AERIAL GAMMA RAY AND MAGNETIC SURVEY
FORT WAYNE QUADRANGLE
INDIANA, OHIO, AND MICHIGAN

FINAL REPORT

Prepared by
EG&G geoMetrics
Sunnyvale, California

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ABSTRACT

The Fort Wayne quadrangle covers approximately 7,000 square miles of area in Indiana, Ohio, and Michigan within the Midwestern Physiographic Province. Within this area, a moderately thick lower Paleozoic section overlies the Precambrian basement. Wisconsinan glacial material and lacustrine sediments comprise the majority of the surficial material.

A search of available literature revealed no known uranium deposits.

A total of seventy-four (74) uranium anomalies were detected and are discussed briefly in this report. Radiometric data appears to reflect the glacial history of the area. None of the anomalies were considered significant and all appear to be related to cultural features.

Magnetic data appears to be in agreement with existing structural interpretations of the area.

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INTRODUCTION

General

The Fort Wayne quadrangle covers a 7,000 square mile area of northeastern Indiana, northwestern Ohio, and southernmost Michigan (see Figure 1).

The geologic base map used was compiled by the Indiana Geological Survey in 1972 from a combination of published and unpublished direct field sources. Both surficial and bedrock units appear on the map, but only surficial units were used except where bedrock is mapped as being exposed. All map unit descriptions, as they appear on the map, can be found in Appendix C. Supplementary geologic information was taken from Fairbridge (ed.) 1975, Flint (ed.) 1959, and Cohee and others (1962). Cultural and physiographic information was taken from the 1:250,000 scale Fort Wayne topographic sheet (1969 version).

Radiometric and magnetic data were acquired from the Fort Wayne quadrangle in October of 1980, and were processed in January 1981. A detailed summary of data acquisition, processing, interpretation, and presentation methods can be found in Appendix A of this report. A flight summary report for the Fort Wayne quadrangle is contained in Appendix B.

Physiography

The area covered by the Fort Wayne quadrangle lies within a flat to slightly irregular glacial plain in the northeast Midwestern Physiographic Province. The largely flat topography is dominated by agricultural activities. The drainage in the area is largely controlled by glacial features. A wide, nearly continuous band of glacial till striking northeasterly through the quadrangle forms a prominent drainage divide. Within this till body, many small lakes have formed. West of the divide, water flows into the Elkhorn River, which eventually reaches Lake Michigan. Water to the east of the divide flows southwest, then makes a 160 degree turn at the central southern border and flows northeasterly into the Mawmee River toward Lake Erie.

Irregularities in the landscape are produced by well-preserved, nearly continuous glacial features. Elevations range from 650 feet at the lowest base level of the Maumee River, to over 1,200 feet in certain areas of the divide at its northern end.

Though the region is predominantly agricultural in orientation, it contains numerous large towns and cities. The largest city is Fort Wayne, with a population of 181,000. The entire quadrangle is covered with a dense grid of roads and railroads, and contains an extensive network of U.S. and interstate freeways.

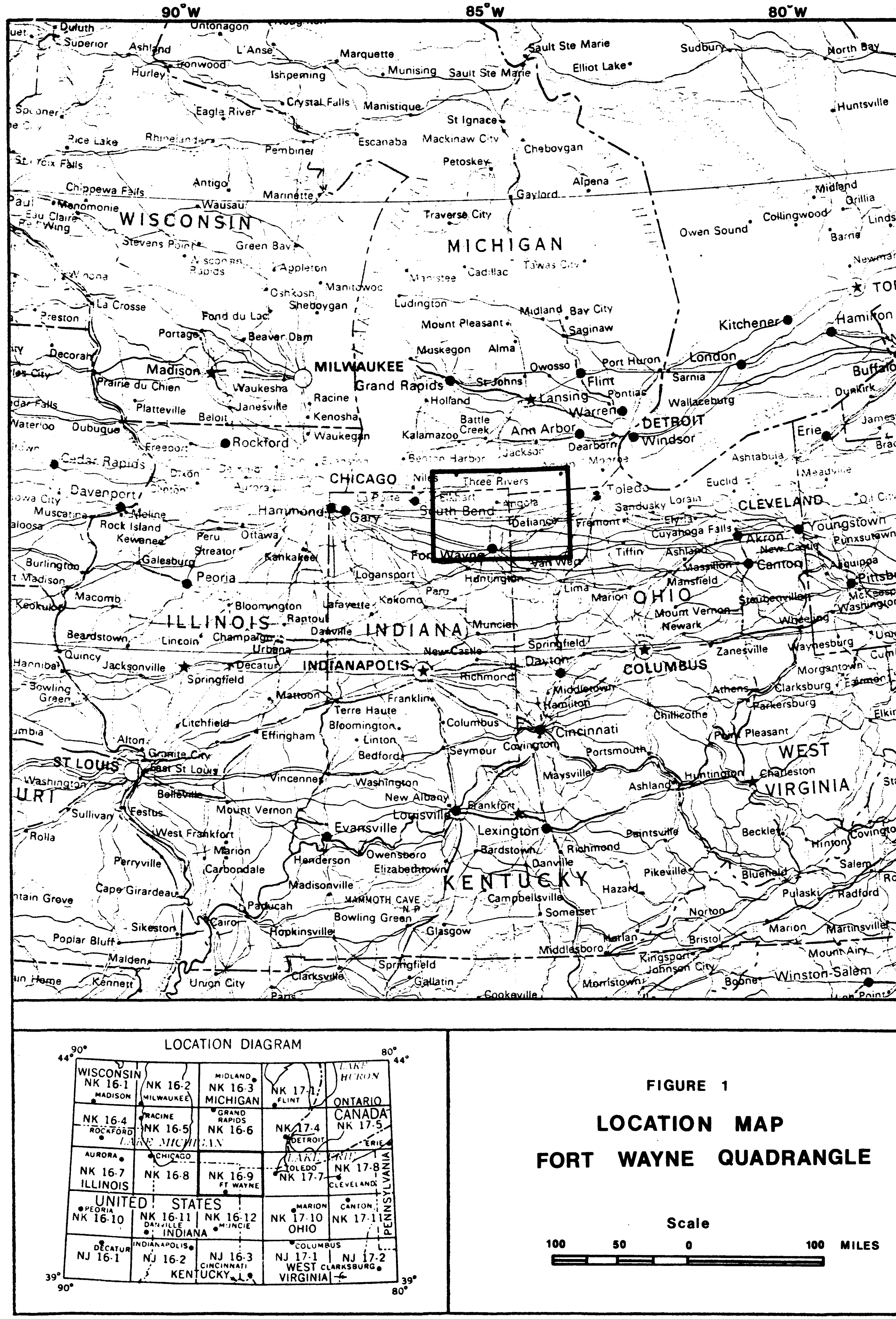


FIGURE 1

LOCATION MAP

FORT WAYNE QUADRANGLE

GEOLOGY

Structure

The Fort Wayne quadrangle covers an area that overlies the southern end of the Michigan Basin, (see Figure 2). The Michigan Basin is a major cratonic basin filled with as much as 15,000 feet of Paleozoic sediments. In the Fort Wayne quadrangle, lower Paleozoic sediments shoal from 5,000 feet in thickness at the eastern northern border to little more than 1,500 feet at the southwestern corner (near the axis of the Kankakee Arch).

No faults of any kind disturb surficial units as mapped by Johnson and Keller (1972), and the map by Cohee and others (1962) show no complexities in bedrock units that could be interpreted as faults.

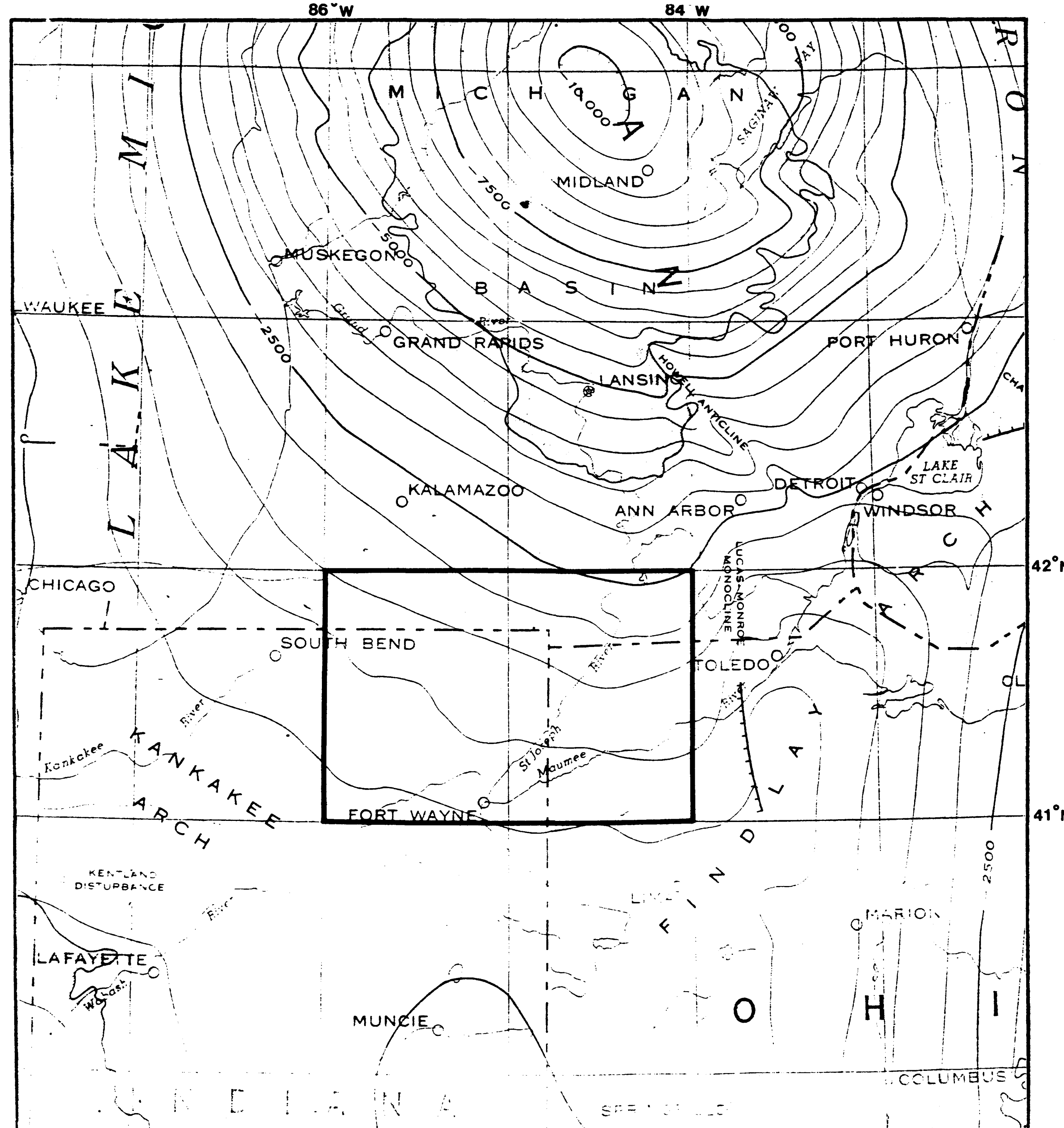
Surficial Geology

As mapped by Johnson and Keller, no bedrock units are exposed anywhere. The entire quadrangle contains a thick mantle of Quaternary material that is a combination of glacial, periglacial, and post-glacial cover.

The Quaternary system is dominated by a wide variety of Wisconsinan (Tazwell or Cary stage) glacial, and related deposits. Glacial till from ground and end moraines cover 62 percent of the surface as mapped. Kames and other stratified drift deposits cover 5 percent of the quadrangle within scattered exposures in the northern and western regions. Lacustrine and related lake deposits account for 20 percent of all surface exposures, and cover most of the southeastern quadrant. Outwash deposits are present in and around present drainage systems, but the most extensive deposits of outwash occur in the northwest. These concentrations of gravel, sand, and silt cover 10 percent of the quadrangle's surface. Minor amounts of eolian sand and silt are also present in the northwest. Post-glacial fluvial, alluvial, colluvial, and paludal deposits occur as small discontinuous surface patches that are nearly ubiquitous throughout the divide area. These deposits account for approximately 1 percent of the surface. Recent alluvial and related deposits cover less than 1 percent of the surface as mapped, and are confined to principal drainage systems.

Uranium

According to available literature, there are no known uranium deposits in the Fort Wayne quadrangle.



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

FIGURE 2

TECTONIC STRUCTURE MAP
FORT WAYNE QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 74 groups of uranium (Bi214) samples meet the minimum statistical requirements for anomaly definition as set forth in the data interpretation section of Appendix A. These are displayed, along with all other anomalous samples and pertinent data, on Figure 3. The anomalies are summarized in a table in Appendix G. The potassium, uranium, thorium, and ratio pseudo-contour maps, which reflect radiometric responses for the entire quadrangle, are found in Appendix H. Discussion of the abundances of potassium, uranium, and thorium are in terms of apparent equivalent percent and apparent equivalent ppm. These equivalent units are derived from scaling of counts per second data by the sensitivities calculated for the detection system and as such cannot be taken as directly determined geochemical values.

The average uranium concentration for the quadrangle is 1.9 ppmeU. Unit uranium averages range as high as 2.7 in map unit QCL (Quaternary lacustrine silt and clay deposits) and 2.9 ppmeU in QTL (Quaternary lake bottom and wave scoured till). Map unit QCL also contains the peak uranium concentration of 4.6 ppmeU. In general, uranium concentrations define two distinct populations that are divisible nearly in half by a northeast-southwest diagonal line through the quadrangle center, (see Appendix H). The upper half contains average concentrations no higher than 2.0 ppmeU, whereas the lower half of the diagonal contains average concentrations of 3.0 ppmeU and higher. The highest average concentrations appear in the south and southwesterly portions of the quadrangle (3.5 ppmeU and higher). This division of average concentrations appears to be due to the later advancement of the Packerton Moraine system, which contains source material from an entirely different region (northeasterly) of lower uranium concentrations, (see Interpretation Map, Page 5).

Average thorium and potassium concentrations for the quadrangle are 4.4 percent and 1.1 ppmeT respectively. Map unit QCL contains the highest peak and average thorium (9.9 ppmeT and 7.1 ppmeT respectively) and average potassium (1.7 percent). Map unit QT (Quaternary ground moraine) contains the peak potassium (2.45 percent). In general, average thorium and potassium concentrations increase from the northwest (3.0 ppmeU and 0.7 percent respectively) to the southeast (7.5 ppmeU and 2.0 percent). The highest thorium and potassium values are found along the southeastern edge (1.9 to 2.1 percent and more than 8.1 ppmeT), in association with lacustrine deposits from post-glacial lakes.

Map units QT and QTE (Quaternary end moraine) show slight bimodal tendencies in uranium, thorium, and potassium. The lower concentration population appears to be due mainly to the Packerton Moraine system, coupled with a large number of post-glacial lakes and ponds produced by the same system.

Anomalies tend to cluster in the south and southeasterly portions of the quadrangle, reflecting the higher concentrations in the pre-Packerton glacial stages and lacustrine sediments. The anomalies range in peak concentrations from 2.5 to 3.5 ppmeU. Specific anomalies appear to result entirely from cultural influences (such as the effects of roads, railroads, pipelines, etc.) that tend to enhance local uranium concentrations.

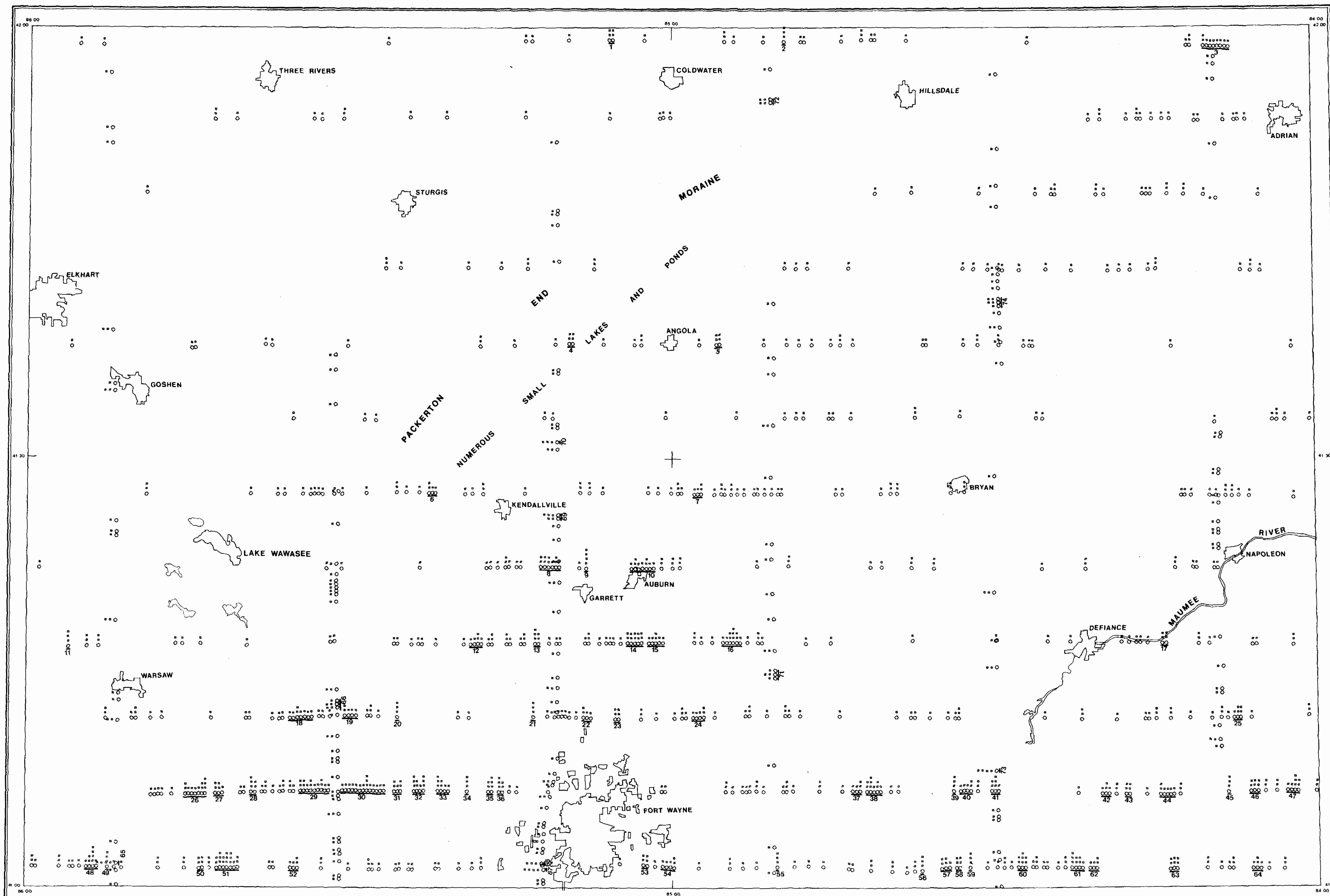
The overall apparent low uranium concentrations, coupled with the high degree of correlation with culture, suggests that none of the anomalies in this area represent significant quantities of naturally occurring uranium. The apparent contrast in the levels of radioactivity in relation to the different glacial stages is an interesting but not clearly understood phenomenon.

Magnetic Data

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

The magnetic field exhibits a number of features which probably relate to complexities in the Precambrian basement rather than in the overlying Paleozoics. Longer wavelengths in the north and east indicate a thickening section of non-magnetic materials (sediments). Shorter wavelength features in general are concentrated in the southeasterly portion of the quadrangle. The balance of the region shows many isolated and linear magnetic features. These features may indicate structural and/or lithologic basement complexities.

FORT WAYNE



URANIUM ANOMALY/ INTERPRETATION MAP

FORT WAYNE 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, $4.0 \leq sum \leq \infty$, WITH AT LEAST ONE SAMPLE OF 2 OR MORE STANDARD DEVIATIONS.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

Figure 3 - Uranium Anomaly/Interpretation Map - Fort Wayne Quadrangle

BIBLIOGRAPHY

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

Flint, R.F. (principal editor), 1959, Glacial Map of the United States East of the Rocky Mountains: Geological Society of America map, scale 1:1,750,000.

Johnson, G.H., and Keller, S.J., 1972, Geologic Map of the Fort Wayne Quadrangle, Indiana, Michigan, and Ohio, Showing Bedrock and Unconsolidated Deposits: Indiana Geological Survey Regional Geologic Map No. 8, scale 1:250,000.

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

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

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

APPENDIX A – Data Acquisition, Processing, and Interpretation Methods

INTRODUCTION

General

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

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

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

Some 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). The Queen Air 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

For the thirty six quadrangles a total of 52,870 line miles, excluding reflights and overlaps and missing data, were flown by the aircraft. The production summary presented below and the detailed daily production in Appendix B describes a portion of the total project.

Prior to the start of the survey operations, the airplane was calibrated at the DoE test pads and Dynamic Test Range in April, 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 aircraft was 140 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 airplane's objective ground speed was 140 mph and was not exceeded unless dictated by safety.

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

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

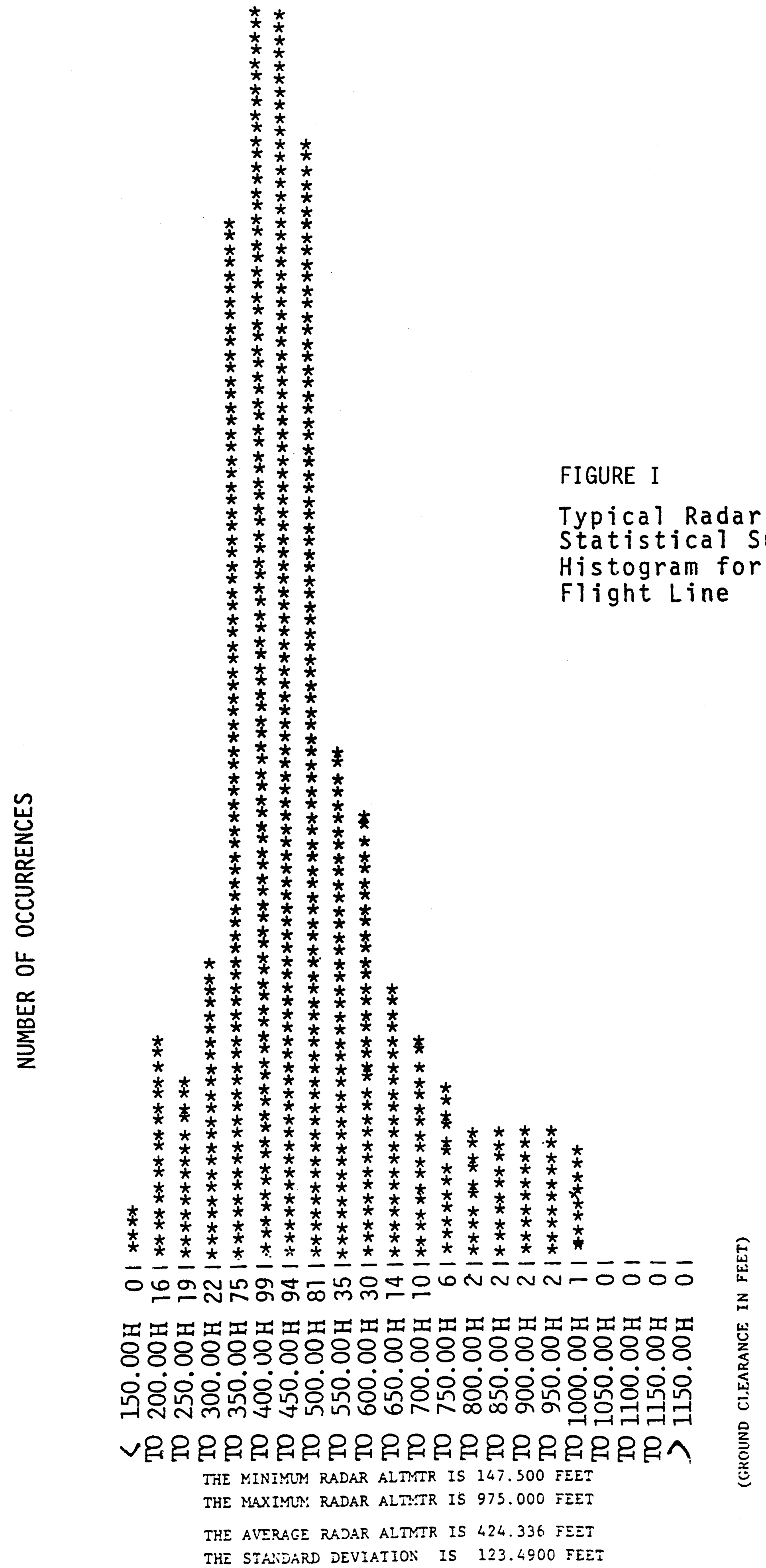


FIGURE I

Typical Radar Altimeter Statistical Summary Histogram for Single Flight Line

Navigation/Flight Path Recovery

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

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

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

Infield System Calibration

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

A. Pre Flight

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

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

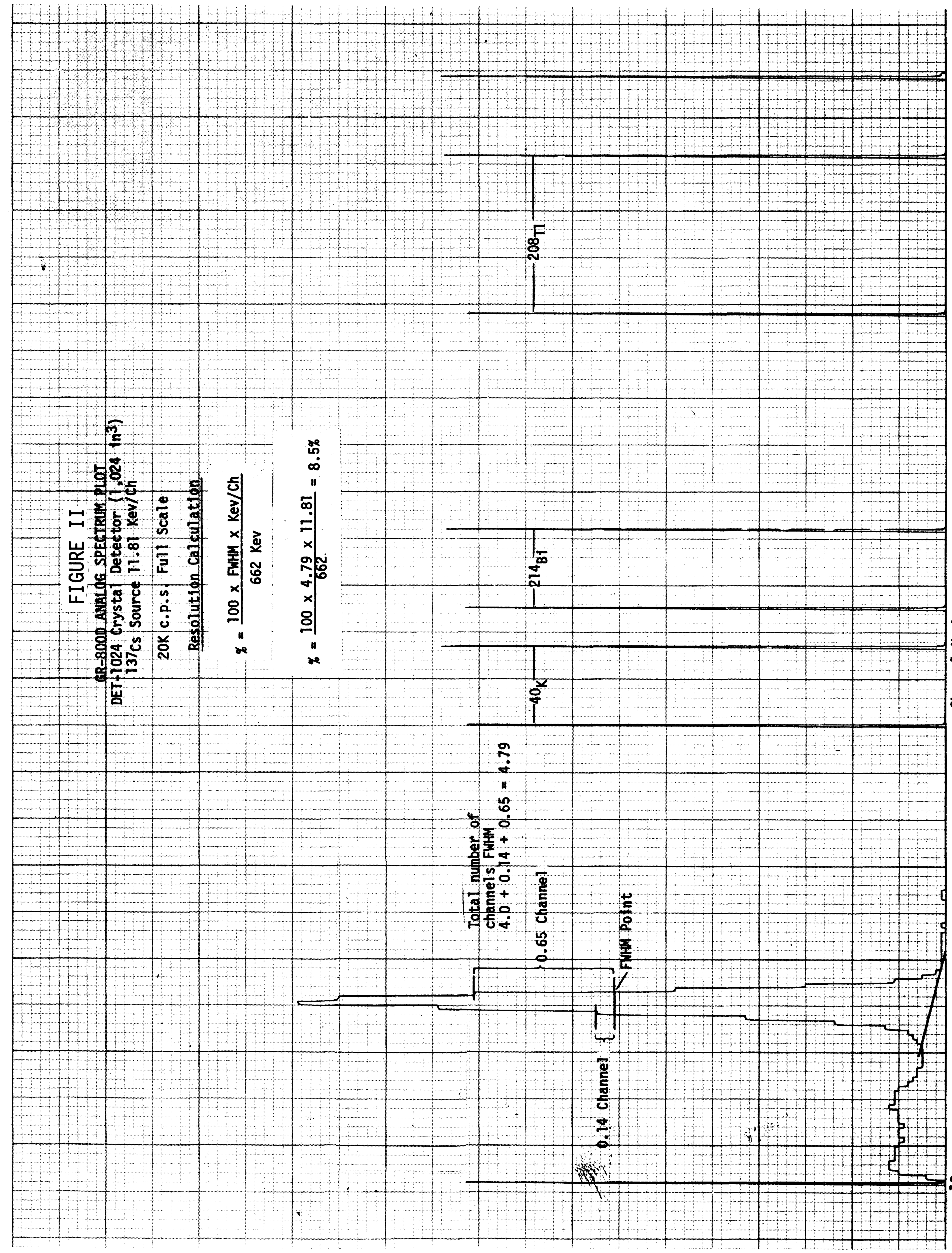
3. Finally run a full thorium analog spectrum of the down crystals and check for centering of K40 and Tl208 peaks in spectrum.

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

B. During Flight

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

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



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

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

C. Post Flight

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

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

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

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

Field Digital Data Verification

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

DATA COLLECTION SYSTEM

AIRCRAFT

The aircraft used for this portion of the survey was a Beechcraft Queen Air Model 65, U.S. Registry Number N9AG. This aircraft, being a medium twin engine aircraft, possesses overall performance and safety features which makes it ideal for low level, fixed-winged airborne geophysical survey work within areas of up to moderatly rough topographic relief. It can carry the adequate payload at the necessary lower constant airspeeds and still maintain a wide envelope of safety, all while operating economically. Performance data for the Queen Air Model 65 in its present survey configuration are give below:

Maximum Aircraft Gross Weight	7,700 lbs.
Aircraft Empty (dry)	4,640 lbs.
Max. useful load including fuel	3,060 lbs.
Geophysical Package	1,110 lbs.
Navigation Eqpt. & Extra Avionics	125 lbs.
Main Fuel Tanks	528 lbs.
Aux. Fuel Tanks	864 lbs.
Pilot	175 lbs.
Electronics Operator	175 lbs.
Total	2,977 lbs.

Minimum Control Speed	95 MPH *IAS at	Gross Weight
Safe Single Engine Speed	105 MPH IAS at	Gross Weight
Rate of climb both engines	1,300 *FPM at	Gross Weight
Rate of climb single engine	210 FPM at	Gross Weight

*IAS = Indicated Air Speed *FPM = Feet Per Minute

Avgas consumption = 36 U.S. gallons [216 lbs] per hour [at 75% power]
Endurance at 36 gallons [216 lbs.] per hour 75% power = 6 hrs. 6 mins.
Range of cruise at 75% power with 45 min. reserve = 1,200 miles

Cruise configuration stalling speed at Gross Weight [7700 lbs] at 0° Bank = 80 MPH IAS at 45° Bank = 95 MPH IAS

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.

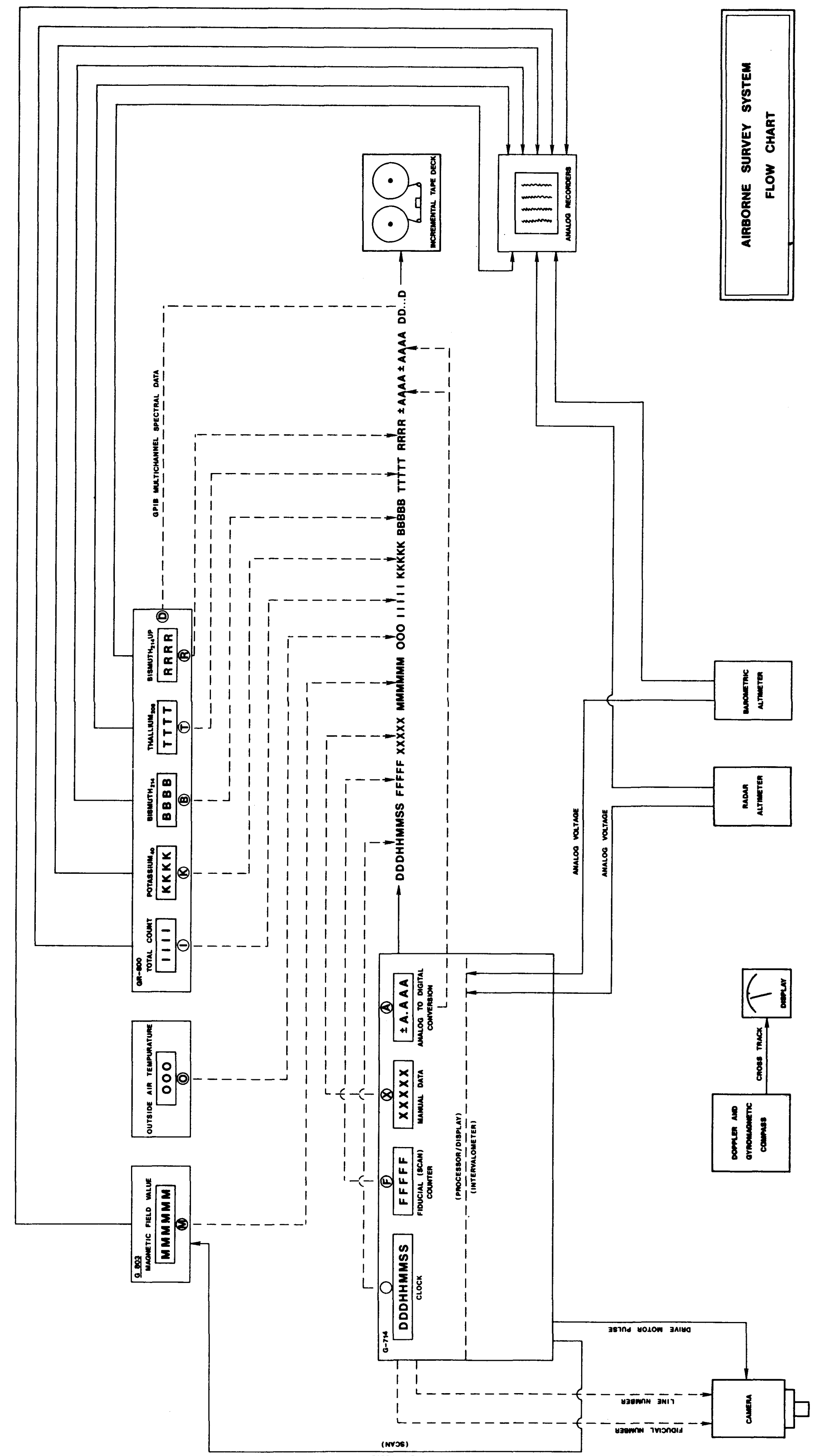


FIGURE III

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:

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

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

SYSTEM CONSTANTS

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

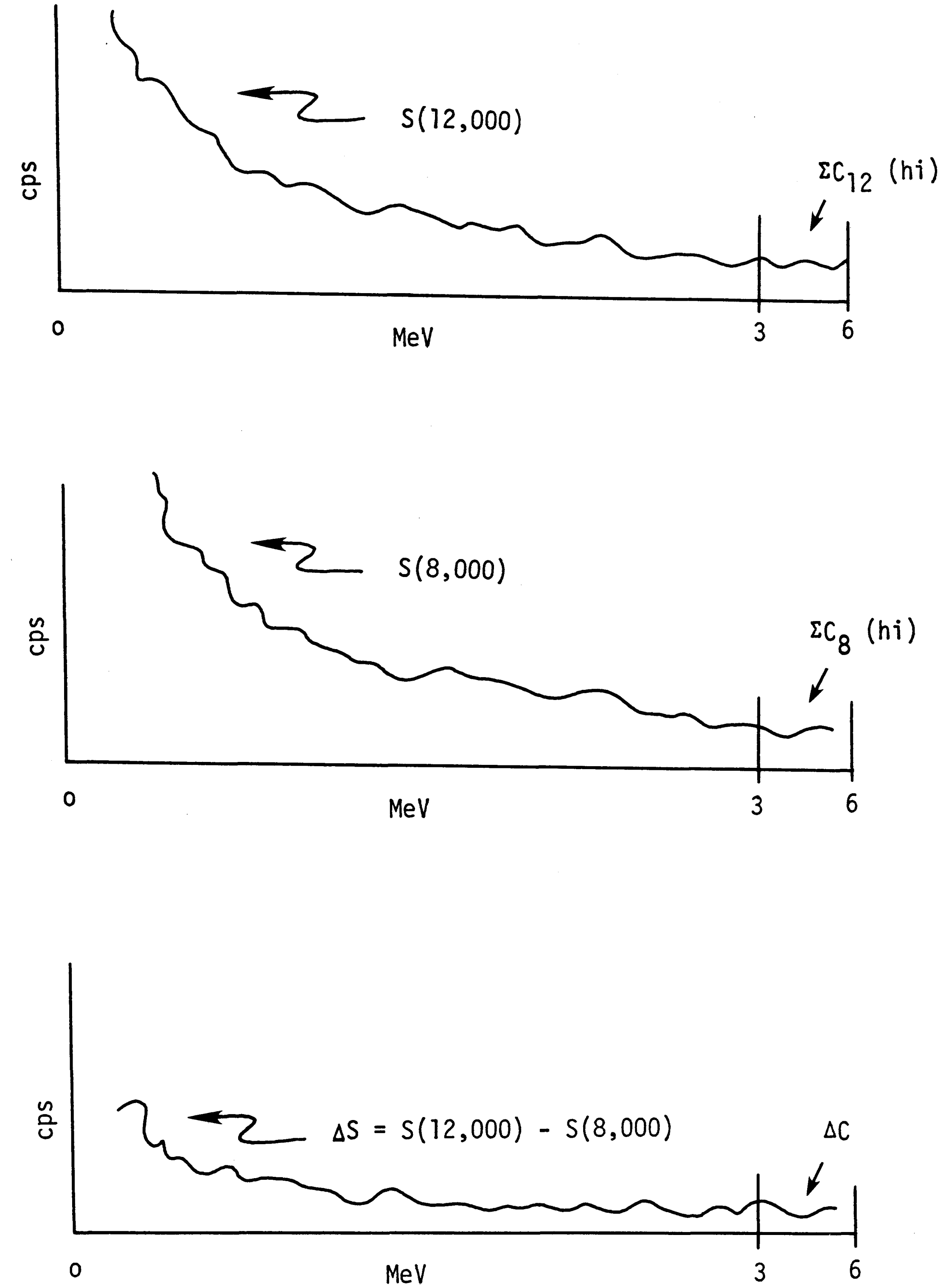


FIGURE IV - Multiple altitude spectra schematic

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

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

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

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

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

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)    4.38 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)    1.481 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)    2.182 CPS *******
CH  34 (0.402 MEV)    2.081 CPS ******* TOTAL COUNT
CH  35 (0.414 MEV)    2.181 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)    2.585 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

CH	MEV	CPS	
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	14.383	
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	10.298	
118	1.395	12.084	
119	1.407	9.642	
120	1.418	11.778	
121	1.430	12.635	
122	1.442	10.601	
123	1.454	9.140	
124	1.466	11.144	
125	1.477	10.766	
126	1.489	9.250	
127	1.501	11.961	
128	1.513	10.296	
129	1.525	10.900	
130	1.537	9.022	
131	1.548	10.311	
132	1.560	10.151	POTASSIUM 40
133	1.572	9.361	
134	1.584	8.753	
135	1.596	11.176	
136	1.608	10.130	
137	1.619	10.551	
138	1.631	9.204	
139	1.643	9.159	
140	1.655	8.738	
141	1.667	8.679	BISMUTH 214
142	1.678	10.154	
143	1.690	9.743	
144	1.702	9.453	
145	1.714	9.418	
146	1.726	8.425	
147	1.738	9.263	
148	1.749	9.653	
149	1.761	9.412	
150	1.773	9.019	
151	1.785	9.329	
152	1.797	10.232	
153	1.808	9.686	
154	1.820	7.911	
155	1.832	8.104	
156	1.844	9.602	
157	1.856	9.473	BISMUTH 214
158	1.868	8.568	
159	1.879	8.105	
160	1.891	8.014	
161	1.903	8.365	
162	1.915	8.759	
163	1.927	6.994	
164	1.938	8.477	
165	1.950	8.144	
166	1.962	7.798	
167	1.974	8.214	
168	1.986	9.240	
169	1.998	7.945	
170	2.009	7.615	
171	2.021	6.816	
172	2.033	8.408	
173	2.045	7.196	
174	2.057	7.231	
175	2.068	7.473	
176	2.080	9.062	
177	2.092	8.116	
178	2.104	8.235	
179	2.116	7.653	
180	2.128	8.338	
181	2.139	7.237	
182	2.151	7.528	
183	2.163	8.039	
184	2.175	8.536	
185	2.187	8.888	
186	2.199	7.485	
187	2.210	8.211	
188	2.222	8.233	
189	2.234	8.055	
190	2.246	7.825	
191	2.258	7.062	
192	2.269	8.435	
193	2.281	7.440	
194	2.293	7.686	
195	2.305	7.110	
196	2.317	7.329	
197	2.329	7.890	
198	2.340	7.771	
199	2.352	7.147	
200	2.364	6.729	
201	2.376	6.264	
202	2.388	6.318	
203	2.399	7.050	
204	2.411	6.506	THALLIUM 208
205	2.423	6.486	
206	2.435	6.589	
207	2.447	7.033	
208	2.459	6.515	
209	2.470	6.852	
210	2.482	6.871	
211	2.494	6.573	
212	2.506	6.417	
213	2.518	5.845	
214	2.529	6.127	
215	2.541	6.355	
216	2.553	6.964	
217	2.565	6.820	
218	2.577	6.670	
219	2.589	6.808	
220	2.600	5.940	
221	2.612	6.177	
222	2.624	6.176	
223	2.636	6.109	
224	2.648	6.347	
225	2.660	7.049	
226	2.671	5.757	
227	2.683	5.645	
228	2.695	5.229	
229	2.707	5.415	
230	2.719	6.190	
231	2.730	6.092	
232	2.742	6.466	
233	2.754	7.032	
234	2.766	5.533	
235	2.778	6.309	
236	2.790	5.559	
237	2.801	5.206	THALLIUM 208
238	2.813	6.045	
239	2.825	5.257	
240	2.837	5.640	
241	2.849	5.835	
242	2.860	5.348	
243	2.872	4.804	
244	2.884	4.742	
245	2.896	5.304	
246	2.908	5.248	
247	2.920	6.036	
248	2.931	5.711	
249	2.943	5.513	
250	2.955	5.010	
251	2.967	5.579	
252	2.979	6.256	
253	2.990	5.207	
254	3.002	9.302	TOTAL COUNT
255	3.014	1000.000	

FIGURE VI

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

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

KC_i = uncorrected system count rate for the K channel

UC_i = uncorrected system count rate for the U channel

TC_i = uncorrected system count rate for the T channel

K_i = the percent differential concentration of potassium

U_i = ppm differential concentration of uranium

T_i = ppm differential concentration of thorium

where "i" refers to the ith pad.

We also define the following:

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

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

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

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

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

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

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

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

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

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

<u>K pad</u>

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

<u>U pad</u>

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

<u>T pad</u>

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

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

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

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

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

The equations can be expressed in matrix notation

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

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

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

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

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

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

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

or

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

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

Rearranging the above equations we have

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

We now define

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

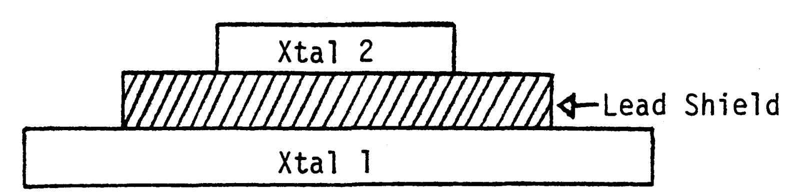
$S_{tu} = \frac{\Delta_{tu}}{\Delta_{tt}}$ (effect of uranium on thorium)

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

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

ATMOSPHERIC RADON CORRECTION

Consider the crystal configuration shown below:



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

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

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

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

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

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

Therefore $$I_1 = I_g$$

$$I_2 = \ell I_g$$

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

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

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

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

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

Consider the equations for I_1 and I_2 again

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

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

Over water $I_g = 0$

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

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

$$I_1 = I_a$$

$$I_2 = mI_a$$

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

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

$$I_1 = I_g + I_a$$

$$I_2 = \ell I_g + mI_a$$

$$mI_a = I_2 - \ell I_g$$

but $$I_g = I_1 - I_a$$

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

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

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

DATA PROCESSING

DATA PREPARATION

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

Field Tape Verification and Edit

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

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

Flight Line Location

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

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

RADIOMETRIC DATA REDUCTION

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

Total count - 0.4 to 3.0 MeV

K - 1.37 to 1.57 MeV

U - 1.66 to 1.87 MeV (downward looking system)

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

T - 2.41 to 2.81 MeV

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

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

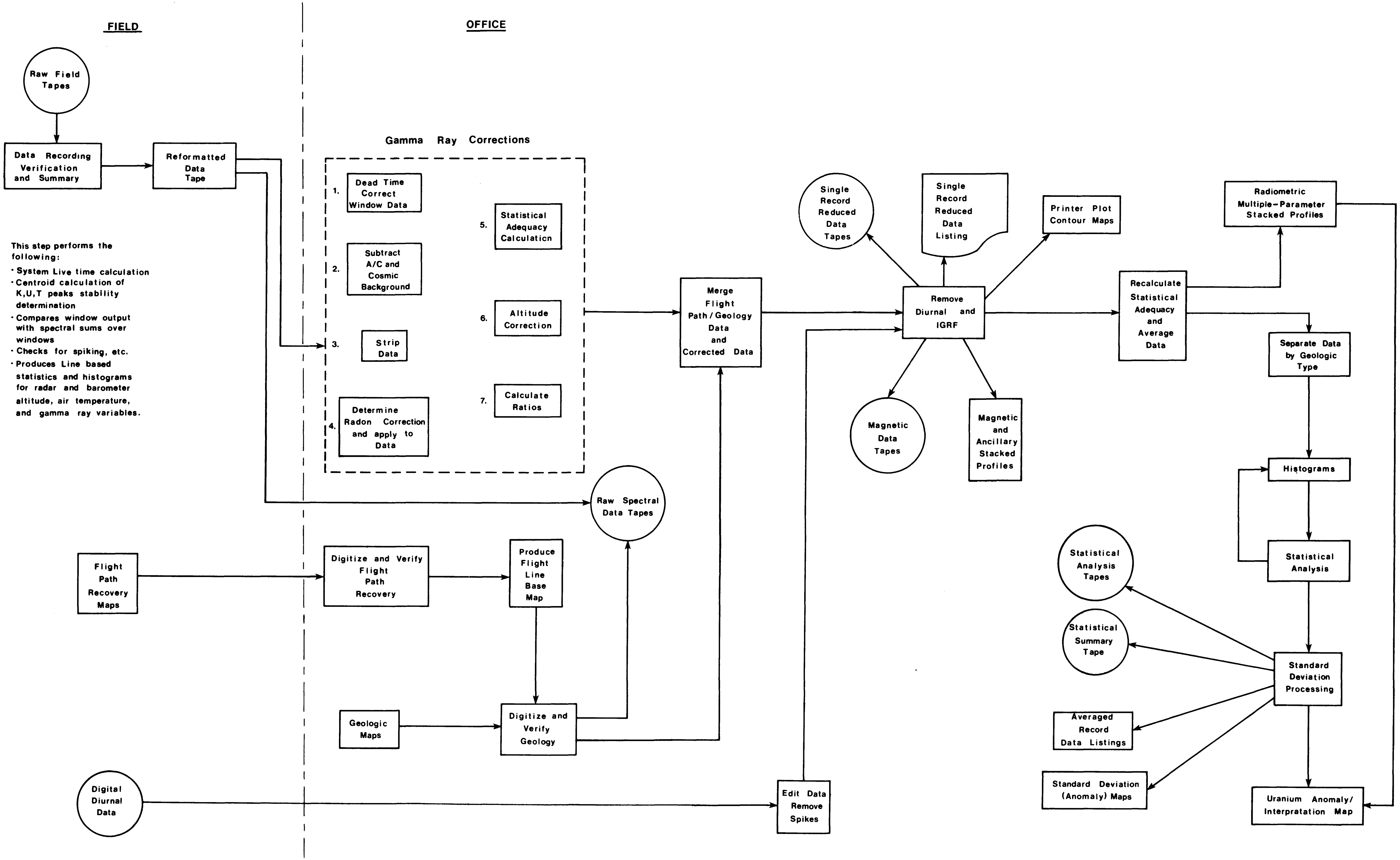
QUEEN AIR

		Aircraft	Cosmic*
TC	(cps)	152.04	2.3833
K	(cps)	16.06	0.1322
U_{dn}	(cps)	6.50	0.1098
U_{up}	(cps)	3.17	0.5540
T	(cps)	3.42	0.1503

*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
S_{ku}	0.8437
S_{kt}	0.1584
S_{ut}	0.2703
S_{uk}	0.0
S_{tu}	0.05614
S_{tk}	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
TC	(per foot)	0.002011
K	(per foot)	0.002740
U	(per foot)	0.002479
T	(per foot)	0.002048

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, u_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
ℓ	0.1101
m	0.596
C'_{uk}	.00947
C'_{uu}	.07136
C'_{ut}	.04636
$\mu\ell$	-0.000032
μm	-0.000192

ı m are altitude dependent as follows:

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

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

: Bi Air data are filtered and the filtered results are then ed on a point by point basis from the corrected uranium window

'indow data are then evaluated for statistical adequacy prior to ude correction to ensure they are significant within the context e anticipated errors in count statistics.

stical Adequacy Test

tatistical adequacy test is made to determine whether the cted data sample is sufficiently greater than the "noise" to sent the "signal" of interest.

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

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

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

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

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

Ihis 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
K	1%K	91.5
U	1 ppmeu	10.4
T	1 ppmeT	6.4

TIC DATA REDUCTION

iagnetic data reduction processes are: correction for diurnal tion, tieing to a common magnetic datum, and subtraction of the nal magnetic field as defined by the International Geomagnetic ence Field (IGRF). During data acquisition, the magnetic field is ored by a ground-based diurnal magnetometer that samples every seconds at a sensitivity of one-quarter gamma. These data are ded on magnetic tape along with the time for synchronization with irborne data.

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

iurnally corrected magnetic data are then processed by a tieing am that compares the magnetic differences at intersections of t lines and tie lines. This program calculates individual mag- field biases for each flight tie line based on tie line intersec- . This allows miss-ties to be minimized throughout the survey. biases usually represent, after diurnal correction, systematic tic changes caused by such things as heading error, changes in ion of the ground-based magnetometer, or changes in the airborne ment. 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.

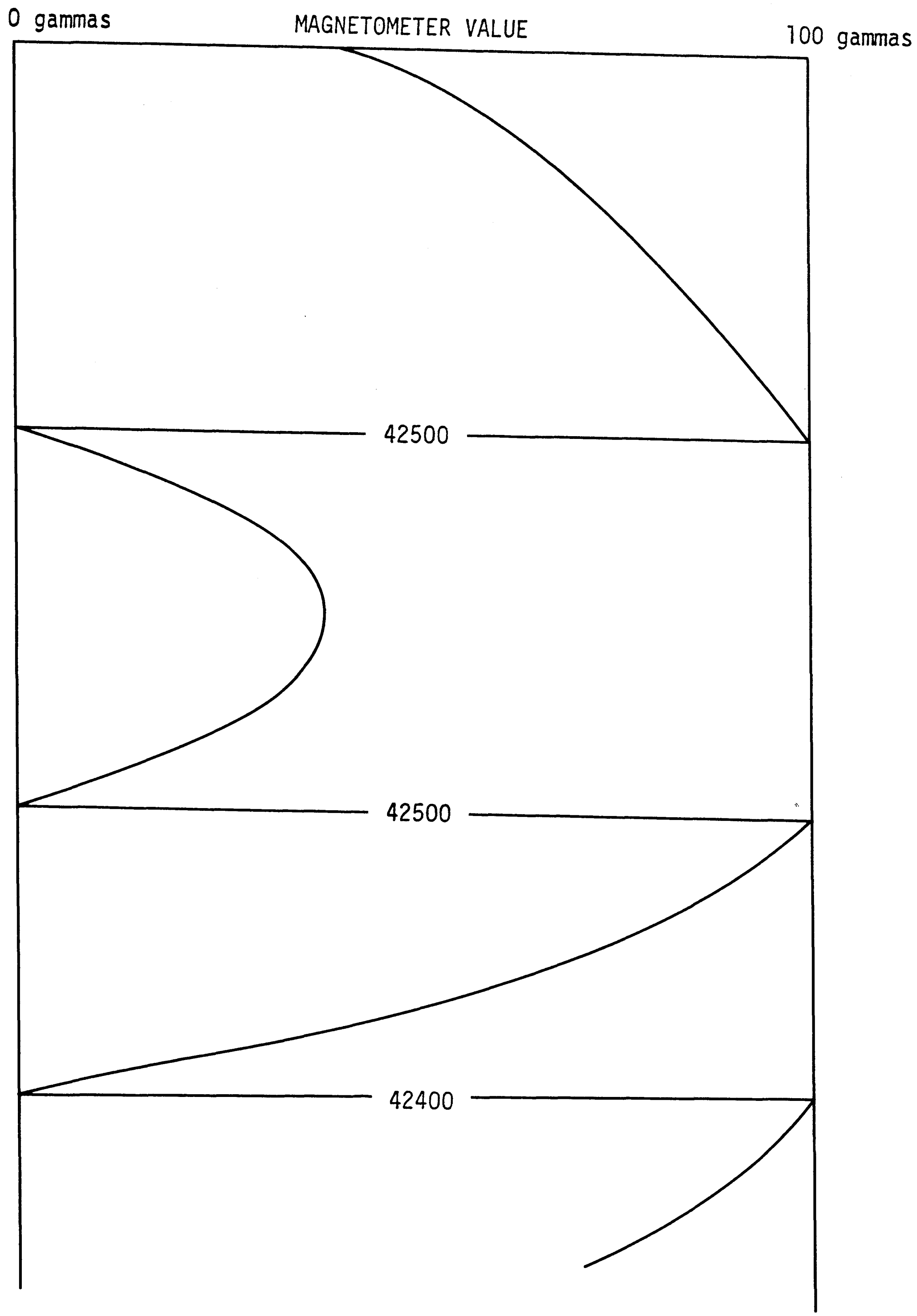


FIGURE VIII Plotter Step Value Labeling

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.

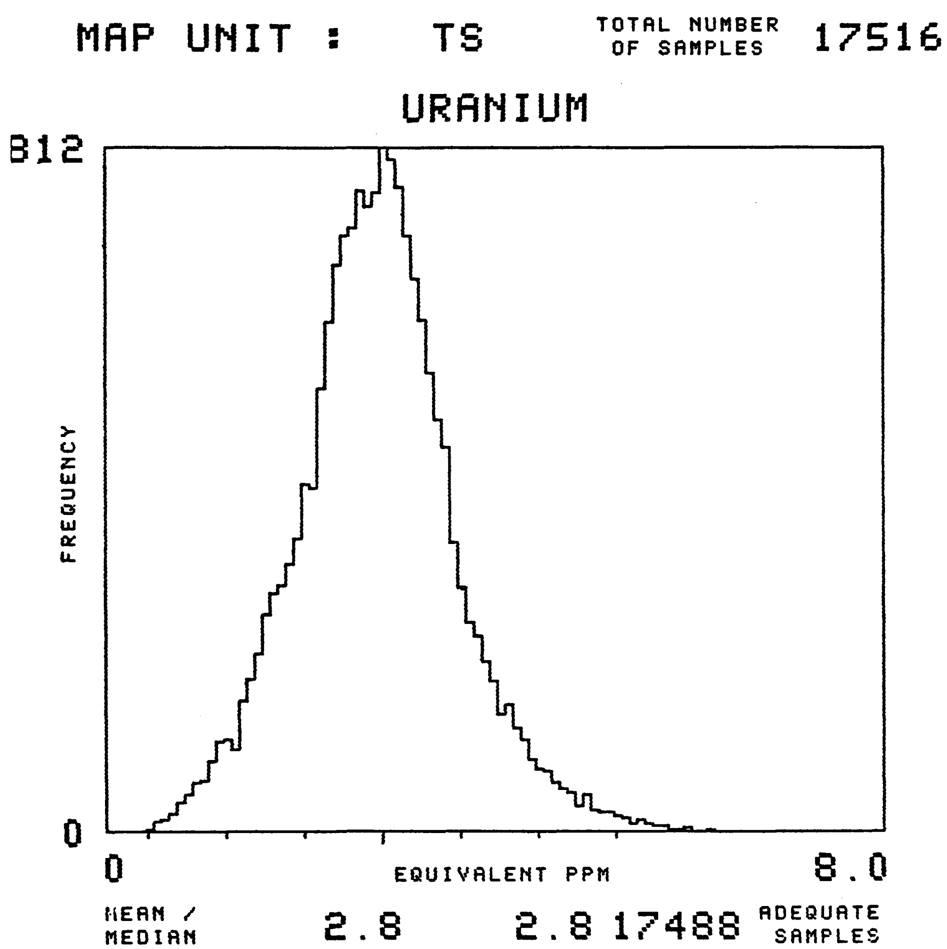


FIGURE IX Sample Computer Map Unit Histogram

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

averaged record (statistical analysis) data listings are summar-
below:

Fiducial number

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.

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

Magnetic field expressed in residual gammas

Geology - code representing geologic formations

%K, eU, eT - percent potassium, equivalent ppm of uranium and thorium data and the number of (±) standard deviations from the mean

eU/eTH, eU/%K, eTh/%K - calculated ratios of the three parameters, and the number of (±) standard deviations from the mean

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

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

Uair - atmospheric Bi-214 in equivalent ppm

TAPES

tape files have been generated for each of the 1:250,000 NTMS rangle sheets. The tapes are IBM compatible and recorded on ·ack EBCDIC at 800 bpi. Five separate types of data tapes are ented: raw spectral data tapes, single record reduced data tapes, istical analysis tapes, magnetic data tapes and a statistical ysis summary tape. Detailed descriptions of the data tape formats ow this discussion.

