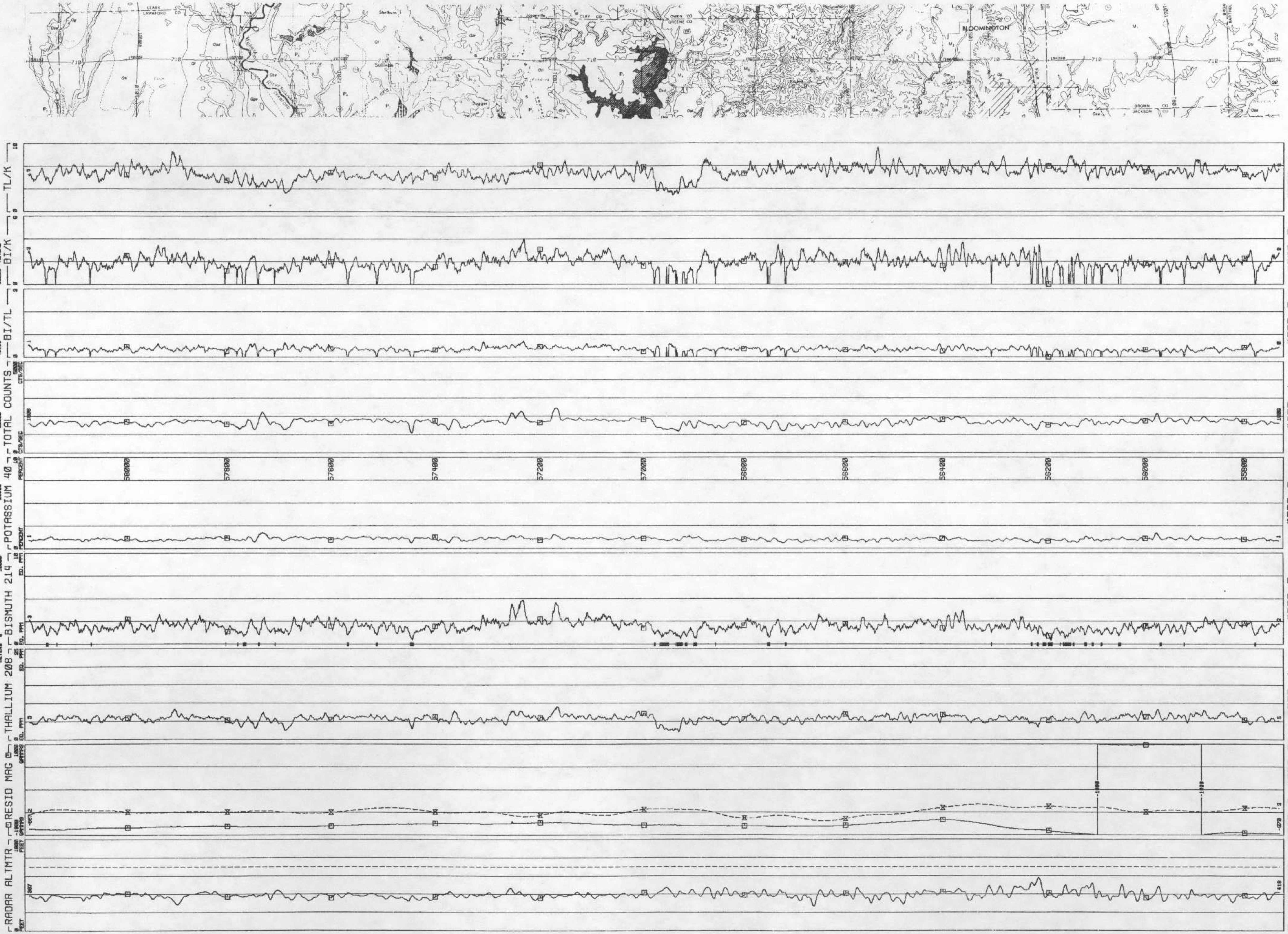
BI AIR CORR
EQ. PPM
MIN 1.849
MAX 3.020
MEAN 2.446
STD DEV .2449

RESID MAG
GAMMAS
MIN -1106
MAX -537.8
MEAN -770.9
STD DEV 102.9

RADAR ALTMTR
FEET
MIN 292.8
MAX 567.2
MEAN 392.9
STD DEV 35.19

LINE 700

LINE 710
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339



TL/K
MIN 2.400
MAX 9.420
MEAN 5.678
STD DEV .9340

BI/K
MIN .0000
MAX 4.024
MEAN 1.856
STD DEV .6835

BI/TL
MIN .0000
MAX .7011
MEAN .3279
STD DEV .1179

TOTAL COUNTS CTS/SEC
MIN 1068
MAX 2455
MEAN 1673
STD DEV 173.5

POTASSIUM 40 PERCENT
MIN .5589
MAX 1.737
MEAN 1.020
STD DEV .1583

BISMUTH 214 EQ. PPM
MIN 1.002
MAX 4.810
MEAN 2.017
STD DEV .5356

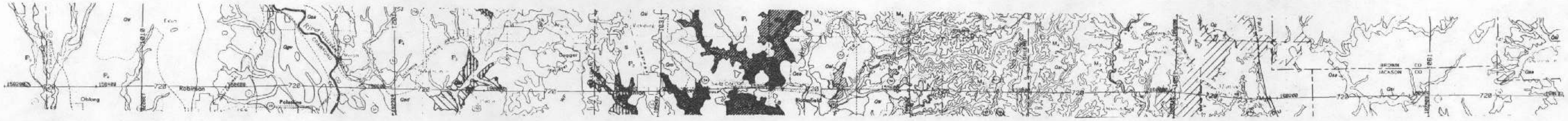
THALLIUM 208 EQ. PPM
MIN 2.121
MAX 8.994
MEAN 5.774
STD DEV .9322

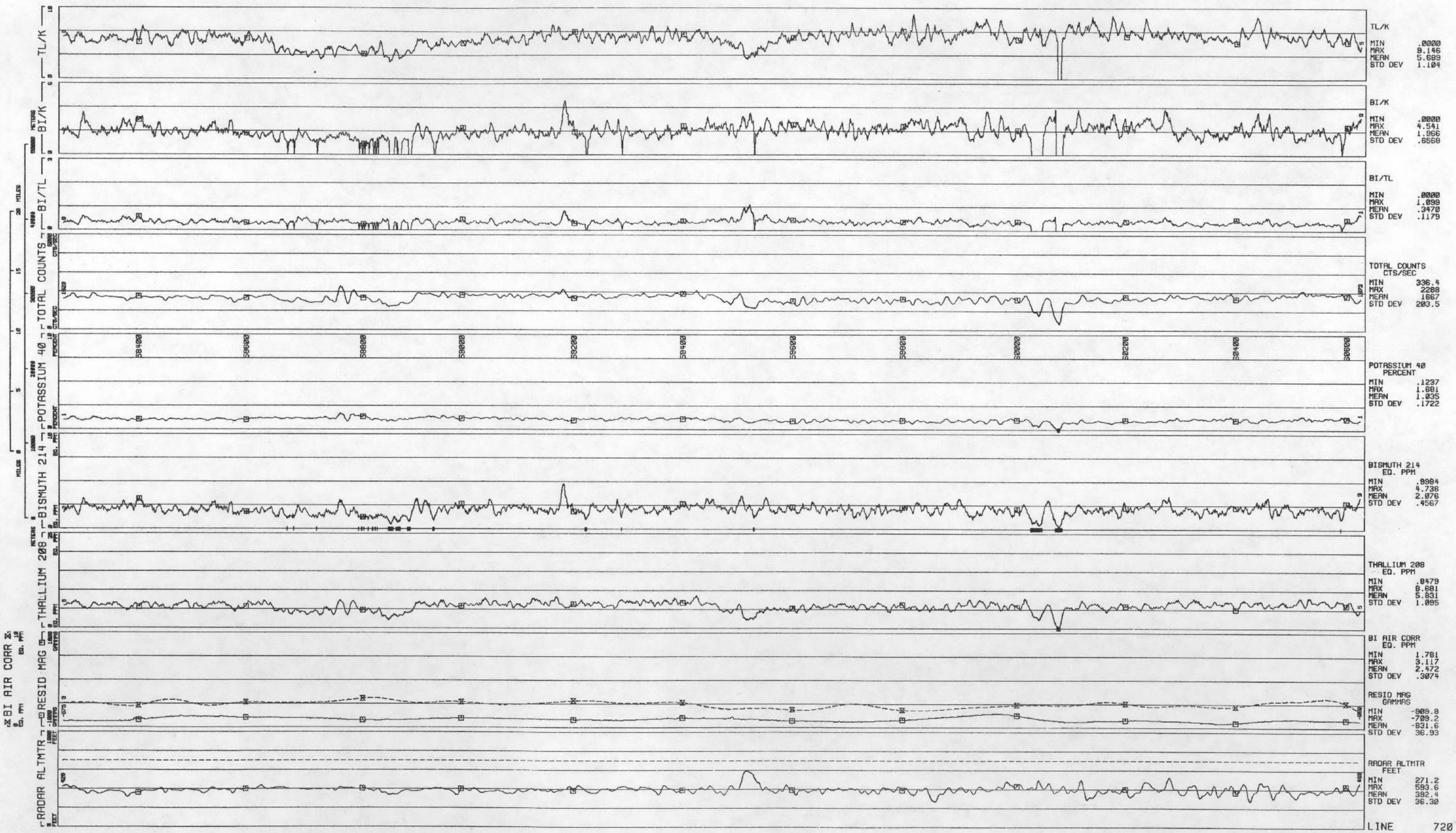
BI AIR CORR EQ. PPM
MIN 1.525
MAX 3.379
MEAN 2.584
STD DEV .3654

RESID MAG GAMMAS
MIN -1026
MAX -671.0
MEAN -828.6
STD DEV 90.34

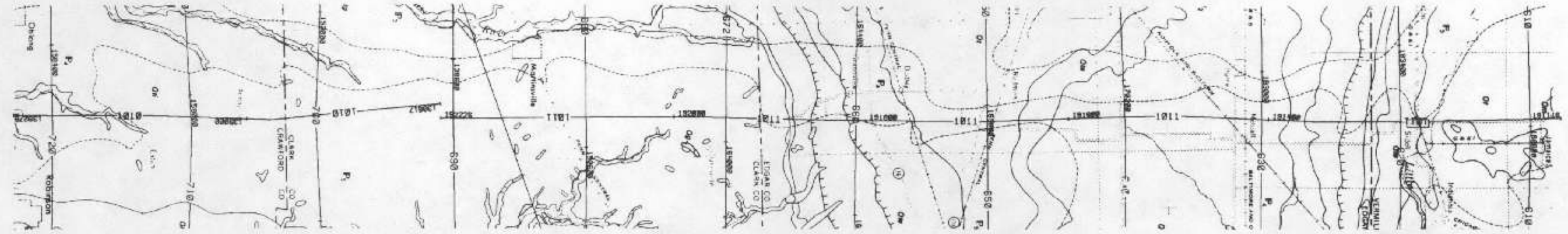
RADAR ALTMTR FEET
MIN 269.1
MAX 580.6
MEAN 391.3
STD DEV 36.84

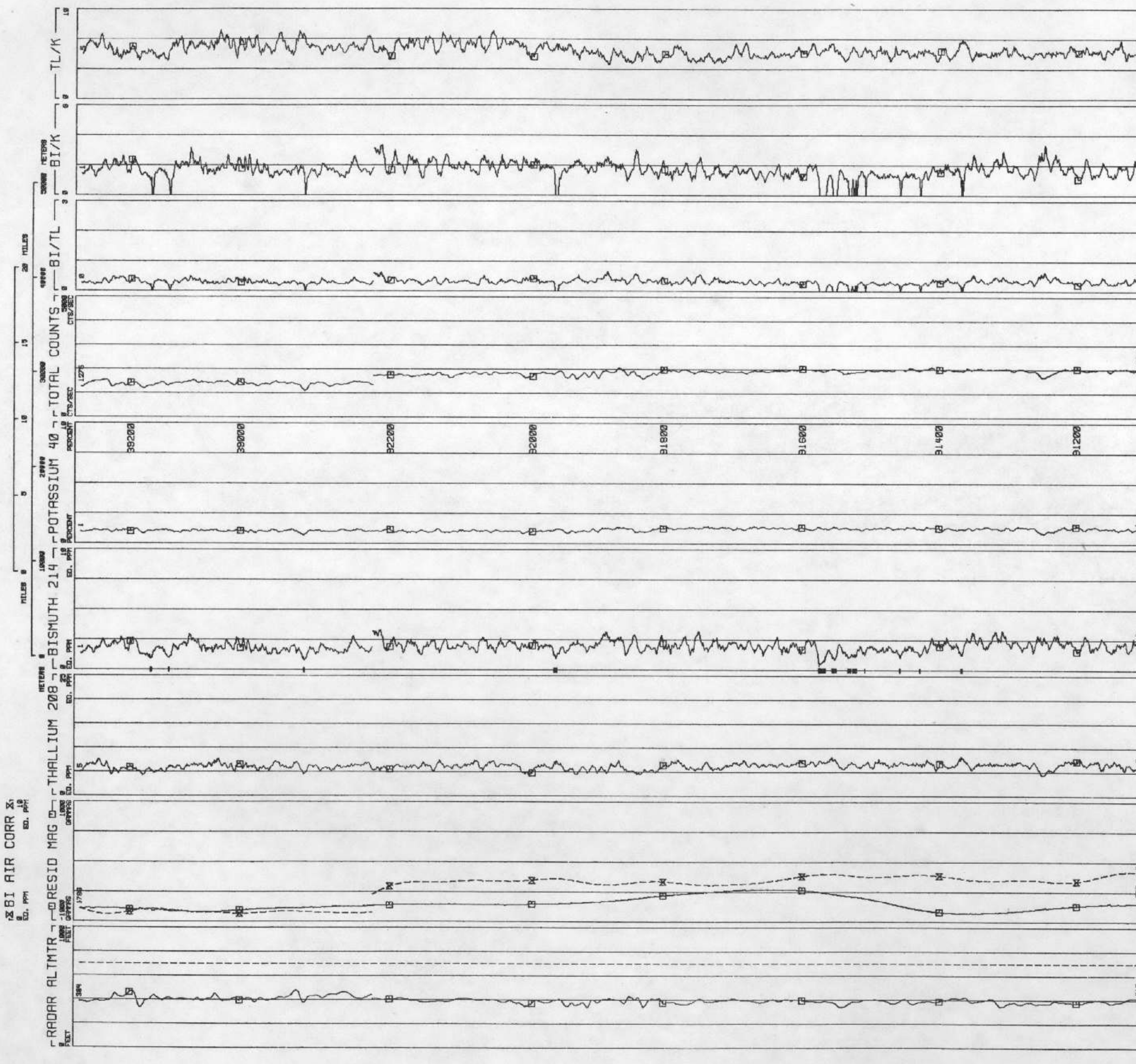
LINE 710




LINE 720
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339
TL/K
MIN .0000
MAX 8.146
MEAN 5.689
STD DEV 1.104
BI/K
MIN .0000
MAX 4.541
MEAN 1.966
STD DEV .6568
BI/TL
MIN .0000
MAX 1.099
MEAN .3470
STD DEV .1179
TOTAL COUNTS CTS/SEC
MIN 336.4
MAX 2288
MEAN 1667
STD DEV 203.5
POTASSIUM 40 PERCENT
MIN .1237
MAX 1.681
MEAN 1.035
STD DEV .1722
BISMUTH 214 EQ. PPM
MIN .8984
MAX 4.738
MEAN 2.076
STD DEV .4567
THALLIUM 208 EQ. PPM
MIN .8479
MAX 8.681
MEAN 5.831
STD DEV 1.085
BI AIR CORR EQ. PPM
MIN 1.781
MAX 3.117
MEAN 2.472
STD DEV .3074
RESID MAG GAMMAS
MIN -909.8
MAX -709.2
MEAN -831.6
STD DEV 36.93
RADAR ALTMTR FEET
MIN 271.2
MAX 593.6
MEAN 382.4
STD DEV 36.30
LINE 720

LINE 1010
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80338





TL/K
MIN 3.865
MAX 7.609
MEAN 5.437
STD DEV .6833

BI/K
MIN .0000
MAX 3.358
MEAN 1.705
STD DEV .5092

BI/TL
MIN .0000
MAX .6639
MEAN .3167
STD DEV .0972

TOTAL COUNTS CTS/SEC
MIN 1102
MAX 2089
MEAN 1748
STD DEV 245.1

POTASSIUM 40 PERCENT
MIN .7142
MAX 1.438
MEAN 1.150
STD DEV .1482

BISMUTH 214 EQ. PPM
MIN .0131
MAX 3.301
MEAN 1.987
STD DEV .4147

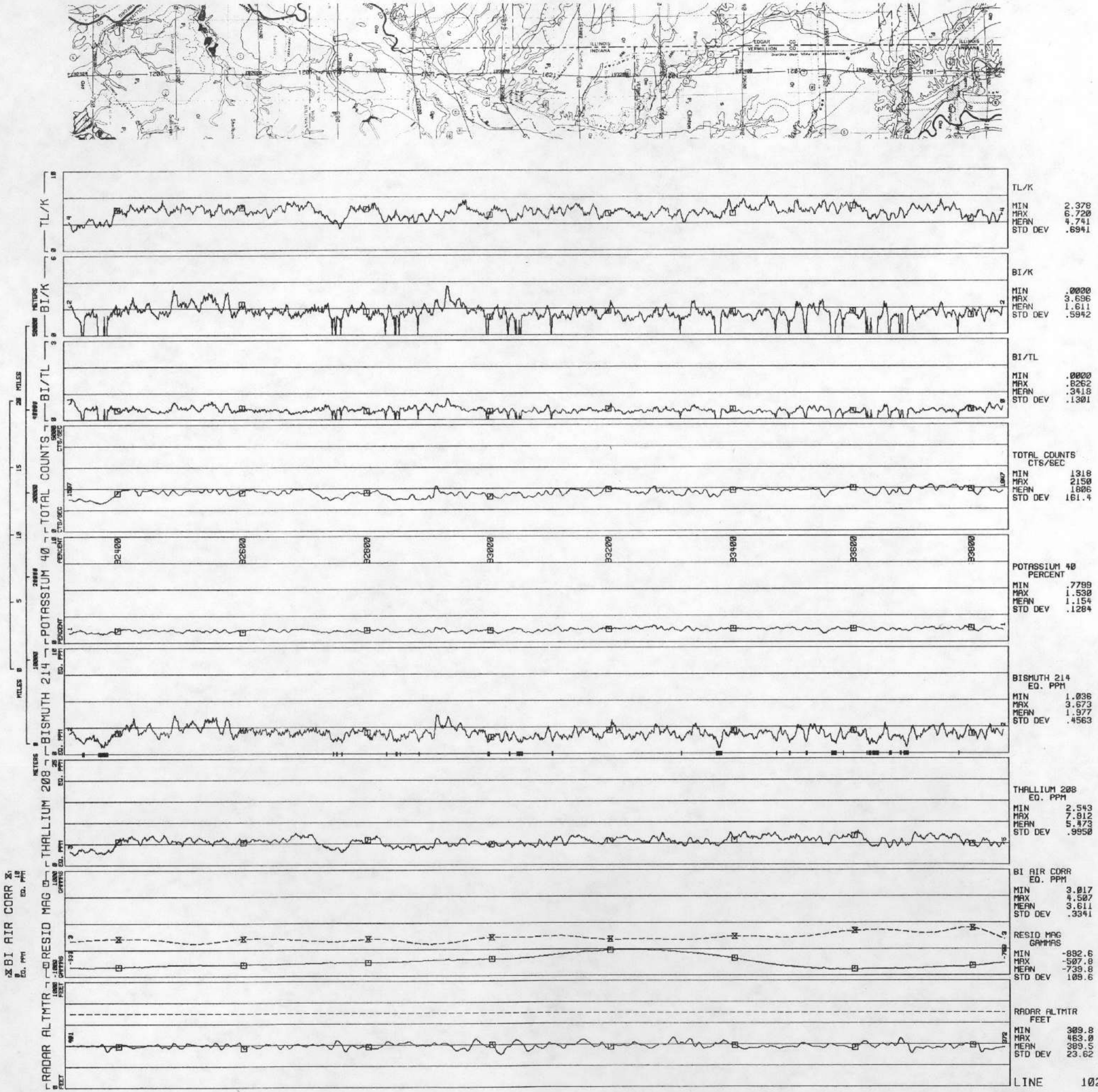
THALLIUM 208 EQ. PPM
MIN 4.269
MAX 8.211
MEAN 6.188
STD DEV .6727

BI AIR CORR EQ. PPM
MIN .5928
MAX 4.183
MEAN 2.692
STD DEV 1.257

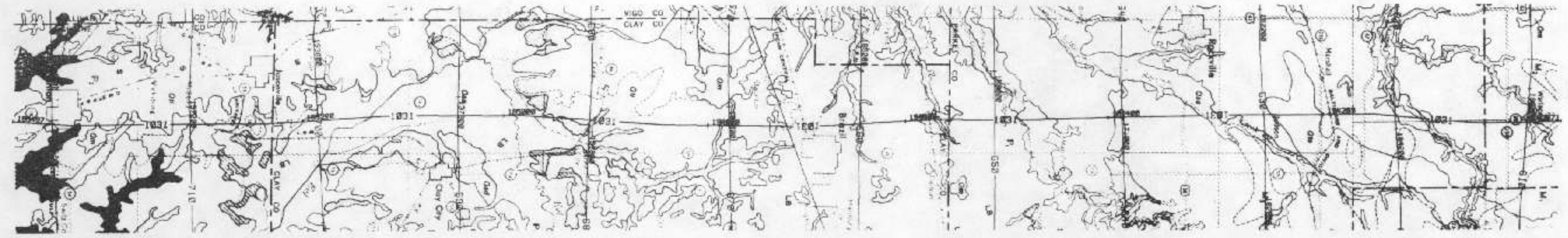
RESID MAG GAMMAS
MIN -861.4
MAX -457.7
MEAN -708.4
STD DEV 116.1

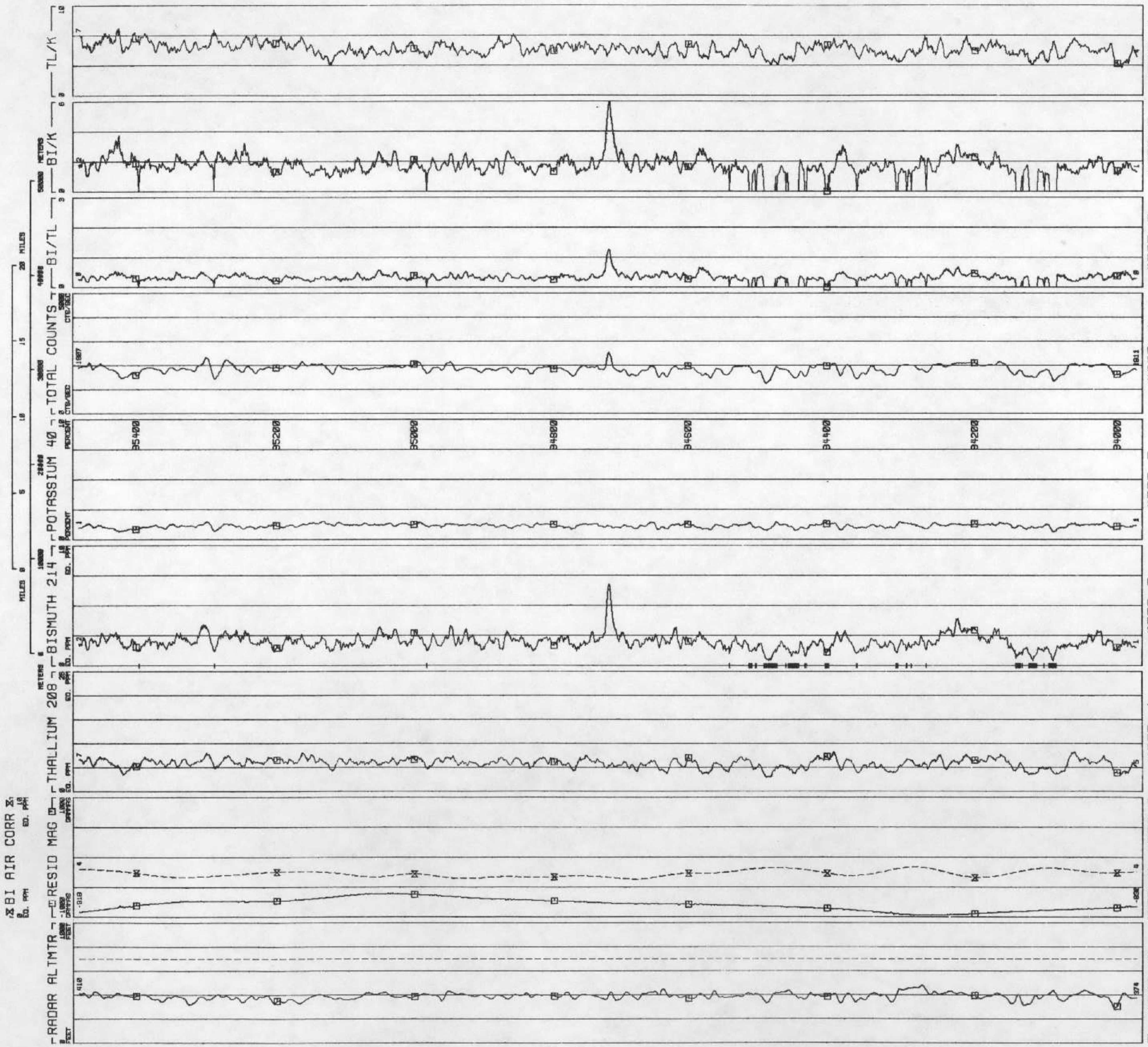
RADAR ALTMTR FEET
MIN 334.0
MAX 479.2
MEAN 395.0
STD DEV 21.78

LINE 1010


LINE 1020
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349
TL/K
MIN 2.378
MAX 6.720
MEAN 4.741
STD DEV .6941
BI/K
MIN .0000
MAX 3.696
MEAN 1.611
STD DEV .5942
BI/TL
MIN .0000
MAX .8262
MEAN .3418
STD DEV .1301
TOTAL COUNTS CTS/SEC
MIN 1318
MAX 2150
MEAN 1806
STD DEV 161.4
POTASSIUM 40 PERCENT
MIN .7799
MAX 1.530
MEAN 1.154
STD DEV .1284
BISMUTH 214 EQ. PPM
MIN 1.036
MAX 3.573
MEAN 1.977
STD DEV .4563
THALLIUM 208 EQ. PPM
MIN 2.543
MAX 7.812
MEAN 5.473
STD DEV .9950
BI AIR CORR EQ. PPM
MIN 3.017
MAX 4.507
MEAN 3.611
STD DEV .3341
RESID MAG GAMMAS
MIN -892.6
MAX -507.0
MEAN -739.8
STD DEV 109.6
RADAR ALTMTR FEET
MIN 309.8
MAX 463.0
MEAN 389.5
STD DEV 23.62
LINE 1020
32400
32600
32800
33000
33200
33400
33600
33800

LINE 1030
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349





TL/K
MIN 3.063
MAX 7.459
MEAN 5.152
STD DEV .7071

BI/K
MIN .0000
MAX 5.998
MEAN 1.696
STD DEV .6739

BI/TL
MIN .0000
MAX 1.264
MEAN .3290
STD DEV .1312

TOTAL COUNTS
CTS/SEC
MIN 1261
MAX 2517
MEAN 1845
STD DEV 172.4

POTASSIUM 40
PERCENT
MIN .6480
MAX 1.519
MEAN 1.134
STD DEV .1543

BISMUTH 214
EQ. PPM
MIN 1.068
MAX 6.726
MEAN 2.043
STD DEV .5555

THALLIUM 208
EQ. PPM
MIN 2.887
MAX 8.222
MEAN 5.820
STD DEV .9800

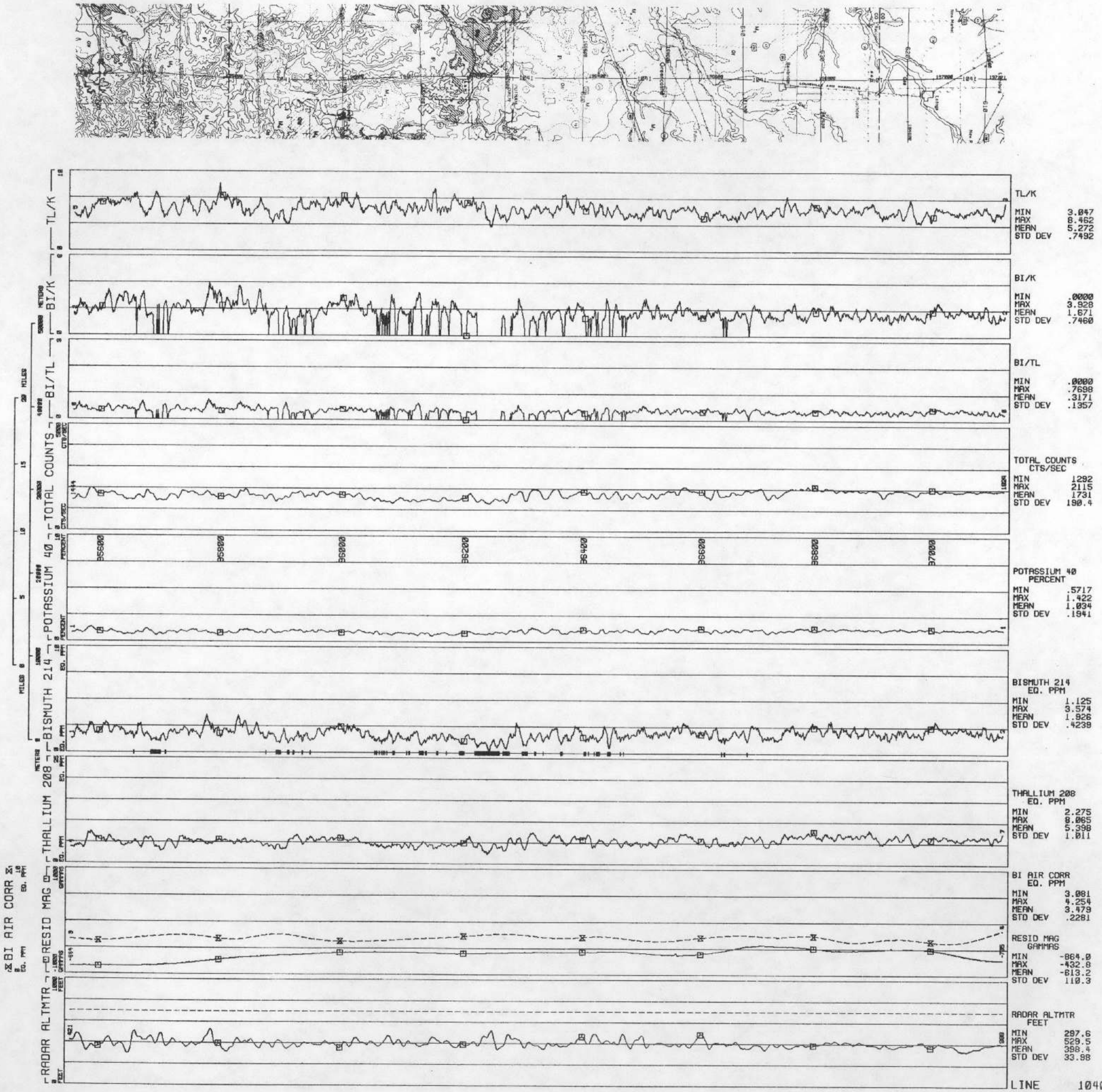
BI AIR CORR
EQ. PPM
MIN 3.139
MAX 4.195
MEAN 3.629
STD DEV .2639

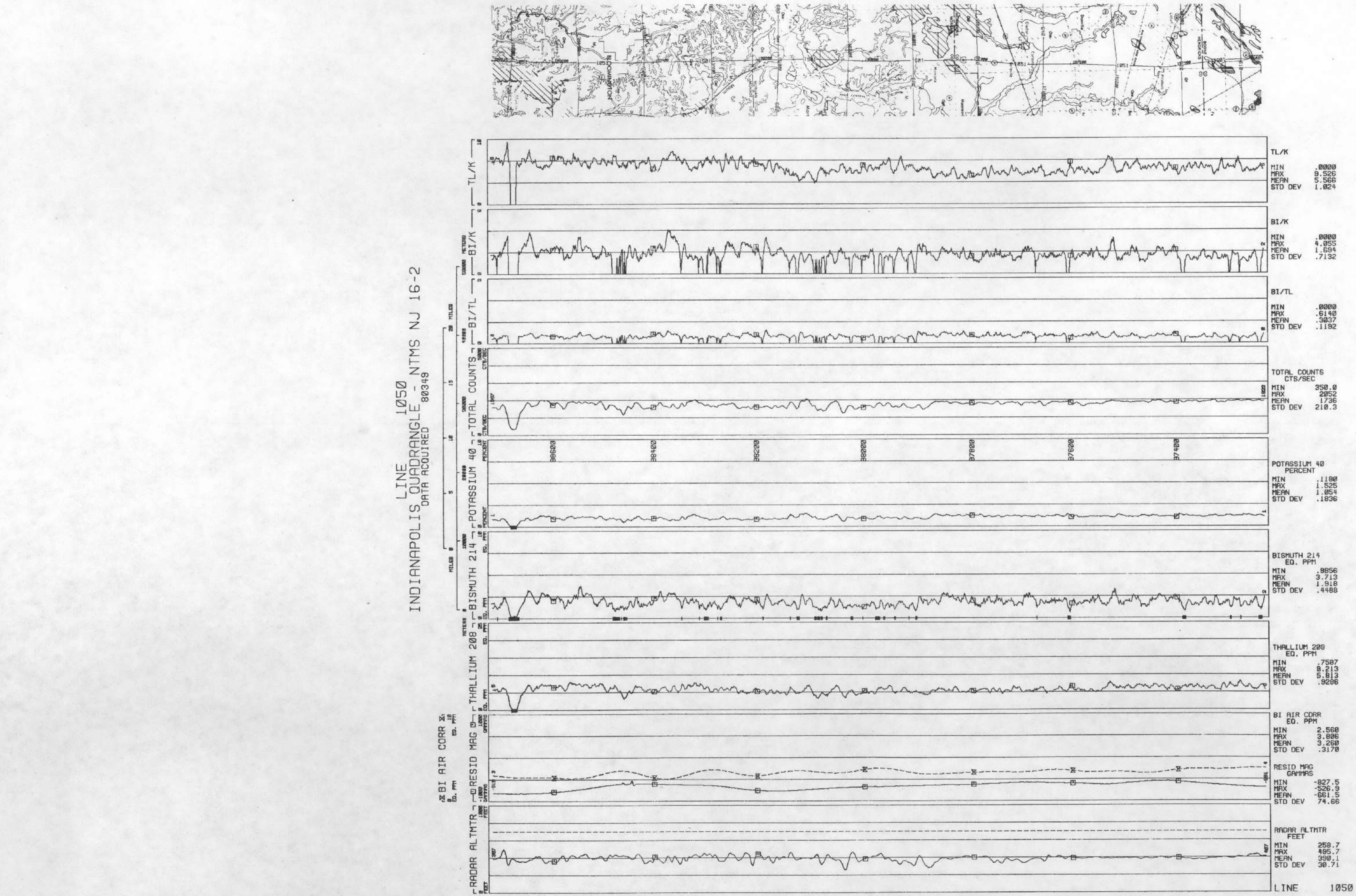
RESID MAG
GAMMAS
MIN -972.9
MAX -604.6
MEAN -793.3
STD DEV 99.58

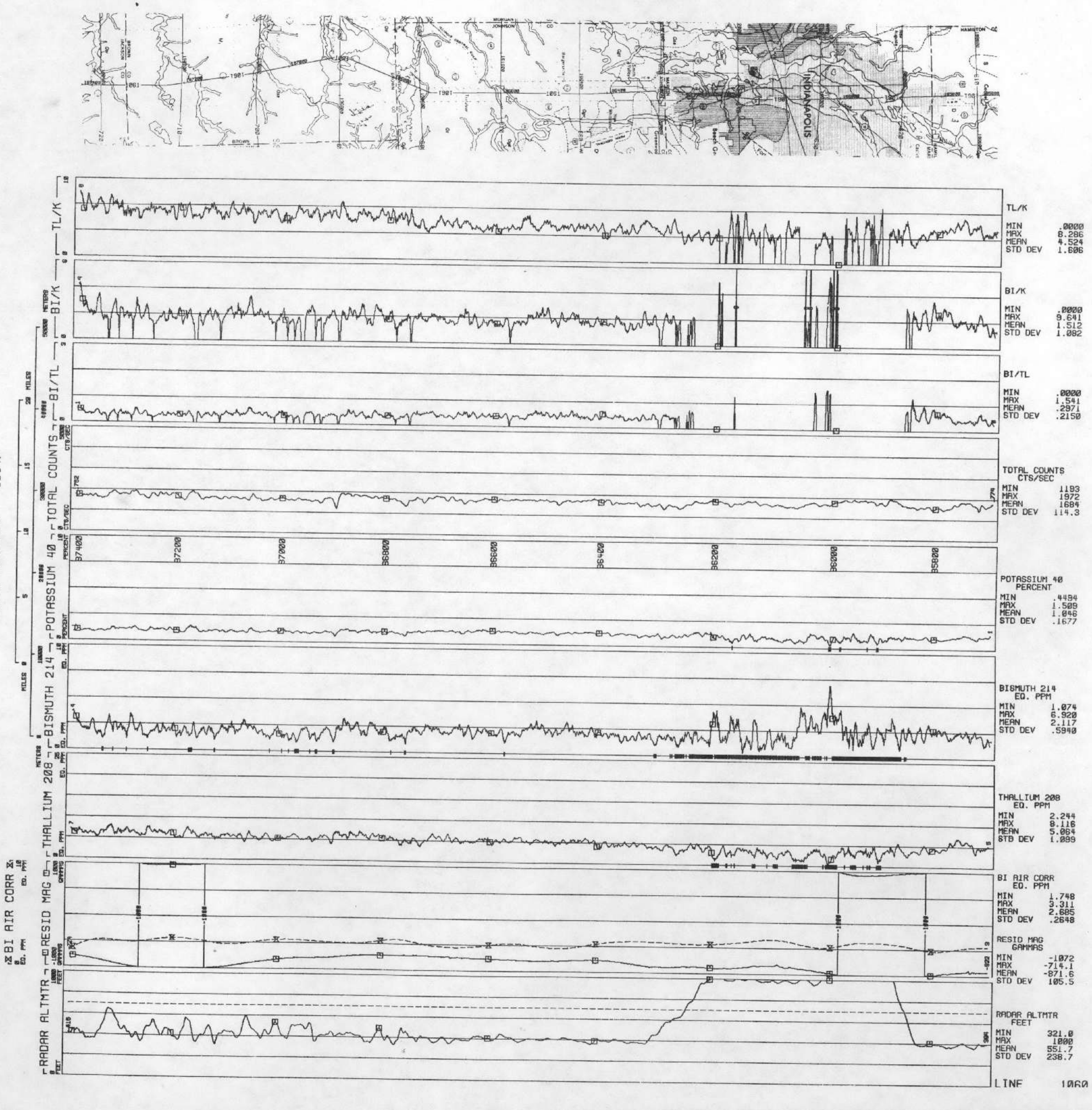
RADAR ALTMTR
FEET
MIN 293.2
MAX 478.4
MEAN 388.9
STD DEV 26.04

LINE 1030

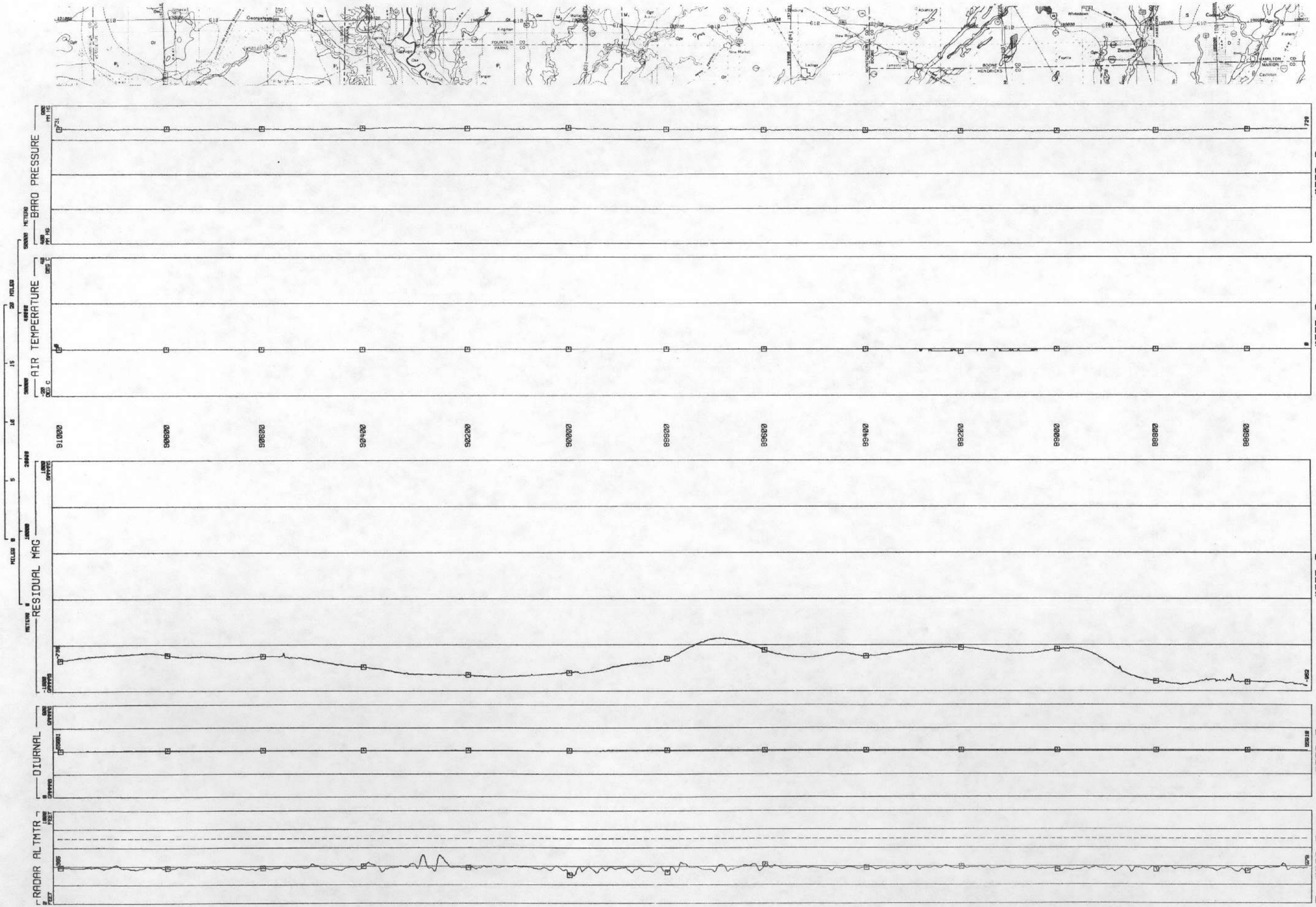
LINE 1040
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349




LINE 1050
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349
TL/K
MIN .0000
MAX 9.526
MEAN 5.566
STD DEV 1.024
BI/K
MIN .0000
MAX 4.055
MEAN 1.694
STD DEV .7132
BI/TL
MIN .0000
MAX .6140
MEAN .3037
STD DEV .1192
TOTAL COUNTS CTS/SEC
MIN 350.0
MAX 2052
MEAN 1736
STD DEV 210.3
POTASSIUM 40 PERCENT
MIN .1180
MAX 1.525
MEAN 1.054
STD DEV .1836
BISMUTH 214 EQ. PPM
MIN .9856
MAX 3.713
MEAN 1.918
STD DEV .4488
THALLIUM 208 EQ. PPM
MIN .7587
MAX 8.213
MEAN 5.813
STD DEV .9286
BI AIR CORR EQ. PPM
MIN 2.560
MAX 3.806
MEAN 3.260
STD DEV .3170
RESID MAG GAMMAS
MIN -827.5
MAX -526.9
MEAN -661.5
STD DEV 74.66
RADAR ALTMTR FEET
MIN 258.7
MAX 495.7
MEAN 390.1
STD DEV 30.71
LINE 1050


LINE 1060
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347
INDIANAPOLIS
TL/K
MIN .0000
MAX 8.286
MEAN 4.524
STD DEV 1.606
BI/K
MIN .0000
MAX 9.641
MEAN 1.512
STD DEV 1.092
BI/TL
MIN .0000
MAX 1.541
MEAN .2971
STD DEV .2150
TOTAL COUNTS CTS/SEC
MIN 1193
MAX 1972
MEAN 1684
STD DEV 114.3
POTASSIUM 40 PERCENT
MIN .4494
MAX 1.509
MEAN 1.046
STD DEV .1677
BISMUTH 214 EQ. PPM
MIN 1.074
MAX 6.920
MEAN 2.117
STD DEV .5940
THALLIUM 208 EQ. PPM
MIN 2.244
MAX 8.116
MEAN 5.064
STD DEV 1.099
BI AIR CORR EQ. PPM
MIN 1.748
MAX 3.311
MEAN 2.685
STD DEV .2648
RESID MAG GAMMAS
MIN -1072
MAX -714.1
MEAN -871.6
STD DEV 105.5
RADAR ALTMTR FEET
MIN 321.0
MAX 1000
MEAN 551.7
STD DEV 238.7
87400
87200
87000
86800
86600
86400
86200
86000
85800
LINE 1060

LINE 610
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349



BARO PRESSURE
MM HG

MIN	721.5
MAX	735.7
MEAN	728.2
STD DEV	3.317

AIR TEMPERATURE
DEG C

MIN	-1.000
MAX	.0000
MEAN	-.0527
STD DEV	.2233

RESIDUAL MAG
GAMMAS

MIN	-951.8
MAX	-541.3
MEAN	-750.3
STD DEV	105.8

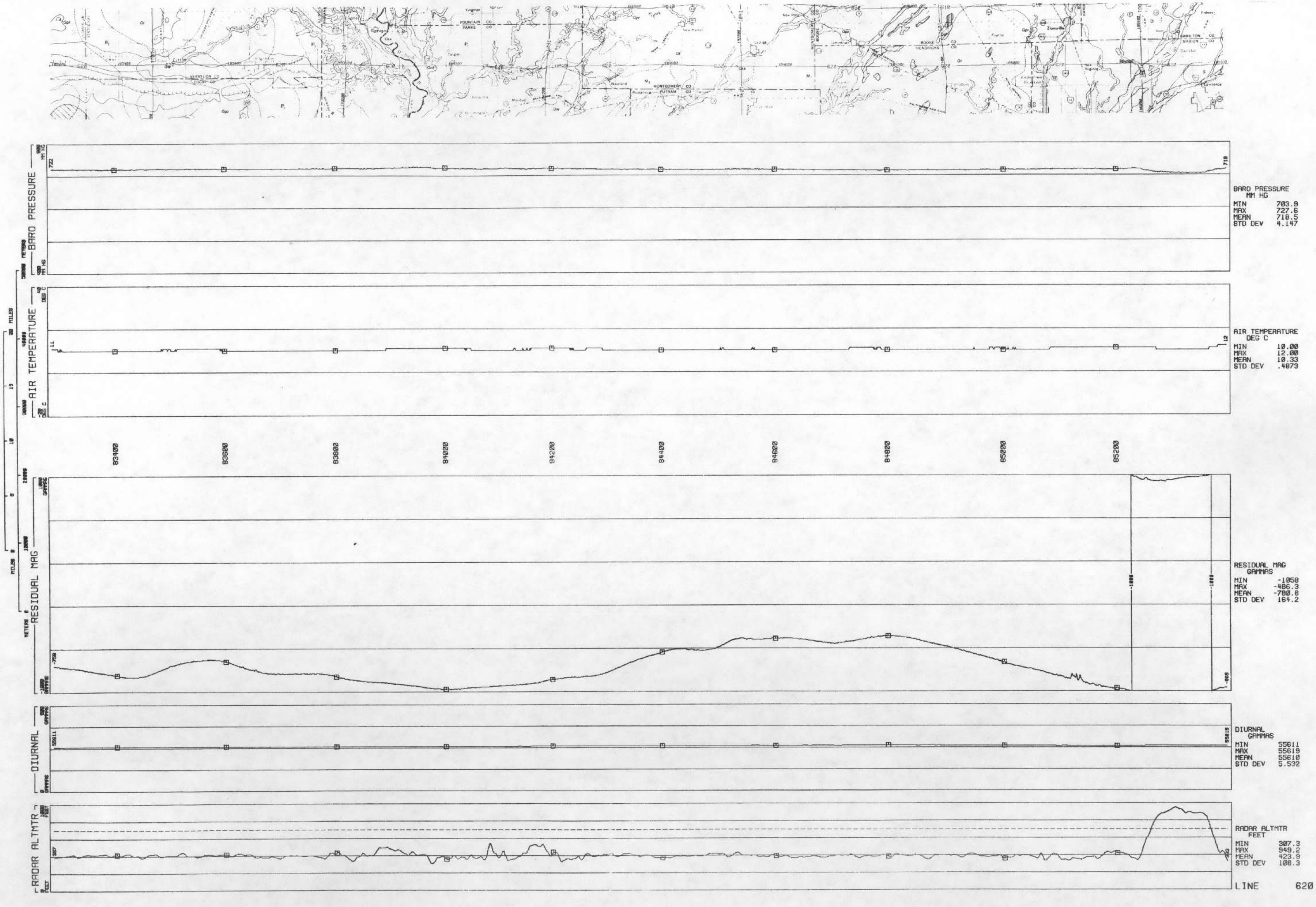
DIURNAL
GAMMAS

MIN	55601
MAX	55610
MEAN	55600
STD DEV	7.154

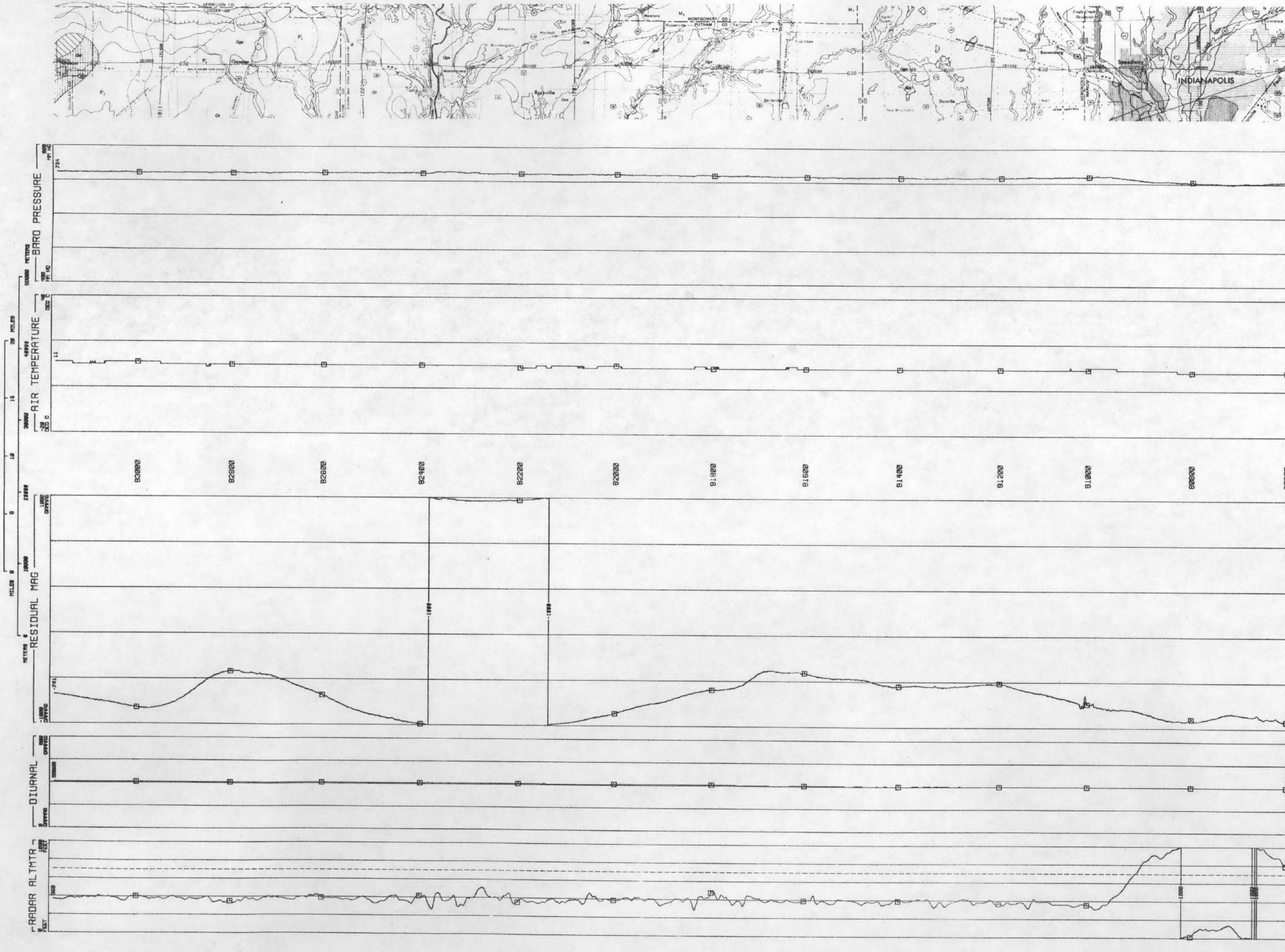
RADAR ALTMTR
FEET

MIN	300.2
MAX	521.5
MEAN	382.7
STD DEV	20.65

LINE 620
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347



LINE 630
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347



BARO PRESSURE
MM HG
MIN 697.9
MAX 728.2
MEAN 718.4
STD DEV 6.393

AIR TEMPERATURE
DEG C
MIN 8.000
MAX 11.00
MEAN 8.436
STD DEV .7378

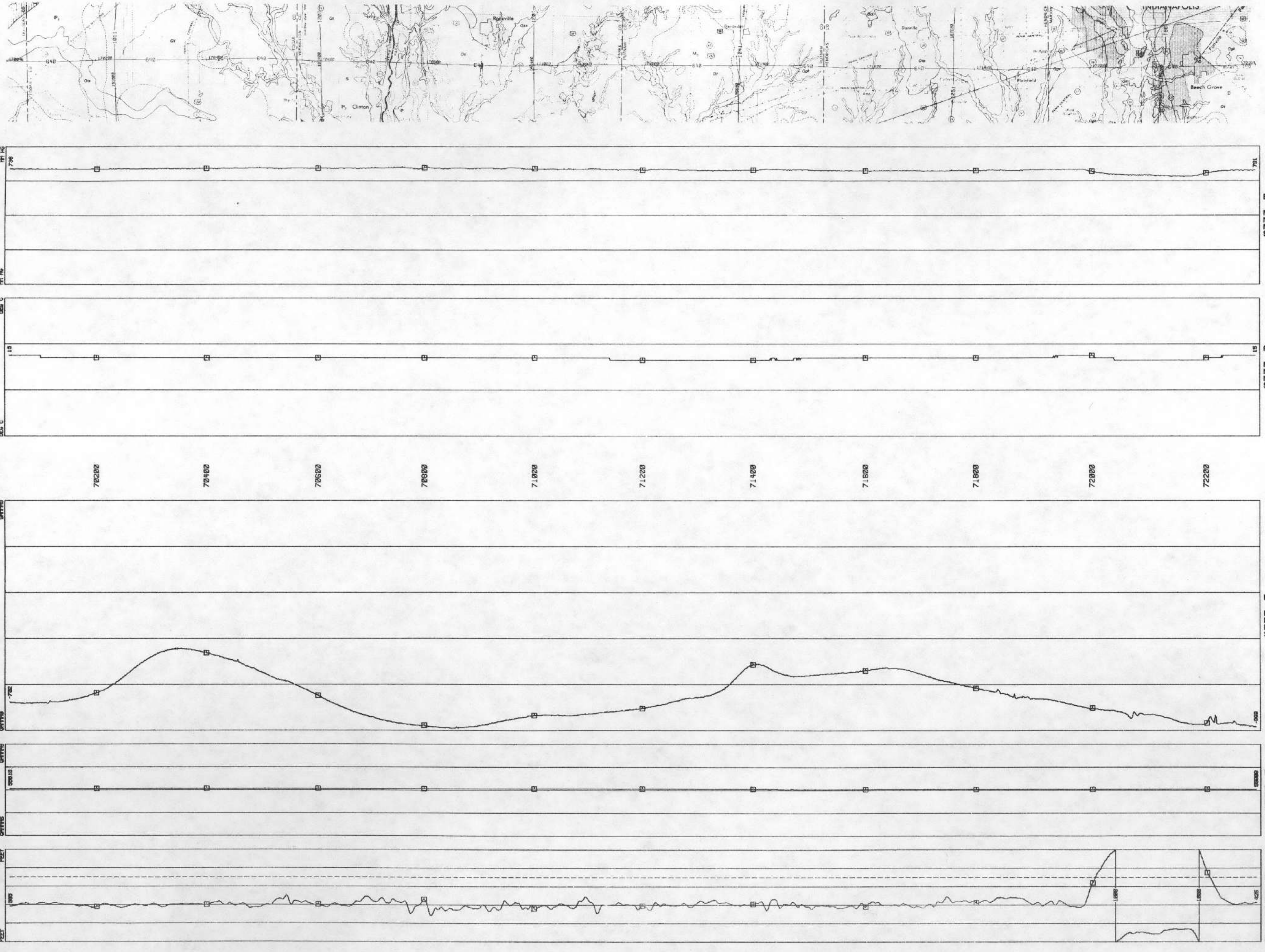
RESIDUAL MAG
GAMMAS
MIN -1031
MAX -506.5
MEAN -774.4
STD DEV 154.7

