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National Uranium Resource Evaluation

AERIAL GAMMA RAY AND MAGNETIC SURVEY
DES MOINES QUADRANGLE
IOWA

FINAL REPORT

EG&G GEOMETRICS
Sunnyvale, California 94086

February 1981

PREPARED FOR U.S. DEPARTMENT OF ENERGY
Assistant Secretary for Resource Applications
Grand Junction Office, Colorado

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

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ABSTRACT

The Des Moines quadrangle covers 7,030 square miles in the heart of the Midwestern Physiographic Province. Though primarily Quaternary glacially-related deposits are exposed, the region contains a thin to moderate thickness of older Phanerozoic sediments atop the shallow Precambrian basement.

No uranium deposits are known within the area.

Of the 109 anomalies defined by the interpretation processes, none were considered significant, and all appeared to relate to specific features of cultural origin. Concentrations of the measured radioactive elements were found to be relatively low.

Magnetic data suggest complexities in the Precambrian basement rather than structures in the Phanerozoic strata.

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INTRODUCTION

General

The Des Moines quadrangle covers 7,030 square miles of area in southeast-central Iowa (see Figure 1).

The geologic base map used for this report was compiled by Fremont Geologic Consultants in 1980 at a scale of 1:250,000. This map was compiled using a single glacial map dated 1980 and pre-1920 county geologic maps. All are of unspecified scales. Appendix C contains map unit descriptions taken directly from the Fremont map legend. Supplementary geologic information was taken from Fairbridge (ed.) 1975, Cohee and others (1962), and Flint (1959 and 1971). Cultural and physiographic information was taken from the 1:250,000 scale Des Moines topographic map (1972 version).

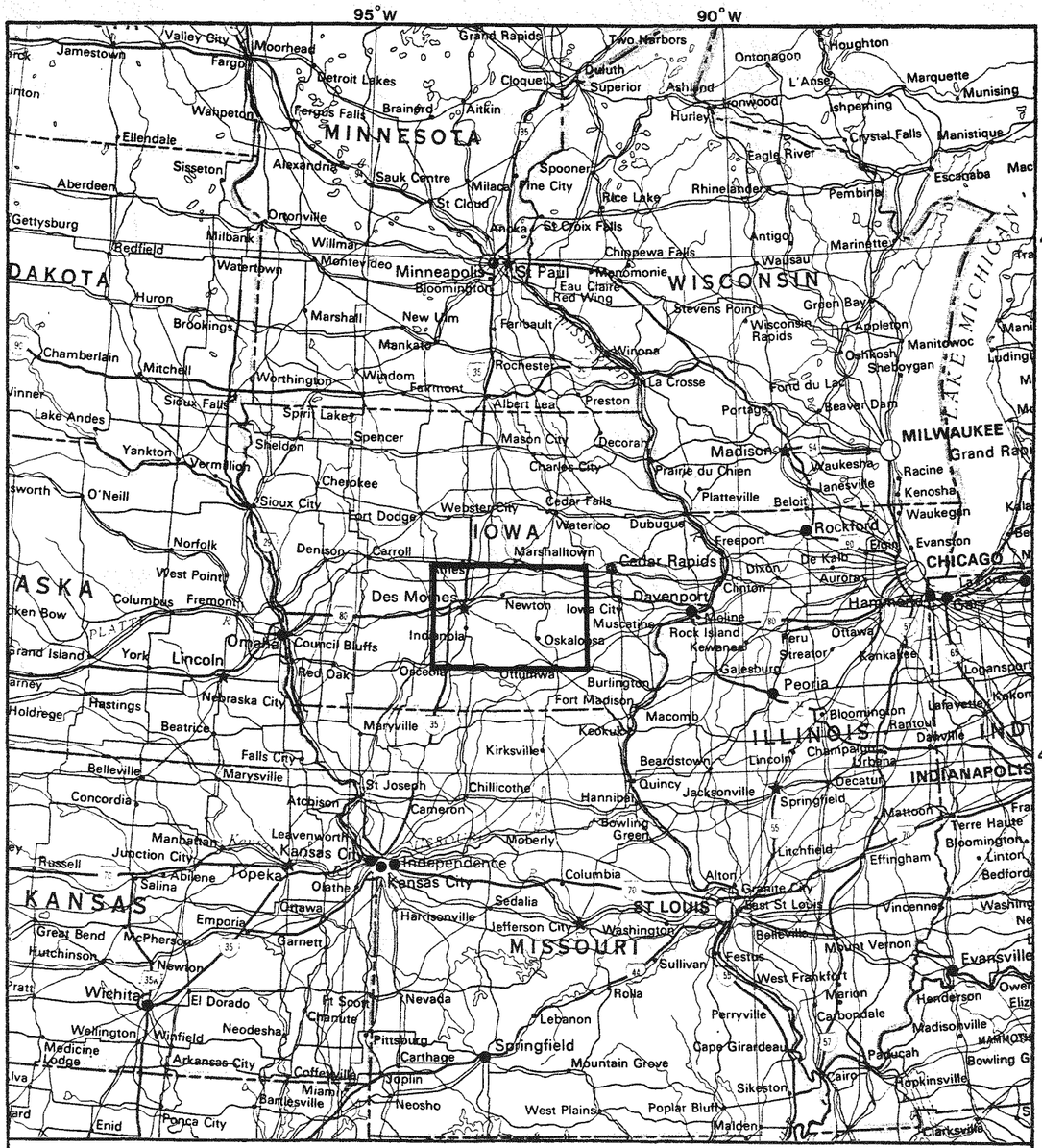
Radiometric and magnetic data for the Des Moines quadrangle were acquired in November 1980, and processed in January of 1981. A detailed summary of data acquisition, processing, interpretation, and presentation methods can be found in Appendix A. Appendix B contains a flight summary report for the Des Moines quadrangle.

Physiography

The Des Moines quadrangle lies within relatively flat but finely dissected terrain in the heart of the Midwestern Physiographic Province. This portion of the Corn Belt is dominated by agricultural activity. All major rivers flow southeasterly and are roughly parallel. The largest of these is the Des Moines River which flows through the quadrangle's center. The Skunk River flows parallel just northeast of the Des Moines. The Iowa River flows through the northeastern quadrant. All these rivers join the Mississippi to the southeast.

Elevations range from 650 feet at the Des Moines River near Ottumwa (along the southern edge) to over 1200 feet in certain portions of the highlands to the southwest of the Des Moines River.

The quadrangle is well developed culturally, particularly along the Des Moines River, where the cities of Des Moines and Ottumwa are located (pop. 194,000 and 28,200, respectively). The region contains a dense rectangular grid of roads, several major railroad lines, and portions of the interstate freeway system. Several strip mining operations (for coal) appear to be in operation in the southeastern quadrant.



LOCATION DIAGRAM

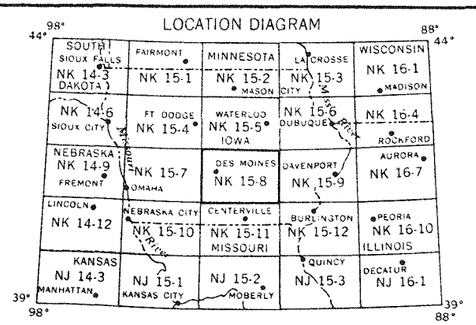


FIGURE 1

LOCATION MAP

DES MOINES QUADRANGLE

Scale

100 50 0 100 MILES

GEOLOGY

Structure

The Des Moines quadrangle lies over the extreme northeastern end of the Forest City Sedimentary Basin (see Figure 2). Early to Middle Paleozoic sediments shoal from 2,500 feet at the southwest corner to 1,500 feet in the northeast. The structural picture is not complicated by any known minor folding or faulting according to the map by Cohee and others (1962). The Fremont Geologic Consultants map shows no surface faulting.

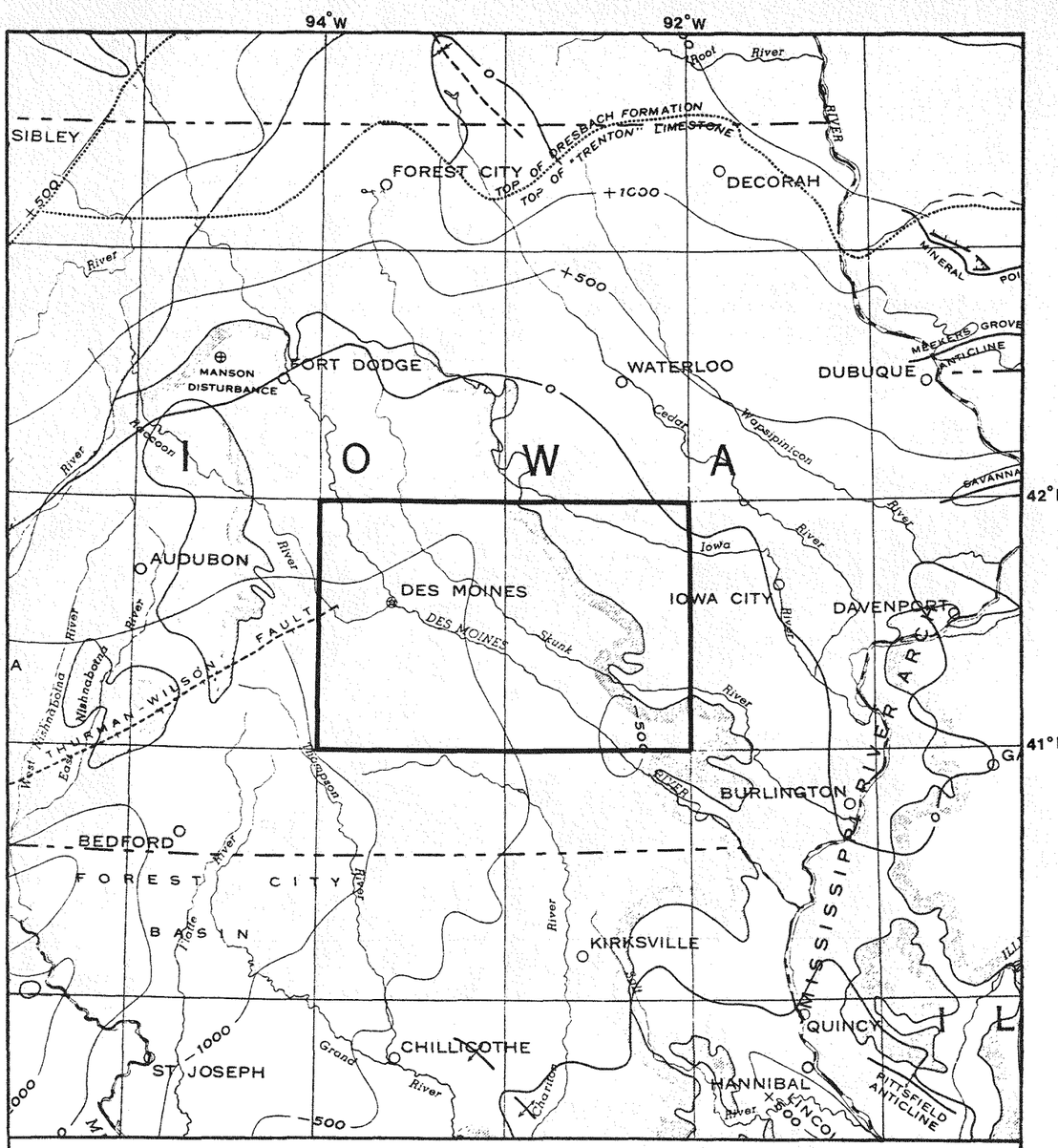
Surface Geology

As mapped by Fremont Geologic Consultants, the quadrangle is completely covered by Quaternary deposits. These deposits represent glacial, periglacial, and post-glacial sediments from pre-Illinoian times to the present. This interpretation is probably accurate, though the strip mines in the south clearly tap Paleozoic coal seams.

Pre-Illinoian till covers 60 percent of the surface as mapped, and covers the entire southern half of the quadrangle (exclusive of the river channels). Wisconsinan age loess and other eolian deposits are mapped in a belt extending easterly across the northern half of the quadrangle, covering 10 percent of the total quadrangle area. Wisconsinan moraine; outwash, and stratified drift cover a large portion of the northwestern quadrant. This material, representing Mankato stage glacial advances, covers 20 percent of the quadrangle. Recent or near-Recent alluvial deposits in river flood plains cover the remaining 10 percent of the surface.

Uranium

According to available literature, there are no known uranium deposits within the Des Moines quadrangle.



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

FIGURE 2

TECTONIC STRUCTURE MAP
DES MOINES QUADRANGLE

Scale 1:2,500,000

25 0 25 50 75 MILES

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

A total of 109 groups of uranium (Bi214) samples meet the minimum statistical requirements for anomaly definitions as set forth in the data interpretation section of Appendix A. These are displayed, along with all other anomalous samples and pertinent data, on Figure 3. The anomalies are summarized in a table in Appendix G. The potassium, uranium, thorium, and ratio pseudo-contour maps, which reflect radiometric responses for the entire quadrangle, are found in Appendix H. Discussion of the abundances of potassium, uranium, and thorium are in terms of apparent equivalent percent and apparent equivalent ppm. These equivalent units are derived from scaling of counts per second data by the sensitivities calculated for the detection system and as such cannot be taken as directly determined geochemical values.

The quadrangle-wide averages for K, U, and T are 1.1 percent, 2.4 ppmeU, and 6.9 ppmeT. Though these values are relatively low, they are typical of the region (as shown by previous surveys of adjacent quadrangles). Potassium and thorium values are extremely uniform, but are locally depressed over water bodies. Bismuth shows more variation, but has trends similar to potassium and thorium, but is abnormally high over the coal mining area near Knoxville.

Potassium, uranium, and thorium have the highest average values in map unit QE (Wisconsinan and Recent eolian sand) at 1.2 percent, 2.8 ppmeU, and 7.3 ppmeT, respectively (though this unit has only 44 samples in this survey). Similar but slightly lower values for potassium and thorium are found in map unit QL (Wisconsinan and Recent loess). Peak uranium and thorium concentrations occur in map unit QK (Pre-Illinoian till) with respective values of 4.72 ppmeU and 10.01 ppmeT. Map unit QKA (Pre-Illinoian argillaceous till) contains the peak potassium concentration for the quadrangle (1.53 percent).

Examination of the gamma ray profiles (Appendix D) shows several lines that have significantly higher uranium and BiAir concentrations. These peculiar radiometric signatures have been encountered in previous surveys nearby, and seem to indicate some weather phenomenon that the present radon correction scheme (based upon the assumption of uniform, homogenous radon distribution) has some difficulty in correcting for. Assuming that the absolute ground uranium concentrations in these areas are actually similar to those of adjacent and crossing lines, an adjustment of the uranium and affected ratios was made. Statistical analysis were done using the corrected values.

Anomalies are scattered throughout the quadrangle but show a slight tendency to group around the city of Des Moines. Peak concentrations range as high as 4.5 ppmeU, but all appear to overlie cultural features (roads, railroads, pipelines, and open pit mines as examples). The perfect correlation with culture suggests that none of the anomalies have any significance.

Magnetic Data

The magnetic field pseudo-contour map appears in Appendix H.

As previously described, the Des Moines quadrangle is covered by a thin to moderate section of Paleozoic and Mesozoic sediments (in addition to the Quaternary cover) overlying Precambrian basement.

The magnetic field is extremely complex. Descrete regions of high and low gradients are clearly defined. Several linear features are suggested along with a large number of isolated structures. The complex nature of the magnetics, coupled with its apparent lack of correlation with Phanerozoic structure, suggests that the magnetics occur largely as the result of lithologic and/or structural character in the Precambrian.

DES MOINES

94 00 | 93 00 | 92 00

42 00

41 30

41 00

IOWA RIVER

DES MOINES RIVER

ANKENNY

NEWTON

GRINNELL

BELLE PLAINE

MARENGO

DES MOINES

WEST DES MOINES

INDIANOLA

KNOXVILLE

PELLA

OSKALOOSA

OSCEOLA

CHARITON

OTTUMWA

URANIUM ANOMALY/ INTERPRETATION MAP

DES MOINES QUADRANGLE

U.S. DEPARTMENT OF ENERGY

APPROXIMATE SCALE 1:500,000

EXPLANATION

□ – CITY OR TOWN

◇ – URANIUM SAMPLE MEETING FOLLOWING CRITERIA:

(1) $1.0 \leq U \leq \infty$

(2) $-1.0 \leq T \leq \infty$

(3) $1.0 \leq U/T \leq \infty$

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

◇◇ – URANIUM ANOMALY:

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

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

Figure 3 - Uranium Anomaly/Interpretation Map - Des Moines Quadrangle

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APPENDIX A - Data Acquisition, Processing, and Interpretation Methods

INTRODUCTION

General

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

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

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

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.

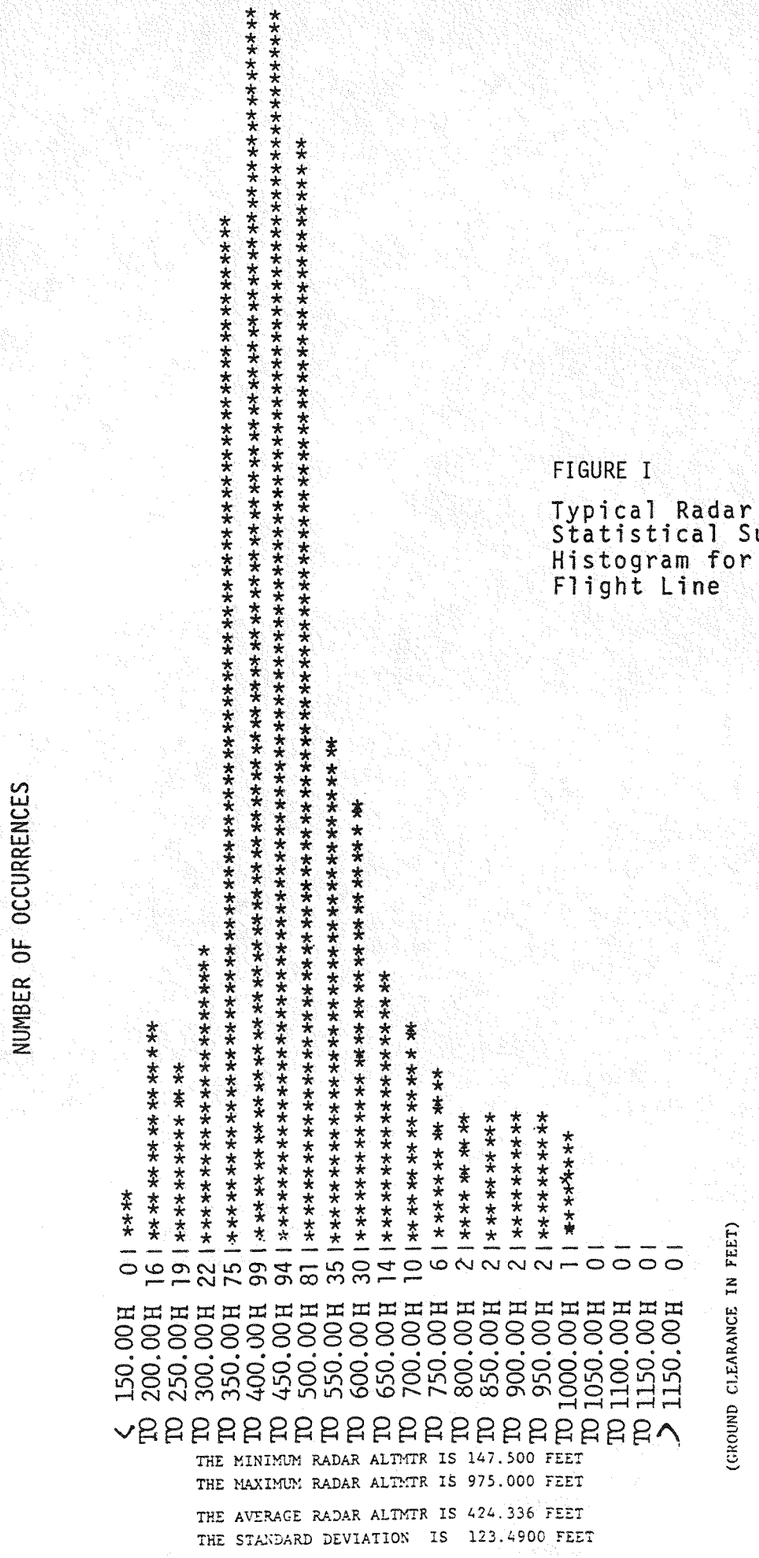


FIGURE I

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.

FIGURE II

GR-800D ANALOG SPECTRUM PLOT
DET-1024 Crystal Detector (1,024 in³)
137Cs Source 11.81 Kev/Ch
20K c.p.s. Full Scale

Resolution Calculation

% = 100 x FWHM x Kev/Ch / 662 Kev

% = 100 x 4.79 x 11.81 / 662 = 8.5%

208Tl
214Bi
40K

Total number of channels FWHM
4.0 + 0.14 + 0.65 = 4.79

0.65 Channel
FWHM Point
0.14 Channel

Channel Number

18

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.

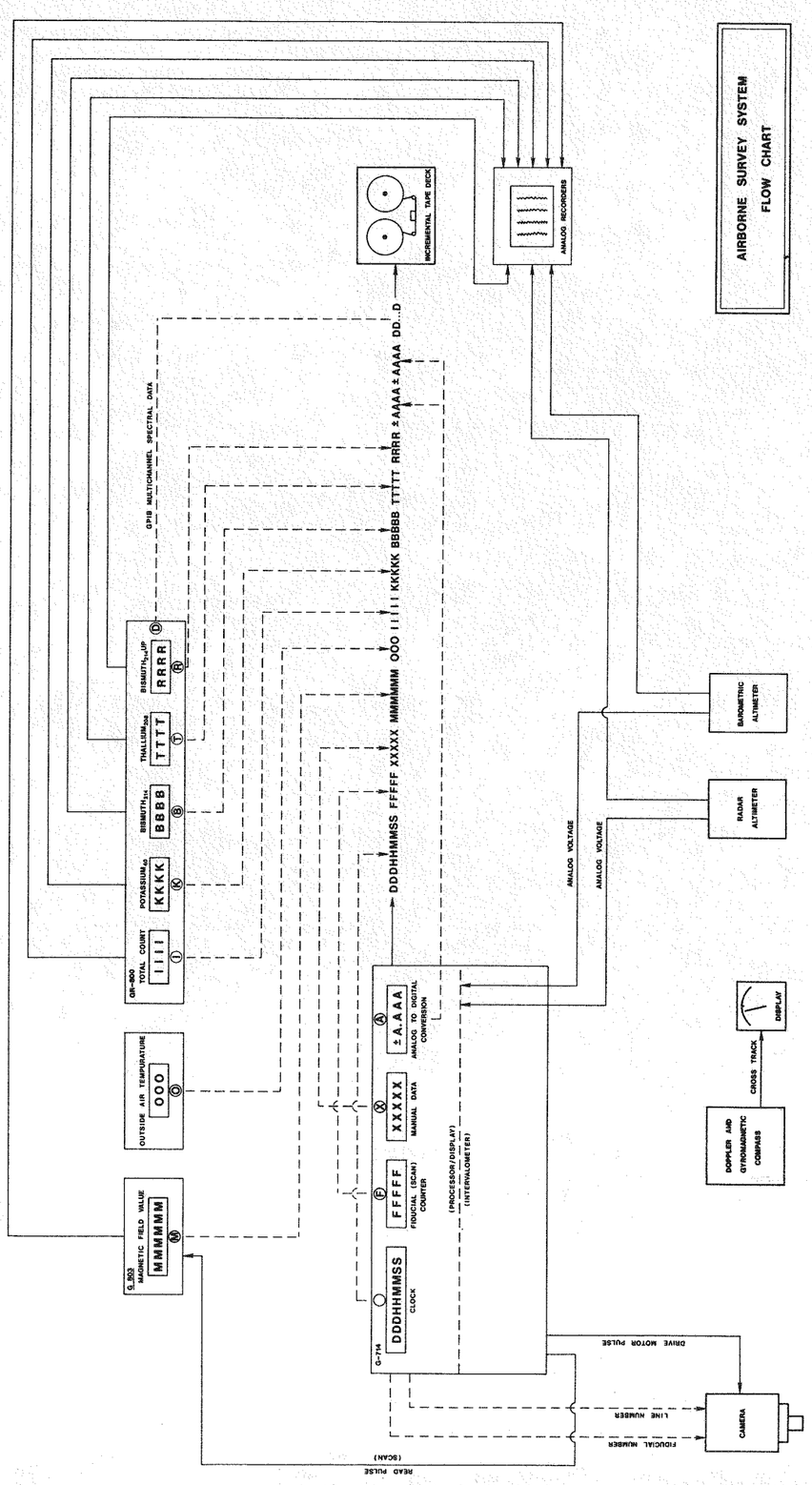


FIGURE III

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:

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

The aircraft background is derived as follows:

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

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

SYSTEM CONSTANTS

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

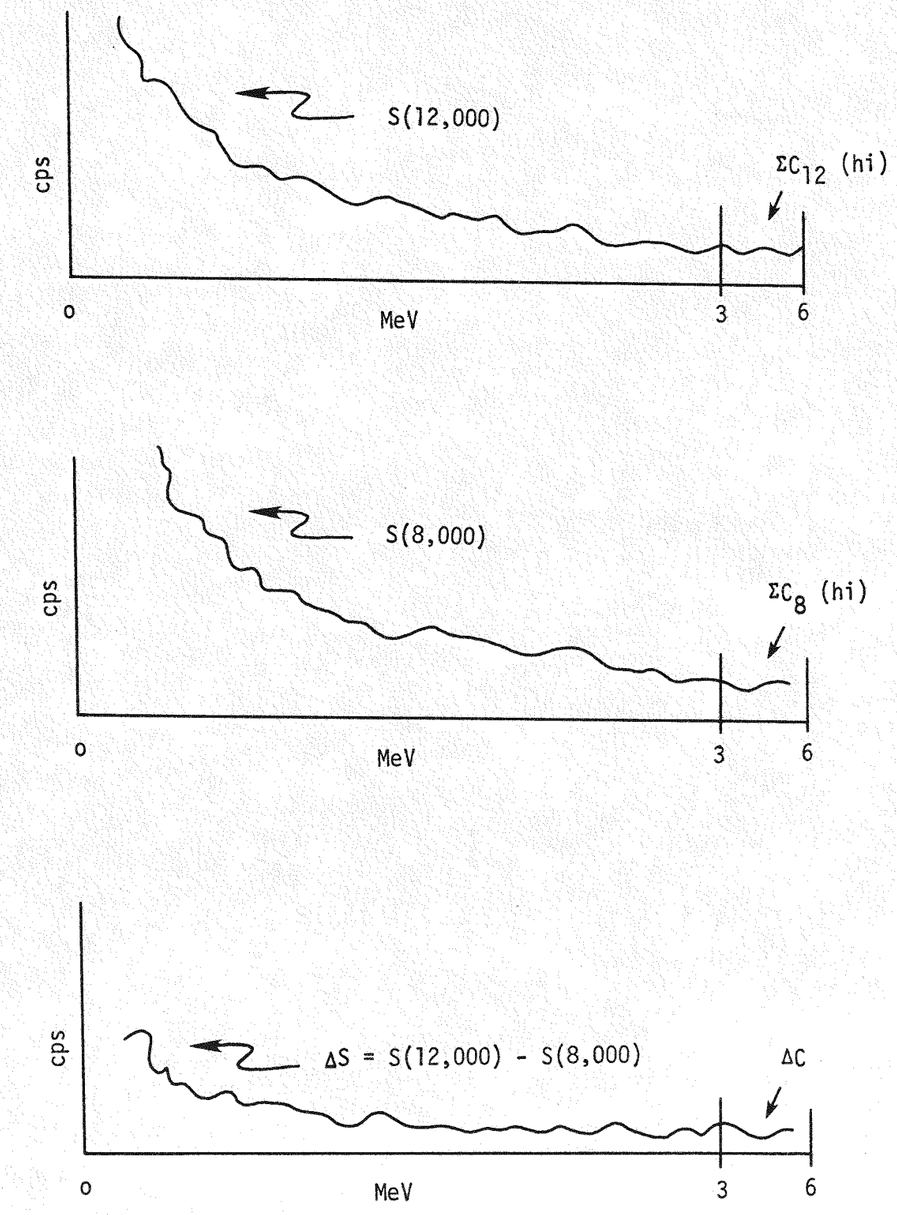


FIGURE IV - Multiple altitude spectra schematic

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

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

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

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

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

DERIVED AIRCRAFT BACKGROUND SPECTRUM FROM PACIFIC OCEAN DATA

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

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

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

```
CH   0 (0.000 MEV)   0.000 CPS *
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)   0.000 CPS *
CH  21 (0.248 MEV)   1.491 CPS *****
CH  22 (0.260 MEV)   3.798 CPS ************
CH  23 (0.272 MEV)   4.280 CPS **************
CH  24 (0.284 MEV)   4.334 CPS **************
CH  25 (0.295 MEV)   3.748 CPS ************
CH  26 (0.307 MEV)   3.897 CPS *************
CH  27 (0.319 MEV)   3.818 CPS ************
CH  28 (0.331 MEV)   4.236 CPS **************
CH  29 (0.343 MEV)   3.433 CPS ***********
CH  30 (0.355 MEV)   2.996 CPS **********
CH  31 (0.366 MEV)   2.559 CPS *********
CH  32 (0.378 MEV)   2.269 CPS ********
CH  33 (0.390 MEV)   2.102 CPS *******
CH  34 (0.402 MEV)   2.081 CPS ******* TOTAL COUNT
CH  35 (0.414 MEV)   2.121 CPS *******
CH  36 (0.426 MEV)   2.114 CPS *******
CH  37 (0.437 MEV)   1.976 CPS *******
CH  38 (0.449 MEV)   2.299 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)   2.185 CPS *******
CH  43 (0.508 MEV)   2.158 CPS *******
CH  44 (0.520 MEV)   2.267 CPS ********
CH  45 (0.532 MEV)   2.217 CPS ********
CH  46 (0.544 MEV)   1.997 CPS *******
CH  47 (0.556 MEV)   2.447 CPS ********
CH  48 (0.567 MEV)   2.540 CPS *********
CH  49 (0.579 MEV)   2.586 CPS *********
CH  50 (0.591 MEV)   2.708 CPS *********
CH  51 (0.603 MEV)   2.481 CPS ********
CH  52 (0.615 MEV)   2.372 CPS ********
CH  53 (0.626 MEV)   1.868 CPS *******
CH  54 (0.638 MEV)   1.682 CPS ******
CH  55 (0.650 MEV)   1.861 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)   1.226 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)   1.041 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)   0.908 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)   0.787 CPS ***
CH  99 (1.170 MEV)   0.751 CPS ***
CH 100 (1.182 MEV)   0.807 CPS *** BISMUTH 214
CH 101 (1.194 MEV)   0.693 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)   0.476 CPS **
CH 107 (1.265 MEV)   0.601 CPS ***
CH 108 (1.277 MEV)   0.661 CPS ***
CH 109 (1.288 MEV)   0.689 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)   0.996 CPS ****
CH 126 (1.489 MEV)   0.967 CPS ****
CH 127 (1.501 MEV)   0.684 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)   0.259 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)   0.276 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 (2.198 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)   0.078 CPS *
CH 206 (2.435 MEV)   0.118 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)   0.098 CPS *
CH 230 (2.719 MEV)   0.027 CPS *
CH 231 (2.730 MEV)   0.012 CPS *
CH 232 (2.742 MEV)  -0.026 CPS *
CH 233 (2.754 MEV)  -0.024 CPS *
CH 234 (2.766 MEV)   0.038 CPS *
CH 235 (2.778 MEV)   0.003 CPS *
CH 236 (2.790 MEV)   0.060 CPS *
CH 237 (2.801 MEV)   0.038 CPS * THALLIUM 208
CH 238 (2.813 MEV)   0.023 CPS *
CH 239 (2.825 MEV)   0.008 CPS *
CH 240 (2.837 MEV)   0.078 CPS *
CH 241 (2.849 MEV)   0.027 CPS *
CH 242 (2.860 MEV)   0.047 CPS *
CH 243 (2.872 MEV)   0.039 CPS *
CH 244 (2.884 MEV)   0.084 CPS *
CH 245 (2.896 MEV)   0.025 CPS *
CH 246 (2.908 MEV)   0.025 CPS *
CH 247 (2.920 MEV)  -0.015 CPS *
CH 248 (2.931 MEV)   0.037 CPS *
CH 249 (2.943 MEV)  -0.005 CPS *
CH 250 (2.955 MEV)   0.042 CPS *
CH 251 (2.967 MEV)   0.002 CPS *
CH 252 (2.979 MEV)  -0.018 CPS *
CH 253 (2.990 MEV)   0.031 CPS *
CH 254 (3.002 MEV)  -0.106 CPS * TOTAL COUNT
CH 255 (3.014 MEV)   0.000 CPS *
```