DATA INTERPRETATION METHODS

General

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

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

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

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

When correlating ground data (geochemical, geological, etc.) with the corrected data derived from raw airborne measurements, the interpreter must remember what an individual airborne gamma ray sample physically measures. First, the terrestrial component of the gamma radiation measured by the airborne detector emanated primarily from the upper 18 inches of material on the earth's surface (Gregory and d, 1963). The airborne measurement cannot "see" any deeper the underlying rock material and is essentially a measurement soil's or exposed (weathered) rock's radioactivity. Secondly, each airborne sample is an accumulation of gamma rays measured moving platform over a fixed period of time, the individual represents a large areal extent of surficial material. For survey, with specifications of 400 feet mean terrain clearance average ground speed of 140 miles per hour, a one second sample ponds to an oval approximately 750 feet long by 600 feet wide ing an infinite, uniformly distributed source). Accordingly, ed samples represent tremendous volumes of surficial materials.

ology

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

anium anomaly/interpretation map displays each individual ed sample that meets the following criteria:

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

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

ach U/T ratio defined in (2) must have a corresponding thorium alue lying at least greater than minus one (-1) standard devia- ion below the mean. If the thorium sample is less than one tandard deviation below the mean, the U/T ratio is considered uestionable.

e possible anomalies displayed on the map are then examined usters, trends, and comparisons with all other available data.

n requirements in the subsequent interpretation discussions of uadrangle for anomalies listed in the uranium anomaly summary fined as follows:

wo (2) consecutive averaged U samples lying two or more stan- ard deviations above the mean or three (3) consecutive averaged samples, two of which are one (1) or more standard deviations nd the third of which is two (2) or more standard deviations bove the mean.

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

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

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

TAPE FORMATS

SINGLE RECORD REDUCED DATA TAPE

REFERENCE: Paragraphs 4.7.6 and 6.1.6, BFEC 1200-C

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

Block 1 - Format Data

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

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

SINGLE RECORD REDUCED DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

ITEM	FORMAT	DESCRIPTION
1.	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
2.	A20	NAME OF SUBCONTRACTOR
3.	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
4.	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
5.	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
6.	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
7.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN CPS PER PERCENT K
8.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
9.	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH
13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4PI SYSTEM FOR FIRST AERIAL SYSTEM
14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2PI SYSTEM FOR FIRST AERIAL SYSTEM
15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
*	*	*
*	*	*
*	*	*
85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
99-101	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
*	*	*
*	*	*
*	*	*
390-392	I4,I6,I3	REPEAT OF ITEMS 96-98 FOR 99th FLIGHT LINE ON THIS TAPE

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

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

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

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

Block 2 - Single Record Reduced Identification Data

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

Block 3 - Single Record Reduced Data

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

STATISTICAL ANALYSIS TAPE

REFERENCE: Paragraphs 4.7.7 and 6.1.6, BFEC 1200-C

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

Block 1 - Format Description Data

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

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

STATISTICAL ANALYSIS DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

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

The remaining 440 characters in this block are blanks.

Block 2 - Statistical Analysis Identification Data

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

Block 3 - Statistical Analysis Data

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

MAGNETIC DATA TAPE

REFERENCE: Paragraphs 4.7.8 and 6.1.6, BFEC 1200-C

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

Block 1 - Tape Format Description

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

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

MAGNETIC DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)

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

The remaining 4616 characters in this block are blanks.

Block 2 - Magnetic Tape Identification Data

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

Block 3 - Magnetic Data

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

STATISTIC ANALYSIS SUMMARY TAPE

REFERENCE: Paragraphs 4.7.9, BFEC 1200-C

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

Block 1 - Format Description Data

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

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

STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

The remaining 2680 characters on this block shall be blanks.

Block 2 - Statistical Analysis Identification Data

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

Block 3 - Statistical Analysis Summary Data

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

BIBLIOGRAPHY

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

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

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

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

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

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

APPENDIX B — Flight Summary

APPENDIX B

DAILY PRODUCTION SUMMARY

October, 1980

QUEEN AIR N9AG

Oct.	10 - 13	
	15	840 line miles Danville, Muncie
	16	840 " " " "
	17	Weather, nil production
	18	840 line miles - Danville, Muncie
	19	831.6 " " " "
	20	832 " " Chicago, Fort Wayne
	21	822 " " " "
	22	694 " " " "
	23	593.6 " " " "

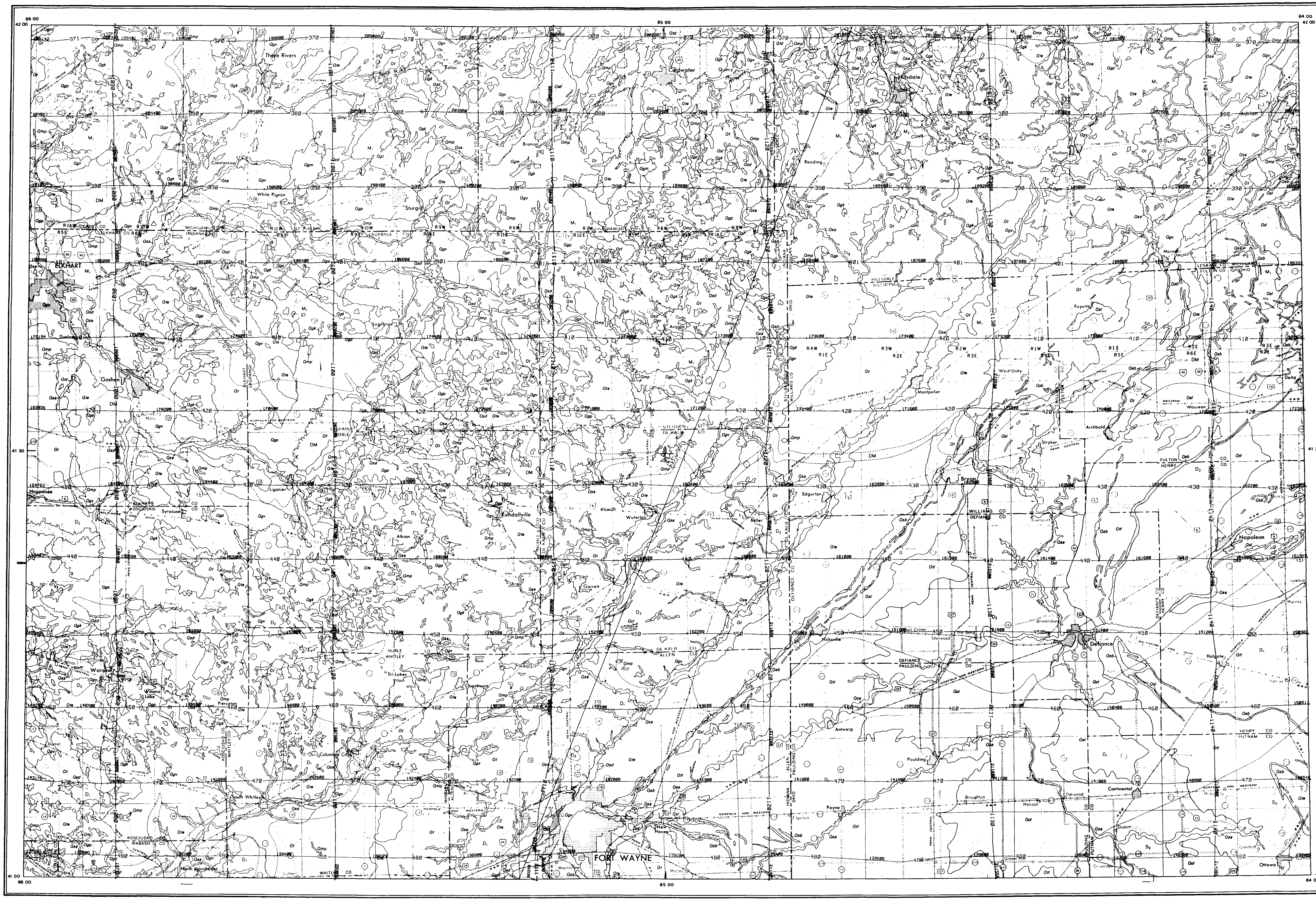
Total miles for the above period - 6,283.2 line miles

Total miles for the included quadrangles:

Danville	1,675.8
Muncie	1,675.8
Chicago	1,275.0
Fort Wayne	1,656.6

APPENDIX C - Flight Path and Geologic Map

C1 FW



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

FIDUCIAL NUMBER

123400 053-0 123600

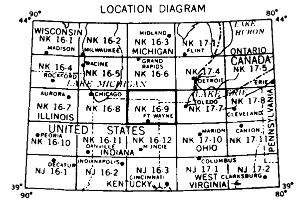
LINE NUMBER

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

FLIGHT ALTITUDE .... 400 FEET AMT

FLOWN AND COMPILED 1980

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

FLIGHT PATH RECOVERY

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

FORT WAYNE QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

BEDROCK UNITS

MISSISSIPPIAN

M_2

Marshall Sandstone

Varicolored micaceous sandstone

M_1

Coldwater Shale

Mostly gray shale. Cuyahoga Formation in Ohio

DEVONIAN AND MISSISSIPPIAN

DM

Sunbury and Ellsworth Shales

Green shale with black shale in upper and lower parts. Includes Berea Sandstone and Bedford Shale in Ohio

DEVONIAN

D_2

Antrim Shale

Black shale with gray shale and limestone in lower part. Ohio Shale and upper part of Traverse Group in Ohio

D_1

Traverse and Detroit River Formations

Mostly limestone and dolomite. Major part of Traverse Group and Dundee Limestone and Detroit River Group in Ohio

SILURIAN

S_2

ˍalina Formation

Limestone and dolomite. Salina Group in Ohio

S_1

Wabash Formation

Dolomite, cherty limestone, and some shale

Boundary of mapped unit

Bedrock boundaries dashed where covered by unconsolidated deposits

Significant ice-marginal position

Marked by stratigraphic or topographic break. Used mainly to supplement or clarify other boundaries

UNCONSOLIDATED DEPOSITS

QUATERNARY (PLEISTOCENE)

Recent

Qm

Made and modified land

Artificial fill and land substantially modified by the removal of unconsolidated deposits. Many small areas not mapped

Qsa

Silt, sand, and gravel

Mostly alluvium, but includes some colluvial and paludal deposits. Martinsville Formation in Indiana

Qmp

Muck, peat, and marl

Paludal and lacustrine deposits. Martinsville Formation in Indiana

Wisconsinan and Recent

Qgm

Muck or silt over sand and gravel

Outwash (mostly valley-train) deposits of sand and gravel overlain in places by thin (generally less than 3 to 5 feet) lacustrine, paludal, or alluvial deposits of muck, peat, clay, silt, or fine sand. Martinsville Formation over outwash facies of Atherton Formation in Indiana

Qsd

Sand and some silt

Dune deposits. Dune facies of Atherton Formation in Indiana

Qsb

Sand and gravel

Beach and shoreline deposits in bars, spits, deltas, and beaches. Includes some dune sand and till. Atherton Formation in Indiana

Wisconsinan

Qcl, Qsl

Clay, silt, and sand

Lacustrine deposits. Qcl, mostly clay and silt; Qsl, mostly sand. Lacustrine facies of Atherton Formation in Indiana

Qgv, Qgp

Gravel, sand, and silt

Outwash deposits. Qgv, valley-train deposits; Qgp, outwash-plain deposits. Outwash facies of Atherton Formation in Indiana

Qk

Gravel, sand, and some silt

Ice-contact stratified drift in kames and kame moraines. Kame facies of Lagro Formation in Indiana

Qgt

Sand, gravel, and till

Undifferentiated ice-contact stratified drift, till, and dune sand in end moraines. Lagro, Trafalgar, and Atherton Formations in Indiana

Qts

Sand or gravel over till or clay

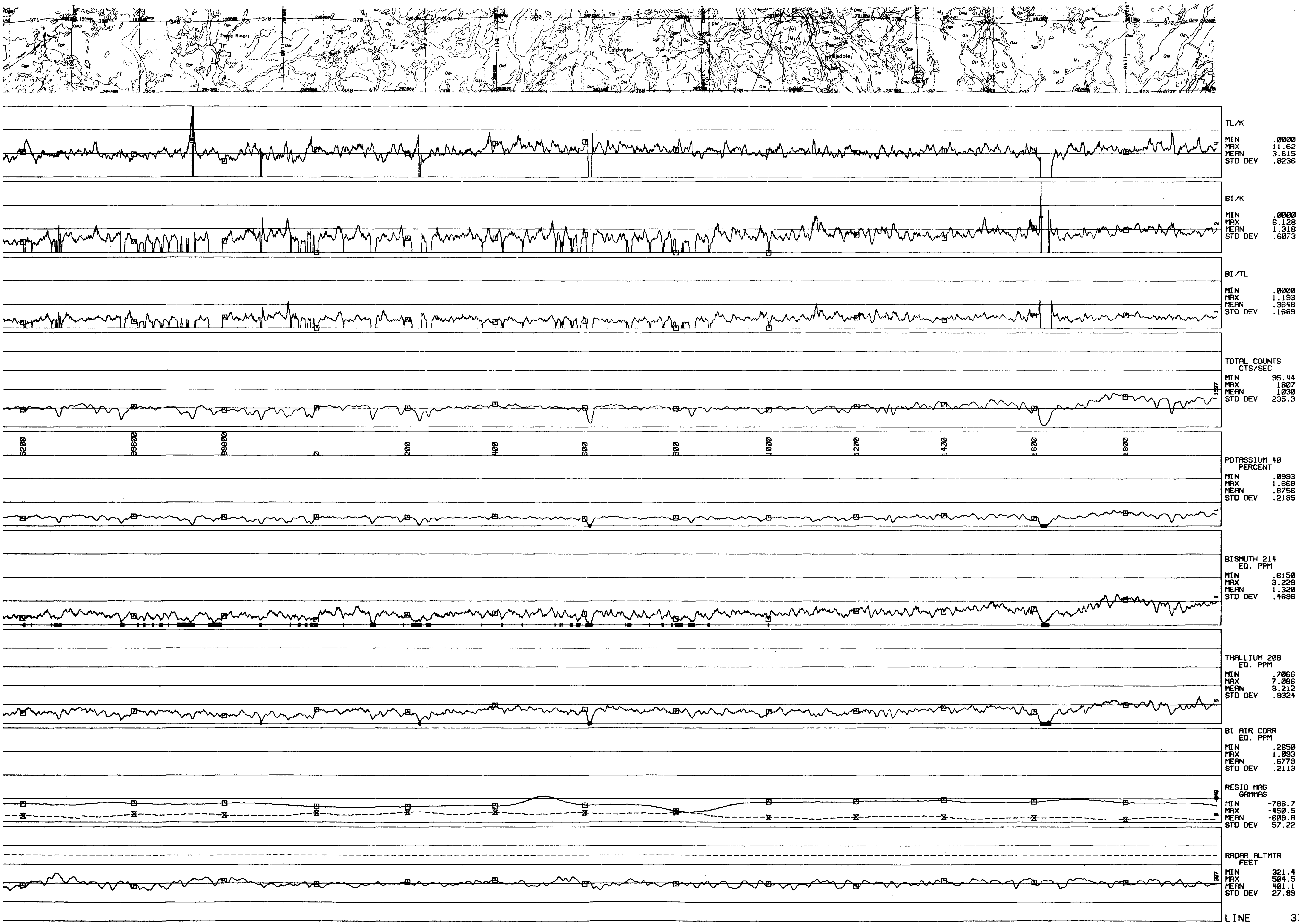
Thin (generally less than 3 to 5 feet) deposits of dune sand and (or) outwash gravel and sand over till or over lacustrine clay in places in Michigan and northernmost Indiana. Part of Atherton Formation over Lagro and Trafalgar Formations in Indiana

Qt, Qtd, Qte, Qtl

Till

Includes some ice-contact stratified drift. Qt, mainly ground-moraine deposits; Qte, mainly end-moraine deposits; Qtd, mainly drumlin deposits; Qtl, wave-scoured lake-bottom till. Mostly Lagro Formation in Indiana

APPENDIX D - Profiles


Three Rivers
Coldwater
Hillsdale
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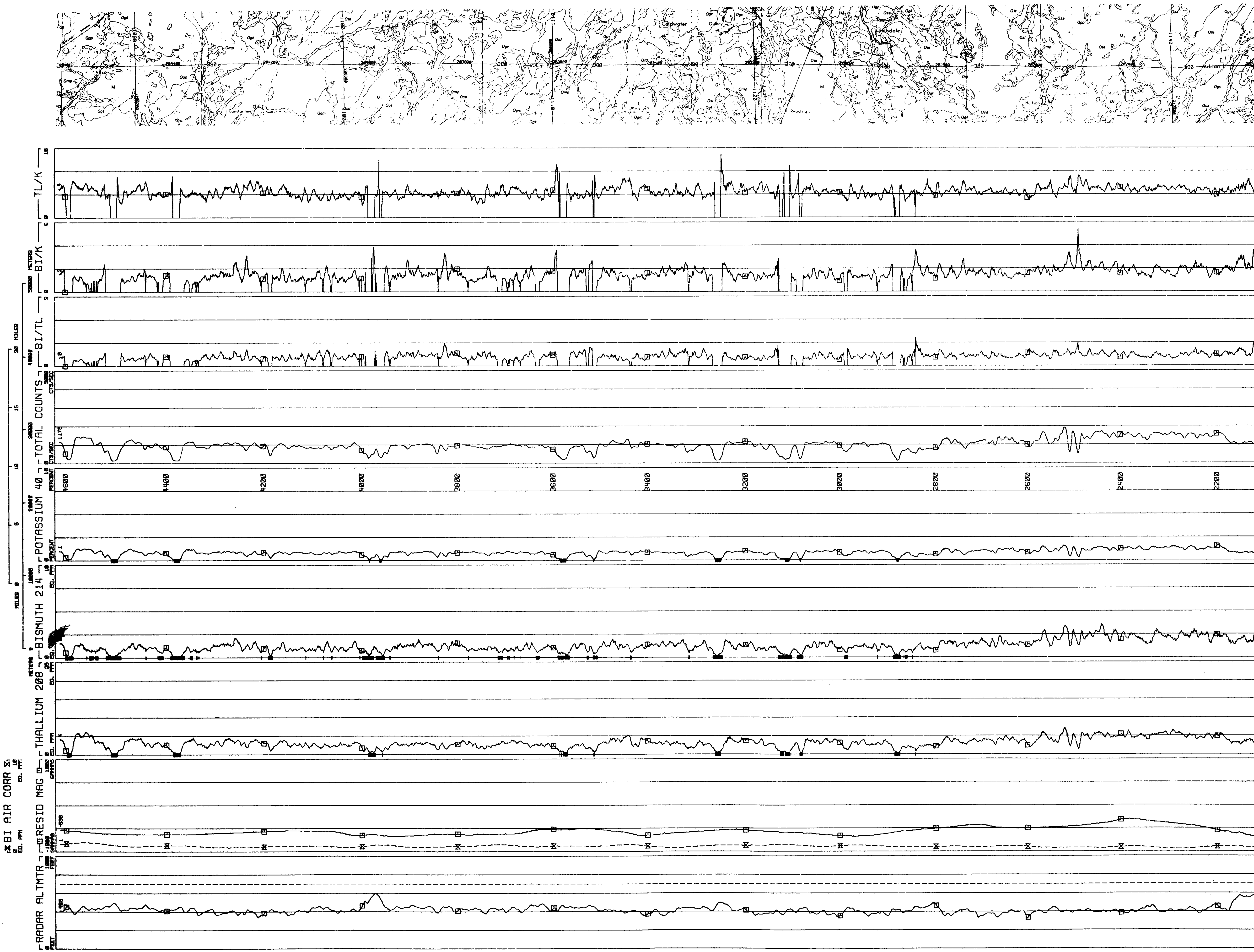
MAX 11.62
MEAN 3.615
STD DEV .8236
BI/K
MIN .0000
MAX 6.128
MEAN 1.318
STD DEV .6073
BI/TL
MIN .0000
MAX 1.193
MEAN .3648
STD DEV .1689
TOTAL COUNTS CTS/SEC
MIN 95.44
MAX 1807
MEAN 1030
STD DEV 235.3
200
400
600
800
1000
1200
1400
1600
1800
POTASSIUM 40 PERCENT
MIN .0993
MAX 1.669
MEAN .8756
STD DEV .2185
BISMUTH 214 EQ. PPM
MIN .6150
MAX 3.229
MEAN 1.320
STD DEV .4696
THALLIUM 208 EQ. PPM
MIN .7066
MAX 7.086
MEAN 3.212
STD DEV .9324
BI AIR CORR EQ. PPM
MIN .2650
MAX 1.093
MEAN .6779
STD DEV .2113
RESID MAG GAMMAS
MIN -788.7
MAX -450.5
MEAN -609.8
STD DEV 57.22
RADAR ALTMTR FEET
MIN 321.4
MAX 504.5
MEAN 401.1
STD DEV 27.89
LINE 370

LINE 380
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



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STD DEV 1.058

BI/K
MIN .0000
MAX 5.379
MEAN 1.366
STD DEV .7102

BI/TL
MIN .0000
MAX 1.207
MEAN .3676
STD DEV .1866

TOTAL COUNTS CTS/SEC
MIN 133.8
MAX 1905
MEAN 985.7
STD DEV 315.4

POTASSIUM 40 PERCENT
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MAX 1.591
MEAN .8523
STD DEV .2704

BISMUTH 214 EQ. PPM
MIN .6069
MAX 3.547
MEAN 1.393
STD DEV .5391

THALLIUM 208 EQ. PPM
MIN .7193
MAX 6.968
MEAN 3.235
STD DEV 1.146

BI AIR CORR EQ. PPM
MIN .2207
MAX .9837
MEAN .5484
STD DEV .1263

RESID MAG GAMMAS
MIN -698.5
MAX -305.4
MEAN -560.8
STD DEV 83.18

RADAR ALTMTR FEET
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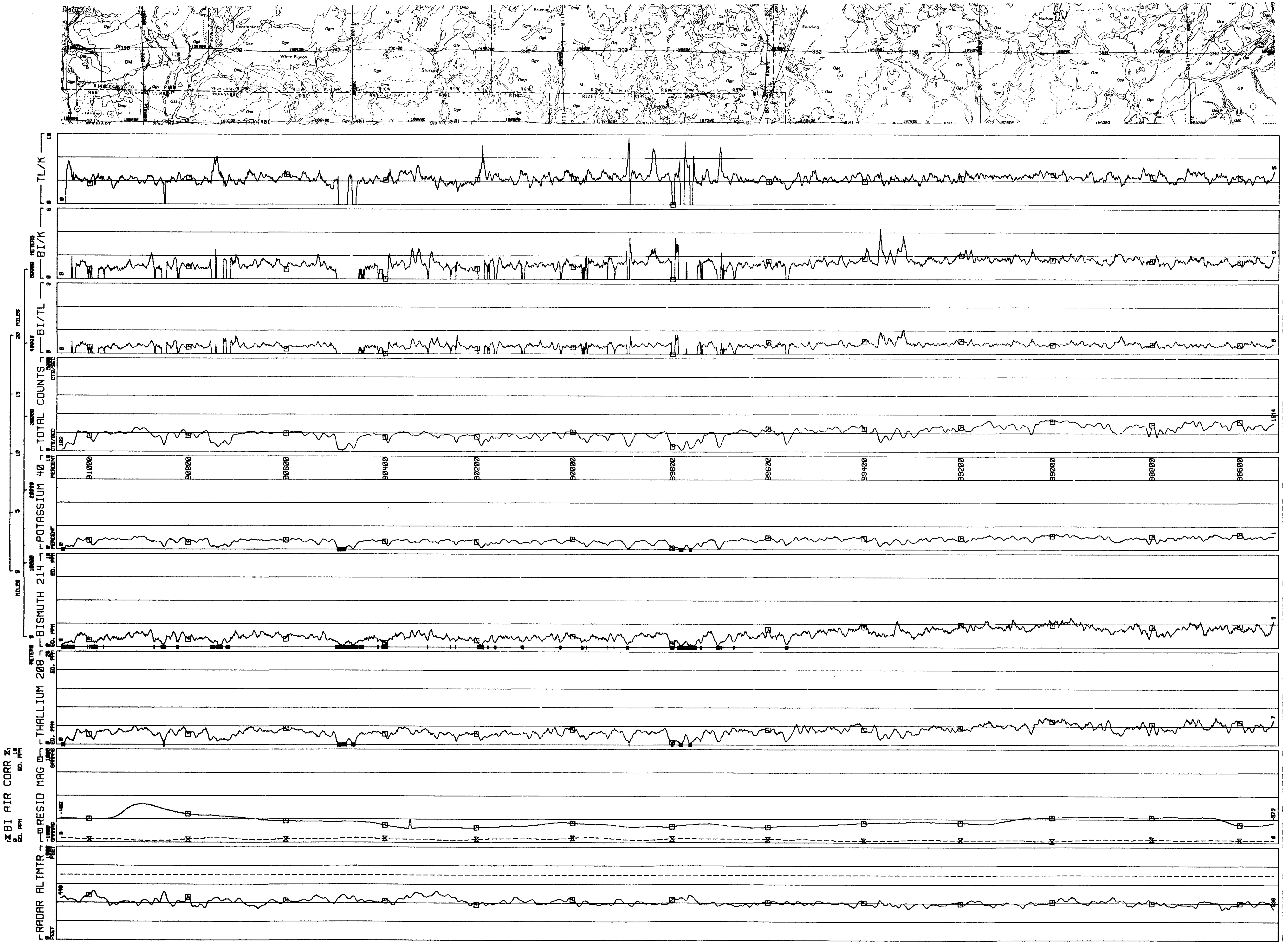
MEAN 418.7
STD DEV 40.37

LINE 380

LINE
390
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80296



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BI/K
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MAX 4.272
MEAN 1.280
STD DEV .5963

BI/TL
MIN .0000
MAX 1.033
MEAN .3425
STD DEV .1573

TOTAL COUNTS CTS/SEC
MIN 84.43
MAX 1721
MEAN 1022
STD DEV 335.8

POTASSIUM 40 PERCENT
MIN .1032
MAX 1.738
MEAN .9822
STD DEV .3162

BISMUTH 214 EQ. PPM
MIN .5278
MAX 3.178
MEAN 1.490
STD DEV .5600

THALLIUM 208 EQ. PPM
MIN .7107
MAX 7.361
MEAN 3.736
STD DEV 1.309

BI AIR CORR EQ. PPM
MIN .1400
MAX .5409
MEAN .3176
STD DEV .0845

RESID MAG GAMMAS
MIN -705.6
MAX -179.6
MEAN -551.6
STD DEV 104.7

RADAR ALTMTR FEET
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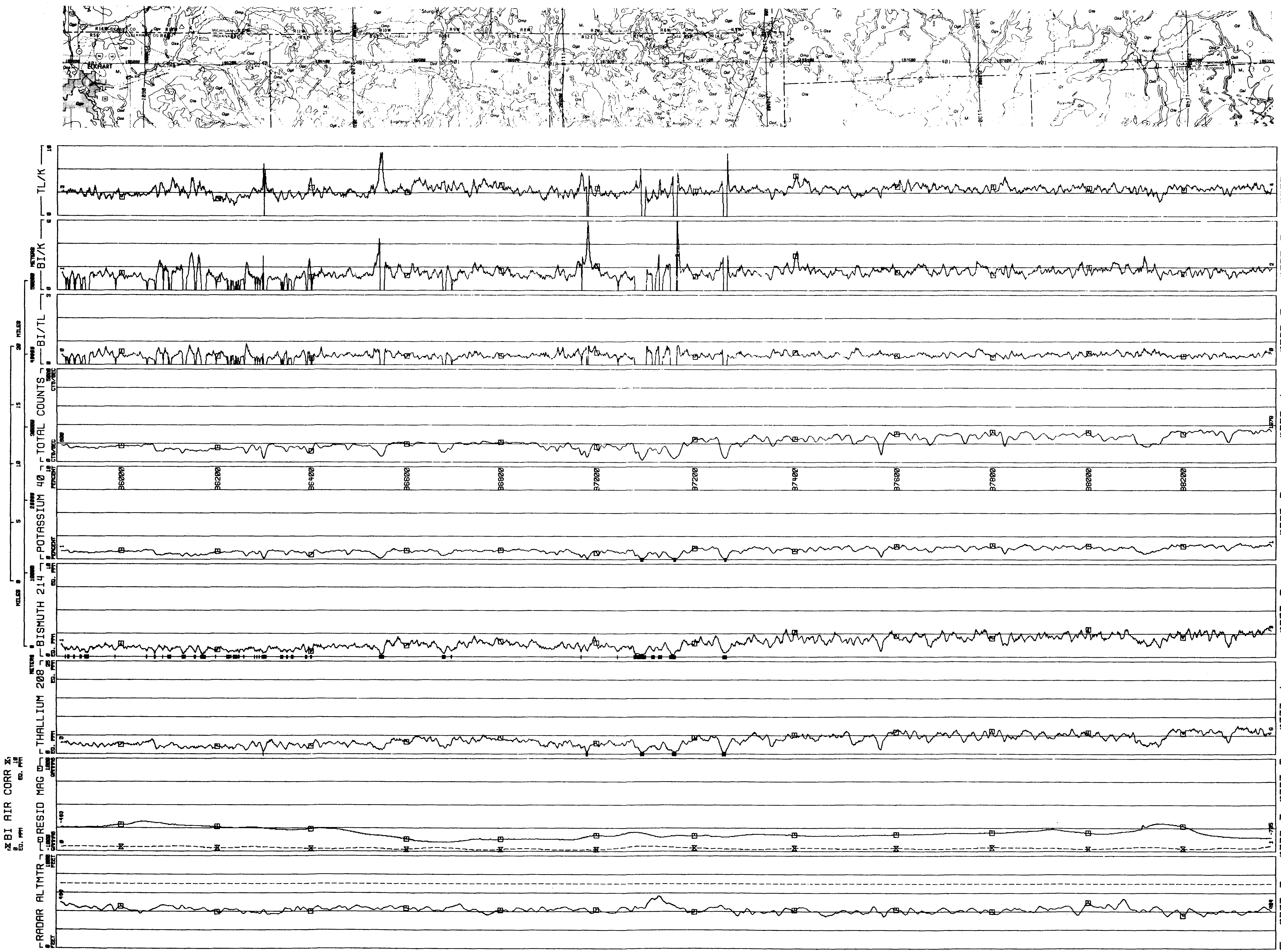
MAX 526.8
MEAN 408.5
STD DEV 32.30

LINE 390

LINE 400
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80296



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MIN	.0000
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MEAN	3.700
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BI/K	
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MAX	6.239
MEAN	1.476
STD DEV	.6109
BI/TL	
MIN	.0000
MAX	.9048
MEAN	.3959
STD DEV	.1517
TOTAL COUNTS CTS/SEC	
MIN	111.5
MAX	1812
MEAN	1071
STD DEV	356.2
POTASSIUM 40 PERCENT	
MIN	.1006
MAX	1.776
MEAN	.9959
STD DEV	.3338
BISMUTH 214 EQ. PPM	
MIN	.5904
MAX	3.143
MEAN	1.612
STD DEV	.6288
THALLIUM 208 EQ. PPM	
MIN	.7550
MAX	7.599
MEAN	3.756
STD DEV	1.491
BI AIR CORR EQ. PPM	
MIN	.1416
MAX	.5700
MEAN	.3362
STD DEV	.1005
RESID MAG GAMMAS	
MIN	-801.3
MAX	-358.2
MEAN	-606.3
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RADAR ALTMTR FEET	
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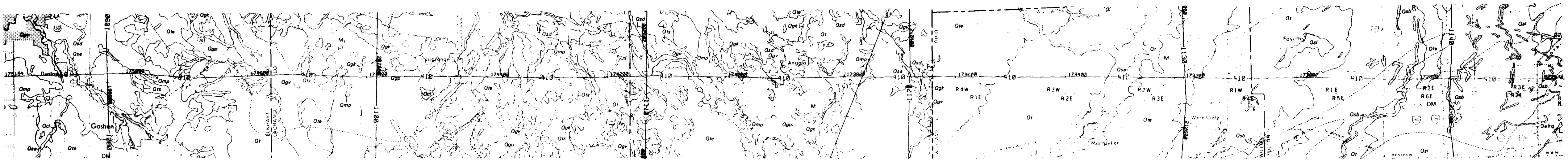
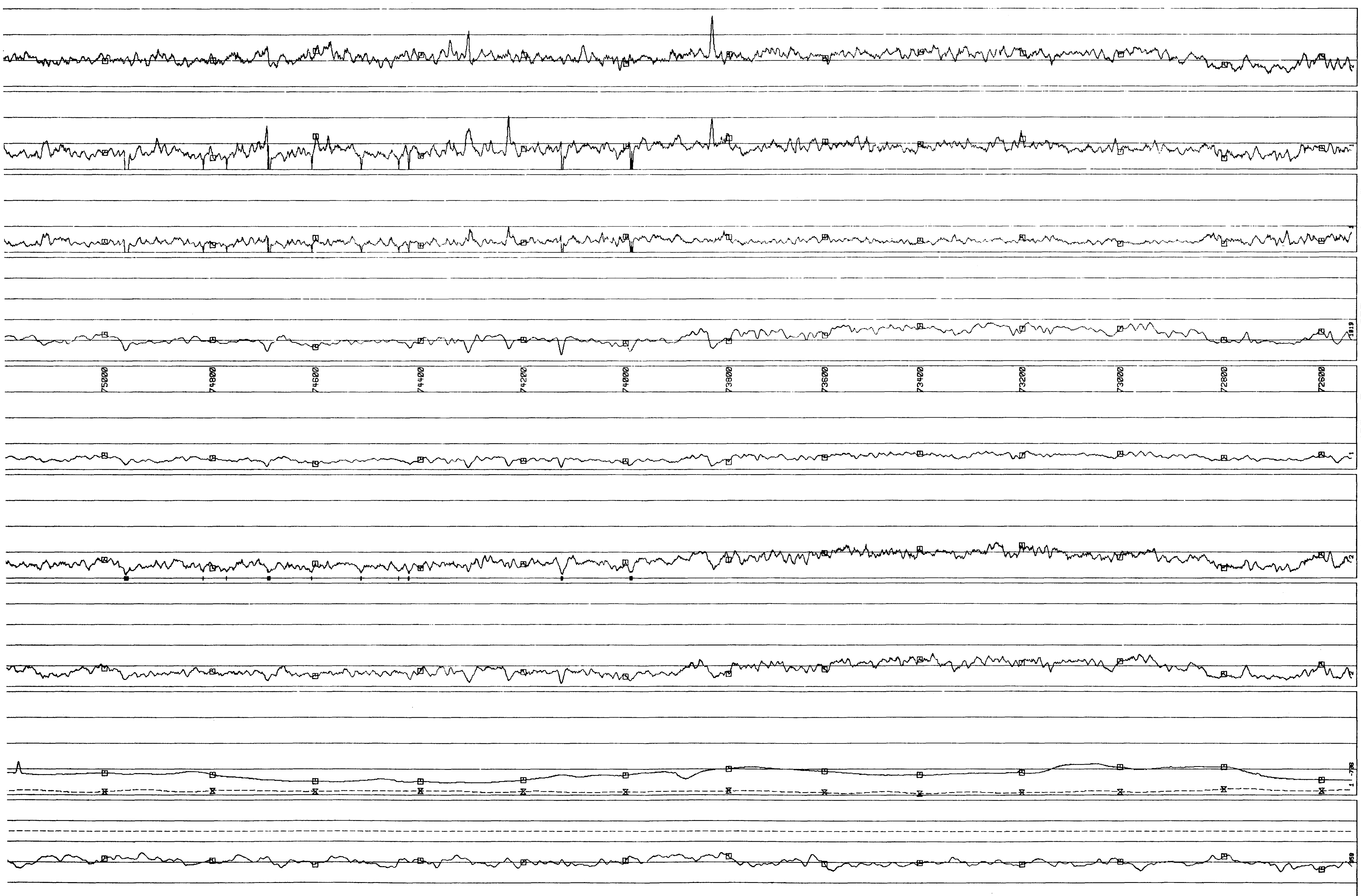
MEAN	420.8
STD DEV	30.86

LINE 400





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MEAN 3.745
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BI/K
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MAX 4.121
MEAN 1.542
STD DEV .4348

BI/TL
MIN .0000
MAX .9891
MEAN .4165
STD DEV .1100

TOTAL COUNTS
CTS/SEC
MIN 299.9
MAX 1847
MEAN 1160
STD DEV 296.0

POTASSIUM 40
PERCENT
MIN .1950
MAX 1.775
MEAN 1.082
STD DEV .2722

BISMUTH 214
EQ. PPM
MIN .5831
MAX 3.429
MEAN 1.688
STD DEV .5922

THALLIUM 208
EQ. PPM
MIN .7768
MAX 7.817
MEAN 4.082
STD DEV 1.389

BI AIR CORR
EQ. PPM
MIN .1381
MAX .6271
MEAN .3453
STD DEV .0814

RESID MAG
GAMMAS
MIN -760.8
MAX -363.1
MEAN -603.1
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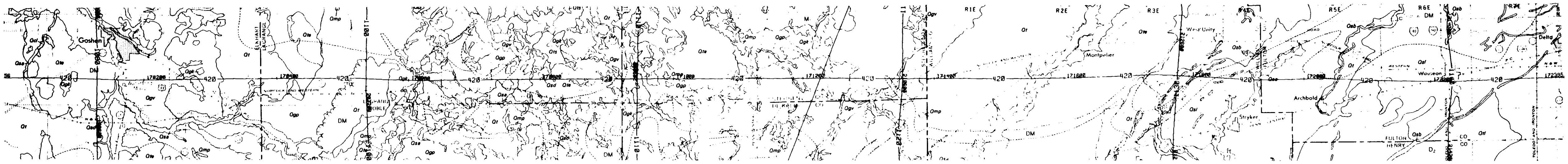
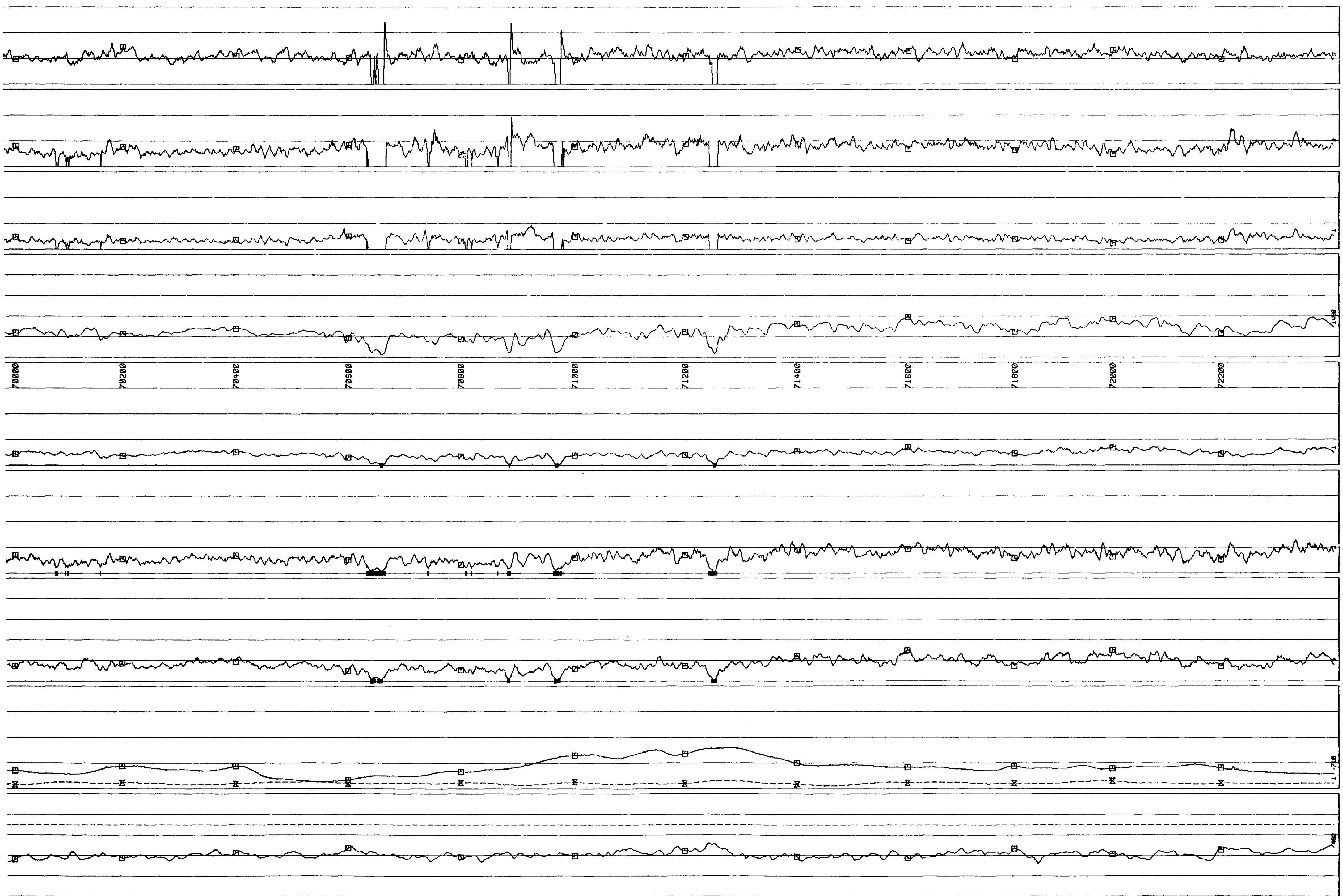
RADAR ALTMTR
FEET
MIN 311.2
MAX 489.7
MEAN 401.8
STD DEV 32.76

LINE 410

D6 F





TL/K

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STD DEV	.7321

BI/K

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MAX	3.831
MEAN	1.435
STD DEV	.4682

BI/TL

MIN	.0000
MAX	.9266
MEAN	.3828
STD DEV	.1256

TOTAL COUNTS
CTS/SEC

MIN	121.6
MAX	1972
MEAN	1282
STD DEV	321.9

POTASSIUM 40
PERCENT

MIN	.0944
MAX	1.774
MEAN	1.116
STD DEV	.2892

BISMUTH 214
EQ. PPM

MIN	.6159
MAX	3.214
MEAN	1.674
STD DEV	.5187

THALLIUM 208
EQ. PPM

MIN	.7852
MAX	7.654
MEAN	4.268
STD DEV	1.248

BI AIR CORR
EQ. PPM

MIN	.3137
MAX	.7946
MEAN	.5454
STD DEV	.0936

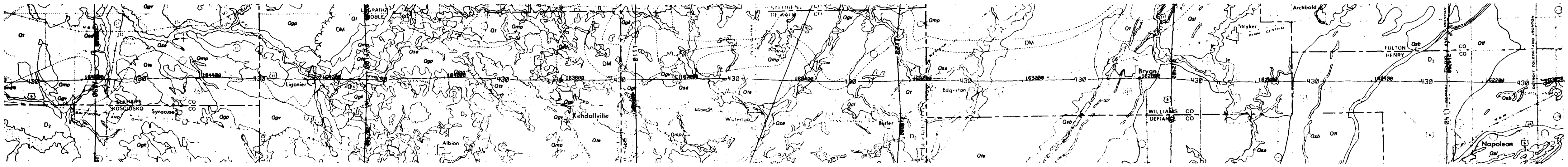
RESID MAG
GAMMAS

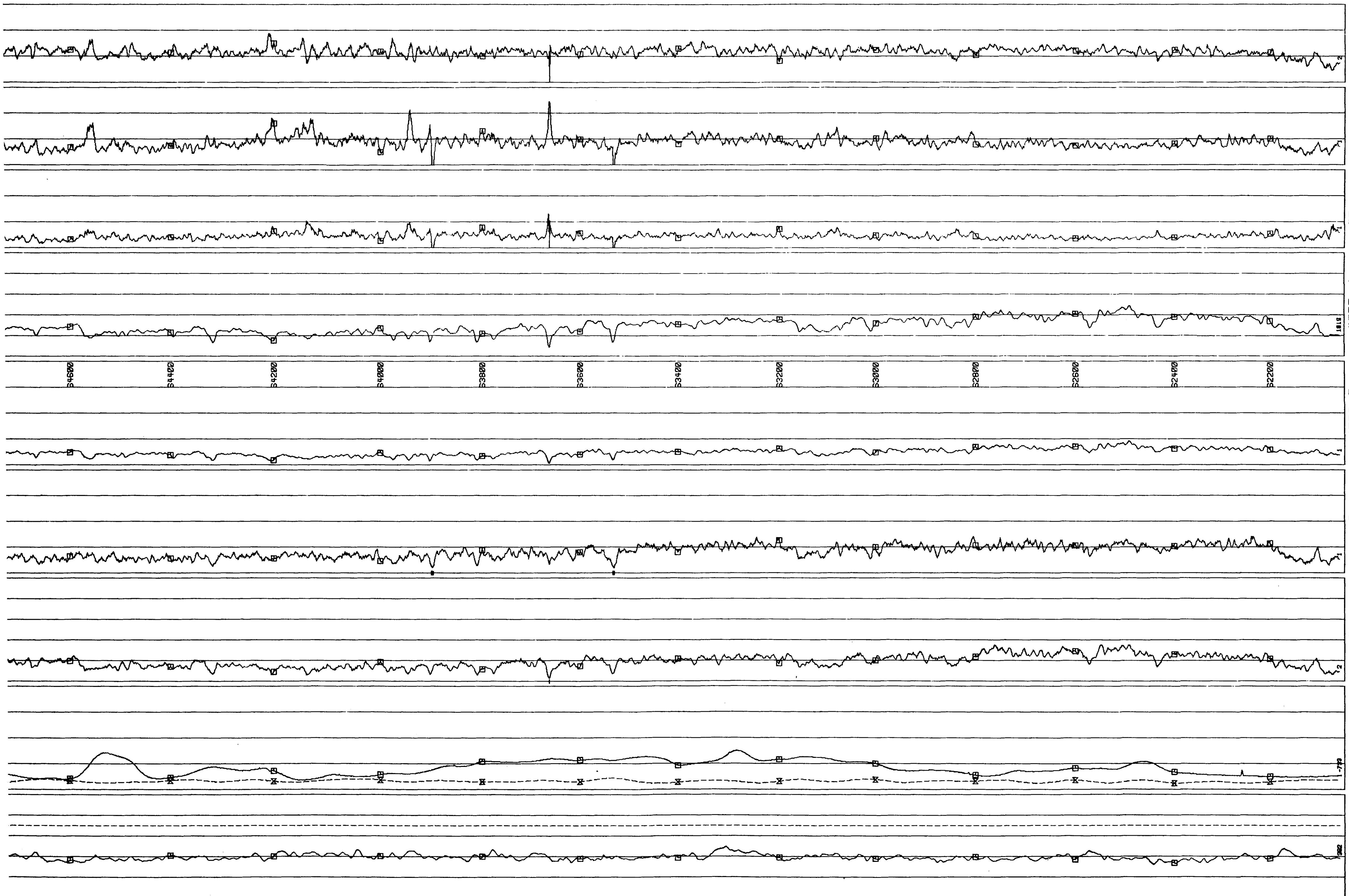
MIN	-860.1
MAX	-199.4
MEAN	-582.4
STD DEV	148.0

RADAR ALTMTR
FEET

MIN	326.9
MAX	520.6
MEAN	409.8
STD DEV	31.21

LINE 420





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MAX 6.240
MEAN 3.874
STD DEV .5529

BI/K
MIN .0000
MAX 4.881
MEAN 1.700
STD DEV .4429

BI/TL
MIN .0000
MAX 1.306
MEAN .4423
STD DEV .1130

TOTAL COUNTS
CTS/SEC
MIN 442.2
MAX 2427
MEAN 1473
STD DEV 347.1

POTASSIUM 40
PERCENT
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MAX 2.298
MEAN 1.218
STD DEV .3277

BISMUTH 214
EQ. PPM
MIN .6711
MAX 3.521
MEAN 2.031
STD DEV .5960

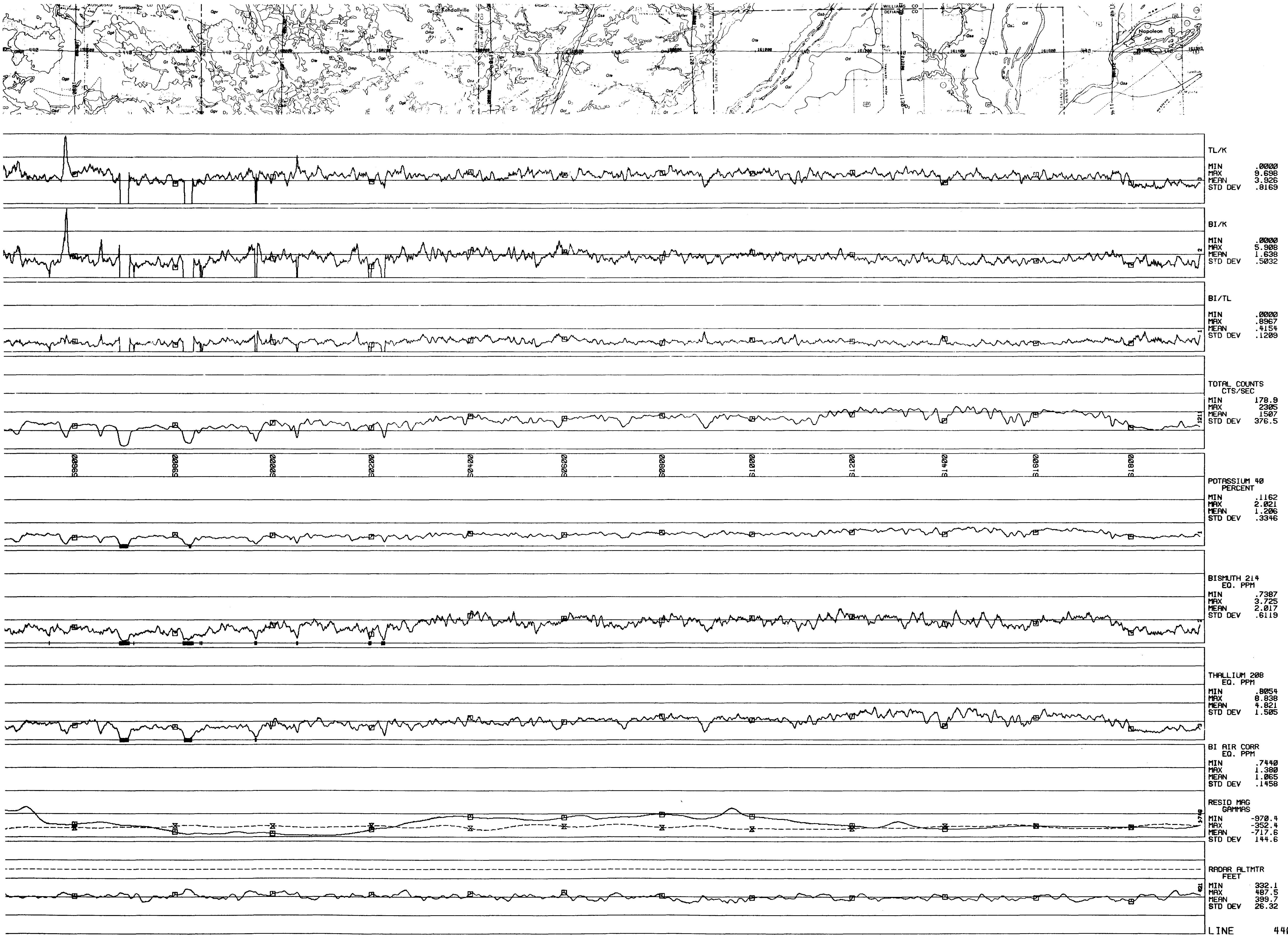
THALLIUM 208
EQ. PPM
MIN .8763
MAX 8.781
MEAN 4.730
STD DEV 1.476

BI AIR CORR
EQ. PPM
MIN .5933
MAX 1.094
MEAN .8051
STD DEV .1118

RESID MAG
GAMMAS
MIN -818.5
MAX -254.0
MEAN -591.0
STD DEV 140.6

RADAR ALTMTR
FEET
MIN 322.6
MAX 483.1
MEAN 393.3
STD DEV 26.92

LINE 430


Syracuse
Kendallville
Albion
Waterloo
Butler
Garrett
WILLIAMS CO
DEFIANCE CO
Napoleon
TL/K
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MAX 9.698
MEAN 3.926
STD DEV .8169
BI/K
MIN .0000
MAX 5.908
MEAN 1.638
STD DEV .5032
BI/TL
MIN .0000
MAX .8967
MEAN .4154
STD DEV .1209
TOTAL COUNTS CTS/SEC
MIN 178.9
MAX 2305
MEAN 1507
STD DEV 376.5
POTASSIUM 40 PERCENT
MIN .1162
MAX 2.021
MEAN 1.206
STD DEV .3346
BISMUTH 214 EQ. PPM
MIN .7387
MAX 3.725
MEAN 2.017
STD DEV .6119
THALLIUM 208 EQ. PPM
MIN .8054
MAX 8.838
MEAN 4.821
STD DEV 1.505
BI AIR CORR EQ. PPM
MIN .7440
MAX 1.380
MEAN 1.065
STD DEV .1458
RESID MAG GAMMAS
MIN -970.4
MAX -352.4
MEAN -717.6
STD DEV 144.6
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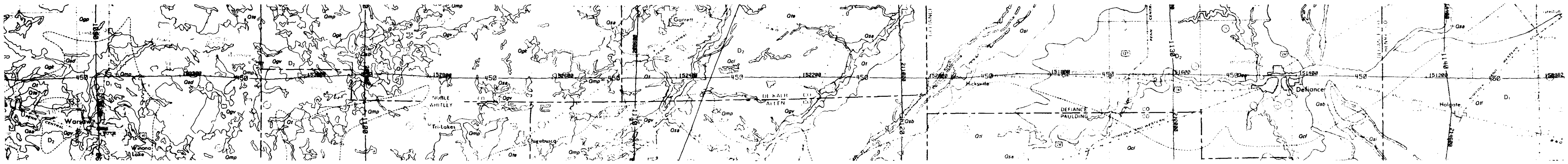
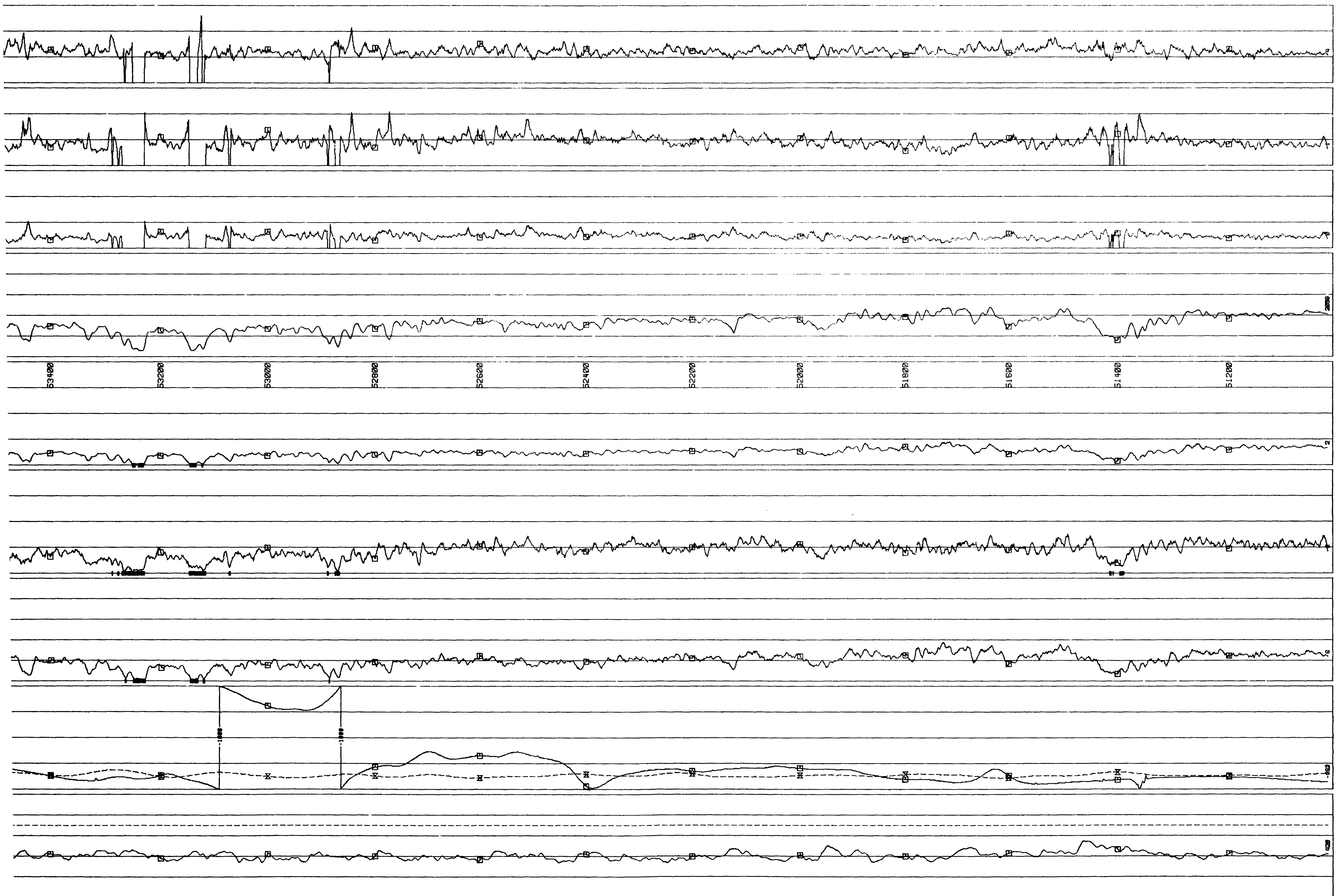
MAX 487.5
MEAN 399.7
STD DEV 26.32
LINE 440





TL/K

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MAX	8.692
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STD DEV	.7970

BI/K

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MAX	4.232
MEAN	1.759
STD DEV	.5903