DIURNAL
GAMMAS
MIN 55598
MAX 55610
MEAN 55600
STD DEV 5.787

RADAR ALTMTR
FEET
MIN 269.0
MAX 1143
MEAN 457.9
STD DEV 200.7

LINE 630

LINE 640
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80341



BARO PRESSURE
MM HG
MIN 712.3
MAX 740.7
MEAN 732.1
STD DEV 5.579

AIR TEMPERATURE
DEG C
MIN 13.00
MAX 15.00
MEAN 13.86
STD DEV .5262

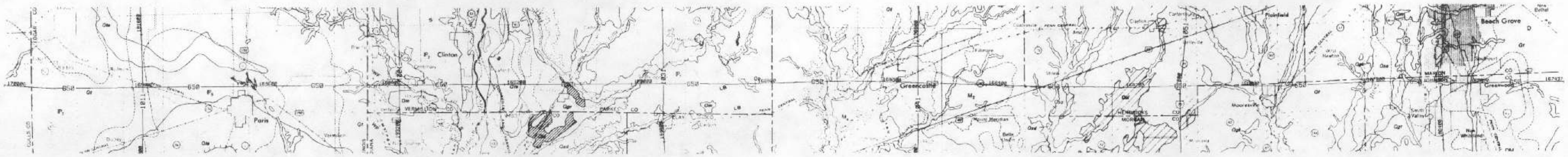
RESIDUAL MAG
GAMMAS
MIN -900.9
MAX -285.3
MEAN -699.6
STD DEV 183.5

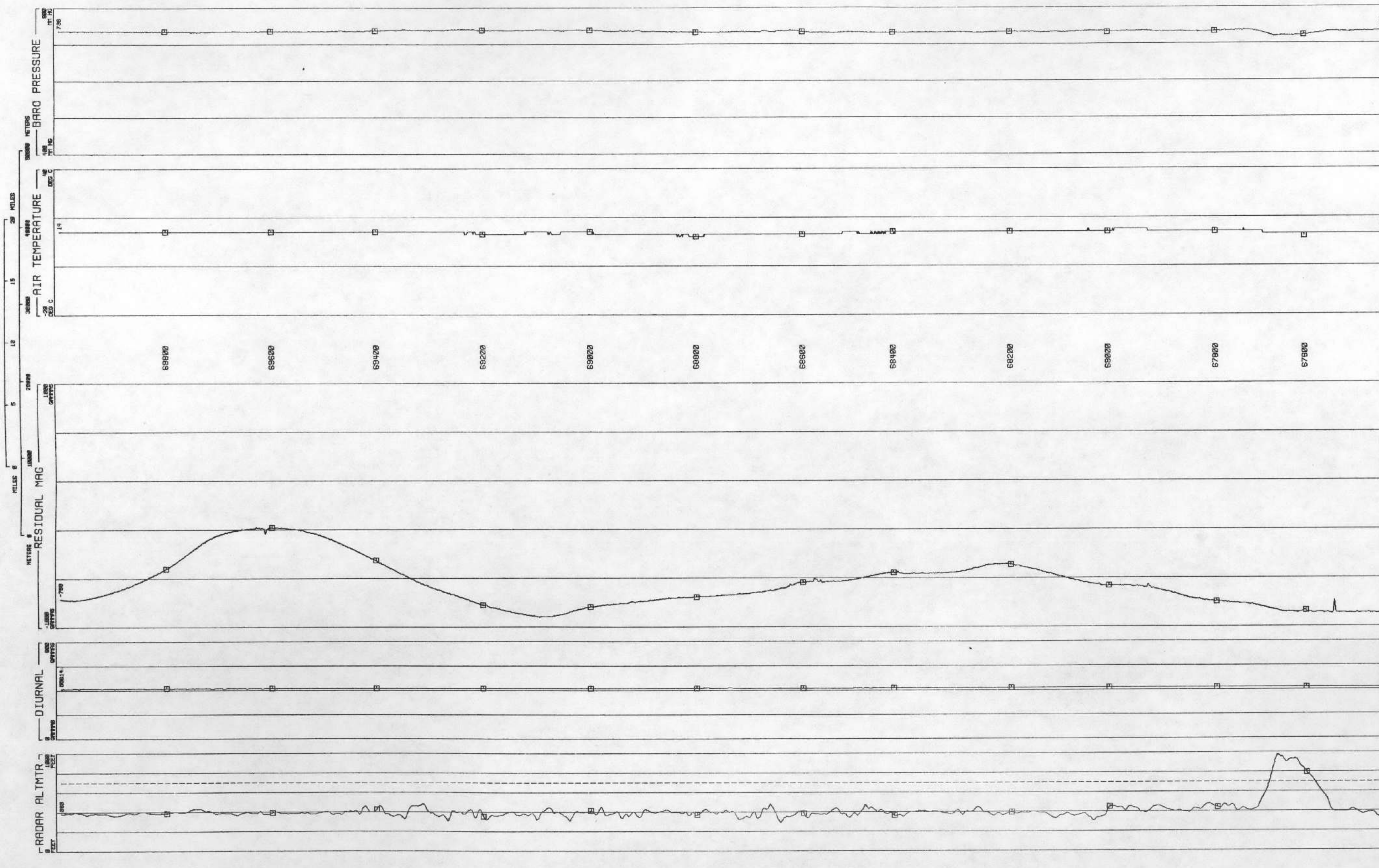
DIURNAL
GAMMAS
MIN 55608
MAX 55614
MEAN 55605
STD DEV 5.641

RADAR ALTMTR
FEET
MIN 284.7
MAX 1142
MEAN 464.7
STD DEV 186.1

LINE 640

LINE 650
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80341





BARO PRESSURE
MM HG
MIN 718.6
MAX 741.3
MEAN 734.0
STD DEV 3.684

AIR TEMPERATURE
DEG C
MIN 12.00
MAX 15.00
MEAN 13.66
STD DEV .5555

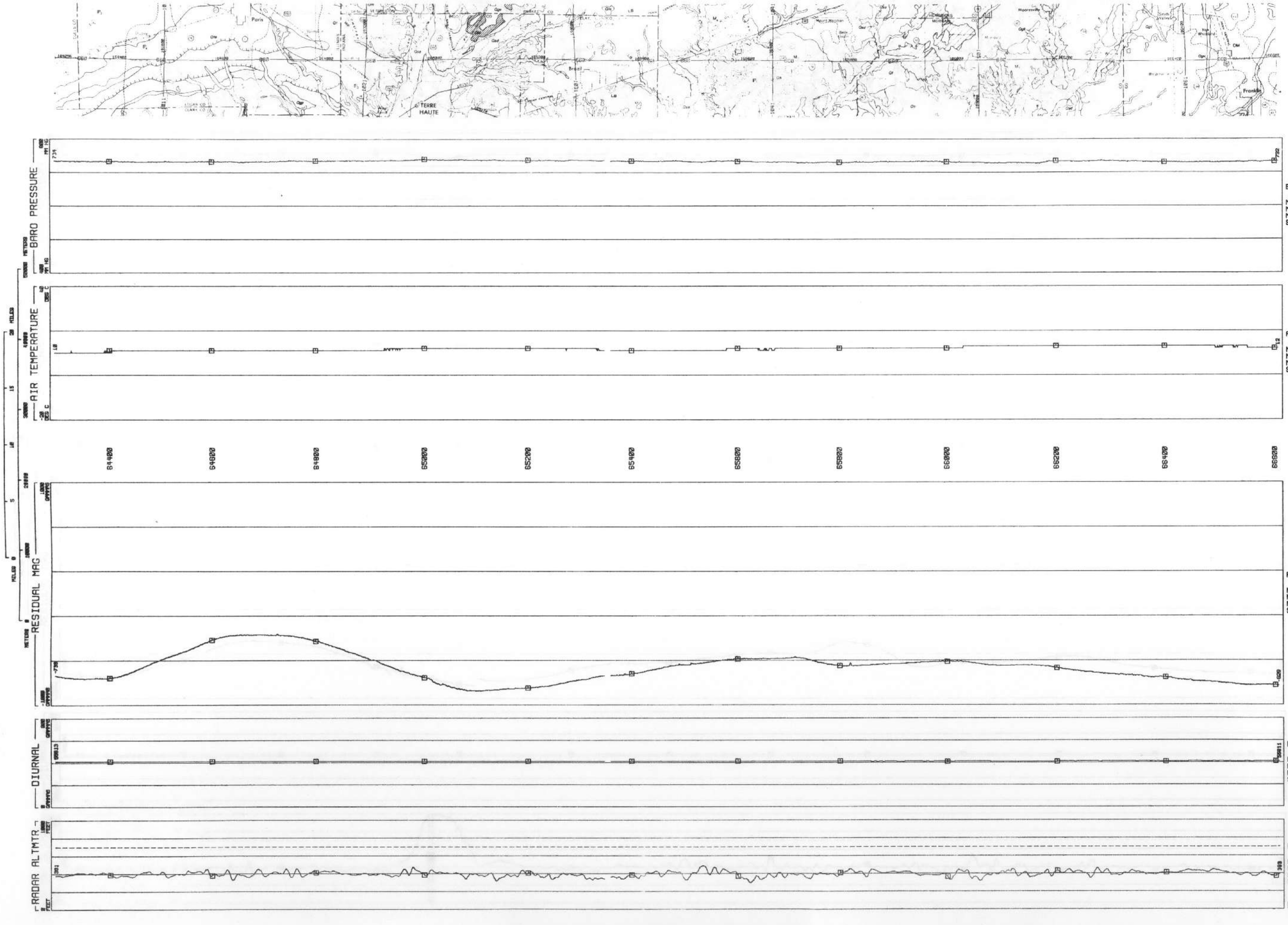
RESIDUAL MAG
GAMMAS
MIN -918.6
MAX -179.7
MEAN -647.9
STD DEV 197.2

DIURNAL
GAMMAS
MIN 55614
MAX 55621
MEAN 55614
STD DEV 4.104

RADAR ALTMTR
FEET
MIN 283.0
MAX 974.6
MEAN 417.4
STD DEV 106.2

LINE 650

LINE 660
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80340



BARO PRESSURE
MM HG
MIN 726.9
MAX 739.7
MEAN 733.0
STD DEV 2.442

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 13.00
MEAN 11.79
STD DEV .8338

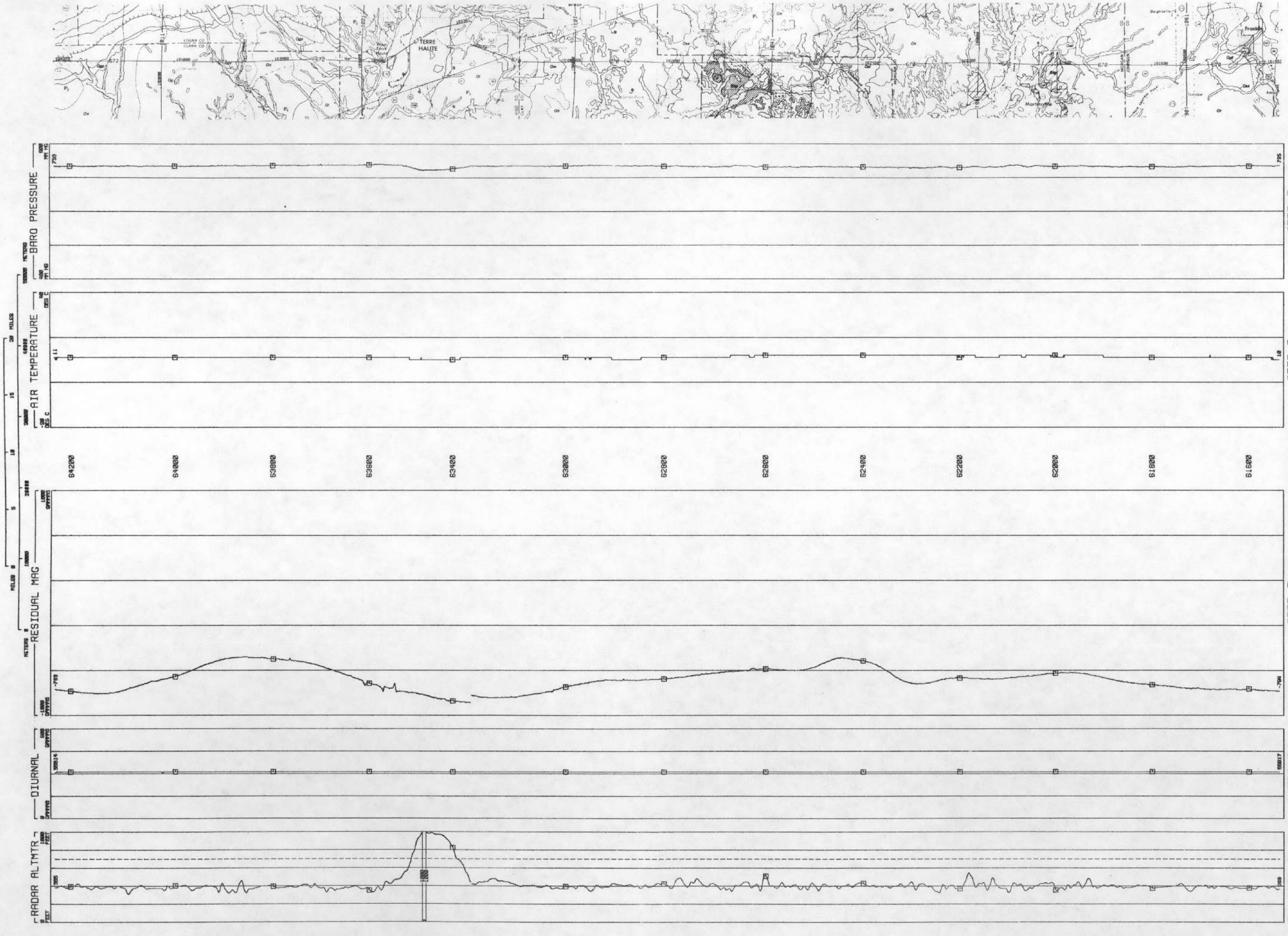
RESIDUAL MAG
GAMMAS
MIN -876.1
MAX -362.0
MEAN -661.6
STD DEV 130.4

DIURNAL
GAMMAS
MIN 55610
MAX 55614
MEAN 55605
STD DEV 6.033

RADAR ALTMTR
FEET
MIN 295.1
MAX 486.0
MEAN 395.7
STD DEV 28.11

LINE 660

LINE 670
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80340



BARO PRESSURE
MM HG
MIN 722.0
MAX 740.7
MEAN 733.4
STD DEV 2.898

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 12.00
MEAN 11.18
STD DEV .5642

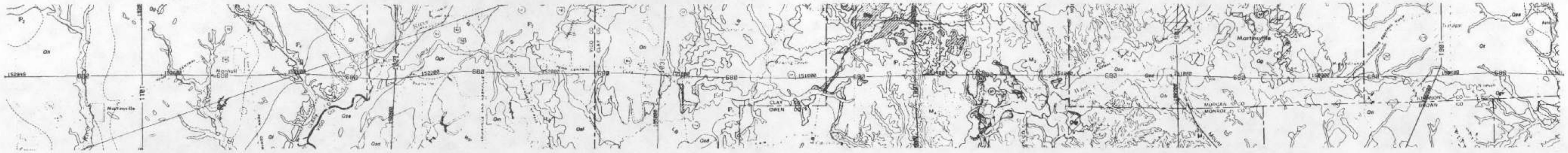
RESIDUAL MAG
GAMMAS
MIN -886.7
MAX -479.1
MEAN -680.6
STD DEV 101.1

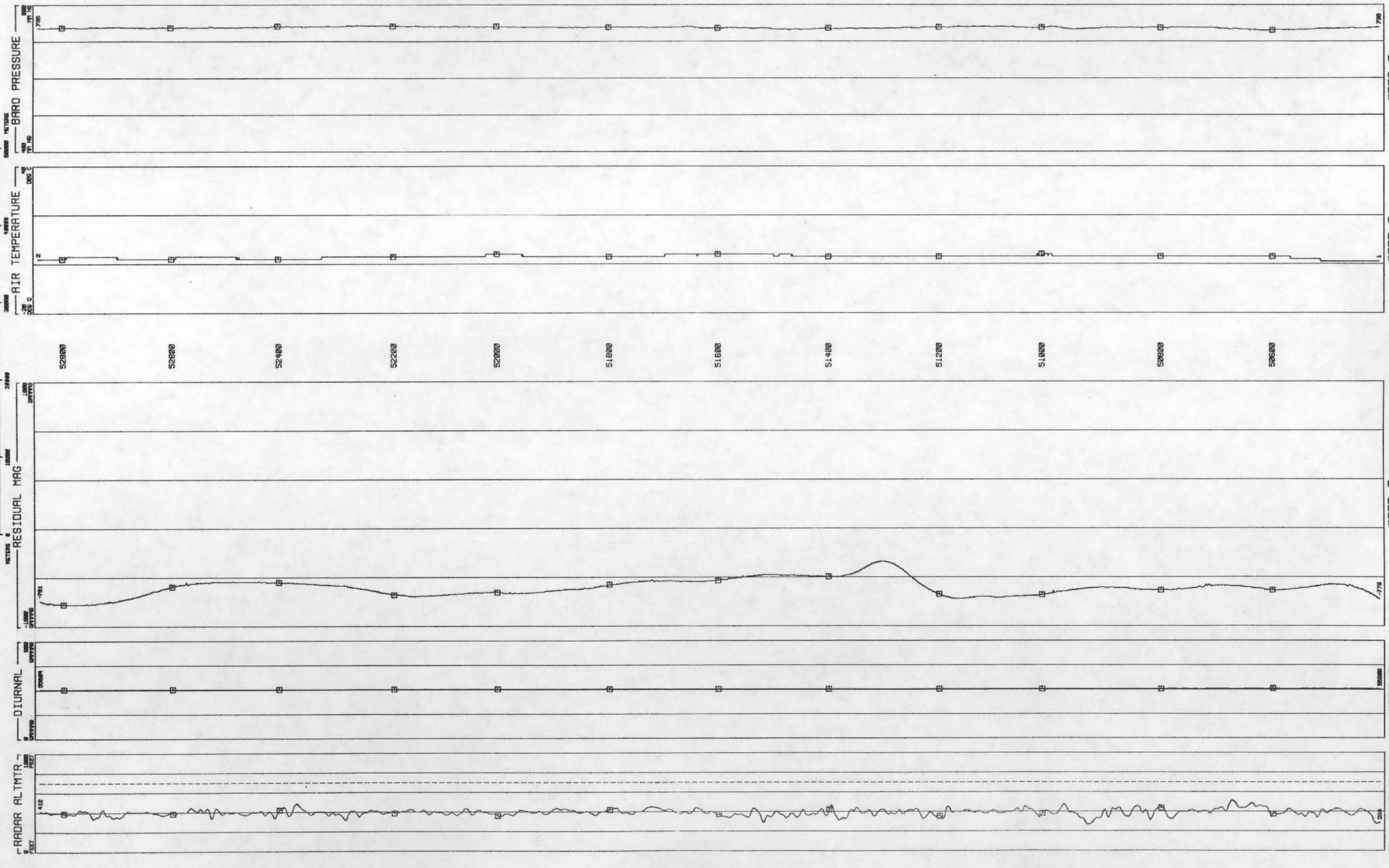
DIURNAL
GAMMAS
MIN 55614
MAX 55618
MEAN 55610
STD DEV 5.249

RADAR ALTMTR
FEET
MIN 310.2
MAX 1018
MEAN 426.1
STD DEV 119.8

LINE 670

LINE 680
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339





BARO PRESSURE
MM HG
MIN 729.7
MAX 743.4
MEAN 737.4
STD DEV 2.529

AIR TEMPERATURE
DEG C
MIN 1.000
MAX 4.000
MEAN 2.895
STD DEV .6567

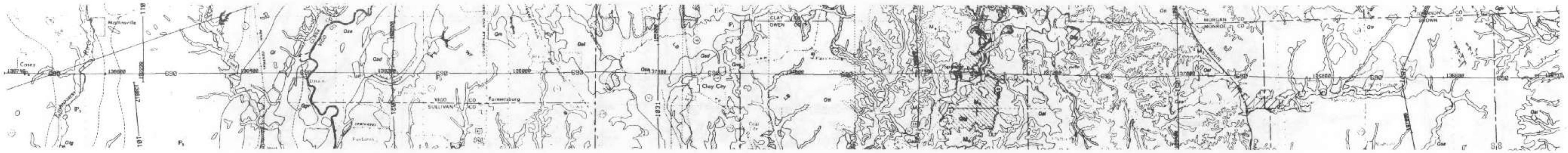
RESIDUAL MAG
GAMMAS
MIN -821.7
MAX -471.4
MEAN -685.1
STD DEV 68.54

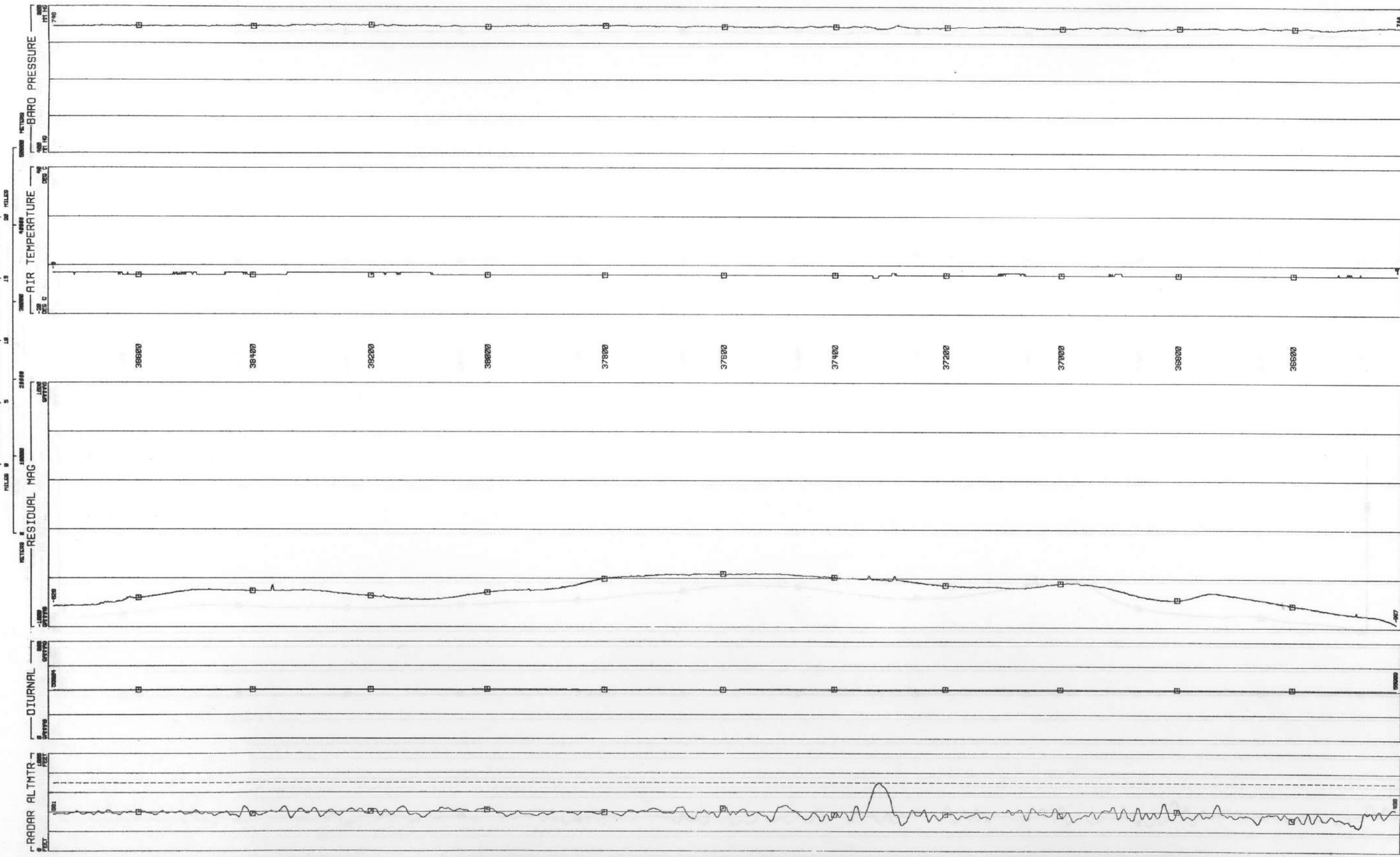
DIURNAL
GAMMAS
MIN 55604
MAX 55606
MEAN 55601
STD DEV 4.801

RADAR ALTMTR
FEET
MIN 269.2
MAX 515.6
MEAN 393.3
STD DEV 31.87

LINE 680

LINE 690
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80338





BARO PRESSURE
MM HG

MIN	737.8
MAX	751.8
MEAN	745.5
STD DEV	2.709

AIR TEMPERATURE
DEG C

MIN	-5.000
MAX	-3.000
MEAN	-3.797
STD DEV	.4125

RESIDUAL MAG
GAMMAS

MIN	-966.5
MAX	-561.5
MEAN	-699.5
STD DEV	89.70

DIURNAL
GAMMAS

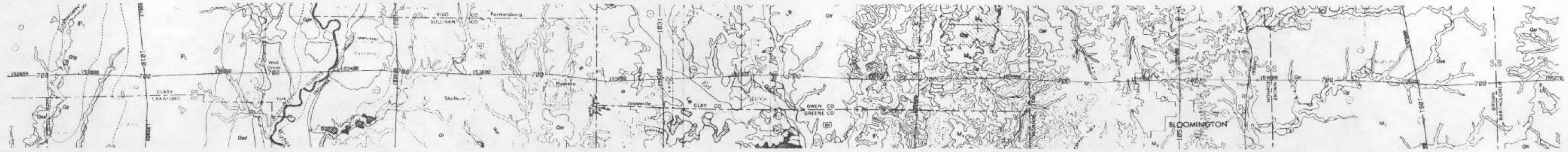
MIN	55604
MAX	55609
MEAN	55601
STD DEV	5.620

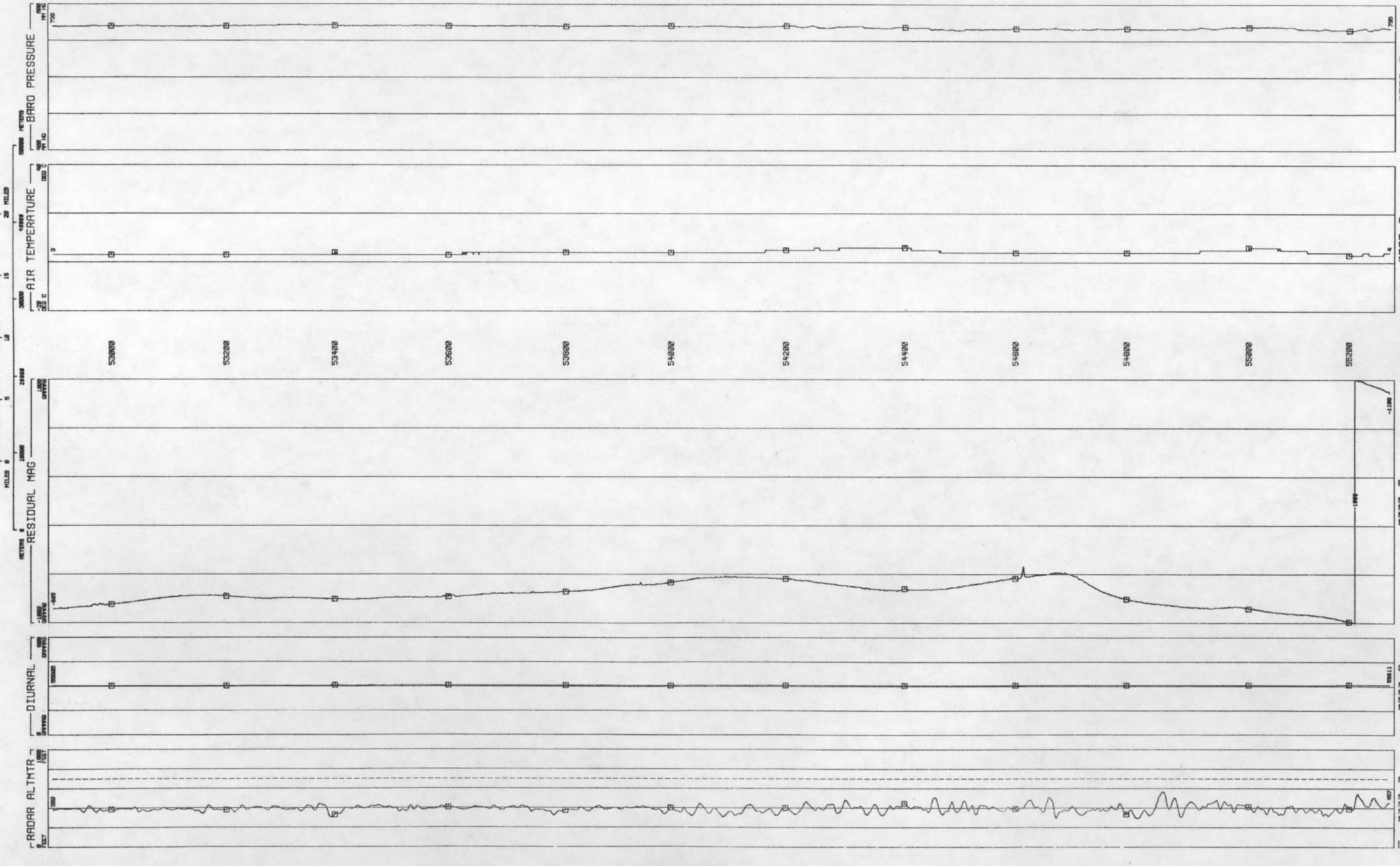
RADAR ALTMTR
FEET

MIN	250.0
MAX	696.7
MEAN	386.5
STD DEV	48.47

LINE 690

LINE 700
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339





BARO PRESSURE
MM HG
MIN 728.4
MAX 743.4
MEAN 737.5
STD DEV 3.396

AIR TEMPERATURE
DEG C
MIN 3.000
MAX 6.000
MEAN 3.964
STD DEV .8849

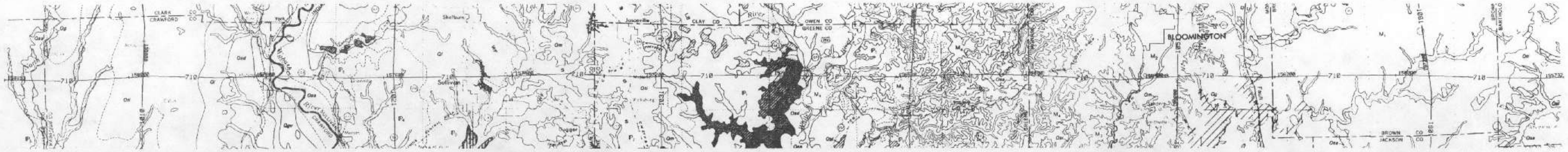
RESIDUAL MAG
GAMMAS
MIN -1106
MAX -537.8
MEAN -770.9
STD DEV 102.9

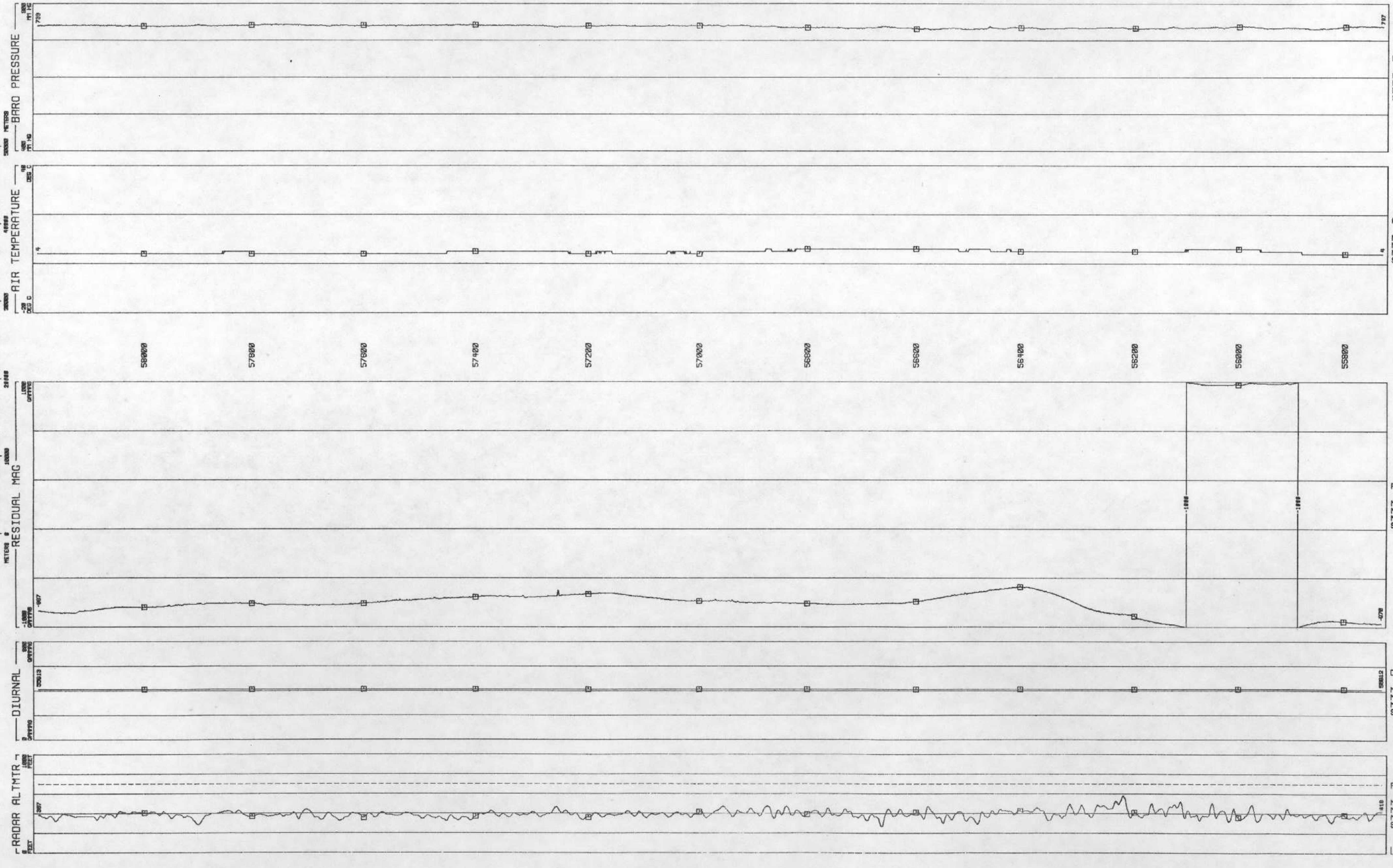
DIURNAL
GAMMAS
MIN 55604
MAX 55611
MEAN 55601
STD DEV 6.737

RADAR ALTMTR
FEET
MIN 292.8
MAX 567.2
MEAN 392.8
STD DEV 35.19

LINE 700

LINE 710
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339





BARO PRESSURE
MM HG
MIN 730.0
MAX 743.4
MEAN 737.3
STD DEV 3.215

AIR TEMPERATURE
DEG C
MIN 4.000
MAX 6.000
MEAN 4.799
STD DEV .7643

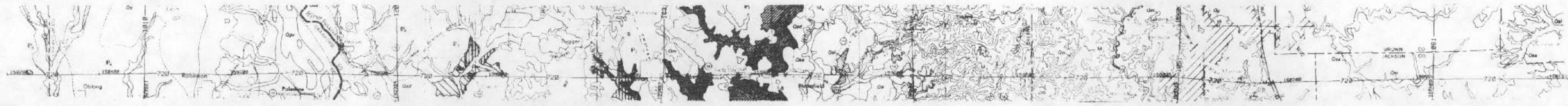
RESIDUAL MAG
GAMMAS
MIN -1026
MAX -671.0
MEAN -820.6
STD DEV 90.34

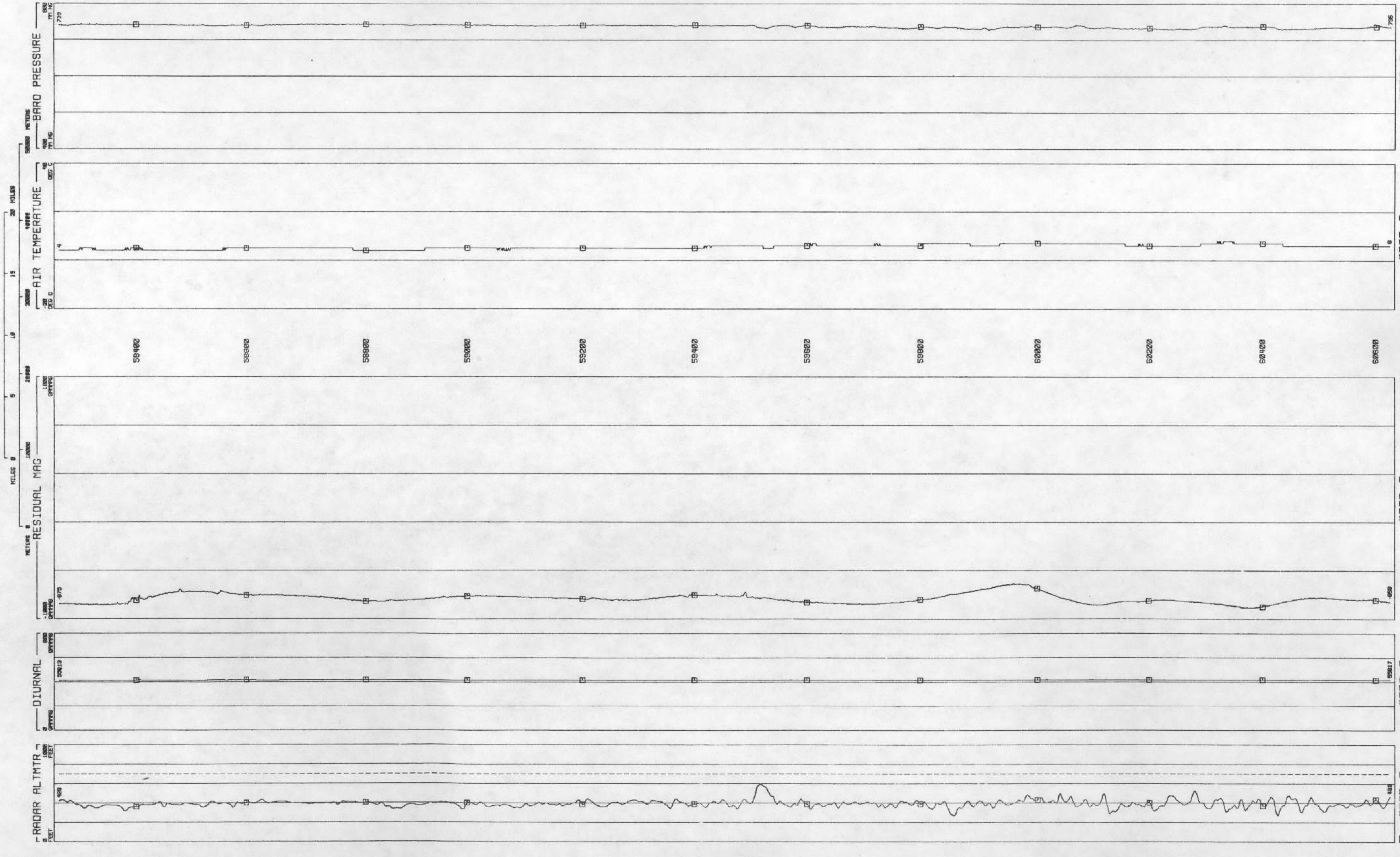
DIURNAL
GAMMAS
MIN 55611
MAX 55613
MEAN 55605
STD DEV 7.473

RADAR ALTMTR
FEET
MIN 269.1
MAX 580.6
MEAN 391.3
STD DEV 36.84

LINE 710

LINE 720
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80339





BARO PRESSURE
MM HG
MIN 727.9
MAX 743.4
MEAN 737.6
STD DEV 3.561

AIR TEMPERATURE
DEG C
MIN 4.000
MAX 8.000
MEAN 5.552
STD DEV 1.009

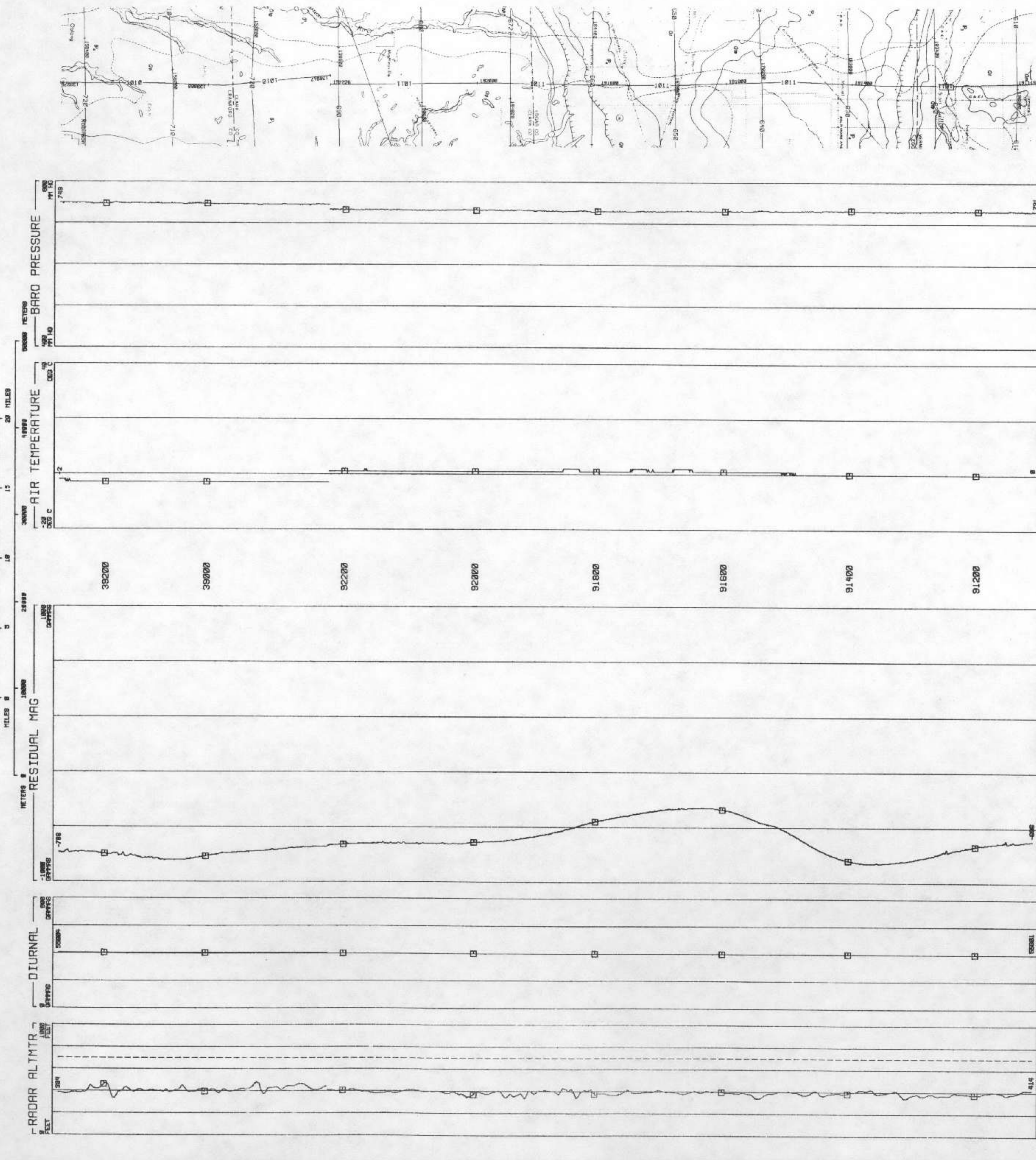
RESIDUAL MAG
GAMMAS
MIN -909.8
MAX -709.2
MEAN -831.6
STD DEV 36.93

DIURNAL
GAMMAS
MIN 55613
MAX 55618
MEAN 55614
STD DEV 2.240

RADAR ALTMTR
FEET
MIN 271.2
MAX 593.6
MEAN 392.4
STD DEV 36.30

LINE 720

LINE 1010
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80338



BARO PRESSURE
MM HG
MIN 727.6
MAX 750.2
MEAN 735.6
STD DEV 7.282

AIR TEMPERATURE
DEG C
MIN -3.000
MAX 2.000
MEAN -.3505
STD DEV 1.760

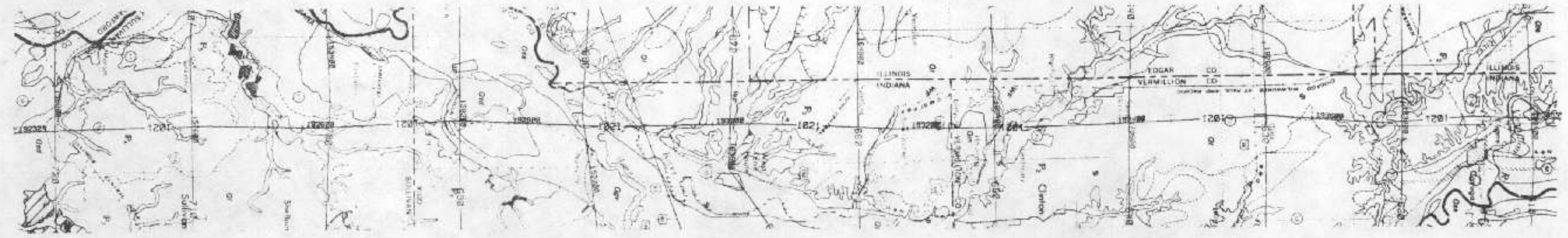
RESIDUAL MAG
GAMMAS
MIN -861.4
MAX -457.7
MEAN -708.4
STD DEV 116.1

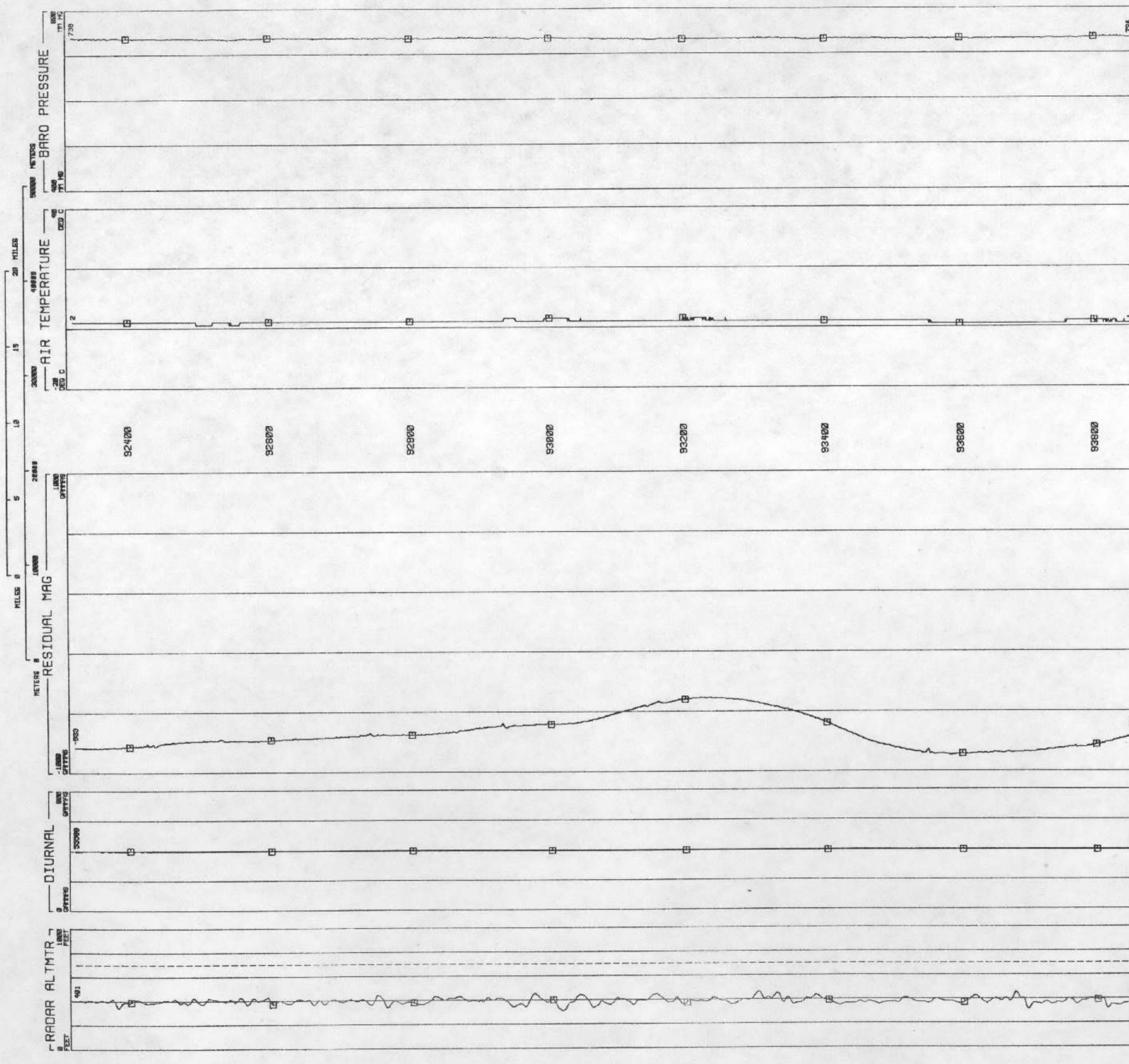
DIURNAL
GAMMAS
MIN 55599
MAX 55605
MEAN 55600
STD DEV 2.615

RADAR ALTMTR
FEET
MIN 334.0
MAX 479.2
MEAN 395.0
STD DEV 21.78

LINE 1010

LINE 1020
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349





BARO PRESSURE
MM HG

MIN	730.3
MAX	738.4
MEAN	733.9
STD DEV	1.700

AIR TEMPERATURE
DEG C

MIN	1.000
MAX	3.000
MEAN	1.878
STD DEV	.4583

RESIDUAL MAG
GAMMAS

MIN	-892.6
MAX	-507.8
MEAN	-739.8
STD DEV	109.6

DIURNAL
GAMMAS

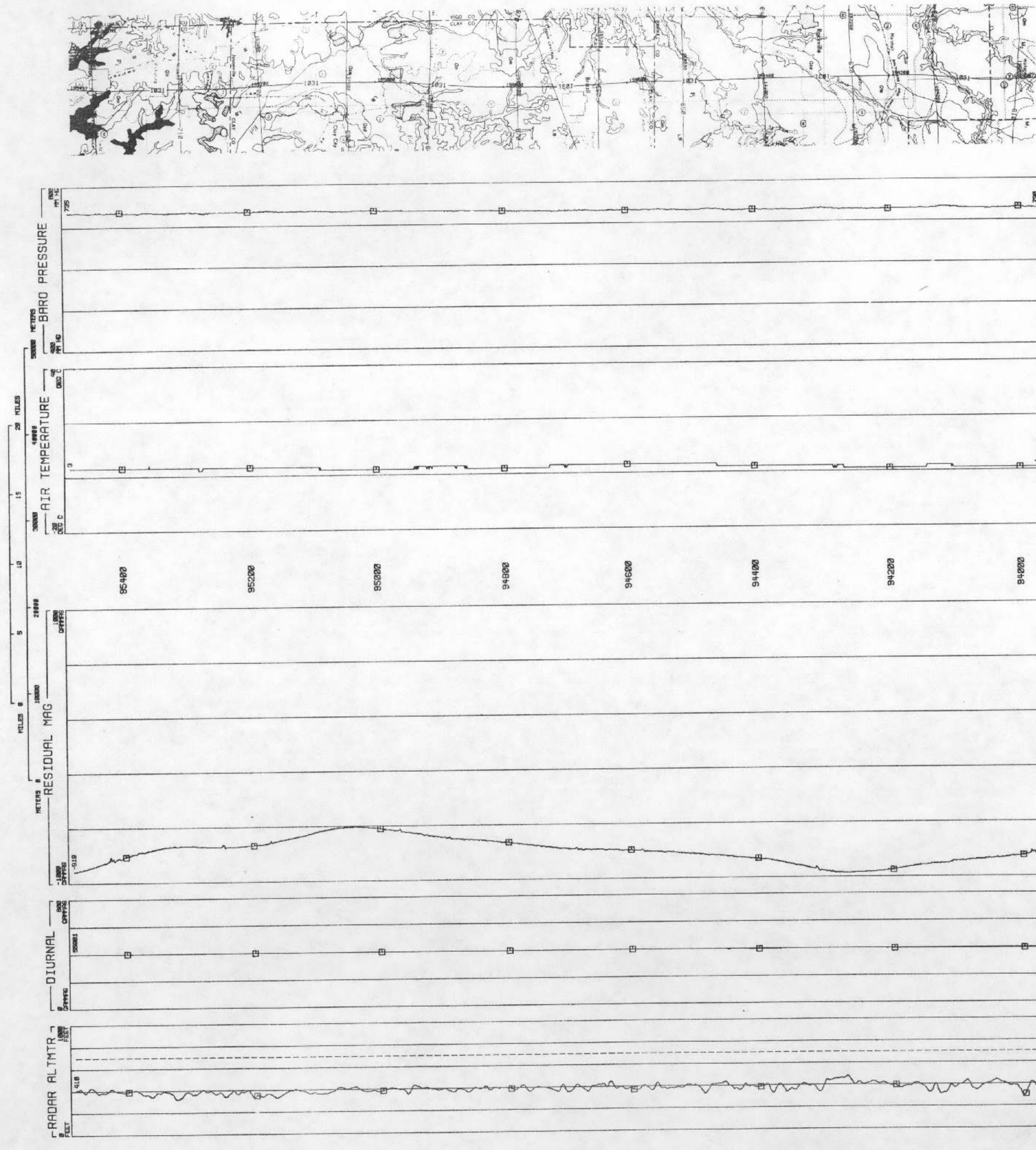
MIN	55595
MAX	55598
MEAN	55592
STD DEV	4.507