FIGURE V

DERIVED COSMIC SPECTRUM FROM PACIFIC OCEAN DATA

DOWNWARD-LOOKING CRYSTAL SPECTRUM FOR LINE COSMIC, DATED 072577

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

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

```
CH   0 (0.000 MEV)    0.000 CPS *
CH   1 (0.012 MEV)    0.000 CPS *
CH   2 (0.024 MEV)    0.000 CPS *
CH   3 (0.035 MEV)    0.000 CPS *
CH   4 (0.047 MEV)    0.000 CPS *
CH   5 (0.059 MEV)    0.000 CPS *
CH   6 (0.071 MEV)    0.000 CPS *
CH   7 (0.083 MEV)    0.000 CPS *
CH   8 (0.095 MEV)    0.000 CPS *
CH   9 (0.106 MEV)    0.000 CPS *
CH  10 (0.118 MEV)    0.000 CPS *
CH  11 (0.130 MEV)    0.000 CPS *
CH  12 (0.142 MEV)    0.000 CPS *
CH  13 (0.154 MEV)    0.000 CPS *
CH  14 (0.165 MEV)    0.000 CPS *
CH  15 (0.177 MEV)    0.000 CPS *
CH  16 (0.189 MEV)    0.000 CPS *
CH  17 (0.201 MEV)    0.000 CPS *
CH  18 (0.213 MEV)    1.091 CPS **
CH  19 (0.225 MEV)    1.313 CPS **
CH  20 (0.236 MEV)    2.226 CPS ***
CH  21 (0.248 MEV)   26.345 CPS ***************************
CH  22 (0.260 MEV)   89.243 CPS *********************************************************************************************
CH  23 (0.272 MEV)  100.516 CPS **************************************************************************************************
CH  24 (0.284 MEV)  103.036 CPS **************************************************************************************************
CH  25 (0.295 MEV)   94.423 CPS ***********************************************************************************************
CH  26 (0.307 MEV)   88.893 CPS *********************************************************************************************
CH  27 (0.319 MEV)   85.038 CPS *****************************************************************************************
CH  28 (0.331 MEV)   89.528 CPS *********************************************************************************************
CH  29 (0.343 MEV)   78.271 CPS *******************************************************************************************
CH  30 (0.355 MEV)   72.498 CPS *****************************************************************************
CH  31 (0.366 MEV)   74.934 CPS ******************************************************************************
CH  32 (0.378 MEV)   65.560 CPS ********************************************************************
CH  33 (0.390 MEV)   65.966 CPS ********************************************************************
CH  34 (0.402 MEV)   63.189 CPS ****************************************************************** TOTAL COUNT
CH  35 (0.414 MEV)   62.880 CPS ******************************************************************
CH  36 (0.426 MEV)   64.078 CPS ********************************************************************
CH  37 (0.437 MEV)   67.602 CPS ***********************************************************************
CH  38 (0.449 MEV)   69.116 CPS *************************************************************************
CH  39 (0.461 MEV)   76.972 CPS ********************************************************************************
CH  40 (0.473 MEV)   84.879 CPS ***********************************************************************************
CH  41 (0.485 MEV)   96.049 CPS ***************************************************************************************************
CH  42 (0.496 MEV)   94.167 CPS ***********************************************************************************************
CH  43 (0.508 MEV)   86.706 CPS ******************************************************************************************
CH  44 (0.520 MEV)   68.016 CPS ************************************************************************
CH  45 (0.532 MEV)   48.444 CPS ***************************************************
CH  46 (0.544 MEV)   40.965 CPS ******************************************
CH  47 (0.556 MEV)   30.512 CPS *******************************
CH  48 (0.567 MEV)   33.160 CPS **********************************
CH  49 (0.579 MEV)   31.892 CPS *********************************
CH  50 (0.591 MEV)   25.907 CPS **************************
CH  51 (0.603 MEV)   30.781 CPS *******************************
CH  52 (0.615 MEV)   27.055 CPS ****************************
CH  53 (0.626 MEV)   27.982 CPS *****************************
CH  54 (0.638 MEV)   25.776 CPS **************************
CH  55 (0.650 MEV)   22.988 CPS ************************
CH  56 (0.662 MEV)   27.787 CPS ****************************
CH  57 (0.674 MEV)   25.274 CPS **************************
CH  58 (0.686 MEV)   25.240 CPS **************************
CH  59 (0.697 MEV)   23.489 CPS ************************
CH  60 (0.709 MEV)   24.769 CPS *************************
CH  61 (0.721 MEV)   22.350 CPS ***********************
CH  62 (0.733 MEV)   22.242 CPS ***********************
CH  63 (0.745 MEV)   22.424 CPS ***********************
CH  64 (0.756 MEV)   22.234 CPS ***********************
CH  65 (0.768 MEV)   20.332 CPS *********************
CH  66 (0.780 MEV)   18.831 CPS *******************
CH  67 (0.792 MEV)   20.493 CPS *********************
CH  68 (0.804 MEV)   19.339 CPS ********************
CH  69 (0.816 MEV)   19.021 CPS ********************
CH  70 (0.827 MEV)   17.949 CPS ******************
CH  71 (0.839 MEV)   20.235 CPS *********************
CH  72 (0.851 MEV)   17.491 CPS ******************
CH  73 (0.863 MEV)   18.370 CPS *******************
CH  74 (0.875 MEV)   16.244 CPS *****************
CH  75 (0.887 MEV)   16.331 CPS *****************
CH  76 (0.898 MEV)   17.519 CPS ******************
CH  77 (0.910 MEV)   16.689 CPS *****************
CH  78 (0.922 MEV)   17.150 CPS ******************
CH  79 (0.934 MEV)   19.230 CPS ********************
CH  80 (0.946 MEV)   17.111 CPS ******************
CH  81 (0.957 MEV)   16.248 CPS *****************
CH  82 (0.969 MEV)   14.954 CPS ***************
CH  83 (0.981 MEV)   17.324 CPS ******************
CH  84 (0.993 MEV)   16.276 CPS *****************
CH  85 (1.005 MEV)   14.813 CPS ***************
CH  86 (1.017 MEV)   15.703 CPS ****************
CH  87 (1.028 MEV)   13.767 CPS **************
CH  88 (1.040 MEV)   16.414 CPS *****************
CH  89 (1.052 MEV)   13.642 CPS ************** BISMUTH 214
CH  90 (1.064 MEV)   13.624 CPS **************
CH  91 (1.076 MEV)   13.517 CPS **************
CH  92 (1.087 MEV)   13.700 CPS **************
CH  93 (1.099 MEV)   14.633 CPS ***************
CH  94 (1.111 MEV)   14.303 CPS ***************
CH  95 (1.123 MEV)   13.766 CPS **************
CH  96 (1.135 MEV)   14.949 CPS ***************
CH  97 (1.147 MEV)   13.503 CPS **************
CH  98 (1.158 MEV)   13.481 CPS **************
CH  99 (1.170 MEV)   13.189 CPS *************
CH 100 (1.182 MEV)   13.602 CPS ************** BISMUTH 214
CH 101 (1.194 MEV)   12.965 CPS *************
CH 102 (1.206 MEV)   12.538 CPS *************
CH 103 (1.217 MEV)   14.001 CPS **************
CH 104 (1.229 MEV)   11.346 CPS ************
CH 105 (1.241 MEV)   11.113 CPS ************
CH 106 (1.253 MEV)   13.669 CPS **************
CH 107 (1.265 MEV)   11.910 CPS *************
CH 108 (1.277 MEV)   12.345 CPS *************
CH 109 (1.288 MEV)   10.736 CPS ***********
CH 110 (1.300 MEV)   11.444 CPS ************
CH 111 (1.312 MEV)   11.433 CPS ************
CH 112 (1.324 MEV)   11.927 CPS *************
CH 113 (1.336 MEV)   11.846 CPS *************
CH 114 (1.347 MEV)   11.896 CPS *************
CH 115 (1.359 MEV)   11.470 CPS ************
CH 116 (1.371 MEV)   11.864 CPS ************ POTASSIUM 40
CH 117 (1.383 MEV)   10.286 CPS ***********
CH 118 (1.395 MEV)   12.084 CPS *************
CH 119 (1.407 MEV)    9.642 CPS **********
CH 120 (1.418 MEV)   11.778 CPS *************
CH 121 (1.430 MEV)   12.635 CPS **************
CH 122 (1.442 MEV)   10.601 CPS ***********
CH 123 (1.454 MEV)    9.140 CPS **********
CH 124 (1.466 MEV)   11.144 CPS ************
CH 125 (1.477 MEV)   10.766 CPS ***********
CH 126 (1.489 MEV)    9.250 CPS **********
CH 127 (1.501 MEV)   11.961 CPS *************
CH 128 (1.513 MEV)   10.296 CPS ***********
CH 129 (1.525 MEV)   10.900 CPS ************
CH 130 (1.537 MEV)    9.022 CPS **********
CH 131 (1.548 MEV)   10.311 CPS ***********
CH 132 (1.560 MEV)   10.151 CPS *********** POTASSIUM 40
CH 133 (1.572 MEV)    9.361 CPS **********
CH 134 (1.584 MEV)    8.753 CPS **********
CH 135 (1.596 MEV)   11.176 CPS ************
CH 136 (1.608 MEV)   10.130 CPS ***********
CH 137 (1.619 MEV)   10.551 CPS ************
CH 138 (1.631 MEV)    9.204 CPS **********
CH 139 (1.643 MEV)    9.159 CPS **********
CH 140 (1.655 MEV)    8.738 CPS **********
CH 141 (1.667 MEV)    8.679 CPS ********** BISMUTH 214
CH 142 (1.678 MEV)   10.154 CPS ***********
CH 143 (1.690 MEV)    9.743 CPS ***********
CH 144 (1.702 MEV)    9.453 CPS **********
CH 145 (1.714 MEV)    9.418 CPS **********
CH 146 (1.726 MEV)    8.485 CPS *********
CH 147 (1.738 MEV)    9.263 CPS **********
CH 148 (1.749 MEV)    9.653 CPS ***********
CH 149 (1.761 MEV)    9.412 CPS **********
CH 150 (1.773 MEV)    9.019 CPS **********
CH 151 (1.785 MEV)    9.389 CPS **********
CH 152 (1.797 MEV)   10.232 CPS ***********
CH 153 (1.808 MEV)    9.686 CPS ***********
CH 154 (1.820 MEV)    7.911 CPS *********
CH 155 (1.832 MEV)    8.104 CPS *********
CH 156 (1.844 MEV)    9.602 CPS ***********
CH 157 (1.856 MEV)    9.473 CPS ********** BISMUTH 214
CH 158 (1.868 MEV)    8.568 CPS **********
CH 159 (1.879 MEV)    8.105 CPS *********
CH 160 (1.891 MEV)    8.014 CPS *********
CH 161 (1.903 MEV)    8.385 CPS *********
CH 162 (1.915 MEV)    8.759 CPS **********
CH 163 (1.927 MEV)    6.994 CPS ********
CH 164 (1.938 MEV)    8.477 CPS *********
CH 165 (1.950 MEV)    8.144 CPS *********
CH 166 (1.962 MEV)    7.798 CPS *********
CH 167 (1.974 MEV)    8.214 CPS *********
CH 168 (1.986 MEV)    9.240 CPS **********
CH 169 (1.998 MEV)    7.945 CPS *********
CH 170 (2.009 MEV)    7.615 CPS *********
CH 171 (2.021 MEV)    6.816 CPS ********
CH 172 (2.033 MEV)    8.408 CPS *********
CH 173 (2.045 MEV)    7.196 CPS ********
CH 174 (2.057 MEV)    7.231 CPS ********
CH 175 (2.068 MEV)    7.473 CPS ********
CH 176 (2.080 MEV)    9.062 CPS **********
CH 177 (2.092 MEV)    8.116 CPS *********
CH 178 (2.104 MEV)    8.235 CPS *********
CH 179 (2.116 MEV)    7.653 CPS *********
CH 180 (2.128 MEV)    8.338 CPS *********
CH 181 (2.139 MEV)    7.237 CPS ********
CH 182 (2.151 MEV)    7.528 CPS *********
CH 183 (2.163 MEV)    8.039 CPS *********
CH 184 (2.175 MEV)    8.536 CPS **********
CH 185 (2.187 MEV)    8.888 CPS **********
CH 186 (2.199 MEV)    7.485 CPS ********
CH 187 (2.210 MEV)    8.211 CPS *********
CH 188 (2.222 MEV)    8.233 CPS *********
CH 189 (2.234 MEV)    8.055 CPS *********
CH 190 (2.246 MEV)    7.825 CPS *********
CH 191 (2.258 MEV)    7.062 CPS ********
CH 192 (2.269 MEV)    8.435 CPS *********
CH 193 (2.281 MEV)    7.440 CPS ********
CH 194 (2.293 MEV)    7.686 CPS *********
CH 195 (2.305 MEV)    7.110 CPS ********
CH 196 (2.317 MEV)    7.329 CPS ********
CH 197 (2.329 MEV)    7.890 CPS *********
CH 198 (2.340 MEV)    7.771 CPS *********
CH 199 (2.352 MEV)    7.147 CPS ********
CH 200 (2.364 MEV)    6.729 CPS ********
CH 201 (2.376 MEV)    6.264 CPS *******
CH 202 (2.388 MEV)    6.318 CPS *******
CH 203 (2.399 MEV)    7.050 CPS ********
CH 204 (2.411 MEV)    6.596 CPS ******** THALLIUM 208
CH 205 (2.423 MEV)    6.486 CPS *******
CH 206 (2.435 MEV)    6.589 CPS ********
CH 207 (2.447 MEV)    7.033 CPS ********
CH 208 (2.459 MEV)    6.515 CPS ********
CH 209 (2.470 MEV)    6.852 CPS ********
CH 210 (2.482 MEV)    6.871 CPS ********
CH 211 (2.494 MEV)    6.573 CPS ********
CH 212 (2.506 MEV)    6.417 CPS *******
CH 213 (2.518 MEV)    5.845 CPS *******
CH 214 (2.529 MEV)    6.127 CPS *******
CH 215 (2.541 MEV)    6.355 CPS *******
CH 216 (2.553 MEV)    6.964 CPS ********
CH 217 (2.565 MEV)    6.820 CPS ********
CH 218 (2.577 MEV)    6.670 CPS ********
CH 219 (2.589 MEV)    6.808 CPS ********
CH 220 (2.600 MEV)    5.940 CPS *******
CH 221 (2.612 MEV)    6.177 CPS *******
CH 222 (2.624 MEV)    6.176 CPS *******
CH 223 (2.636 MEV)    6.109 CPS *******
CH 224 (2.648 MEV)    6.347 CPS *******
CH 225 (2.660 MEV)    7.049 CPS ********
CH 226 (2.671 MEV)    5.757 CPS *******
CH 227 (2.683 MEV)    5.645 CPS *******
CH 228 (2.695 MEV)    5.229 CPS ******
CH 229 (2.707 MEV)    5.415 CPS ******
CH 230 (2.719 MEV)    6.190 CPS *******
CH 231 (2.730 MEV)    6.092 CPS *******
CH 232 (2.742 MEV)    6.466 CPS *******
CH 233 (2.754 MEV)    7.032 CPS ********
CH 234 (2.766 MEV)    5.533 CPS *******
CH 235 (2.778 MEV)    6.309 CPS *******
CH 236 (2.790 MEV)    5.559 CPS *******
CH 237 (2.801 MEV)    5.206 CPS ****** THALLIUM 208
CH 238 (2.813 MEV)    6.045 CPS *******
CH 239 (2.825 MEV)    5.257 CPS ******
CH 240 (2.837 MEV)    5.640 CPS *******
CH 241 (2.849 MEV)    5.835 CPS *******
CH 242 (2.860 MEV)    5.348 CPS ******
CH 243 (2.872 MEV)    4.804 CPS ******
CH 244 (2.884 MEV)    4.742 CPS ******
CH 245 (2.896 MEV)    5.304 CPS ******
CH 246 (2.908 MEV)    5.248 CPS ******
CH 247 (2.920 MEV)    6.036 CPS *******
CH 248 (2.931 MEV)    5.711 CPS *******
CH 249 (2.943 MEV)    5.513 CPS *******
CH 250 (2.955 MEV)    5.010 CPS ******
CH 251 (2.967 MEV)    5.570 CPS *******
CH 252 (2.979 MEV)    6.256 CPS *******
CH 253 (2.990 MEV)    5.207 CPS ******
CH 254 (3.002 MEV)    9.302 CPS ********** TOTAL COUNT
CH 255 (3.014 MEV)1000.000 CPS ********************************************************************************************************************
```

FIGURE VI

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

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

KC_i = uncorrected system count rate for the K channel

UC_i = uncorrected system count rate for the U channel

TC_i = uncorrected system count rate for the T channel

K_i = the percent differential concentration of potassium

U_i = ppm differential concentration of uranium

T_i = ppm differential concentration of thorium

where "i" refers to the ith pad.

We also define the following:

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

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

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

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

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

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

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

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

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

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

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

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

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

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 $\bar{A}$.

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

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)

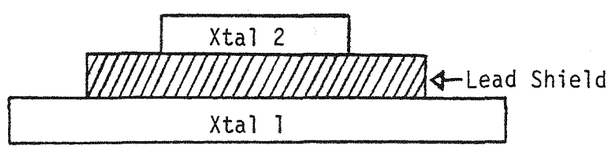
$S_{tu} = \frac{\Delta tu}{\Delta tt}$ (effect of uranium on thorium)

$S_{tk} = \frac{\Delta tk}{\Delta tt}$ (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.

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

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

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

Consider the equations for I_1 and I_2 again

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

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

Over water $I_g = 0$

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

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

$$I_1 = I_a$$

$$I_2 = mI_a$$

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

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

$$I_1 = I_g + I_a$$

$$I_2 = \ell I_g + mI_a$$

$$mI_a = I_2 - \ell I_g$$

but $I_g = I_1 - I_a$

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:

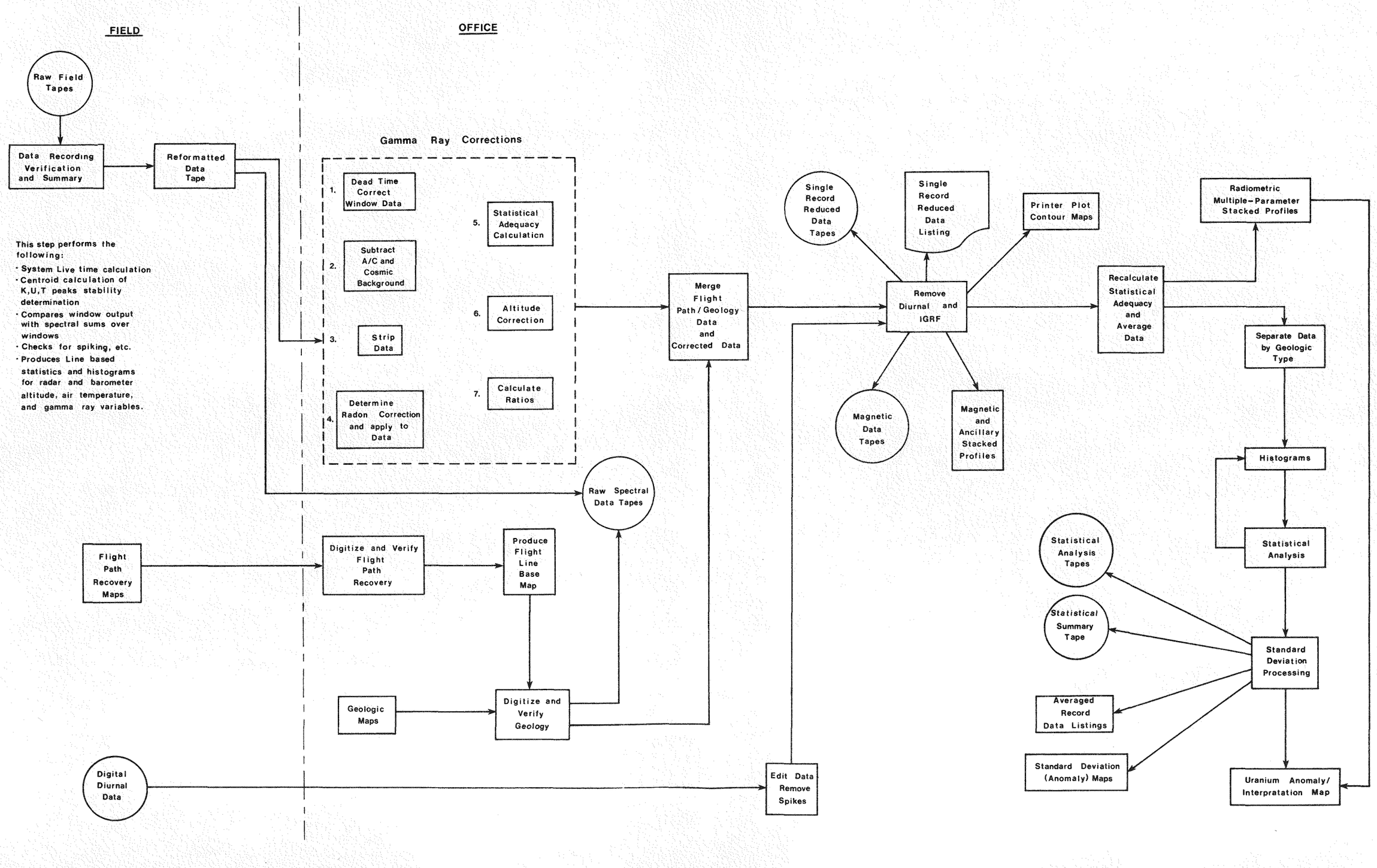
QUEEN AIR

		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:

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

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

$\mu\ell$ & μ m are altitude dependent as follows:

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

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

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

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

Statistical Adequacy Test

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

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

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

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

2. The sum of these corrections also follows a Poisson distribution.

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

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

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

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

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

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

Conversion to Equivalent ppm and Percent

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

Radioelement	Equivalent Percent/ppm	Queen Air Counts/Second
K	1%K	91.5
U	1 ppmeu	10.4
T	1 ppmeT	6.4

MAGNETIC DATA REDUCTION

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

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

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

DATA PRESENTATION

General

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

Radiometric Profiles

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

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

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

MAGNETIC PROFILES

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

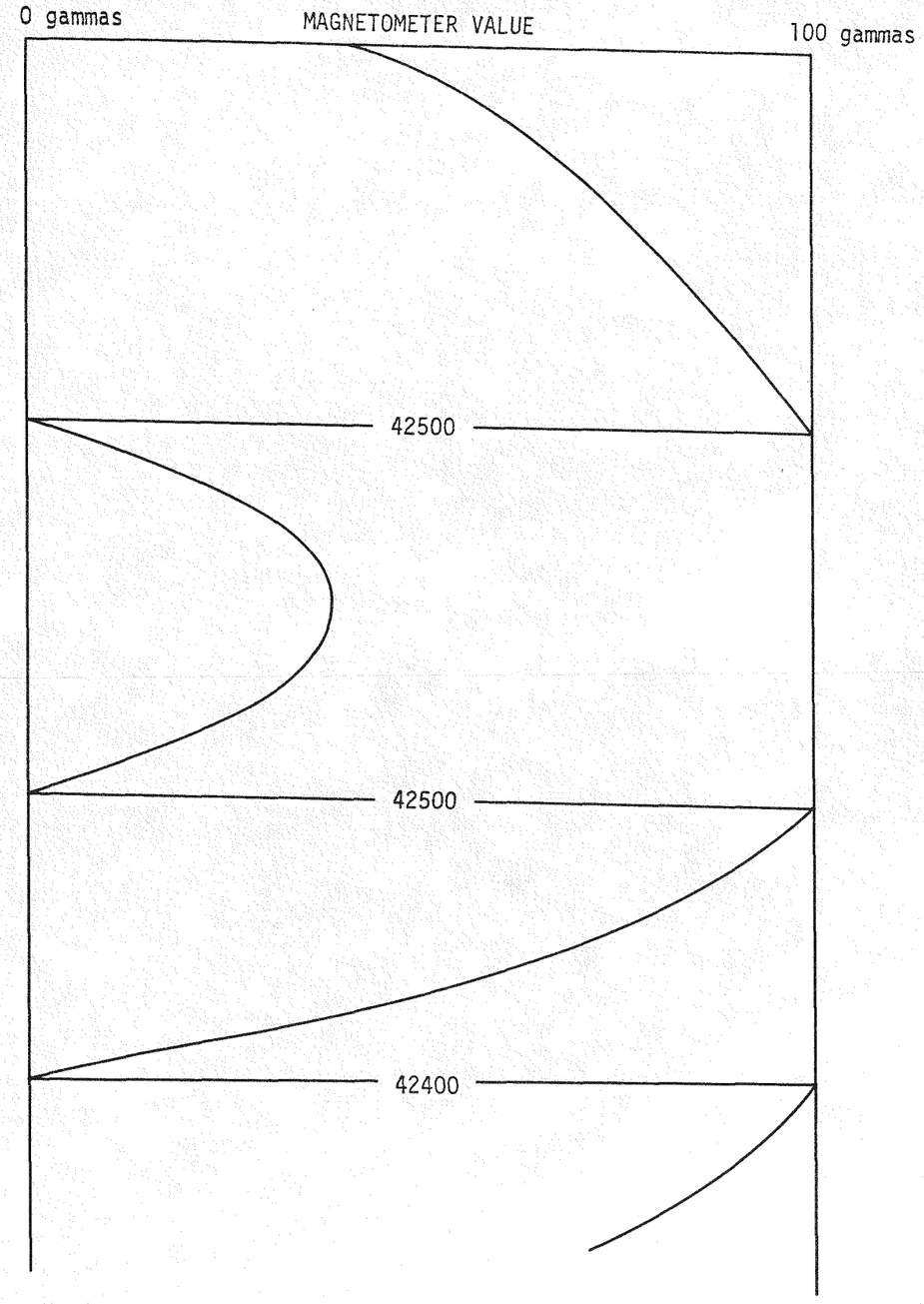


FIGURE VIII Plotter Step Value Labeling

FLIGHT PATH MAPS

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

STANDARD DEVIATION MAPS

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

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

HISTOGRAMS

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

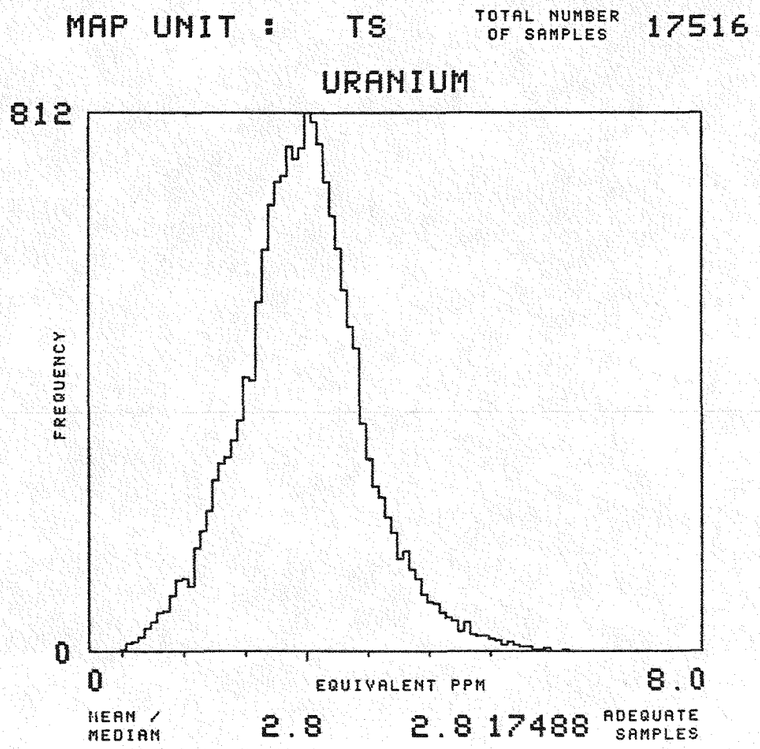


FIGURE IX Sample Computer Map Unit Histogram

DATA LISTINGS

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

1. Fiducial number
2. System/Quality (SAKUT) - The first digit identifies the system used to collect the sample. The remaining digits define the results of statistical adequacy testing for altitude, potassium, uranium, and thorium. A value of 0 indicated that the data are statistically adequate. A value of 1 indicates that the data are statistically inadequate. All data collected in excess of 700 feet and less than 200 feet are considered statistically inadequate.
3. Time - time presented in hours, minutes, and seconds
4. Altitude - altitude presented in feet above terrain
5. LAT/LONG - Latitude and Longitude presented in terms of decimal degrees
6. Magnetic field expressed in residual gammas
7. Geology - code representing geologic units
8. %K, eU, eT - percent potassium, equivalent ppm of uranium and thorium
9. eU/eTH, eU/%K, eTH/%K - calculated ratios of the three parameters
10. Total count - corrected total count data (0.4 to 3.0 MeV)
11. COS - downward looking cosmic count rate in the 3-6 MeV channel
12. Uair - atmospheric Bi-214 equivalent ppm
13. Temperature - outside air temperature in degrees centigrade
14. Press - barometric pressure in mm of mercury

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

1. Fiducial number

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

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

4. Magnetic field expressed in residual gammas

5. Geology - code representing geologic formations

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

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

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

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

10. Uair - atmospheric Bi-214 in equivalent ppm

DATA TAPES

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

DATA INTERPRETATION METHODS

General

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

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

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

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

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

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

Methodology

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

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

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

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

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

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

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

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

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

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

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

TAPE FORMATS

SINGLE RECORD REDUCED DATA TAPE

REFERENCE: Paragraphs 4.7.6 and 6.1.6, BFEC 1200-C

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

Block 1 - Format Data

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

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

SINGLE RECORD REDUCED DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

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

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

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

Block 2 - Single Record Reduced Identification Data

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

Block 3 - Single Record Reduced Data

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

STATISTICAL ANALYSIS TAPE

REFERENCE: Paragraphs 4.7.7 and 6.1.6, BFEC 1200-C

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

Block 1 - Format Description Data

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

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

STATISTICAL ANALYSIS DATA TAPE

FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)

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

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

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

ITEM	FORMAT	DESCRIPTION
1	I1	AERIAL SYSTEM IDENTIFICATION CODE
2	I4	FLIGHT LINE NUMBER
3	I6	RECORD IDENTIFICATION NUMBER
4	I6	GMT TIME OF DAY (HHMMSS)
5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
8	F7.1	RESIDUAL (IGRF Removed) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
9	A8	SURFACE GEOLOGIC MAP UNIT CODE
10	I4	QUALITY FLAG CODES
11	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K
12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K
13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRIACALLY SIGNED.
20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND
22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DEICMAL PLACE IN PPM EQUIVALENT U
24	F4.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
27	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
D8	F6.1	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 EQUIVALENT TH
18	A3	URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE
19	I6	NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
20	F6.1	URANIUM -TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K
21	F6.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT
22	A3	URANIUM-TO-POTASSIUM RATIO DISTRIBUTION
23	I6	NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS COMPUTED FOR GEOLOGIC UNIT
24	F6.1	THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
25	F6.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K
26	A3	THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE

The remaining 2680 characters on this block shall be blanks.