BI/TL

MIN	.0000
MAX	1.047
MEAN	.4412
STD DEV	.1460

TOTAL COUNTS CTS/SEC

MIN	287.6
MAX	2377
MEAN	1598
STD DEV	408.4

POTASSIUM 40 PERCENT

MIN	.1032
MAX	2.223
MEAN	1.225
STD DEV	.3840

BISMUTH 214 EQ. PPM

MIN	.7039
MAX	3.755
MEAN	2.298
STD DEV	.5962

THALLIUM 208 EQ. PPM

MIN	.8121
MAX	9.317
MEAN	5.031
STD DEV	1.559

BI AIR CORR EQ. PPM

MIN	1.073
MAX	1.871
MEAN	1.352
STD DEV	.1530

RESID MAG GAMMAS

MIN	-1474
MAX	-271.3
MEAN	-749.1
STD DEV	240.0

RADAR ALTMTR FEET

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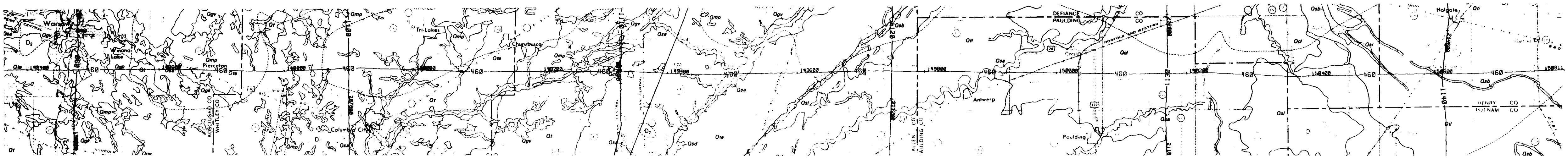
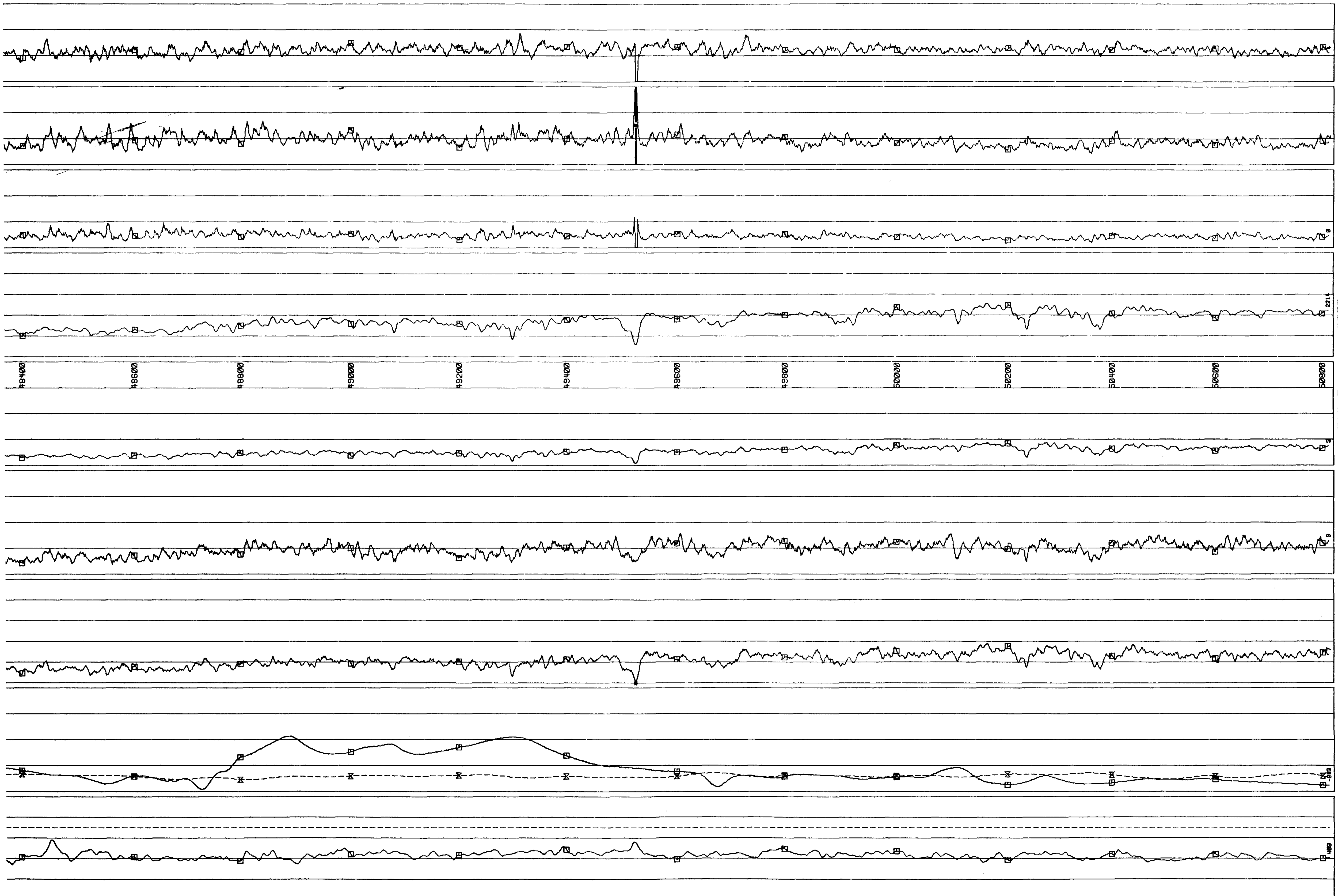
MAX	546.5
MEAN	406.4
STD DEV	34.73

LINE 450





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BI/K
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MAX 6.269
MEAN 1.843
STD DEV .4484

BI/TL
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MAX 1.164
MEAN .4561
STD DEV .1073

TOTAL COUNTS
CTS/SEC
MIN 586.8
MAX 2554
MEAN 1770
STD DEV 368.1

POTASSIUM 40
PERCENT
MIN .1953
MAX 2.186
MEAN 1.345
STD DEV .3631

BISMUTH 214
EQ. PPM
MIN .8522
MAX 3.905
MEAN 2.402
STD DEV .6040

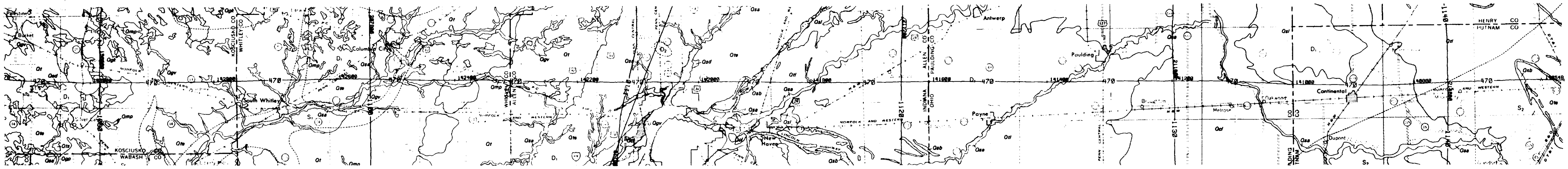
THALLIUM 208
EQ. PPM
MIN 1.095
MAX 9.546
MEAN 5.464
STD DEV 1.575

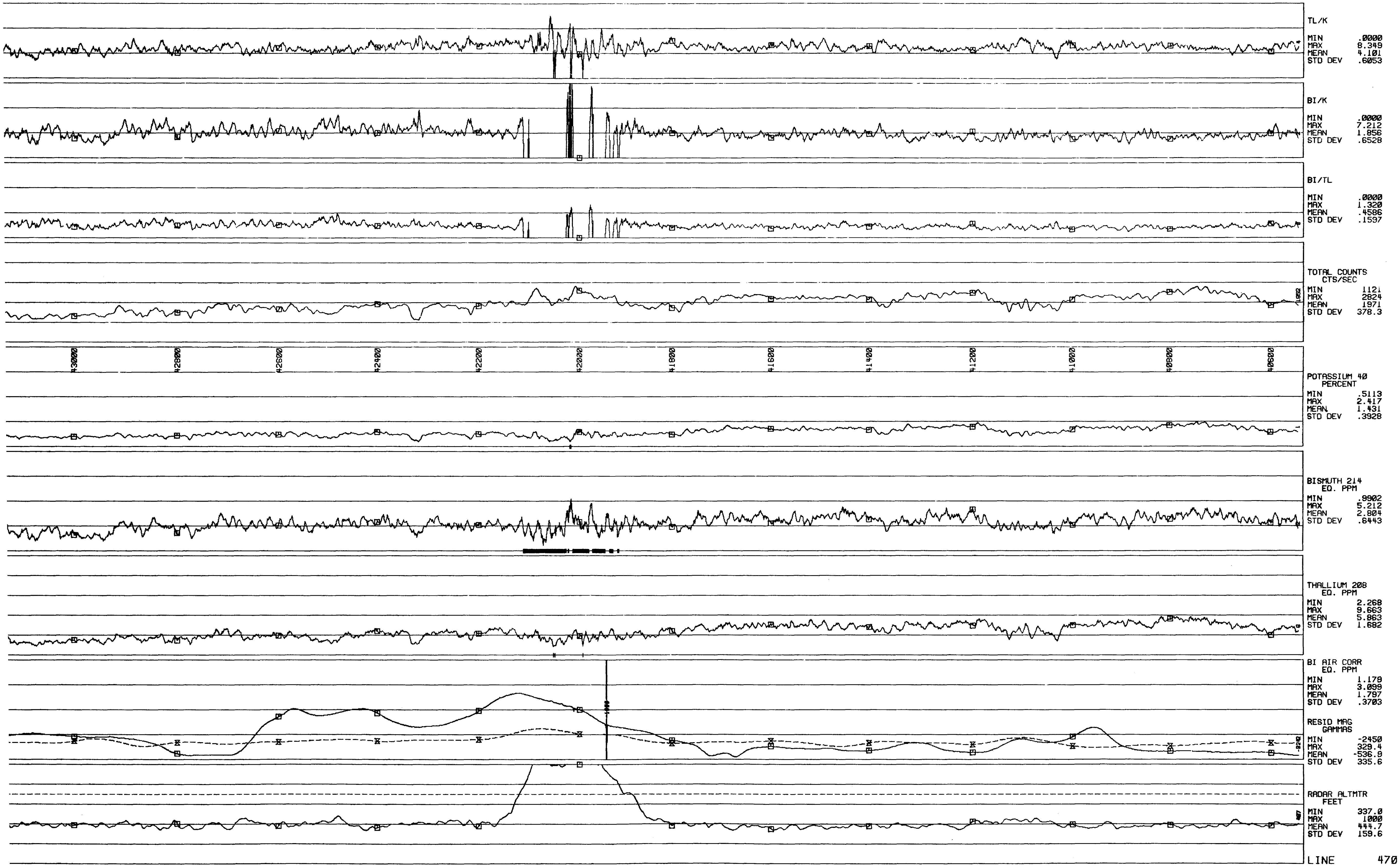
BI AIR CORR
EQ. PPM
MIN 1.132
MAX 1.797
MEAN 1.479
STD DEV .1448

RESID MAG
GAMMAS
MIN -957.3
MAX 64.79
MEAN -577.9
STD DEV 271.0

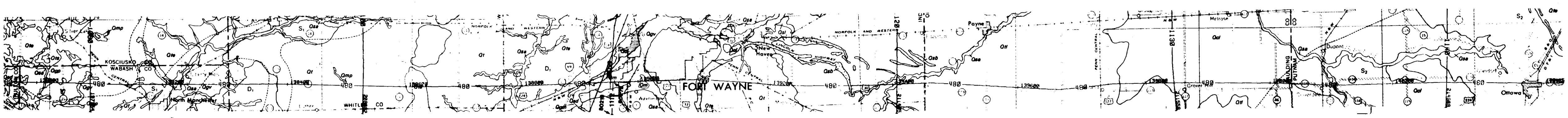
RADAR ALTMTR
FEET
MIN 339.8
MAX 578.8
MEAN 430.8
STD DEV 32.87

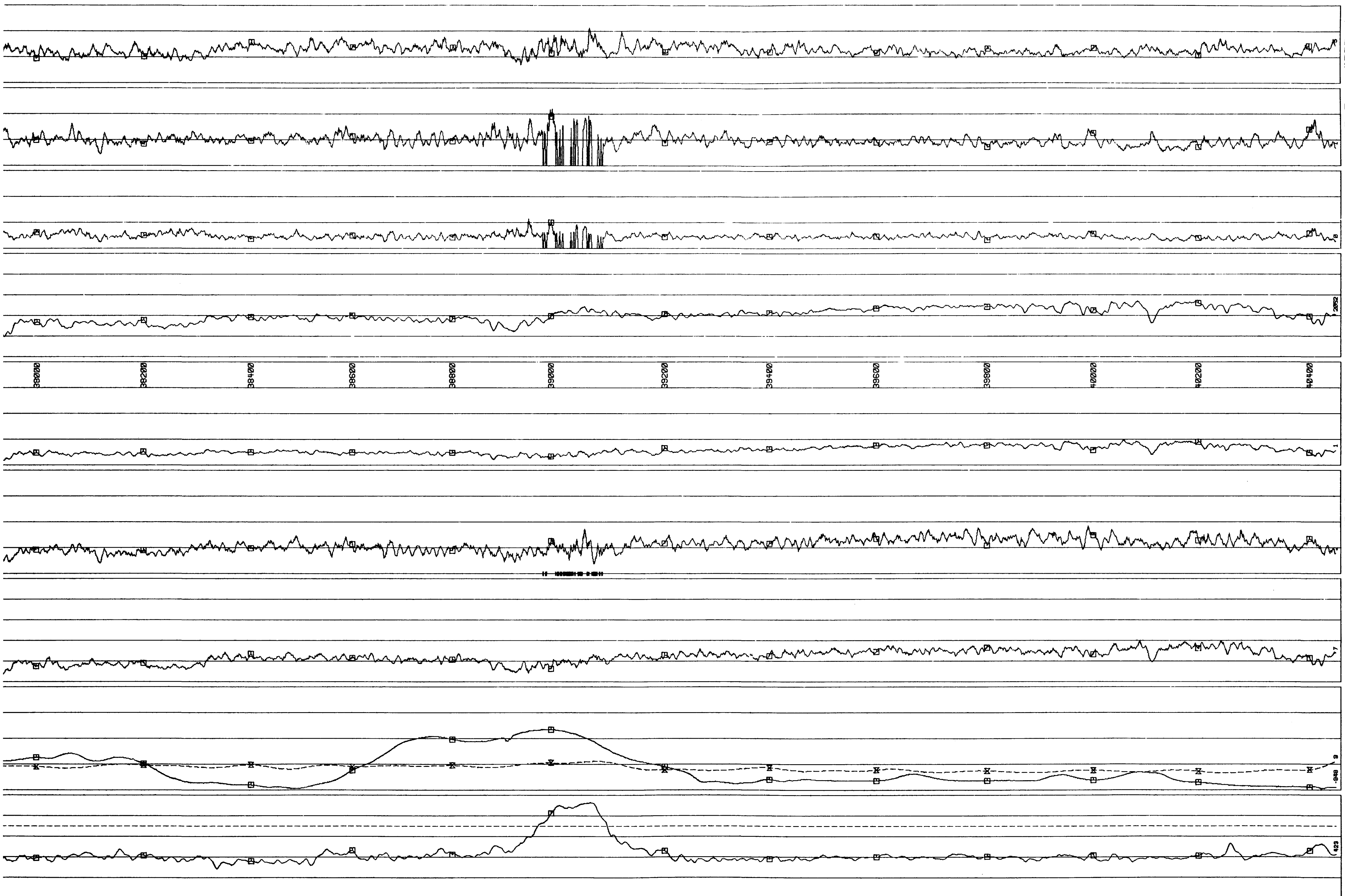
LINE 460


South Whitley
KOSCIUSKO
WABASH CO
Antwerp
Paulding
Payne
Continental
HENRY CO
PUTNAM CO
470


43000
42800
42600
42400
42200
42000
41800
41600
41400
41200
41000
40800
40600
TL/K
MIN .0000
MAX 8.349
MEAN 4.101
STD DEV .6053
BI/K
MIN .0000
MAX 7.212
MEAN 1.856
STD DEV .6528
BI/TL
MIN .0000
MAX 1.320
MEAN .4586
STD DEV .1597
TOTAL COUNTS
CTS/SEC
MIN 1121
MAX 2824
MEAN 1971
STD DEV 378.3
POTASSIUM 40
PERCENT
MIN .5113
MAX 2.417
MEAN 1.431
STD DEV .3928
BISMUTH 214
EQ. PPM
MIN .9902
MAX 5.212
MEAN 2.804
STD DEV .6443
THALLIUM 208
EQ. PPM
MIN 2.268
MAX 9.663
MEAN 5.863
STD DEV 1.682
BI AIR CORR
EQ. PPM
MIN 1.179
MAX 3.099
MEAN 1.797
STD DEV .3703
RESID MAG
GAMMAS
MIN -2450
MAX 329.4
MEAN -536.9
STD DEV 335.6
RADAR ALTMTR
FEET
MIN 337.0
MAX 1000
MEAN 444.7
STD DEV 159.6
LINE 470

D12 fw





TL/K

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STD DEV	.6001

BI/K

MIN	.0000
MAX	4.351
MEAN	1.927
STD DEV	.5038

BI/TL

MIN	.0000
MAX	1.142
MEAN	.4575
STD DEV	.1224

TOTAL COUNTS
CTS/SEC

MIN	965.8
MAX	2691
MEAN	2020
STD DEV	341.9

POTASSIUM 40
PERCENT

MIN	.4447
MAX	2.396
MEAN	1.426
STD DEV	.3923

BISMUTH 214
EQ. PPM

MIN	.8997
MAX	4.605
MEAN	2.746
STD DEV	.6190

THALLIUM 208
EQ. PPM

MIN	1.876
MAX	9.965
MEAN	6.026
STD DEV	1.587

BI AIR CORR
EQ. PPM

MIN	1.632
MAX	2.792
MEAN	2.109
STD DEV	.2757

RESID MAG
GAMMAS

MIN	-977.9
MAX	171.7
MEAN	-602.2
STD DEV	329.3

RADAR ALTMTR
FEET

MIN	287.6
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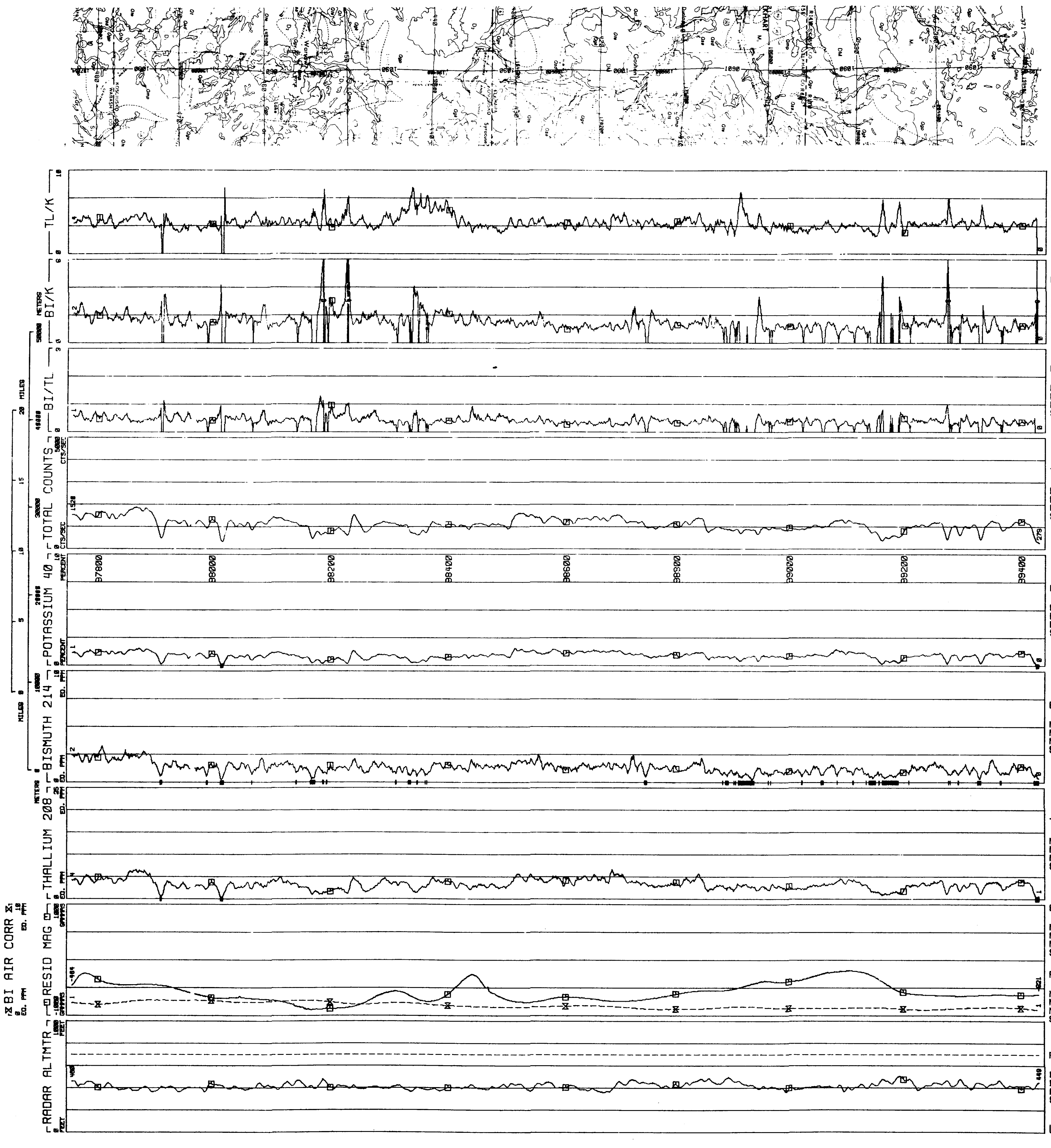
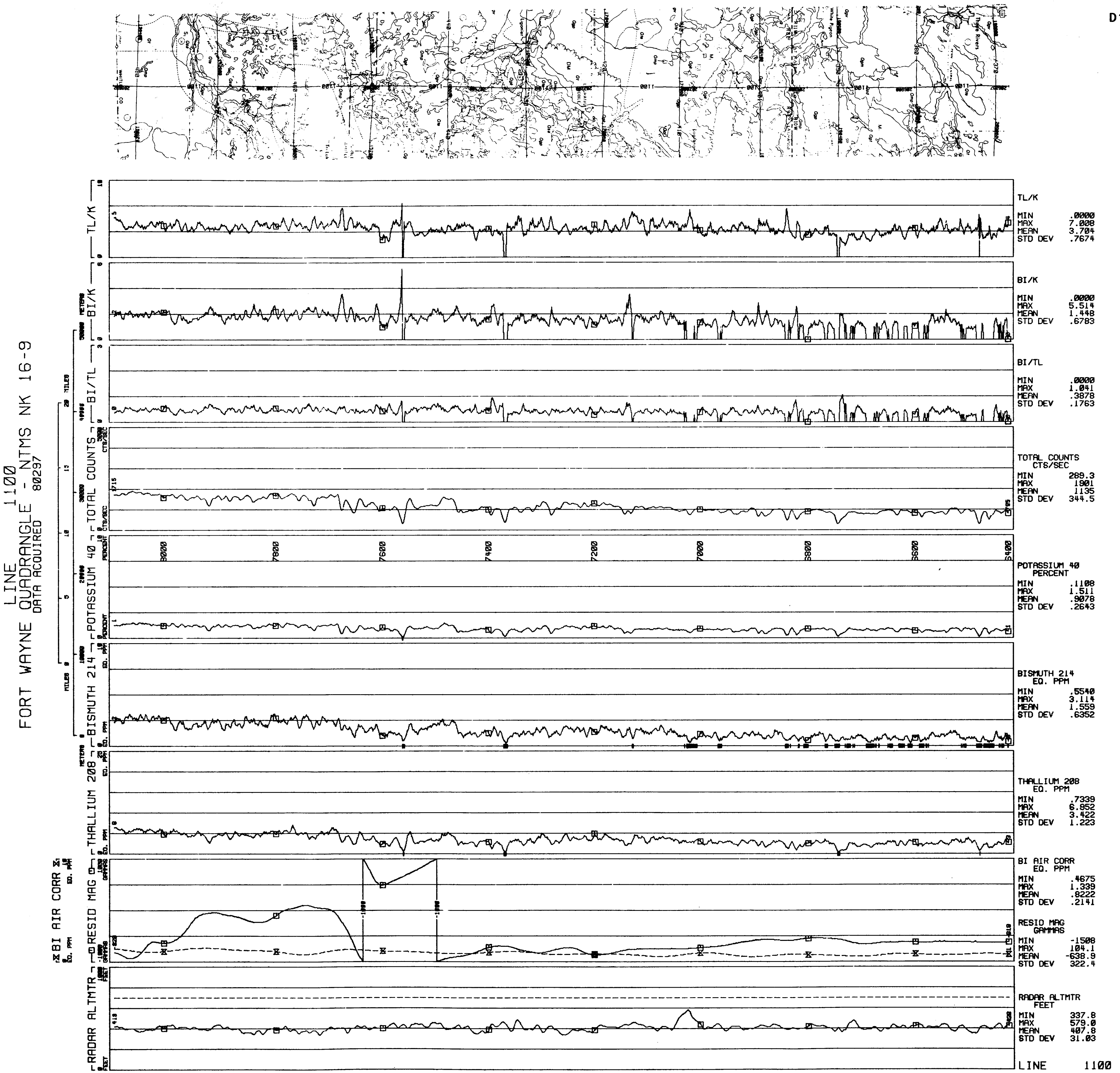
STD DEV	107.7

LINE 480

LINE 1090
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



D14 fw


LINE 1100
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297
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MAX 7.008
MEAN 3.704
STD DEV .7674
BI/K
MIN .0000
MAX 5.514
MEAN 1.448
STD DEV .6783
BI/TL
MIN .0000
MAX 1.041
MEAN .3878
STD DEV .1763
TOTAL COUNTS
CTS/SEC
MIN 269.3
MAX 1901
MEAN 1135
STD DEV 344.5
POTASSIUM 40
PERCENT
MIN .1108
MAX 1.511
MEAN .9078
STD DEV .2643
BISMUTH 214
EQ. PPM
MIN .5540
MAX 3.114
MEAN 1.559
STD DEV .6352
THALLIUM 208
EQ. PPM
MIN .7339
MAX 6.852
MEAN 3.422
STD DEV 1.223
BI AIR CORR
EQ. PPM
MIN .4675
MAX 1.339
MEAN .8222
STD DEV .2141
RESID MAG
GAMMAS
MIN -1508
MAX 104.1
MEAN -638.9
STD DEV 322.4
RADAR ALTMTR
FEET
MIN 337.8
MAX 579.0
MEAN 407.8
STD DEV 31.03
LINE 1100
8000
7800
7600
7400
7200
7000
6800
6600
6400
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
X BI AIR CORR
RESID MAG
RADAR ALTMTR

D15

LINE 1110
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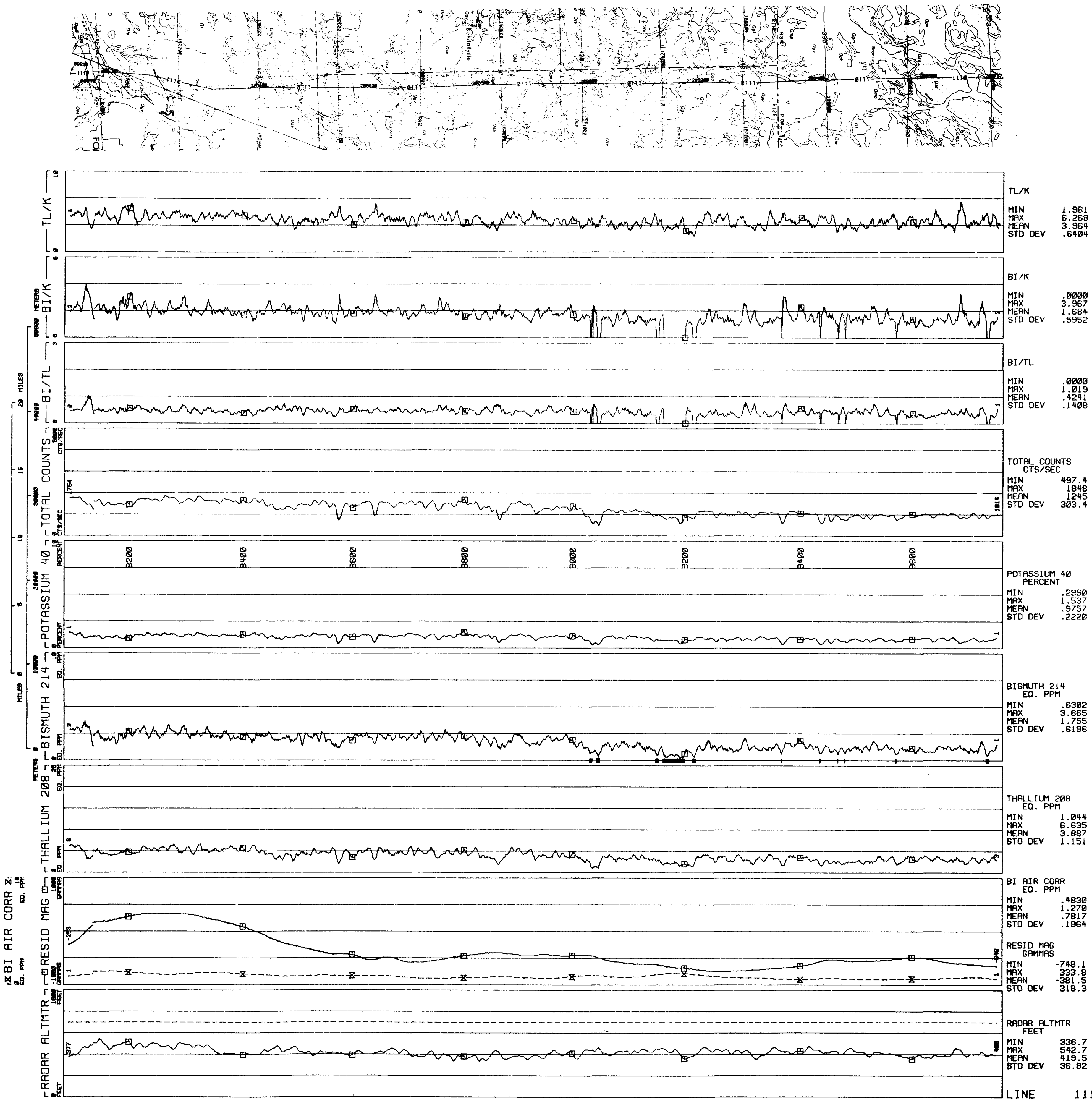
DATA ACQUIRED 80293



LINE 1120
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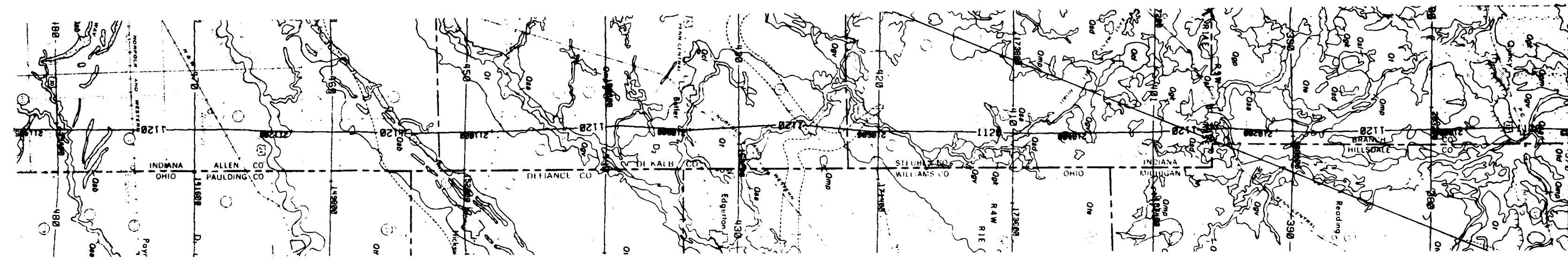
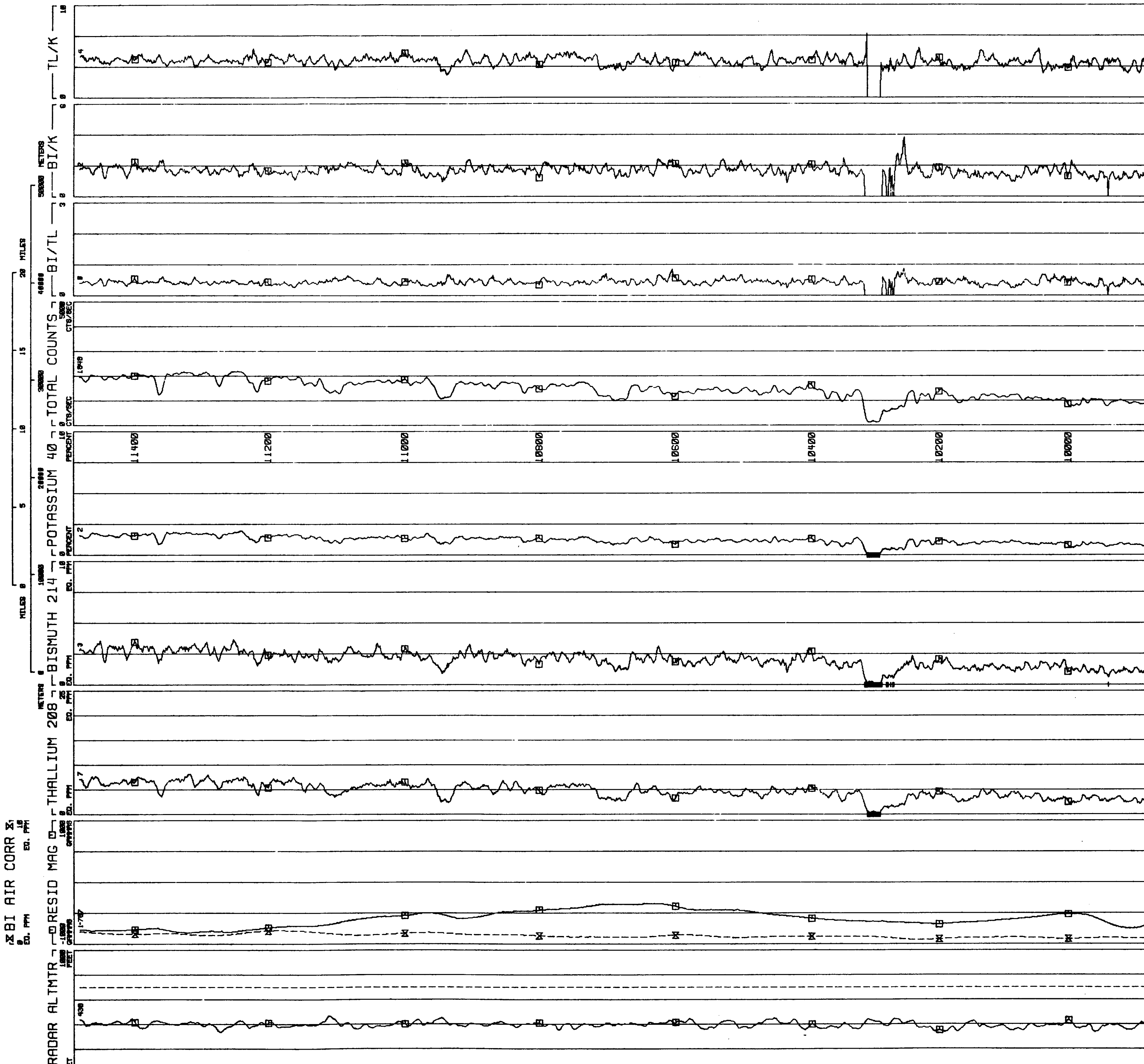
DATA ACQUIRED 80297





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MIN .0000
MAX 6.897
MEAN 3.860
STD DEV .6627

BI/K
MIN .0000
MAX 3.826
MEAN 1.639
STD DEV .3934

BI/TL
MIN .0000
MAX .8630
MEAN .4231
STD DEV .1070

TOTAL COUNTS CTS/SEC
MIN 121.1
MAX 2189
MEAN 1438
STD DEV 410.0

POTASSIUM 40 PERCENT
MIN .1190
MAX 1.963
MEAN 1.203
STD DEV .3183

BISMUTH 214 EQ. PPM
MIN .5860
MAX 3.627
MEAN 2.035
STD DEV .6205

THALLIUM 208 EQ. PPM
MIN .7266
MAX 8.186
MEAN 4.750
STD DEV 1.475

BI AIR CORR EQ. PPM
MIN .3511
MAX 1.089
MEAN .6616
STD DEV .1787

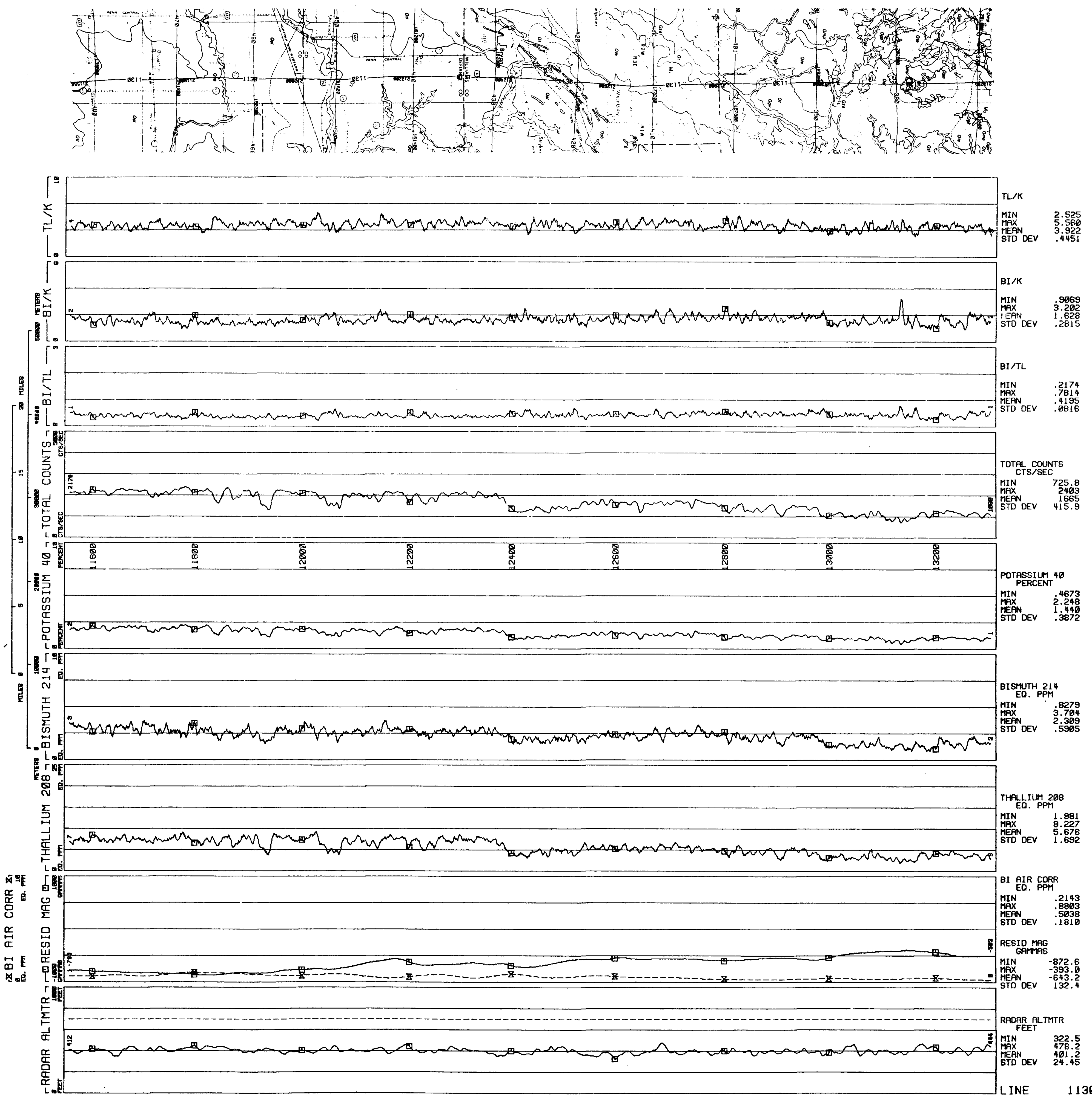
RESID MAG GAMMAS
MIN -816.9
MAX -345.7
MEAN -595.9
STD DEV 130.0

RADAR ALTMTR FEET
MIN 336.3
MAX 467.5
MEAN 395.0
STD DEV 22.88

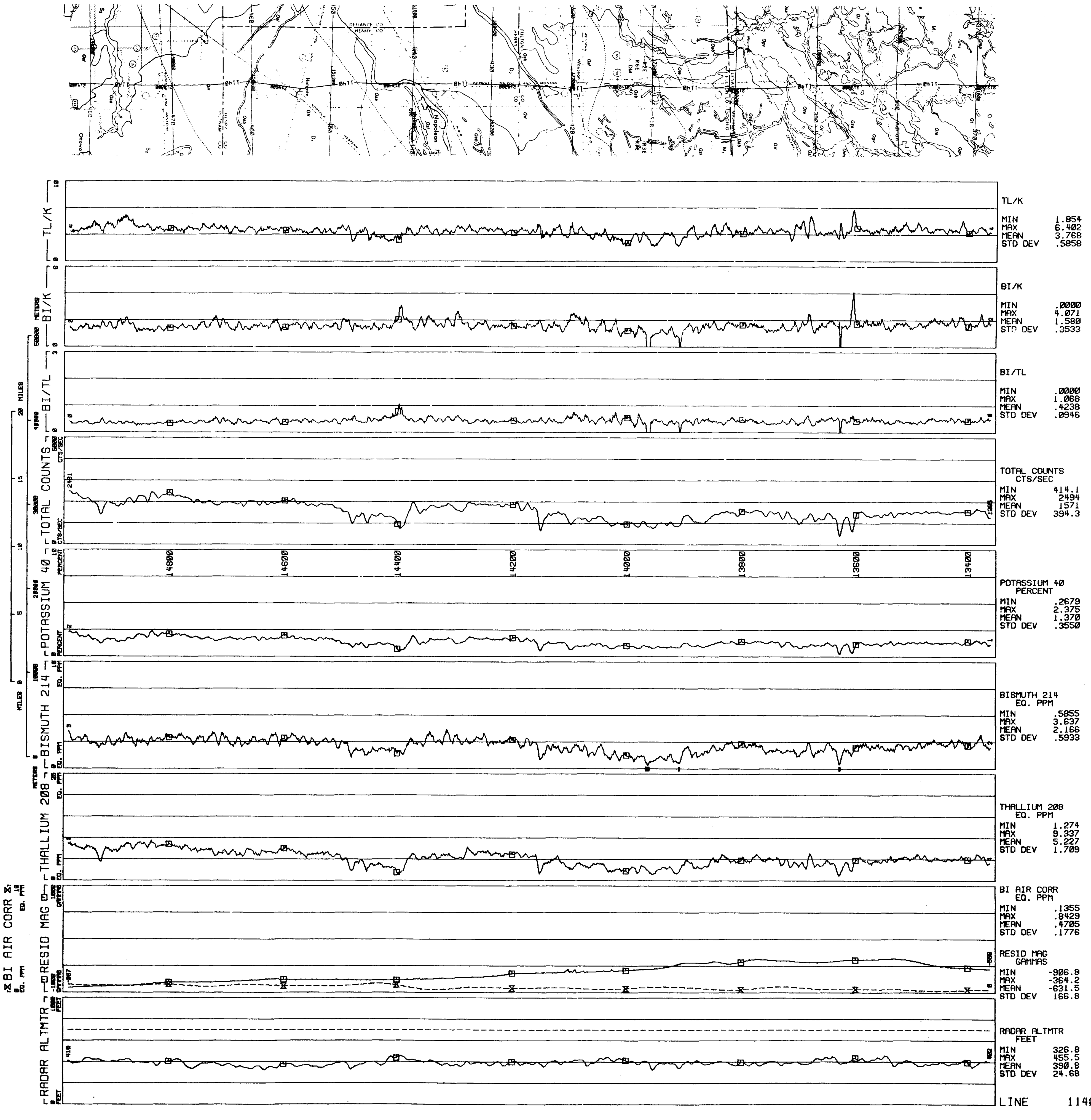
LINE 1120

D17

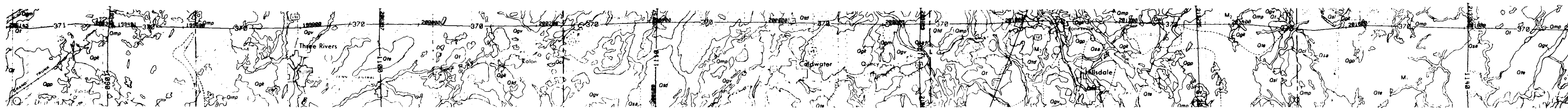
LINE 1130
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297

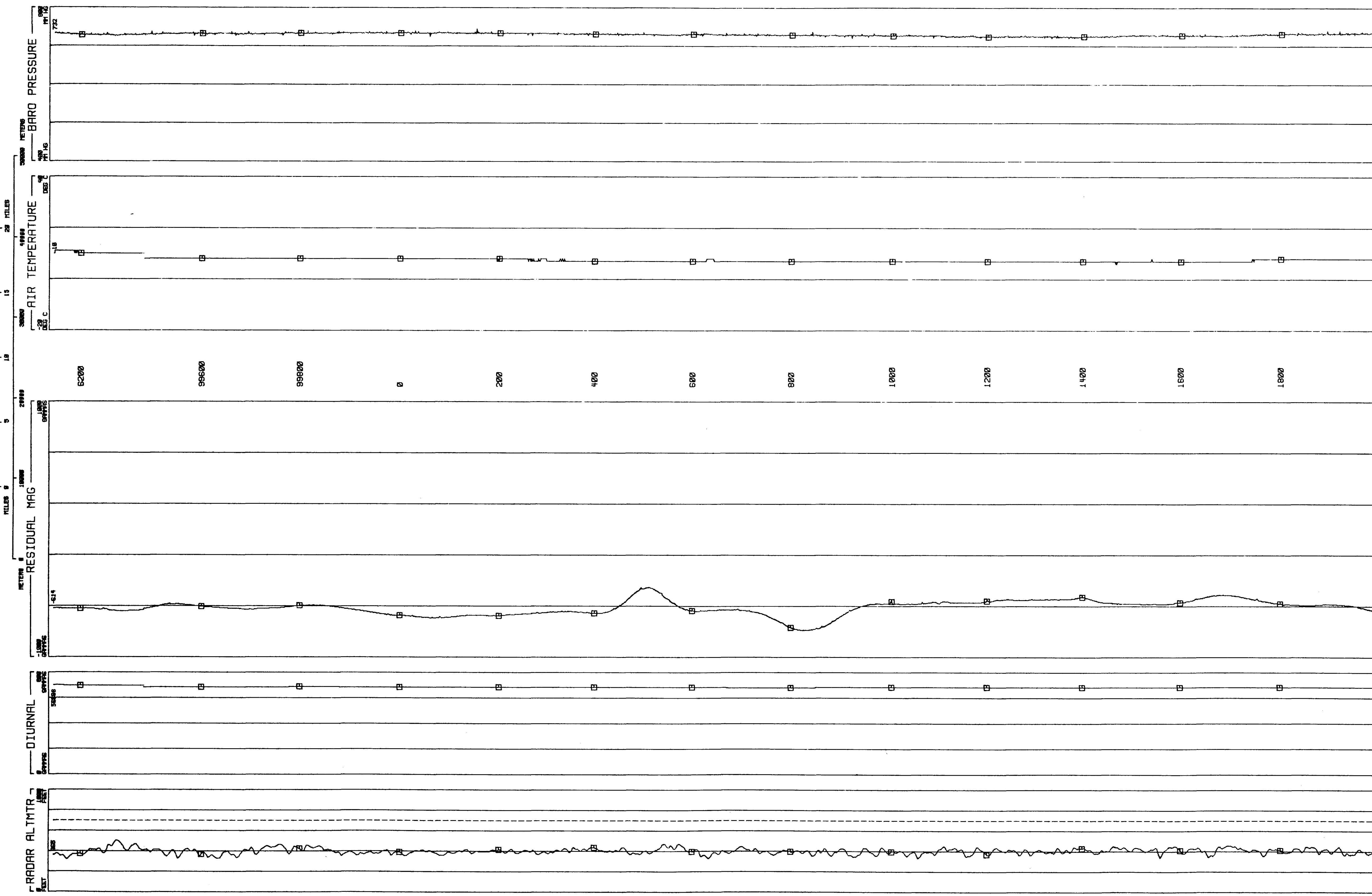


LINE 1140
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



LINE 370
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297





BARO PRESSURE
MM HG
MIN 720.8
MAX 743.8
MEAN 730.0
STD DEV 3.029

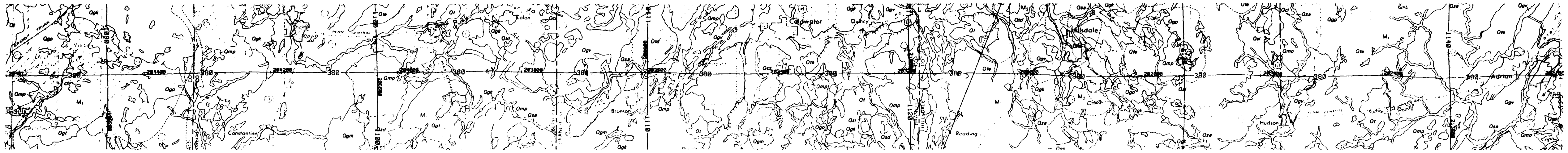
AIR TEMPERATURE
DEG C
MIN 6.000
MAX 11.00
MEAN 7.623
STD DEV .8736

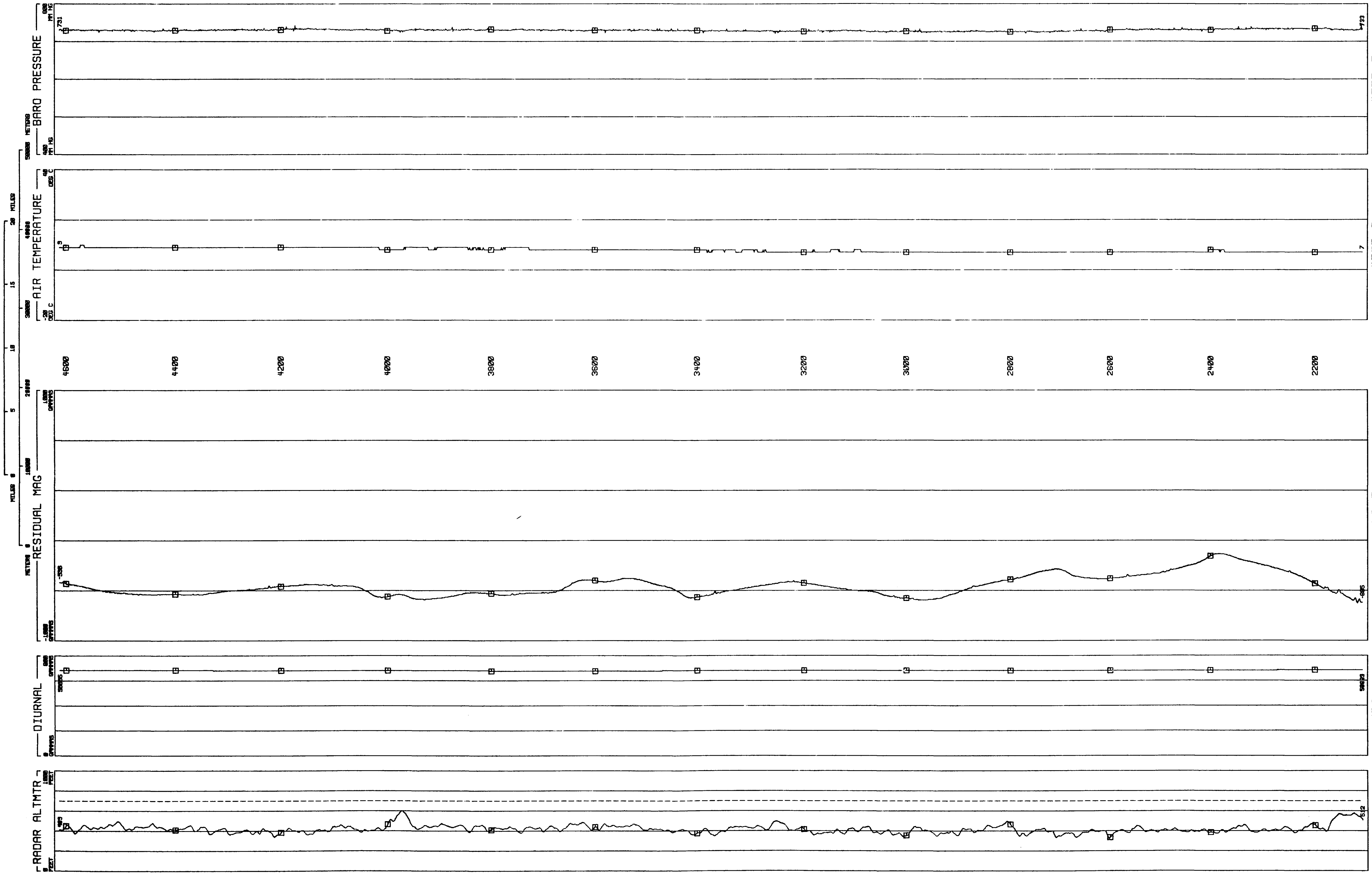
RESIDUAL MAG
GAMMAS
MIN -788.7
MAX -450.5
MEAN -609.8
STD DEV 57.22

DIURNAL
GAMMAS
MIN 56682
MAX 56698
MEAN 56677
STD DEV 8.294

RADAR ALTMTR
FEET
MIN 321.4
MAX 504.5
MEAN 401.1
STD DEV 27.89

LINE 380
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297





BARO PRESSURE
MM HG
MIN 721.0
MAX 742.1
MEAN 729.6
STD DEV 2.604

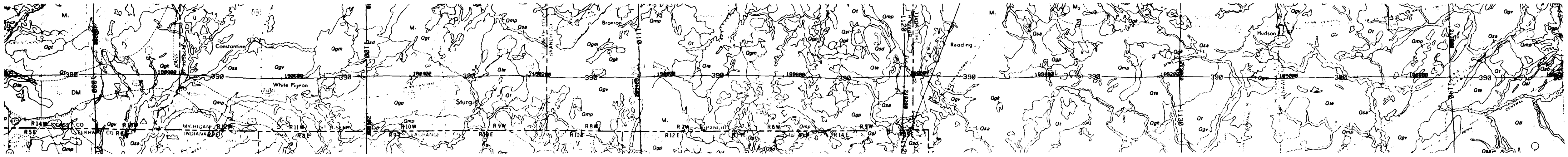
AIR TEMPERATURE
DEG C
MIN 7.000
MAX 10.00
MEAN 7.862
STD DEV .8665

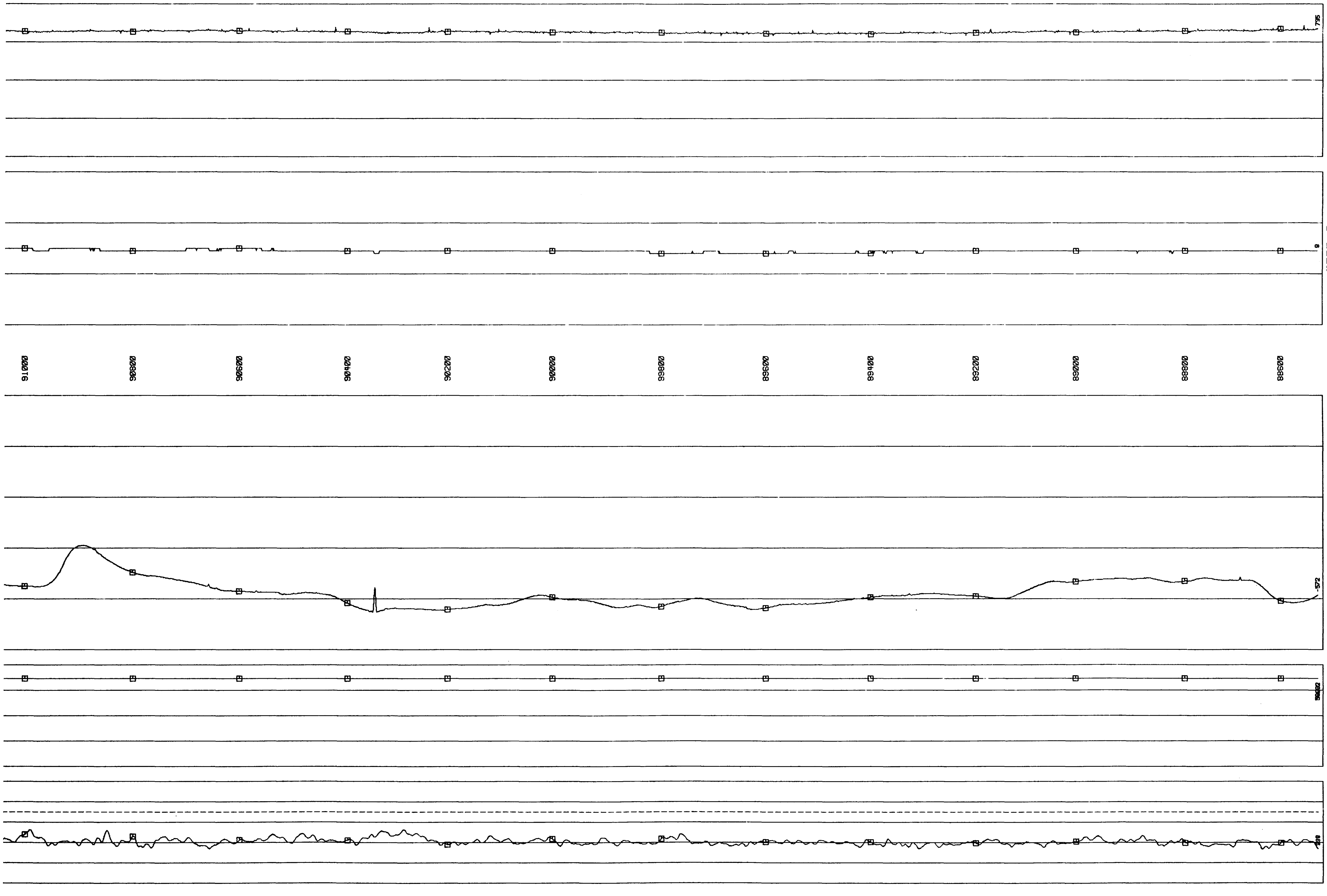
RESIDUAL MAG
GAMMAS
MIN -698.5
MAX -305.4
MEAN -560.8
STD DEV 83.18