RADAR ALTMTR
FEET

MIN	309.6
MAX	463.0
MEAN	389.5
STD DEV	23.62

LINE 1020

LINE 1030
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349



BARO PRESSURE
MM HG

MIN	726.8
MAX	737.1
MEAN	732.1
STD DEV	2.142

AIR TEMPERATURE
DEG C

MIN	1.000
MAX	4.000
MEAN	2.308
STD DEV	.7504

RESIDUAL MAG
GAMMAS

MIN	-972.9
MAX	-604.6
MEAN	-793.3
STD DEV	99.58

DIURNAL
GAMMAS

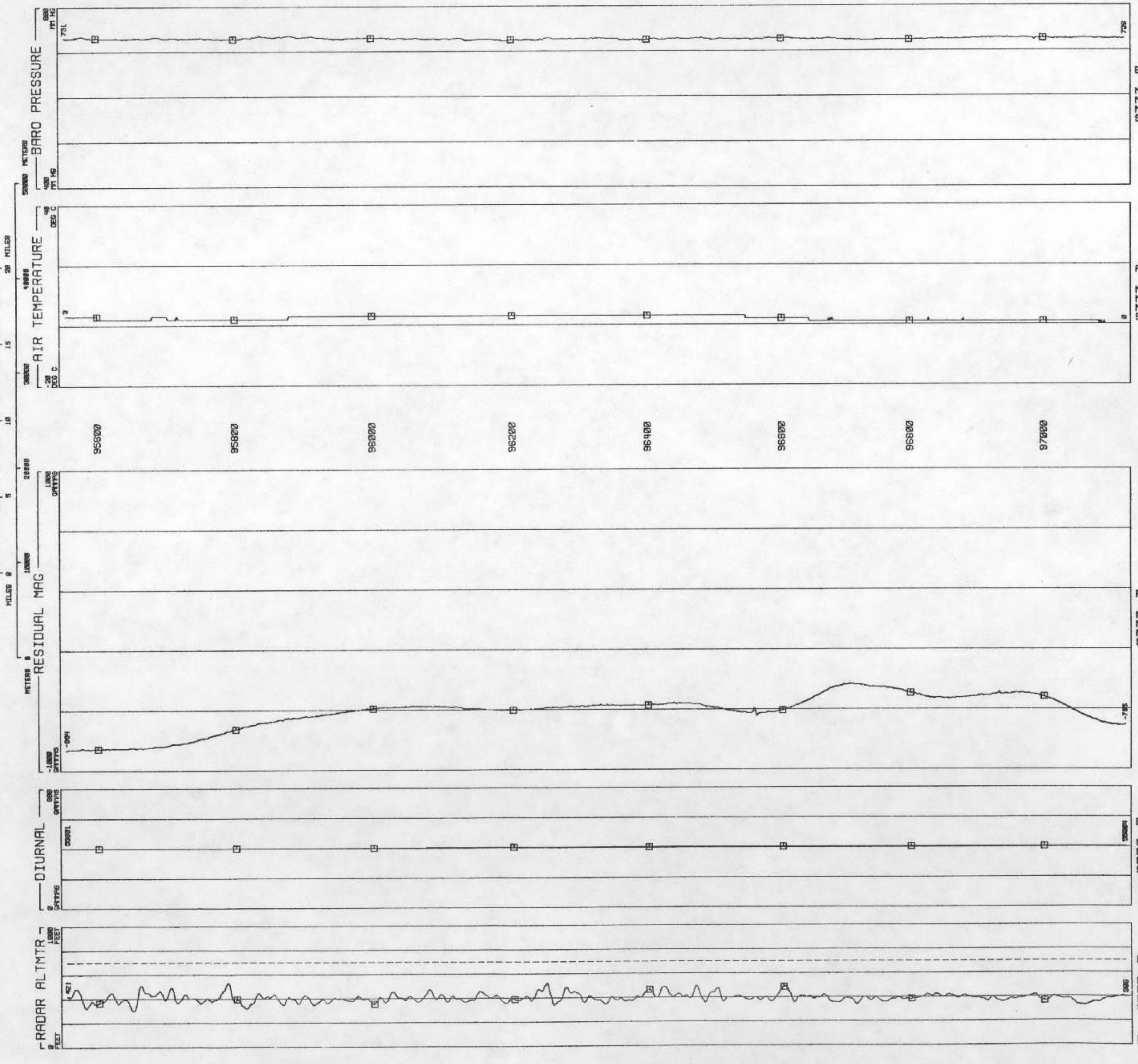
MIN	55597
MAX	55602
MEAN	55594
STD DEV	5.375

RADAR ALTMTR
FEET

MIN	293.2
MAX	478.4
MEAN	388.9
STD DEV	26.04

LINE 1030

LINE 1040
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349



BARO PRESSURE
MM HG
MIN 722.3
MAX 735.5
MEAN 727.4
STD DEV 2.413

AIR TEMPERATURE
DEG C
MIN .0000
MAX 3.000
MEAN 2.149
STD DEV .9057

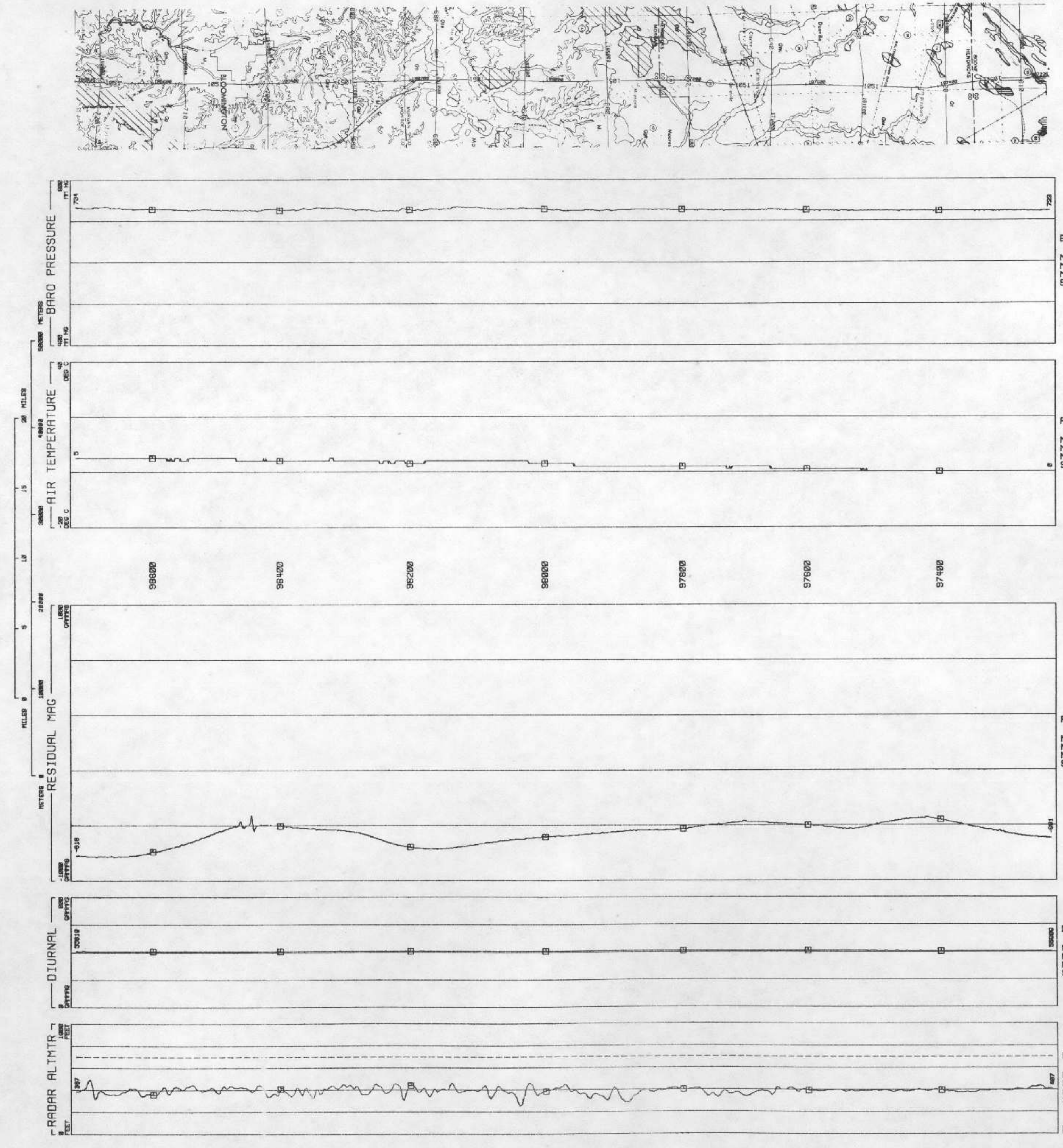
RESIDUAL MAG
GAMMAS
MIN -864.0
MAX -432.8
MEAN -613.2
STD DEV 110.3

DIURNAL
GAMMAS
MIN 55600
MAX 55604
MEAN 55600
STD DEV 2.883

RADAR ALTMTR
FEET
MIN 297.6
MAX 529.5
MEAN 398.4
STD DEV 33.98

LINE 1040

LINE 1050
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80349



BARO PRESSURE
MM HG
MIN 721.2
MAX 734.7
MEAN 726.4
STD DEV 2.837

AIR TEMPERATURE
DEG C
MIN .0000
MAX 5.000
MEAN 2.632
STD DEV 1.754

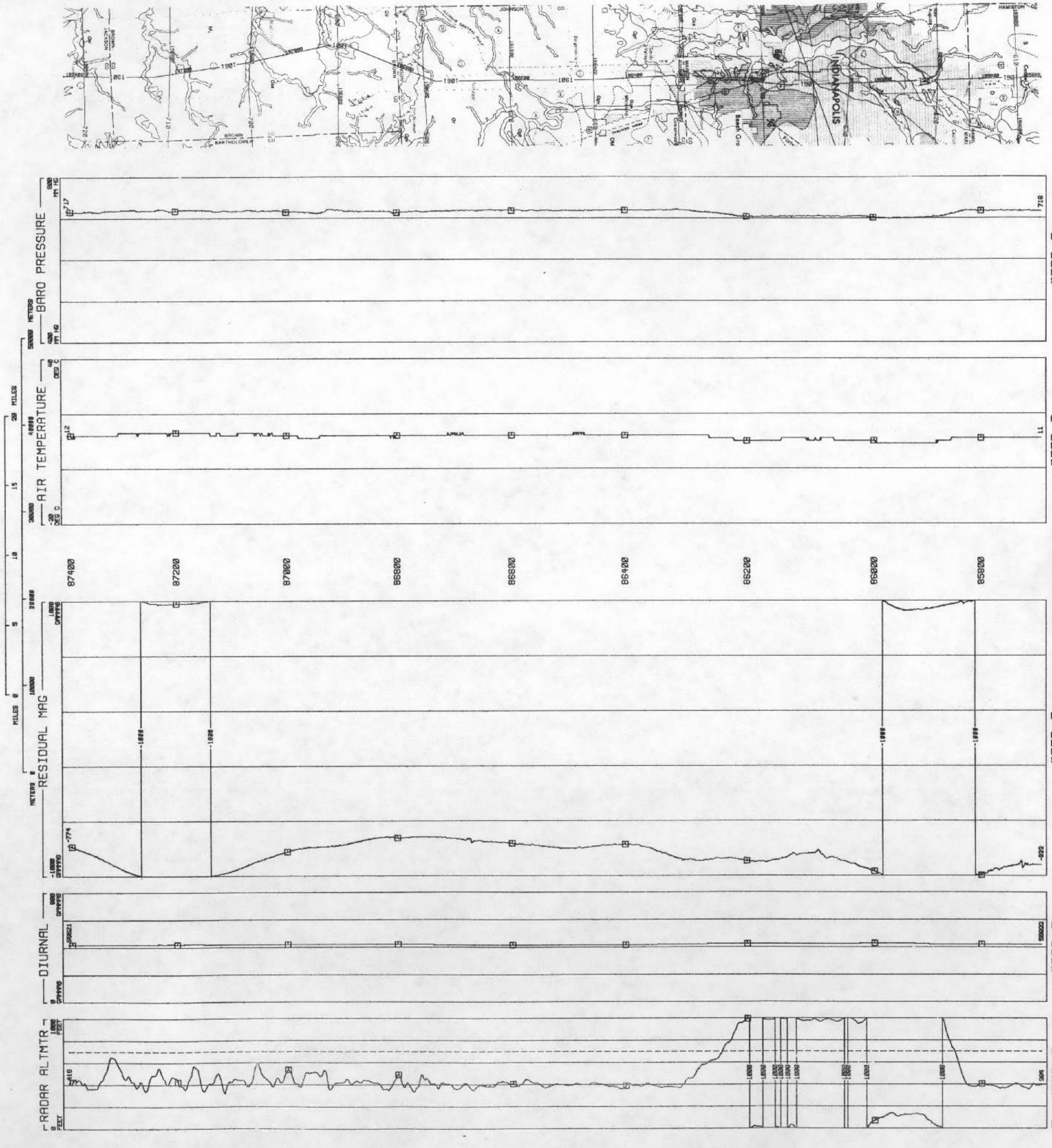
RESIDUAL MAG
GAMMAS
MIN -927.5
MAX -526.9
MEAN -661.5
STD DEV 74.66

DIURNAL
GAMMAS
MIN 55605
MAX 55610
MEAN 55605
STD DEV 3.487

RADAR ALTMTR
FEET
MIN 258.7
MAX 495.7
MEAN 390.1
STD DEV 30.71

LINE 1050

LINE 1060
INDIANAPOLIS QUADRANGLE - NTMS NJ 16-2
DATA ACQUIRED 80347



BARO PRESSURE
MM HG
MIN 699.1
MAX 722.3
MEAN 714.3
STD DEV 6.018

AIR TEMPERATURE
DEG C
MIN 9.000
MAX 13.00
MEAN 11.53
STD DEV 1.083

RESIDUAL MAG
GAMMAS
MIN -1072
MAX -714.1
MEAN -871.6
STD DEV 105.5

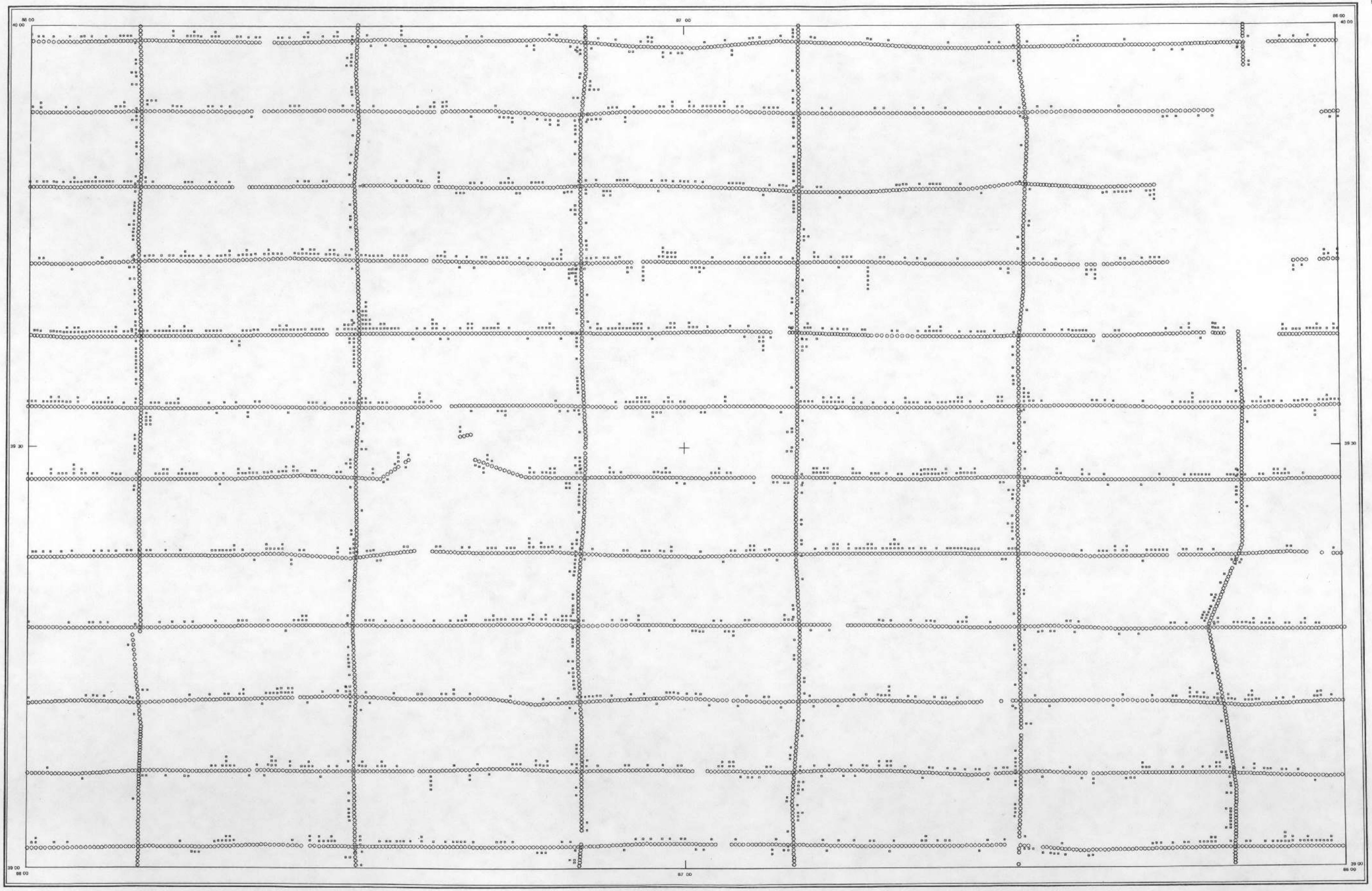
DIURNAL
GAMMAS
MIN 55615
MAX 55628
MEAN 55617
STD DEV 5.203

RADAR ALTMTR
FEET
MIN 321.0
MAX 1138
MEAN 560.1
STD DEV 255.7

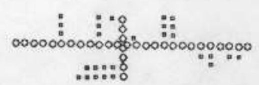
LINE 1060

APPENDIX E - Standard Deviation Maps

INDIANAPOLIS



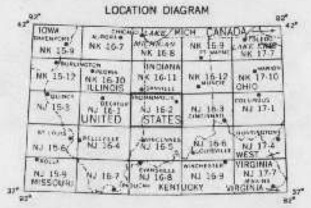
SCALE 1:500,000



○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY
NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH. ON N-S LINES, +σ TO WEST, -σ TO EAST.

SURVEY AND COMPILATION BY:
EG&G GEOMETRICS

LOCATION DIAGRAM

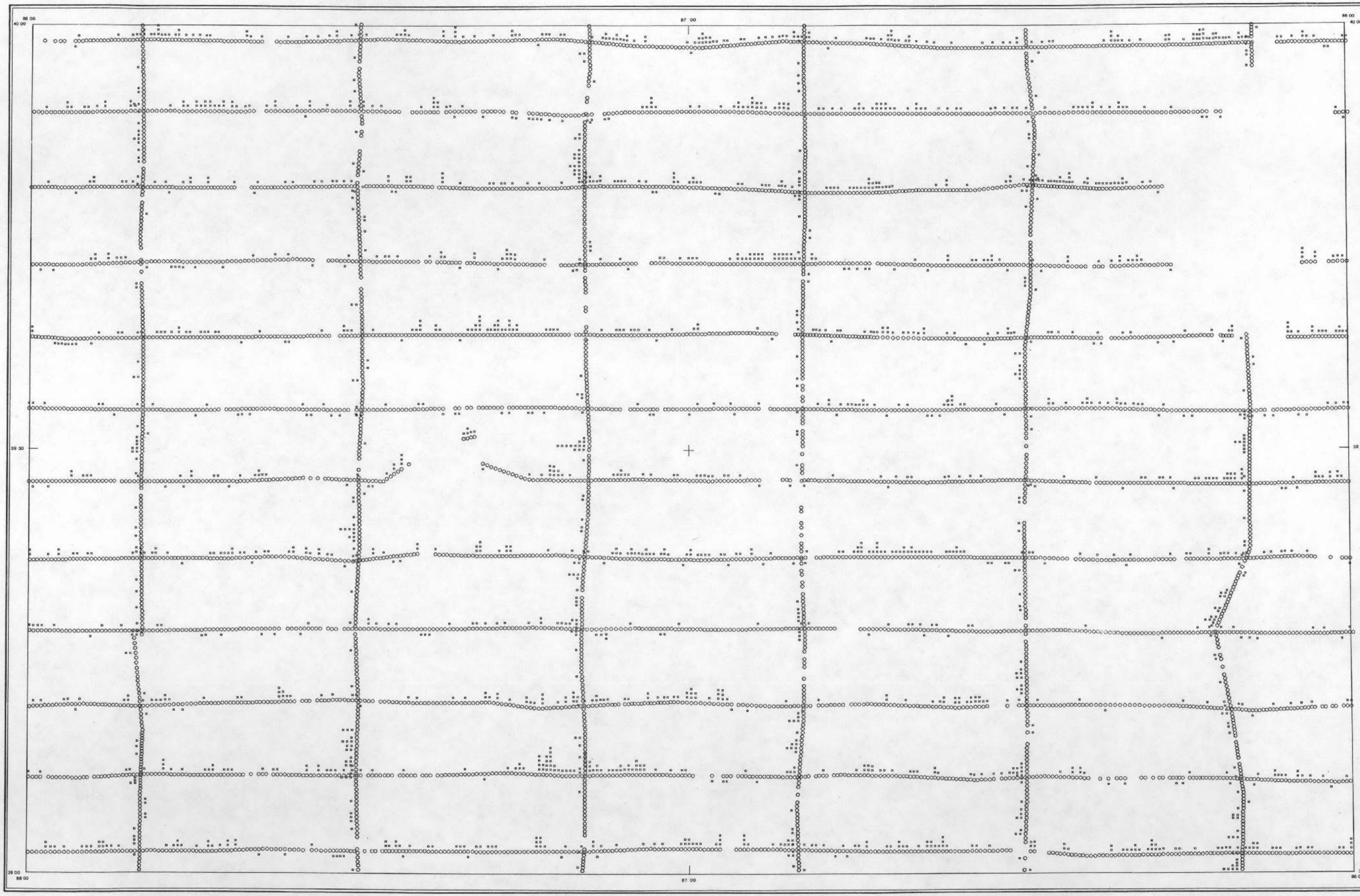


POTASSIUM STANDARD DEVIATION MAP

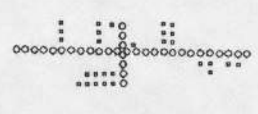
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

INDIANAPOLIS



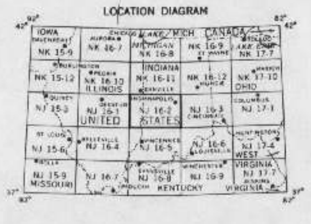
SCALE 1:500,000



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

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

LOCATION DIAGRAM



URANIUM STANDARD DEVIATION MAP

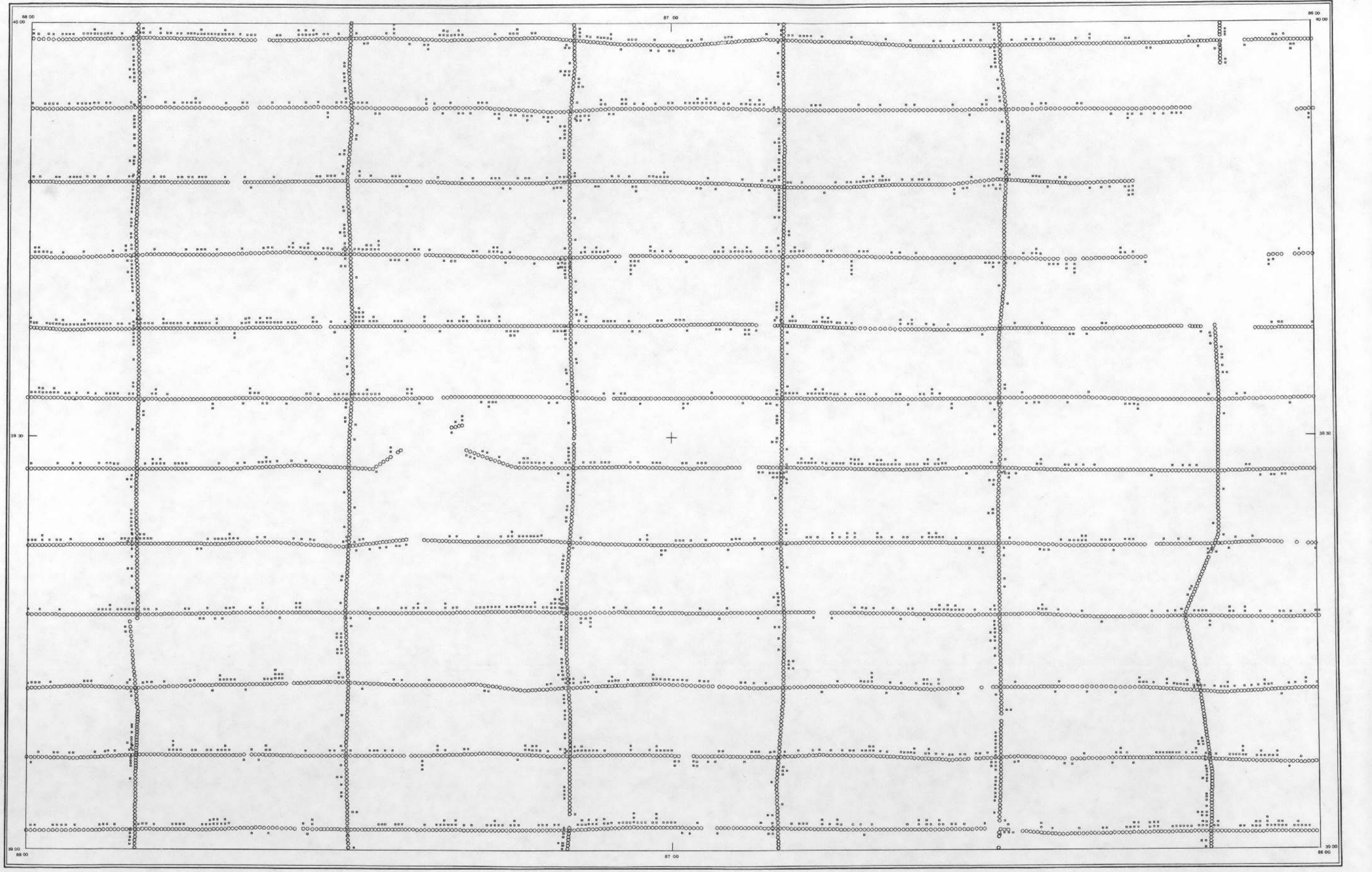
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

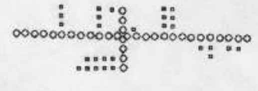
SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

INDIANAPOLIS



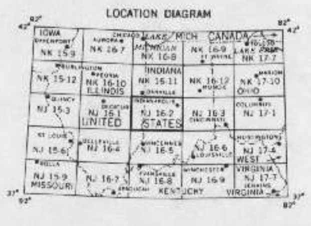
SCALE 1:500,000



○ - 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



THORIUM STANDARD DEVIATION MAP

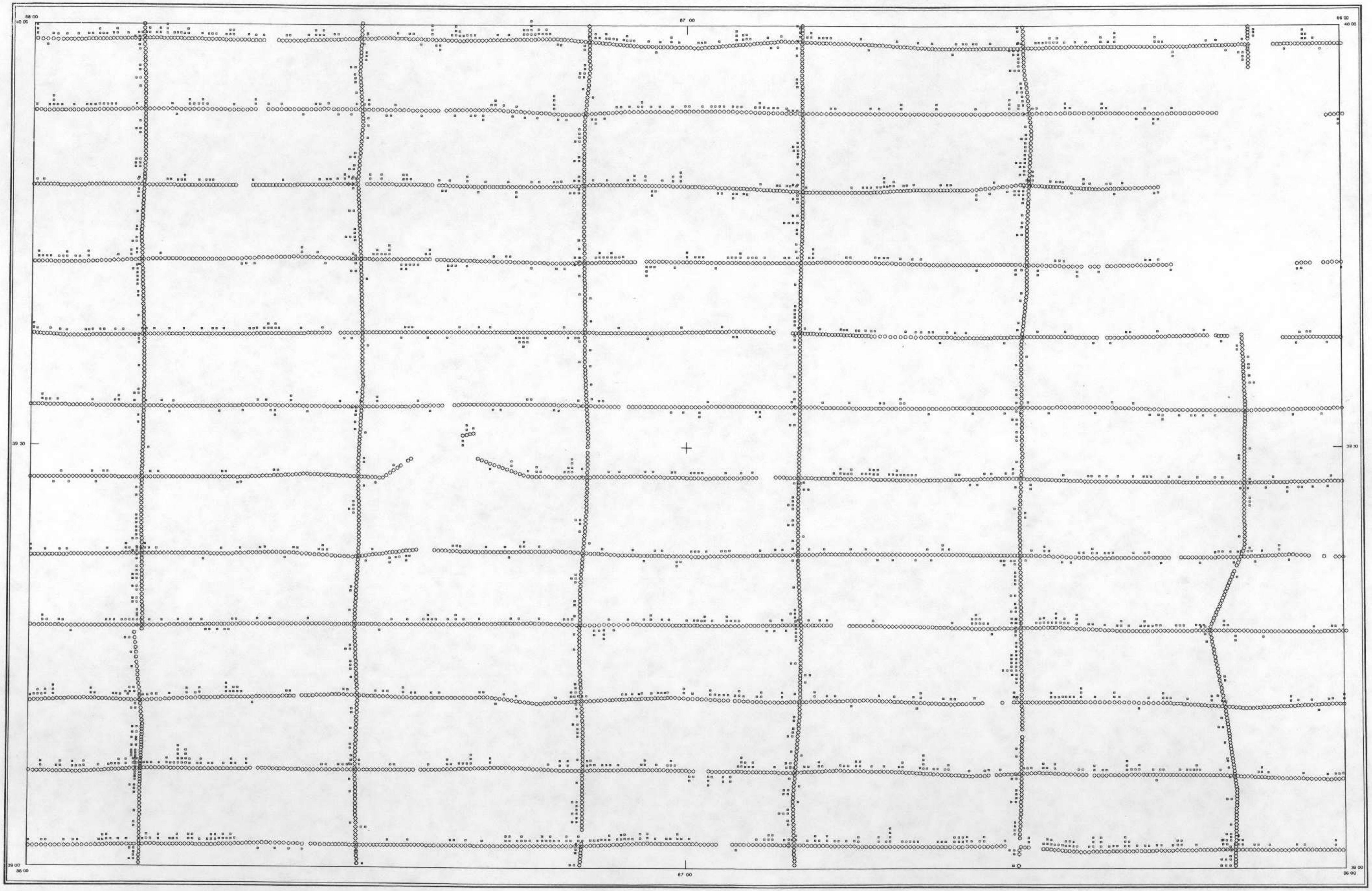
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

INDIANAPOLIS



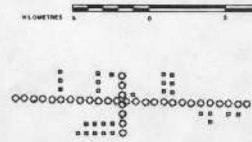
SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

SURVEY AND COMPILATION BY:

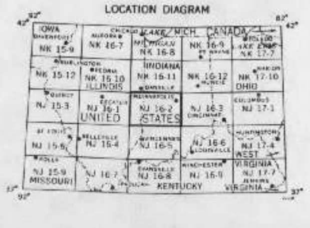
EG&G GEOMETRICS



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

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

LOCATION DIAGRAM

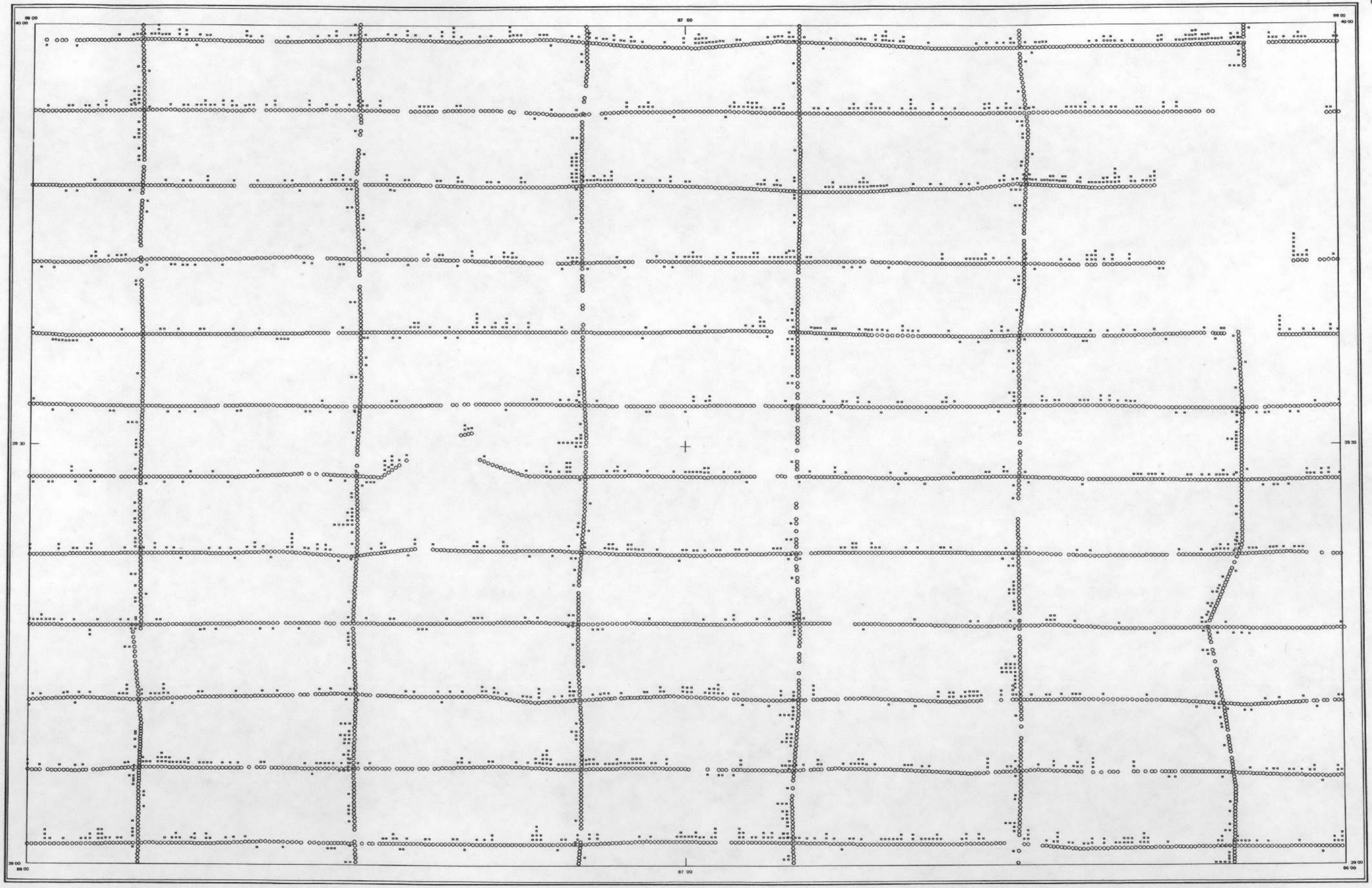


THORIUM/POTASSIUM STANDARD DEVIATION MAP

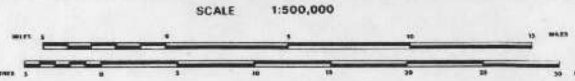
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

INDIANAPOLIS

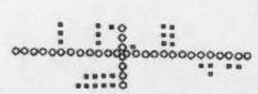


SCALE 1:500,000



SURVEY AND COMPILATION BY:

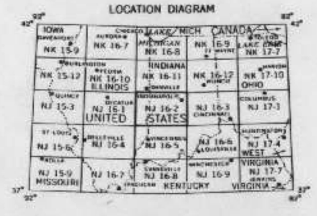
EG&G GEOMETRICS



○ - 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

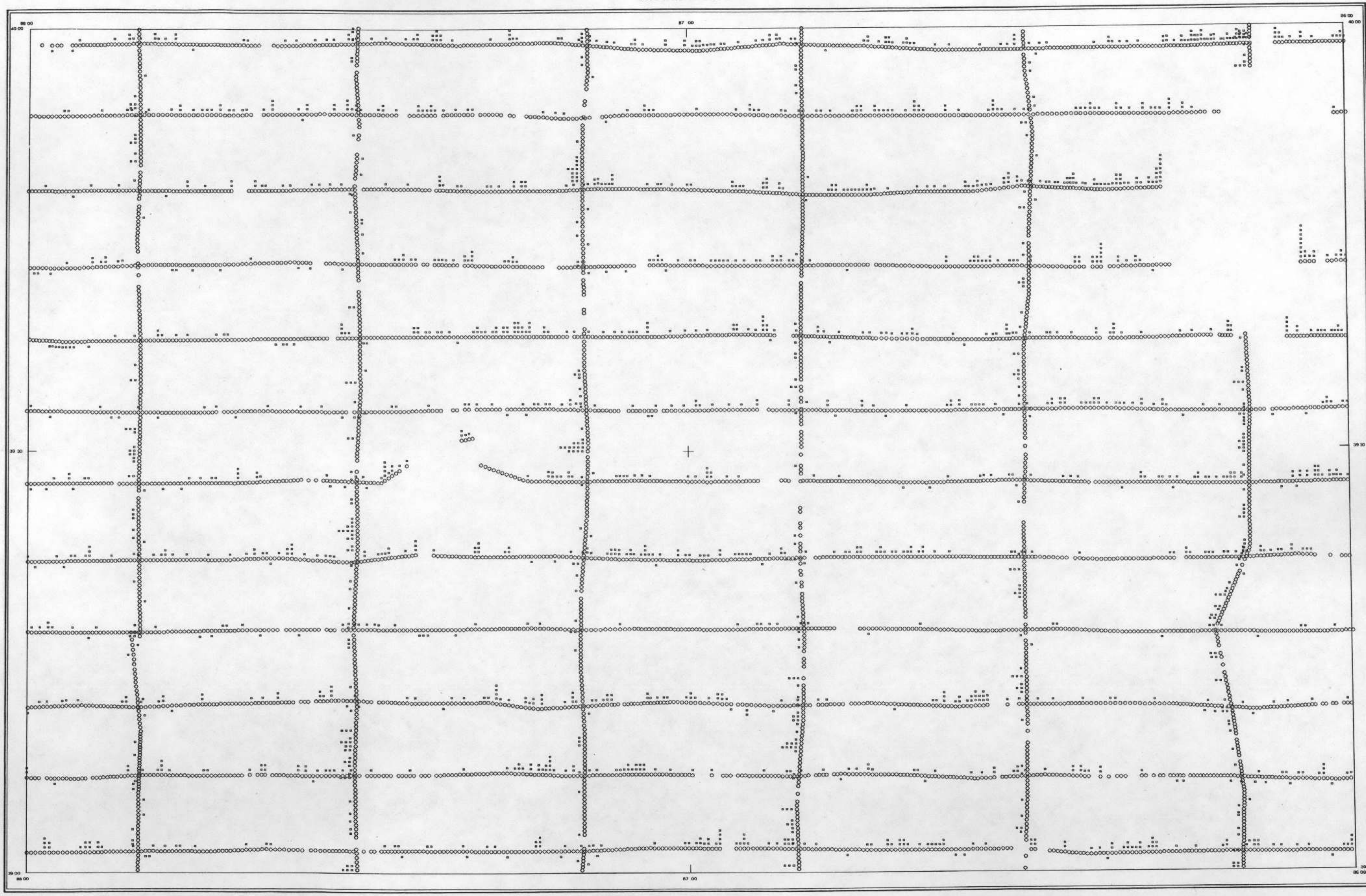


URANIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

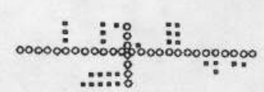
INDIANAPOLIS



SCALE 1:500,000

MILES

KILOMETRES



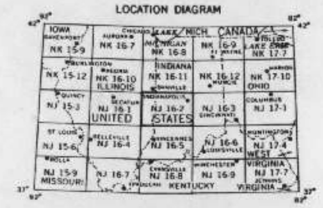
○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

LOCATION DIAGRAM



URANIUM/THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

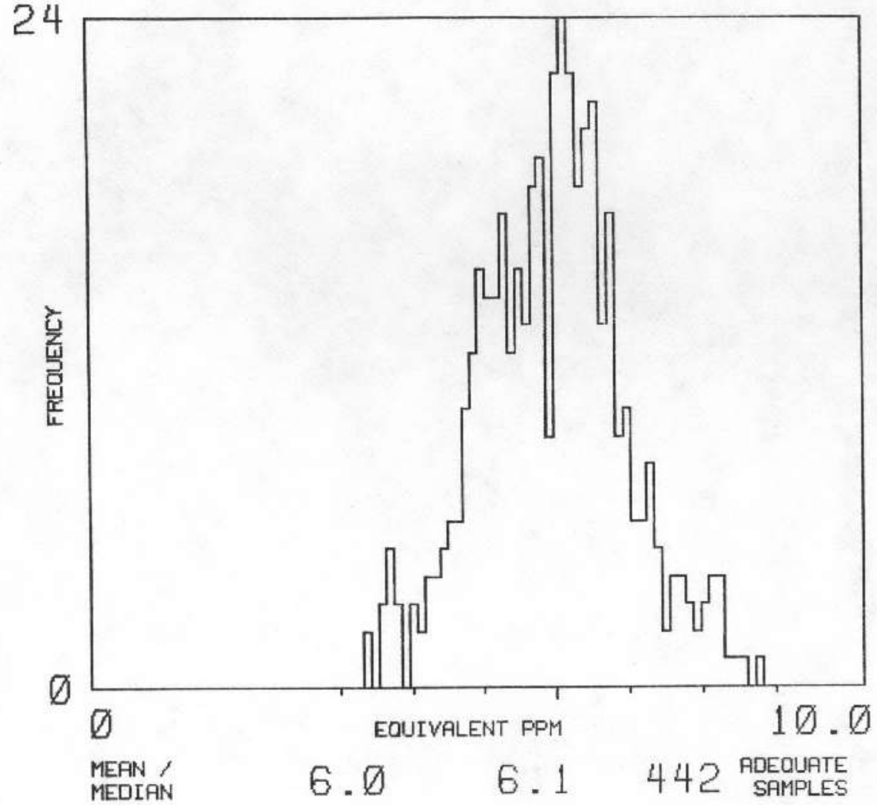
U. S. DEPARTMENT OF ENERGY

APPENDIX F – Histograms and Map Unit Conversion Table

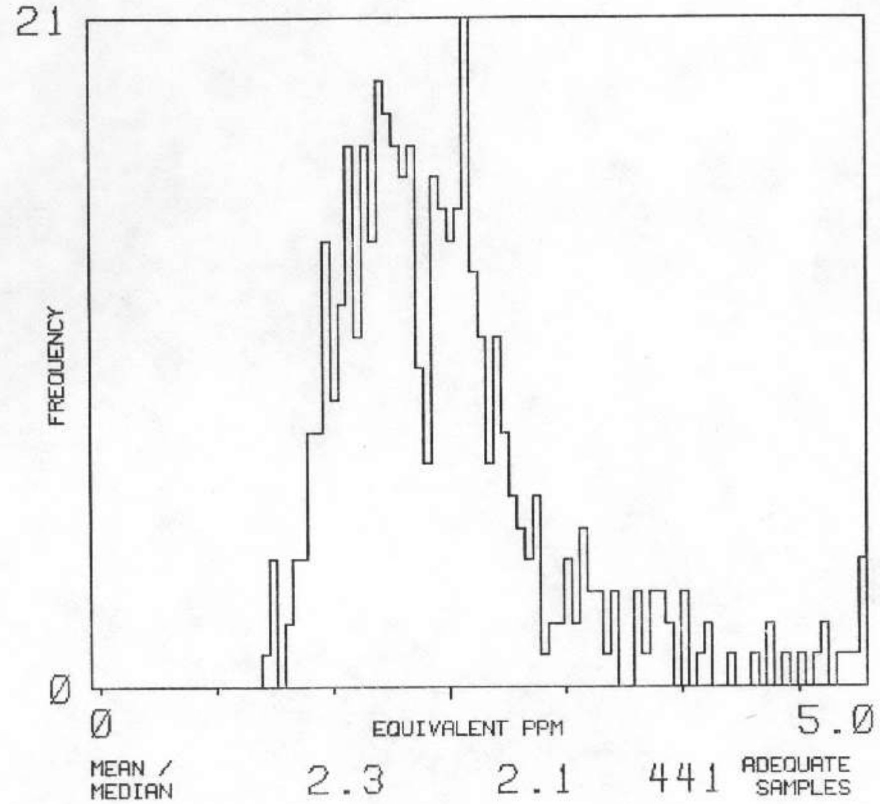
F1 i

NJ 16-2 INDIANAPOLIS MAP UNIT : QM TOTAL NUMBER OF SAMPLES 442

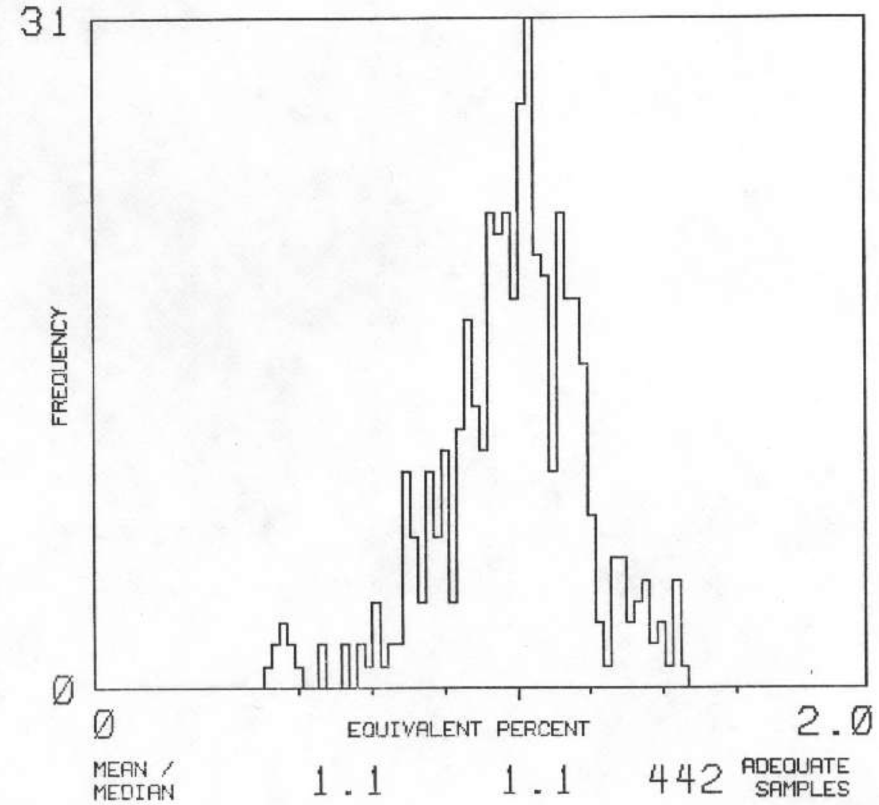
THORIUM



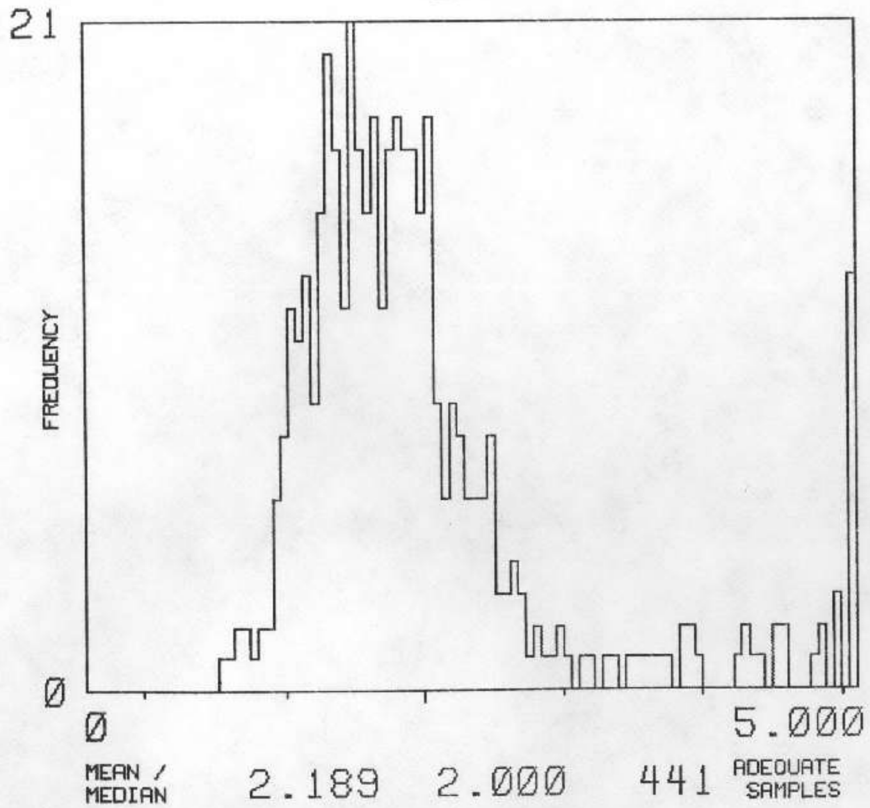
URANIUM



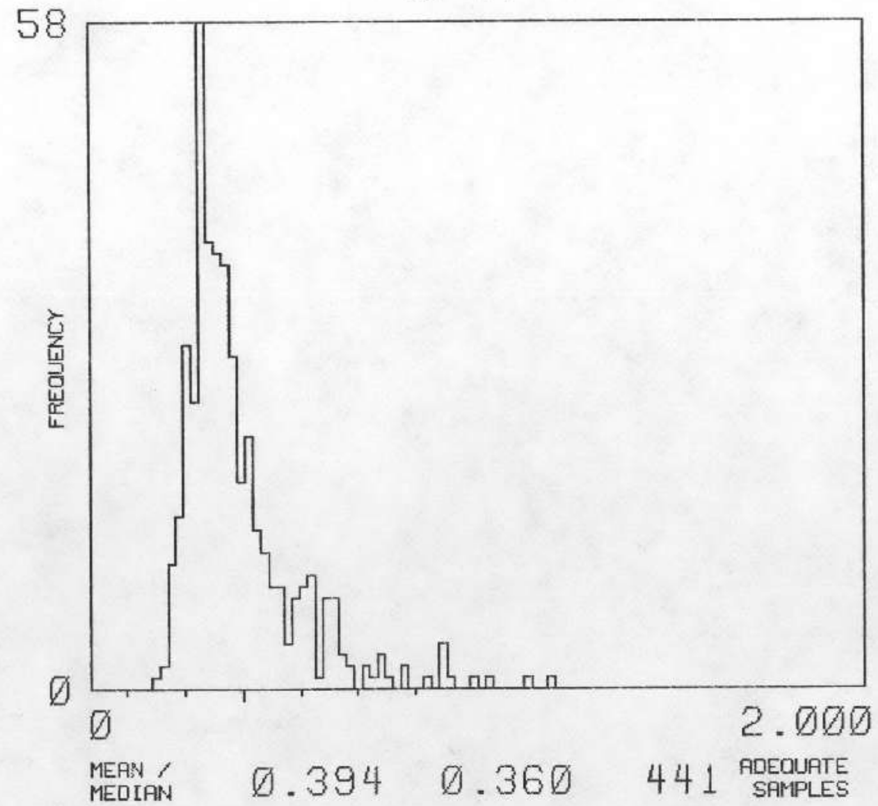
POTASSIUM



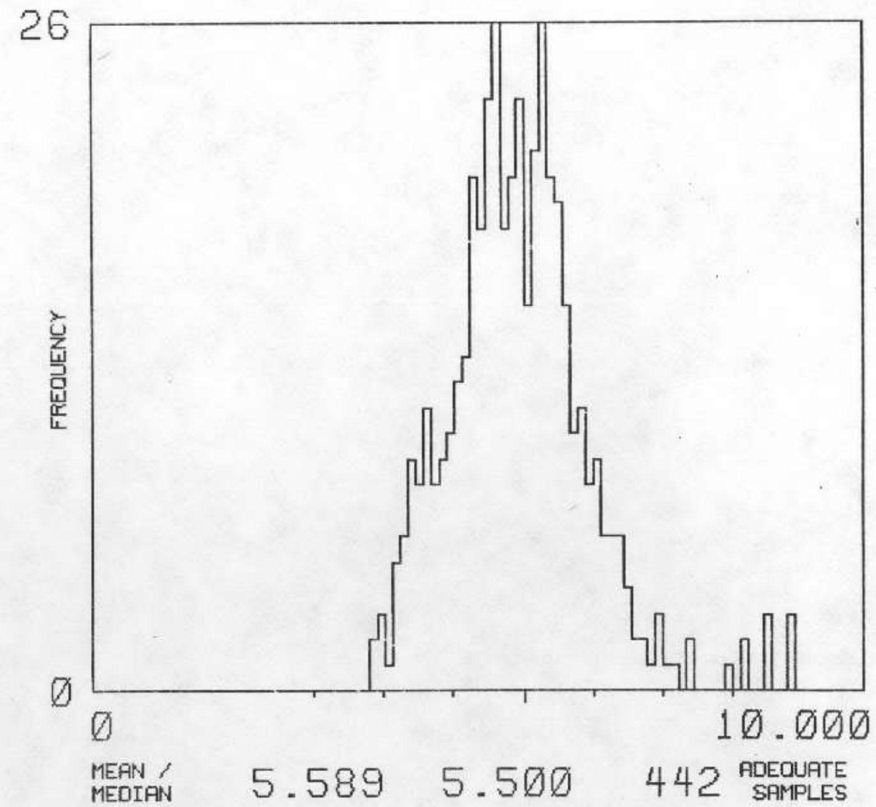
U/K



U/TH

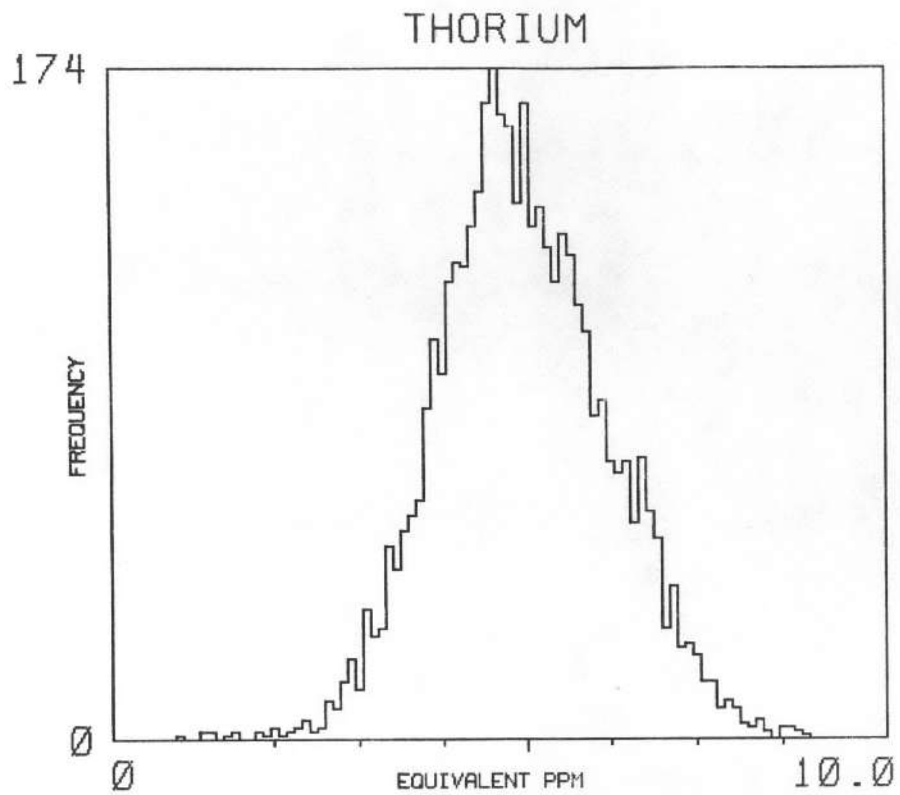


TH/K

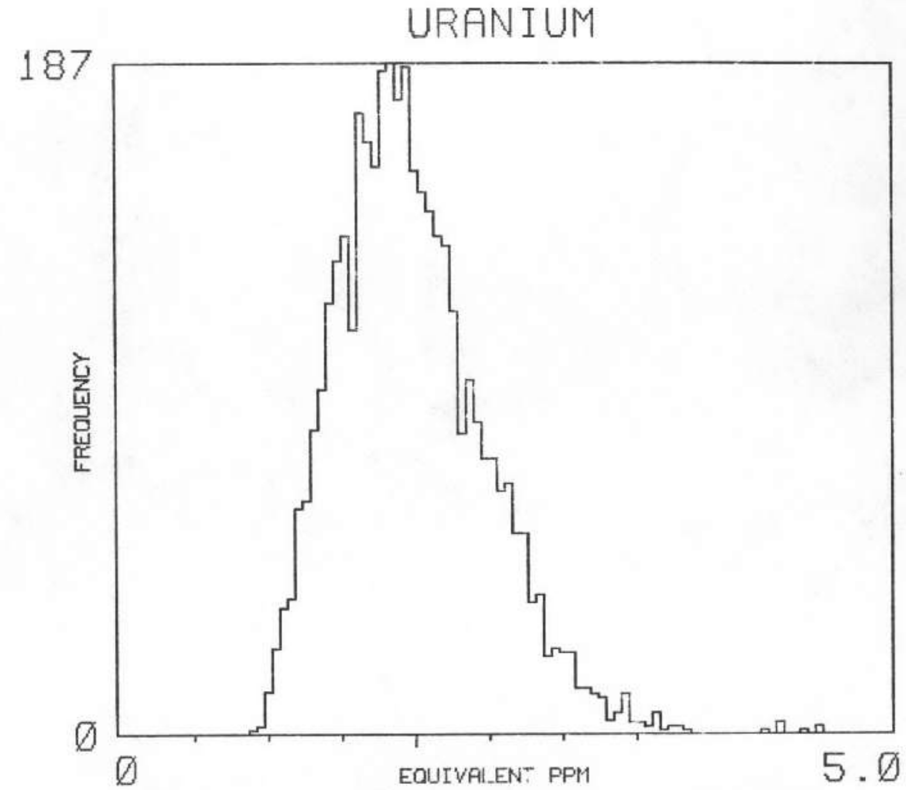


NJ 16-2 INDIANAPOLIS

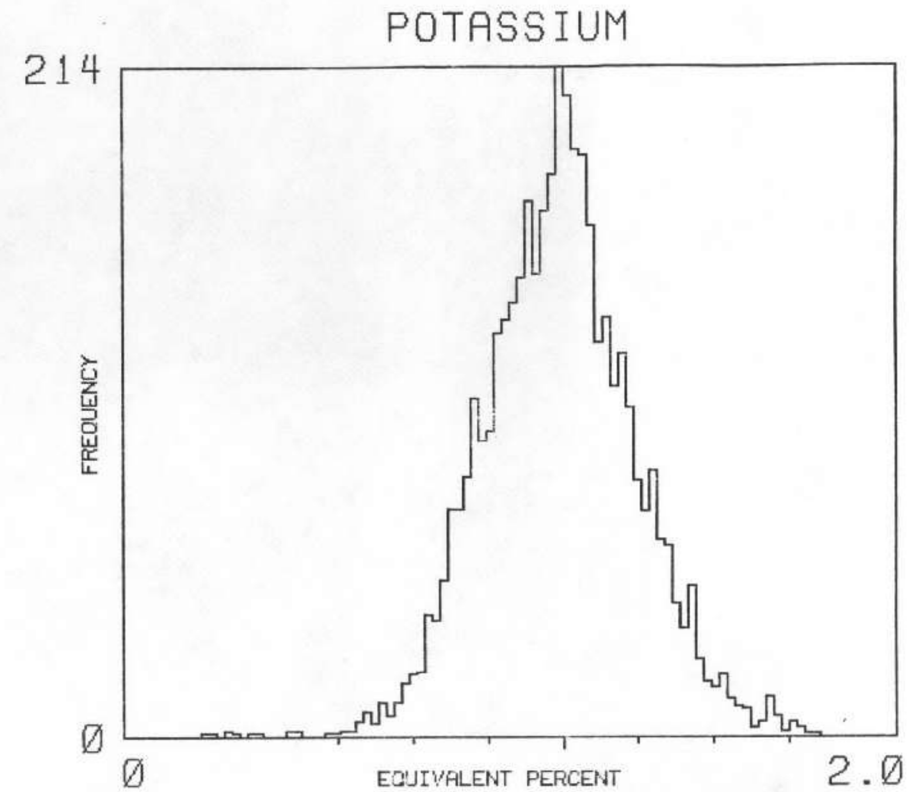
MAP UNIT : QSA TOTAL NUMBER OF SAMPLES 4240



