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National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY COLUMBUS QUADRANGLE OHIO

FINAL REPORT

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EG&G GEOMETRICS
Sunnyvale, California 94086

GEOLOGICAL SURVEY OF WYOMING

July 1981

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Grand Junction Office, Colorado

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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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Prepared by
EG&G geoMetrics
Sunnyvale, California

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Prepared for the U.S. Department of Energy
Grand Junction Office, Colorado
Under Contract No. DE-AC13-76GJ01664
and Bendix Field Engineering Corporation
Subcontract No. 80-479-L

ABSTRACT

The Columbus quadrangle covers a 7,100 square mile area of south central Ohio which is located within the Midwestern Physiographic Province. Up to 6,000 feet of Paleozoic strata overlie the east dipping Precambrian basement. Flat lying Quaternary glacial sediments cover a large part of the surface in the north and west regions of the quadrangle.

A search of available literature revealed no known uranium deposits.

A total of ninety-nine (99) uranium anomalies were detected and are discussed briefly in this report. Radiometric data reflect the presence of two zones of higher than average uranium anomaly occurrences. One zone is the northerly continuation of a trend observed in a contiguous quadrangle and occurs over undifferentiated Devonian and Mississippian sediments. Some anomalies appear to be culturally induced such as those in the vicinity of the city of Columbus. The outlined area in Figure 3 (indicated by a dashed contour line) should be considered for further investigation.

The magnetic data indicate more structural complexity in underlying rocks than inferred by the structural interpretation of the area. The broad zones with long wavelength magnetic signatures on the east are interrupted further west by many small magnetic features whose sources may be attributed to undefined lithologic and/or structural elements in the Precambrian basement.

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INTRODUCTION

General

The Columbus quadrangle covers 7,100 square miles in south-central Ohio. A five square mile area of West Virginia is included in the southeast corner (see Figure 1).

The geologic base map used in the interpretation was compiled at 1:250,000 scale by Fremont Geologic Consultants in 1981. Principal sources of geologic data for the map came from 1:62,500 scale quadrangles published by the Ohio Division of Geological Survey. Additional published sources include geologic and glacial maps and reports of smaller areas issued by the Ohio and West Virginia Geological Surveys. Geologic unit descriptions in the report conform to those in the legend of the geologic base map (see Appendix C). Supplementary geologic information came from Cohee and others (1962), Flint (1959, 1971) and Weller (1975). Cultural and physiographic information came from the 1:250,000 scale Columbus topographic quadrangle (1967 edition).

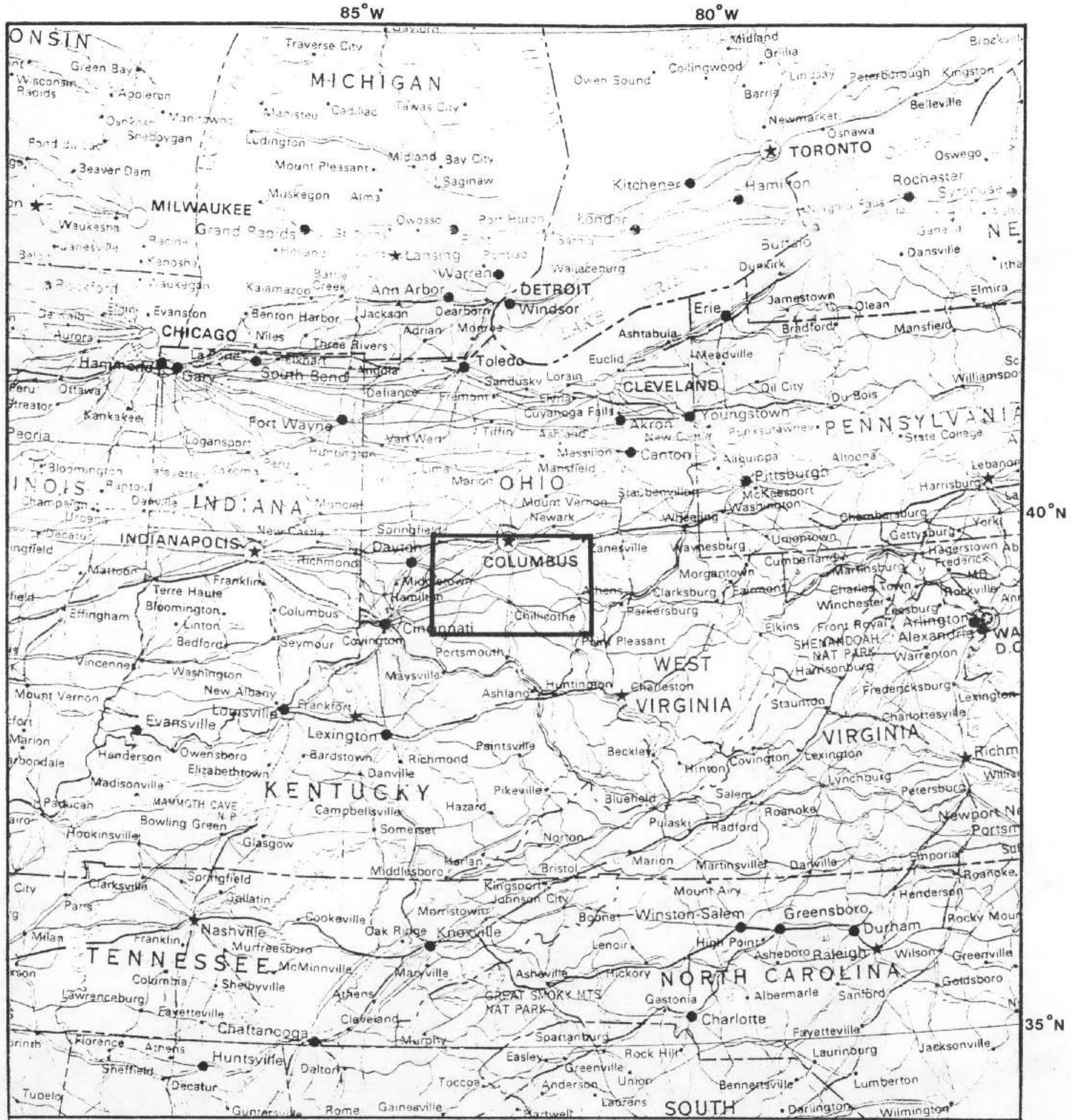
Radiometric and magnetic data were acquired during the months of December 1980 and May 1981 and processed in June 1981. Appendix A contains a summary of data acquisition, processing, interpretation and presentation methods. Refer to Appendix B for the flight line summary of this quadrangle.

Physiography

The area within the Columbus quadrangle is situated on the border between two physiographic provinces. The western two-thirds of the area comprises a broad glaciated plain which lies at the northeastern edge of the Midwestern Physiographic Province. To the east and south the unglaciated strata have been eroded into a maze of ridges and valleys characteristic of the Allegheny Plateau. The region is drained southward by the Scioto River and other tributaries of the Ohio River that flow out of the quadrangle on three sides (see Figure 3). Ponds, small lakes and water supply reservoirs are common, particularly in glacially influenced terrain.

Elevations range from a low of 560 feet in the Scioto river valley, as it passes out of the area, to a high of 1,211 feet in the northwest near Brighton. Other locations in the center of the quadrangle reach just over 1,200 feet elevation. Local relief in some areas is as great as 550 feet but generally is not more than 200 feet.

A part of the city of Columbus (582,000 pop.) is situated within the region. Smaller population centers are scattered equidistantly throughhout the area. A highly developed network of primary and secondary roads connects cities and towns. Numerous railroads serve the cities and towns of north.



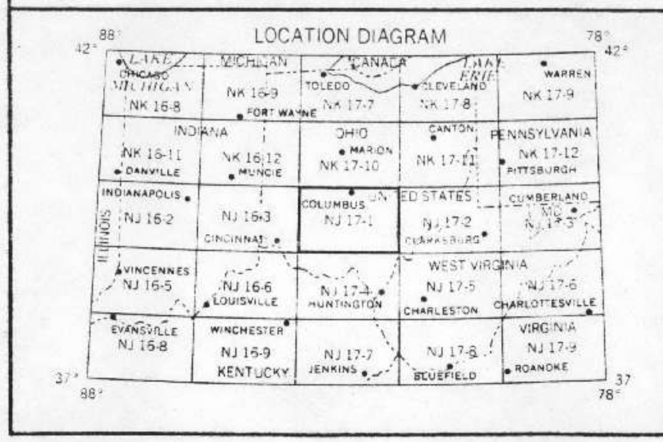


FIGURE 1

LOCATION MAP
COLUMBUS QUADRANGLE

Scale

100 50 0 100 MILES

GEOLOGY

Structure

The Columbus quadrangle overlies the northeastern flank of a basement structure called the Cincinnati Arch, just to the south of its extension, the Findlay Arch (see Figure 2). Throughout the quadrangle the basement dips steeply eastward toward the Allegheny Basin resulting in a sequence of Paleozoic sedimentary rocks that reach a maximum thickness of 6,000 feet. The sedimentary strata thins to less than 1,000 feet in the southwest corner of the quadrangle, but increases in thickness to the north over the terminus of the Cincinnati Arch as it drops away toward the Findlay Arch. At the ground surface, a general northeast strike is apparent in the gently westward dipping sedimentary strata.

No faults displace bedrock units, or are inferred under the glacial till as indicated by the geologic base map. A local feature in the basement called the Serpent Mound Disturbance (a cryptoexplosion structure), occurs southwest of the town of Chillicothe but it has not been mapped at this scale.

Surface Geology

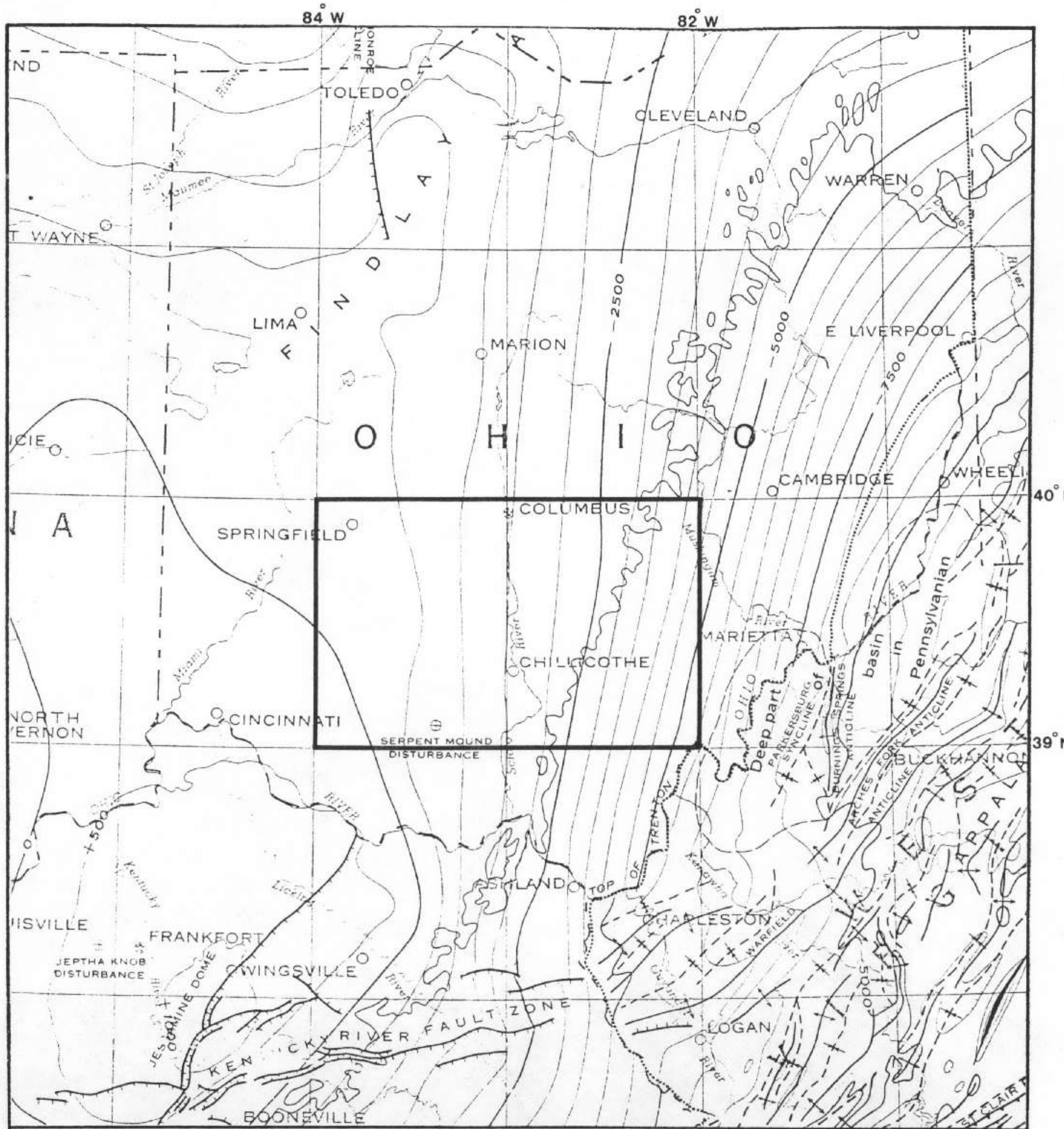
Mapped surface exposures include Pleistocene glacial deposits and Paleozoic sedimentary rocks. About 60% of the quadrangle is covered by glacial drift, less than 40% by Paleozoics and about 1% is covered by recent alluvial deposits that are restricted to modern drainage channels.

Two stages of glaciation are recognized in this quadrangle. Older Illinoian material extends roughly from northeast to southwest, bordering the Paleozoic rocks to the southeast. Wisconsinan Stage deposits cover the Illinoian drift which, in places, narrows to a zone only several miles wide. Wisconsinan deposits cover greater surface area (42%) than Illinoian deposits (12%) and contain numerous well defined end moraines separated by wide ground moraines.

The Paleozoic sequence in the east and south ranges in age from Ordovician through Pennsylvanian. Mississippian and Pennsylvanian units show wide areal distribution and are intensly eroded. In the southwest corner, quarries have exposed Silurian rocks, indicating only a thin cover of glacial sediments.

A notable geomorphic feature is the drift border which marks the maximum extent of all glaciation. It separates glacial deposits in the northwest from Paleozoic bedrock in the east and south and results in a dramatic contrast in soil type and vegetation.

Structures formed by glacial deposits include ground and end moraines which are composed of unsorted, unstratified till. Other structures such as kames, eskers, lacustrine and outwash deposits contain stratified, frequently cross-bedded sand, silt and gravel.



After

USGS and AAPG

Tectonic Map of the United States

by

Cohee and others (1962)

FIGURE 2

TECTONIC STRUCTURE MAP
COLUMBUS QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

Uranium

According to available literature, there are no known uranium deposits in the Columbus quadrangle (Butler and others, 1962, Schnabel, 1955).

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

Potassium, uranium, and thorium display low quadrangle-wide values which are not significantly different than previously surveyed areas to the south and west. Uranium has a quadrangle-wide average value of 2.6 parts per million equivalent of uranium (ppmeU) while potassium and thorium average 1.0 percent and 6.1 ppmeT respectively.

The highest peak uranium value (7.0 ppmeU) occurs over map unit Du (undifferentiated Devonian rocks which include gray to black shales and some limestone). Average values of uranium on a geologic unit basis range from a minimum of 2.3 ppmeU over map unit Su (undifferentiated Silurian rocks including interbedded shale and limestone) to the maximum value of 3.6 ppmeU over map unit Du. In general, the pseudo-contour map (Appendix H) indicates increasing uranium quantities from east to west although the total range is only 1.8 to 2.8 ppmeU. Lowest values occur over Paleozoic bedrock in the southeast, while glacial tills exhibit slightly higher values (up to 3.5 ppmeU). Highly anomalous areas (3.5 to 7.0 ppmeU) include; the city of Columbus and its environs, and a northeasterly trending belt of higher uranium values which begins at the south central map border and continues in a broad zone toward the center of the quadrangle. Elsewhere, the generally uniform distribution of uranium values bears little relation to surface geologic units.

Overall, thorium values are relatively uniform throughout the quadrangle (see Appendix H). The average values on a geologic unit basis range from a low of 5.3 ppmeT over map unit Qo (Wisconsian and Illinoian outwash material) to 6.7 ppmeT over map unit Pm (Pennsylvanian non-marine clastic sediments including coal). The highest observed peak value for thorium is 11.1 ppmeT over map unit Pap (undifferentiated Pennsylvanian sandstone, siltstone, and shale with some coal). In contrast with uranium and potassium, thorium values are relatively higher over Pennsylvanian bedrock. Elsewhere the broad lobate form of glacial deposits in the west central part of the quadrangle is vaguely reflected in the pseudo-contour map for thorium.

Average potassium values range from a minimum of 0.76 percent over map unit Qim (Illinoian end moraine) to 1.2 percent over map unit Qwm (Wisconsinan end moraine). The highest peak potassium value is 1.8 percent over map unit Pap in addition to a slightly lower value of 1.74 percent observed over map unit QWG (Wisconsinan ground moraine). The pseudo-contour map shows a broad area of reasonably uniform potassium values that correlates well with the lobate form of the glacial region southwest of Columbus. (This region was only barely visable in the thorium data.)

Examination of the gamma ray profiles (Appendix D) shows several lines that have significantly higher uranium and BiAir concentrations. These peculiar radiometric signatures have been encountered in previous surveys nearby and are considered to be weather phenomena that are not easily corrected by the present radon correction scheme which is based upon the assumption of uniform, homogenous radon distribution. An adjustment of the uranium and affected ratios was made, assuming that the absolute ground uranium concentrations in these areas are actually similar to those of adjacent and crossing lines. Statistical analyses were done using the corrected values.

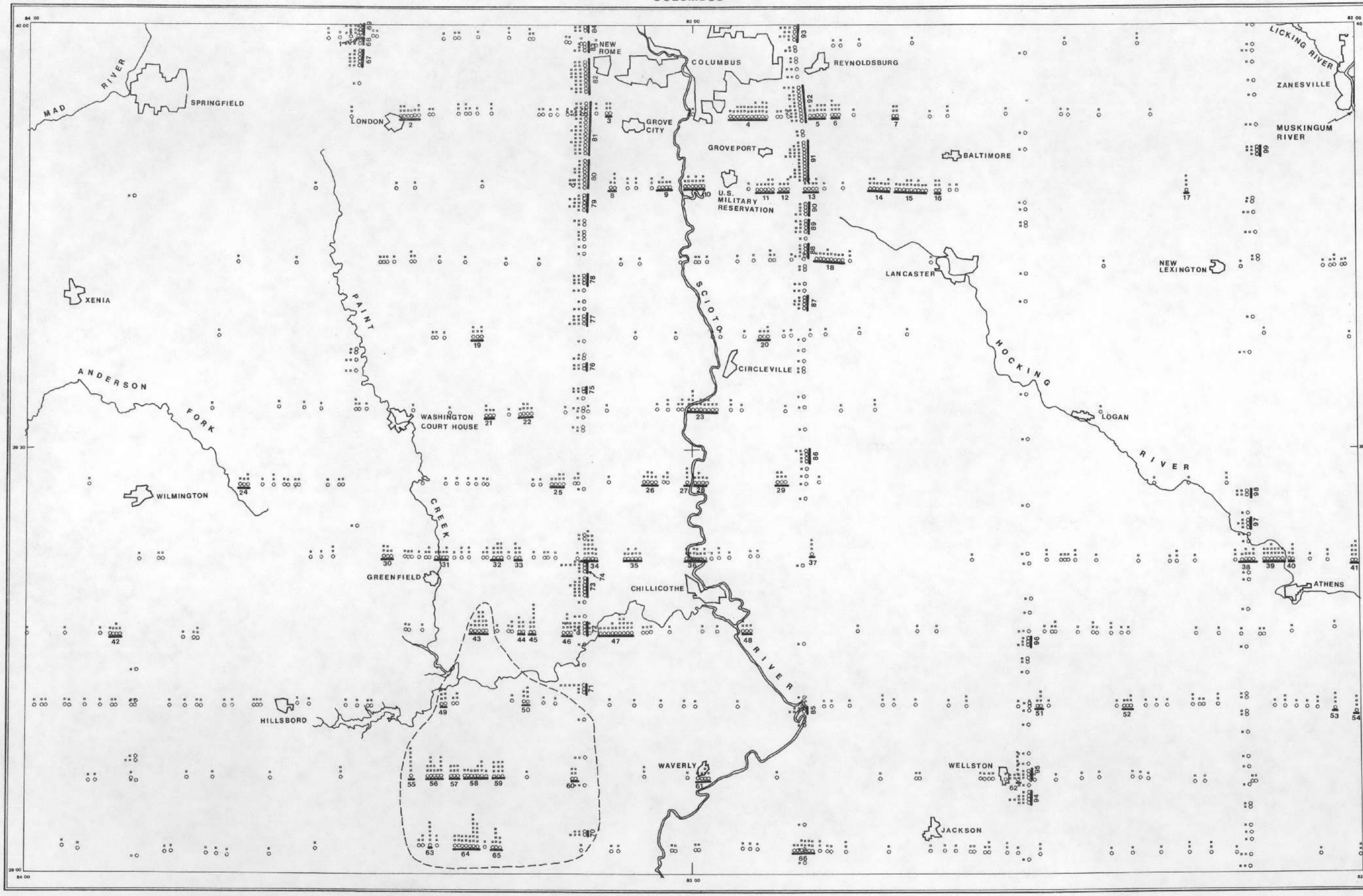
Anomalies tend to cluster in a broad north-south zone along the central portion of the quadrangle, in addition to a smaller cluster in the southeastern corner. Most have peak values at 3.0 to 4.5 ppmeU, and all are related to some cultural activity (roads, railroads, cities, quarries, etc.). One outlined group overlies a higher uranium region (see Figure 3) which is a continuation of the anomalous belt defined in the Huntington quadrangle. This northeasterly trending belt contains anomaly Nos. 43, 55-60, 63-65, and 70, which have peak values in the 4.3 to 7.0 ppmeU range. The high uranium anomalies primarily overlie map units DU and MU (Undivided Mississippian). Extending northeasterly beyond the outlined area, anomalies appear to mainly overlie Wisconsinan morainal material. Despite the cultural origins of specific anomalies, the high uranium levels coupled with the geographic coherence of the anomaly group implies high uranium values throughout the units. Further investigation of uranium should concentrate on this outlined region and on the geologic units involved.

Magnetic Data

The magnetic field within this quadrangle infers more structural complexity than that displayed by the tectonic map of the basement (Figure 2). To the east the relatively broad north-south trending zones follow the direction of the basement contours rather closely (see Appendix H). But farther west where the basement is closer to the surface, a complicated northeasterly trending pattern of small magnetic features is superimposed on the regional field. It is therefore likely that unknown lithologic and/or structural elements in the Precambrian basement rocks create the dominate influence on the magnetic field.

CO

COLUMBUS



URANIUM ANOMALY/ INTERPRETATION MAP

COLUMBUS QUADRANGLE

U.S. DEPARTMENT OF ENERGY

APPROXIMATE SCALE 1:500,000

EXPLANATION

□ - CITY OR TOWN

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

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

- URANIUM ANOMALY:

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

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

Figure 3 - Uranium Anomaly/Interpretation Map - Columbus Quadrangle

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APPENDIX A – Data Acquisition, Processing, and Interpretation Methods

INTRODUCTION

General

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

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

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

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

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

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

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

OPERATIONS

PRODUCTION SUMMARY

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

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

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

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

DATA COLLECTION PROCEDURES

Operating Parameters/Sampling Procedures

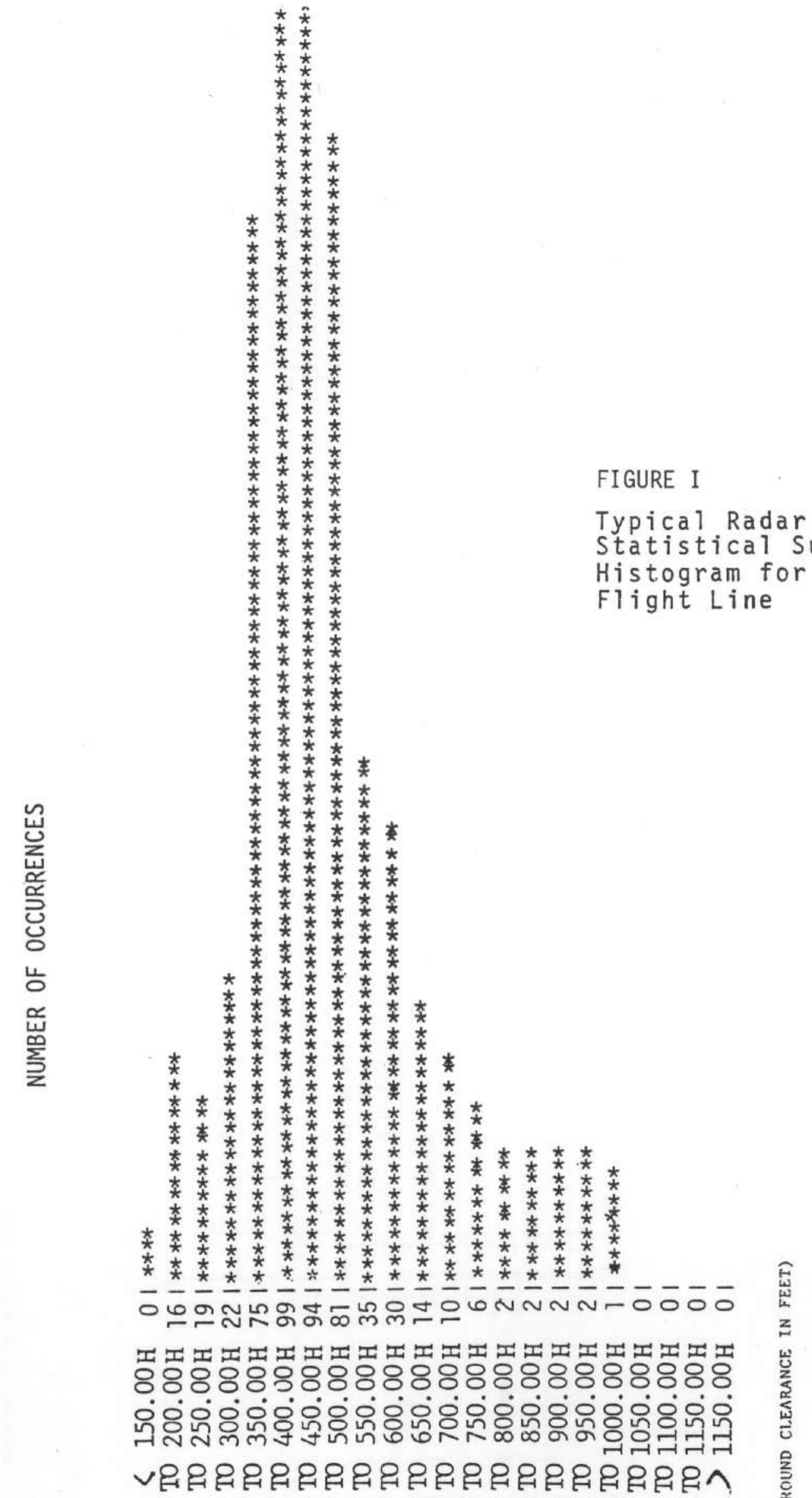
This survey was conducted using data collection parameters summarized below:

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

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

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

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



THE MINIMUM RADAR ALTMTR IS 147.500 FEET
THE MAXIMUM RADAR ALTMTR IS 975.000 FEET
THE AVERAGE RADAR ALTMTR IS 424.336 FEET
THE STANDARD DEVIATION IS 123.4900 FEET

FIGURE I

Typical Radar Altimeter Statistical Summary Histogram for Single Flight Line

Navigation/Flight Path Recovery

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

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

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

Infield System Calibration

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

A. Pre Flight

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

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

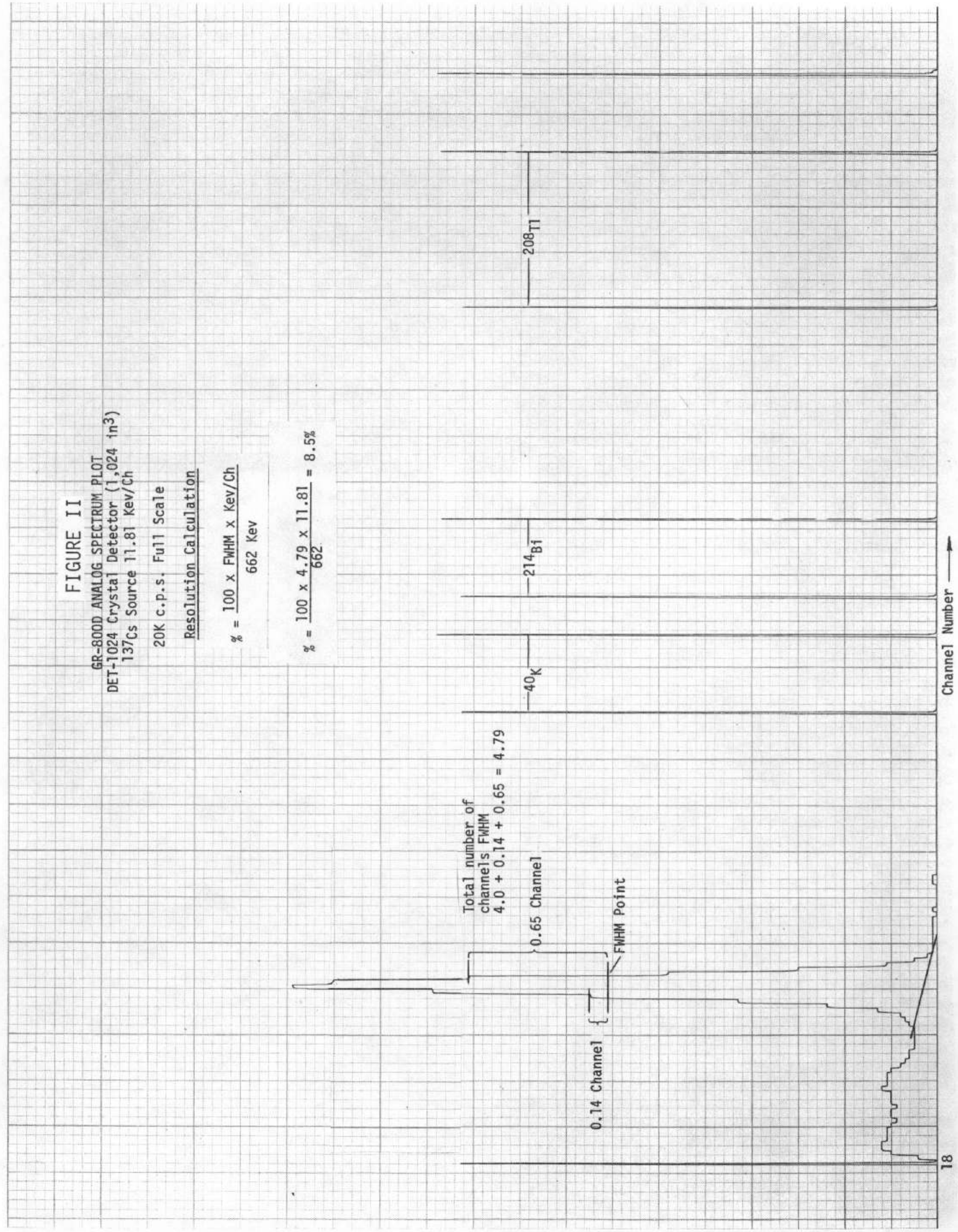
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.

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

B. During Flight

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

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



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

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

C. Post Flight

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

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

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

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

Field Digital Data Verification

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

DATA COLLECTION SYSTEM

AIRCRAFT

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

	QUEEN AIR	AERO COMMANDER
Maximum Aircraft Gross Weight	7,700 lbs.	8,500 lbs.
Aircraft Empty (dry)	4,640 lbs.	5,200 lbs.
Max. useful load including fuel	3,060 lbs.	3,300 lbs
Geophysical Package	1,110 lbs.	1,110 lbs.
Navigation Equipment	125 lbs.	125 lbs.
Fuel Tanks Full	528 lbs.	1,338 lbs
Pilot & Electronics Operator	350 lbs.	350 lbs.
Total	2,113 lbs.	2,923 lbs.
Min. Control Speed at G.W. (IAS)	95 mph	NG
Safe Single Eng. Speed @ G.W. (IAS)	105 mph	NG
Rate of Climb 2 engines @ gross (FPM)	1,300	1,500
Rate of climb 1 engine @ gross (FPM)	210	250
Avgas consumption (ga/hr) at 75% power	36	38
Endurance (75% power)	6 hrs/6 mins.	5 hrs/30 mins.
Range (75% power - 45 min. reserve)	1,200 miles	1,100 miles
Cruise Configuration stalling speed at gross weight (IAS)		
0° bank	80 mph	80 mph
45° bank	95 mph	NG

Electronics

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

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

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

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

   a. 512 channels of gamma ray spectrometer data

   b. Total magnetic intensity

   c. Fiducial number from data system/camera

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

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

   f. Time in days, hours, minutes and seconds

   g. Outside air temperature

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

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

6. Rosemont Barometric Altimeter with recording output and display.

7. Recording Thermometer for monitoring outside air temperature.

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

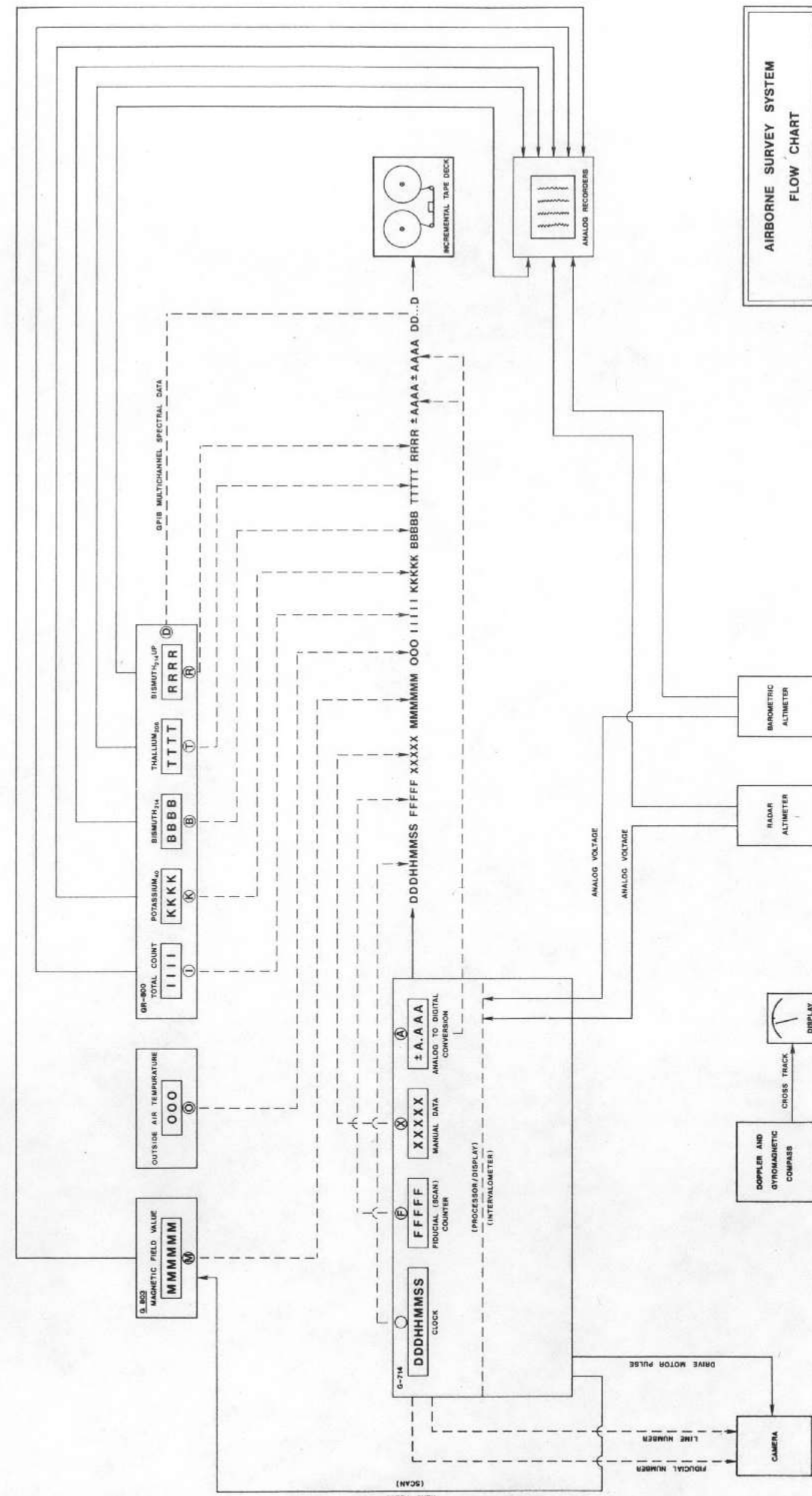


FIGURE III

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

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

   b. Bi air background from the upward looking system.

   c. Magnetometer

   d. Radar Altitude

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

   f. Barometric Altitude

   g. Time markers

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

SYSTEM CALIBRATION

AIRCRAFT AND COSMIC BACKGROUND

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

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

and

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

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

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

The aircraft background is derived as follows:

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

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:

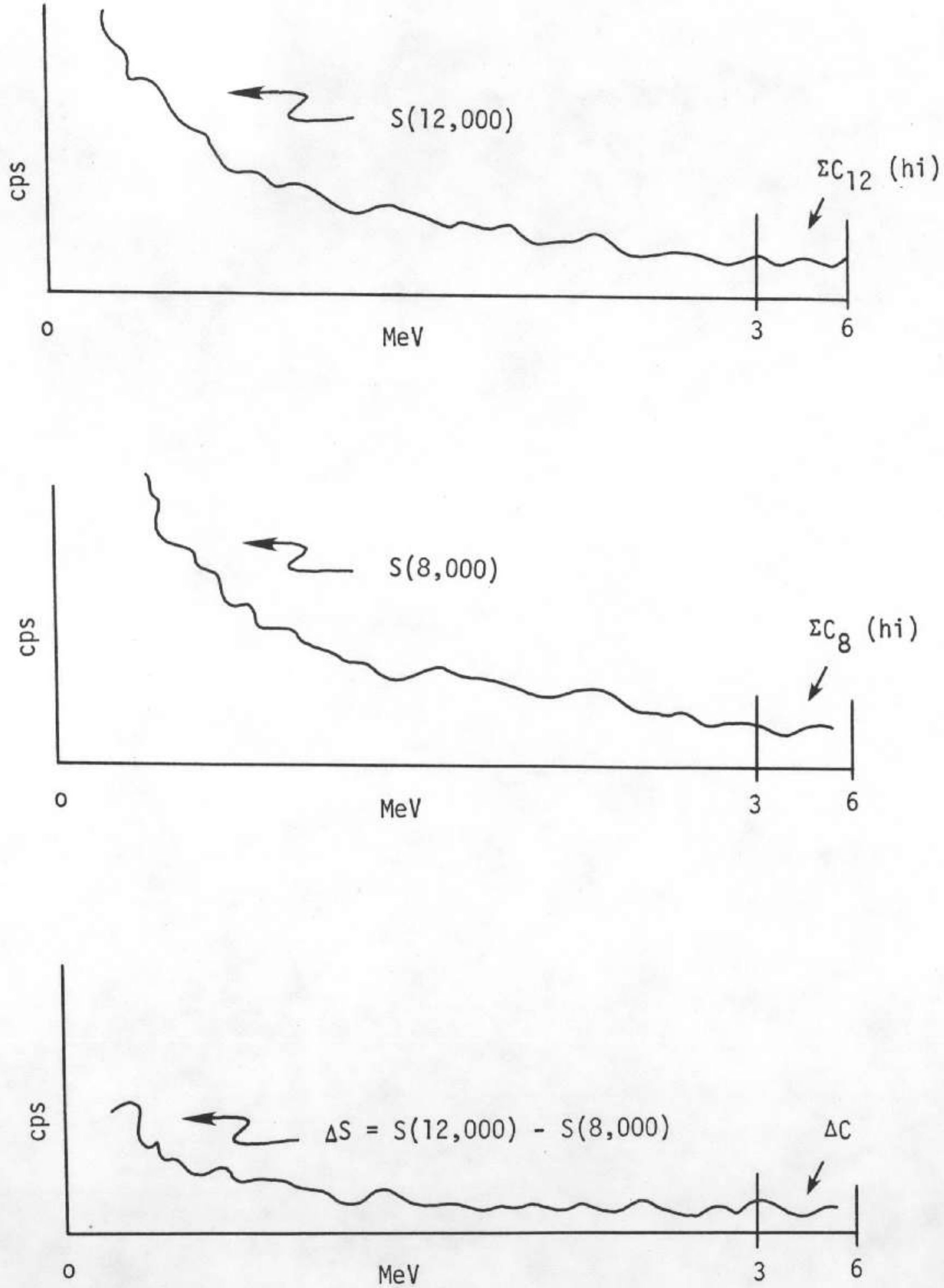


FIGURE IV - Multiple altitude spectra schematic

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).

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

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DERIVED AIRCRAFT BACKGROUND SPECTRUM FROM PACIFIC OCEAN DATA

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

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

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

FIGURE V

DERIVED COSMIC SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE COSMIC, DATED 072577

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

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

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

FIGURE VI

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

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

KC_i = uncorrected system count rate for the K channel

UC_i = uncorrected system count rate for the U channel

TC_i = uncorrected system count rate for the T channel

K_i = the percent differential concentration of potassium

U_i = ppm differential concentration of uranium

T_i = ppm differential concentration of thorium

where "i" refers to the ith pad.

We also define the following:

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

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

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

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

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

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

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

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

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

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

<u>K pad</u>

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

<u>U pad</u>

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

<u>T pad</u>

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

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

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

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

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

The equations can be expressed in matrix notation

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

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

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

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

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

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

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

or

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

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

Rearranging the above equations we have

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

We now define

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

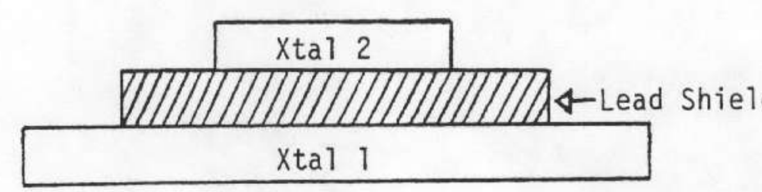
$S_{tu} = \frac{\Delta_{tu}}{\Delta_{tt}}$ (effect of uranium on thorium)

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

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

ATMOSPHERIC RADON CORRECTION

Consider the crystal configuration shown below:



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

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

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

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

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 $\quad I_1 = I_g$

$$I_2 = \ell I_g$$

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

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

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

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 $\quad I_g = I_1 - I_a$

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

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

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

DATA PROCESSING

DATA PREPARATION

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

Field Tape Verification and Edit

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

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

Flight Line Location

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

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

RADIOMETRIC DATA REDUCTION

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

Total count - 0.4 to 3.0 MeV

K - 1.37 to 1.57 MeV

U - 1.66 to 1.87 MeV (downward looking system)

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

T - 2.41 to 2.81 MeV

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

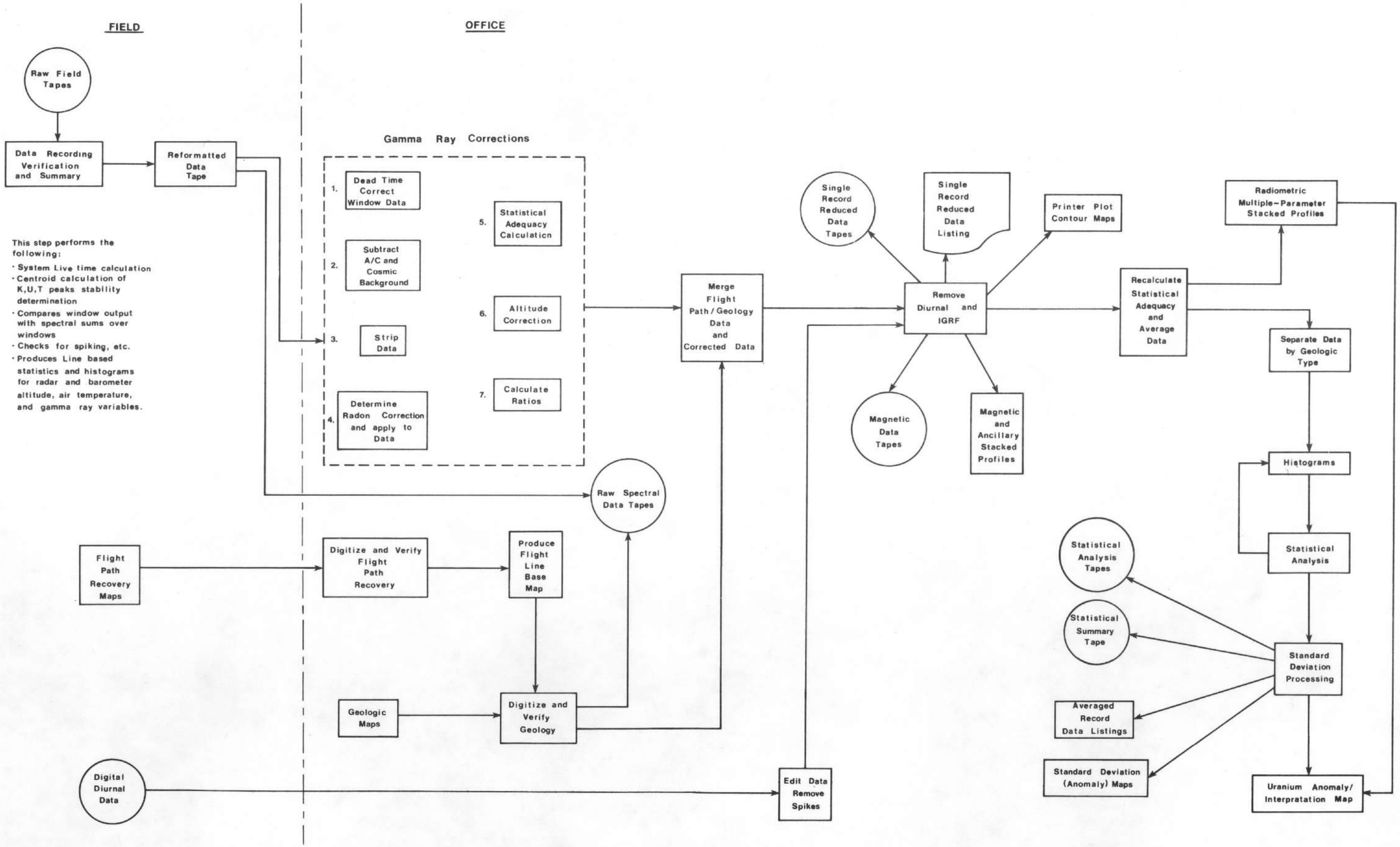
Aircraft and Cosmic background for the Queen Air/Aero Commander over these windows are as follows:

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

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

DATA PROCESSING FLOW DIAGRAM

FIGURE VII



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

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

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

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

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

Altitude attenuation coefficients used are defined as follows:

ALTITUDE ATTENUATION COEFFICIENTS

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

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

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

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

Bi Air calculations are made using the following expressions:

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

Where U_{up} = count rate from upward detectors

ℓ = crystal coupling constant

m = crystal geometric factor

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

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

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

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

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

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

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

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

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

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

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

Statistical Adequacy Test

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

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

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

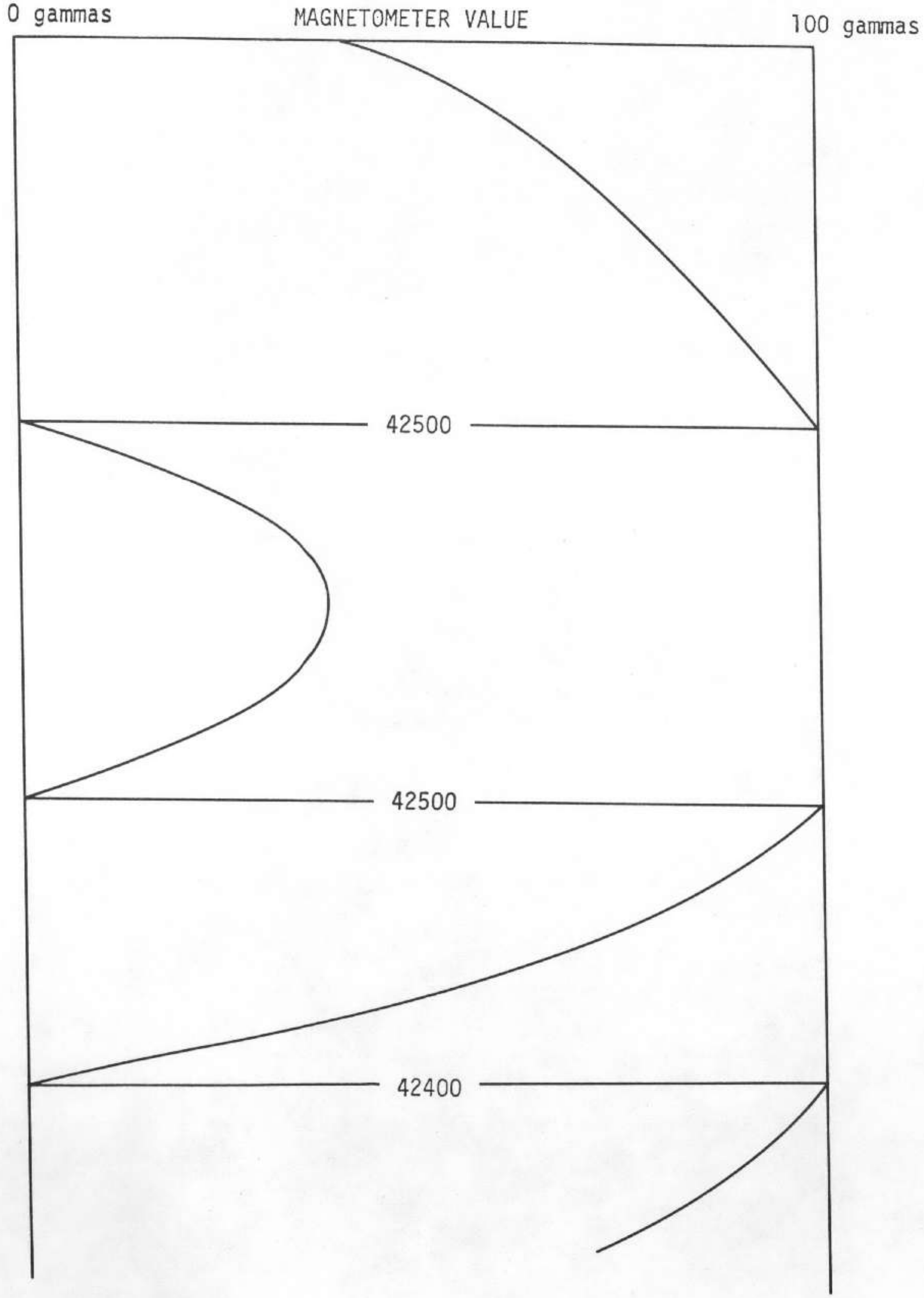


FIGURE VIII Plotter Step Value Labeling

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.

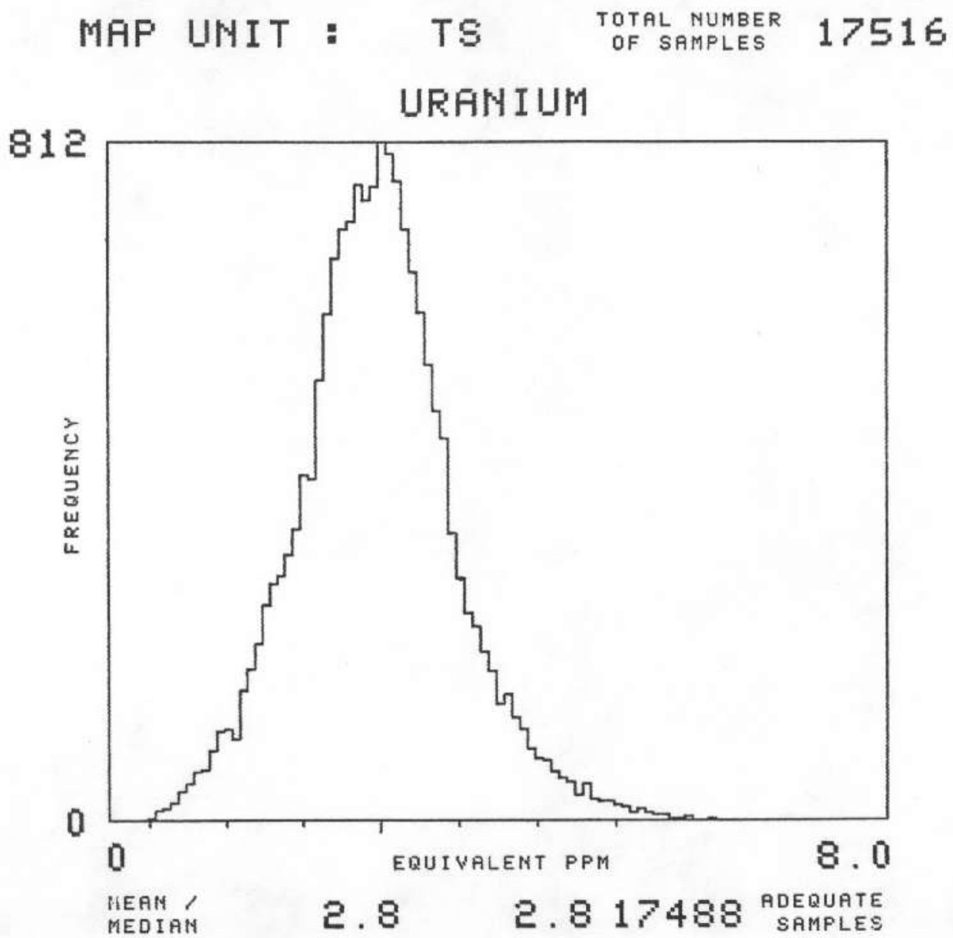


FIGURE IX Sample Computer Map Unit Histogram

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

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

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

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

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

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

Block 2 - Single Record Reduced Identification Data

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

Block 3 - Single Record Reduced Data

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

STATISTICAL ANALYSIS TAPE

REFERENCE: Paragraphs 4.7.7 and 6.1.6, BFEC 1200-C

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

Block 1 - Format Description Data

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

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

STATISTICAL ANALYSIS DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

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

The remaining 440 characters in this block are blanks.

Block 2 - Statistical Analysis Identification Data

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

Block 3 - Statistical Analysis Data

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

MAGNETIC DATA TAPE

REFERENCE: Paragraphs 4.7.8 and 6.1.6, BFEC 1200-C

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

Block 1 - Tape Format Description

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

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

MAGNETIC DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)

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

The remaining 4616 characters in this block are blanks.

Block 2 - Magnetic Tape Identification Data

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

Block 3 - Magnetic Data

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

STATISTIC ANALYSIS SUMMARY TAPE

REFERENCE: Paragraphs 4.7.9, BFEC 1200-C

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

Block 1 - Format Description Data

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

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

STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

The remaining 2680 characters on this block shall be blanks.

Block 2 - Statistical Analysis Identification Data

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

Block 3 - Statistical Analysis Summary Data

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

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APPENDIX B - Flight Summary

APPENDIX B

DAILY PRODUCTION SUMMARY

QUEEN AIR N9AG

DECEMBER, 1980

Dec. 12	630 line miles, Marion
13	630 line miles, Marion
14	671 line miles, Marion, Toledo

MAY, 1981

May 17-19	Base Mobilization
20	550 line miles, Toledo
21	701 line miles, Toledo, Marion, Columbus
22	Base Mobilization - nil production
23	500 line miles, Toledo, Marion, Columbus
24	763.8 line miles, Columbus

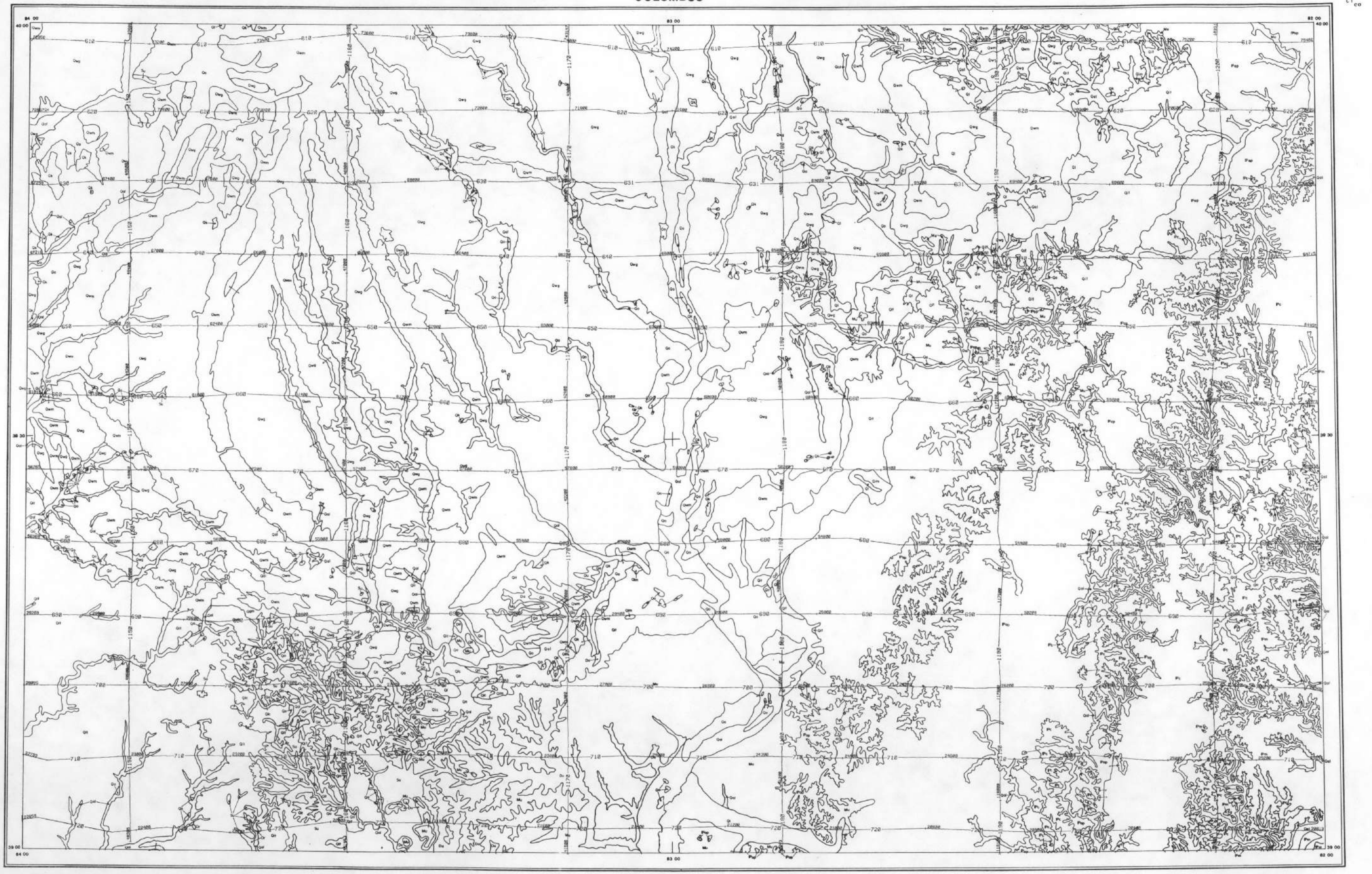
Total miles for the above periods = 4,445.8 line miles

Total miles for the included quadrangles:

Marion	1,675.8
Toledo	1,076.2
Columbus	1,693.8

APPENDIX C - Flight Path and Geologic Map

COLUMBUS



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

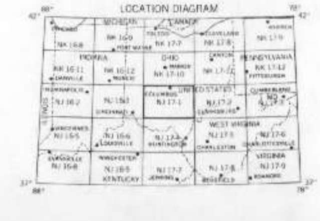
KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

FIDUCIAL NUMBER

053-0

LINE NUMBER

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



SURVEY AND
COMPILATION BY:

EG&G GEOMETRICS

FLIGHT PATH RECOVERY

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

COLUMBUS QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

Cenozoic — Quaternary — Pleistocene & Holocene

Qal Alluvium

Qwm Wisconsinan end moraine

Unsorted, unstratified clastics from clay to boulders. Includes lenses of stratified drift

Qwg Wisconsinan ground moraine

Discontinuous, smooth-surfaced deposits of unsorted, unstratified till

Qk Wisconsinan kames & eskers

Ql Wisconsinan – Pre-Illinoian lacustrine deposits

Generally laminated silt & clay, with some muck, peat, & loess

Qo Wisconsinan & Illinoian outwash

Layered, frequently cross-bedded sand & gravel, locally cemented

Qic Illinoian ice-contact stratified drift, kames, & eskers

Bedded, moderately well to poorly sorted clastics from fine sand to coarse cobbles

Qit Illinoian ground moraine & till plain

Mainly continuous, smooth-surfaced deposits of unsorted, unstrated till

Qim Illinoian end moraine

Silty till with large masses of deeply weathered gravel

Paleozoic

Pennsylvanian

IPm Monongahela Group

Non-marine, cyclic sandstone, siltstone, shale, limestone, & coal

IPc Conemaugh Group

Cyclic sandstone, siltstone, & shale, with thin limestones & coals

IPap Allegheny & Pottsville Groups, undifferentiated

Sandstone with siltstone, shale, limestone, & coal.

Mississippian

Mu Mississippian rocks undifferentiated

Red, green, & gray shale & sandstone with some limestone.

Devonian

Du Devonian rocks undifferentiated

Gray to black shale with limestone increasing toward base, & some sandstone & siltstone.

Silurian

Su Silurian rocks undifferentiated

Interbedded shale & limestone with sandstone near base.

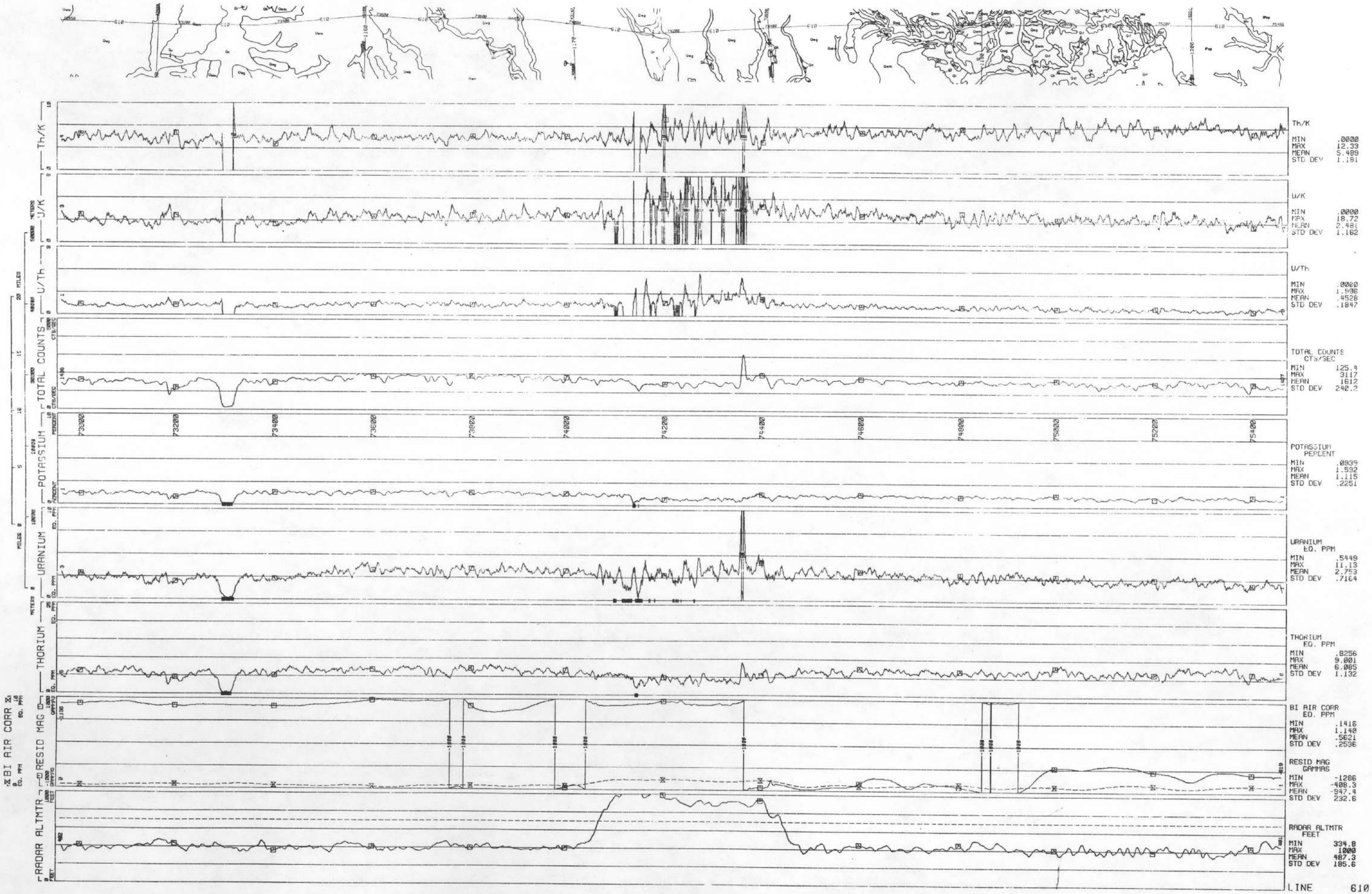
Ordovician

Or Richmond Formation

Interbedded calcareous shale & argillaceous limestone.