Block 2 - Statistical Analysis Identification Data

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

Block 3 - Statistical Analysis Summary Data

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

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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, NOVEMBER, 1980

QUEEN AIR N9AG

Oct. 24-25	Base Mobilization
26	612 line miles, Ft. Dodge, Waterloo, Dubuque
27	Weather - nil production
28	" " "
29	740 line miles, Fairmont, Mason City, La Crosse
30	740 " " " " "
31	Testing - nil production
Nov. 1	" " "
2	" "
3	Weather - nil production
4	420 line miles, Mason City, La Crosse
5	740 " " Fairmont, Mason City, La Crosse
6	Aircraft Maintenance
7	" "
8	Weather - nil production
9	740 line miles, Fairmont, Mason City, La Crosse
10	810 " " , " " "
11	661 " " , " " "
12	886 " " , Ft. Dodge, Waterloo, Dubuque, Omaha
13	Weather - nil production
14	886 line miles, Ft. Dodge, Waterloo, Dubuque, Omaha
15	886 " " " " " "
16	612 " " , " " " "
17	886 " " , Ft. Dodge, Waterloo, Dubuque, Davenport
18	Aircraft problems - nil production
19	Weather - nil production
20	898 lines miles, Omaha, Des Moines, Dubuque, Davenport
21	898 " " , Omaha, Des Moines, Waterloo, Davenport
22	Weather - nil production
23	335 line miles, Davenport, Dubuque
24	1051 " " , Omaha, Des Moines, Davenport
25	1034 " " , Omaha, Des Moines, Davenport, Dubuque
26	898 " " , Omaha, Des Moines, Davenport, Waterloo

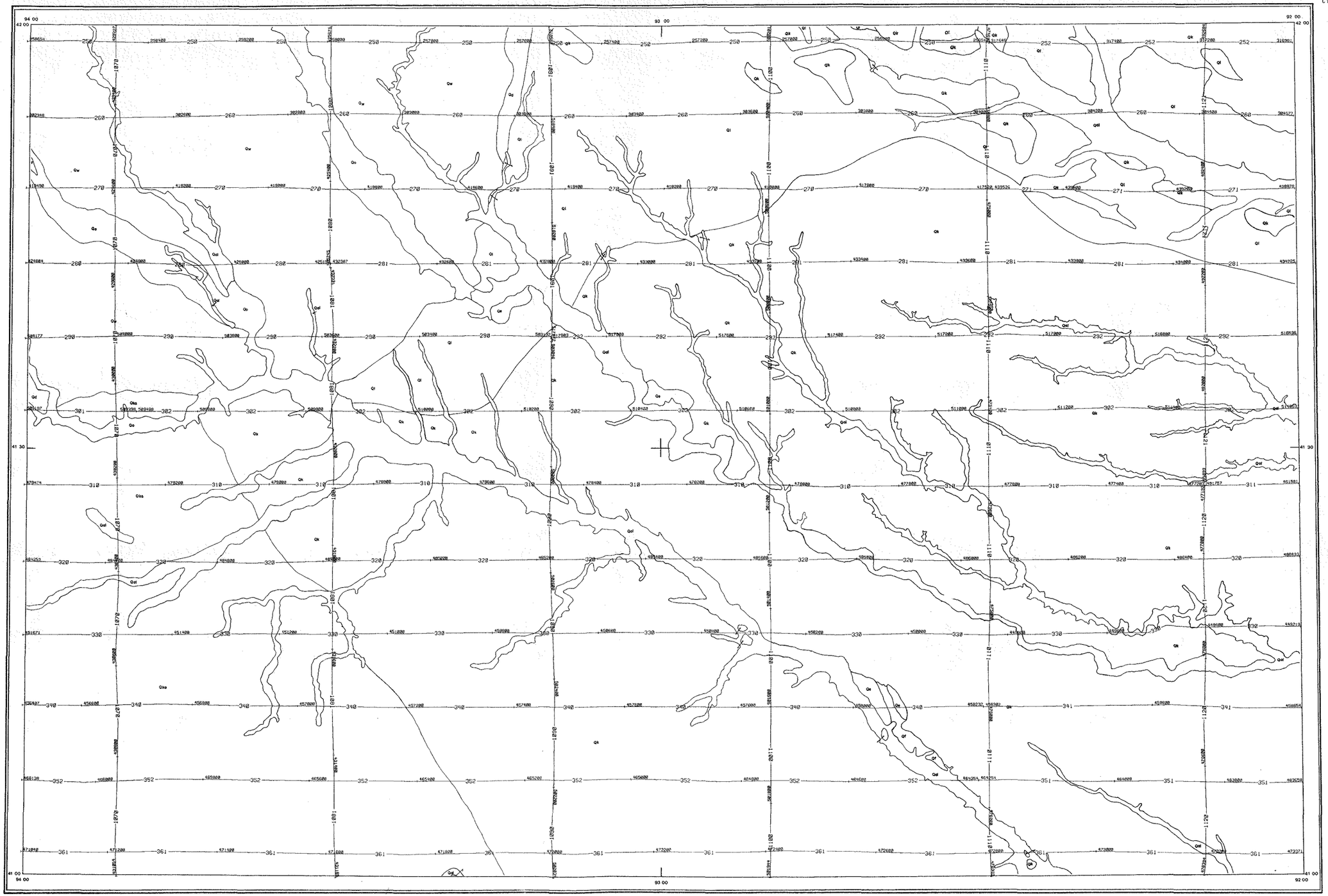
Total miles for the above period = 14,733 line miles

Total miles for the included quadrangles:

Fairmont	1,617.0
La Crosse	1,617.0
Mason City	1,617.0
Fort Dodge	1,637.4
Dubuque	1,637.4
Waterloo	1,637.4
Omaha	1,656.6
Des Moines	1,656.6
Davenport	1,656.6

APPENDIX C - Flight Path and Geologic Map

DES MOINES



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

FIDUCIAL NUMBER 193600 — 193650

053-0 LINE NUMBER

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

LOCATION DIAGRAM

SOUTH DAKOTA NK 14-3	FAIRMONT NK 15-1	MINNESOTA NK 15-2 MASON CITY	LA CROSSE NK 15-3	WISCONSIN NK 16-1 WINONA
NK 14-6 SIOUX FALLS	FT DODGE NK 15-4	WATERLOO NK 15-5 IOWA	NK 15-6 DUBUQUE	NK 16-4 ROCKFORD
NEBRASKA NK 14-9 FREMONT	DES MOINES NK 15-7	NK 15-8	OAKWOOD NK 15-9	NK 16-7 AURORA
LINCOLN NK 14-12	NEBRASKA CITY NK 15-10	CENTERVILLE NK 15-11 MISSOURI	BURLINGTON NK 15-12	PEORIA NK 16-10 ILLINOIS
KANSAS NJ 14-3 MANHATTAN	NJ 15-1 KANSAS CITY	NJ 15-2 ROLLA	QUINCY NJ 15-3	DECATUR NJ 16-1

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

FLIGHT PATH RECOVERY

IOWA PROJECT

U. S. DEPARTMENT OF ENERGY

DES MOINES QUADRANGLE
GEOLOGIC MAP EXPLANATION
(Martel Laboratories, 1981)

Cenozoic

- Qal — **Holocene & Wisconsinan alluvium**
- Ql — **Holocene & Wisconsinan loess**
- Qe — **Holocene & Wisconsinan eolian sand**
- Qo — **Holocene & Wisconsinan outwash**
  Meltwater deposits. Includes glacial channel deposits &, locally, alluvium.
- Qw — **Wisconsinan till**
  ***Moraines** with calcareous matrices.*
- Qd — **Wisconsinan till & stratified drift**
  Till & loam interbedded with stratified drift.
- Qf — **Illinoian fluvial deposits**
  Clay, silt, sand, & gravel in terraces.
- Qk — **Pre-Illinoian till**
  Loam with pebbles & calcareous matrix.
- Qka — **Pre-Illinoian argillaceous till**
  Argillaceous loam with pebbles & calcareous matrix.

Holocene & Pleistocene

Pleistocene

Quaternary

APPENDIX D - Profiles

D1 dm

LINE 250
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80325

TL/K
MIN 3.203
MAX 7.850
MEAN 5.850
STD DEV .7014

BI/K
MIN 1.198
MAX 4.362
MEAN 2.509
STD DEV .4896

BI/TL
MIN .2019
MAX .7788
MEAN .4324
STD DEV .0886

TOTAL COUNTS CTS/SEC
MIN 1383
MAX 2775
MEAN 2188
STD DEV 304.5

POTASSIUM 40 PERCENT
MIN .7230
MAX 1.463
MEAN 1.114
STD DEV .1166

BISMUTH 214 EQ. PPM
MIN 1.269
MAX 4.952
MEAN 2.782
STD DEV .5641

THALLIUM 208 EQ. PPM
MIN 3.589
MAX 9.129
MEAN 6.517
STD DEV 1.025

BI AIR CORR EQ. PPM
MIN 1.074
MAX 6.246
MEAN 4.329
STD DEV 1.470

RESID MAG GAMMAS
MIN -1017
MAX -172.4
MEAN -683.7
STD DEV 192.0

RADAR ALTMTR FEET
MIN 290.0
MAX 490.4
MEAN 398.3
STD DEV 32.25

LINE 250

D2 dm

LINE 260
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80325

TL/K
MIN 3.322
MAX 8.964
MEAN 5.803
STD DEV .7570

BI/K
MIN 1.061
MAX 5.174
MEAN 2.257
STD DEV .5491

BI/TL
MIN .2074
MAX .8592
MEAN .3893
STD DEV .0862

TOTAL COUNTS CTS/SEC
MIN 1557
MAX 2654
MEAN 2053
STD DEV 272.5

POTASSIUM 40 PERCENT
MIN .5288
MAX 1.453
MEAN 1.100
STD DEV .1267

BISMUTH 214 EQ. PPM
MIN 1.183
MAX 4.356
MEAN 2.462
STD DEV .5739

THALLIUM 208 EQ. PPM
MIN 3.206
MAX 9.233
MEAN 6.382
STD DEV 1.108

BI AIR CORR EQ. PPM
MIN 2.250
MAX 5.459
MEAN 3.723
STD DEV .7694

RESID MAG GAMMAS
MIN -1007
MAX -464.9
MEAN -783.3
STD DEV 112.7

RADAR ALTMTR FEET
MIN 303.0
MAX 520.8
MEAN 402.5
STD DEV 35.99

LINE 260

D3 dm

LINE 270
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326

TL/K
MIN .0000
MAX 8.490
MEAN 5.785
STD DEV .8967

BI/K
MIN .0000
MAX 11.50
MEAN 2.393
STD DEV .5074

BI/TL
MIN .0000
MAX 1.453
MEAN .4209
STD DEV .0997

TOTAL COUNTS CTS/SEC
MIN 521.1
MAX 1938
MEAN 1640
STD DEV 170.0

POTASSIUM 40 PERCENT
MIN .1275
MAX 1.417
MEAN 1.117
STD DEV .1175

BISMUTH 214 EQ. PPM
MIN 1.182
MAX 3.962
MEAN 2.652
STD DEV .4764

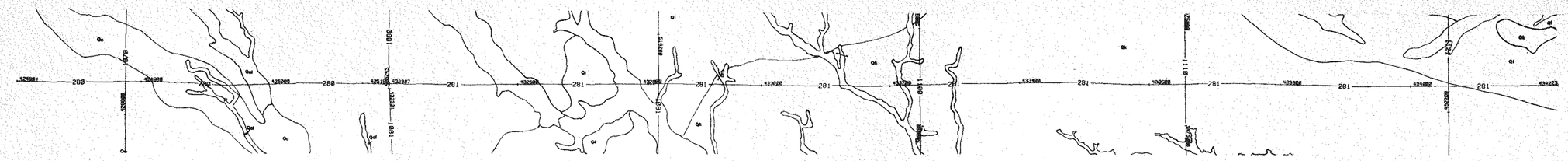
THALLIUM 208 EQ. PPM
MIN .9916
MAX 9.075
MEAN 6.468
STD DEV 1.160

BI AIR CORR EQ. PPM
MIN .1790
MAX 1.812
MEAN .8200
STD DEV .3407

RESID MAG GAMMAS
MIN -909.8
MAX -285.9
MEAN -749.6
STD DEV 135.8

RADAR ALTMTR FEET
MIN 314.5
MAX 569.9
MEAN 411.0
STD DEV 46.04

LINE 270



LINE 280
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326

TL/K
MIN .0000
MAX 8.728
MEAN 5.794
STD DEV 1.051

BI/K
MIN .0000
MAX 6.016
MEAN 1.971
STD DEV .4592

BI/TL
MIN .0000
MAX 1.192
MEAN .3407
STD DEV .0831

TOTAL COUNTS CTS/SEC
MIN 351.2
MAX 1875
MEAN 1615
STD DEV 191.3

POTASSIUM 40 PERCENT
MIN .1653
MAX 1.360
MEAN 1.099
STD DEV .1197

BISMUTH 214 EQ. PPM
MIN .8643
MAX 3.595
MEAN 2.171
STD DEV .4429

THALLIUM 208 EQ. PPM
MIN .8340
MAX 8.834
MEAN 6.428
STD DEV 1.148

BI AIR CORR EQ. PPM
MIN .8348
MAX 1.921
MEAN 1.271
STD DEV .2616

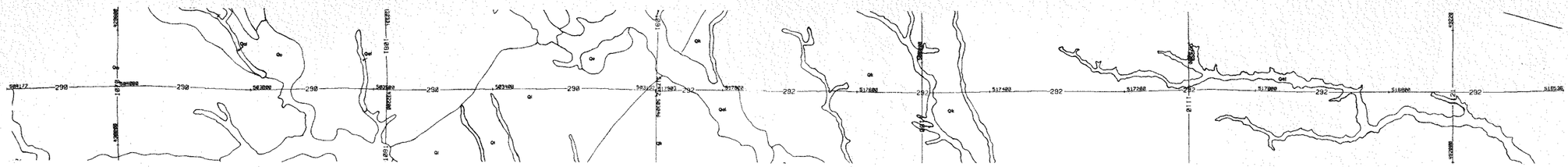
RESID MAG GAMMAS
MIN -1055
MAX 76.95
MEAN -735.1
STD DEV 277.2

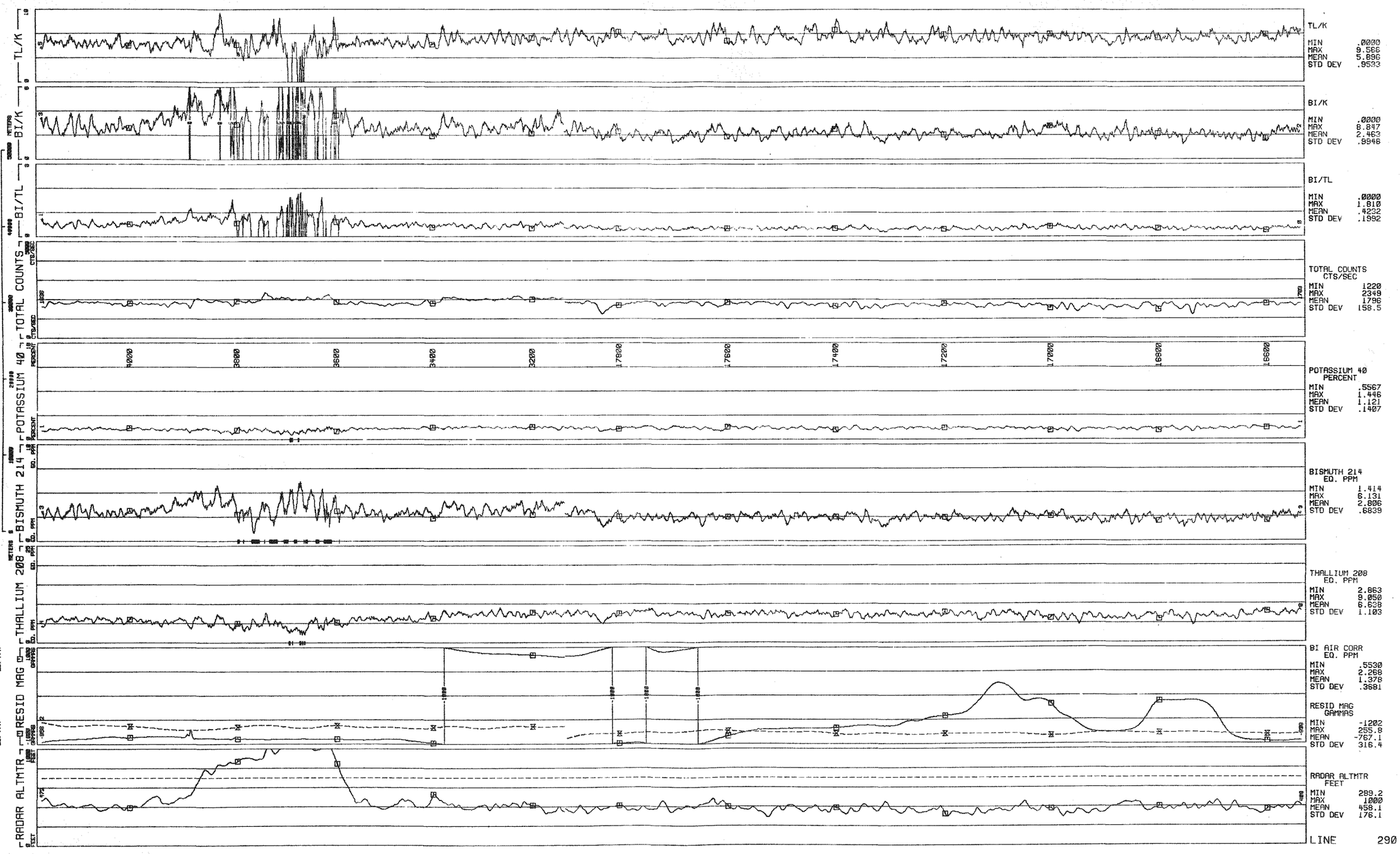
RADAR ALTMTR FEET
MIN 344.7
MAX 535.0
MEAN 422.4
STD DEV 34.69

LINE 280

D5 dm

LINE 290
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331





TL/K
MIN .0000
MAX 9.566
MEAN 5.896
STD DEV .9533

BI/K
MIN .0000
MAX 8.847
MEAN 2.463
STD DEV .9948

BI/TL
MIN .0000
MAX 1.810
MEAN .4232
STD DEV .1992

TOTAL COUNTS CTS/SEC
MIN 1220
MAX 2349
MEAN 1796
STD DEV 158.5

POTASSIUM 40 PERCENT
MIN .5567
MAX 1.446
MEAN 1.121
STD DEV .1407

BISMUTH 214 EQ. PPM
MIN 1.414
MAX 6.131
MEAN 2.806
STD DEV .6839

THALLIUM 208 EQ. PPM
MIN 2.863
MAX 9.050
MEAN 6.628
STD DEV 1.103

BI AIR CORR EQ. PPM
MIN .5530
MAX 2.268
MEAN 1.378
STD DEV .3681

RESID MAG GAMMAS
MIN -1202
MAX 255.8
MEAN -767.1
STD DEV 316.4

RADAR ALTMTR FEET
MIN 289.2
MAX 1000
MEAN 458.1
STD DEV 176.1

LINE 290

D6 dm

LINE 300
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331

TL/K
MIN .0000
MAX 10.79
MEAN 6.405
STD DEV .7118

BI/K
MIN .0000
MAX 11.04
MEAN 2.632
STD DEV .5950

BI/TL
MIN .2068
MAX 1.311
MEAN .4139
STD DEV .0922

TOTAL COUNTS CTS/SEC
MIN 794.3
MAX 2223
MEAN 1688
STD DEV 166.1

POTASSIUM 40 PERCENT
MIN .1667
MAX 1.534
MEAN 1.145
STD DEV .1524

BISMUTH 214 EQ. PPM
MIN 1.632
MAX 4.857
MEAN 2.980
STD DEV .5752

THALLIUM 208 EQ. PPM
MIN 1.435
MAX 9.975
MEAN 7.301
STD DEV .9924

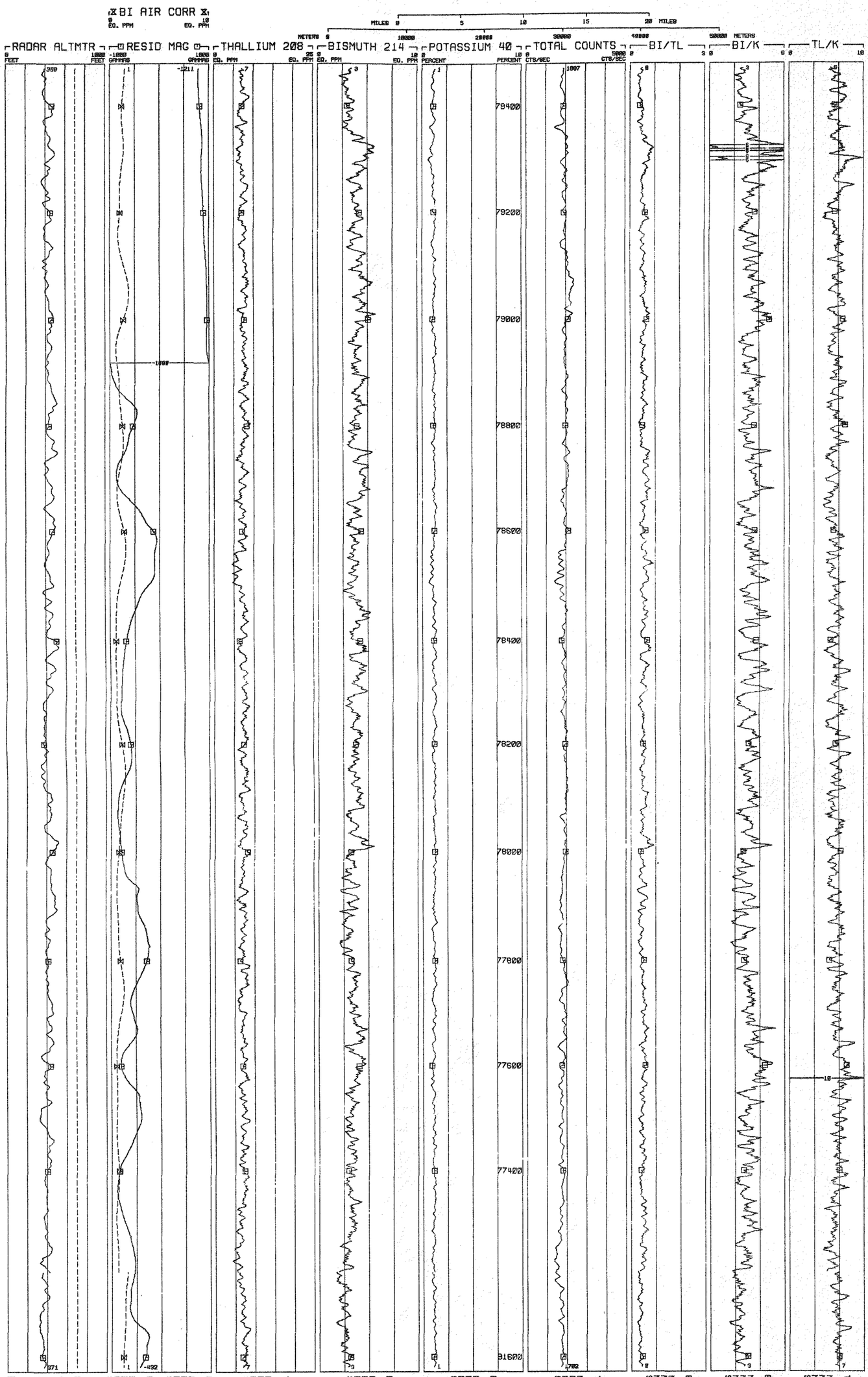
BI AIR CORR EQ. PPM
MIN 1.304
MAX 2.510
MEAN 1.883
STD DEV .2748

RESID MAG GAMMAS
MIN -1073
MAX 117.8
MEAN -677.4
STD DEV 280.0

RADAR ALTMTR FEET
MIN 334.2
MAX 588.5
MEAN 420.0
STD DEV 43.69

LINE 300

LINE 310
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330



LINE 310

RADAR ALTMTR (FEET)
MIN 219.0
MAX 571.0
MEAN 422.9
STD DEV 39.09

RESID MAG (GAMMAS)
MIN -1212
MAX 1211
MEAN -567.2
STD DEV 287.8

BI AIR CORR (EQ. PPM)
MIN .4569
MAX 1.911
MEAN .9724
STD DEV .3511

THALLIUM 208 (EQ. PPM)
MIN 4.421
MAX 9.115
MEAN 7.115
STD DEV .7697

BISMUTH 214 (EQ. PPM)
MIN 1.634
MAX 5.819
MEAN 3.5978
STD DEV .6913

POTASSIUM 40 (PERCENT)
MIN .6455
MAX 1.948
MEAN 1.1135
STD DEV .1238

TOTAL COUNTS (CTS/SEC)
MIN 1370
MAX 2408
MEAN 1755.5
STD DEV 155.5

BI/TL
MIN .2213
MAX .8869
MEAN .5049
STD DEV .1079

BI/K
MIN 1.508
MAX 7.498
MEAN 3.188
STD DEV .7188

TL/K
MIN 4.537
MAX 10.174
MEAN 6.343
STD DEV .7284

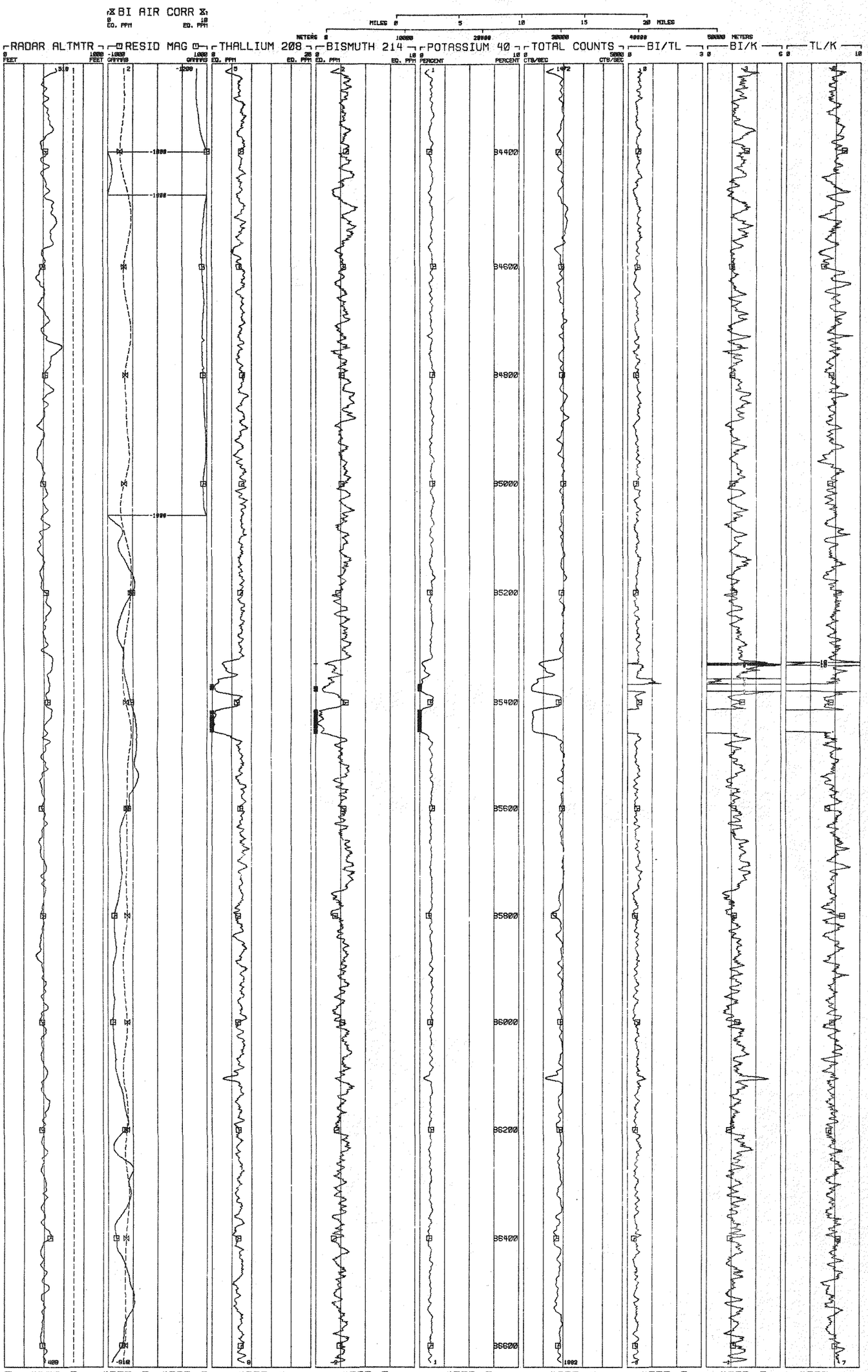


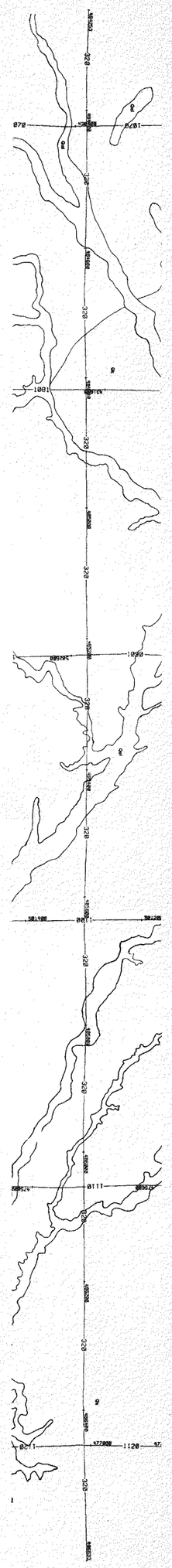
D7 dm

LINE 320

DES MOINES QUADRANGLE - NTMS NK 15-8

DATA ACQUIRED 80330





LINE 320

RADAR ALTMTR FEET
MIN 322.4
MAX 519.1
MEAN 410.1
STD DEV 38.89

RESID MAG GAMMAS
MIN -1221
MAX -387.4
MEAN -824.9
STD DEV 217.7

BI AIR CORR EQ. PPM
MIN 1.222
MAX 2.361
MEAN 1.839
STD DEV .2543

THALLIUM 208 EQ. PPM
MIN .8619
MAX 9.831
MEAN 7.0710
STD DEV 1.047

BISMUTH 214 EQ. PPM
MIN .8717
MAX 4.184
MEAN 2.8690
STD DEV .6892

POTASSIUM 40 PERCENT
MIN 1.423
MAX 1.520
MEAN 1.112
STD DEV .1643

TOTAL COUNTS CTS/SEC
MIN 387.6
MAX 1023
MEAN 723.9
STD DEV 286.2

BI/TL
MIN .8000
MAX 1.388
MEAN .3753
STD DEV .1019

BI/K
MIN .8000
MAX 2.760
MEAN 2.407
STD DEV .6883

TL/K
MIN .8000
MAX 12.45
MEAN 6.278
STD DEV 1.207

D9 dm

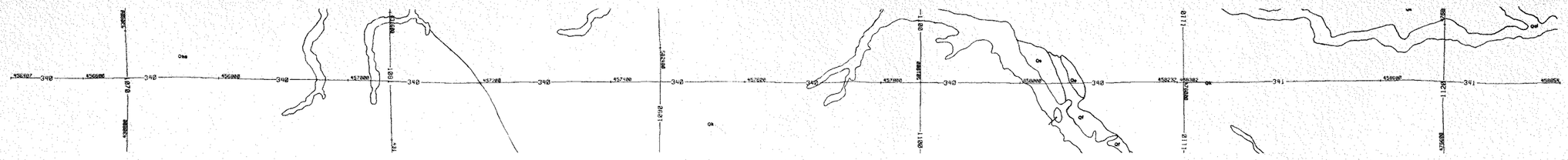
LINE 330
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329

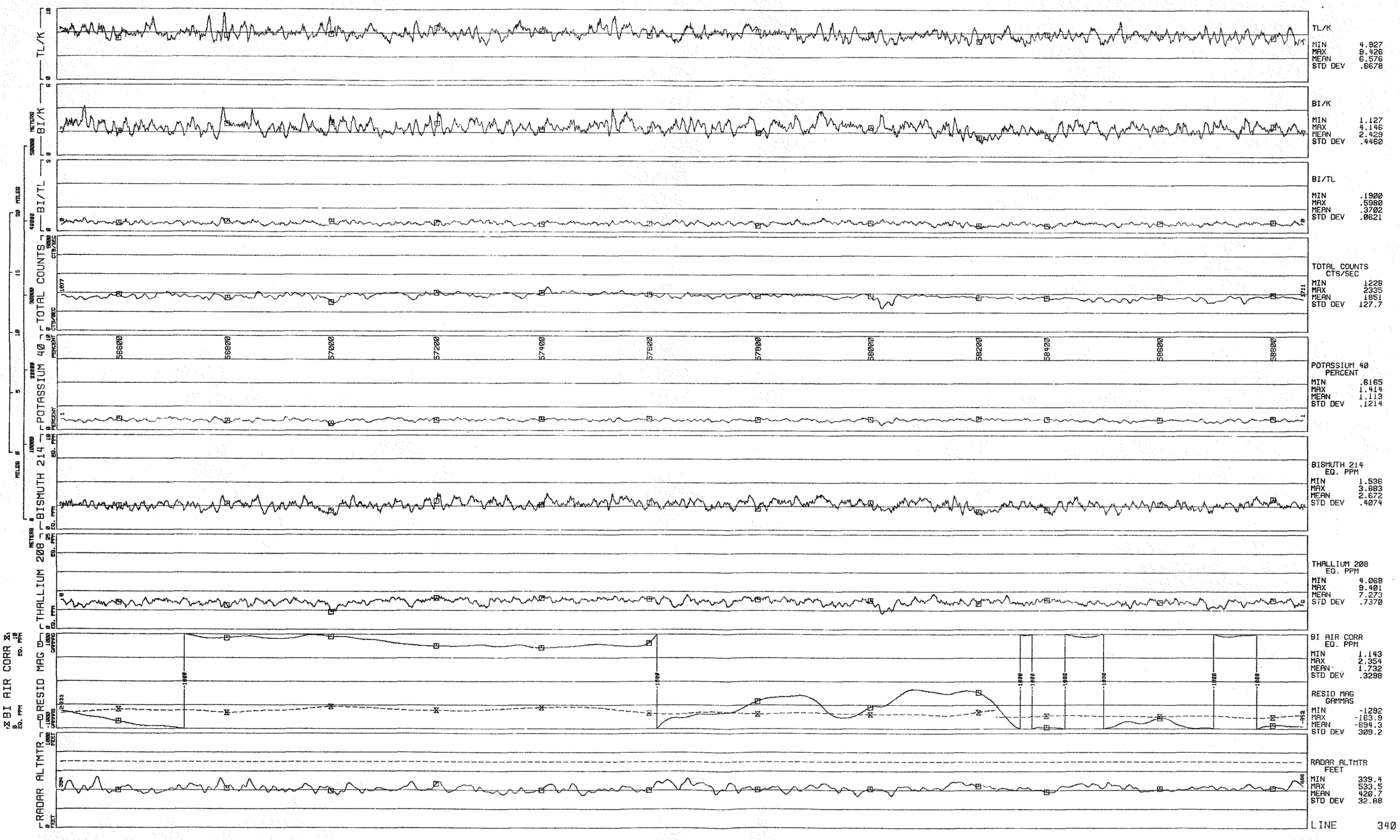
	TL/K	BI/K	BI/TL	TOTAL COUNTS CTS/SEC	POTASSIUM 40 PERCENT	BISMUTH 214 EQ. PPM	THALLIUM 208 EQ. PPM	BI AIR CORR EQ. PPM	RESID MAG GAMMAS	RADAR ALTMTR FEET
MIN	4.471	1.521	.2226	1399	.6029	1.727	4.667	.4948	-1185	330.8
MAX	9.358	5.357	.8437	2349	1.476	4.885	10.08	1.846	-405.9	672.5
MEAN	6.579	2.820	.4309	1859	1.126	3.136	7.364	1.240	-918.8	416.8
STD DEV	.7252	.5395	.0806	137.6	.1209	.4740	.8070	.3001	219.7	54.44