DIURNAL
GAMMAS
MIN 56676
MAX 56685
MEAN 56675
STD DEV 5.872

RADAR ALTMTR
FEET
MIN 326.4
MAX 600.6
MEAN 418.7
STD DEV 40.37

D21 fw





BARO PRESSURE
MM HG

MIN	716.7
MAX	742.1
MEAN	726.7
STD DEV	2.910

AIR TEMPERATURE
DEG C

MIN	8.000
MAX	10.00
MEAN	8.947
STD DEV	.5220

RESIDUAL MAG
GAMMAS

MIN	-705.6
MAX	-179.6
MEAN	-551.6
STD DEV	104.7

DIURNAL
GAMMAS

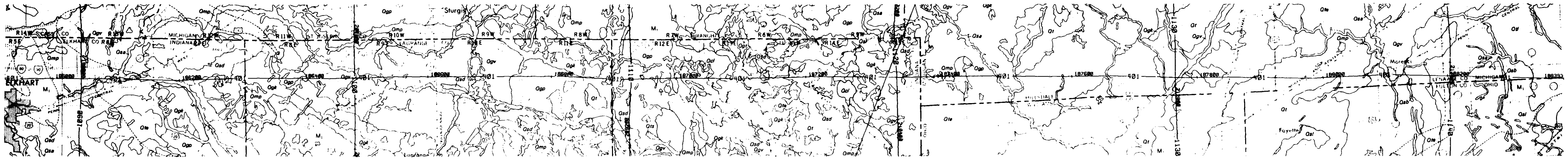
MIN	56691
MAX	56694
MEAN	56687
STD DEV	5.042

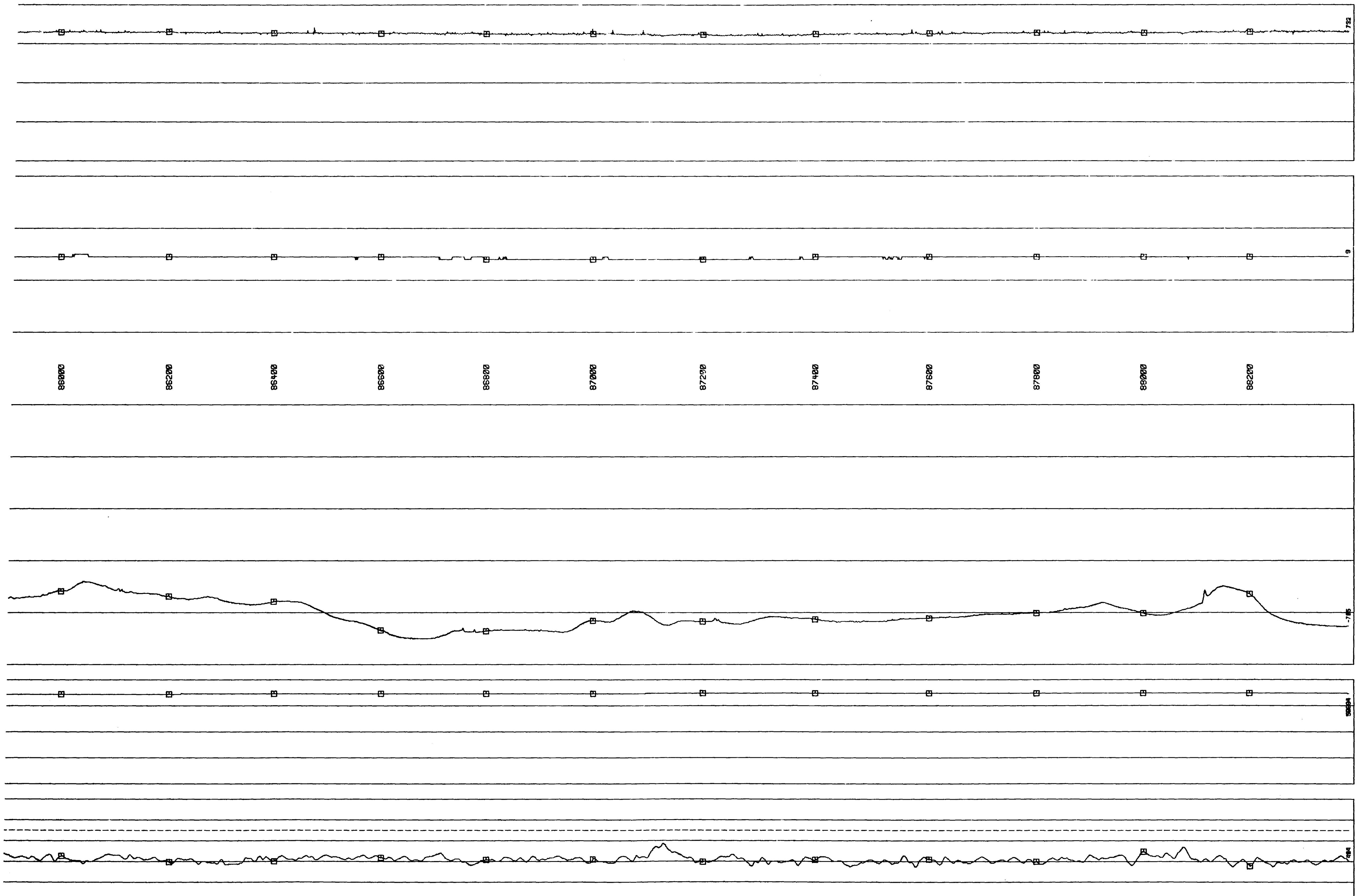
RADAR ALTMTR
FEET

MIN	334.4
MAX	526.8
MEAN	409.5
STD DEV	32.30

LINE 390

D22 fw





BARO PRESSURE
MM HG
MIN 719.3
MAX 741.0
MEAN 727.3
STD DEV 2.750

AIR TEMPERATURE
DEG C
MIN 8.000
MAX 10.00
MEAN 8.760
STD DEV .4508

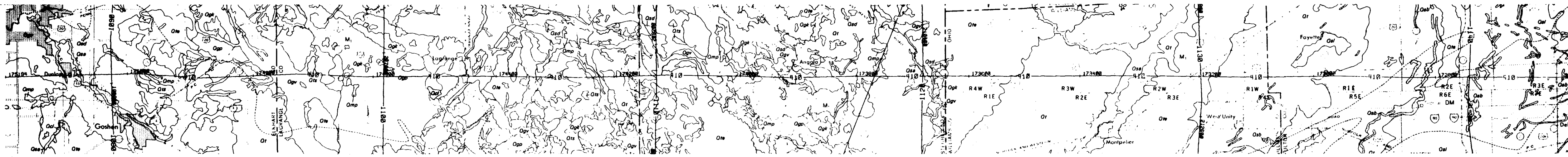
RESIDUAL MAG
GAMMAS
MIN -801.3
MAX -358.2
MEAN -606.3
STD DEV 104.4

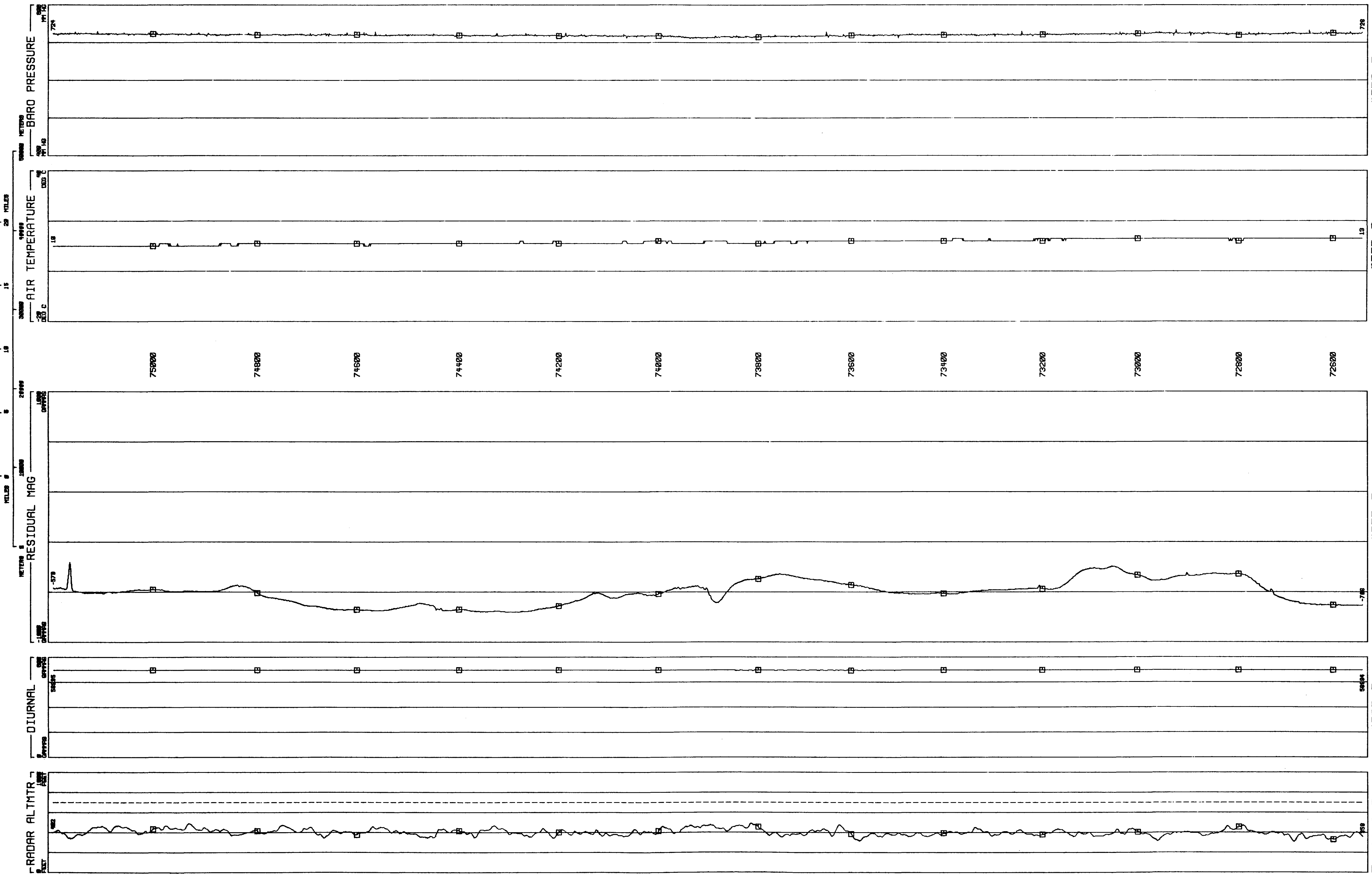
DIURNAL
GAMMAS
MIN 56688
MAX 56696
MEAN 56687
STD DEV 6.308

RADAR ALTMTR
FEET
MIN 348.3
MAX 568.5
MEAN 420.8
STD DEV 30.86

LINE 400

LINE
410
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80295





BARO PRESSURE
MM HG
MIN 711.7
MAX 733.4
MEAN 720.2
STD DEV 2.838

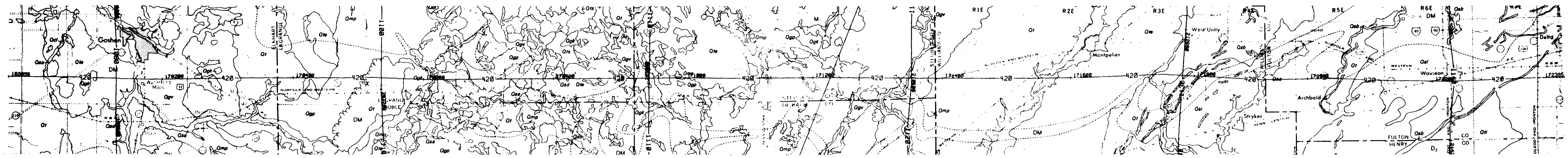
AIR TEMPERATURE
DEG C
MIN 10.00
MAX 13.00
MEAN 11.63
STD DEV .9875

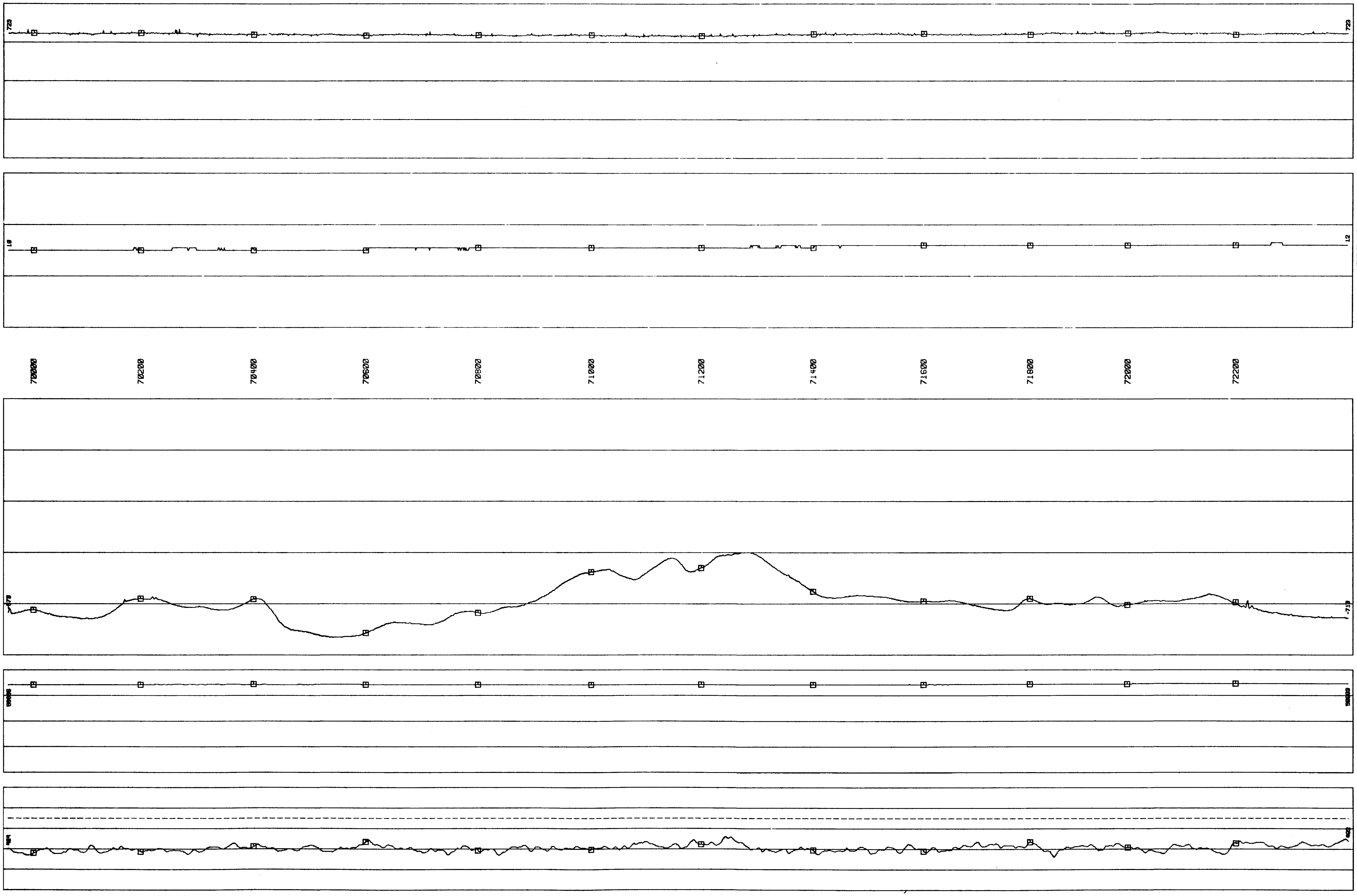
RESIDUAL MAG
GAMMAS
MIN -760.8
MAX -363.1
MEAN -603.1
STD DEV 94.41

DIURNAL
GAMMAS
MIN 56694
MAX 56697
MEAN 56688
STD DEV 7.205

RADAR ALTMTR
FEET
MIN 311.2
MAX 489.7
MEAN 401.8
STD DEV 32.76

LINE 410





BARO PRESSURE
MM HG
MIN 713.8
MAX 733.4
MEAN 720.7
STD DEV 2.509

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 13.00
MEAN 11.19
STD DEV .8133

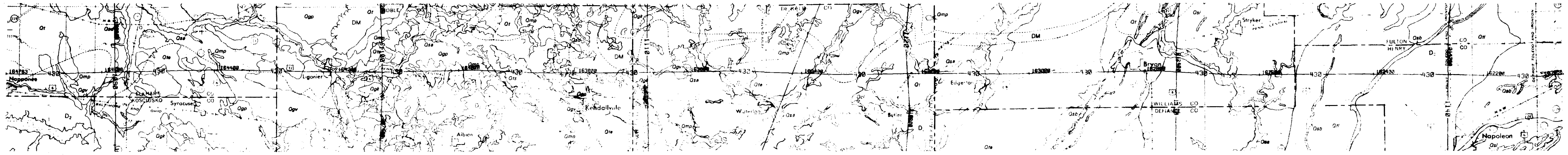
RESIDUAL MAG
GAMMAS
MIN -860.1
MAX -199.4
MEAN -582.4
STD DEV 148.0

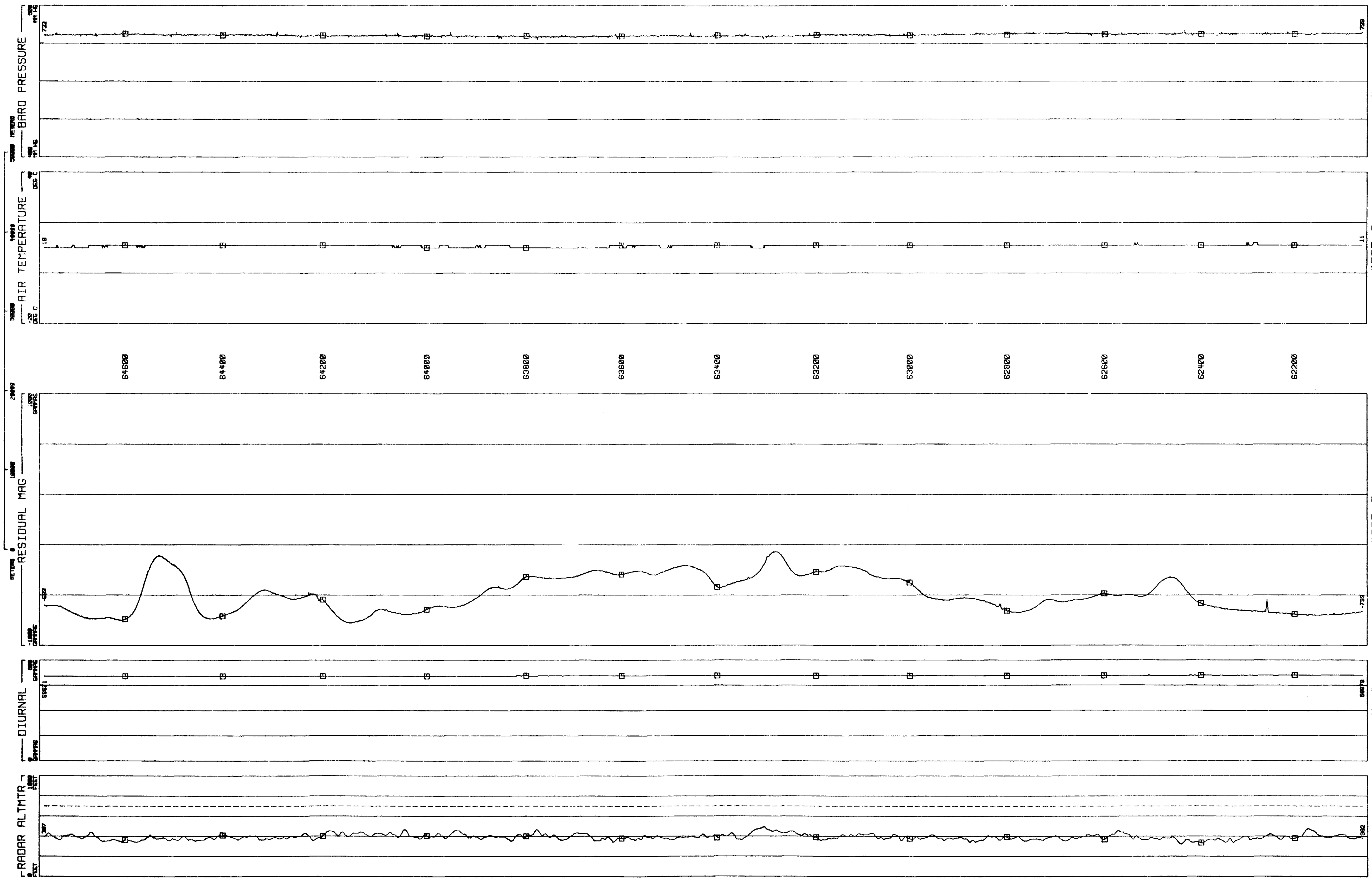
DIURNAL
GAMMAS
MIN 56683
MAX 56693
MEAN 56679
STD DEV 7.690

RADAR ALTMTR
FEET
MIN 326.9
MAX 520.6
MEAN 409.8
STD DEV 31.21

LINE 420

LINE 430
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 90295





BARO PRESSURE
MM HG
MIN 710.3
MAX 732.9
MEAN 722.1
STD DEV 2.831

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 12.00
MEAN 10.83
STD DEV .3931

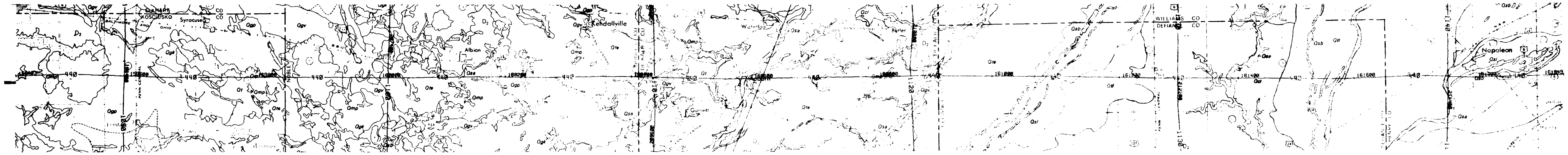
RESIDUAL MAG
GAMMAS
MIN -818.5
MAX -254.0
MEAN -591.0
STD DEV 140.6

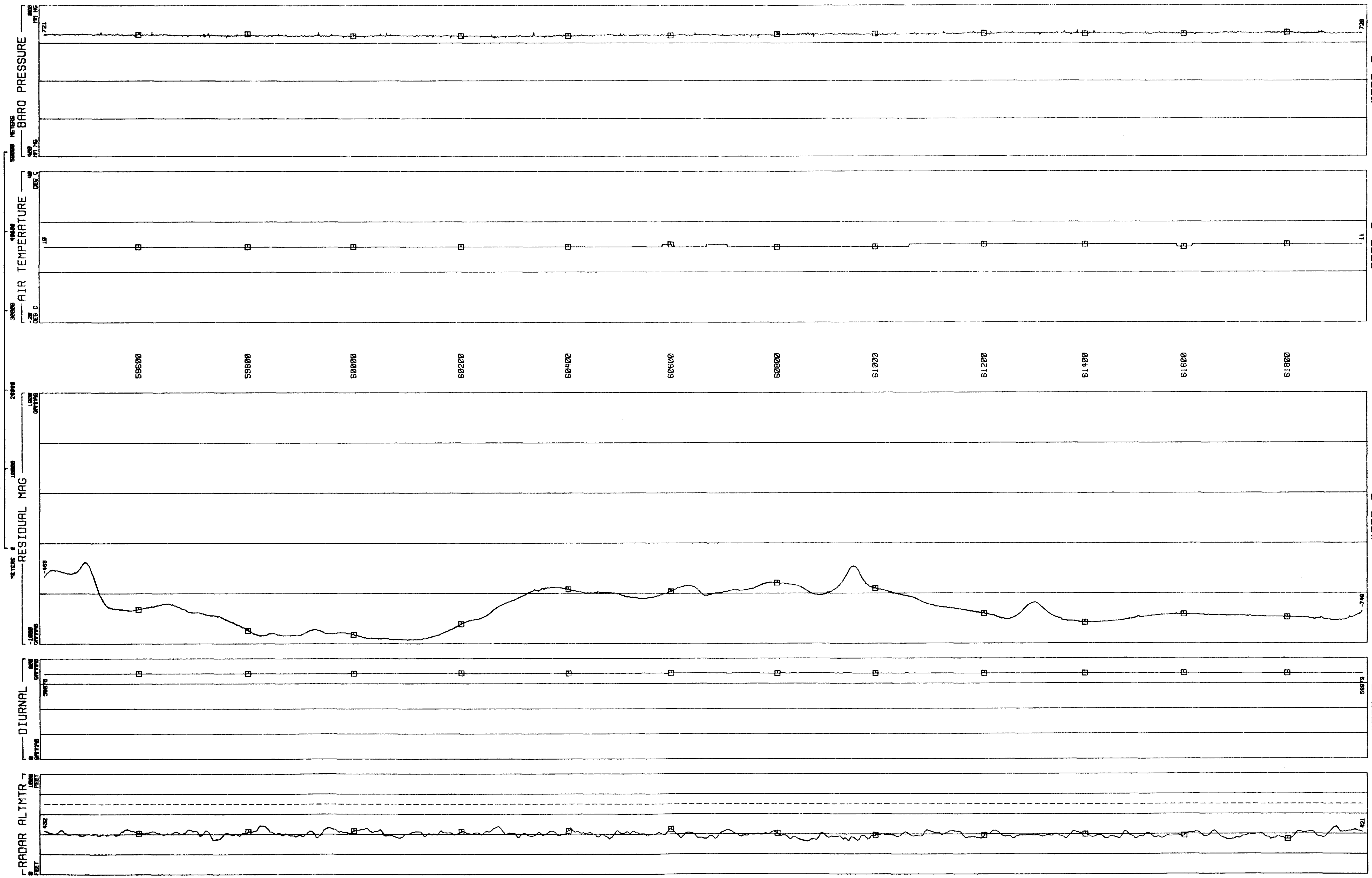
DIURNAL
GAMMAS
MIN 56671
MAX 56679
MEAN 56671
STD DEV 4.436

RADAR ALTMTR
FEET
MIN 322.6
MAX 493.1
MEAN 393.3
STD DEV 26.92

LINE 430

LINE 440
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80295





BARO PRESSURE
MM HG
MIN 713.2
MAX 734.0
MEAN 722.3
STD DEV 3.008

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 11.00
MEAN 10.36
STD DEV .4798

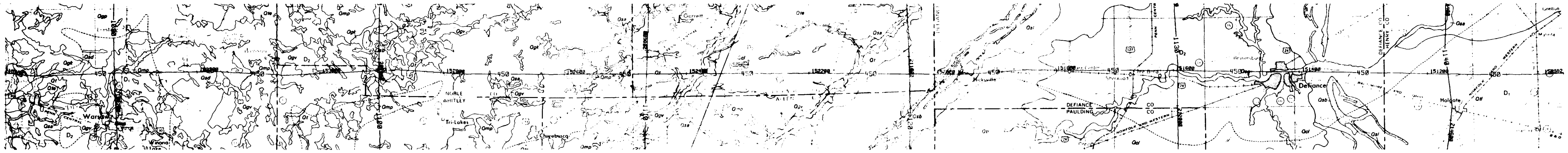
RESIDUAL MAG
GAMMAS
MIN -970.4
MAX -352.4
MEAN -717.6
STD DEV 144.6

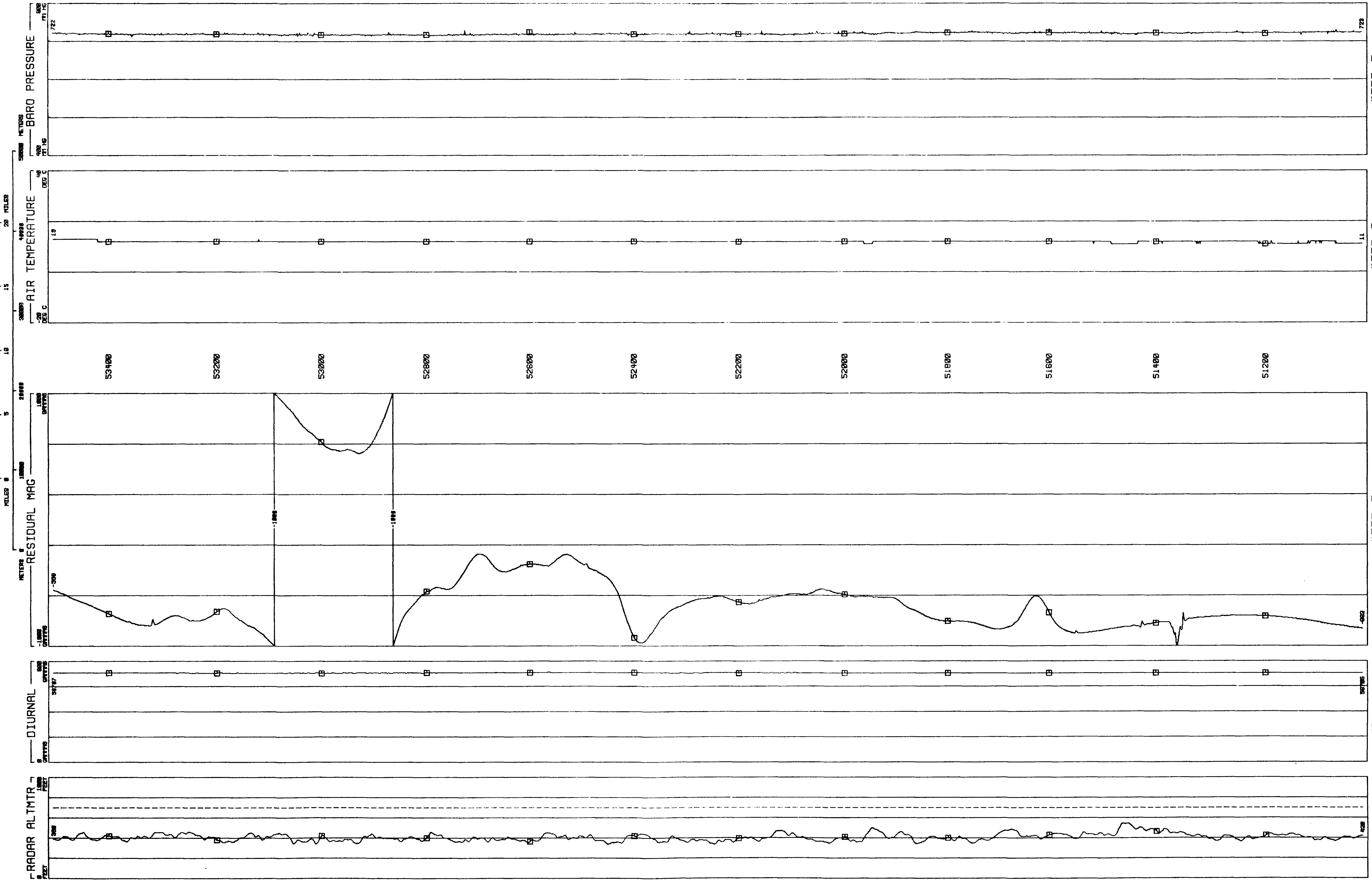
DIURNAL
GAMMAS
MIN 56677
MAX 56682
MEAN 56675
STD DEV 6.078

RADAR ALTMTR
FEET
MIN 332.1
MAX 487.5
MEAN 399.7
STD DEV 26.32

LINE 440

LINE 450
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80294





BARO PRESSURE
MM HG
MIN 711.4
MAX 732.3
MEAN 720.0
STD DEV 2.367

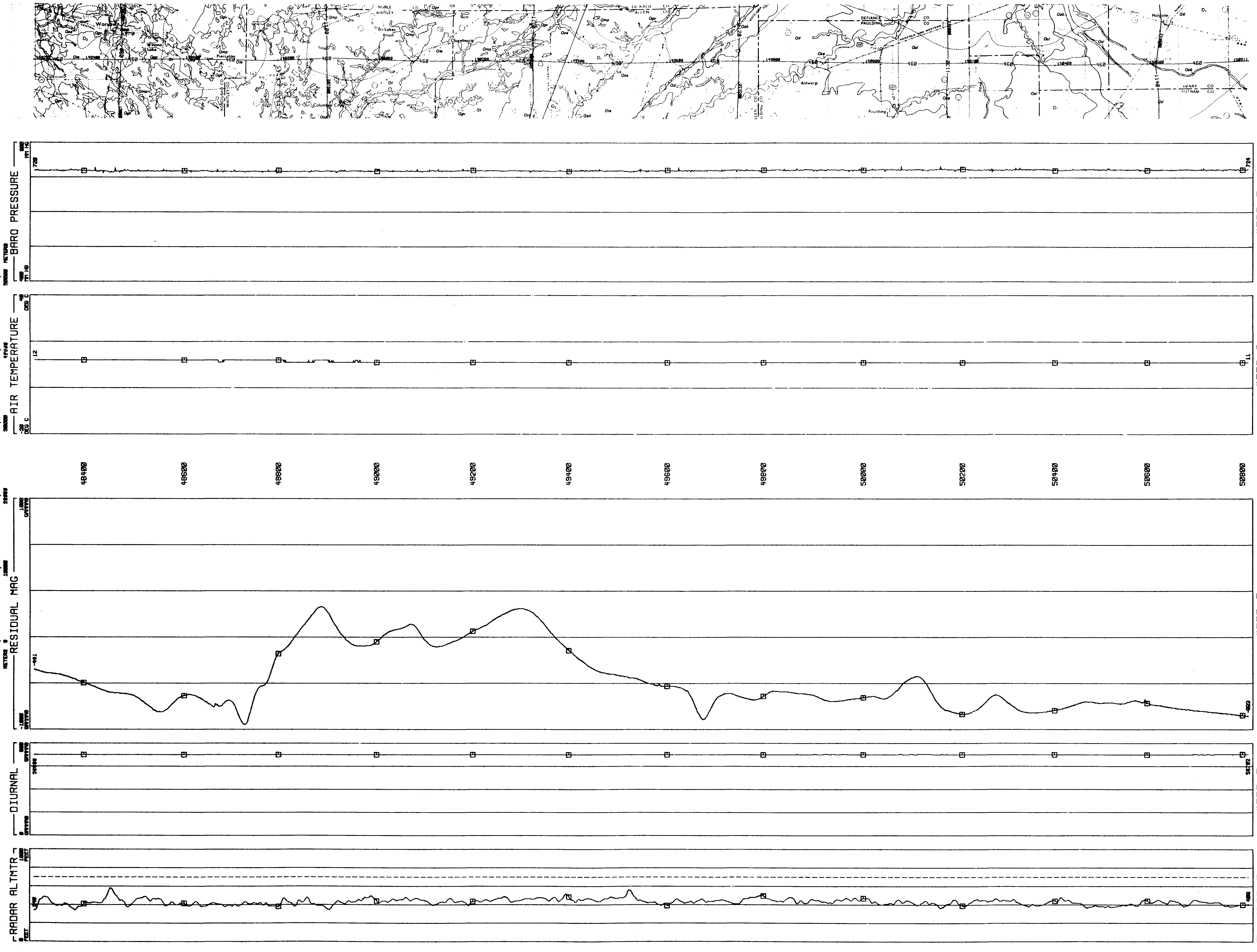
AIR TEMPERATURE
DEG C
MIN 11.00
MAX 13.00
MEAN 11.94
STD DEV .3371

RESIDUAL MAG
GAMMAS
MIN -1474
MAX -271.3
MEAN -749.1
STD DEV 240.0

DIURNAL
GAMMAS
MIN 56705
MAX 56714
MEAN 56704
STD DEV 1.775

RADAR ALTMTR
FEET
MIN 336.7
MAX 546.5
MEAN 406.4
STD DEV 34.73

LINE 460
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80294



BARO PRESSURE
MM HG
MIN 711.7
MAX 732.3
MEAN 720.0
STD DEV 2.387

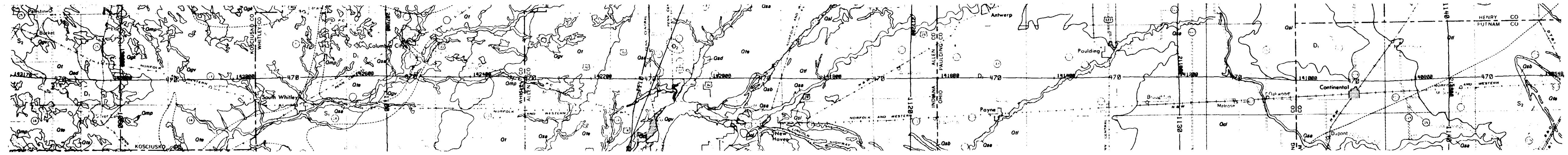
AIR TEMPERATURE
DEG C
MIN 11.00
MAX 12.00
MEAN 11.22
STD DEV .4120

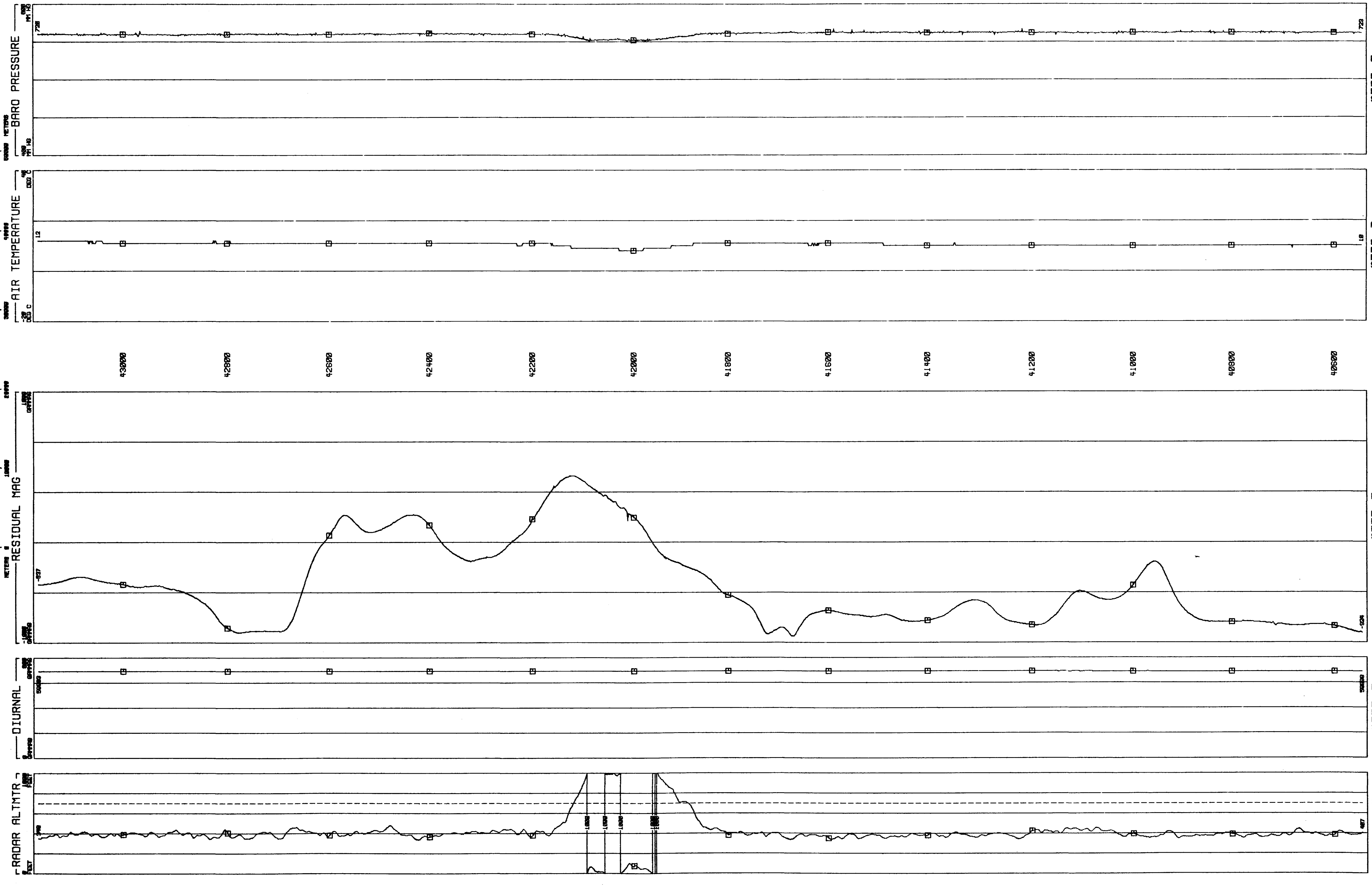
RESIDUAL MAG
GAMMAS
MIN -957.3
MAX 64.79
MEAN -577.9
STD DEV 271.0

DIURNAL
GAMMAS
MIN 56698
MAX 56702
MEAN 56691
STD DEV 9.481

RADAR ALTMTR
FEET
MIN 339.8
MAX 578.8
MEAN 430.8
STD DEV 32.87

LINE 470
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80294





BARO PRESSURE
MM HG
MIN 701.9
MAX 734.0
MEAN 720.8
STD DEV 5.023

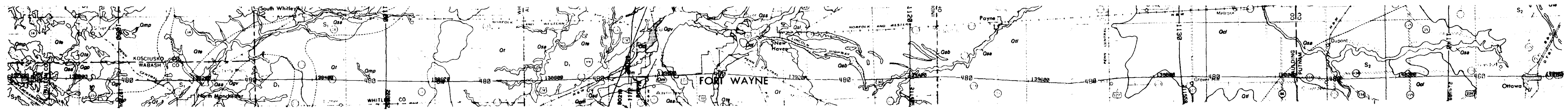
AIR TEMPERATURE
DEG C
MIN 8.000
MAX 12.00
MEAN 10.48
STD DEV .7677

RESIDUAL MAG
GAMMAS
MIN -949.3
MAX 329.4
MEAN -536.1
STD DEV 333.5

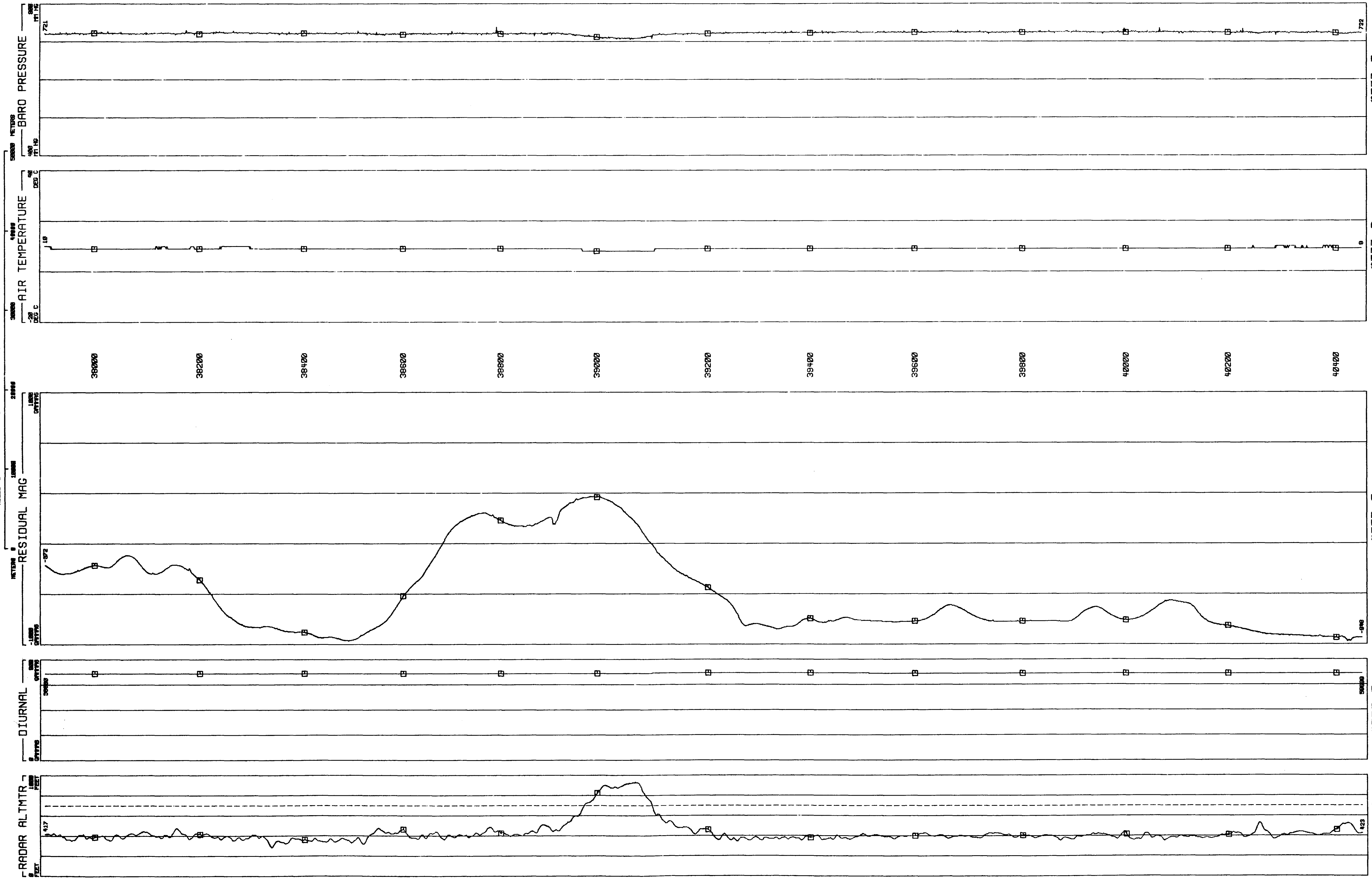
DIURNAL
GAMMAS
MIN 56689
MAX 56693
MEAN 56687
STD DEV 4.440

RADAR ALTMTR
FEET
MIN 337.0
MAX 1098
MEAN 446.4
STD DEV 165.7

LINE 470



LINE 480
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80294



BARO PRESSURE
MM HG

MIN	705.3
MAX	737.2
MEAN	722.0
STD DEV	3.399

AIR TEMPERATURE
DEG C

MIN	8.000
MAX	10.00
MEAN	9.001
STD DEV	.3261

RESIDUAL MAG
GAMMAS

MIN	-977.9
MAX	171.7
MEAN	-602.2
STD DEV	329.3

DIURNAL
GAMMAS

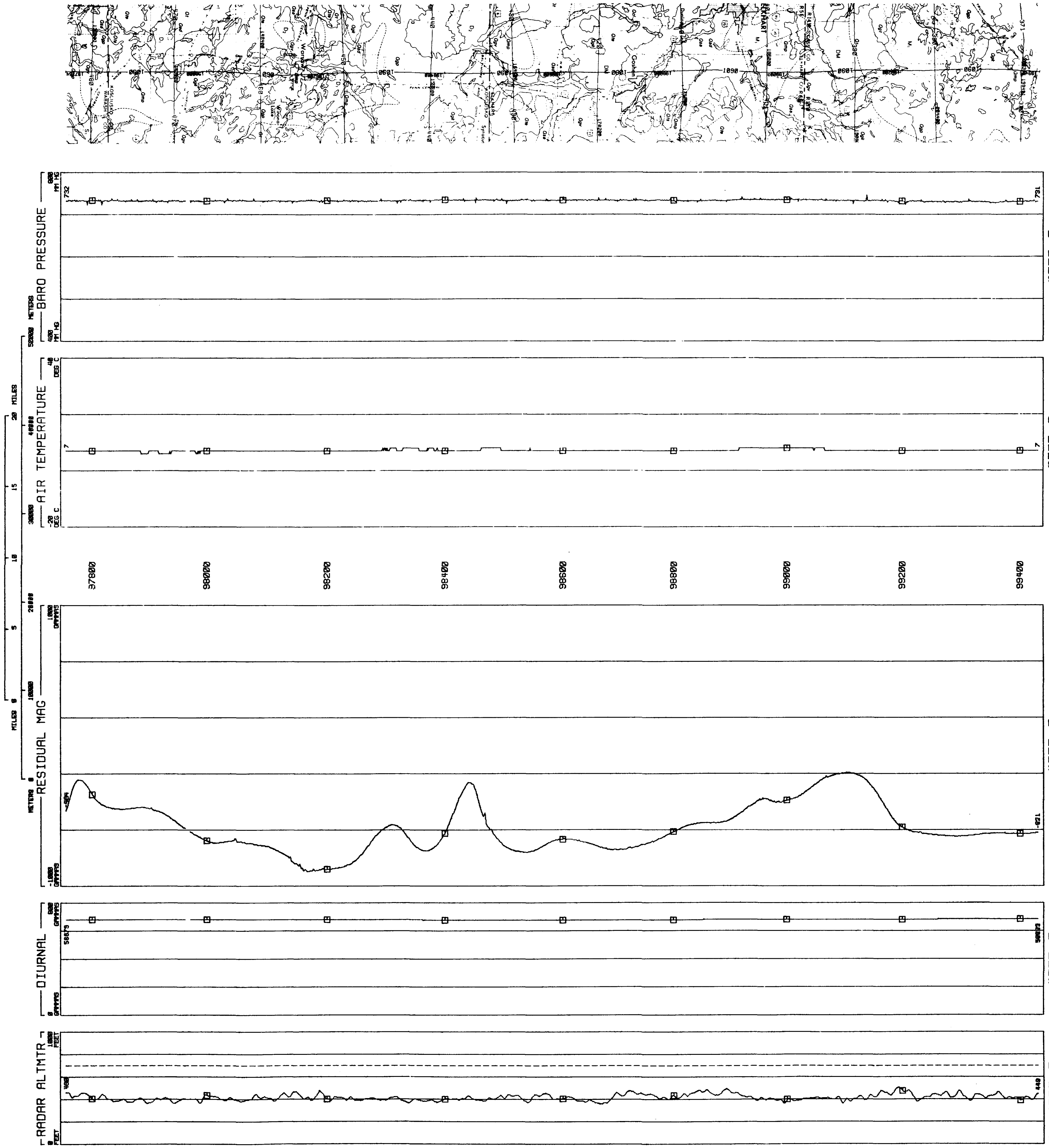
MIN	56688
MAX	56691
MEAN	56686
STD DEV	3.750

RADAR ALTMTR
FEET

MIN	287.6
MAX	928.1
MEAN	429.1
STD DEV	107.7

LINE 480

LINE 1090
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



BARO PRESSURE
MM HG
MIN 722.6
MAX 745.4
MEAN 732.7
STD DEV 1.760

AIR TEMPERATURE
DEG C
MIN 6.000
MAX 8.000
MEAN 7.122
STD DEV .3953

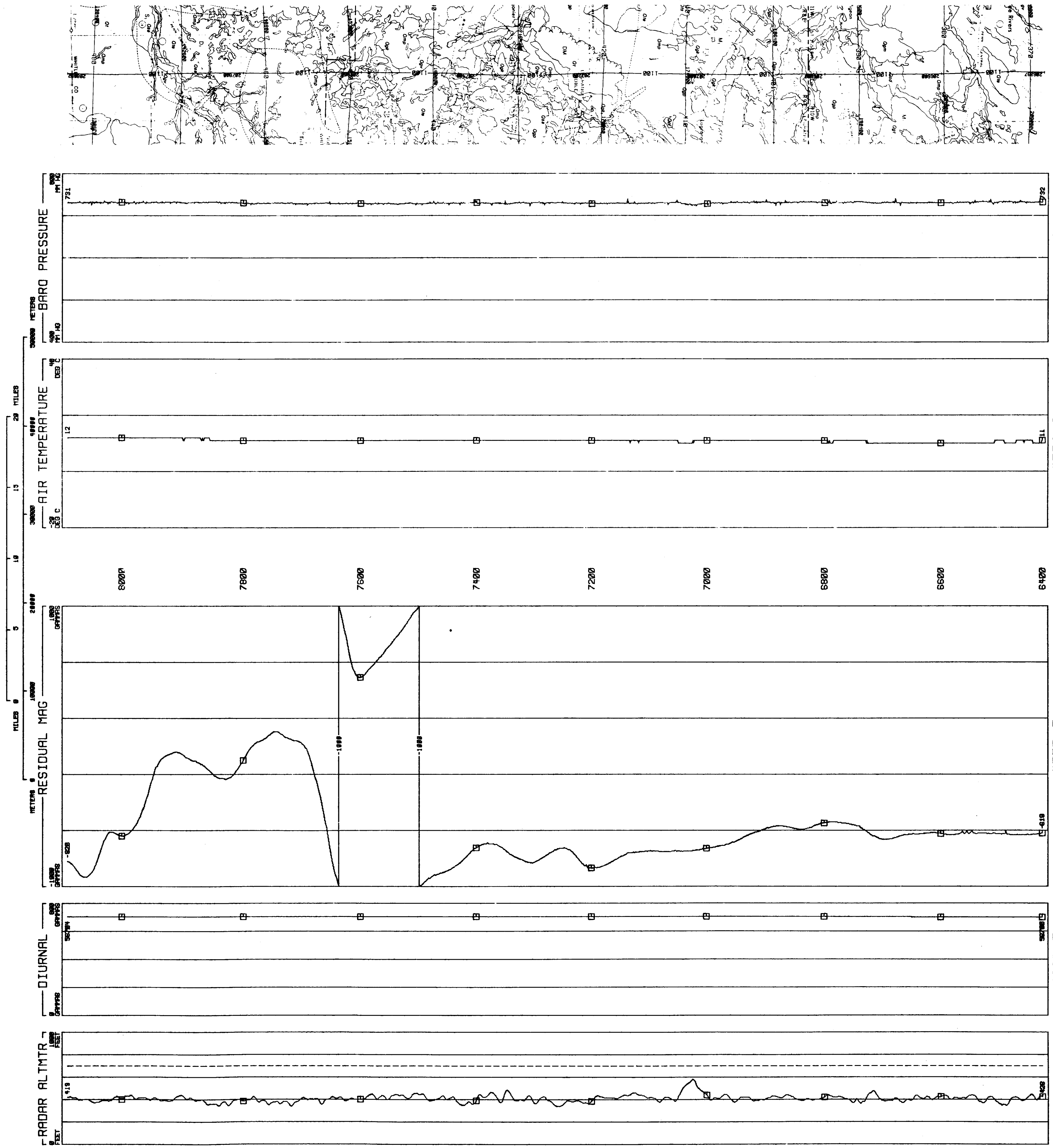
RESIDUAL MAG
GAMMAS
MIN -898.0
MAX -191.9
MEAN -581.5
STD DEV 171.6

DIURNAL
GAMMAS
MIN 56676
MAX 56683
MEAN 56674
STD DEV 5.423

RADAR ALTMTR
FEET
MIN 358.2
MAX 505.8
MEAN 415.5
STD DEV 27.56

LINE 1090

LINE 1100
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



BARO PRESSURE
MM HG
MIN 722.4
MAX 739.4
MEAN 730.3
STD DEV 1.718

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 12.00
MEAN 10.95
STD DEV .5607

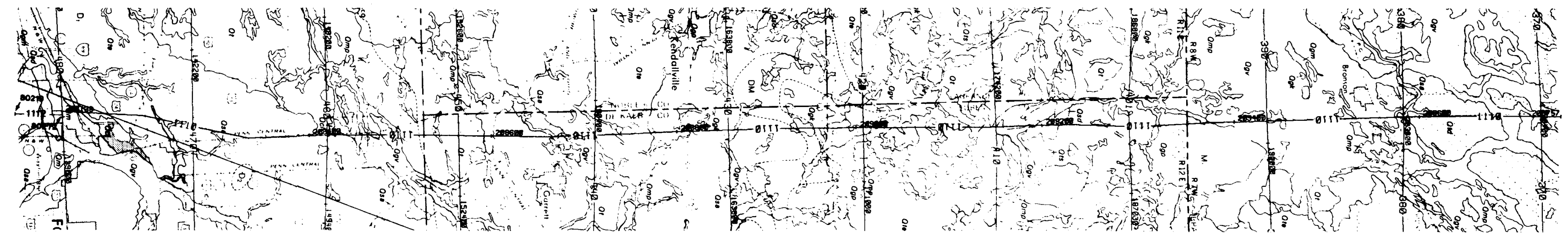
RESIDUAL MAG
GAMMAS
MIN -1508
MAX 104.1
MEAN -638.9
STD DEV 322.4

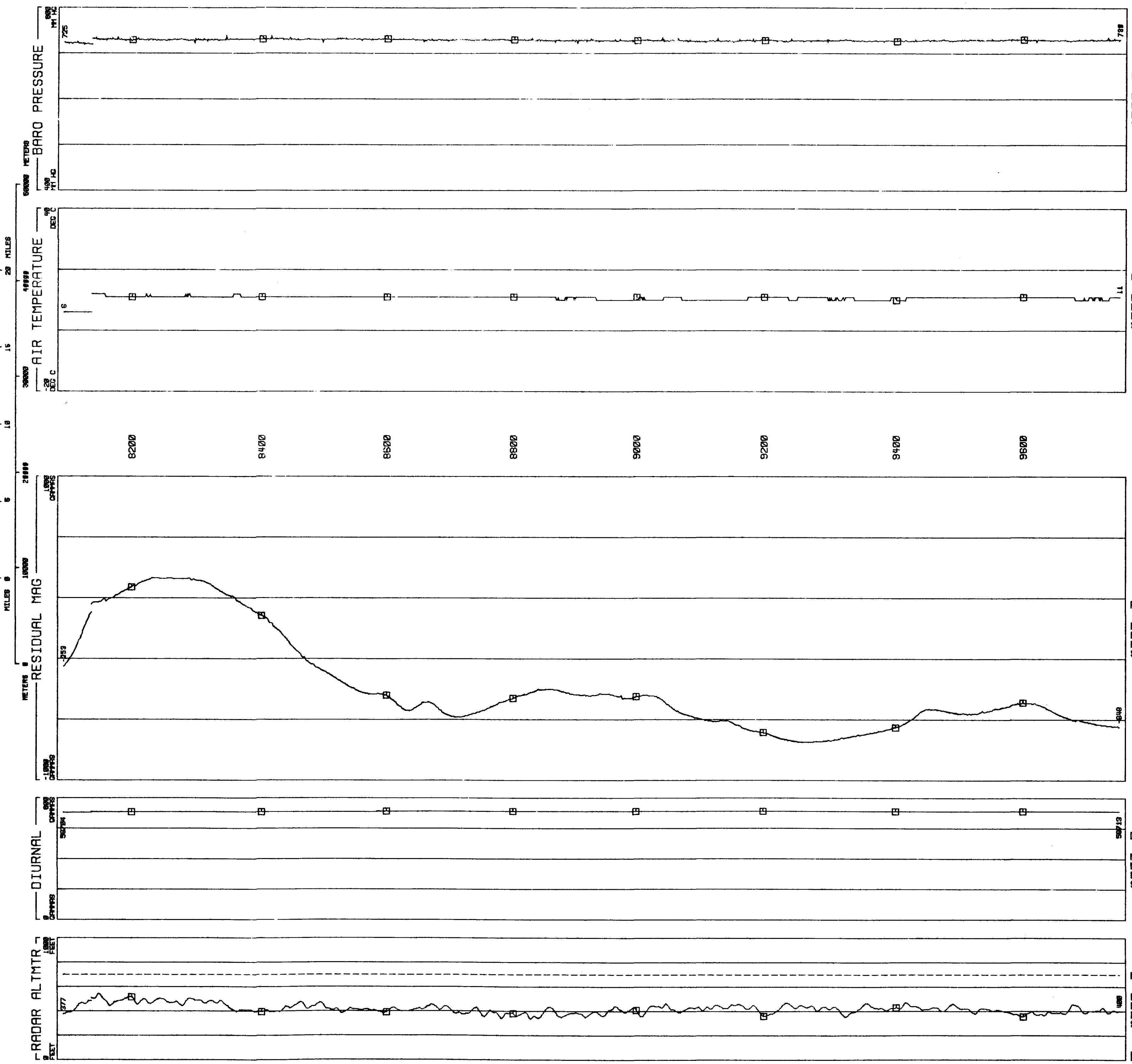
DIURNAL
GAMMAS
MIN 56700
MAX 56704
MEAN 56695
STD DEV 7.211