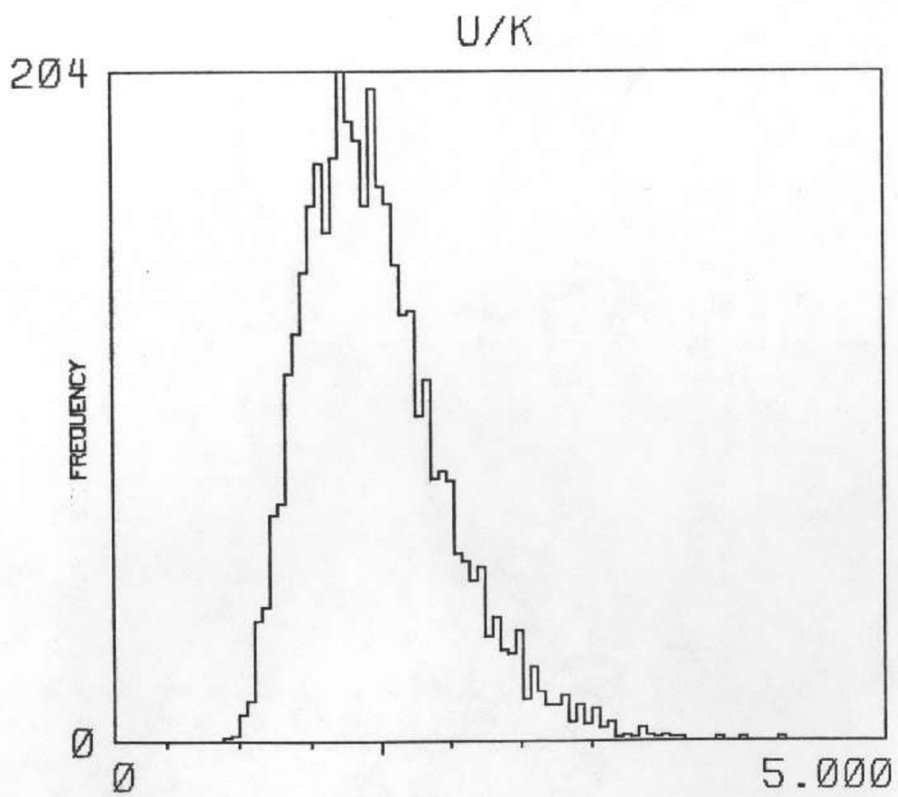
MEAN / MEDIAN 5.3 5.3 4183 ADEQUATE SAMPLES



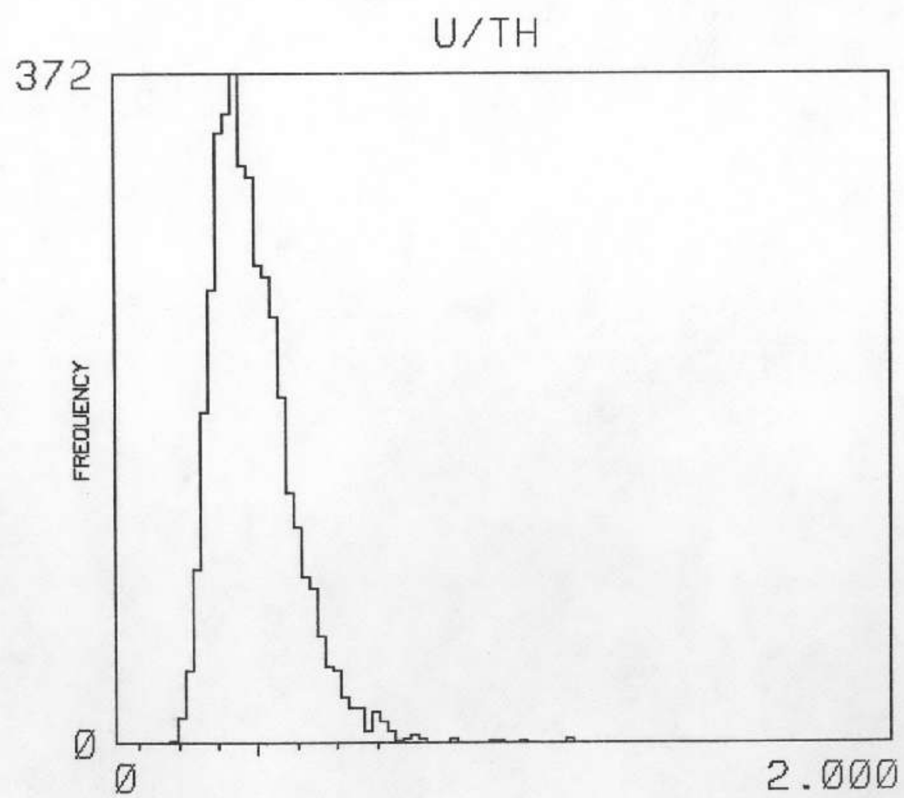
MEAN / MEDIAN 1.9 1.8 3940 ADEQUATE SAMPLES



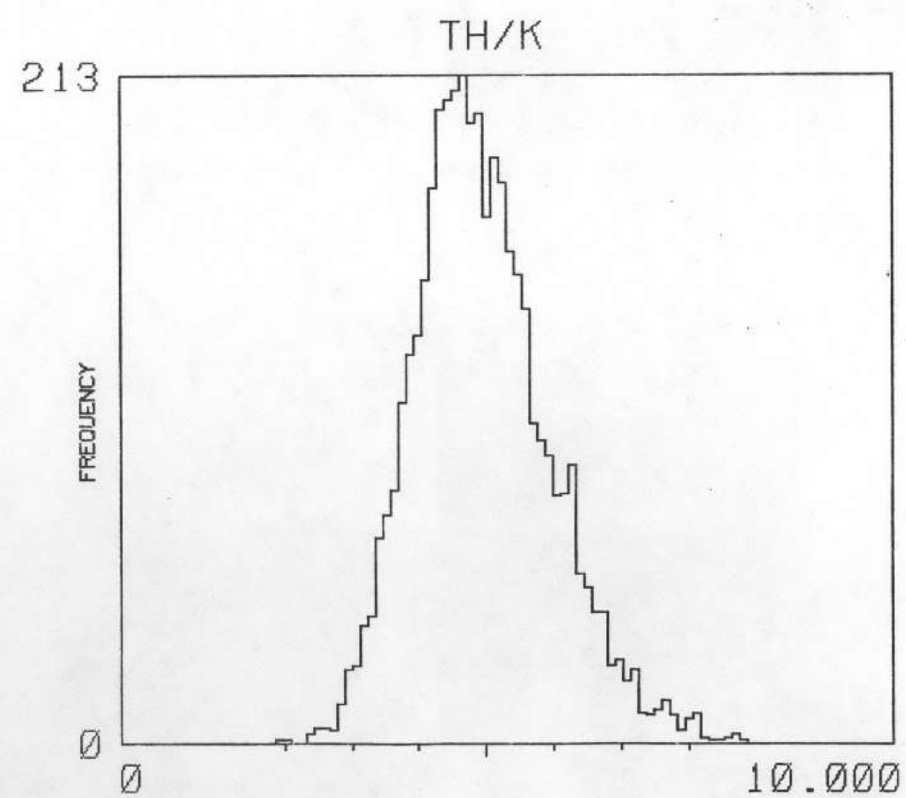
MEAN / MEDIAN 1.1 1.1 4186 ADEQUATE SAMPLES



MEAN / MEDIAN 1.719 1.650 3940 ADEQUATE SAMPLES



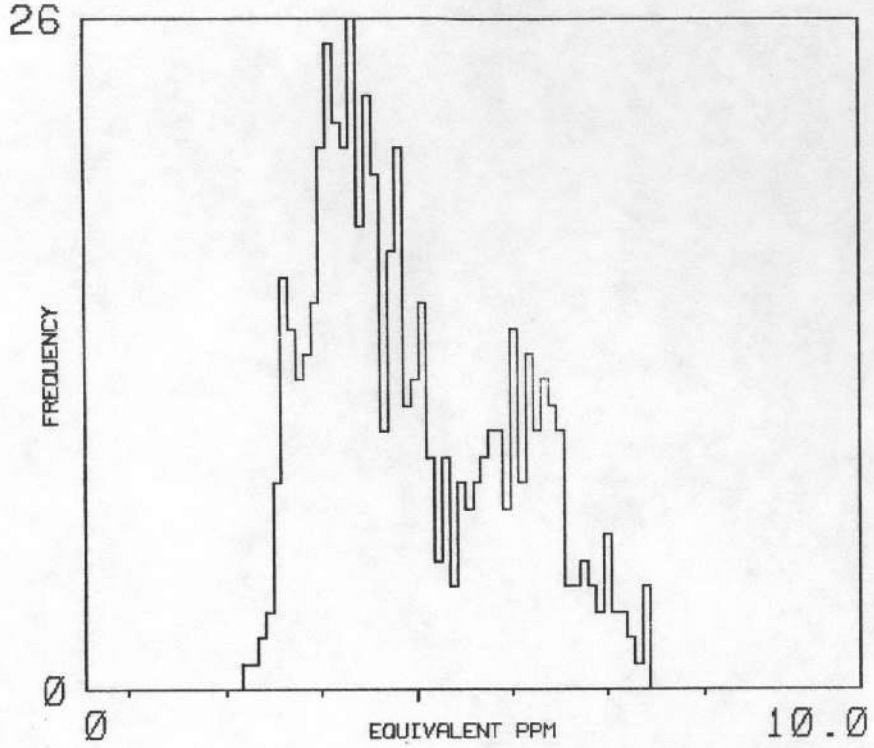
MEAN / MEDIAN 0.367 0.340 3938 ADEQUATE SAMPLES



MEAN / MEDIAN 4.731 4.600 4183 ADEQUATE SAMPLES

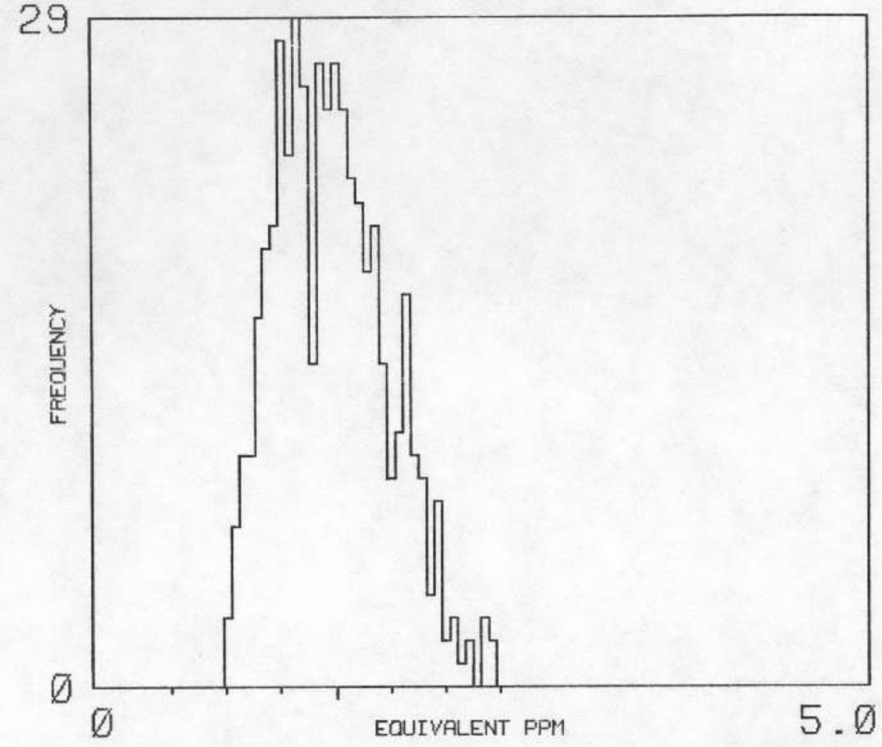
NJ 16-2 INDIANAPOLIS MAP UNIT : QSD TOTAL NUMBER OF SAMPLES 55Ø

THORIUM



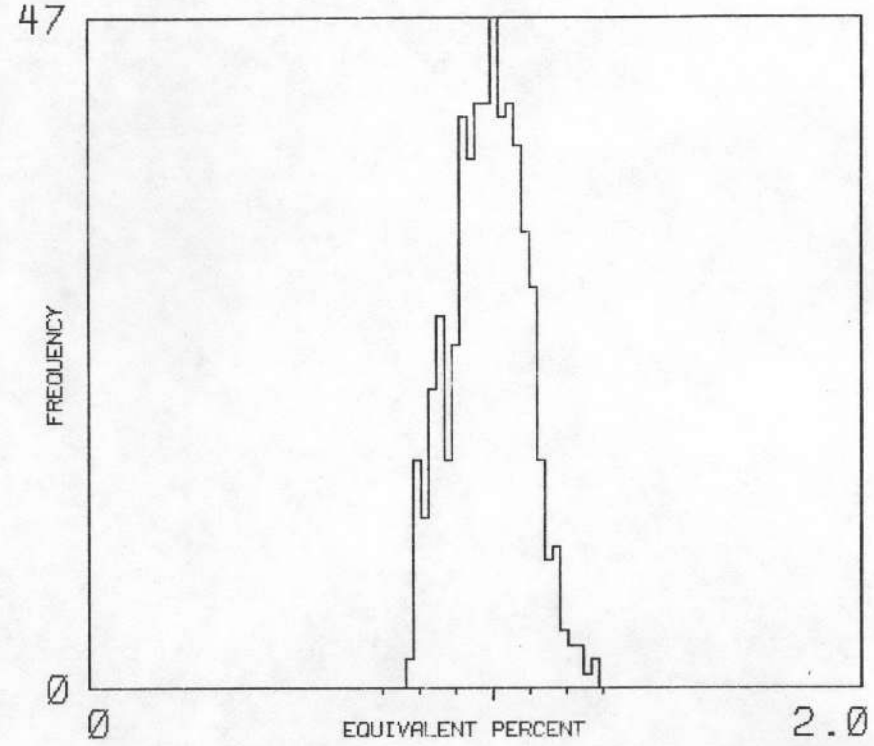
MEAN / MEDIAN 4.3 4.Ø 55Ø ADEQUATE SAMPLES

URANIUM



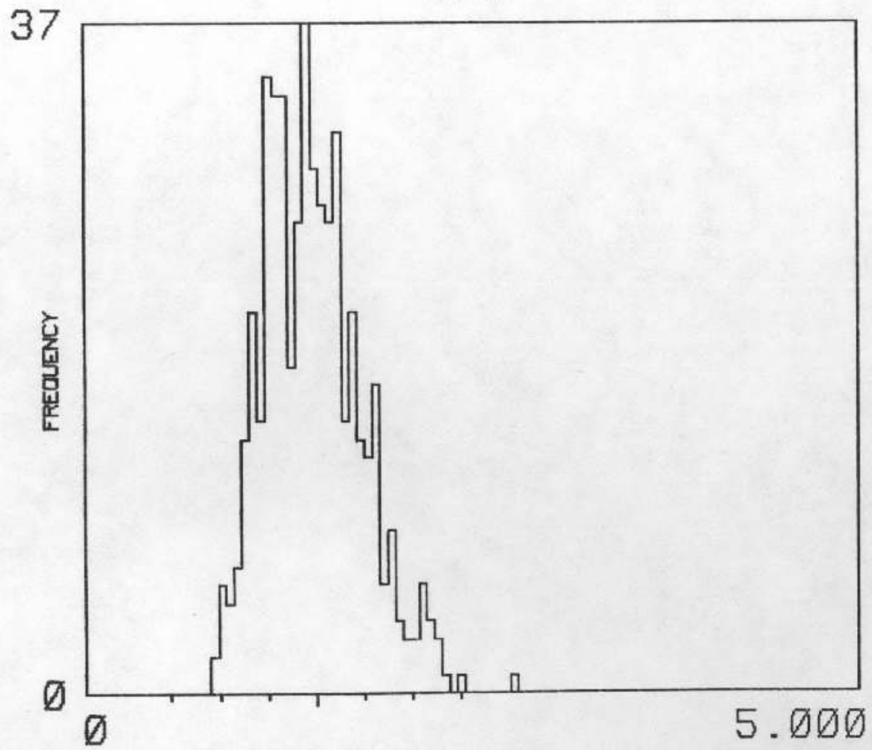
MEAN / MEDIAN 1.6 1.5 485 ADEQUATE SAMPLES

POTASSIUM



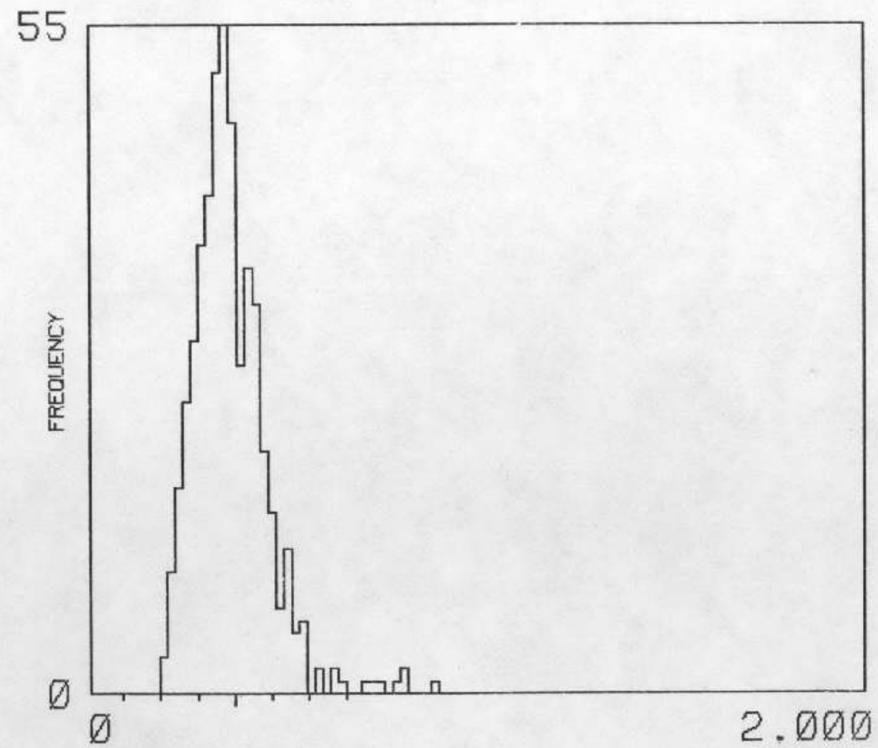
MEAN / MEDIAN 1.Ø 1.Ø 55Ø ADEQUATE SAMPLES

U/K



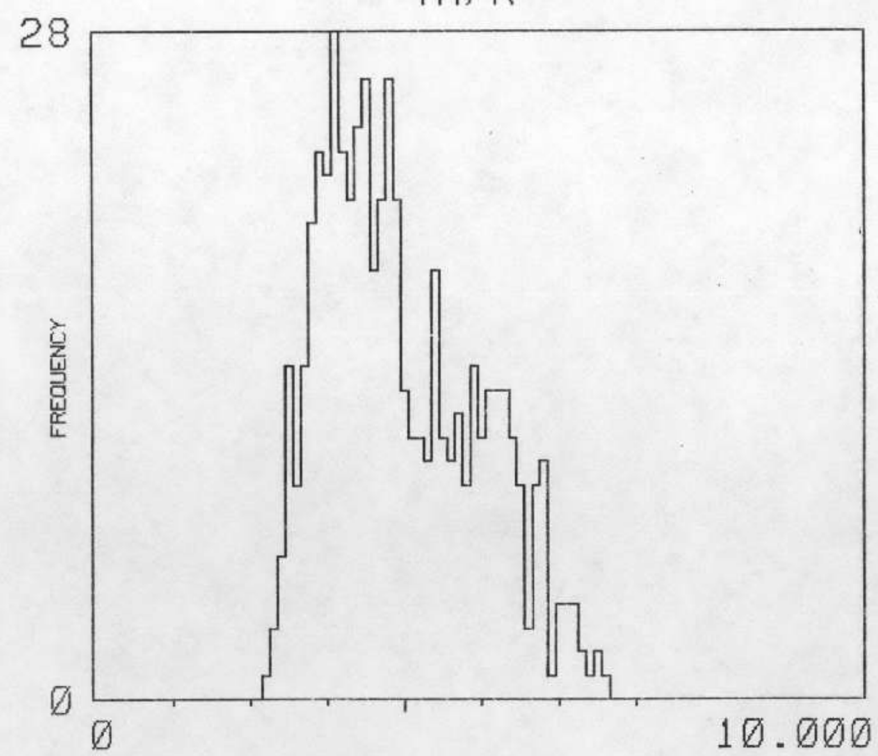
MEAN / MEDIAN 1.489 1.45Ø 485 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.374 Ø.36Ø 485 ADEQUATE SAMPLES

TH/K



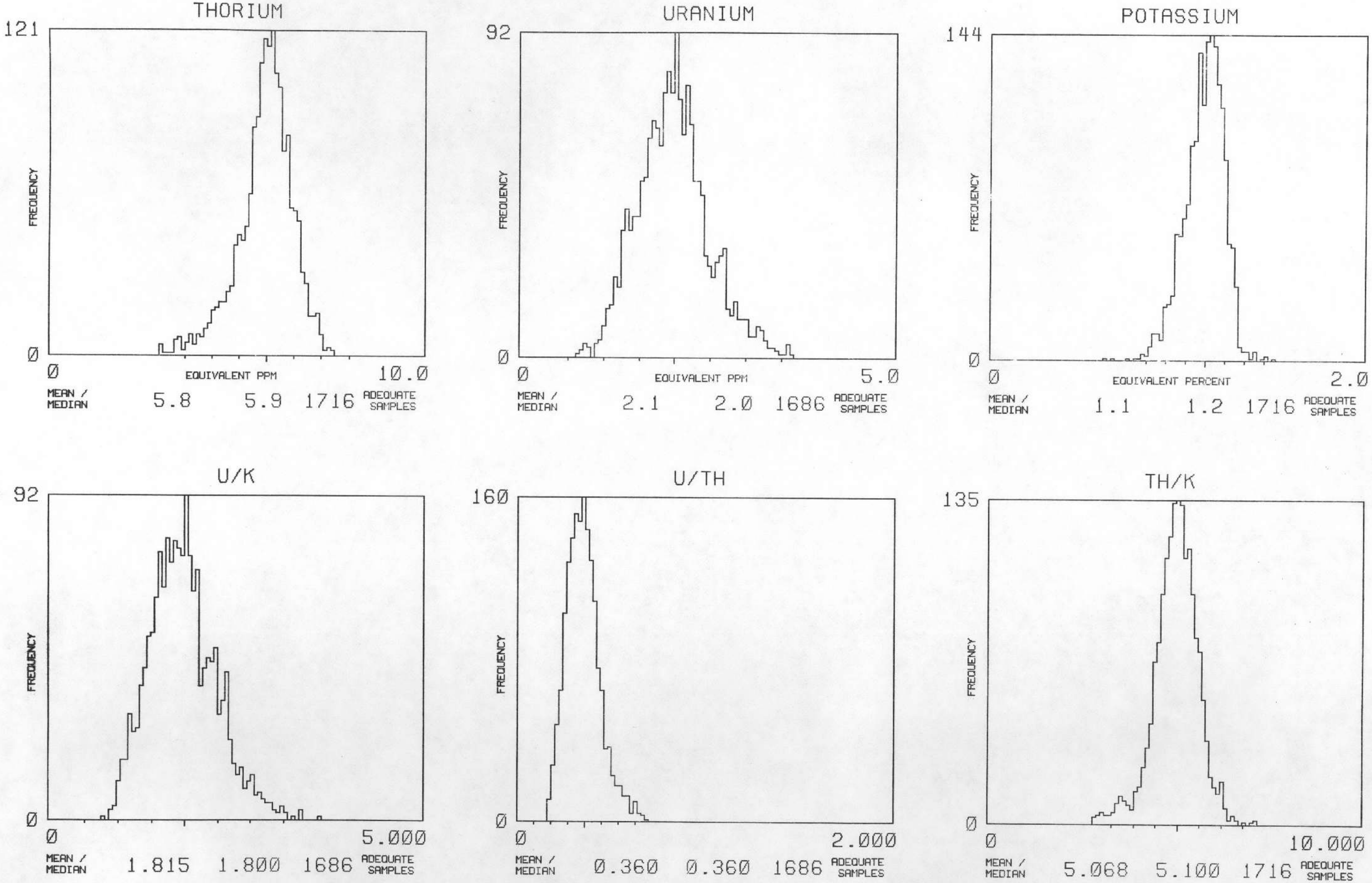
MEAN / MEDIAN 4.Ø53 3.9ØØ 55Ø ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS

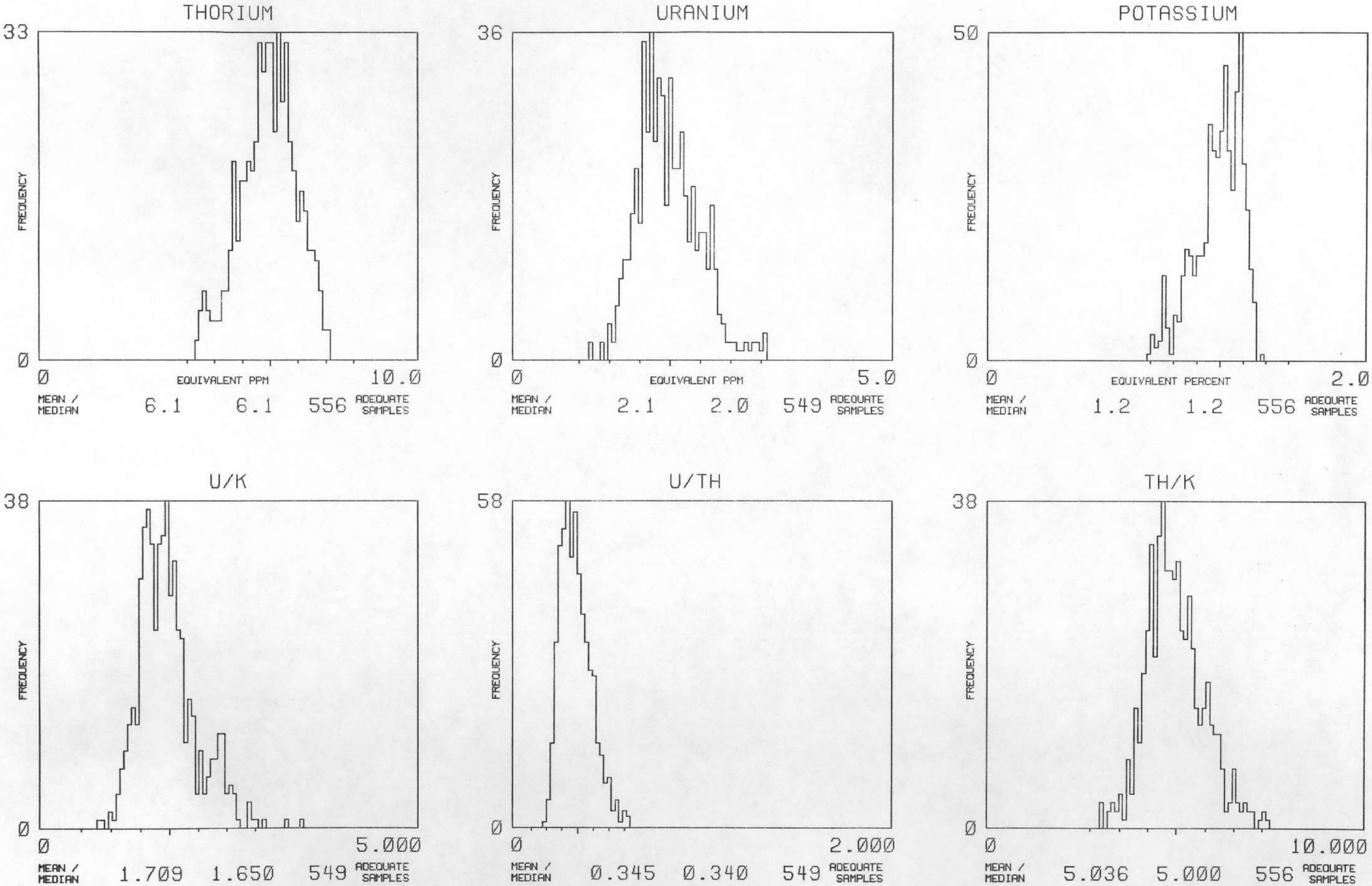
MAP UNIT : QL

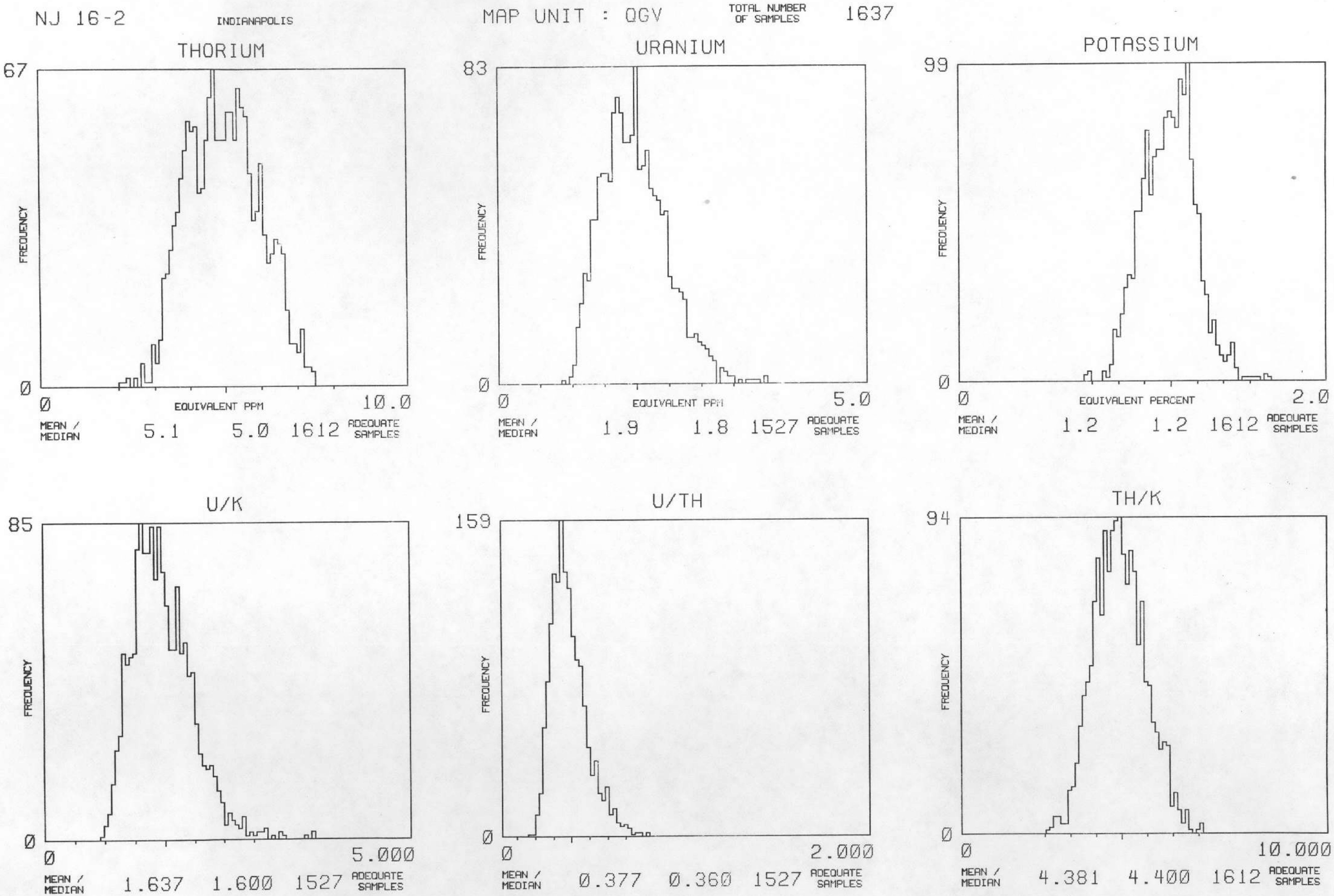
TOTAL NUMBER OF SAMPLES 1750

F4 i

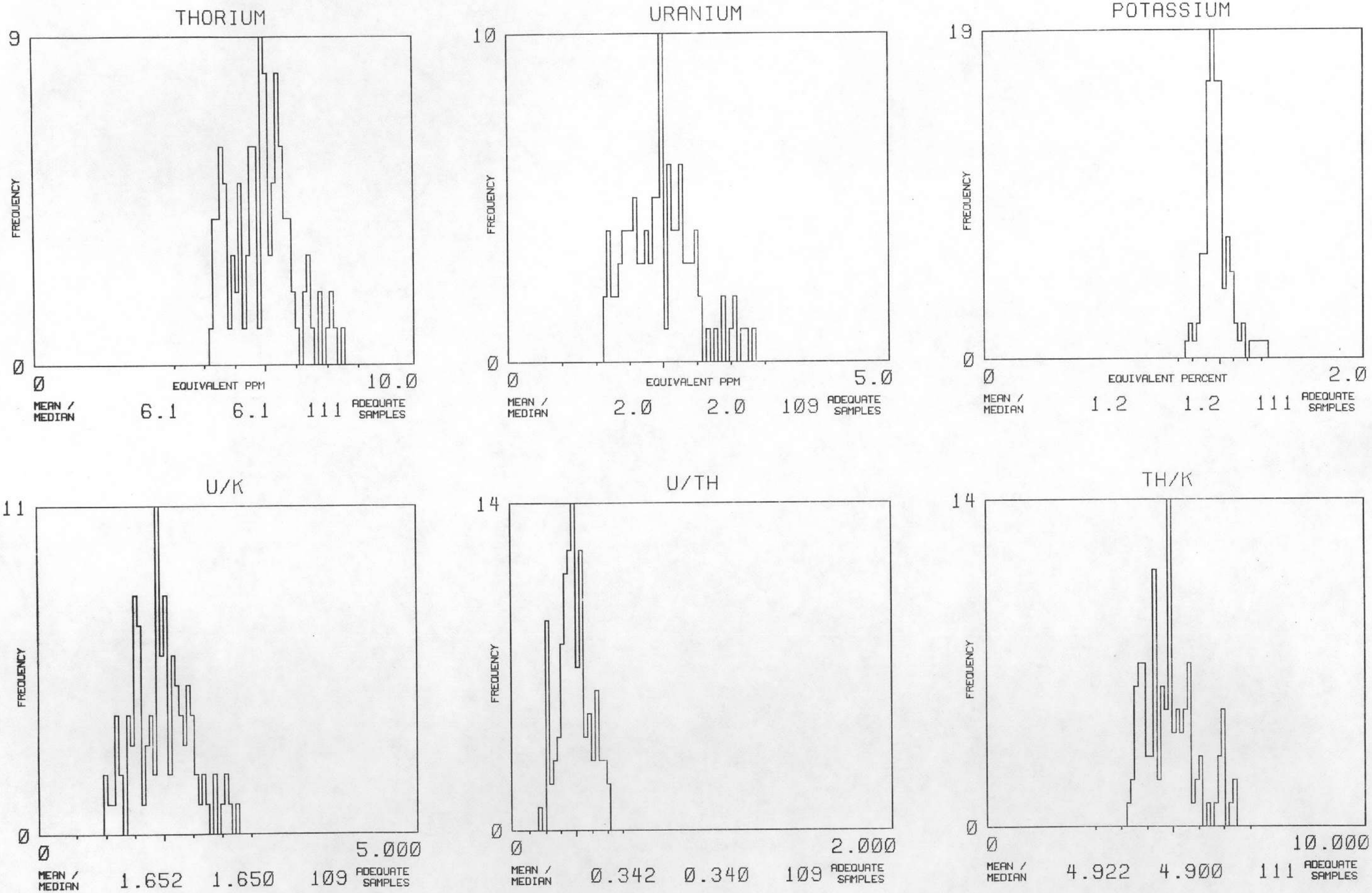


NJ 16-2 INDIANAPOLIS MAP UNIT : QCL TOTAL NUMBER OF SAMPLES 556

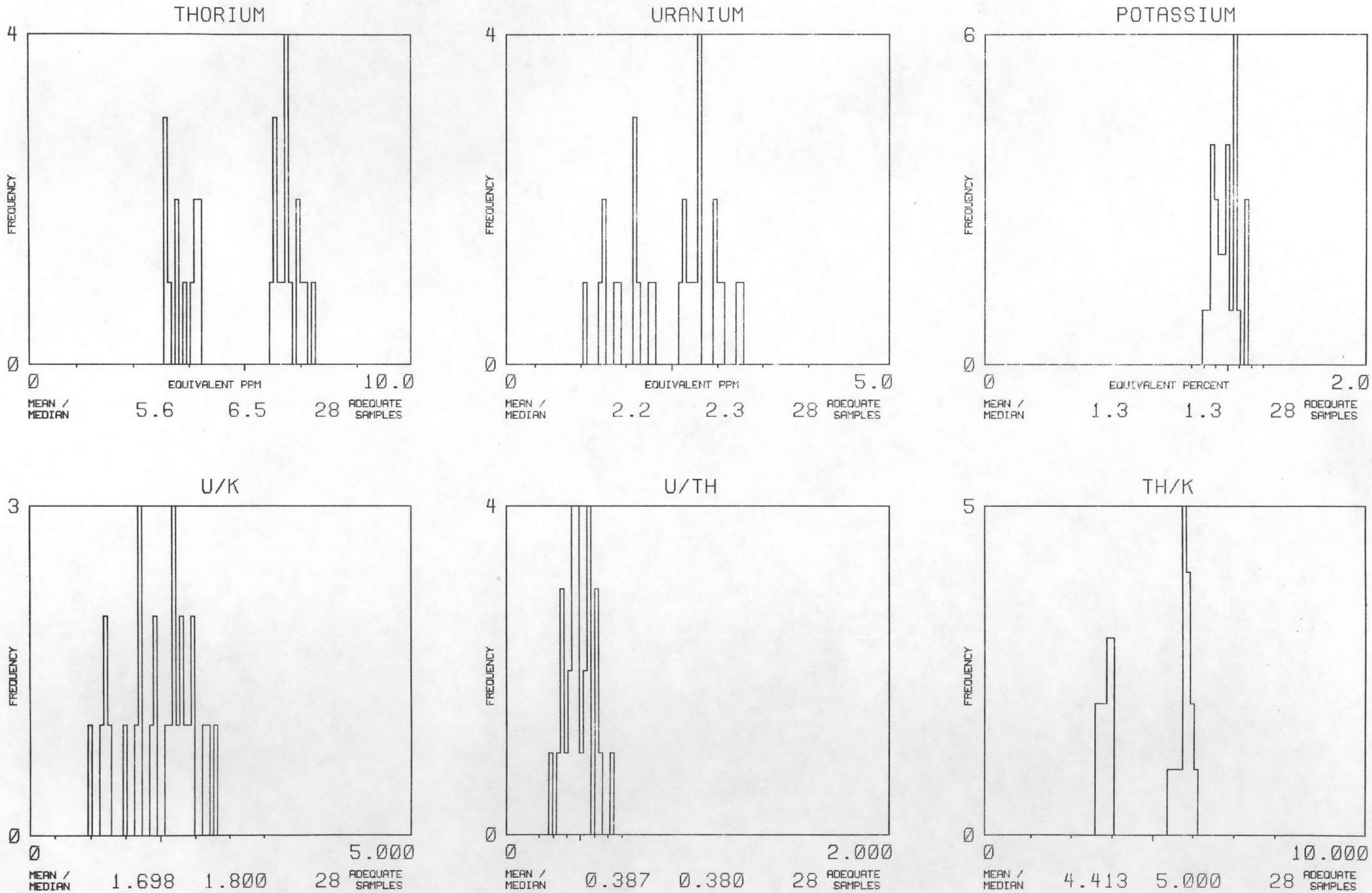



NJ 16-2
INDIANAPOLIS
MAP UNIT : QGV
TOTAL NUMBER OF SAMPLES
1637
THORIUM
67
0
FREQUENCY
0
EQUIVALENT PPM
10.0
MEAN / MEDIAN
5.1
5.0
1612
ADEQUATE SAMPLES
URANIUM
83
0
FREQUENCY
0
EQUIVALENT PPM
5.0
MEAN / MEDIAN
1.9
1.8
1527
ADEQUATE SAMPLES
POTASSIUM
99
0
FREQUENCY
0
EQUIVALENT PERCENT
2.0
MEAN / MEDIAN
1.2
1.2
1612
ADEQUATE SAMPLES
U/K
85
0
FREQUENCY
0
5.000
MEAN / MEDIAN
1.637
1.600
1527
ADEQUATE SAMPLES
U/TH
159
0
FREQUENCY
0
2.000
MEAN / MEDIAN
0.377
0.360
1527
ADEQUATE SAMPLES
TH/K
94
0
FREQUENCY
0
10.000
MEAN / MEDIAN
4.381
4.400
1612
ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS MAP UNIT : QGP TOTAL NUMBER OF SAMPLES 111



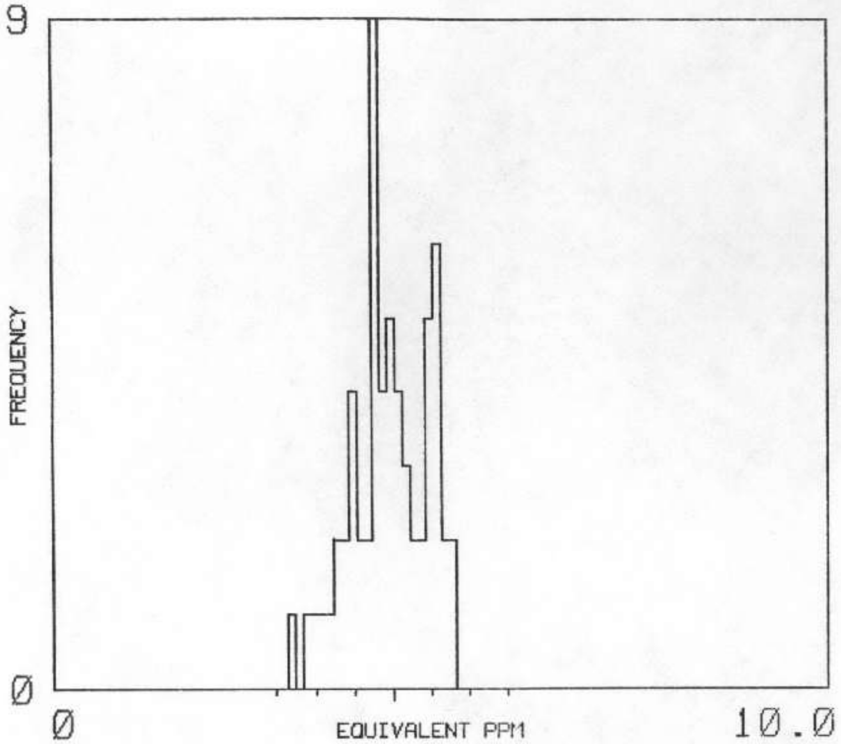
NJ 16-2 INDIANAPOLIS MAP UNIT : QGK TOTAL NUMBER OF SAMPLES 28



NJ 16-2 INDIANAPOLIS

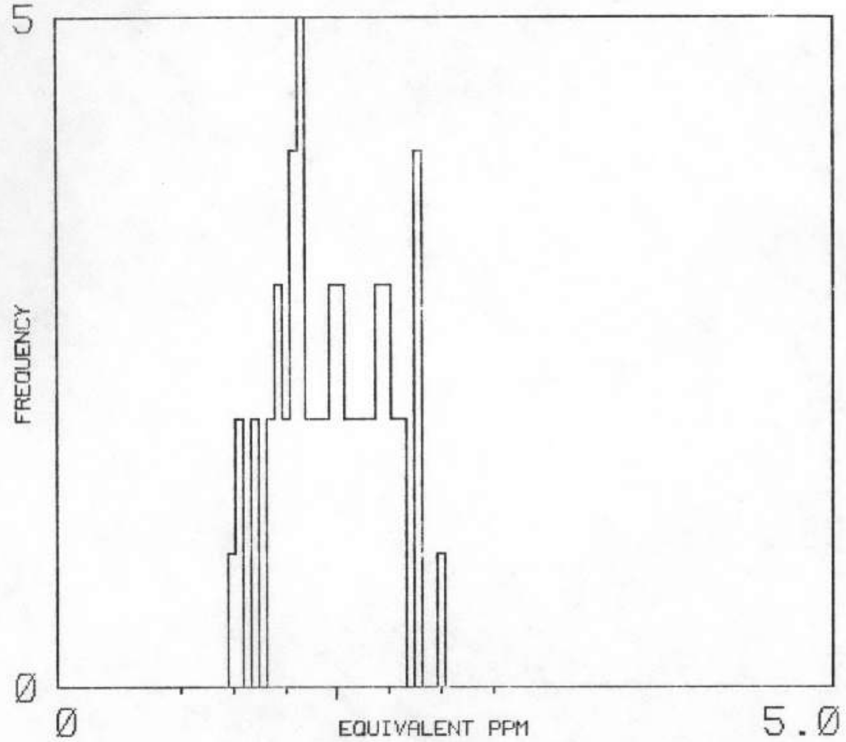
MAP UNIT : QGT TOTAL NUMBER OF SAMPLES 102

THORIUM



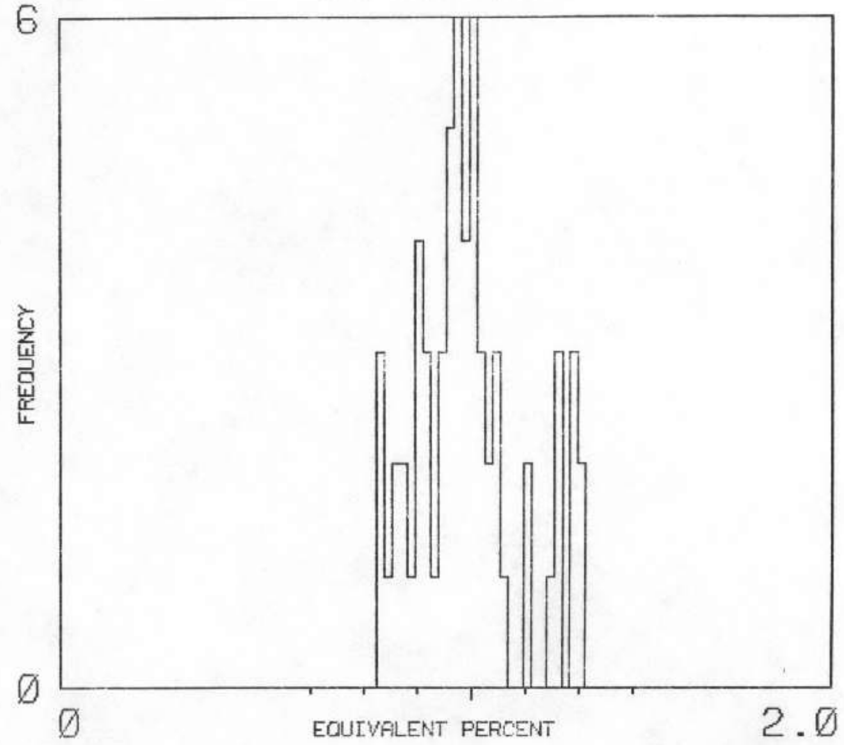
MEAN / MEDIAN 4.4 4.4 61 ADEQUATE SAMPLES

URANIUM



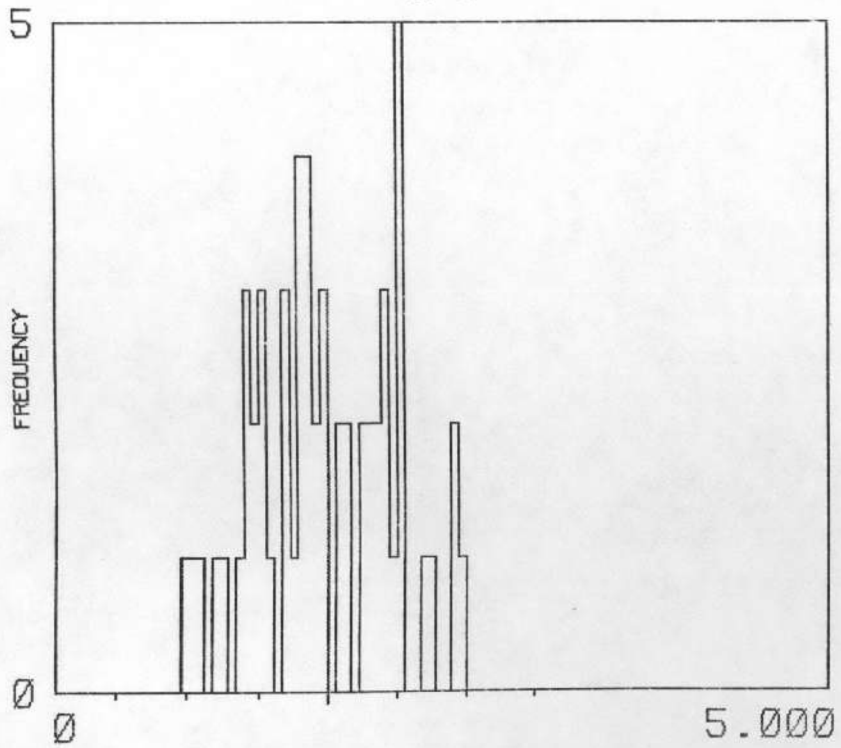
MEAN / MEDIAN 1.8 1.8 56 ADEQUATE SAMPLES