LINE 330

D10 dm

LINE 340
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329





	TL/K	BI/K	BI/TL	TOTAL COUNTS CTS/SEC	POTASSIUM 40 PERCENT	BISMUTH 214 EQ. PPM	THALLIUM 208 EQ. PPM	BI AIR CORR EQ. PPM	RESID MAG GAMMAS	RADAR ALTMTR FEET
MIN	4.927	1.127	.1900	1228	.6165	1.536	4.068	1.143	-1292	339.4
MAX	9.426	4.146	.5900	2335	1.414	3.883	9.401	2.354	-163.9	533.5
MEAN	6.576	2.429	.3702	1851	1.113	2.672	7.273	1.732	-894.3	420.7
STD DEV	.6678	.4460	.0621	127.7	.1214	.4074	.7370	.3298	309.2	32.88

LINE 340

D11 dm

LINE 350
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329

TL/K
MIN 3.898
MAX 9.603
MEAN 6.857
STD DEV .7489

BI/K
MIN .0000
MAX 3.875
MEAN 2.265
STD DEV .3879

BI/TL
MIN .0000
MAX .5584
MEAN .3324
STD DEV .0583

TOTAL COUNTS CTS/SEC
MIN 1015
MAX 1871
MEAN 1690
STD DEV 122.0

POTASSIUM 40 PERCENT
MIN .5388
MAX 1.419
MEAN 1.070
STD DEV .1264

BISMUTH 214 EQ. PPM
MIN 1.325
MAX 3.832
MEAN 2.406
STD DEV .3789

THALLIUM 208 EQ. PPM
MIN 3.163
MAX 9.091
MEAN 7.266
STD DEV .7642

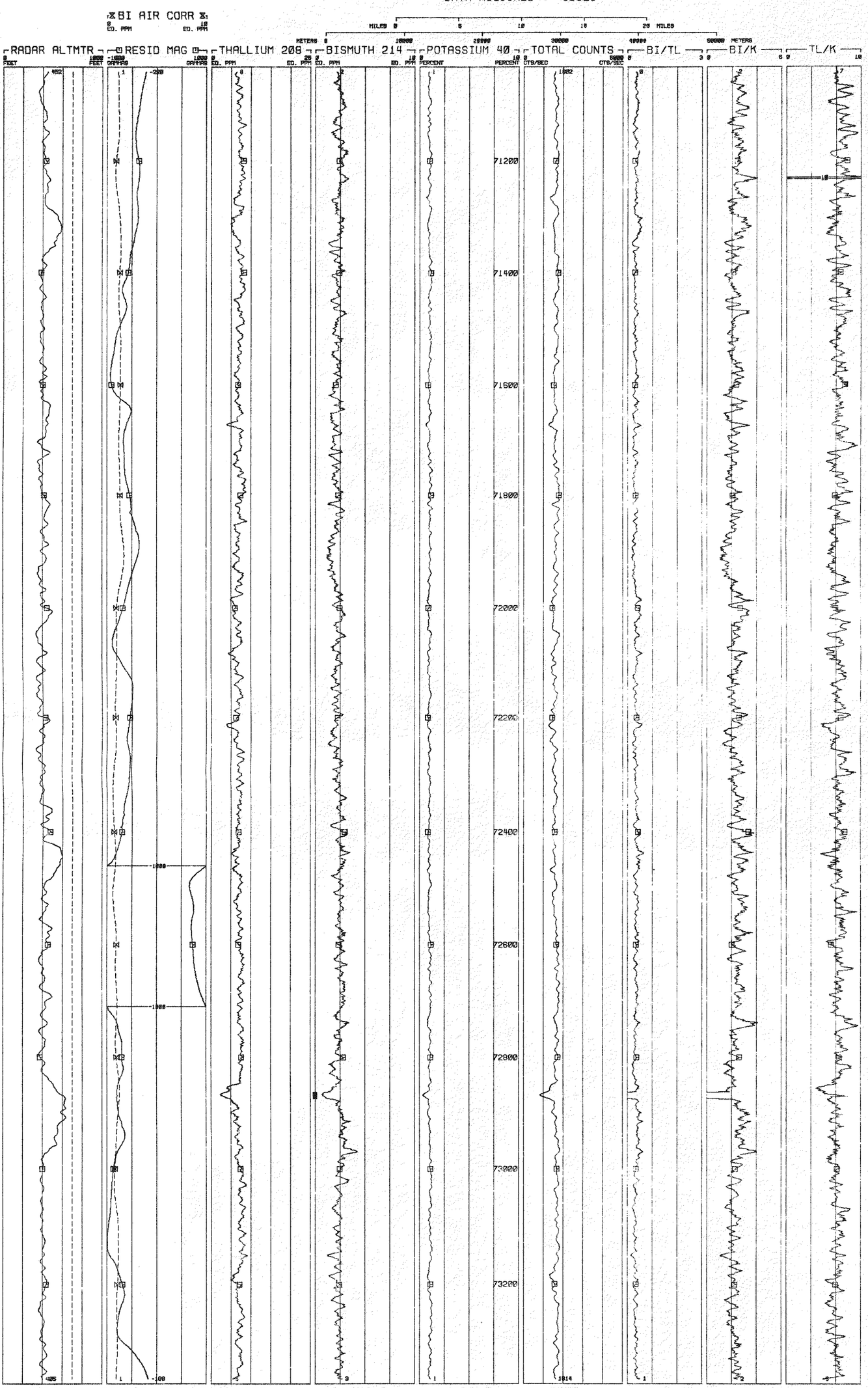
BI AIR CORR EQ. PPM
MIN .5479
MAX 1.790
MEAN 1.115
STD DEV .2685

RESID MAG GAMMAS
MIN -1373
MAX -433.8
MEAN -942.6
STD DEV 195.9

RADAR ALTMTR FEET
MIN 313.4
MAX 799.5
MEAN 412.8
STD DEV 49.63

LINE 350

LINE 360
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329



LINE 360

BI AIR CORR EQ. PPM
MIN 5951
MAX 1.7226
MEAN 1.2654
STD DEV .2682

RADAR ALTMTR FEET
MIN 334.1
MAX 636.3
MEAN 424.6
STD DEV 57.35

RESID MAG GAMMAS
MIN -1337
MAX -169.3
MEAN -599.4
STD DEV 257.0

THALLIUM 208 EQ. PPM
MIN 2.403
MAX 6.064
MEAN 6.966
STD DEV .8388

BISMUTH 214 EQ. PPM
MIN 1.141
MAX 2.503
MEAN 2.503
STD DEV .4083

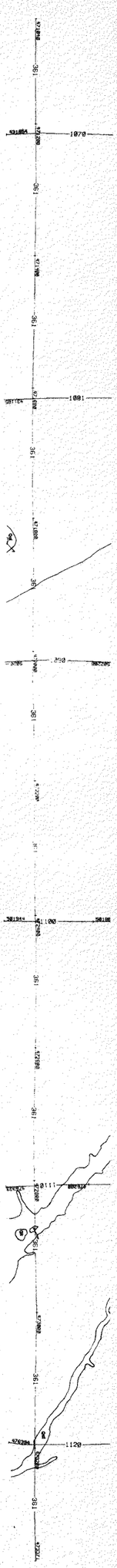
POTASSIUM 40 PERCENT
MIN .3487
MAX 1.295
MEAN 1.008
STD DEV .1116

TOTAL COUNTS CTS/SEC
MIN 817.1
MAX 1618
MEAN 1613.3

BI/TL
MIN .0000
MAX .8422
MEAN .3319
STD DEV .0746

BI/K
MIN .0000
MAX 4.8996
MEAN 2.2229
STD DEV .4940

TL/K
MIN 4.830
MAX 10.36
MEAN 6.944
STD DEV .7861



D12

D13 dm

LINE 1070
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326

TL/K
MIN 3.303
MAX 8.584
MEAN 5.979
STD DEV .9791

BI/K
MIN .7522
MAX 3.674
MEAN 1.998
STD DEV .4465

BI/TL
MIN .1242
MAX .6012
MEAN .3367
STD DEV .0673

TOTAL COUNTS CTS/SEC
MIN 1080
MAX 1962
MEAN 1611
STD DEV 155.0

POTASSIUM 40 PERCENT
MIN .6468
MAX 1.458
MEAN 1.080
STD DEV .1241

BISMUTH 214 EQ. PPM
MIN .8375
MAX 3.310
MEAN 2.135
STD DEV .4442

THALLIUM 208 EQ. PPM
MIN 3.533
MAX 8.778
MEAN 6.419
STD DEV 1.064

BI AIR CORR EQ. PPM
MIN .9451
MAX 1.544
MEAN 1.247
STD DEV .1509

RESID MAG GAMMAS
MIN -1154
MAX -348.8
MEAN -833.6
STD DEV 217.1

RADAR ALTMTR FEET
MIN 307.9
MAX 511.5
MEAN 388.3
STD DEV 39.58

LINE 1070

LINE 1080
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326

TL/K
MIN 3.520
MAX 9.434
MEAN 6.009
STD DEV 1.048

BI/K
MIN .0000
MAX 3.822
MEAN 2.018
STD DEV .4507

BI/TL
MIN .0000
MAX .8100
MEAN .3390
STD DEV .0689

TOTAL COUNTS CTS/SEC
MIN 985.3
MAX 1924
MEAN 1619
STD DEV 149.9

POTASSIUM 40 PERCENT
MIN .5468
MAX 1.378
MEAN 1.075
STD DEV .1206

BISMUTH 214 EQ. PPM
MIN .9880
MAX 3.486
MEAN 2.154
STD DEV .4690

THALLIUM 208 EQ. PPM
MIN 2.954
MAX 9.258
MEAN 6.426
STD DEV 1.155

BI AIR CORR EQ. PPM
MIN .8691
MAX 1.748
MEAN 1.306
STD DEV .1511

RESID MAG GAMMAS
MIN -1180
MAX -572.2
MEAN -919.1
STD DEV 144.2

RADAR ALTMTR FEET
MIN 321.2
MAX 530.9
MEAN 414.9
STD DEV 37.27

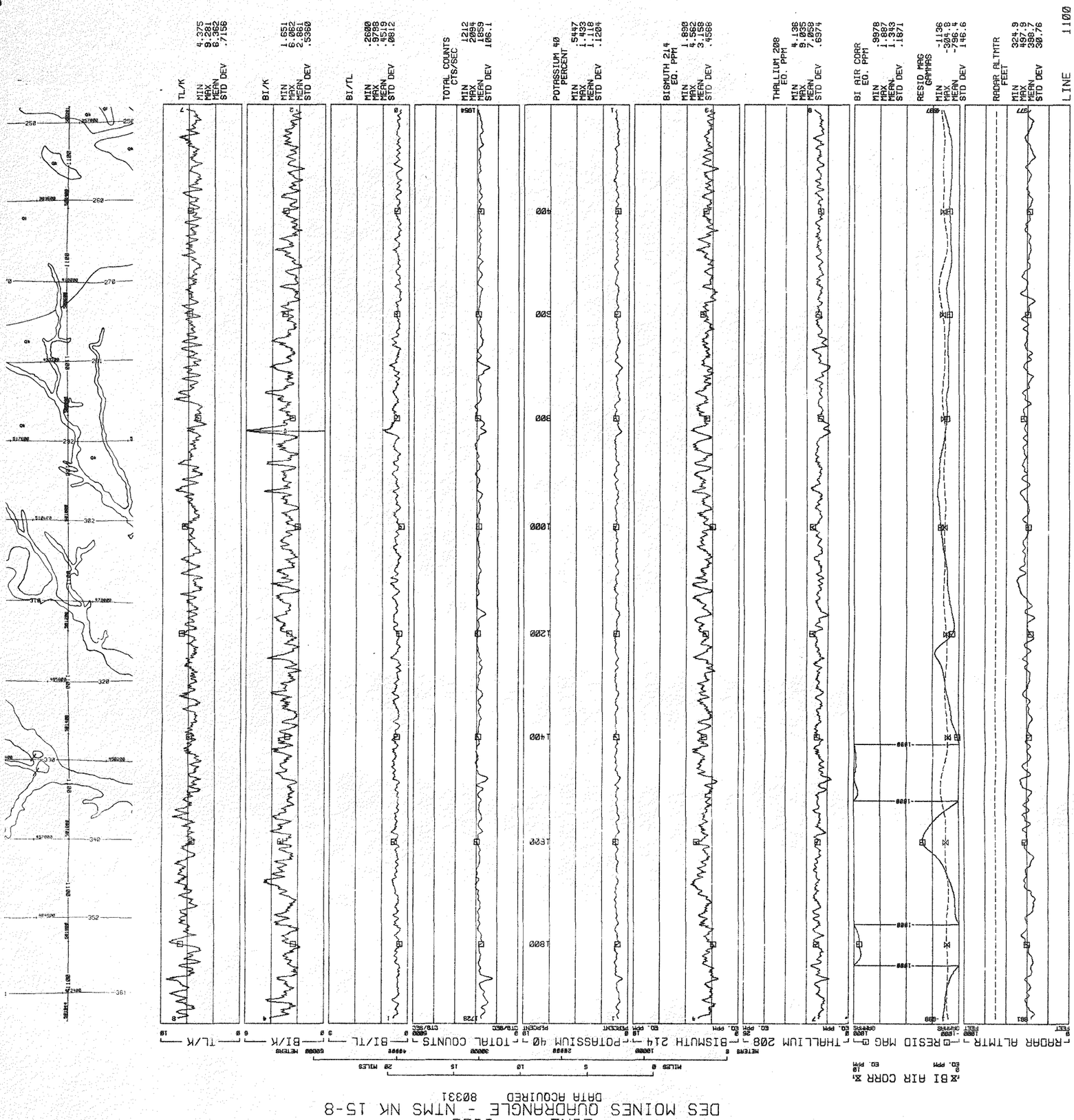
LINE 1080

LINE 1090
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331

	TL/K	BI/K	BI/TL	TOTAL COUNTS CTS/SEC	POTASSIUM 40 PERCENT	BISMUTH 214 EQ. PPM	THALLIUM 208 EQ. PPM	BI AIR CORR EQ. PPM	RESID MAG GAMMAS	RADAR ALTMTR FEET
MIN	4.998	1.196	.1688	1320	.6738	1.432	4.230	1.062	-1277	312.6
MAX	8.781	4.447	.7024	2229	1.437	4.576	9.616	2.415	-55.02	504.4
MEAN	6.487	2.583	.3989	1884	1.139	2.907	7.346	1.612	-822.6	382.6
STD DEV	.6428	.5442	.0794	152.0	.1249	.5283	.7079	.3525	300.7	32.39

LINE 1090

D16 dm


TL/K
MIN 4.375
MAX 9.281
MEAN 6.352
STD DEV .7158
BI/K
MIN 1.651
MAX 6.862
MEAN 2.881
STD DEV .5880
BI/TL
MIN .2600
MAX .9798
MEAN .4519
STD DEV .0812
TOTAL COUNTS CTS/SEC
MIN 1212
MAX 2094
MEAN 1859
STD DEV 106.1
POTASSIUM 40 PERCENT
MIN .5447
MAX 1.433
MEAN 1.128
STD DEV .1284
BISMUTH 214 EQ. PPM
MIN 1.898
MAX 4.882
MEAN 3.158
STD DEV .4568
THALLIUM 208 EQ. PPM
MIN 4.136
MAX 9.035
MEAN 7.059
STD DEV .6974
BI AIR CORR EQ. PPM
MIN .9978
MAX 1.887
MEAN 1.393
STD DEV .1871
RESID MAG GAMMAS
MIN -1136
MAX -384.8
MEAN -586.4
STD DEV 146.6
RADAR ALTMTR FEET
MIN 324.9
MAX 497.9
MEAN 386.7
STD DEV 30.76
LINE 1100
TL/K
BI/K
BI/TL
TOTAL COUNTS
POTASSIUM 40
BISMUTH 214
THALLIUM 208
RESID MAG
RADAR ALTMTR
BI AIR CORR
LINE 1100
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331

LINE 1110
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330

TL/K
MIN 4.350
MAX 8.971
MEAN 6.314
STD DEV .6838

BI/K
MIN 1.755
MAX 6.633
MEAN 3.066
STD DEV .7157

BI/TL
MIN .2568
MAX .8534
MEAN .4875
STD DEV .1086

TOTAL COUNTS CTS/SEC
MIN 1333
MAX 2196
MEAN 1758
STD DEV 149.8

POTASSIUM 40 PERCENT
MIN .5896
MAX 1.392
MEAN 1.098
STD DEV .1102

BISMUTH 214 EQ. PPM
MIN 1.847
MAX 5.358
MEAN 3.329
STD DEV .6663

THALLIUM 208 EQ. PPM
MIN 4.189
MAX 8.613
MEAN 6.900
STD DEV .7293

BI AIR CORR EQ. PPM
MIN .2624
MAX 1.589
MEAN .6841
STD DEV .2718

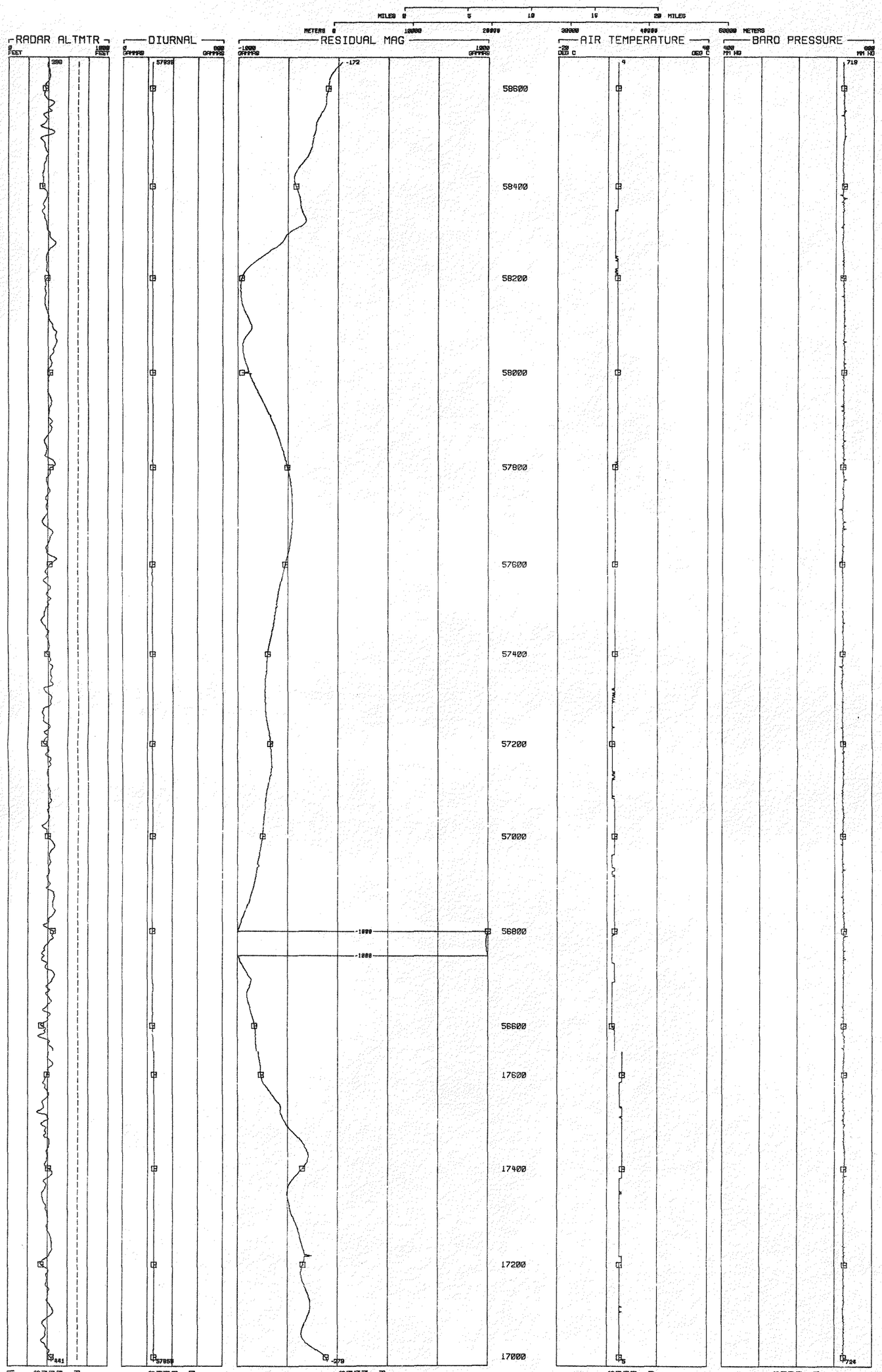
RESID MAG GAMMAS
MIN -976.3
MAX 283.9
MEAN -570.0
STD DEV 286.4

RADAR ALTMTR FEET
MIN 317.9
MAX 511.7
MEAN 404.7
STD DEV 33.09

LINE 1110

LINE 1120
DES MOINES QUADRANGLE - NTMS NK 15-9
DATA ACQUIRED 80330

LINE 250
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80325



LINE 250

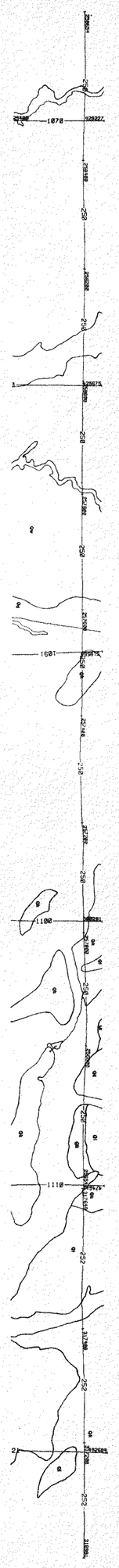
RADAR ALTMTR FEET
MIN 280.0
MAX 490.4
MEAN 398.3
STD DEV 32.25

DIURNAL GAMMAS
MIN 57837
MAX 57933
MEAN 57883
STD DEV 10.06

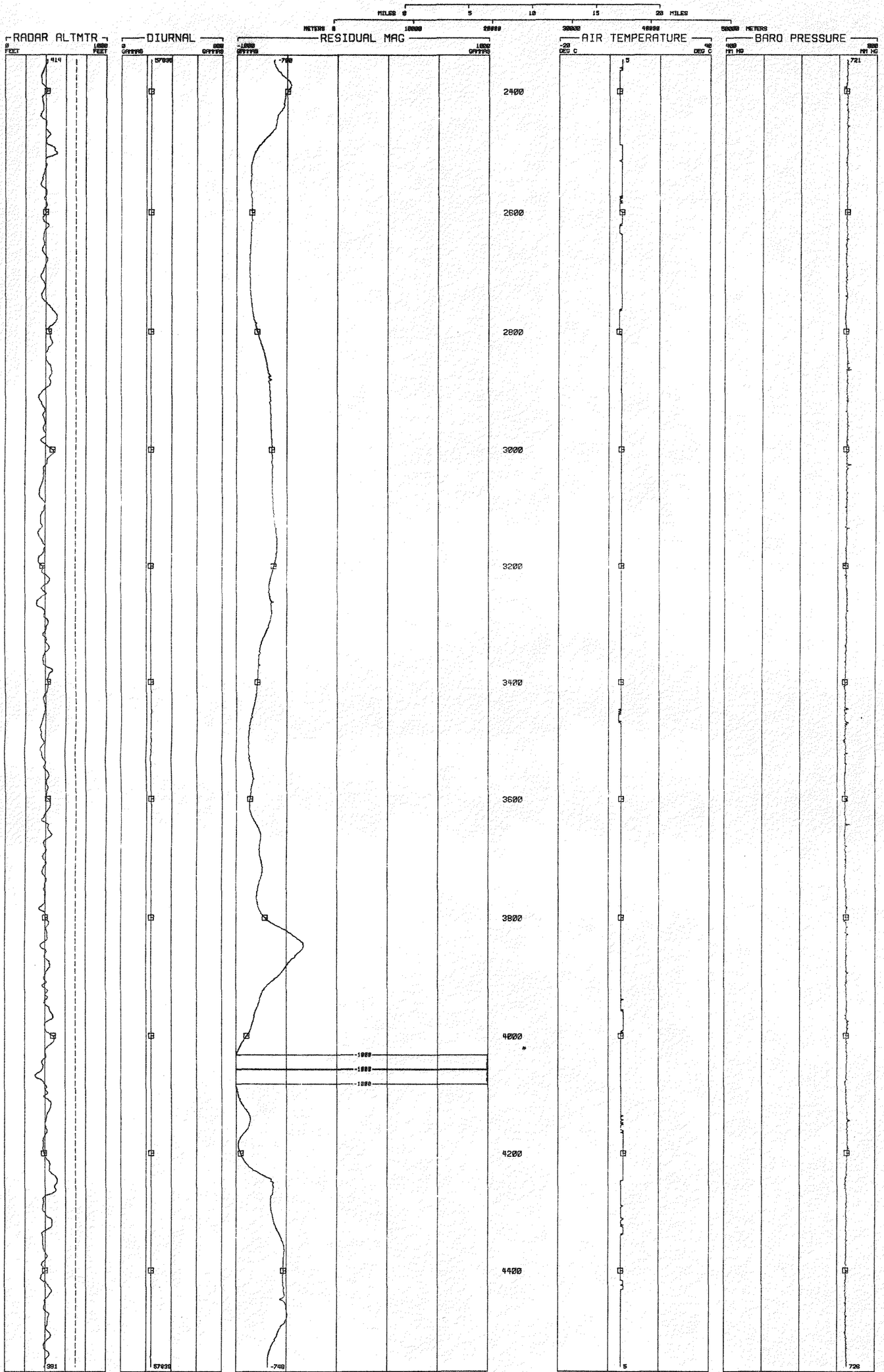
RESIDUAL MAG GAMMAS
MIN -1017
MAX 1217
MEAN -883.7
STD DEV 192.0

AIR TEMPERATURE DEG C
MIN 2.000
MAX 9.000
MEAN 3.678
STD DEV 1.146

BARO PRESSURE MM HG
MIN 710.9
MAX 734.0
MEAN 721.9
STD DEV 2.077



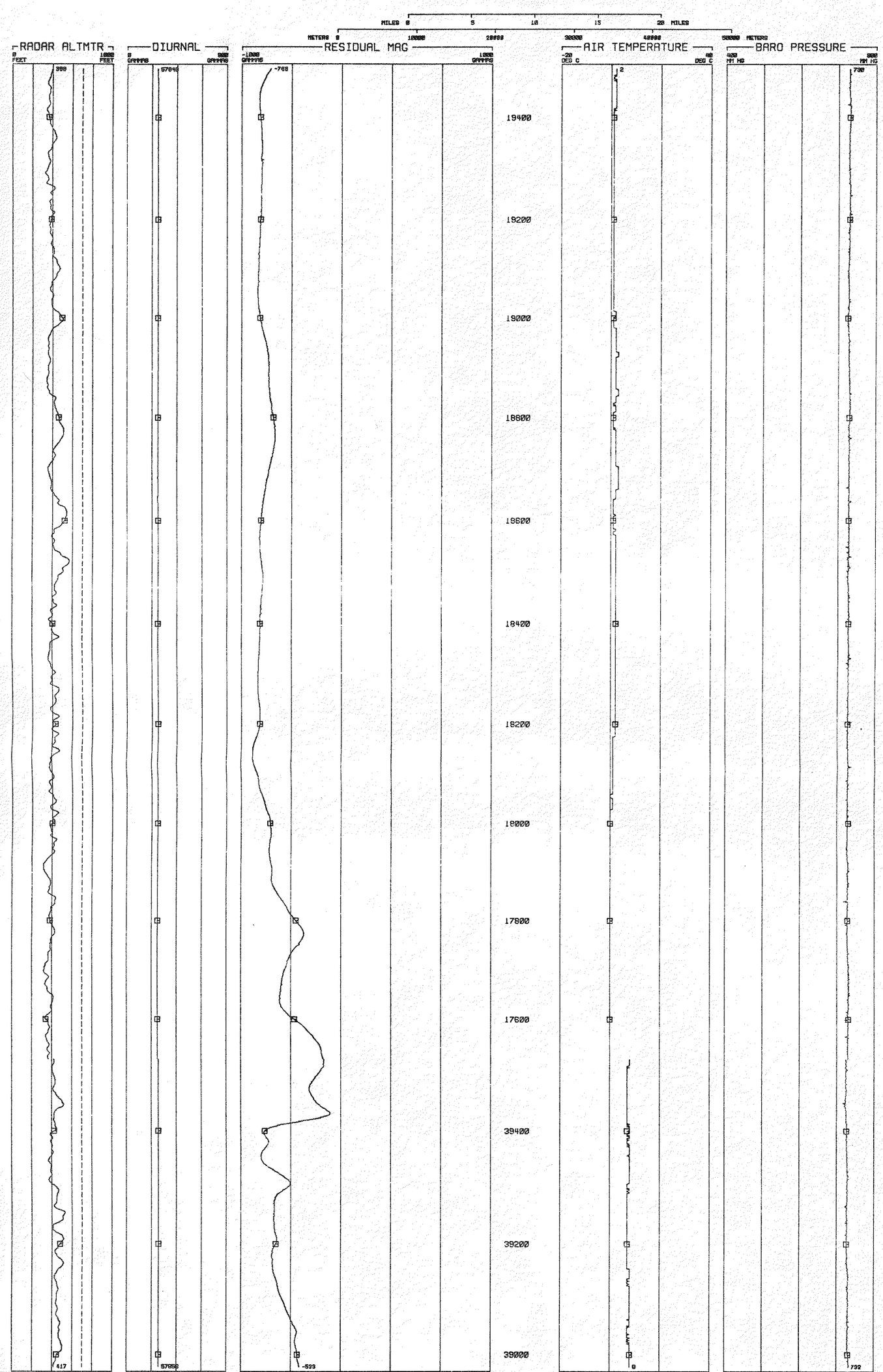
LINE 260
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80325

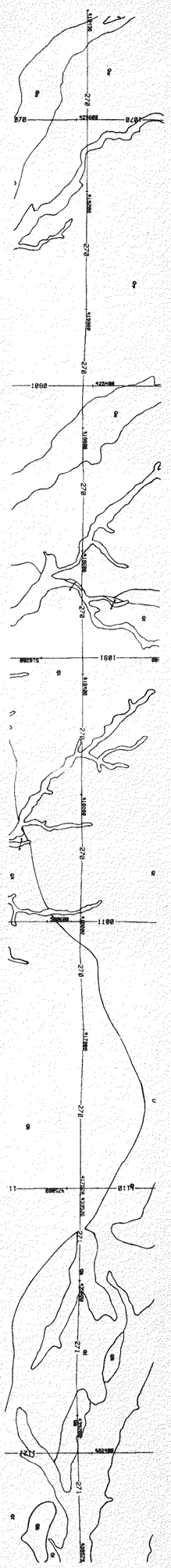


LINE 260

D20 dm

LINE 270
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326





RADAR ALTMTR FEET
MIN 314.5
MAX 569.5
MEAN 411.0
STD DEV 46.04

DIURNAL GAMMAS
MIN 57846
MAX 57859
MEAN 57850
STD DEV 8.211

RESIDUAL MAG GAMMAS
MIN -909.8
MAX 769.6
MEAN -219.6
STD DEV 135.8

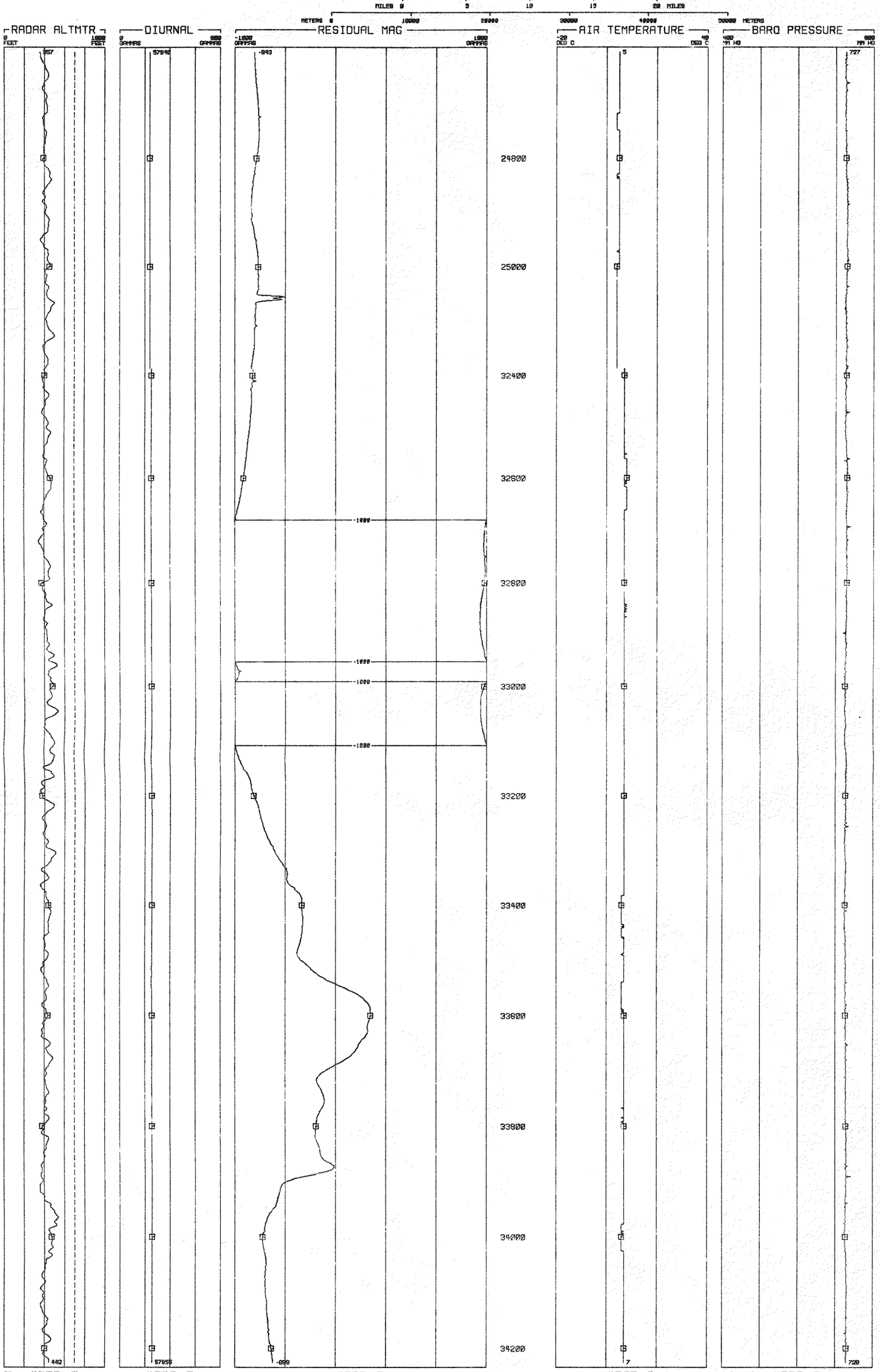
AIR TEMPERATURE DEG C
MIN .0000
MAX 8.0000
MEAN 2.5365
STD DEV 2.709