APPENDIX D - Profiles

D1 co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COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144
Th/K
U/K
U/Th
TOTAL COUNTS
POTASSIUM
URANIUM
THORIUM
RESID MAG
BI AIR CORR
RADAR ALTMTR
73000
73200
73400
73600
73800
74000
74200
74400
74600
74800
75000
75200
75400
Th/K
MIN .0000
MAX 12.33
MEAN 5.489
STD DEV 1.181
U/K
MIN .0000
MAX 18.72
MEAN 2.481
STD DEV 1.162
U/Th
MIN .0000
MAX 1.906
MEAN .4528
STD DEV .1847
TOTAL COUNTS CTs/SEC
MIN 125.4
MAX 3117
MEAN 1612
STD DEV 240.2
POTASSIUM PERCENT
MIN .0939
MAX 1.592
MEAN 1.115
STD DEV .2251
URANIUM EQ. PPM
MIN .5449
MAX 11.13
MEAN 2.753
STD DEV .7164
THORIUM EQ. PPM
MIN .8256
MAX 9.001
MEAN 6.085
STD DEV 1.132
BI AIR CORR EQ. PPM
MIN .1416
MAX 1.140
MEAN .5621
STD DEV .2536
RESID MAG GAMMAS
MIN -1286
MAX -408.3
MEAN -947.4
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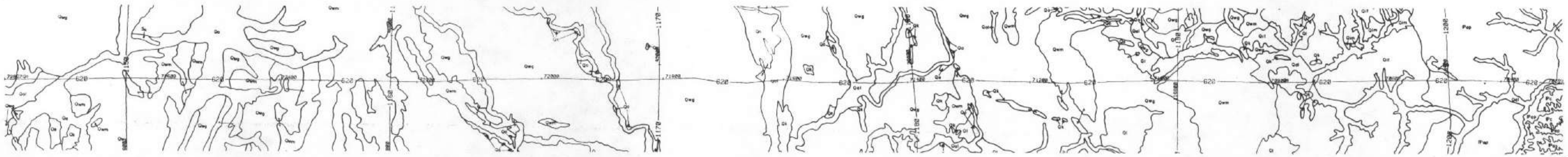
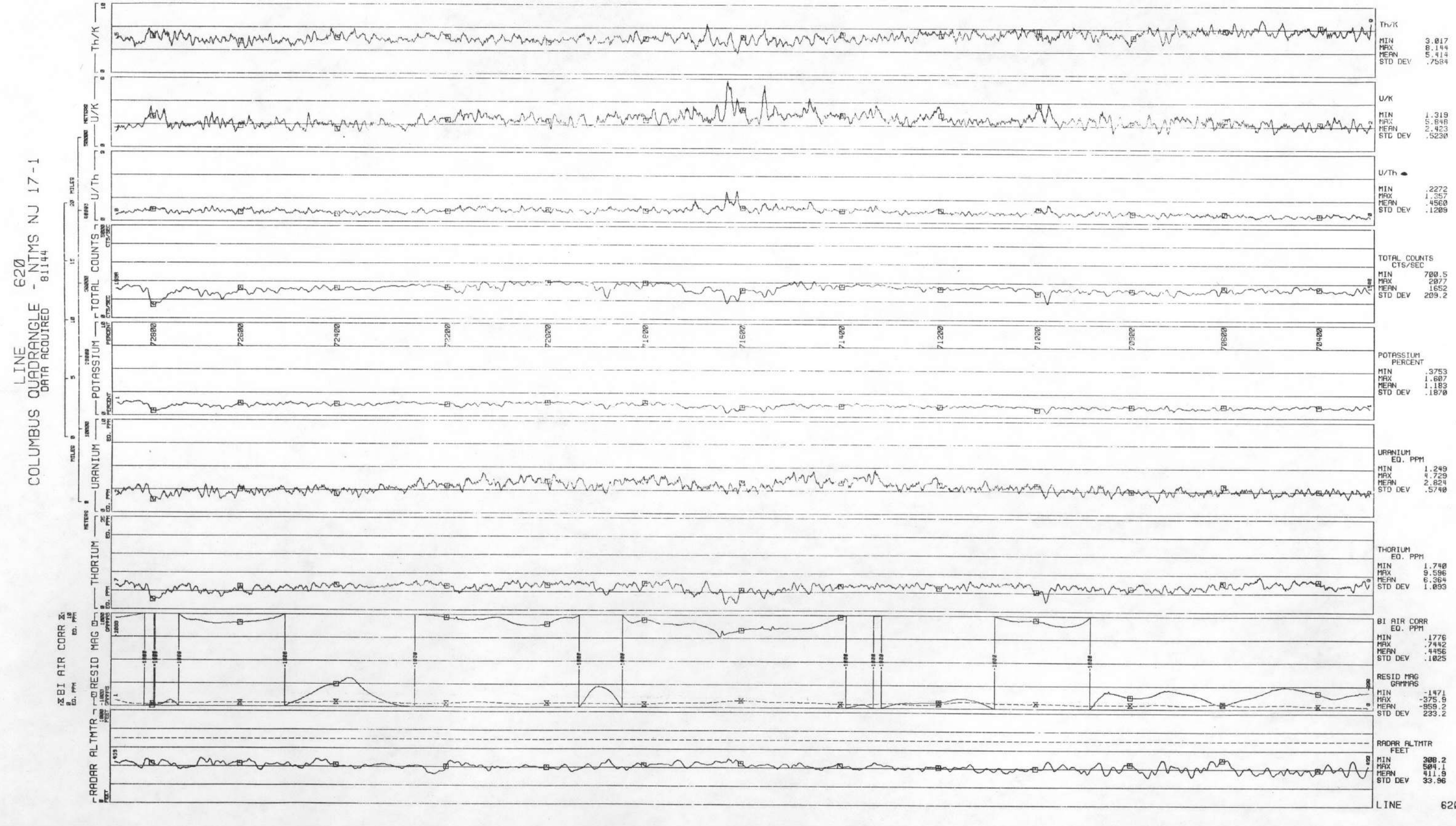
MAX 1000
MEAN 487.3
STD DEV 185.6
LINE 610

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U/K
MIN 1.319
MAX 5.848
MEAN 2.423
STD DEV .5230
U/Th
MIN .2272
MAX 1.357
MEAN .4560
STD DEV .1209
TOTAL COUNTS CTS/SEC
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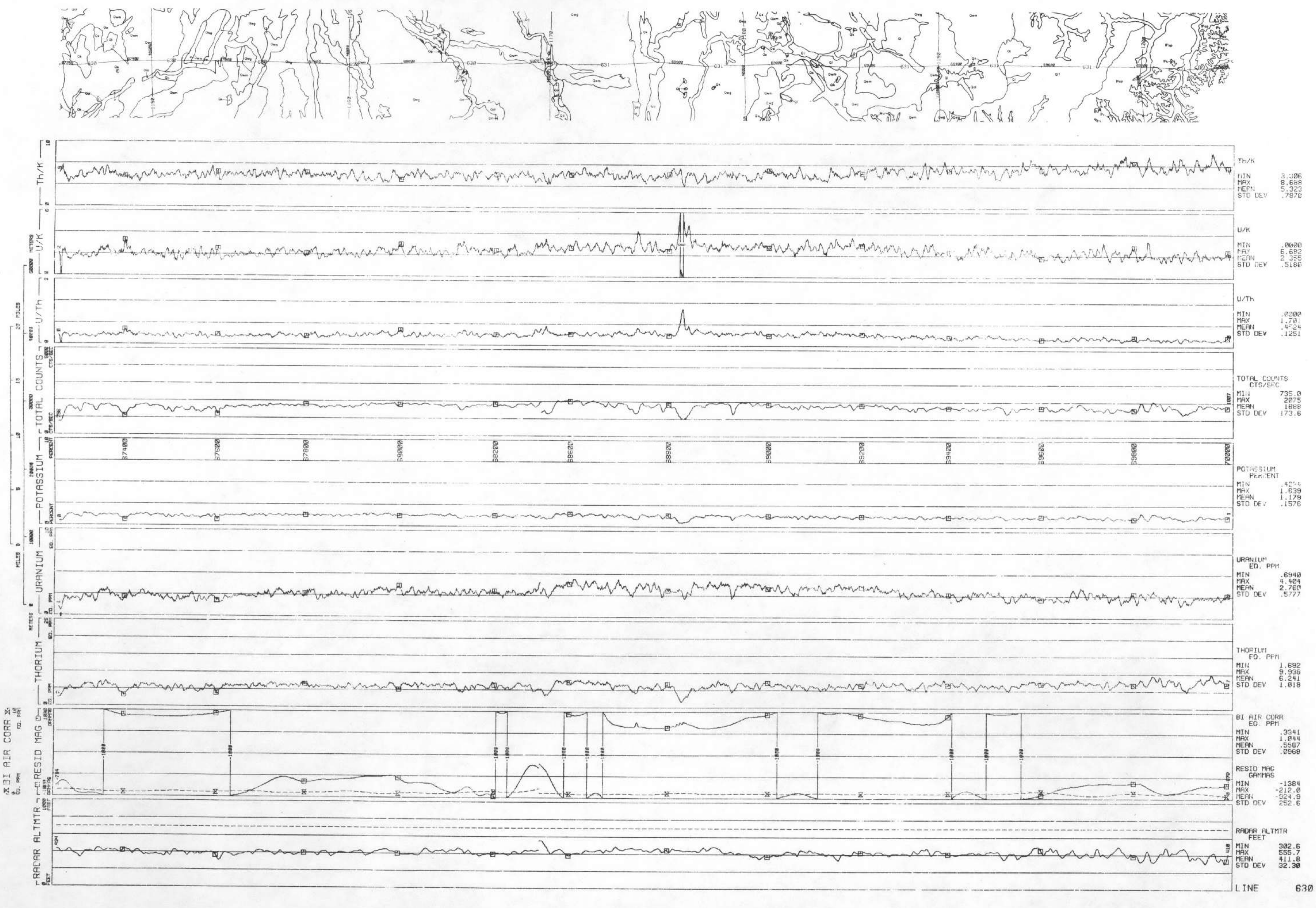
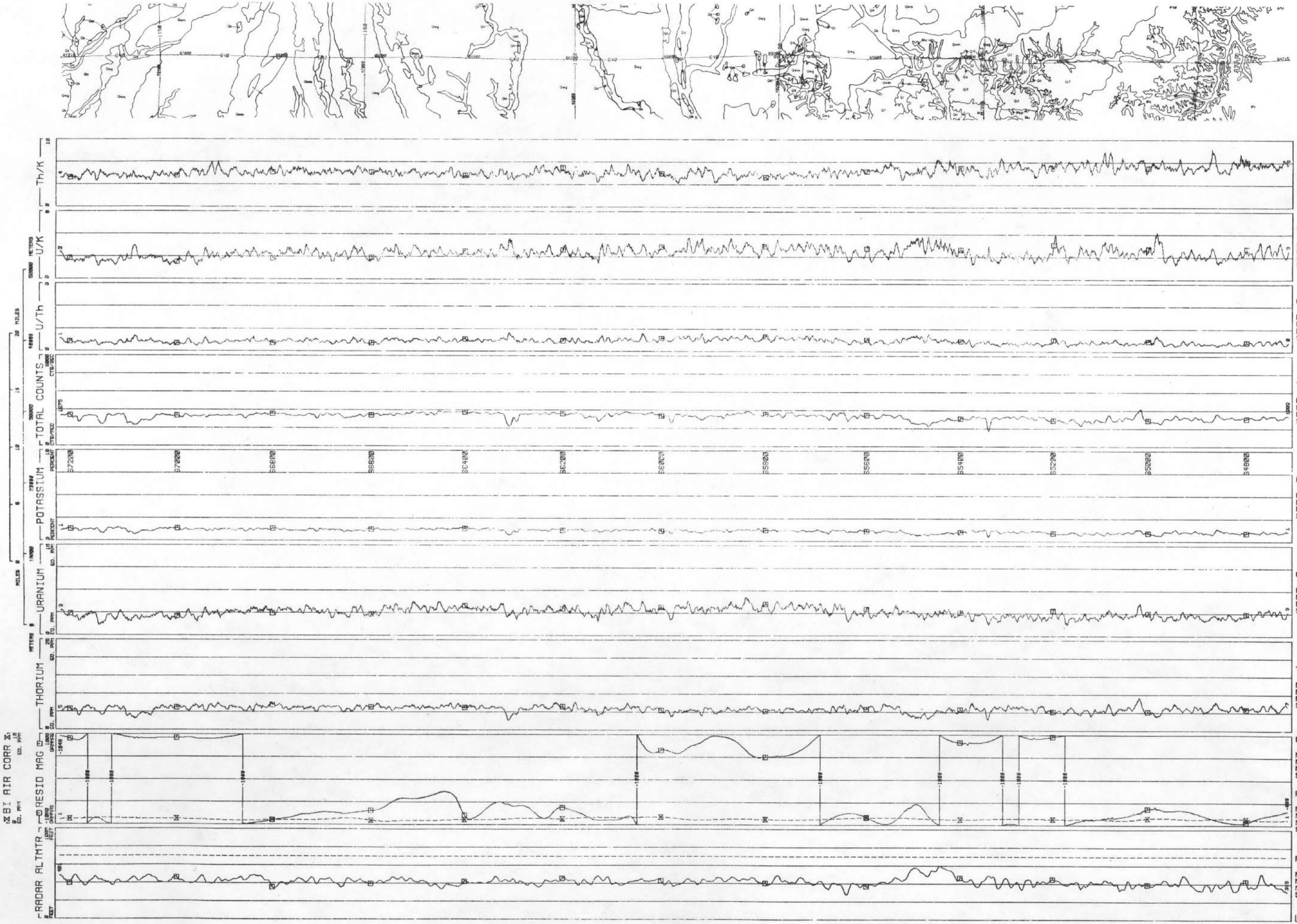
MAX 2077
MEAN 1652
STD DEV 209.2
POTASSIUM PERCENT
MIN .3753
MAX 1.607
MEAN 1.183
STD DEV .1870
URANIUM EQ. PPM
MIN 1.249
MAX 4.729
MEAN 2.824
STD DEV .5740
THORIUM EQ. PPM
MIN 1.740
MAX 9.596
MEAN 6.364
STD DEV 1.093
BI AIR CORR EQ. PPM
MIN .1776
MAX .7442
MEAN .4456
STD DEV .1025
RESID MAG GAMMAS
MIN -1471
MAX -375.9
MEAN -959.2
STD DEV 233.2
RADAR ALTMTR FEET
MIN 308.2
MAX 504.1
MEAN 411.9
STD DEV 33.96
LINE 620

LINE 630
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



LINE 640
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



Th/K
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U/K
MIN 1.109
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MEAN 2.326
STD DEV .4697

U/Th
MIN .2200
MAX .8273
MEAN .4460
STD DEV .1018

TOTAL COUNTS CTS/SEC
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MAX 2073
MEAN 1641
STD DEV 162.6

POTASSIUM PERCENT
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MAX 1.465
MEAN 1.115
STD DEV .1656

URANIUM EQ. PPM
MIN 1.126
MAX 4.250
MEAN 2.559
STD DEV .4944

THORIUM EQ. PPM
MIN 2.724
MAX 8.111
MEAN 5.838
STD DEV .8172

BI AIR CORR EQ. PPM
MIN .3633
MAX .8721
MEAN .6305
STD DEV .1071

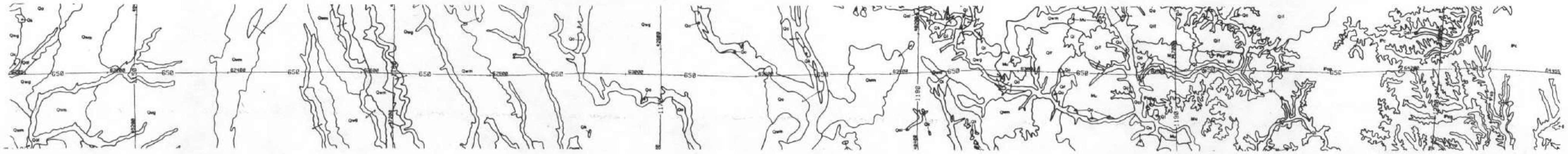
RESID MAG GAMMAS
MIN -1510
MAX -263.1
MEAN -904.1
STD DEV 253.6

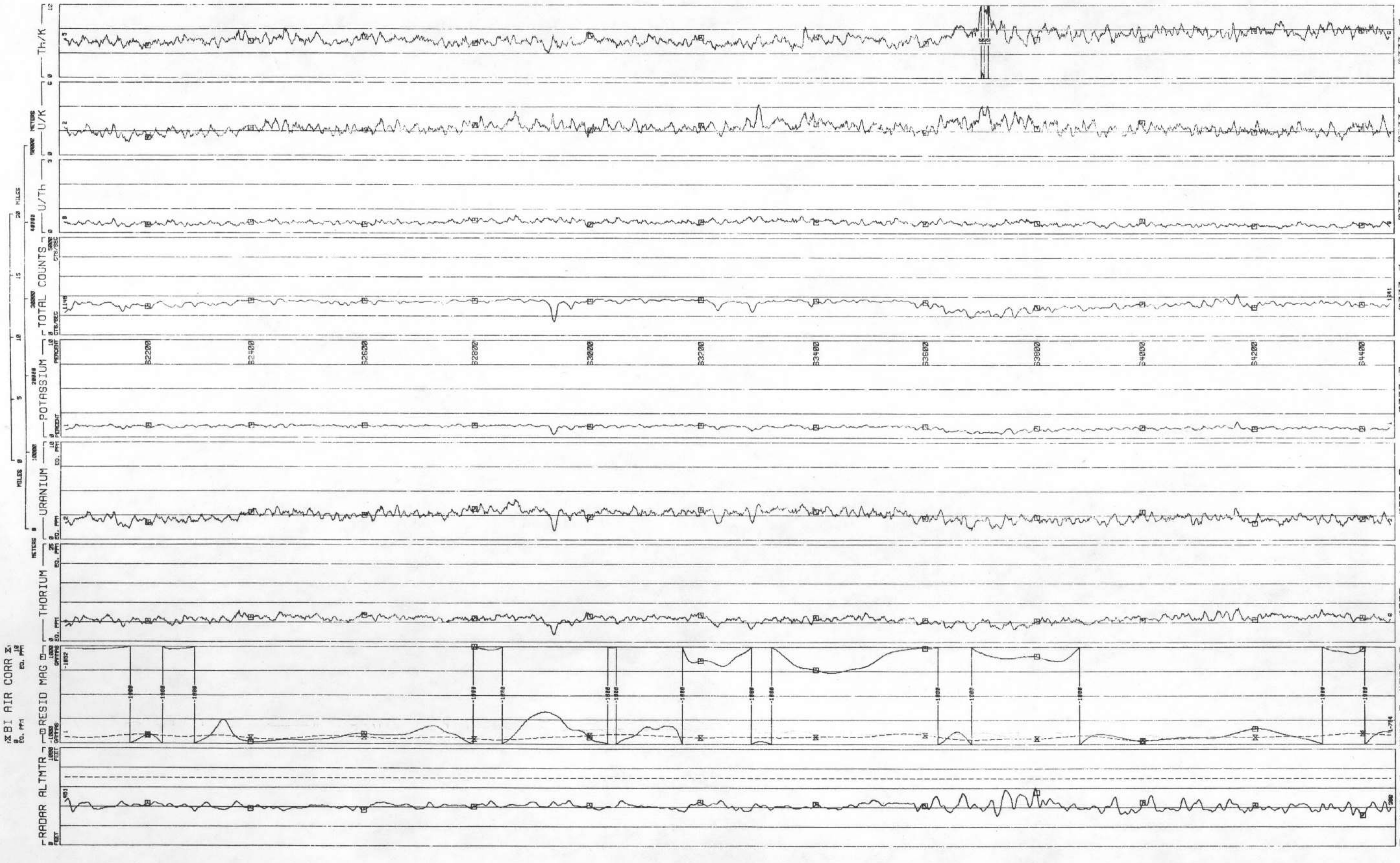
RADAR ALTMTR FEET
MIN 279.6
MAX 601.7
MEAN 420.1
STD DEV 43.15

LINE 640

D5 co

LINE 650
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 8:144





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MEAN 2.282
STD DEV .4250

U/Th
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MAX .7616
MEAN .4229
STD DEV .0885

TOTAL COUNTS
CTS/SEC
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MAX 2127
MEAN 1631
STD DEV 185.7

POTASSIUM
PERCENT
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MAX 1.670
MEAN 1.084
STD DEV .1791

URANIUM
EQ. PPM
MIN .8889
MAX 4.174
MEAN 2.446
STD DEV .5017

THORIUM
EQ. PPM
MIN 1.864
MAX 8.716
MEAN 5.852
STD DEV .8557

BI AIR CORR
EQ. PPM
MIN .4117
MAX 1.126
MEAN .7271
STD DEV .1630

RESID MAG
GAMMAS
MIN -1532
MAX -333.1
MEAN -959.1
STD DEV 228.5

RADAR ALTMTR
FEET
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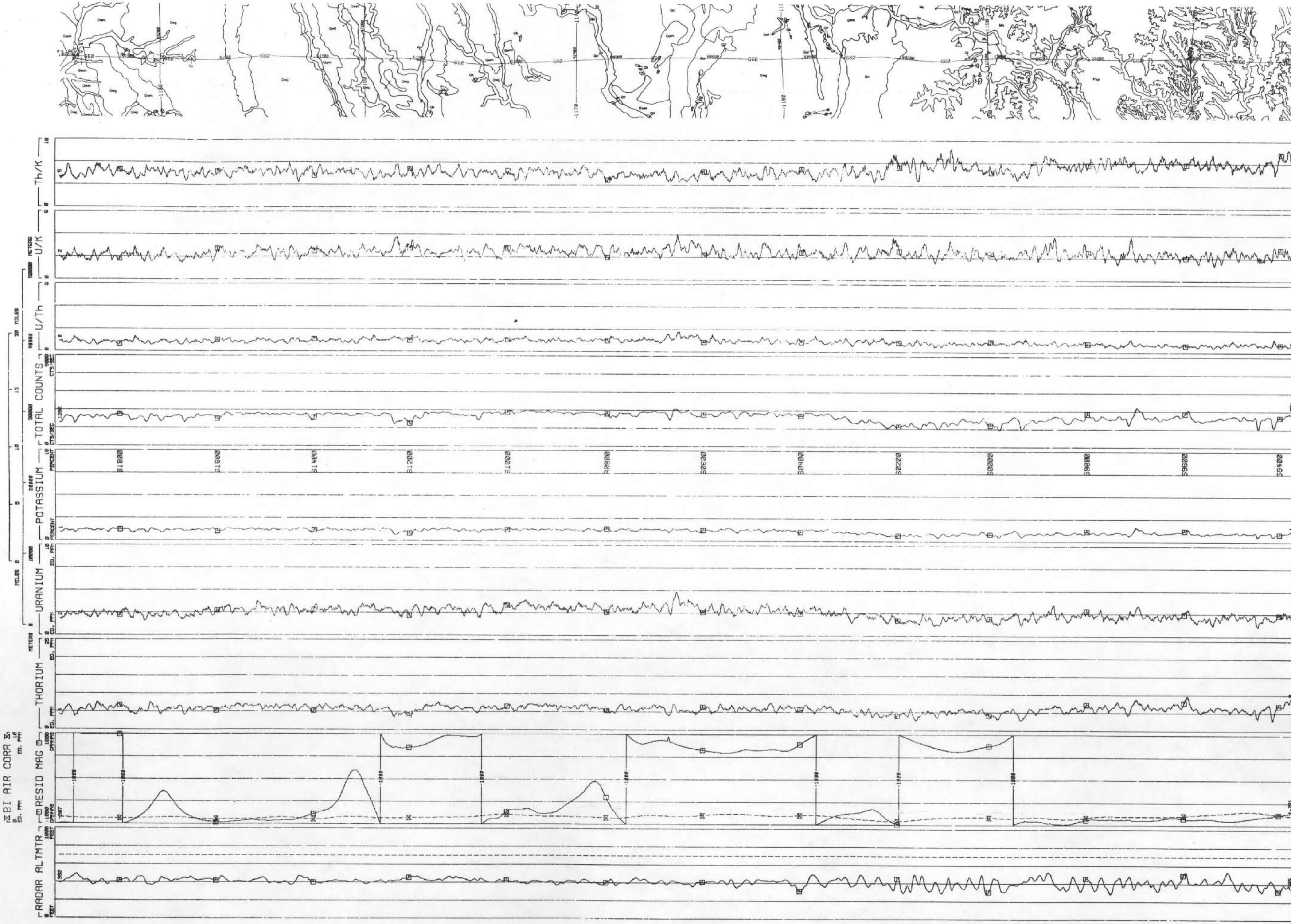
MAX 604.4
MEAN 412.5
STD DEV 36.26

LINE 650

LINE 660
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



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U/K	
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MAX	4.047
MEAN	2.374
STD DEV	.3949

U/Th	
MIN	.1954
MAX	.8921
MEAN	.4410
STD DEV	.0975

TOTAL COUNTS CTS/SEC	
MIN	920.8
MAX	2200
MEAN	1638
STD DEV	213.4

POTASSIUM PERCENT	
MIN	.4647
MAX	1.578
MEAN	1.070
STD DEV	.1918

URANIUM EQ. PPM	
MIN	1.038
MAX	4.849
MEAN	2.525
STD DEV	.5575

THORIUM EQ. PPM	
MIN	2.757
MAX	9.699
MEAN	5.797
STD DEV	.9271

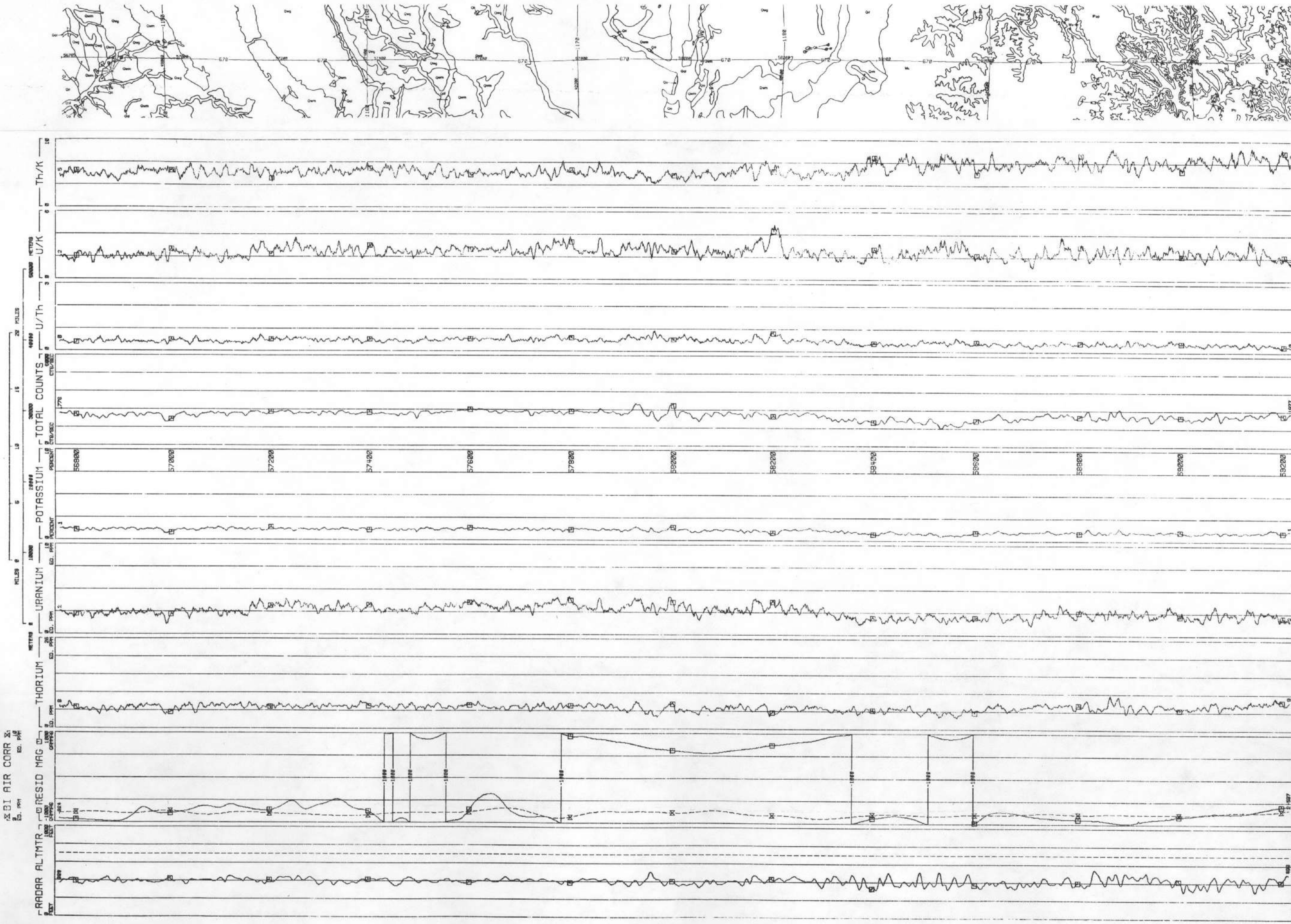
BI AIR CORR EQ. PPM	
MIN	.4015
MAX	1.506
MEAN	.8269
STD DEV	.2244

RESID MAG GAMMAS	
MIN	-1412
MAX	192.9
MEAN	-935.6
STD DEV	291.1

RADAR ALTMTR FEET	
MIN	283.8
MAX	533.1
MEAN	409.9
STD DEV	39.04

LINE 660

LINE 670
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



Th/K	
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U/K	
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MAX	4.92[illegible]
MEAN	2.43[illegible]
STD DEV	.4764
U/Th	
MIN	.1725
MAX	.9166
MEAN	.4392
STD DEV	.1107
TOTAL COUNTS CTS/SEC	
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MAX	2336
MEAN	1703
STD DEV	191.5
POTASSIUM PERCENT	
MIN	.4287
MAX	1.506
MEAN	1.067
STD DEV	.1734
URANIUM EQ. PPM	
MIN	1.075
MAX	4.202
MEAN	2.578
STD DEV	.5868
THORIUM EQ. PPM	
MIN	3.200
MAX	9.616
MEAN	5.960
STD DEV	.8692
BI AIR CORR EQ. PPM	
MIN	.5367
MAX	1.642
MEAN	1.059
STD DEV	.2081
RESID MAG GAMMAS	
MIN	-1437
MAX	-353.9
MEAN	-917.7
STD DEV	237.8
RADAR ALTMTR FEET	
MIN	299.7
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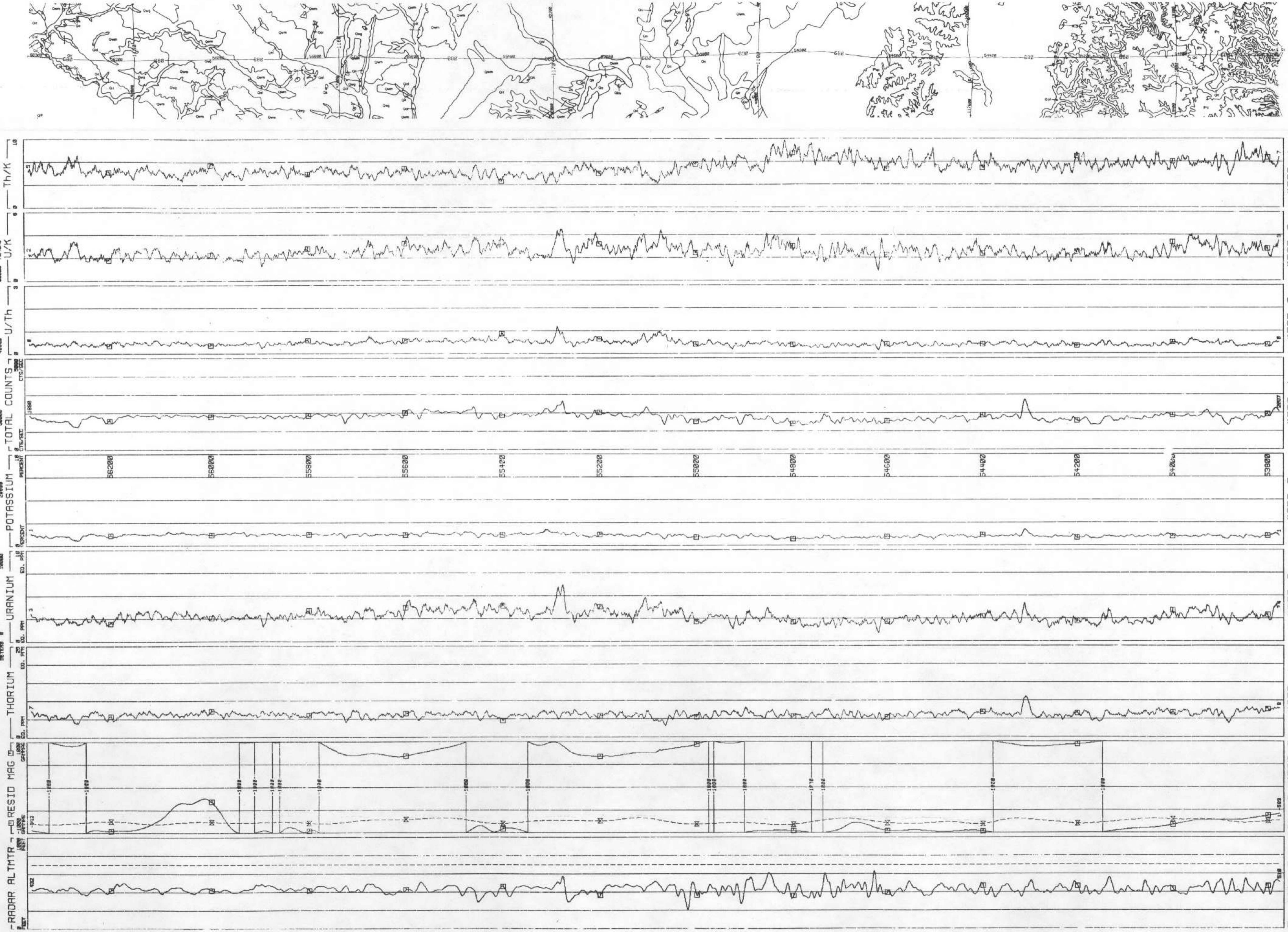
STD DEV	35.38

LINE 670

LINE 680
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



D9 co

LINE 690
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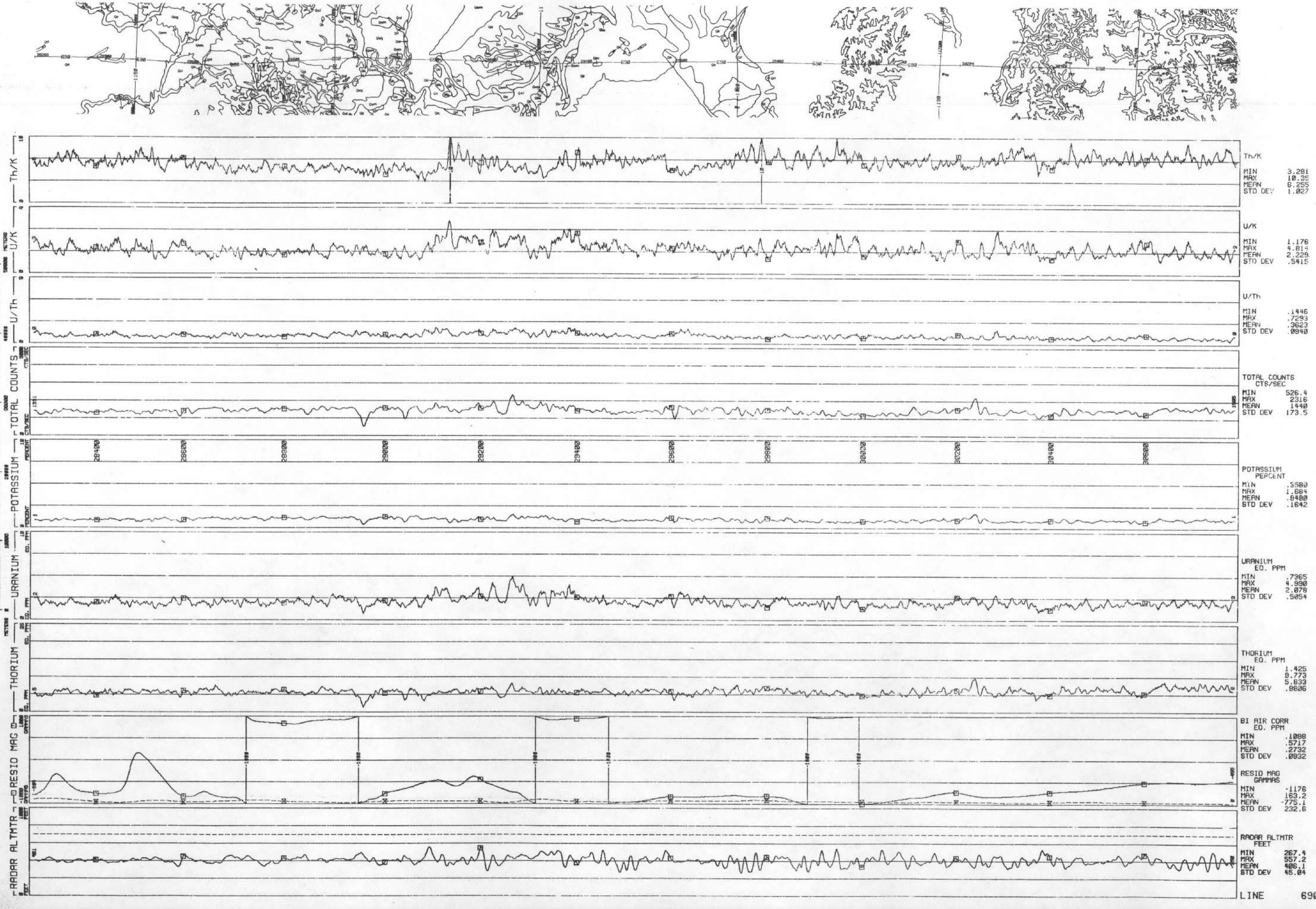

D10 co

LINE 700
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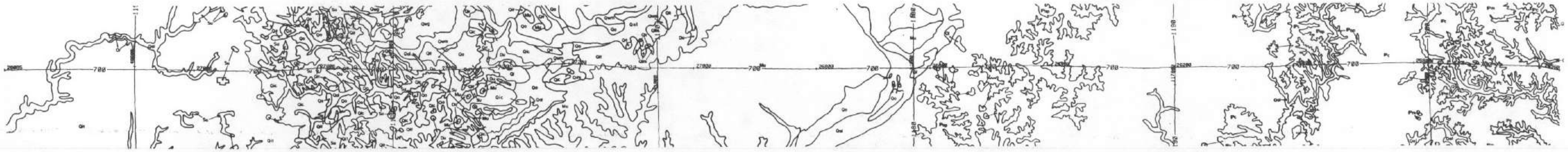

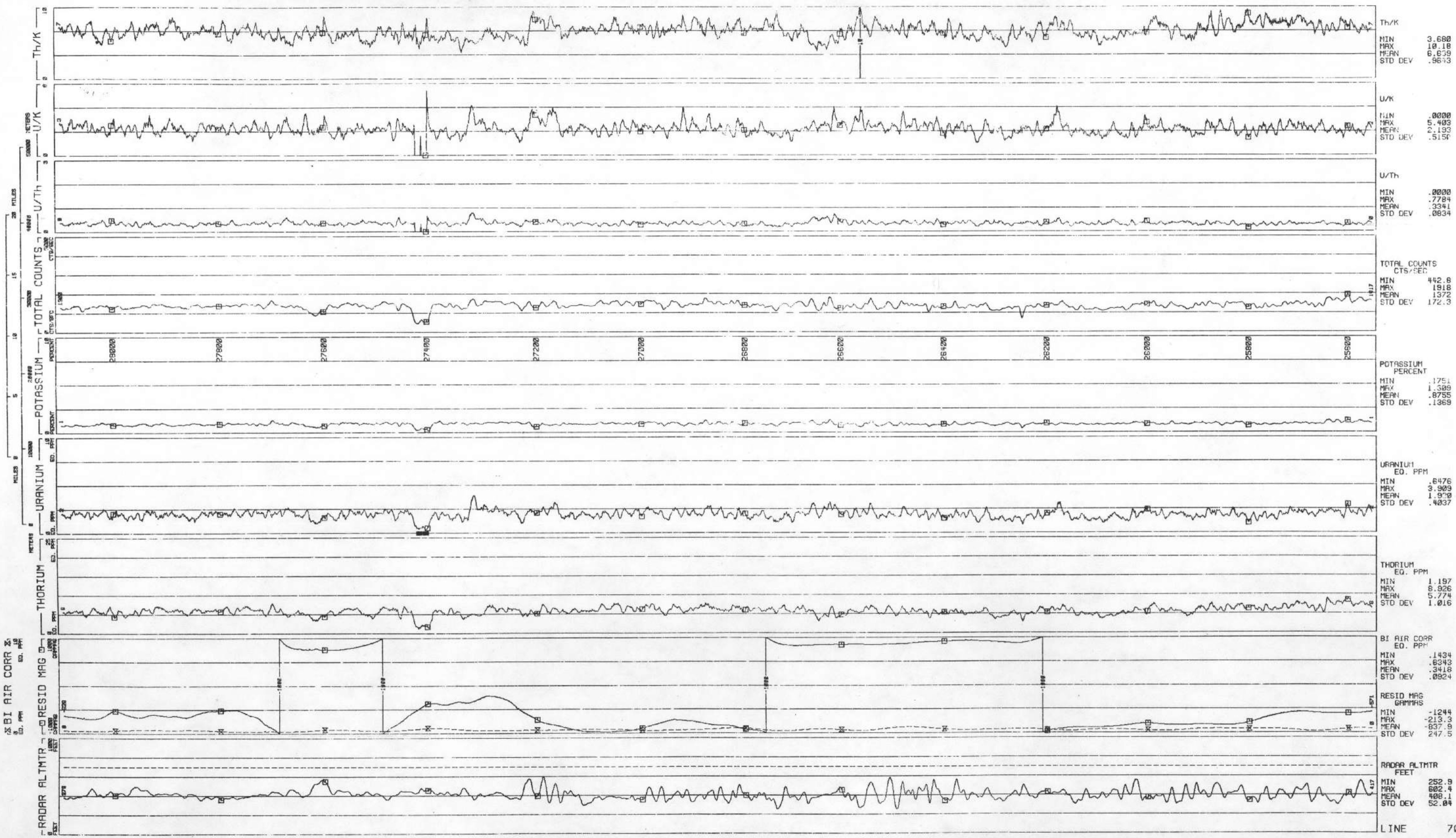

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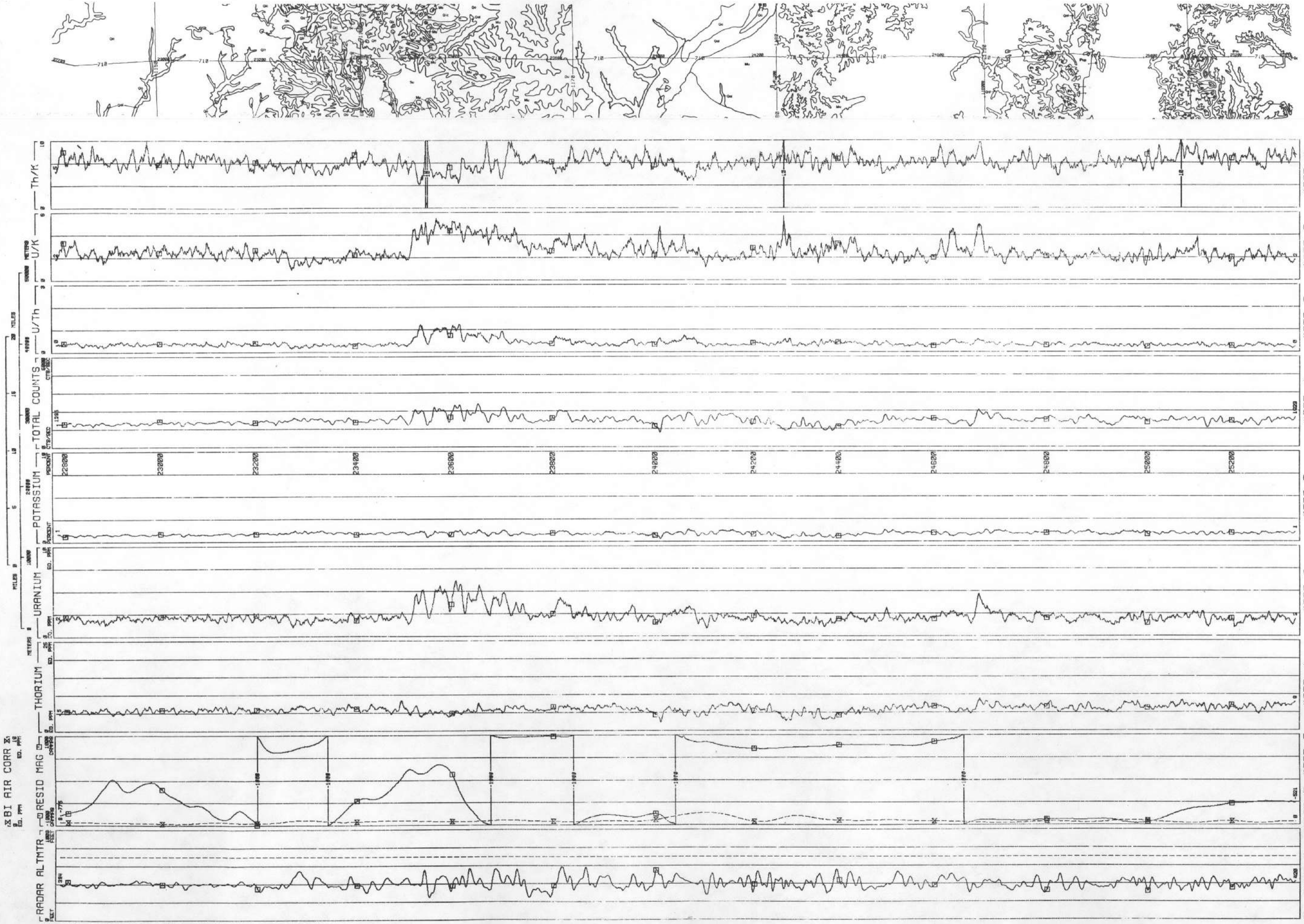

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U/K
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MAX 5.603
MEAN 2.553
STD DEV .7741

U/Th
MIN .1504
MAX 1.246
MEAN .3853
STD DEV .1536

TOTAL COUNTS CTS/SEC
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MAX 2377
MEAN 1467
STD DEV 217.9

POTASSIUM PERCENT
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MAX 1.355
MEAN .8816
STD DEV .1586

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MAX 6.173
MEAN 2.222
STD DEV .7677

THORIUM EQ. PPM
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MAX 8.856
MEAN 5.912
STD DEV .9363

BI AIR CORR EQ. PPM
MIN .1727
MAX 1.349
MEAN .4429
STD DEV .2277

RESID MAG GAMMAS
MIN -1373
MAX 349.7
MEAN -806.8
STD DEV 401.1

RADAR ALTMTR FEET
MIN 249.7
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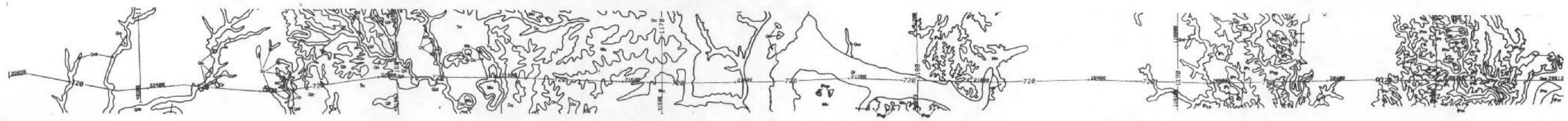
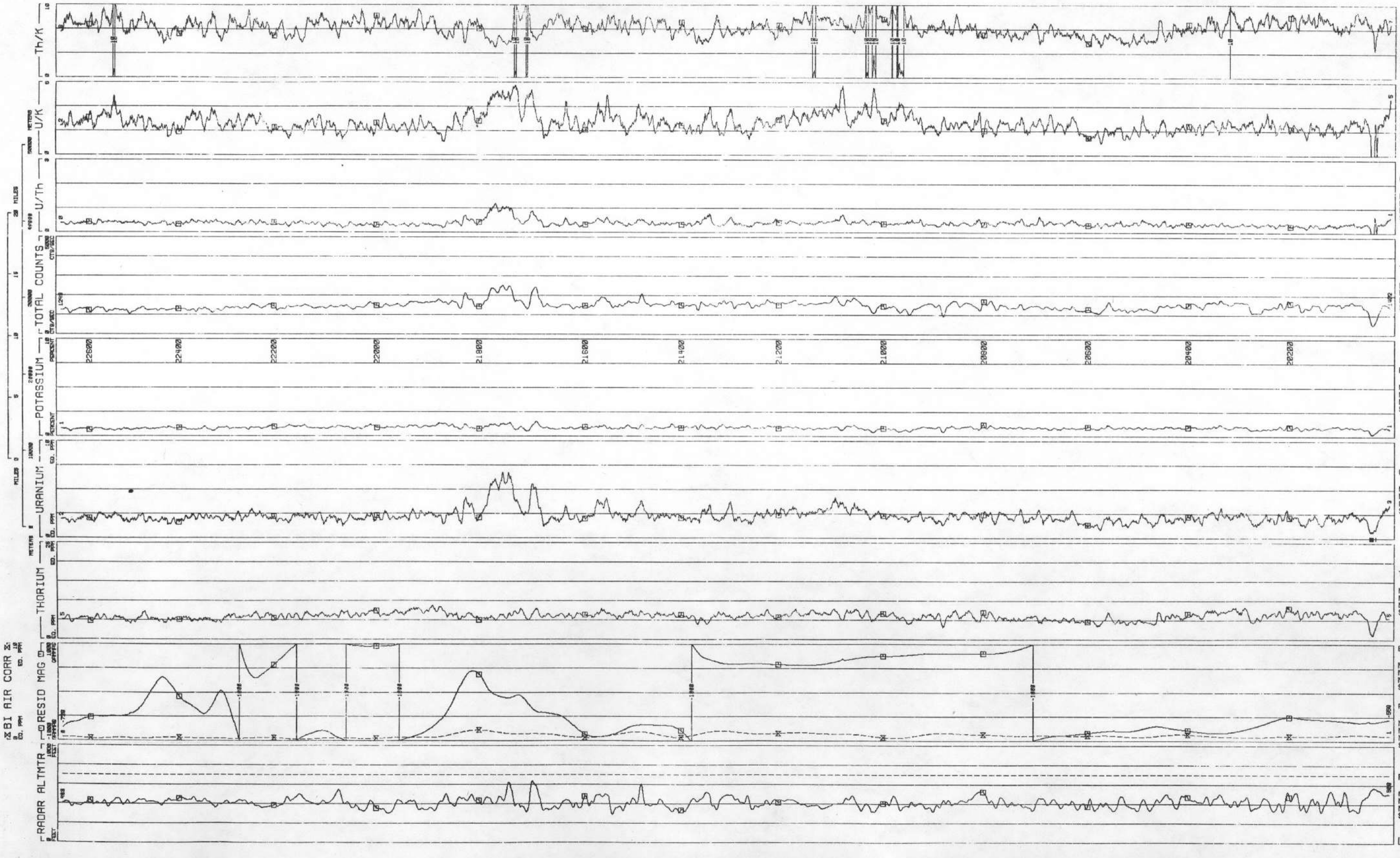
STD DEV 52.48

LINE 710

D12 co

LINE 720
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141





Th/K
MIN 3.807
MAX 13.13
MEAN 7.003
STD DEV 1.174

U/K
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MAX 5.771
MEAN 2.6[illegible]
STD DEV .7535

U/Th
MIN .0000
MAX 1.206
MEAN .3824
STD DEV .1193

TOTAL COUNTS CTS/SEC
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MAX 2533
MEAN 1469
STD DEV 222.6

POTASSIUM PERCENT
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MAX 1.520
MEAN .8691
STD DEV .1478

URANIUM EQ. PPM
MIN .8352
MAX 6.756
MEAN 2.280
STD DEV .7139

THORIUM EQ. PPM
MIN 1.077
MAX 8.756
MEAN 5.996
STD DEV .9543

BI AIR CORR EQ. PPM
MIN .1361
MAX 1.092
MEAN .5128
STD DEV .2201

RESID MAG GAMMAS
MIN -1700
MAX 442.0
MEAN -806.6
STD DEV 432.2

RADAR ALTMTR FEET
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MEAN 414.4
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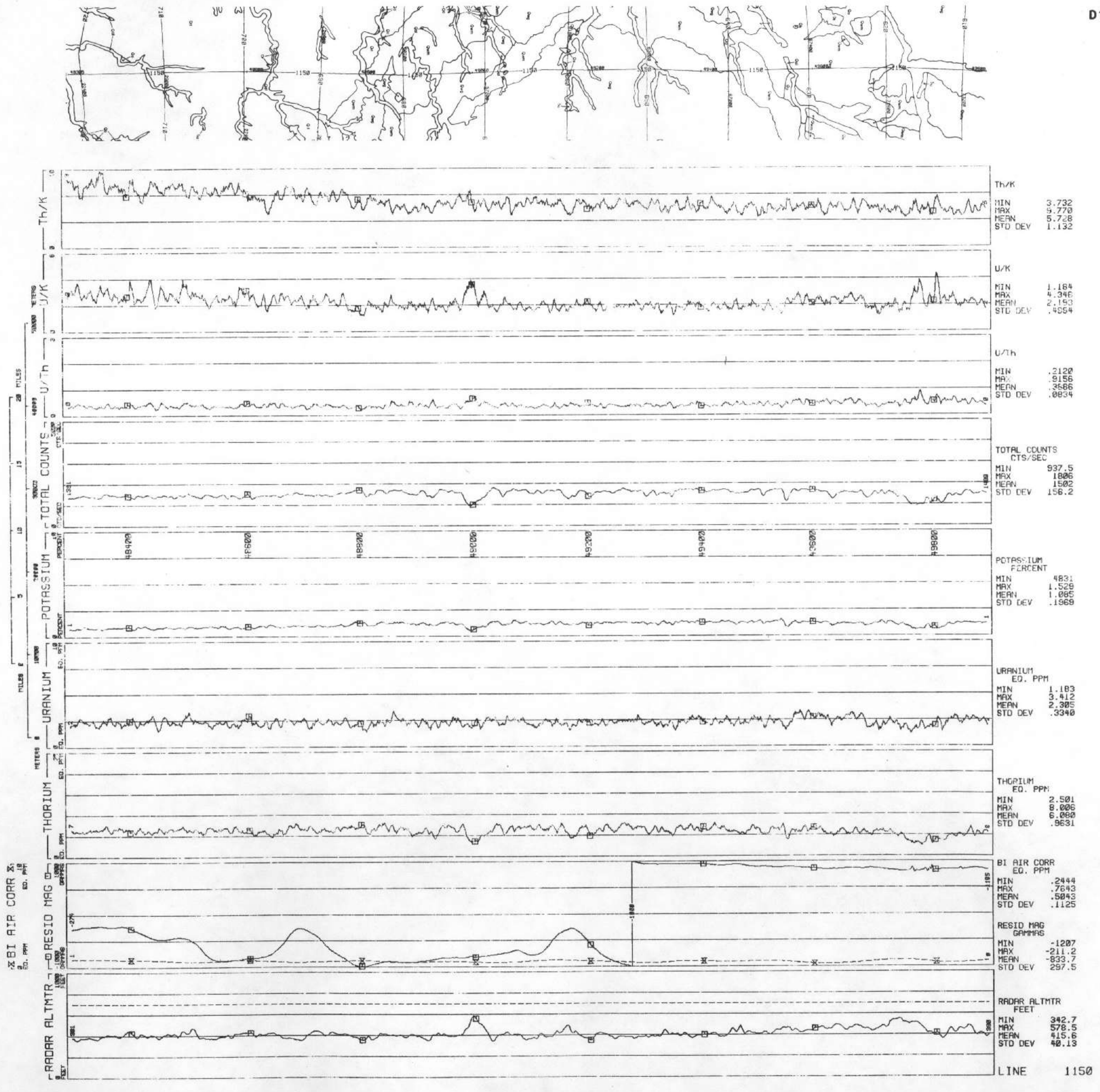
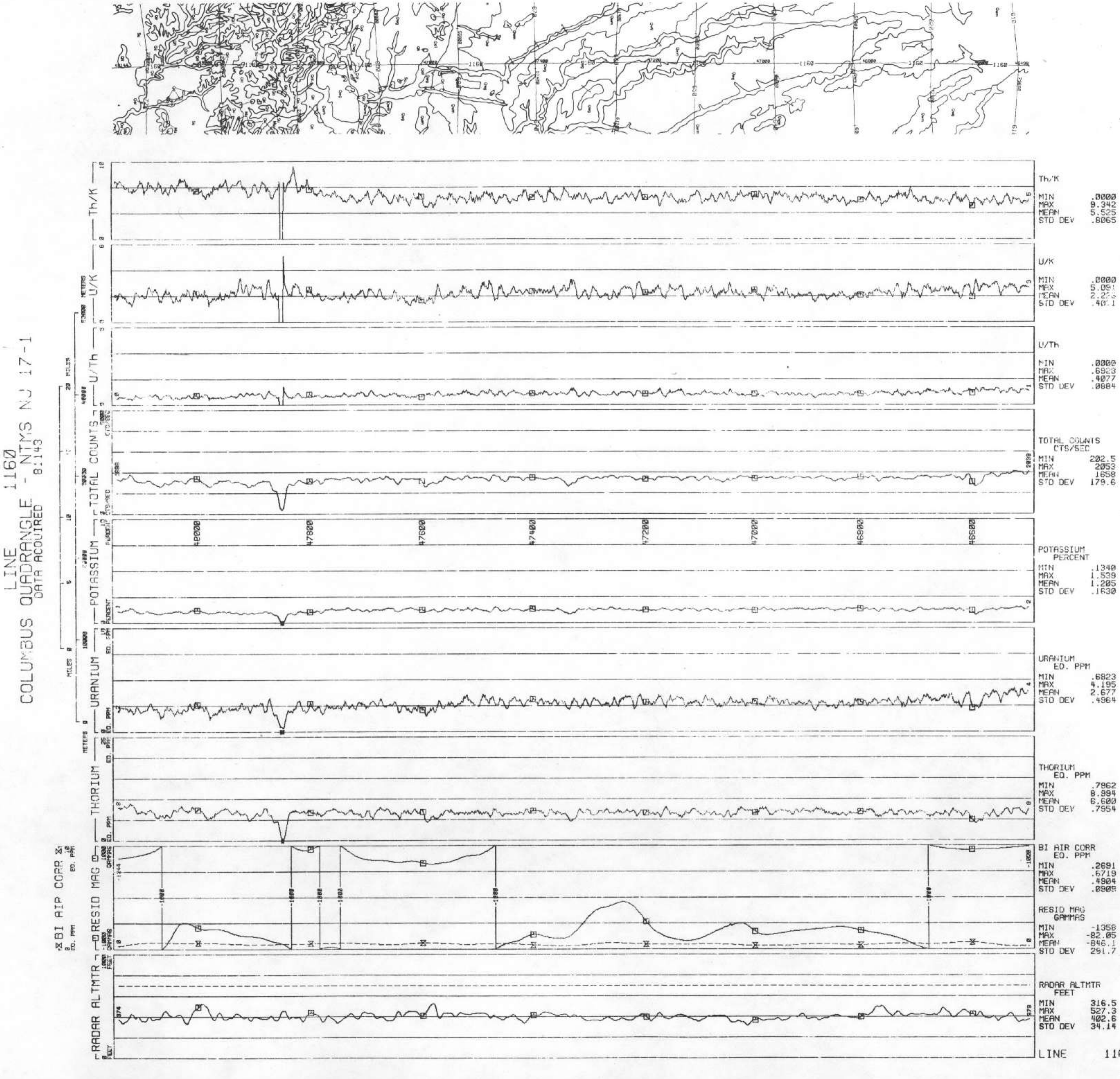
LINE 720

LINE 1150
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143

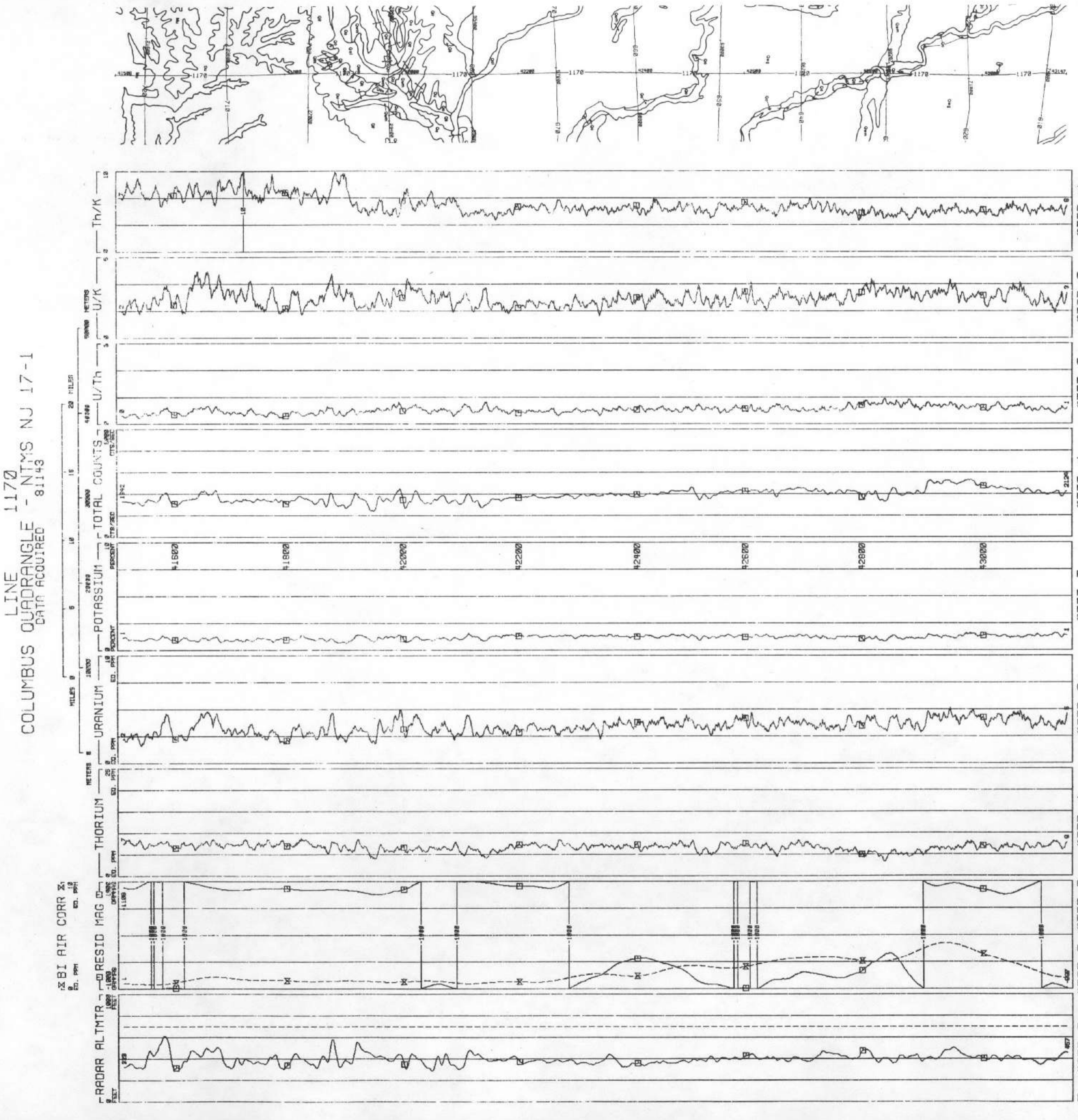




LINE 1160
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 8:143

D15 co

LINE 1170
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143



Th/K
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U/Th
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MAX .9495
MEAN .5228
STD DEV .1250