RADAR ALTMTR
FEET
MIN 337.8
MAX 579.0
MEAN 407.8
STD DEV 31.03

LINE 1100

LINE 1110
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80293





BARO PRESSURE
MM HG
MIN 718.3
MAX 738.5
MEAN 728.9
STD DEV 2.078

AIR TEMPERATURE
DEG C
MIN 6.000
MAX 12.00
MEAN 10.66
STD DEV .9208

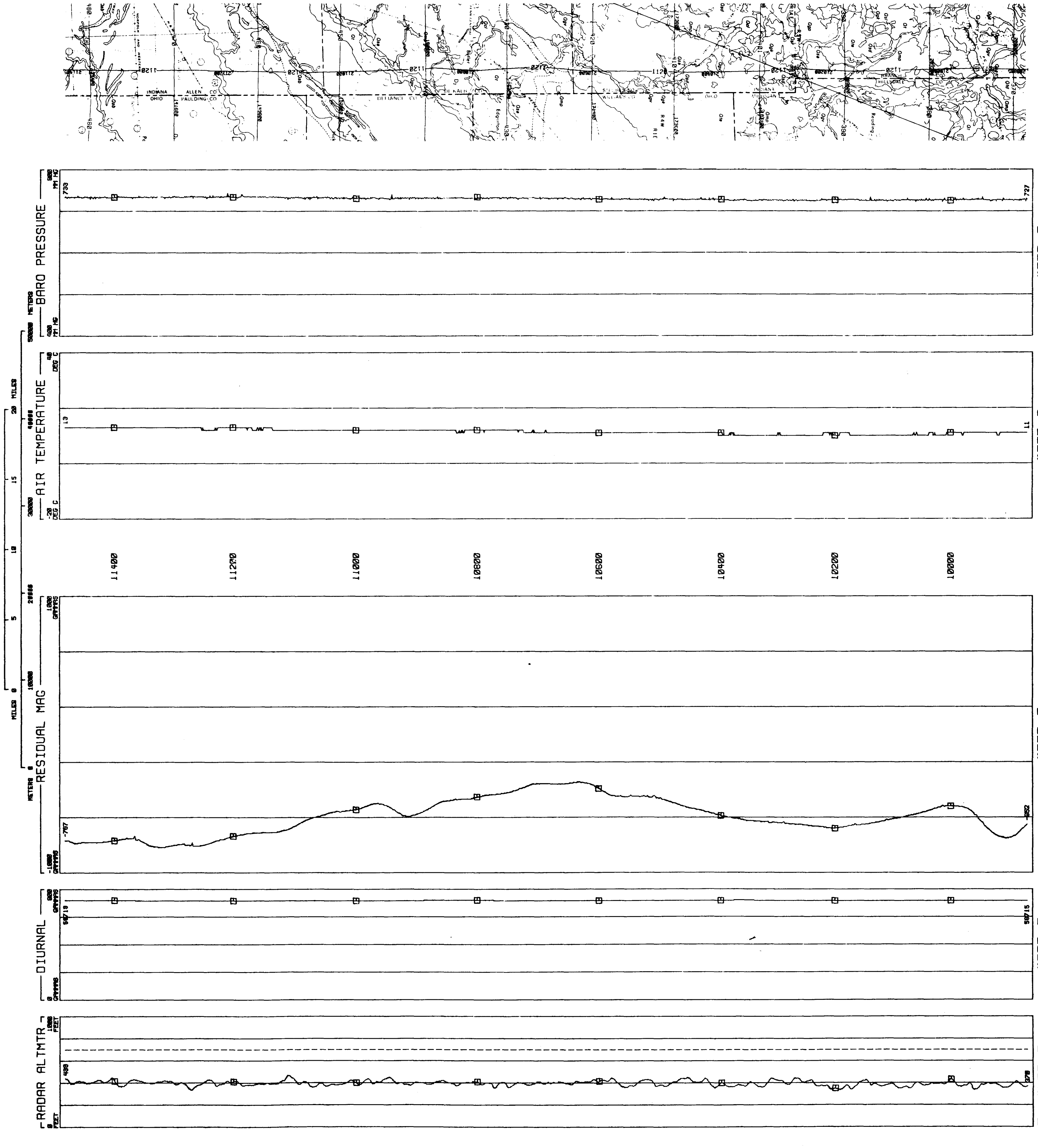
RESIDUAL MAG
GAMMAS
MIN -748.1
MAX 333.8
MEAN -381.5
STD DEV 318.3

DIURNAL
GAMMAS
MIN 56704
MAX 56713
MEAN 56705
STD DEV 5.532

RADAR ALTMTR
FEET
MIN 336.7
MAX 542.7
MEAN 419.5
STD DEV 36.82

LINE 1110

LINE 1120
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



BARO PRESSURE
MM HG
MIN 722.1
MAX 743.2
MEAN 729.9
STD DEV 3.226

AIR TEMPERATURE
DEG C
MIN 10.00
MAX 13.00
MEAN 11.44
STD DEV 1.027

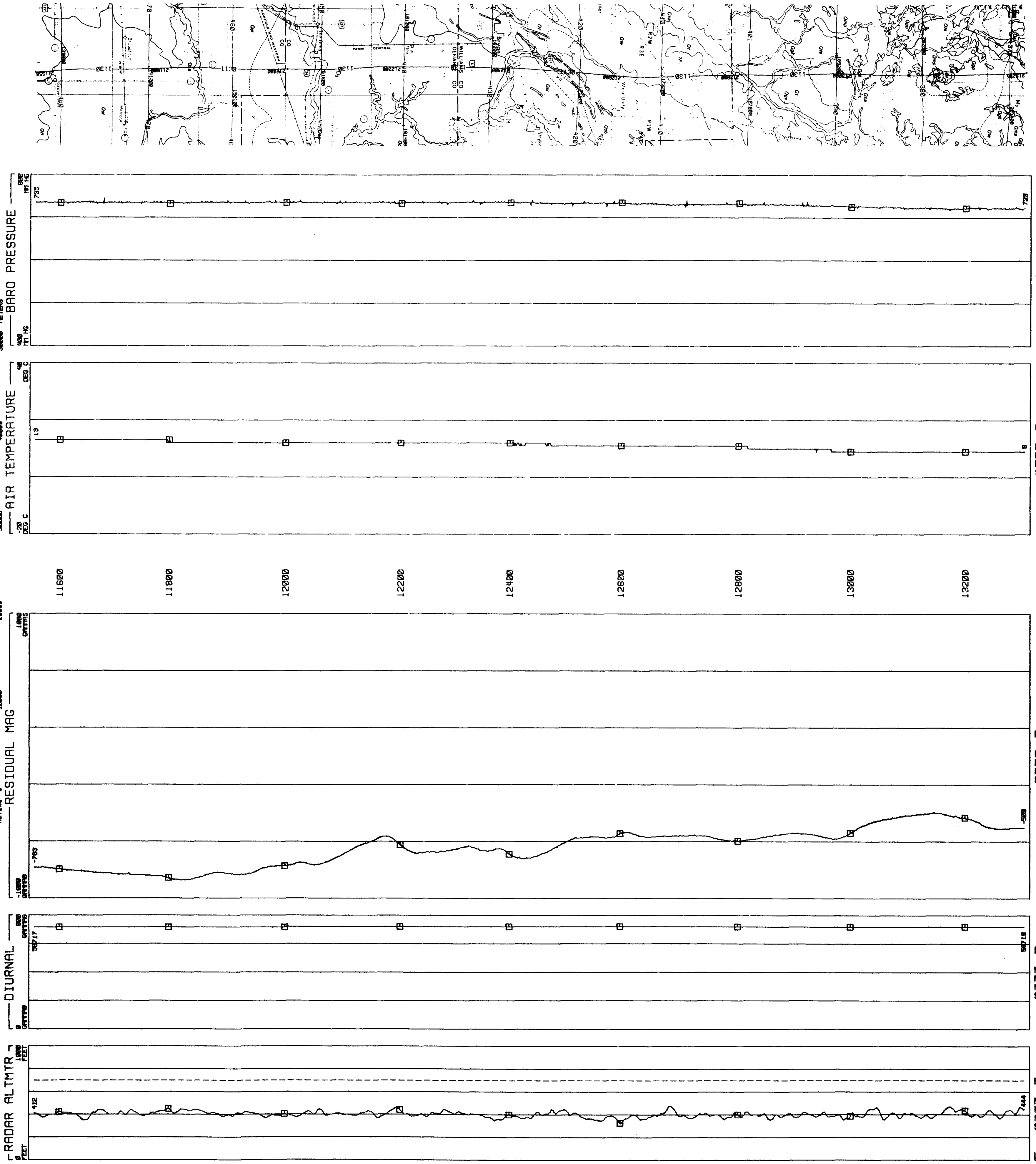
RESIDUAL MAG
GAMMAS
MIN -816.9
MAX -345.7
MEAN -595.9
STD DEV 130.0

DIURNAL
GAMMAS
MIN 56715
MAX 56719
MEAN 56711
STD DEV 5.811

RADAR ALTMTR
FEET
MIN 336.3
MAX 467.5
MEAN 395.0
STD DEV 22.88

LINE 1120

LINE 1130
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



BARO PRESSURE
MM HG
MIN 718.6
MAX 743.8
MEAN 731.9
STD DEV 4.443

AIR TEMPERATURE
DEG C
MIN 9.000
MAX 13.00
MEAN 11.19
STD DEV 1.320

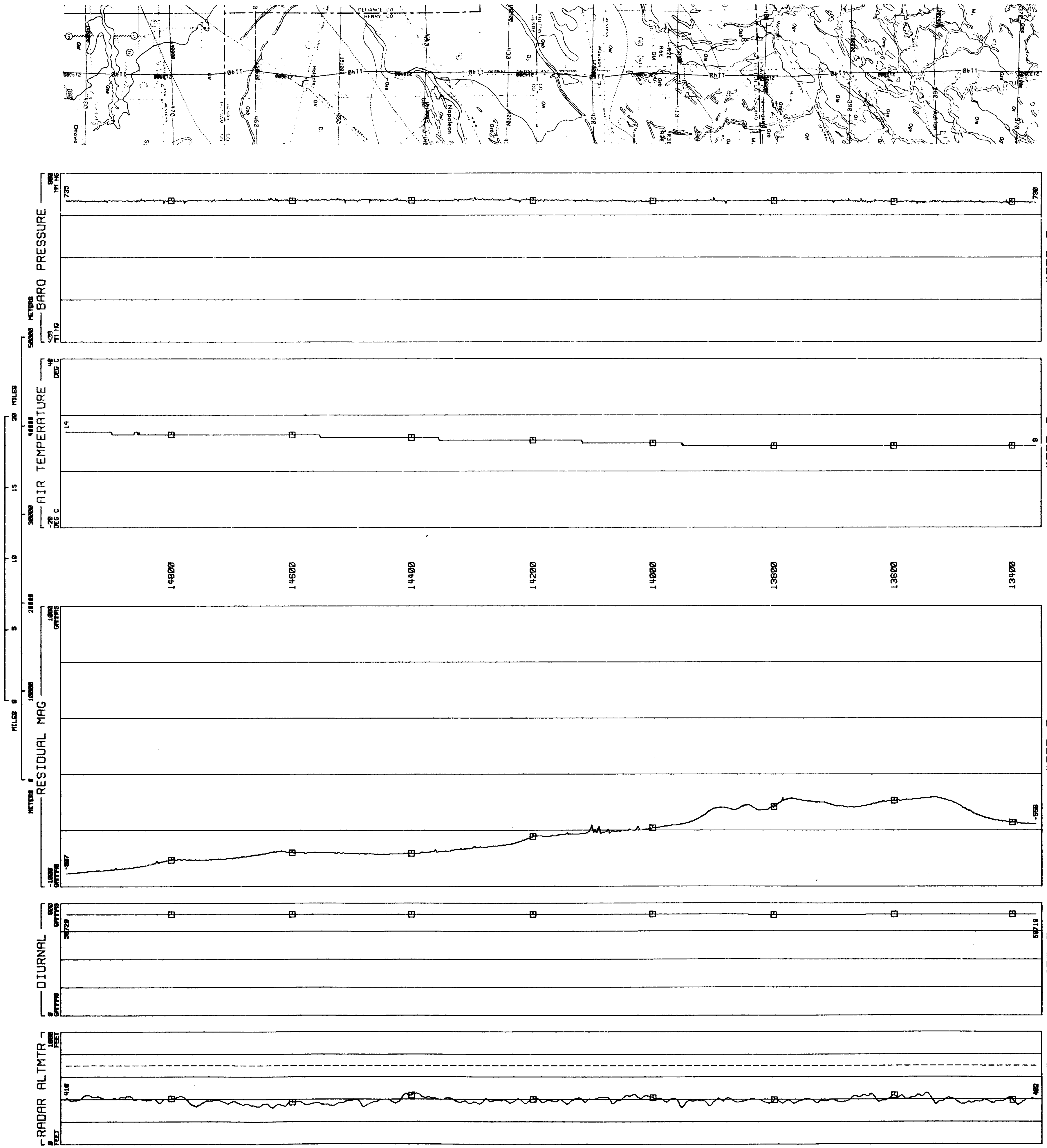
RESIDUAL MAG
GAMMAS
MIN -872.6
MAX -393.0
MEAN -643.2
STD DEV 132.4

DIURNAL
GAMMAS
MIN 56717
MAX 56721
MEAN 56714
STD DEV 5.371

RADAR ALTMTR
FEET
MIN 322.5
MAX 476.2
MEAN 401.2
STD DEV 24.45

LINE 1130

LINE 1140
FORT WAYNE QUADRANGLE - NTMS NK 16-9
DATA ACQUIRED 80297



BARO PRESSURE
MM HG
MIN 726.4
MAX 742.1
MEAN 734.5
STD DEV 1.895

AIR TEMPERATURE
DEG C
MIN 9.000
MAX 14.00
MEAN 10.87
STD DEV 1.730

RESIDUAL MAG
GAMMAS
MIN -906.9
MAX -364.2
MEAN -631.5
STD DEV 166.8

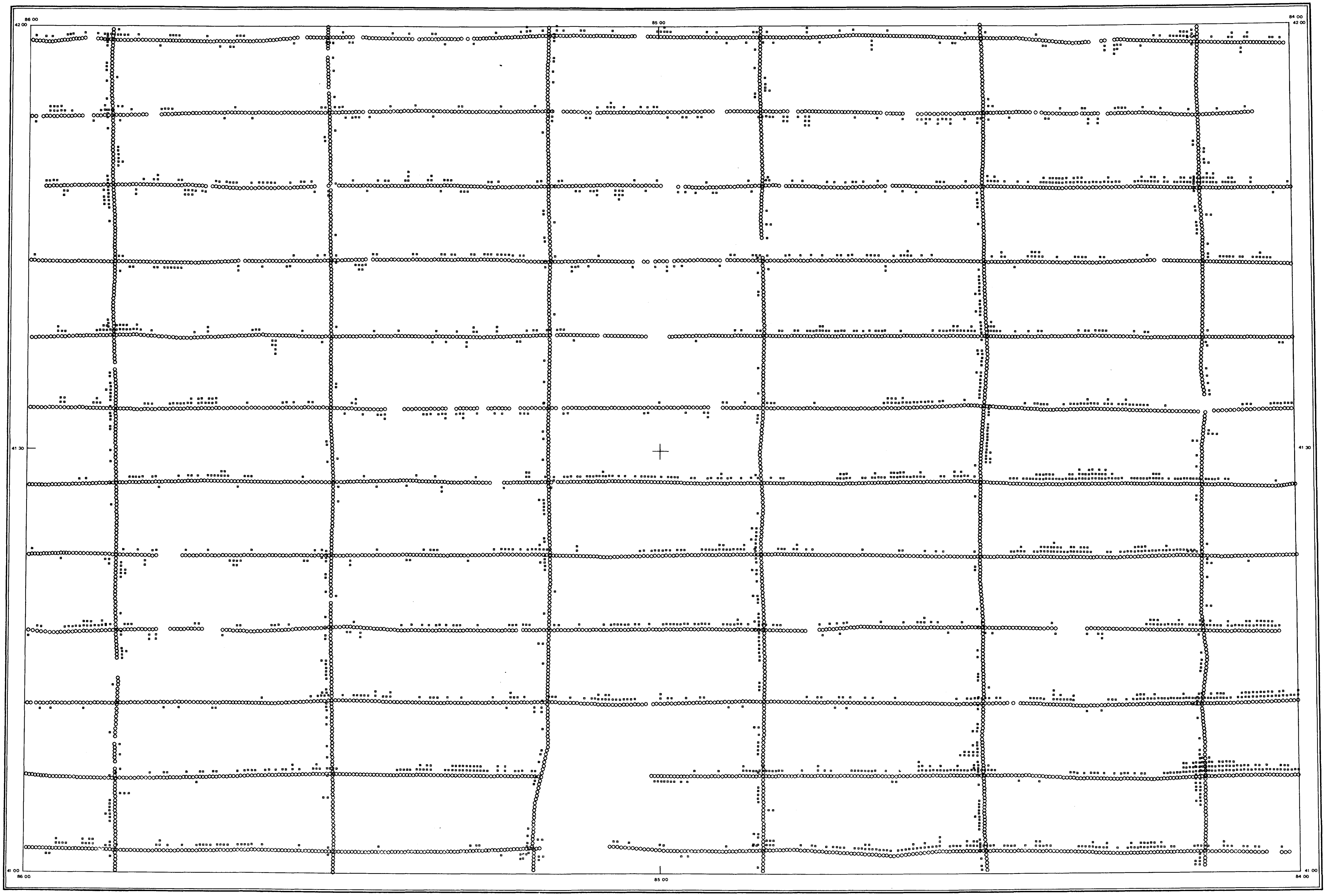
DIURNAL
GAMMAS
MIN 56718
MAX 56721
MEAN 56714
STD DEV 5.484

RADAR ALTMTR
FEET
MIN 326.8
MAX 455.5
MEAN 390.8
STD DEV 24.68

LINE 1140

APPENDIX E - Standard Deviation Maps

FORT WAYNE

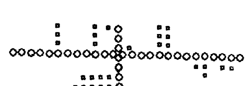


E1 fw

SCALE 1:500,000

MILES 5 0 5 10 15 MILES

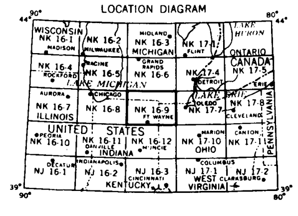
KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



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

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

LOCATION DIAGRAM



POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

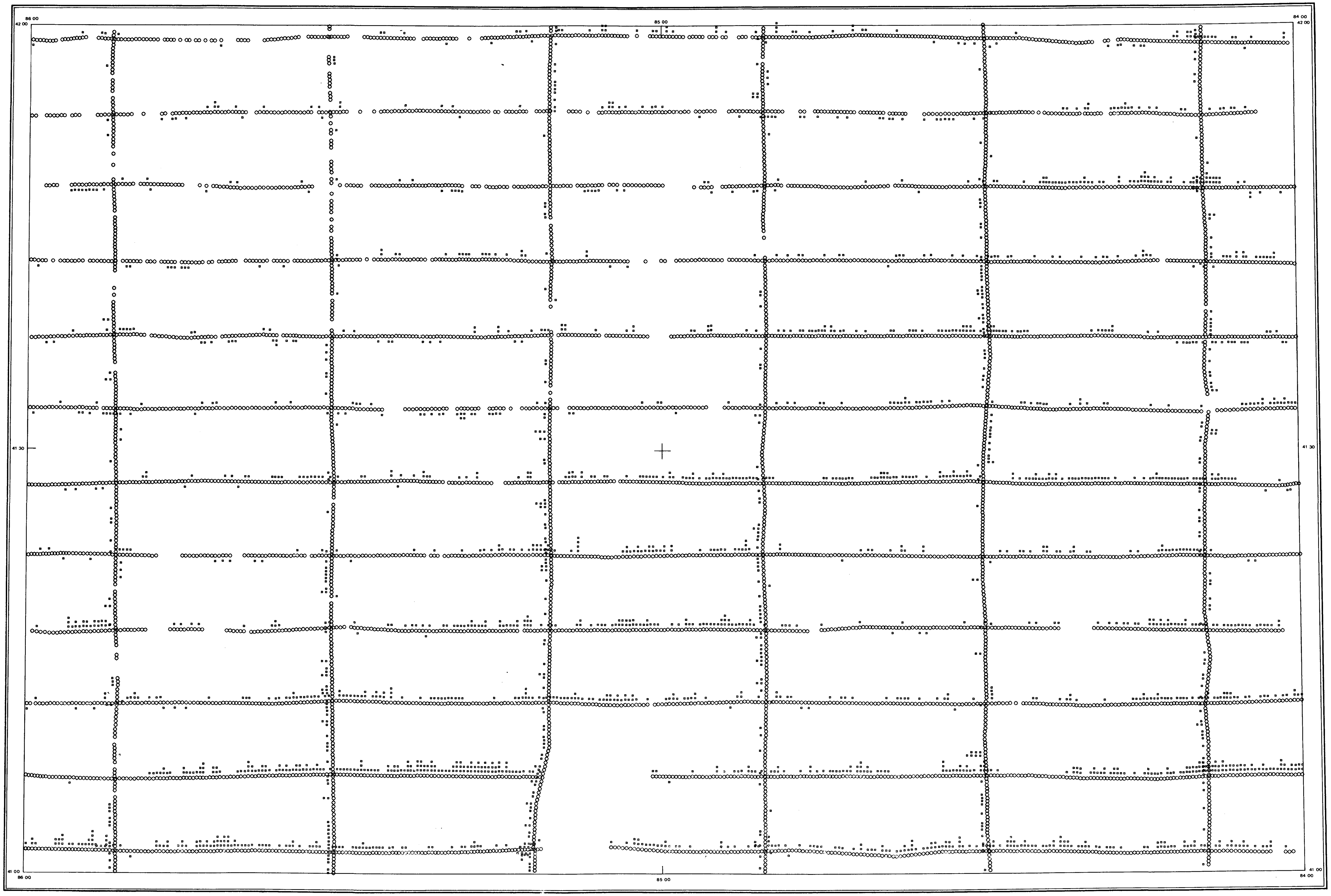
U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

N

FORT WAYNE



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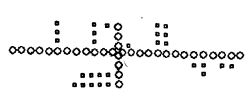
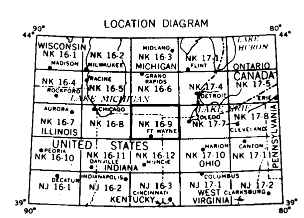
KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



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

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

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

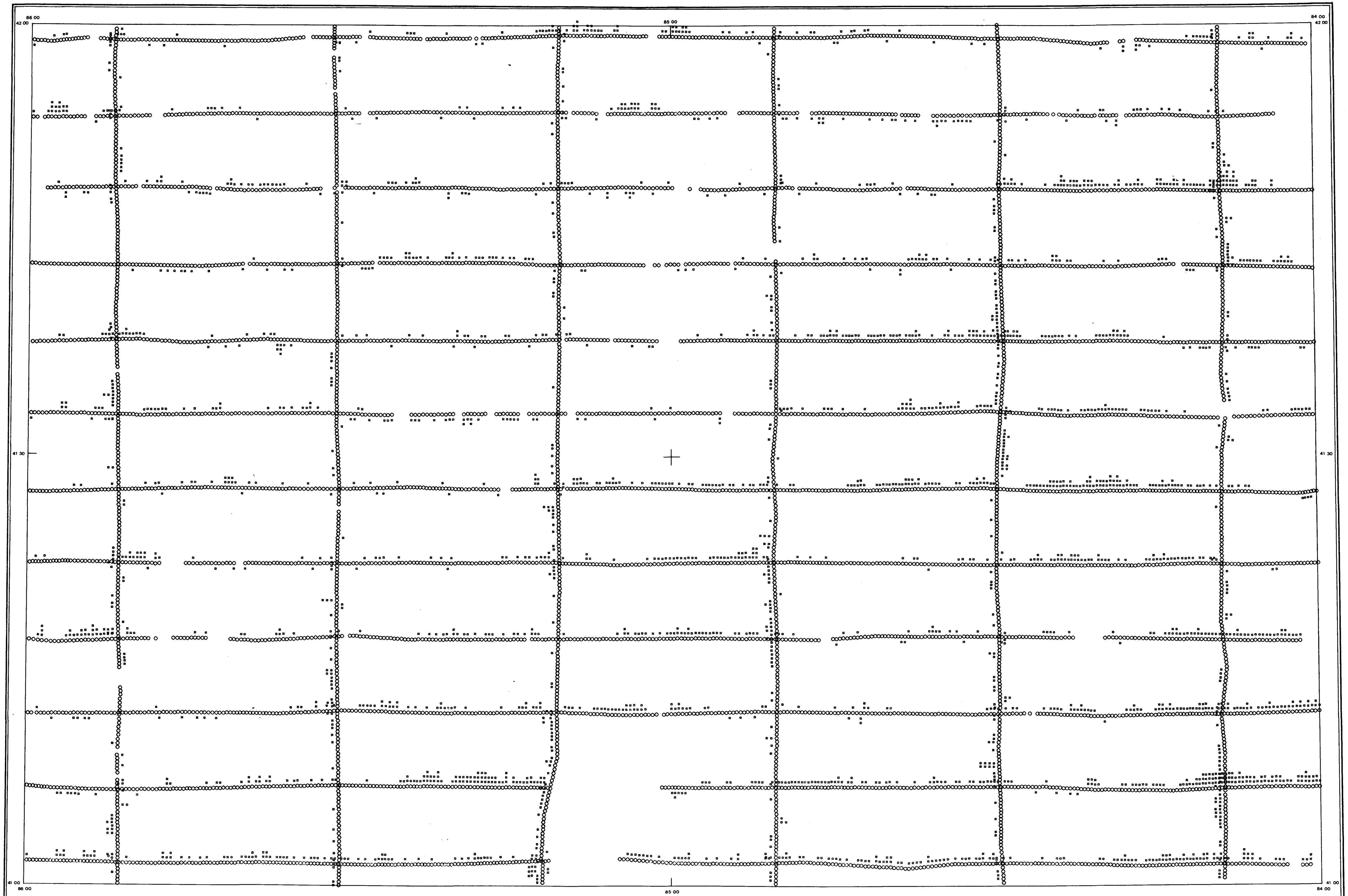
EG&G GEOMETRICS

URANIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

FORT WAYNE



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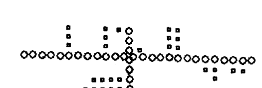
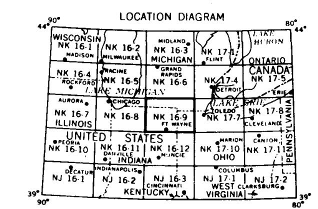


◇ - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▪ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

LOCATION DIAGRAM



THORIUM STANDARD DEVIATION MAP

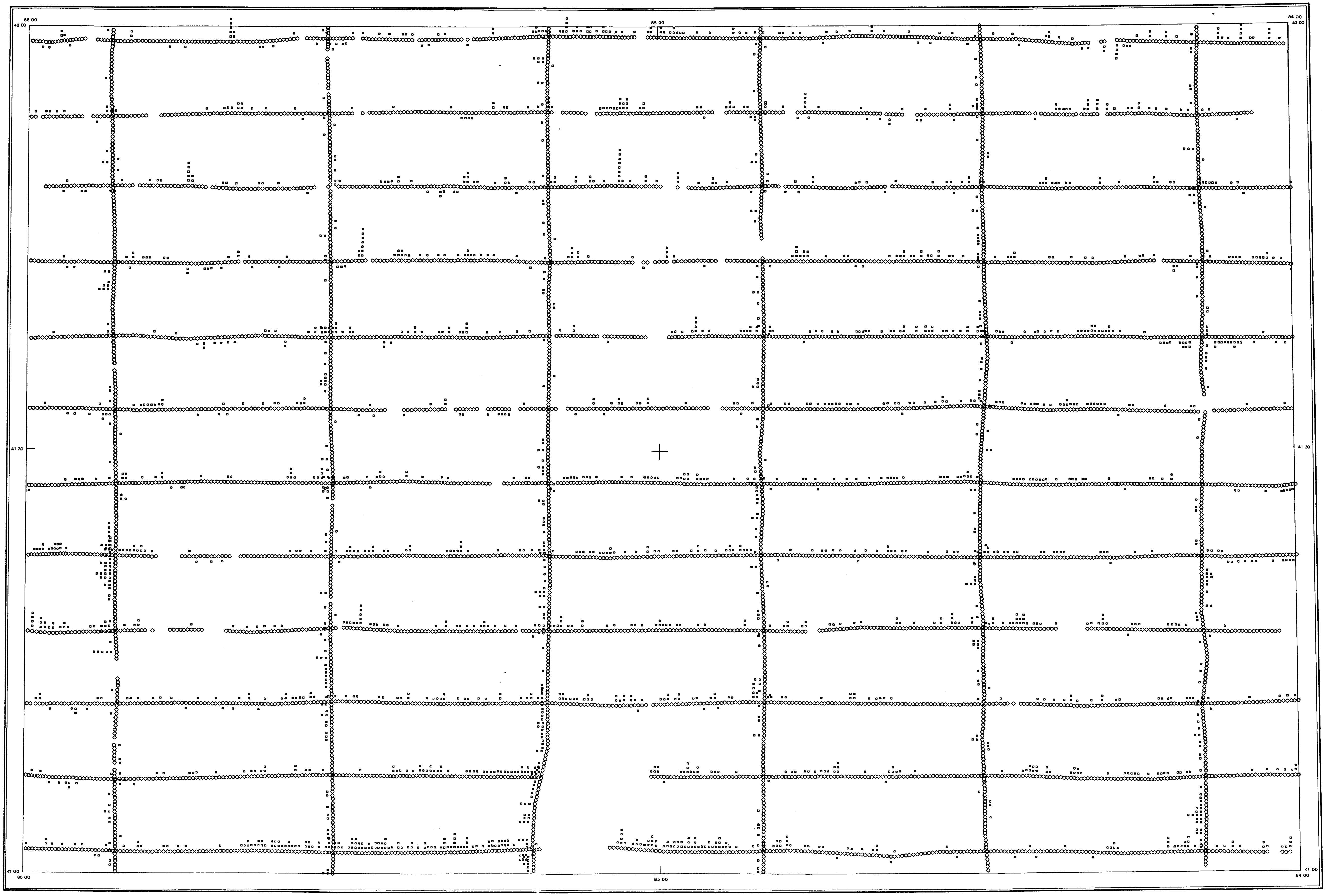
GREAT LAKES PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

FORT WAYNE



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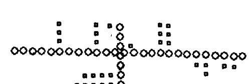
SURVEY AND COMPILATION BY:

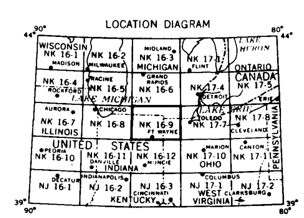
EG&G GEOMETRICS



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

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

LOCATION DIAGRAM



THORIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

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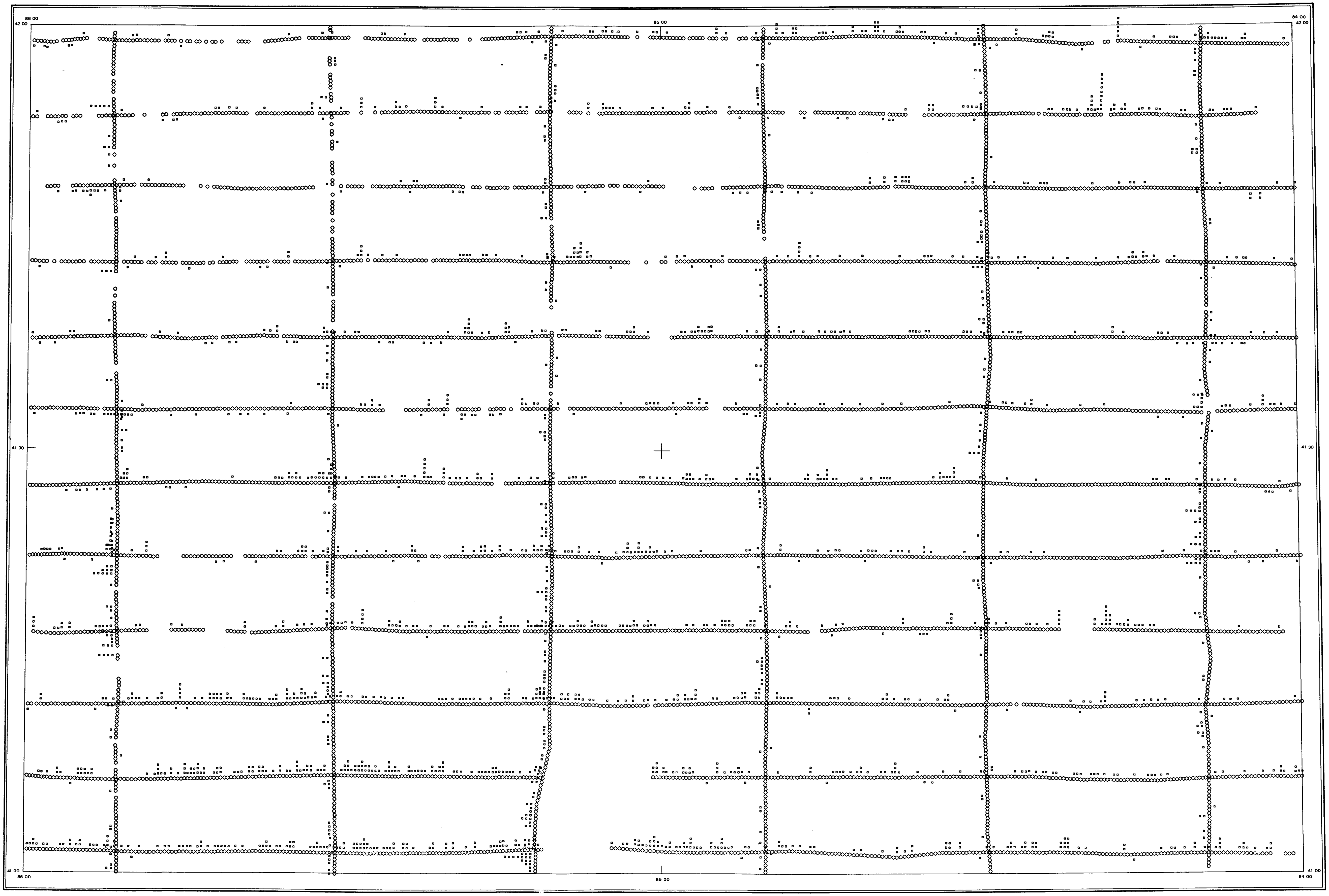

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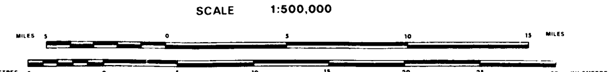
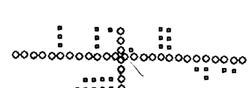
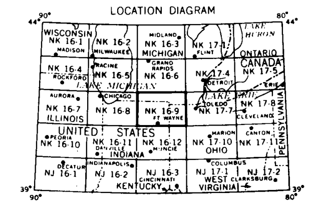




O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
▫ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

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

LOCATION DIAGRAM



/URANIUM/POTASSIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

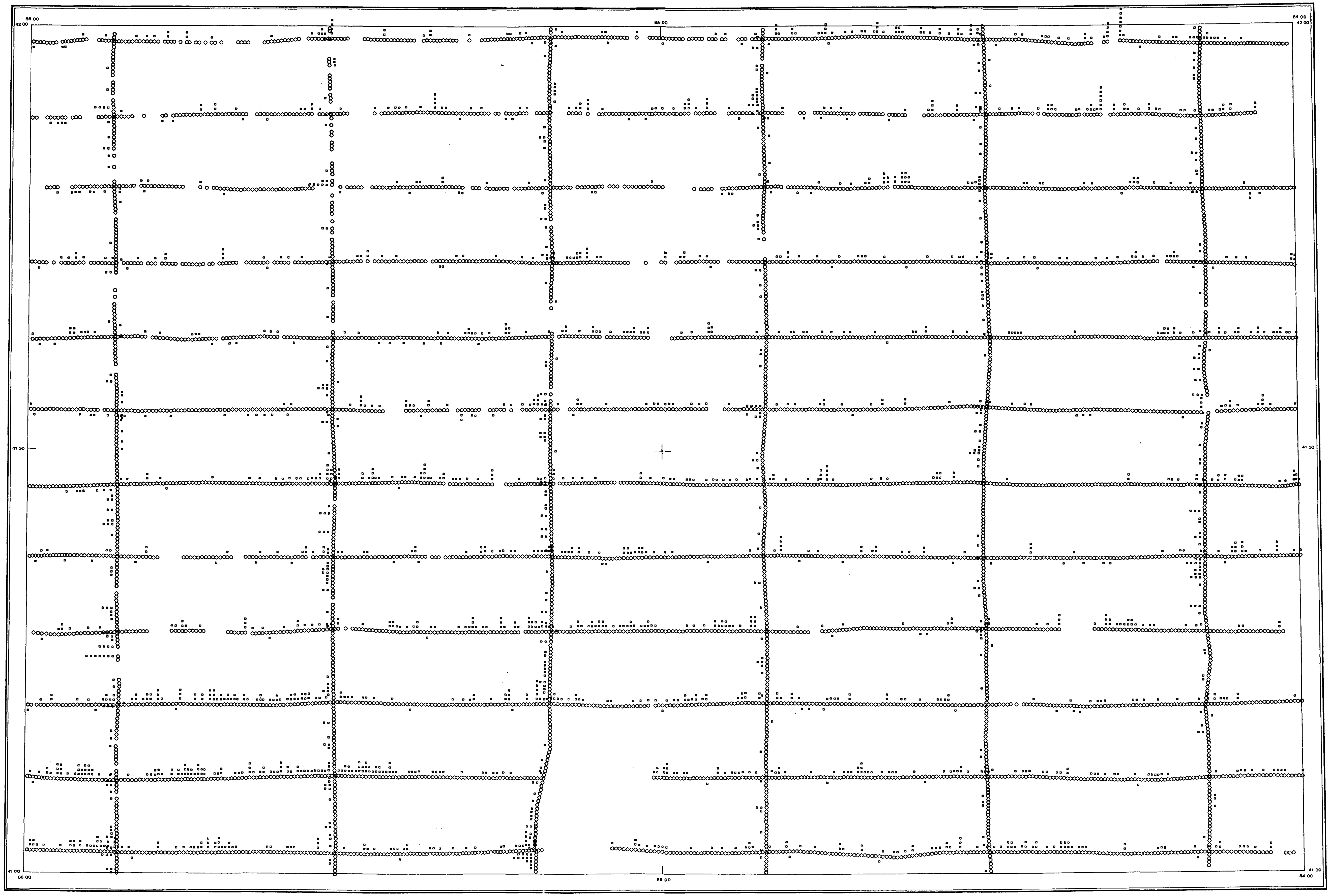
U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

FORT WAYNE

E6 Fw



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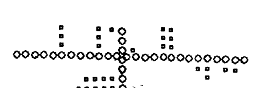
KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES



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

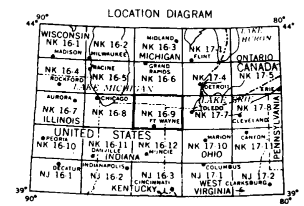
NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

N

LOCATION DIAGRAM



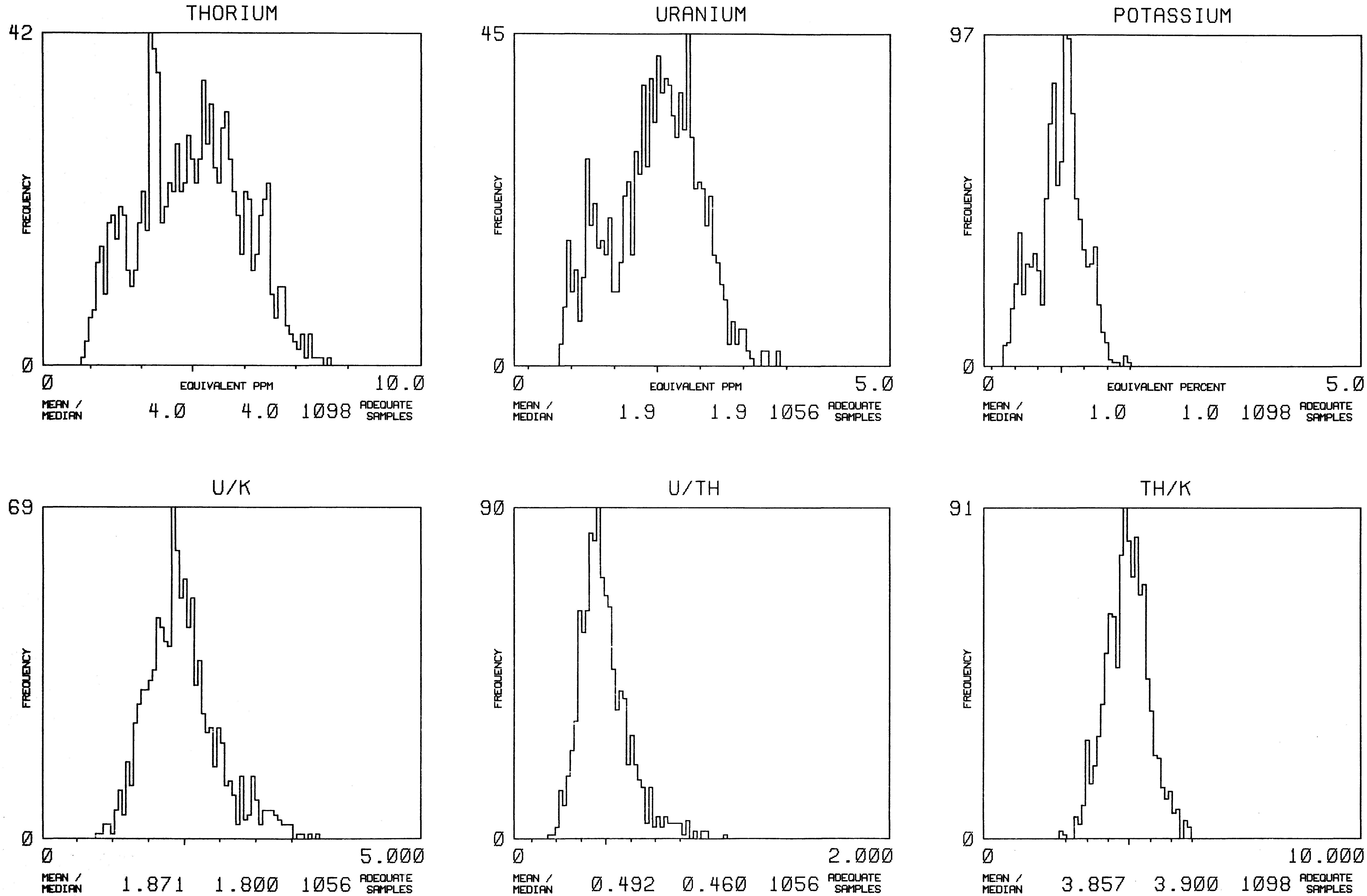
URANIUM/THORIUM STANDARD DEVIATION MAP

GREAT LAKES PROJECT

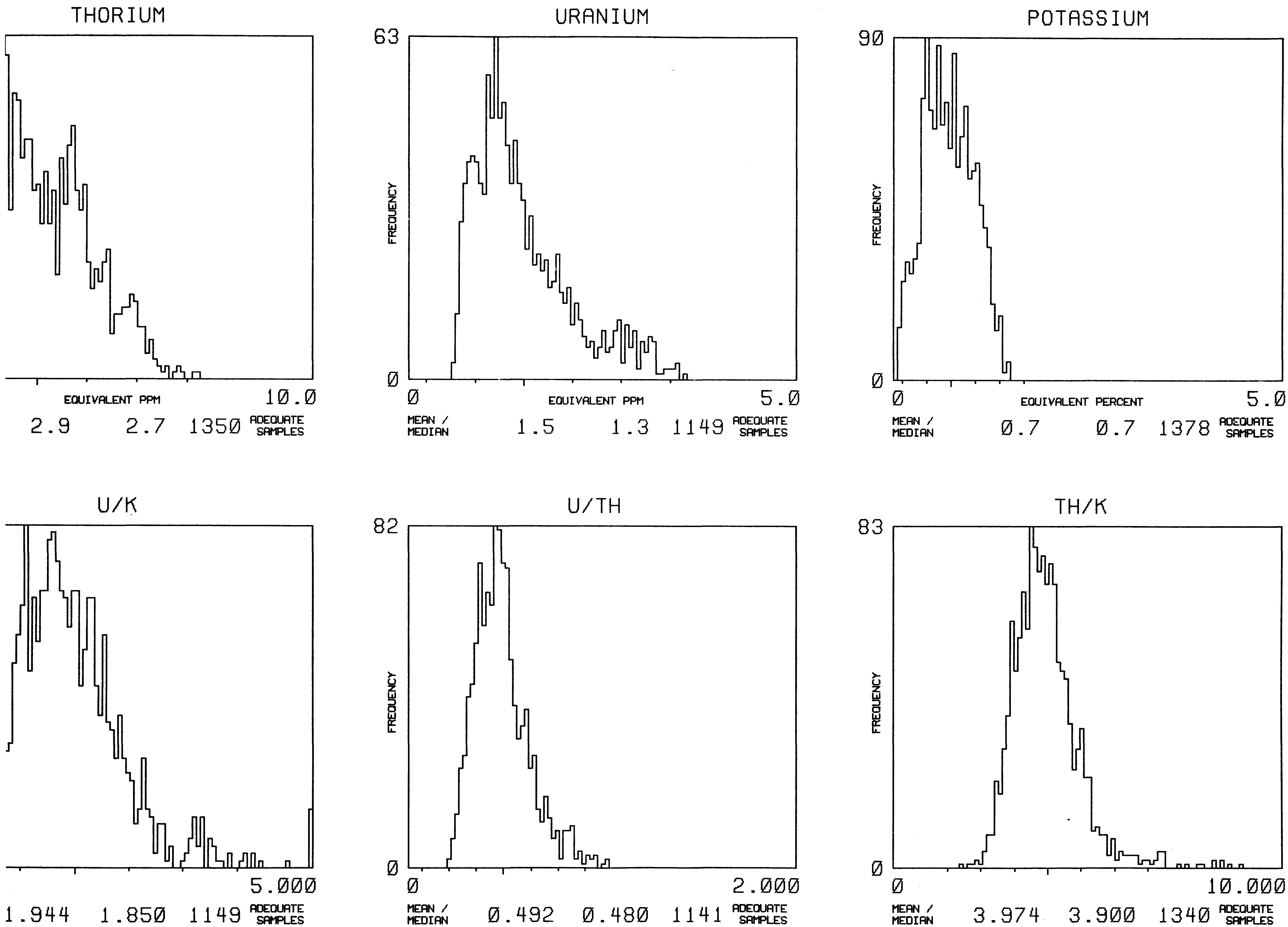
U. S. DEPARTMENT OF ENERGY

APPENDIX F - Histograms and Map Unit Conversion Table

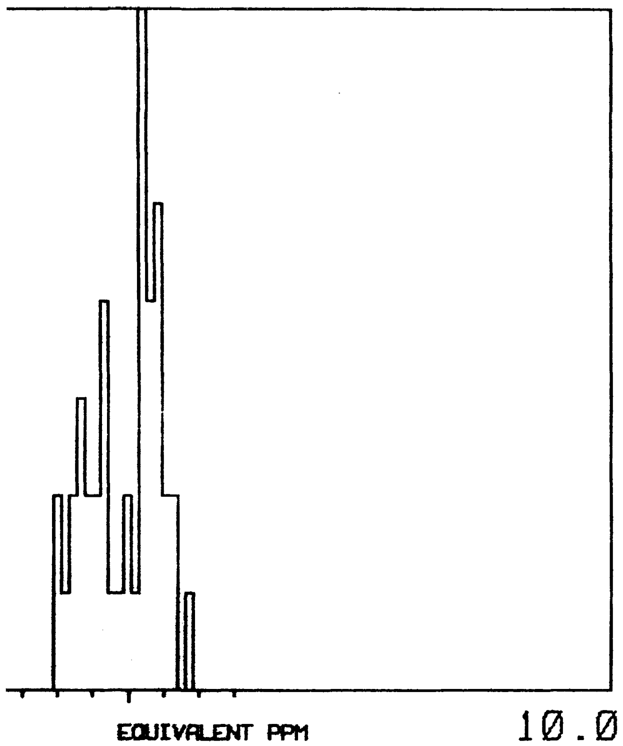
NK 16-9 FORT VAYNE MAP UNIT : QSA TOTAL NUMBER OF SAMPLES 1137 F1fw



9 FORT WAYNE MAP UNIT : QMP TOTAL NUMBER OF SAMPLES 1439 F2 fw

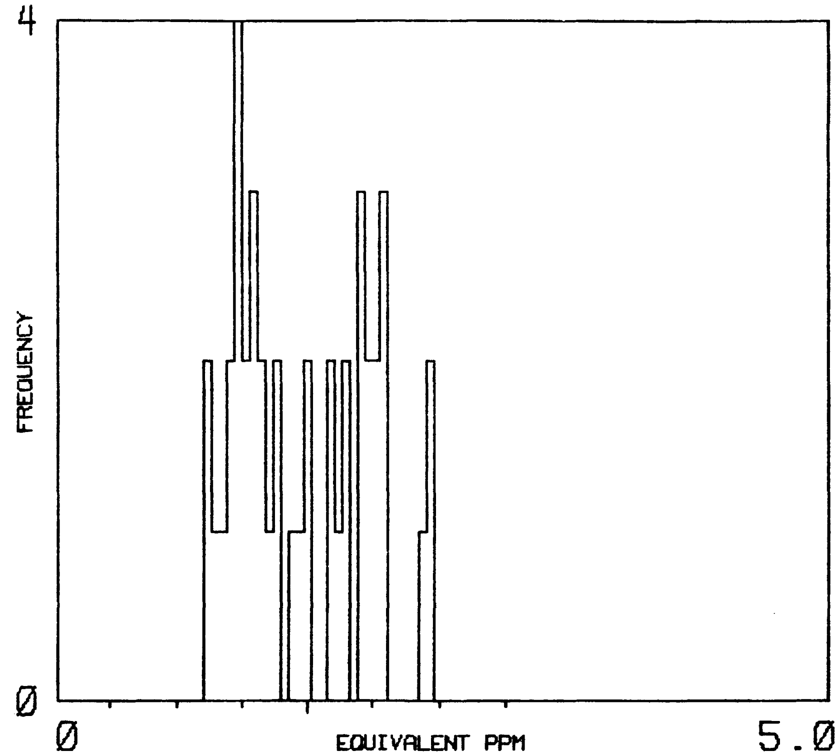


THORIUM



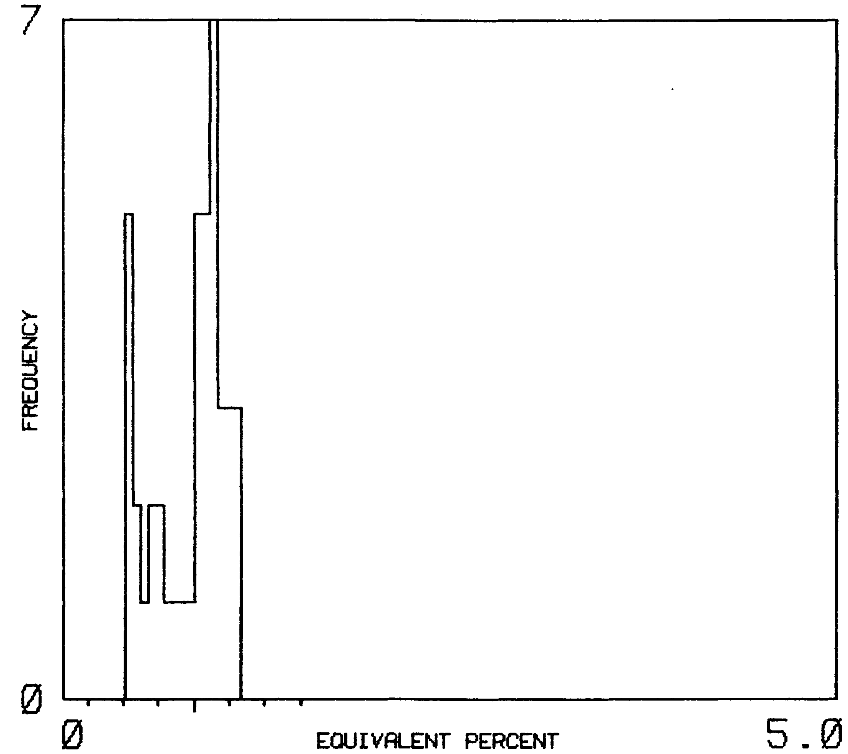
3.8 3.9 42 ADEQUATE SAMPLES

URANIUM



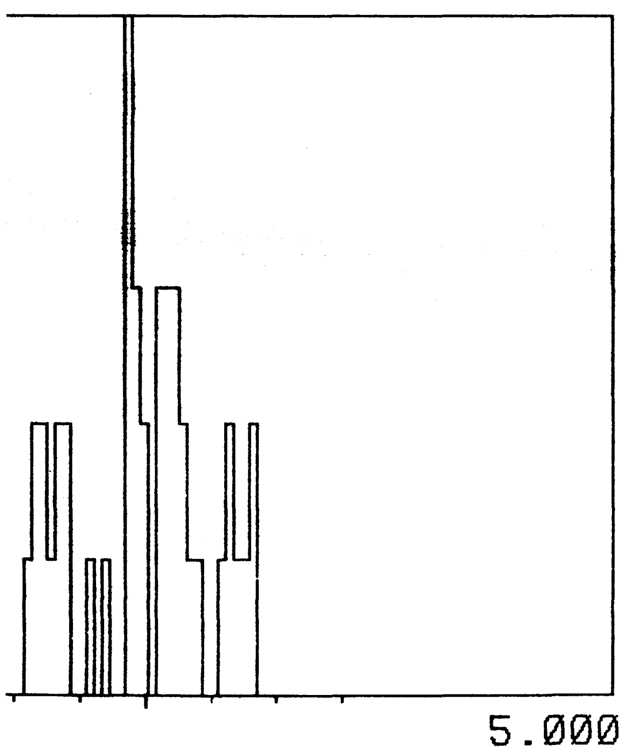
MEAN / MEDIAN 1.6 1.5 42 ADEQUATE SAMPLES

POTASSIUM



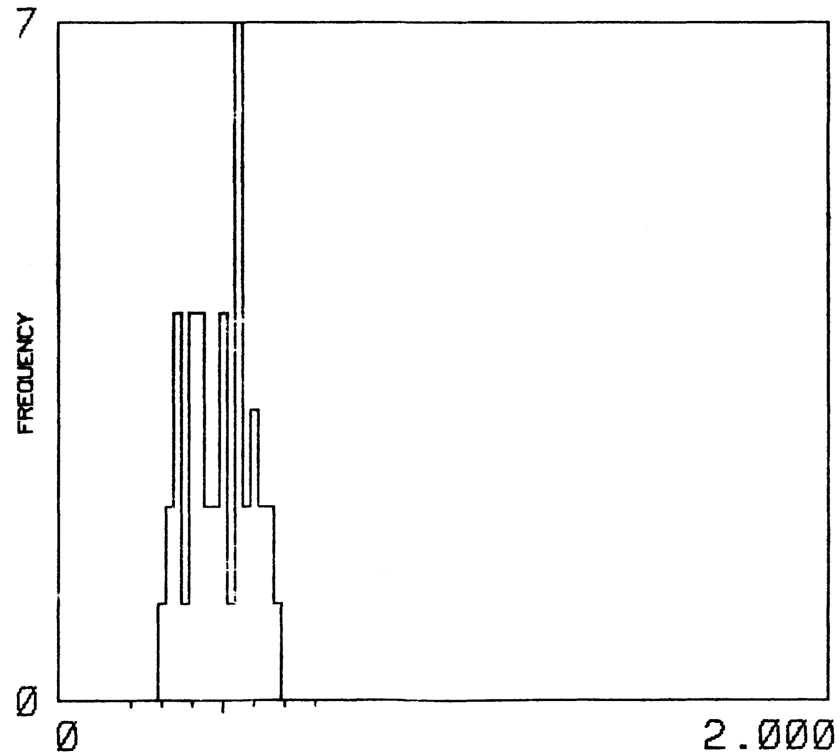
MEAN / MEDIAN 0.8 0.9 42 ADEQUATE SAMPLES