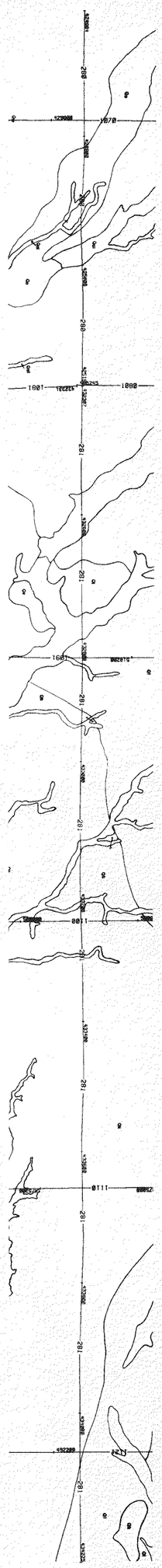
BARO PRESSURE MM HG
MIN 717.8
MAX 732.4
MEAN 727.2
STD DEV 1.276

LINE 270

D21 dm

LINE 280
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326





RADAR ALTMTR FEET
MIN 344.7
MAX 535.0
MEAN 442.4
STD DEV 34.69

DIURNAL GAMMAS
MIN 57840
MAX 57858
MEAN 57841
STD DEV 10.79

RESIDUAL MAG GAMMAS
MIN -1055
MAX 76.95
MEAN -735.1
STD DEV 277.2

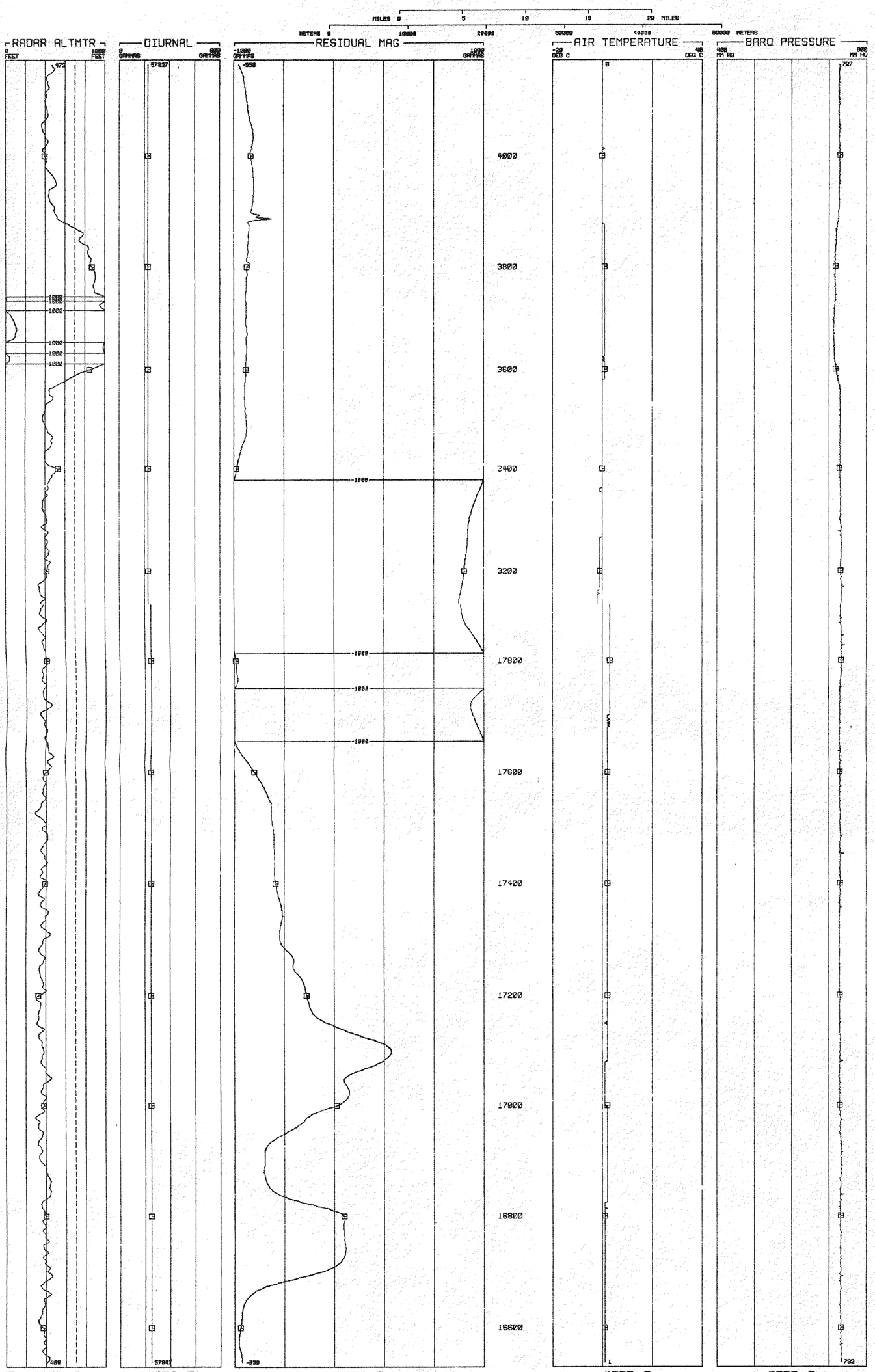
AIR TEMPERATURE DEG C
MIN 4.000
MAX 8.1020
MEAN 6.339
STD DEV 1.069

BARO PRESSURE MM HG
MIN 719.9
MAX 741.8
MEAN 722.5
STD DEV 1.821

LINE 280

D22 dm

LINE 290
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331



LINE 290

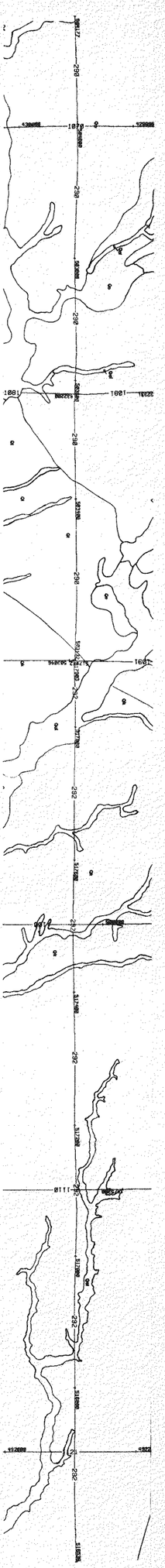
RADAR ALTMTR FEET
MIN 289.2
MAX 1111
MEAN 180.3
STD DEV 180.8

DIURNAL GAMMAS
MIN 57827
MAX 57869
MEAN 57834
STD DEV 11.39

RESIDUAL MAG GAMMAS
MIN -1202
MAX 255.8
MEAN -767.1
STD DEV 316.4

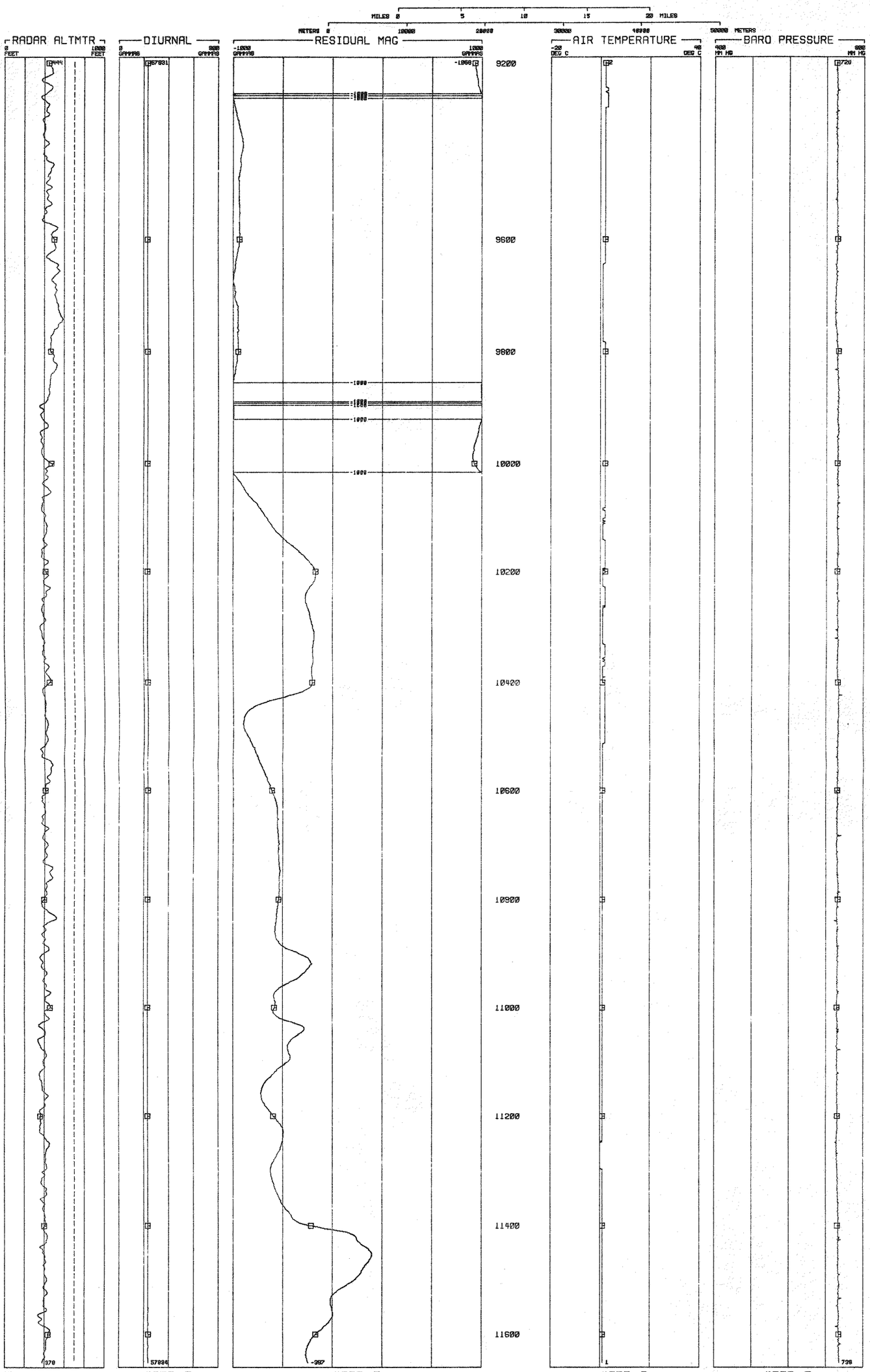
AIR TEMPERATURE DEG C
MIN -2.000
MAX 3.000
MEAN 1.119
STD DEV 1.094

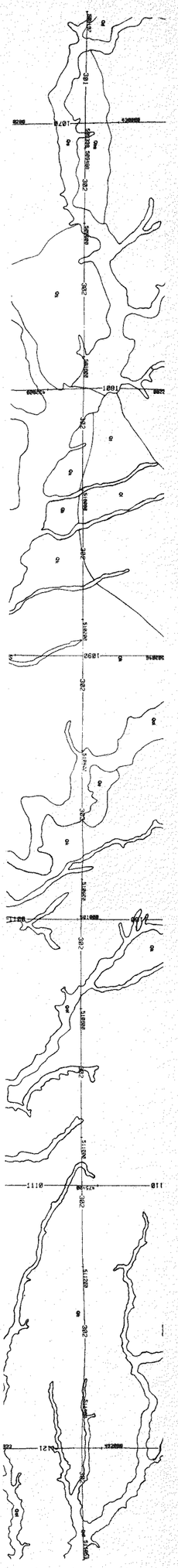
BARO PRESSURE MM HG
MIN 709.8
MAX 732.2
MEAN 728.2
STD DEV 5.855



D23 dm

LINE 300
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331





LINE 300

RADAR ALTMTR FEET
MIN 334.2
MAX 588.0
MEAN 470.9
STD DEV 43.69

DIURNAL GAMMAS
MIN 57831
MAX 57835
MEAN 57827
STD DEV 5.410

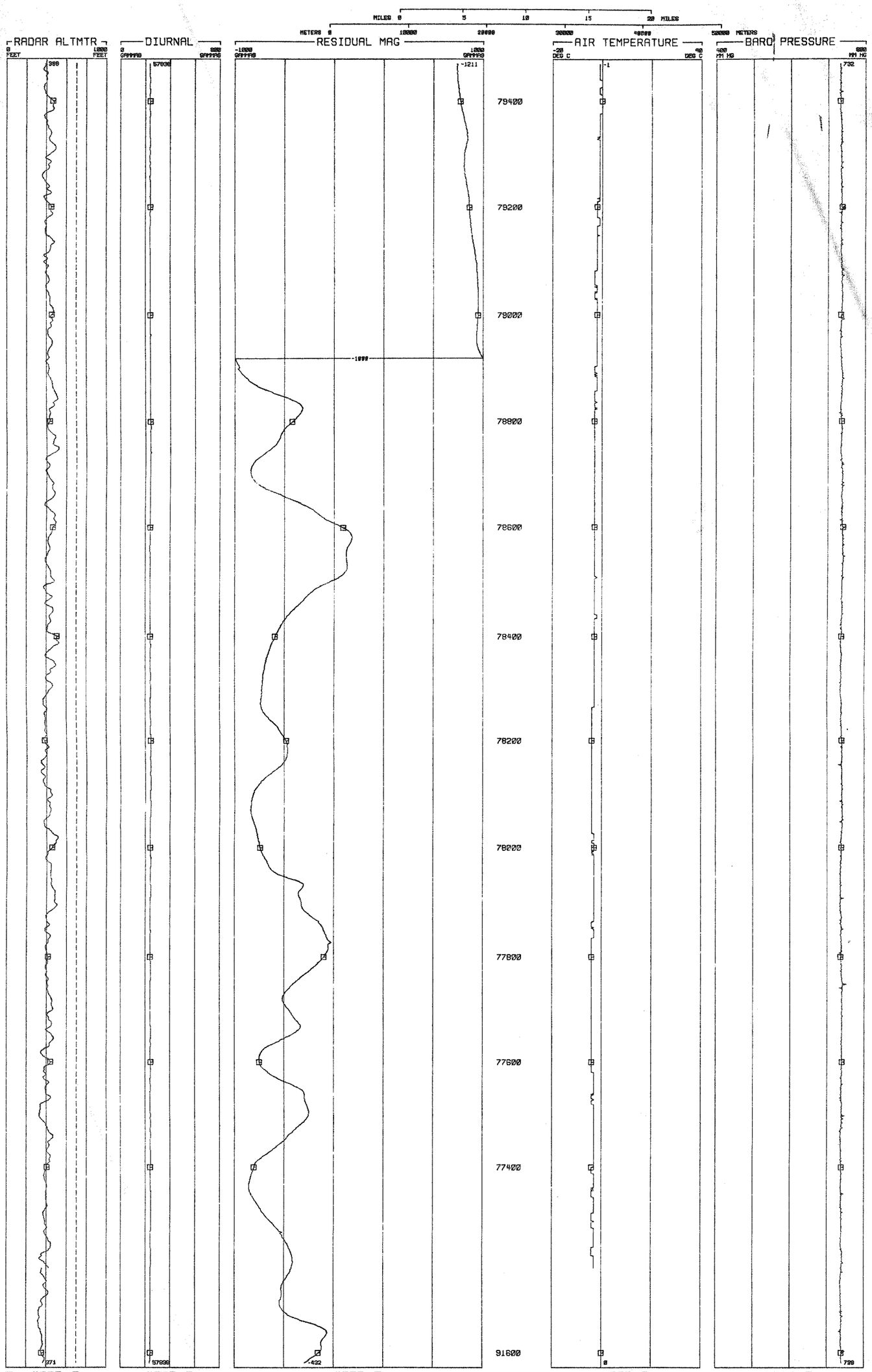
RESIDUAL MAG GAMMAS
MIN -1073
MAX 111.8
MEAN -627.4
STD DEV 280.0

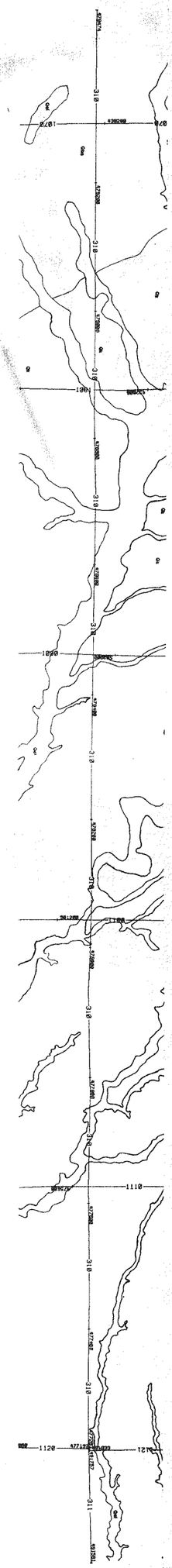
AIR TEMPERATURE DEG C
MIN .0000
MAX 3.000
MEAN 1.278
STD DEV .5519

BARO PRESSURE MM HG
MIN 723.1
MAX 738.2
MEAN 730.2
STD DEV 2.469

D24 dm

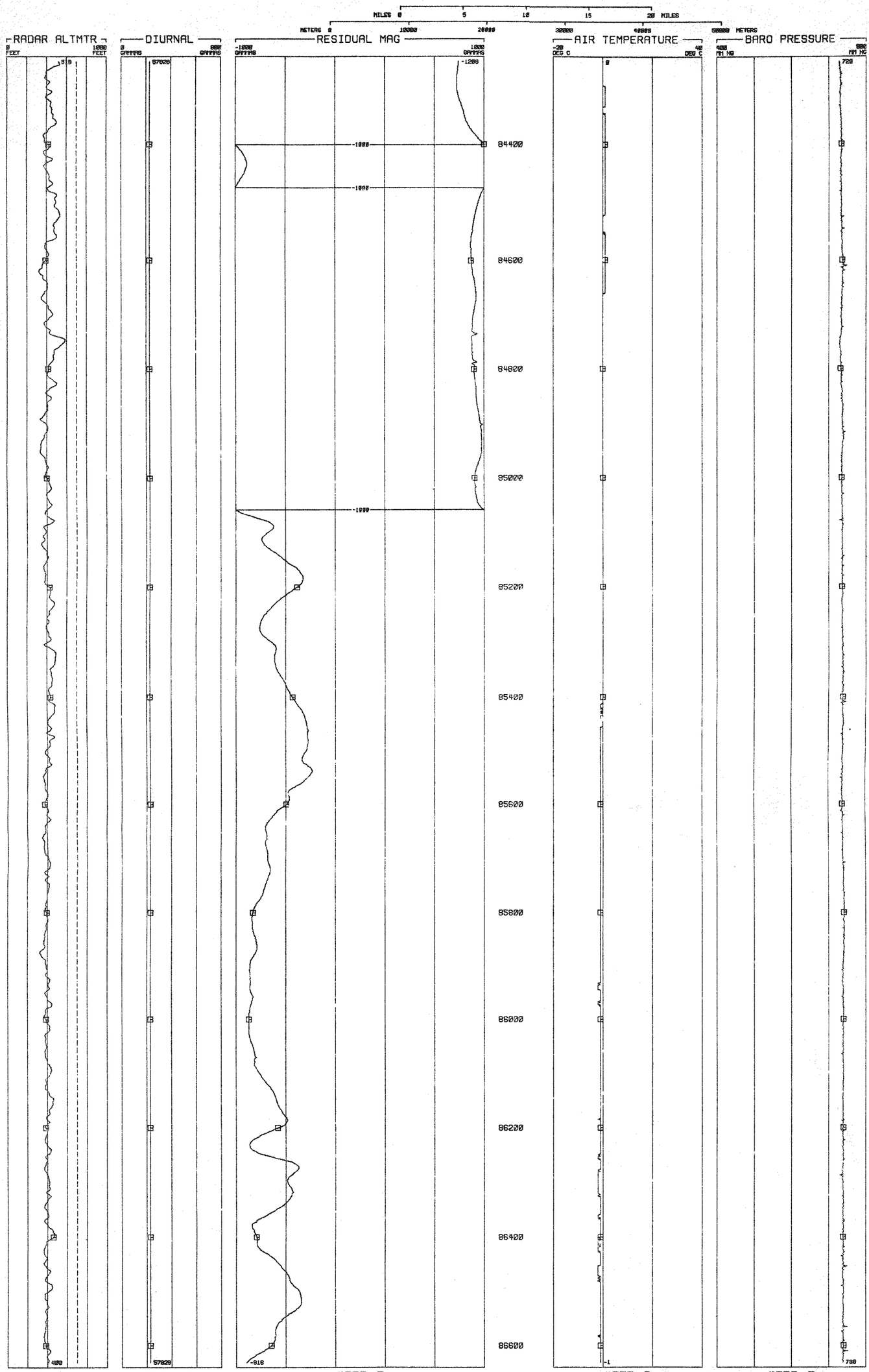
LINE 310
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330

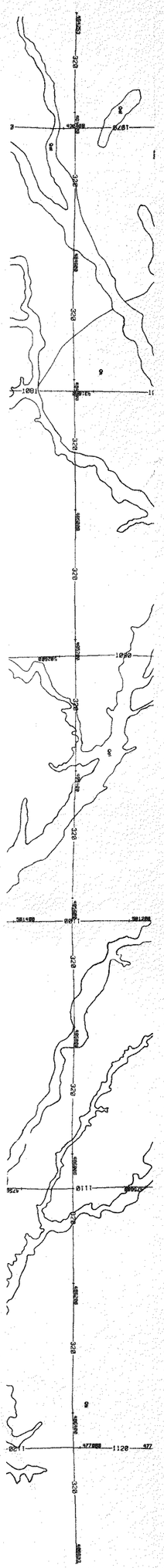




D25 dm

LINE 320
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330





RADAR ALTMTR FEET
MIN 322.4
MAX 587.4
MEAN 410.1
STD DEV 38.89

DIURNAL GAMMAS
MIN 57827
MAX 57829
MEAN 57825
STD DEV 3.367

RESIDUAL MAG GAMMAS
MIN -1221
MAX -387.4
MEAN -824.9
STD DEV 217.7

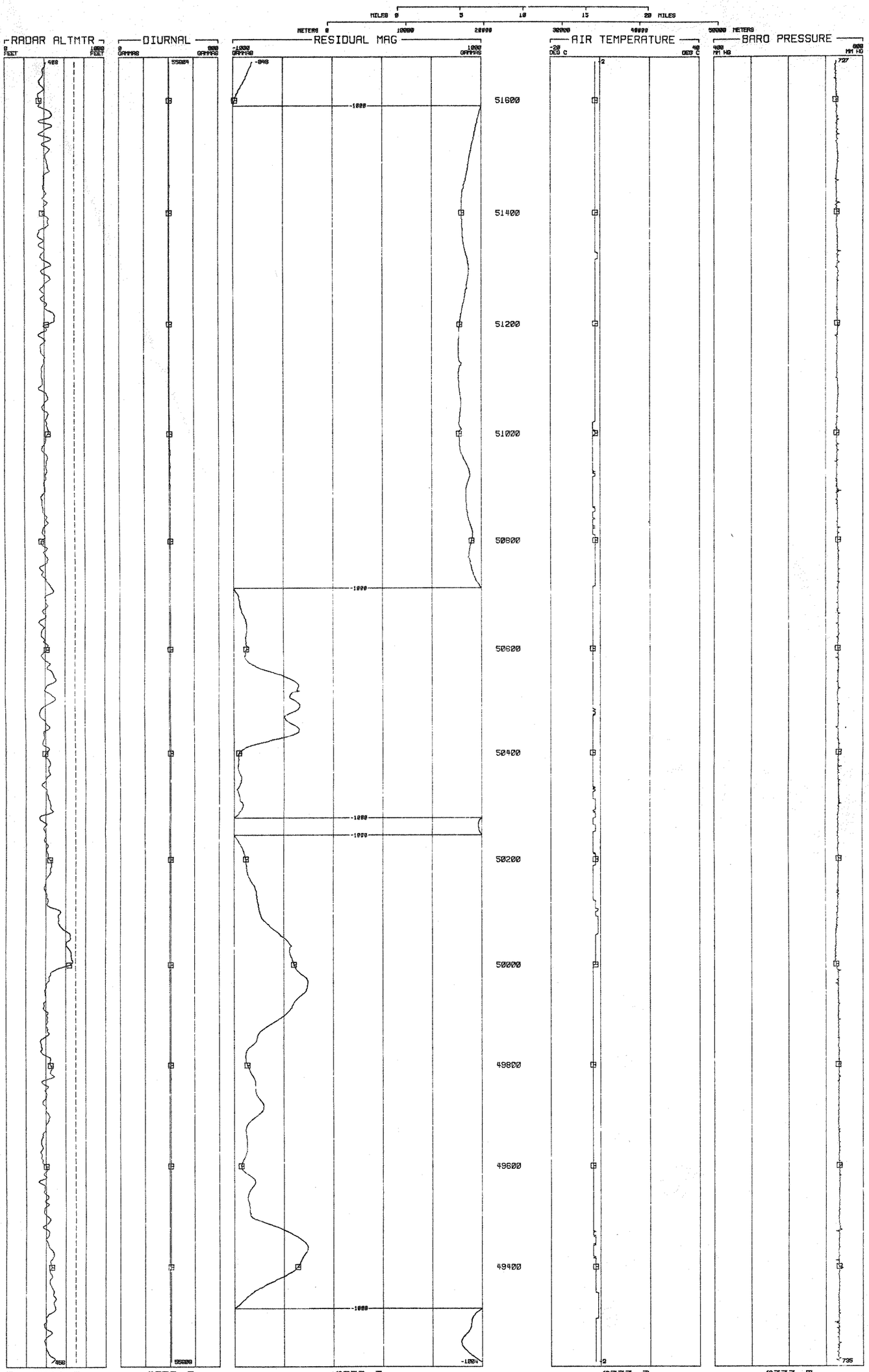
AIR TEMPERATURE DEG C
MIN -2.000
MAX -1.000
MEAN -1.197
STD DEV .7849

BARO PRESSURE MM HG
MIN 728.3
MAX 750.1
MEAN 737.1
STD DEV 2.887

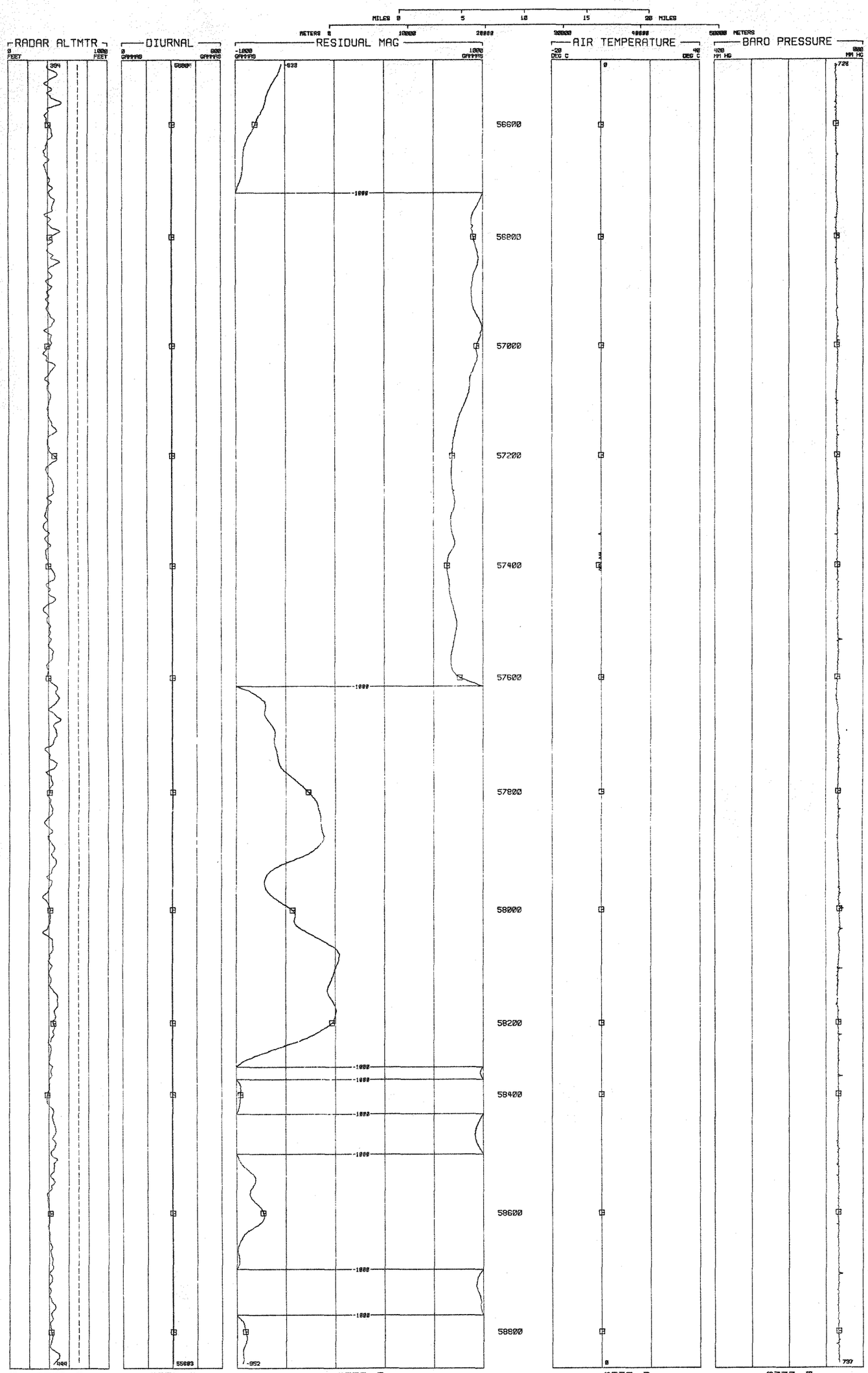
LINE 320

D26

LINE 330
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329



LINE 340
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329



LINE 340

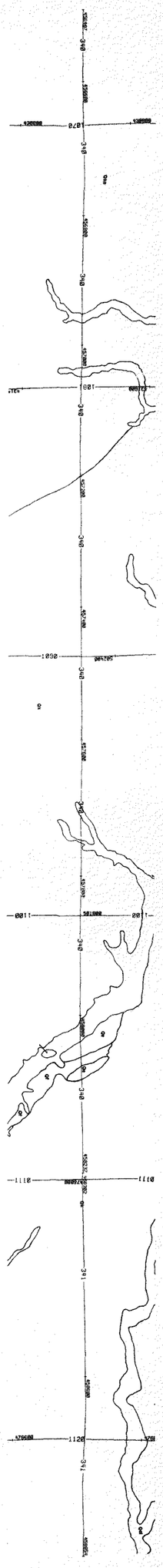
RADAR ALTMTR FEET
MIN 339.4
MAX 533.5
MEAN 420.7
STD DEV 32.88