TOTAL COUNTS CTS/SEC
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MAX 2658
MEAN 1930
STD DEV 265.3

POTASSIUM PERCENT
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MEAN 1.171
STD DEV .1780

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MAX 5.165
MEAN 3.404
STD DEV .6459

THORIUM EQ. PPM
MIN 3.313
MAX 8.703
MEAN 6.647
STD DEV .8853

BI AIR CORR EQ. PPM
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MAX 4.261
MEAN 1.571
STD DEV 1.037

RESID MAG GAMMAS
MIN -1248
MAX -336.5
MEAN -940.9
STD DEV 223.9

RADAR ALTMTR FEET
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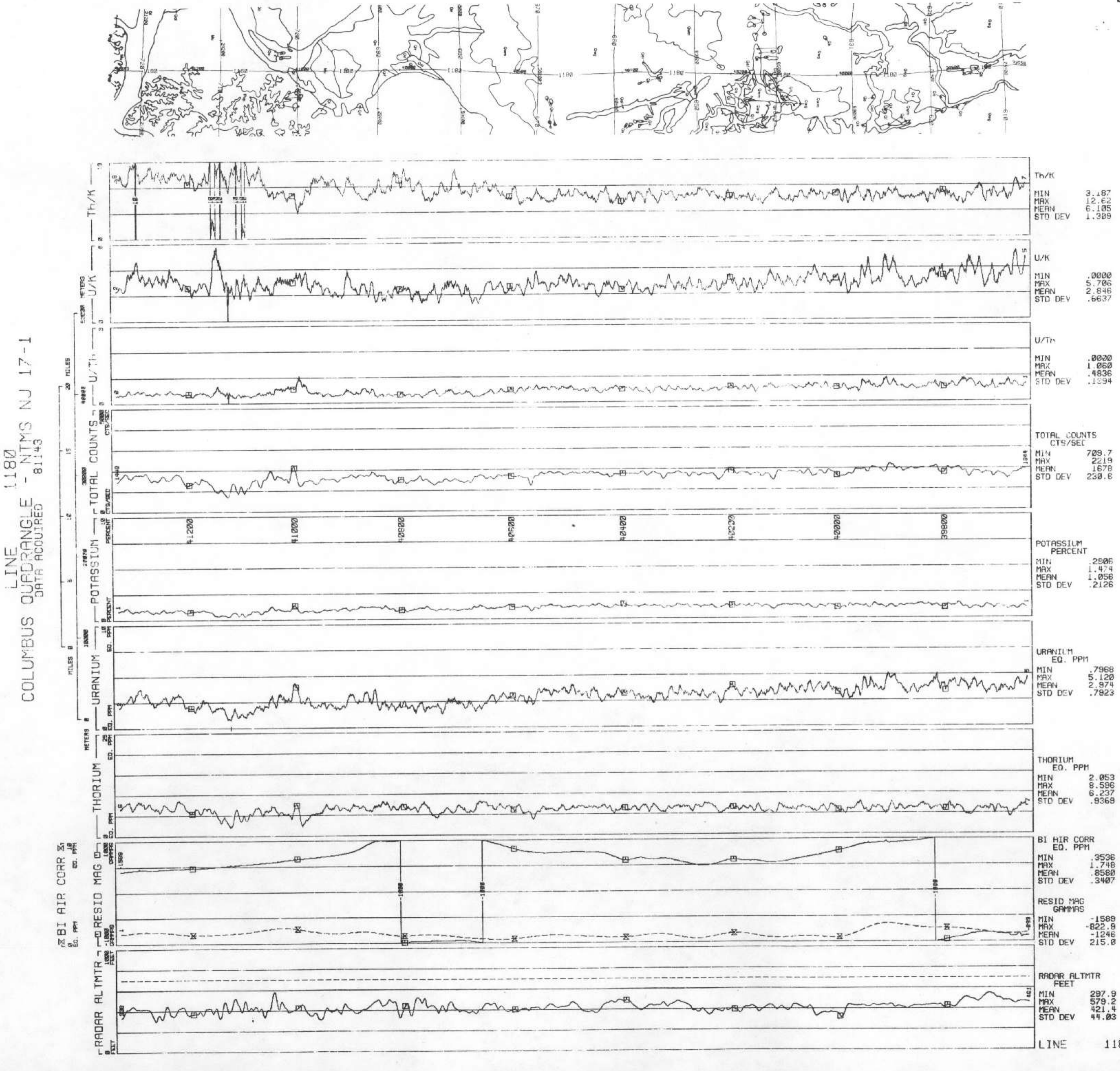
MAX 610.0
MEAN 398.3
STD DEV 47.46

LINE 1170

D16 co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DATA ACQUIRED 81143
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MEAN 6.105
STD DEV 1.309
U/K
MIN .0000
MAX 5.706
MEAN 2.846
STD DEV .6637
U/Th
MIN .0000
MAX 1.060
MEAN .4836
STD DEV .1394
TOTAL COUNTS CTS/SEC
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MAX 2219
MEAN 1678
STD DEV 230.6
POTASSIUM PERCENT
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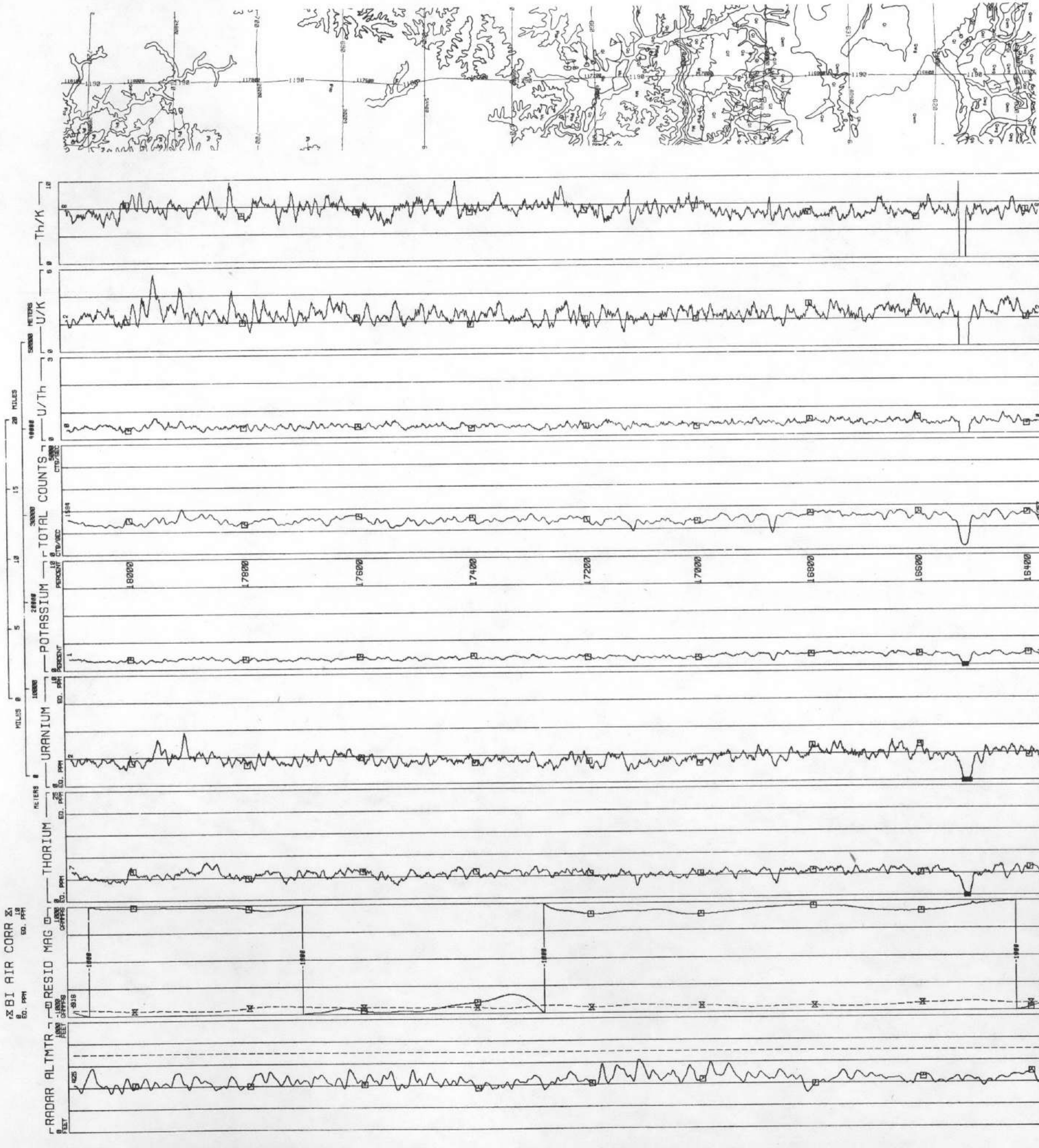
MAX 1.474
MEAN 1.056
STD DEV .2126
URANIUM EQ. PPM
MIN .7968
MAX 5.120
MEAN 2.974
STD DEV .7923
THORIUM EQ. PPM
MIN 2.053
MAX 8.596
MEAN 6.237
STD DEV .9369
BI AIR CORR EQ. PPM
MIN .3536
MAX 1.748
MEAN .8580
STD DEV .3407
RESID MAG GAMMAS
MIN -1589
MAX -822.9
MEAN -1246
STD DEV 215.0
RADAR ALTMTR FEET
MIN 297.9
MAX 579.2
MEAN 421.4
STD DEV 44.03
LINE 1180

D17 co

LINE 1190
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81157



Th/K		
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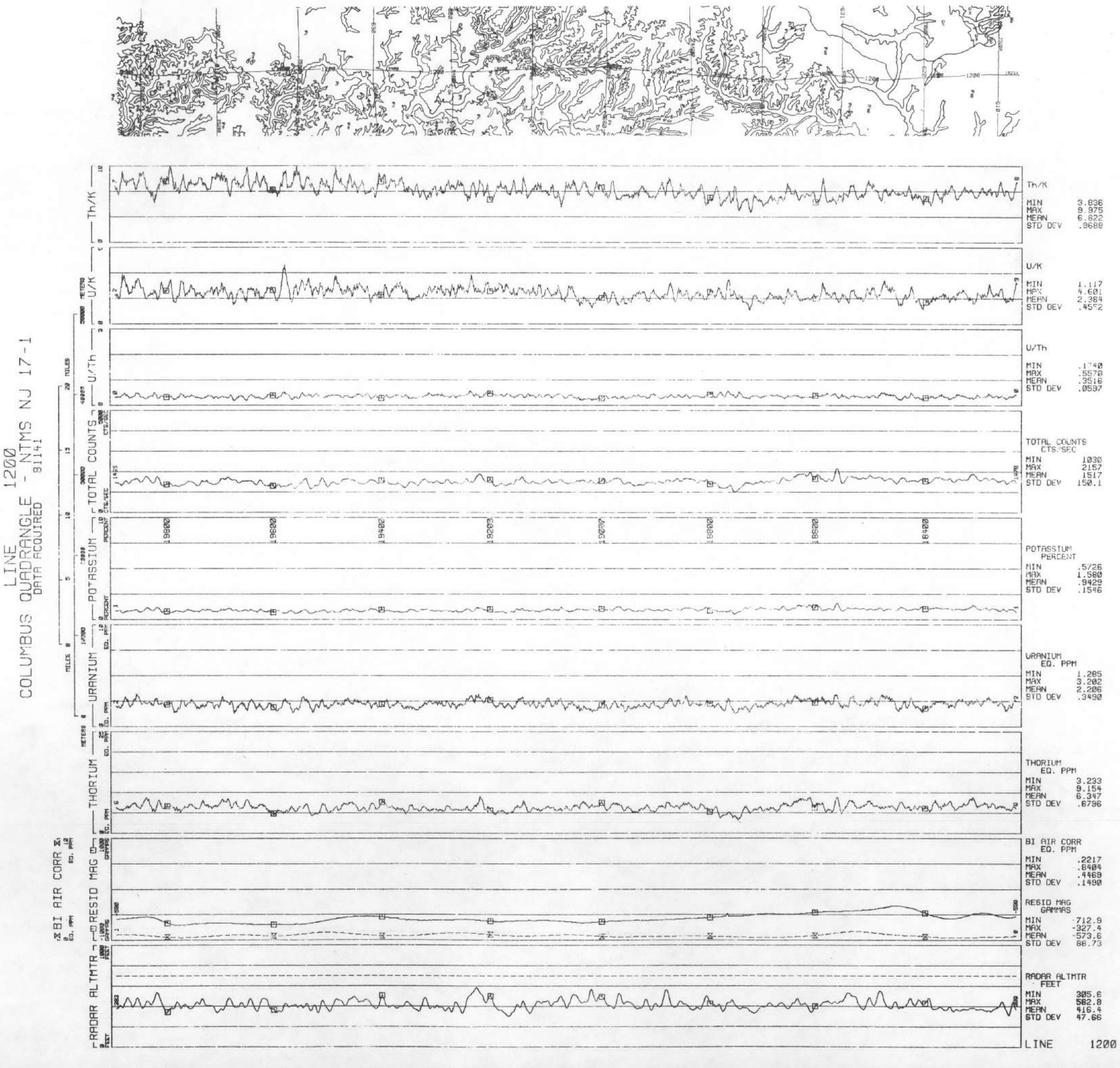
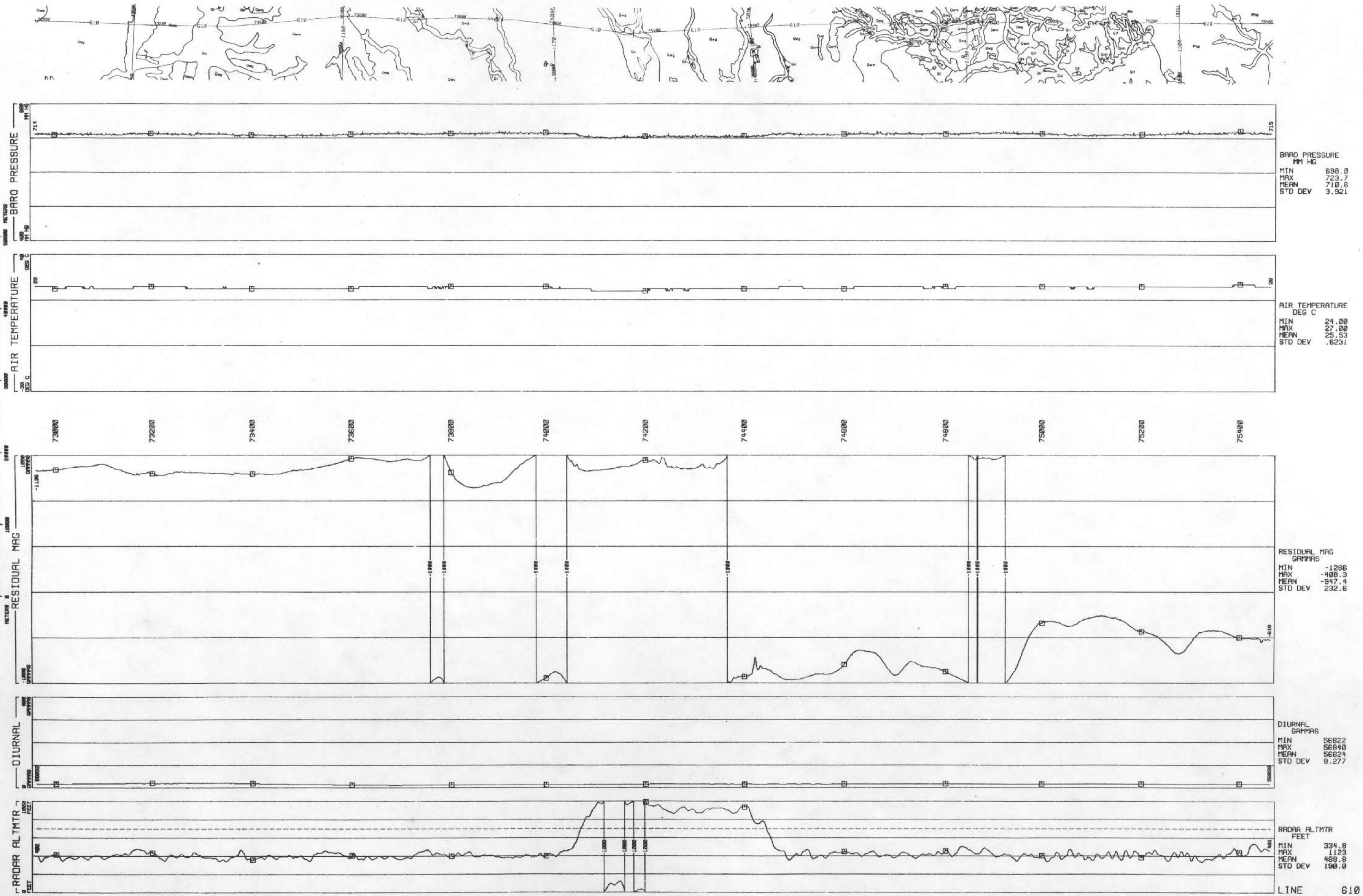
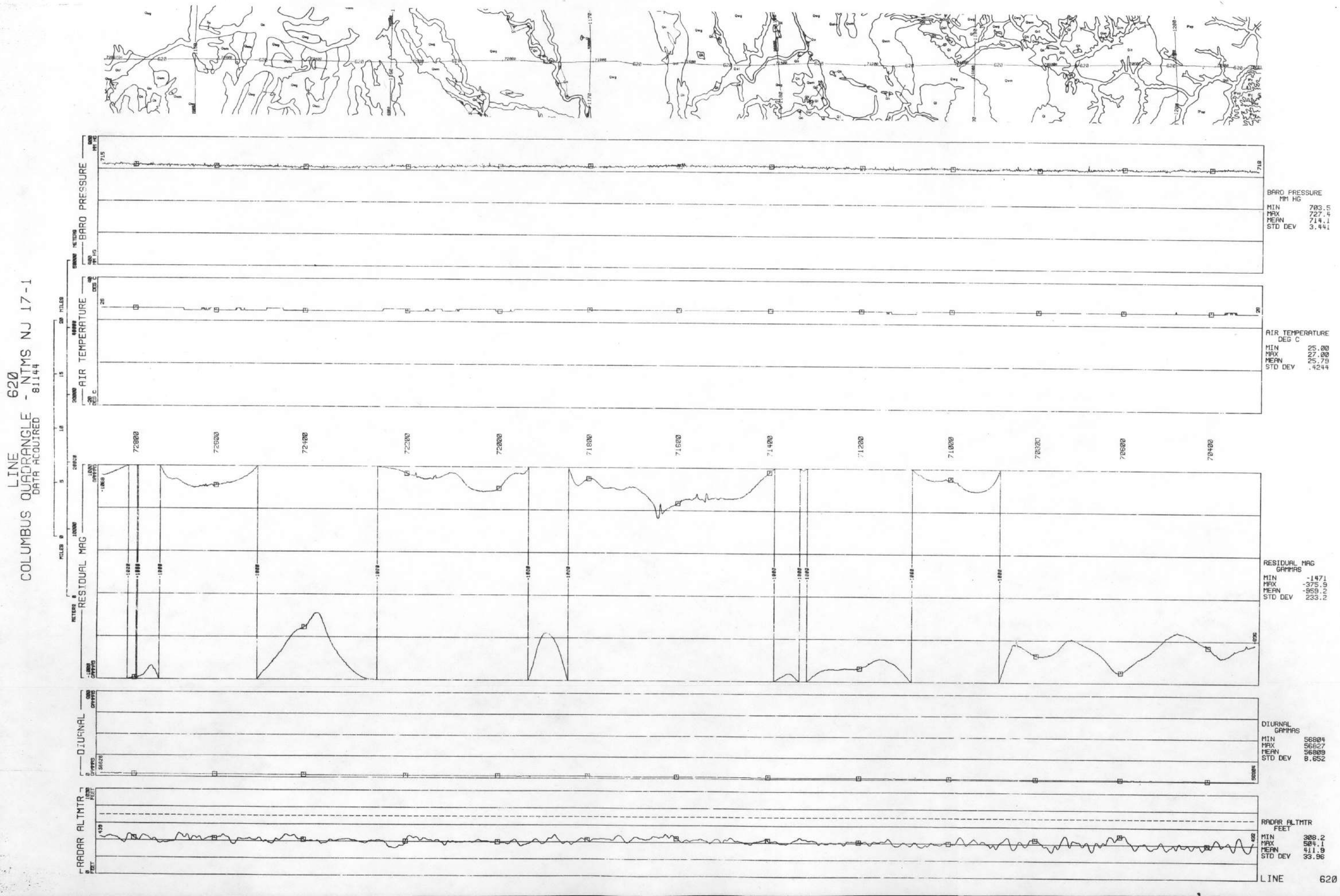
MEAN		6.079
STD DEV		.8891
U/K		
MIN		.0000
MAX		5.501
MEAN		2.458
STD DEV		.5569
U/Th		
MIN		.0000
MAX		.8039
MEAN		.4058
STD DEV		.0932
TOTAL COUNTS CTS/SEC		
MIN		150.8
MAX		2030
MEAN		1458
STD DEV		197.0
POTASSIUM PERCENT		
MIN		.0989
MAX		1.279
MEAN		.9115
STD DEV		.1414
URANIUM EQ. PPM		
MIN		.8764
MAX		4.753
MEAN		2.253
STD DEV		.4814
THORIUM EQ. PPM		
MIN		.8684
MAX		8.642
MEAN		5.527
STD DEV		.8477
BI AIR CORR EQ. PPM		
MIN		.3269
MAX		.8426
MEAN		.5768
STD DEV		.1169
RESID MAG GAMMAS		
MIN		-1221
MAX		-658.9
MEAN		-1043
STD DEV		123.7
RADAR ALTMTR FEET		
MIN		317.3
MAX		621.7
MEAN		445.2
STD DEV		46.57

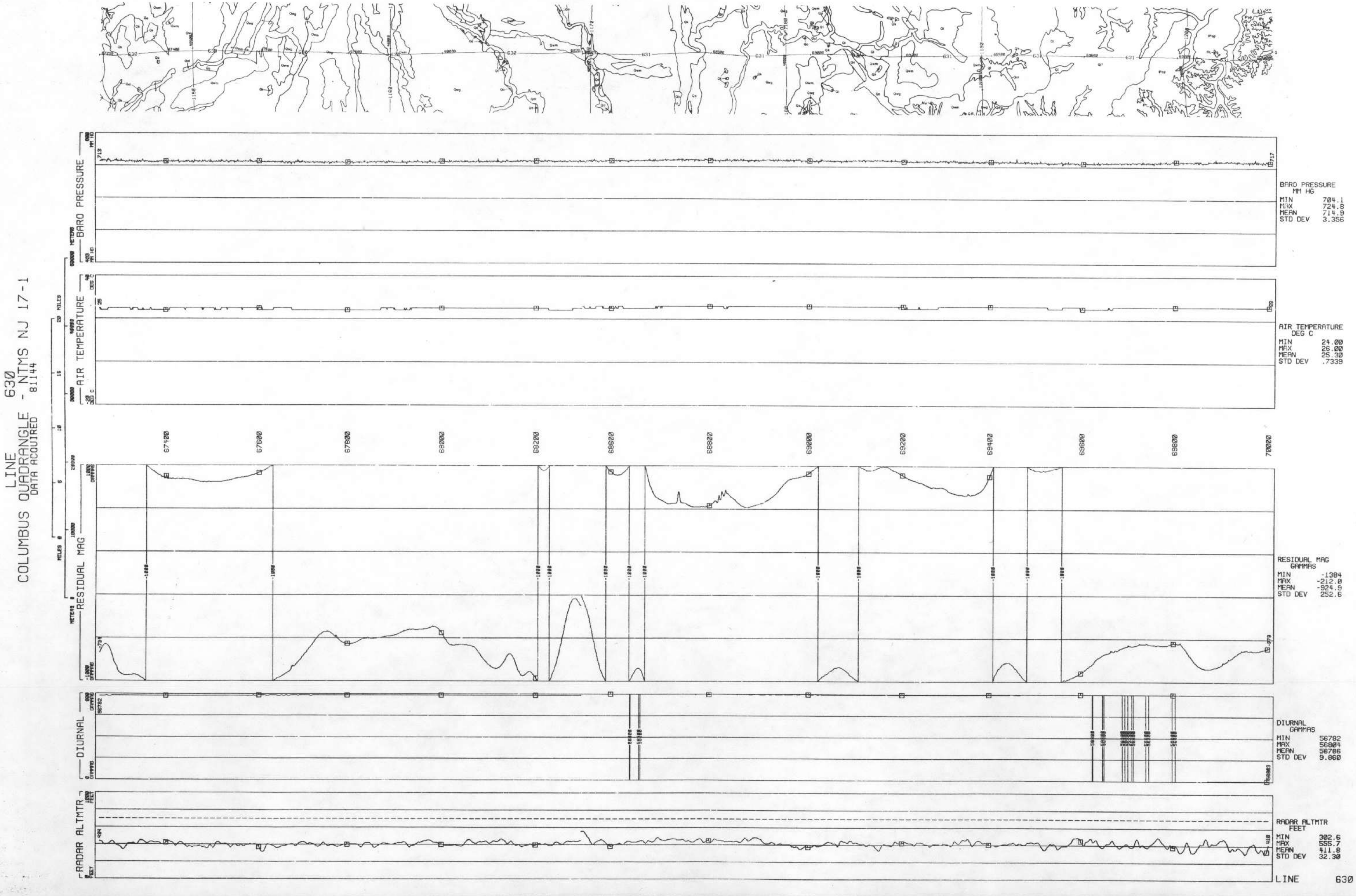
LINE 1190


LINE 1200
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141
Th/K
MIN 3.836
MAX 9.975
MEAN 6.822
STD DEV .9688
U/K
MIN 1.117
MAX 4.601
MEAN 2.384
STD DEV .4552
U/Th
MIN .1740
MAX .5570
MEAN .3516
STD DEV .0597
TOTAL COUNTS CTS/SEC
MIN 1030
MAX 2157
MEAN 1517
STD DEV 150.1
POTASSIUM PERCENT
MIN .5726
MAX 1.580
MEAN .9429
STD DEV .1546
URANIUM EQ. PPM
MIN 1.285
MAX 3.202
MEAN 2.206
STD DEV .3490
THORIUM EQ. PPM
MIN 3.233
MAX 9.154
MEAN 6.347
STD DEV .8796
BI AIR CORR EQ. PPM
MIN .2217
MAX .8404
MEAN .4469
STD DEV .1490
RESID MAG GAMMAS
MIN -712.9
MAX -327.4
MEAN -573.6
STD DEV 88.73
RADAR ALTMTR FEET
MIN 305.6
MAX 562.8
MEAN 416.4
STD DEV 47.66
LINE 1200

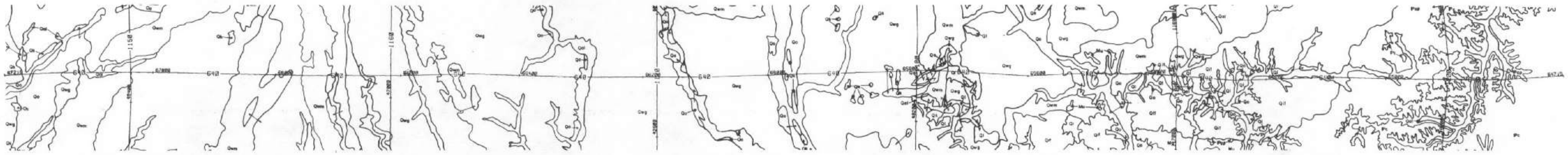
LINE 610
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144

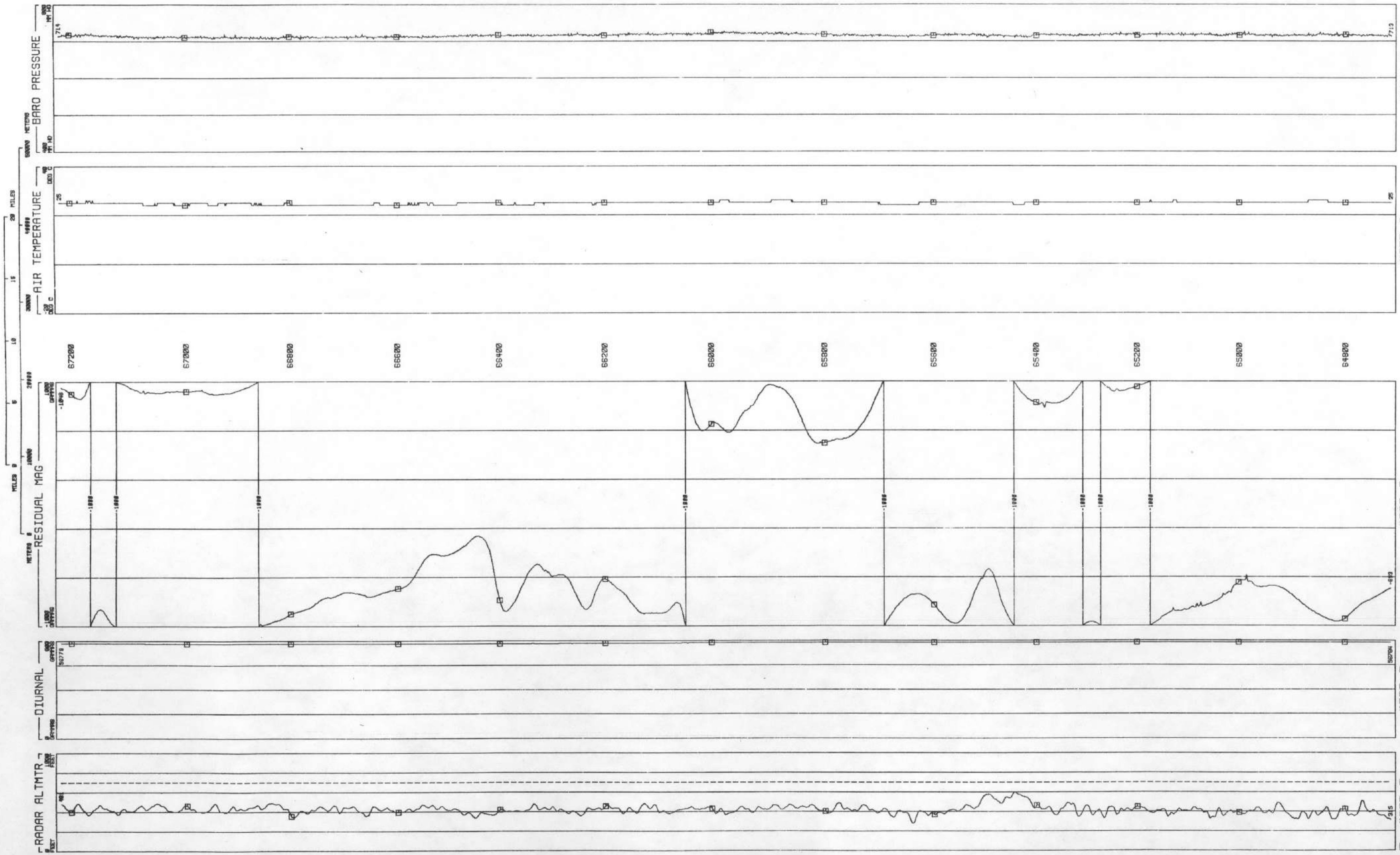



LINE 620
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
72800
72600
72400
72200
72000
71800
71600
71400
71200
71000
70800
70600
70400
BARO PRESSURE MM HG
MIN 703.5
MAX 727.4
MEAN 714.1
STD DEV 3.441
AIR TEMPERATURE DEG C
MIN 25.00
MAX 27.00
MEAN 25.79
STD DEV .4244
RESIDUAL MAG GAMMAS
MIN -1471
MAX -375.9
MEAN -959.2
STD DEV 233.2
DIURNAL GAMMAS
MIN 56804
MAX 56827
MEAN 56809
STD DEV 8.652
RADAR ALTMTR FEET
MIN 308.2
MAX 504.1
MEAN 411.9
STD DEV 33.96
LINE 620


LINE 630
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
67400
67600
67800
68000
68200
68400
68600
69000
69200
69400
69600
69800
70000
BARO PRESSURE MM HG
MIN 704.1
MAX 724.8
MEAN 714.9
STD DEV 3.356
AIR TEMPERATURE DEG C
MIN 24.00
MAX 26.00
MEAN 25.30
STD DEV .7339
RESIDUAL MAG GAMMAS
MIN -1384
MAX -212.0
MEAN -924.9
STD DEV 252.6
DIURNAL GAMMAS
MIN 56782
MAX 56804
MEAN 56786
STD DEV 9.060
RADAR ALTMTR FEET
MIN 302.6
MAX 555.7
MEAN 411.8
STD DEV 32.30
LINE 630

LINE 640
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144





BARO PRESSURE
MM HG
MIN 704.5
MAX 726.9
MEAN 715.4
STD DEV 3.377

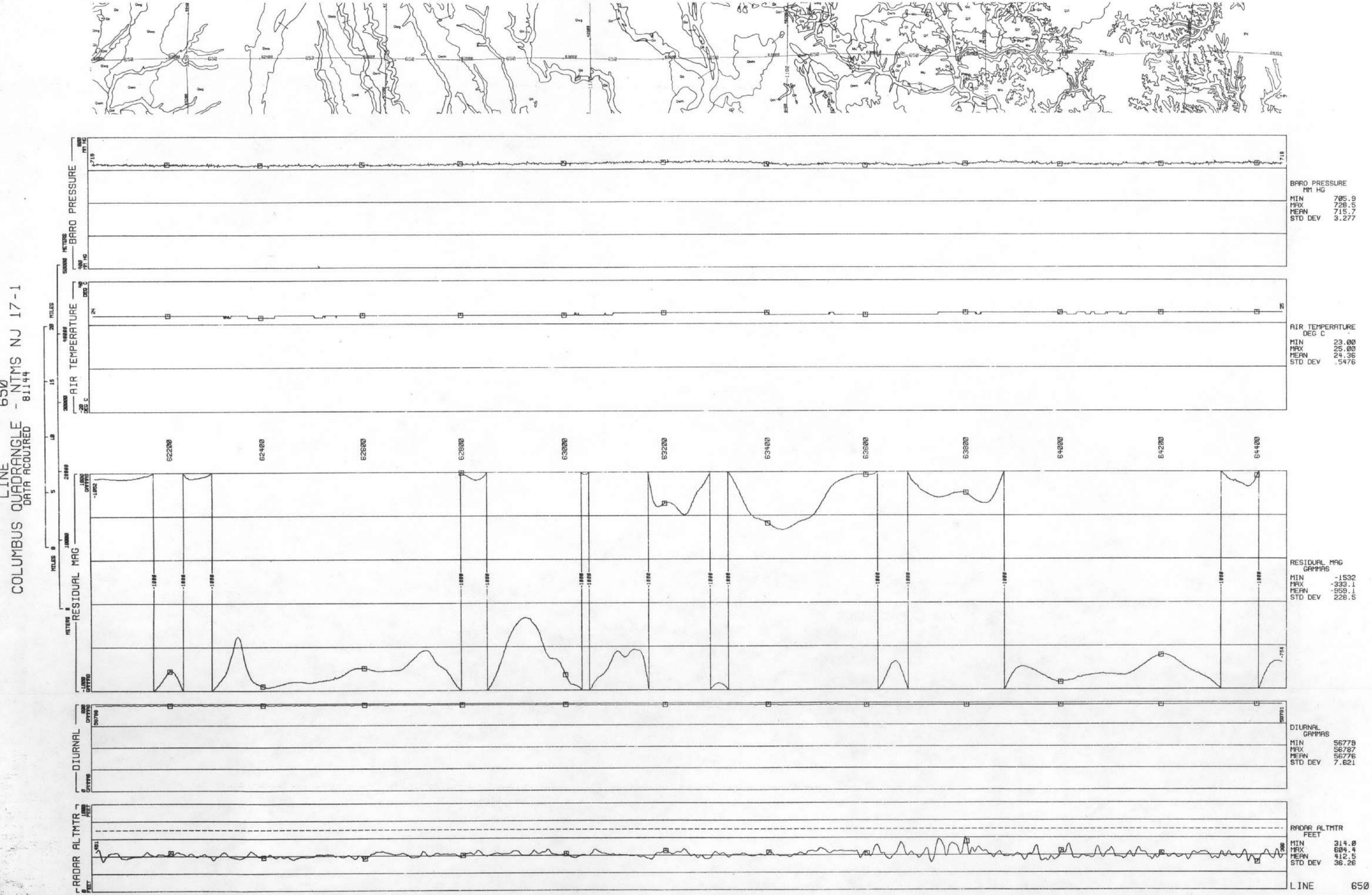
AIR TEMPERATURE
DEG C
MIN 24.00
MAX 26.00
MEAN 24.82
STD DEV .4850

RESIDUAL MAG
GAMMAS
MIN -1510
MAX -263.1
MEAN -904.1
STD DEV 253.6

DIURNAL
GAMMAS
MIN 56775
MAX 56785
MEAN 56774
STD DEV 7.488

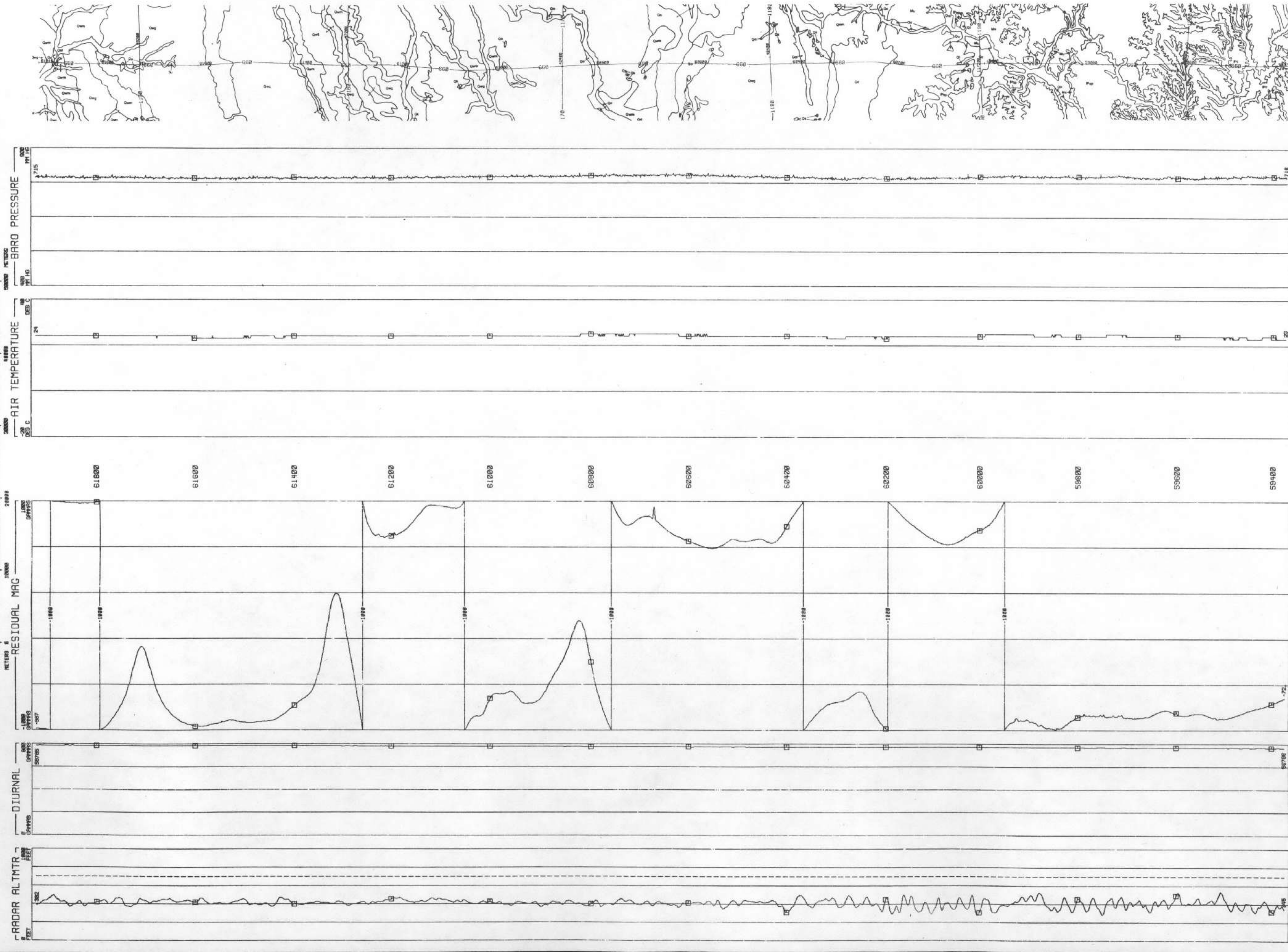
RADAR ALTMTR
FEET
MIN 279.6
MAX 601.7
MEAN 420.1
STD DEV 43.15

LINE 640


LINE 650
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
62200
62400
62600
62800
63000
63200
63400
63600
63800
64000
64200
64400
BARO PRESSURE MM HG
MIN 705.9
MAX 728.5
MEAN 715.7
STD DEV 3.277
AIR TEMPERATURE DEG C
MIN 23.00
MAX 25.00
MEAN 24.36
STD DEV .5476
RESIDUAL MAG GAMMAS
MIN -1532
MAX -333.1
MEAN -959.1
STD DEV 228.5
DIURNAL GAMMAS
MIN 56779
MAX 56787
MEAN 56776
STD DEV 7.621
RADAR ALTMTR FEET
MIN 314.0
MAX 604.4
MEAN 412.5
STD DEV 36.26
LINE 650

D24 co

LINE 660
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



BARO PRESSURE MM HG

MIN	706.4
MAX	728.5
MEAN	716.7
STD DEV	3.518

AIR TEMPERATURE DEG C

MIN	23.00
MAX	25.00
MEAN	24.04
STD DEV	.4803

RESIDUAL MAG GAMMAS

MIN	-1412
MAX	192.9
MEAN	-935.6
STD DEV	291.1

DIURNAL GAMMAS

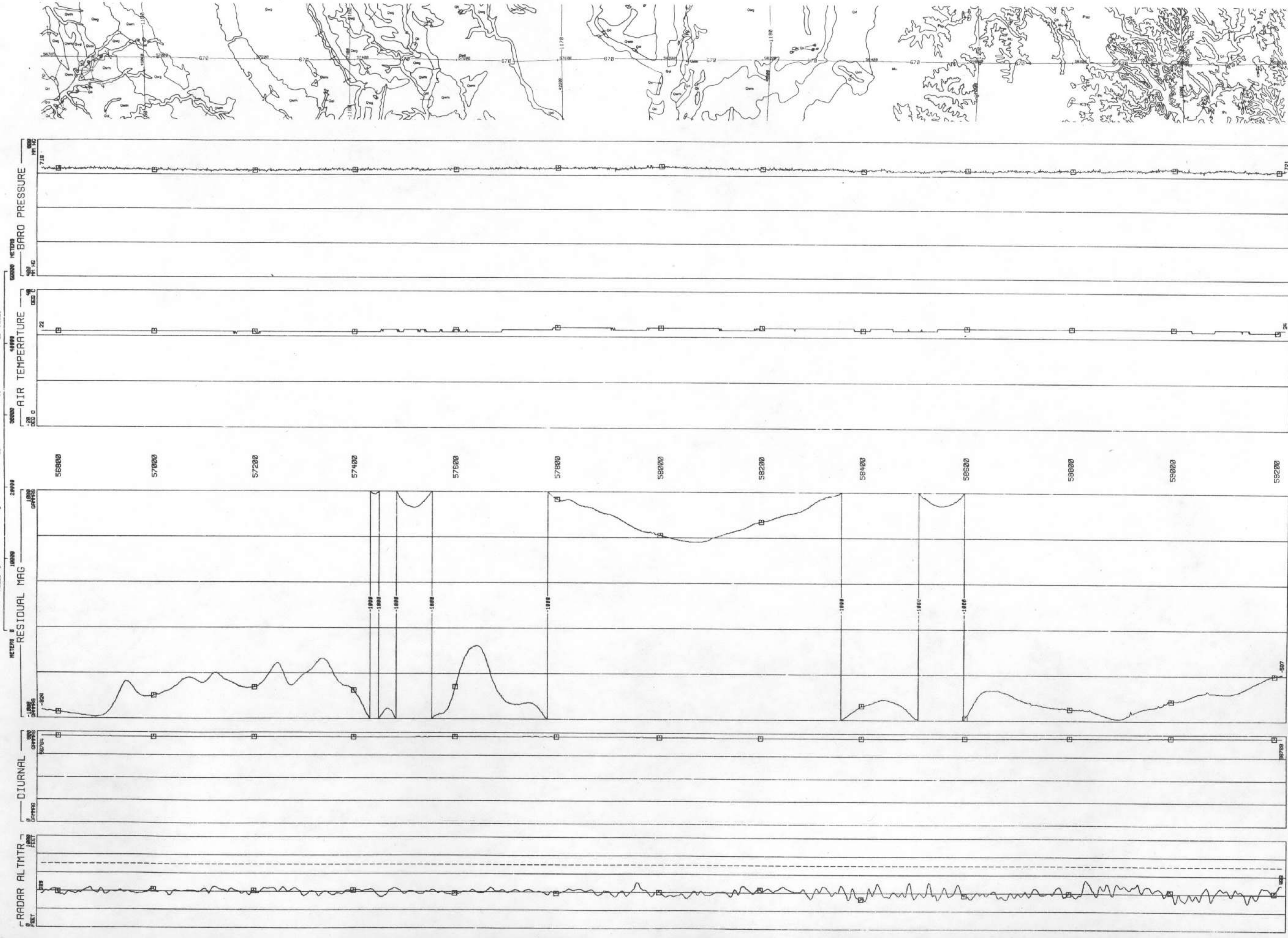
MIN	56765
MAX	56786
MEAN	56771
STD DEV	8.091

RADAR ALTMTR FEET

MIN	283.8
MAX	533.1
MEAN	409.9
STD DEV	39.04

LINE 660

LINE 670
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



BARO PRESSURE
MM HG

MIN	708.0
MAX	729.6
MEAN	717.4
STD DEV	3.487

AIR TEMPERATURE
DEG C

MIN	21.00
MAX	24.00
MEAN	23.09
STD DEV	.8839

RESIDUAL MAG
GAMMAS

MIN	-1437
MAX	-353.9
MEAN	-917.7
STD DEV	237.8

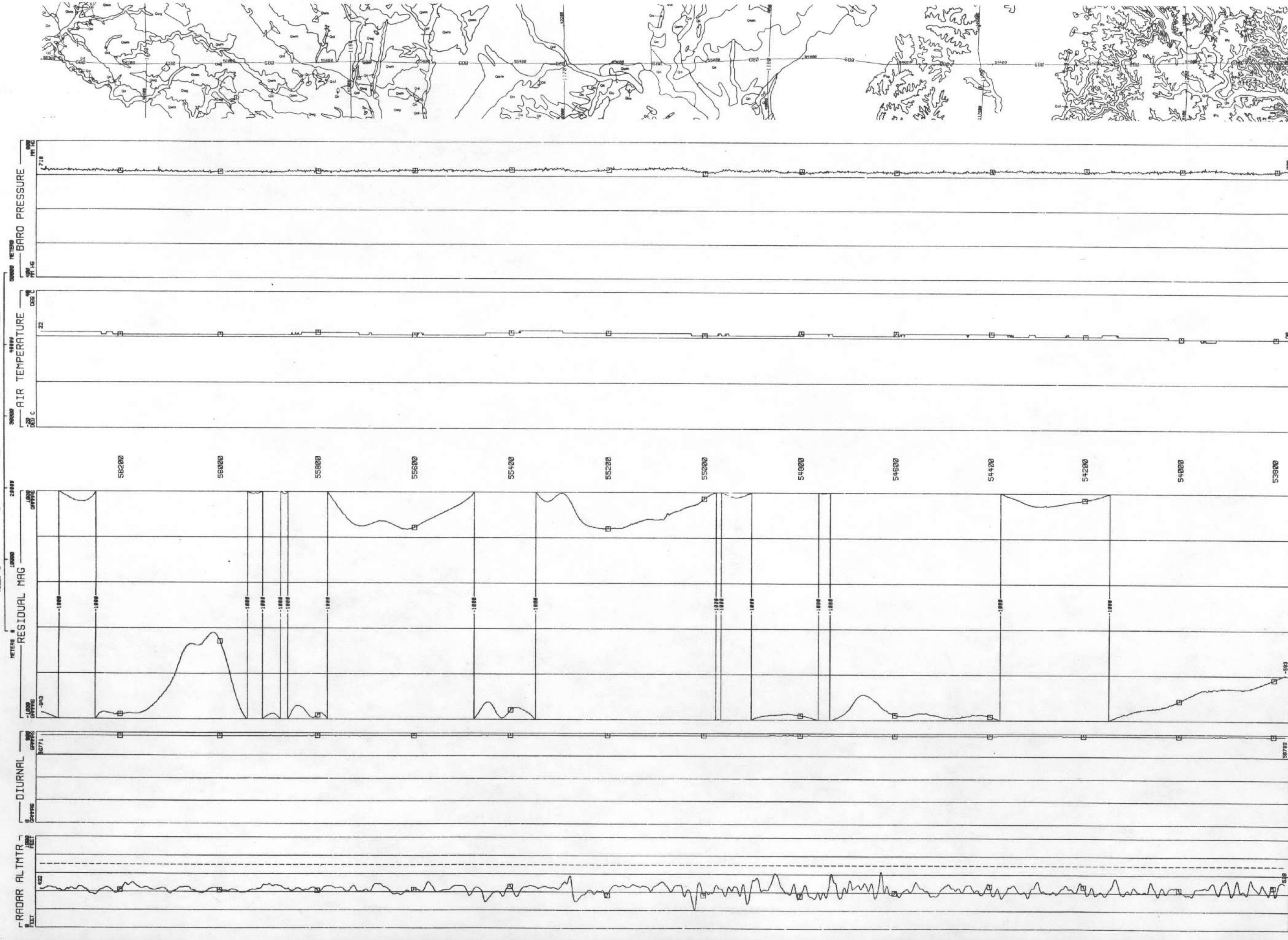
DIURNAL
GAMMAS

MIN	56755
MAX	56768
MEAN	56755
STD DEV	7.171

RADAR ALTMTR
FEET

MIN	289.7
MAX	544.1
MEAN	404.3
STD DEV	35.38

LINE 680
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81144



BARO PRESSURE MM HG
MIN 707.2
MAX 729.1
MEAN 716.3
STD DEV 3.326

AIR TEMPERATURE DEG C
MIN 19.00
MAX 23.00
MEAN 21.33
STD DEV .7268

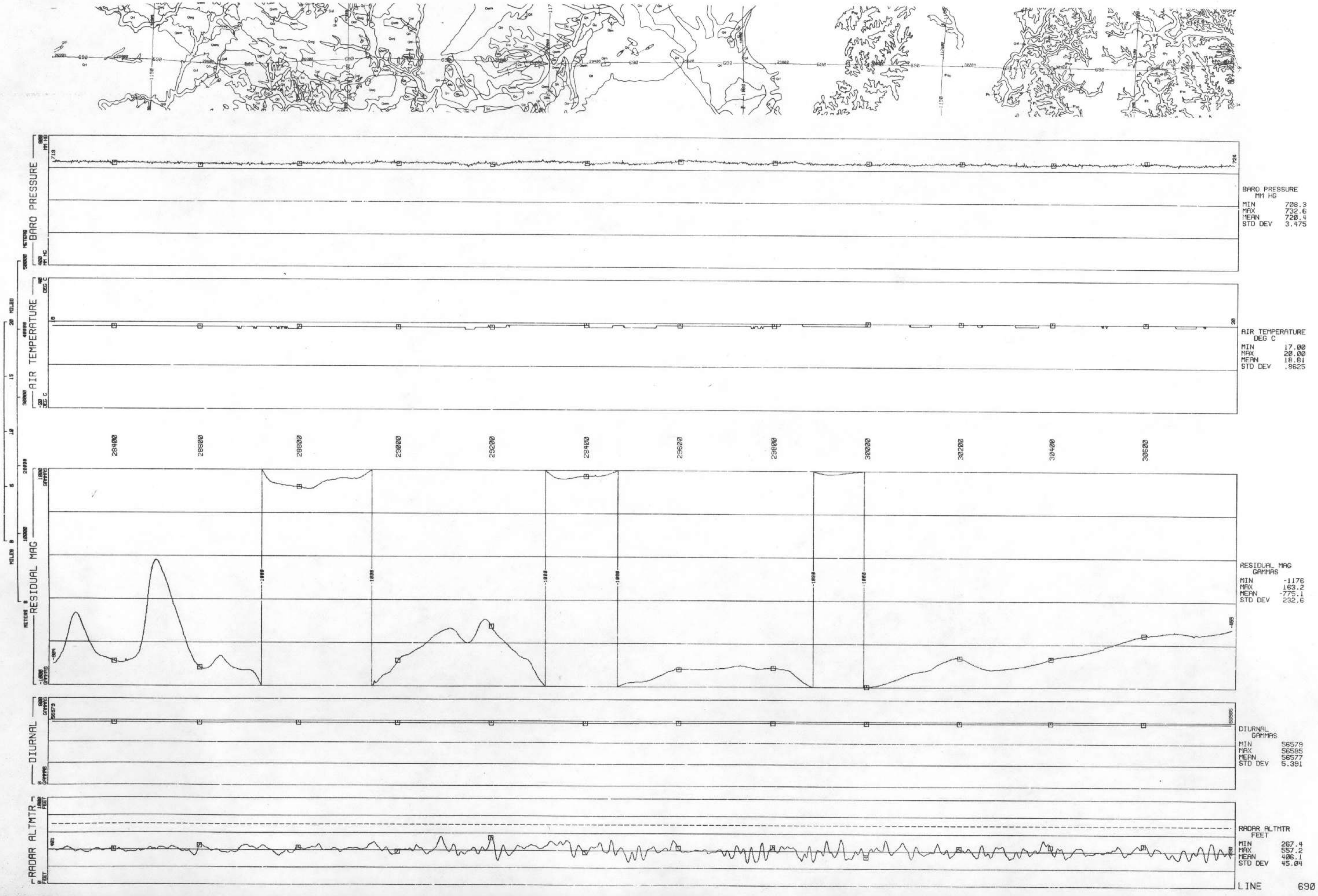
RESIDUAL MAG GAMMAS
MIN -1327
MAX -240.7
MEAN -978.1
STD DEV 205.0

DIURNAL GAMMAS
MIN 56771
MAX 56785
MEAN 56771
STD DEV 8.846

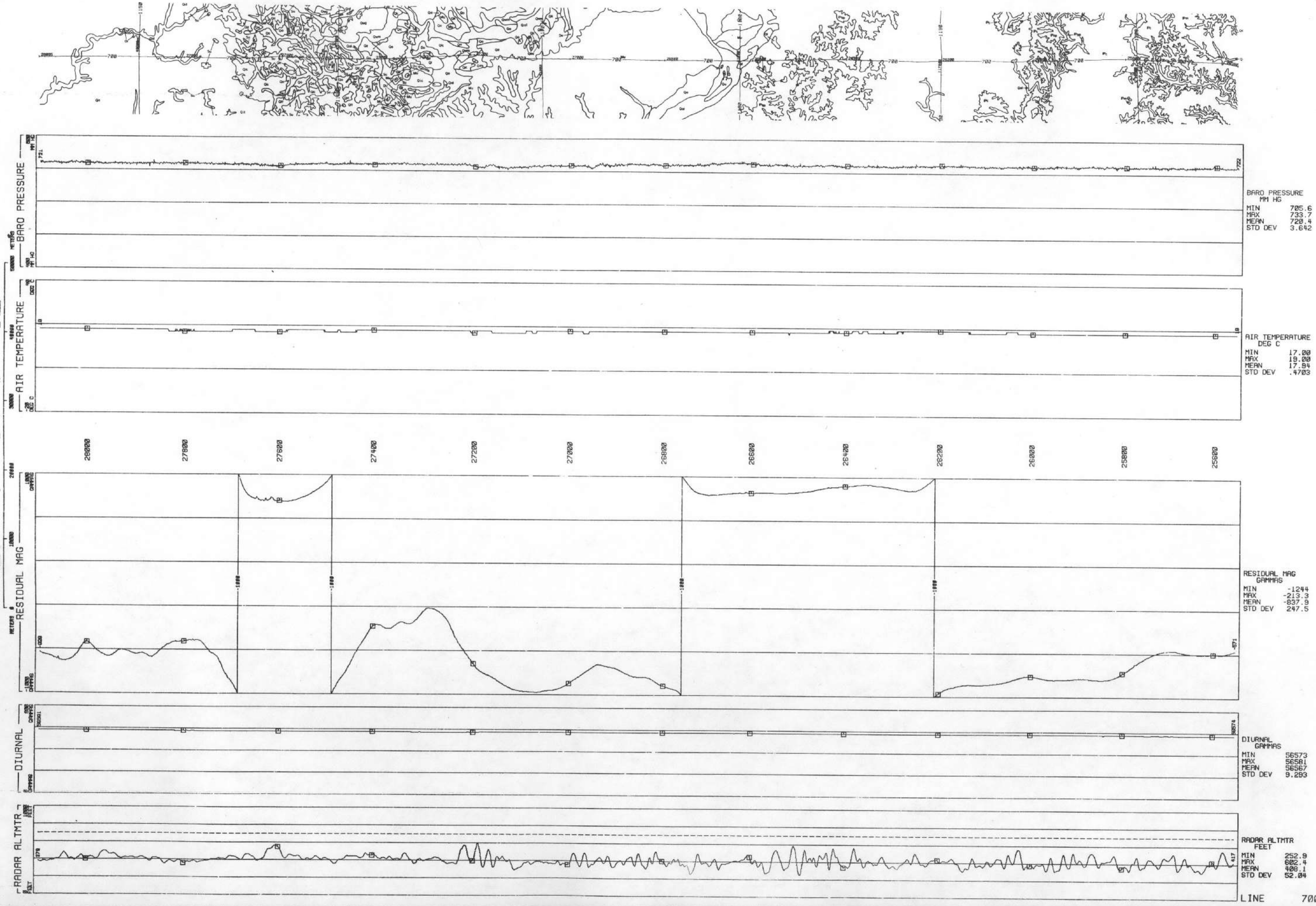
RADAR ALTMTR FEET
MIN 206.0
MAX 630.1
MEAN 431.8
STD DEV 46.88