POTASSIUM



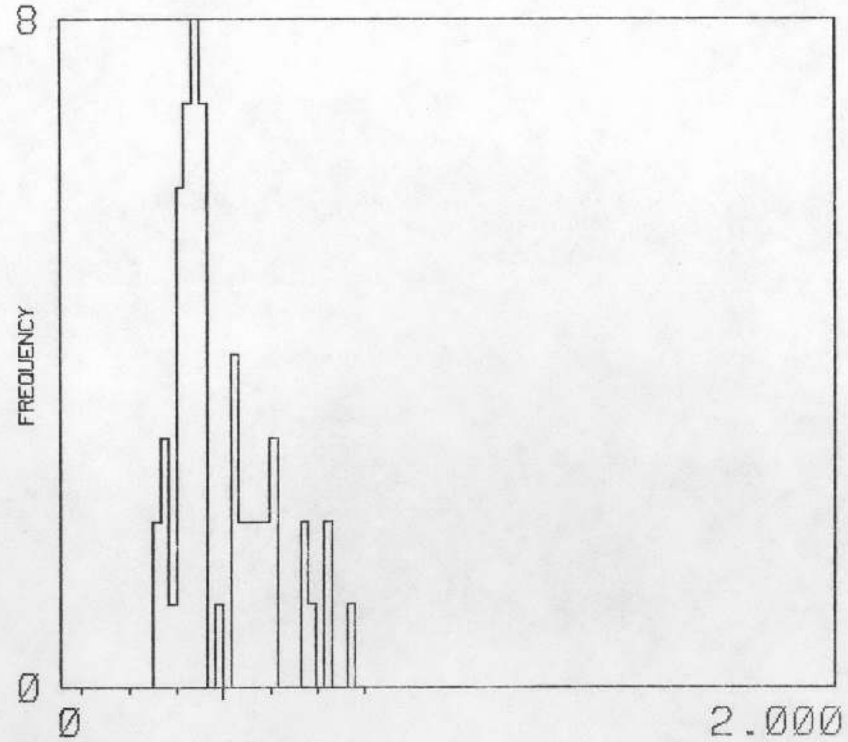
MEAN / MEDIAN 1.1 1.Ø 61 ADEQUATE SAMPLES

U/K



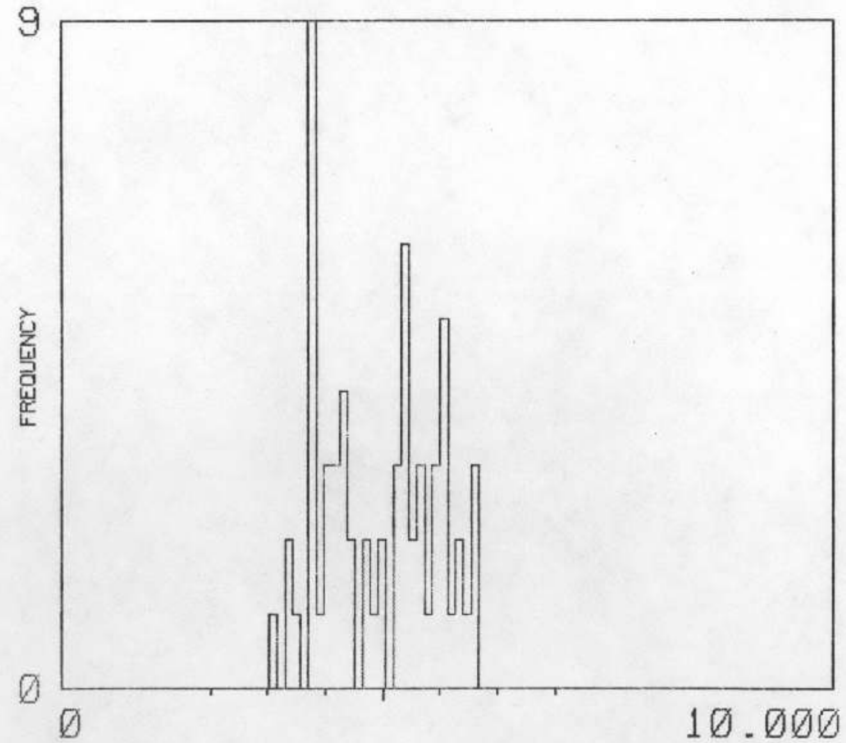
MEAN / MEDIAN 1.747 1.7ØØ 56 ADEQUATE SAMPLES

U/TH



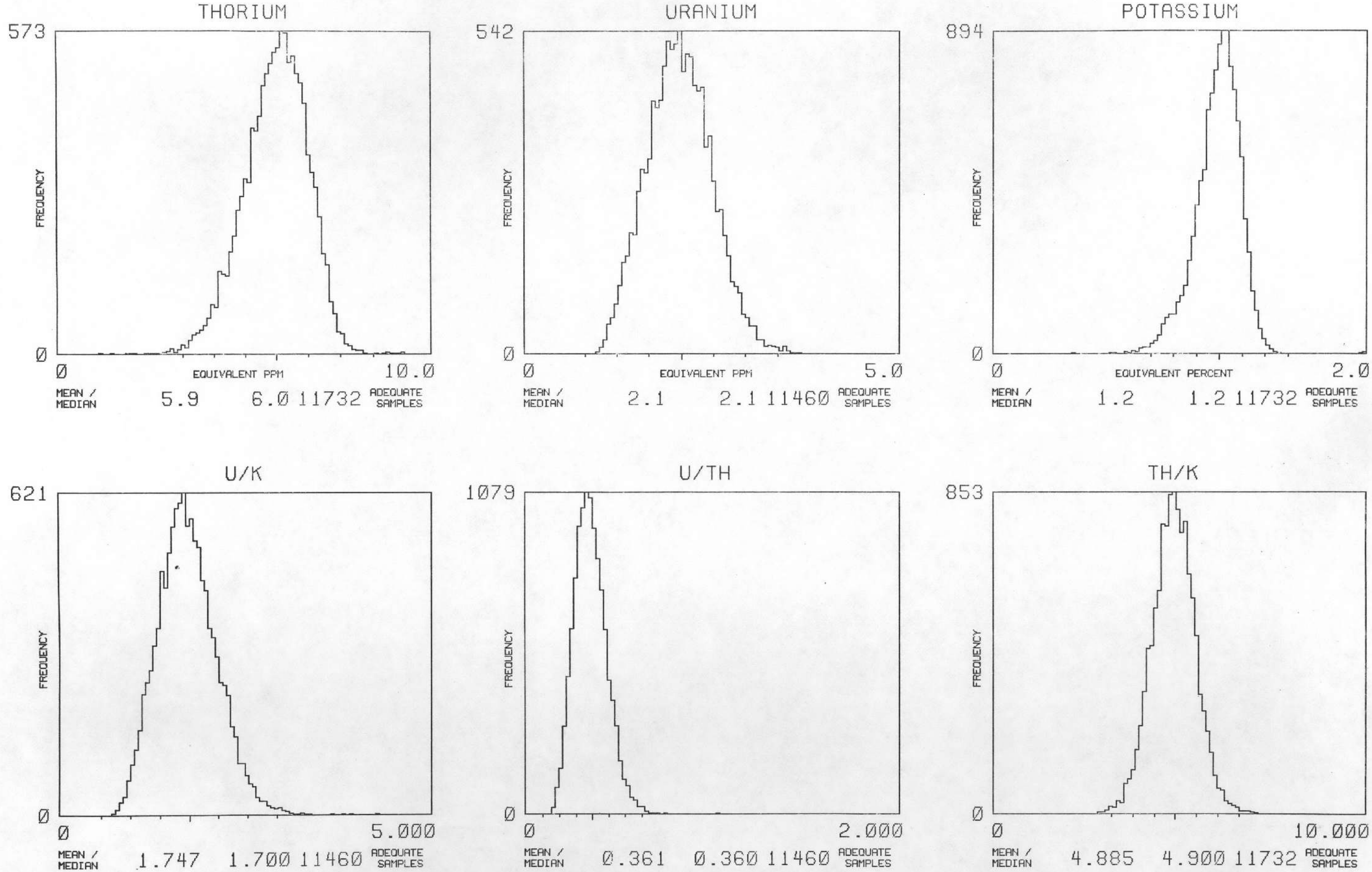
MEAN / MEDIAN Ø.422 Ø.38Ø 56 ADEQUATE SAMPLES

TH/K



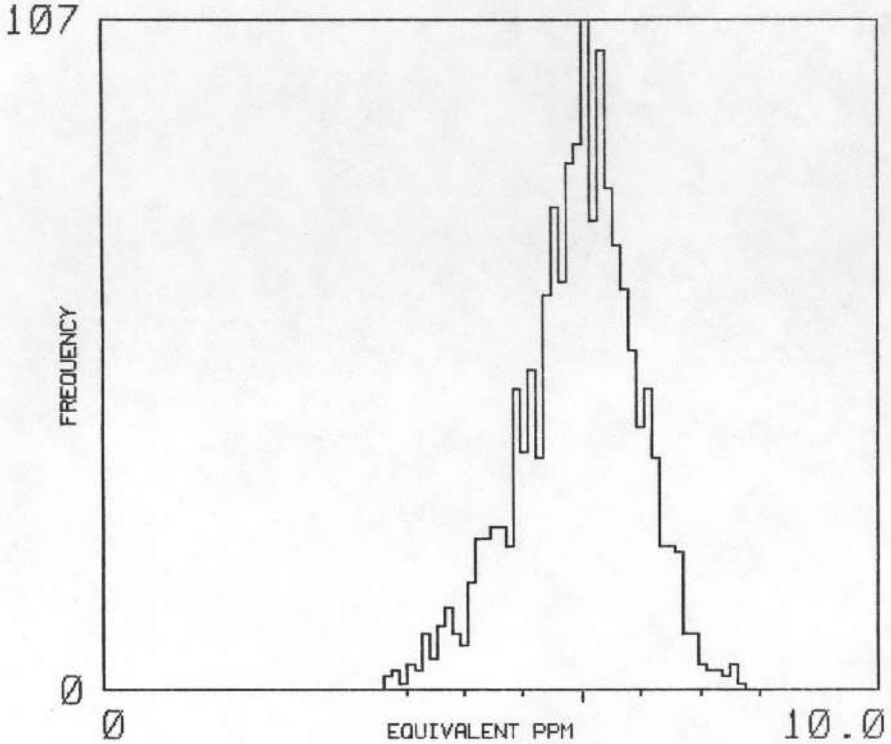
MEAN / MEDIAN 4.17Ø 4.2ØØ 61 ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS MAP UNIT : QT TOTAL NUMBER OF SAMPLES 11789



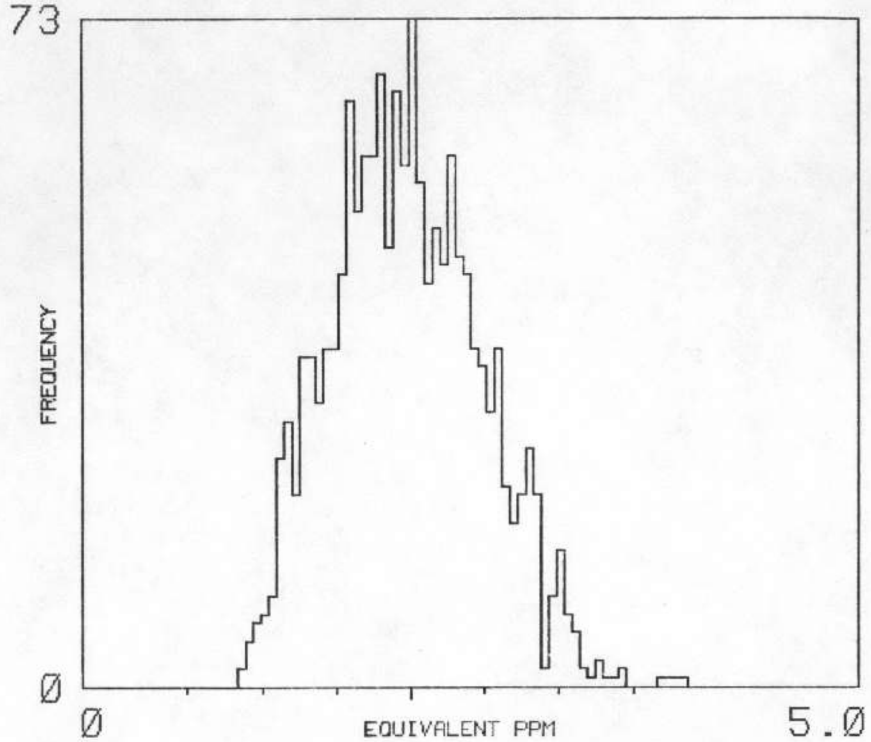
NJ 16-2 INDIANAPOLIS MAP UNIT : QTE TOTAL NUMBER OF SAMPLES 1539

THORIUM



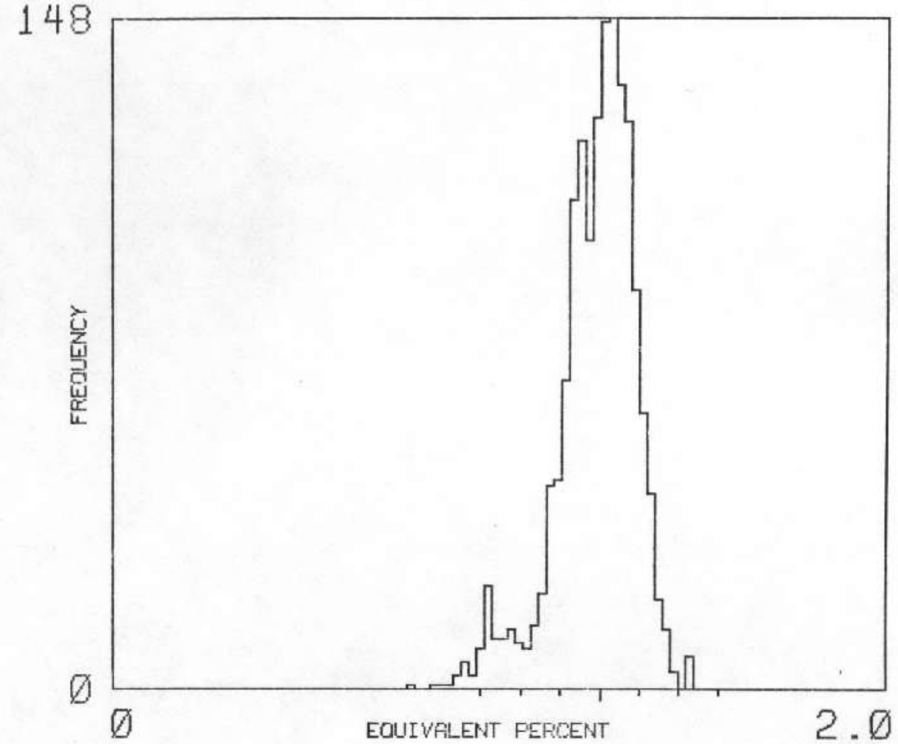
MEAN / MEDIAN 6.2 6.3 1539 ADEQUATE SAMPLES

URANIUM



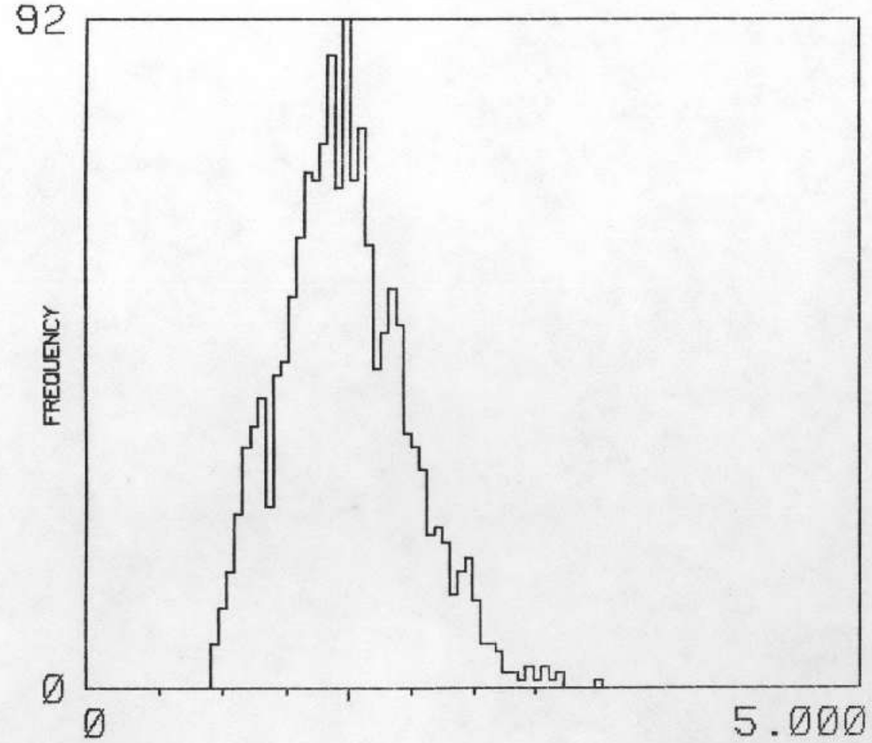
MEAN / MEDIAN 2.1 2.1 1518 ADEQUATE SAMPLES

POTASSIUM



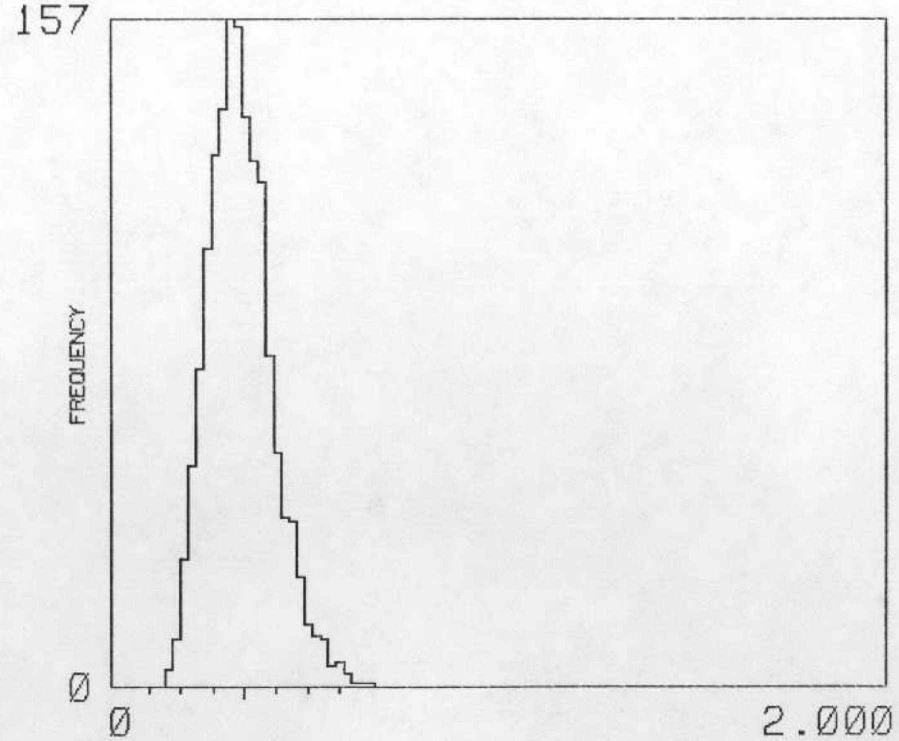
MEAN / MEDIAN 1.3 1.3 1539 ADEQUATE SAMPLES

U/K



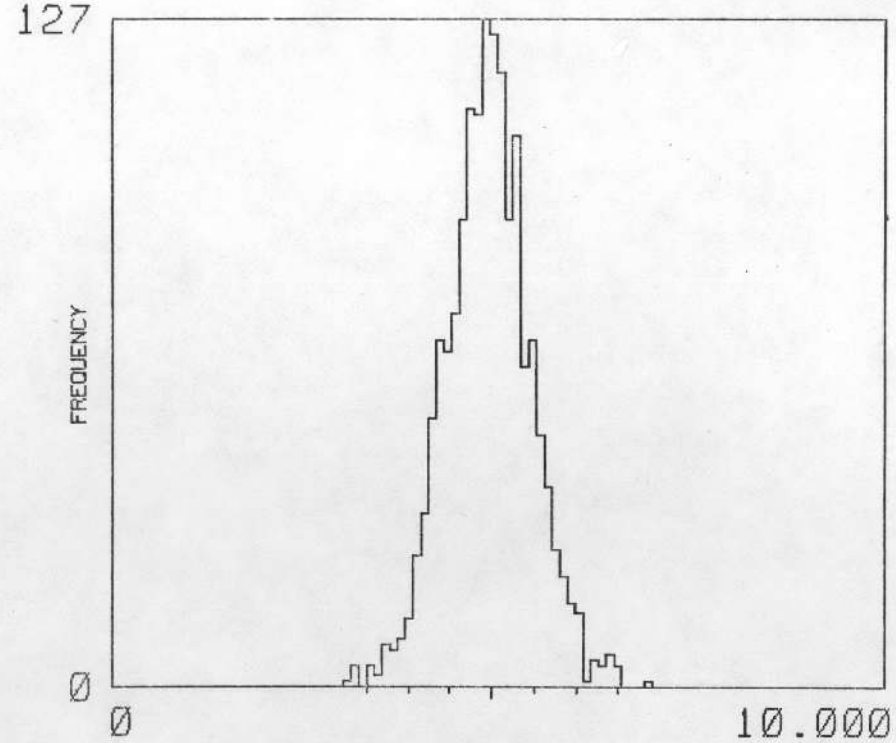
MEAN / MEDIAN 1.692 1.650 1518 ADEQUATE SAMPLES

U/TH



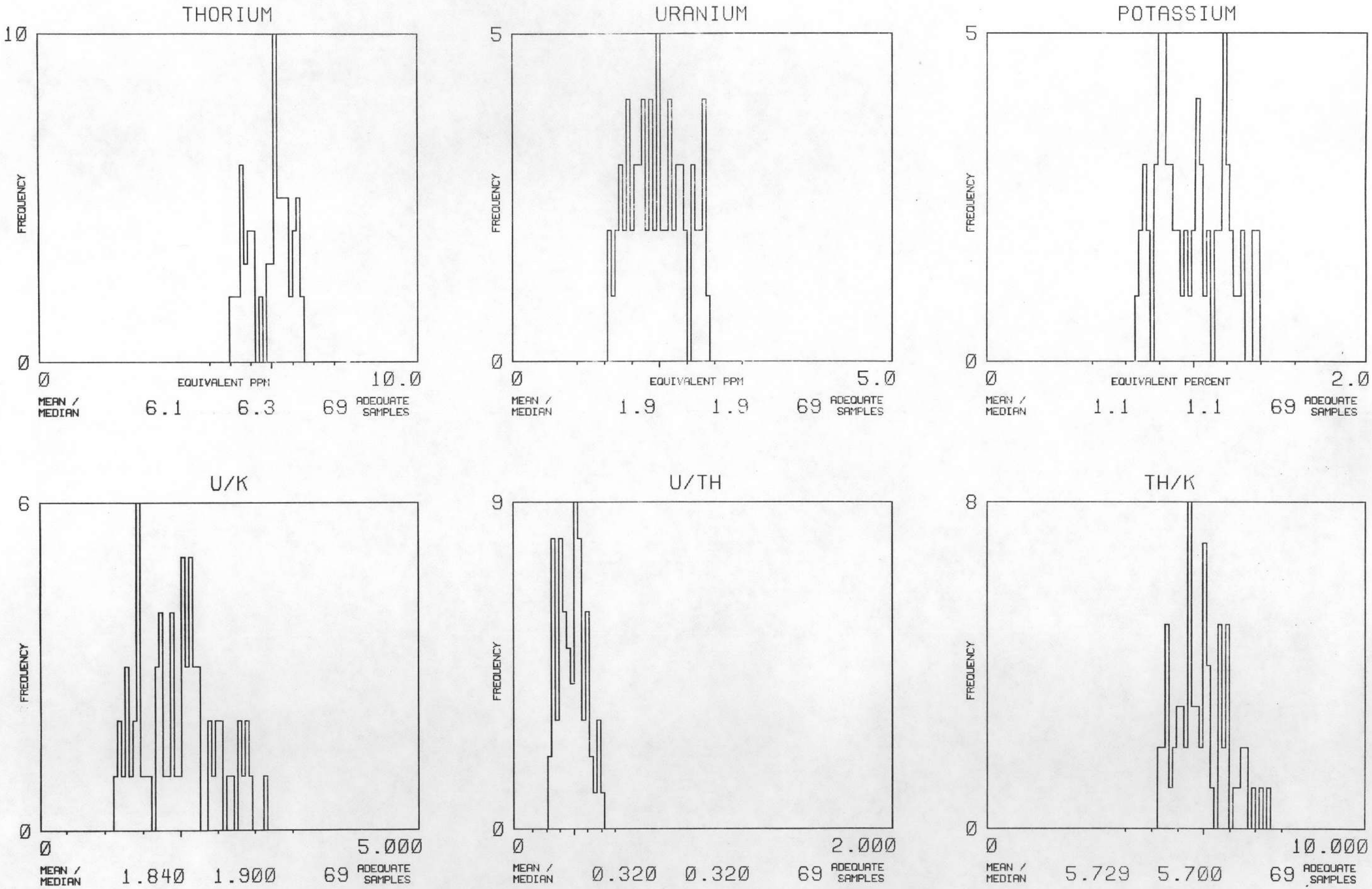
MEAN / MEDIAN 0.345 0.340 1518 ADEQUATE SAMPLES

TH/K

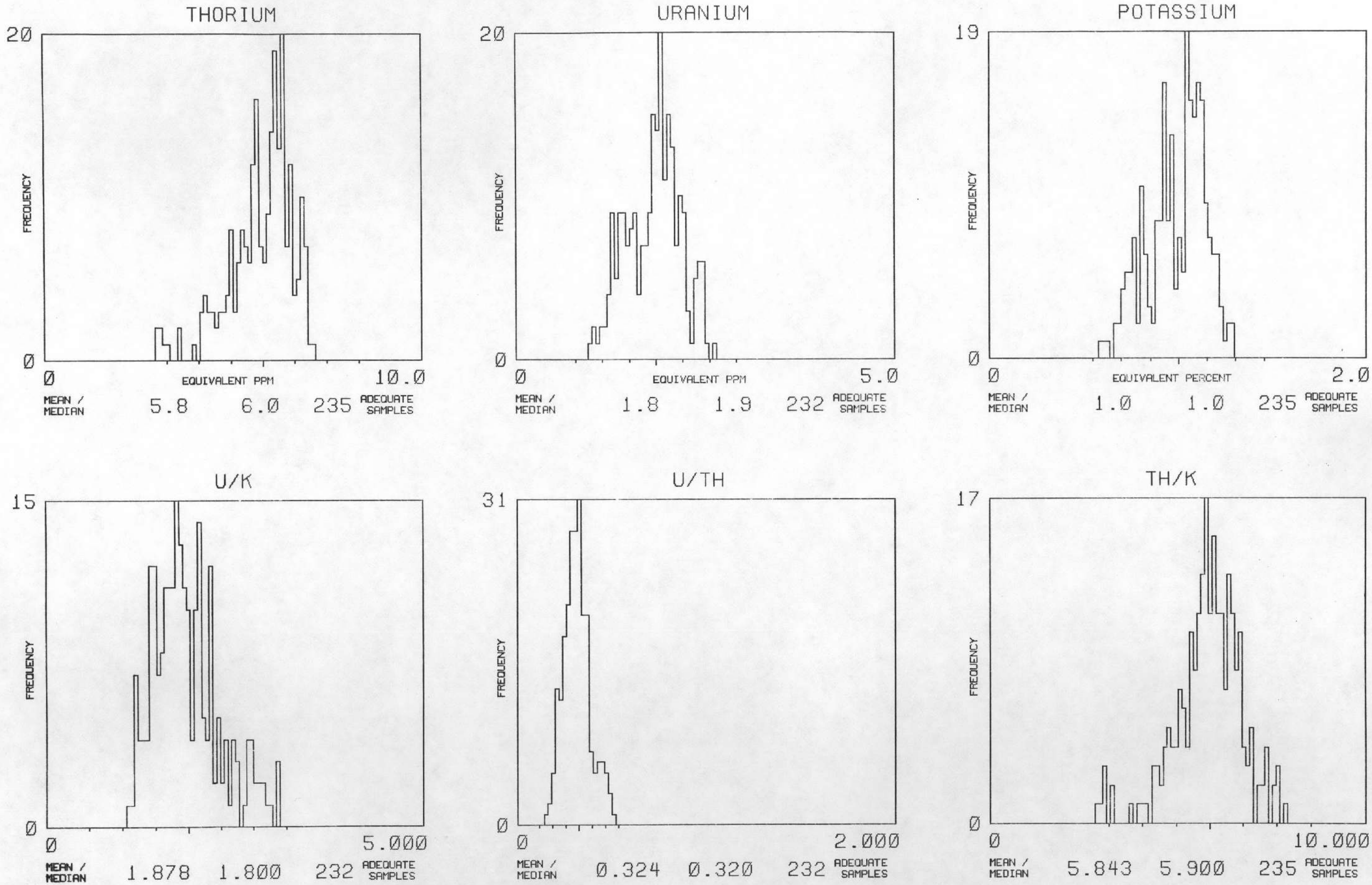


MEAN / MEDIAN 4.931 4.900 1539 ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS MAP UNIT : QSI TOTAL NUMBER OF SAMPLES 69



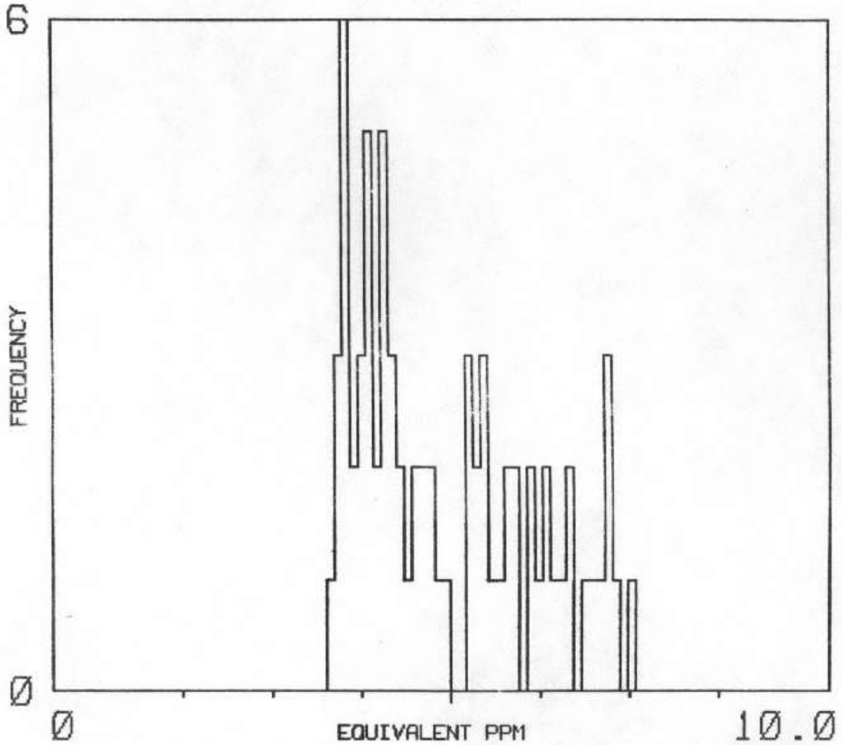
NJ 16-2 INDIANAPOLIS MAP UNIT : QSL TOTAL NUMBER OF SAMPLES 235



NJ 16-2 INDIANAPOLIS

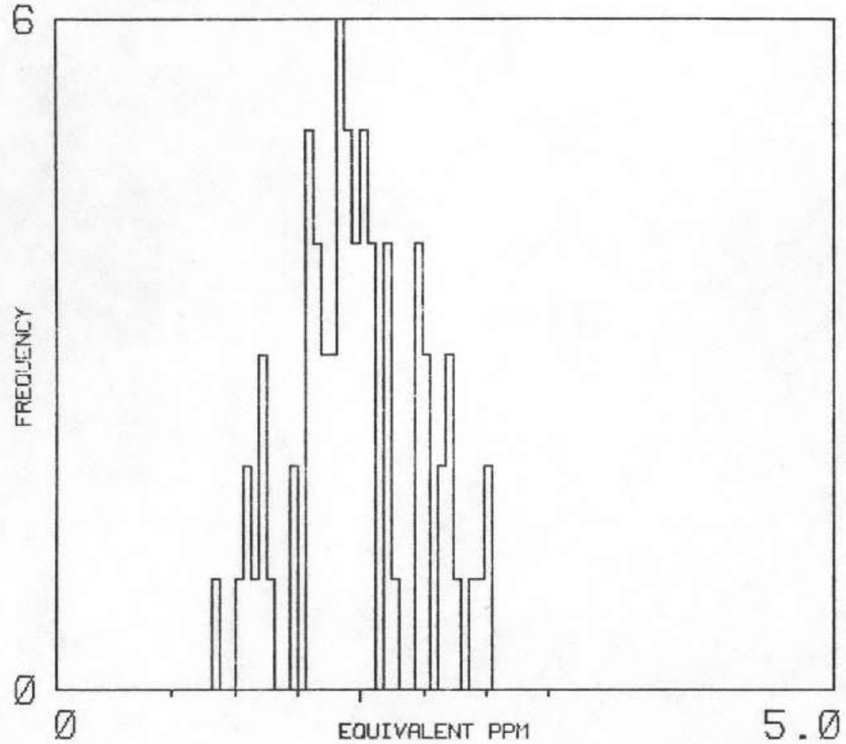
MAP UNIT : QG TOTAL NUMBER OF SAMPLES 72

THORIUM



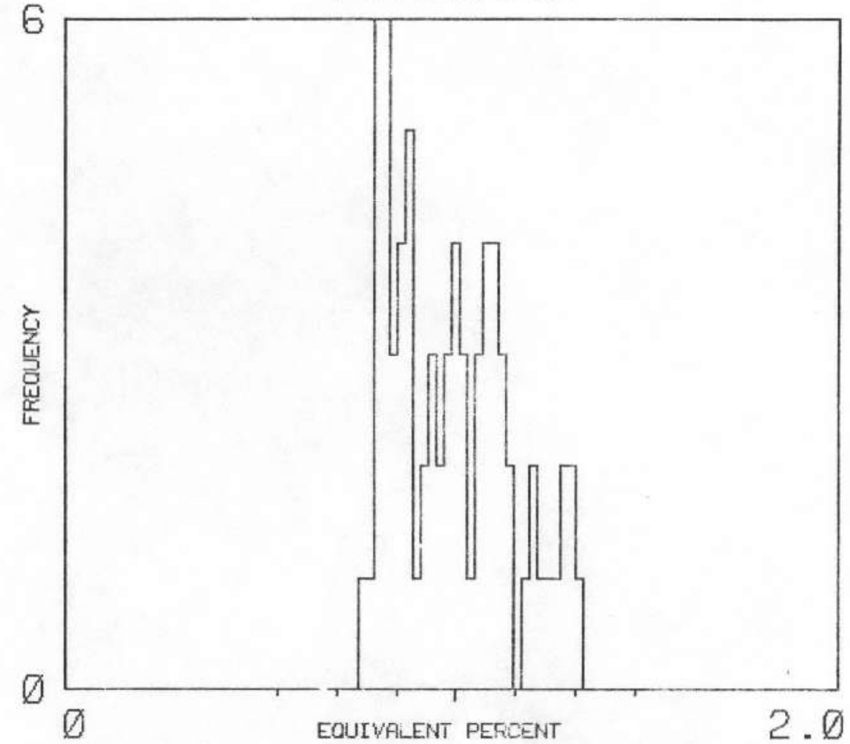
MEAN / MEDIAN 5.1 4.8 72 ADEQUATE SAMPLES

URANIUM



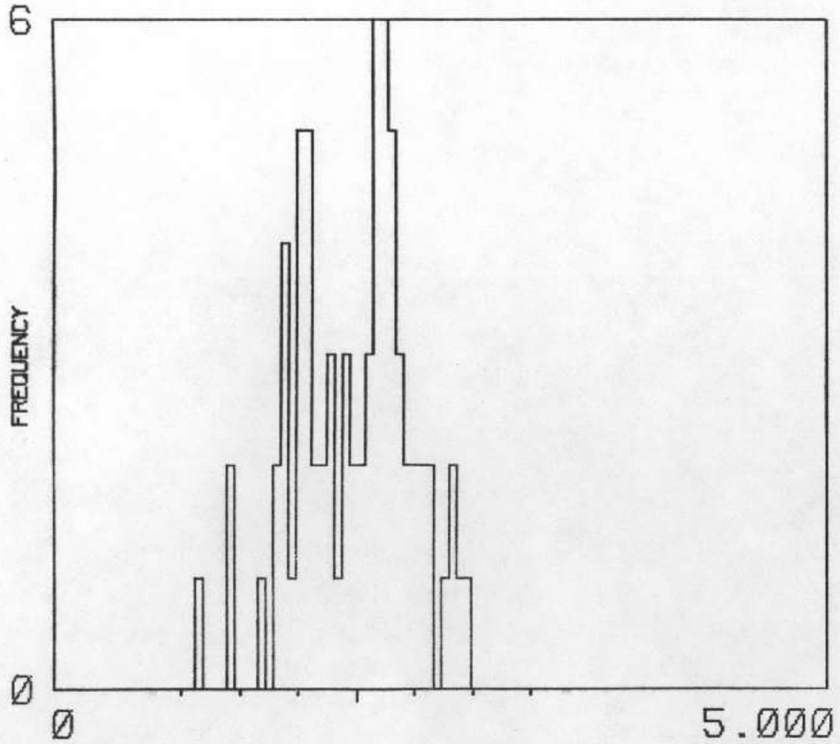
MEAN / MEDIAN 2.0 1.9 72 ADEQUATE SAMPLES

POTASSIUM



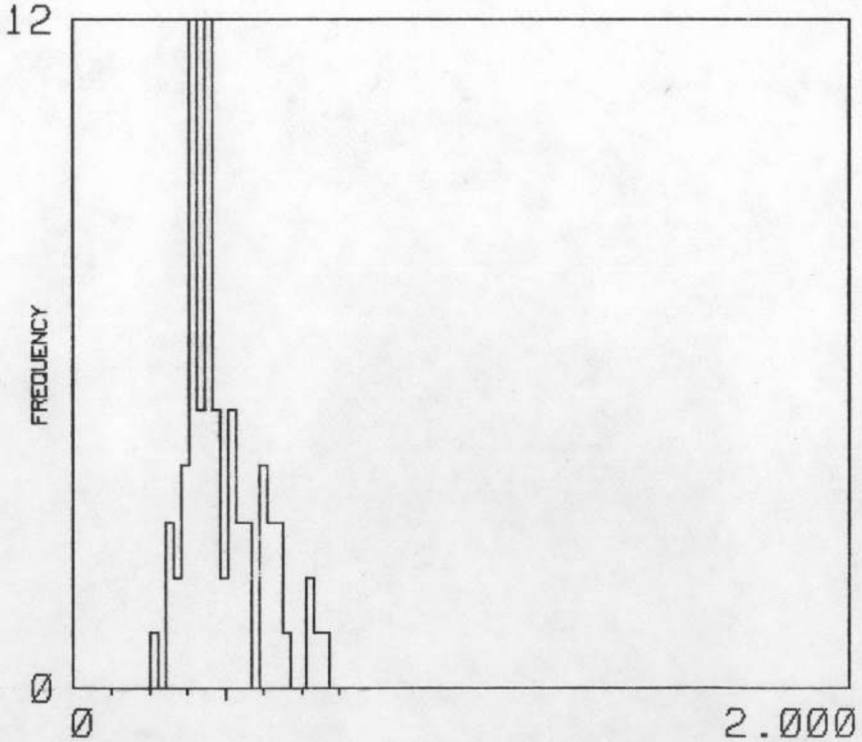
MEAN / MEDIAN 1.0 1.0 72 ADEQUATE SAMPLES

U/K



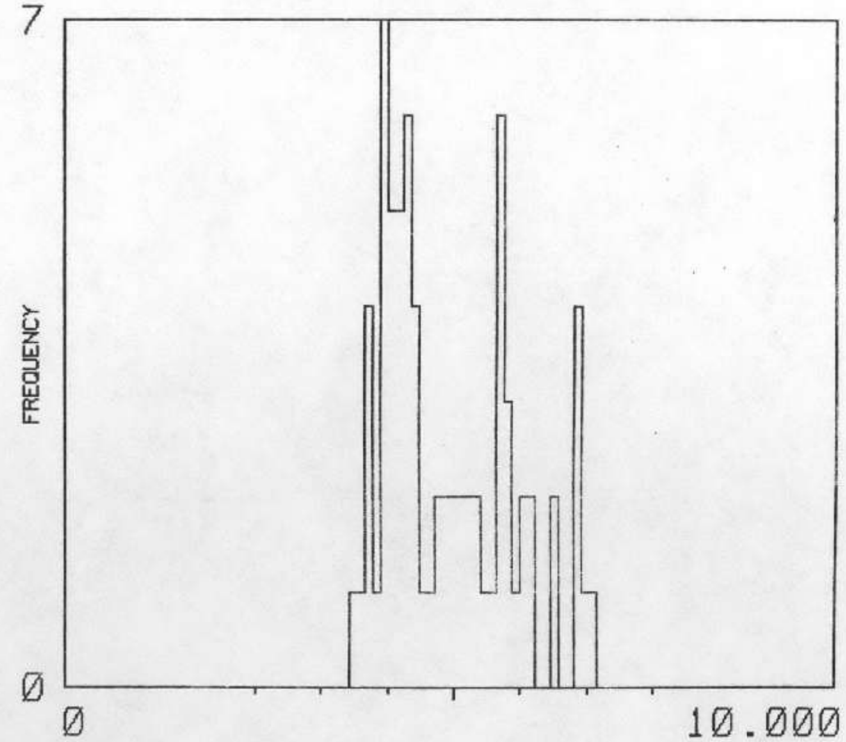
MEAN / MEDIAN 1.949 2.000 72 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.394 0.360 72 ADEQUATE SAMPLES

TH/K

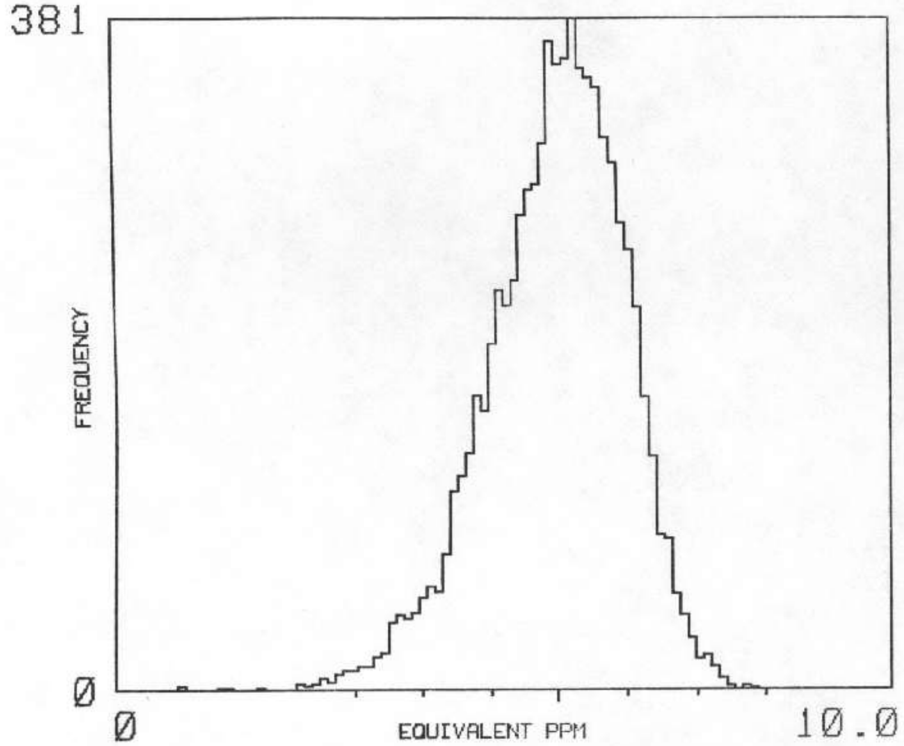


MEAN / MEDIAN 5.052 4.800 72 ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS

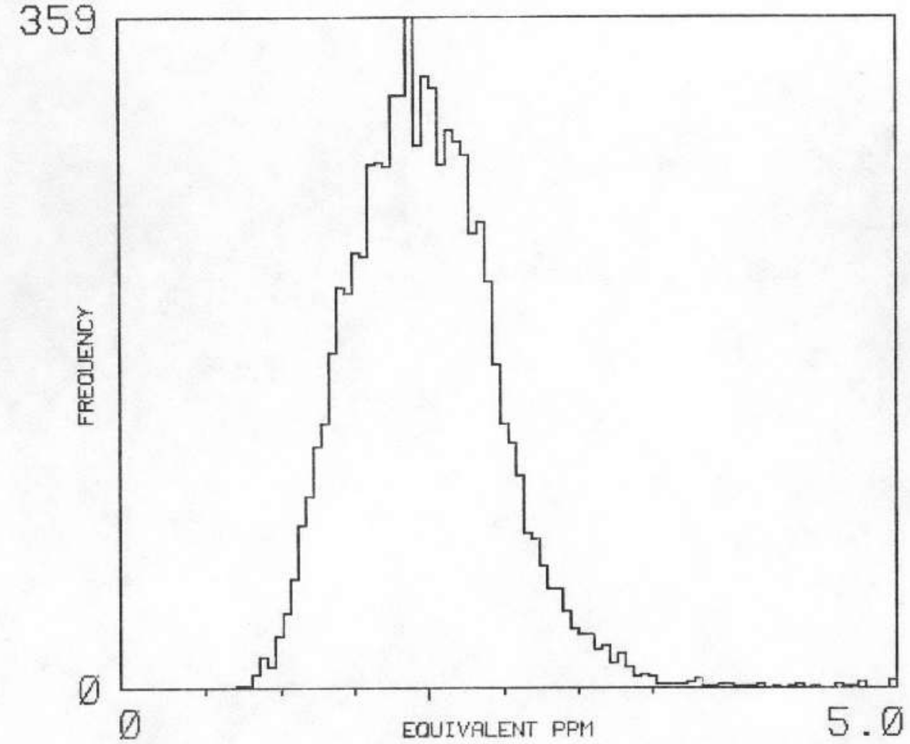
MAP UNIT : QTI TOTAL NUMBER OF SAMPLES 7774

THORIUM



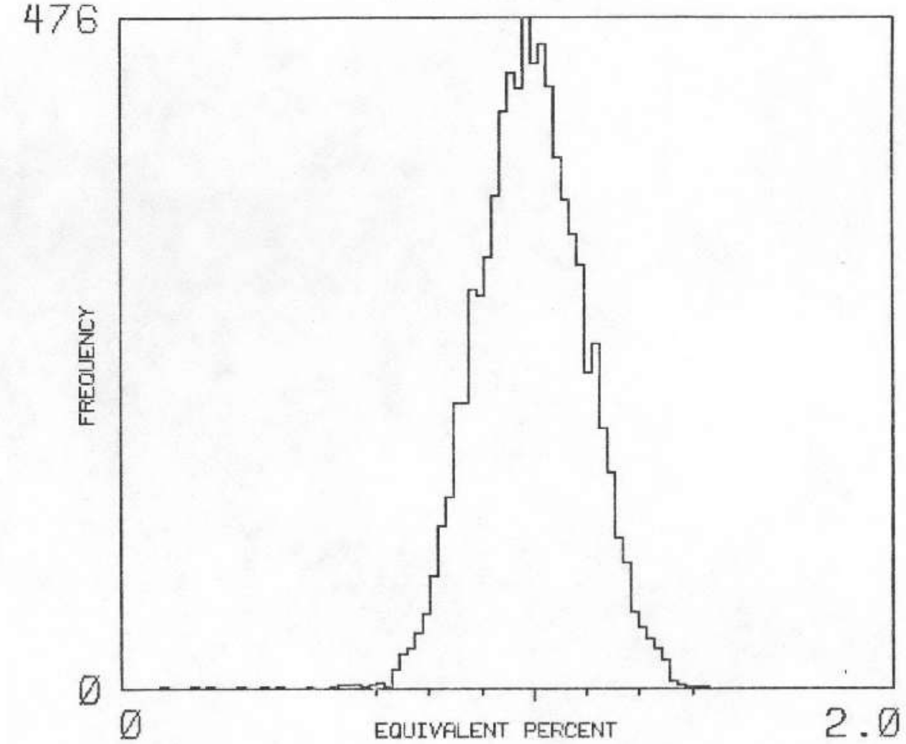
MEAN / MEDIAN 5.7 5.8 7763 ADEQUATE SAMPLES

URANIUM



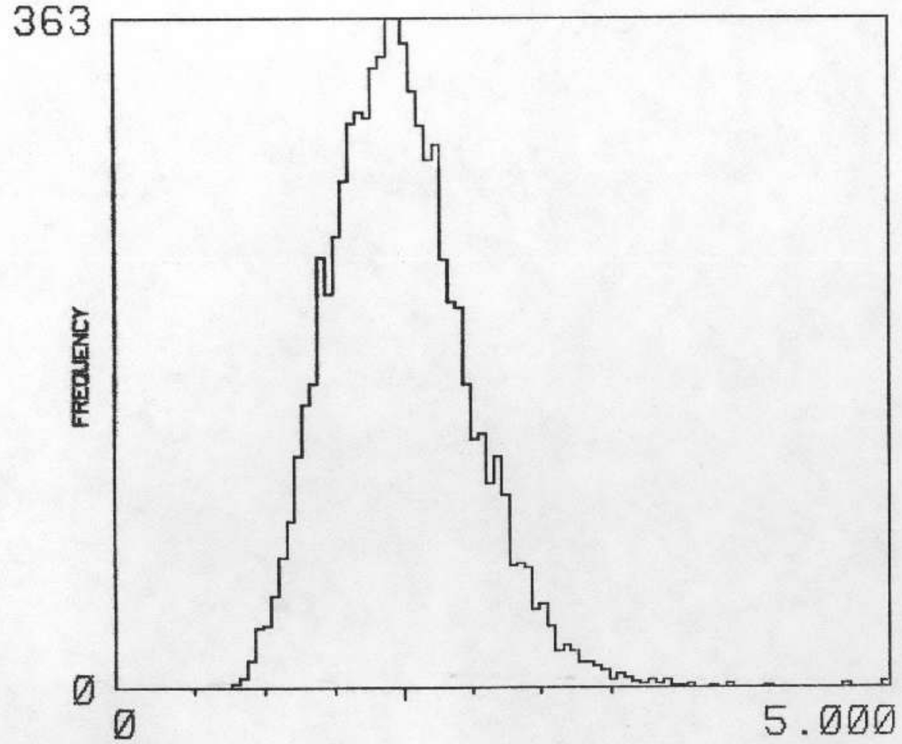
MEAN / MEDIAN 2.0 1.9 7501 ADEQUATE SAMPLES

POTASSIUM



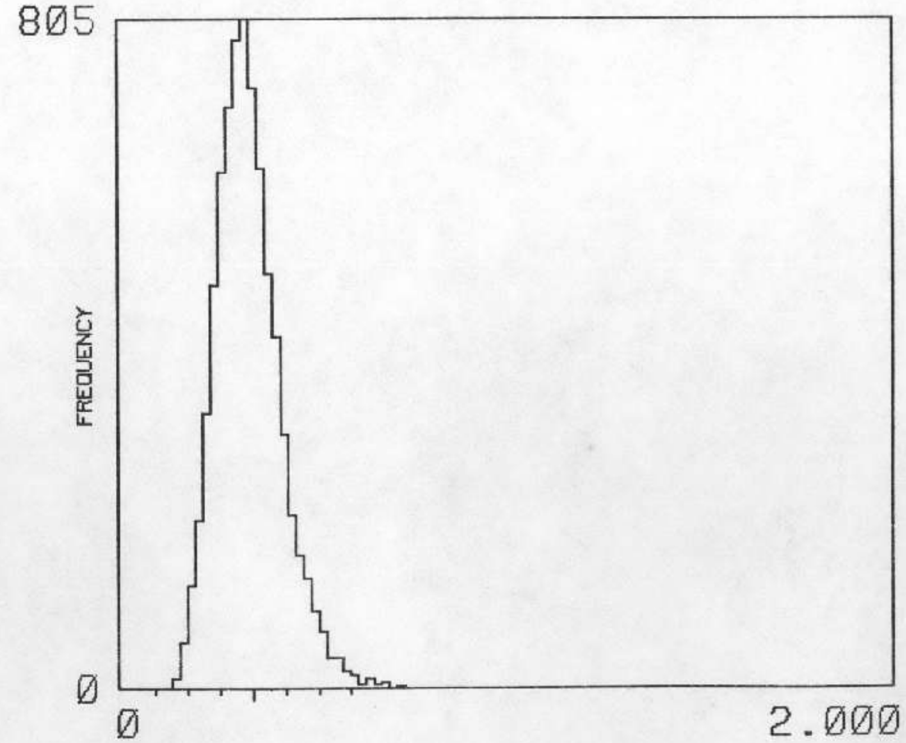
MEAN / MEDIAN 1.1 1.1 7765 ADEQUATE SAMPLES

U/K



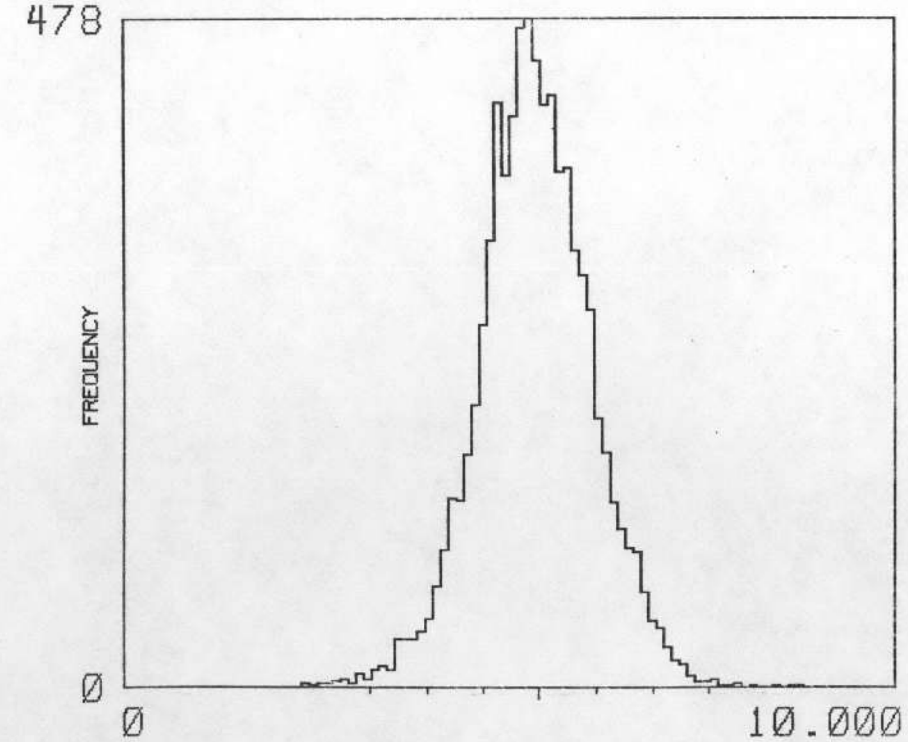
MEAN / MEDIAN 1.867 1.850 7501 ADEQUATE SAMPLES

U/TH



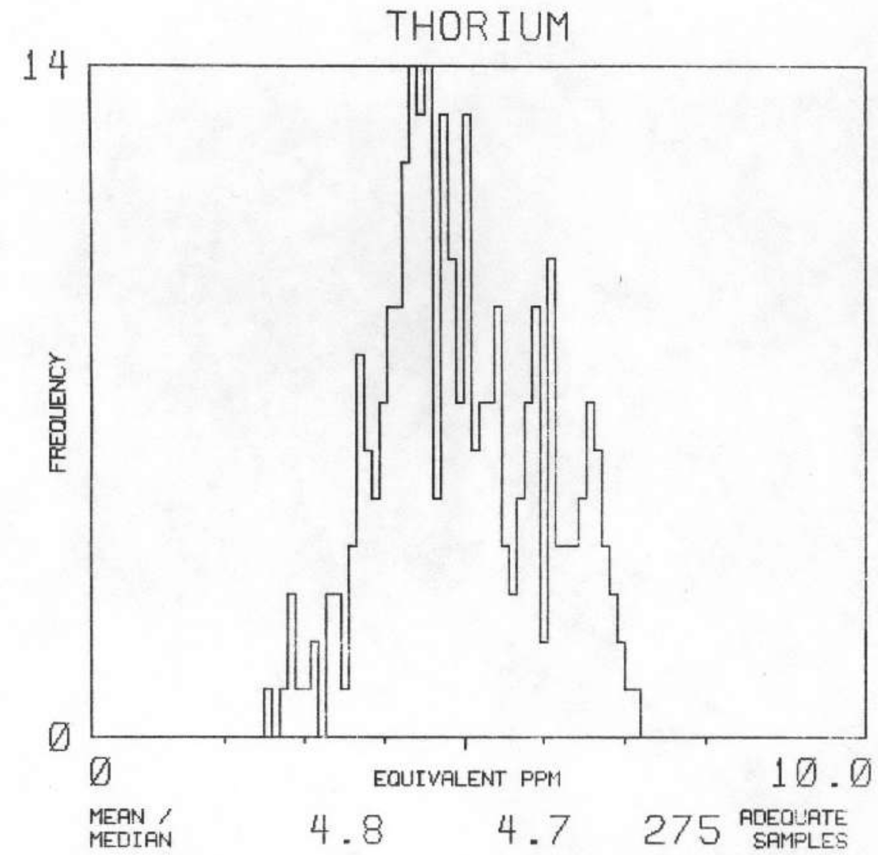
MEAN / MEDIAN 0.349 0.340 7501 ADEQUATE SAMPLES