DIURNAL GAMMAS
MIN 55602
MAX 55695
MEAN 55661
STD DEV 3.166

RESIDUAL MAG GAMMAS
MIN -1232
MAX 833
MEAN -894.3
STD DEV 309.2

AIR TEMPERATURE DEG C
MIN -1.000
MAX 0.000
MEAN -.0961
STD DEV .0779

BARO PRESSURE MM HG
MIN 724.0
MAX 737.7
MEAN 731.7
STD DEV 2.813



LINE 350
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329

BARO PRESSURE

BARO PRESSURE
MM HG
MIN 720.8
MAX 744.0
MEAN 730.7
STD DEV 2.968

AIR TEMPERATURE

AIR TEMPERATURE
DEG C
MIN .0000
MAX 2.000
MEAN 1.078
STD DEV .7445

RESIDUAL MAG

RESIDUAL MAG
GAMMAS
MIN -1373
MAX -433.8
MEAN -942.6
STD DEV 195.9

DIURNAL

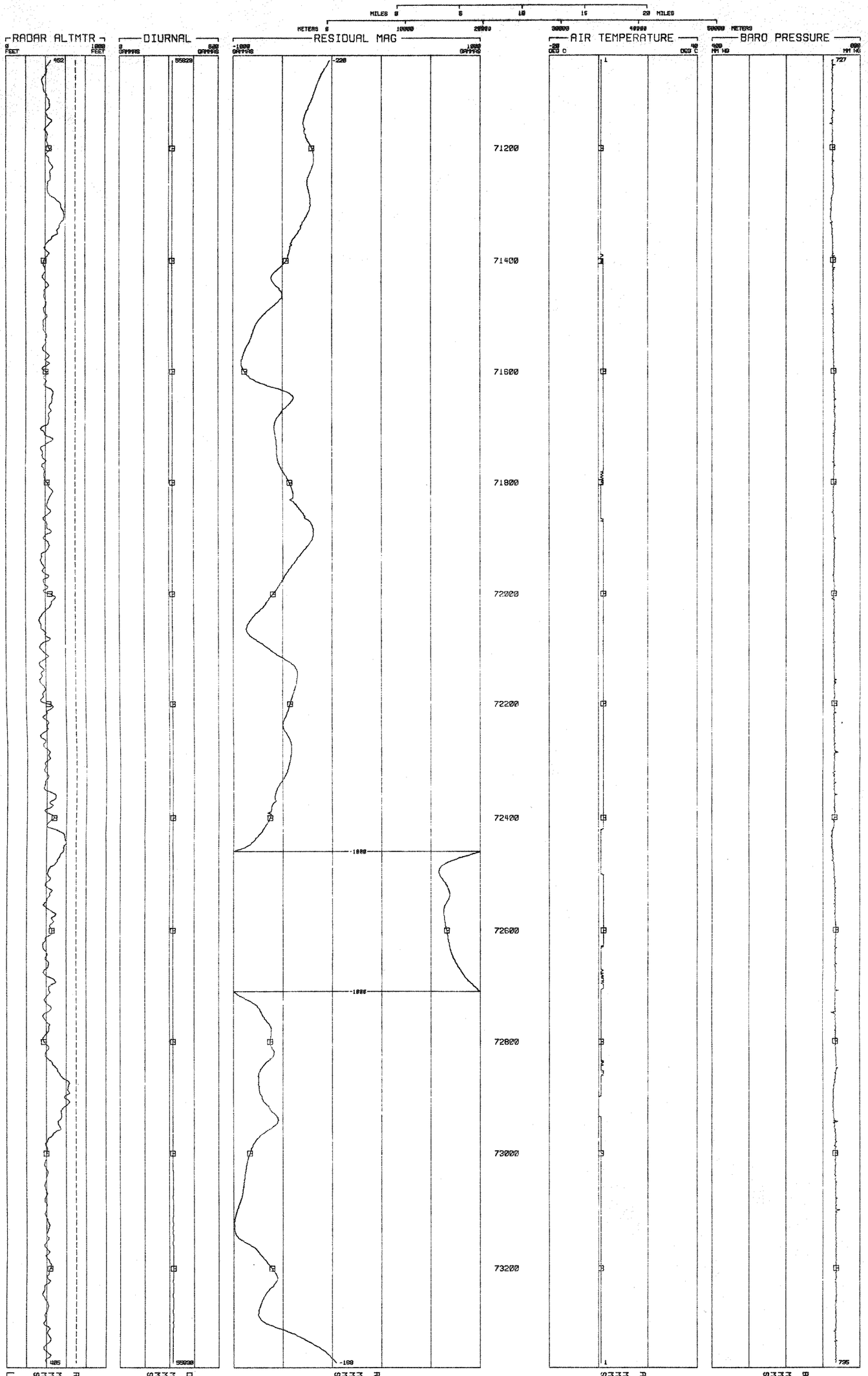
DIURNAL
GAMMAS
MIN 55615
MAX 55621
MEAN 55616
STD DEV 3.759

RADAR ALTMTR

RADAR ALTMTR
FEET
MIN 313.4
MAX 799.5
MEAN 412.8
STD DEV 49.63

LINE 350

LINE 360
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80329



LINE 360

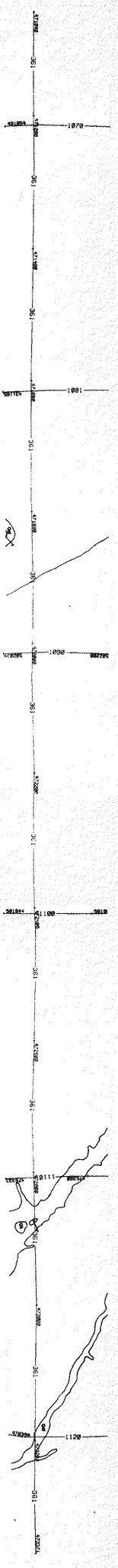
RADAR ALTMTR FEET
MIN 334.1
MAX 636.3
MEAN 424.6
STD DEV 57.35

DIURNAL GAMMAS
MIN 55528
MAX 55821
MEAN 55681
STD DEV 7.882

RESIDUAL MAG GAMMAS
MIN -1337
MAX 1888
MEAN -688.4
STD DEV 257.0

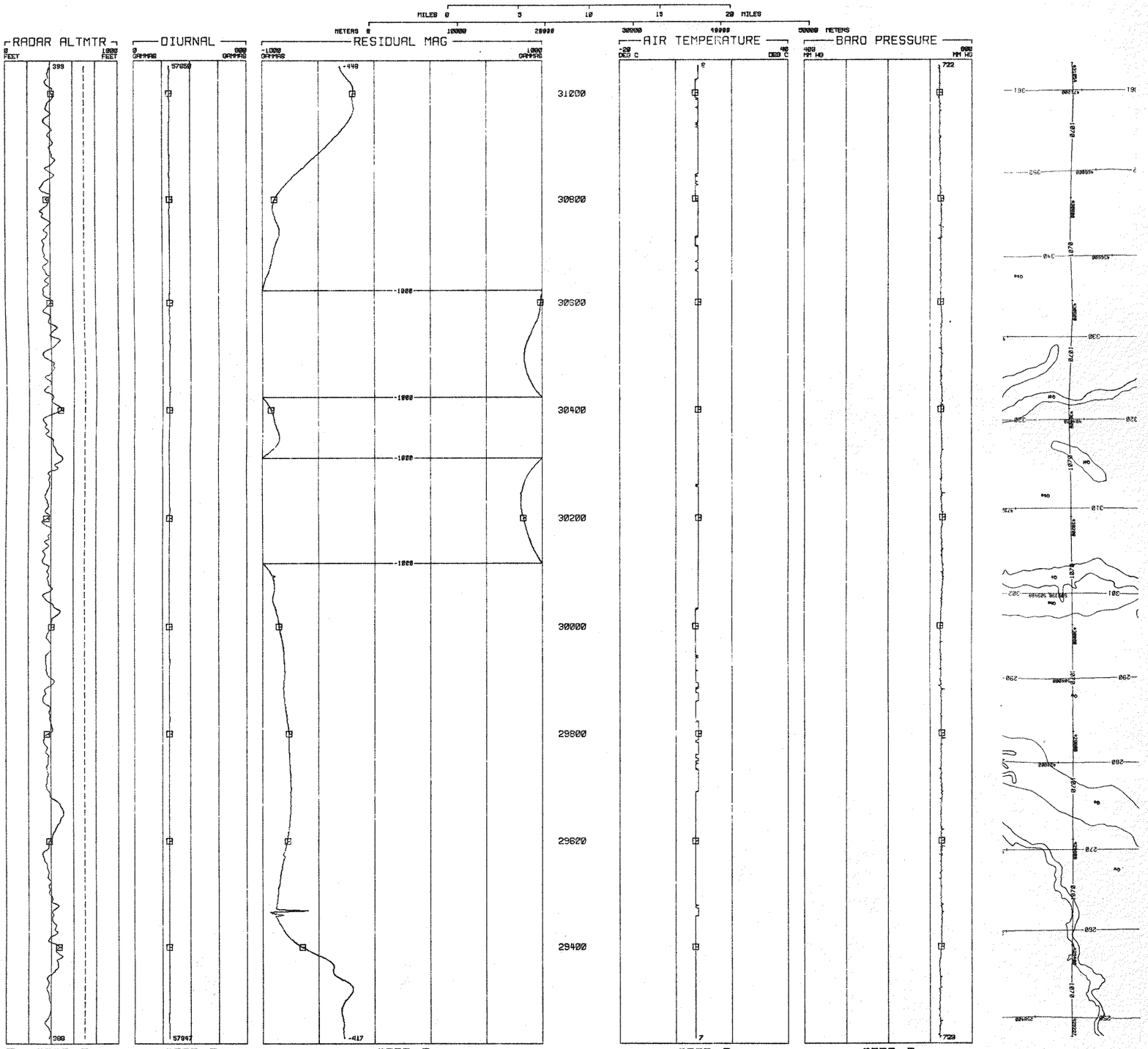
AIR TEMPERATURE DEG C
MIN 2.0000
MAX 7.0000
MEAN 4.461
STD DEV .5294

BARO PRESSURE MM HG
MIN 717.8
MAX 746.0
MEAN 734.7
STD DEV 3.987



D30 dm

LINE 1070
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326



LINE 1070

RADAR ALTMTR FEET
MIN 207.9
MAX 511.5
MEAN 398.3
STD DEV 38.58

DIURNAL GAMMAS
MIN 57846
MAX 57851
MEAN 57845
STD DEV 3.857

RESIDUAL MAG GAMMAS
MIN -1154
MAX -346.8
MEAN -833.6
STD DEV 217.1

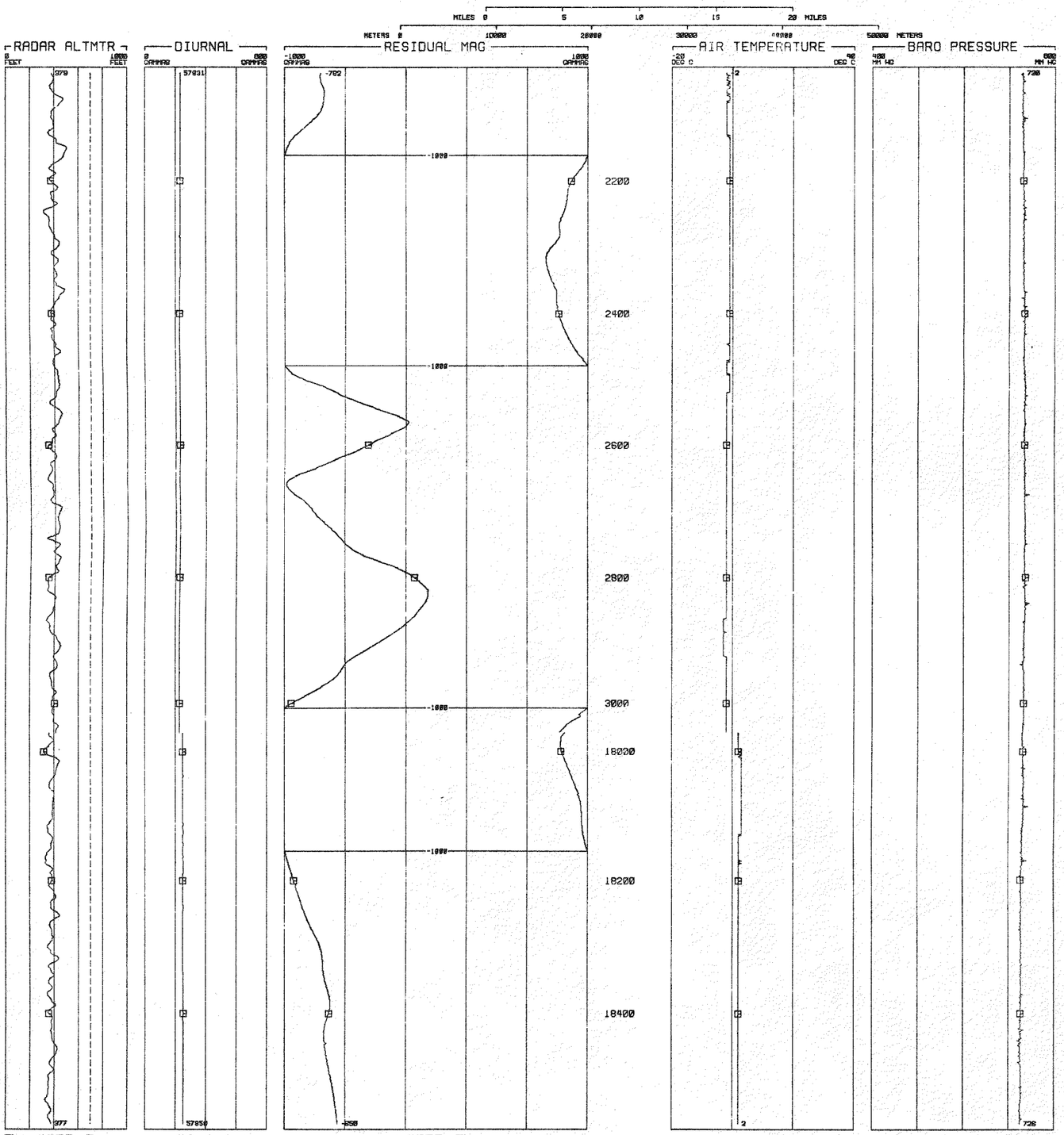
AIR TEMPERATURE DEG C
MIN 7.000
MAX 8.000
MEAN 7.576
STD DEV .4941

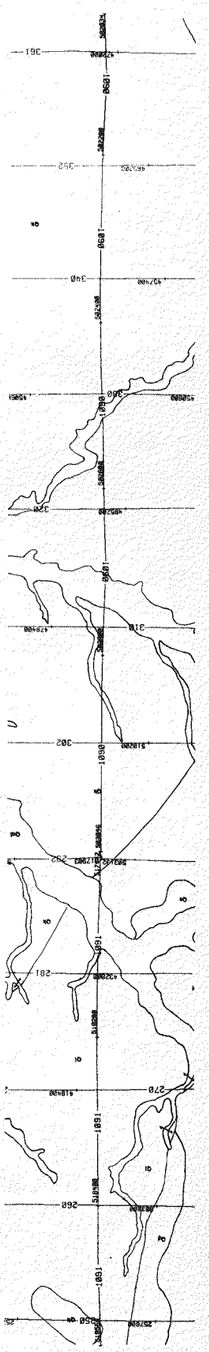
BARO PRESSURE MM HG
MIN 718.8
MAX 729.1
MEAN 725.1
STD DEV 2.829

D31 dm

LINE 1080
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80326

LINE 1090
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331





LINE 1090

RADAR ALTMTR FEET
MIN 312.6
MAX 584.4
MEAN 508.5
STD DEV 32.38

DIURNAL GAMMAS
MIN 57828
MAX 57851
MEAN 57833
STD DEV 10.91

RESIDUAL MAG GAMMAS
MIN -1277
MAX -55.02
MEAN -822.6
STD DEV 300.7

AIR TEMPERATURE DEG F
MIN -3.000
MAX 3.000
MEAN -.2365
STD DEV 1.948

BARO PRESSURE MM HG
MIN 720.5
MAX 743.3
MEAN 731.1
STD DEV 3.141

D33 d

LINE 1100
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80331

LINE 1110
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330

BARO PRESSURE
MM HG
MIN 728.5
MAX 747.9
MEAN 738.0
STD DEV 2.140

AIR TEMPERATURE
DEG C
MIN -6.000
MAX -3.000
MEAN -3.935
STD DEV .7197

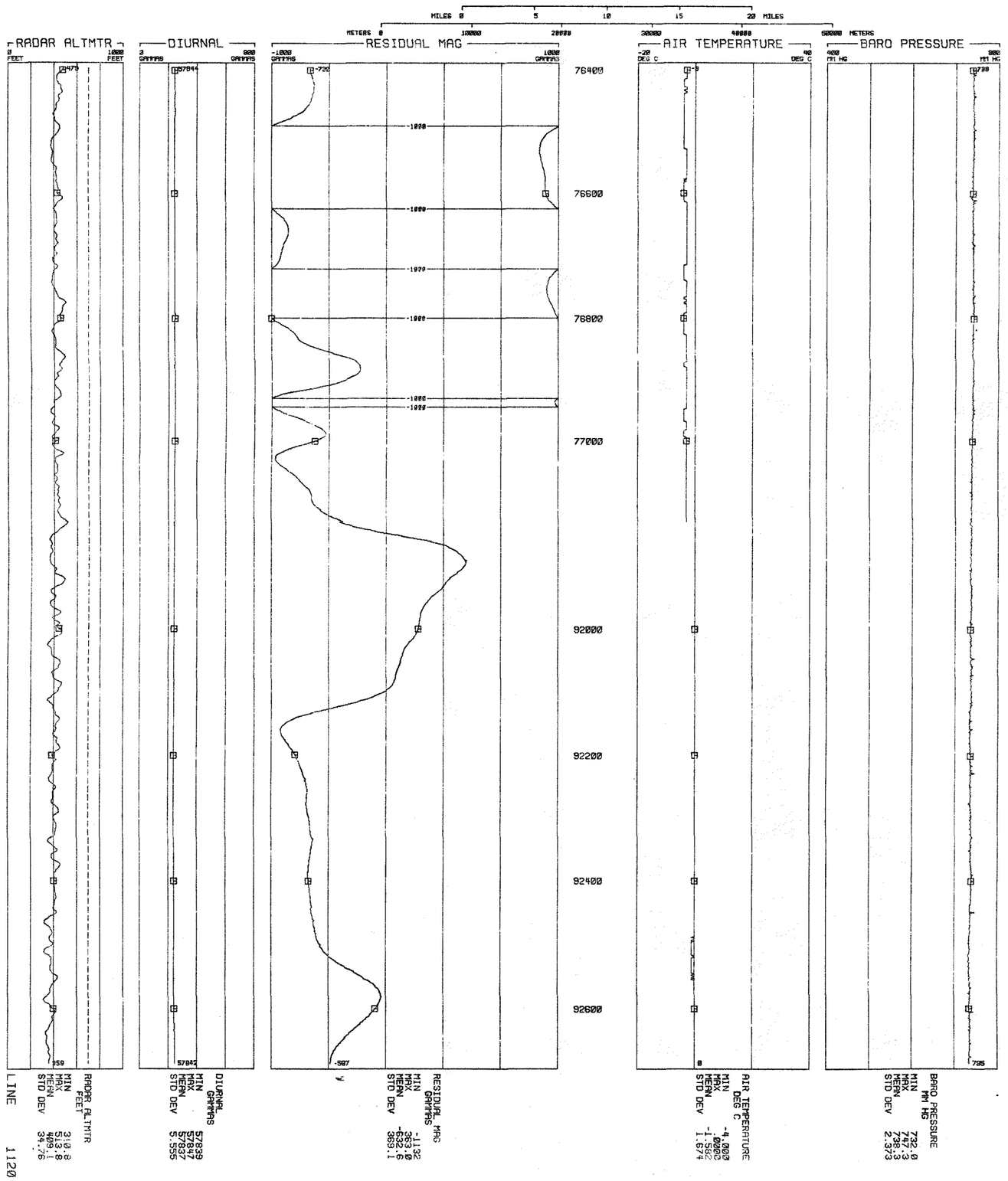
RESIDUAL MAG
GAMMAS
MIN -976.9
MAX 283.9
MEAN -570.0
STD DEV 286.4

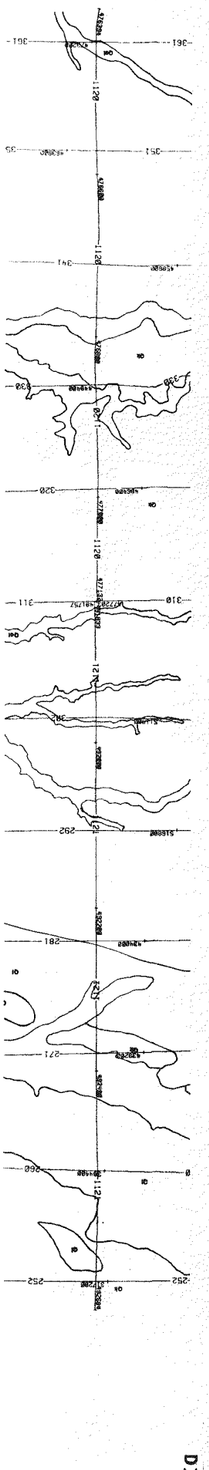
DIURNAL
GAMMAS
MIN 57845
MAX 57851
MEAN 57843
STD DEV 4.933

RADAR ALTMTR
FEET
MIN 317.9
MAX 511.7
MEAN 404.7
STD DEV 33.09

LINE 1110

LINE 1120
DES MOINES QUADRANGLE - NTMS NK 15-8
DATA ACQUIRED 80330





LINE 1120

RADAR ALTMTR FEET
MIN 310.8
MAX 513.8
MEAN 409.1
STD DEV 36.78

DIURNAL GAMMAS
MIN 57839
MAX 57847
MEAN 57837
STD DEV 5.555

RESIDUAL MAG GAMMAS
MIN -1192
MAX 353.0
MEAN -632.6
STD DEV 369.1

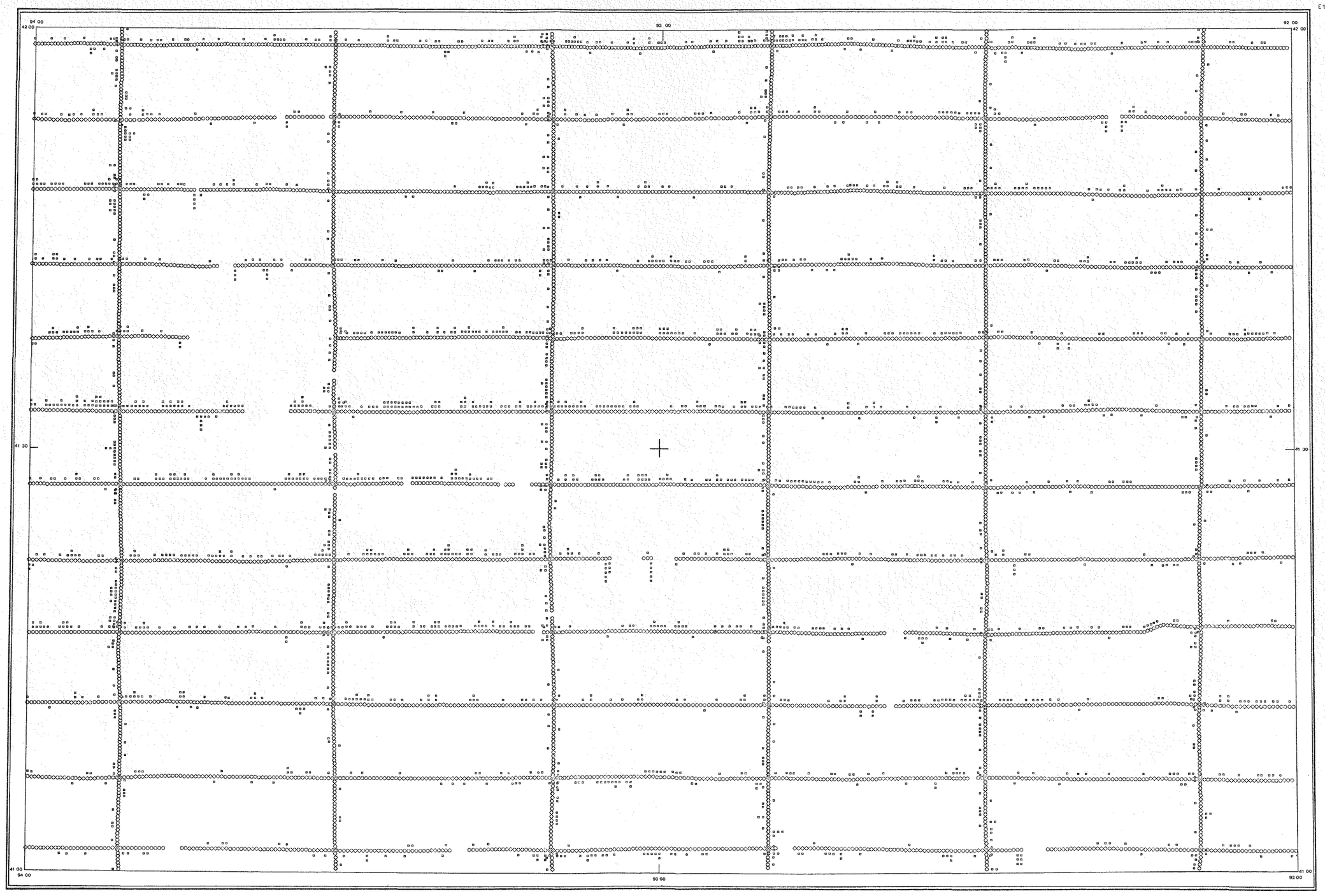
AIR TEMPERATURE DEG C
MIN -4.000
MAX 0.0000
MEAN -1.582
STD DEV 1.674

BARO PRESSURE MM HG
MIN 732.0
MAX 747.3
MEAN 738.3
STD DEV 2.373

D36 dm

APPENDIX E - Standard Deviation Maps

DES MOINES



SCALE 1:500,000

MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

O - DATA STATISTICALLY ADEQUATE
BLANK - DATA STATISTICALLY INADEQUATE
σ - 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

SOUTH DAKOTA NK 14-4 SIOUX FALLS	FAIRMONT NK 15-1	MINNESOTA NK 15-2 MASON CITY	LA CROSSE NK 15-3	WISCONSIN NK 16-1 MADISON
NK 14-5 SIOUX CITY	FT DODGE NK 15-4	WATERLOO NK 15-5* DUBUQUE		NK 16-4 ROCKFORD
NEBRASKA NK 14-9 FREMONT	NK 15-7 OMAHA	DES MOINES NK 15-8 Oma	DAVENPORT NK 15-9	AURORA NK 16-7
LINCOLN NK 14-12	NEBRASKA CITY NK 15-10	CENTERVILLE NK 15-11	BURLINGTON NK 15-12	PEORIA NK 16-10
KANSAS NJ 14-3 MANHATTAN	NJ 15-1 KANSAS CITY	NJ 15-2 MISSOURI ROBERTS	QUINCY NJ 15-3	ILLINOIS DECATUR NJ 16-1

98° 44° 88° 39°

POTASSIUM STANDARD DEVIATION MAP

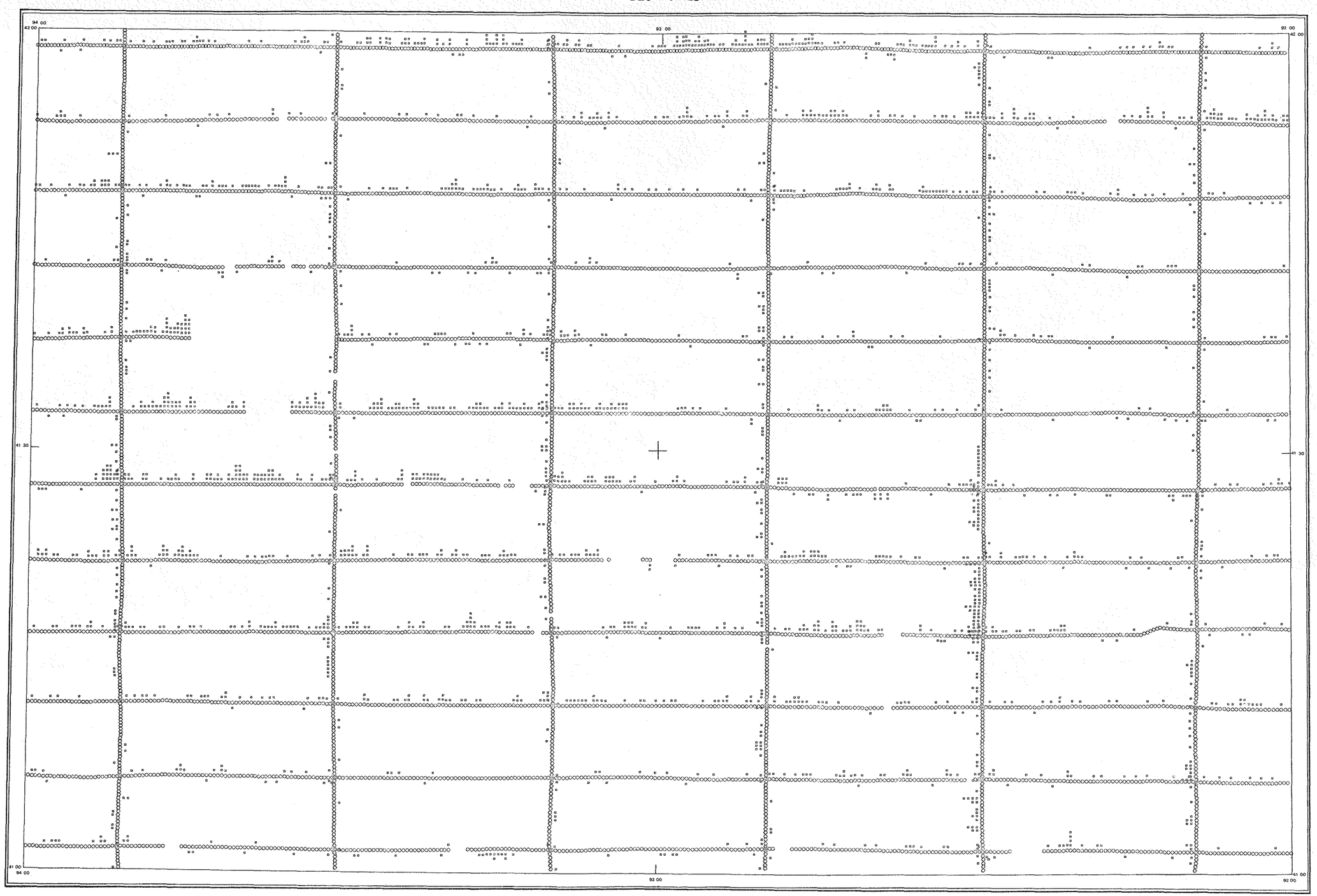
IOWA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

DES MOINES



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
σ - 1 σ ABOUT MEASURE OF CENTRAL TENDENCY

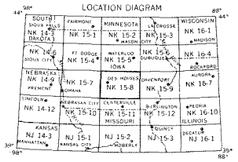
NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
ON N-S LINES, +σ TO WEST, -σ TO EAST.