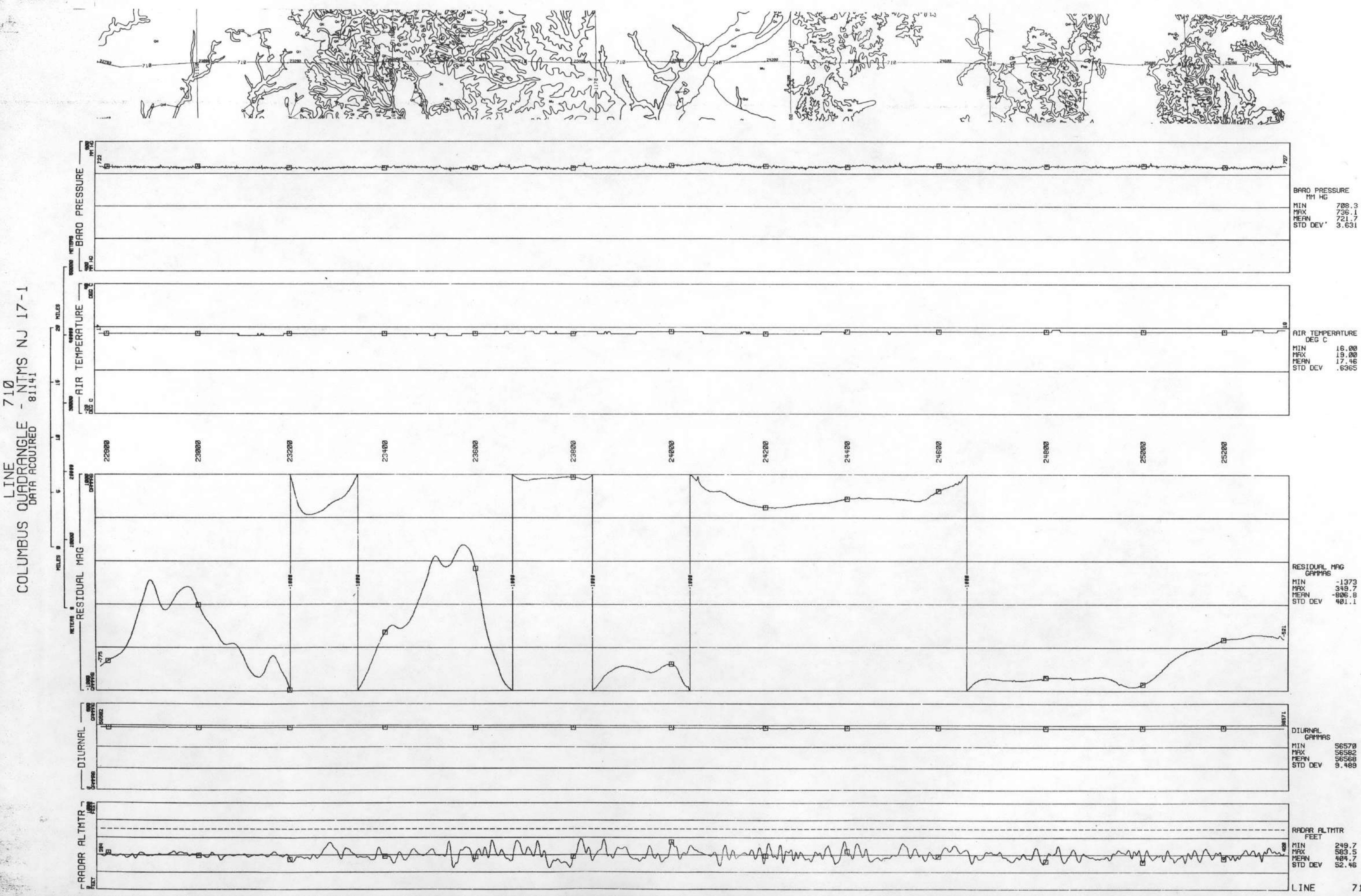
D27 co

LINE 690
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141

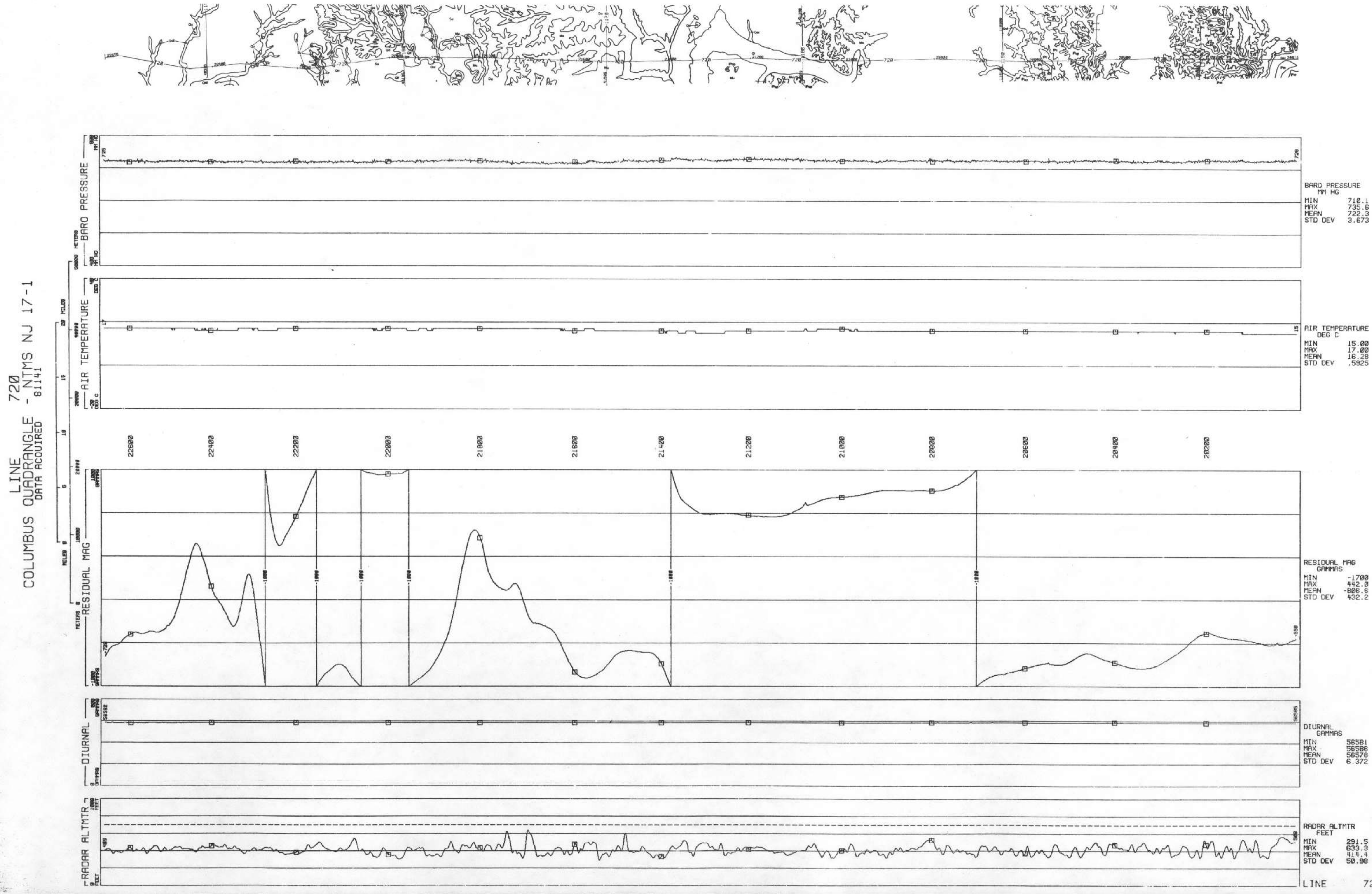


LINE 700
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141

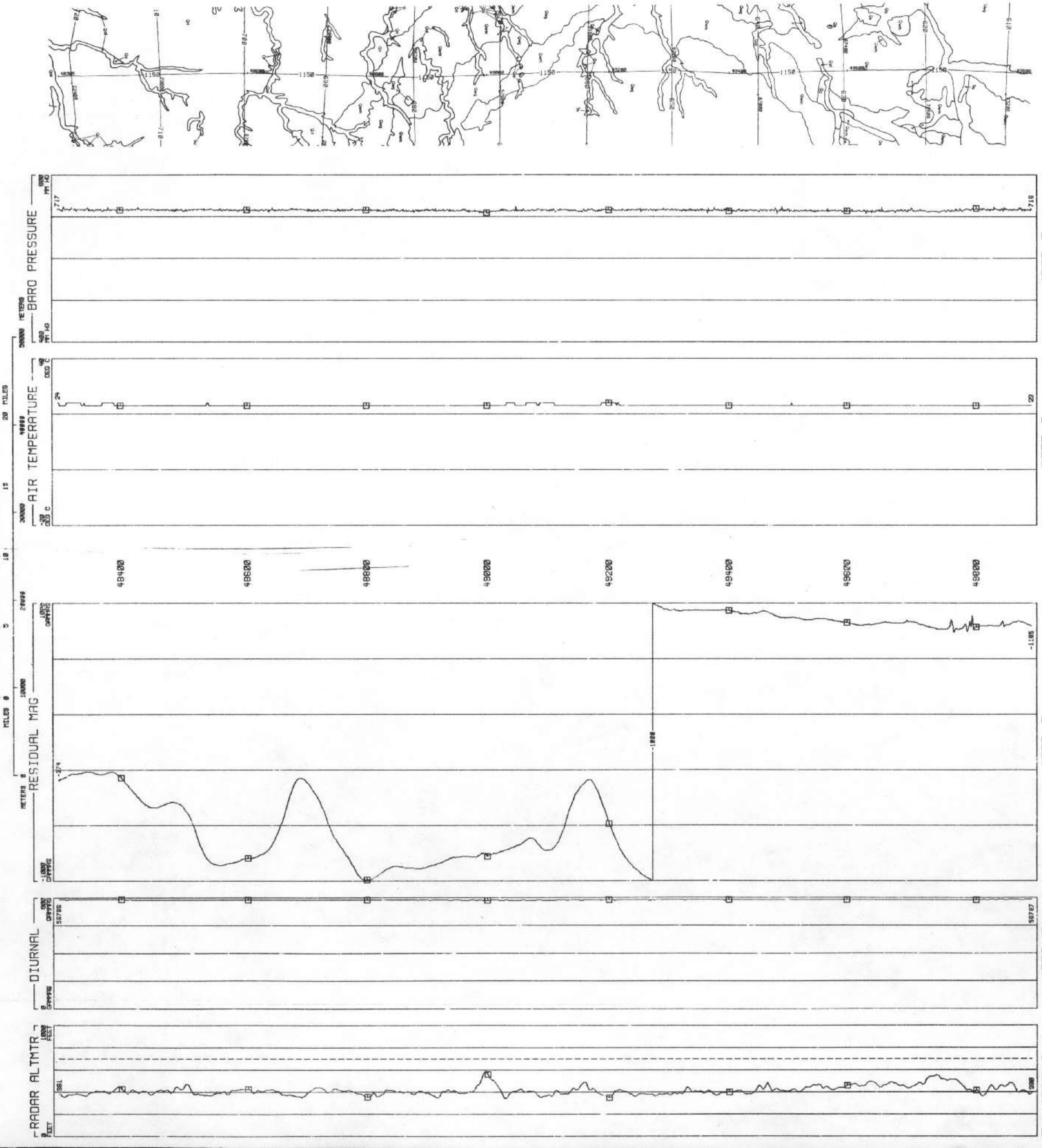



LINE 710
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
22800
23000
23200
23400
23600
23800
24000
24200
24400
24600
24800
25000
25200
BARO PRESSURE MM HG
MIN 708.3
MAX 736.1
MEAN 721.7
STD DEV 3.631
AIR TEMPERATURE DEG C
MIN 16.00
MAX 19.00
MEAN 17.46
STD DEV .6365
RESIDUAL MAG GAMMAS
MIN -1373
MAX 349.7
MEAN -806.8
STD DEV 401.1
DIURNAL GAMMAS
MIN 56570
MAX 56582
MEAN 56568
STD DEV 9.489
RADAR ALTMTR FEET
MIN 249.7
MAX 583.5
MEAN 404.7
STD DEV 52.48

D30 co


LINE 720
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
22600
22400
22200
22000
21800
21600
21400
21200
21000
20800
20600
20400
20200
BARO PRESSURE MM HG
MIN 710.1
MAX 735.6
MEAN 722.3
STD DEV 3.673
AIR TEMPERATURE DEG C
MIN 15.00
MAX 17.00
MEAN 16.28
STD DEV .5925
RESIDUAL MAG GAMMAS
MIN -1700
MAX 442.0
MEAN -806.6
STD DEV 432.2
DIURNAL GAMMAS
MIN 56581
MAX 56586
MEAN 56578
STD DEV 6.372
RADAR ALTMTR FEET
MIN 291.5
MAX 633.3
MEAN 414.4
STD DEV 50.98
LINE 720

LINE 1150
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143



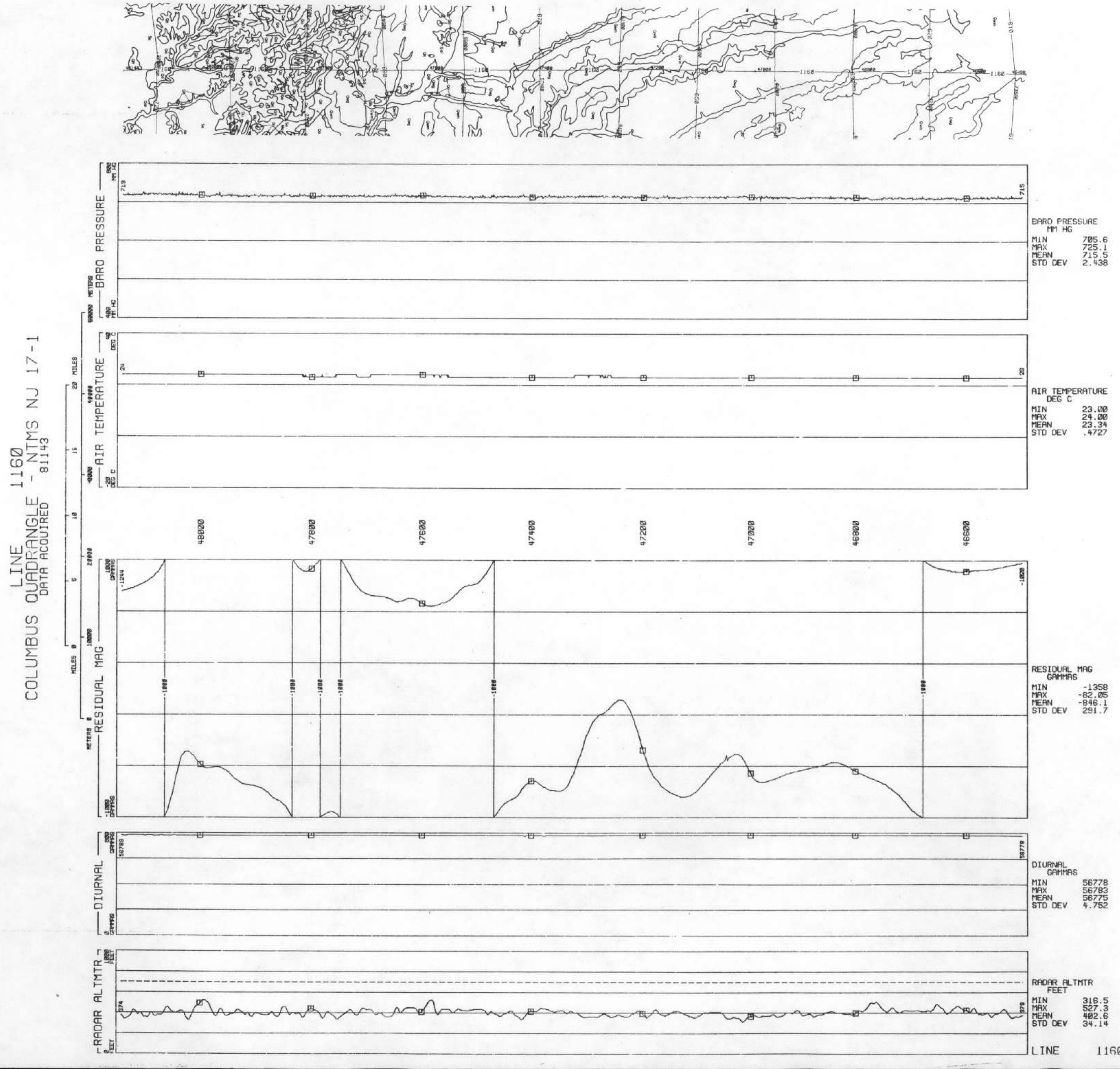
BARO PRESSURE
MM HG
MIN 707.2
MAX 724.5
MEAN 715.2
STD DEV 2.029

AIR TEMPERATURE
DEG C
MIN 23.00
MAX 24.00
MEAN 23.08
STD DEV .2775

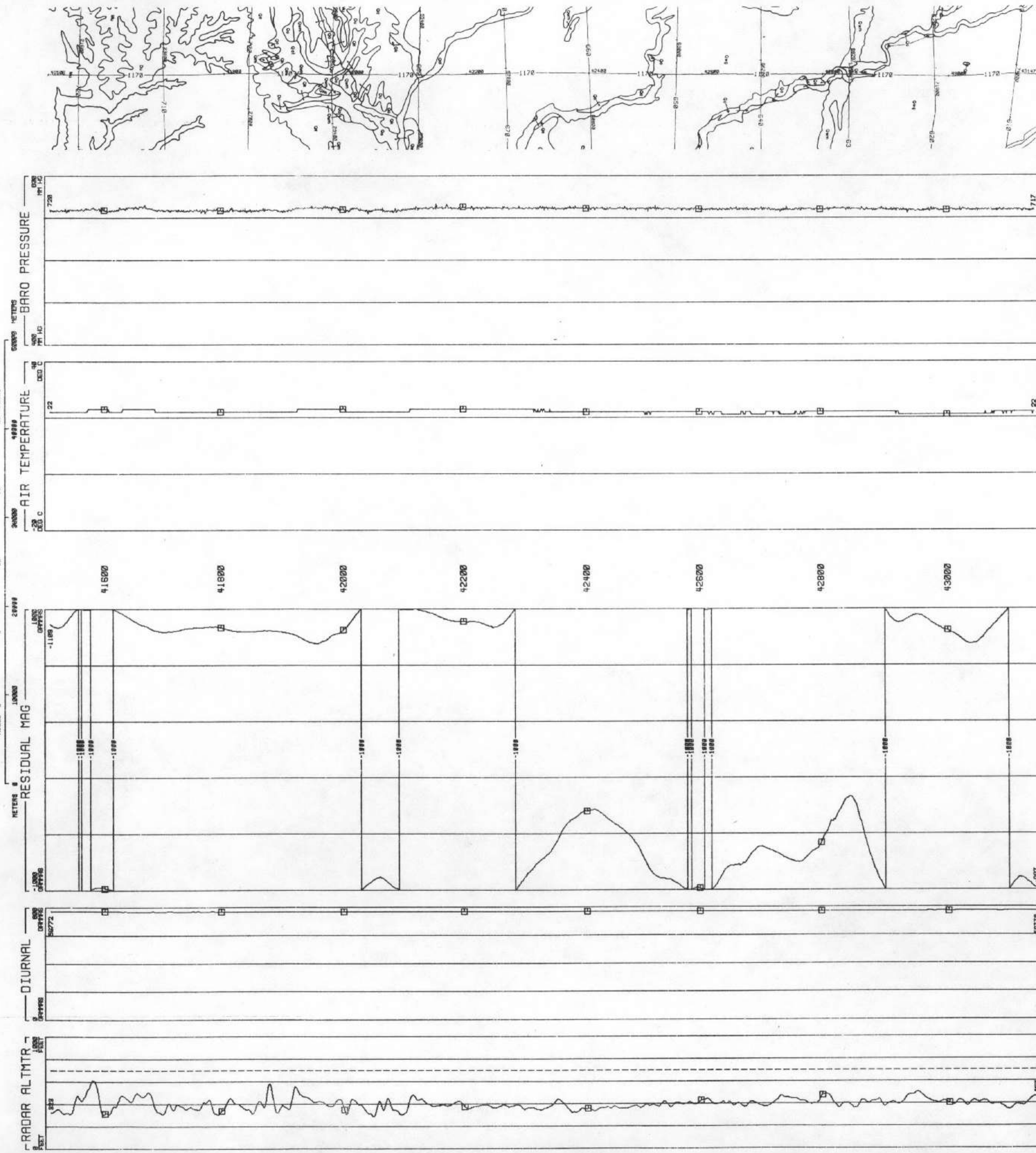
RESIDUAL MAG
GAMMAS
MIN -1207
MAX -211.2
MEAN -833.7
STD DEV 297.5

DIURNAL
GAMMAS
MIN 56781
MAX 56788
MEAN 56780
STD DEV 4.349

RADAR ALTMTR
FEET
MIN 342.7
MAX 570.5
MEAN 415.6
STD DEV 40.13


LINE 1160
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
48000
47800
47600
47400
47200
47000
46800
46600
BARO PRESSURE MM HG
MIN 705.6
MAX 725.1
MEAN 715.5
STD DEV 2.438
AIR TEMPERATURE DEG C
MIN 23.00
MAX 24.00
MEAN 23.34
STD DEV .4727
RESIDUAL MAG GAMMAS
MIN -1358
MAX -82.05
MEAN -846.1
STD DEV 291.7
DIURNAL GAMMAS
MIN 56778
MAX 56783
MEAN 56775
STD DEV 4.752
RADAR ALTMTR FEET
MIN 316.5
MAX 527.3
MEAN 402.6
STD DEV 34.14
LINE 1160

LINE 1170
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143



BARO PRESSURE
MM HG
MIN 710.6
MAX 732.9
MEAN 720.4
STD DEV 2.946

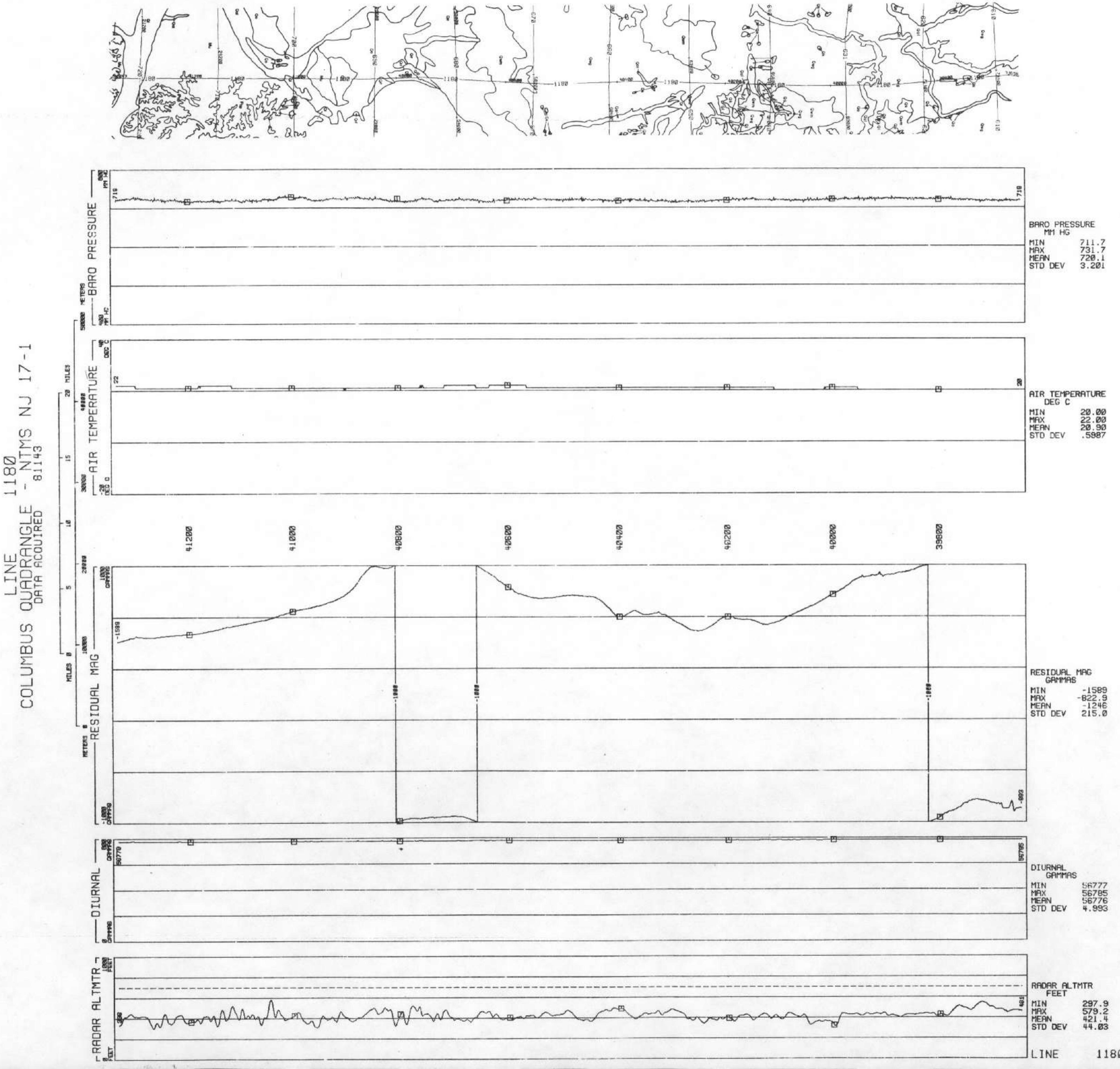
AIR TEMPERATURE
DEG C
MIN 21.00
MAX 23.00
MEAN 22.06
STD DEV .6178

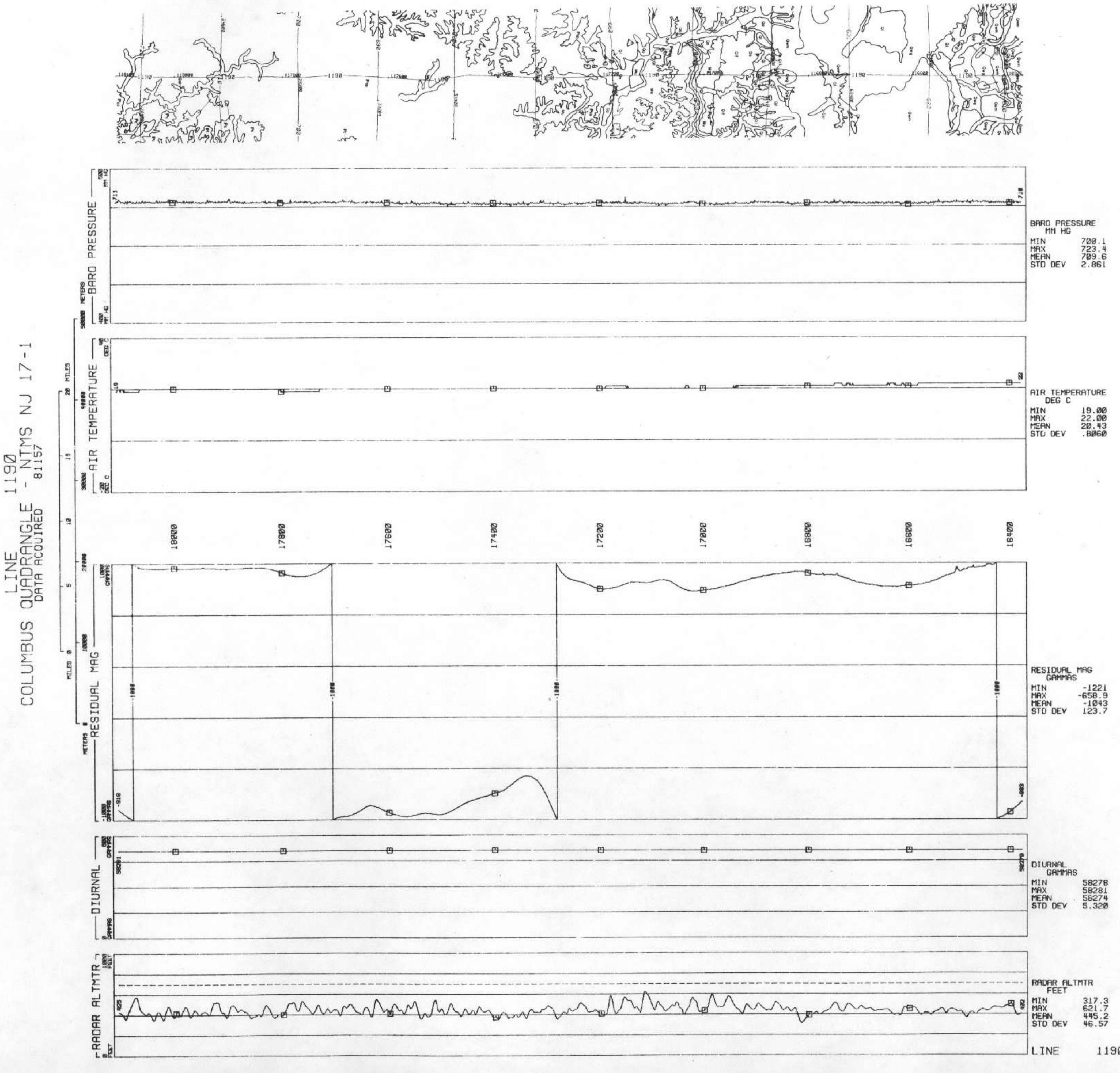
RESIDUAL MAG
GAMMAS
MIN -1249
MAX -336.5
MEAN -948.9
STD DEV 223.9

DIURNAL
GAMMAS
MIN 56766
MAX 56772
MEAN 56766
STD DEV 3.247

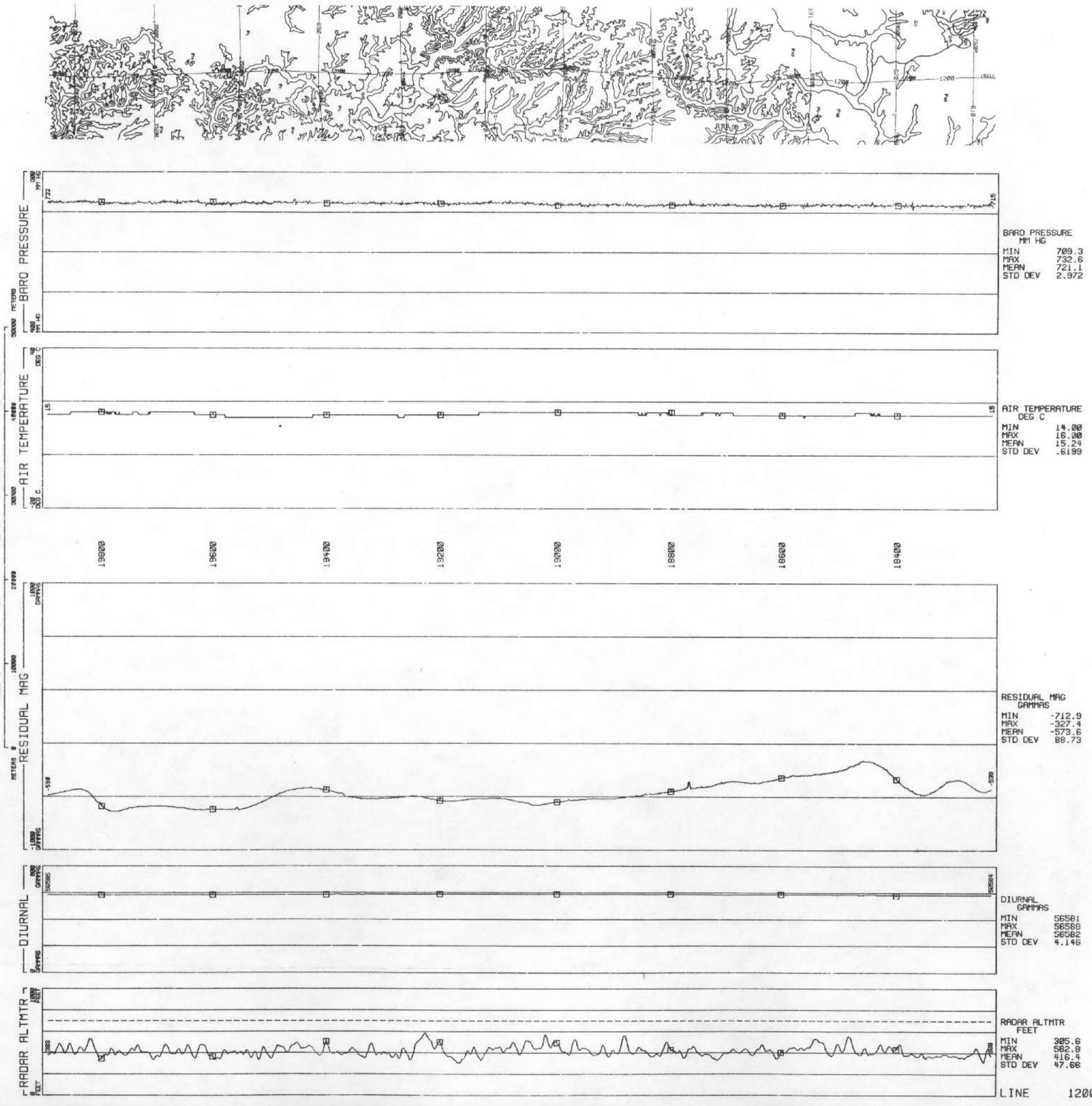
RADAR ALTMTR
FEET
MIN 287.6
MAX 610.0
MEAN 398.3
STD DEV 47.46

LINE 1170


LINE 1180
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81143
MILES 0 5 10 15 20 MILES
METERS 0 10000 20000 30000 40000 50000 METERS
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
41200
41000
40800
40600
40400
40200
40000
39800
BARO PRESSURE MM HG
MIN 711.7
MAX 731.7
MEAN 720.1
STD DEV 3.201
AIR TEMPERATURE DEG C
MIN 20.00
MAX 22.00
MEAN 20.90
STD DEV .5987
RESIDUAL MAG GAMMAS
MIN -1589
MAX -822.9
MEAN -1246
STD DEV 215.0
DIURNAL GAMMAS
MIN 56777
MAX 56785
MEAN 56776
STD DEV 4.993
RADAR ALTMTR FEET
MIN 297.9
MAX 579.2
MEAN 421.4
STD DEV 44.03
LINE 1180

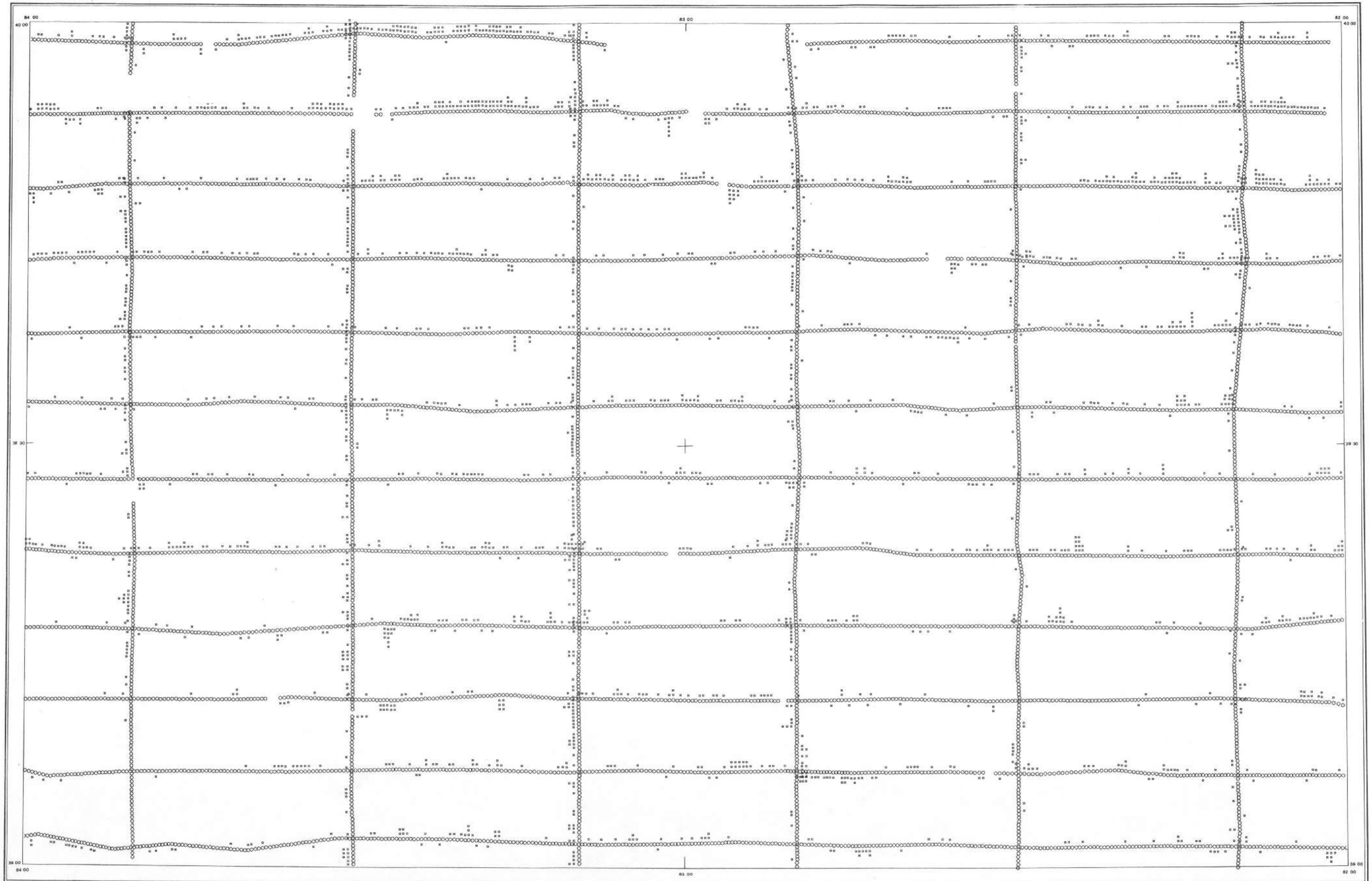

LINE 1190
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81:157
BARO PRESSURE
AIR TEMPERATURE
RESIDUAL MAG
DIURNAL
RADAR ALTMTR
18000
17800
17600
17400
17200
17000
16800
16600
16400
BARO PRESSURE MM HG
MIN 700.1
MAX 723.4
MEAN 709.6
STD DEV 2.861
AIR TEMPERATURE DEG C
MIN 19.00
MAX 22.00
MEAN 20.43
STD DEV .8060
RESIDUAL MAG GAMMAS
MIN -1221
MAX -658.9
MEAN -1043
STD DEV 123.7
DIURNAL GAMMAS
MIN 58270
MAX 58281
MEAN 58274
STD DEV 5.320
RADAR ALTMTR FEET
MIN 317.3
MAX 621.7
MEAN 445.2
STD DEV 46.57
LINE 1190

LINE 1200
COLUMBUS QUADRANGLE - NTMS NJ 17-1
DATA ACQUIRED 81141



APPENDIX E - Standard Deviation Maps

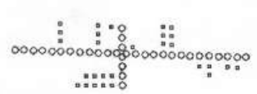
COLUMBUS



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



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

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

SURVEY AND COMPILATION BY:

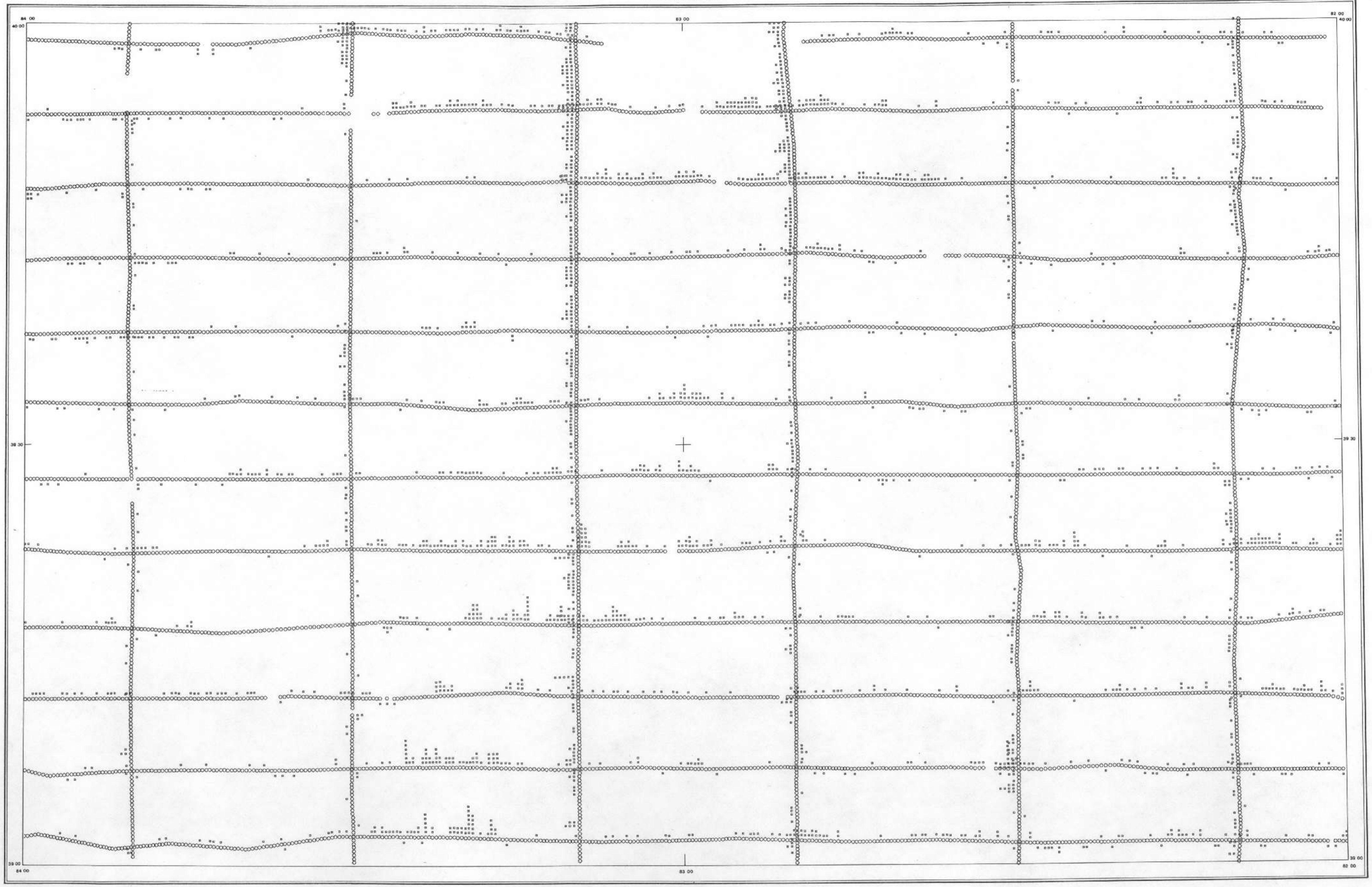
EG&G GEOMETRICS

POTASSIUM STANDARD DEVIATION MAP

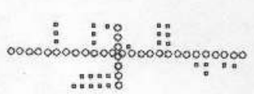
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

COLUMBUS



SCALE 1:500,000



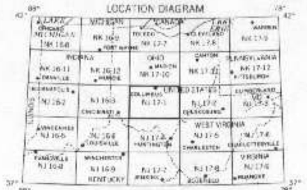
○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

SURVEY AND COMPILATION BY

EG&G GEOMETRICS

LOCATION DIAGRAM

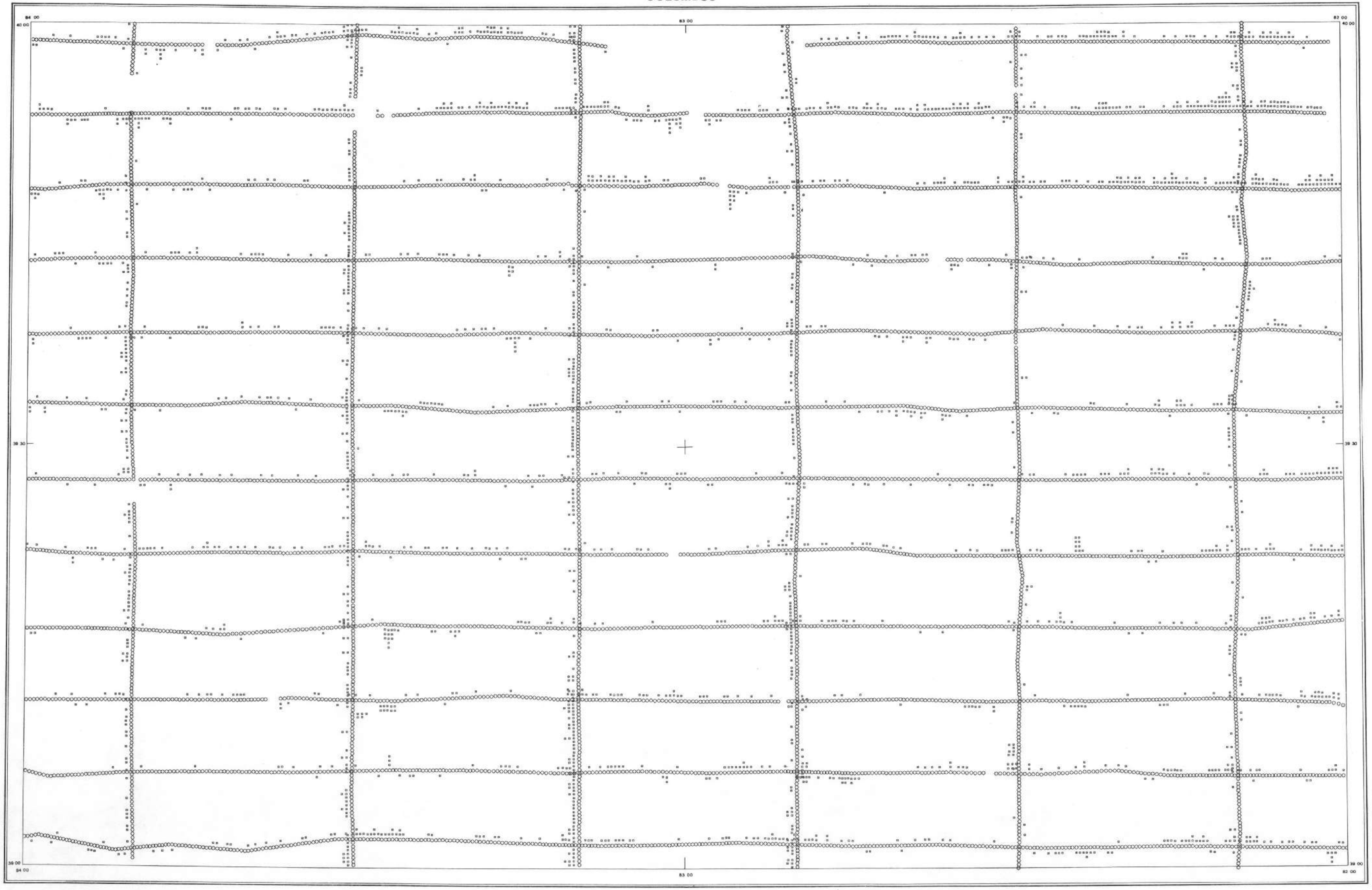


URANIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

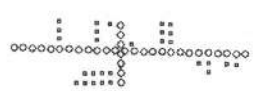
COLUMBUS



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

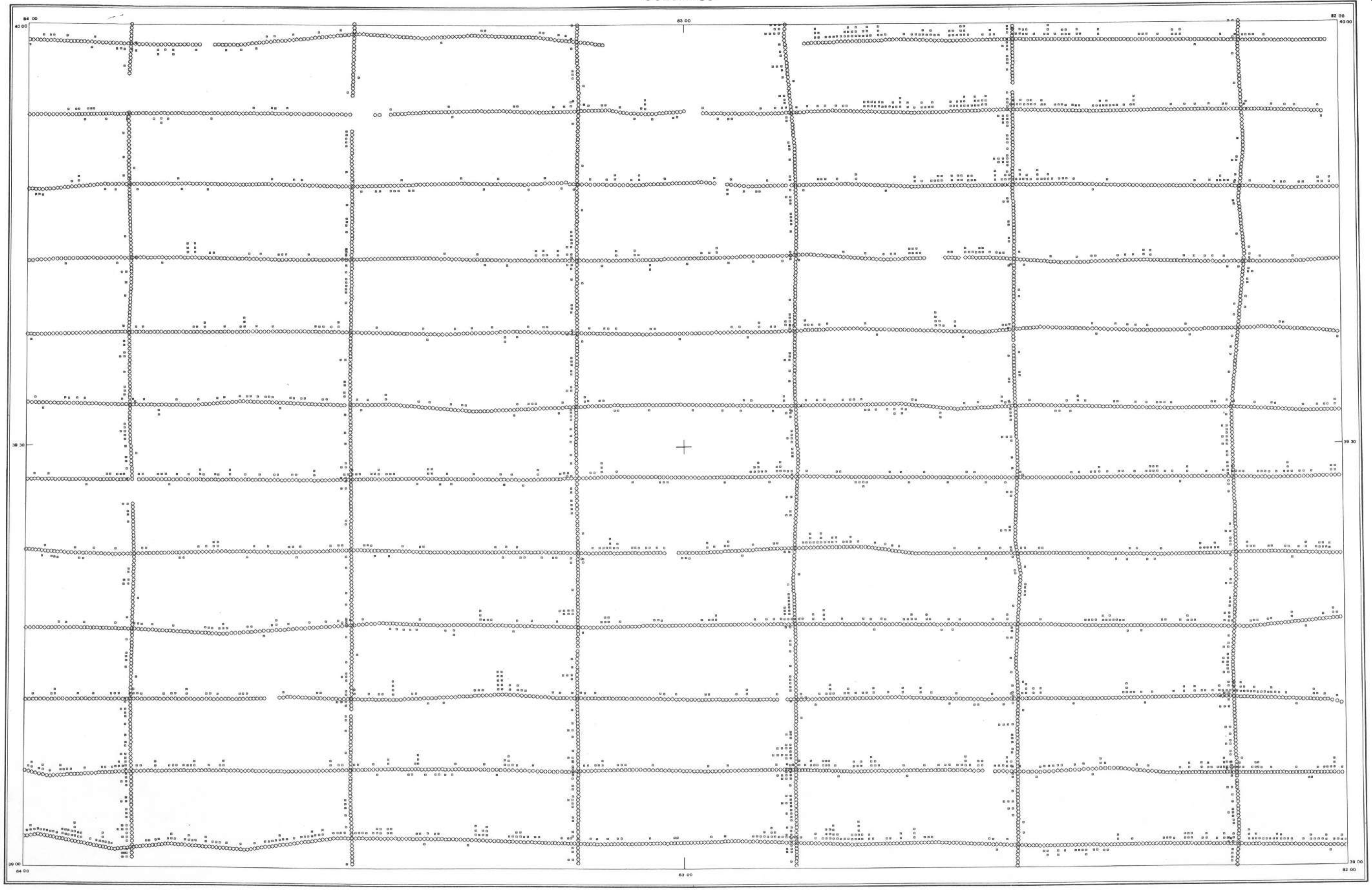
EG&G GEOMETRICS

THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

COLUMBUS



SCALE 1:500,000

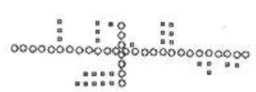
MILES

KILOMETERS

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

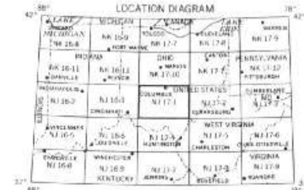
N



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

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

LOCATION DIAGRAM

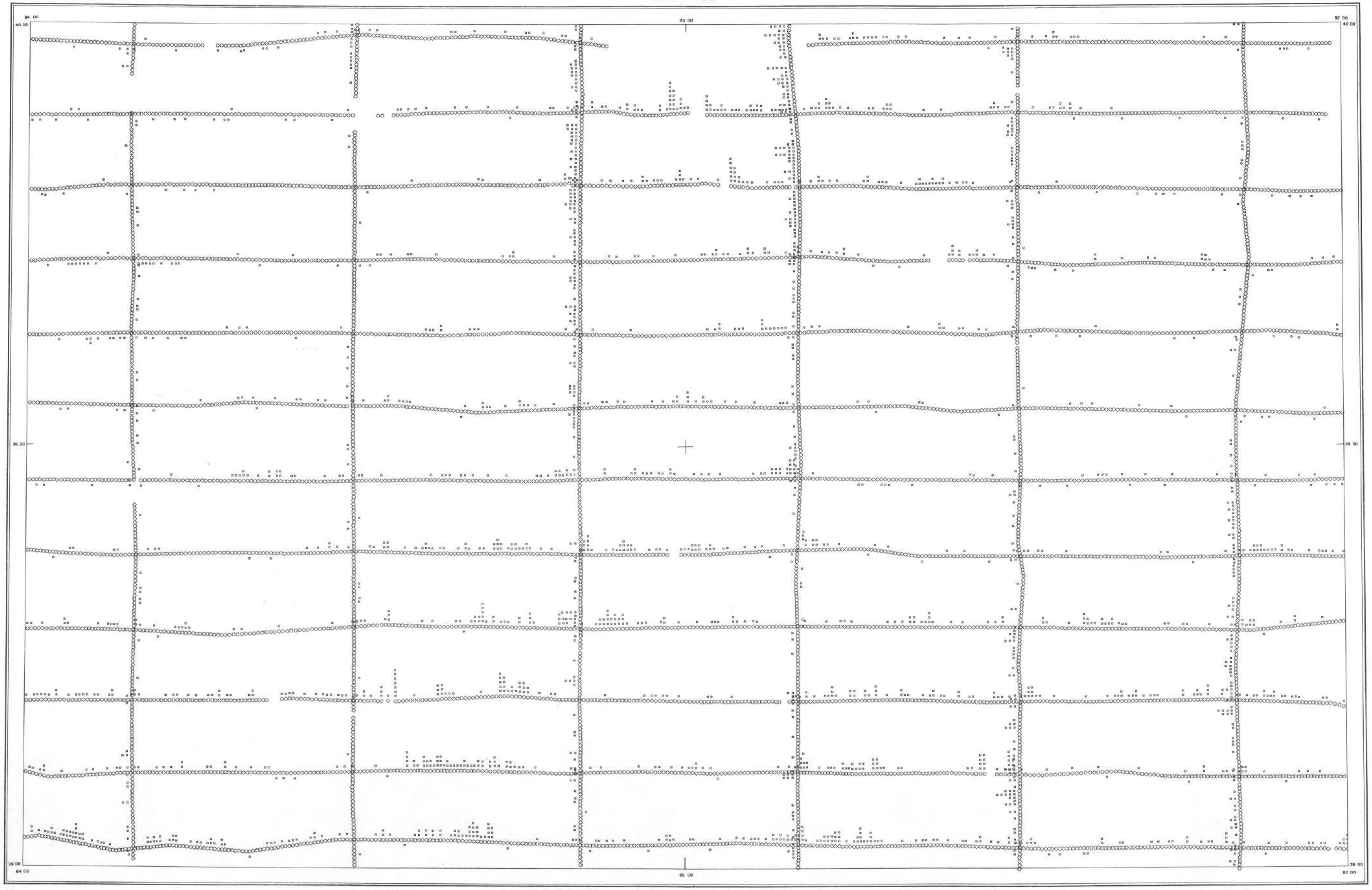


THORIUM / POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

COLUMBUS



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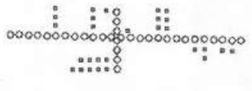
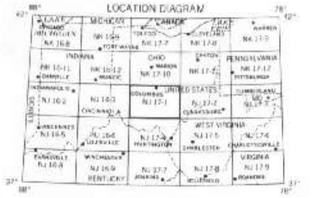


○ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

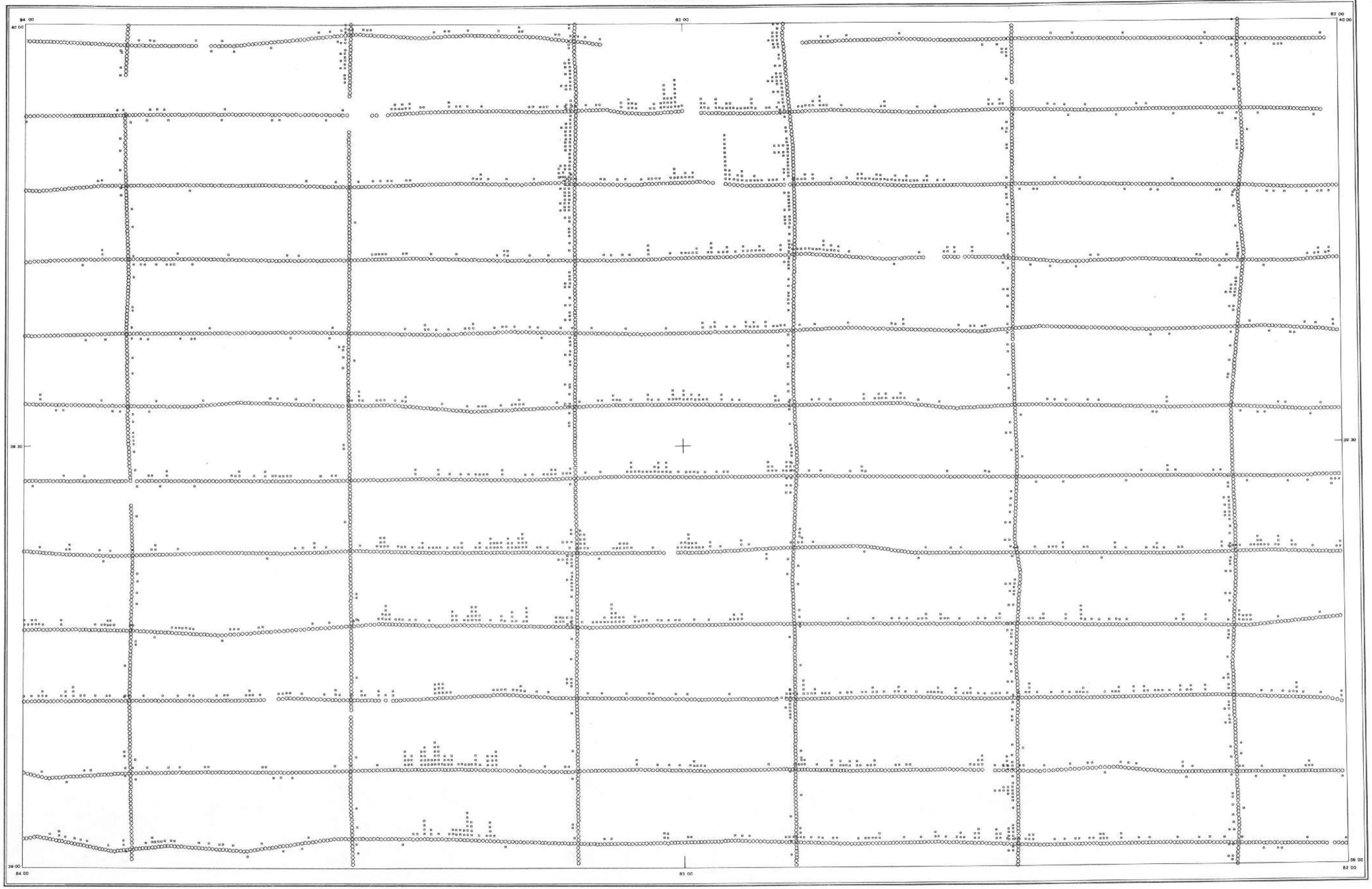
EG&G GEOMETRICS

URANIUM / POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

COLUMBUS



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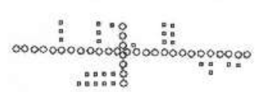
MILES

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

URANIUM / THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

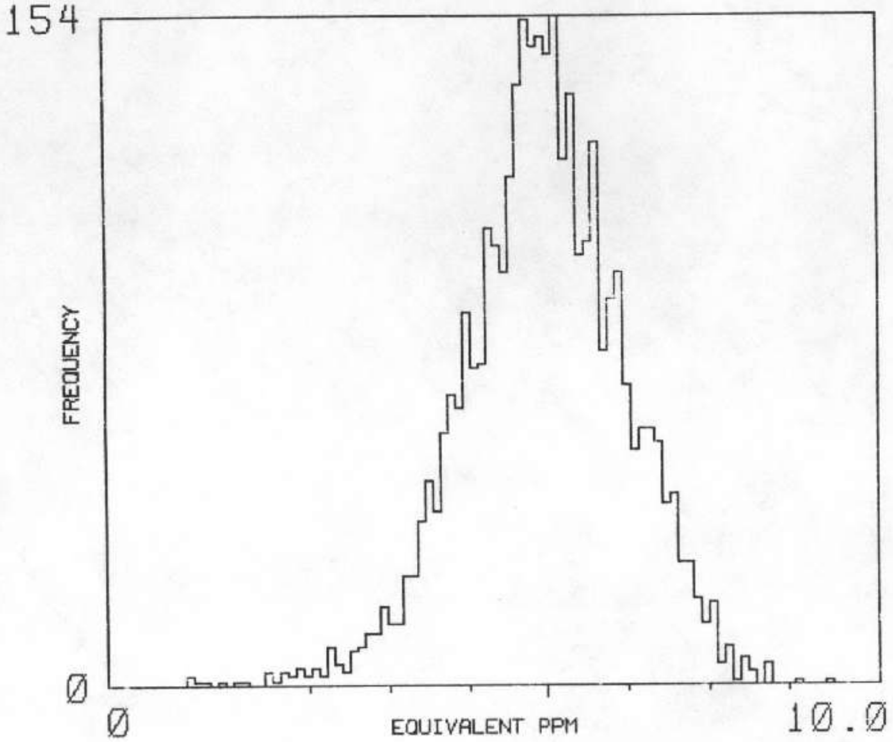
APPENDIX F – Histograms and Map Unit Conversion Table

F1 co

NTMS NJ 17-1 COLUMBUS

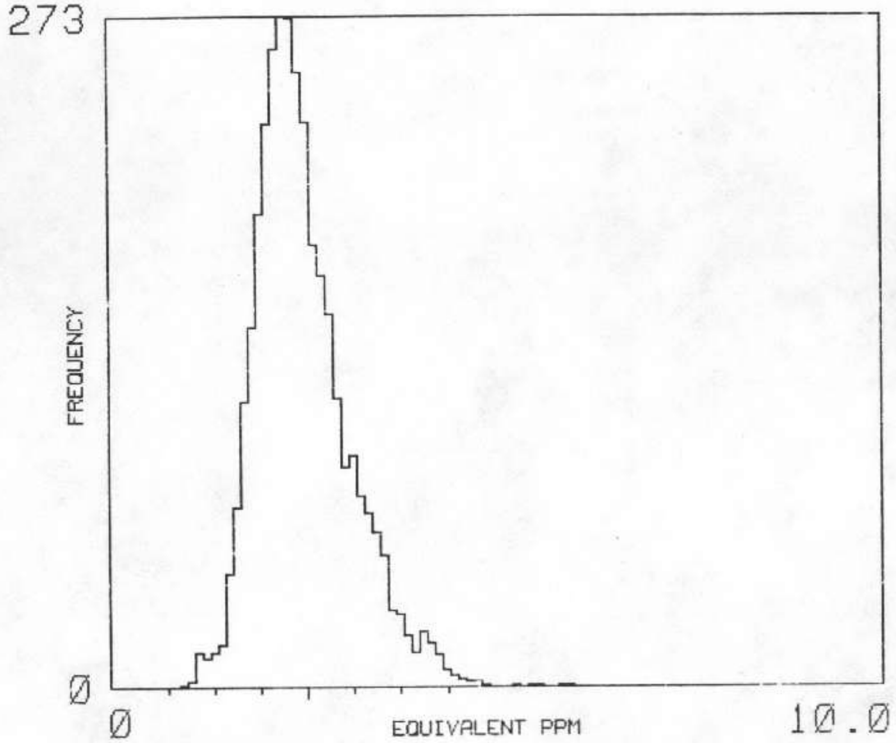
MAP UNIT : QAL TOTAL NUMBER OF SAMPLES 3463

THORIUM



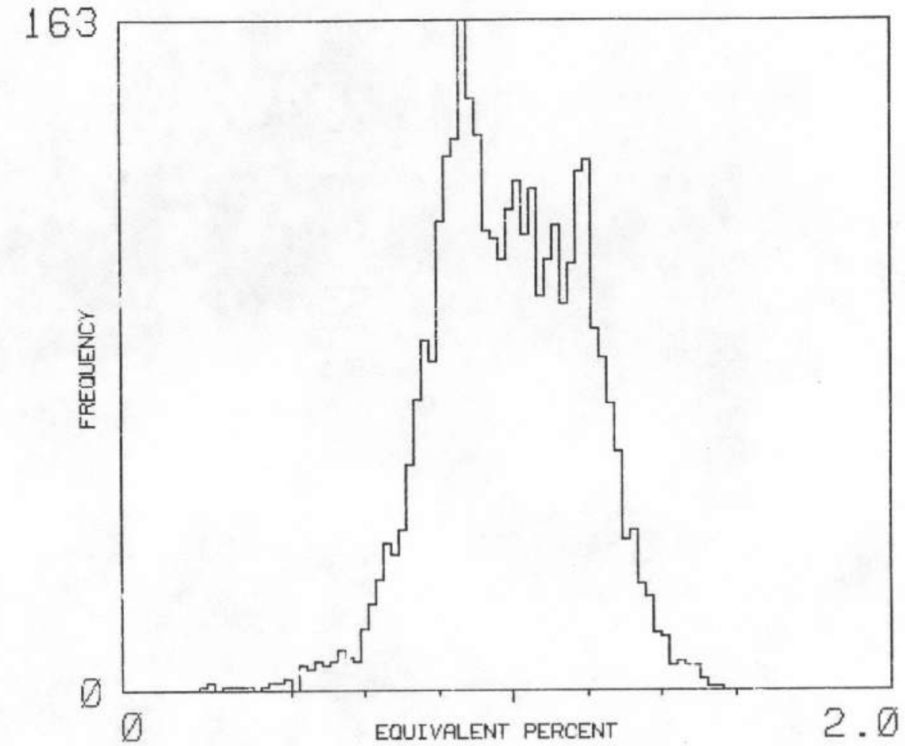
MEAN / MEDIAN 5.7 5.7 3400 ADEQUATE SAMPLES

URANIUM



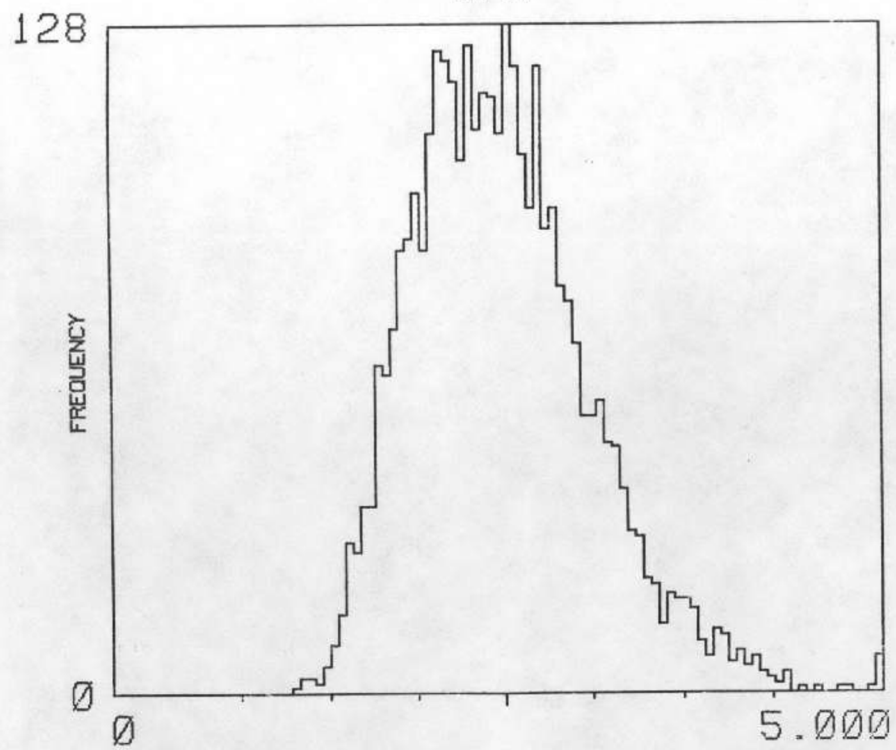
MEAN / MEDIAN 2.6 2.5 3392 ADEQUATE SAMPLES