U/K



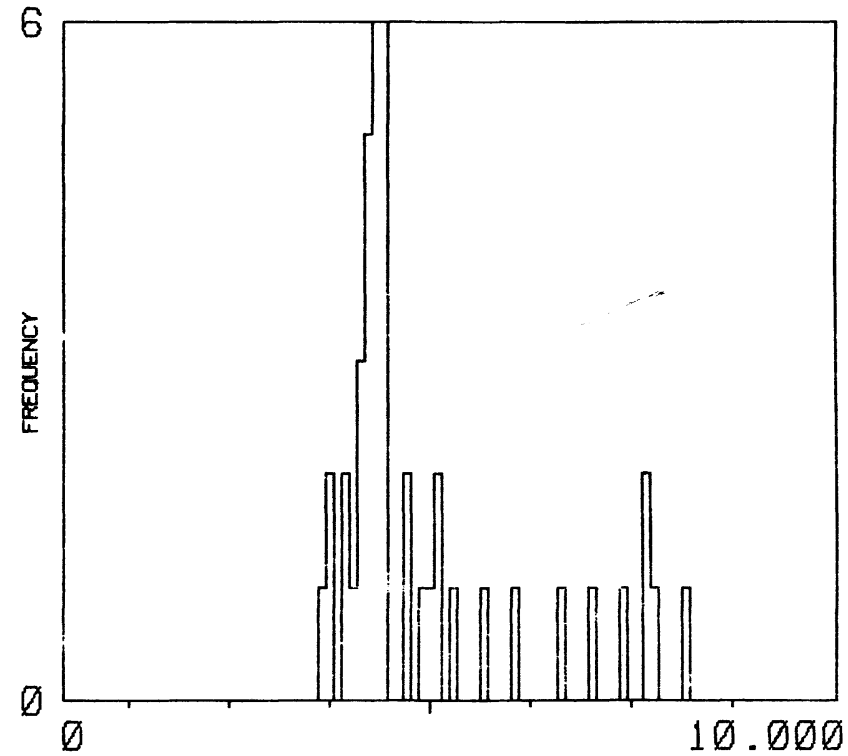
1.987 2.000 42 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.428 0.440 42 ADEQUATE SAMPLES

TH/K



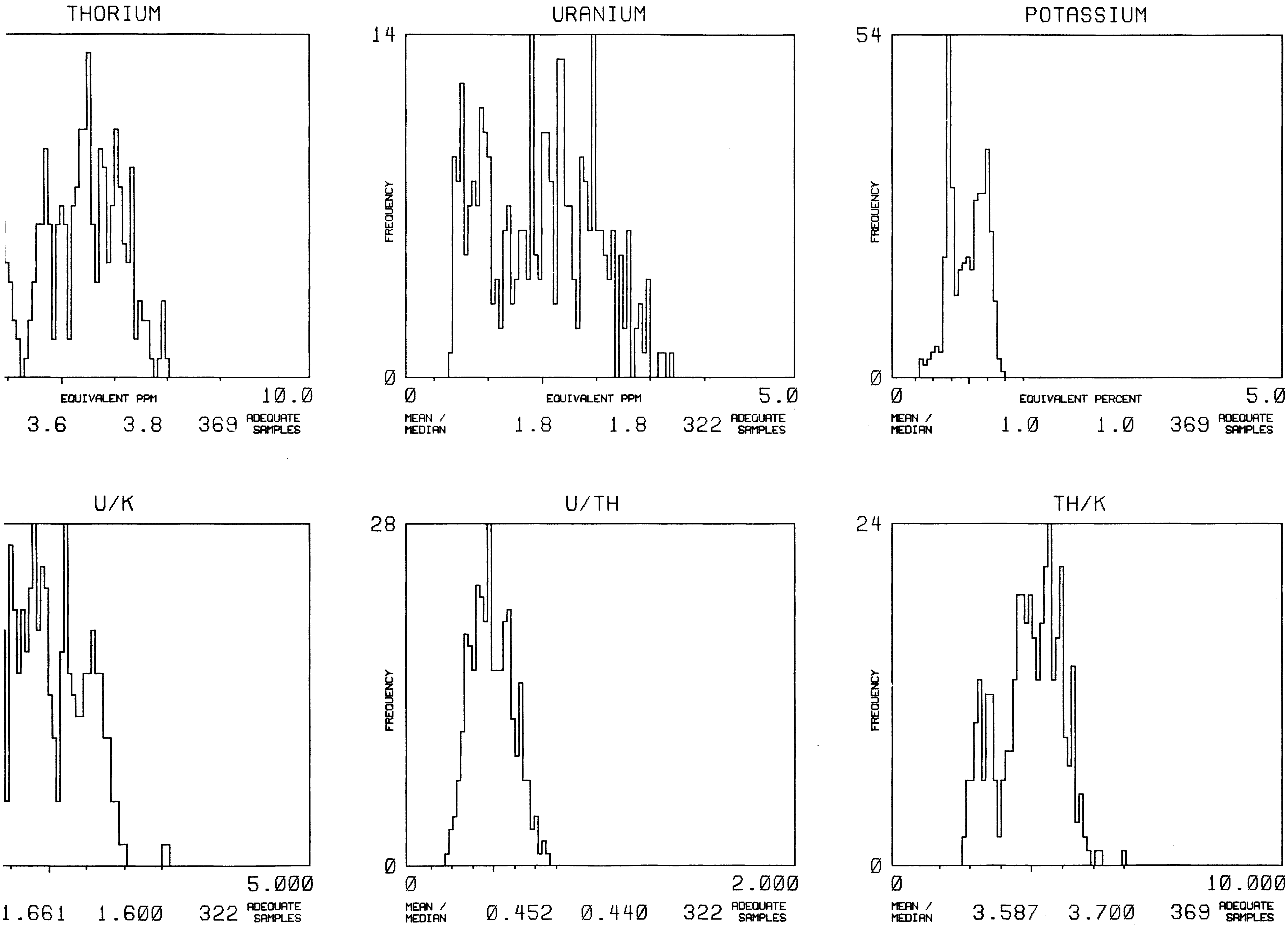
MEAN / MEDIAN 4.756 4.200 42 ADEQUATE SAMPLES

) FORT WAYNE

MAP UNIT : QSD

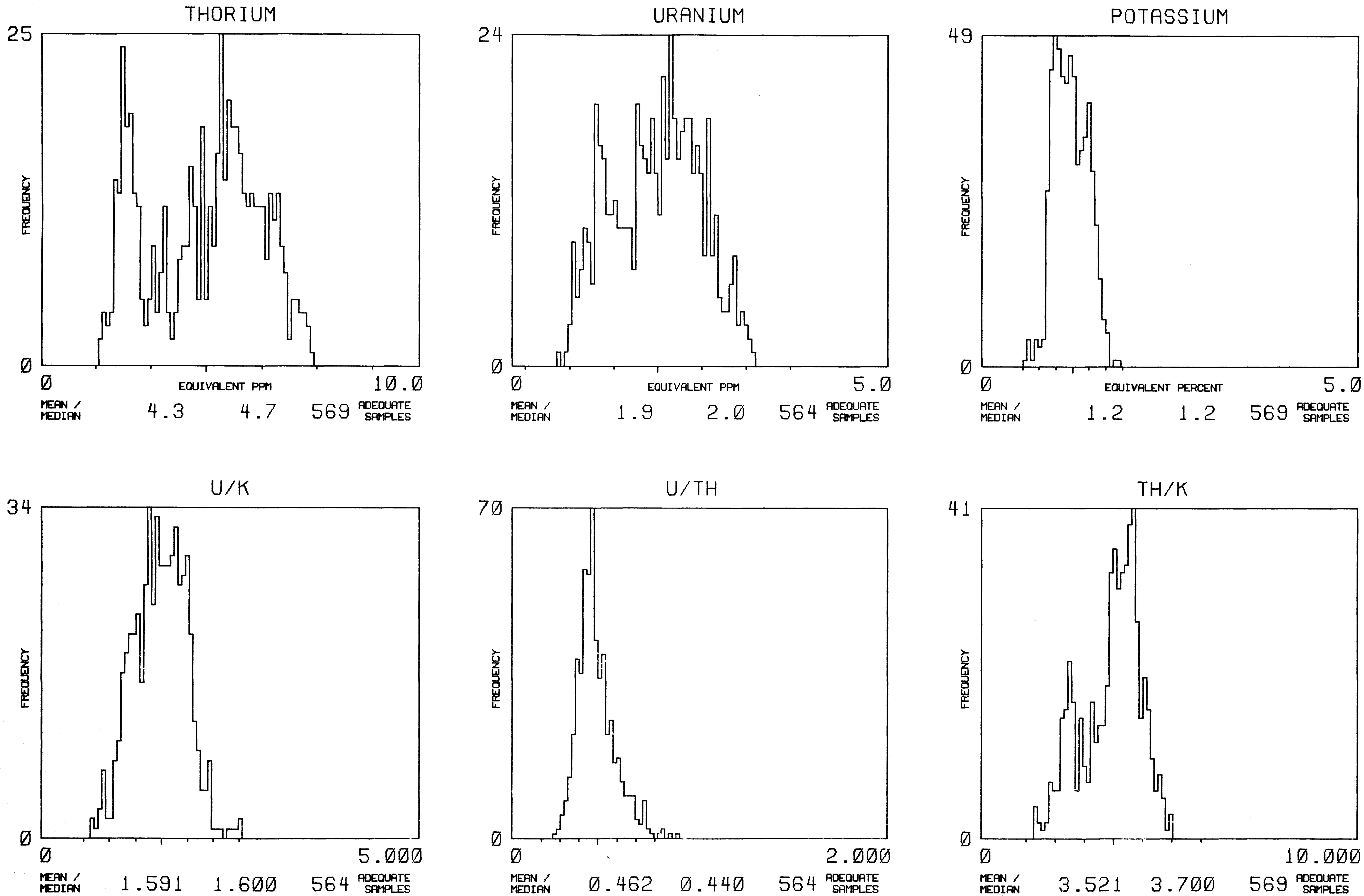
TOTAL NUMBER OF SAMPLES 369

F4 fw



NK 16-9 FORT WAYNE MAP UNIT : QSB TOTAL NUMBER OF SAMPLES 582

F5 fw



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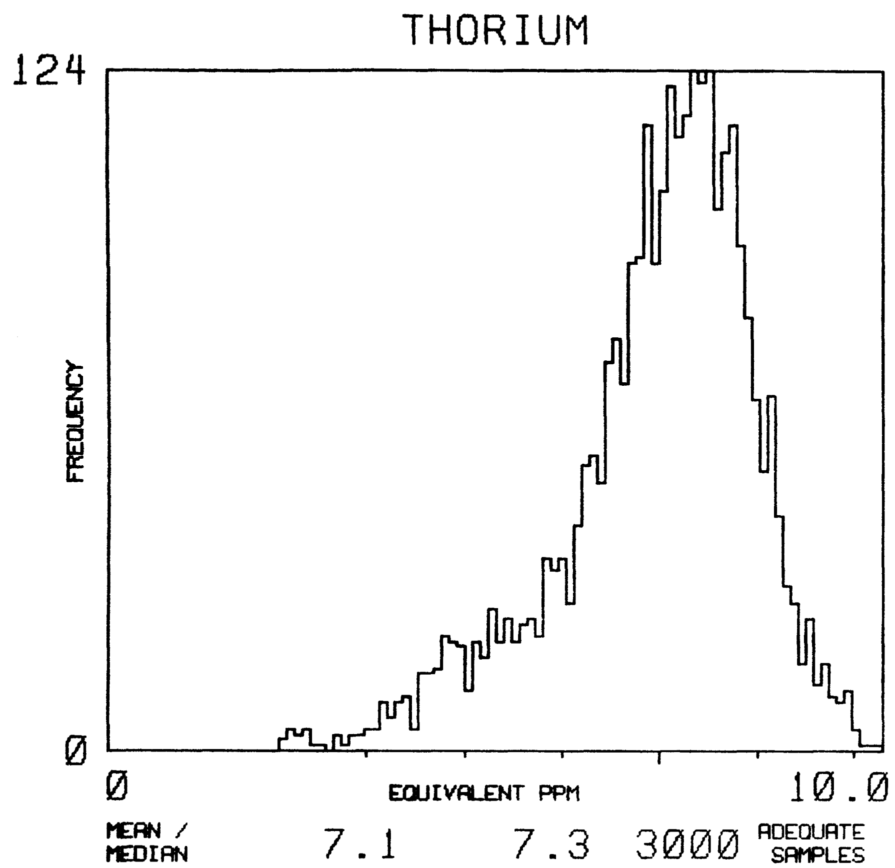
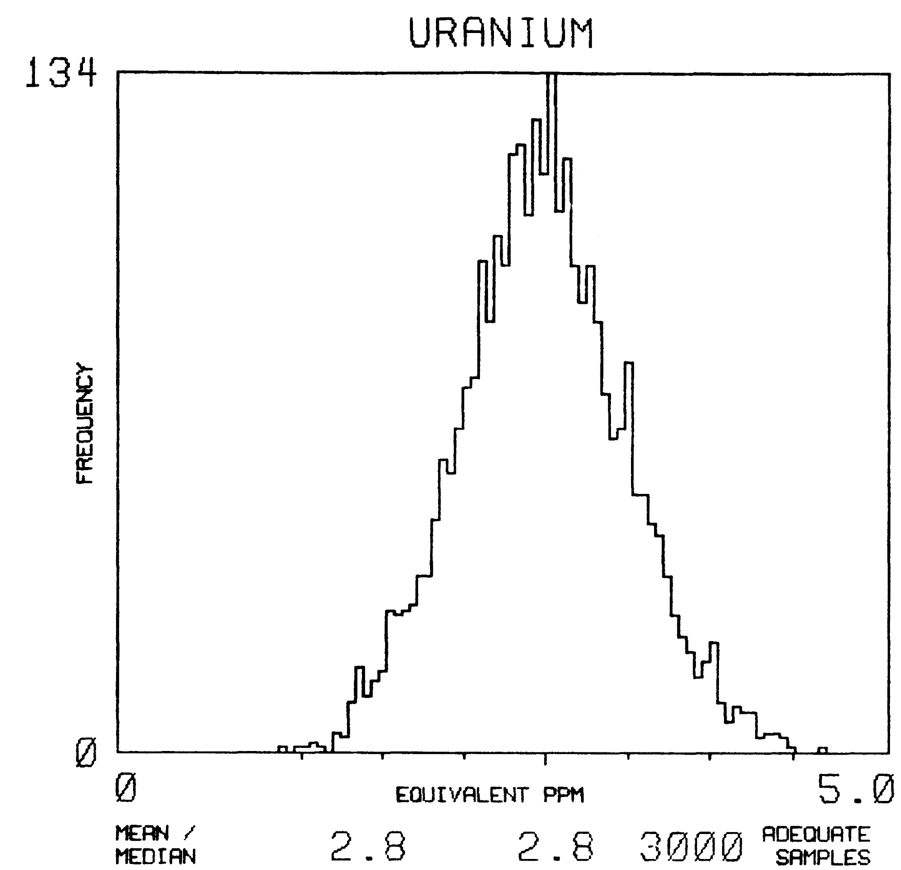
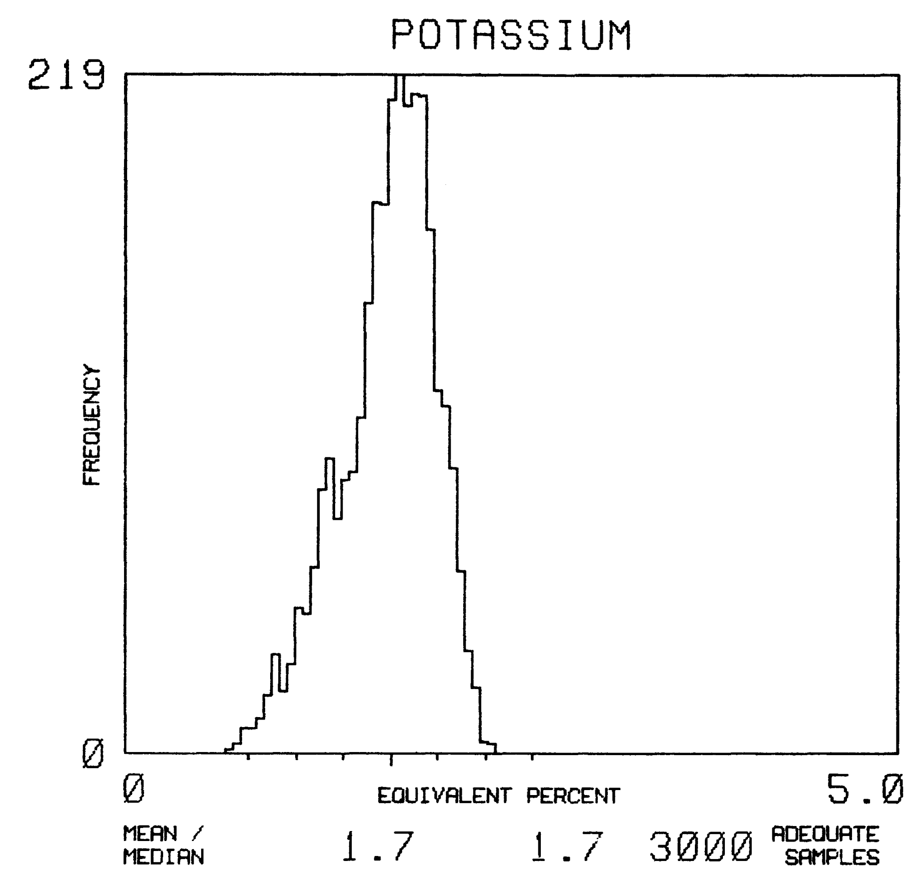
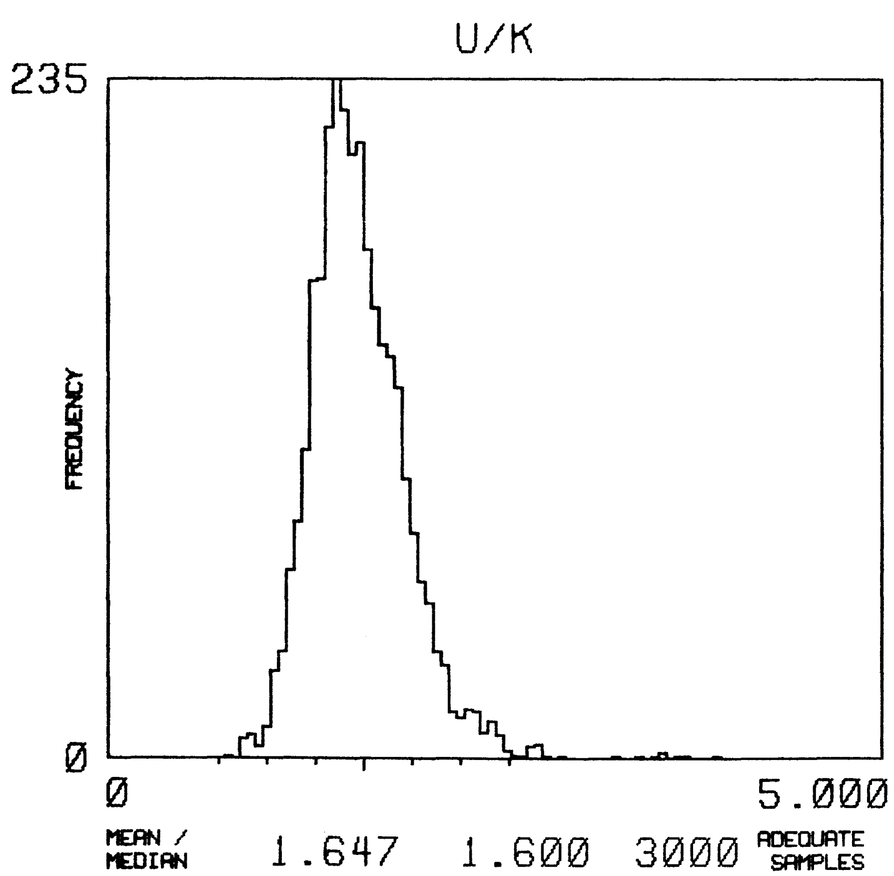
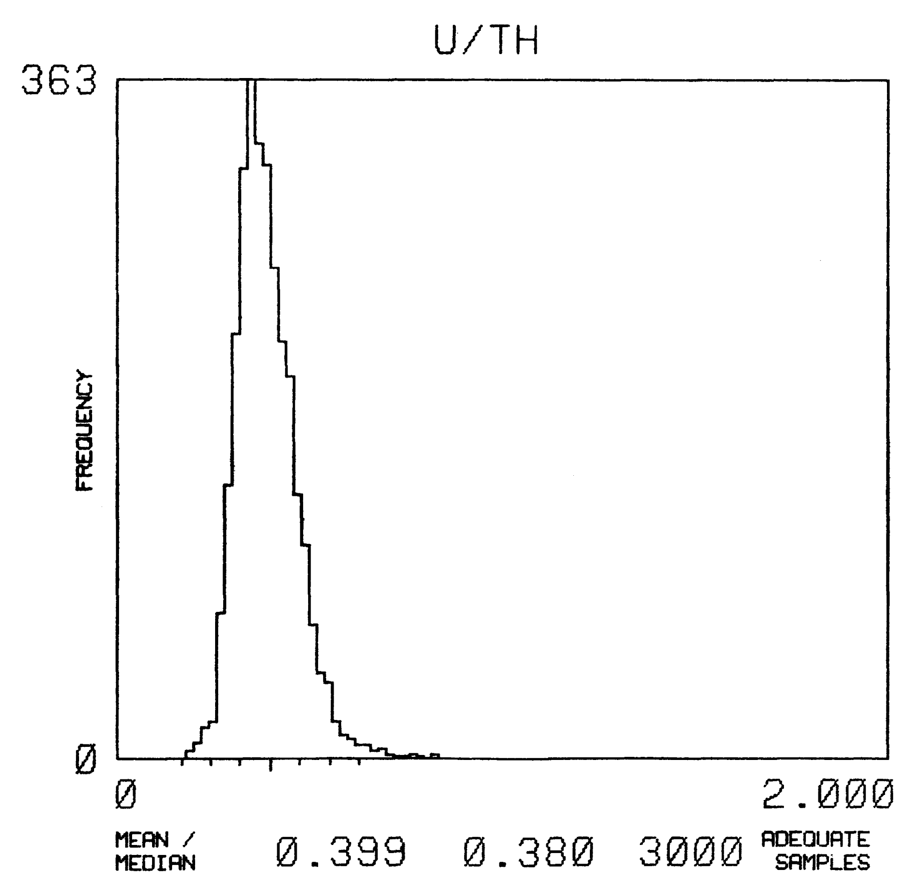
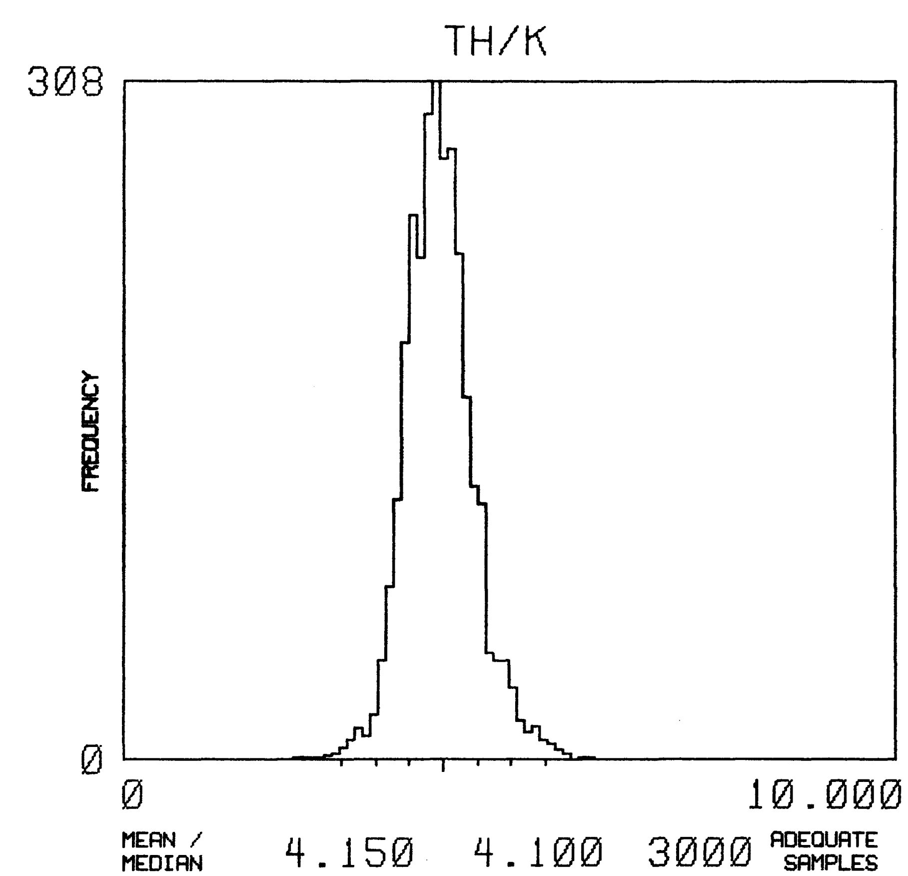




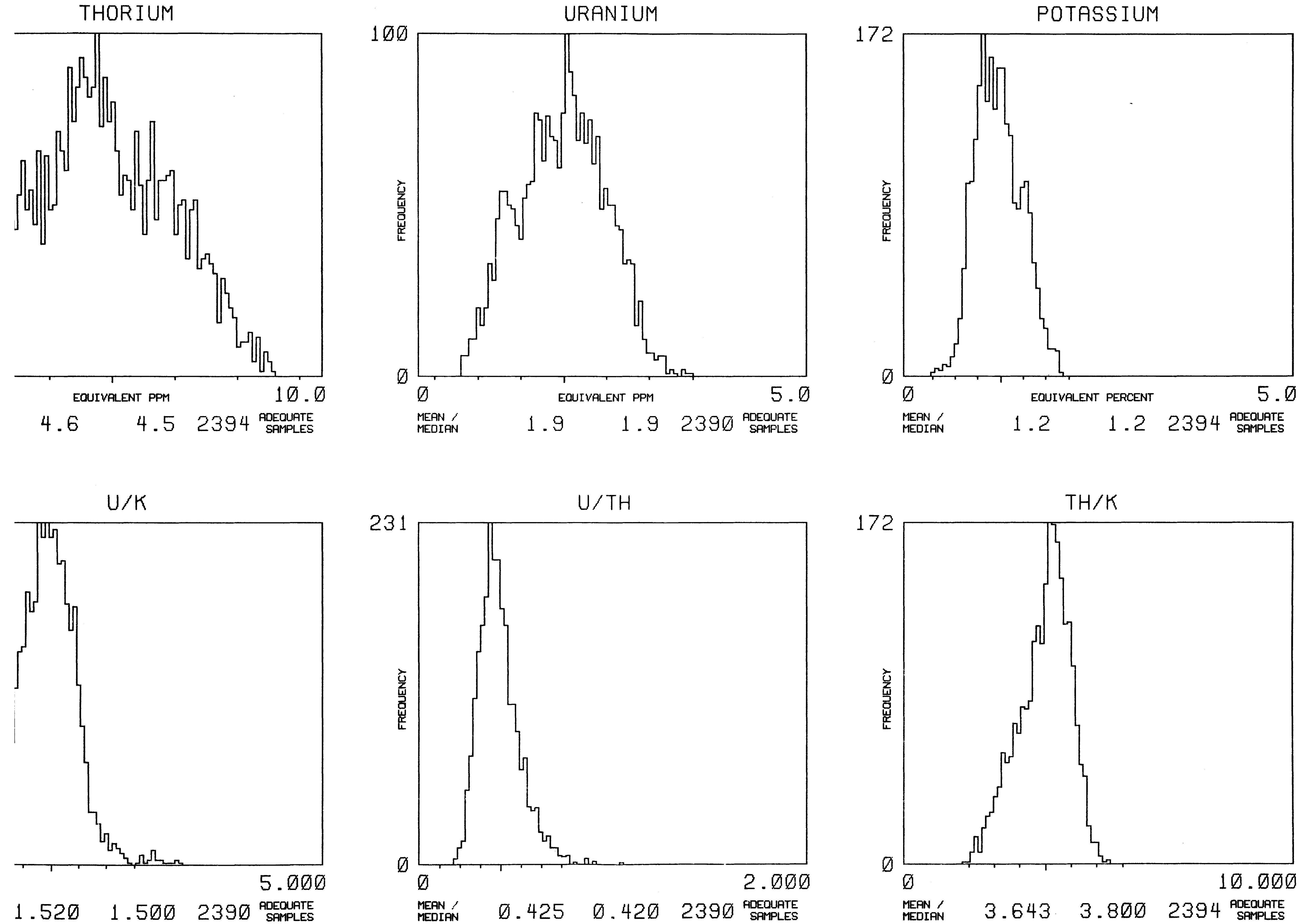






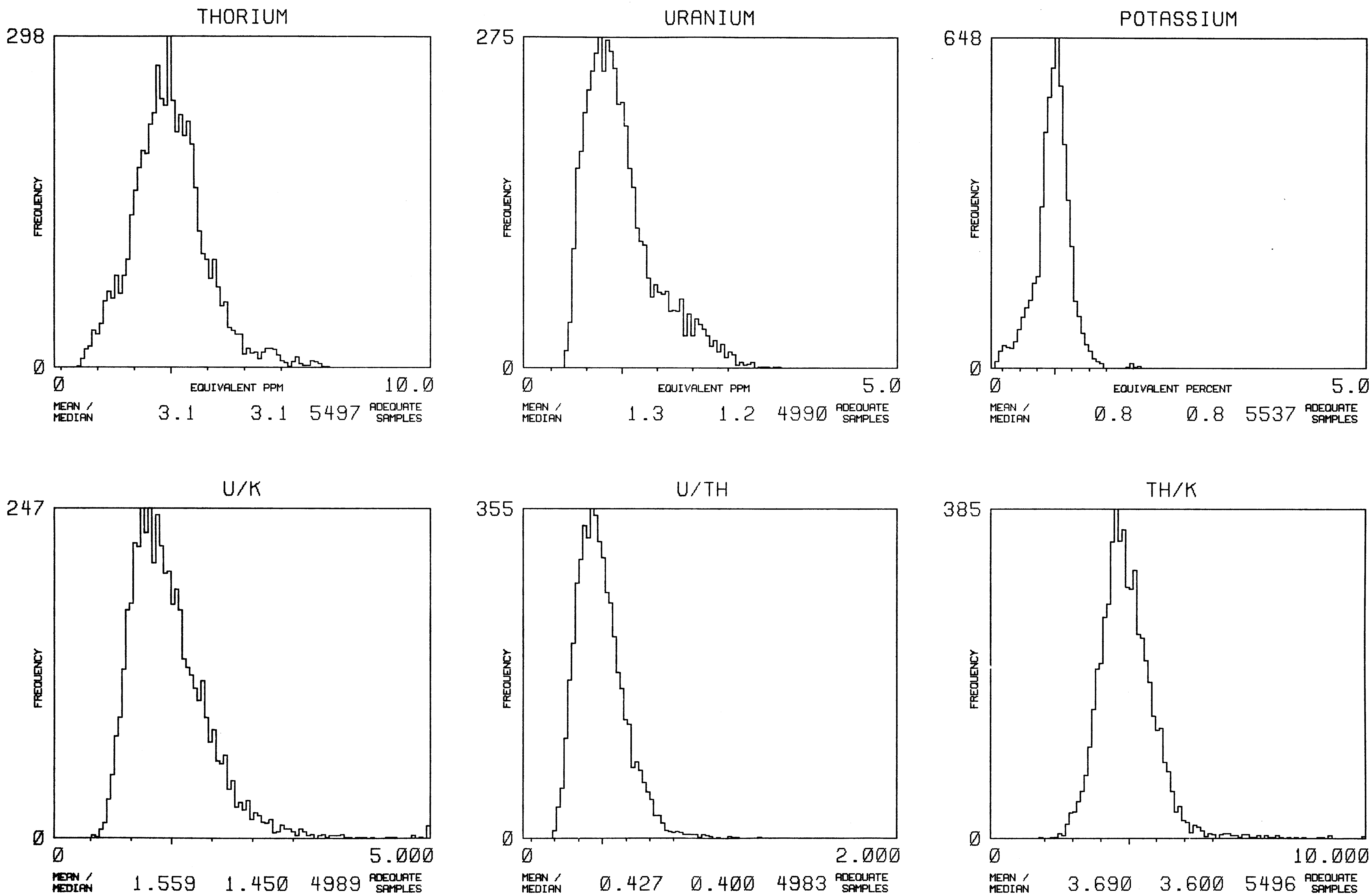


3 FORT WAYNE MAP UNIT : QSL TOTAL NUMBER OF SAMPLES 2406 F7fw



NK 16-9 FORT WAYNE MAP UNIT : QGV TOTAL NUMBER OF SAMPLES 5567

F8 fw



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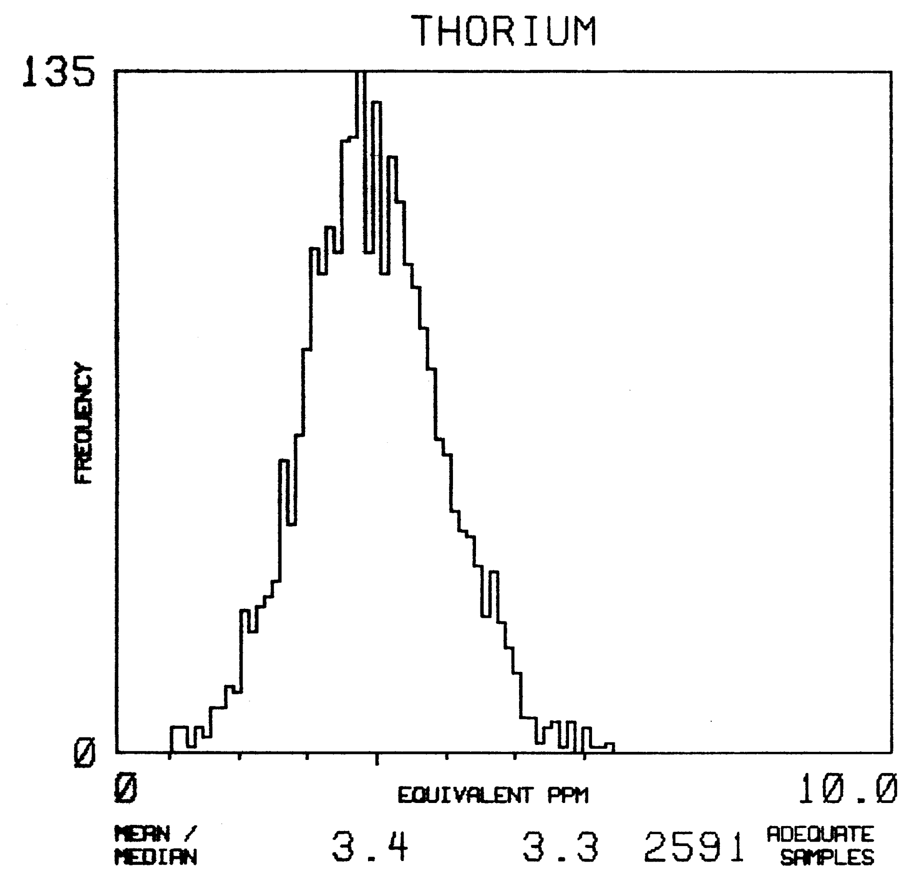
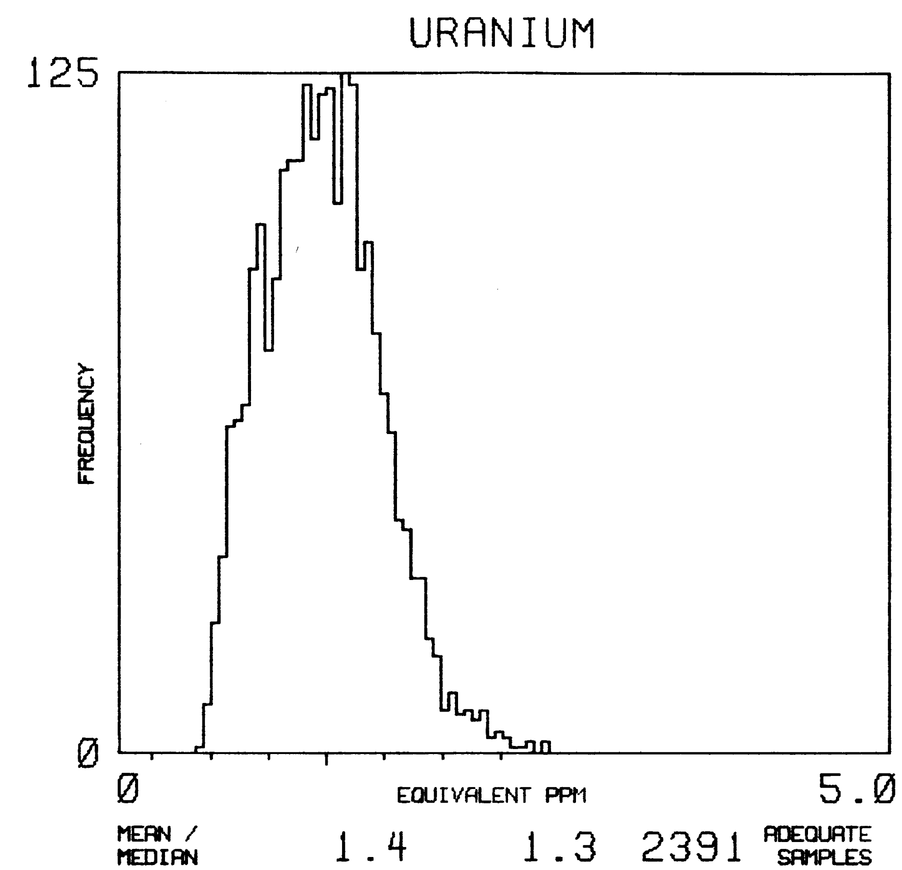
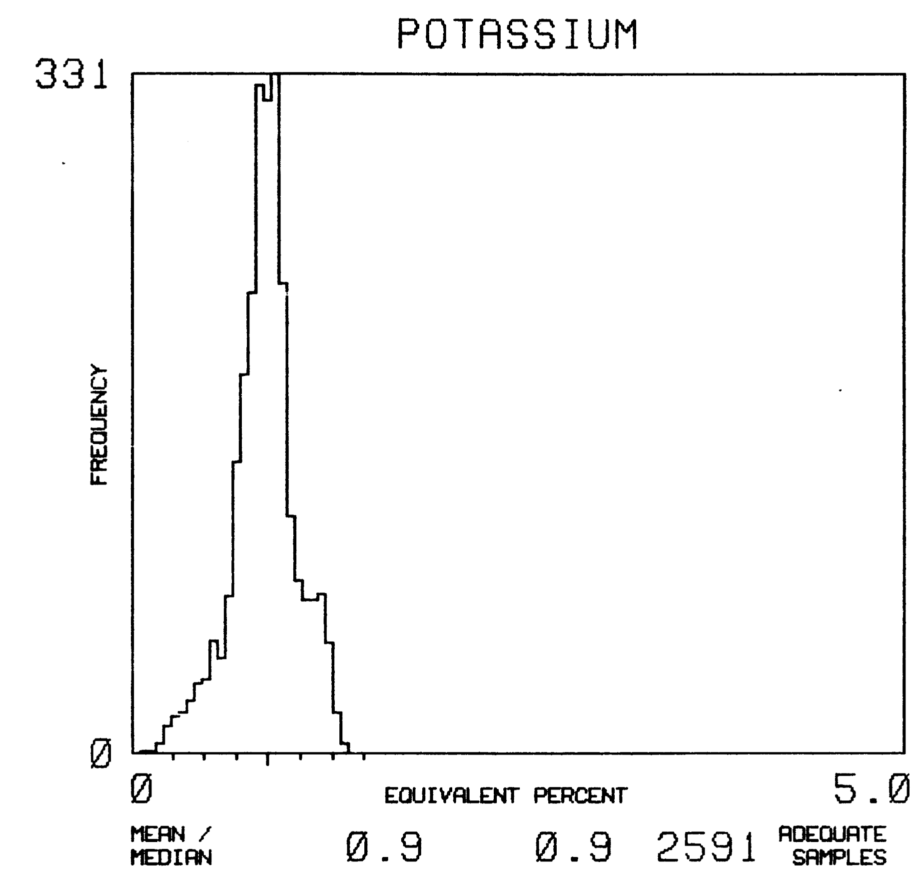
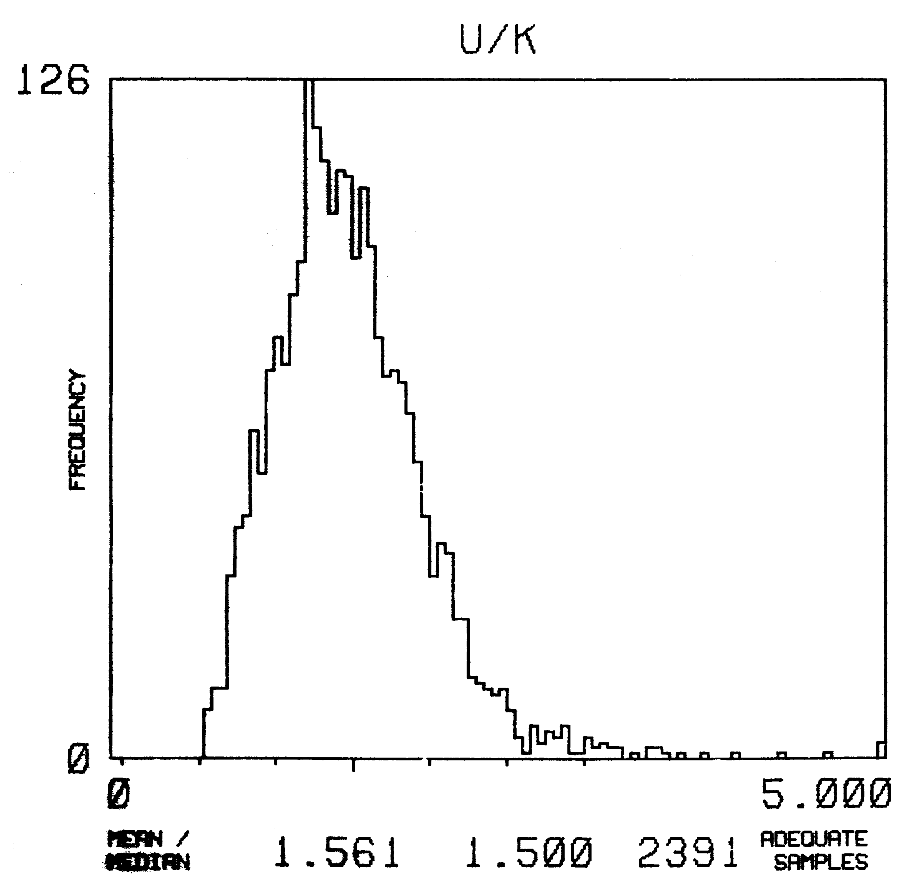
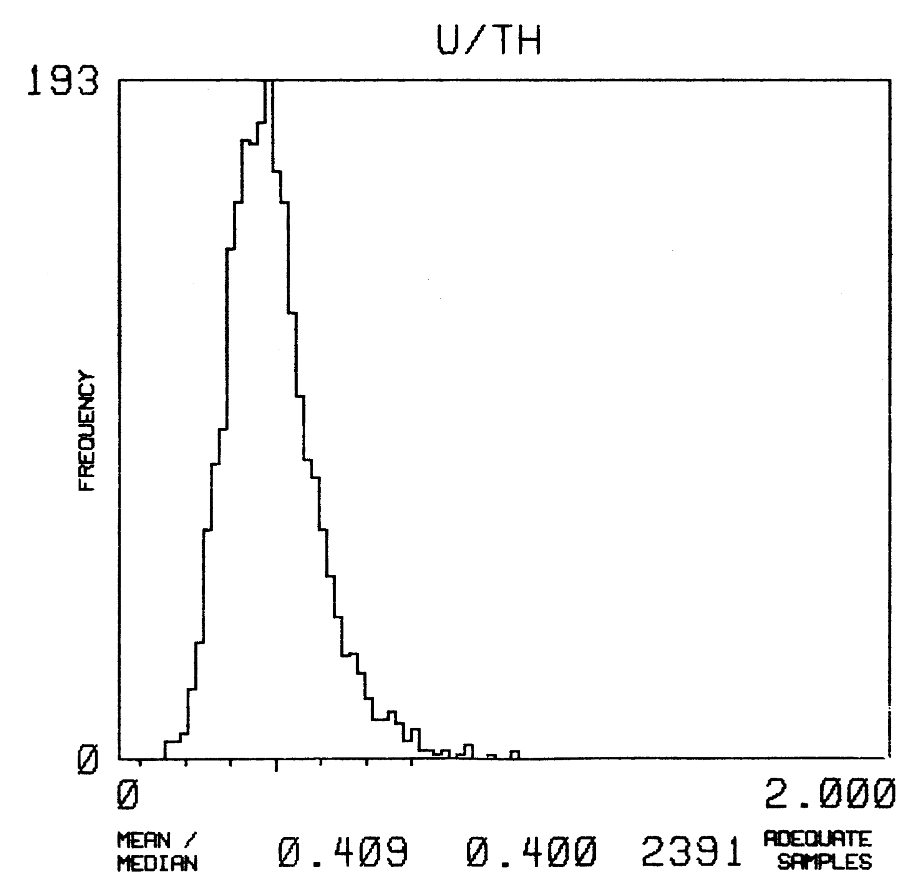
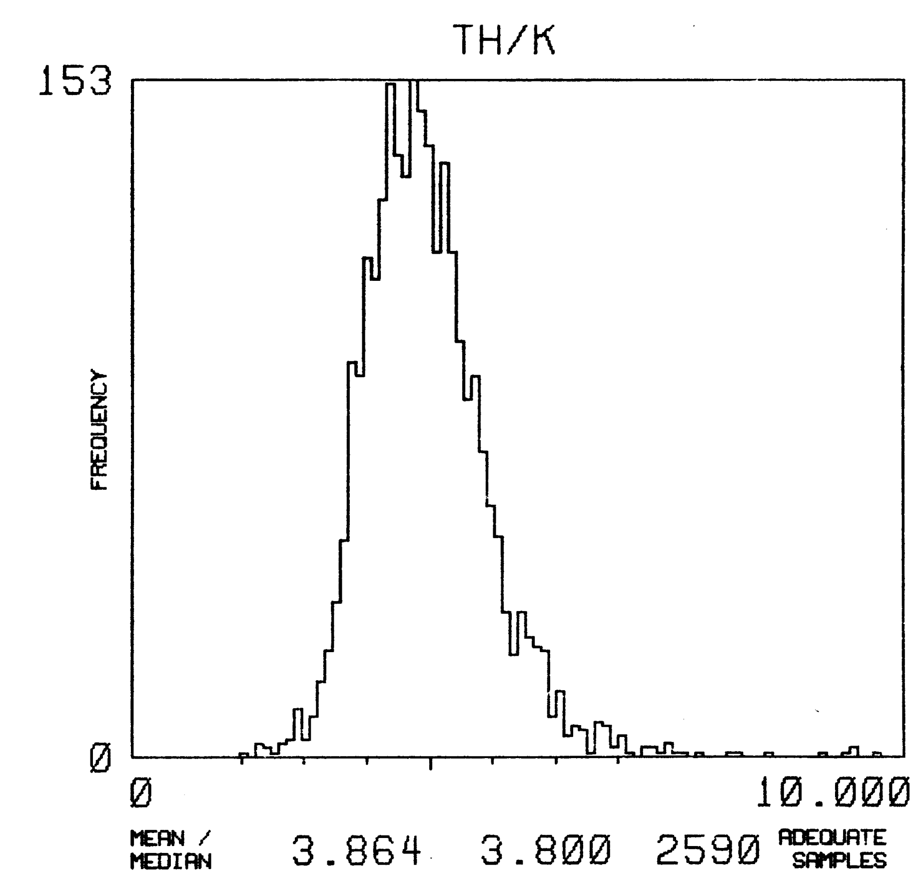




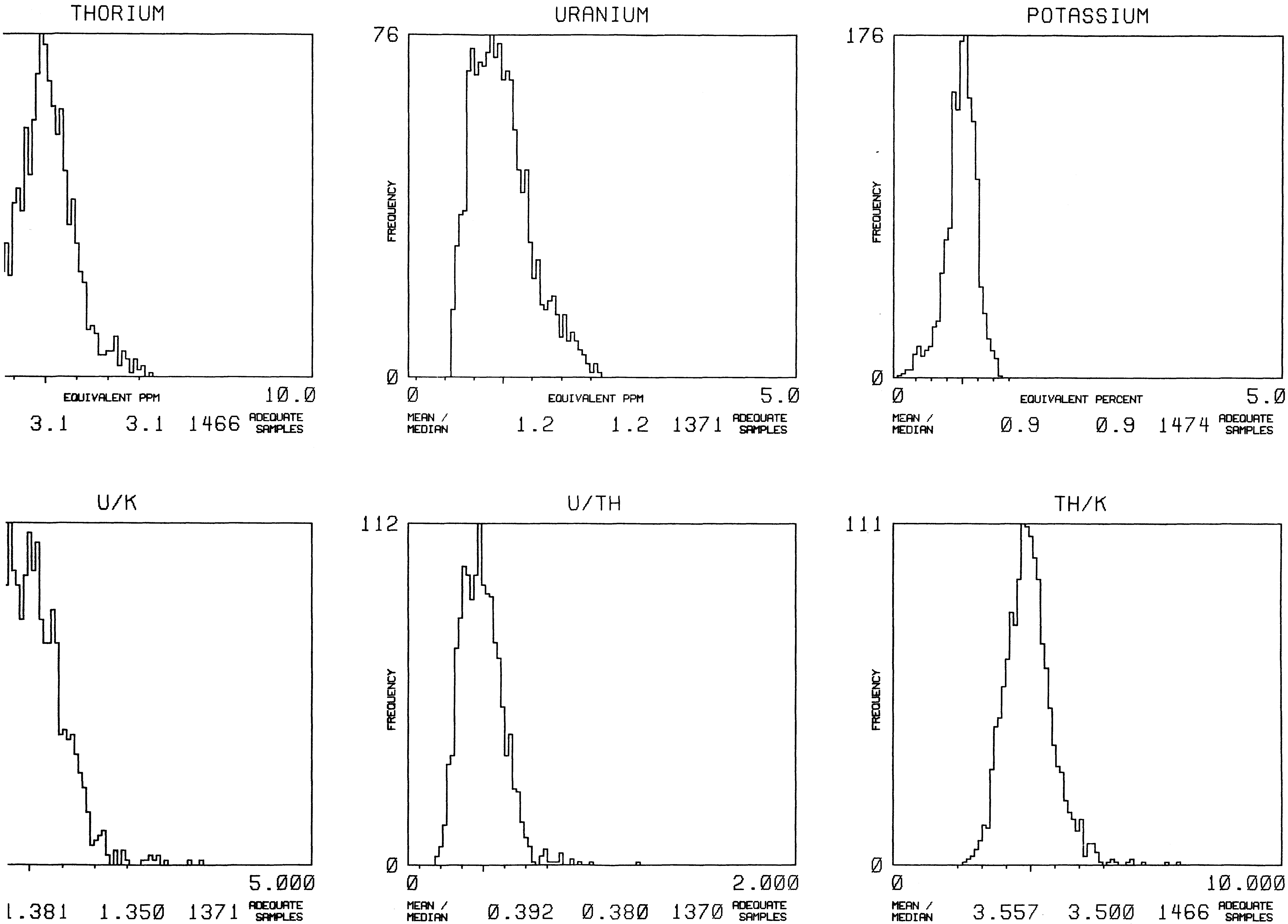








9 FORT WAYNE MAP UNIT : QGK TOTAL NUMBER OF SAMPLES 1476 F10fw



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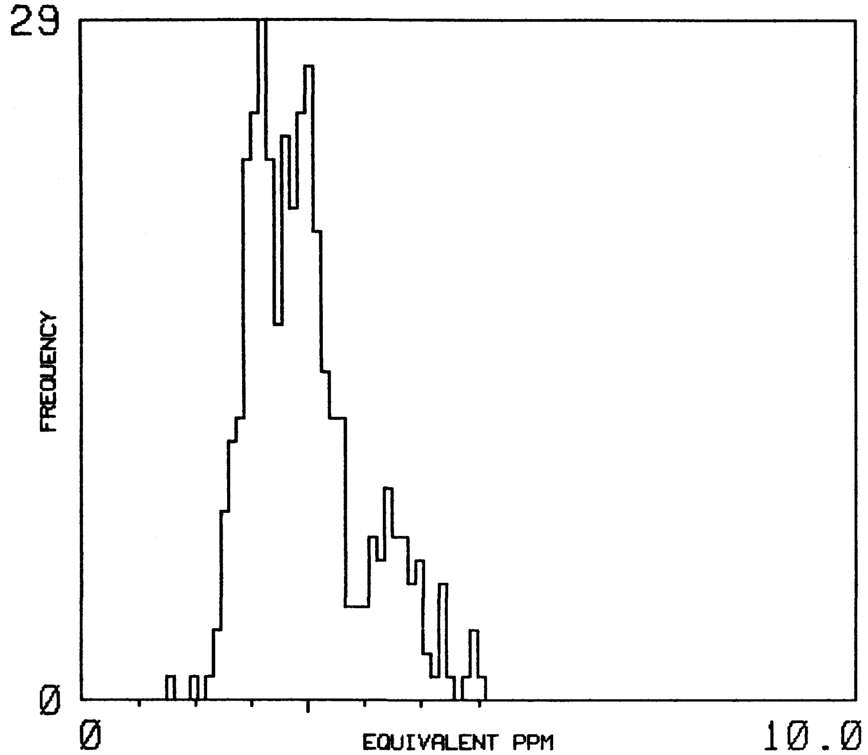
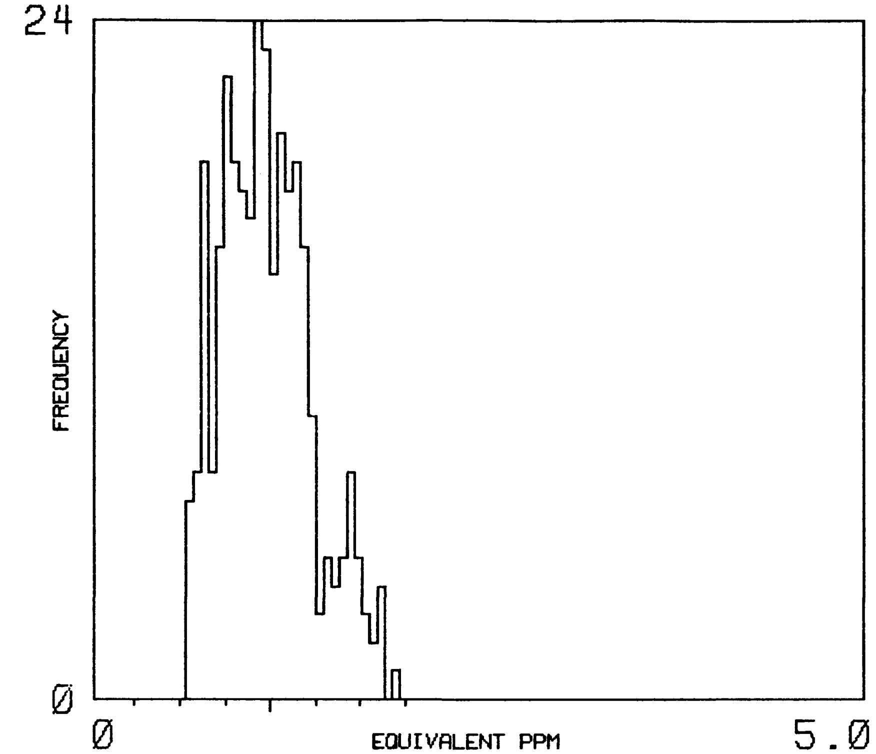


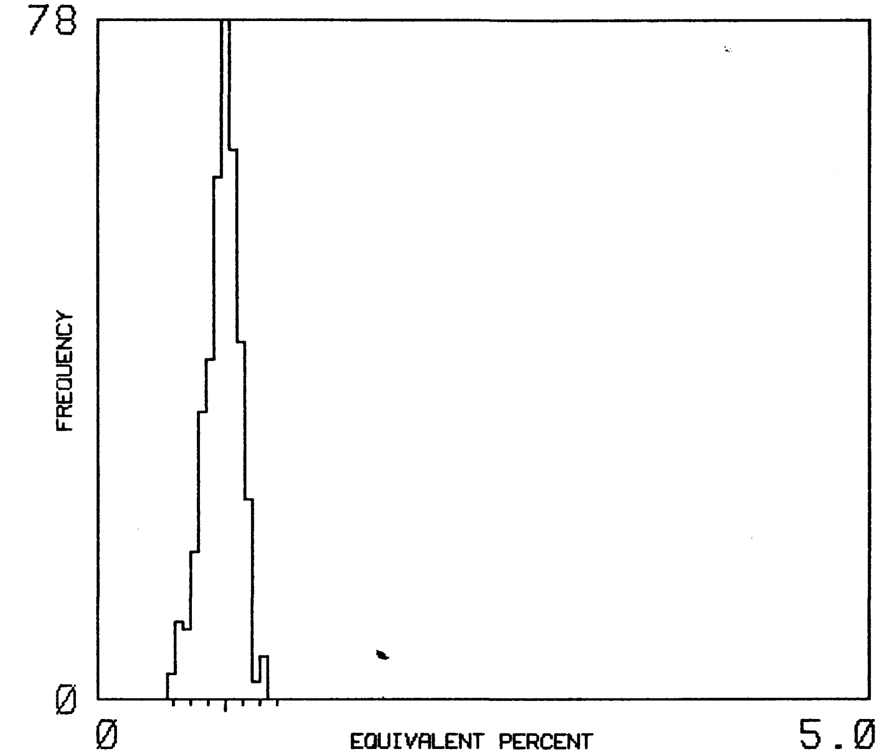
MEAN / MEDIAN 2.9 2.8 381 ADEQUATE SAMPLES