N

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

LOCATION DIAGRAM

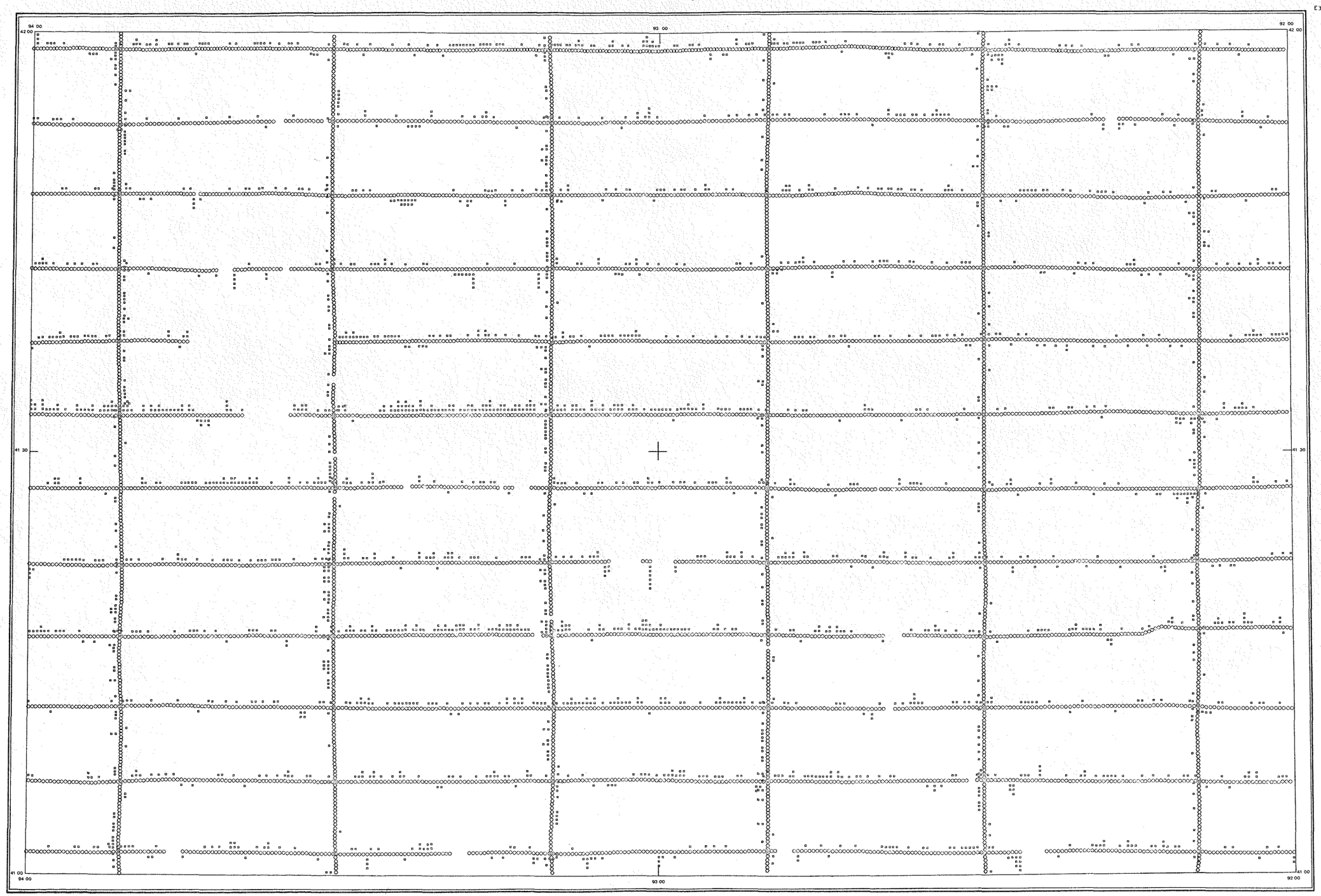


URANIUM STANDARD DEVIATION MAP

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DES MOINES



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
o - 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

SOUTH DAKOTA NK 14-3 DAKOTA	FAIRMONT NK 15-1	MINNESOTA NK 15-2 MASON CITY	LACROSSE NK 15-3	WISCONSIN NK 16-1 MADISON
SIOUX CITY NK 14-6	FT DODGE NK 15-4	WATERLOO NK 15-5 IOWA	DUBUQUE NK 15-6	NK 16-4
NEBRASKA NK 14-9 FRENCH	NK 15-7 IOWA	DES MOINES NK 15-8	DAVENPORT NK 15-9	BURLINGTON NK 16-7
LINCOLN NK 14-12	NEBRASKA CITY NK 15-10	CENTERVILLE NK 15-11 MISSOURI	BOWLING GREEN NK 15-12	PEORIA NK 16-10 ILLINOIS
KANSAS NJ 14-3 MANHATTAN	NJ 15-1 KANSAS CITY	NJ 15-2 TOPEKA	QUINCY NJ 15-3	DECATUR NJ 16-1

98° 44° 39°

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

N

THORIUM STANDARD DEVIATION MAP

IOWA PROJECT

U. S. DEPARTMENT OF ENERGY

DES MOINES

E4 dm

94 00 | 93 00 | 92 00

42 00

41 30

41 00

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
σ - 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.

N

LOCATION DIAGRAM

SOUTH DAKOTA NK 14-9	FAIRMONT NK 15-1	MINNESOTA NK 15-2	LA CROSSE NK 15-3	WISCONSIN NK 16-1
NK 14-6	FT DODGE NK 15-4	WATERLOO NK 15-5 IOWA	DUBUQUE NK 15-6	NK 16-4
NEBRASKA NK 14-3	NK 15-7	DES MOINES NK 15-8	DAVENPORT NK 15-9	AURORA NK 16-7
NK 14-12	NEBRASKA CITY NK 15-10	CENTERVILLE NK 15-11 MISSOURI	HANNIBAL NK 15-12	MEMPHIS NK 16-10 ILLINOIS
KANSAS NJ 14-3	NJ 15-1	NJ 15-2	QUINCY NJ 15-3	PEORIA NJ 16-1

THORIUM/POTASSIUM STANDARD DEVIATION MAP

IOWA PROJECT

U. S. DEPARTMENT OF ENERGY

SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

DES MOINES

94 00
42 00
93 00
92 00
41 30
41 00

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
σ - 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

SOUTH DAKOTA NK 14-3	FAIRMONT NK 15-1	MINNESOTA	LA CROSSE NK 15-3	WISCONSIN NK 16-1
NK 14-6 SIOUX CITY	FT DODGE NK 15-4	WATERLOO NK 15-5 IOWA	DUBUQUE NK 15-6	NK 16-4 MADISON
NEBRASKA NK 14-9 FREMONT	NK 15-7	DES MOINES NK 15-8	DAVENPORT NK 15-9	AURORA NK 16-7 ROCKFORD
LINCOLN NK 14-12	NEBRASKA CITY NK 15-10	CENTERVILLE NK 15-11 MISSOURI	BURLINGTON NK 15-12	PEORIA NK 16-10 ILLINOIS
KANSAS NJ 14-3 MANHATTAN	NJ 15-1 KANSAS CITY	NJ 15-2	QUINCY NJ 15-3	SPRINGFIELD NJ 16-1

98° 44° 88°
39° 98° 88°

SURVEY AND COMPILATION BY:

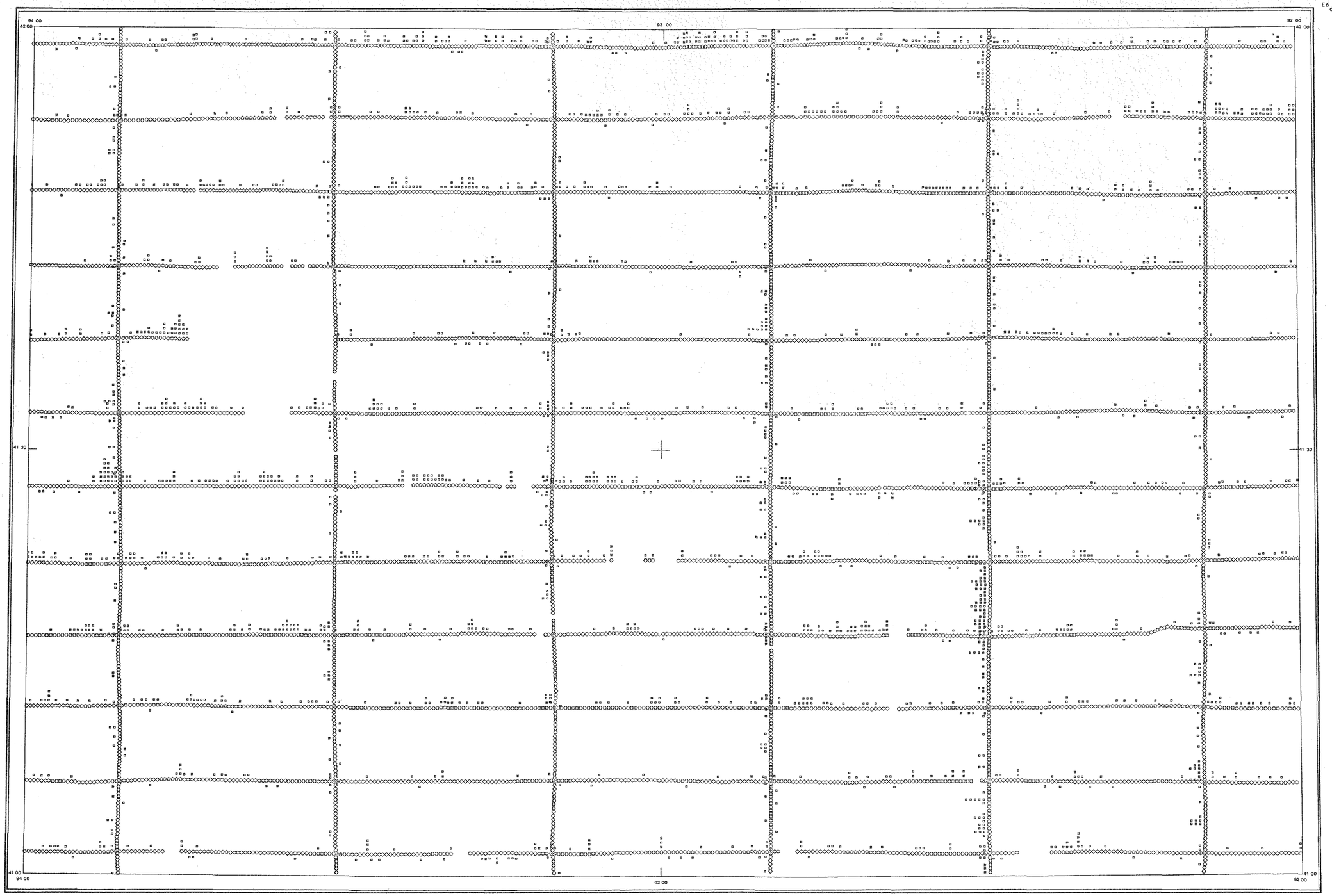
EG&G GEOMETRICS

URANIUM/POTASSIUM STANDARD DEVIATION MAP

IOWA PROJECT

U. S. DEPARTMENT OF ENERGY

DES MOINES



SCALE 1:500,000

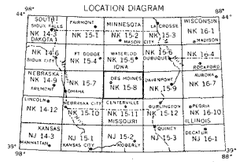
MILES 5 0 5 10 15 MILES

KILOMETRES 5 0 5 10 15 20 25 30 KILOMETRES

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

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

LOCATION DIAGRAM



SURVEY AND COMPILATION BY:

EG&G GEOMETRICS

URANIUM/THORIUM STANDARD DEVIATION MAP

IOWA PROJECT

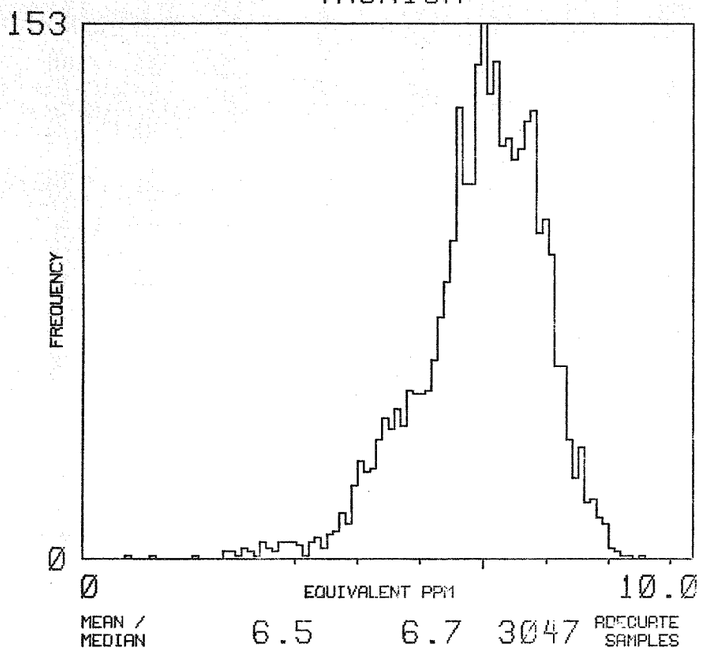
U. S. DEPARTMENT OF ENERGY

APPENDIX F - Histograms and Map Unit Conversion Table

NK 15-8 DES MOINES

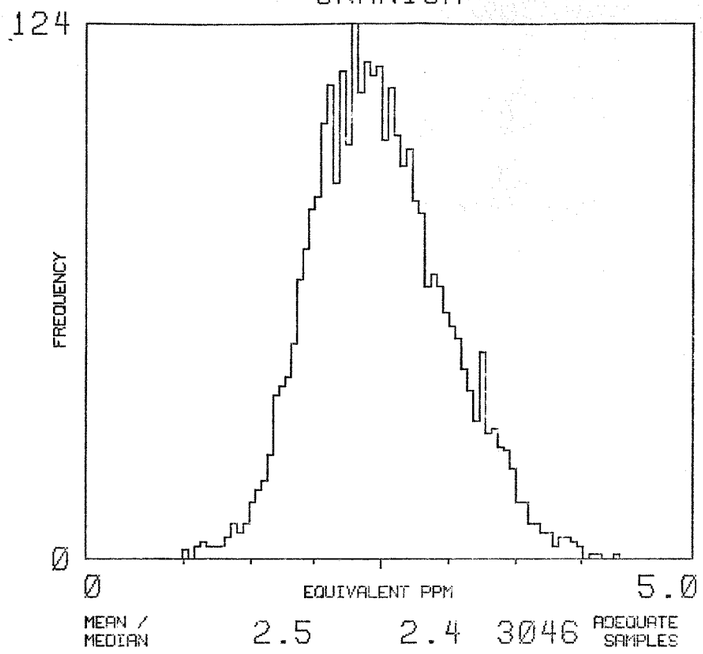
MAP UNIT : QAL TOTAL NUMBER OF SAMPLES 3067

THORIUM



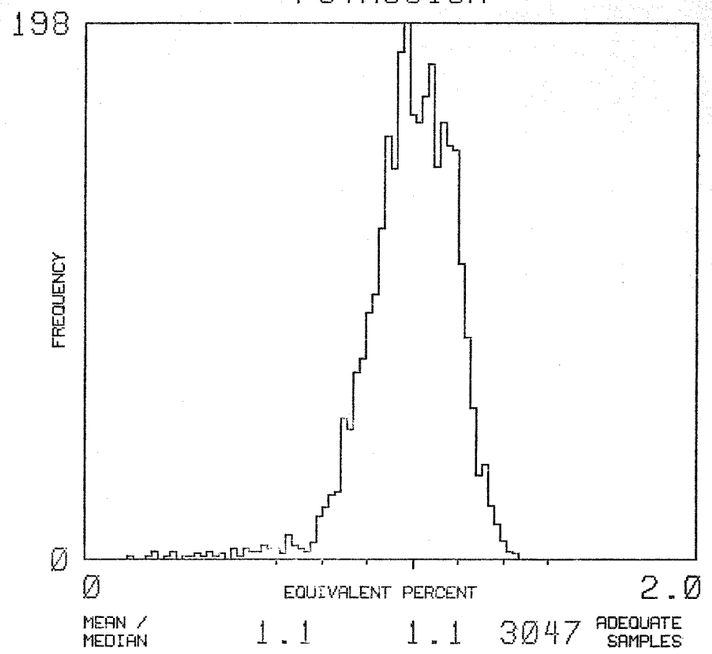
MEAN / MEDIAN 6.5 6.7 3047 ADEQUATE SAMPLES

URANIUM



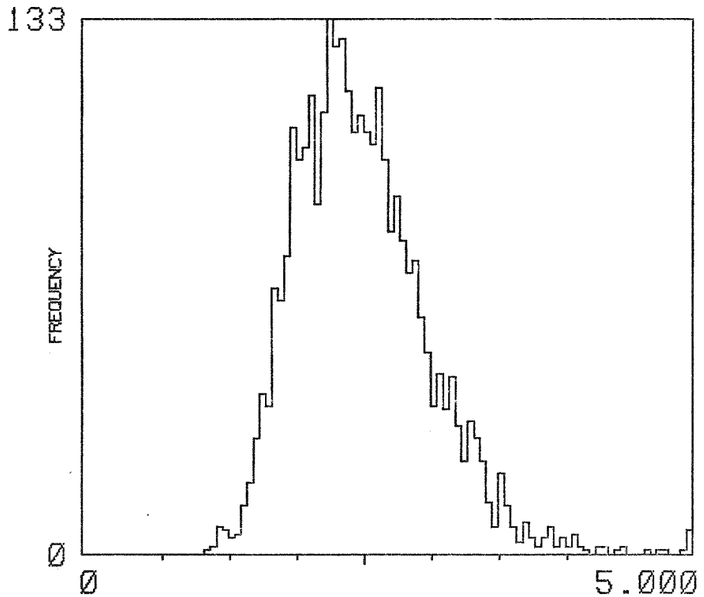
MEAN / MEDIAN 2.5 2.4 3046 ADEQUATE SAMPLES

POTASSIUM



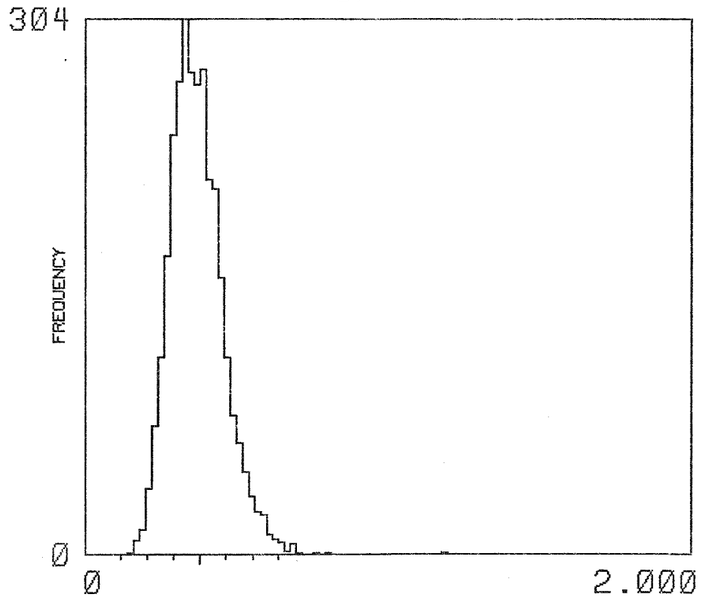
MEAN / MEDIAN 1.1 1.1 3047 ADEQUATE SAMPLES

U/K



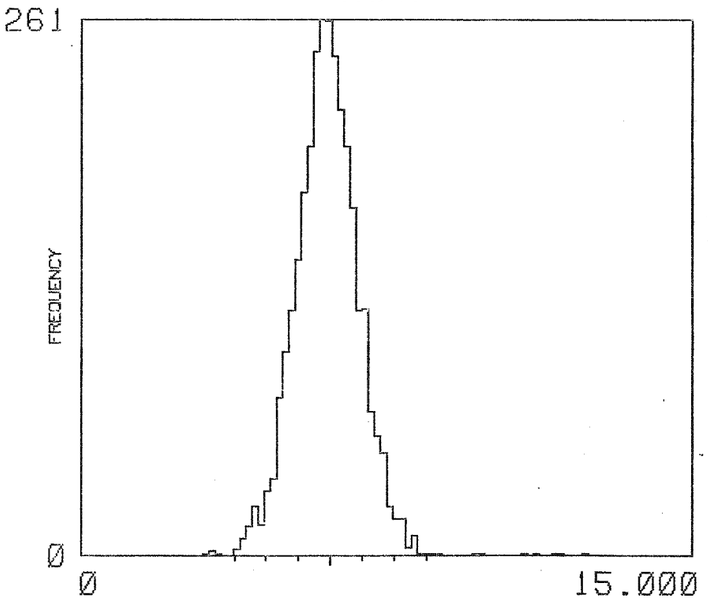
MEAN / MEDIAN 2.310 2.250 3038 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.380 Ø.380 3038 ADEQUATE SAMPLES

TH/K



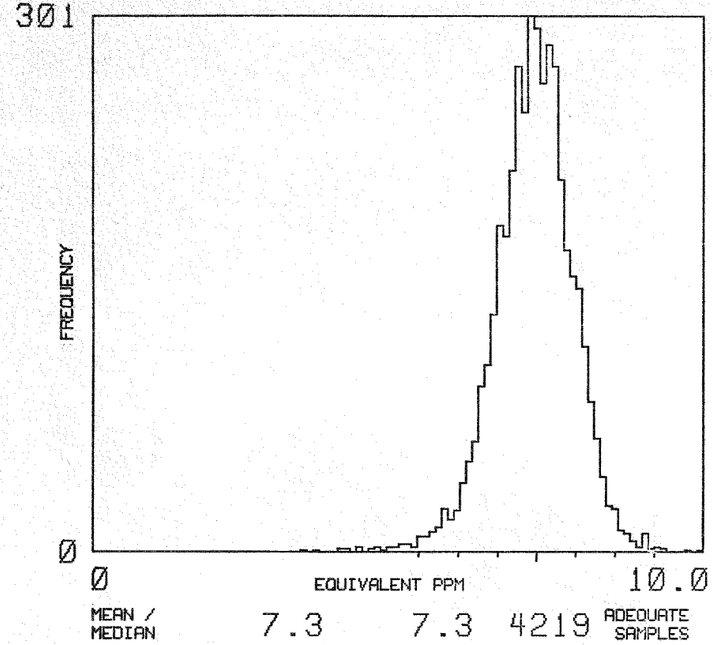
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NK 15-8 DES MOINES

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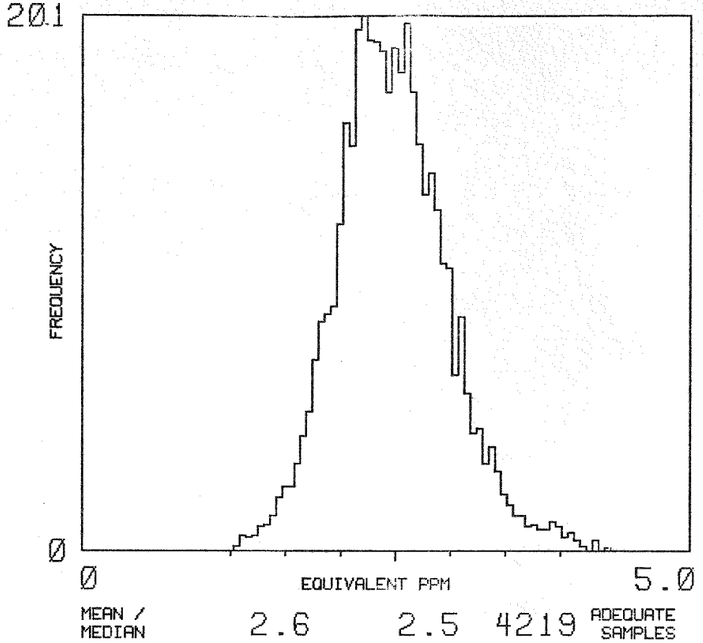
F2dm

THORIUM



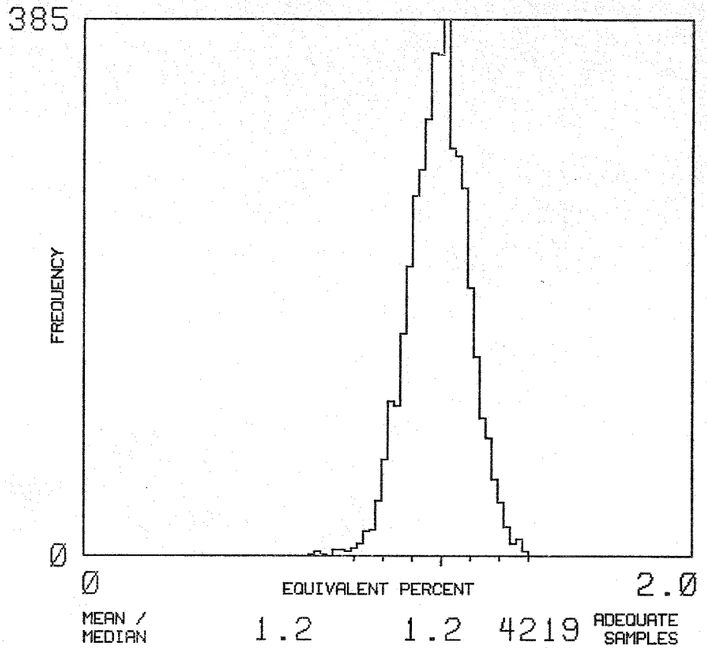
MEAN / MEDIAN 7.3 7.3 4219 ADEQUATE SAMPLES

URANIUM



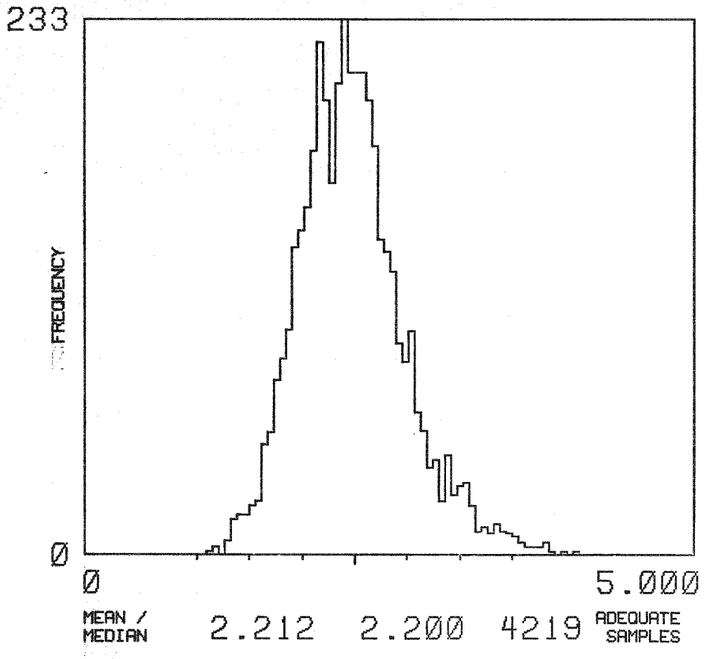
MEAN / MEDIAN 2.6 2.5 4219 ADEQUATE SAMPLES

POTASSIUM



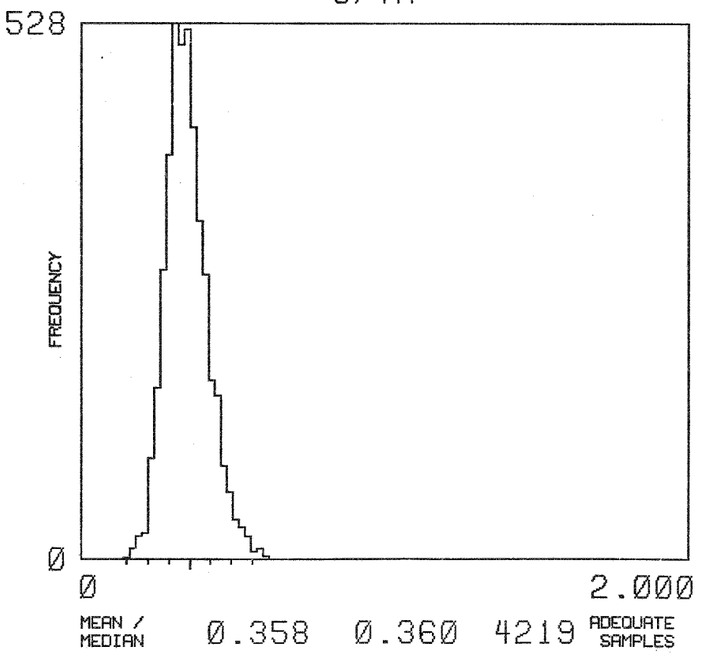
MEAN / MEDIAN 1.2 1.2 4219 ADEQUATE SAMPLES

U/K



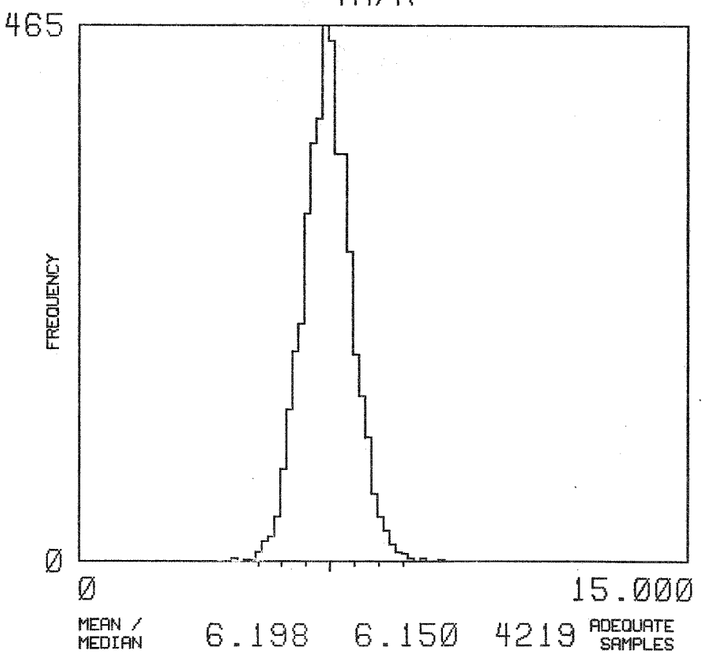
MEAN / MEDIAN 2.212 2.200 4219 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.358 Ø.360 4219 ADEQUATE SAMPLES

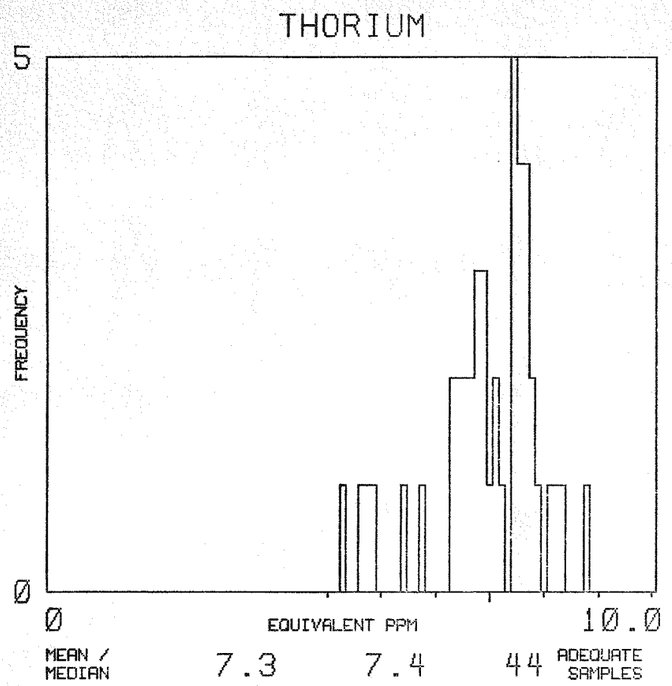
TH/K

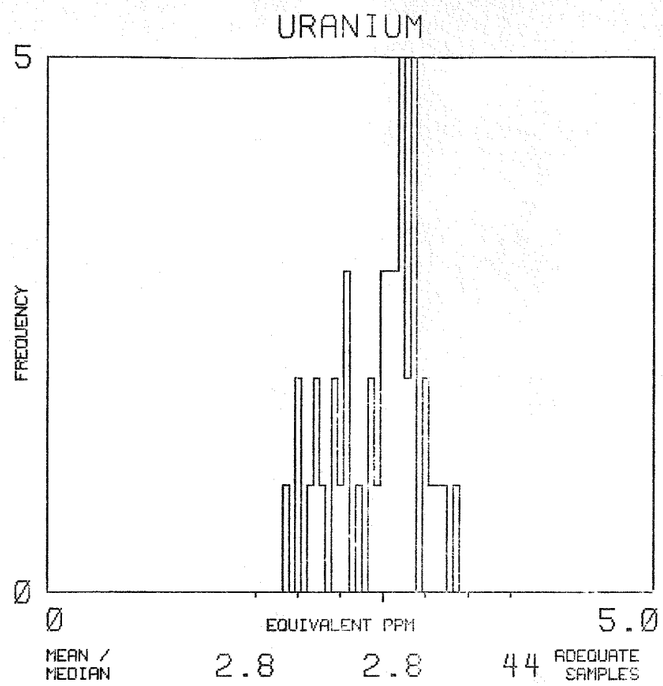


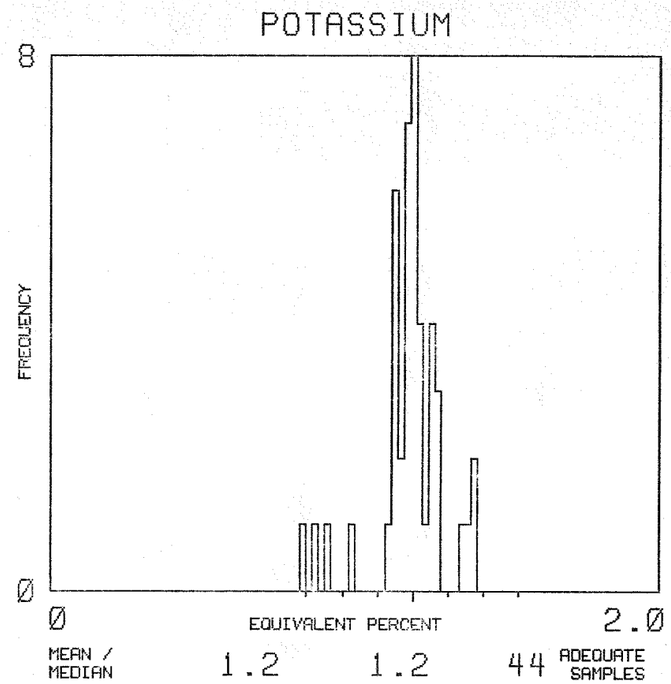
MEAN / MEDIAN 6.198 6.150 4219 ADEQUATE SAMPLES