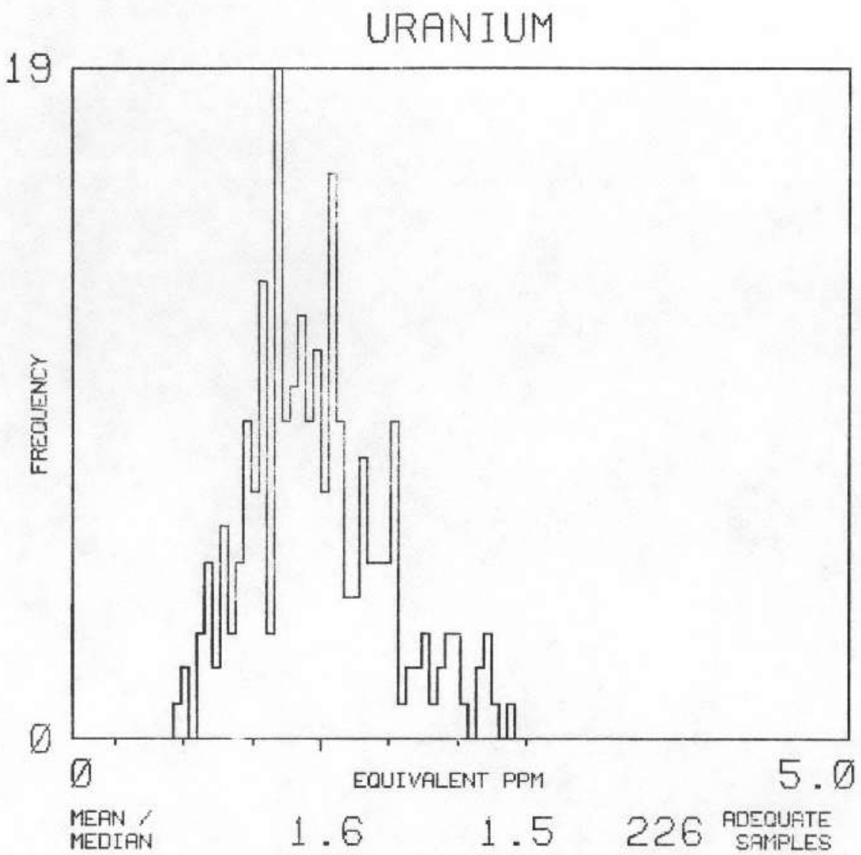
TH/K

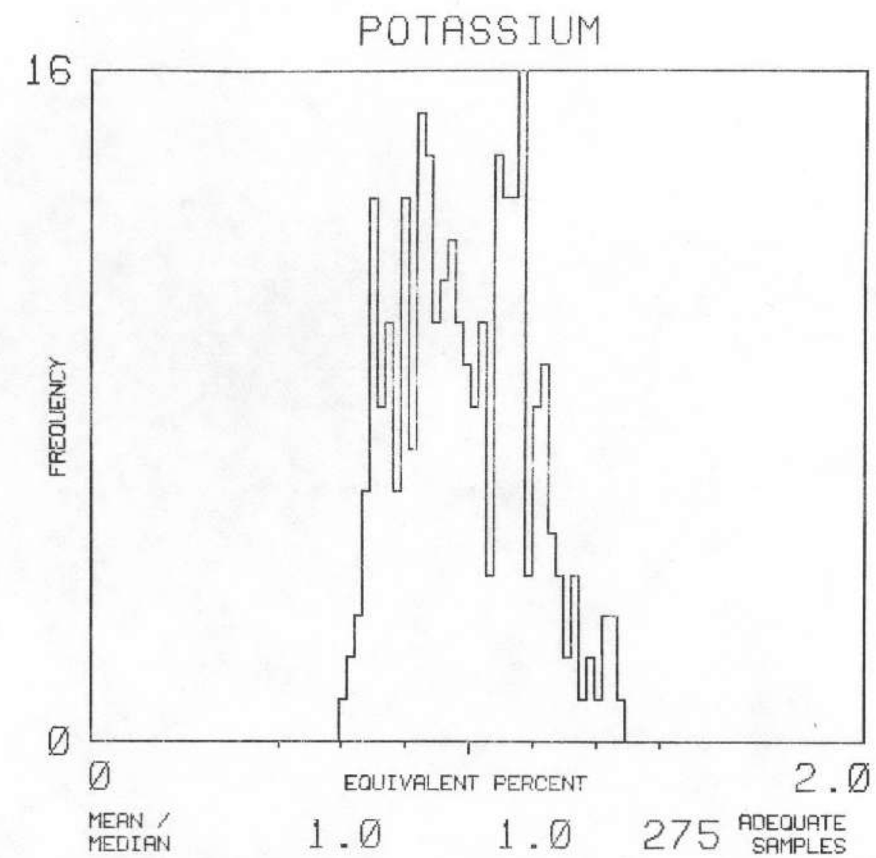


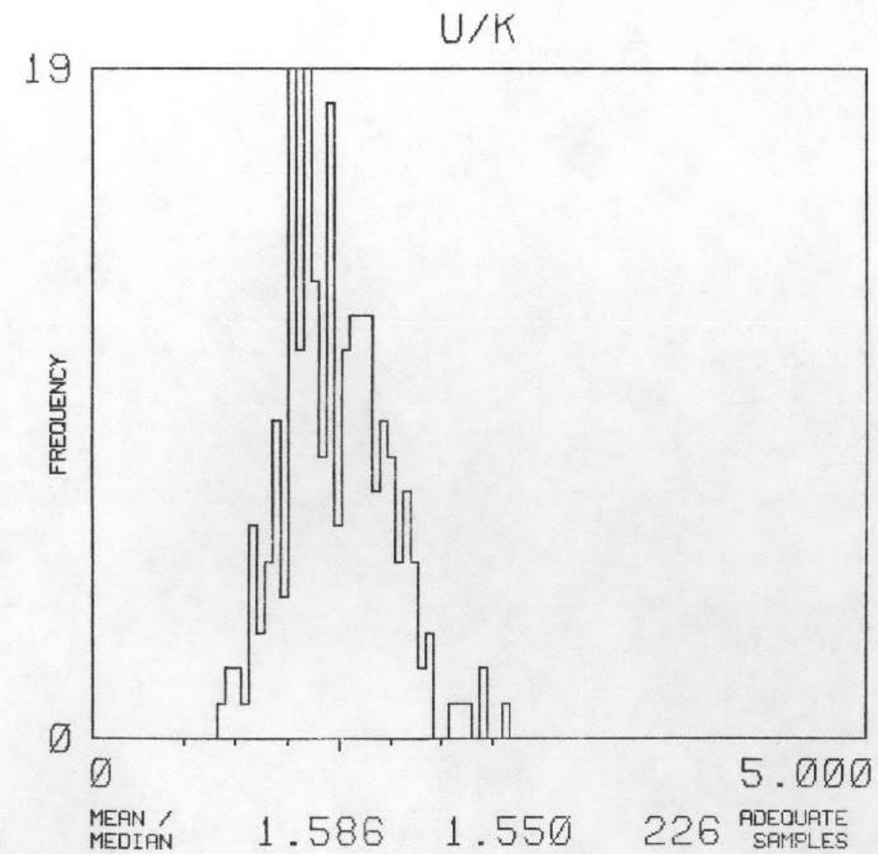
MEAN / MEDIAN 5.382 5.400 7763 ADEQUATE SAMPLES

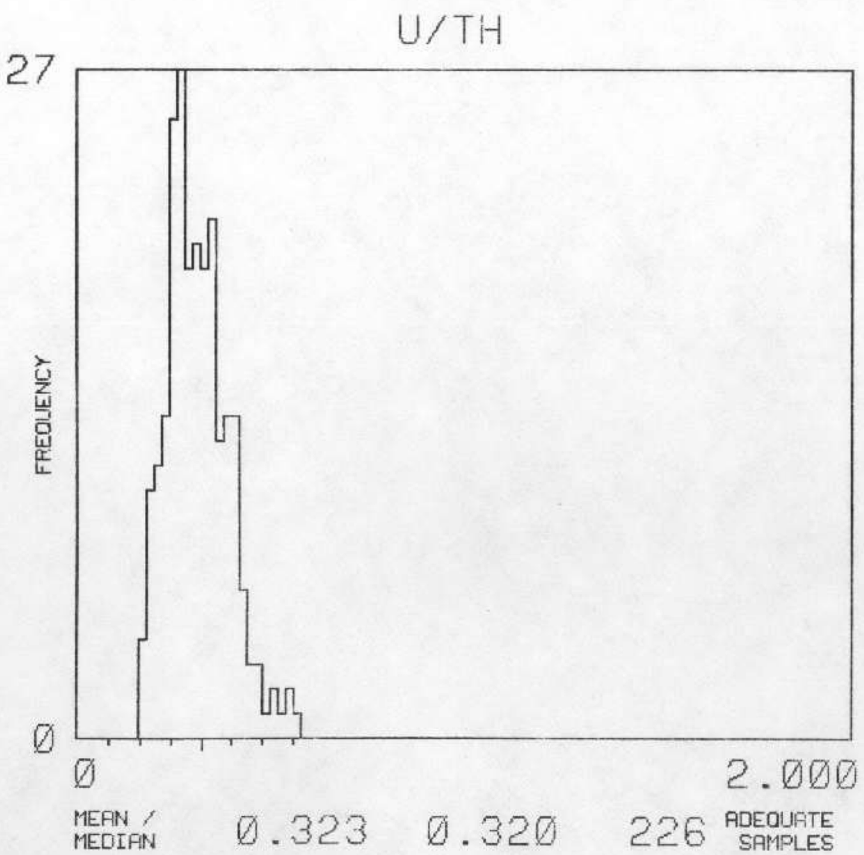
NJ 16-2 INDIANAPOLIS MAP UNIT : QTG TOTAL NUMBER OF SAMPLES 275

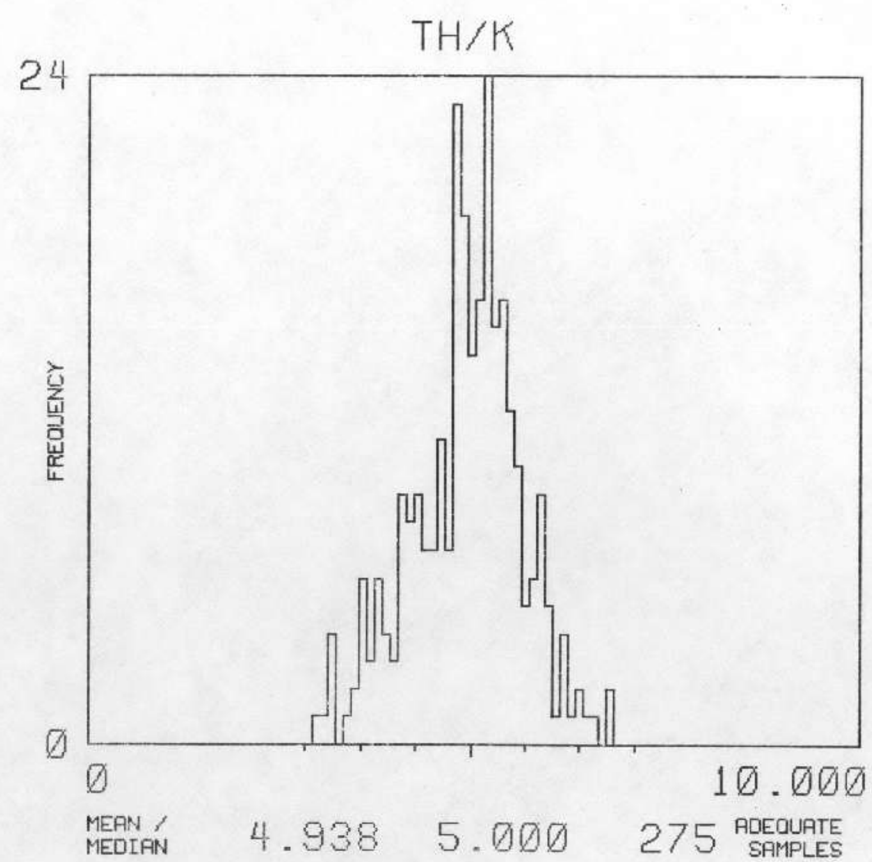






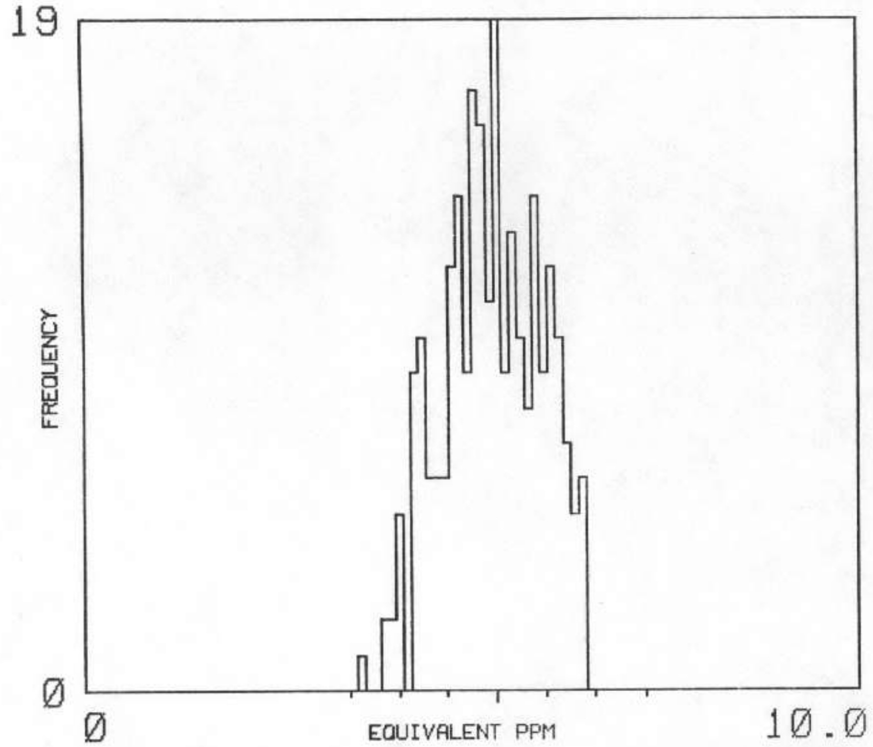






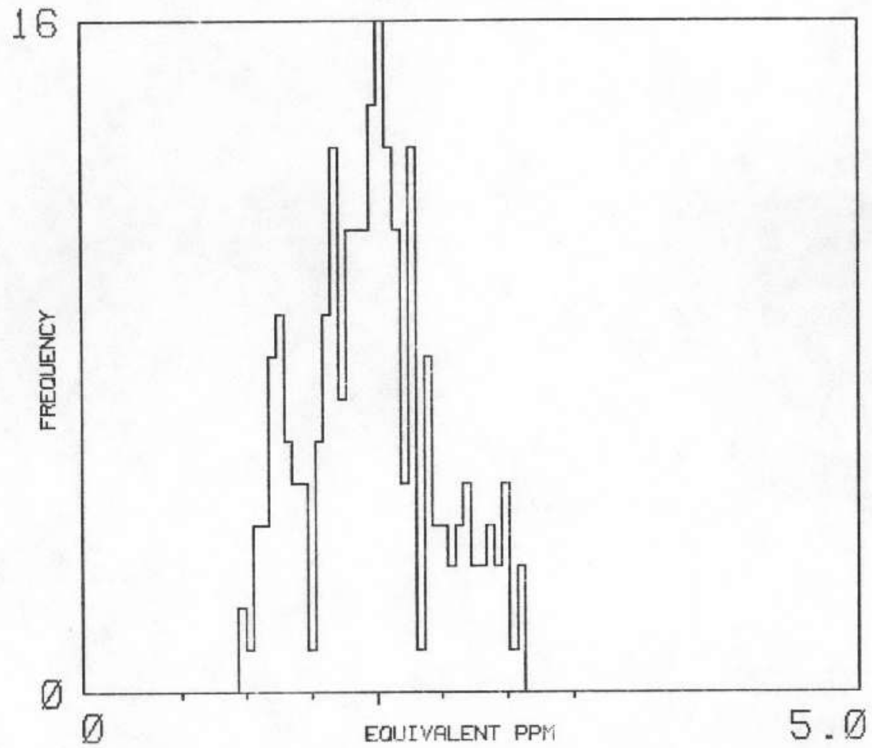
NJ 16-2 INDIANAPOLIS MAP UNIT : MS TOTAL NUMBER OF SAMPLES 248

THORIUM



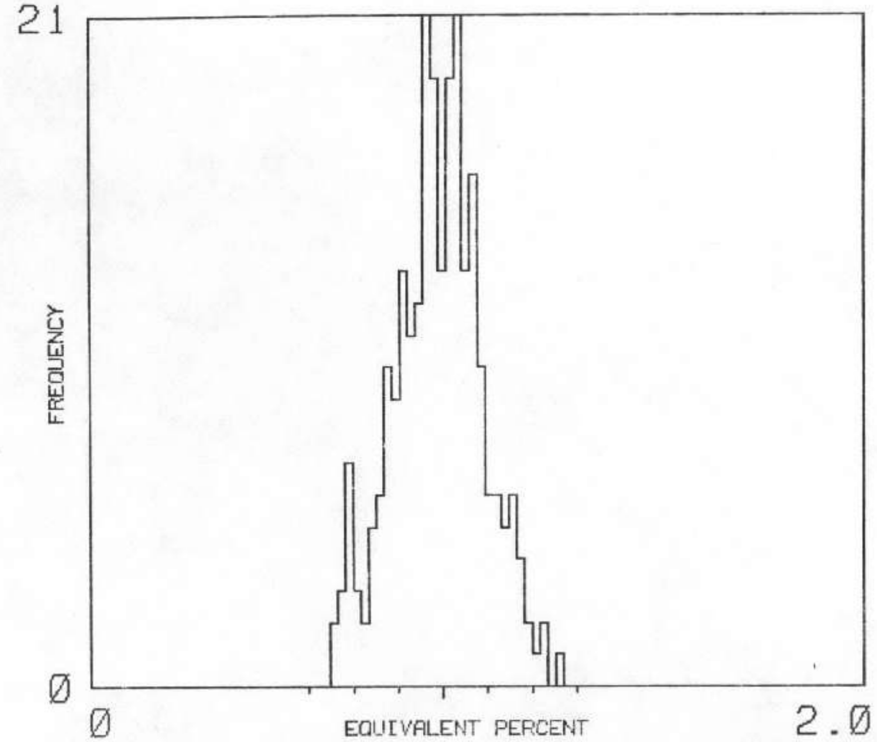
MEAN / MEDIAN 5.3 5.3 248 ADEQUATE SAMPLES

URANIUM



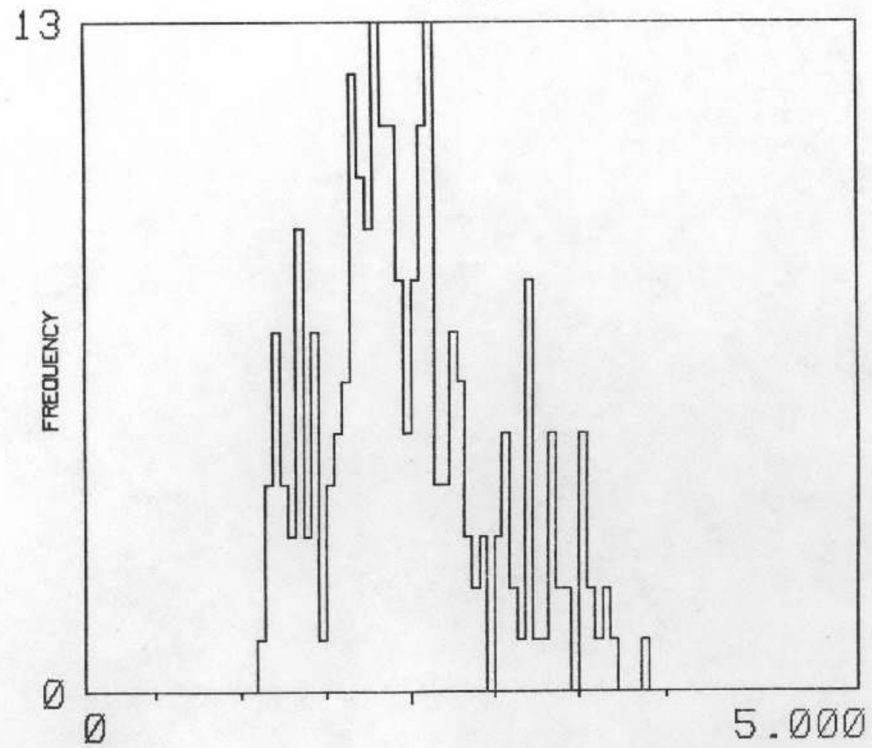
MEAN / MEDIAN 1.9 1.9 236 ADEQUATE SAMPLES

POTASSIUM



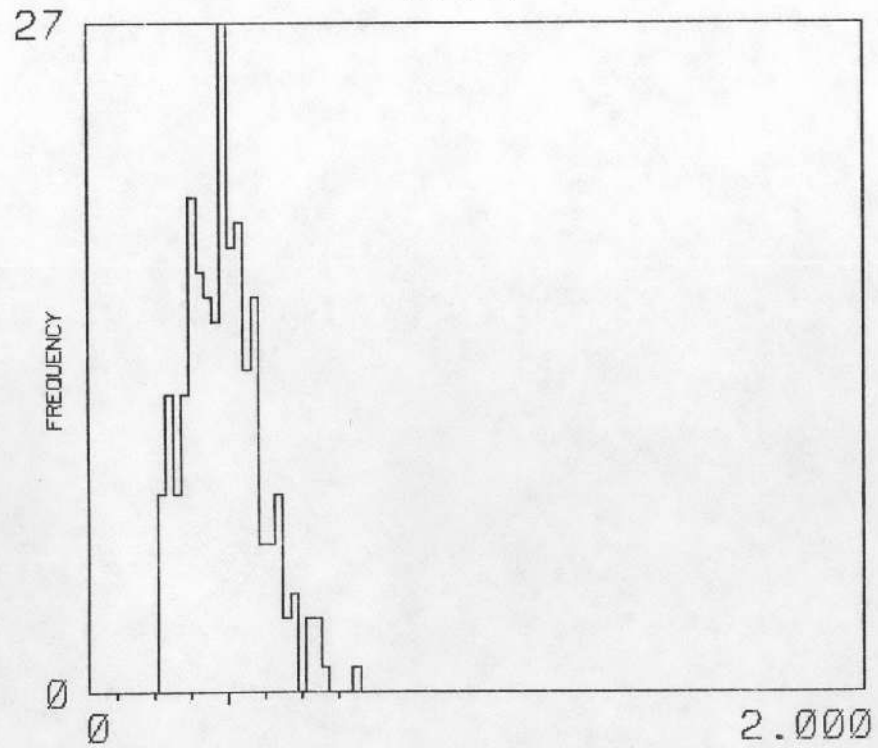
MEAN / MEDIAN Ø.9 Ø.9 248 ADEQUATE SAMPLES

U/K



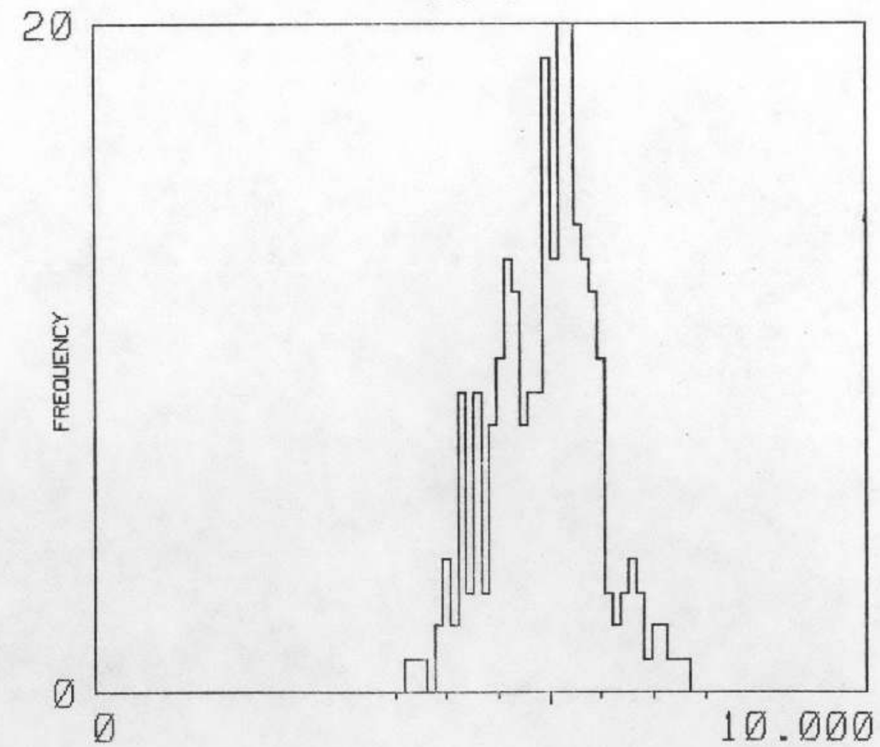
MEAN / MEDIAN 2.1Ø6 2.ØØØ 236 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.361 Ø.36Ø 236 ADEQUATE SAMPLES

TH/K

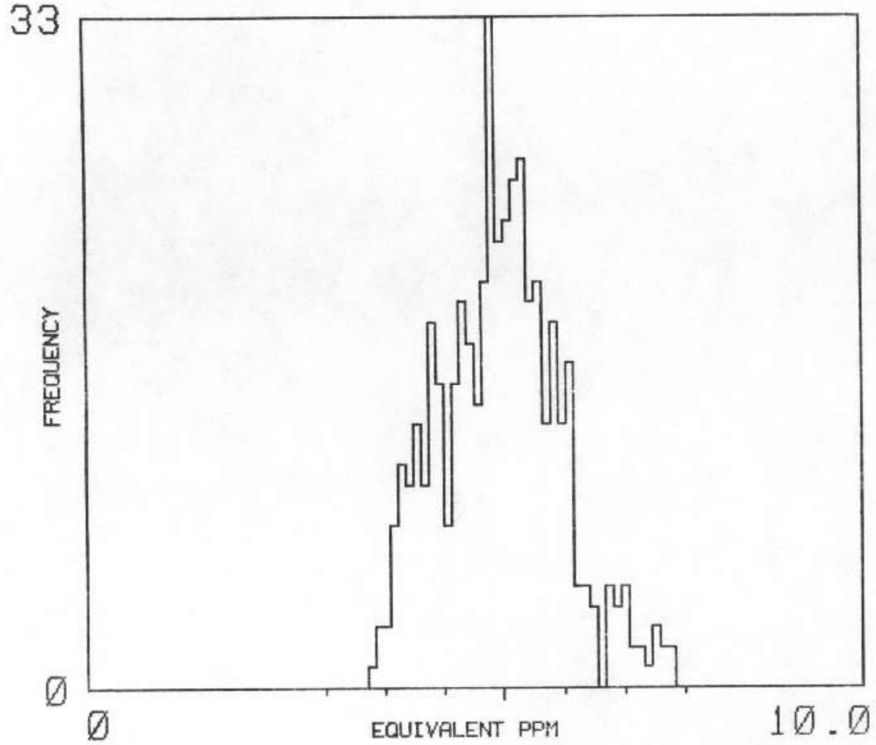


MEAN / MEDIAN 5.892 6.ØØØ 248 ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS

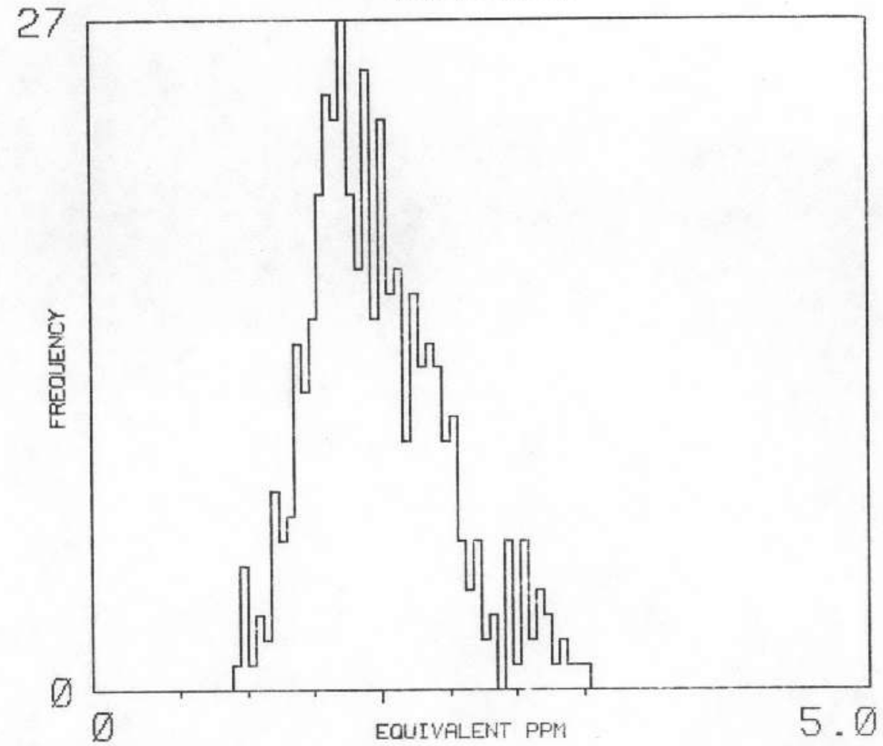
MAP UNIT : MWB TOTAL NUMBER OF SAMPLES 453

THORIUM



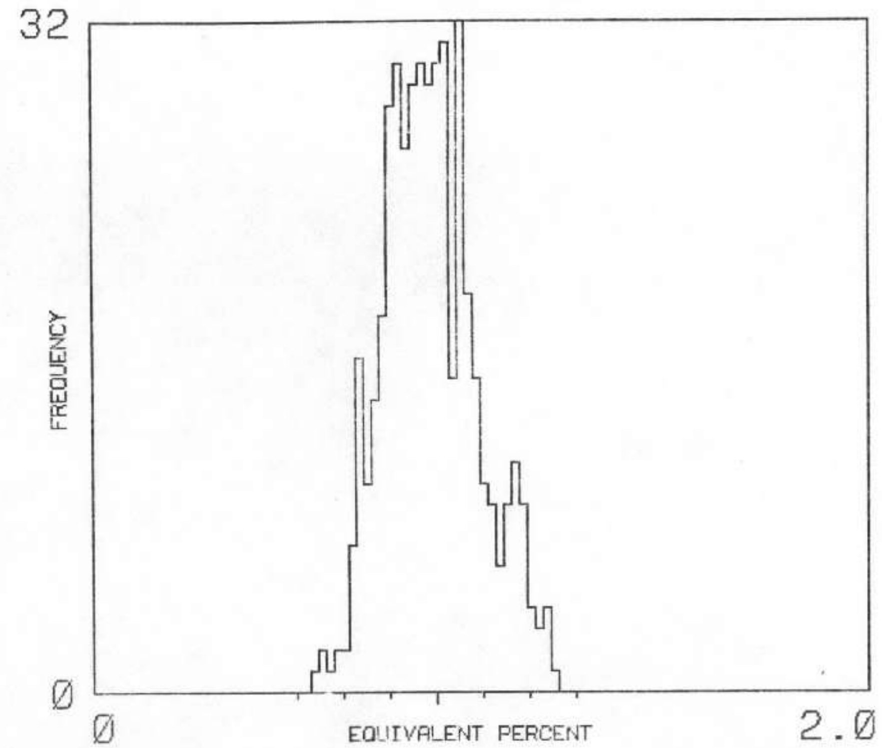
MEAN / MEDIAN 5.4 5.4 453 ADEQUATE SAMPLES

URANIUM



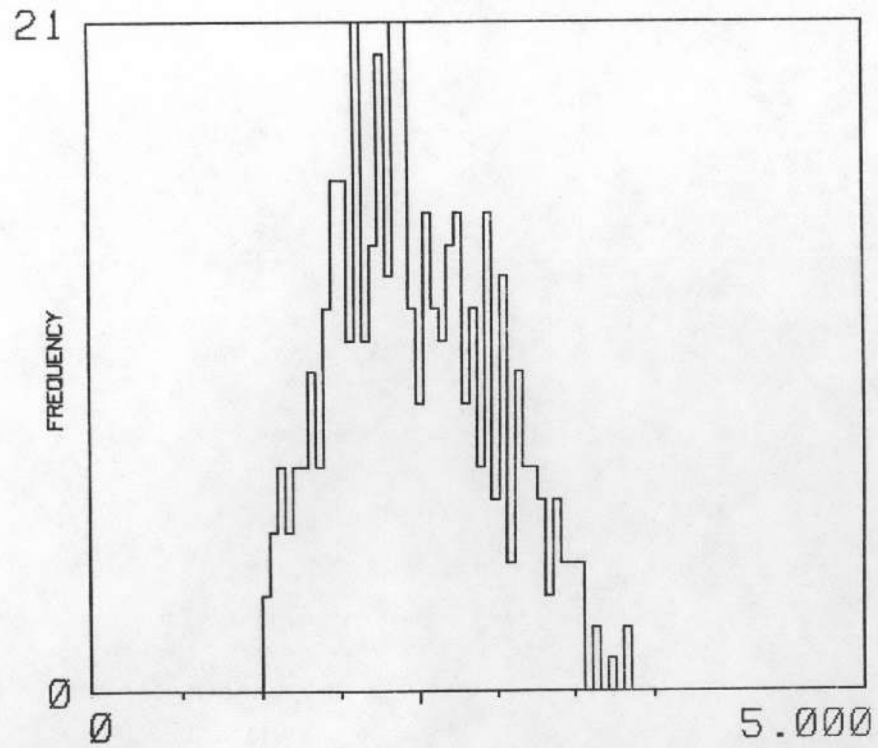
MEAN / MEDIAN 1.9 1.8 437 ADEQUATE SAMPLES

POTASSIUM



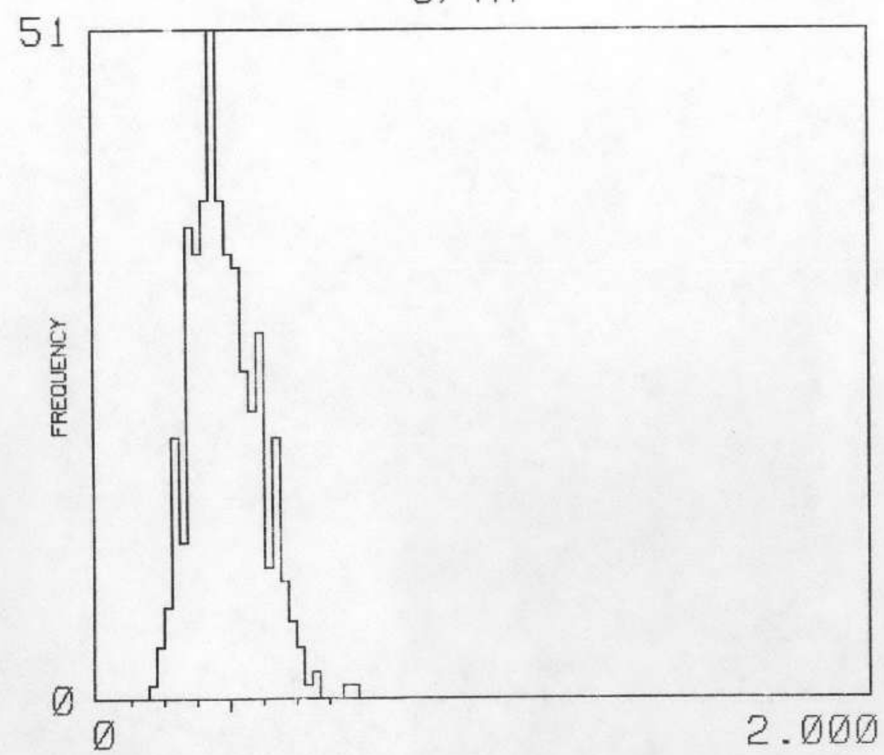
MEAN / MEDIAN Ø.9 Ø.9 453 ADEQUATE SAMPLES

U/K



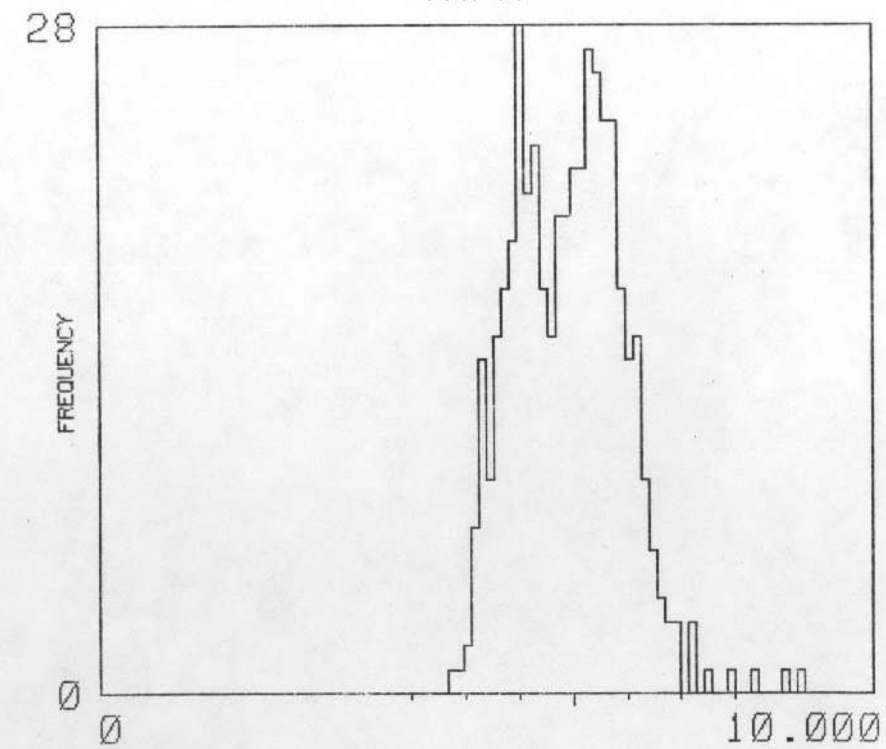
MEAN / MEDIAN 2.121 2.Ø5Ø 437 ADEQUATE SAMPLES

U/TH



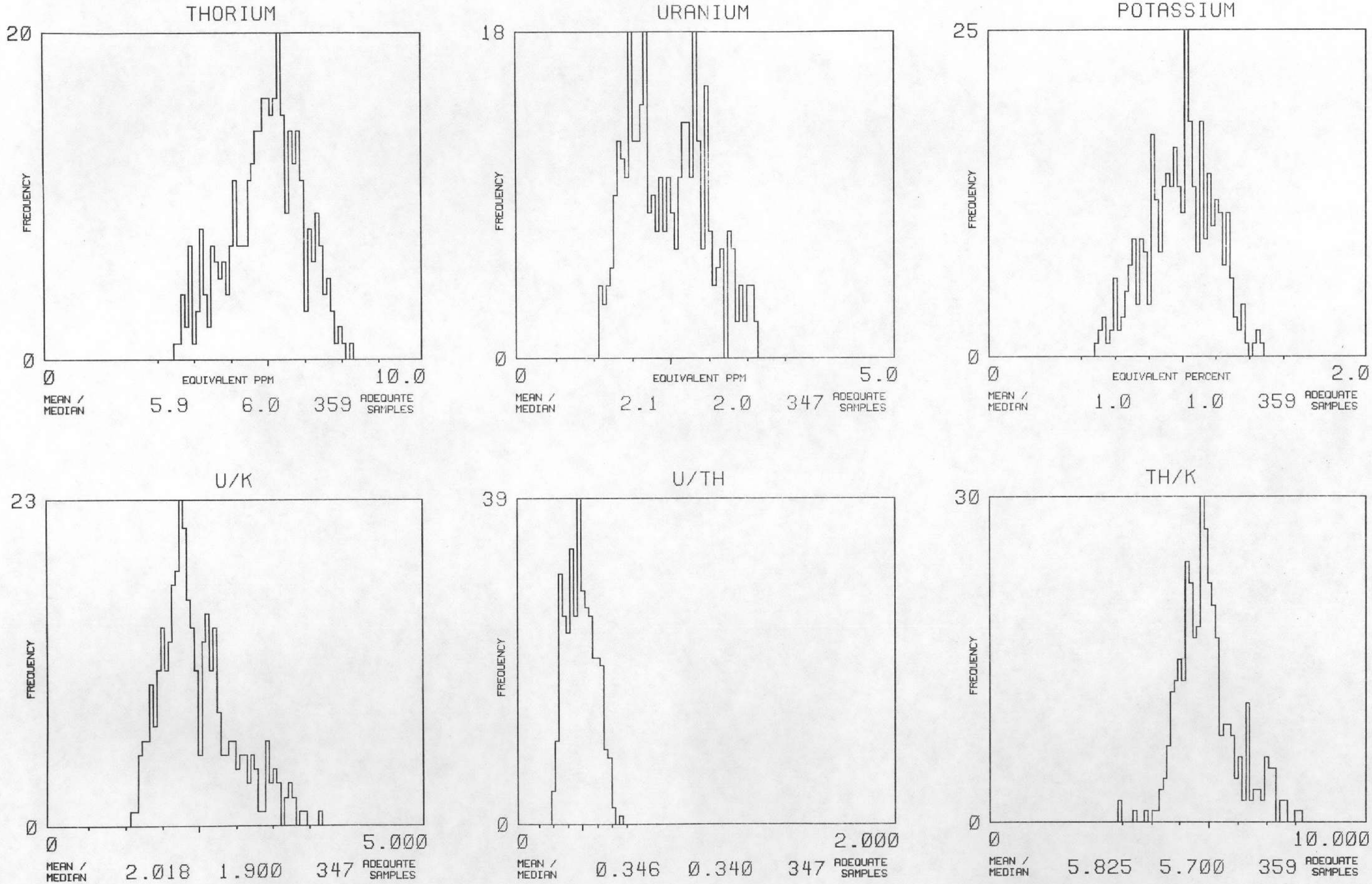
MEAN / MEDIAN Ø.349 Ø.34Ø 437 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 6.118 6.1ØØ 453 ADEQUATE SAMPLES

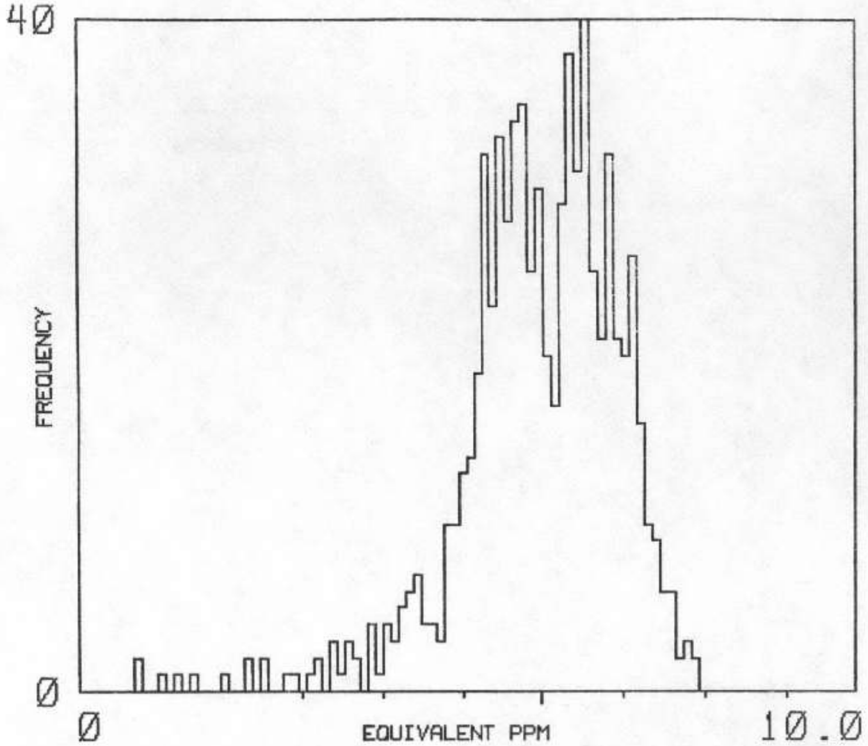
NJ 16-2 INDIANAPOLIS MAP UNIT : MB TOTAL NUMBER OF SAMPLES 359



NJ 16-2 INDIANAPOLIS

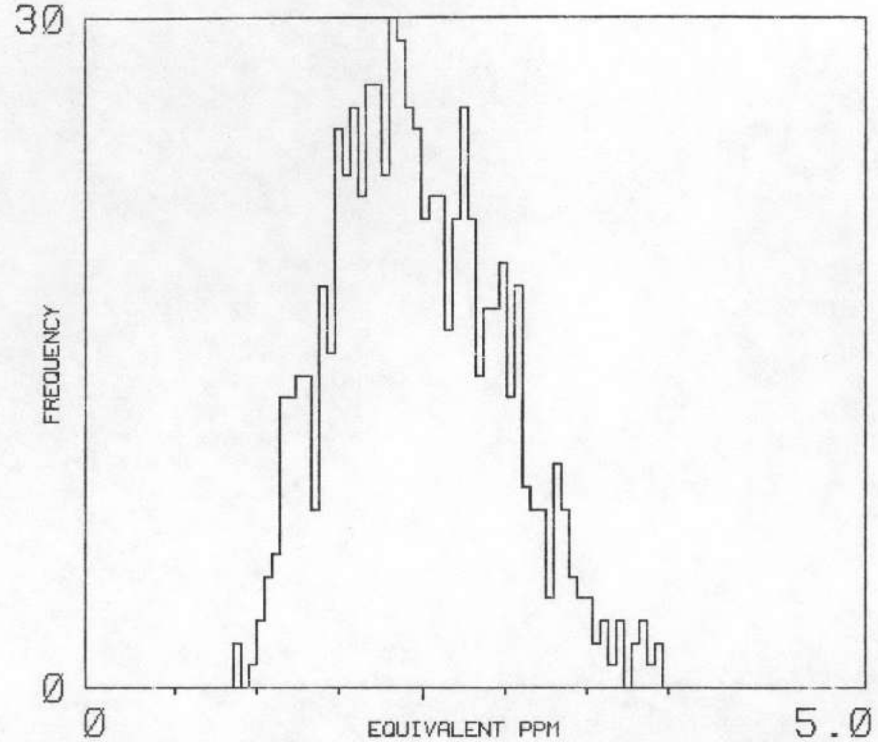
MAP UNIT : MSS TOTAL NUMBER OF SAMPLES 756

THORIUM



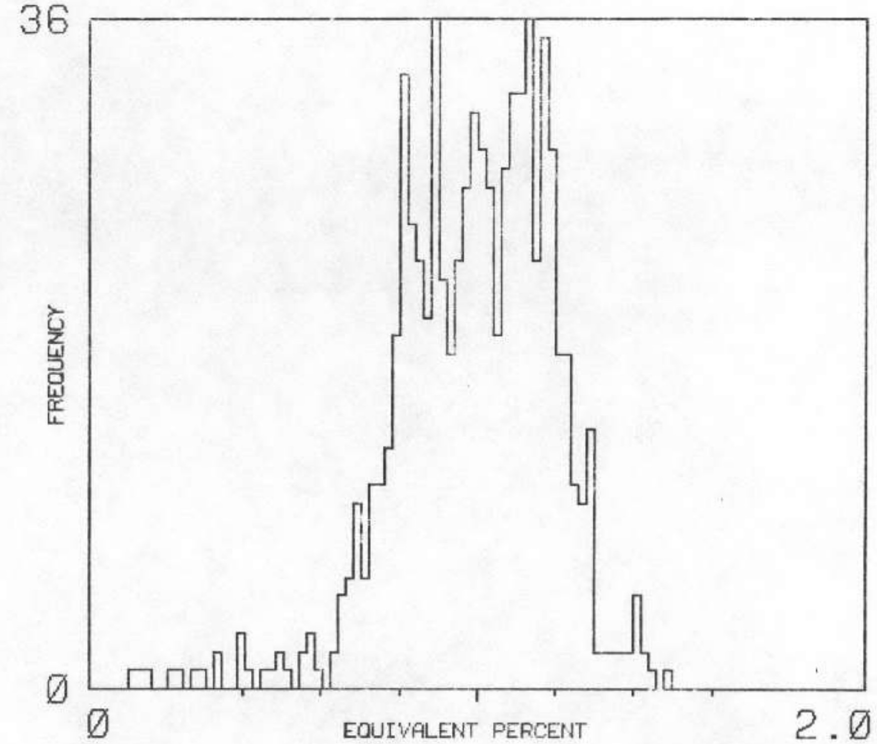
MEAN / MEDIAN 6.0 6.1 745 ADEQUATE SAMPLES

URANIUM



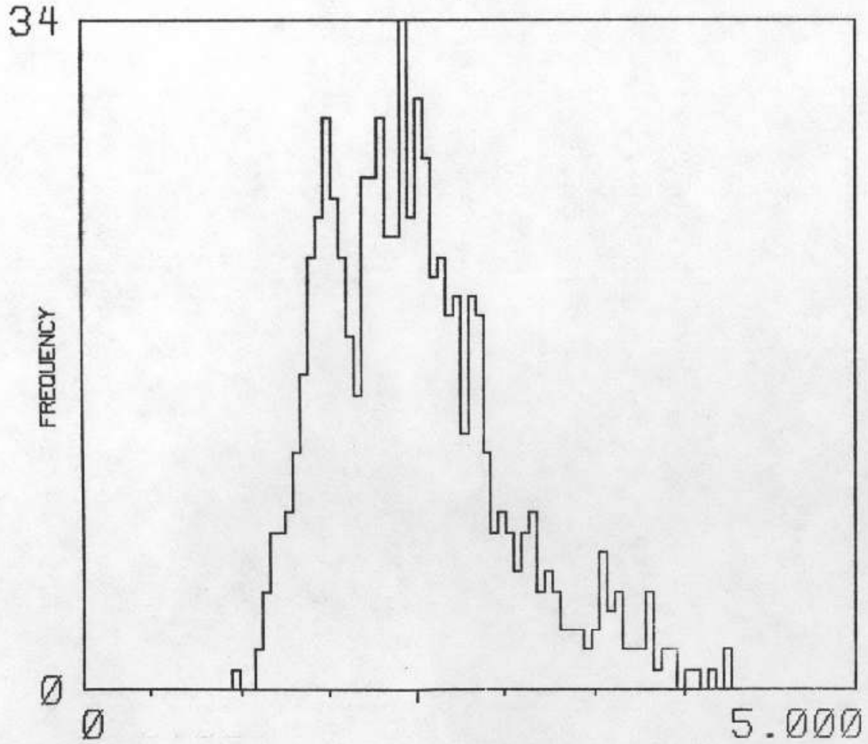
MEAN / MEDIAN 2.2 2.1 719 ADEQUATE SAMPLES

POTASSIUM



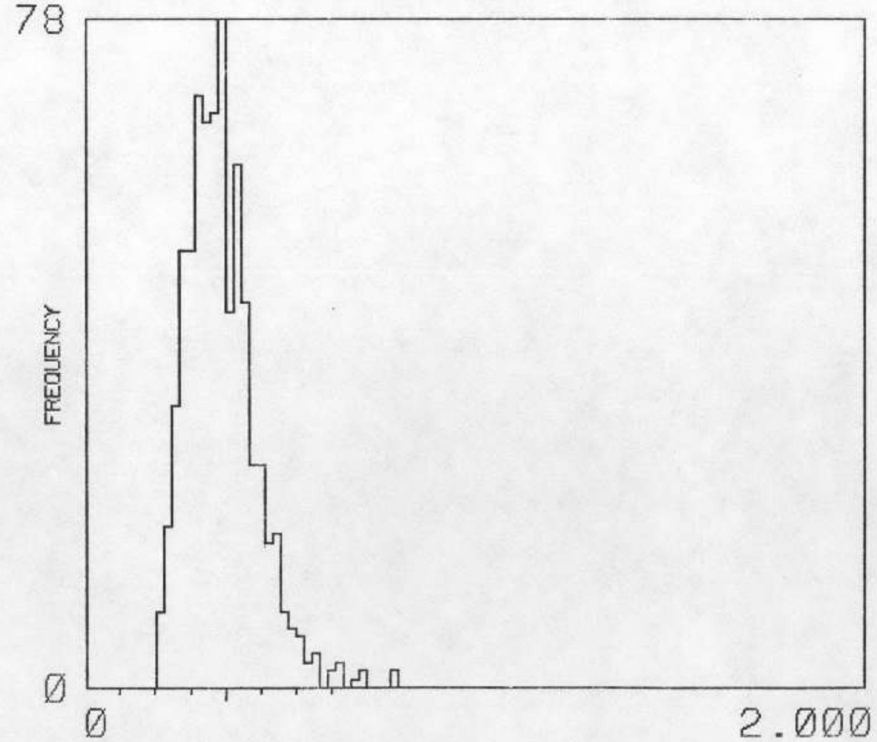
MEAN / MEDIAN 1.0 1.0 745 ADEQUATE SAMPLES

U/K



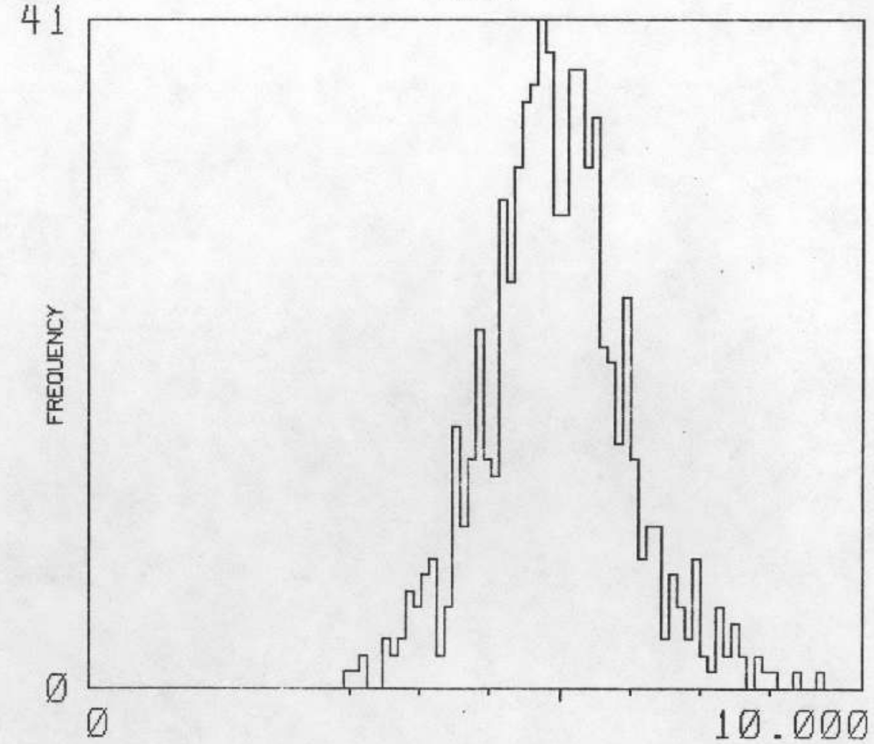
MEAN / MEDIAN 2.165 2.100 719 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.358 0.340 719 ADEQUATE SAMPLES