POTASSIUM



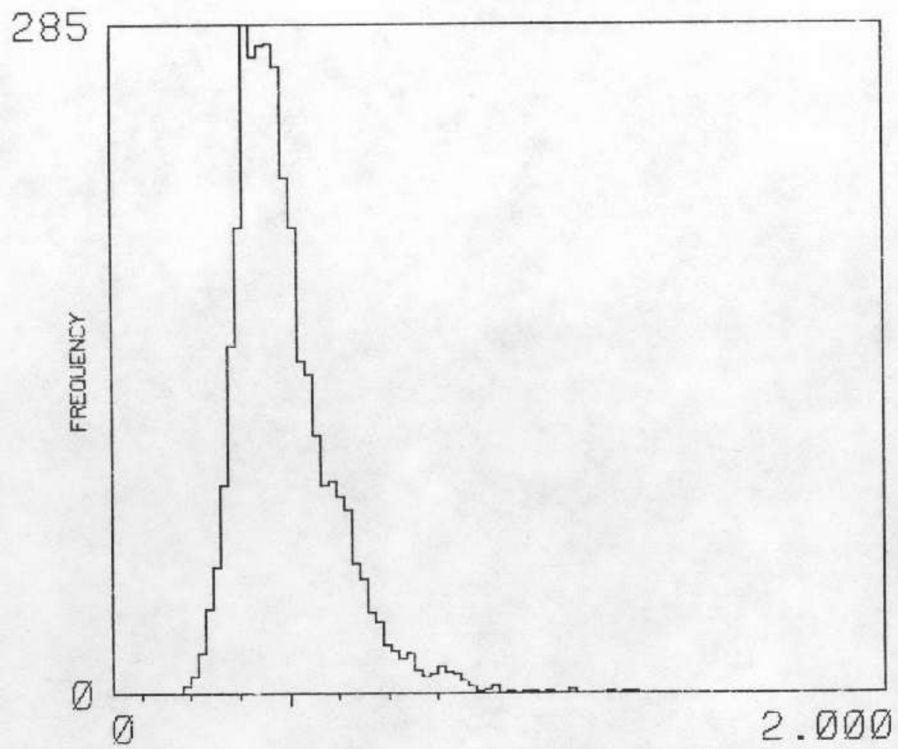
MEAN / MEDIAN 1.Ø 1.Ø 3400 ADEQUATE SAMPLES

U/K



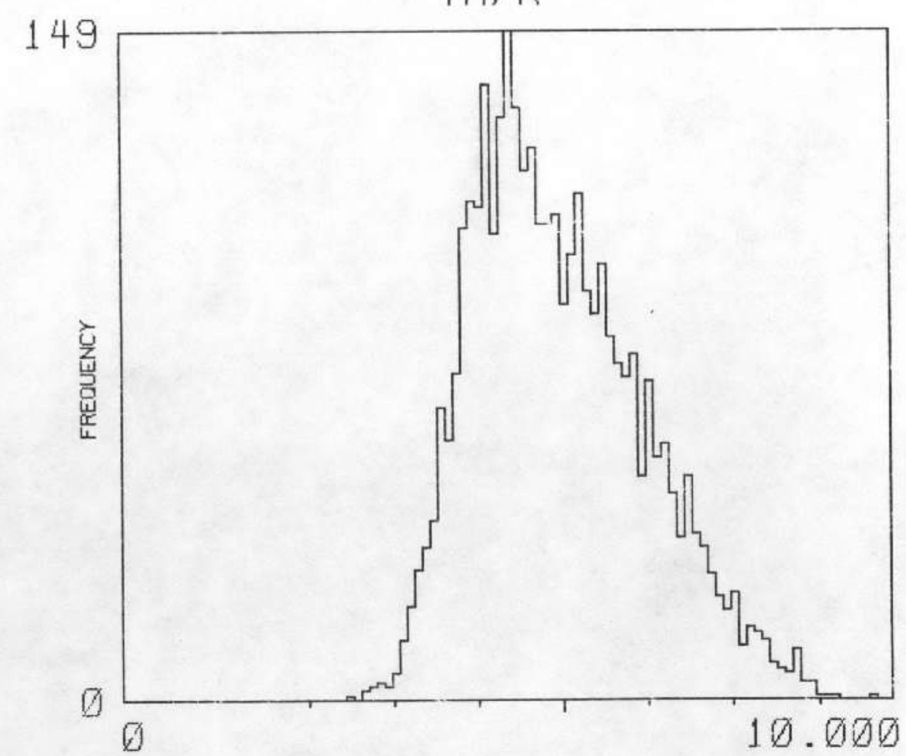
MEAN / MEDIAN 2.553 2.5ØØ 3392 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.458 Ø.44Ø 3392 ADEQUATE SAMPLES

TH/K

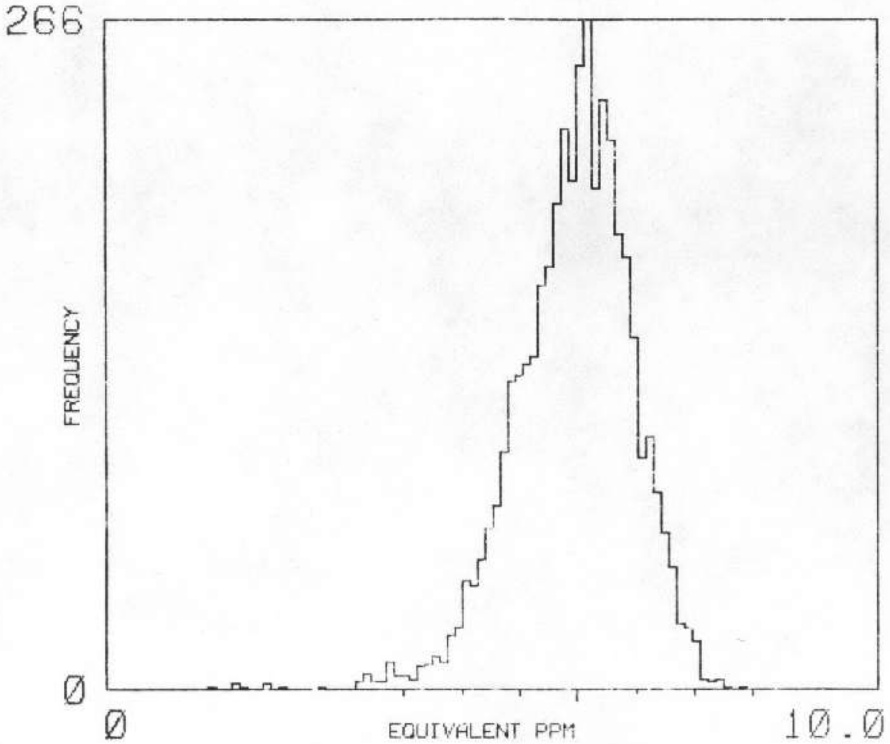


MEAN / MEDIAN 5.726 5.6ØØ 3400 ADEQUATE SAMPLES

F2co

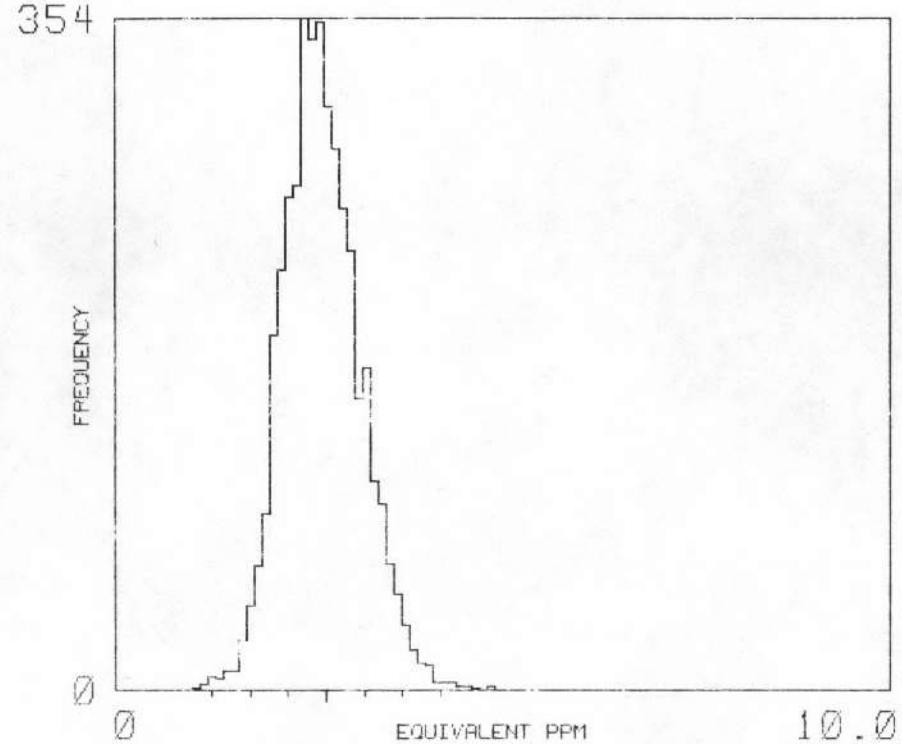
NTMS NJ 17-1 COLUMBUS MAP UNIT : QWM TOTAL NUMBER OF SAMPLES 4078

THORIUM



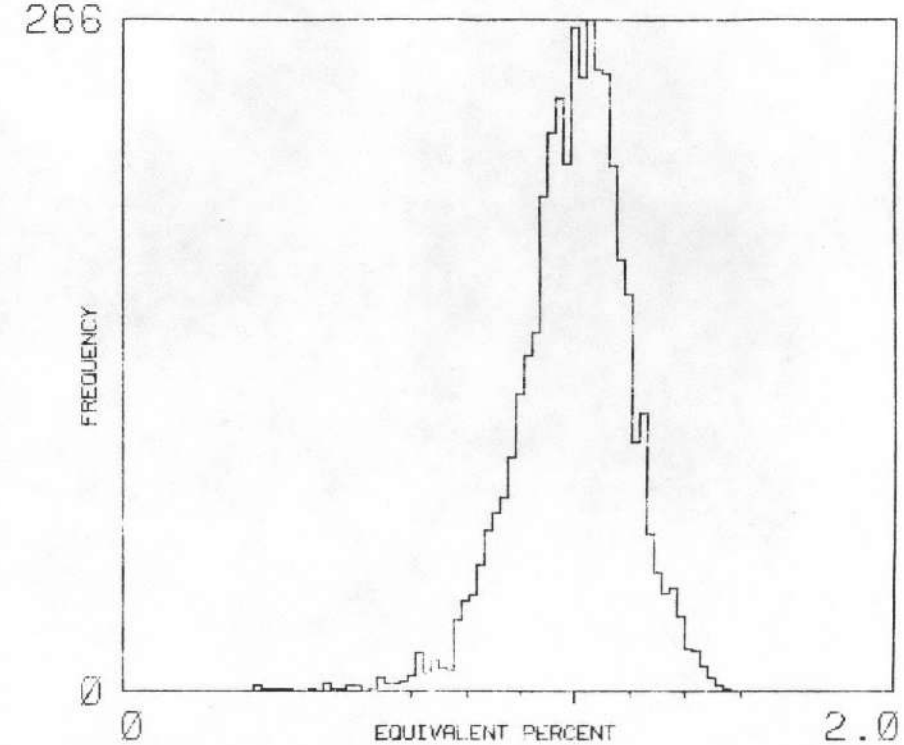
MEAN / MEDIAN 6.1 6.2 4078 ADEQUATE SAMPLES

URANIUM



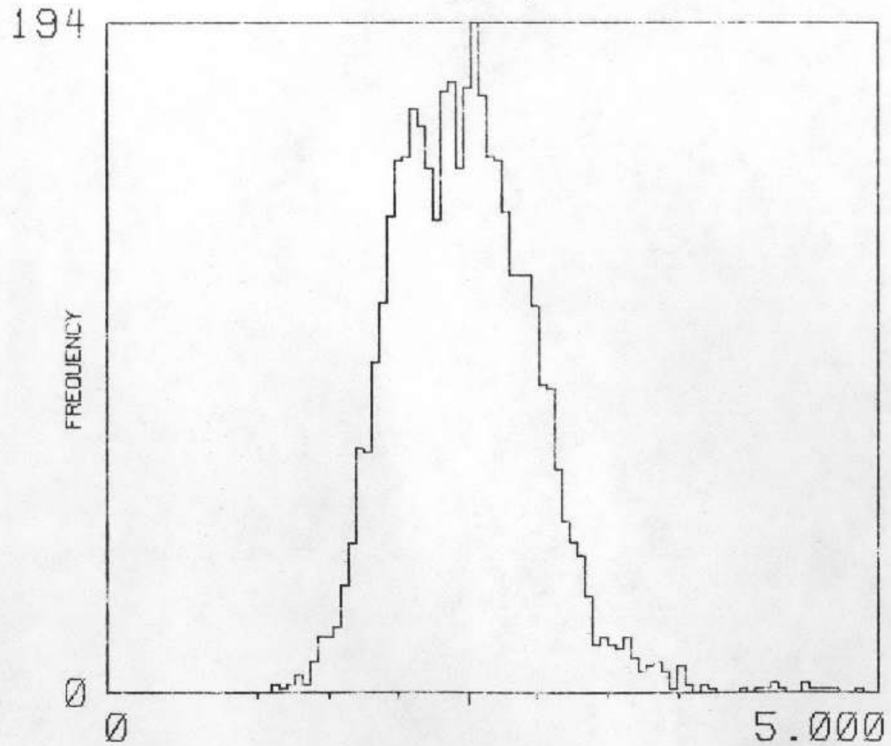
MEAN / MEDIAN 2.7 2.7 4078 ADEQUATE SAMPLES

POTASSIUM



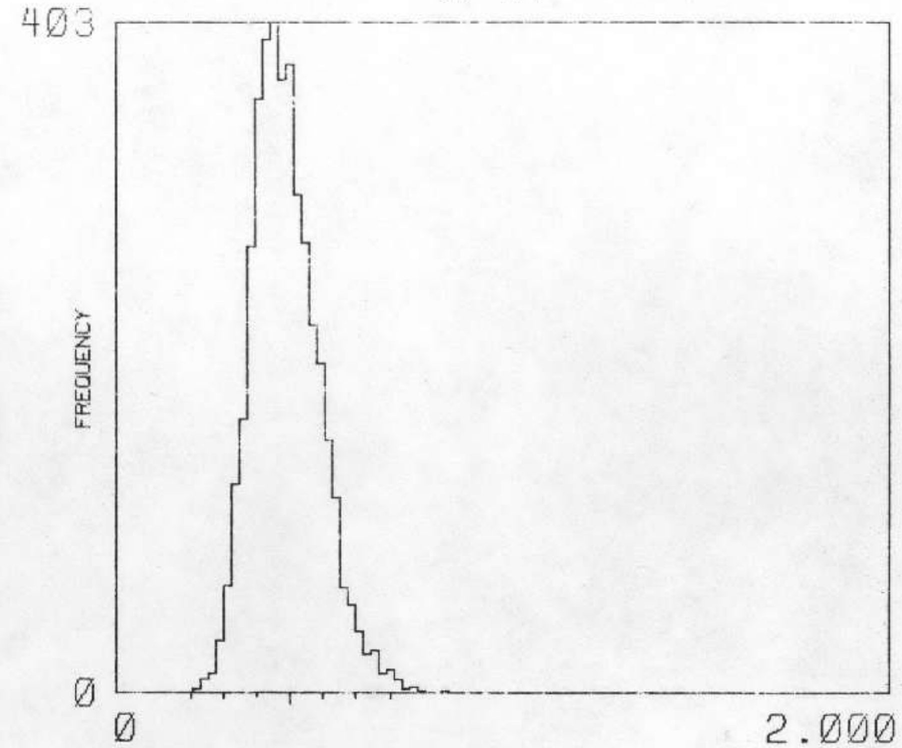
MEAN / MEDIAN 1.2 1.2 4078 ADEQUATE SAMPLES

U/K



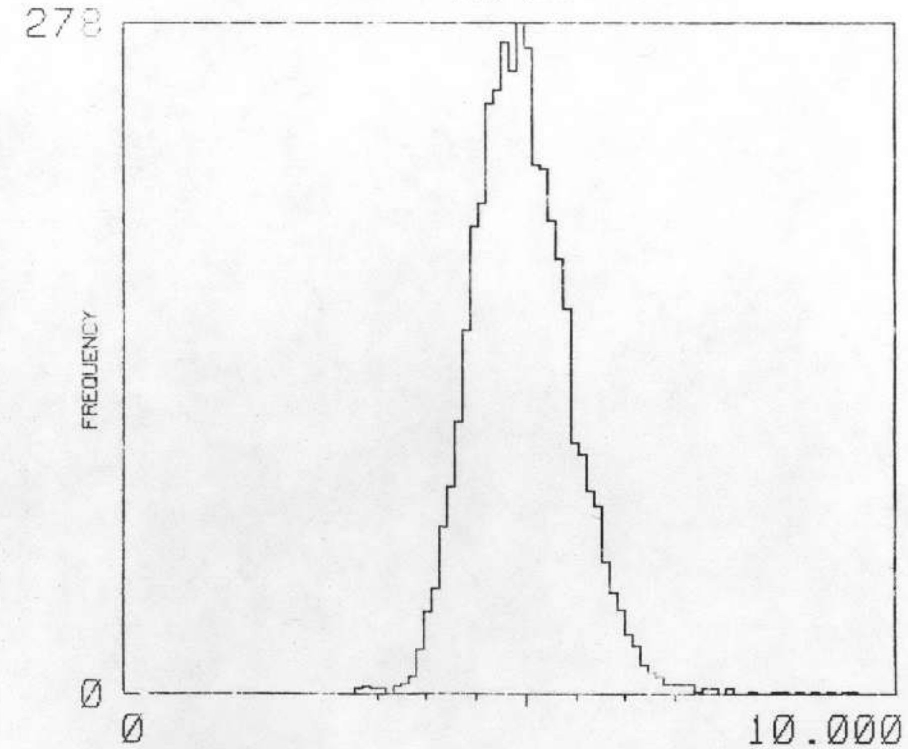
MEAN / MEDIAN 2.336 2.300 4078 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.450 0.440 4078 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 5.221 5.200 4078 ADEQUATE SAMPLES

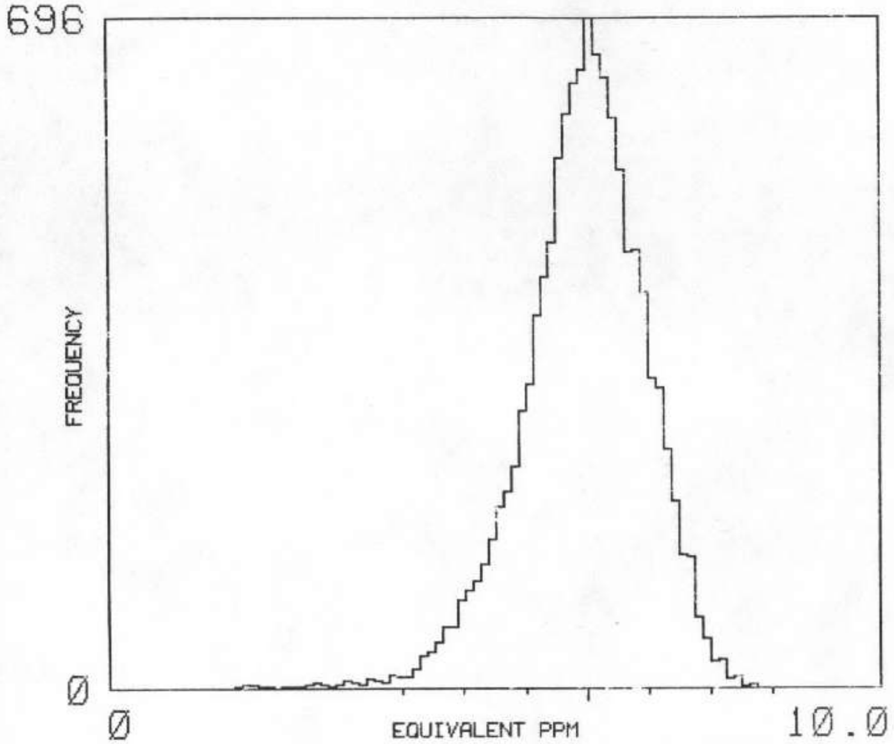
F3 co

NTMS NJ 17-1 COLUMBUS

MAP UNIT : QWG

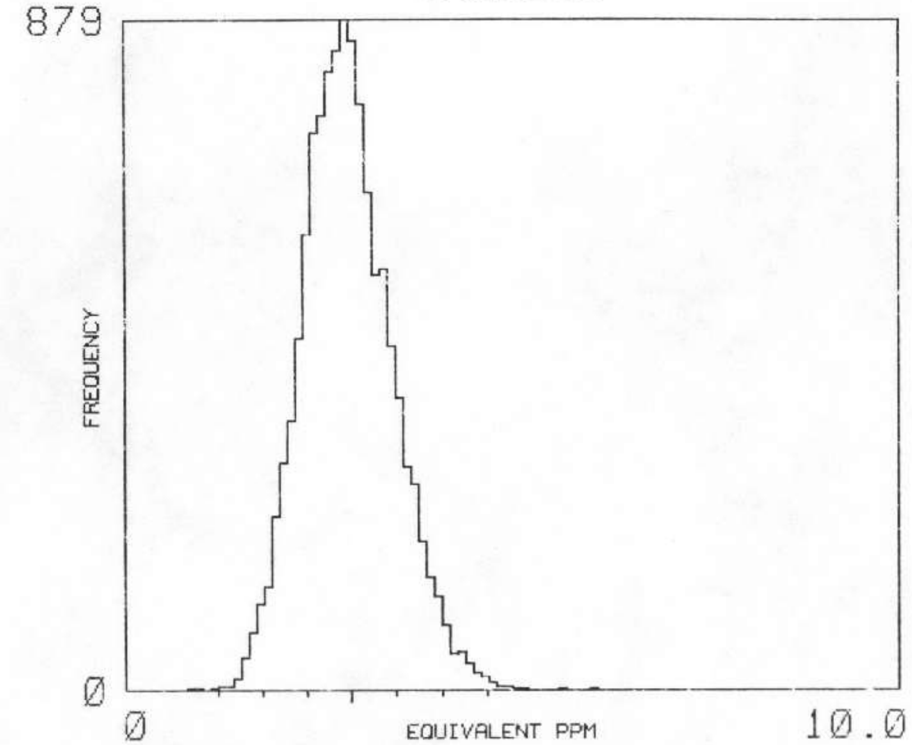
TOTAL NUMBER OF SAMPLES 12011

THORIUM



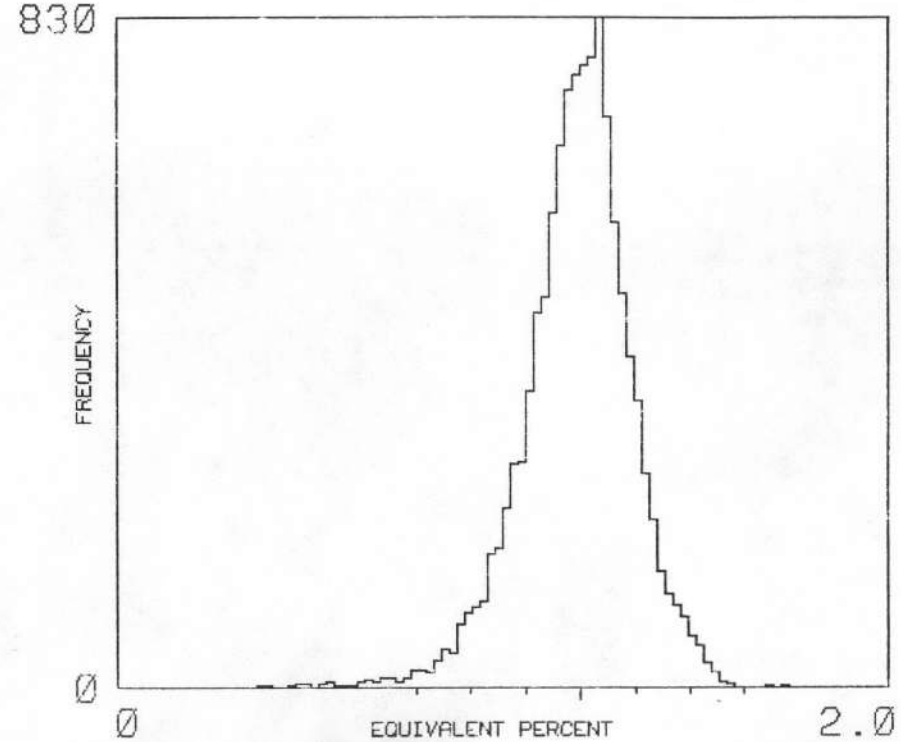
MEAN / MEDIAN 6.2 6.3 11892 ADEQUATE SAMPLES

URANIUM



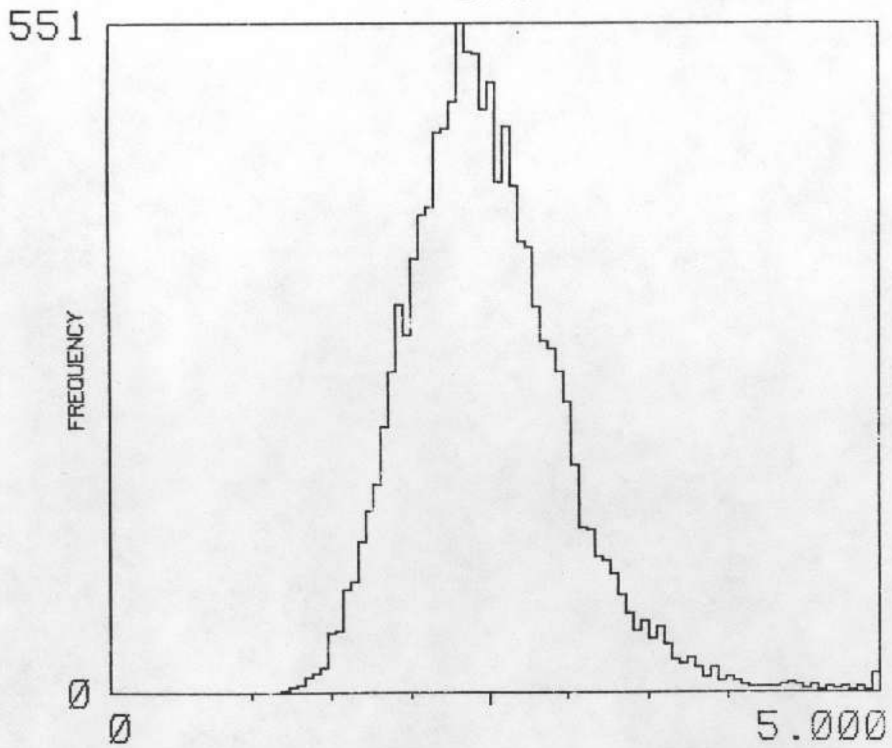
MEAN / MEDIAN 2.9 2.9 11890 ADEQUATE SAMPLES

POTASSIUM



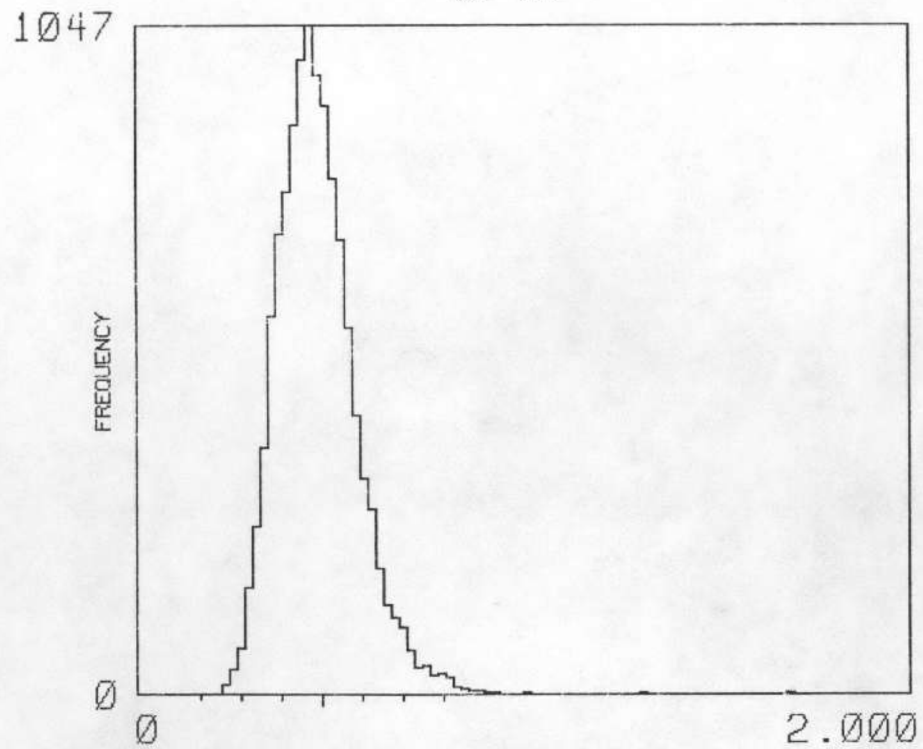
MEAN / MEDIAN 1.2 1.2 11892 ADEQUATE SAMPLES

U/K



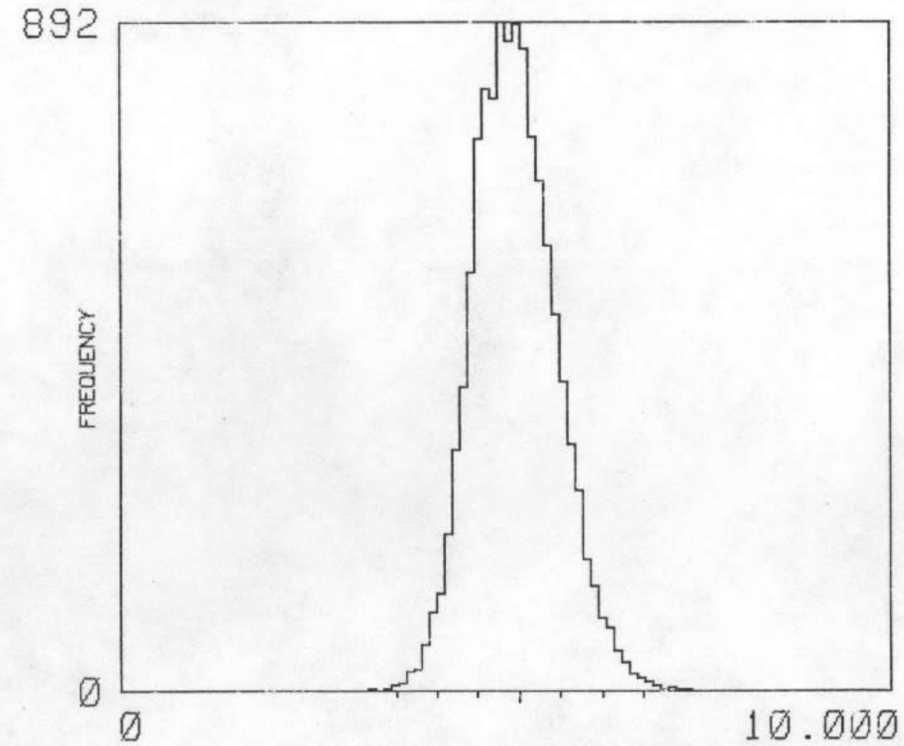
MEAN / MEDIAN 2.463 2.4ØØ 11890 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.479 Ø.46Ø 11890 ADEQUATE SAMPLES

TH/K

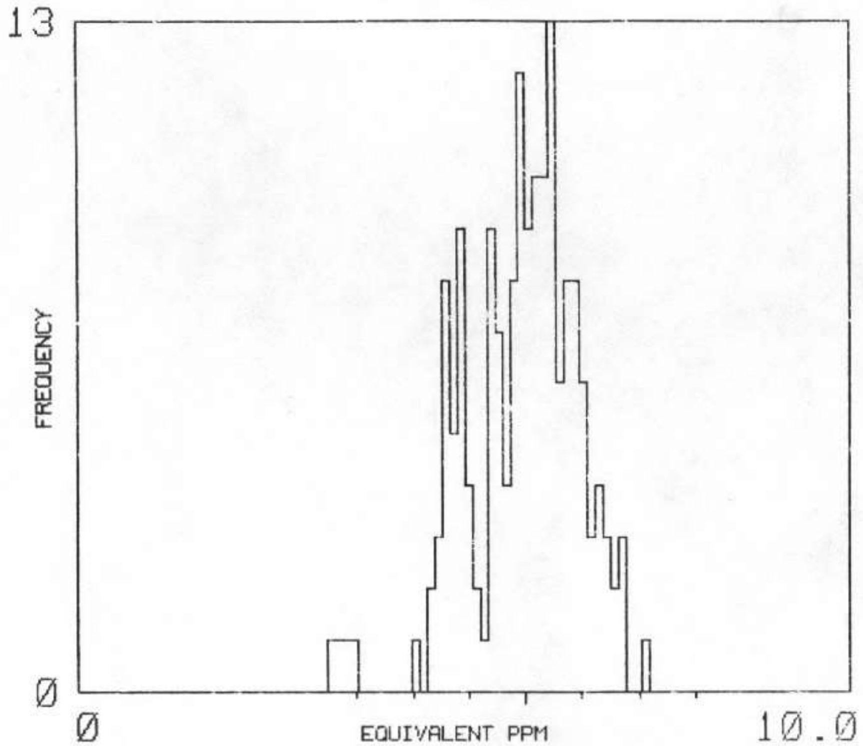


MEAN / MEDIAN 5.172 5.1ØØ 11892 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS MAP UNIT : OK TOTAL NUMBER OF SAMPLES 165

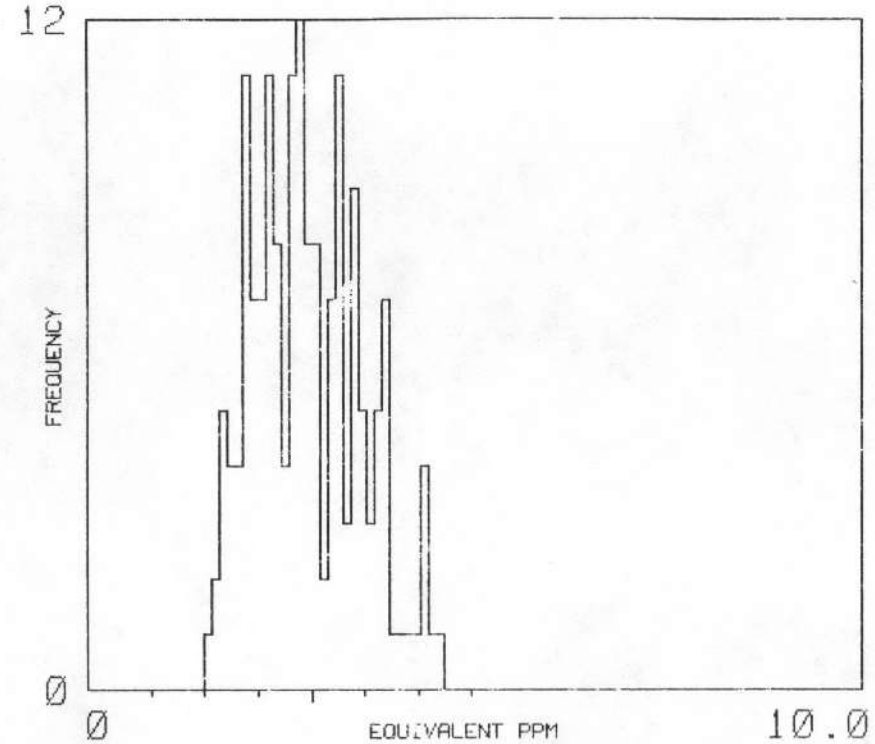
F4 co

THORIUM



MEAN / MEDIAN 5.8 5.9 165 ADEQUATE SAMPLES

URANIUM



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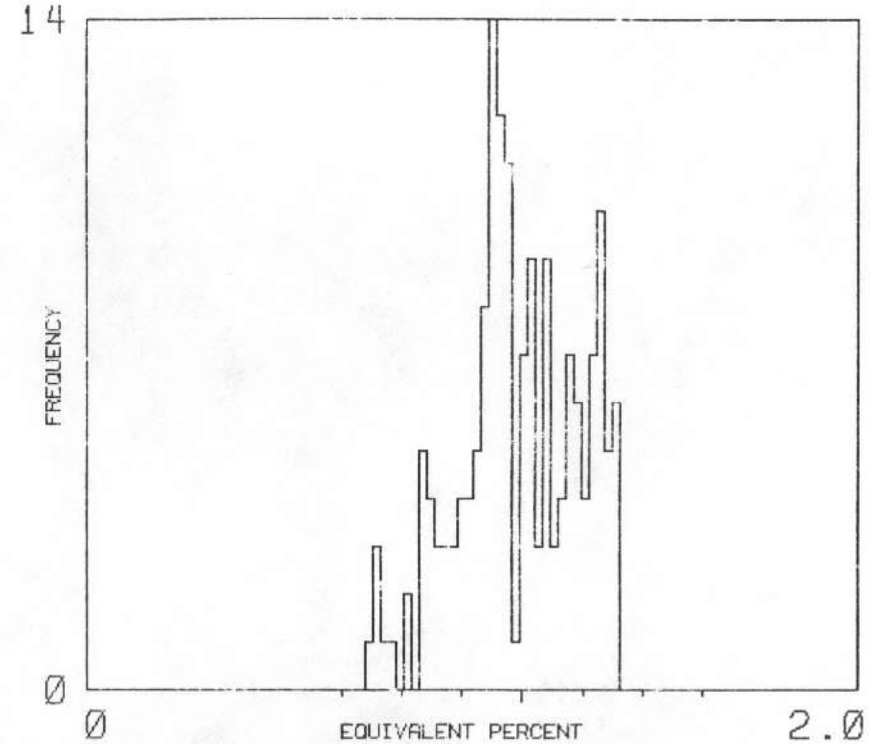
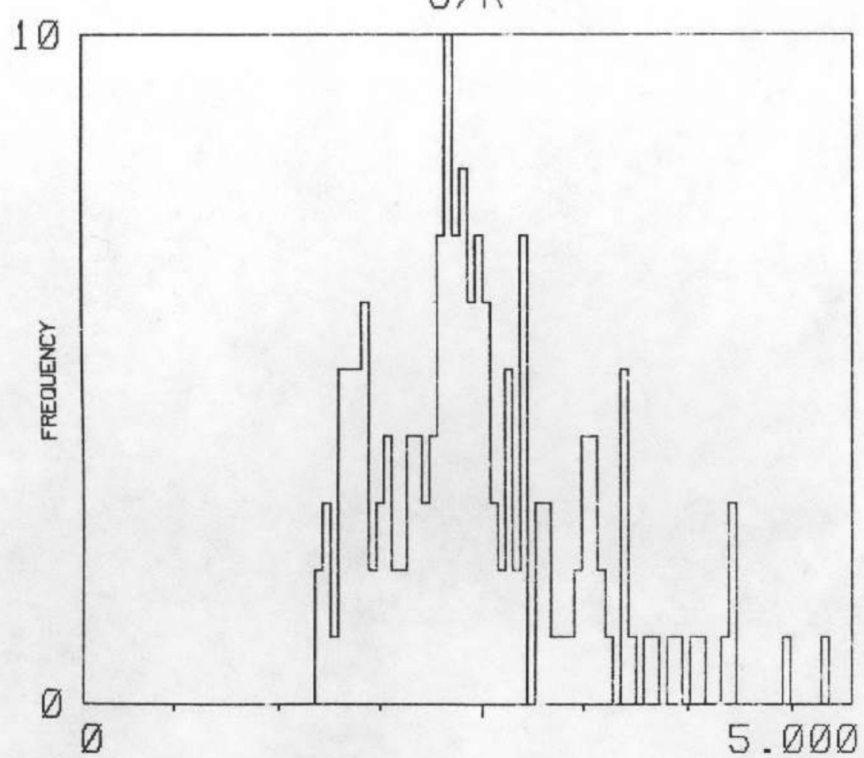


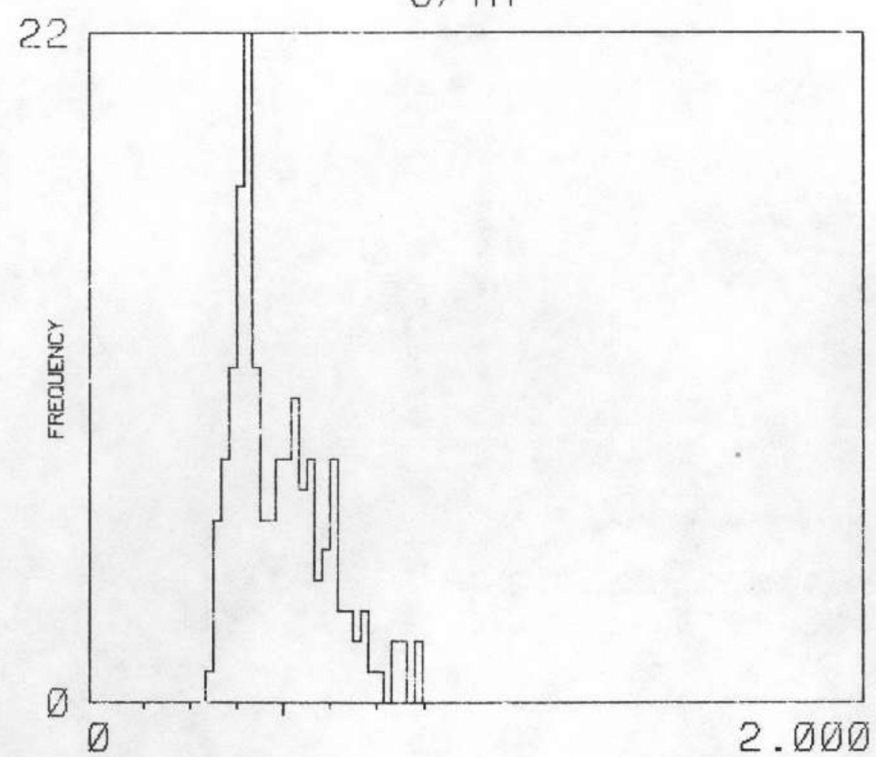
MEAN / MEDIAN 1.1 1.1 165 ADEQUATE SAMPLES

U/K



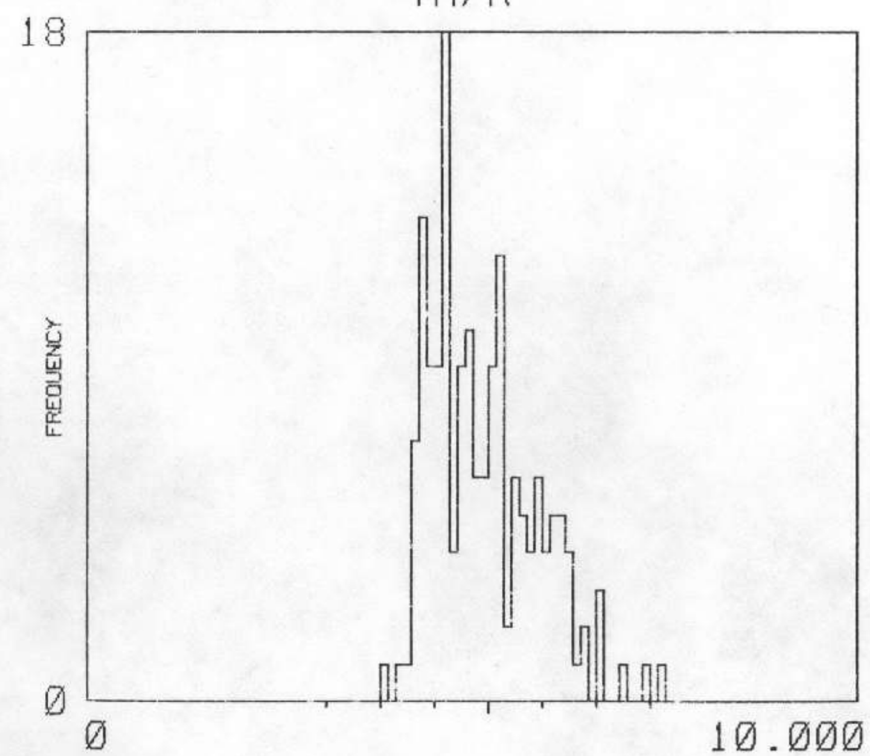
MEAN / MEDIAN 2.598 2.500 165 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.502 0.480 165 ADEQUATE SAMPLES

TH/K



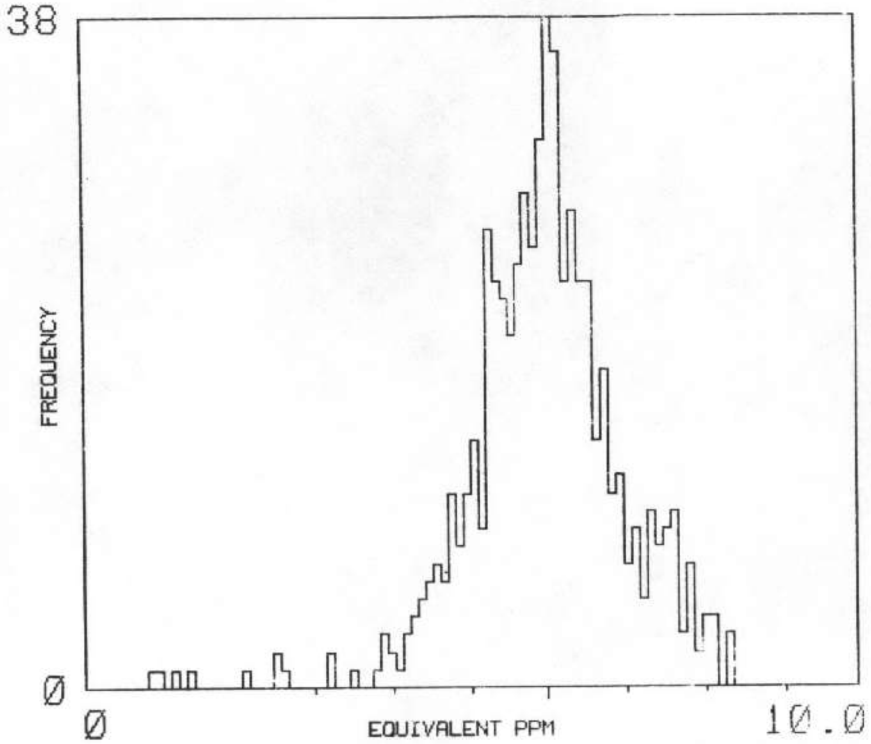
MEAN / MEDIAN 5.197 5.100 165 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS

MAP UNIT : OL

TOTAL NUMBER OF SAMPLES 618

THORIUM



MEAN / MEDIAN 6.0 6.1 607 ADEQUATE SAMPLES

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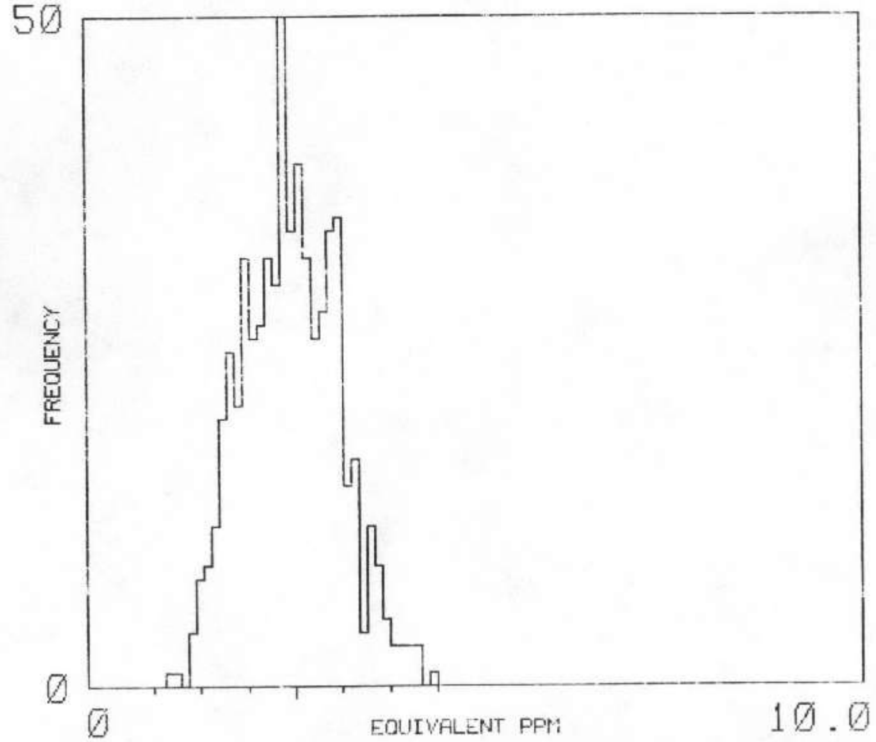

MEAN / MEDIAN 2.7 2.7 601 ADEQUATE SAMPLES

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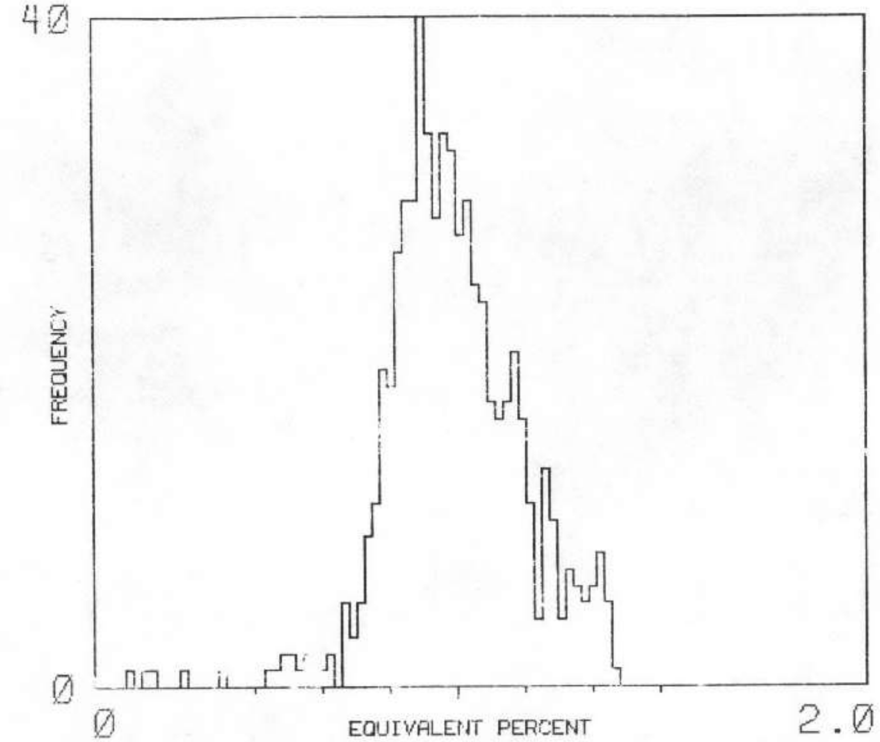
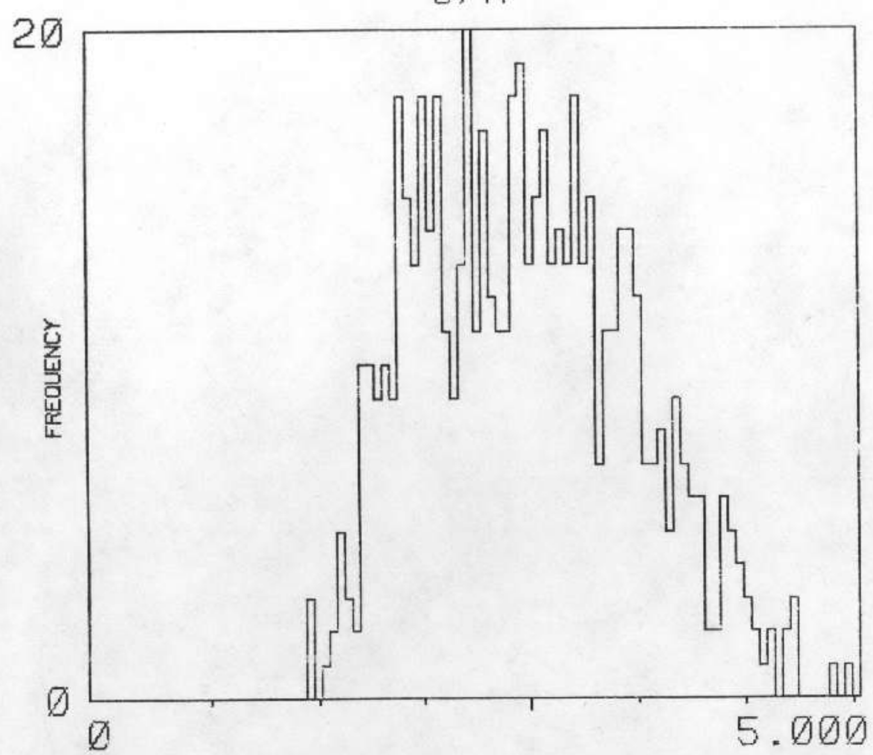


MEAN / MEDIAN 0.9 0.9 607 ADEQUATE SAMPLES

U/K



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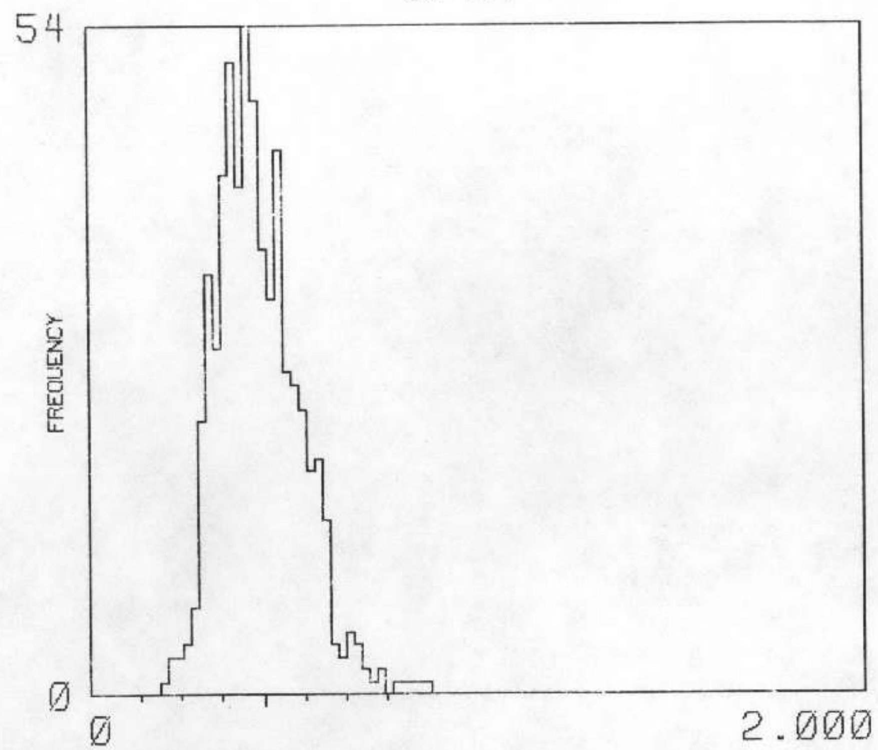
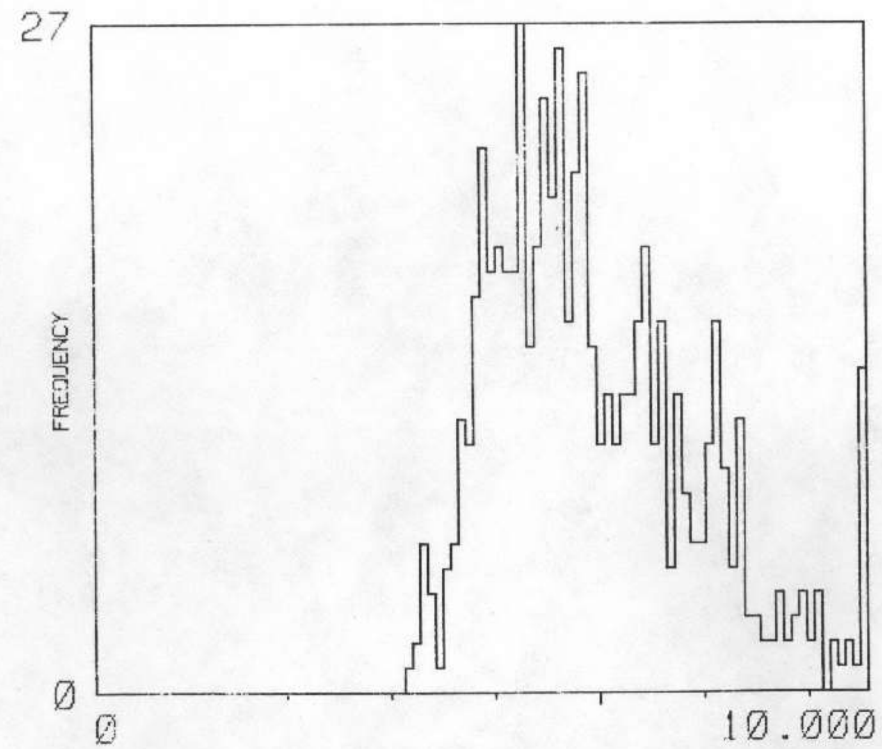
U/TH



MEAN / MEDIAN 0.448 0.440 601 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 6.532 6.300 606 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS MAP UNIT : QO TOTAL NUMBER OF SAMPLES 1388

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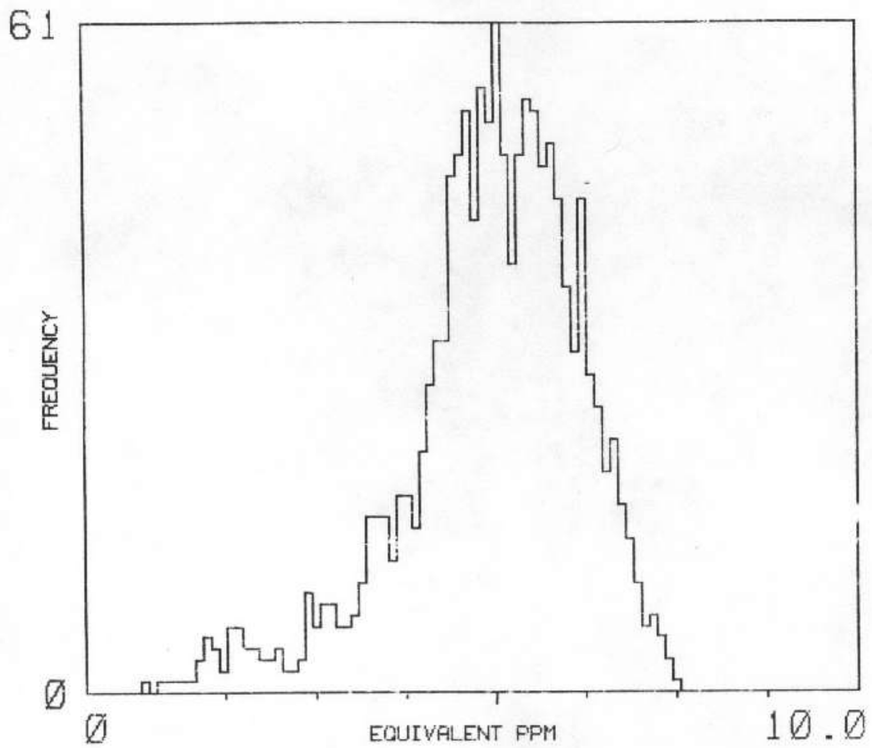

MEAN / MEDIAN 5.3 5.4 1363 ADEQUATE SAMPLES

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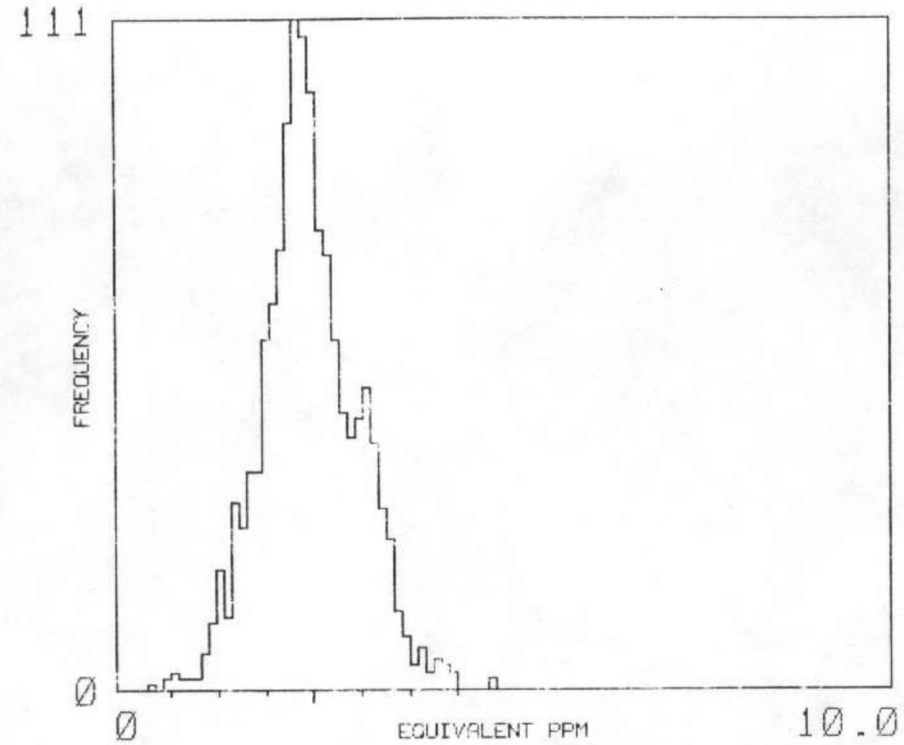
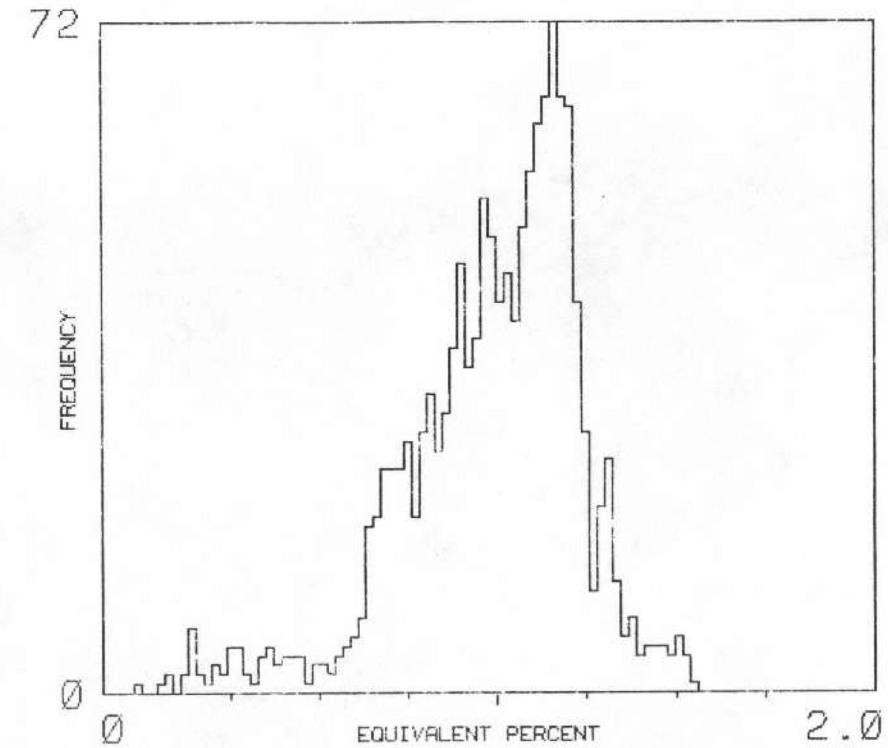