URANIUM



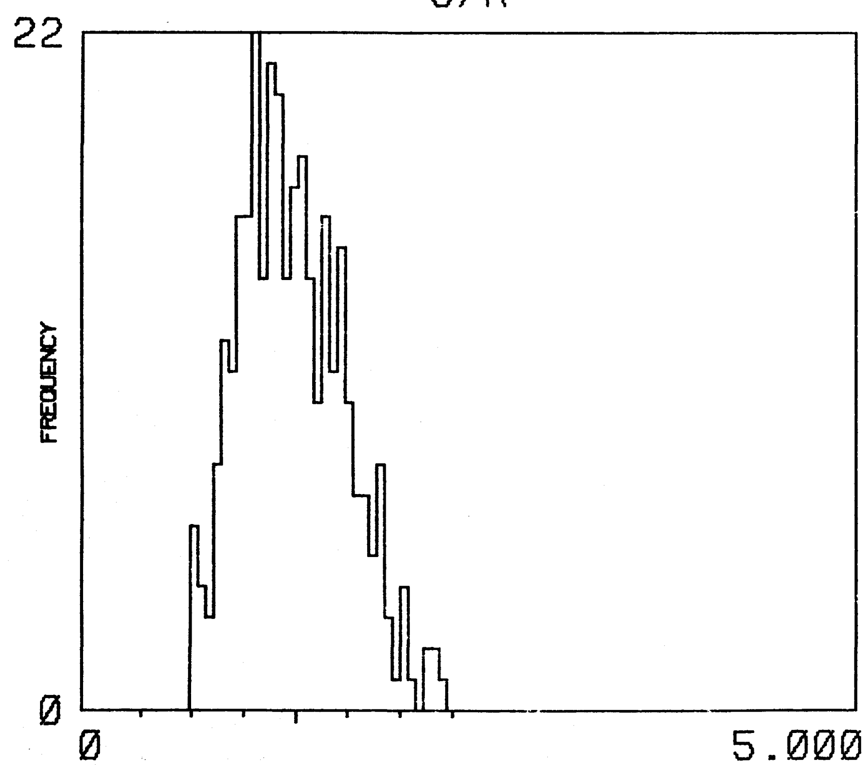
MEAN / MEDIAN 1.2 1.1 319 ADEQUATE SAMPLES

POTASSIUM



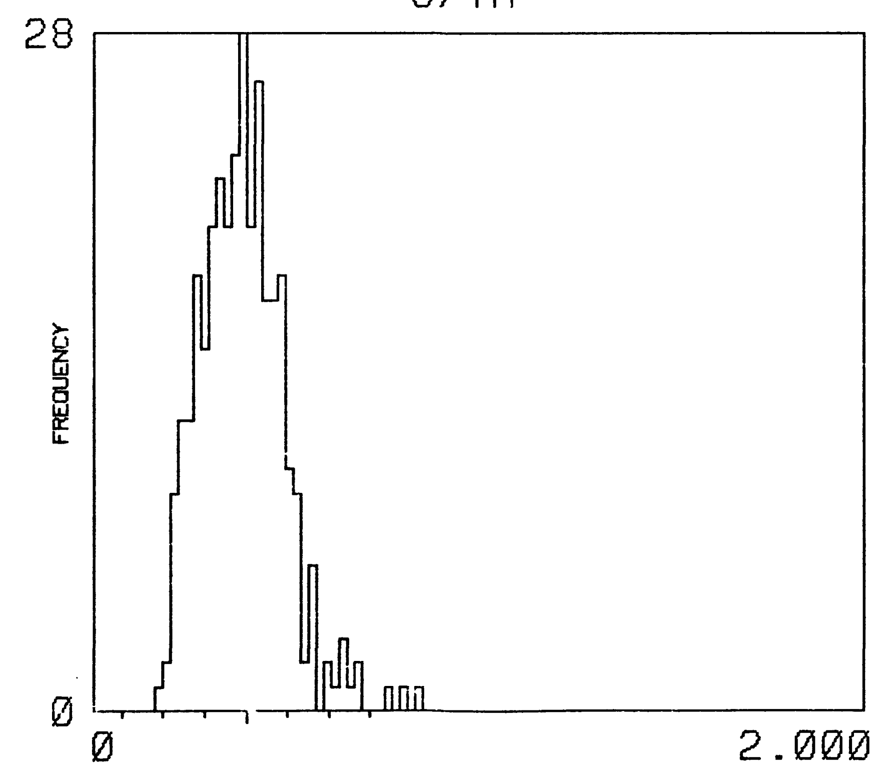
MEAN / MEDIAN 0.8 0.8 381 ADEQUATE SAMPLES

U/K



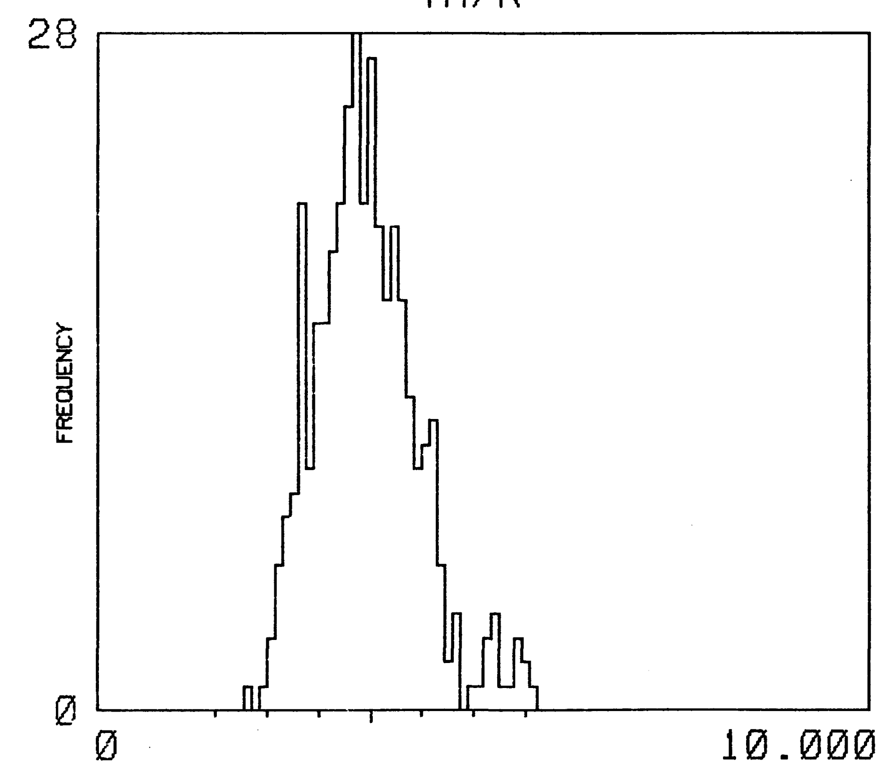
MEAN / MEDIAN 1.384 1.350 319 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.398 0.400 319 ADEQUATE SAMPLES

TH/K

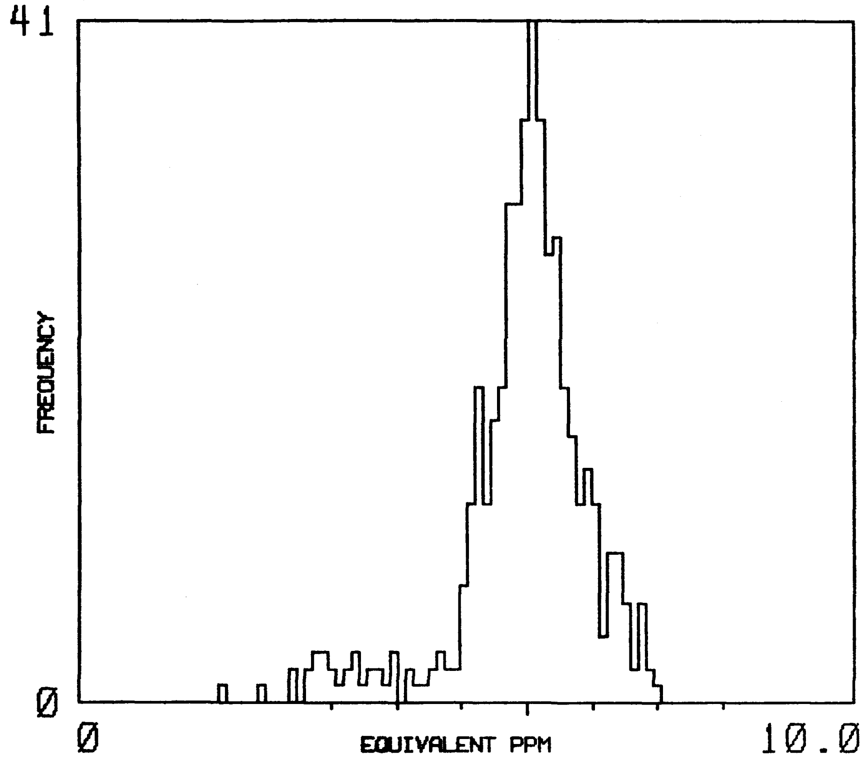


MEAN / MEDIAN 3.538 3.500 381 ADEQUATE SAMPLES

NK 16-9 FORT WAYNE

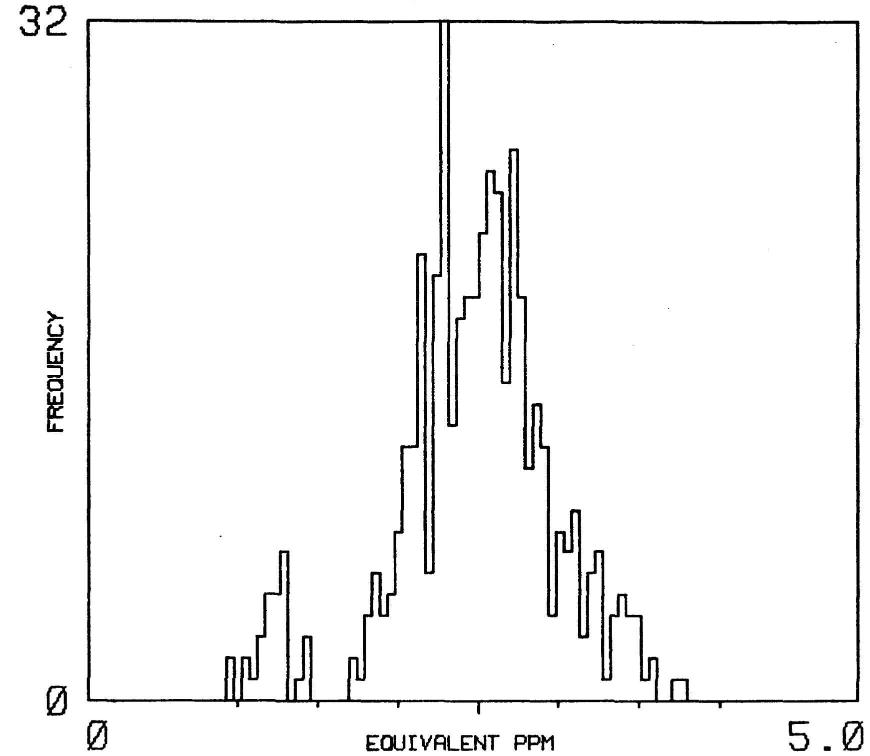
MAP UNIT : QTS TOTAL NUMBER OF SAMPLES 466

THORIUM



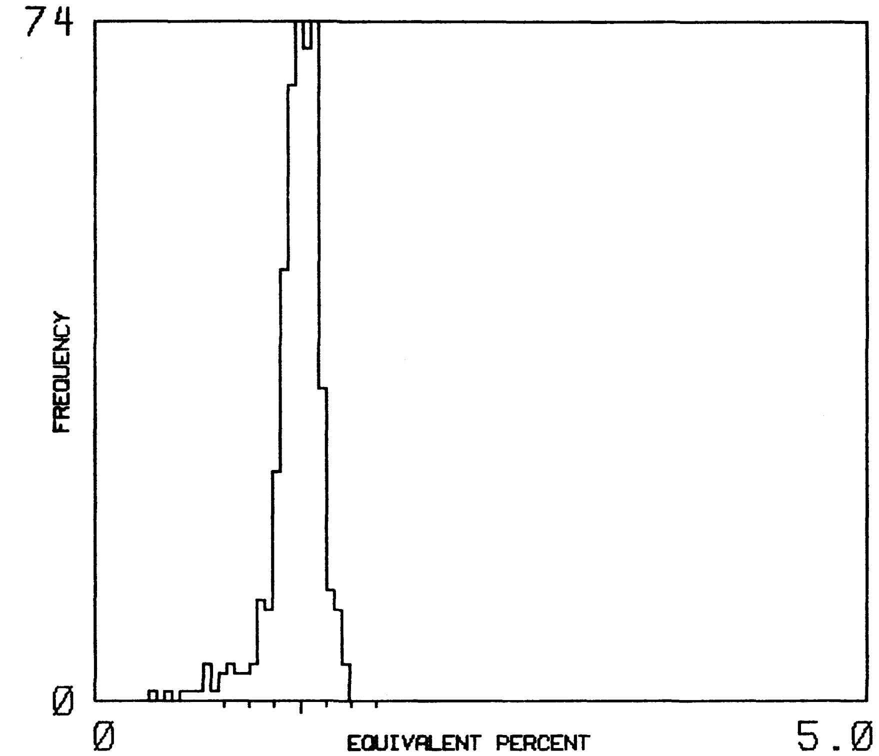
MEAN / MEDIAN 5.8 5.9 466 ADEQUATE SAMPLES

URANIUM



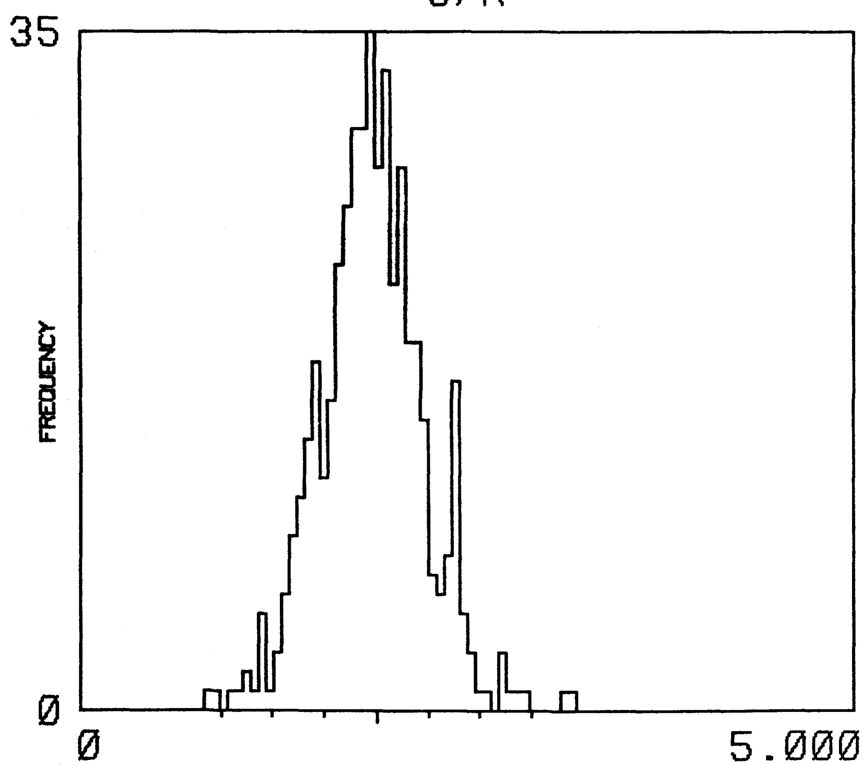
MEAN / MEDIAN 2.5 2.6 466 ADEQUATE SAMPLES

POTASSIUM



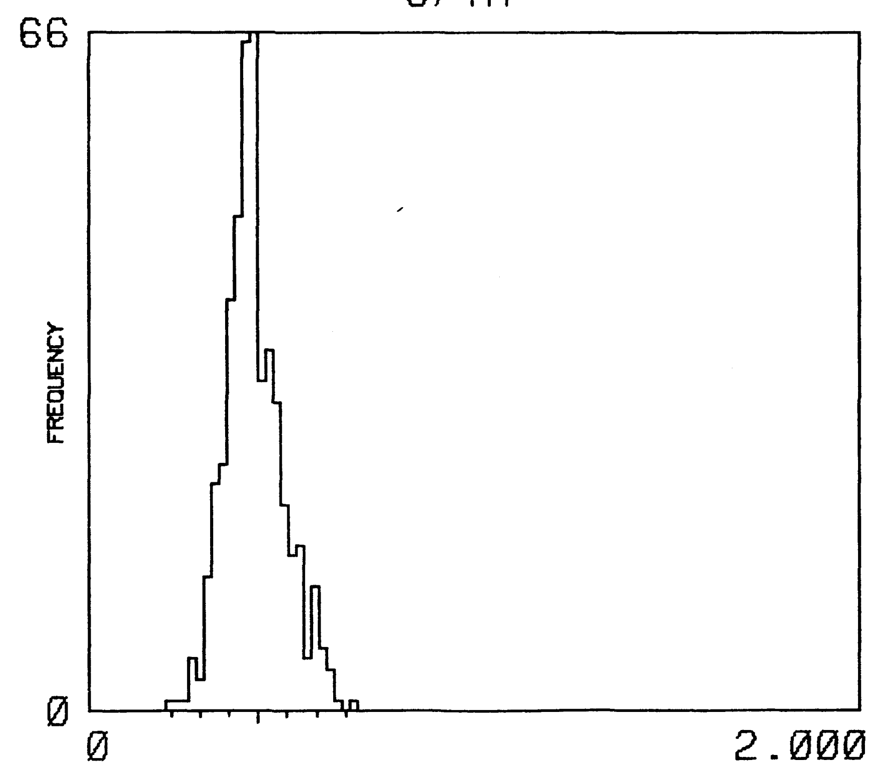
MEAN / MEDIAN 1.3 1.3 466 ADEQUATE SAMPLES

U/K



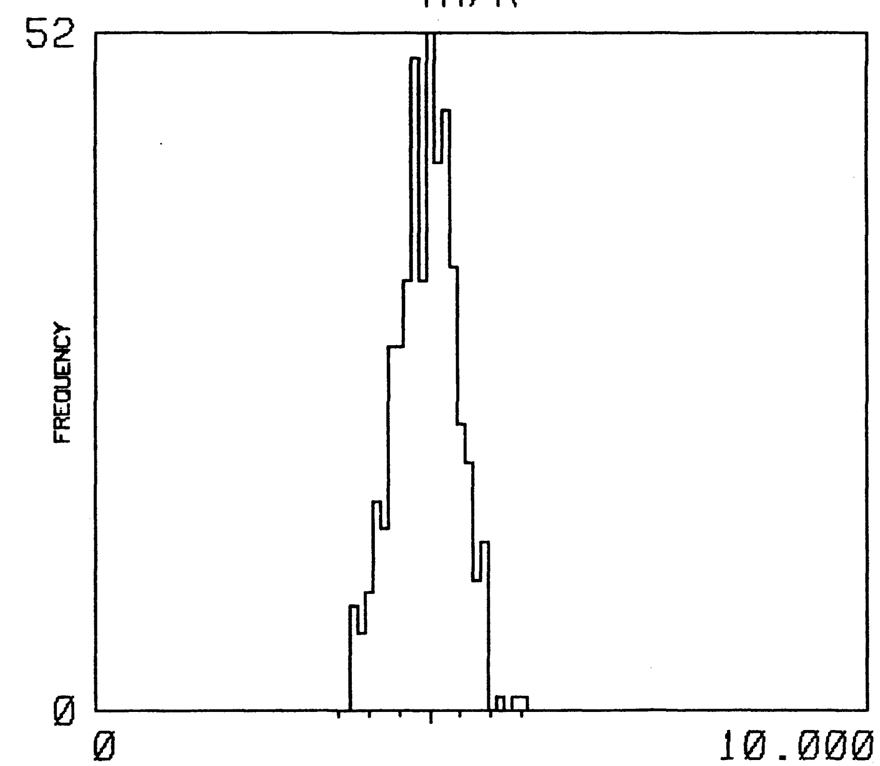
MEAN / MEDIAN 1.910 1.900 466 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.442 0.440 466 ADEQUATE SAMPLES

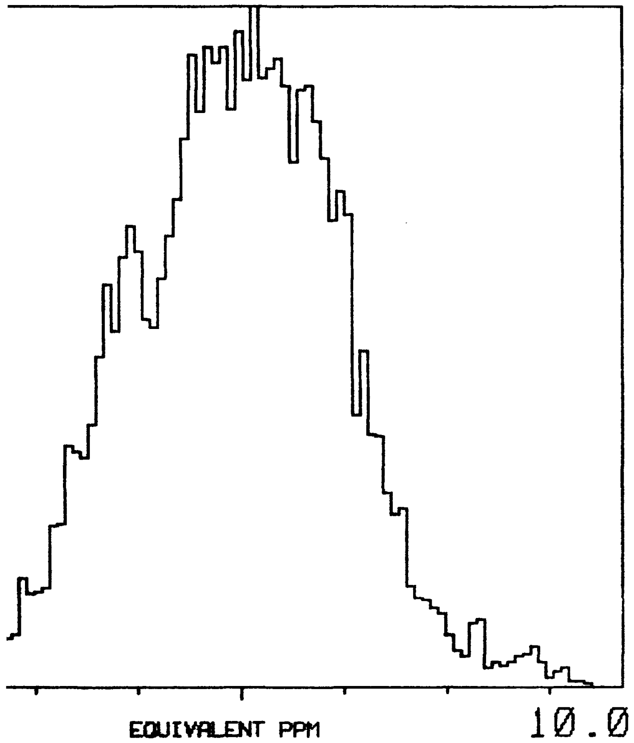
TH/K



MEAN / MEDIAN 4.339 4.400 466 ADEQUATE SAMPLES

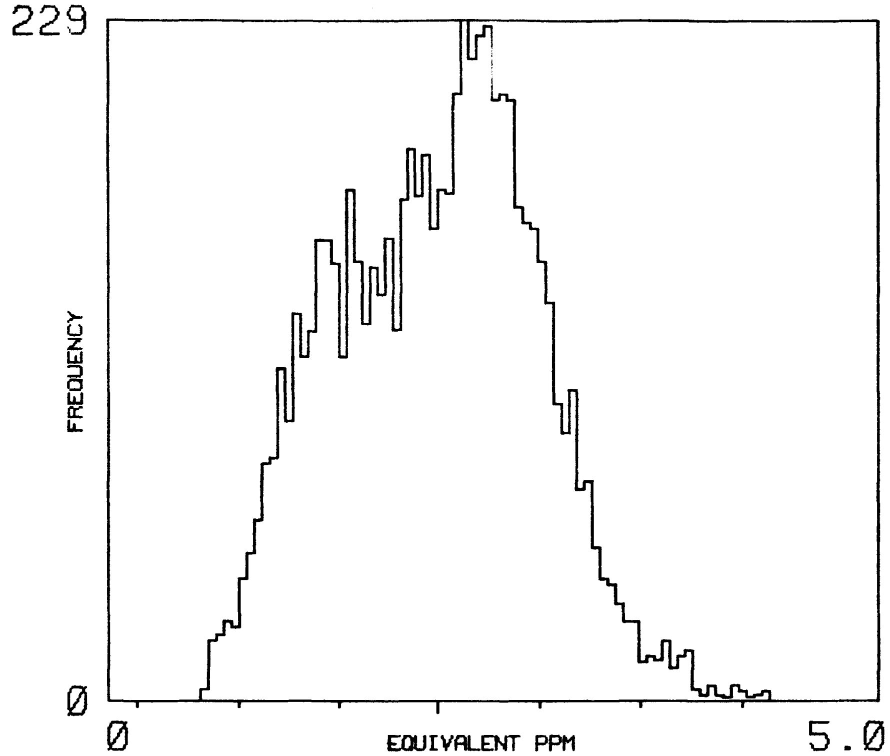
MAP UNIT : QT TOTAL NUMBER OF SAMPLES 7081

THORIUM



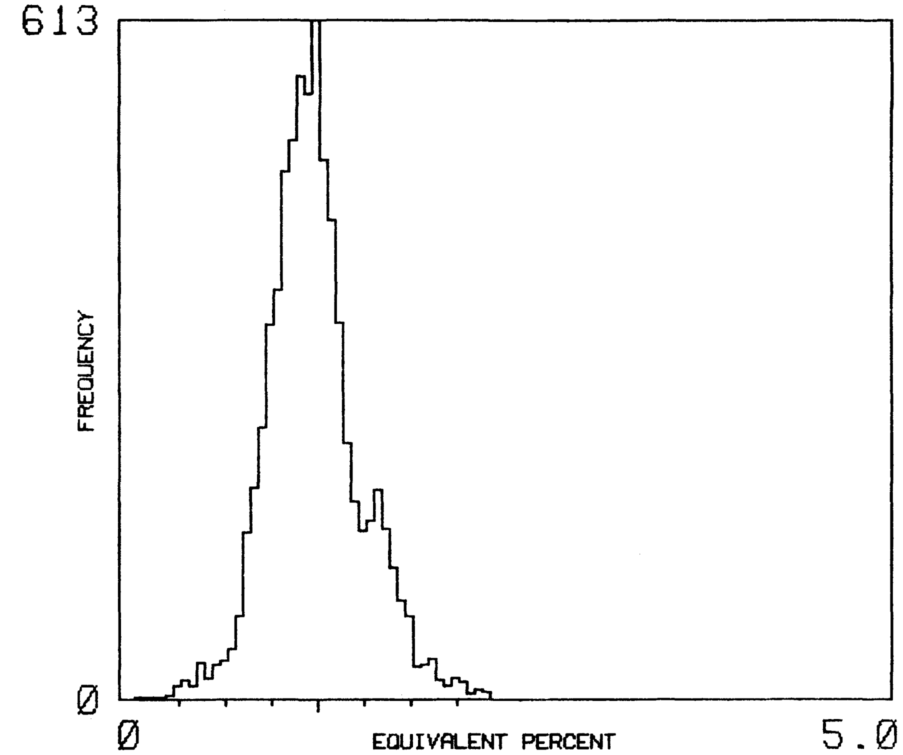
5.1 5.1 7080 ADEQUATE SAMPLES

URANIUM



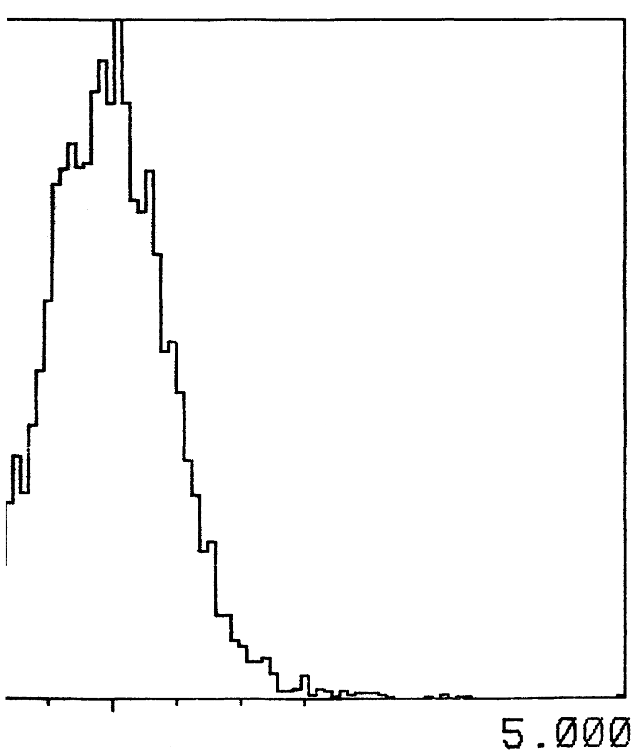
MEAN / MEDIAN 2.2 2.2 7051 ADEQUATE SAMPLES

POTASSIUM



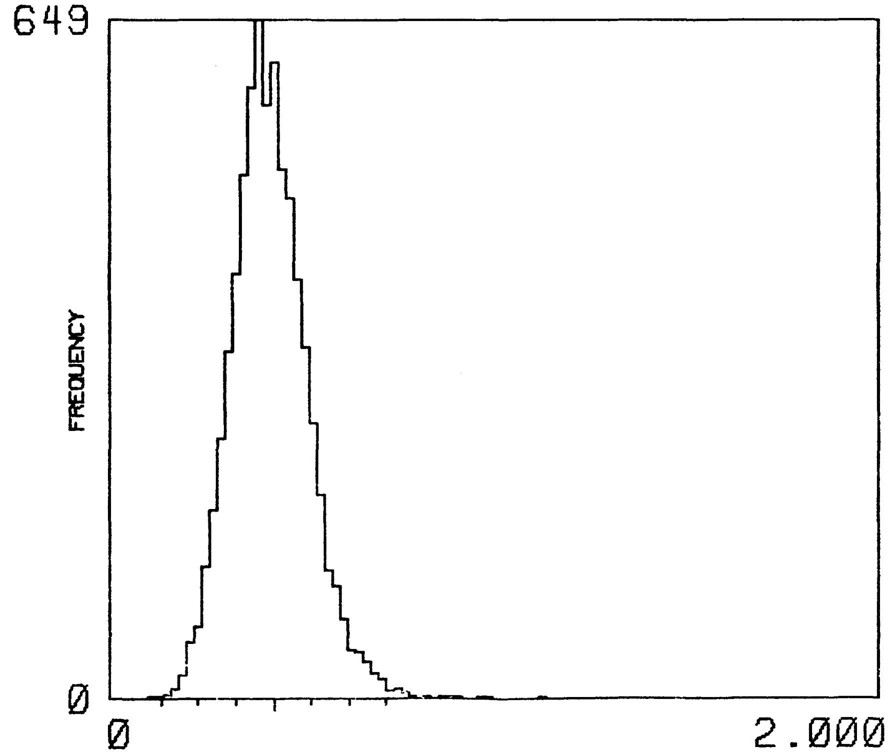
MEAN / MEDIAN 1.3 1.2 7081 ADEQUATE SAMPLES

U/K



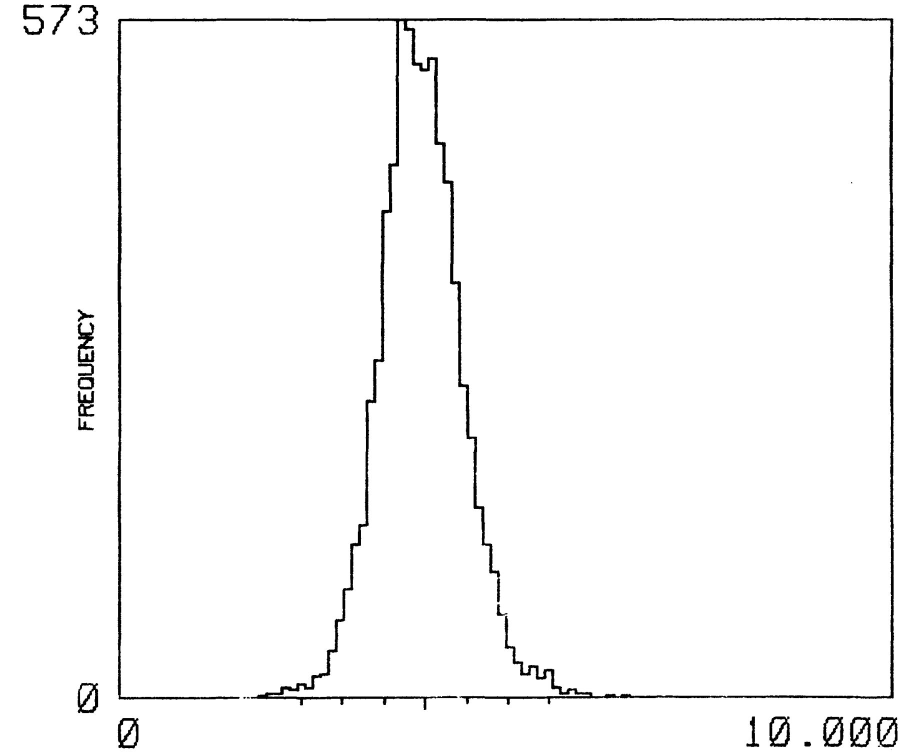
1.685 1.650 7051 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.428 0.420 7051 ADEQUATE SAMPLES

TH/K



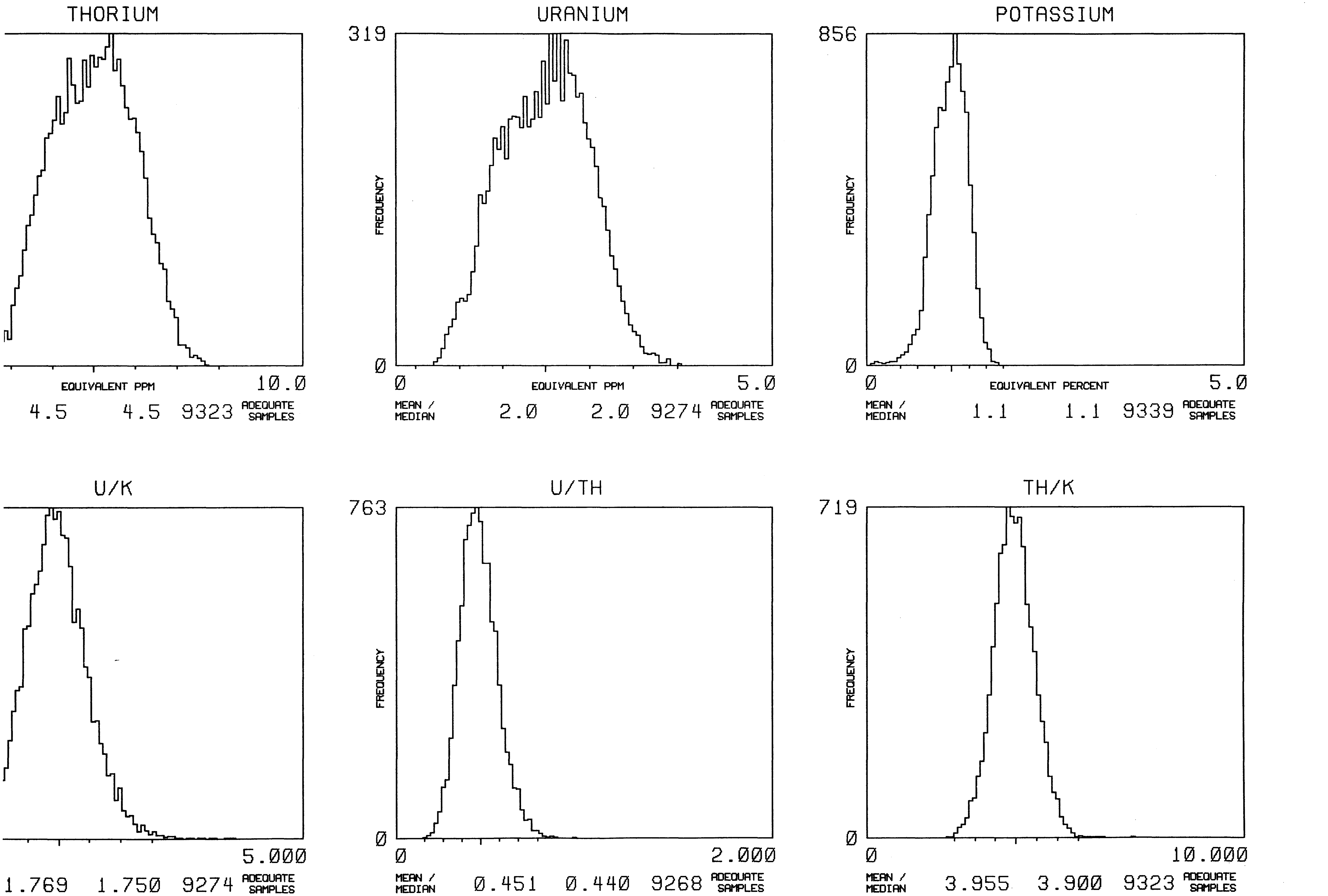
MEAN / MEDIAN 3.955 3.900 7080 ADEQUATE SAMPLES

3 FORT WAYNE

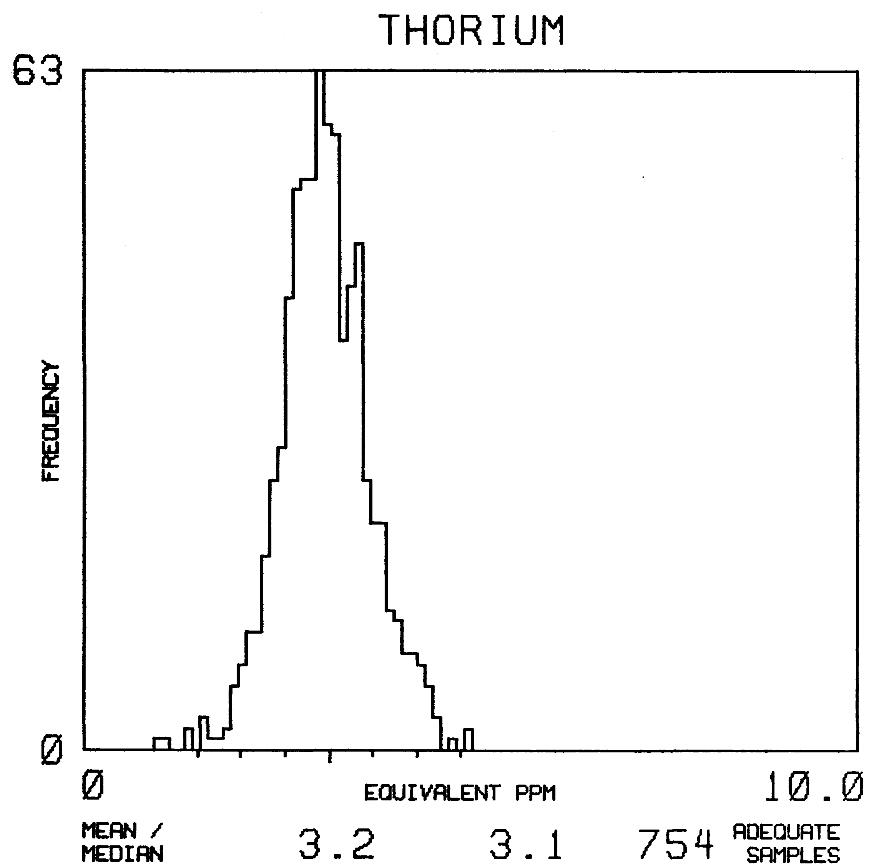
MAP UNIT : QTE

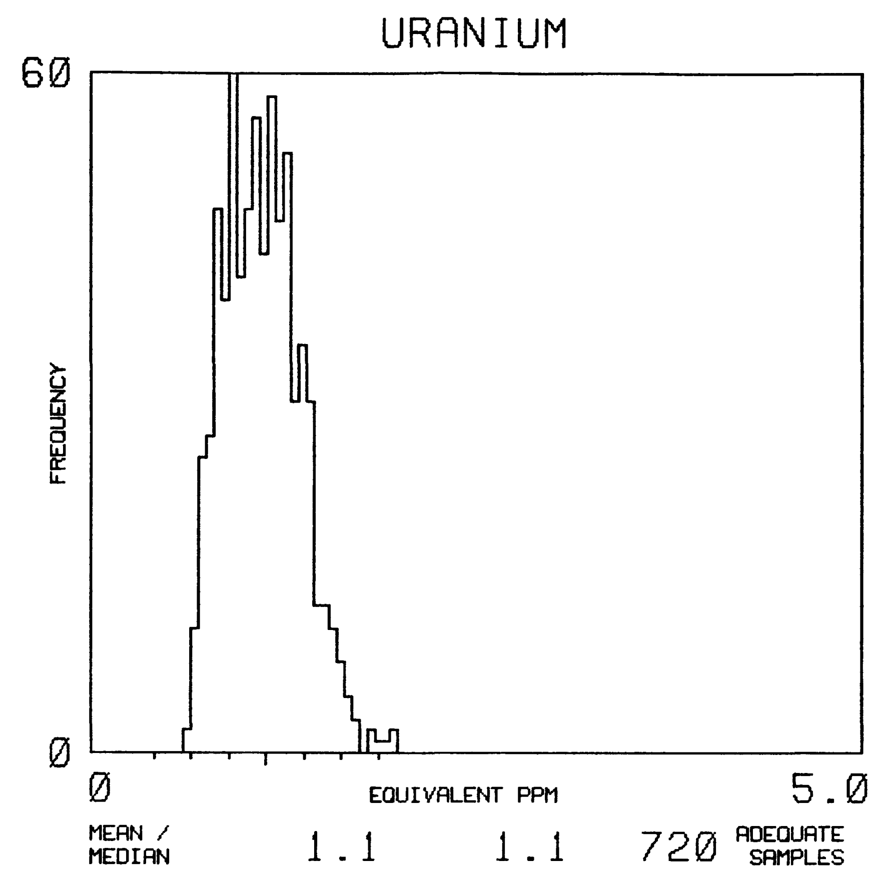
TOTAL NUMBER OF SAMPLES 9561

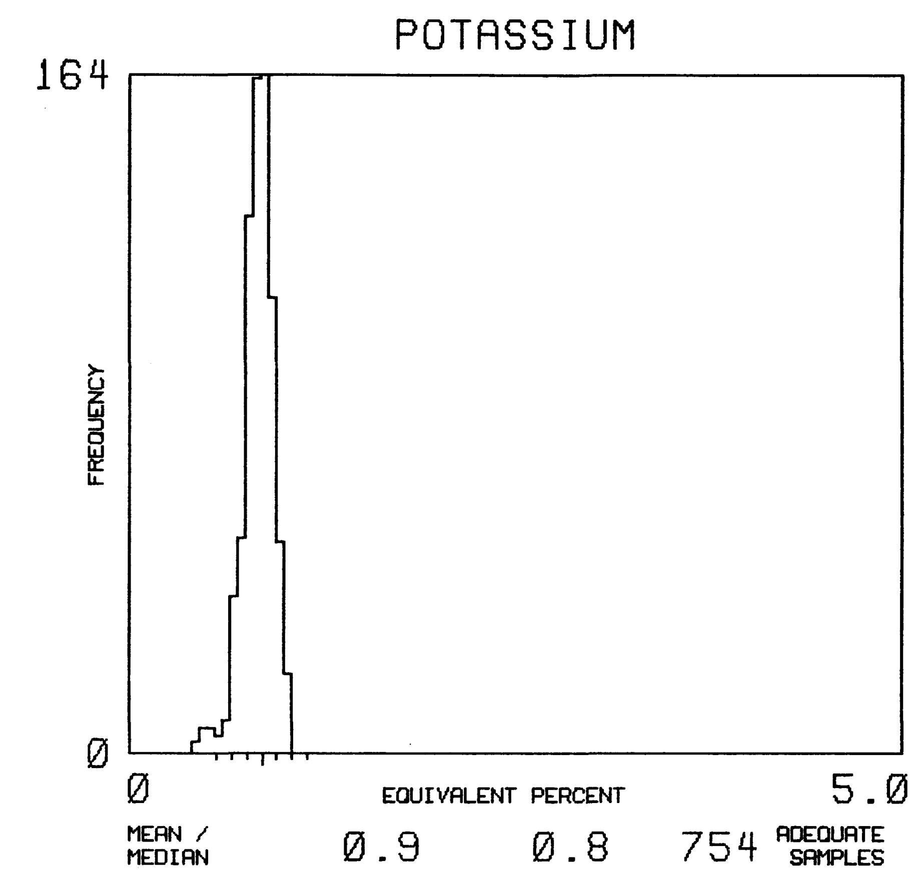
F14 fw

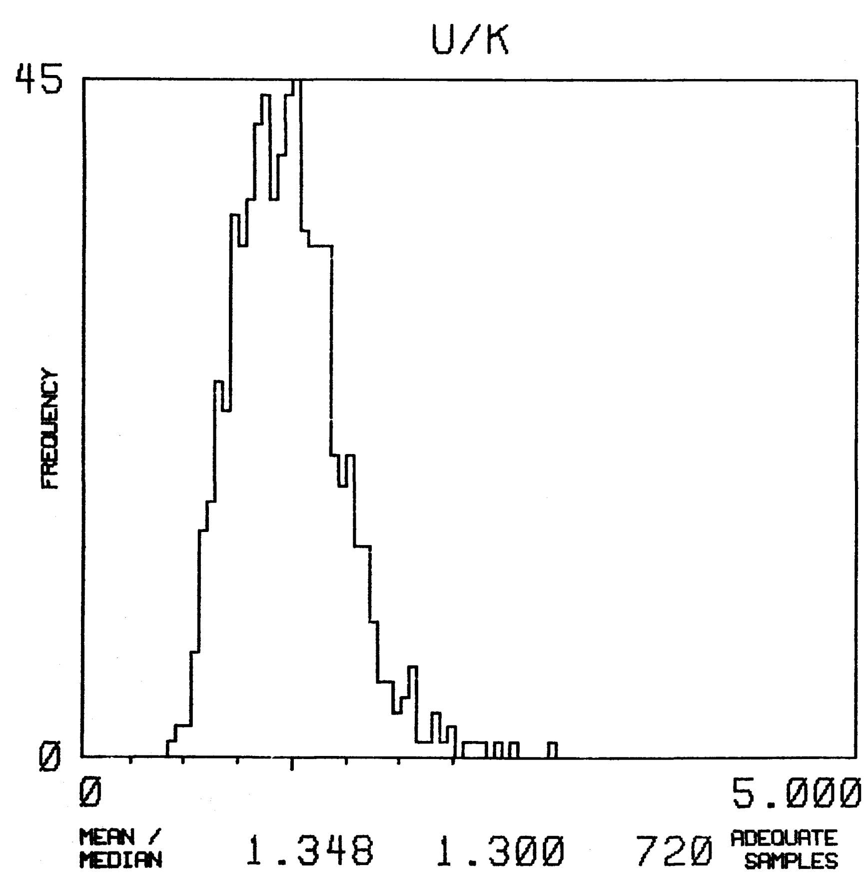


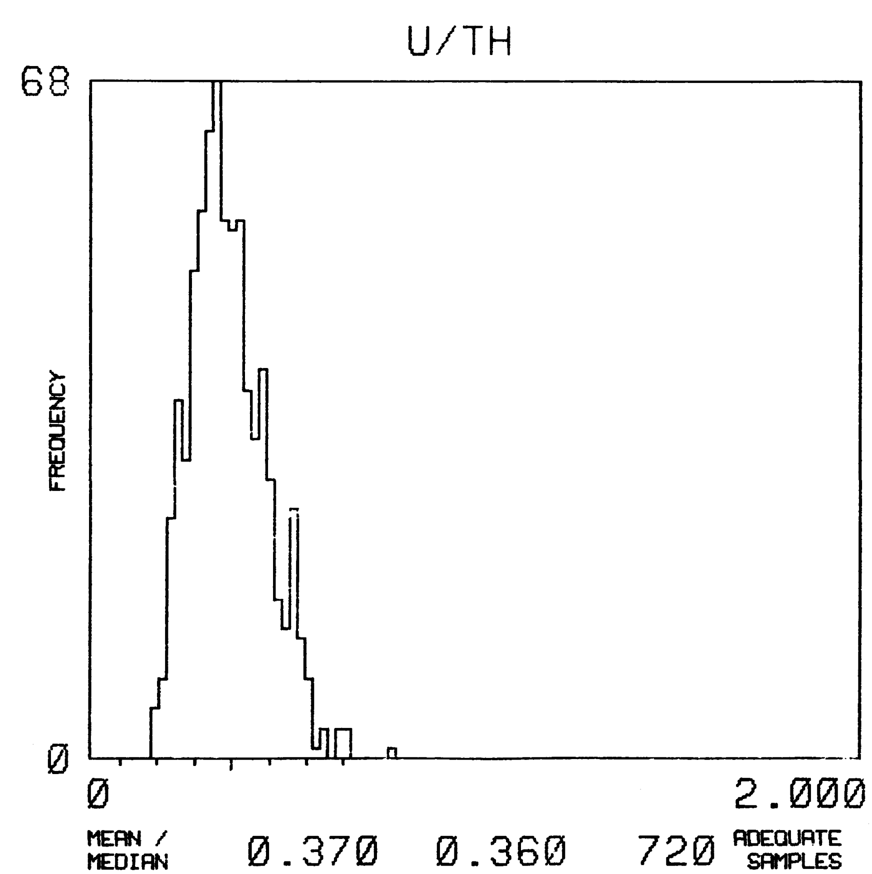
NK 16-9 FORT WAYNE MAP UNIT : QTD TOTAL NUMBER OF SAMPLES 754 F15fw

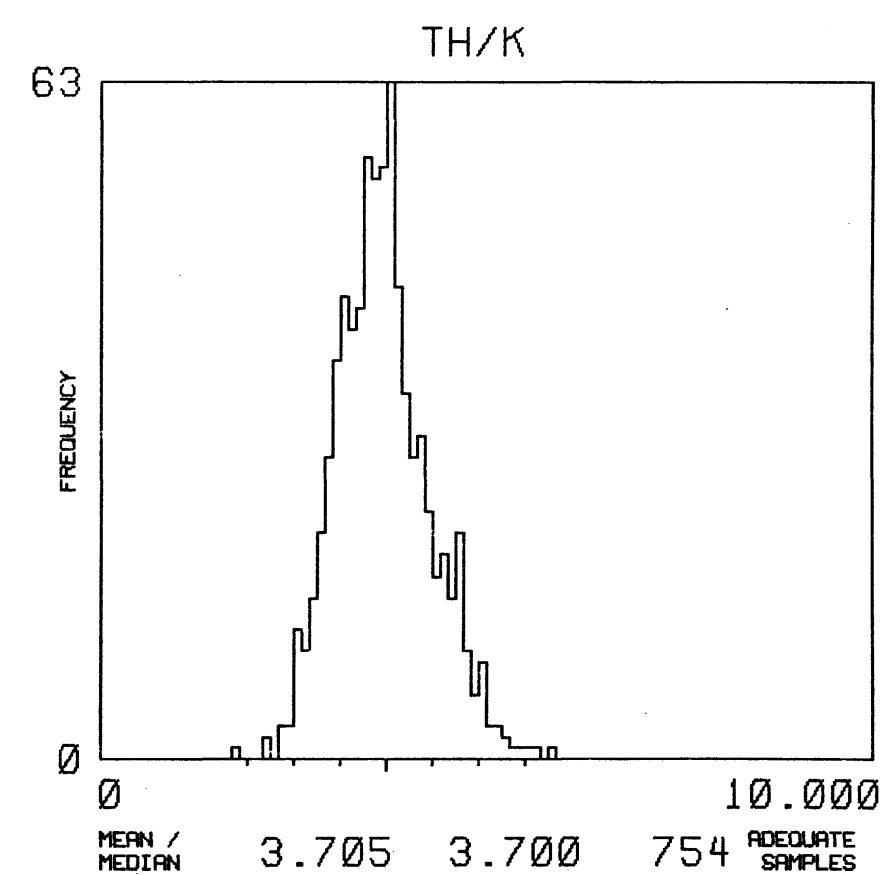




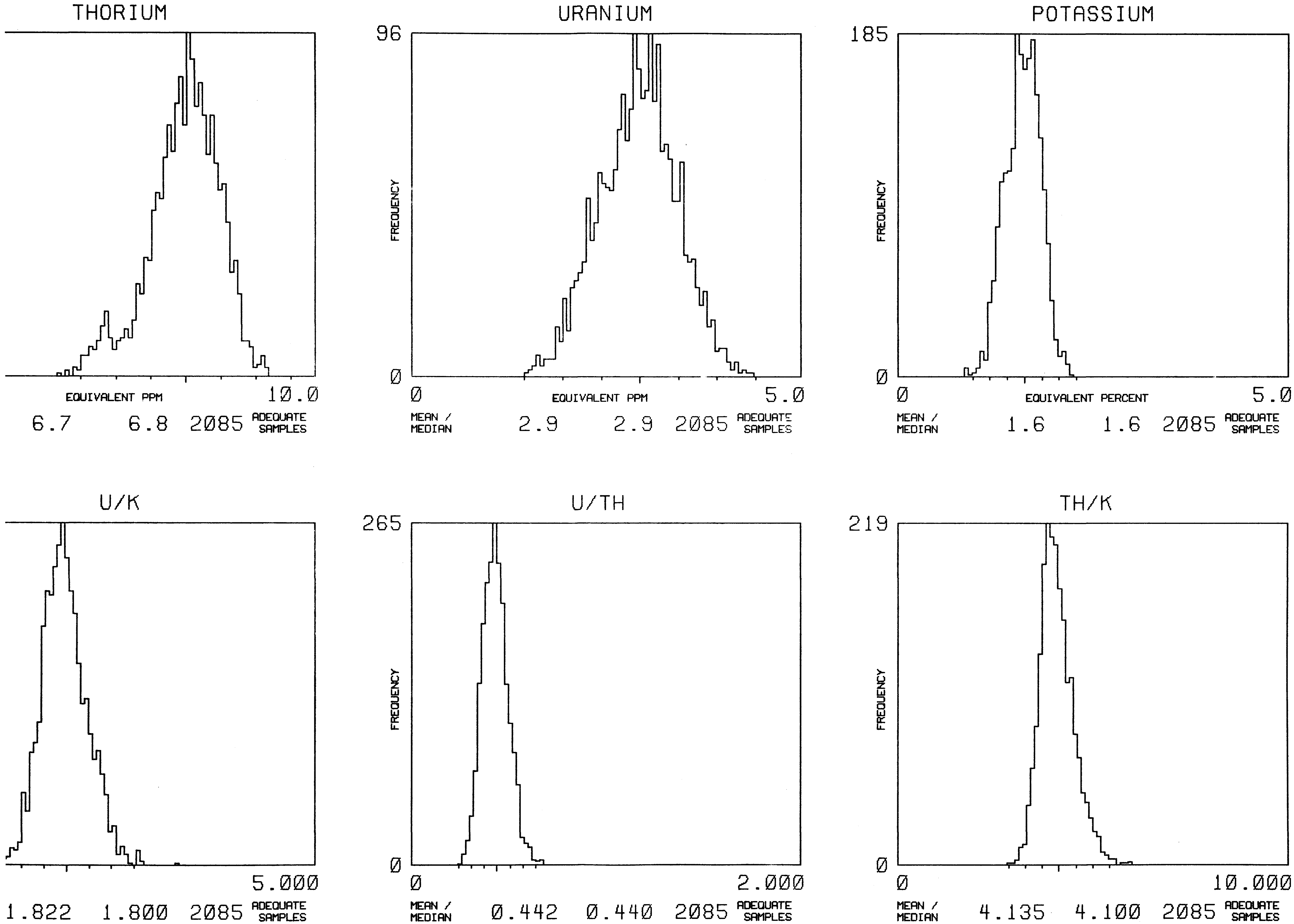


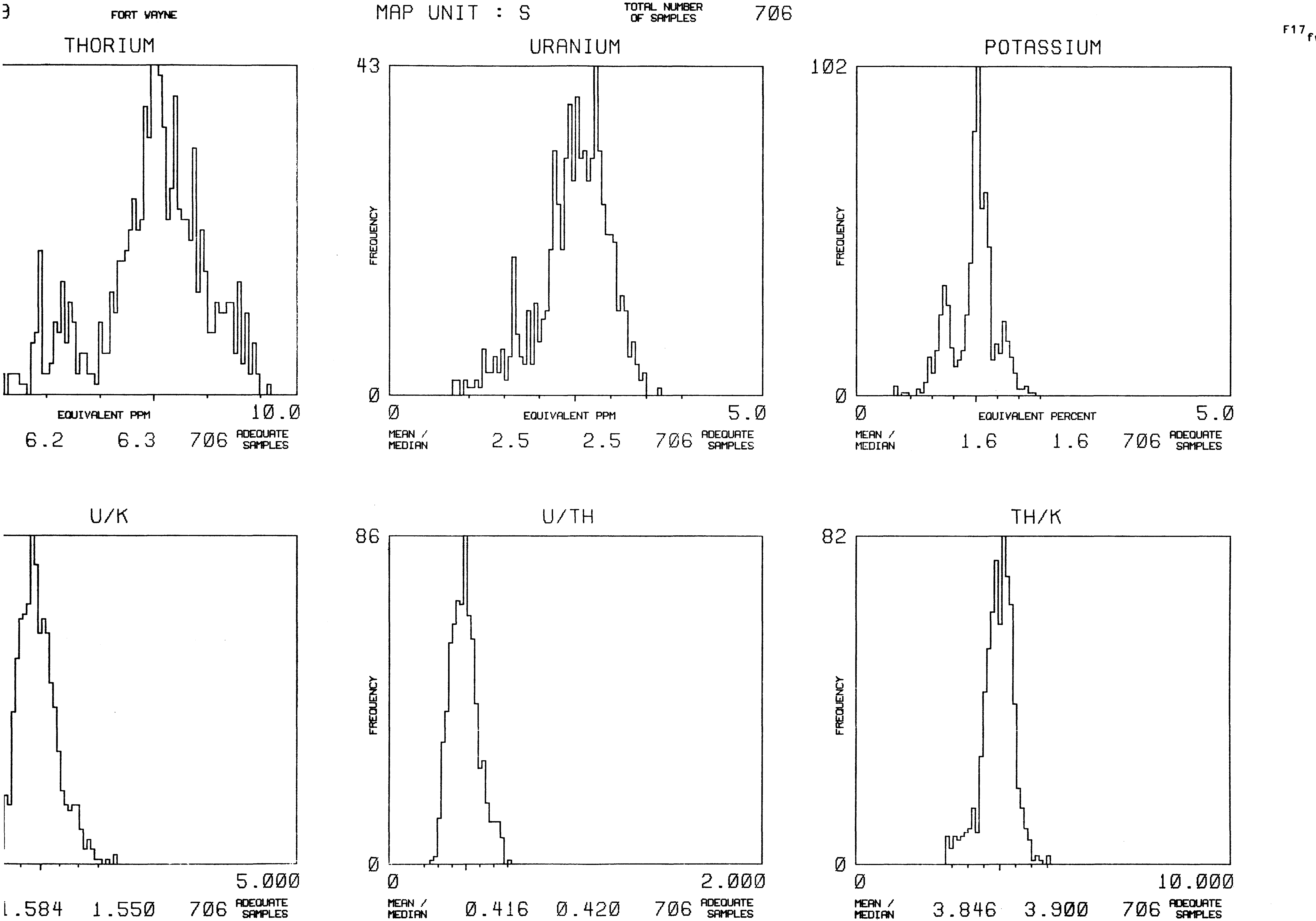






9 FORT WAYNE MAP UNIT : QTL TOTAL NUMBER OF SAMPLES 2085 F16fw




9
FORT WAYNE
MAP UNIT : S
TOTAL NUMBER OF SAMPLES
706
F17fw
THORIUM
EQUIVALENT PPM
10.0
6.2
6.3
706
ADEQUATE SAMPLES
URANIUM
43
FREQUENCY
0
0
EQUIVALENT PPM
5.0
MEAN / MEDIAN
2.5
2.5
706
ADEQUATE SAMPLES
POTASSIUM
102
FREQUENCY
0
0
EQUIVALENT PERCENT
5.0
MEAN / MEDIAN
1.6
1.6
706
ADEQUATE SAMPLES
U/K
5.000
1.584
1.550
706
ADEQUATE SAMPLES
U/TH
86
FREQUENCY
0
0
2.000
MEAN / MEDIAN
0.416
0.420
706
ADEQUATE SAMPLES
TH/K
82
FREQUENCY
0
0
10.000
MEAN / MEDIAN
3.846
3.900
706
ADEQUATE SAMPLES

FORT WAYNE QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
* QM	Qm
QSA	Qsa
QMP	Qmp
QGM	Qgm
QSD	Qsd
QSB	Qsb
QCL	Qcl
QSL	Qsl
QGV	Qgv
QGP	Qgp
QGK	Qgk
QGT	Qgt
QTS	Qts
QT	Qt
QTE	Qte
QTD	Qtd
QTL	Qtl
S	S

NOTES:

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

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

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

* No statistical analysis was performed due to an inadequate number of samples.