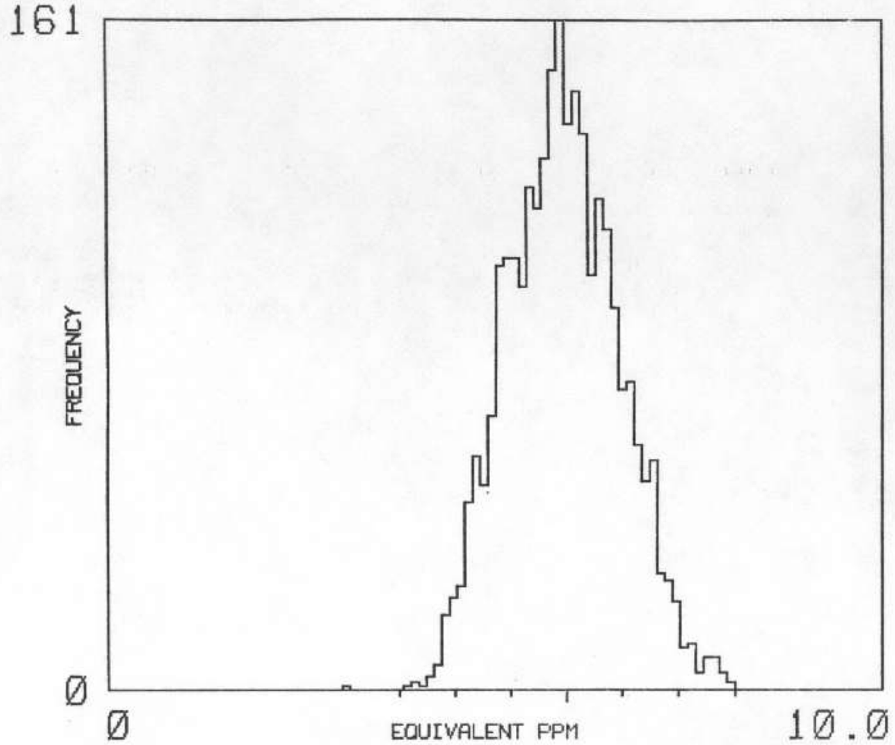
TH/K



MEAN / MEDIAN 6.088 6.000 745 ADEQUATE SAMPLES

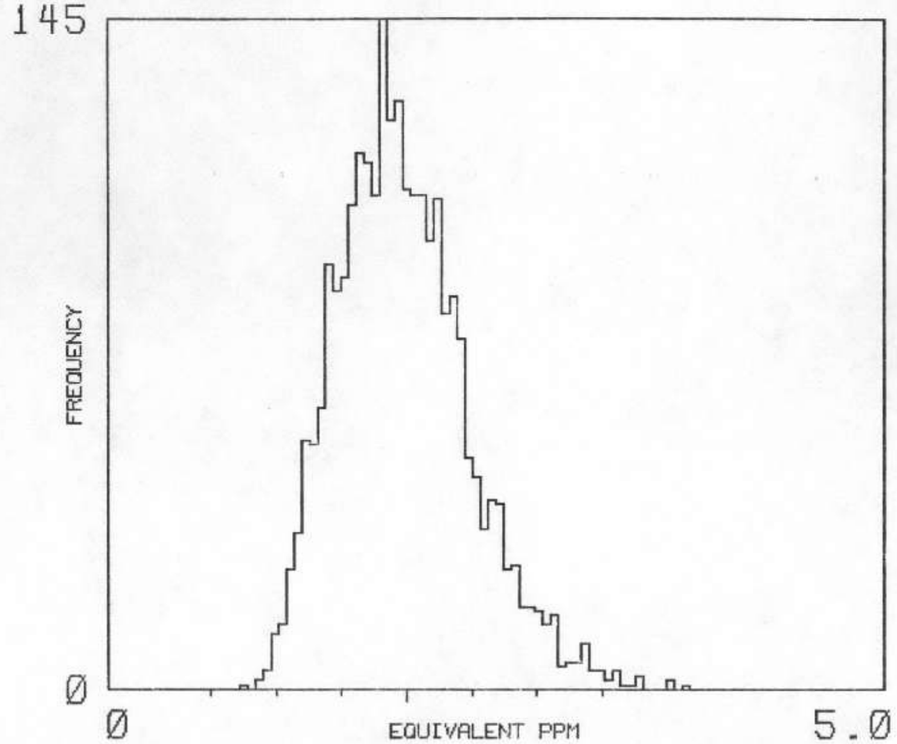
NJ 16-2 INDIANAPOLIS MAP UNIT : MBR TOTAL NUMBER OF SAMPLES 2644

THORIUM



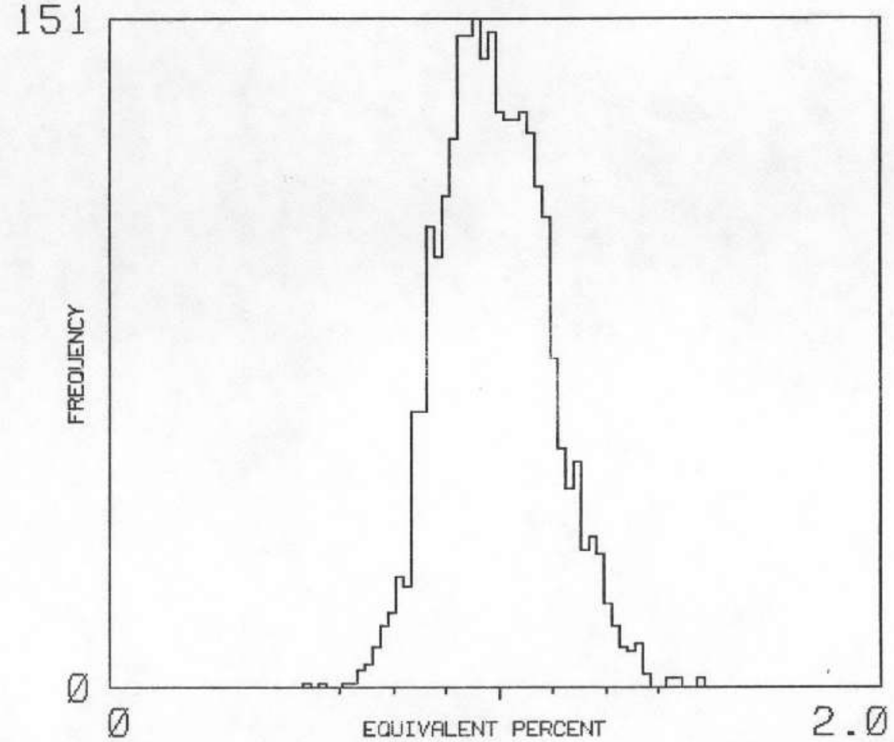
MEAN / MEDIAN 5.9 5.9 2644 ADEQUATE SAMPLES

URANIUM



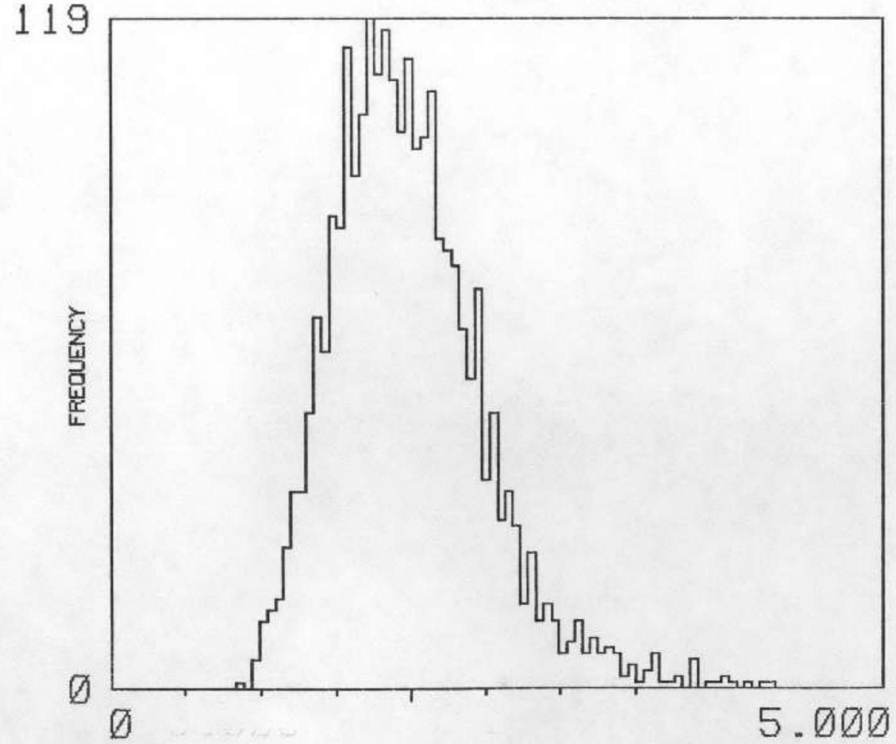
MEAN / MEDIAN 1.9 1.9 2529 ADEQUATE SAMPLES

POTASSIUM



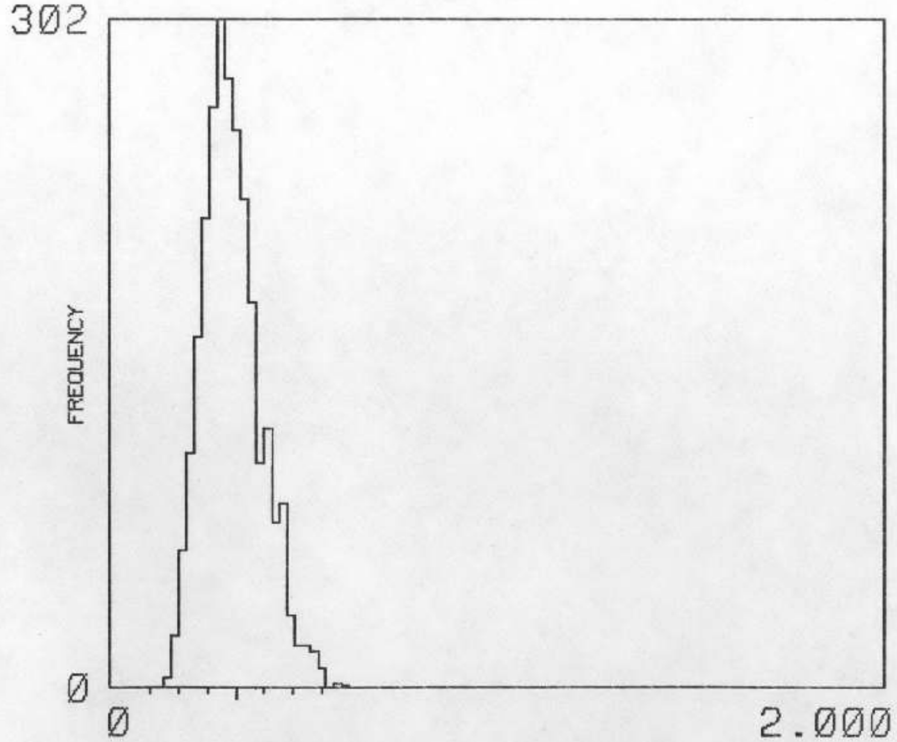
MEAN / MEDIAN 1.Ø 1.Ø 2644 ADEQUATE SAMPLES

U/K



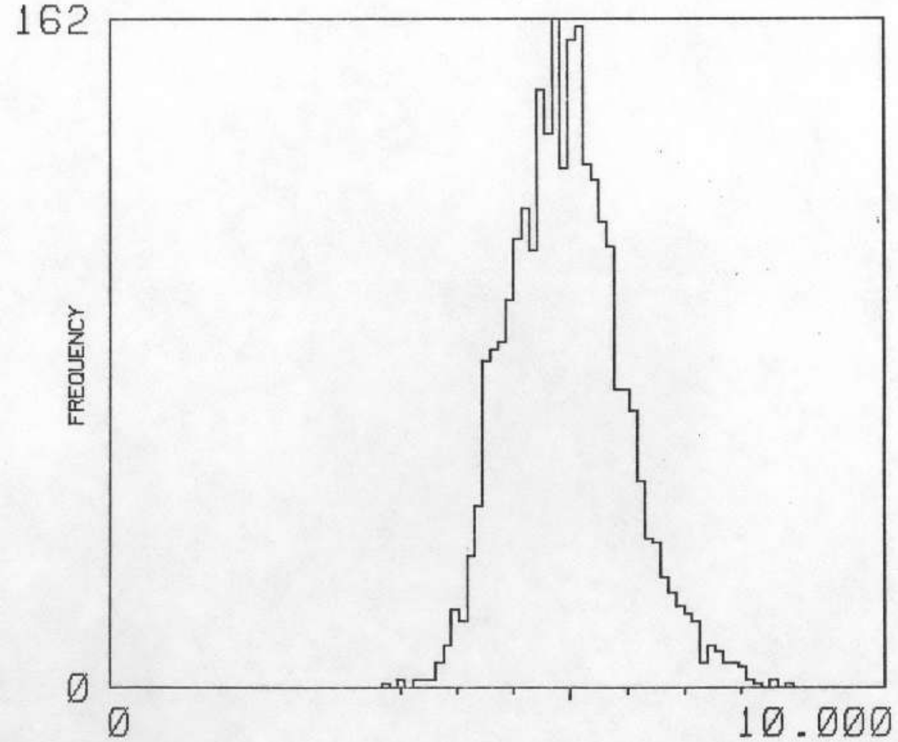
MEAN / MEDIAN 1.939 1.9ØØ 2529 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.328 Ø.32Ø 2529 ADEQUATE SAMPLES

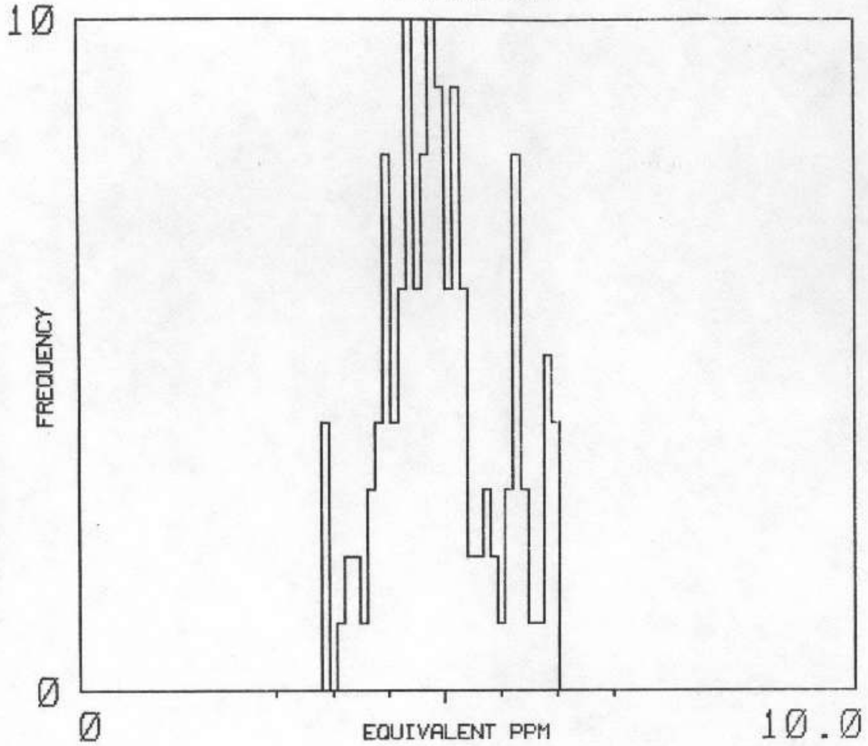
TH/K



MEAN / MEDIAN 5.936 5.9ØØ 2644 ADEQUATE SAMPLES

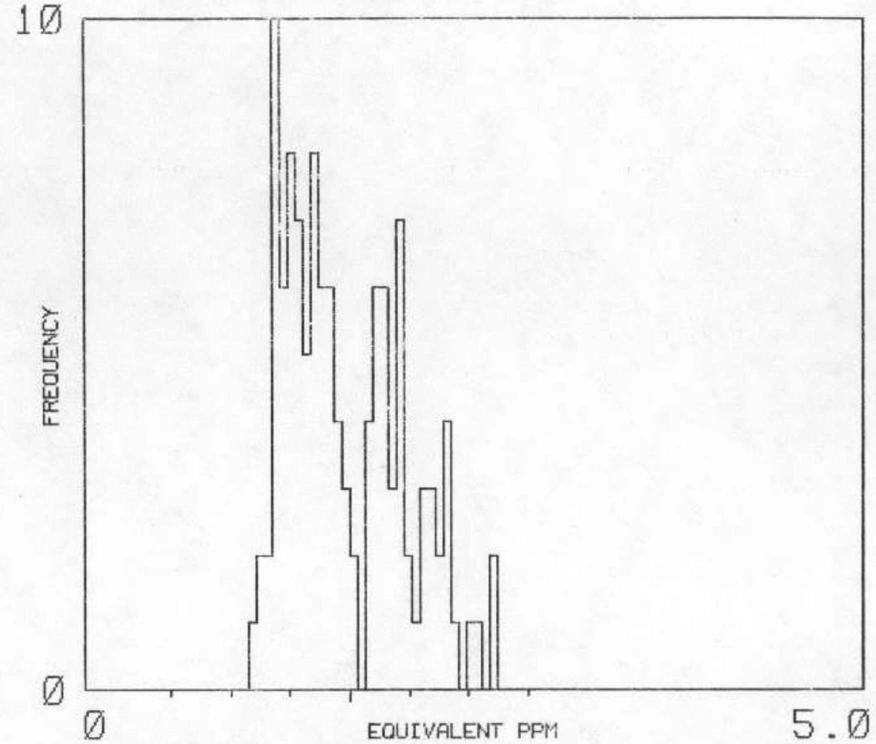
NJ 16-2 INDIANAPOLIS MAP UNIT : PB TOTAL NUMBER OF SAMPLES 134

THORIUM



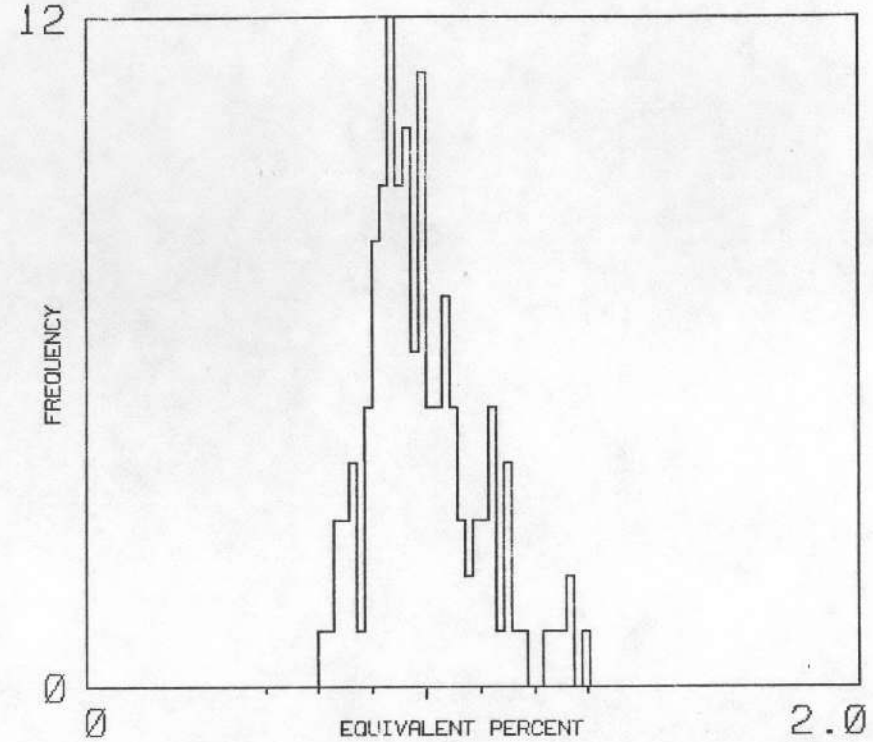
MEAN / MEDIAN 4.7 4.6 134 ADEQUATE SAMPLES

URANIUM



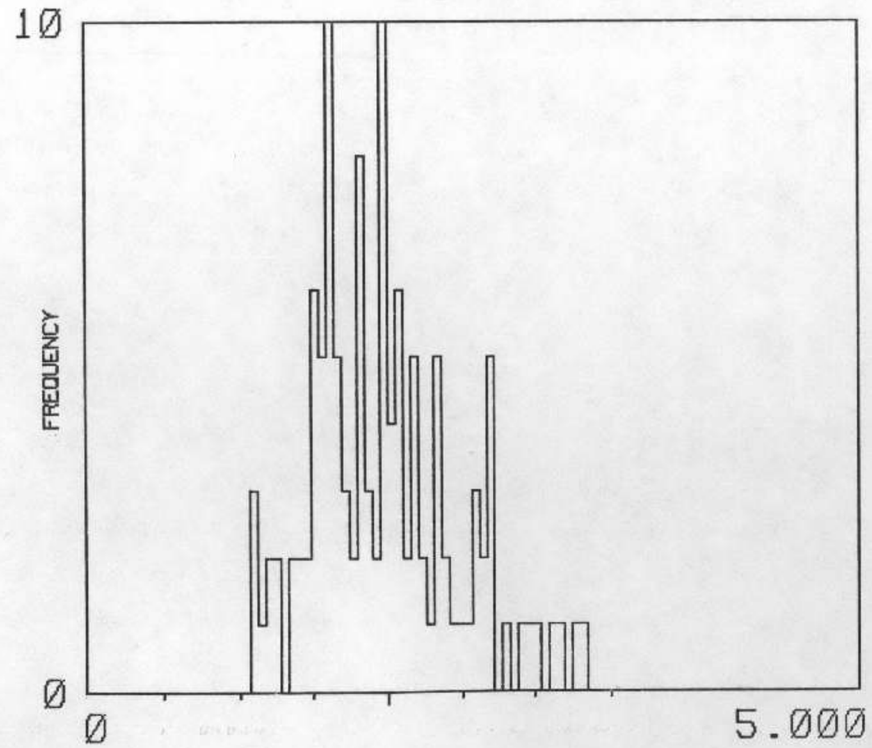
MEAN / MEDIAN 1.7 1.6 116 ADEQUATE SAMPLES

POTASSIUM



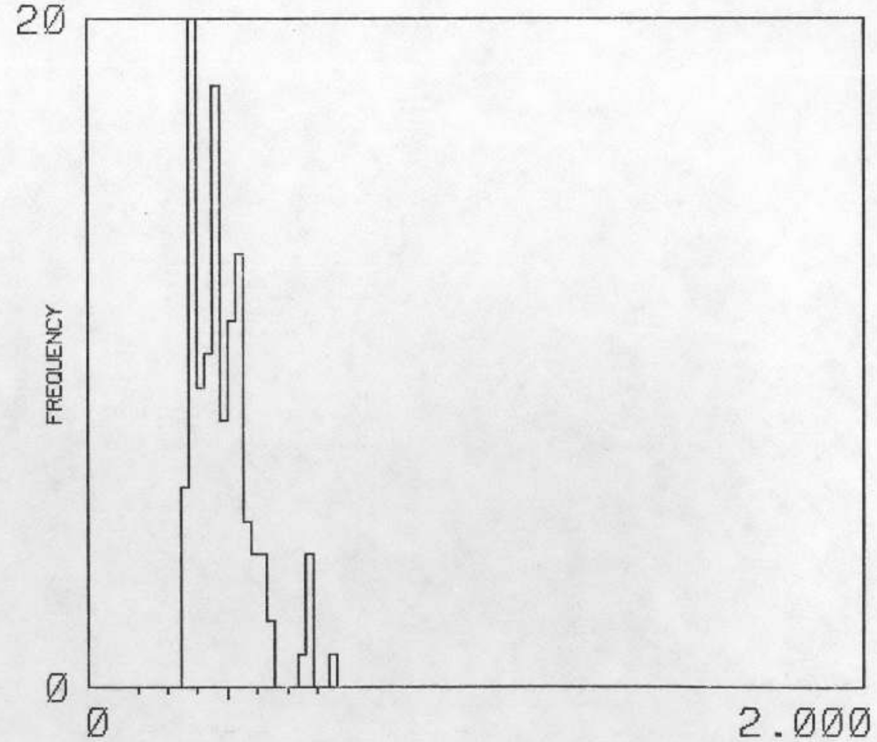
MEAN / MEDIAN 0.9 0.9 134 ADEQUATE SAMPLES

U/K



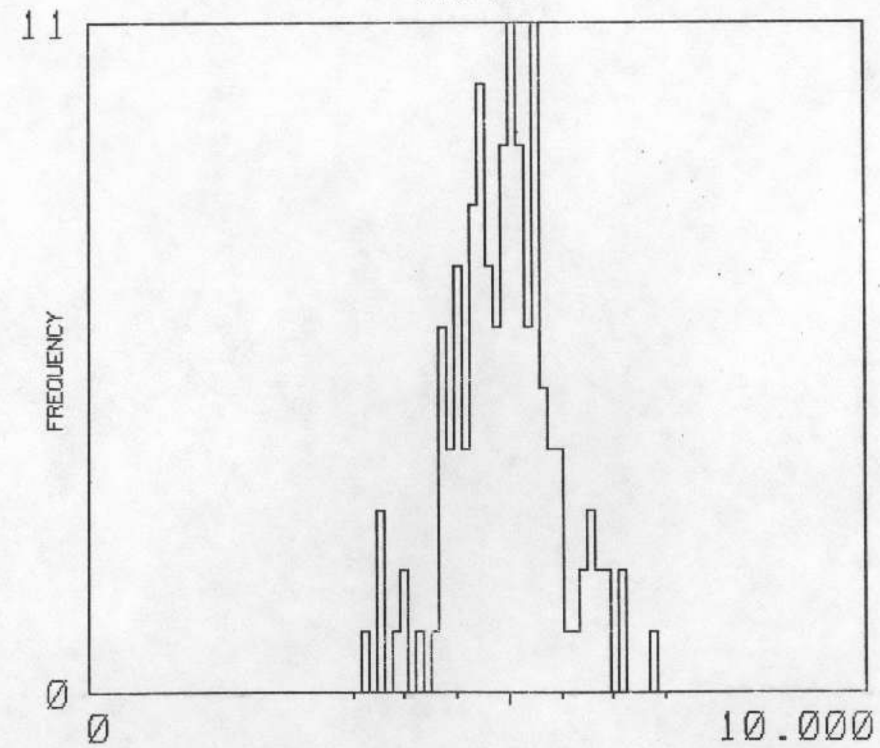
MEAN / MEDIAN 1.950 1.900 116 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.359 0.340 116 ADEQUATE SAMPLES

TH/K

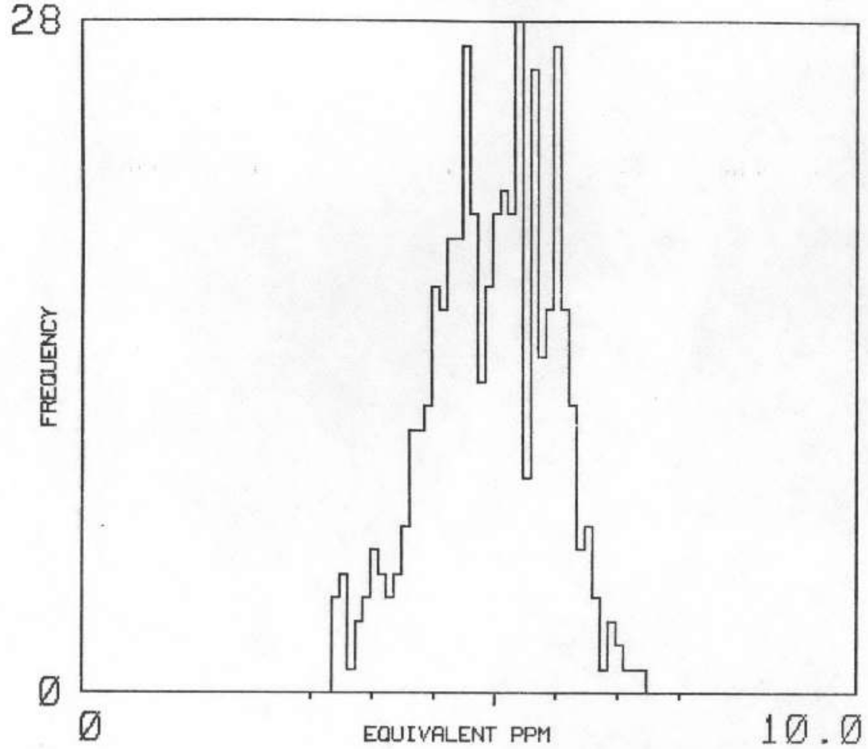


MEAN / MEDIAN 5.396 5.400 134 ADEQUATE SAMPLES

NJ 16-2 INDIANAPOLIS

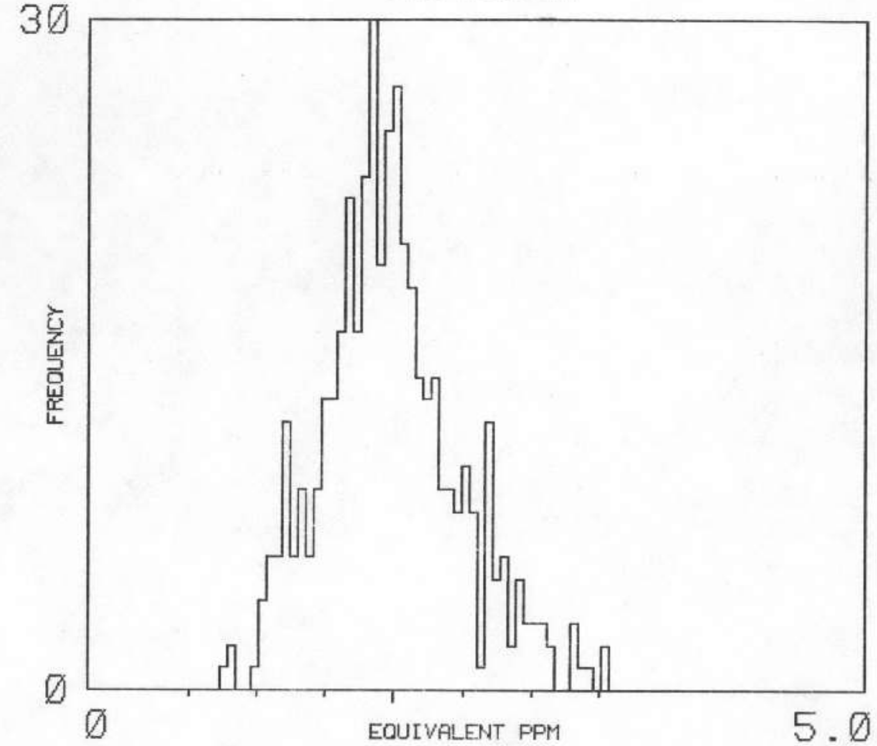
MAP UNIT : PR TOTAL NUMBER OF SAMPLES 461

THORIUM



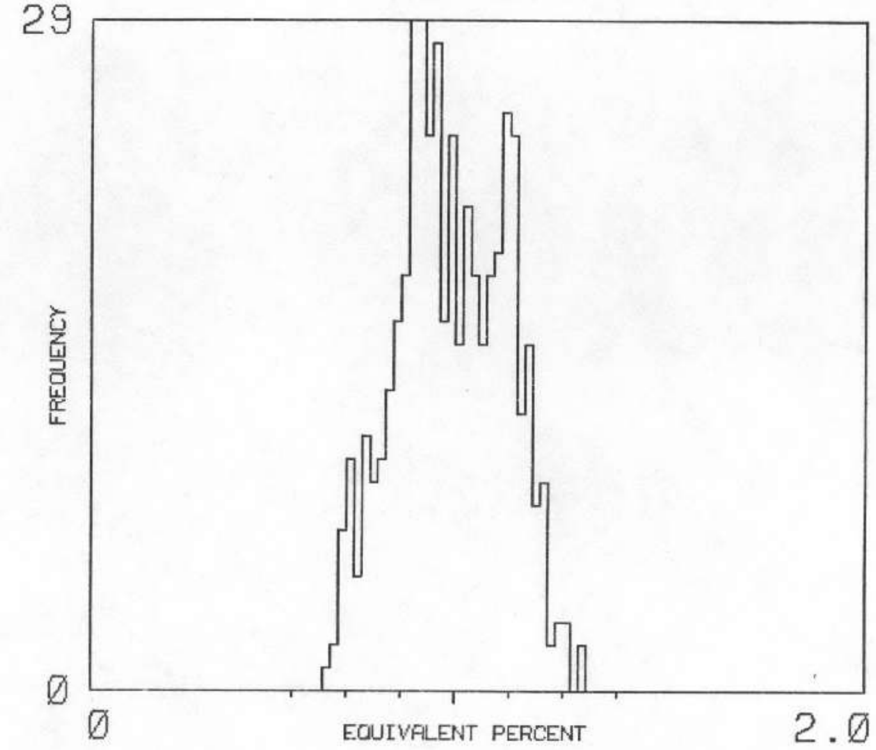
MEAN / MEDIAN 5.3 5.4 461 ADEQUATE SAMPLES

URANIUM



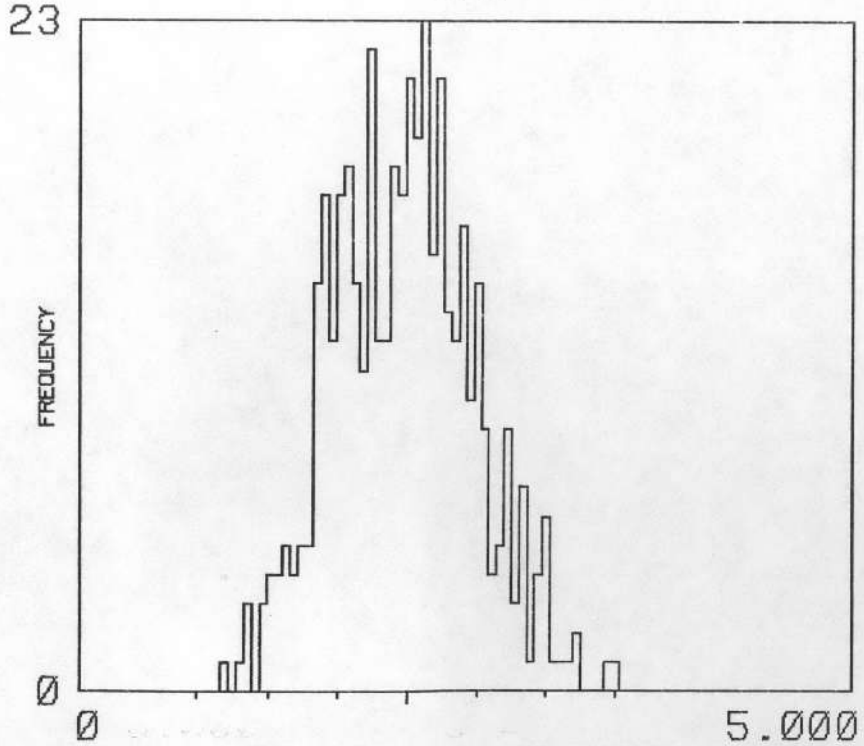
MEAN / MEDIAN 2.Ø 1.9 438 ADEQUATE SAMPLES

POTASSIUM



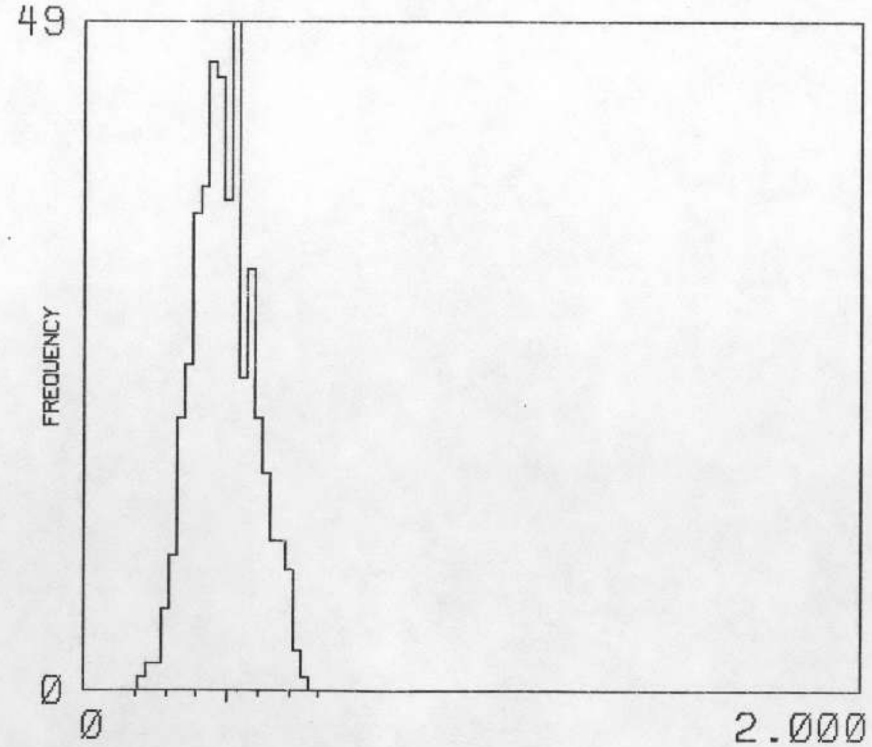
MEAN / MEDIAN Ø.9 Ø.9 461 ADEQUATE SAMPLES

U/K



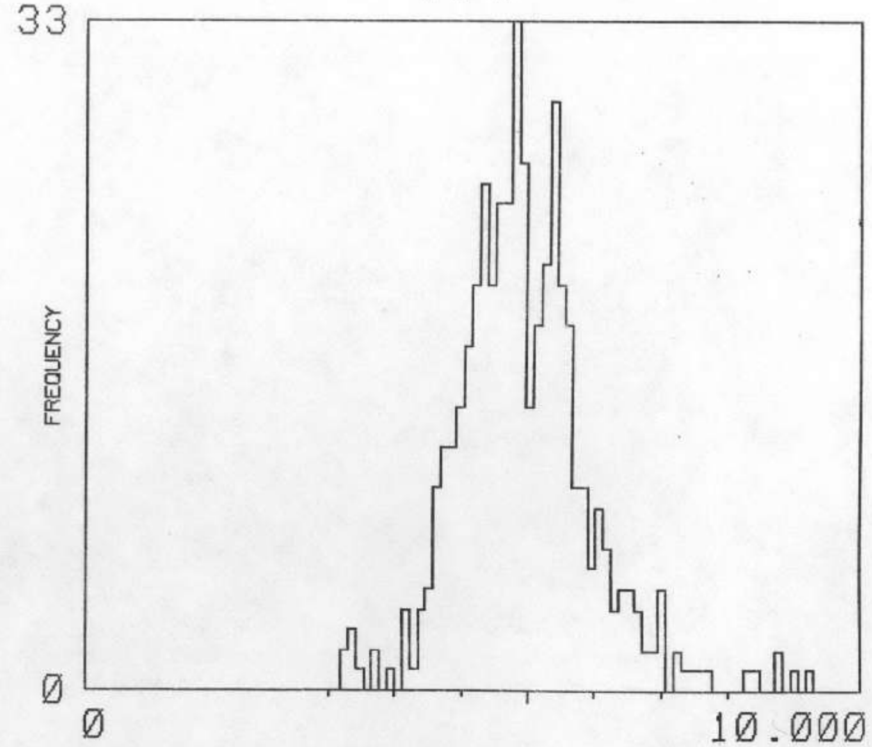
MEAN / MEDIAN 2.115 2.1ØØ 438 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.371 Ø.36Ø 438 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 5.724 5.6ØØ 461 ADEQUATE SAMPLES

INDIANAPOLIS QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
QM	Qm
QSA	Qsa
QSD	Qsd
QL	Ql
QCL	Qcl
QGV	Qgv
QGP	Qgp
QGK	Qgk
QGT	Qgt
QT	Qt
QTE	Qte
QSI	Qsi
QSL	Qsl
QG	Qg
QTI	Qti
QTG	Qtg
MS	M5
MWB	M4
MB	M3
MSS	M2
MBR	M1
*DM	Dm
*D	D
*S	S
*PM	P5
PB	P4
*PMC	P3
*PC	P2
PR	P1

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 inadequate number of samples.

APPENDIX G - Uranium Anomaly Summary and Statistical Tables

ANOMALY SUMMARY TABLE

ANO	FLIGHT	COMPUTER MAP	UNIT AND NO. ANOMALOUS SAMPLES IN UNIT			PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF : 1	2	3	4	5	6	7	GT7
1	C	610	QTE / 2	/ 0	/ 0	3.3	1	0	1	0	0	0	0	0
2	C	610	QGV / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
3	C	610	QT / 3	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
4	C	610	QT / 7	/ 0	/ 0	3.5	3	3	1	0	0	0	0	0
5	C	610	QGP / 2QT	/ 1	/ 0	3.2	1	1	1	0	0	0	0	0
6	C	610	QT / 2	/ 0	/ 0	3.2	1	0	1	0	0	0	0	0
7	C	610	QT / 1QSA	/ 1	/ 0	3.1	0	2	0	0	0	0	0	0
8	C	610	QT / 8	/ 0	/ 0	3.4	2	4	2	0	0	0	0	0
9	C	610	QT / 4	/ 0	/ 0	3.1	3	1	0	0	0	0	0	0
10	C	620	QT / 3	/ 0	/ 0	3.0	1	2	0	0	0	0	0	0
11	C	620	QSA / 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
12	C	620	QT / 3	/ 0	/ 0	3.2	2	0	1	0	0	0	0	0
13	C	620	QT / 3	/ 0	/ 0	3.3	0	2	1	0	0	0	0	0
14	C	620	QT / 1QSA	/ 1	/ 0	3.0	0	2	0	0	0	0	0	0
15	C	620	QT / 3	/ 0	/ 0	2.9	2	1	0	0	0	0	0	0
16	C	620	QT / 5	/ 0	/ 0	2.9	2	3	0	0	0	0	0	0
17	C	620	QT / 1QGV	/ 1QSA	/ 1	3.1	2	1	0	0	0	0	0	0
18	C	620	QT / 4	/ 0	/ 0	2.8	3	1	0	0	0	0	0	0
19	C	630	QL / 1	/ 0	/ 0	3.6	0	0	1	0	0	0	0	0
20	C	630	QT / 2	/ 0	/ 0	3.2	0	1	1	0	0	0	0	0
21	C	630	QT / 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
22	C	630	QT / 8	/ 0	/ 0	3.5	5	2	1	0	0	0	0	0
23	C	630	QT / 2QSA	/ 1	/ 0	3.3	2	0	1	0	0	0	0	0
24	C	640	QTI / 3	/ 0	/ 0	3.2	0	2	1	0	0	0	0	0
25	C	640	QT / 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
26	C	640	QT / 3	/ 0	/ 0	3.0	0	3	0	0	0	0	0	0
27	C	640	QT / 1QTE	/ 2	/ 0	2.9	2	1	0	0	0	0	0	0
28	C	650	QGV / 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0
29	C	650	QTI / 2	/ 0	/ 0	3.7	0	1	0	1	0	0	0	0
30	C	650	QTI / 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
31	C	650	QCL / 2	/ 0	/ 0	3.2	1	0	1	0	0	0	0	0
32	C	650	QT / 3	/ 0	/ 0	2.8	1	2	0	0	0	0	0	0
33	C	650	QT / 1	/ 0	/ 0	3.6	0	0	1	0	0	0	0	0
34	C	650	QT / 3	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
35	C	660	QCL / 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
36	C	660	MBR / 3	/ 0	/ 0	2.6	2	1	0	0	0	0	0	0
37	C	660	QGV / 2QT	/ 1	/ 0	2.8	2	1	0	0	0	0	0	0
38	C	670	QSA / 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
39	C	670	QTI / 2QM	/ 2	/ 0	3.6	1	1	2	0	0	0	0	0
40	C	670	QTI / 3QSA	/ 1	/ 0	3.0	3	1	0	0	0	0	0	0
41	C	670	QT / 4	/ 0	/ 0	3.0	1	3	0	0	0	0	0	0
42	C	670	QSA / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
43	C	680	QL / 2	/ 0	/ 0	3.3	0	1	1	0	0	0	0	0
44	C	680	QSA / 1QTI	/ 1	/ 0	2.9	0	2	0	0	0	0	0	0
45	C	680	QTI / 3	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
46	C	680	QTI / 2QCL	/ 1	/ 0	3.0	2	1	0	0	0	0	0	0
47	C	680	QTI / 4	/ 0	/ 0	2.9	3	1	0	0	0	0	0	0
48	C	680	QTG / 2	/ 0	/ 0	2.8	0	1	1	0	0	0	0	0
49	C	680	QTG / 3	/ 0	/ 0	2.7	2	0	1	0	0	0	0	0
50	C	680	QTI / 2MSS	/ 1	/ 0	3.1	1	2	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	700	QSA / 1	/ 0	/ 0	3.6	0	0	1	0	0	0	0	0
52 C	700	QM / 1QTI	/ 2	/ 0	3.6	2	1	0	0	0	0	0	0
53 C	700	QTI / 1	/ 0	/ 0	3.6	0	0	1	0	0	0	0	0
54 C	700	QM / 2	/ 0	/ 0	4.4	1	0	1	0	0	0	0	0
55 C	700	QSA / 2PR	/ 1	/ 0	3.3	0	2	1	0	0	0	0	0
56 C	700	QTI / 3	/ 0	/ 0	3.2	1	0	2	0	0	0	0	0
57 C	700	MB / 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
58 C	700	MB / 2MSS	/ 2	/ 0	3.2	1	3	0	0	0	0	0	0
59 C	710	QTI / 1	/ 0	/ 0	3.3	0	0	1	0	0	0	0	0
60 C	710	QTI / 3	/ 0	/ 0	2.8	2	1	0	0	0	0	0	0
61 C	710	QTI / 5	/ 0	/ 0	4.8	0	2	0	2	0	1	0	0
62 C	710	QSA / 2	/ 0	/ 0	4.5	0	0	1	0	1	0	0	0
63 C	710	QTI / 8	/ 0	/ 0	3.3	3	4	1	0	0	0	0	0
64 C	710	MWB / 2	/ 0	/ 0	2.8	0	2	0	0	0	0	0	0
65 C	710	MSS / 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
66 C	720	QTI / 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
67 C	720	QM / 1QCL	/ 1	/ 0	4.6	0	0	2	0	0	0	0	0
68 C	720	QTI / 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
69 C	720	QSA / 2	/ 0	/ 0	3.4	1	0	1	0	0	0	0	0
70 C	720	QSA / 2	/ 0	/ 0	3.2	1	0	1	0	0	0	0	0
71 C	720	QSL / 2PR	/ 1	/ 0	2.7	2	1	0	0	0	0	0	0
72 C	720	MS / 1MWB	/ 1QSI	/ 1	2.7	2	1	0	0	0	0	0	0
73 C	720	MWB / 5	/ 0	/ 0	3.1	2	2	1	0	0	0	0	0
74 C	720	MBR / 5	/ 0	/ 0	2.8	4	1	0	0	0	0	0	0
75 C	720	MBR / 3	/ 0	/ 0	3.1	1	1	1	0	0	0	0	0
76 C	720	MBR / 2	/ 0	/ 0	2.9	0	2	0	0	0	0	0	0
77 C	720	QSA / 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0
78 C	1010	QTI / 2	/ 0	/ 0	3.0	0	2	0	0	0	0	0	0
79 C	1010	QTI / 2QGP	/ 1	/ 0	2.8	1	2	0	0	0	0	0	0
80 C	1010	QTE / 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
81 C	1020	QL / 2	/ 0	/ 0	3.6	1	0	1	0	0	0	0	0
82 C	1020	QL / 3	/ 0	/ 0	2.9	1	2	0	0	0	0	0	0
83 C	1020	QL / 4	/ 0	/ 0	3.3	1	2	1	0	0	0	0	0
84 C	1020	QL / 1	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
85 C	1020	QSA / 2QGV	/ 1QL	/ 1	3.5	2	1	0	1	0	0	0	0
86 C	1030	QTI / 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0
87 C	1030	QM / 1QTI	/ 3	/ 0	5.2	1	1	1	0	0	0	1	0
88 C	1030	QTE / 5QT	/ 1	/ 0	3.5	1	4	1	0	0	0	0	0
89 C	1040	MWB / 4	/ 0	/ 0	3.0	2	1	1	0	0	0	0	0
90 C	1040	QSA / 3	/ 0	/ 0	3.3	2	0	1	0	0	0	0	0
91 C	1050	MSS / 1MBR	/ 2	/ 0	2.6	2	1	0	0	0	0	0	0
92 C	1050	QT / 3	/ 0	/ 0	2.7	2	1	0	0	0	0	0	0
93 C	1060	MBR / 2	/ 0	/ 0	3.4	0	1	0	1	0	0	0	0
94 C	1060	MBR / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
95 C	1060	MBR / 2	/ 0	/ 0	2.9	0	2	0	0	0	0	0	0
96 C	1060	MBR / 2	/ 0	/ 0	3.1	0	1	1	0	0	0	0	0
97 C	1060	MBR / 3	/ 0	/ 0	2.8	1	2	0	0	0	0	0	0
98 C	1060	QT / 6	/ 0	/ 0	3.2	5	0	1	0	0	0	0	0
99 C	1060	QT / 3	/ 0	/ 0	2.9	2	1	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	0.5316	0.7203	0.9090	1.0977	1.2864	1.4751	1.6638
URANIUM	DIST NORMAL	0.0665	0.8163	1.5661	2.3159	3.0657	3.8155	4.5653
THORIUM	DIST NORMAL	3.1920	4.1387	5.0854	6.0321	6.9788	7.9255	8.8722
U/K	DIST NORMAL	-0.5322	0.3749	1.2820	2.1891	3.0962	4.0033	4.9104
U/TH	DIST NORMAL	-0.0543	0.0950	0.2443	0.3936	0.5429	0.6922	0.8415
TH/K	DIST NORMAL	2.8700	3.7763	4.6826	5.5889	6.4952	7.4015	8.3078

MAP UNIT QSA

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.5564	0.7504	0.9444	1.1384	1.3324	1.5264	1.7204
URANIUM	DIST NORMAL	0.5037	0.9783	1.4529	1.9275	2.4021	2.8767	3.3513
THORIUM	DIST NORMAL	2.0429	3.1421	4.2413	5.3405	6.4397	7.5389	8.6381
U/K	DIST NORMAL	0.3353	0.7965	1.2577	1.7189	2.1801	2.6413	3.1025
U/TH	DIST NORMAL	0.0605	0.1626	0.2647	0.3668	0.4689	0.5710	0.6731
TH/K	DIST NORMAL	2.1193	2.9898	3.8603	4.7308	5.6013	6.4718	7.3423

MAP UNIT QSD

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.7626	0.8572	0.9518	1.0464	1.1410	1.2356	1.3302
URANIUM	DIST NORMAL	0.5104	0.8633	1.2162	1.5691	1.9220	2.2749	2.6278
THORIUM	DIST NORMAL	0.5487	1.7898	3.0309	4.2720	5.5131	6.7542	7.9953
U/K	DIST NORMAL	0.5543	0.8660	1.1777	1.4894	1.8011	2.1128	2.4245
U/TH	DIST NORMAL	0.0868	0.1824	0.2780	0.3736	0.4692	0.5648	0.6604
TH/K	DIST NORMAL	1.0521	2.0523	3.0525	4.0527	5.0529	6.0531	7.0533

MAP UNIT QL

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.8322	0.9366	1.0410	1.1454	1.2498	1.3542	1.4586
URANIUM	DIST NORMAL	0.6503	1.1225	1.5947	2.0669	2.5391	3.0113	3.4835
THORIUM	DIST NORMAL	3.5907	4.3237	5.0567	5.7897	6.5227	7.2557	7.9887
U/K	DIST NORMAL	0.4821	0.9264	1.3707	1.8150	2.2593	2.7036	3.1479
U/TH	DIST NORMAL	0.0901	0.1802	0.2703	0.3604	0.4505	0.5406	0.6307
TH/K	DIST NORMAL	3.2994	3.8890	4.4786	5.0682	5.6578	6.2474	6.8370

MAP UNIT QCL

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.8580	0.9804	1.1028	1.2252	1.3476	1.4700	1.5924
URANIUM	DIST NORMAL	0.8695	1.2702	1.6709	2.0716	2.4723	2.8730	3.2737
THORIUM	DIST NORMAL	3.8952	4.6353	5.3754	6.1155	6.8556	7.5957	8.3358
U/K	DIST NORMAL	0.5532	0.9386	1.3240	1.7094	2.0948	2.4802	2.8656
U/TH	DIST NORMAL	0.0977	0.1800	0.2623	0.3446	0.4269	0.5092	0.5915
TH/K	DIST NORMAL	2.7601	3.5187	4.2773	5.0359	5.7945	6.5531	7.3117

MAP UNIT QGV

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.7252	0.8686	1.0120	1.1554	1.2988	1.4422	1.5856
URANIUM	DIST NORMAL	0.5629	0.9999	1.4369	1.8739	2.3109	2.7479	3.1849
THORIUM	DIST NORMAL	2.1070	3.0903	4.0736	5.0569	6.0402	7.0235	8.0068
U/K	DIST NORMAL	0.4086	0.8180	1.2274	1.6368	2.0462	2.4556	2.8650
U/TH	DIST NORMAL	0.0821	0.1803	0.2785	0.3767	0.4749	0.5731	0.6713
TH/K	DIST NORMAL	2.2844	2.9834	3.6824	4.3814	5.0804	5.7794	6.4784

MAP UNIT QGP

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	1.0247	1.0977	1.1707	1.2437	1.3167	1.3897	1.4627
URANIUM	DIST NORMAL	0.7150	1.1576	1.6002	2.0428	2.4854	2.9280	3.3706
THORIUM	DIST NORMAL	3.6633	4.4784	5.2935	6.1086	6.9237	7.7388	8.5539
U/K	DIST NORMAL	0.4983	0.8830	1.2677	1.6524	2.0371	2.4218	2.8065
U/TH	DIST NORMAL	0.0955	0.1775	0.2595	0.3415	0.4235	0.5055	0.5875
TH/K	DIST NORMAL	2.8789	3.5598	4.2407	4.9216	5.6025	6.2834	6.9643

MAP UNIT QGK

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	1.0867	1.1492	1.2117	1.2742	1.3367	1.3992	1.4617
URANIUM	DIST NORMAL	0.3774	0.9726	1.5678	2.1630	2.7582	3.3534	3.9486
THORIUM	DIST NORMAL	1.2345	2.7057	4.1769	5.6481	7.1193	8.5905	10.0617
U/K	DIST NORMAL	0.3242	0.7823	1.2404	1.6985	2.1566	2.6147	3.0728
U/TH	DIST NORMAL	0.1712	0.2433	0.3154	0.3875	0.4596	0.5317	0.6038
TH/K	DIST NORMAL	1.2128	2.2797	3.3466	4.4135	5.4804	6.5473	7.6142