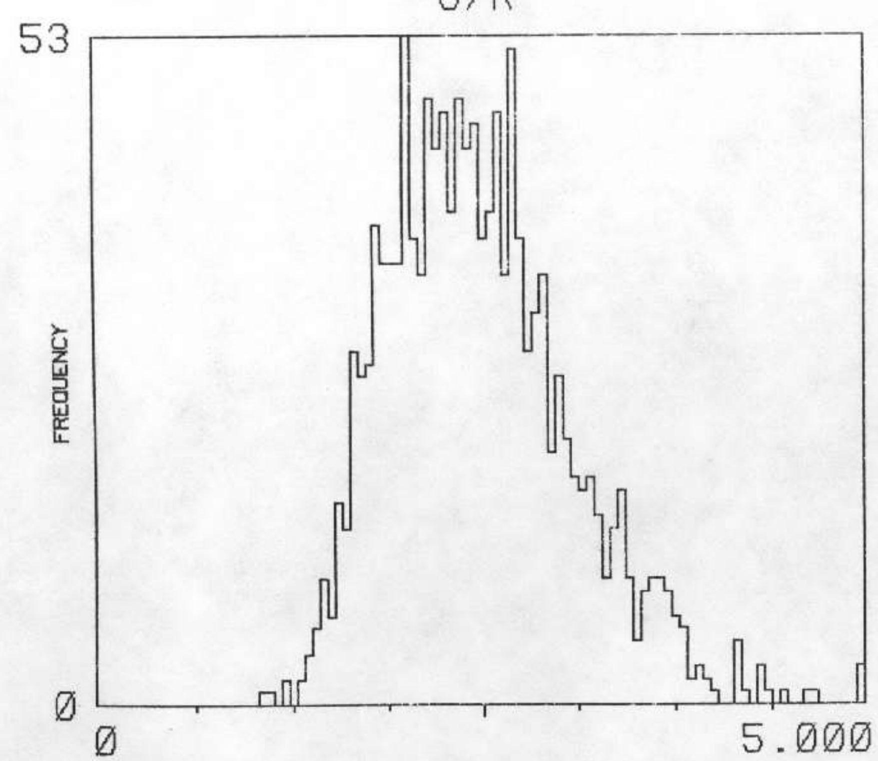
MEAN / MEDIAN 2.6 2.5 1333 ADEQUATE SAMPLES

POTASSIUM



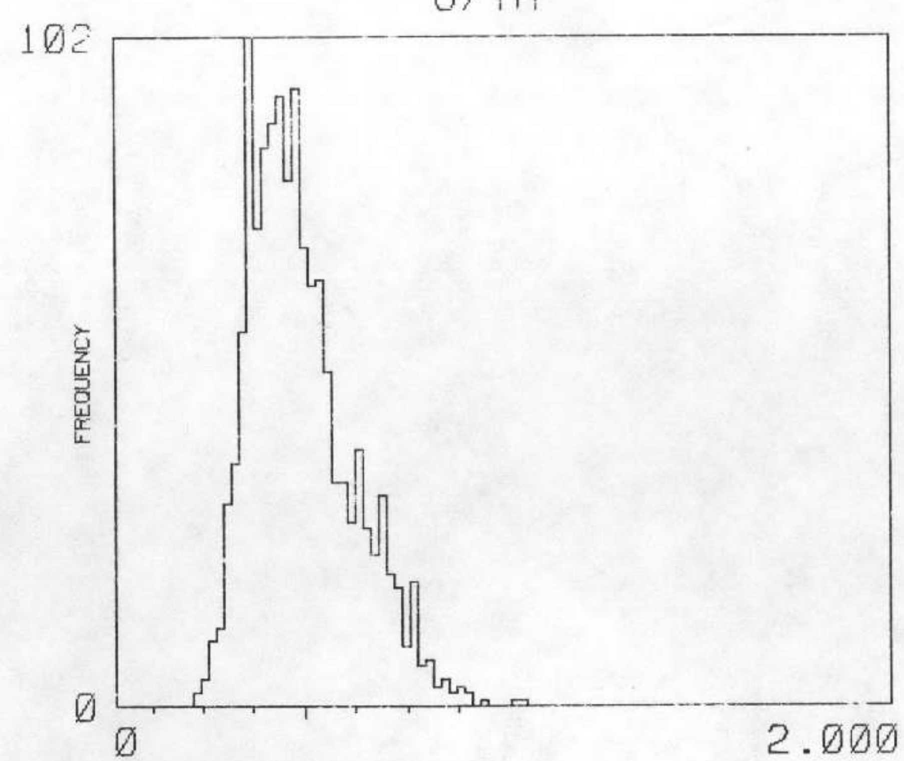
MEAN / MEDIAN 1.Ø 1.1 1362 ADEQUATE SAMPLES

U/K



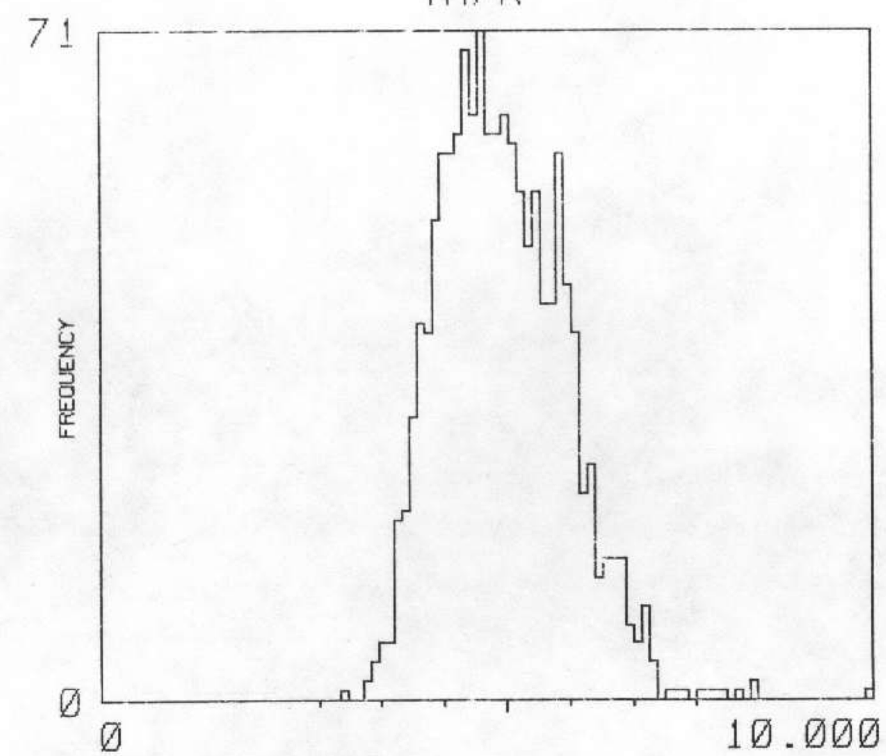
MEAN / MEDIAN 2.521 2.45Ø 1332 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.489 Ø.46Ø 1332 ADEQUATE SAMPLES

TH/K



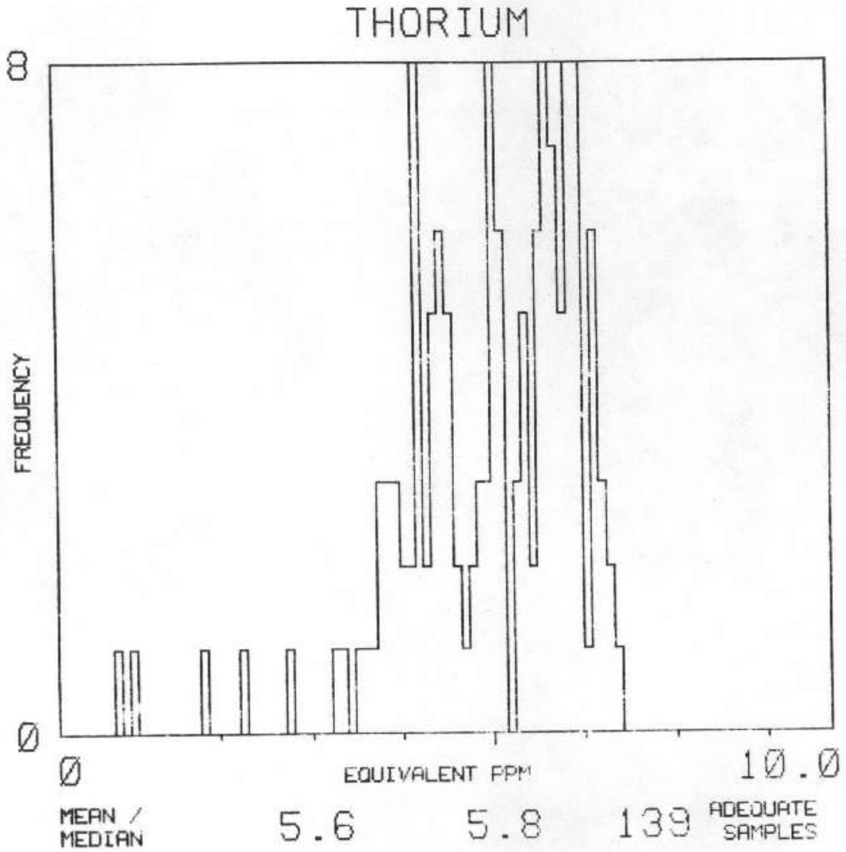
MEAN / MEDIAN 5.262 5.2ØØ 1362 ADEQUATE SAMPLES

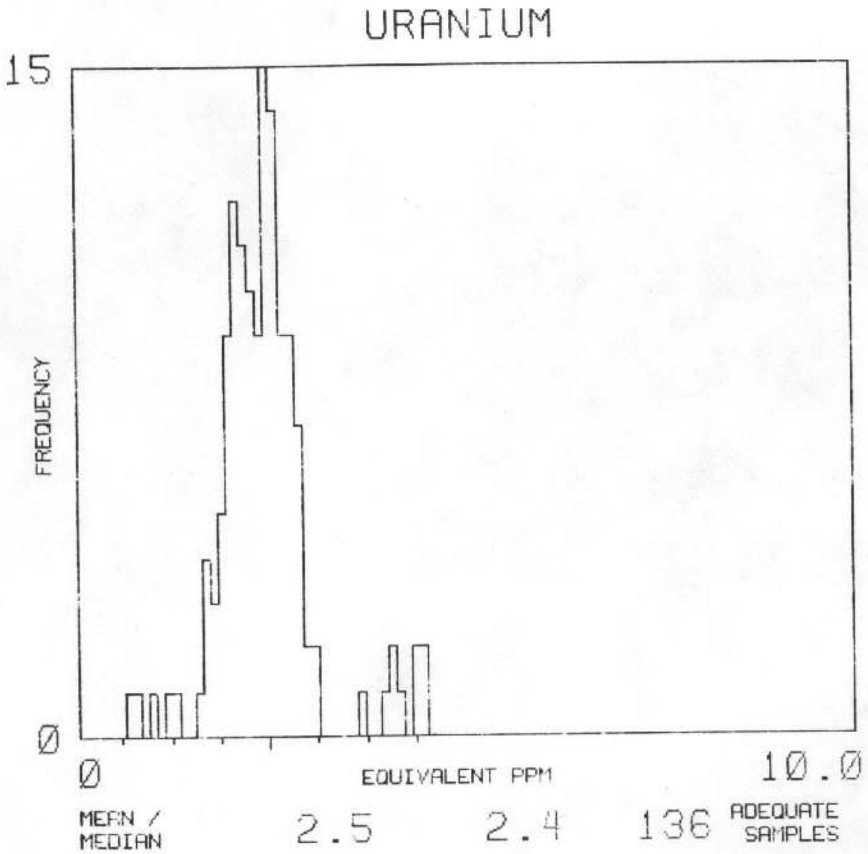
F7 co

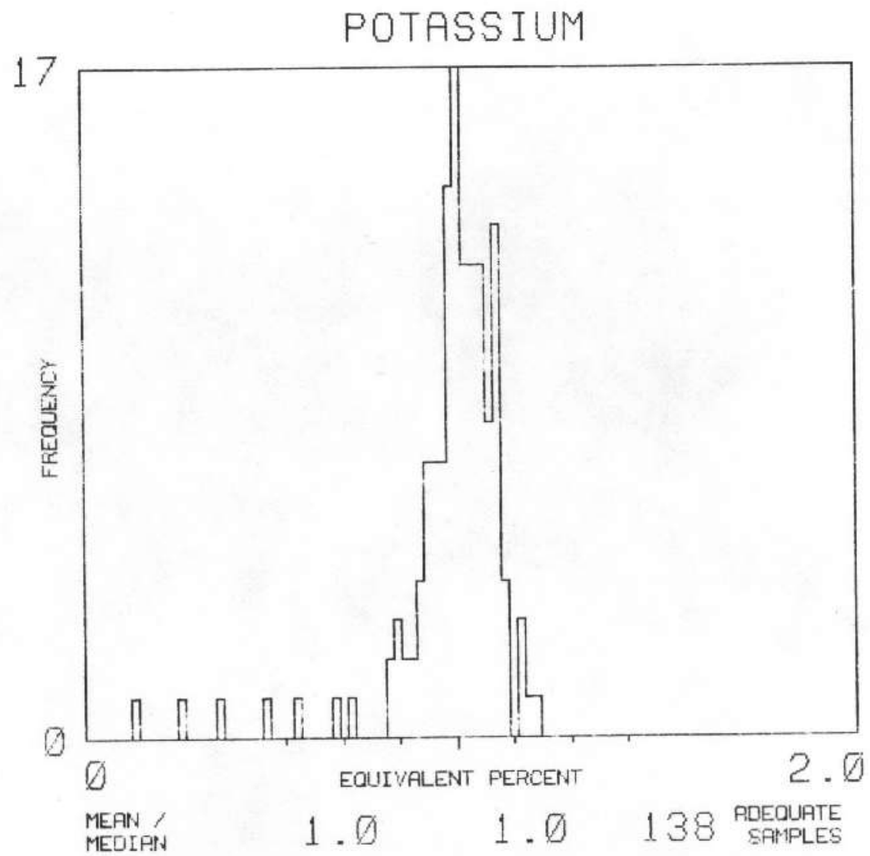
NTMS NJ 17-1 COLUMBUS

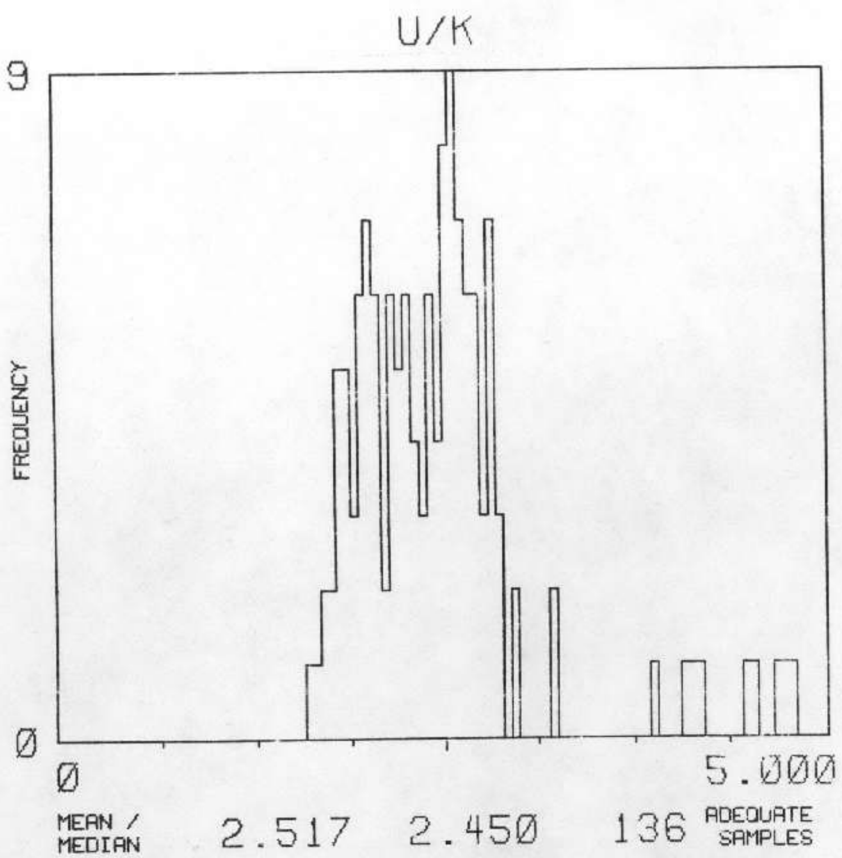
MAP UNIT : QIC

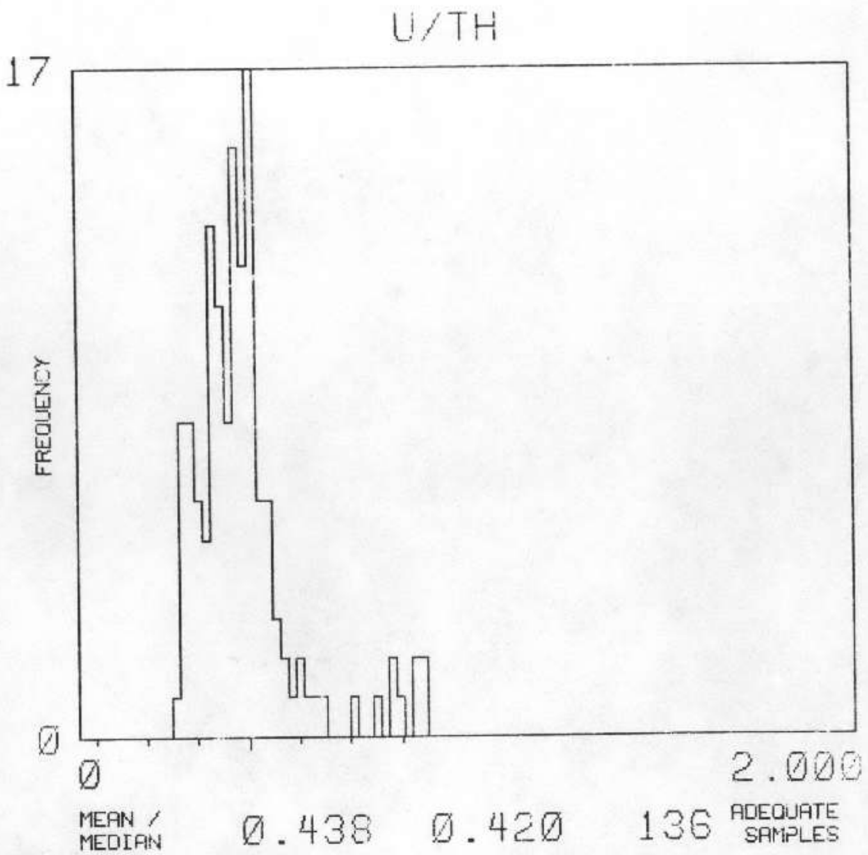
TOTAL NUMBER OF SAMPLES 143

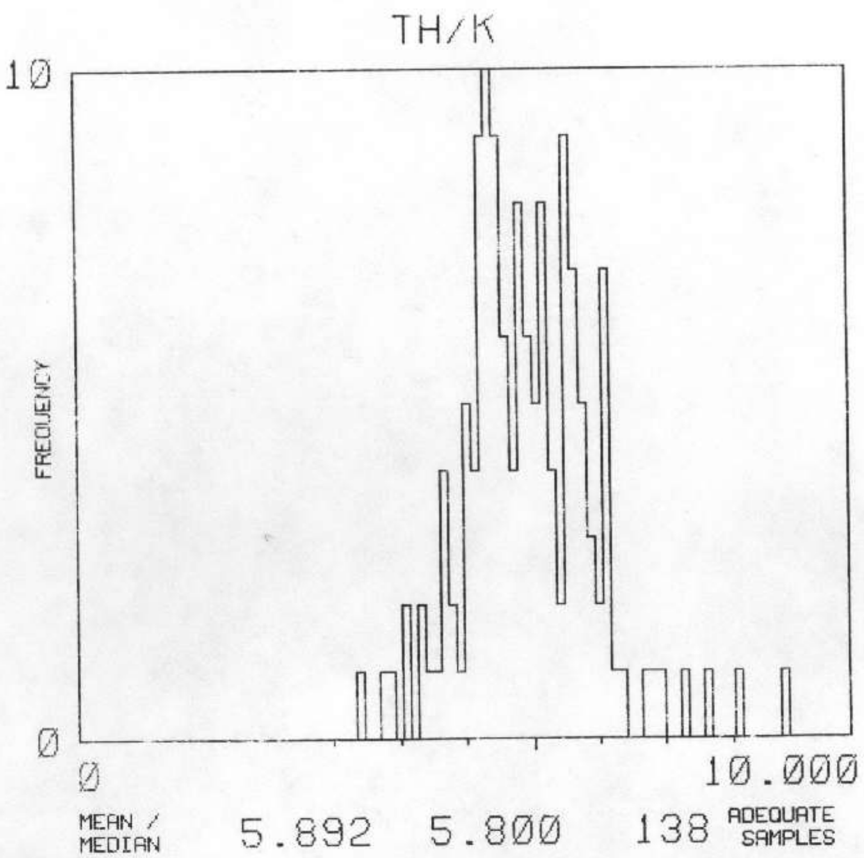








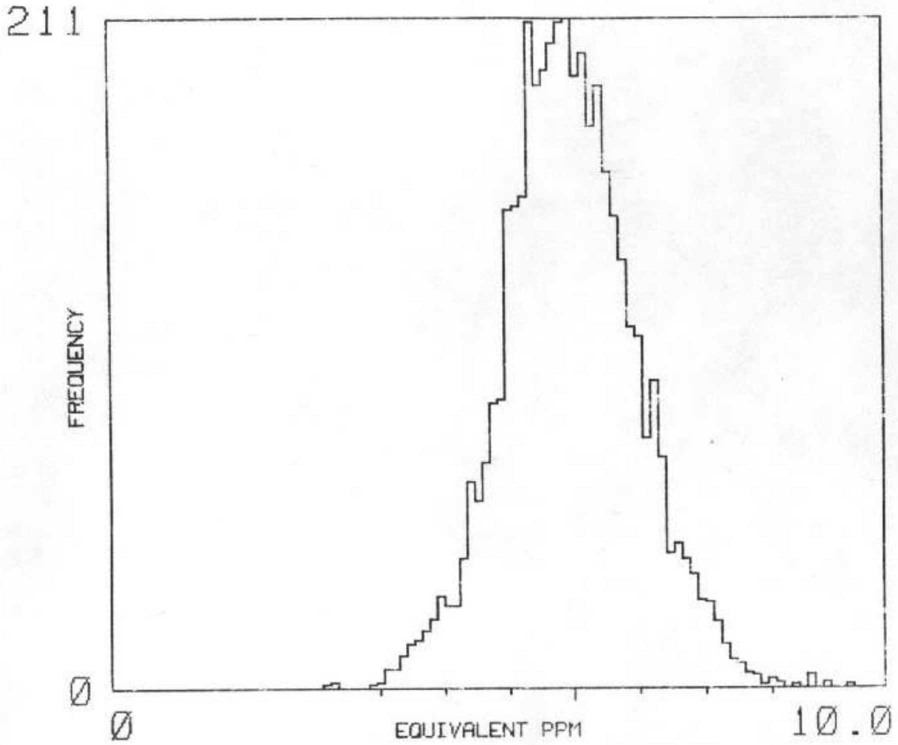




NTMS NJ 17-1 COLUMBUS

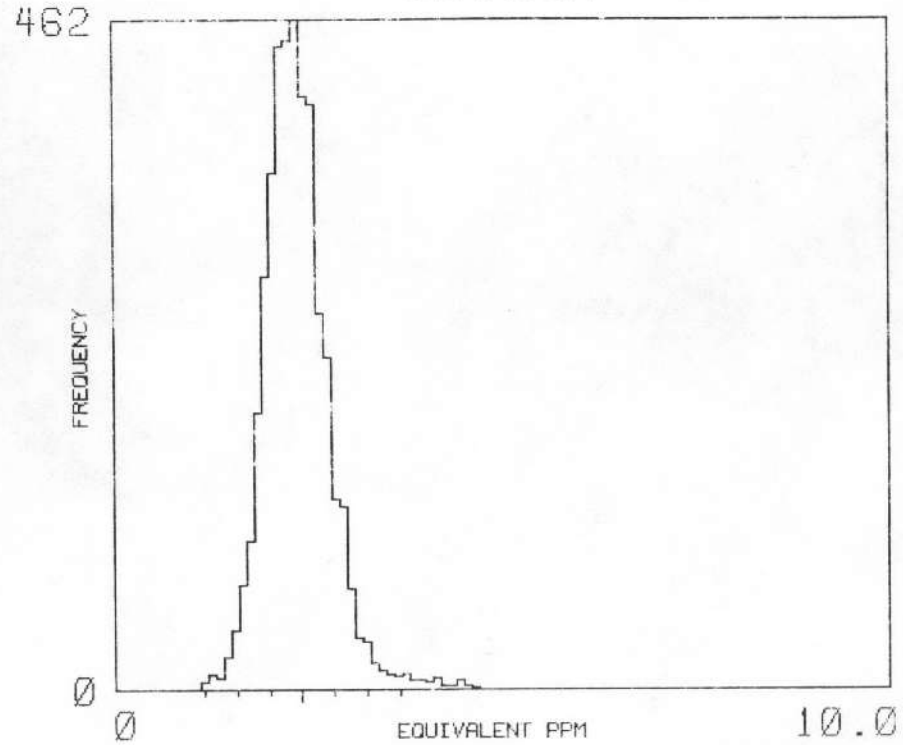
MAP UNIT : QIT   TOTAL NUMBER OF SAMPLES 4249

THORIUM



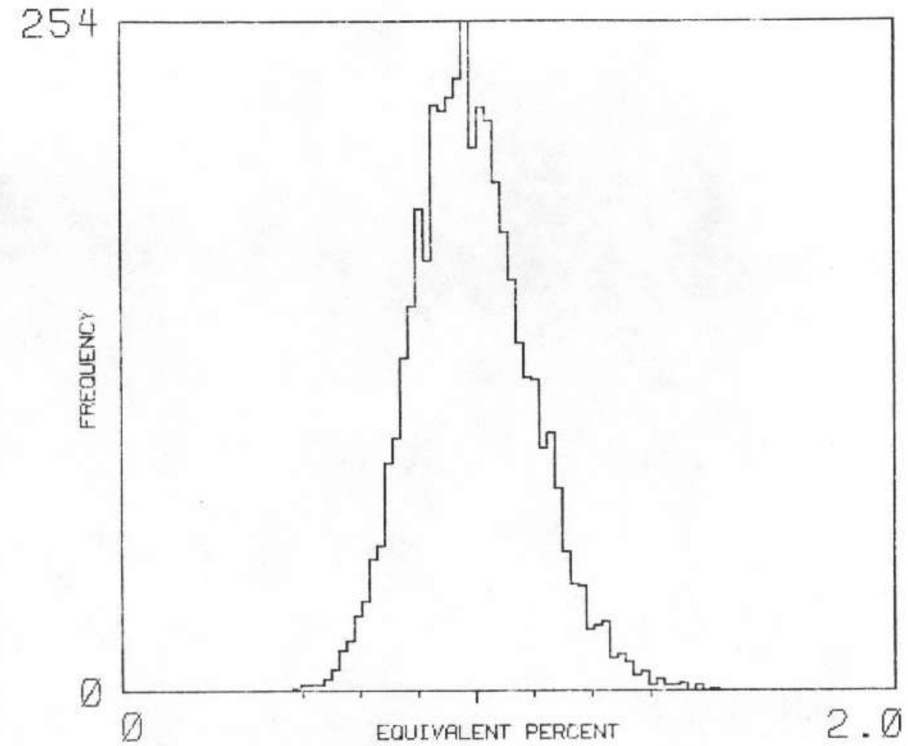
MEAN / MEDIAN 6.0 6.0 4249 ADEQUATE SAMPLES

URANIUM



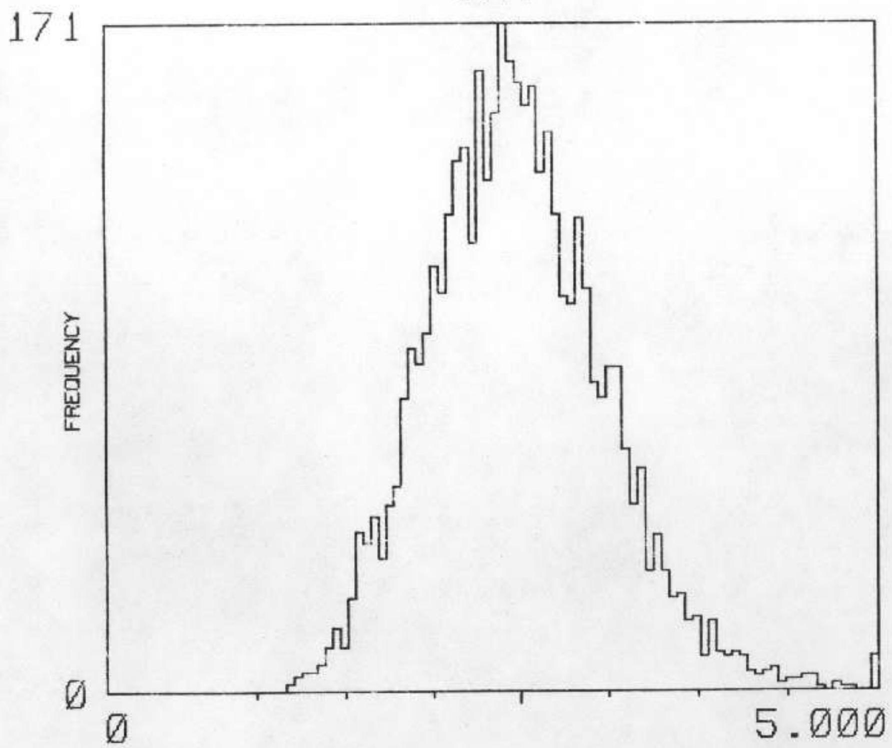
MEAN / MEDIAN 2.4 2.4 4249 ADEQUATE SAMPLES

POTASSIUM



MEAN / MEDIAN 0.9 0.9 4249 ADEQUATE SAMPLES

U/K



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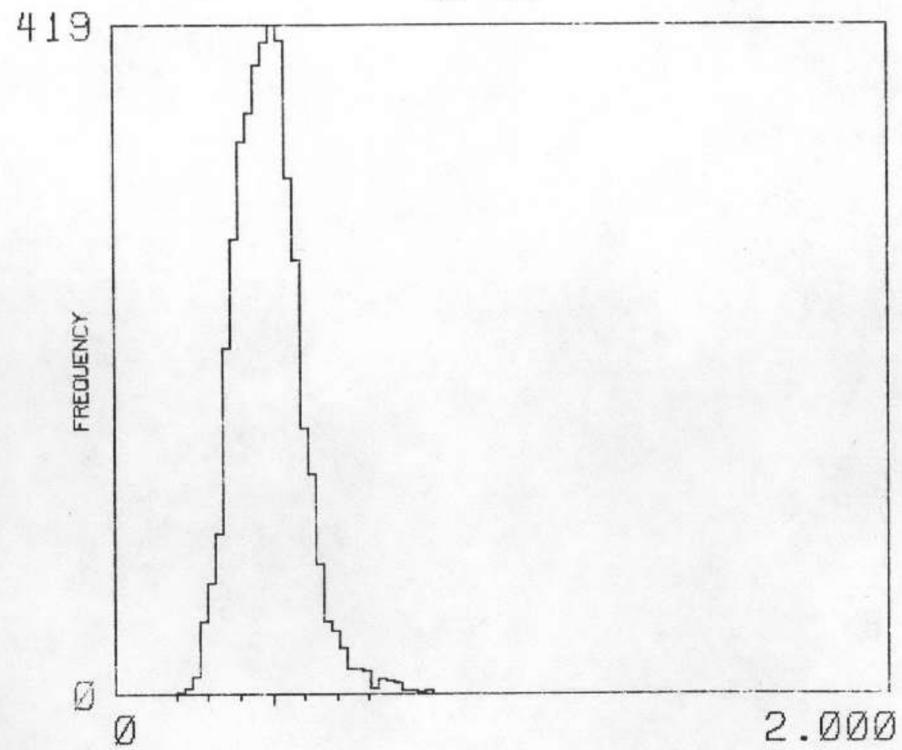
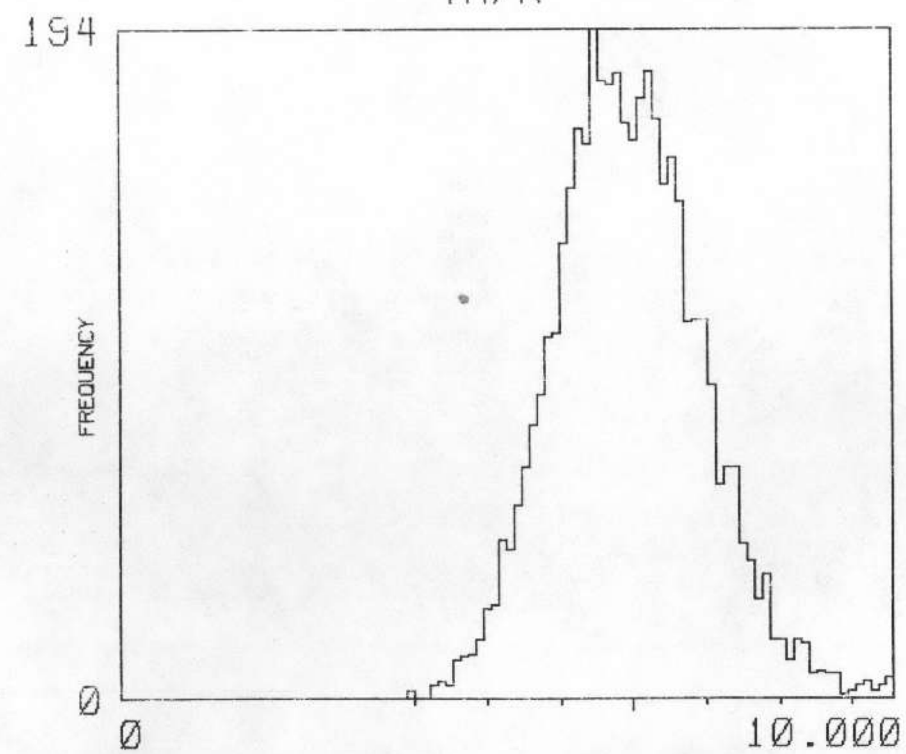
U/TH



MEAN / MEDIAN 0.408 0.400 4249 ADEQUATE SAMPLES

TH/K



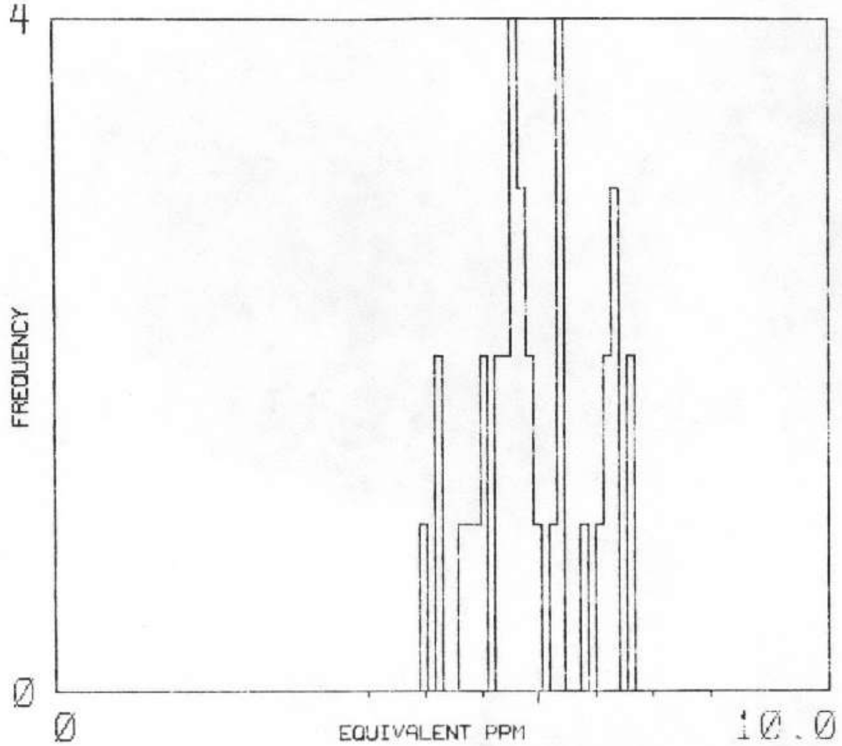
MEAN / MEDIAN 6.634 6.600 4249 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS

MAP UNIT : OIM TOTAL NUMBER OF SAMPLES 36

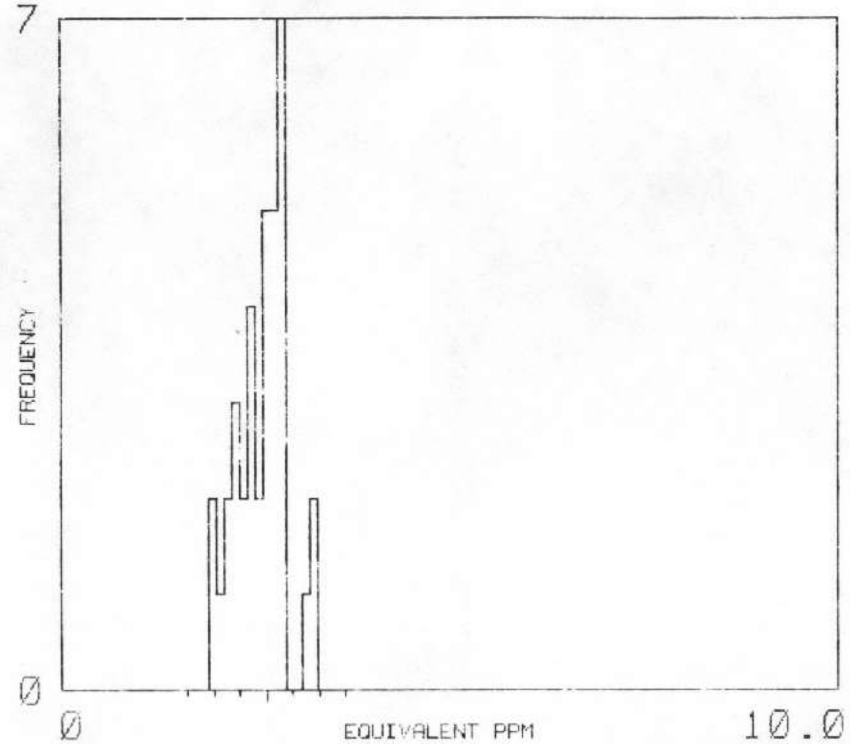
F9 co

THORIUM



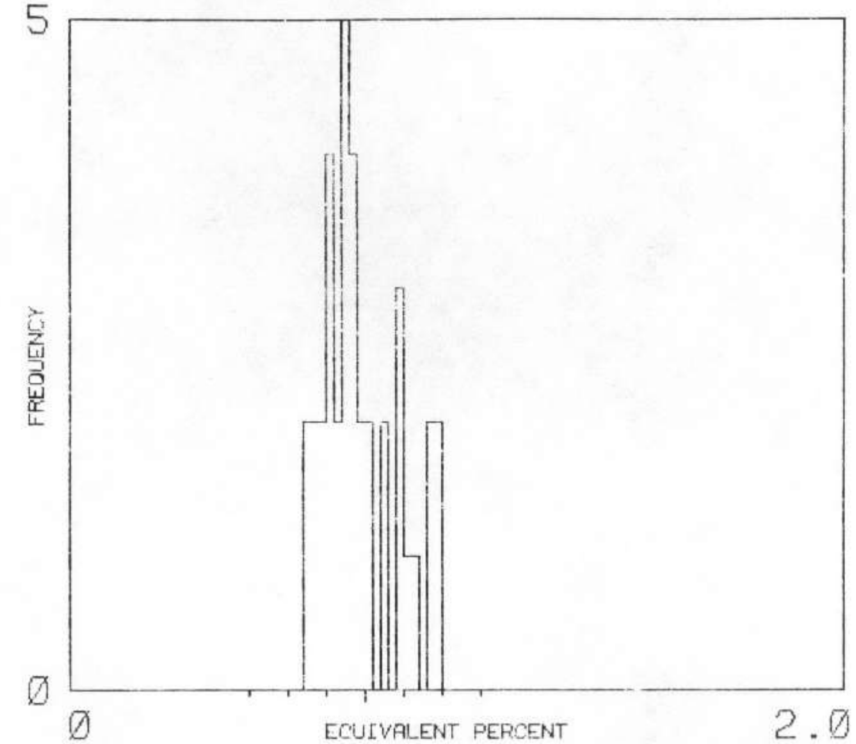
MEAN / MEDIAN 6.3 6.1 36 ADEQUATE SAMPLES

URANIUM



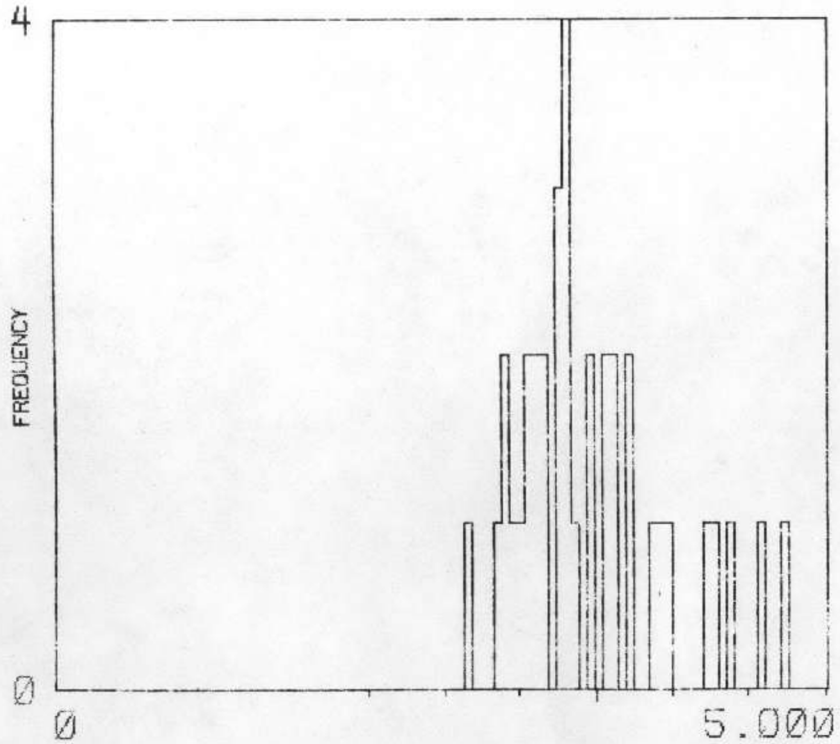
MEAN / MEDIAN 2.6 2.7 36 ADEQUATE SAMPLES

POTASSIUM



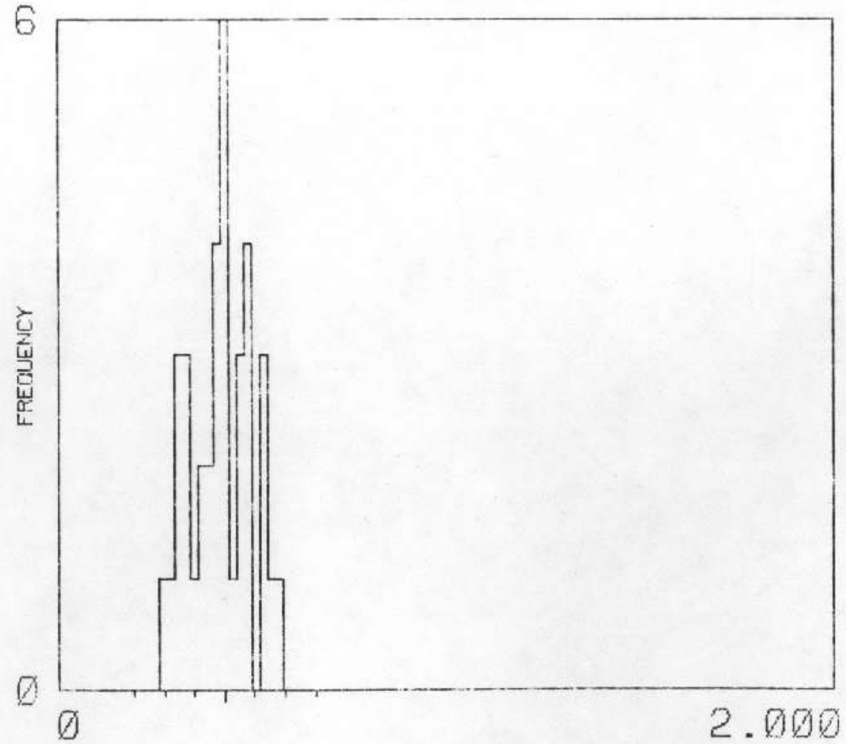
MEAN / MEDIAN 0.8 0.7 36 ADEQUATE SAMPLES

U/K



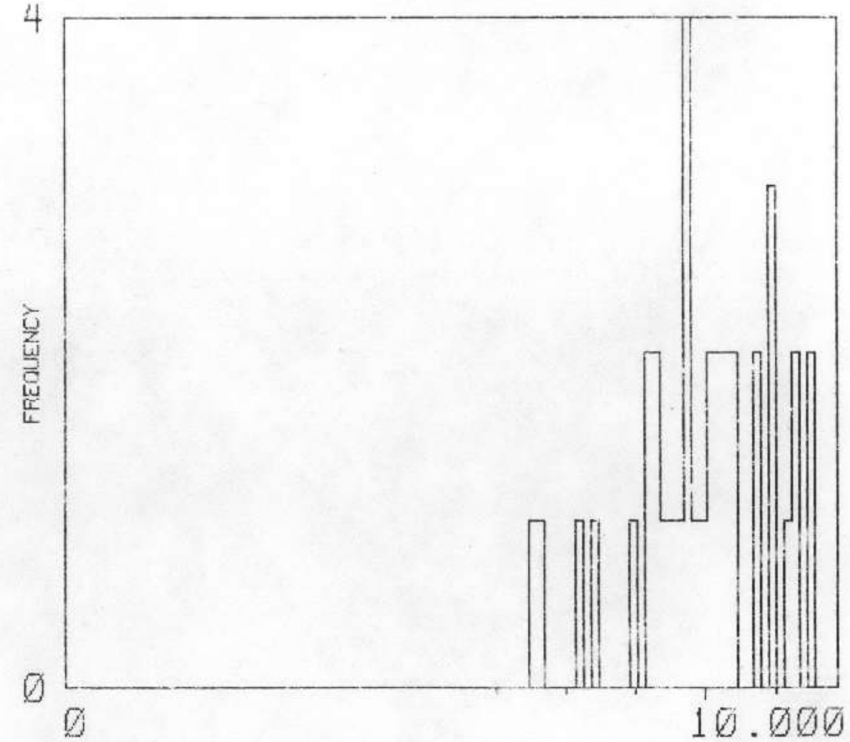
MEAN / MEDIAN 3.508 3.350 36 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.429 0.440 36 ADEQUATE SAMPLES

TH/K

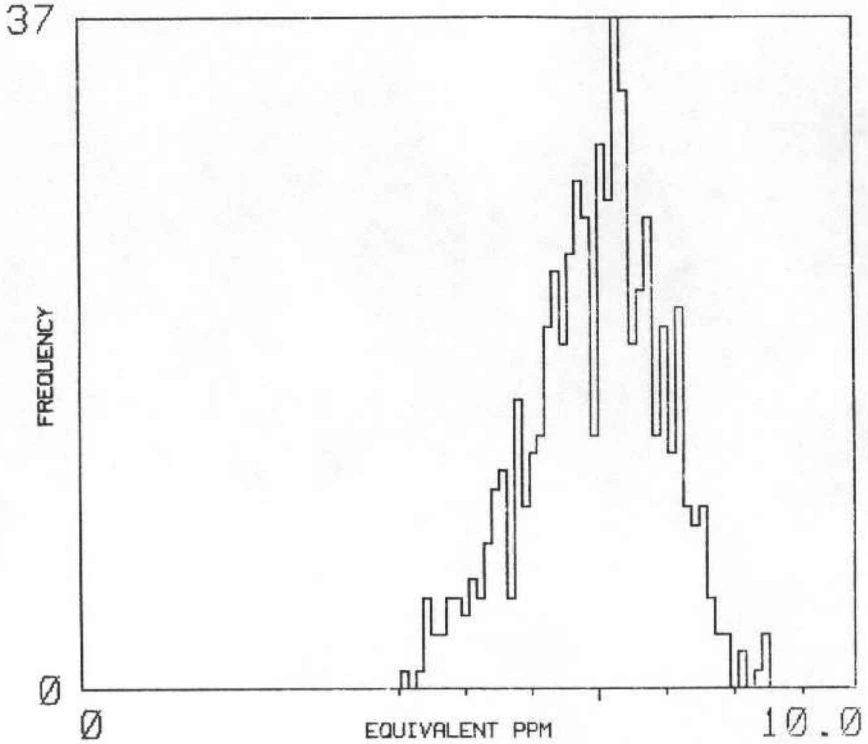


MEAN / MEDIAN 8.287 8.300 36 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS

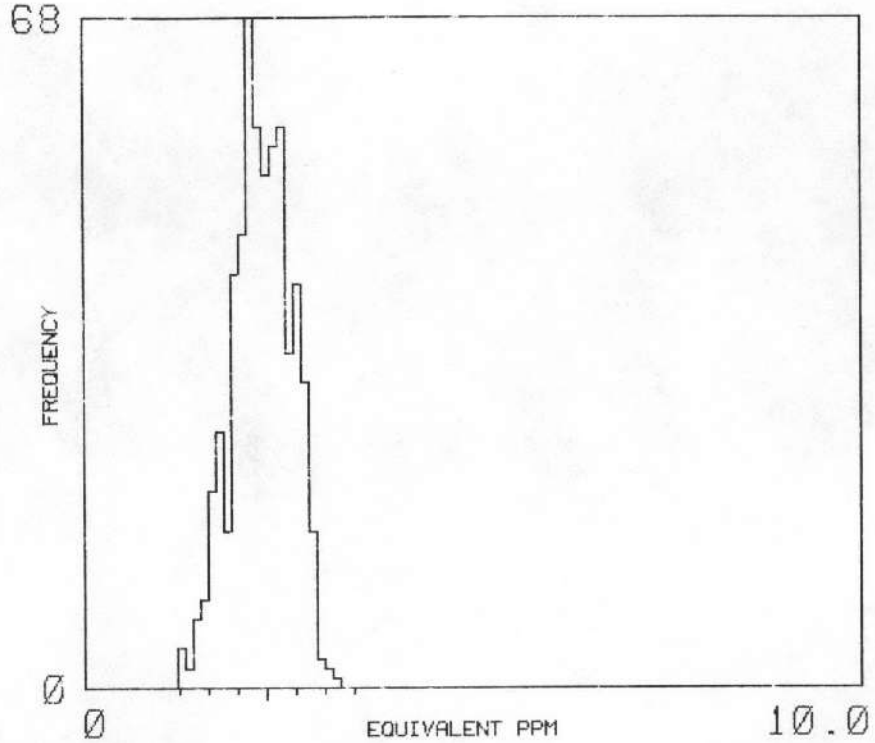
MAP UNIT : PM TOTAL NUMBER OF SAMPLES 589

THORIUM



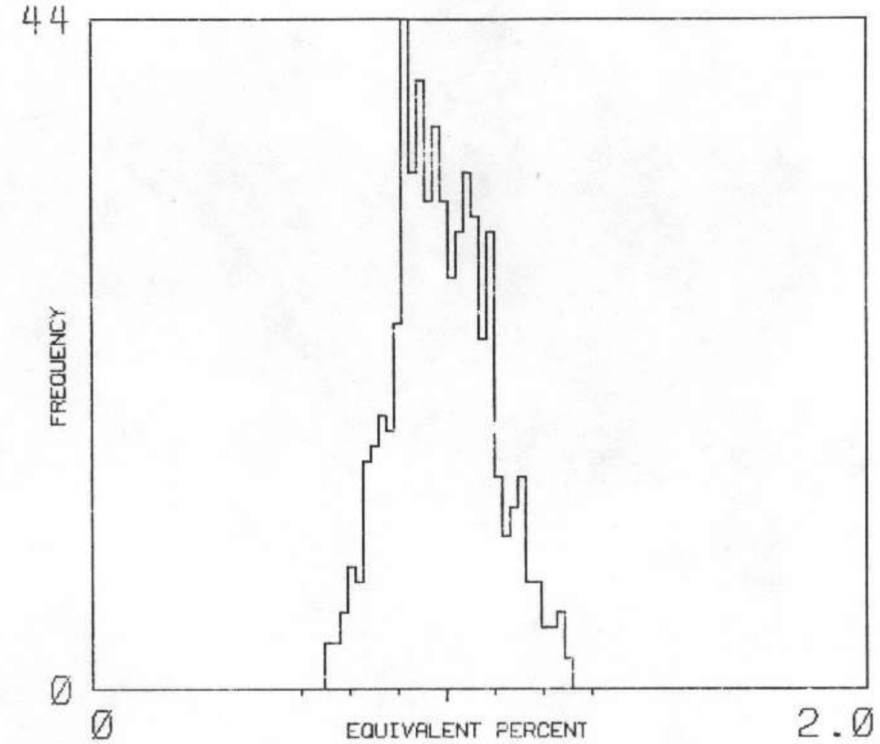
MEAN / MEDIAN 6.7 6.8 589 ADEQUATE SAMPLES

URANIUM



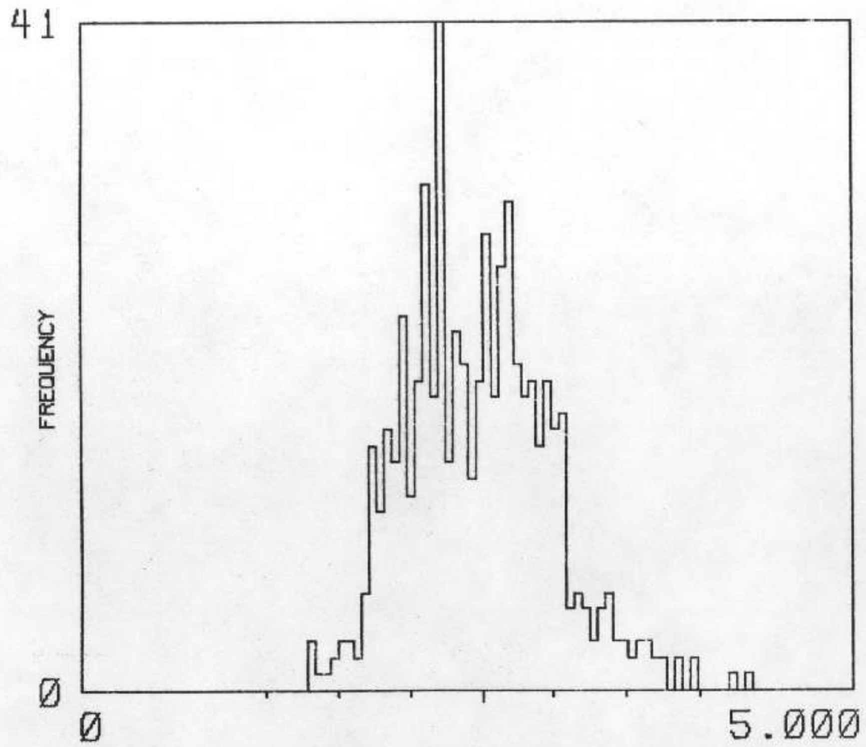
MEAN / MEDIAN 2.3 2.3 589 ADEQUATE SAMPLES

POTASSIUM



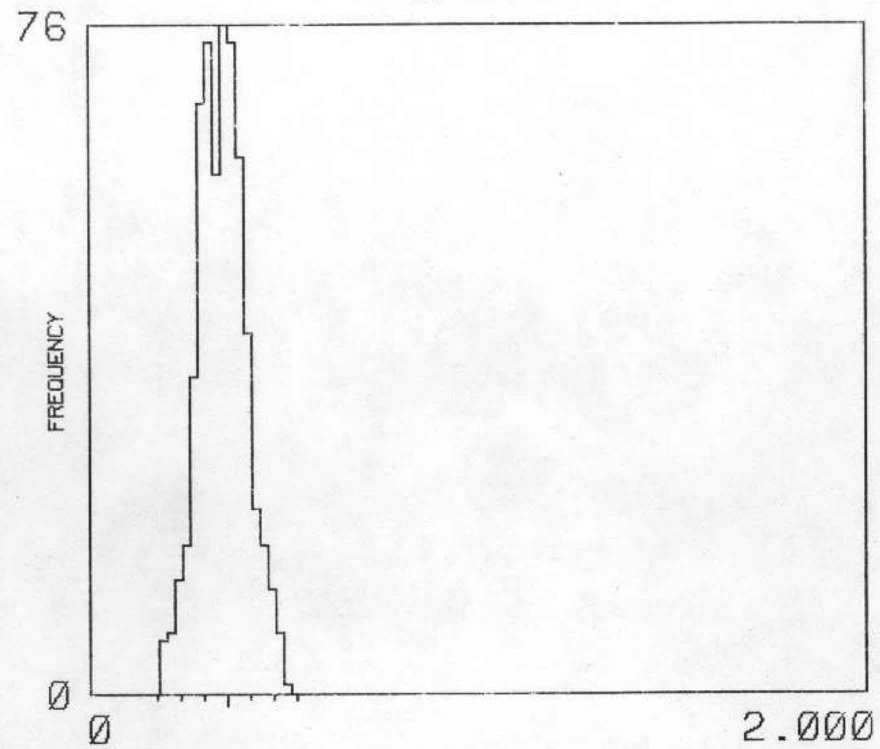
MEAN / MEDIAN 0.9 0.9 589 ADEQUATE SAMPLES

U/K



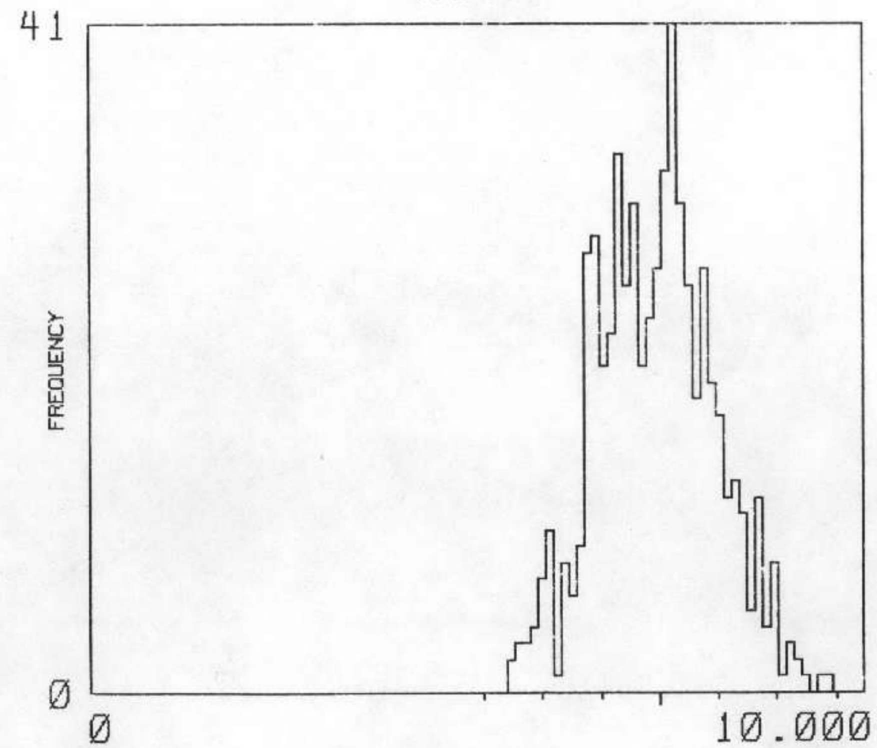
MEAN / MEDIAN 2.595 2.600 589 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.353 0.360 589 ADEQUATE SAMPLES

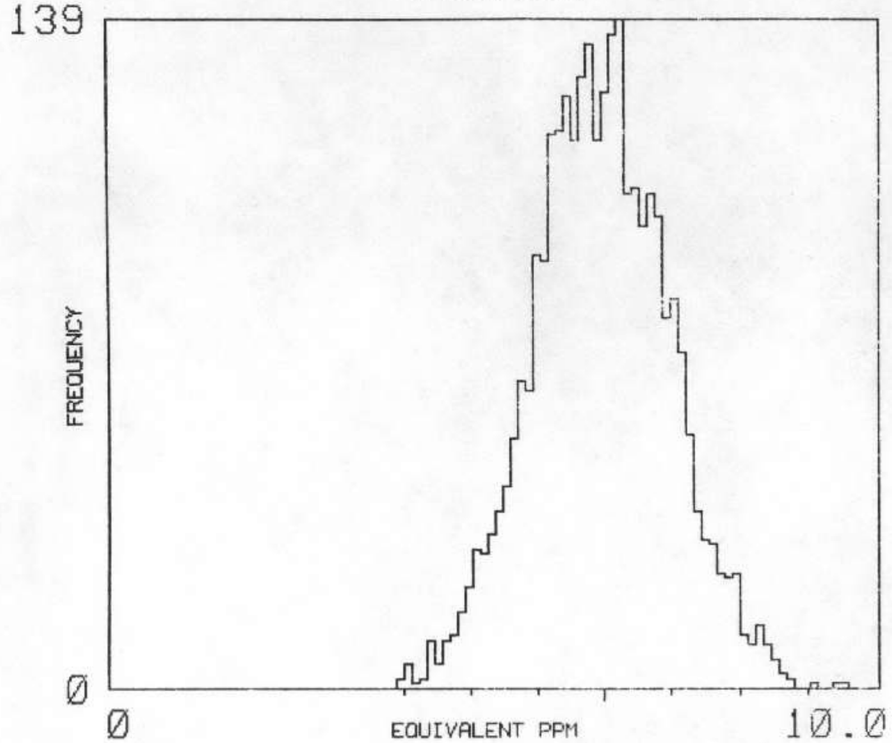
TH/K



MEAN / MEDIAN 7.373 7.400 589 ADEQUATE SAMPLES

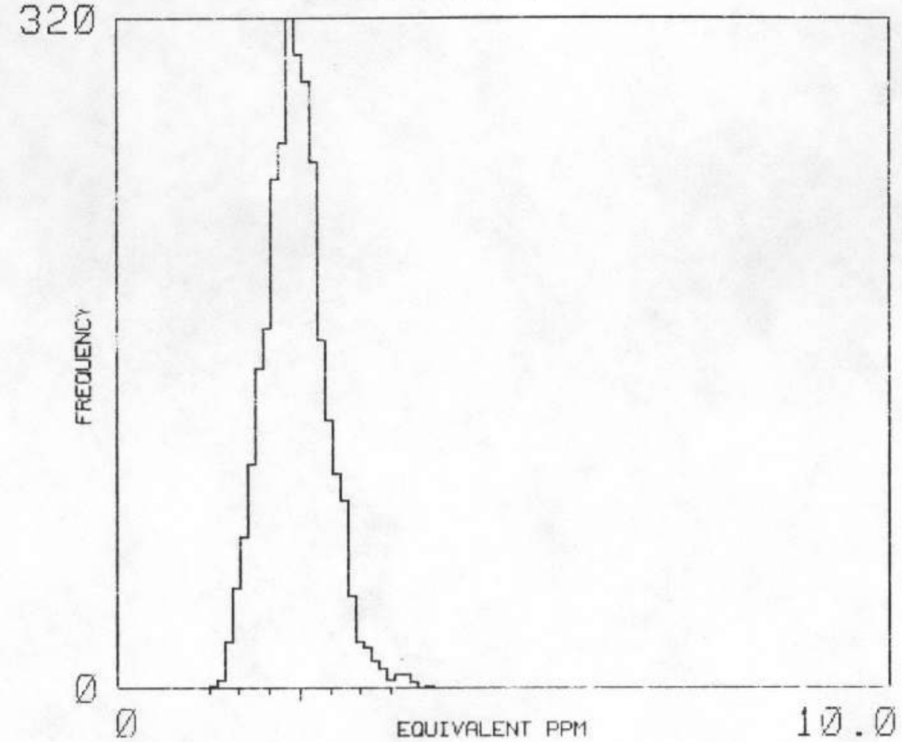
NTMS NJ 17-1 COLUMBUS   MAP UNIT : PC   TOTAL NUMBER OF SAMPLES 2860

THORIUM



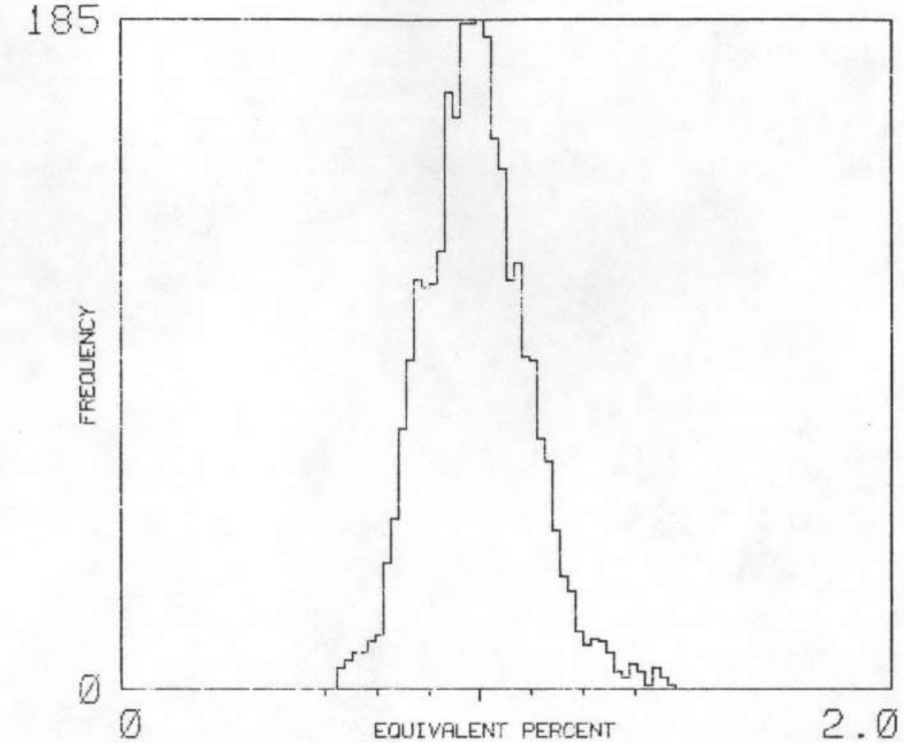
MEAN / MEDIAN 6.4 6.4 2860 ADEQUATE SAMPLES