APPENDIX G - Uranium Anomaly Summary and Statistical Tables

ANOMALY SUMMARY TABLE

ANOMALY		FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT				PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF : 1	2	3	4	5	6	7	GT7
1	C	370	QTD	/ 2	/ 0	/ 0	1.6	0	2	0	0	0	0	0	0
2	C	370	QTD	/ 1	/ 0	/ 0	1.7	0	0	1	0	0	0	0	0
3	C	370	QTE	/ 3QT	/ 5	/ 0	2.9	7	1	0	0	0	0	0	0
4	C	410	QGK	/ 2	/ 0	/ 0	2.0	0	2	0	0	0	0	0	0
5	C	410	QGV	/ 2	/ 0	/ 0	2.3	0	2	0	0	0	0	0	0
6	C	430	QGV	/ 2QGP	/ 1	/ 0	2.2	2	1	0	0	0	0	0	0
7	C	430	QT	/ 2QGV	/ 1	/ 0	2.7	2	1	0	0	0	0	0	0
8	C	440	QTE	/ 4QSD	/ 2	/ 0	3.3	2	4	0	0	0	0	0	0
9	C	440	QGV	/ 1	/ 0	/ 0	3.4	0	0	0	1	0	0	0	0
10	C	440	QGV	/ 2QTE	/ 5	/ 0	3.3	5	2	0	0	0	0	0	0
11	C	450	QGP	/ 1	/ 0	/ 0	2.4	0	0	1	0	0	0	0	0
12	C	450	QTE	/ 4	/ 0	/ 0	2.9	3	1	0	0	0	0	0	0
13	C	450	QMP	/ 2	/ 0	/ 0	3.4	0	1	1	0	0	0	0	0
14	C	450	QTE	/ 5	/ 0	/ 0	3.2	0	5	0	0	0	0	0	0
15	C	450	QTE	/ 5	/ 0	/ 0	3.0	4	1	0	0	0	0	0	0
16	C	450	QTE	/ 2QGV	/ 2QT	/ 2	3.4	3	2	1	0	0	0	0	0
17	C	450	QT	/ 2	/ 0	/ 0	3.5	0	2	0	0	0	0	0	0
18	C	460	QTE	/ 7	/ 0	/ 0	3.2	6	1	0	0	0	0	0	0
19	C	460	QTE	/ 4	/ 0	/ 0	2.9	3	1	0	0	0	0	0	0
20	C	460	QMP	/ 1	/ 0	/ 0	3.2	0	0	1	0	0	0	0	0
21	C	460	QGV	/ 1	/ 0	/ 0	2.6	0	0	1	0	0	0	0	0
22	C	460	QTE	/ 3	/ 0	/ 0	3.1	2	1	0	0	0	0	0	0
23	C	460	QTE	/ 2	/ 0	/ 0	3.1	0	2	0	0	0	0	0	0
24	C	460	QTS	/ 4	/ 0	/ 0	3.7	3	1	0	0	0	0	0	0
25	C	460	QT	/ 3	/ 0	/ 0	3.5	1	2	0	0	0	0	0	0
26	C	470	QTE	/ 5QGV	/ 2	/ 0	3.0	4	2	1	0	0	0	0	0
27	C	470	QGV	/ 3	/ 0	/ 0	2.4	1	2	0	0	0	0	0	0
28	C	470	QTE	/ 2	/ 0	/ 0	3.6	0	1	1	0	0	0	0	0
29	C	470	QTE	/ 9	/ 0	/ 0	3.3	5	4	0	0	0	0	0	0
30	C	470	QGV	/ 2QSA	/ 6QT	/ 5	3.1	12	0	1	0	0	0	0	0
31	C	470	QT	/ 2QTE	/ 1	/ 0	3.4	1	2	0	0	0	0	0	0
32	C	470	QTE	/ 3QGV	/ 1	/ 0	3.5	1	1	2	0	0	0	0	0
33	C	470	QGV	/ 4	/ 0	/ 0	3.0	2	1	1	0	0	0	0	0
34	C	470	QMP	/ 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
35	C	470	QGV	/ 2	/ 0	/ 0	2.5	0	1	1	0	0	0	0	0
36	C	470	QGV	/ 2	/ 0	/ 0	2.7	0	1	1	0	0	0	0	0
37	C	470	QTL	/ 3	/ 0	/ 0	3.7	2	1	0	0	0	0	0	0
38	C	470	QTL	/ 5	/ 0	/ 0	4.2	2	2	1	0	0	0	0	0
39	C	470	QTL	/ 1	/ 0	/ 0	4.2	0	0	1	0	0	0	0	0
40	C	470	QTL	/ 4	/ 0	/ 0	4.1	3	1	0	0	0	0	0	0
41	C	470	QCL	/ 3	/ 0	/ 0	4.2	1	1	1	0	0	0	0	0
42	C	470	QCL	/ 3	/ 0	/ 0	3.6	2	1	0	0	0	0	0	0
43	C	470	QCL	/ 2	/ 0	/ 0	3.7	0	2	0	0	0	0	0	0
44	C	470	QCL	/ 5	/ 0	/ 0	4.0	4	1	0	0	0	0	0	0
45	C	470	QT	/ 1	/ 0	/ 0	4.3	0	0	1	0	0	0	0	0
46	C	470	QT	/ 3	/ 0	/ 0	3.8	0	3	0	0	0	0	0	0
47	C	470	QSB	/ 1QTE	/ 3	/ 0	3.5	2	1	1	0	0	0	0	0
48	C	480	QTE	/ 2QGP	/ 2	/ 0	2.7	2	1	0	1	0	0	0	0
49	C	480	QGV	/ 1	/ 0	/ 0	2.8	0	0	1	0	0	0	0	0
50	C	480	QGV	/ 2	/ 0	/ 0	2.4	0	2	0	0	0	0	0	0

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT			PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF : 1	2	3	4	5	6	7	GT7
51 C	480	QGV / 5QT	/ 2	/ 0	3.2	1	3	3	0	0	0	0	0
52 C	480	QT / 3	/ 0	/ 0	3.1	2	1	0	0	0	0	0	0
53 C	480	QT / 2	/ 0	/ 0	3.6	0	2	0	0	0	0	0	0
54 C	480	QT / 4	/ 0	/ 0	3.4	3	1	0	0	0	0	0	0
55 C	480	QSA / 1	/ 0	/ 0	3.4	0	0	1	0	0	0	0	0
56 C	480	QTL / 1	/ 0	/ 0	4.2	0	0	1	0	0	0	0	0
57 C	480	QTL / 3	/ 0	/ 0	3.7	1	2	0	0	0	0	0	0
58 C	480	QTL / 1QCL	/ 1	/ 0	4.1	0	2	0	0	0	0	0	0
59 C	480	QCL / 1	/ 0	/ 0	4.2	0	0	1	0	0	0	0	0
60 C	480	QCL / 3	/ 0	/ 0	4.2	0	2	1	0	0	0	0	0
61 C	480	QCL / 4	/ 0	/ 0	4.1	1	2	1	0	0	0	0	0
62 C	480	QCL / 3	/ 0	/ 0	4.1	2	1	0	0	0	0	0	0
63 C	480	QCL / 3	/ 0	/ 0	3.9	0	3	0	0	0	0	0	0
64 C	480	QT / 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
65 C	1090	QGV / 1	/ 0	/ 0	3.2	0	0	0	1	0	0	0	0
66 C	1100	QMP / 1QSD	/ 2	/ 0	2.9	1	2	0	0	0	0	0	0
67 C	1110	QGV / 1	/ 0	/ 0	3.0	0	0	0	1	0	0	0	0
68 C	1110	QGV / 1	/ 0	/ 0	2.5	0	0	1	0	0	0	0	0
69 C	1110	QGK / 2	/ 0	/ 0	2.4	0	1	1	0	0	0	0	0
70 C	1110	QGK / 1	/ 0	/ 0	2.2	0	0	1	0	0	0	0	0
71 C	1120	QSL / 1QSB	/ 1QTE	/ 1	3.0	2	1	0	0	0	0	0	0
72 C	1120	QTD / 2	/ 0	/ 0	1.7	0	2	0	0	0	0	0	0
73 C	1130	QGV / 1	/ 0	/ 0	3.5	0	0	0	1	0	0	0	0
74 C	1130	QTE / 2QSB	/ 1	/ 0	3.1	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 QSA

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.1057	0.4116	0.7175	1.0234	1.3293	1.6352	1.9411
URANIUM DIST NORMAL	0.1857	0.7608	1.3359	1.9110	2.4861	3.0612	3.6363
THORIUM DIST NORMAL	-0.1187	1.2413	2.6013	3.9613	5.3213	6.6813	8.0413
U/K DIST NORMAL	0.4559	0.9277	1.3995	1.8713	2.3431	2.8149	3.2867
U/TH DIST NORMAL	0.0952	0.2275	0.3598	0.4921	0.6244	0.7567	0.8890
TH/K DIST NORMAL	2.1846	2.7420	3.2994	3.8568	4.4142	4.9716	5.5290

MAP UNIT QMP

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	-0.2083	0.1064	0.4211	0.7358	1.0505	1.3652	1.6799
URANIUM DIST NORMAL	-0.4042	0.2273	0.8588	1.4903	2.1218	2.7533	3.3848
THORIUM DIST NORMAL	-0.9335	0.3499	1.6333	2.9167	4.2001	5.4835	6.7669
U/K DIST NORMAL	-0.1345	0.5583	1.2511	1.9439	2.6367	3.3295	4.0223
U/TH DIST NORMAL	0.0696	0.2105	0.3514	0.4923	0.6332	0.7741	0.9150
TH/K DIST NORMAL	1.3998	2.2580	3.1162	3.9744	4.8326	5.6908	6.5490

MAP UNIT QGM

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.1565	0.3862	0.6159	0.8456	1.0753	1.3050	1.5347
URANIUM DIST NORMAL	0.3400	0.7690	1.1980	1.6270	2.0560	2.4850	2.9140
THORIUM DIST NORMAL	2.4042	2.8578	3.3114	3.7650	4.2186	4.6722	5.1258
U/K DIST NORMAL	0.7218	1.1435	1.5652	1.9869	2.4086	2.8303	3.2520
U/TH DIST NORMAL	0.1877	0.2679	0.3481	0.4283	0.5085	0.5887	0.6689
TH/K DIST NORMAL	0.8528	2.1540	3.4552	4.7564	6.0576	7.3588	8.6600

MAP UNIT QSD

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.2938	0.5261	0.7584	0.9907	1.2230	1.4553	1.6876
URANIUM DIST NORMAL	-0.3347	0.3635	1.0617	1.7599	2.4581	3.1563	3.8545
THORIUM DIST NORMAL	-0.4136	0.9368	2.2872	3.6376	4.9880	6.3384	7.6888
U/K DIST NORMAL	0.2168	0.6982	1.1796	1.6610	2.1424	2.6238	3.1052
U/TH DIST NORMAL	0.1299	0.2373	0.3447	0.4521	0.5595	0.6669	0.7743
TH/K DIST NORMAL	1.2139	2.0050	2.7961	3.5872	4.3783	5.1694	5.9605

MAP UNIT QSB

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5446	0.7660	0.9874	1.2088	1.4302	1.6516	1.8730
URANIUM DIST NORMAL	0.1812	0.7693	1.3574	1.9455	2.5336	3.1217	3.7098
THORIUM DIST NORMAL	-0.0476	1.4180	2.8836	4.3492	5.8148	7.2804	8.7460
U/K DIST NORMAL	0.5636	0.9059	1.2482	1.5905	1.9328	2.2751	2.6174
U/TH DIST NORMAL	0.1604	0.2610	0.3616	0.4622	0.5628	0.6634	0.7640
TH/K DIST NORMAL	1.1941	1.9696	2.7451	3.5206	4.2961	5.0716	5.8471

MAP UNIT QCL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.8041	1.1099	1.4157	1.7215	2.0273	2.3331	2.6389
URANIUM DIST NORMAL	1.1986	1.7293	2.2600	2.7907	3.3214	3.8521	4.3828
THORIUM DIST NORMAL	3.3339	4.5933	5.8527	7.1121	8.3715	9.6309	10.8903
U/K DIST NORMAL	0.7115	1.0232	1.3349	1.6466	1.9583	2.2700	2.5817
U/TH DIST NORMAL	0.1683	0.2453	0.3223	0.3993	0.4763	0.5533	0.6303
TH/K DIST NORMAL	2.8210	3.2641	3.7072	4.1503	4.5934	5.0365	5.4796

MAP UNIT QSL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3688	0.6611	0.9534	1.2457	1.5380	1.8303	2.1226
URANIUM DIST NORMAL	0.2148	0.7704	1.3260	1.8816	2.4372	2.9928	3.5484
THORIUM DIST NORMAL	-0.1802	1.4212	3.0226	4.6240	6.2254	7.8268	9.4282
U/K DIST NORMAL	0.4589	0.8127	1.1665	1.5203	1.8741	2.2279	2.5817
U/TH DIST NORMAL	0.1108	0.2156	0.3204	0.4252	0.5300	0.6348	0.7396
TH/K DIST NORMAL	1.6698	2.3277	2.9856	3.6435	4.3014	4.9593	5.6172

MAP UNIT QGV

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.1501	0.3817	0.6133	0.8449	1.0765	1.3081	1.5397
URANIUM DIST NORMAL	-0.0951	0.3797	0.8545	1.3293	1.8041	2.2789	2.7537
THORIUM DIST NORMAL	0.1804	1.1543	2.1282	3.1021	4.0760	5.0499	6.0238
U/K DIST NORMAL	-0.0565	0.4819	1.0203	1.5587	2.0971	2.6355	3.1739
U/TH DIST NORMAL	0.0441	0.1717	0.2993	0.4269	0.5545	0.6821	0.8097
TH/K DIST NORMAL	1.4501	2.1967	2.9433	3.6899	4.4365	5.1831	5.9297

MAP UNIT QGP

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.2587	0.4661	0.6735	0.8809	1.0883	1.2957	1.5031
URANIUM DIST NORMAL	0.2165	0.5948	0.9731	1.3514	1.7297	2.1080	2.4863
THORIUM DIST NORMAL	0.6831	1.5721	2.4611	3.3501	4.2391	5.1281	6.0171
U/K DIST NORMAL	0.0783	0.5727	1.0671	1.5615	2.0559	2.5503	3.0447
U/TH DIST NORMAL	0.0562	0.1737	0.2912	0.4087	0.5262	0.6437	0.7612
TH/K DIST NORMAL	1.4169	2.2326	3.0483	3.8640	4.6797	5.4954	6.3111

MAP UNIT QGK

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.2843	0.4855	0.6867	0.8879	1.0891	1.2903	1.4915
URANIUM DIST NORMAL	0.0955	0.4728	0.8501	1.2274	1.6047	1.9820	2.3593
THORIUM DIST NORMAL	0.7375	1.5400	2.3425	3.1450	3.9475	4.7500	5.5525
U/K DIST NORMAL	0.1403	0.5538	0.9673	1.3808	1.7943	2.2078	2.6213
U/TH DIST NORMAL	0.0622	0.1720	0.2818	0.3916	0.5014	0.6112	0.7210
TH/K DIST NORMAL	1.6868	2.3102	2.9336	3.5570	4.1804	4.8038	5.4272

MAP UNIT QGT

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4877	0.6006	0.7135	0.8264	0.9393	1.0522	1.1651
URANIUM DIST NORMAL	0.2675	0.5627	0.8579	1.1531	1.4483	1.7435	2.0387
THORIUM DIST NORMAL	0.7425	1.4712	2.1999	2.9286	3.6573	4.3860	5.1147
U/K DIST NORMAL	0.3833	0.7167	1.0501	1.3835	1.7169	2.0503	2.3837
U/TH DIST NORMAL	0.0742	0.1821	0.2900	0.3979	0.5058	0.6137	0.7216
TH/K DIST NORMAL	1.5266	2.1970	2.8674	3.5378	4.2082	4.8786	5.5490

MAP UNIT QTS

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.8355	1.0013	1.1671	1.3329	1.4987	1.6645	1.8303
URANIUM DIST NORMAL	0.9752	1.4984	2.0216	2.5448	3.0680	3.5912	4.1144
THORIUM DIST NORMAL	3.2540	4.0954	4.9368	5.7782	6.6196	7.4610	8.3024
U/K DIST NORMAL	0.9082	1.2422	1.5762	1.9102	2.2442	2.5782	2.9122
U/TH DIST NORMAL	0.2141	0.2899	0.3657	0.4415	0.5173	0.5931	0.6689
TH/K DIST NORMAL	3.1496	3.5461	3.9426	4.3391	4.7356	5.1321	5.5286

MAP UNIT QT

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.3822	0.6830	0.9838	1.2846	1.5854	1.8862	2.1870
URANIUM DIST NORMAL	0.1897	0.8446	1.4995	2.1544	2.8093	3.4642	4.1191
THORIUM DIST NORMAL	1.1065	2.4303	3.7541	5.0779	6.4017	7.7255	9.0493
U/K DIST NORMAL	0.4500	0.8616	1.2732	1.6848	2.0964	2.5080	2.9196
U/TH DIST NORMAL	0.1347	0.2324	0.3301	0.4278	0.5255	0.6232	0.7209
TH/K DIST NORMAL	2.3483	2.8838	3.4193	3.9548	4.4903	5.0258	5.5613

MAP UNIT QTE

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.4522	0.6783	0.9044	1.1305	1.3566	1.5827	1.8088
URANIUM DIST NORMAL	0.2677	0.8471	1.4265	2.0059	2.5853	3.1647	3.7441
THORIUM DIST NORMAL	1.1941	2.2911	3.3881	4.4851	5.5821	6.6791	7.7761
U/K DIST NORMAL	0.5429	0.9517	1.3605	1.7693	2.1781	2.5869	2.9957
U/TH DIST NORMAL	0.1481	0.2489	0.3497	0.4505	0.5513	0.6521	0.7529
TH/K DIST NORMAL	2.3192	2.8646	3.4100	3.9554	4.5008	5.0462	5.5916

MAP UNIT QTD

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.5628	0.6610	0.7592	0.8574	0.9556	1.0538	1.1520
URANIUM DIST NORMAL	0.4072	0.6510	0.8948	1.1386	1.3824	1.6262	1.8700
THORIUM DIST NORMAL	1.4706	2.0357	2.6008	3.1659	3.7310	4.2961	4.8612
U/K DIST NORMAL	0.3094	0.6557	1.0020	1.3483	1.6946	2.0409	2.3872
U/TH DIST NORMAL	0.0789	0.1761	0.2733	0.3705	0.4677	0.5649	0.6621
TH/K DIST NORMAL	1.9079	2.5068	3.1057	3.7046	4.3035	4.9024	5.5013

MAP UNIT QTL

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.9575	1.1796	1.4017	1.6238	1.8459	2.0680	2.2901
URANIUM DIST NORMAL	1.4561	1.9501	2.4441	2.9381	3.4321	3.9261	4.4201
THORIUM DIST NORMAL	3.9934	4.8888	5.7842	6.6796	7.5750	8.4704	9.3658
U/K DIST NORMAL	0.9669	1.2520	1.5371	1.8222	2.1073	2.3924	2.6775
U/TH DIST NORMAL	0.2445	0.3105	0.3765	0.4425	0.5085	0.5745	0.6405
TH/K DIST NORMAL	2.8504	3.2785	3.7066	4.1347	4.5628	4.9909	5.4190

MAP UNIT S

	-3	-2	-1	0	+1	+2	+3
POTASIUM DIST NORMAL	0.7255	1.0150	1.3045	1.5940	1.8835	2.1730	2.4625
URANIUM DIST NORMAL	1.0767	1.5514	2.0261	2.5008	2.9755	3.4502	3.9249
THORIUM DIST NORMAL	1.8905	3.3199	4.7493	6.1787	7.6081	9.0375	10.4669
U/K DIST NORMAL	0.8225	1.0762	1.3299	1.5836	1.8373	2.0910	2.3447
U/TH DIST NORMAL	0.1904	0.2656	0.3408	0.4160	0.4912	0.5664	0.6416
TH/K DIST NORMAL	2.5777	3.0006	3.4235	3.8464	4.2693	4.6922	5.1151

LINE BASED MEAN CONCENTRATIONS AND RATIOS PER ROCK TYPE

MAP UNIT QSA

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.770	0.991	0.942	0.743	1.123	1.200	1.071	1.142	0.961	1.082	1.074	1.127	0.838	0.710	1.160
URANIUM	1.532	1.594	1.948	1.289	2.047	1.861	2.069	1.847	2.185	2.153	2.416	2.275	1.342	1.387	2.228
THORIUM	2.867	3.536	3.761	2.618	4.734	4.606	4.341	4.503	3.805	4.532	4.345	4.472	2.900	2.822	4.787
U/K	1.899	1.695	1.835	1.737	1.829	1.553	2.111	1.651	2.217	2.002	2.300	2.076	1.664	1.917	1.927
U/TH	0.532	0.489	0.483	0.488	0.439	0.408	0.531	0.421	0.564	0.488	0.587	0.534	0.468	0.480	0.470
TH/K	3.764	3.516	3.852	3.587	4.204	3.832	4.066	3.956	4.028	4.168	4.020	3.941	3.555	4.056	4.120

	1120	1130	1140
POTASIUM	1.147	1.223	1.217
URANIUM	1.906	2.177	1.938
THORIUM	4.391	4.664	4.204
U/K	1.645	1.819	1.615
U/TH	0.436	0.483	0.482
TH/K	3.818	3.824	3.415

MAP UNIT QMP

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.864	0.503	0.732	0.585	0.764	0.572	0.886	0.767	0.664	0.998	1.218	0.635	0.704	0.640	0.694
URANIUM	1.479	0.959	1.147	1.071	1.290	1.309	1.402	1.371	1.728	2.082	2.744	1.584	1.331	1.390	1.493
THORIUM	3.222	1.829	2.755	2.237	2.758	2.010	3.483	3.300	2.802	4.046	5.268	2.798	2.566	2.694	2.645
U/K	1.678	1.711	1.472	1.932	1.813	1.913	1.689	1.793	2.364	2.148	2.255	2.531	2.139	2.098	1.968
U/TH	0.452	0.492	0.384	0.501	0.476	0.619	0.415	0.421	0.557	0.524	0.522	0.591	0.555	0.516	0.534
TH/K	3.730	3.625	3.935	3.791	3.743	3.519	4.022	4.276	4.401	4.098	4.350	4.376	3.800	4.158	3.760

	1120	1130	1140
POTASIUM	0.535	0.901	1.004
URANIUM	1.120	1.801	1.556
THORIUM	1.959	3.099	3.079
U/K	2.151	2.001	1.546
U/TH	0.553	0.586	0.507
TH/K	3.663	3.433	3.055

MAP UNIT QGM

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	0.639	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.016
URANIUM	0.000	0.000	1.224	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.960
THORIUM	0.000	0.000	3.330	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.125
U/K	0.000	0.000	2.020	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.959
U/TH	0.000	0.000	0.372	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.475
TH/K	0.000	0.000	5.566	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	4.087

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

MAP UNIT QSD

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.769	1.056	0.580	1.105	1.305	1.106	1.253	0.000	0.000	1.007	1.042	0.677
URANIUM	0.000	0.000	0.000	0.802	1.356	0.814	1.812	2.953	2.392	2.153	0.000	0.000	1.341	1.958	0.850
THORIUM	0.000	0.000	0.000	1.893	4.254	2.081	4.703	5.455	4.508	4.205	0.000	0.000	3.916	3.892	1.894
U/K	0.000	0.000	0.000	1.043	1.285	1.334	1.661	2.259	2.161	1.717	0.000	0.000	1.331	1.816	1.096
U/TH	0.000	0.000	0.000	0.417	0.319	0.396	0.392	0.544	0.534	0.513	0.000	0.000	0.349	0.482	0.466
TH/K	0.000	0.000	0.000	2.460	4.031	3.607	4.250	4.181	4.124	3.356	0.000	0.000	3.874	3.670	2.899

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

MAP UNIT QSB

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	1.220	1.170	0.935	1.213	1.186	1.086	1.178	1.335	1.463	1.366	0.000	0.000	0.000
URANIUM	0.000	0.000	1.713	1.939	1.219	1.863	1.778	1.463	2.122	2.321	2.891	2.594	0.000	0.000	0.000
THORIUM	0.000	0.000	4.276	4.419	2.441	4.372	3.619	3.473	3.770	5.241	6.315	6.627	0.000	0.000	0.000
U/K	0.000	0.000	1.403	1.623	1.318	1.552	1.467	1.346	1.799	1.734	1.996	1.905	0.000	0.000	0.000
U/TH	0.000	0.000	0.406	0.428	0.500	0.432	0.541	0.448	0.564	0.443	0.462	0.392	0.000	0.000	0.000
TH/K	0.000	0.000	3.500	3.754	2.644	3.601	2.893	3.126	3.202	3.927	4.329	4.855	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.473	1.260	1.129
URANIUM	2.747	2.158	1.563
THORIUM	5.856	4.935	3.466
U/K	1.879	1.729	1.313
U/TH	0.479	0.444	0.451
TH/K	3.965	3.922	2.942

MAP UNIT QCL

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	1.712	1.671	1.568	1.740	1.772	1.881	0.000	0.000	1.047
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	2.680	2.589	2.546	2.761	3.026	3.209	0.000	0.000	2.516
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	7.123	7.259	6.810	7.174	7.442	7.614	0.000	0.000	4.746
U/K	0.000	0.000	0.000	0.000	0.000	0.000	1.575	1.554	1.665	1.610	1.725	1.733	0.000	0.000	2.472
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.381	0.360	0.381	0.390	0.411	0.432	0.000	0.000	0.536
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	4.157	4.353	4.375	4.140	4.221	4.046	0.000	0.000	4.584

	1120	1130	1140
POTASIUM	0.000	1.679	1.762
URANIUM	0.000	2.599	2.706
THORIUM	0.000	6.749	7.725
U/K	0.000	1.571	1.566
U/TH	0.000	0.393	0.351
TH/K	0.000	4.029	4.468

MAP UNIT QSL

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.844	0.987	1.275	1.480	1.139	1.342	1.465	1.326	1.169	1.386	1.486	0.000	0.000	0.000	0.000
URANIUM	1.569	1.713	1.763	2.425	1.628	2.025	2.149	1.908	2.051	2.091	2.587	0.000	0.000	0.000	0.000
THORIUM	3.225	3.729	4.400	5.926	3.774	5.193	5.509	4.829	4.694	5.503	6.210	0.000	0.000	0.000	0.000
U/K	1.913	1.724	1.391	1.645	1.410	1.529	1.459	1.453	1.748	1.543	1.735	0.000	0.000	0.000	0.000
U/TH	0.497	0.477	0.406	0.415	0.454	0.401	0.402	0.426	0.440	0.397	0.433	0.000	0.000	0.000	0.000
TH/K	3.860	3.737	3.443	3.991	3.208	3.854	3.676	3.535	4.052	3.953	4.133	0.000	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.249	0.953	1.039
URANIUM	2.223	1.457	1.487
THORIUM	4.797	3.536	3.549
U/K	1.793	1.563	1.435
U/TH	0.471	0.425	0.432
TH/K	3.837	3.709	3.349

MAP UNIT QGV

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.799	0.730	0.902	0.796	0.856	0.879	0.926	0.809	0.843	0.861	1.049	1.051	0.833	0.796	0.841
URANIUM	1.128	1.087	1.278	1.143	1.256	1.213	1.621	1.653	1.522	1.680	2.269	2.176	1.193	1.257	1.427
THORIUM	2.860	2.535	3.448	2.845	3.072	3.343	3.540	3.312	3.368	3.542	4.450	3.874	2.895	2.746	3.096
U/K	1.399	1.481	1.336	1.462	1.514	1.348	1.847	1.874	1.763	1.974	2.217	2.083	1.509	1.544	1.661
U/TH	0.402	0.433	0.359	0.407	0.417	0.373	0.475	0.492	0.454	0.480	0.524	0.572	0.420	0.444	0.449
TH/K	3.642	3.498	3.839	3.646	3.661	3.690	3.873	3.752	3.961	4.145	4.258	3.714	3.566	3.488	3.685

	1120	1130	1140
POTASIUM	0.859	1.921	1.023
URANIUM	1.390	2.828	1.677
THORIUM	3.162	6.720	4.044
U/K	1.485	1.472	1.649
U/TH	0.425	0.423	0.424
TH/K	3.543	3.505	3.963

MAP UNIT QGP

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.720	0.907	0.927	0.842	1.076	1.111	0.862	0.863	1.151	0.822	0.000	1.030	0.766	0.804	0.848
URANIUM	1.067	1.155	1.372	1.255	1.389	1.369	1.485	1.434	1.989	1.688	0.000	2.042	1.372	1.171	1.208
THORIUM	2.457	3.448	3.529	3.024	3.820	3.800	3.268	3.728	4.812	3.012	0.000	4.067	3.189	2.943	3.222
U/K	1.279	1.316	1.428	1.523	1.313	1.269	1.739	1.823	1.740	2.079	0.000	1.989	1.842	1.467	1.470
U/TH	0.391	0.351	0.377	0.424	0.368	0.364	0.460	0.391	0.415	0.574	0.000	0.511	0.444	0.405	0.386
TH/K	3.461	3.814	3.855	3.625	3.571	3.503	3.830	4.484	4.207	3.667	0.000	3.925	4.360	3.686	3.831

	1120	1130	1140
POTASIUM	0.000	0.912	0.000
URANIUM	0.000	1.440	0.000
THORIUM	0.000	3.154	0.000
U/K	0.000	1.580	0.000
U/TH	0.000	0.459	0.000
TH/K	0.000	3.469	0.000

MAP UNIT QGK

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.905	0.692	0.829	0.827	0.842	0.967	1.075	0.994	1.104	0.000	0.000	0.000	0.000	0.826	1.005
URANIUM	1.026	1.001	1.055	1.017	1.300	1.305	1.810	1.122	1.998	0.000	0.000	0.000	0.000	1.231	1.632
THORIUM	2.917	2.532	2.998	2.779	3.167	3.481	3.908	3.366	4.680	0.000	0.000	0.000	0.000	2.970	3.770
U/K	1.157	1.656	1.196	1.206	1.570	1.334	1.686	1.138	1.826	0.000	0.000	0.000	0.000	1.476	1.621
U/TH	0.362	0.455	0.345	0.359	0.416	0.384	0.464	0.334	0.433	0.000	0.000	0.000	0.000	0.419	0.436
TH/K	3.252	3.594	3.622	3.412	3.814	3.528	3.622	3.415	4.234	0.000	0.000	0.000	0.000	3.600	3.768

	1120	1130	1140
POTASIUM	0.000	0.995	0.000
URANIUM	0.000	1.264	0.000
THORIUM	0.000	3.076	0.000
U/K	0.000	1.273	0.000
U/TH	0.000	0.413	0.000
TH/K	0.000	3.089	0.000

MAP UNIT QGT

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.848	0.909	0.000	0.000	0.000	0.000	0.959	0.000	0.000	0.000	0.000	0.000	0.756	0.000
URANIUM	0.000	1.203	1.329	0.000	0.000	0.000	0.000	1.582	0.000	0.000	0.000	0.000	0.000	0.882	0.000
THORIUM	0.000	3.114	3.402	0.000	0.000	0.000	0.000	2.467	0.000	0.000	0.000	0.000	0.000	2.472	0.000
U/K	0.000	1.414	1.560	0.000	0.000	0.000	0.000	1.656	0.000	0.000	0.000	0.000	0.000	1.200	0.000
U/TH	0.000	0.393	0.419	0.000	0.000	0.000	0.000	0.651	0.000	0.000	0.000	0.000	0.000	0.377	0.000
TH/K	0.000	3.659	3.740	0.000	0.000	0.000	0.000	2.568	0.000	0.000	0.000	0.000	0.000	3.304	0.000

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

MAP UNIT QTS

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.680	0.978	0.000	1.338	1.428	1.358	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	1.269	1.205	0.000	2.466	2.780	2.800	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	2.916	3.650	0.000	5.812	6.088	6.036	0.000	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	1.926	1.244	0.000	1.853	1.954	2.069	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.442	0.334	0.000	0.426	0.461	0.467	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	4.343	3.733	0.000	4.356	4.268	4.453	0.000	0.000	0.000	0.000	0.000

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

MAP UNIT QT

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	1.085	1.139	1.111	1.215	1.263	1.158	1.354	1.361	1.409	1.490	1.528	1.290	1.153	1.194	1.092
URANIUM	1.997	2.028	1.416	2.050	1.939	1.589	2.236	2.089	2.596	2.487	2.795	2.604	1.546	2.079	2.097
THORIUM	4.225	4.556	3.968	4.672	4.973	4.363	5.262	5.252	5.581	5.916	5.871	5.854	4.136	4.751	4.569
U/K	1.832	1.835	1.227	1.686	1.521	1.385	1.664	1.544	1.896	1.695	1.865	2.043	1.391	1.715	1.947
U/TH	0.472	0.458	0.344	0.443	0.392	0.369	0.432	0.401	0.474	0.428	0.497	0.450	0.391	0.435	0.465
TH/K	3.911	4.034	3.556	3.848	3.900	3.760	3.892	3.869	4.026	4.001	3.783	4.574	3.581	3.964	4.209

	1120	1130	1140
POTASIUM	1.108	0.000	1.276
URANIUM	1.845	0.000	2.196
THORIUM	4.456	0.000	5.022
U/K	1.680	0.000	1.727
U/TH	0.427	0.000	0.440
TH/K	3.982	0.000	3.943

MAP UNIT QTE

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	1.051	0.936	1.150	1.215	1.194	1.087	1.211	1.125	1.181	1.121	1.191	1.135	1.129	1.150	1.057
URANIUM	1.705	1.549	1.826	1.975	2.087	1.786	2.123	2.078	2.272	2.209	2.466	2.248	1.754	2.072	1.910
THORIUM	3.963	3.607	4.443	4.811	4.804	4.222	4.850	4.588	4.756	4.481	4.813	4.829	4.169	4.624	4.354
U/K	1.615	1.602	1.589	1.653	1.736	1.644	1.758	1.846	1.937	1.975	2.073	1.999	1.571	1.759	1.791
U/TH	0.442	0.421	0.417	0.419	0.437	0.425	0.443	0.456	0.484	0.500	0.518	0.476	0.437	0.437	0.437
TH/K	3.701	3.833	3.871	3.973	3.999	3.879	3.993	4.094	4.033	3.979	4.029	4.260	3.653	4.018	4.116

	1120	1130	1140
POTASIUM	1.164	1.180	1.142
URANIUM	1.973	2.050	1.871
THORIUM	4.591	4.524	4.326
U/K	1.694	1.729	1.677
U/TH	0.436	0.457	0.434
TH/K	3.934	3.817	3.861

MAP UNIT QTD

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.852	0.868	0.906	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.709
URANIUM	1.169	1.007	0.890	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.121
THORIUM	3.275	3.068	2.652	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.305
U/K	1.394	1.167	0.995	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.581
U/TH	0.368	0.337	0.352	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.487
TH/K	3.851	3.558	2.909	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	3.250

	1120	1130	1140
POTASIUM	0.855	0.000	0.000
URANIUM	1.200	0.000	0.000
THORIUM	2.899	0.000	0.000
U/K	1.402	0.000	0.000
U/TH	0.420	0.000	0.000
TH/K	3.401	0.000	0.000

MAP UNIT QTL

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	1.404	1.524	0.000	0.000	0.000	1.608	1.579	1.521	1.679	1.692	0.000	0.000	0.000
URANIUM	0.000	0.000	2.109	2.561	0.000	0.000	0.000	2.896	2.577	2.792	3.160	3.200	0.000	0.000	0.000
THORIUM	0.000	0.000	5.516	6.239	0.000	0.000	0.000	6.630	6.410	6.305	6.937	7.094	0.000	0.000	0.000
U/K	0.000	0.000	1.510	1.684	0.000	0.000	0.000	1.815	1.647	1.856	1.904	1.913	0.000	0.000	0.000
U/TH	0.000	0.000	0.384	0.414	0.000	0.000	0.000	0.439	0.404	0.448	0.460	0.454	0.000	0.000	0.000
TH/K	0.000	0.000	3.927	4.103	0.000	0.000	0.000	4.132	4.079	4.157	4.160	4.243	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	1.620	1.630	1.320
URANIUM	2.740	2.839	2.131
THORIUM	6.583	6.357	4.868
U/K	1.702	1.736	1.616
U/TH	0.420	0.448	0.442
TH/K	4.073	3.902	3.691

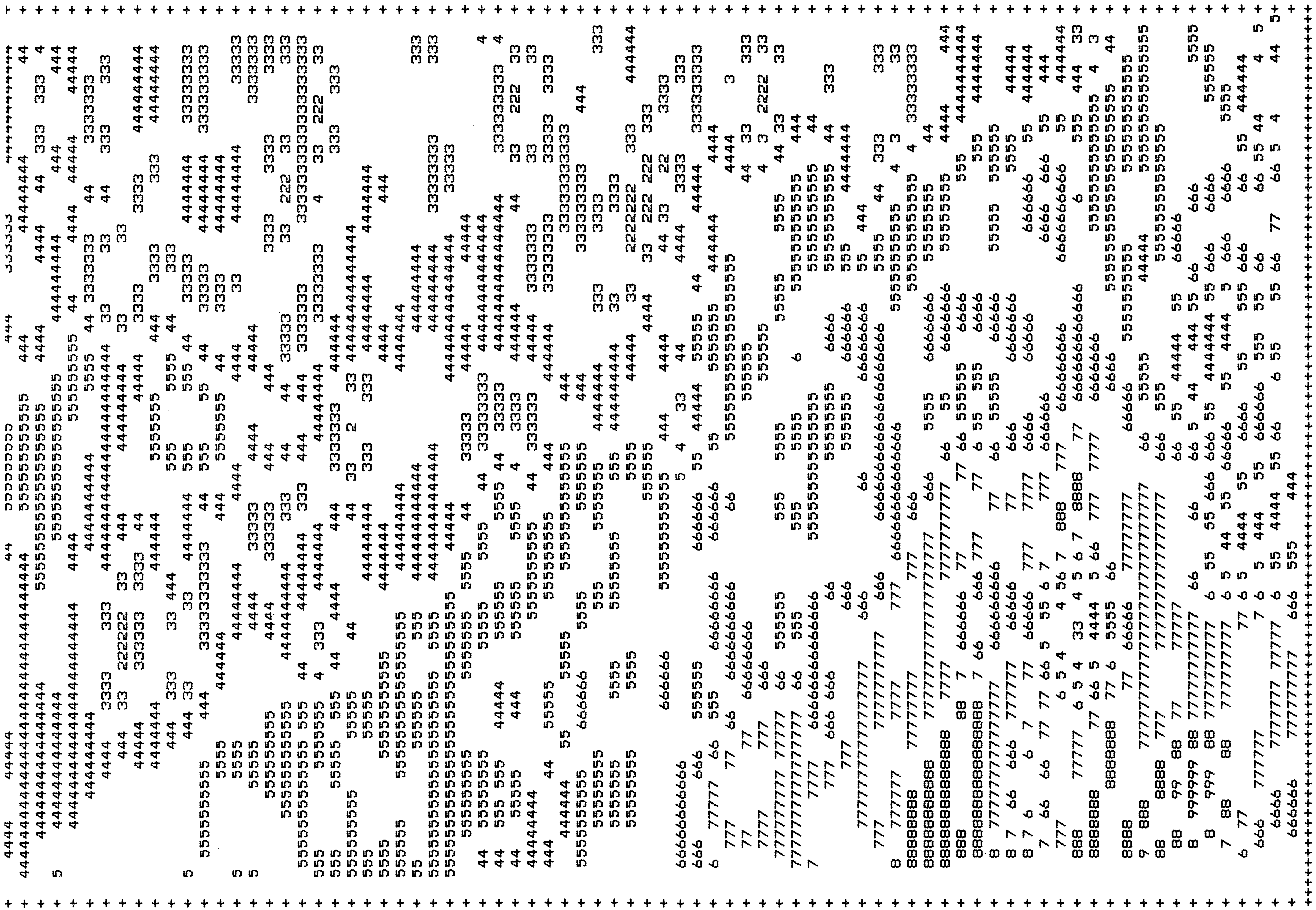
MAP UNIT S

	370	380	390	400	410	420	430	440	450	460	470	480	1090	1100	1110
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1120	1130	1140
POTASIUM	0.000	0.000	1.594
URANIUM	0.000	0.000	2.501
THORIUM	0.000	0.000	6.179
U/K	0.000	0.000	1.584
U/TH	0.000	0.000	0.416
TH/K	0.000	0.000	3.846

APPENDIX H - Pseudo Contour Maps

FORT WAYNE



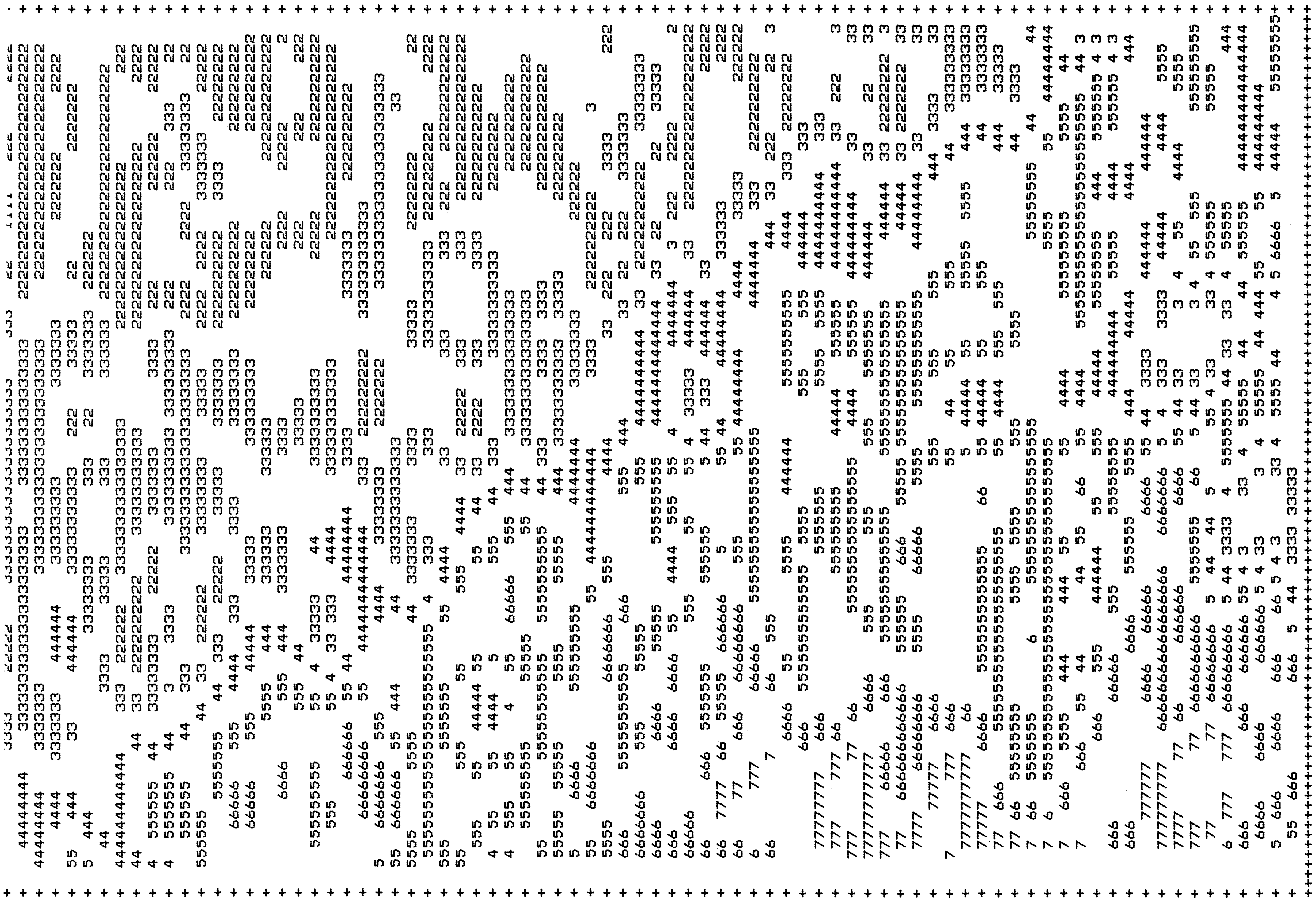
Potassium Pseudo-Contour Map - Fort Wayne Quadrangle

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

FORT WAYNE



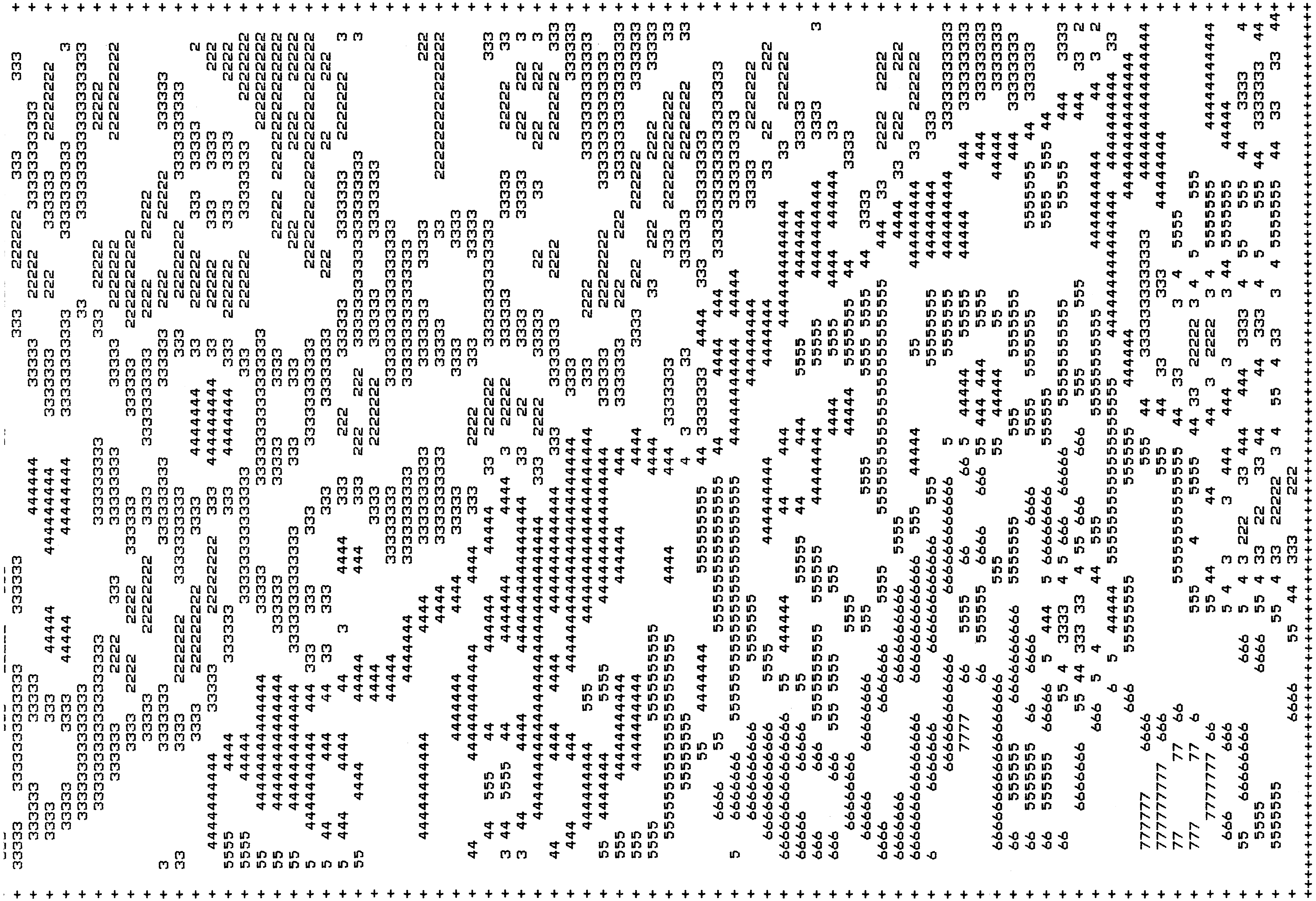
Uranium Pseudo-Contour Map - Fort Wayne Quadrangle

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

FORT WAYNE



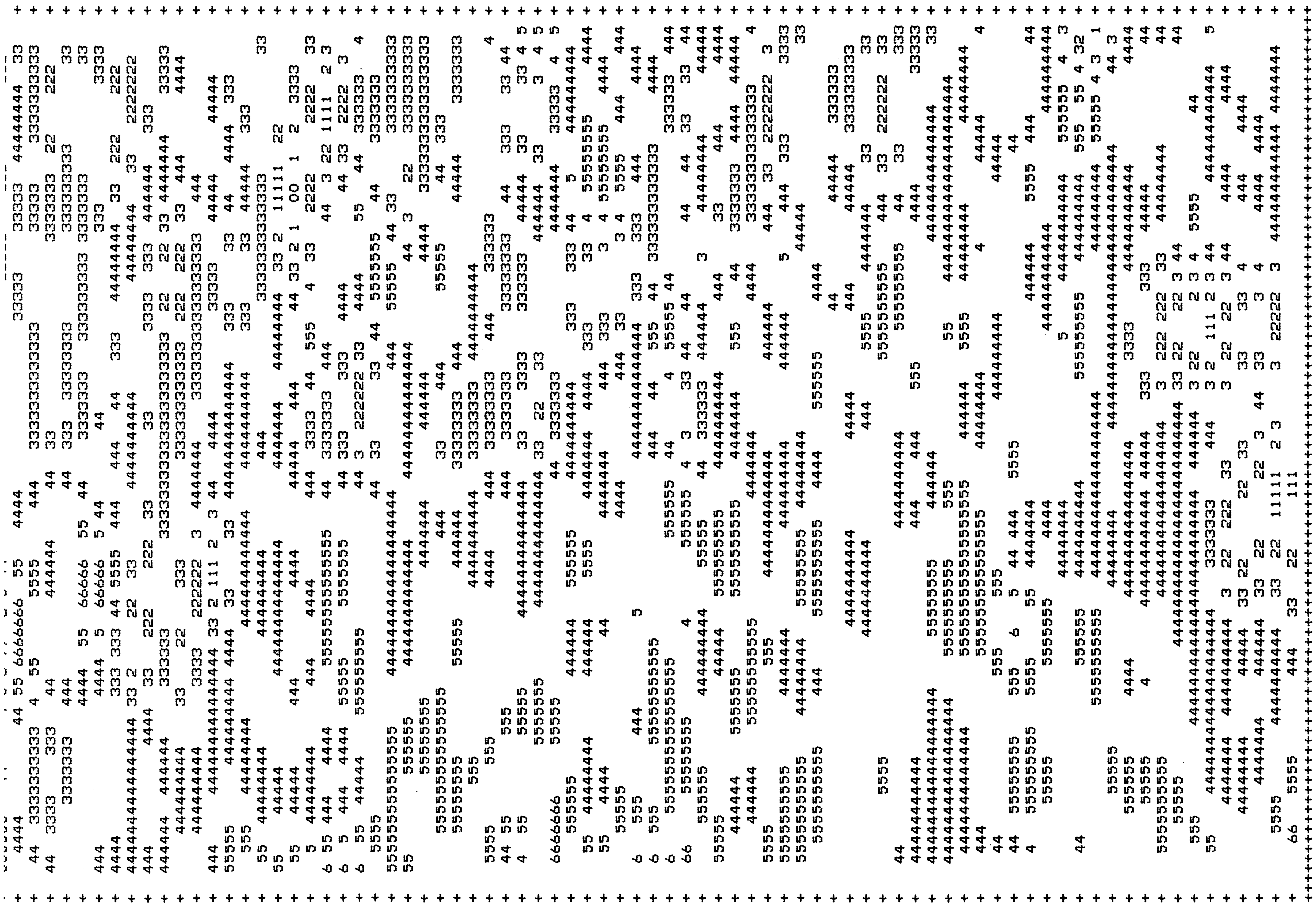
EXPLANATION

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

SCALE IN EQUIVALENT PPM

Thorium Pseudo-Contour Map - Fort Wayne Quadrangle

FORT WAYNE



EXPLANATION

PRINT CHARACTER	VALUE	
0	LE	2.0000
	2.0000	2.2500
1	2.2500	2.5000
	2.5000	2.7500
2	2.7500	3.0000
	3.0000	3.2500
3	3.2500	3.5000
	3.5000	3.7500
4	3.7500	4.0000
	4.0000	4.2500
5	4.2500	4.5000
	4.5000	4.7500
6	4.7500	5.0000
	5.0000	5.2500
7	5.2500	5.5000
	5.5000	5.7500
8	5.7500	6.0000
	6.0000	6.2500
9	6.2500	6.5000
	GT	6.5000

Thorium/Potassium Pseudo-Contour Map - Fort Wayne Quadrangle

H5 fw

FORT WAYNE

Uranium/Potassium Pseudo-Contour Map - Fort Wayne 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

FORT WAYNE

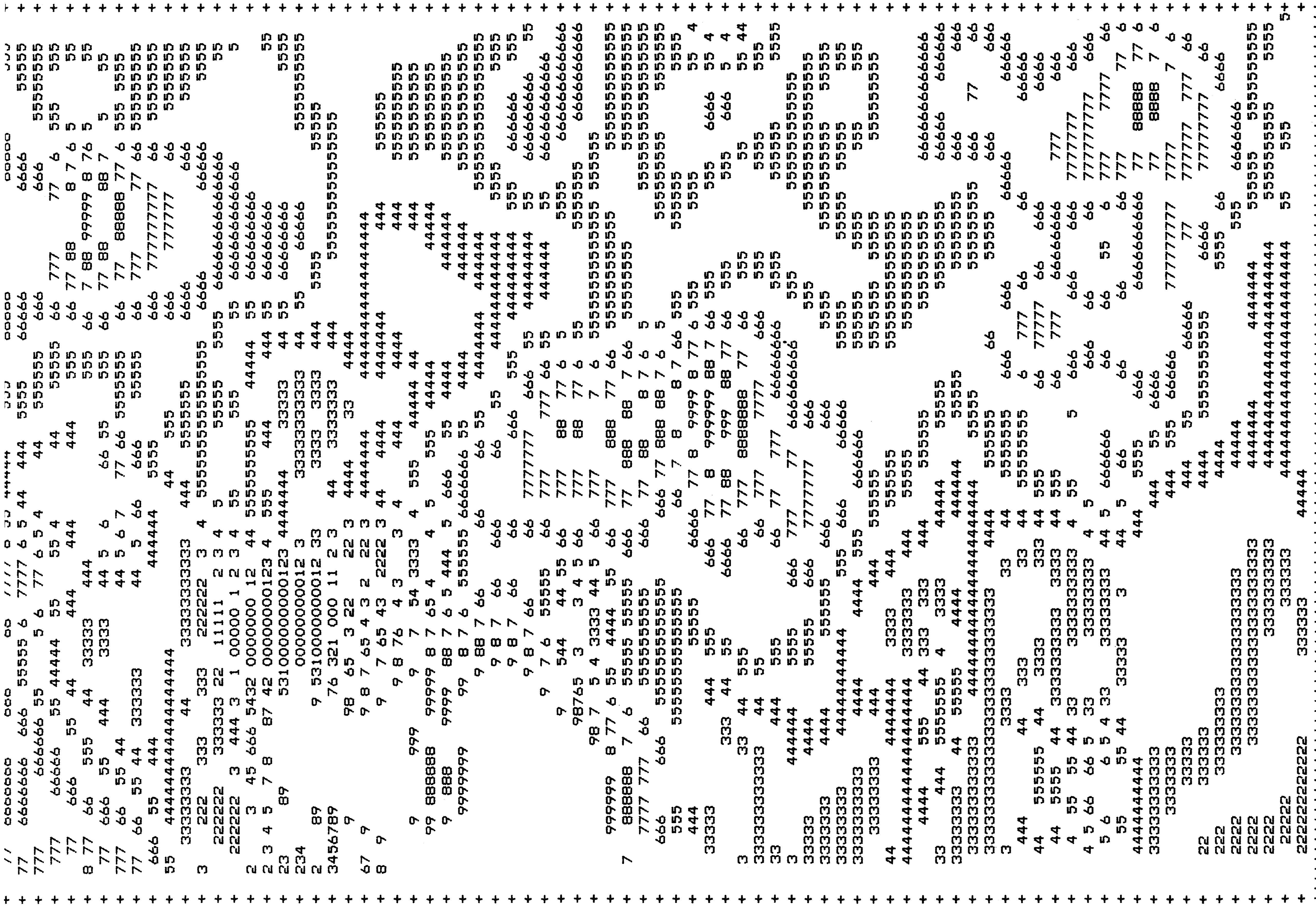
EXPLANATION

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 - Fort Wayne Quadrangle

$H7_{fw}$

FORT WAYNE



EXPLANATION

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

SCALE IN GAMMAS

Residual Magnetic Pseudo-Contour Map - Fort Wayne Quadrangle