MAP UNIT QGT

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.6478	0.7872	0.9266	1.0660	1.2054	1.3448	1.4842
URANIUM	DIST NORMAL	0.7975	1.1332	1.4689	1.8046	2.1403	2.4760	2.8117
THORIUM	DIST NORMAL	2.8616	3.3637	3.8658	4.3679	4.8700	5.3721	5.8742
U/K	DIST NORMAL	0.3903	0.8425	1.2947	1.7469	2.1991	2.6513	3.1035
U/TH	DIST NORMAL	0.0569	0.1786	0.3003	0.4220	0.5437	0.6654	0.7871
TH/K	DIST NORMAL	1.9416	2.6843	3.4270	4.1697	4.9124	5.6551	6.3978

MAP UNIT QT

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.8426	0.9652	1.0878	1.2104	1.3330	1.4556	1.5782
URANIUM	DIST NORMAL	0.8111	1.2397	1.6683	2.0969	2.5255	2.9541	3.3827
THORIUM	DIST NORMAL	3.3538	4.2055	5.0572	5.9089	6.7606	7.6123	8.4640
U/K	DIST NORMAL	0.5595	0.9553	1.3511	1.7469	2.1427	2.5385	2.9343
U/TH	DIST NORMAL	0.0974	0.1852	0.2730	0.3608	0.4486	0.5364	0.6242
TH/K	DIST NORMAL	3.1685	3.7408	4.3131	4.8854	5.4577	6.0300	6.6023

MAP UNIT QTE

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.9518	1.0537	1.1556	1.2575	1.3594	1.4613	1.5632
URANIUM	DIST NORMAL	0.6805	1.1581	1.6357	2.1133	2.5909	3.0685	3.5461
THORIUM	DIST NORMAL	3.8958	4.6609	5.4260	6.1911	6.9562	7.7213	8.4864
U/K	DIST NORMAL	0.4707	0.8779	1.2851	1.6923	2.0995	2.5067	2.9139
U/TH	DIST NORMAL	0.0986	0.1808	0.2630	0.3452	0.4274	0.5096	0.5918
TH/K	DIST NORMAL	3.2992	3.8431	4.3870	4.9309	5.4748	6.0187	6.5626

MAP UNIT QSI

		-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST NORMAL	0.5532	0.7317	0.9102	1.0887	1.2672	1.4457	1.6242
URANIUM	DIST NORMAL	0.8478	1.2112	1.5746	1.9380	2.3014	2.6648	3.0282
THORIUM	DIST NORMAL	4.4733	5.0279	5.5825	6.1371	6.6917	7.2463	7.8009
U/K	DIST NORMAL	0.3385	0.8390	1.3395	1.8400	2.3405	2.8410	3.3415
U/TH	DIST NORMAL	0.1022	0.1747	0.2472	0.3197	0.3922	0.4647	0.5372
TH/K	DIST NORMAL	3.6566	4.3473	5.0380	5.7287	6.4194	7.1101	7.8008

MAP UNIT QSL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5508	0.7021	0.8534	1.0047	1.1560	1.3073	1.4586
URANIUM DIST NORMAL	0.7872	1.1414	1.4956	1.8498	2.2040	2.5582	2.9124
THORIUM DIST NORMAL	3.2324	4.0871	4.9418	5.7965	6.6512	7.5059	8.3606
U/K DIST NORMAL	0.5630	1.0013	1.4396	1.8779	2.3162	2.7545	3.1928
U/TH DIST NORMAL	0.1133	0.1835	0.2537	0.3239	0.3941	0.4643	0.5345
TH/K DIST NORMAL	3.1709	4.0617	4.9525	5.8433	6.7341	7.6249	8.5157

MAP UNIT QG

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5477	0.7026	0.8575	1.0124	1.1673	1.3222	1.4771
URANIUM DIST NORMAL	0.7417	1.1457	1.5497	1.9537	2.3577	2.7617	3.1657
THORIUM DIST NORMAL	1.6456	2.8009	3.9562	5.1115	6.2668	7.4221	8.5774
U/K DIST NORMAL	0.8061	1.1871	1.5681	1.9491	2.3301	2.7111	3.0921
U/TH DIST NORMAL	0.1024	0.1996	0.2968	0.3940	0.4912	0.5884	0.6856
TH/K DIST NORMAL	2.4742	3.3335	4.1928	5.0521	5.9114	6.7707	7.6300

MAP UNIT QTI

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.6613	0.7975	0.9337	1.0699	1.2061	1.3423	1.4785
URANIUM DIST NORMAL	0.5529	1.0320	1.5111	1.9902	2.4693	2.9484	3.4275
THORIUM DIST NORMAL	3.0640	3.9543	4.8446	5.7349	6.6252	7.5155	8.4058
U/K DIST NORMAL	0.5185	0.9681	1.4177	1.8673	2.3169	2.7665	3.2161
U/TH DIST NORMAL	0.0962	0.1805	0.2648	0.3491	0.4334	0.5177	0.6020
TH/K DIST NORMAL	3.1805	3.9142	4.6479	5.3816	6.1153	6.8490	7.5827

MAP UNIT QTG

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4830	0.6472	0.8114	0.9756	1.1398	1.3040	1.4682
URANIUM DIST NORMAL	0.2754	0.7172	1.1590	1.6008	2.0426	2.4844	2.9262
THORIUM DIST NORMAL	1.6878	2.7297	3.7716	4.8135	5.8554	6.8973	7.9392
U/K DIST NORMAL	0.5832	0.9176	1.2520	1.5864	1.9208	2.2552	2.5896
U/TH DIST NORMAL	0.0842	0.1637	0.2432	0.3227	0.4022	0.4817	0.5612
TH/K DIST NORMAL	2.8100	3.5194	4.2288	4.9382	5.6476	6.3570	7.0664

MAP UNIT MS

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5655	0.6804	0.7953	0.9102	1.0251	1.1400	1.2549
URANIUM DIST NORMAL	0.6340	1.0544	1.4748	1.8952	2.3156	2.7360	3.1564
THORIUM DIST NORMAL	3.3951	4.0382	4.6813	5.3244	5.9675	6.6106	7.2537
U/K DIST NORMAL	0.4547	1.0050	1.5553	2.1056	2.6559	3.2062	3.7565
U/TH DIST NORMAL	0.0768	0.1714	0.2660	0.3606	0.4552	0.5498	0.6444
TH/K DIST NORMAL	3.8879	4.5560	5.2241	5.8922	6.5603	7.2284	7.8965

MAP UNIT MWB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5262	0.6457	0.7652	0.8847	1.0042	1.1237	1.2432
URANIUM DIST NORMAL	0.5649	0.9973	1.4297	1.8621	2.2945	2.7269	3.1593
THORIUM DIST NORMAL	3.0465	3.8263	4.6061	5.3859	6.1657	6.9455	7.7253
U/K DIST NORMAL	0.5875	1.0987	1.6099	2.1211	2.6323	3.1435	3.6547
U/TH DIST NORMAL	0.0939	0.1788	0.2637	0.3486	0.4335	0.5184	0.6033
TH/K DIST NORMAL	4.0296	4.7257	5.4218	6.1179	6.8140	7.5101	8.2062

MAP UNIT MB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4916	0.6704	0.8492	1.0280	1.2068	1.3856	1.5644
URANIUM DIST NORMAL	0.5388	1.0435	1.5482	2.0529	2.5576	3.0623	3.5670
THORIUM DIST NORMAL	2.9757	3.9606	4.9455	5.9304	6.9153	7.9002	8.8851
U/K DIST NORMAL	0.5505	1.0398	1.5291	2.0184	2.5077	2.9970	3.4863
U/TH DIST NORMAL	0.1146	0.1918	0.2690	0.3462	0.4234	0.5006	0.5778
TH/K DIST NORMAL	3.5324	4.2965	5.0606	5.8247	6.5888	7.3529	8.1170

MAP UNIT MSS

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3961	0.5973	0.7985	0.9997	1.2009	1.4021	1.6033
URANIUM DIST NORMAL	0.5741	1.1017	1.6293	2.1569	2.6845	3.2121	3.7397
THORIUM DIST NORMAL	2.8457	3.8918	4.9379	5.9840	7.0301	8.0762	9.1223
U/K DIST NORMAL	0.4308	1.0088	1.5868	2.1648	2.7428	3.3208	3.8988
U/TH DIST NORMAL	0.0871	0.1775	0.2679	0.3583	0.4487	0.5391	0.6295
TH/K DIST NORMAL	3.3697	4.2757	5.1817	6.0877	6.9937	7.8997	8.8057

MAP UNIT MBR

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5950	0.7327	0.8704	1.0081	1.1458	1.2835	1.4212
URANIUM DIST NORMAL	0.6635	1.0845	1.5055	1.9265	2.3475	2.7685	3.1895
THORIUM DIST NORMAL	3.7618	4.4842	5.2066	5.9290	6.6514	7.3738	8.0962
U/K DIST NORMAL	0.4772	0.9646	1.4520	1.9394	2.4268	2.9142	3.4016
U/TH DIST NORMAL	0.1051	0.1794	0.2537	0.3280	0.4023	0.4766	0.5509
TH/K DIST NORMAL	3.7505	4.4790	5.2075	5.9360	6.6645	7.3930	8.1215

MAP UNIT PB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4630	0.6019	0.7408	0.8797	1.0186	1.1575	1.2964
URANIUM DIST NORMAL	0.5479	0.9320	1.3161	1.7002	2.0843	2.4684	2.8525
THORIUM DIST NORMAL	2.5120	3.2452	3.9784	4.7116	5.4448	6.1780	6.9112
U/K DIST NORMAL	0.5023	0.9847	1.4671	1.9495	2.4319	2.9143	3.3967
U/TH DIST NORMAL	0.1280	0.2050	0.2820	0.3590	0.4360	0.5130	0.5900
TH/K DIST NORMAL	3.3922	4.0602	4.7282	5.3962	6.0642	6.7322	7.4002

MAP UNIT PR

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5182	0.6585	0.7988	0.9391	1.0794	1.2197	1.3600
URANIUM DIST NORMAL	0.6534	1.0918	1.5302	1.9686	2.4070	2.8454	3.2838
THORIUM DIST NORMAL	2.9142	3.7161	4.5180	5.3199	6.1218	6.9237	7.7256
U/K DIST NORMAL	0.7526	1.2068	1.6610	2.1152	2.5694	3.0236	3.4778
U/TH DIST NORMAL	0.1354	0.2138	0.2922	0.3706	0.4490	0.5274	0.6058
TH/K DIST NORMAL	3.1393	4.0010	4.8627	5.7244	6.5861	7.4478	8.3095

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT QM

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.838	1.112	0.000	0.000	0.000	1.153	1.027	1.250	1.091	0.933	1.100	1.109	0.000	1.392	1.110
URANIUM	1.629	2.339	0.000	0.000	0.000	2.014	2.362	2.568	1.825	3.306	2.092	2.386	0.000	1.864	2.311
THORIUM	5.137	4.805	0.000	0.000	0.000	5.290	5.970	6.144	5.652	5.357	6.013	6.808	0.000	5.781	5.893
U/K	1.945	2.106	0.000	0.000	0.000	1.754	2.517	2.056	1.672	3.659	1.913	2.168	0.000	1.335	2.086
U/TH	0.318	0.487	0.000	0.000	0.000	0.382	0.405	0.418	0.325	0.625	0.355	0.358	0.000	0.321	0.403
TH/K	6.128	4.324	0.000	0.000	0.000	4.602	6.073	4.923	5.203	5.793	5.493	6.151	0.000	4.153	5.328

	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 QSA

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.173	1.116	1.034	1.156	1.232	1.101	1.155	1.185	1.125	1.153	1.074	1.101	1.026	1.130	1.186
URANIUM	2.185	2.015	1.979	1.873	1.963	1.698	1.896	1.949	1.771	1.990	1.980	2.028	1.714	1.898	1.946
THORIUM	5.249	4.632	4.365	4.688	5.166	4.809	5.203	5.434	5.734	5.810	5.499	5.272	5.338	4.894	5.843
U/K	1.877	1.802	1.965	1.613	1.629	1.564	1.669	1.641	1.600	1.751	1.891	1.899	1.656	1.666	1.650
U/TH	0.424	0.426	0.483	0.398	0.394	0.361	0.372	0.360	0.309	0.348	0.354	0.399	0.318	0.384	0.331
TH/K	4.467	4.182	4.124	4.059	4.203	4.396	4.534	4.600	5.163	5.091	5.210	4.863	5.216	4.346	4.950

	1040	1050	1060
POTASIUM	1.027	1.102	1.088
URANIUM	2.008	1.930	1.832
THORIUM	4.861	5.873	5.790
U/K	1.988	1.855	1.768
U/TH	0.408	0.335	0.342
TH/K	4.802	5.475	5.375

MAP UNIT QSD

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	1.030	0.000	0.000	0.000	1.009	0.000	1.012	1.045	1.033	1.119	1.049	0.000	1.032	0.000
URANIUM	0.000	1.732	0.000	0.000	0.000	1.243	0.000	1.788	1.362	1.572	1.723	1.624	0.000	1.654	0.000
THORIUM	0.000	4.209	0.000	0.000	0.000	3.414	0.000	5.151	3.697	4.443	4.910	4.649	0.000	3.804	0.000
U/K	0.000	1.682	0.000	0.000	0.000	1.225	0.000	1.778	1.301	1.513	1.546	1.532	0.000	1.584	0.000
U/TH	0.000	0.412	0.000	0.000	0.000	0.371	0.000	0.350	0.374	0.366	0.364	0.341	0.000	0.438	0.000
TH/K	0.000	4.075	0.000	0.000	0.000	3.368	0.000	5.116	3.528	4.295	4.364	4.377	0.000	3.661	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 QL

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.263	0.000	1.455	0.000	0.000	0.998	1.137	1.161	1.157	1.152	1.141	1.139	0.000	1.131	0.000
URANIUM	2.101	0.000	3.344	0.000	0.000	1.556	2.116	2.193	1.813	1.917	2.039	2.128	0.000	2.266	0.000
THORIUM	6.110	0.000	5.988	0.000	0.000	4.216	5.877	5.622	5.718	5.804	5.920	6.081	0.000	5.776	0.000
U/K	1.678	0.000	2.296	0.000	0.000	1.533	1.857	1.909	1.574	1.678	1.798	1.880	0.000	2.018	0.000
U/TH	0.348	0.000	0.564	0.000	0.000	0.375	0.359	0.397	0.322	0.333	0.344	0.353	0.000	0.398	0.000
TH/K	4.878	0.000	4.103	0.000	0.000	4.295	5.184	4.858	4.936	5.050	5.217	5.353	0.000	5.114	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 QCL

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.217	1.182	1.299	0.000	1.274	1.328	0.000	1.086	0.955	0.000	1.116	1.163	0.000	0.000	0.000
URANIUM	2.063	2.293	1.903	0.000	2.133	2.185	0.000	2.151	1.547	0.000	2.276	2.081	0.000	0.000	0.000
THORIUM	6.105	5.104	6.298	0.000	5.837	5.923	0.000	5.455	5.066	0.000	6.984	6.558	0.000	0.000	0.000
U/K	1.713	1.956	1.471	0.000	1.685	1.644	0.000	1.977	1.622	0.000	2.045	1.821	0.000	0.000	0.000
U/TH	0.342	0.451	0.305	0.000	0.369	0.371	0.000	0.404	0.307	0.000	0.329	0.321	0.000	0.000	0.000
TH/K	5.027	4.328	4.850	0.000	4.587	4.456	0.000	5.065	5.298	0.000	6.280	5.693	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	1.188	0.000
URANIUM	0.000	1.776	0.000
THORIUM	0.000	6.249	0.000
U/K	0.000	1.496	0.000
U/TH	0.000	0.286	0.000
TH/K	0.000	5.264	0.000

MAP UNIT QGV

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.094	1.110	1.205	1.245	1.187	1.208	1.167	1.187	1.158	1.055	0.976	1.185	0.000	1.081	0.971
URANIUM	1.978	2.114	1.855	2.014	1.877	1.684	1.856	1.893	1.721	1.598	1.561	1.474	0.000	1.938	1.366
THORIUM	5.204	4.929	5.110	5.295	4.932	4.850	5.746	4.985	4.680	4.246	4.798	4.684	0.000	4.607	4.002
U/K	1.816	1.892	1.544	1.639	1.602	1.380	1.623	1.604	1.463	1.528	1.592	1.256	0.000	1.810	1.434
U/TH	0.387	0.430	0.371	0.391	0.384	0.342	0.337	0.388	0.357	0.382	0.331	0.314	0.000	0.428	0.321
TH/K	4.738	4.443	4.227	4.266	4.178	4.006	4.930	4.187	4.042	4.043	4.949	3.974	0.000	4.264	4.132

	1040	1050	1060
POTASIUM	1.246	1.345	1.255
URANIUM	1.731	2.070	1.992
THORIUM	5.261	6.322	5.206
U/K	1.389	1.558	1.598
U/TH	0.329	0.331	0.384
TH/K	4.222	4.705	4.149

MAP UNIT QGP

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.237	0.000	1.232	0.000	0.000	0.000	1.339	0.000	0.000	0.000	0.000	0.000	1.206	0.000	0.000
URANIUM	2.721	0.000	1.928	0.000	0.000	0.000	1.828	0.000	0.000	0.000	0.000	0.000	2.044	0.000	0.000
THORIUM	5.986	0.000	5.623	0.000	0.000	0.000	6.513	0.000	0.000	0.000	0.000	0.000	7.140	0.000	0.000
U/K	2.204	0.000	1.569	0.000	0.000	0.000	1.386	0.000	0.000	0.000	0.000	0.000	1.703	0.000	0.000
U/TH	0.454	0.000	0.346	0.000	0.000	0.000	0.282	0.000	0.000	0.000	0.000	0.000	0.295	0.000	0.000
TH/K	4.843	0.000	4.566	0.000	0.000	0.000	4.889	0.000	0.000	0.000	0.000	0.000	5.923	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 QGK

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.293	0.000	0.000	0.000	0.000	0.000	1.249	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.618	0.000	0.000	0.000	0.000	0.000	1.556	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	6.867	0.000	0.000	0.000	0.000	0.000	4.023	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.028	0.000	0.000	0.000	0.000	0.000	1.259	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.382	0.000	0.000	0.000	0.000	0.000	0.395	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	5.311	0.000	0.000	0.000	0.000	0.000	3.217	0.000	0.000	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 QGT

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	1.222	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	1.833	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	4.044	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	1.540	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.471	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	3.306	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.000	1.001
URANIUM	0.000	0.000	1.791
THORIUM	0.000	0.000	4.503
U/K	0.000	0.000	1.845
U/TH	0.000	0.000	0.399
TH/K	0.000	0.000	4.531

MAP UNIT QT

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.196	1.179	1.195	1.222	1.272	1.286	1.225	1.173	0.000	0.000	0.000	0.000	1.280	1.203	1.142
URANIUM	2.202	2.187	2.212	2.034	2.122	1.936	2.147	2.161	0.000	0.000	0.000	0.000	1.974	1.914	1.933
THORIUM	5.965	5.696	5.899	5.930	6.170	6.006	5.593	5.545	0.000	0.000	0.000	0.000	6.534	5.931	5.701
U/K	1.856	1.852	1.867	1.678	1.688	1.522	1.763	1.868	0.000	0.000	0.000	0.000	1.561	1.593	1.683
U/TH	0.375	0.385	0.380	0.350	0.352	0.328	0.389	0.394	0.000	0.000	0.000	0.000	0.308	0.323	0.341
TH/K	4.995	4.822	4.942	4.849	4.858	4.676	4.585	4.750	0.000	0.000	0.000	0.000	5.116	4.935	4.989

	1040	1050	1060
POTASIUM	1.197	1.159	1.167
URANIUM	2.012	1.942	2.106
THORIUM	6.006	5.906	5.104
U/K	1.690	1.698	1.821
U/TH	0.338	0.336	0.418
TH/K	5.020	5.117	4.387

MAP UNIT QTE

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.268	1.266	1.228	1.205	1.280	1.267	1.324	0.000	0.000	0.000	0.000	0.000	1.255	0.000	1.231
URANIUM	2.539	2.248	2.262	2.071	2.002	1.822	1.790	0.000	0.000	0.000	0.000	0.000	2.162	0.000	2.844
THORIUM	6.799	6.447	5.252	5.982	6.294	6.017	5.816	0.000	0.000	0.000	0.000	0.000	6.149	0.000	6.436
U/K	2.030	1.786	1.841	1.719	1.574	1.444	1.360	0.000	0.000	0.000	0.000	0.000	1.742	0.000	2.318
U/TH	0.377	0.351	0.436	0.352	0.328	0.306	0.311	0.000	0.000	0.000	0.000	0.000	0.356	0.000	0.453
TH/K	5.386	5.107	4.275	4.954	4.904	4.756	4.400	0.000	0.000	0.000	0.000	0.000	4.907	0.000	5.227

	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 QSI

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.028	1.195	0.000	0.918	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.945	1.790	0.000	2.210	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.607	6.417	0.000	5.845	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.898	1.517	0.000	2.414	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.347	0.280	0.000	0.382	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.471	5.439	0.000	6.377	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 QSL

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.998	1.105	1.038	0.904	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.802	1.916	1.757	1.904	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.821	6.184	5.221	5.719	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.837	1.731	1.761	2.137	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.311	0.313	0.354	0.338	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.929	5.624	5.066	6.354	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.930	0.000	0.951
URANIUM	2.058	0.000	1.674
THORIUM	5.637	0.000	5.590
U/K	2.213	0.000	1.757
U/TH	0.365	0.000	0.299
TH/K	6.060	0.000	5.877

MAP UNIT QG

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.011	1.080	0.000	0.000	0.955	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.458	1.458	0.000	0.000	1.888	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.280	4.549	0.000	0.000	5.810	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.436	1.353	0.000	0.000	2.010	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.579	0.323	0.000	0.000	0.327	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.226	4.207	0.000	0.000	6.149	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	1.020	0.000	0.000
URANIUM	2.014	0.000	0.000
THORIUM	5.084	0.000	0.000
U/K	1.985	0.000	0.000
U/TH	0.409	0.000	0.000
TH/K	4.930	0.000	0.000

MAP UNIT QTI

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	1.025	0.917	1.030	1.093	1.123	1.074	1.113	1.130	1.056	1.042	1.023	1.065	1.036	1.123	1.112
URANIUM	1.994	1.508	1.850	1.882	2.029	1.842	1.918	2.134	1.901	2.035	2.187	2.217	1.948	1.675	2.030
THORIUM	5.542	3.777	5.289	5.223	5.397	5.433	5.720	5.901	5.852	5.876	5.817	6.115	6.002	5.089	5.901
U/K	1.957	1.652	1.772	1.707	1.803	1.726	1.721	1.898	1.815	1.970	2.140	2.099	1.888	1.522	1.841
U/TH	0.367	0.400	0.346	0.366	0.381	0.342	0.335	0.365	0.327	0.350	0.377	0.369	0.329	0.331	0.346
TH/K	5.413	4.124	5.093	4.738	4.795	5.067	5.139	5.229	5.571	5.667	5.725	5.749	5.819	4.590	5.327

	1040	1050	1060
POTASIUM	0.976	0.932	0.944
URANIUM	1.842	1.497	1.785
THORIUM	5.245	5.242	5.005
U/K	1.875	1.648	1.896
U/TH	0.349	0.292	0.359
TH/K	5.379	5.639	5.314

MAP UNIT QTG

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.976	1.096	0.896	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	1.495	1.977	1.149	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	5.005	5.152	4.390	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	1.522	1.797	1.264	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	0.299	0.392	0.262	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	5.128	4.674	4.868	0.000	0.000	0.000	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.809	1.036	0.000
URANIUM	1.478	1.545	0.000
THORIUM	4.260	4.843	0.000
U/K	1.747	1.452	0.000
U/TH	0.302	0.305	0.000
TH/K	5.237	4.673	0.000

MAP UNIT MS

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.875	0.900	0.931	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.720	1.701	2.052	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.805	5.457	5.687	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.961	1.858	2.201	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.358	0.306	0.365	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.530	6.093	6.145	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.911	0.000	0.000
URANIUM	1.915	0.000	0.000
THORIUM	5.180	0.000	0.000
U/K	2.177	0.000	0.000
U/TH	0.379	0.000	0.000
TH/K	5.744	0.000	0.000

MAP UNIT MWB

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.854	0.891	0.883	0.901	0.905	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.402	1.816	1.627	1.970	2.096	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.816	4.958	5.212	5.741	5.691	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.642	2.086	1.839	2.208	2.339	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.295	0.373	0.314	0.346	0.376	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.644	5.600	5.927	6.412	6.334	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.805	0.000	0.000
URANIUM	2.135	0.000	0.000
THORIUM	5.213	0.000	0.000
U/K	2.676	0.000	0.000
U/TH	0.415	0.000	0.000
TH/K	6.527	0.000	0.000

MAP UNIT MB

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	1.136	0.000	1.065	0.000	1.239	1.060	1.056	0.000	0.879	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	2.318	0.000	1.409	0.000	2.308	1.904	2.152	0.000	1.999	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	5.528	0.000	4.488	0.000	6.453	5.994	6.190	0.000	6.139	0.000	0.000	0.000
U/K	0.000	0.000	0.000	2.065	0.000	1.245	0.000	1.868	1.797	2.045	0.000	2.308	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.421	0.000	0.361	0.000	0.362	0.319	0.347	0.000	0.332	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	4.891	0.000	4.237	0.000	5.210	5.658	5.879	0.000	7.009	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.719	0.000	0.000
URANIUM	1.594	0.000	0.000
THORIUM	4.105	0.000	0.000
U/K	2.262	0.000	0.000
U/TH	0.387	0.000	0.000
TH/K	5.789	0.000	0.000

MAP UNIT MSS

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	1.213	0.000	0.000	0.000	1.285	1.176	1.042	0.962	1.019	0.872	0.000	0.000	0.000
URANIUM	0.000	0.000	2.089	0.000	0.000	0.000	1.996	2.550	1.928	2.431	2.347	1.997	0.000	0.000	0.000
THORIUM	0.000	0.000	5.041	0.000	0.000	0.000	6.343	6.000	5.906	5.600	6.265	5.829	0.000	0.000	0.000
U/K	0.000	0.000	1.731	0.000	0.000	0.000	1.561	2.184	1.839	2.585	2.314	2.311	0.000	0.000	0.000
U/TH	0.000	0.000	0.420	0.000	0.000	0.000	0.320	0.426	0.325	0.448	0.374	0.337	0.000	0.000	0.000
TH/K	0.000	0.000	4.154	0.000	0.000	0.000	4.928	5.137	5.674	5.830	6.194	6.792	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.958	0.000
URANIUM	0.000	2.109	0.000
THORIUM	0.000	6.121	0.000
U/K	0.000	2.152	0.000
U/TH	0.000	0.333	0.000
TH/K	0.000	6.446	0.000

MAP UNIT MBR

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.989	1.036	1.018	1.034	1.013	0.994	1.023	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	2.087	1.856	1.729	1.744	1.782	1.835	2.131	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	5.247	5.425	5.126	5.873	5.900	6.029	6.283	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	2.118	1.798	1.685	1.712	1.805	1.859	2.138	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.400	0.344	0.336	0.300	0.306	0.307	0.343	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	5.328	5.254	5.076	5.728	5.884	6.113	6.216	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.000	0.899	1.026
URANIUM	0.000	1.962	2.046
THORIUM	0.000	5.648	5.983
U/K	0.000	2.222	2.005
U/TH	0.000	0.354	0.343
TH/K	0.000	6.317	5.877

MAP UNIT PB

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.173
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.387
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.835
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.184
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.286
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.159

	1040	1050	1060
POTASIUM	0.856	0.000	0.000
URANIUM	1.727	0.000	0.000
THORIUM	4.702	0.000	0.000
U/K	2.014	0.000	0.000
U/TH	0.365	0.000	0.000
TH/K	5.496	0.000	0.000

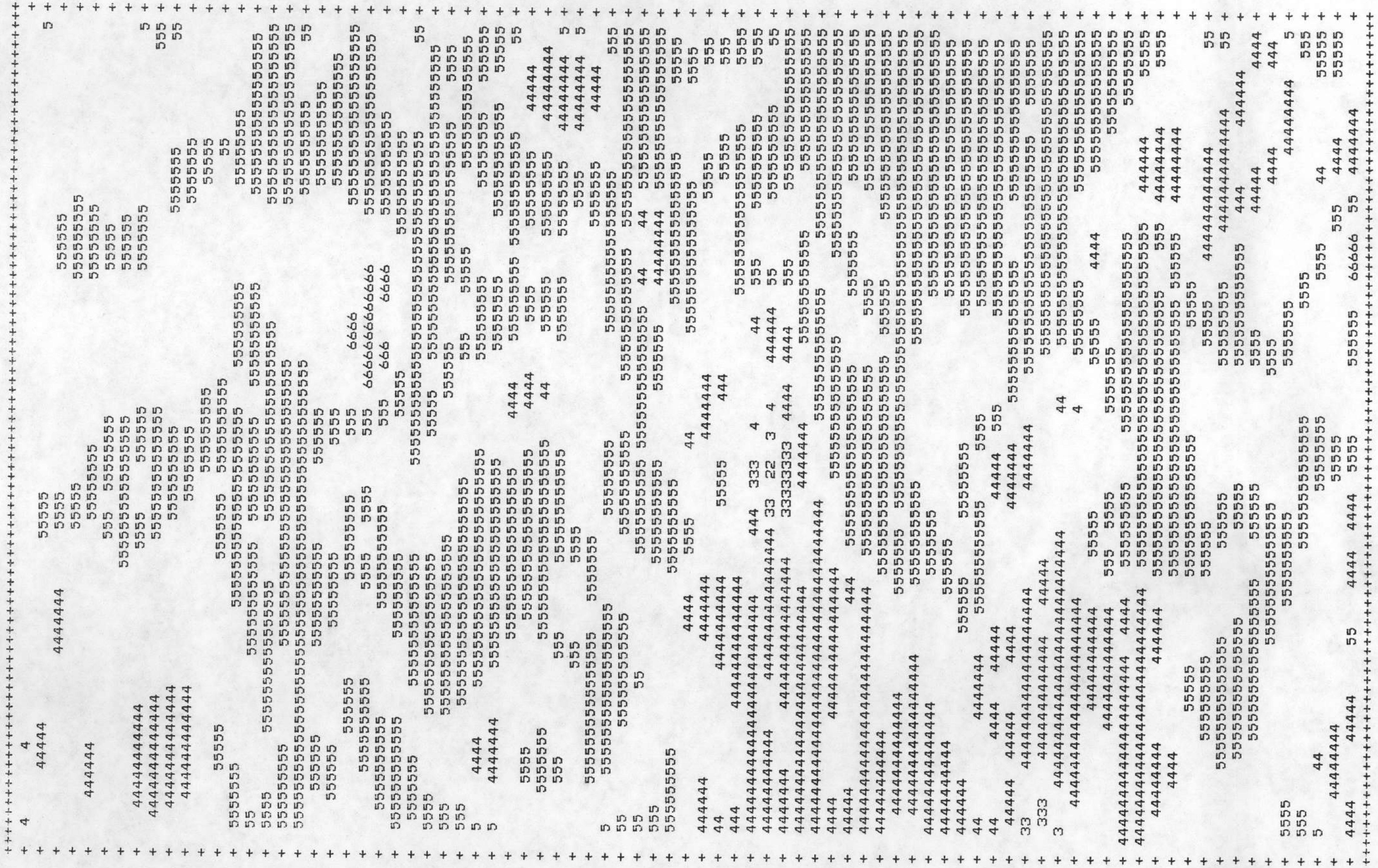
MAP UNIT PR

	610	620	630	640	650	660	670	680	690	700	710	720	1010	1020	1030
POTASIUM	0.870	0.847	0.000	0.000	0.000	0.000	0.000	0.960	0.909	1.005	0.989	0.942	0.000	0.000	0.000
URANIUM	1.786	1.456	0.000	0.000	0.000	0.000	0.000	2.082	2.027	1.918	1.938	2.144	0.000	0.000	0.000
THORIUM	4.441	4.006	0.000	0.000	0.000	0.000	0.000	5.210	5.057	5.482	5.829	5.550	0.000	0.000	0.000
U/K	2.075	1.754	0.000	0.000	0.000	0.000	0.000	2.201	2.233	1.902	2.005	2.290	0.000	0.000	0.000
U/TH	0.408	0.361	0.000	0.000	0.000	0.000	0.000	0.405	0.404	0.350	0.331	0.387	0.000	0.000	0.000
TH/K	5.099	4.752	0.000	0.000	0.000	0.000	0.000	5.484	5.581	5.485	6.015	5.930	0.000	0.000	0.000

	1040	1050	1060
POTASIUM	0.833	0.000	0.000
URANIUM	1.877	0.000	0.000
THORIUM	5.015	0.000	0.000
U/K	2.264	0.000	0.000
U/TH	0.369	0.000	0.000
TH/K	6.061	0.000	0.000

APPENDIX H - Pseudo Contour Maps

INDIANAPOLIS



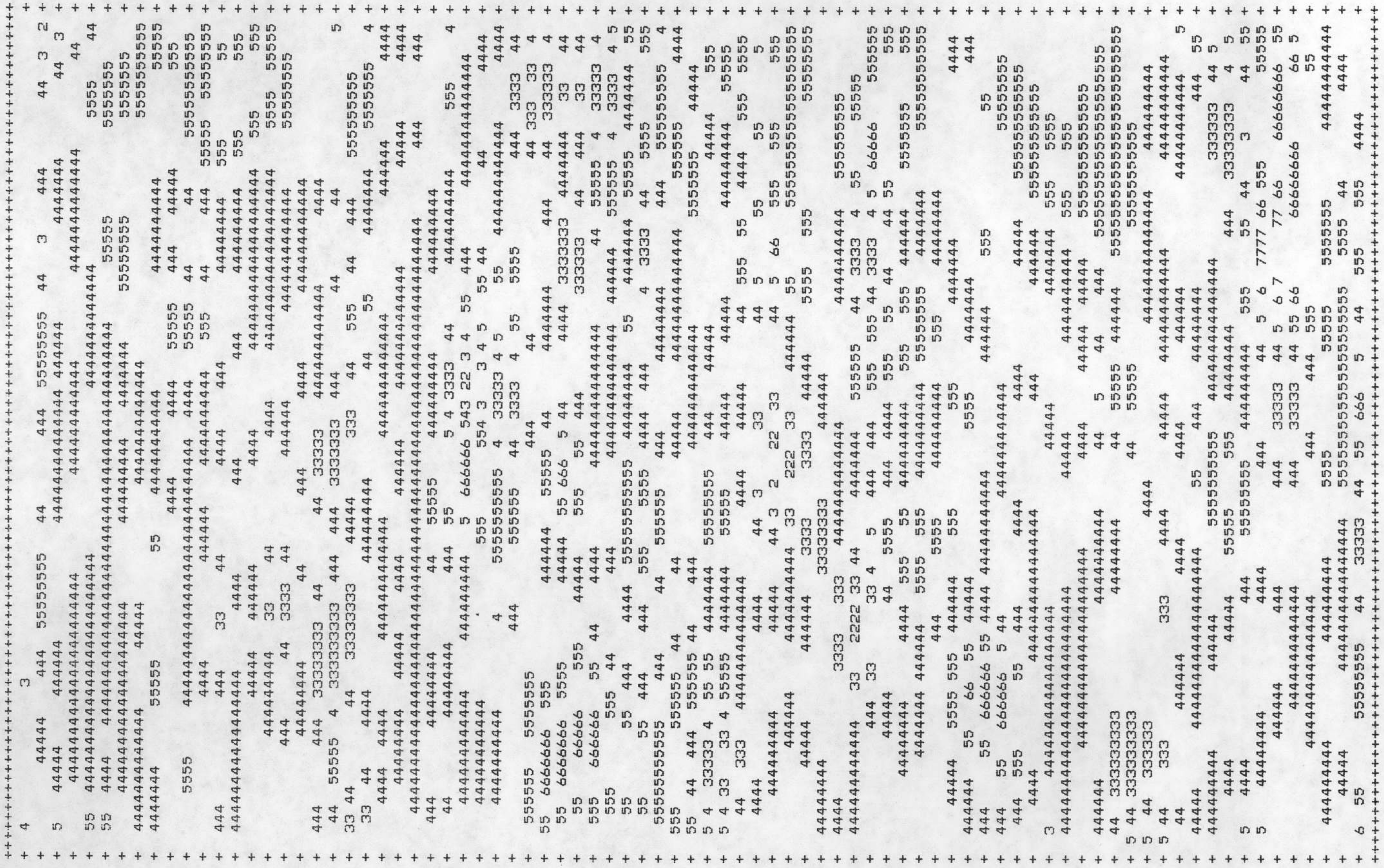
Potassium Pseudo-Contour Map - Indianapolis Quadrangle

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

INDIANAPOLIS



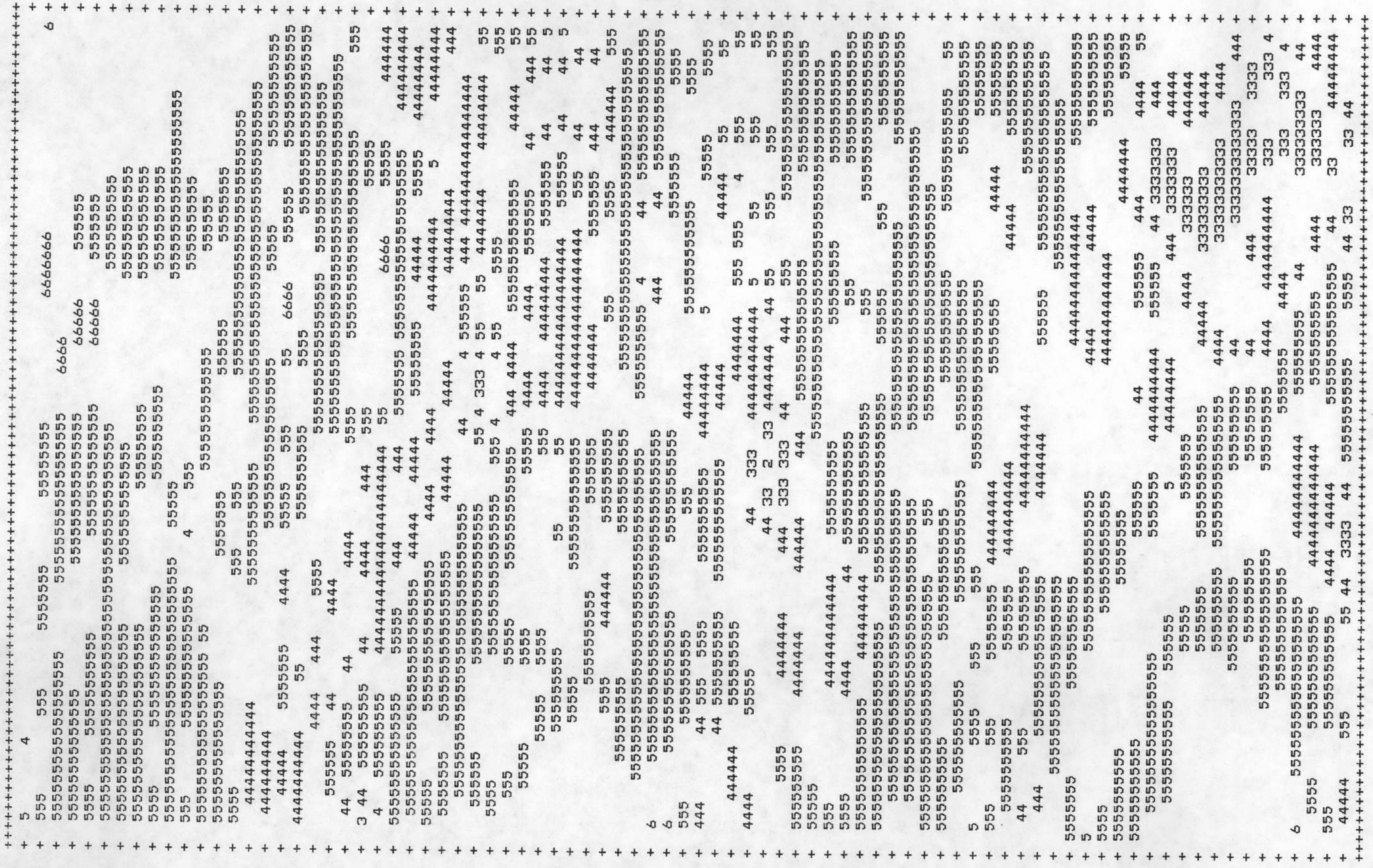
EXPLANATION

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 Pseudo-Contour Map - Indiananpolis Quadrangle

SCALE IN EQUIVALENT PPM

INDIANAPOLIS



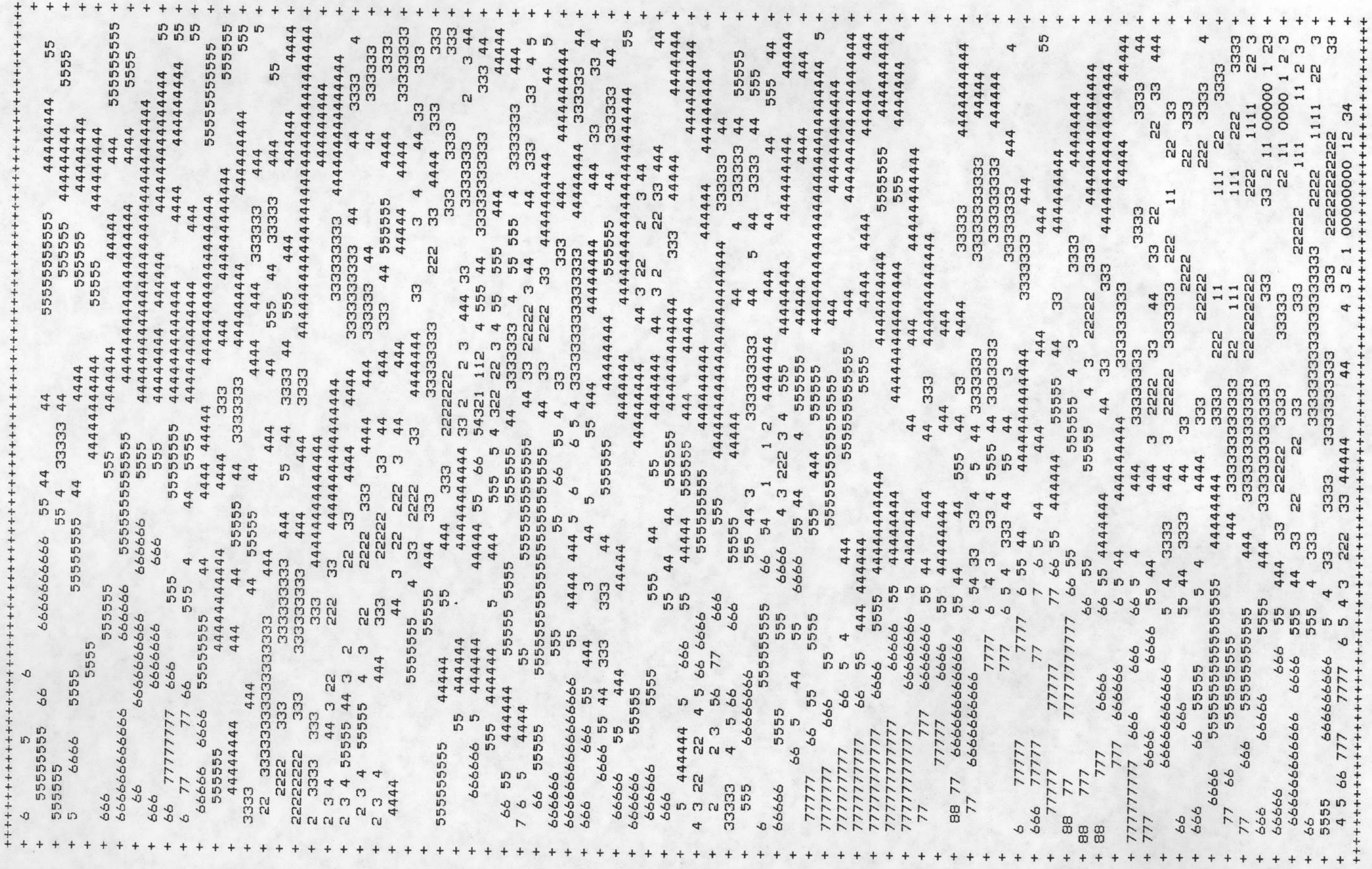
Thorium Pseudo-Contour Map - Indianapolis Quadrangle

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

INDIANAPOLIS

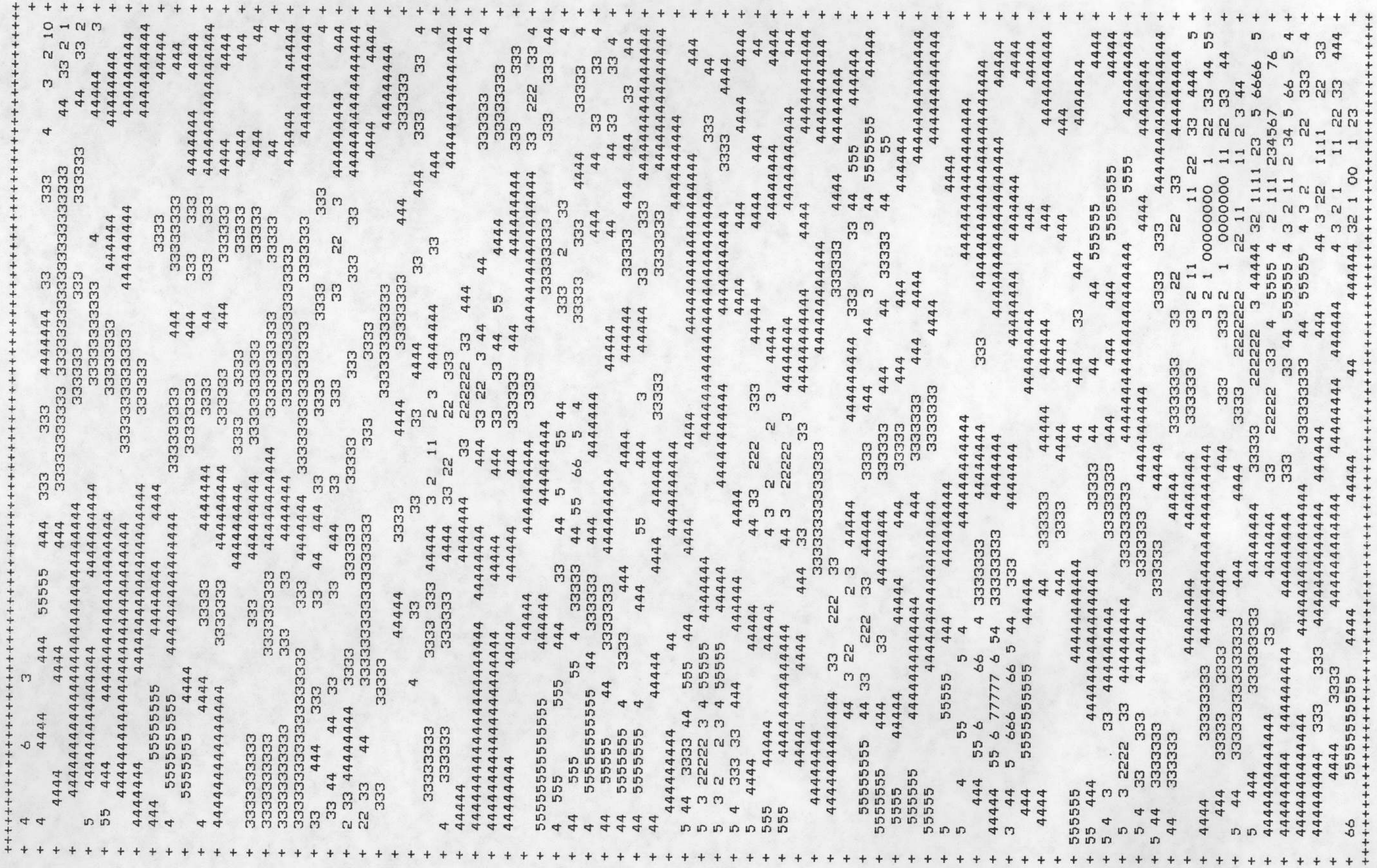


EXPLANATION

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 - Indianapolis Quadrangle

INDIANAPOLIS

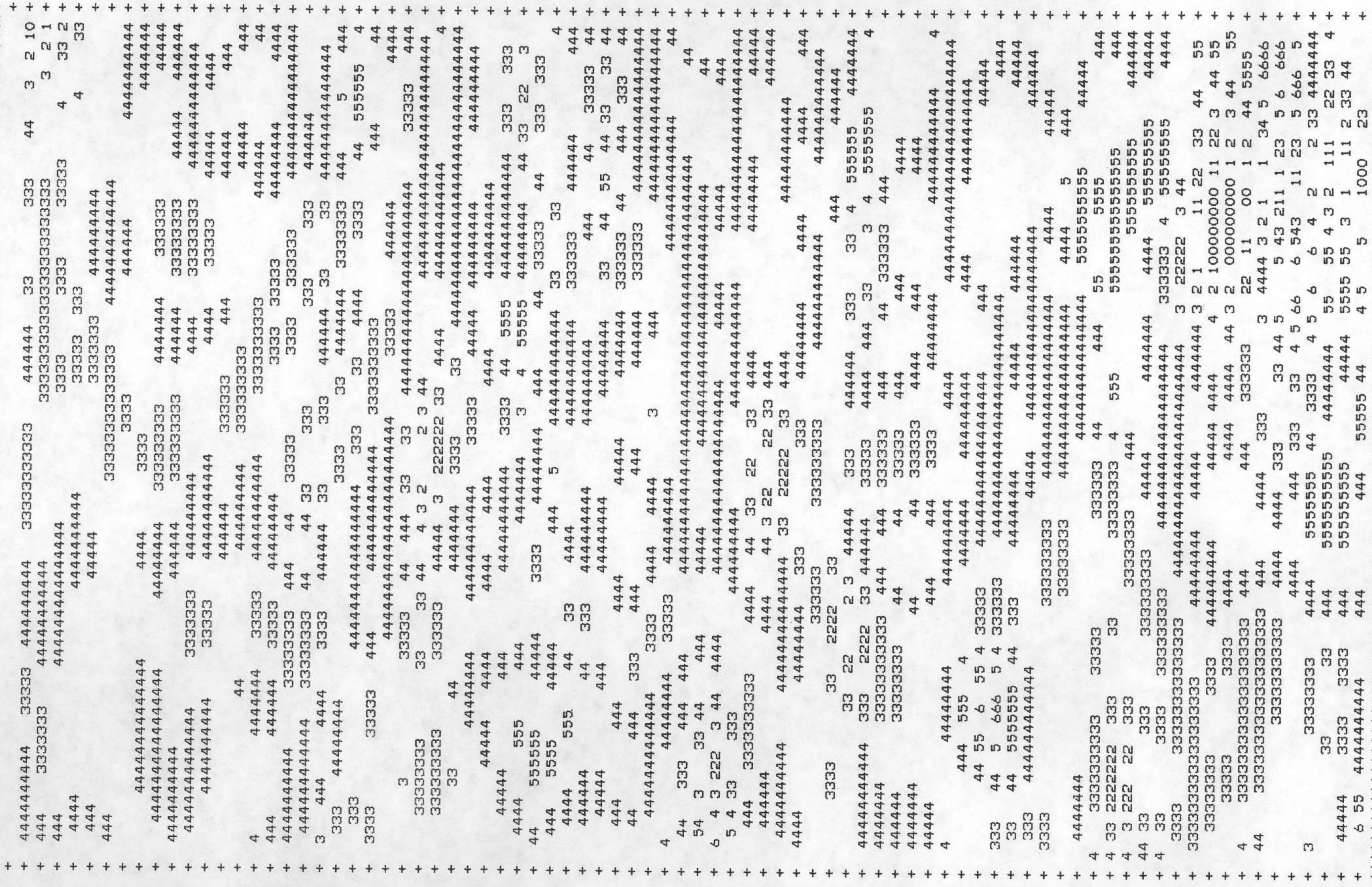


EXPLANATION

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 - Indianapolis Quadrangle

INDIANAPOLIS

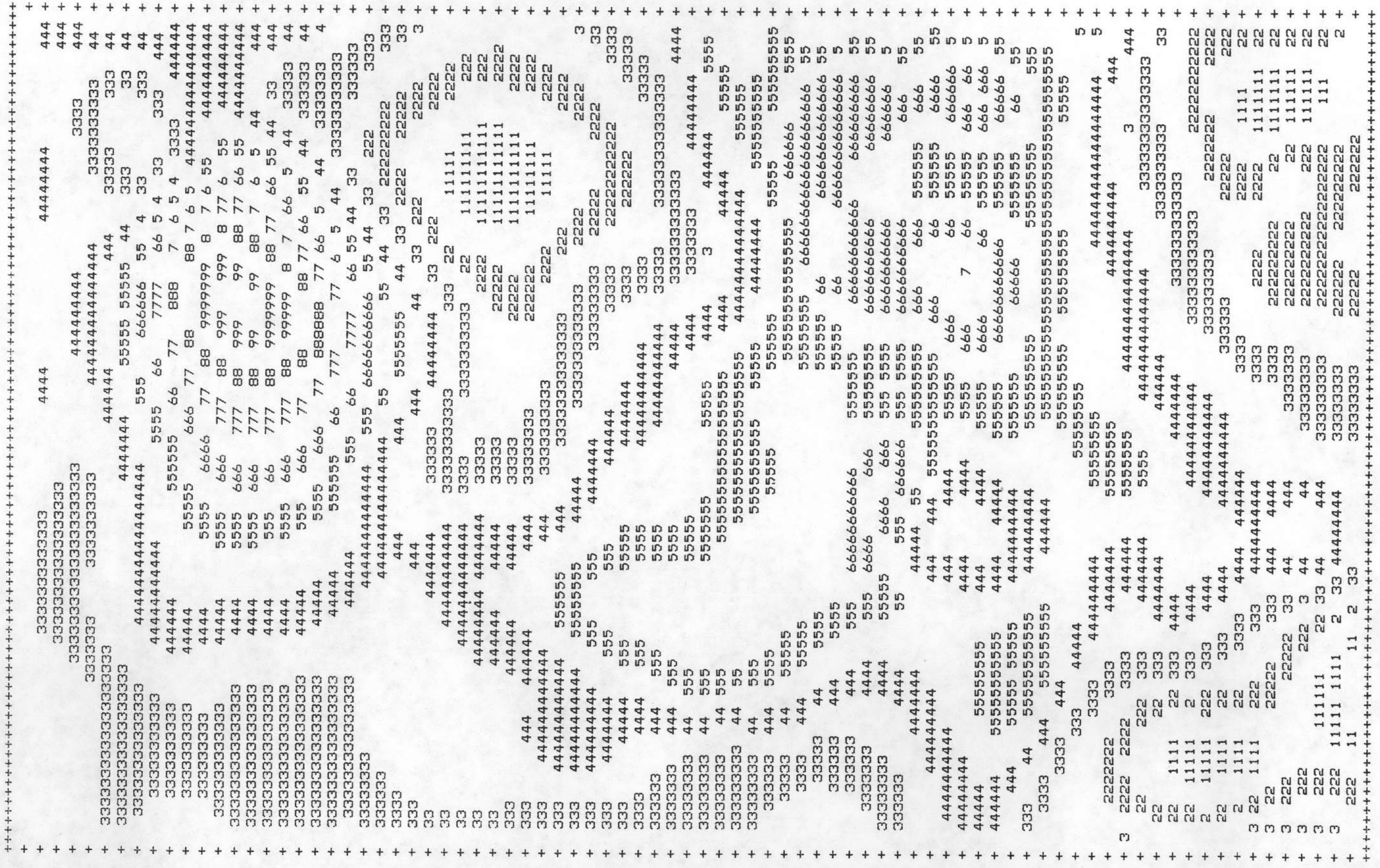


EXPLANATION

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 - Indianapolis Quadrangle

INDIANAPOLIS



EXPLANATION

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

Residual Magnetic Pseudo-Contour Map - Indianapolis Quadrangle

SCALE IN GAMMAS