URANIUM



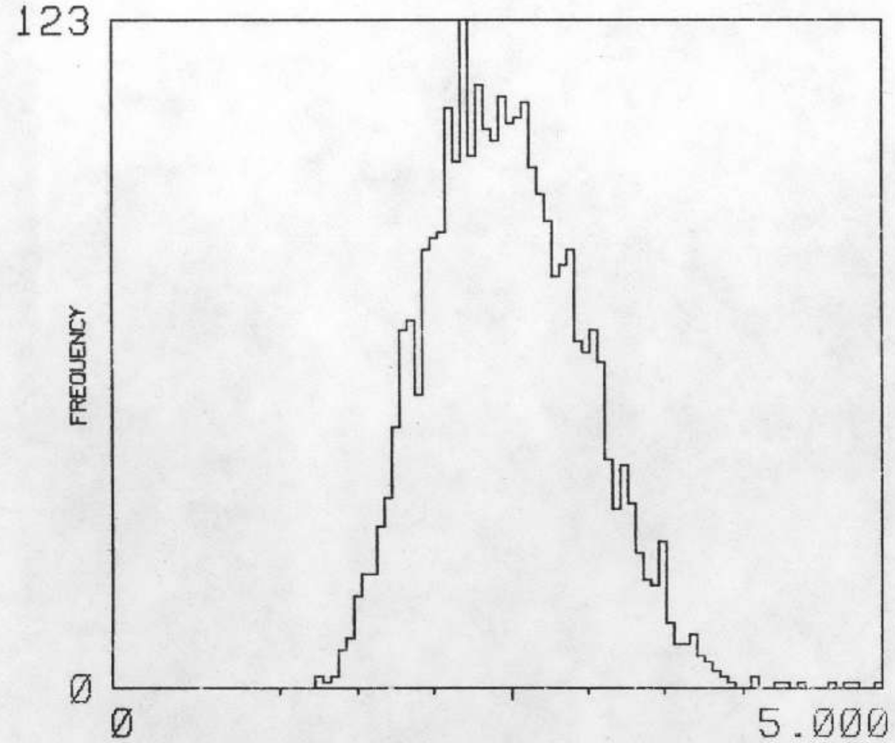
MEAN / MEDIAN 2.4 2.4 2860 ADEQUATE SAMPLES

POTASSIUM



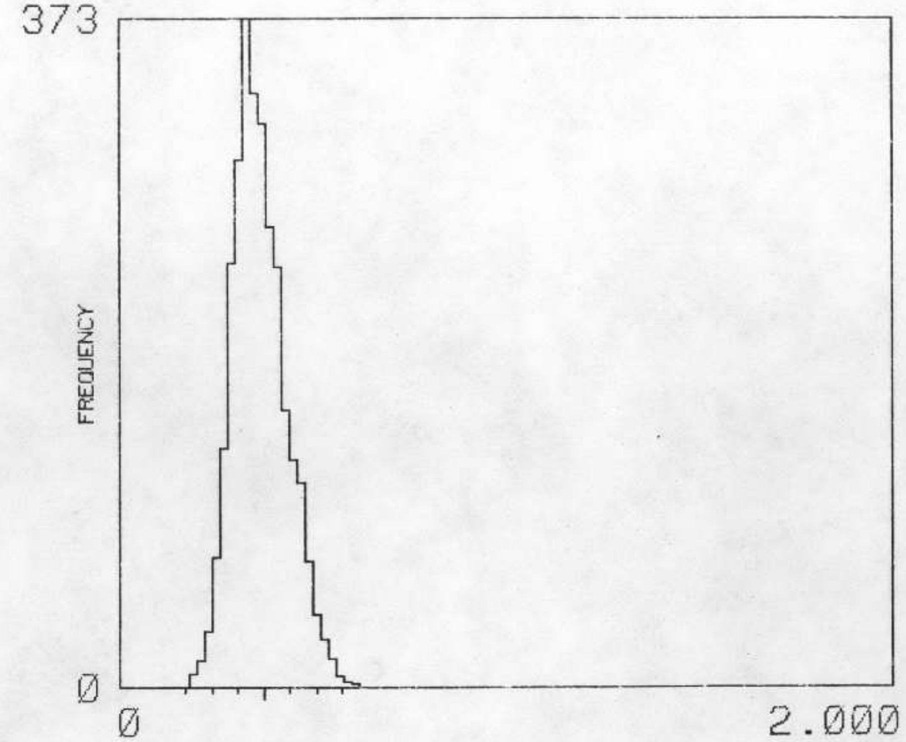
MEAN / MEDIAN 0.9 0.9 2860 ADEQUATE SAMPLES

U/K



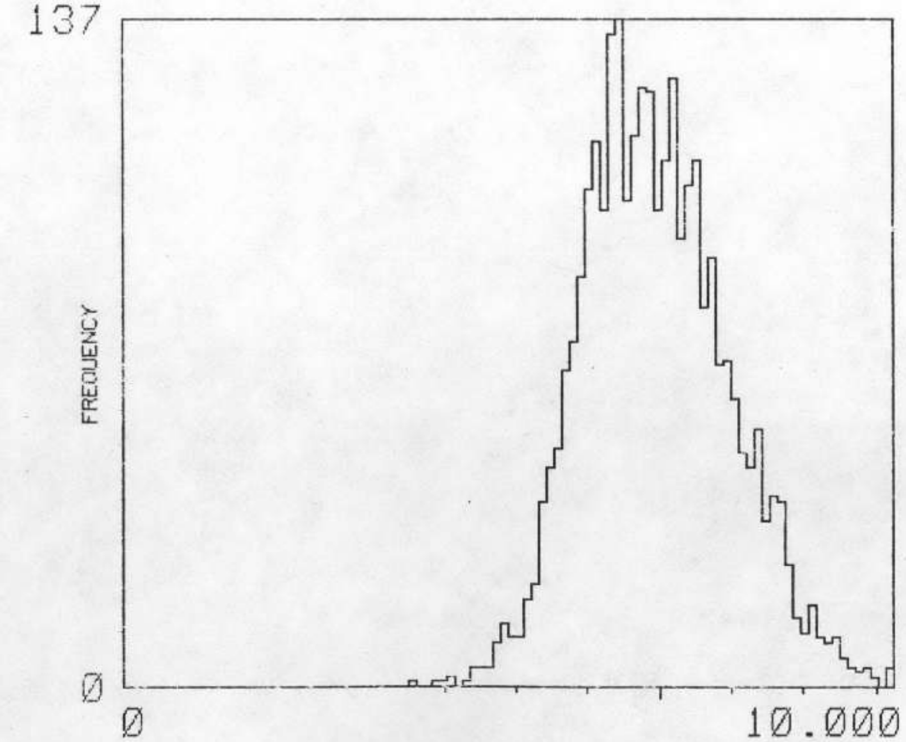
MEAN / MEDIAN 2.583 2.550 2860 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.373 0.360 2860 ADEQUATE SAMPLES

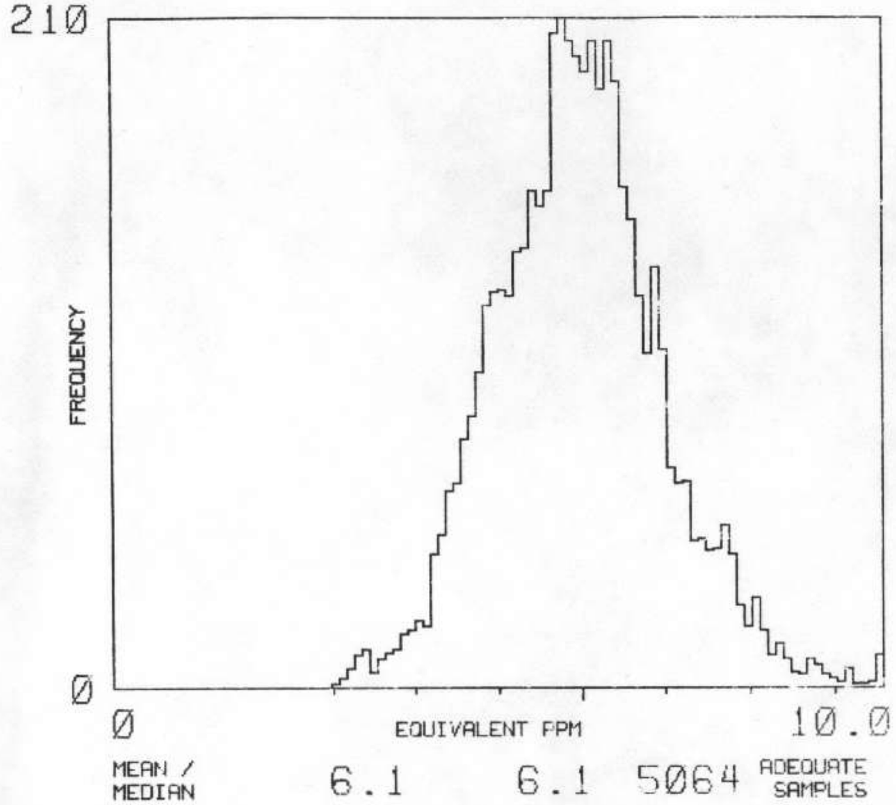
TH/K



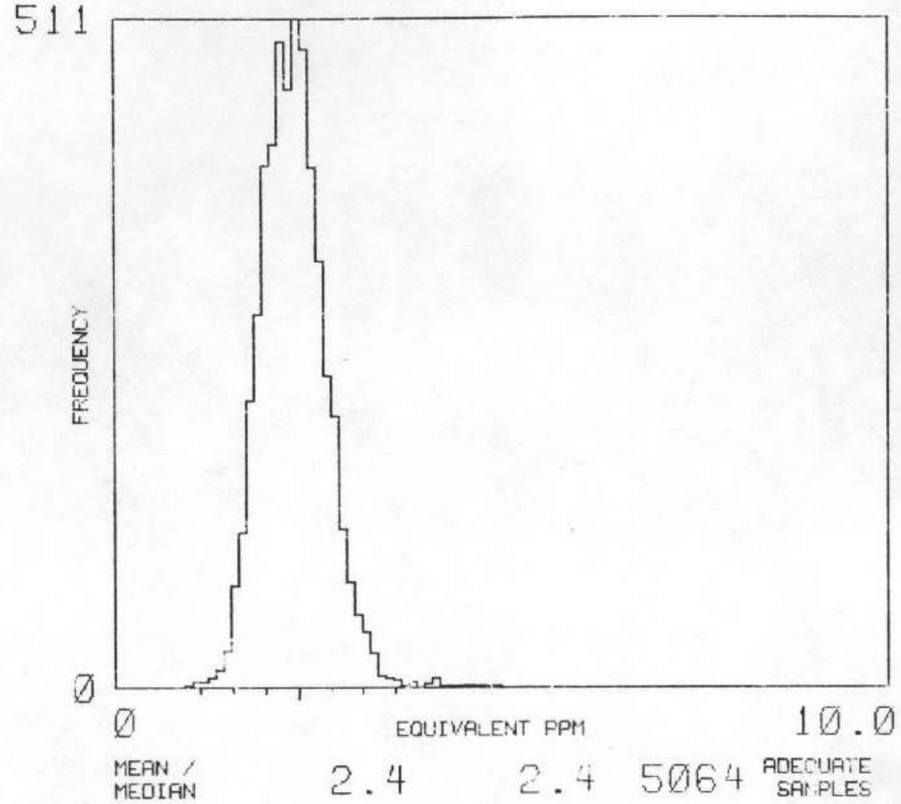
MEAN / MEDIAN 6.966 6.900 2860 ADEQUATE SAMPLES

NTMS NJ 17-1 COLUMBUS MAP UNIT : PAP TOTAL NUMBER OF SAMPLES 5064

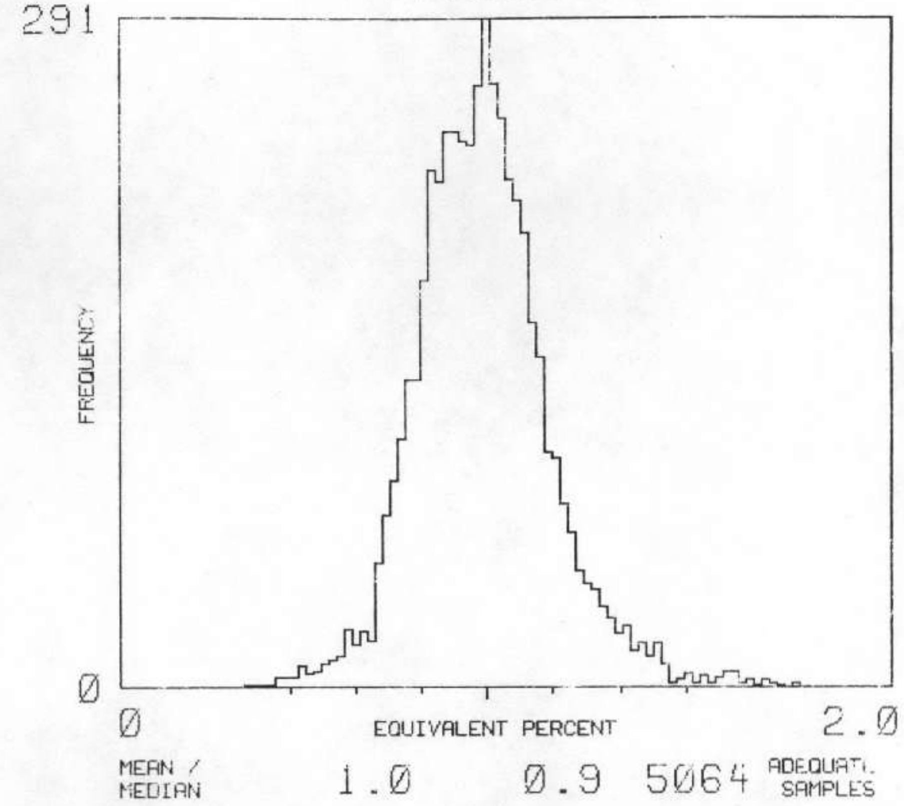
THORIUM



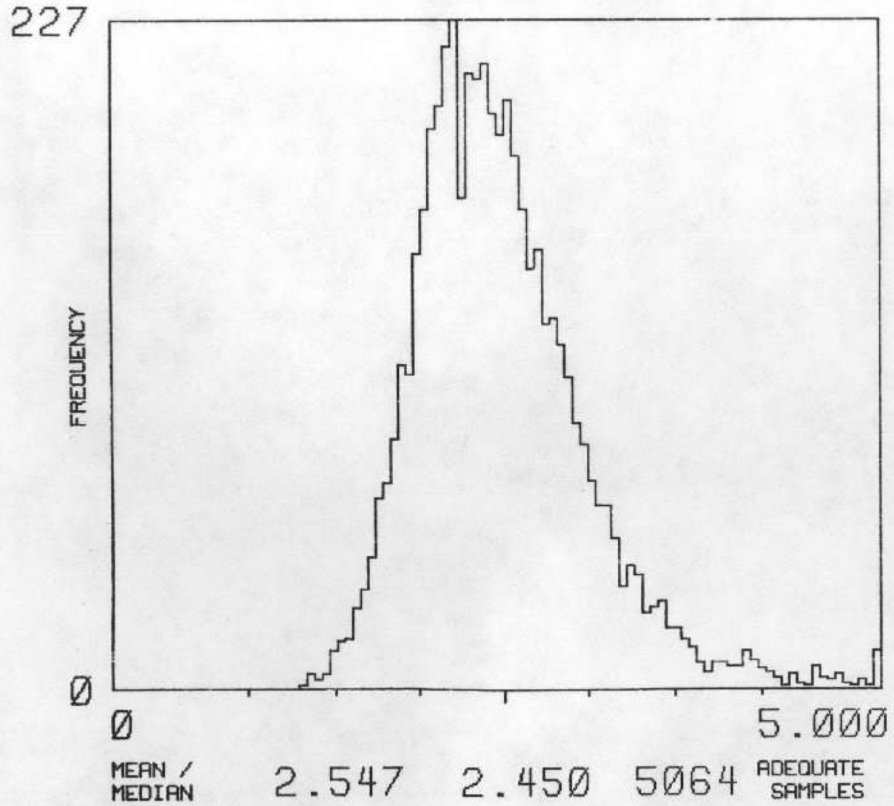
URANIUM



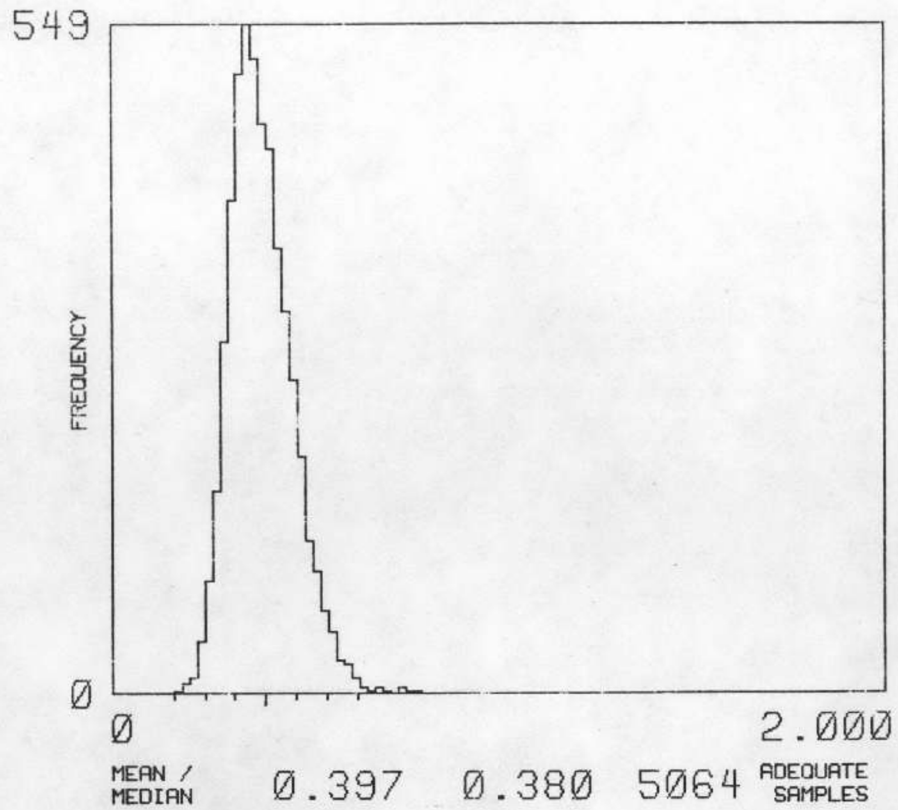
POTASSIUM



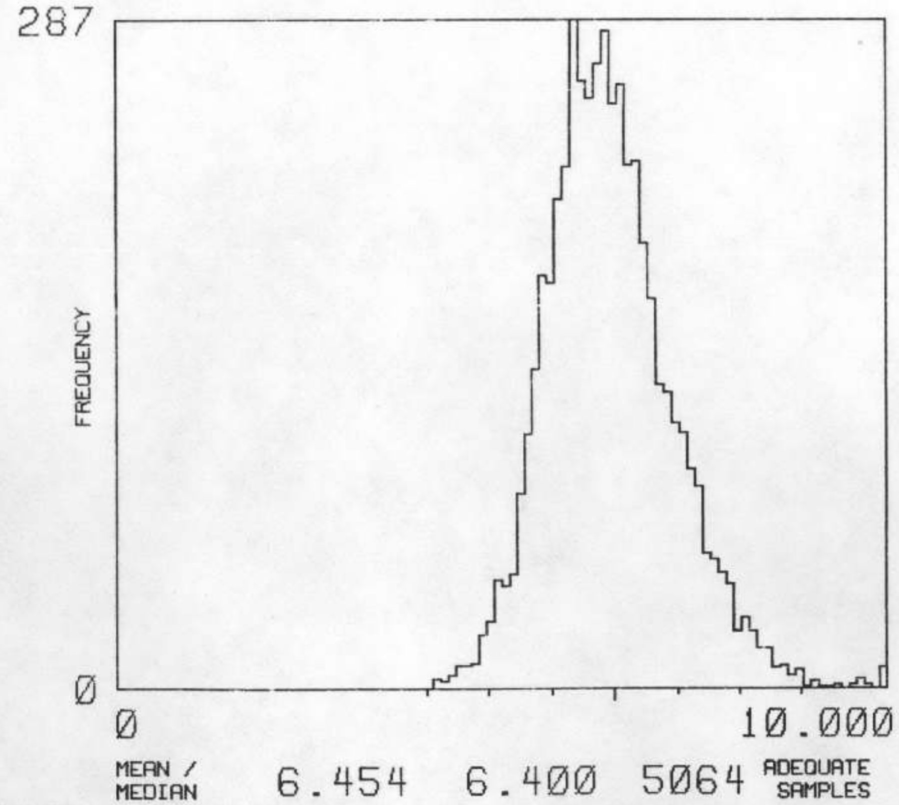
U/K



U/TH

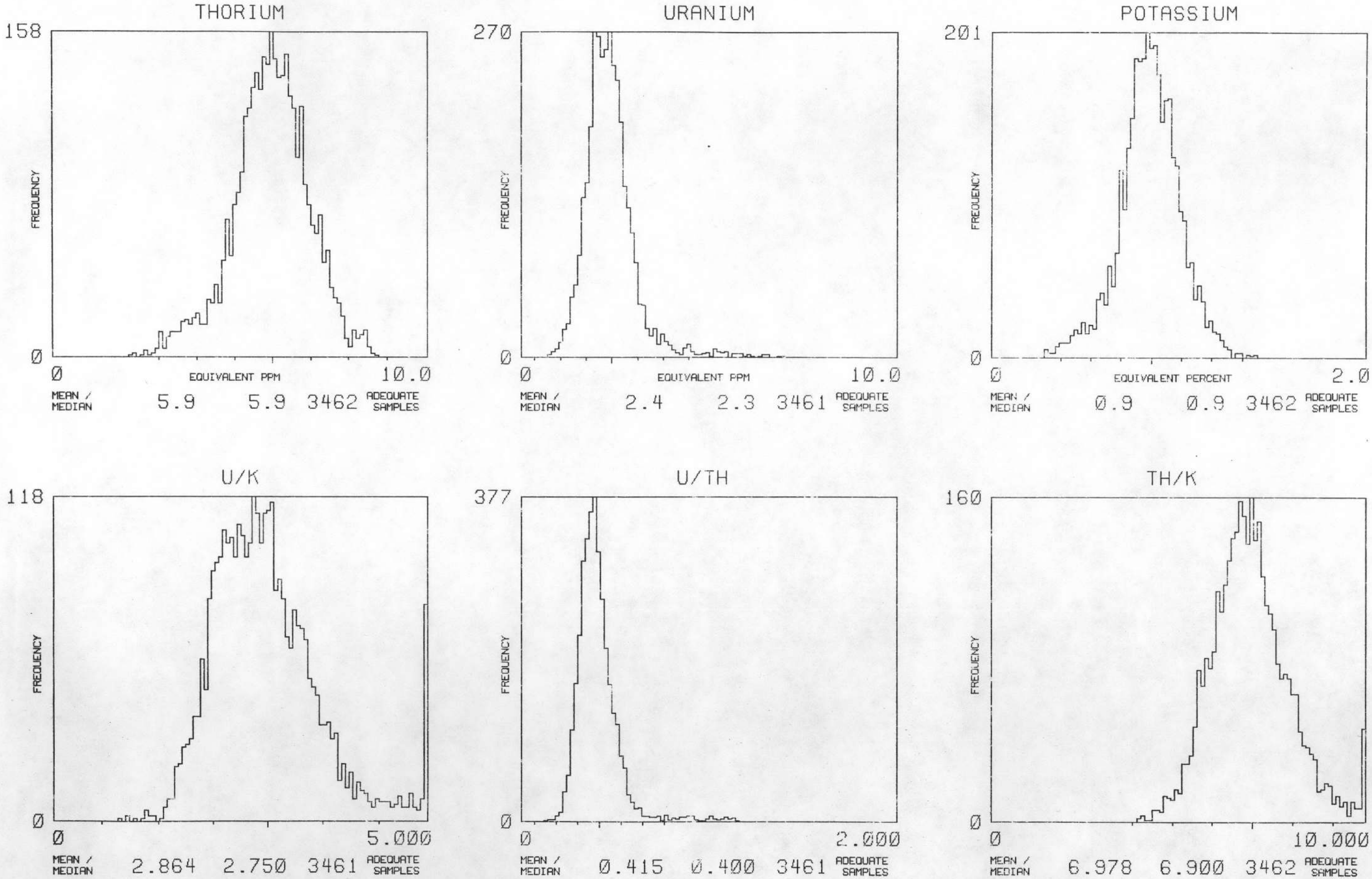


TH/K



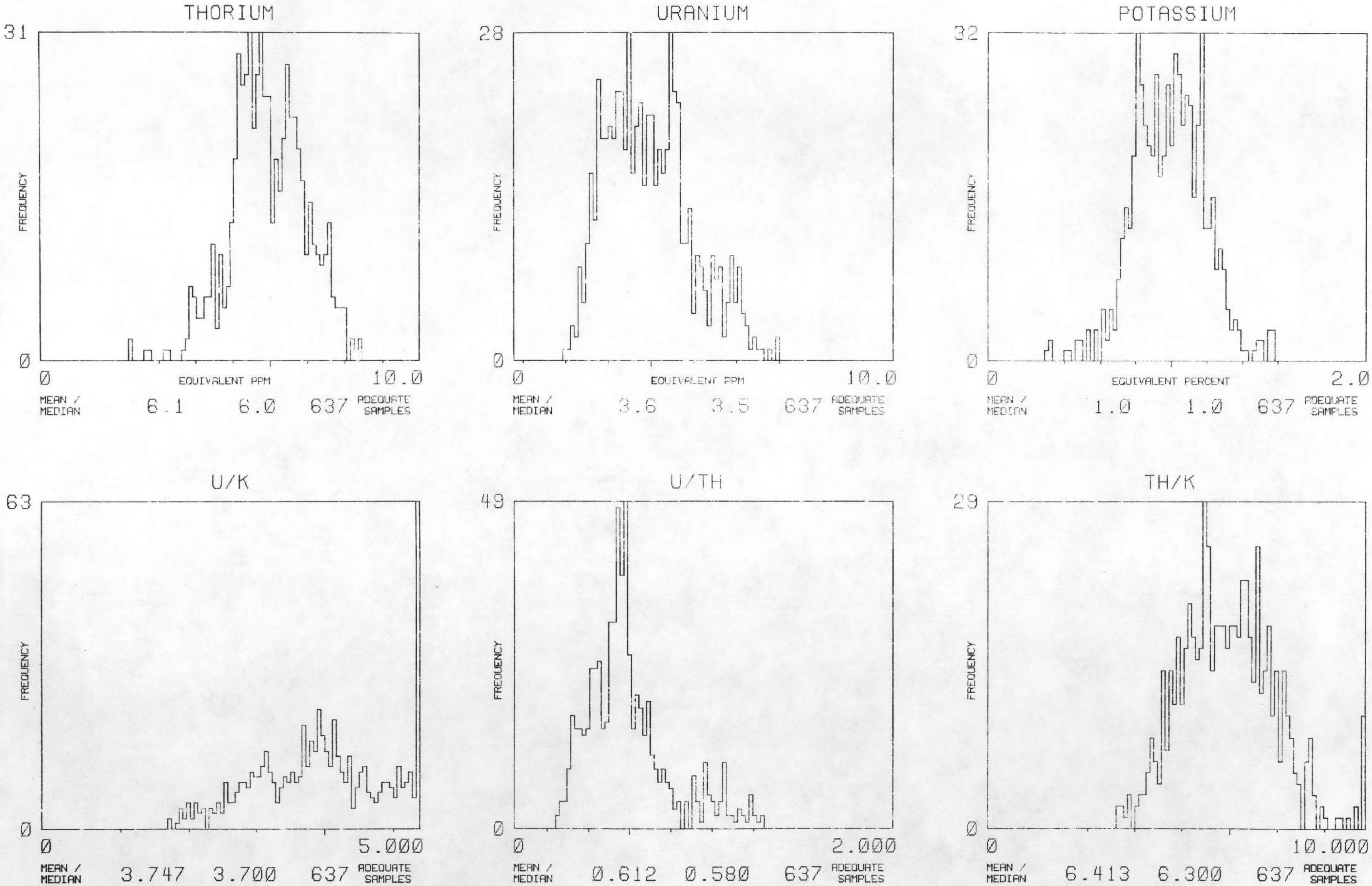
F13 co

NTMS NJ 17-1 COLUMBUS MAP UNIT : MU TOTAL NUMBER OF SAMPLES 3462



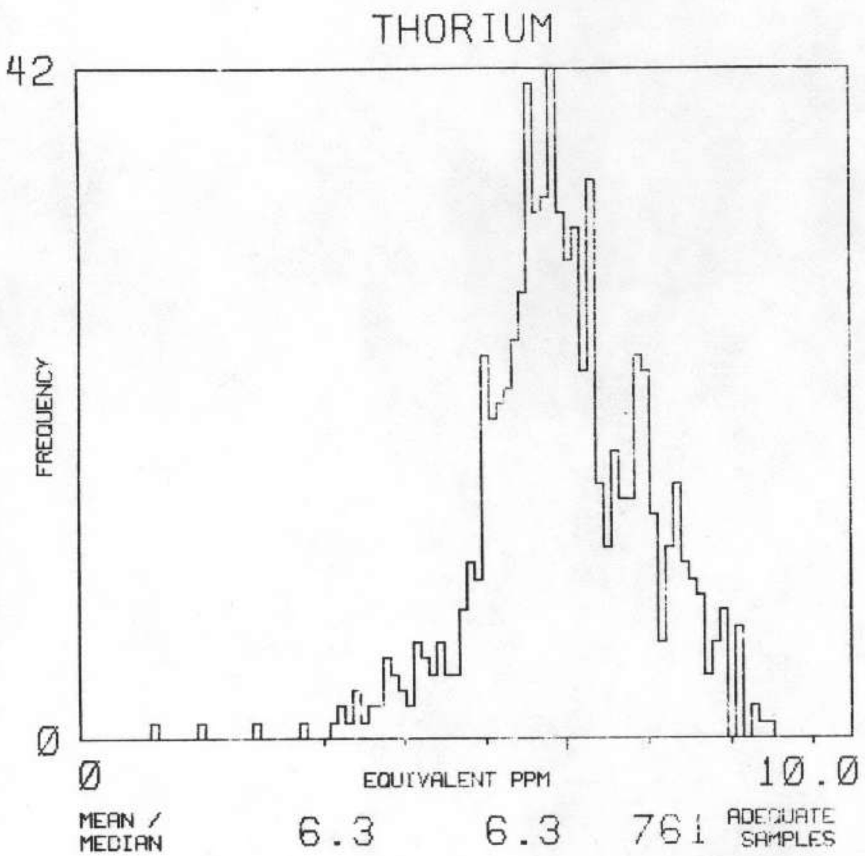
F14 co

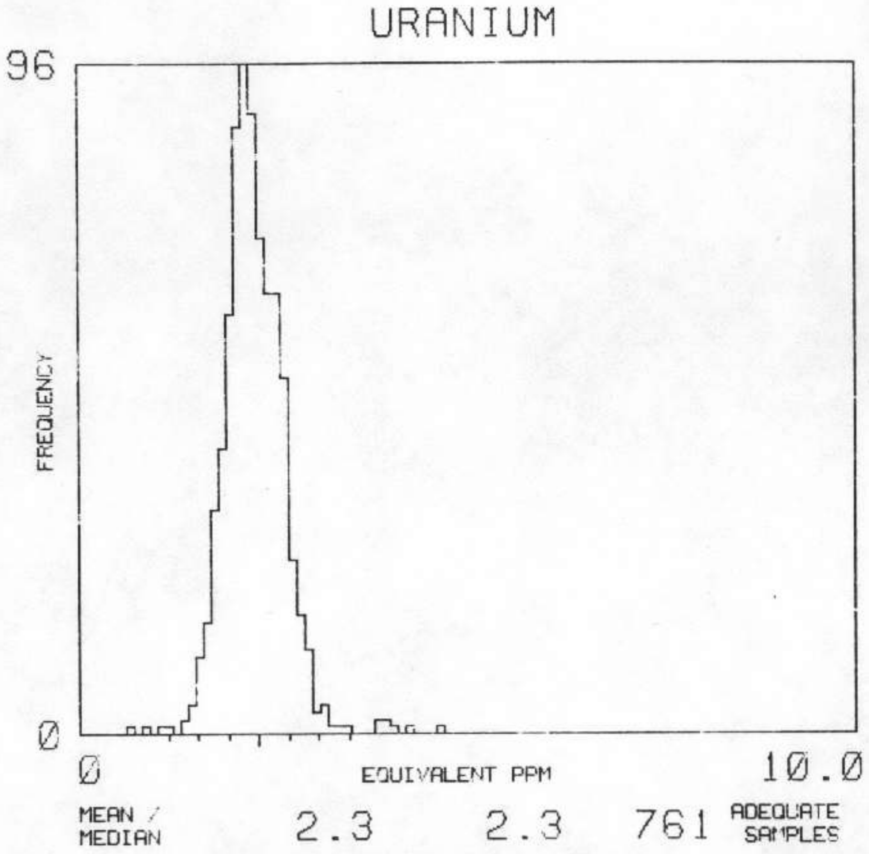
NTMS NJ 17 1 COLUMBUS MAP UNIT : DU TOTAL NUMBER OF SAMPLES 637

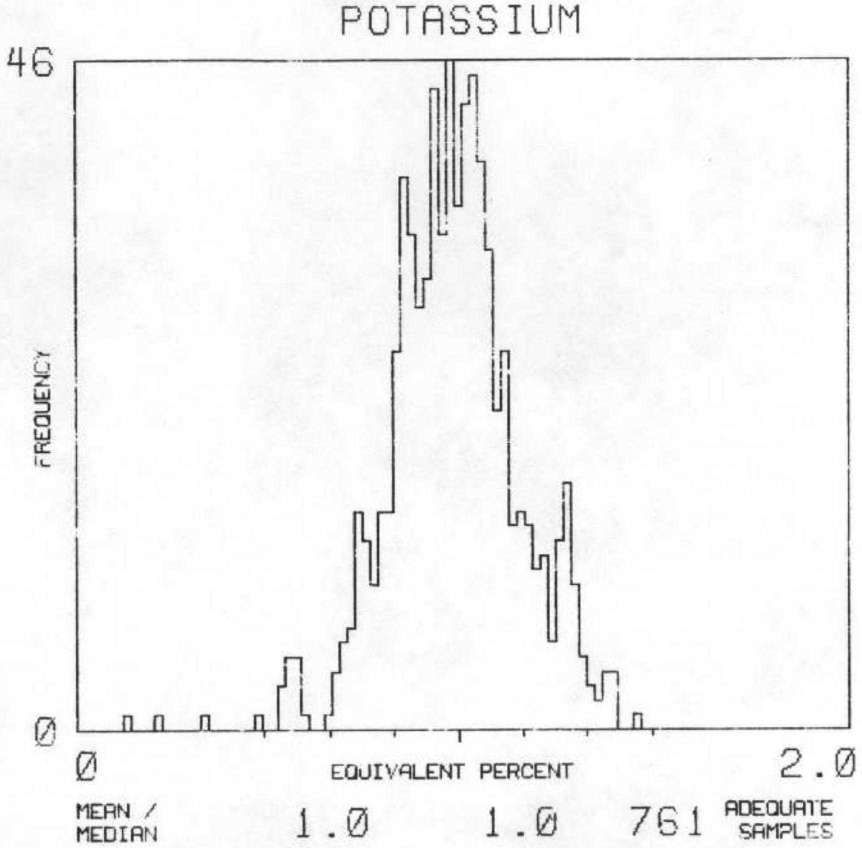


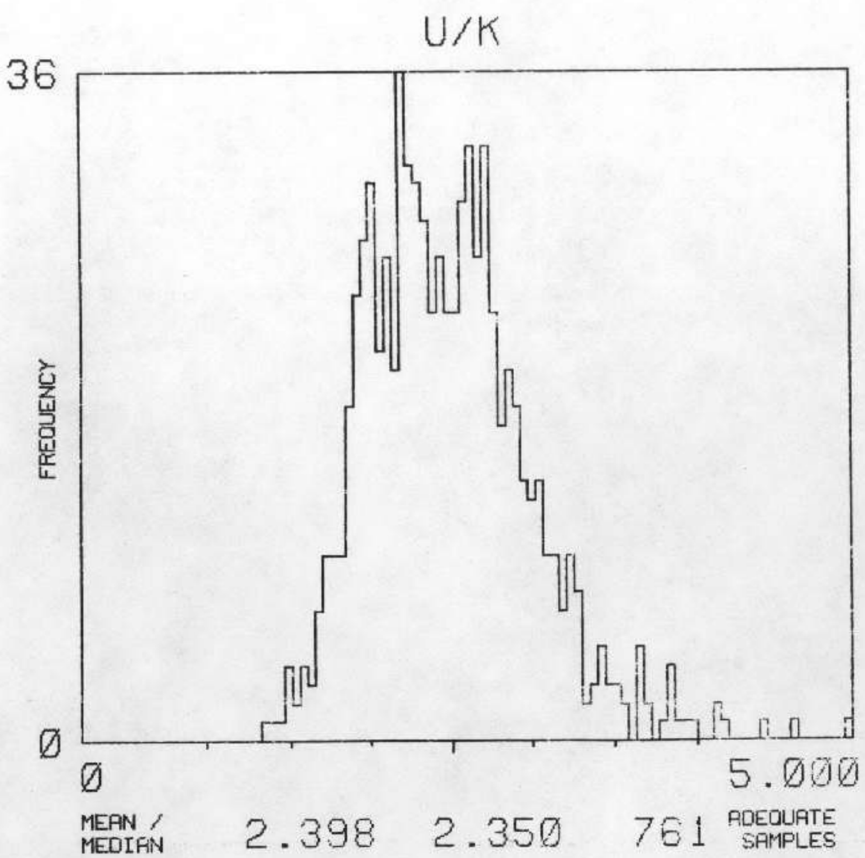
F15 co

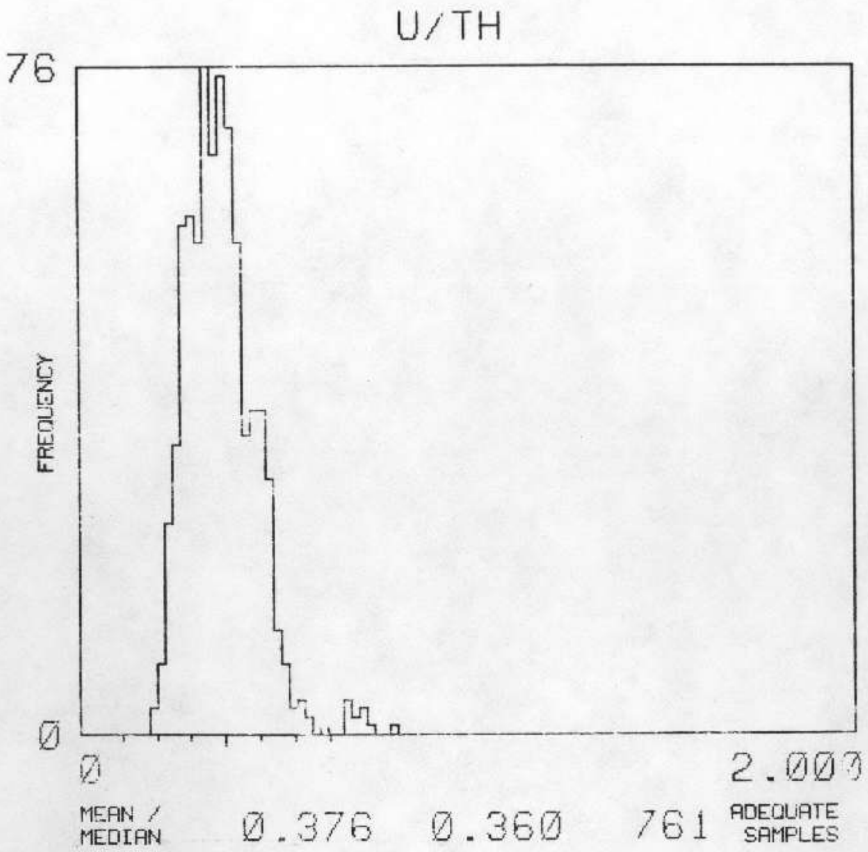
NTMS NJ 17-1 COLUMBUS   MAP UNIT : SU   TOTAL NUMBER OF SAMPLES 761

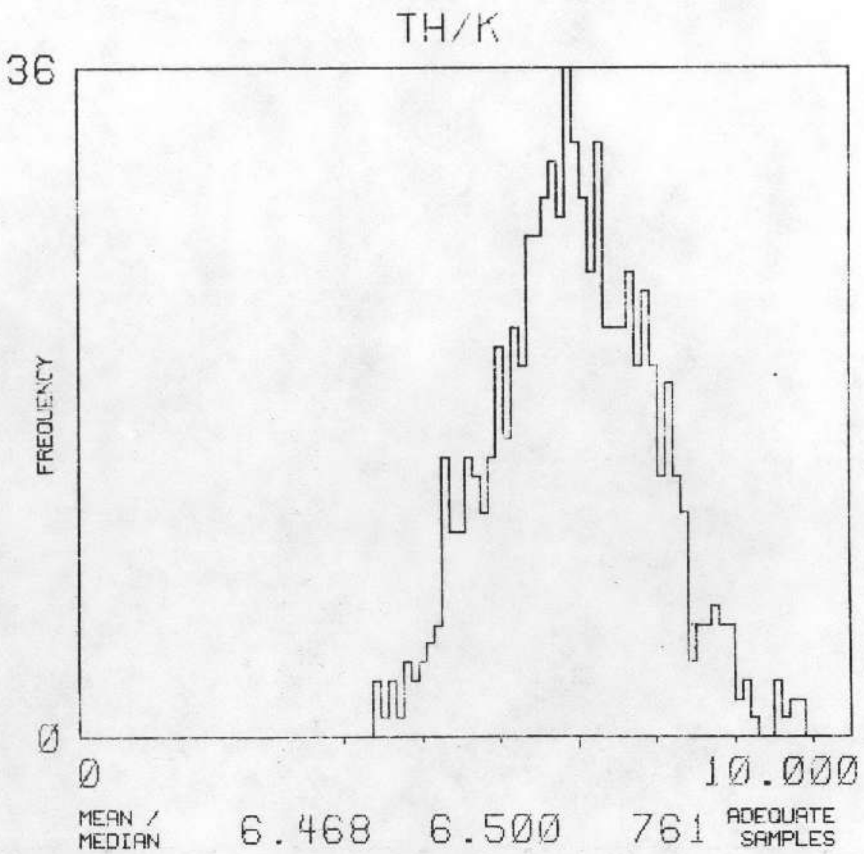








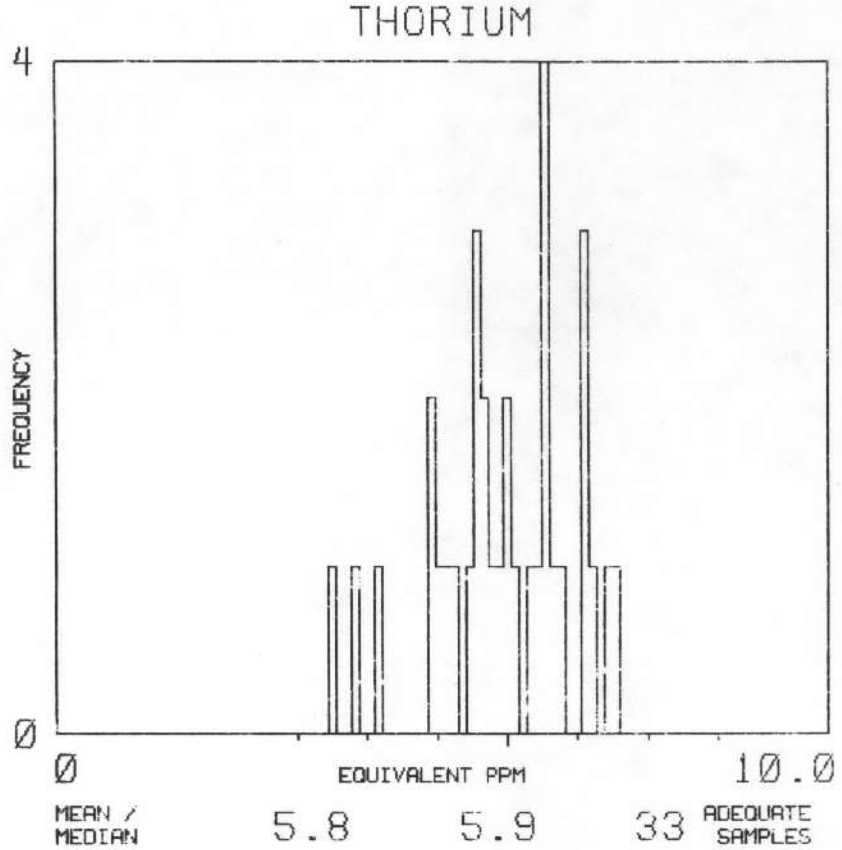


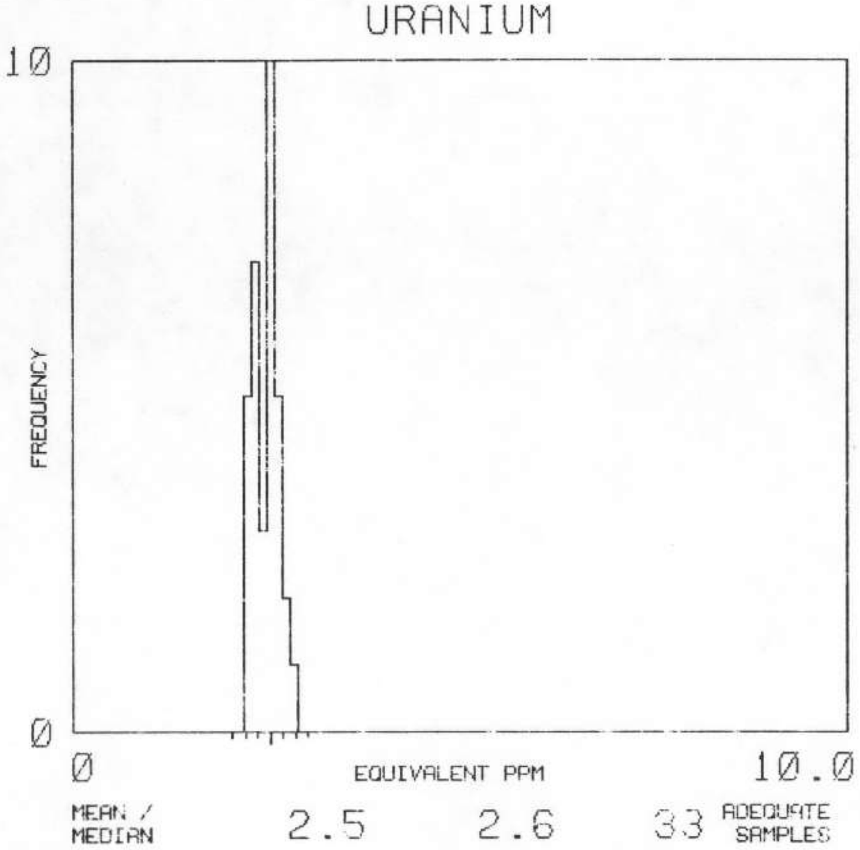


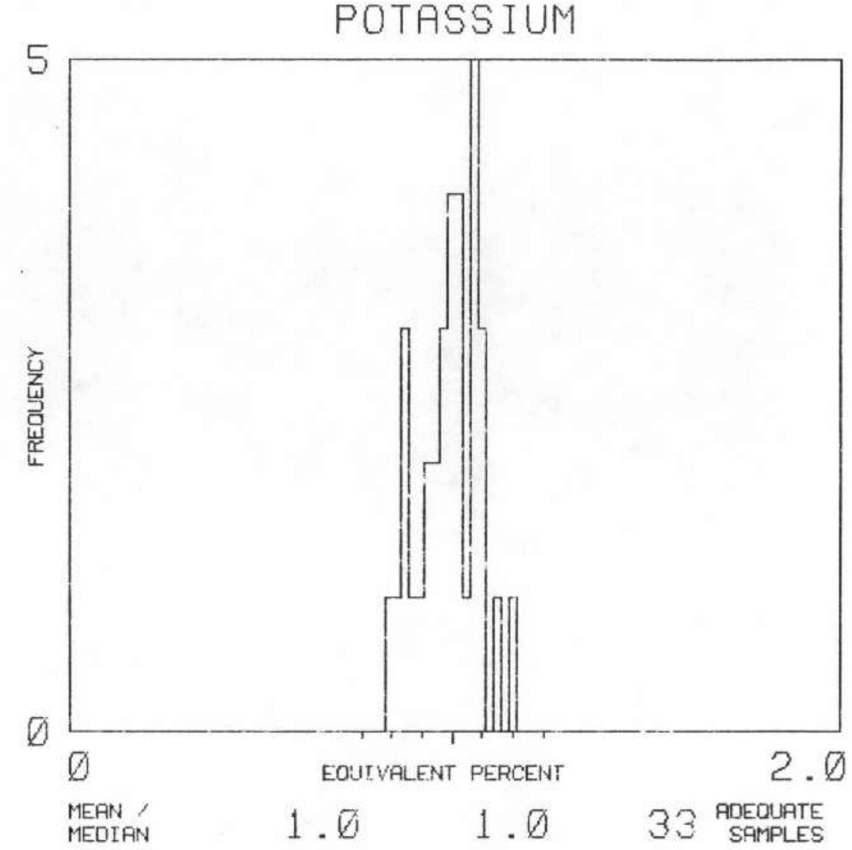
NTMS NJ 17-1 COLUMBUS

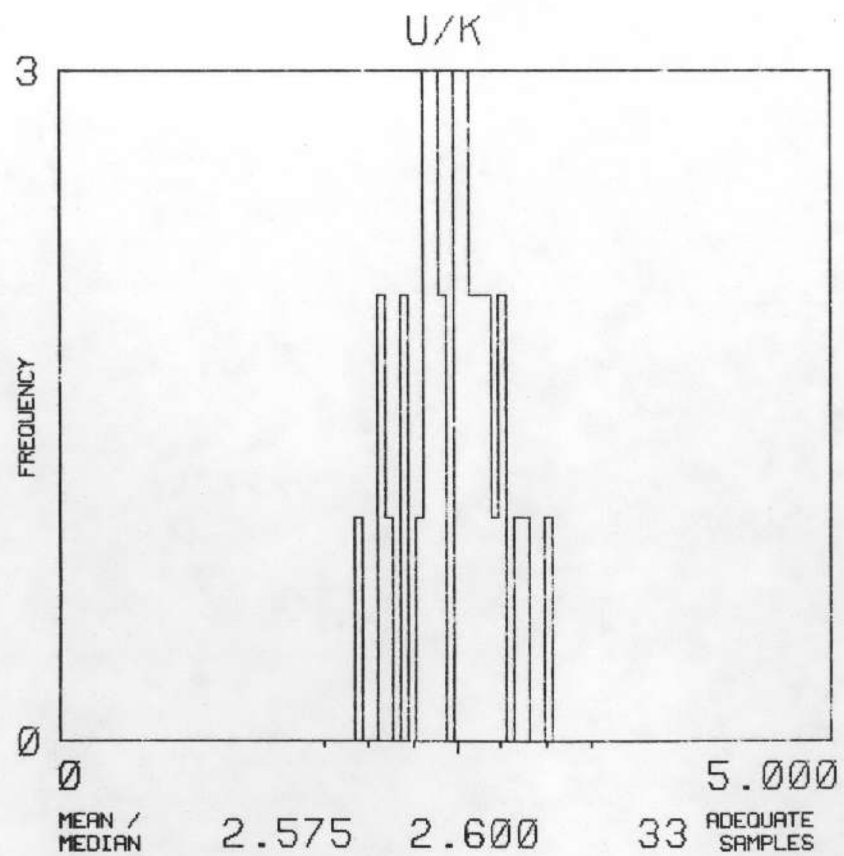
MAP UNIT : OR

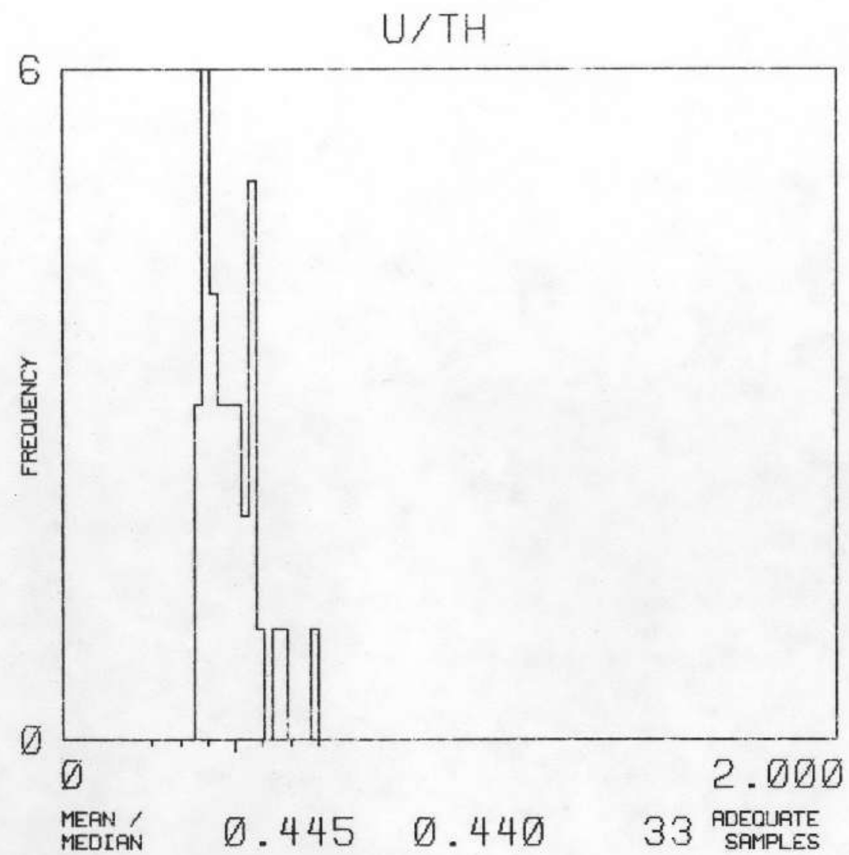
TOTAL NUMBER OF SAMPLES 33

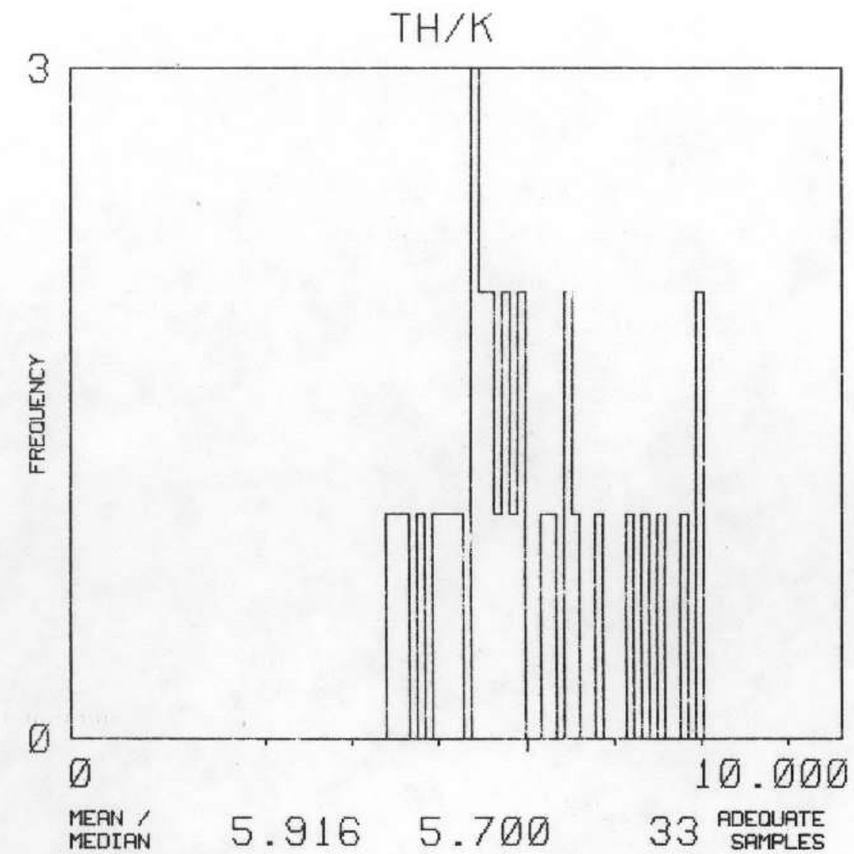












COLUMBUS QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
QAL	Qal
QWM	Qwm
QWG	Qwg
QK	Qk
QL	Ql
QO	Qo
QIC	Qic
QIT	Qit
QIM	Qim
PM	Pm
PC	Pc
PAP	Pap
MU	Mu
DU	Du
SU	Su
OR	Or

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 C.

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

APPENDIX G - Uranium Anomaly Summary and Statistical Tables

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT						PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF : 1	2	3	4	5	6	7	GT7
1 C	610	QWM	/ 2	/ 0	/ 0	/ 0	/ 0	3.9	0	2	0	0	0	0	0	0
2 C	620	QWM	/ 4QWG	/ 2	/ 0	/ 0	/ 0	4.3	3	3	0	0	0	0	0	0
3 C	620	QWG	/ 2	/ 0	/ 0	/ 0	/ 0	4.1	0	2	0	0	0	0	0	0
4 C	620	QWG	/ 5QAL	/ 6	/ 0	/ 0	/ 0	4.6	2	6	3	0	0	0	0	0
5 C	620	QWG	/ 5	/ 0	/ 0	/ 0	/ 0	4.3	1	4	0	0	0	0	0	0
6 C	620	QWG	/ 1QWM	/ 2	/ 0	/ 0	/ 0	4.7	0	2	1	0	0	0	0	0
7 C	620	QWG	/ 2	/ 0	/ 0	/ 0	/ 0	3.9	0	2	0	0	0	0	0	0
8 C	630	QWG	/ 2	/ 0	/ 0	/ 0	/ 0	4.4	1	0	1	0	0	0	0	0
9 C	630	QWG	/ 4	/ 0	/ 0	/ 0	/ 0	4.0	3	1	0	0	0	0	0	0
10 C	630	QAL	/ 6	/ 0	/ 0	/ 0	/ 0	4.0	3	3	0	0	0	0	0	0
11 C	630	QWG	/ 4QAL	/ 1	/ 0	/ 0	/ 0	3.8	3	2	0	0	0	0	0	0
12 C	630	QWG	/ 3	/ 0	/ 0	/ 0	/ 0	3.9	2	1	0	0	0	0	0	0
13 C	630	QWG	/ 4	/ 0	/ 0	/ 0	/ 0	4.0	1	3	0	0	0	0	0	0
14 C	630	QWM	/ 4QK	/ 1QWG	/ 1	/ 0	/ 0	3.7	3	3	0	0	0	0	0	0
15 C	630	QL	/ 7QWG	/ 2	/ 0	/ 0	/ 0	3.7	6	3	0	0	0	0	0	0
16 C	630	QWM	/ 2	/ 0	/ 0	/ 0	/ 0	3.6	0	2	0	0	0	0	0	0
17 C	630	QIT	/ 1	/ 0	/ 0	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
18 C	640	QWM	/ 3QAL	/ 3QL	/ 2	/ 0	/ 0	3.5	7	1	0	0	0	0	0	0
19 C	650	QWG	/ 2QAL	/ 1	/ 0	/ 0	/ 0	3.9	1	2	0	0	0	0	0	0
20 C	650	QWM	/ 3	/ 0	/ 0	/ 0	/ 0	3.5	2	1	0	0	0	0	0	0
21 C	660	QWM	/ 3	/ 0	/ 0	/ 0	/ 0	3.5	2	1	0	0	0	0	0	0
22 C	660	QWM	/ 3QWG	/ 1	/ 0	/ 0	/ 0	3.8	2	2	0	0	0	0	0	0
23 C	660	QAL	/ 6QD	/ 2	/ 0	/ 0	/ 0	4.8	3	4	0	1	0	0	0	0
24 C	670	QWM	/ 3	/ 0	/ 0	/ 0	/ 0	3.5	2	1	0	0	0	0	0	0
25 C	670	QWG	/ 4	/ 0	/ 0	/ 0	/ 0	4.0	2	2	0	0	0	0	0	0
26 C	670	QWG	/ 4	/ 0	/ 0	/ 0	/ 0	4.0	2	2	0	0	0	0	0	0
27 C	670	QAL	/ 1	/ 0	/ 0	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0
28 C	670	QD	/ 3QAL	/ 1	/ 0	/ 0	/ 0	3.5	3	1	0	0	0	0	0	0
29 C	670	QWG	/ 3	/ 0	/ 0	/ 0	/ 0	4.0	1	2	0	0	0	0	0	0
30 C	680	QAL	/ 1QWM	/ 2	/ 0	/ 0	/ 0	3.7	1	2	0	0	0	0	0	0
31 C	680	QWG	/ 3QAL	/ 1	/ 0	/ 0	/ 0	4.1	3	1	0	0	0	0	0	0
32 C	680	QWM	/ 3	/ 0	/ 0	/ 0	/ 0	4.2	0	1	2	0	0	0	0	0
33 C	680	QWM	/ 2	/ 0	/ 0	/ 0	/ 0	4.1	0	1	1	0	0	0	0	0
34 C	680	QAL	/ 2QWG	/ 2	/ 0	/ 0	/ 0	6.0	0	1	1	0	1	1	0	0
35 C	680	QWG	/ 3QWM	/ 2	/ 0	/ 0	/ 0	4.2	3	2	0	0	0	0	0	0
36 C	680	QAL	/ 4QD	/ 2	/ 0	/ 0	/ 0	4.2	2	3	1	0	0	0	0	0
37 C	680	QIT	/ 1	/ 0	/ 0	/ 0	/ 0	3.7	0	0	1	0	0	0	0	0
38 C	680	PC	/ 4	/ 0	/ 0	/ 0	/ 0	3.1	2	2	0	0	0	0	0	0
39 C	680	QAL	/ 2QD	/ 1PC	/ 3	/ 0	/ 0	3.9	0	5	1	0	0	0	0	0
40 C	680	PC	/ 2	/ 0	/ 0	/ 0	/ 0	3.5	1	0	1	0	0	0	0	0
41 C	680	PC	/ 2	/ 0	/ 0	/ 0	/ 0	3.8	0	0	1	1	0	0	0	0
42 C	690	QIT	/ 4	/ 0	/ 0	/ 0	/ 0	3.0	3	1	0	0	0	0	0	0
43 C	690	DU	/ 1QIT	/ 4	/ 0	/ 0	/ 0	4.2	1	2	0	2	0	0	0	0
44 C	690	QIT	/ 2	/ 0	/ 0	/ 0	/ 0	3.6	0	1	1	0	0	0	0	0
45 C	690	QIT	/ 2	/ 0	/ 0	/ 0	/ 0	4.7	0	1	0	0	0	0	0	0
46 C	690	QWM	/ 3	/ 0	/ 0	/ 0	/ 0	4.5	1	1	0	1	0	0	0	0
47 C	690	QK	/ 1QAL	/ 2QWM	/ 1QD	/ 1QIT	/ 4	4.2	4	3	1	1	0	0	0	0
48 C	690	QD	/ 3	/ 0	/ 0	/ 0	/ 0	3.7	2	1	0	0	0	0	0	0
49 C	700	QIC	/ 2	/ 0	/ 0	/ 0	/ 0	4.1	0	0	2	0	0	0	0	0
50 C	700	QIT	/ 2	/ 0	/ 0	/ 0	/ 0	3.7	0	1	1	0	0	0	0	0

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT					PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF: 1	2	3	4	5	6	7	GT7
51 C	700	PAP / 2	/ 0	/ 0	/ 0	/ 0	3.6	1	0	1	0	0	0	0	0
52 C	700	PAP / 2PC	/ 1	/ 0	/ 0	/ 0	3.0	2	1	0	0	0	0	0	0
53 C	700	PC / 1	/ 0	/ 0	/ 0	/ 0	3.5	0	0	1	0	0	0	0	0
54 C	700	PC / 1	/ 0	/ 0	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
55 C	710	SU / 1	/ 0	/ 0	/ 0	/ 0	4.7	0	0	0	0	0	1	0	0
56 C	710	MU / 3DU	/ 2	/ 0	/ 0	/ 0	5.5	1	2	0	2	0	0	0	0
57 C	710	DU / 3	/ 0	/ 0	/ 0	/ 0	6.1	0	3	0	0	0	0	0	0
58 C	710	DU / 5MU	/ 2	/ 0	/ 0	/ 0	6.0	5	1	1	0	0	0	0	0
59 C	710	MU / 3	/ 0	/ 0	/ 0	/ 0	4.5	0	0	3	0	0	0	0	0
60 C	710	MU / 2	/ 0	/ 0	/ 0	/ 0	3.7	0	2	0	0	0	0	0	0
61 C	710	QAL / 2QO	/ 2	/ 0	/ 0	/ 0	3.6	3	1	0	0	0	0	0	0
62 C	710	PAP / 1	/ 0	/ 0	/ 0	/ 0	4.9	0	0	0	0	0	0	0	0
63 C	720	SU / 1	/ 0	/ 0	/ 0	/ 0	4.1	0	0	0	0	1	0	0	0
64 C	720	DU / 5MU	/ 2	/ 0	/ 0	/ 0	7.0	0	5	0	0	1	0	1	0
65 C	720	MU / 2DU	/ 1	/ 0	/ 0	/ 0	5.5	1	1	0	1	0	0	0	0
66 C	720	QL / 4MU	/ 2	/ 0	/ 0	/ 0	4.0	2	4	0	0	0	0	0	0
67 C	1160	QWM / 5	/ 0	/ 0	/ 0	/ 0	3.9	1	4	0	0	0	0	0	0
68 C	1160	QWM / 2	/ 0	/ 0	/ 0	/ 0	4.1	0	1	1	0	0	0	0	0
69 C	1160	QWM / 3	/ 0	/ 0	/ 0	/ 0	4.1	0	1	2	0	0	0	0	0
70 C	1170	MU / 2	/ 0	/ 0	/ 0	/ 0	4.4	0	1	1	0	0	0	0	0
71 C	1170	QIT / 3	/ 0	/ 0	/ 0	/ 0	4.6	2	0	0	0	1	0	0	0
72 C	1170	QAL / 1QO	/ 2QWM	/ 1	/ 0	/ 0	4.9	1	2	0	1	0	0	0	0
73 C	1170	QIT / 6	/ 0	/ 0	/ 0	/ 0	3.7	1	4	1	0	0	0	0	0
74 C	1170	QIT / 3QWM	/ 1	/ 0	/ 0	/ 0	4.4	2	1	0	0	1	0	0	0
75 C	1170	QWG / 2	/ 0	/ 0	/ 0	/ 0	4.3	0	2	0	0	0	0	0	0
76 C	1170	QWG / 2	/ 0	/ 0	/ 0	/ 0	4.1	0	2	0	0	0	0	0	0
77 C	1170	QWG / 3	/ 0	/ 0	/ 0	/ 0	4.4	0	2	1	0	0	0	0	0
78 C	1170	QWG / 3	/ 0	/ 0	/ 0	/ 0	4.0	0	3	0	0	0	0	0	0
79 C	1170	QWG / 1QAL	/ 2QO	/ 2	/ 0	/ 0	4.4	2	1	2	0	0	0	0	0
80 C	1170	QO / 5QAL	/ 2QWG	/ 1	/ 0	/ 0	4.4	4	2	2	0	0	0	0	0
81 C	1170	QWG /14	/ 0	/ 0	/ 0	/ 0	5.0	1	9	3	1	0	0	0	0
82 C	1170	QWG / 9	/ 0	/ 0	/ 0	/ 0	4.5	0	5	4	0	0	0	0	0
83 C	1170	QWG / 3	/ 0	/ 0	/ 0	/ 0	4.1	2	1	0	0	0	0	0	0
84 C	1170	QWG / 2	/ 0	/ 0	/ 0	/ 0	4.1	0	2	0	0	0	0	0	0
85 C	1180	QL / 1QO	/ 1	/ 0	/ 0	/ 0	4.3	0	1	1	0	0	0	0	0
86 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	4.1	3	1	0	0	0	0	0	0
87 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	3.8	2	2	0	0	0	0	0	0
88 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	3.9	3	1	0	0	0	0	0	0
89 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	4.1	1	3	0	0	0	0	0	0
90 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	3.8	3	1	0	0	0	0	0	0
91 C	1180	QWG /10QAL	/ 2	/ 0	/ 0	/ 0	5.1	5	3	3	1	0	0	0	0
92 C	1180	QWG / 9QAL	/ 1	/ 0	/ 0	/ 0	4.6	2	5	3	0	0	0	0	0
93 C	1180	QWG / 4	/ 0	/ 0	/ 0	/ 0	4.5	1	1	2	0	0	0	0	0
94 C	1190	PAP / 4	/ 0	/ 0	/ 0	/ 0	4.1	1	2	0	1	0	0	0	0
95 C	1190	PAP / 3	/ 0	/ 0	/ 0	/ 0	4.2	1	0	0	2	0	0	0	0
96 C	1190	PAP / 3	/ 0	/ 0	/ 0	/ 0	3.1	2	1	0	0	0	0	0	0
97 C	1200	PC / 3	/ 0	/ 0	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
98 C	1200	PC / 1PAP	/ 1	/ 0	/ 0	/ 0	3.2	0	2	0	0	0	0	0	0
99 C	1200	PAP / 2QIT	/ 1	/ 0	/ 0	/ 0	3.3	1	2	0	0	0	0	0	0

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

C INDICATES THAT THE ANOMALY LIES OVER A CULTURAL FEATURE.

W INDICATES POSSIBLE INTERFERENCE BY WEATHER PHENOMENA.

MAP UNIT QAL

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.4381	0.6308	0.8235	1.0162	1.2089	1.4016	1.5943
URANIUM	DIST	NORMAL	0.7473	1.3500	1.9527	2.5554	3.1581	3.7608	4.3635
THORIUM	DIST	NORMAL	2.5845	3.6261	4.6677	5.7093	6.7509	7.7925	8.8341
U/K	DIST	NORMAL	0.8196	1.3974	1.9752	2.5530	3.1308	3.7086	4.2864
U/TH	DIST	NORMAL	0.0743	0.2023	0.3303	0.4583	0.5863	0.7143	0.8423
TH/K	DIST	NORMAL	2.4138	3.5178	4.6218	5.7258	6.8298	7.9338	9.0378

MAP UNIT QWM

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.7502	0.8926	1.0350	1.1774	1.3198	1.4622	1.6046
URANIUM	DIST	NORMAL	1.2482	1.7396	2.2310	2.7224	3.2138	3.7052	4.1966
THORIUM	DIST	NORMAL	3.8284	4.5878	5.3472	6.1066	6.8660	7.6254	8.3848
U/K	DIST	NORMAL	0.9651	1.4221	1.8791	2.3361	2.7931	3.2501	3.7071
U/TH	DIST	NORMAL	0.1928	0.2786	0.3644	0.4502	0.5360	0.6218	0.7076
TH/K	DIST	NORMAL	3.2936	3.9362	4.5788	5.2214	5.8640	6.5066	7.1492

MAP UNIT QWG

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.7750	0.9170	1.0590	1.2010	1.3430	1.4850	1.6270
URANIUM	DIST	NORMAL	1.1984	1.7769	2.3554	2.9339	3.5124	4.0909	4.6694
THORIUM	DIST	NORMAL	3.7825	4.5857	5.3889	6.1921	6.9953	7.7985	8.6017
U/K	DIST	NORMAL	0.9104	1.4281	1.9458	2.4635	2.9812	3.4989	4.0166
U/TH	DIST	NORMAL	0.1651	0.2698	0.3745	0.4792	0.5839	0.6886	0.7933
TH/K	DIST	NORMAL	3.5658	4.1013	4.6368	5.1723	5.7078	6.2433	6.7788

MAP UNIT QK

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.6578	0.8140	0.9702	1.1264	1.2826	1.4388	1.5950
URANIUM	DIST	NORMAL	0.8158	1.5069	2.1980	2.8891	3.5802	4.2713	4.9624
THORIUM	DIST	NORMAL	3.5874	4.3237	5.0600	5.7963	6.5326	7.2689	8.0052
U/K	DIST	NORMAL	0.5876	1.2576	1.9276	2.5976	3.2676	3.9376	4.6076
U/TH	DIST	NORMAL	0.1409	0.2612	0.3815	0.5018	0.6221	0.7424	0.8627
TH/K	DIST	NORMAL	3.0995	3.7985	4.4975	5.1965	5.8955	6.5945	7.2935

MAP UNIT QL

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.4173	0.5918	0.7663	0.9408	1.1153	1.2898	1.4643
URANIUM	DIST	NORMAL	0.8491	1.4583	2.0675	2.6767	3.2859	3.8951	4.5043
THORIUM	DIST	NORMAL	2.9444	3.9666	4.9888	6.0110	7.0332	8.0554	9.0776
U/K	DIST	NORMAL	0.7852	1.4813	2.1774	2.8735	3.5696	4.2657	4.9618
U/TH	DIST	NORMAL	0.1305	0.2362	0.3419	0.4476	0.5533	0.6590	0.7647
TH/K	DIST	NORMAL	2.4852	3.8342	5.1832	6.5322	7.8812	9.2302	10.5792

MAP UNIT QO

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.3303	0.5608	0.7913	1.0218	1.2523	1.4828	1.7133
URANIUM	DIST	NORMAL	0.7091	1.3259	1.9427	2.5595	3.1763	3.7931	4.4099
THORIUM	DIST	NORMAL	1.7662	2.9421	4.1180	5.2939	6.4698	7.6457	8.8216
U/K	DIST	NORMAL	0.6470	1.2715	1.8960	2.5205	3.1450	3.7695	4.3940
U/TH	DIST	NORMAL	0.0928	0.2250	0.3572	0.4894	0.6216	0.7538	0.8860
TH/K	DIST	NORMAL	2.8155	3.6309	4.4463	5.2617	6.0771	6.8925	7.7079

MAP UNIT QIC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5223	0.6695	0.8167	0.9639	1.1111	1.2583	1.4055
URANIUM DIST NORMAL	0.5597	1.1913	1.8229	2.4545	3.0861	3.7177	4.3493
THORIUM DIST NORMAL	2.0576	3.2440	4.4304	5.6168	6.8032	7.9896	9.1760
U/K DIST NORMAL	0.6747	1.2888	1.9029	2.5170	3.1311	3.7452	4.3593
U/TH DIST NORMAL	0.0435	0.1751	0.3067	0.4383	0.5699	0.7015	0.8331
TH/K DIST NORMAL	3.3119	4.1718	5.0317	5.8916	6.7515	7.6114	8.4713

MAP UNIT QIT

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4673	0.6170	0.7667	0.9164	1.0661	1.2158	1.3655
URANIUM DIST NORMAL	1.1522	1.5713	1.9904	2.4095	2.8286	3.2477	3.6668
THORIUM DIST NORMAL	3.4517	4.3015	5.1513	6.0011	6.8509	7.7007	8.5505
U/K DIST NORMAL	0.9587	1.5349	2.1111	2.6873	3.2635	3.8397	4.4159
U/TH DIST NORMAL	0.1598	0.2425	0.3252	0.4079	0.4906	0.5733	0.6560
TH/K DIST NORMAL	3.8121	4.7528	5.6935	6.6342	7.5749	8.5156	9.4563

MAP UNIT QIM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4603	0.5604	0.6605	0.7606	0.8607	0.9608	1.0609
URANIUM DIST NORMAL	1.6311	1.9686	2.3061	2.6436	2.9811	3.3186	3.6561
THORIUM DIST NORMAL	4.0364	4.7765	5.5166	6.2567	6.9968	7.7369	8.4770
U/K DIST NORMAL	2.0303	2.5227	3.0151	3.5075	3.9999	4.4923	4.9847
U/TH DIST NORMAL	0.1954	0.2733	0.3512	0.4291	0.5070	0.5849	0.6628
TH/K DIST NORMAL	5.5848	6.4856	7.3864	8.2872	9.1880	10.0888	10.9896

MAP UNIT PM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5377	0.6630	0.7883	0.9136	1.0389	1.1642	1.2895
URANIUM DIST NORMAL	1.2150	1.5908	1.9666	2.3424	2.7182	3.0940	3.4698
THORIUM DIST NORMAL	4.0715	4.9468	5.8221	6.6974	7.5727	8.4480	9.3233
U/K DIST NORMAL	1.1828	1.6536	2.1244	2.5952	3.0660	3.5368	4.0076
U/TH DIST NORMAL	0.1730	0.2331	0.2932	0.3533	0.4134	0.4735	0.5336
TH/K DIST NORMAL	5.1042	5.8605	6.6168	7.3731	8.1294	8.8857	9.6420

MAP UNIT PC

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5311	0.6649	0.7987	0.9325	1.0663	1.2001	1.3339
URANIUM DIST NORMAL	1.1886	1.5831	1.9776	2.3721	2.7666	3.1611	3.5556
THORIUM DIST NORMAL	3.7997	4.6778	5.5559	6.4340	7.3121	8.1902	9.0683
U/K DIST NORMAL	1.0699	1.5744	2.0789	2.5834	3.0879	3.5924	4.0969
U/TH DIST NORMAL	0.1697	0.2375	0.3053	0.3731	0.4409	0.5087	0.5765
TH/K DIST NORMAL	4.1677	5.1005	6.0333	6.9661	7.8989	8.8317	9.7645

MAP UNIT PAP

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4388	0.6096	0.7804	0.9512	1.1220	1.2928	1.4636
URANIUM DIST NORMAL	1.1074	1.5276	1.9478	2.3680	2.7882	3.2084	3.6286
THORIUM DIST NORMAL	2.8207	3.9120	5.0033	6.0946	7.1859	8.2772	9.3685
U/K DIST NORMAL	0.8741	1.4318	1.9895	2.5472	3.1049	3.6626	4.2203
U/TH DIST NORMAL	0.1589	0.2381	0.3173	0.3965	0.4757	0.5549	0.6341
TH/K DIST NORMAL	4.0231	4.8335	5.6439	6.4543	7.2647	8.0751	8.8855

MAP UNIT MU

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3684	0.5300	0.6916	0.8532	1.0148	1.1764	1.3380
URANIUM DIST NORMAL	0.3582	1.0408	1.7234	2.4060	3.0886	3.7712	4.4538
THURIUM DIST NORMAL	2.8017	3.8238	4.8459	5.8680	6.8901	7.9122	8.9343
U/K DIST NORMAL	0.6412	1.3821	2.1230	2.8639	3.6048	4.3457	5.0866
U/TH DIST NORMAL	0.0686	0.1841	0.2996	0.4151	0.5306	0.6461	0.7616
TH/K DIST NORMAL	3.7686	4.8385	5.9084	6.9783	8.0482	9.1181	10.1880

MAP UNIT DU

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4052	0.5937	0.7822	0.9707	1.1592	1.3477	1.5362
URANIUM DIST NORMAL	0.2560	1.3795	2.5030	3.6265	4.7500	5.8735	6.9970
THURIUM DIST NORMAL	3.0878	4.0822	5.0766	6.0710	7.0654	8.0598	9.0542
U/K DIST NORMAL	1.0342	1.9385	2.8428	3.7471	4.6514	5.5557	6.4600
U/TH DIST NORMAL	-0.0411	0.1766	0.3943	0.6120	0.8297	1.0474	1.2651
TH/K DIST NORMAL	2.6411	3.8984	5.1557	6.4130	7.6703	8.9276	10.1849

MAP UNIT SU

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4869	0.6540	0.8211	0.9882	1.1553	1.3224	1.4895
URANIUM DIST NORMAL	1.1423	1.5310	1.9197	2.3084	2.6971	3.0858	3.4745
THURIUM DIST NORMAL	3.1213	4.1847	5.2481	6.3115	7.3749	8.4383	9.5017
U/K DIST NORMAL	0.8020	1.3340	1.8660	2.3980	2.9300	3.4620	3.9940
U/TH DIST NORMAL	0.1094	0.1984	0.2874	0.3764	0.4654	0.5544	0.6434
TH/K DIST NORMAL	3.4370	4.4474	5.4578	6.4682	7.4786	8.4890	9.4994

MAP UNIT OR

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7584	0.8369	0.9154	0.9939	1.0724	1.1509	1.2294
URANIUM DIST NORMAL	2.0493	2.2131	2.3769	2.5407	2.7045	2.8683	3.0321
THURIUM DIST NORMAL	3.0979	4.0112	4.9245	5.8378	6.7511	7.6644	8.5777
U/K DIST NORMAL	1.7007	1.9922	2.2837	2.5752	2.8667	3.1582	3.4497
U/TH DIST NORMAL	0.2313	0.3026	0.3739	0.4452	0.5165	0.5878	0.6591
TH/K DIST NORMAL	2.5212	3.6527	4.7842	5.9157	7.0472	8.1787	9.3102

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT QAL

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1.112	1.096	1.138	0.981	1.011	1.044	1.083	1.042	0.943	0.882	0.911	0.830	1.124	1.157	1.118
URANIUM	2.609	2.901	2.917	2.255	2.394	2.465	2.604	2.889	2.414	2.581	2.351	2.380	2.196	2.404	3.229
THURIUM	6.149	5.761	5.969	5.336	5.230	5.323	5.820	6.041	5.446	5.710	5.922	5.506	5.602	6.271	5.582
U/K	2.369	2.738	2.589	2.348	2.422	2.363	2.406	2.774	2.619	2.946	2.593	2.841	2.010	2.081	2.920
U/TH	0.432	0.538	0.506	0.431	0.464	0.468	0.463	0.498	0.452	0.463	0.406	0.435	0.396	0.384	0.591
TH/K	5.559	5.253	5.302	5.518	5.275	5.200	5.499	5.919	5.853	6.554	6.541	6.657	5.066	5.466	4.994

	1180	1190	1200
POTASIUM	1.147	0.869	0.902
URANIUM	3.055	2.367	2.532
THURIUM	6.074	5.263	6.184
U/K	2.671	2.734	2.845
U/TH	0.512	0.453	0.413
TH/K	5.320	6.082	6.925

MAP UNIT QWM

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1.218	1.204	1.180	1.129	1.148	1.211	1.134	1.194	1.032	0.863	0.000	0.000	1.228	1.283	1.118
URANIUM	2.645	2.705	2.777	2.684	2.517	2.903	2.634	2.954	2.627	2.796	0.000	0.000	2.324	2.981	3.219
THURIUM	6.202	6.422	5.888	5.865	5.805	6.182	5.684	6.184	5.697	5.751	0.000	0.000	6.337	6.613	6.334
U/K	2.200	2.267	2.364	2.407	2.198	2.403	2.337	2.487	2.590	3.466	0.000	0.000	1.899	2.328	2.965
U/TH	0.429	0.424	0.476	0.463	0.435	0.474	0.470	0.482	0.474	0.489	0.000	0.000	0.371	0.453	0.508
TH/K	5.149	5.373	5.009	5.228	5.071	5.117	5.018	5.198	5.517	7.034	0.000	0.000	5.177	5.170	5.856

	1180	1190	1200
POTASIUM	1.139	1.000	0.000
URANIUM	2.811	2.698	0.000
THURIUM	6.185	5.733	0.000
U/K	2.492	2.711	0.000
U/TH	0.464	0.472	0.000
TH/K	5.439	5.773	0.000

MAP UNIT QWG

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1.235	1.226	1.207	1.196	1.180	1.169	1.157	1.243	1.083	0.000	0.000	0.000	1.212	1.255	1.276
URANIUM	2.921	3.032	2.883	2.748	2.676	2.771	2.898	3.121	2.547	0.000	0.000	0.000	2.387	2.773	3.629
THORIUM	6.431	6.303	6.127	6.016	5.942	5.953	6.020	6.258	5.492	0.000	0.000	0.000	6.356	6.656	6.667
U/K	2.390	2.504	2.406	2.318	2.273	2.387	2.526	2.538	2.378	0.000	0.000	0.000	1.985	2.228	2.866
U/TH	0.458	0.490	0.477	0.463	0.454	0.470	0.487	0.504	0.474	0.000	0.000	0.000	0.381	0.421	0.551
TH/K	5.246	5.162	5.091	5.043	5.043	5.112	5.225	5.070	5.070	0.000	0.000	0.000	5.254	5.313	5.234

	1180	1190	1200
POTASIUM	1.174	1.042	0.000
URANIUM	3.505	2.799	0.000
THORIUM	6.295	5.693	0.000
U/K	3.026	2.706	0.000
U/TH	0.563	0.497	0.000
TH/K	5.391	5.483	0.000

MAP UNIT QK

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.868	1.137	1.262	0.783	0.986	0.000	0.000	1.126	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	2.275	2.724	2.398	1.878	2.519	0.000	0.000	3.074	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	5.593	5.813	5.686	3.458	5.530	0.000	0.000	5.728	0.000	0.000	0.000	0.000	0.000	0.000
U/K	0.000	2.628	2.401	1.918	2.397	2.577	0.000	0.000	2.752	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.407	0.470	0.428	0.544	0.458	0.000	0.000	0.543	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	6.486	5.152	4.506	4.430	5.663	0.000	0.000	5.082	0.000	0.000	0.000	0.000	0.000	0.000

	1180	1190	1200
POTASIUM	1.170	0.000	0.000
URANIUM	3.588	0.000	0.000
THORIUM	6.173	0.000	0.000
U/K	3.145	0.000	0.000
U/TH	0.591	0.000	0.000
TH/K	5.304	0.000	0.000

MAP UNIT QL

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.864	1.165	1.000	0.913	0.905	0.921	0.000	0.000	0.804	0.000	0.880	0.000	0.000	0.000
URANIUM	0.000	2.597	3.052	2.438	1.972	2.298	2.332	0.000	0.000	3.020	0.000	2.878	0.000	0.000	0.000
THORIUM	0.000	4.763	5.967	5.683	5.612	6.176	6.166	0.000	0.000	4.234	0.000	6.541	0.000	0.000	0.000
U/K	0.000	3.060	2.628	2.427	2.169	2.618	2.519	0.000	0.000	3.782	0.000	3.329	0.000	0.000	0.000
U/TH	0.000	0.558	0.513	0.437	0.351	0.384	0.379	0.000	0.000	0.719	0.000	0.441	0.000	0.000	0.000
TH/K	0.000	5.509	5.161	5.728	6.179	6.811	6.717	0.000	0.000	5.276	0.000	7.587	0.000	0.000	0.000

	1180	1190	1200
POTASIUM	0.976	0.827	0.000
URANIUM	3.167	2.315	0.000
THORIUM	7.071	4.745	0.000
U/K	3.300	2.605	0.000
U/TH	0.458	0.452	0.000
TH/K	7.408	5.869	0.000

MAP UNIT QO

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1.028	1.125	1.038	1.103	1.100	1.010	1.185	0.978	1.053	0.822	1.094	0.891	1.033	0.890	1.119
URANIUM	2.424	2.348	2.211	2.379	2.855	2.432	2.971	3.203	2.788	2.599	3.356	2.359	2.341	2.227	3.772
THORIUM	5.007	5.940	5.191	5.253	5.226	5.154	5.262	5.338	5.737	4.623	4.998	5.571	4.809	5.234	5.210
U/K	2.248	2.154	2.155	2.223	2.592	2.400	2.495	3.338	2.681	2.969	3.180	2.644	2.330	2.463	3.381
U/TH	0.465	0.407	0.441	0.465	0.546	0.474	0.571	0.630	0.494	0.524	0.680	0.423	0.496	0.418	0.729
TH/K	5.120	5.367	5.006	4.829	4.787	5.178	4.452	5.434	5.523	5.711	4.643	6.255	4.707	5.875	4.667

	1180	1190	1200
POTASIUM	1.038	0.921	0.000
URANIUM	2.659	2.344	0.000
THORIUM	5.784	5.121	0.000
U/K	2.626	2.542	0.000
U/TH	0.498	0.458	0.000
TH/K	5.521	5.604	0.000

MAP UNIT QIC

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.978	0.000	0.000	0.000	0.932	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.586	0.000	0.000	0.000	2.149	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.419	0.000	0.000	0.000	6.044	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.649	0.000	0.000	0.000	2.210	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.484	0.000	0.000	0.000	0.333	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.533	0.000	0.000	0.000	6.683	0.000

	1180	1190	1200
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 QIT

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1.008	1.061	1.143	1.085	0.746	0.837	0.896	0.965	0.883	0.888	0.852	0.788	0.921	0.978	1.035
URANIUM	2.353	2.523	2.409	2.114	2.137	2.080	1.834	2.438	2.624	2.621	2.263	2.322	2.296	2.315	3.089
THORIUM	6.747	6.944	6.963	6.148	4.729	4.568	5.144	6.004	5.729	5.915	5.760	5.594	6.421	6.496	6.466
U/K	2.346	2.398	2.117	1.956	2.853	2.527	2.078	2.591	3.004	2.984	2.704	3.012	2.537	2.384	2.998
U/TH	0.352	0.369	0.347	0.346	0.455	0.459	0.359	0.410	0.462	0.449	0.397	0.419	0.360	0.360	0.483
TH/K	6.749	6.543	6.117	5.716	6.336	5.568	5.870	6.348	6.556	6.698	6.836	7.189	7.064	6.650	6.355

	1180	1190	1200
POTASIUM	0.989	0.945	1.014
URANIUM	2.222	2.349	3.163
THORIUM	6.589	5.141	6.541
U/K	2.282	2.520	3.123
U/TH	0.342	0.462	0.484
TH/K	6.713	5.467	6.460

MAP UNIT QIM

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.764	0.000	0.000	0.000	0.000	0.759
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.938	0.000	0.000	0.000	0.000	2.477
THURIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.207	0.000	0.000	0.000	0.000	6.285
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.922	0.000	0.000	0.000	0.000	3.273
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.483	0.000	0.000	0.000	0.000	0.399
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	8.132	0.000	0.000	0.000	0.000	8.375

	1180	1190	1200
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THURIUM	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 PM

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	1.120	0.985	1.026	1.006	0.991	0.884	0.858	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	2.236	2.290	2.698	2.393	2.740	2.167	2.284	0.000	0.000	0.000
THURIUM	0.000	0.000	0.000	0.000	0.000	8.214	7.632	7.378	7.182	7.059	6.533	6.353	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	2.003	2.342	2.626	2.399	2.815	2.476	2.678	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.274	0.302	0.364	0.335	0.393	0.334	0.361	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	7.347	7.762	7.193	7.181	7.169	7.439	7.445	0.000	0.000	0.000

	1180	1190	1200
POTASIUM	0.000	0.000	0.842
URANIUM	0.000	0.000	2.369
THURIUM	0.000	0.000	6.262
U/K	0.000	0.000	2.837
U/TH	0.000	0.000	0.383
TH/K	0.000	0.000	7.447

MAP UNIT PC

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0. 000	0. 000	1. 218	0. 990	0. 999	0. 957	0. 994	0. 999	0. 910	0. 884	0. 904	0. 900	0. 000	0. 000	0. 000
URANIUM	0. 000	0. 000	2. 353	2. 303	2. 135	2. 112	2. 219	2. 624	2. 371	2. 493	2. 226	2. 323	0. 000	0. 000	0. 000
THURIUM	0. 000	0. 000	8. 094	6. 230	6. 499	6. 361	6. 922	6. 476	6. 344	6. 497	6. 472	6. 382	0. 000	0. 000	0. 000
U/K	0. 000	0. 000	1. 944	2. 344	2. 153	2. 222	2. 258	2. 628	2. 650	2. 837	2. 481	2. 599	0. 000	0. 000	0. 000
U/TH	0. 000	0. 000	0. 293	0. 374	0. 332	0. 334	0. 323	0. 407	0. 379	0. 388	0. 346	0. 368	0. 000	0. 000	0. 000
TH/K	0. 000	0. 000	6. 672	6 321	6. 516	6. 674	7. 016	6. 513	7. 010	7. 388	7. 211	7. 148	0. 000	0. 000	0. 000

	1180	1190	1200
POTASIUM	0. 000	0. 000	0. 907
URANIUM	0. 000	0. 000	2. 486
THURIUM	0. 000	0. 000	6. 315
U/K	0. 000	0. 000	2. 804
U/TH	0. 000	0. 000	0. 399
TH/K	0. 000	0. 000	7. 068

MAP UNIT PAP

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	1. 013	1. 174	1. 145	1. 040	1. 053	0. 991	0. 973	1. 008	0. 916	0. 817	0. 876	0. 872	0. 000	0. 000	0. 000
URANIUM	2. 218	2. 503	2. 307	2. 257	2. 259	2. 241	2. 341	2. 444	2. 385	2. 288	2. 368	2. 338	0. 000	0. 000	0. 000
THURIUM	6. 638	7. 389	7. 498	6. 361	6. 554	6. 427	6. 422	6. 238	5. 815	5. 183	5. 897	5. 471	0. 000	0. 000	0. 000
U/K	2. 216	2. 151	2. 040	2. 194	2. 158	2. 287	2. 426	2. 443	2. 685	2. 828	2. 796	2. 725	0. 000	0. 000	0. 000
U/TH	0. 339	0. 343	0. 310	0. 358	0. 346	0. 352	0. 368	0. 397	0. 417	0. 446	0. 408	0. 432	0. 000	0. 000	0. 000
TH/K	6. 569	6. 304	6. 622	6. 141	6. 256	6. 525	6. 628	6. 201	6. 422	6. 372	6. 843	6. 336	0. 000	0. 000	0. 000

	1180	1190	1200
POTASIUM	0. 710	0. 880	1. 031
URANIUM	1. 784	2. 428	2. 553
THURIUM	5. 548	5. 691	6. 488
U/K	2. 565	2. 789	2. 500
U/TH	0. 323	0. 433	0. 398
TH/K	7. 977	6. 497	6. 317

MAP UNIT MU

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.892	1.103	0.000	0.000	0.773	0.793	0.805	0.855	0.850	0.889	0.853	0.861	0.000	0.000	1.004
URANIUM	1.742	2.421	0.000	0.000	1.927	1.877	1.837	2.045	2.468	2.572	2.704	2.859	0.000	0.000	2.789
THORIUM	5.083	7.543	0.000	0.000	4.984	4.971	5.176	6.039	5.742	6.148	5.781	6.149	0.000	0.000	7.410
U/K	1.982	2.192	0.000	0.000	2.595	2.383	2.351	2.428	2.944	2.931	3.237	3.374	0.000	0.000	2.820
U/TH	0.351	0.323	0.000	0.000	0.393	0.381	0.364	0.342	0.433	0.423	0.481	0.469	0.000	0.000	0.379
TH/K	5.688	6.863	0.000	0.000	6.652	6.322	6.500	7.146	6.862	6.974	6.907	7.321	0.000	0.000	7.462

	1180	1190	1200
POTASIUM	0.777	0.830	1.084
URANIUM	2.204	2.106	2.121
THORIUM	5.932	5.188	5.955
U/K	2.901	2.561	1.958
U/TH	0.374	0.409	0.357
TH/K	7.842	6.290	5.500

MAP UNIT DU

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.010	1.054	0.924	0.957	0.000	0.000	1.040
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.594	2.971	3.827	3.529	0.000	0.000	3.589
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.629	6.485	5.494	6.323	0.000	0.000	7.066
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.557	2.826	4.136	3.663	0.000	0.000	3.485
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.634	0.462	0.712	0.564	0.000	0.000	0.512
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.648	6.157	6.158	6.828	0.000	0.000	6.870

	1180	1190	1200
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

MAP UNIT SU

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	1.067	0.000	0.000	1.117	0.885	0.952	0.951	0.000	1.076	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	2.078	0.000	0.000	2.479	2.385	2.342	2.392	0.000	2.074	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	5.070	0.000	0.000	5.642	5.329	6.022	6.708	0.000	6.960	0.000
U/K	0.000	0.000	0.000	0.000	0.000	1.947	0.000	0.000	2.239	2.759	2.483	2.563	0.000	1.984	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.417	0.000	0.000	0.444	0.455	0.393	0.362	0.000	0.307	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	4.748	0.000	0.000	5.071	6.081	6.380	7.141	0.000	6.526	0.000

	1180	1190	1200
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

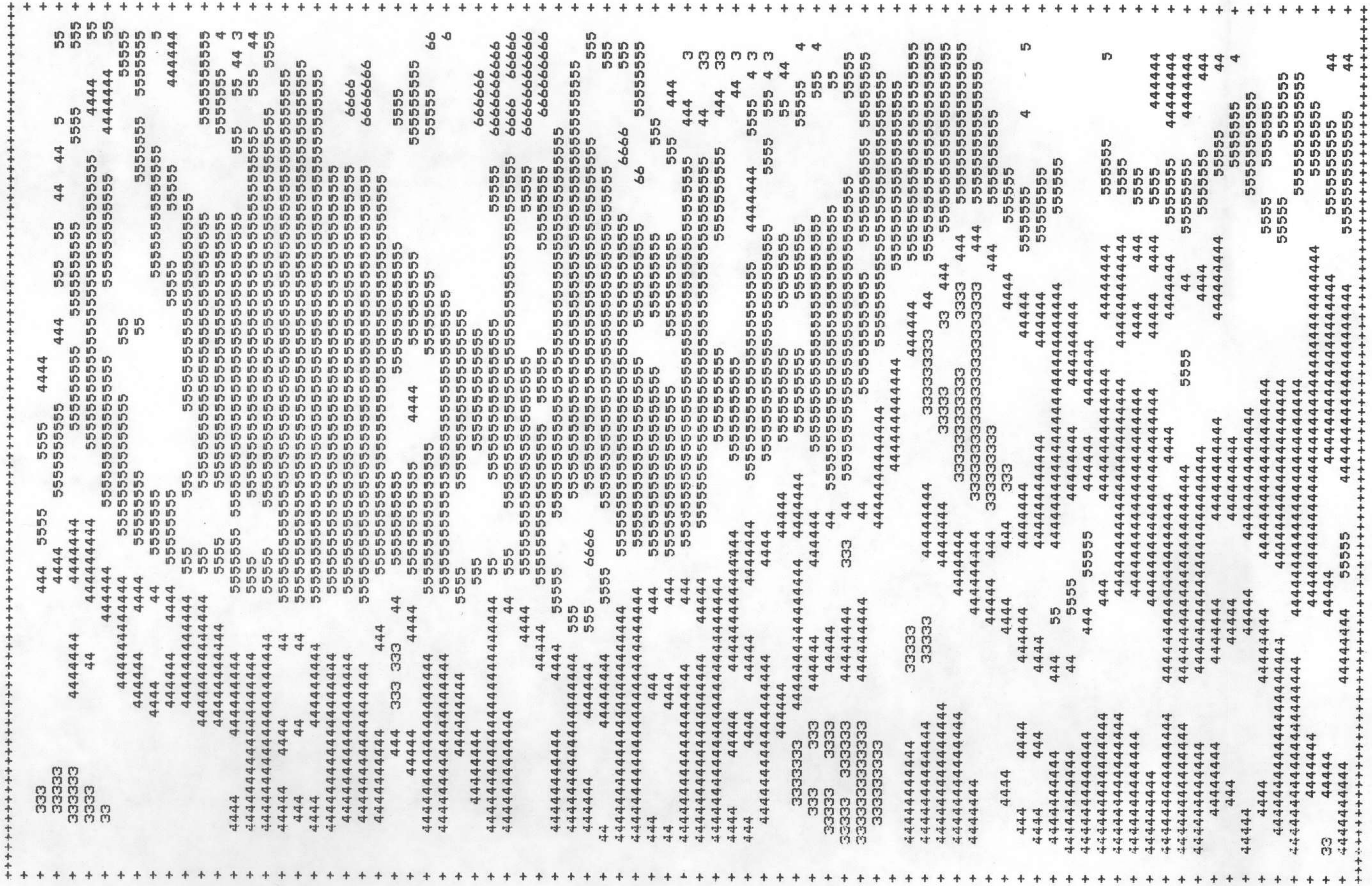
MAP UNIT OR

	610	620	630	640	650	660	670	680	690	700	710	720	1150	1160	1170
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.954	0.000	0.000	0.000	0.000	0.000	0.999	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	2.364	0.000	0.000	0.000	0.000	0.000	2.565	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	4.154	0.000	0.000	0.000	0.000	0.000	6.070	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	2.491	0.000	0.000	0.000	0.000	0.000	2.587	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.575	0.000	0.000	0.000	0.000	0.000	0.427	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	4.344	0.000	0.000	0.000	0.000	0.000	6.133	0.000	0.000	0.000

	1180	1190	1200
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

APPENDIX H - Pseudo Contour Maps

COLUMBUS



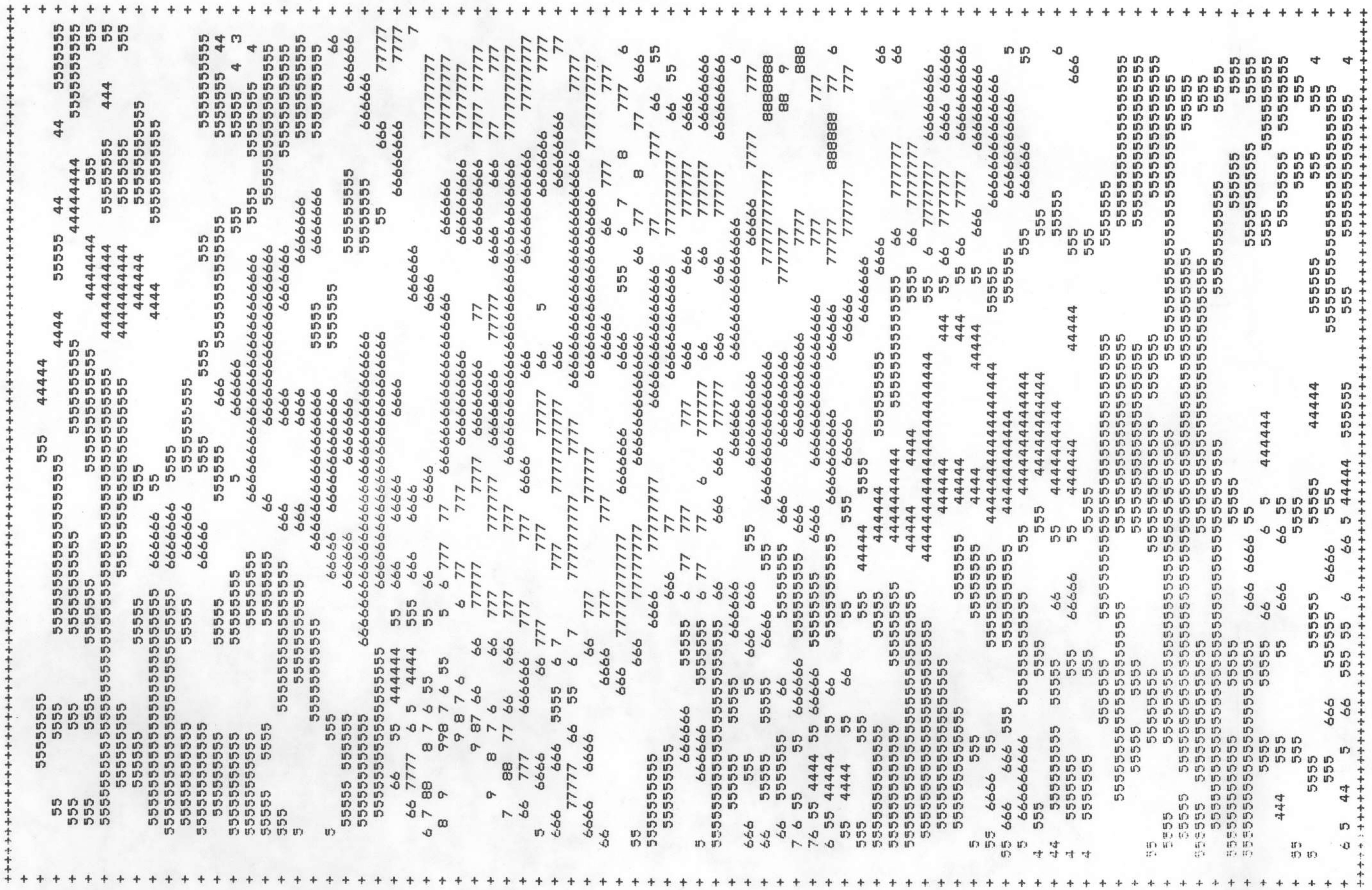
Potassium Pseudo-Contour Map - Columbus Quadrangle

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

COLUMBUS



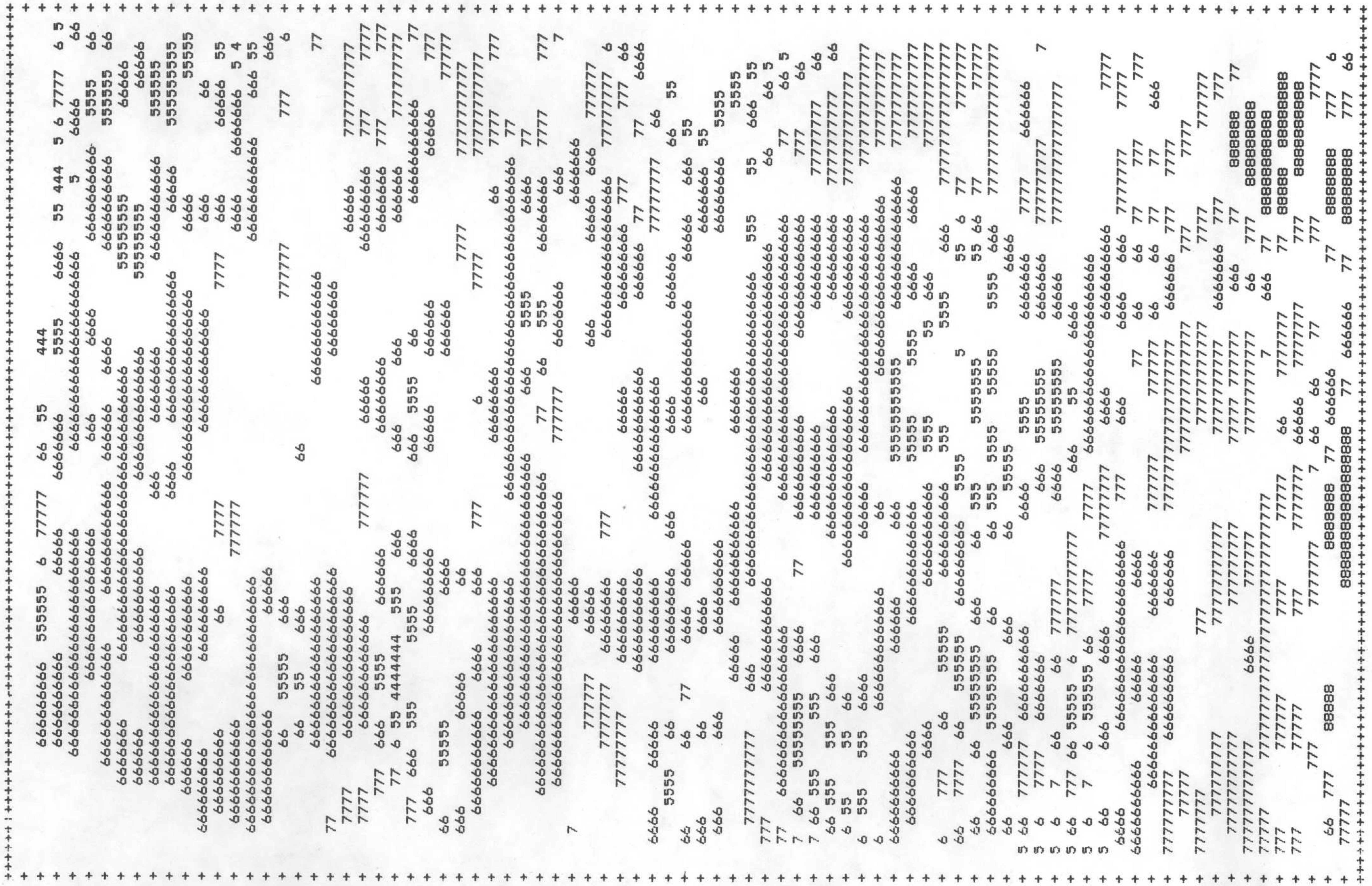
Uranium Pseudo-Contour Map - Columbus Quadrangle

EXPLANATION

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

SCALE IN EQUIVALENT PPM

COLUMBUS



Thorium Pseudo-Contour Map - Columbus Quadrangle

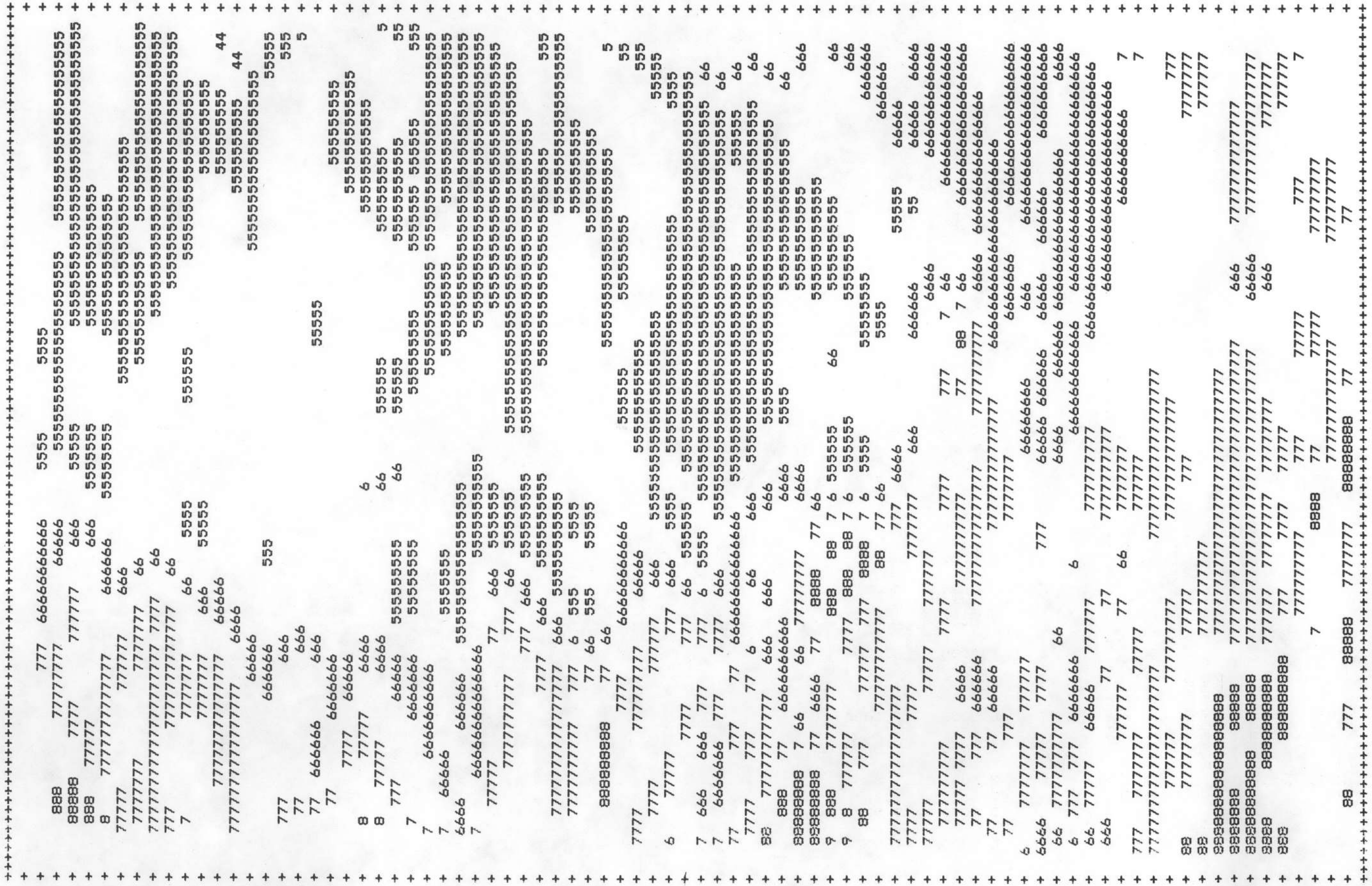
EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.5000
1	0.5000	1.0000
	1.0000	1.5000
2	1.5000	2.0000
	2.0000	2.5000
3	2.5000	3.0000
	3.0000	3.5000
4	3.5000	4.0000
	4.0000	4.5000
5	4.5000	5.0000
	5.0000	5.5000
6	5.5000	6.0000
	6.0000	6.5000
7	6.5000	7.0000
	7.0000	7.5000
8	7.5000	8.0000
	8.0000	8.5000
9	8.5000	9.0000
	GT	9.0000

SCALE IN EQUIVALENT PPM

H4 co

COLUMBUS

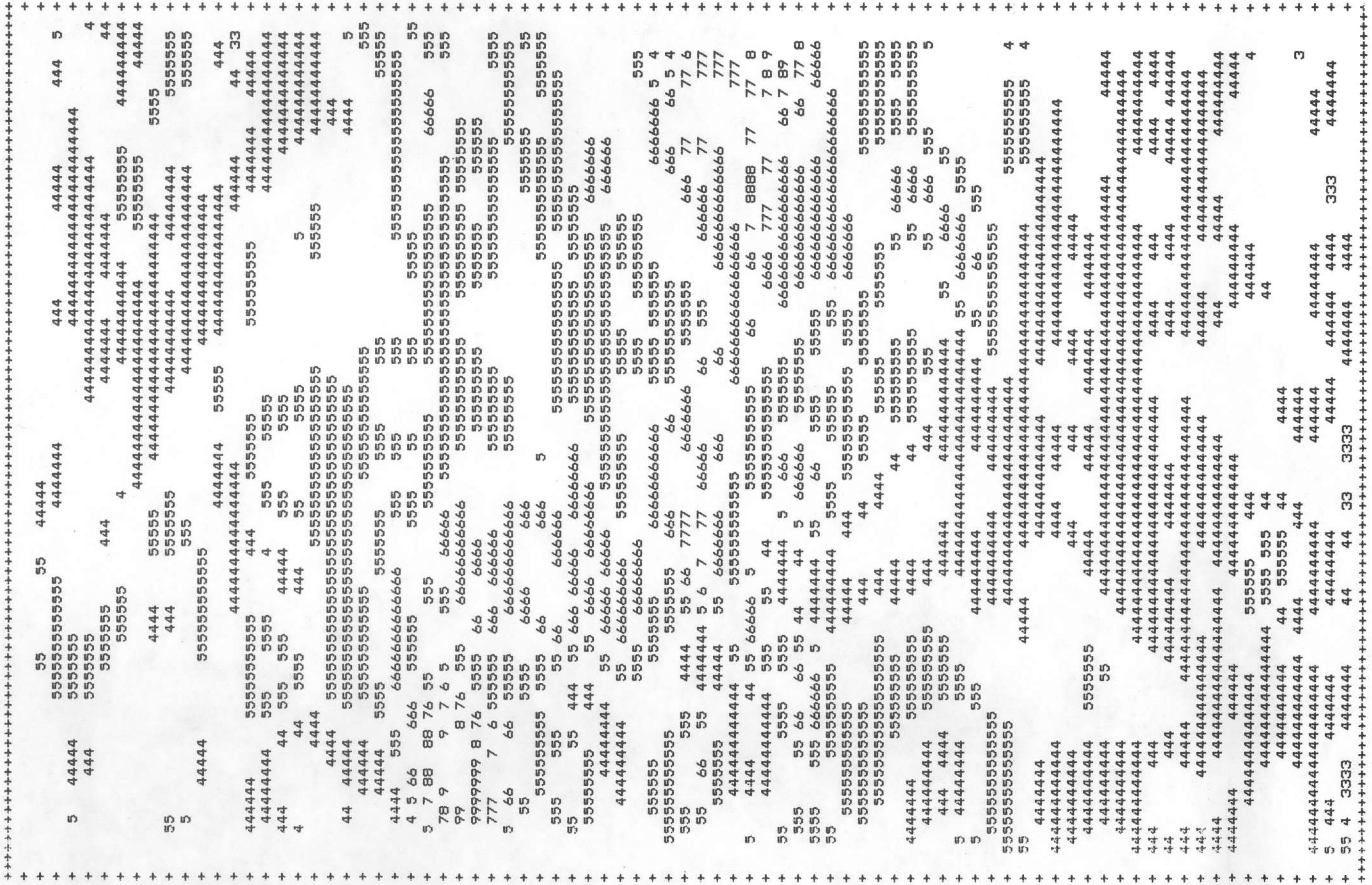


EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.5000
1	0.5000	1.0000
	1.0000	1.5000
2	1.5000	2.0000
	2.0000	2.5000
3	2.5000	3.0000
	3.0000	3.5000
4	3.5000	4.0000
	4.0000	4.5000
5	4.5000	5.0000
	5.0000	5.5000
6	5.5000	6.0000
	6.0000	6.5000
7	6.5000	7.0000
	7.0000	7.5000
8	7.5000	8.0000
	8.0000	8.5000
9	8.5000	9.0000
	GT	9.0000

Thorium/Potassium Pseudo-Contour Map - Columbus Quadrangle

COLUMBUS

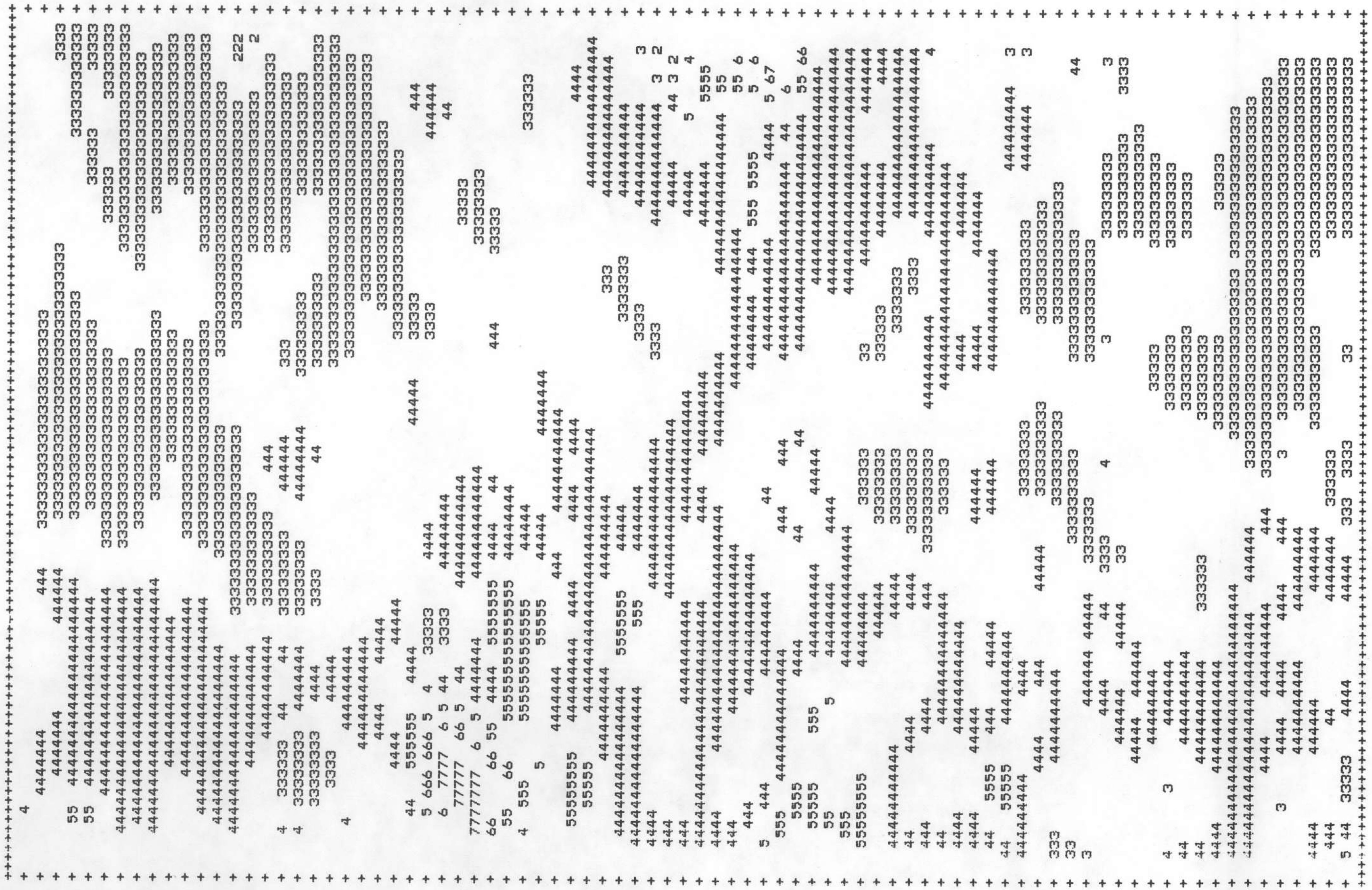


EXPLANATION

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 - Columbus Quadrangle

COLUMBUS

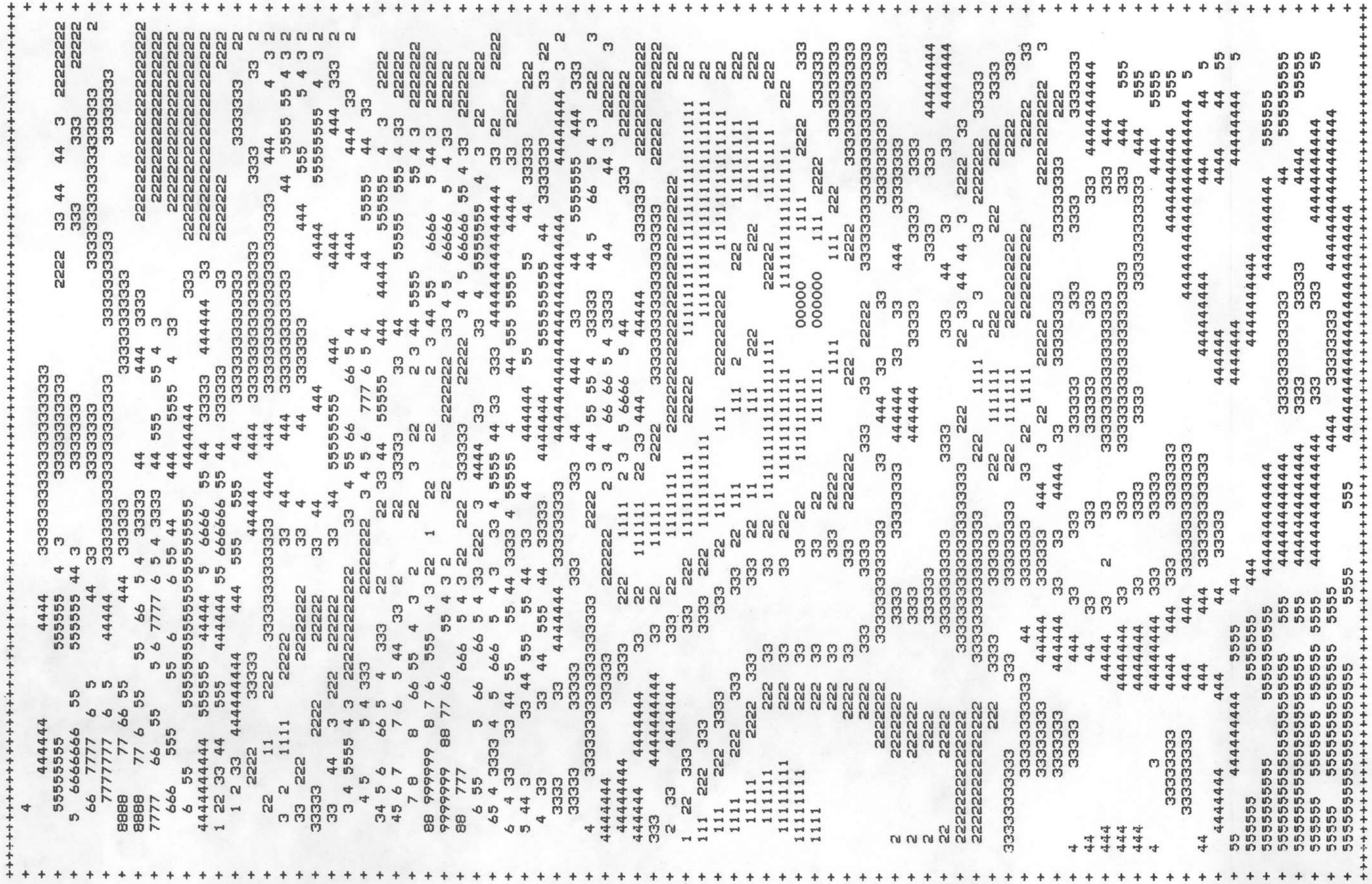


EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	0.0000
	0.0000	0.3750
1	0.3750	0.7500
	0.7500	1.1250
2	1.1250	1.5000
	1.5000	1.8750
3	1.8750	2.2500
	2.2500	2.6250
4	2.6250	3.0000
	3.0000	3.3750
5	3.3750	3.7500
	3.7500	4.1250
6	4.1250	4.5000
	4.5000	4.8750
7	4.8750	5.2500
	5.2500	5.6250
8	5.6250	6.0000
	6.0000	6.3750
9	6.3750	6.7500
	GT	6.7500

Uranium/Potassium Pseudo-Contour Map - Columbus Quadrangle

COLUMBUS



Residual Magnetic Pseudo-Contour Map - Columbus Quadrangle

EXPLANATION

PRINT CHARACTER	VALUE
0	LE-1500.0000
	-1500.0000-1400.0000
1	-1400.0000-1300.0000
	-1300.0000-1200.0000
2	-1200.0000-1100.0000
	-1100.0000-1000.0000
3	-1000.0000 -900.0000
	-900.0000 -800.0000
4	-800.0000 -700.0000
	-700.0000 -600.0000
5	-600.0000 -500.0000
	-500.0000 -400.0000
6	-400.0000 -300.0000
	-300.0000 -200.0000
7	-200.0000 -100.0000
	-100.0000 0.0000
8	0.0000 100.0000
	100.0000 200.0000
9	200.0000 300.0000
	GT 300.0000

SCALE IN GAMMAS