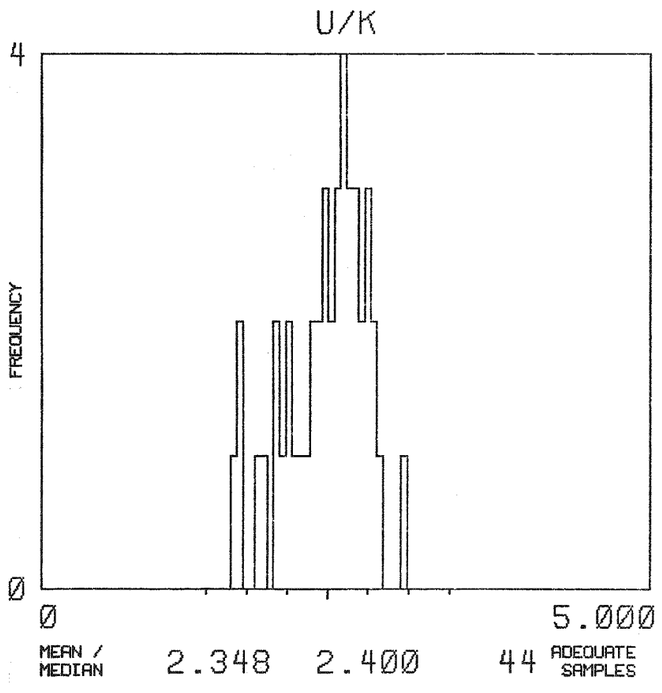
NK 15-8 DES MOINES

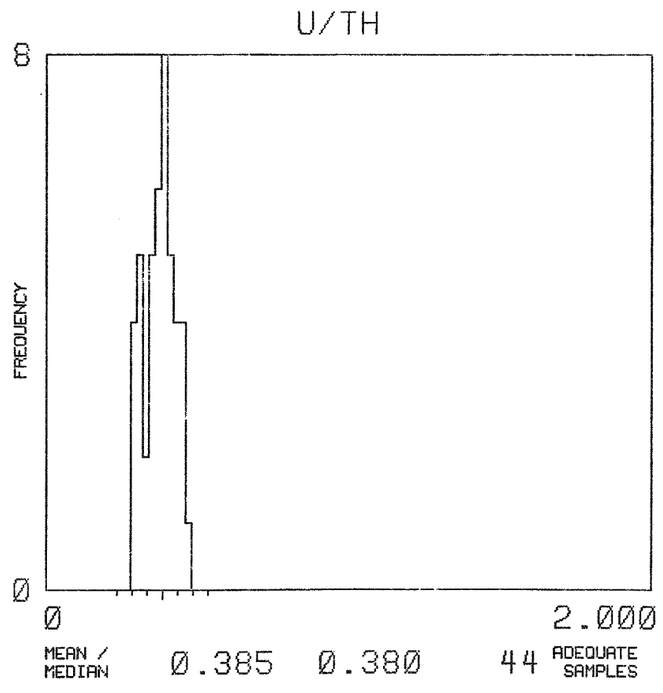
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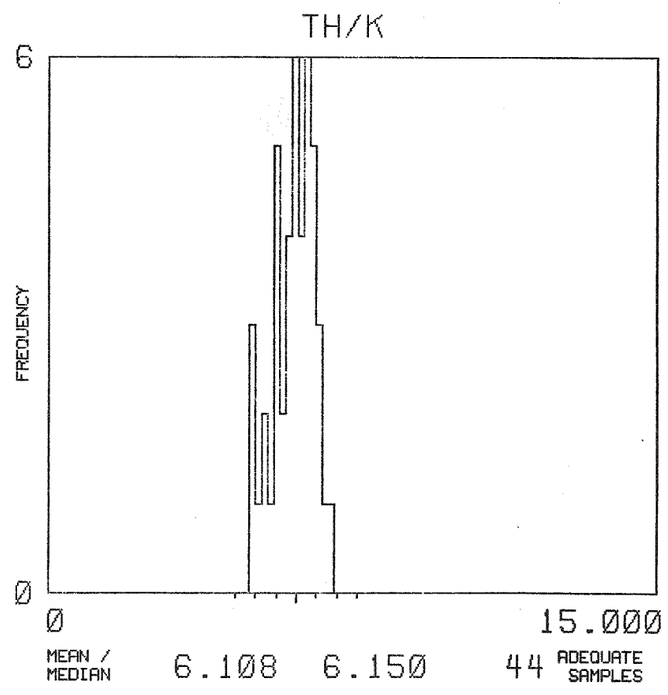








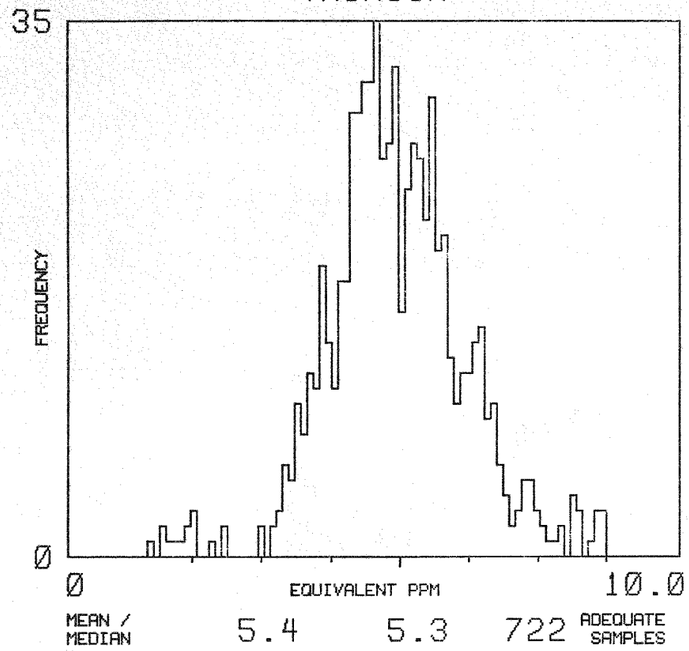




NK 15-8 DES MOINES

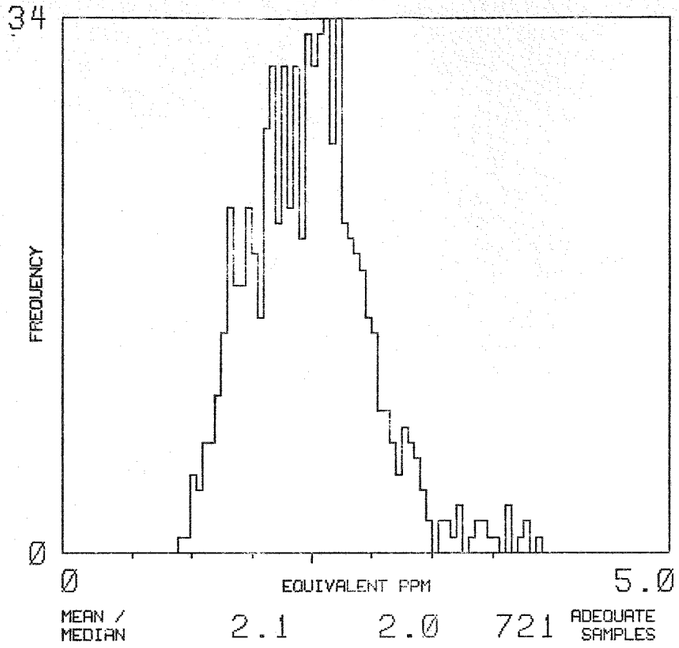
MAP UNIT : QO TOTAL NUMBER OF SAMPLES 738

THORIUM



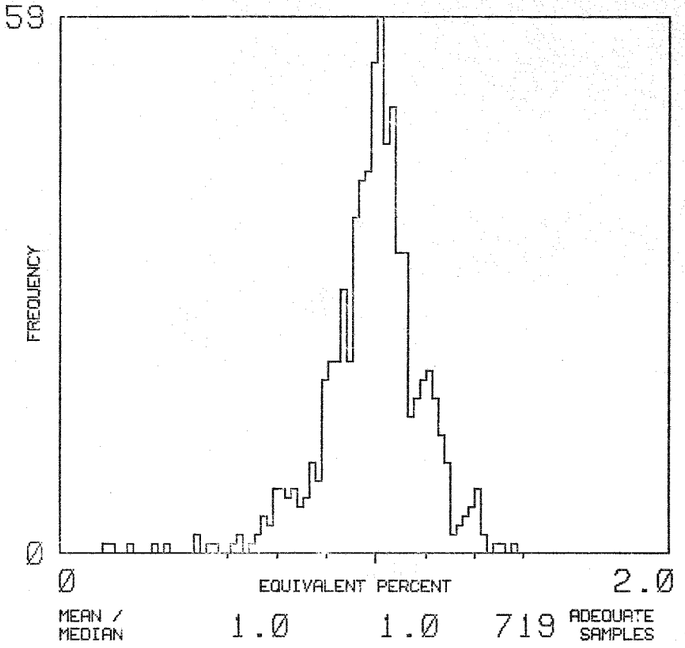
MEAN / MEDIAN 5.4 5.3 722 ADEQUATE SAMPLES

URANIUM



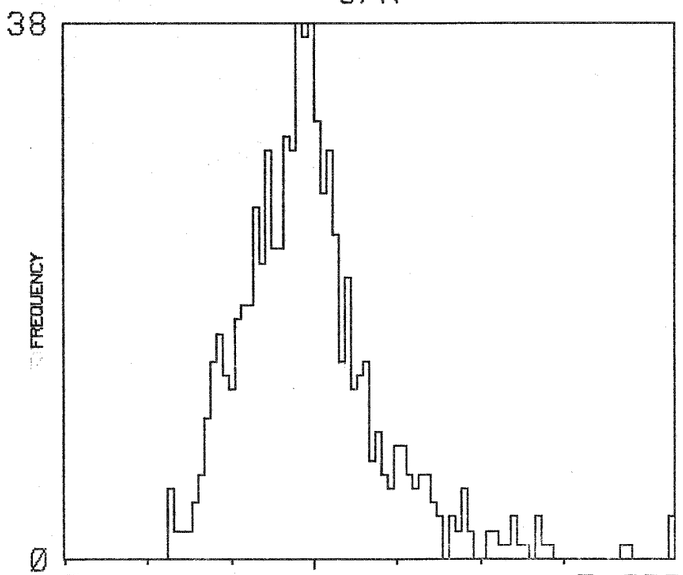
MEAN / MEDIAN 2.1 2.0 721 ADEQUATE SAMPLES

POTASSIUM



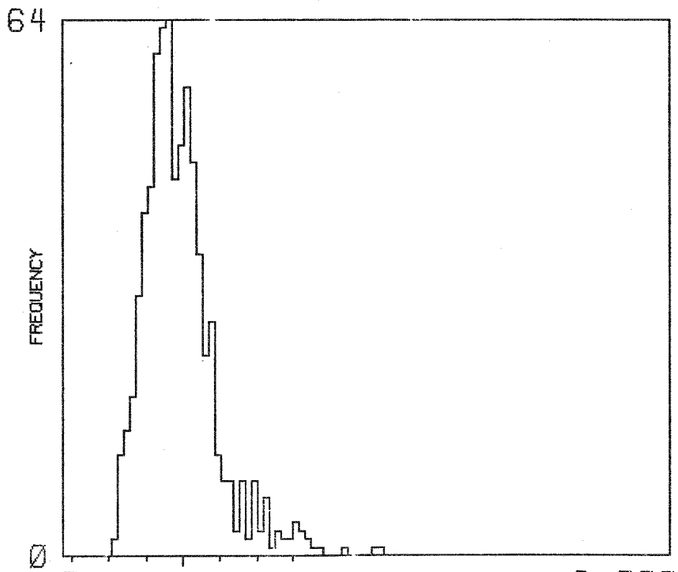
MEAN / MEDIAN 1.Ø 1.Ø 719 ADEQUATE SAMPLES

U/K



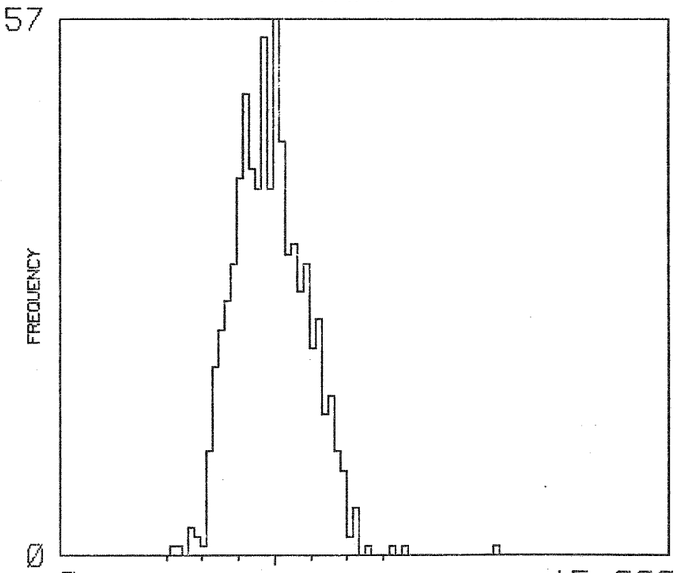
MEAN / MEDIAN 2.Ø5Ø 2.ØØØ 718 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.395 Ø.38Ø 721 ADEQUATE SAMPLES

TH/K



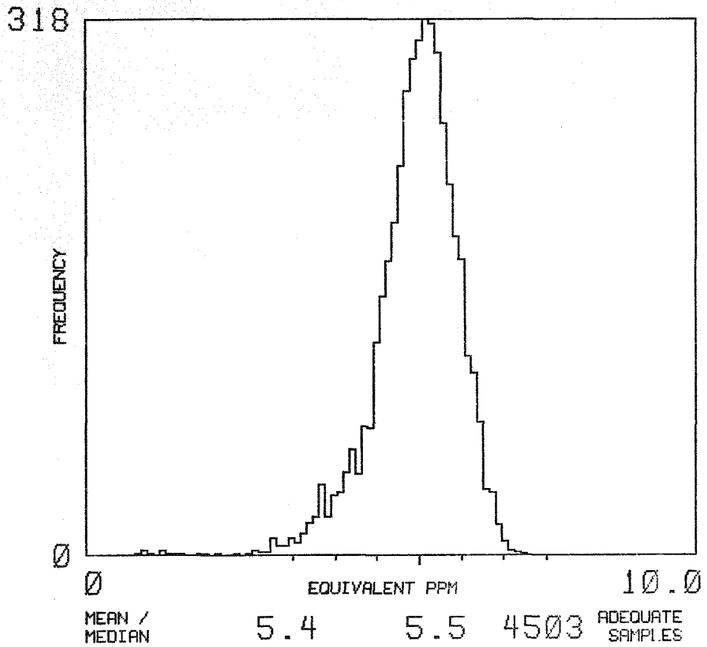
MEAN / MEDIAN 5.284 5.25Ø 719 ADEQUATE SAMPLES

NK 15-8 DES MOINES

MAP UNIT : QW

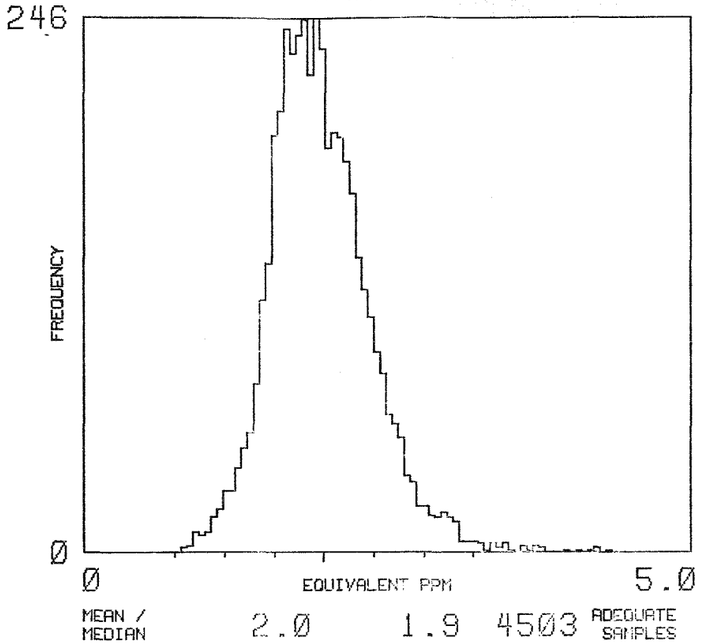
TOTAL NUMBER OF SAMPLES 4523

THORIUM



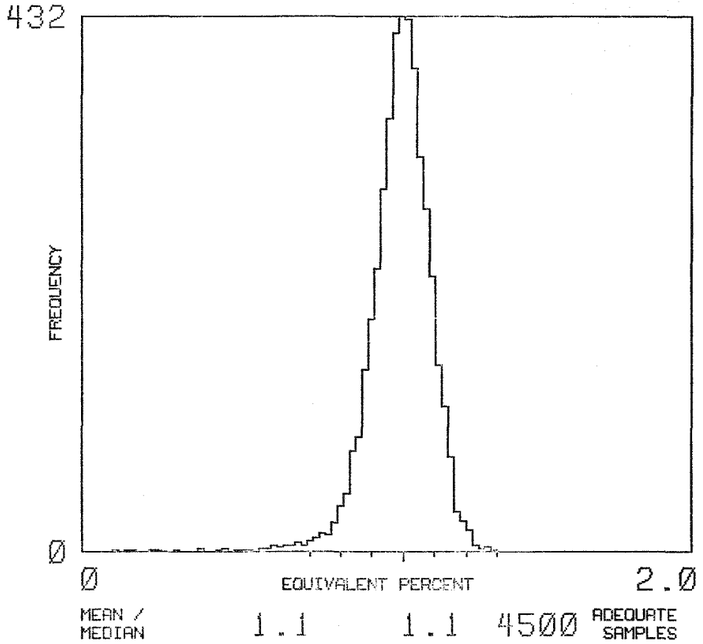
MEAN / MEDIAN 5.4 5.5 4503 ADEQUATE SAMPLES

URANIUM



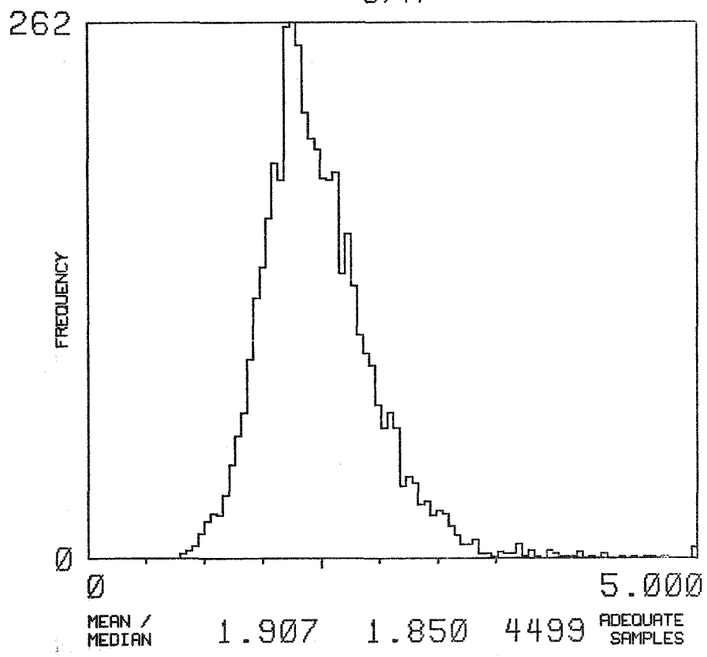
MEAN / MEDIAN 2.Ø 1.9 4503 ADEQUATE SAMPLES

POTASSIUM



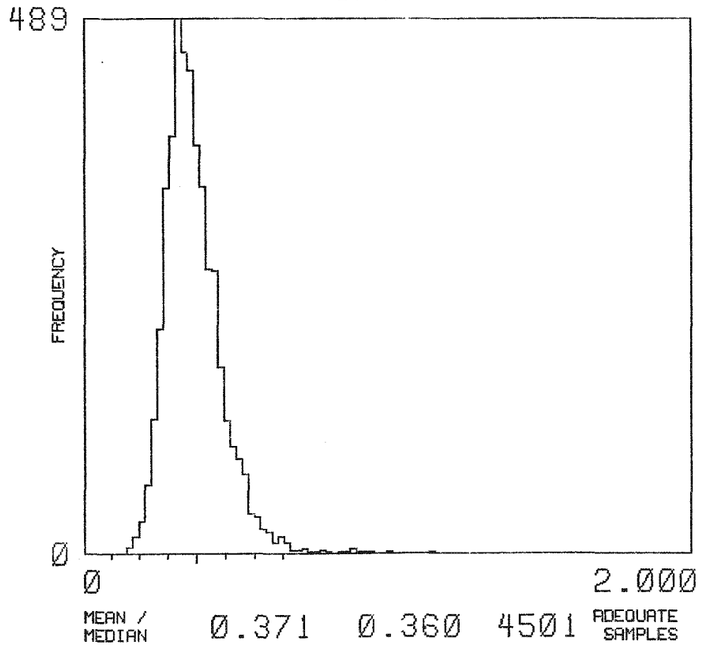
MEAN / MEDIAN 1.1 1.1 4500 ADEQUATE SAMPLES

U/K



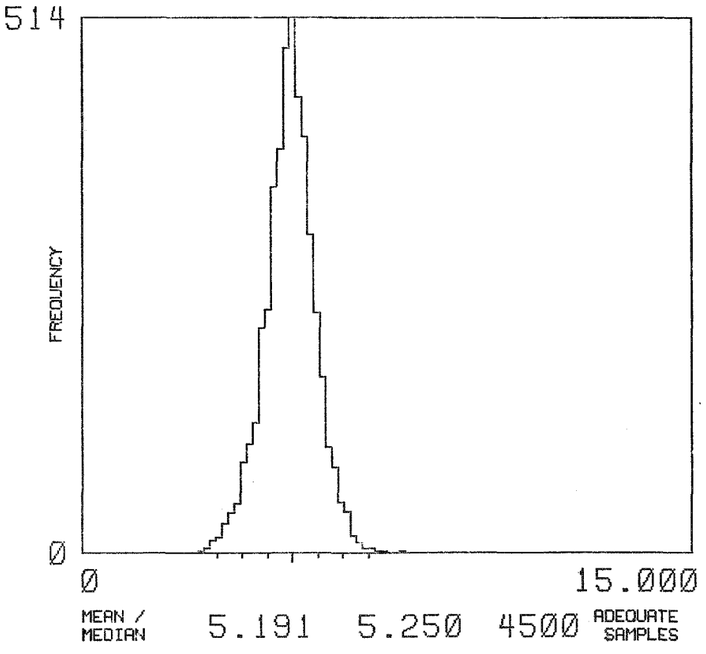
MEAN / MEDIAN 1.9Ø7 1.85Ø 4499 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.371 Ø.36Ø 4501 ADEQUATE SAMPLES

TH/K



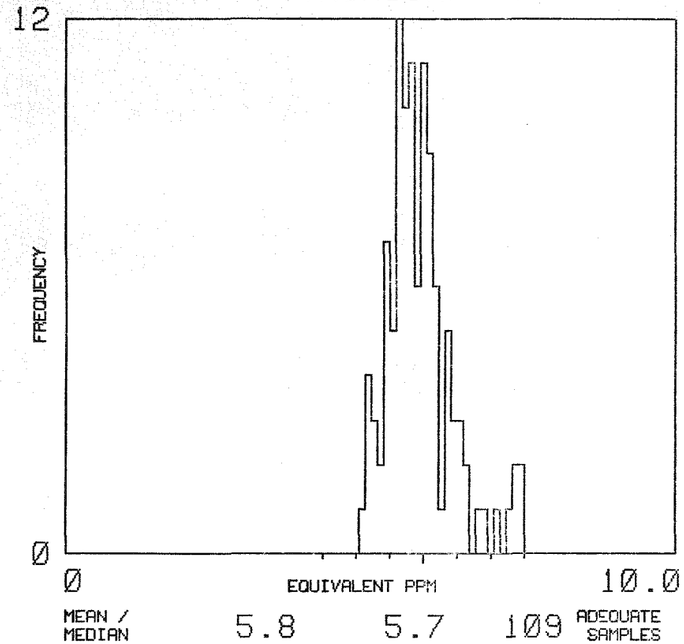
MEAN / MEDIAN 5.191 5.250 4500 ADEQUATE SAMPLES

NK 15-8 DES MOINES

MAP UNIT : QD

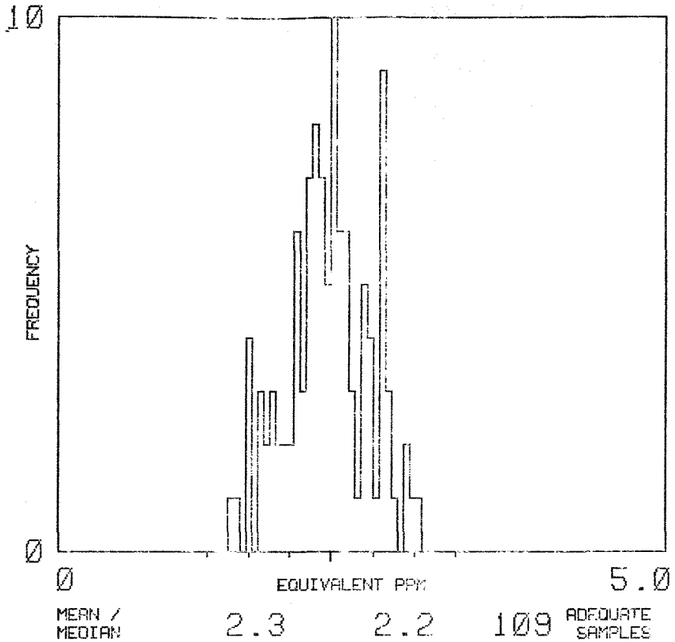
TOTAL NUMBER OF SAMPLES 109

THORIUM



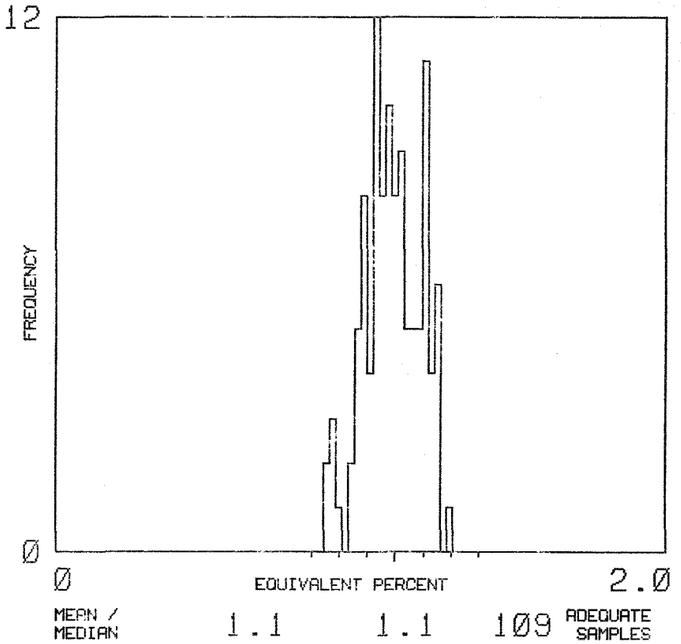
MEAN / MEDIAN 5.8 5.7 109 ADEQUATE SAMPLES

URANIUM



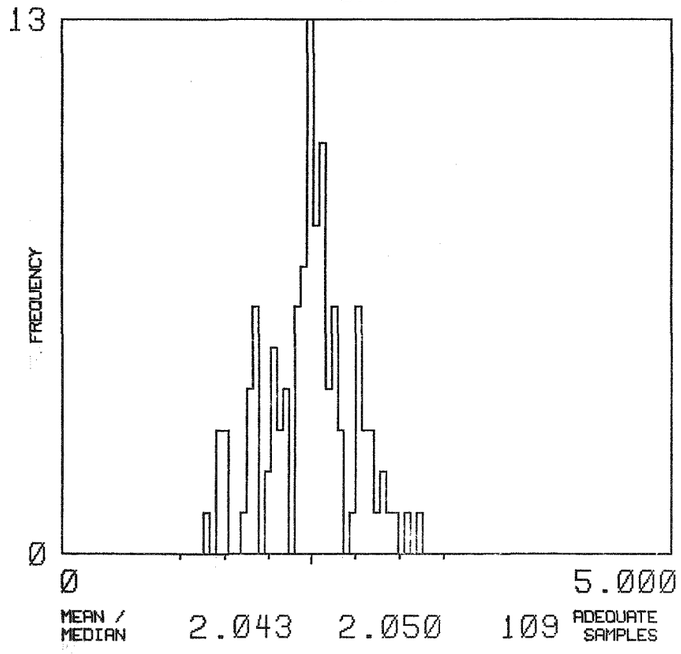
MEAN / MEDIAN 2.3 2.2 109 ADEQUATE SAMPLES

POTASSIUM



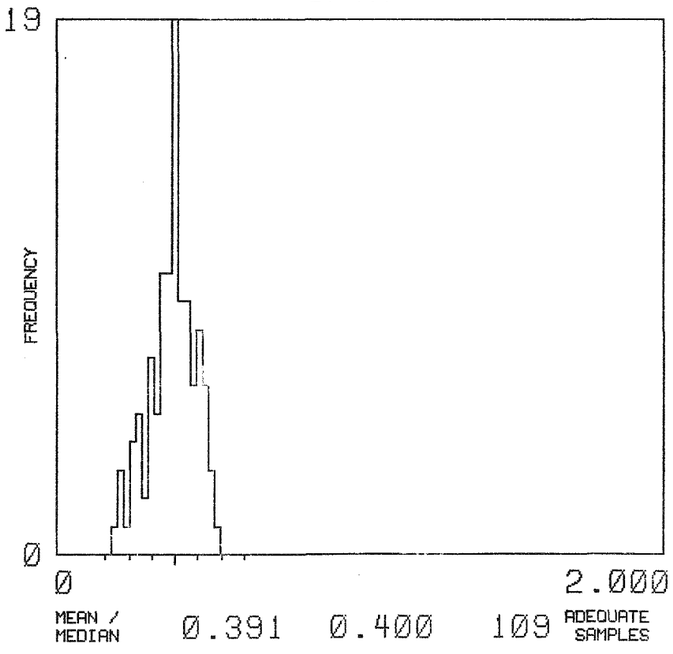
MEAN / MEDIAN 1.1 1.1 109 ADEQUATE SAMPLES

U/K



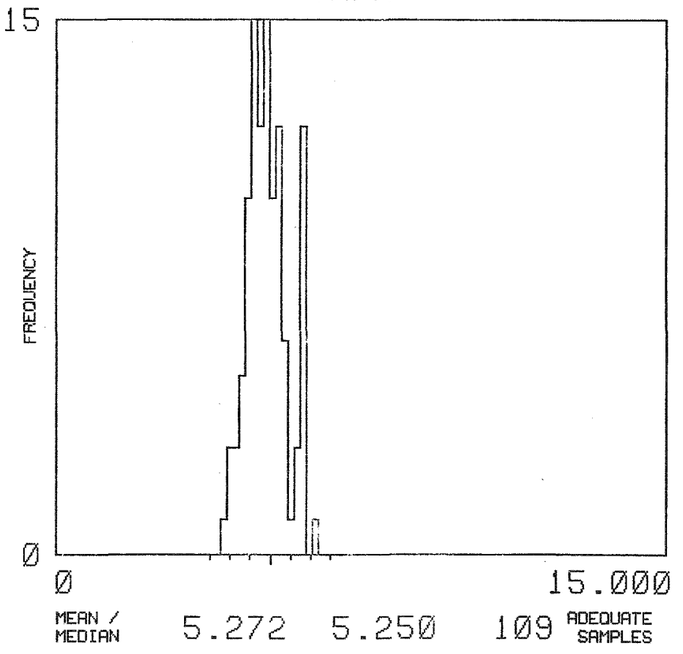
MEAN / MEDIAN 2.043 2.050 109 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN 0.391 0.400 109 ADEQUATE SAMPLES

TH/K



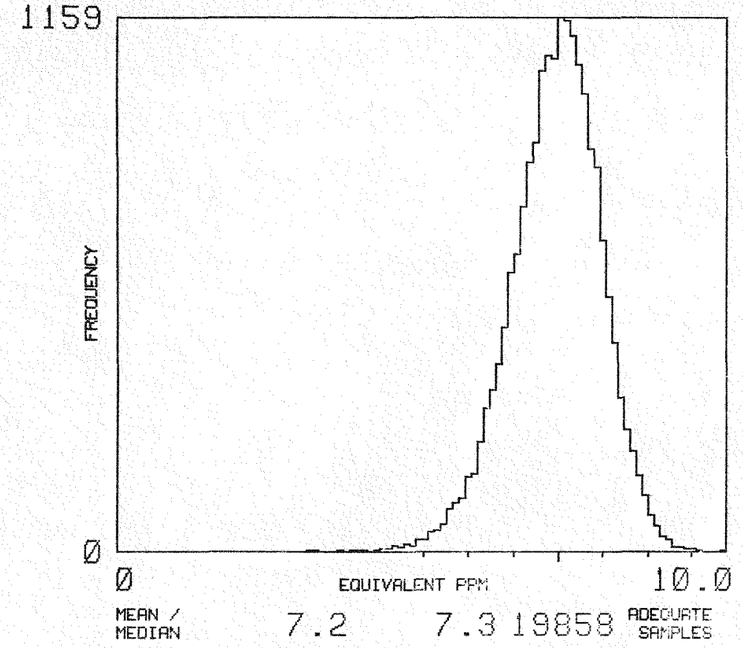
MEAN / MEDIAN 5.272 5.250 109 ADEQUATE SAMPLES

NK 15-8 DES MOINES

MAP UNIT : QK

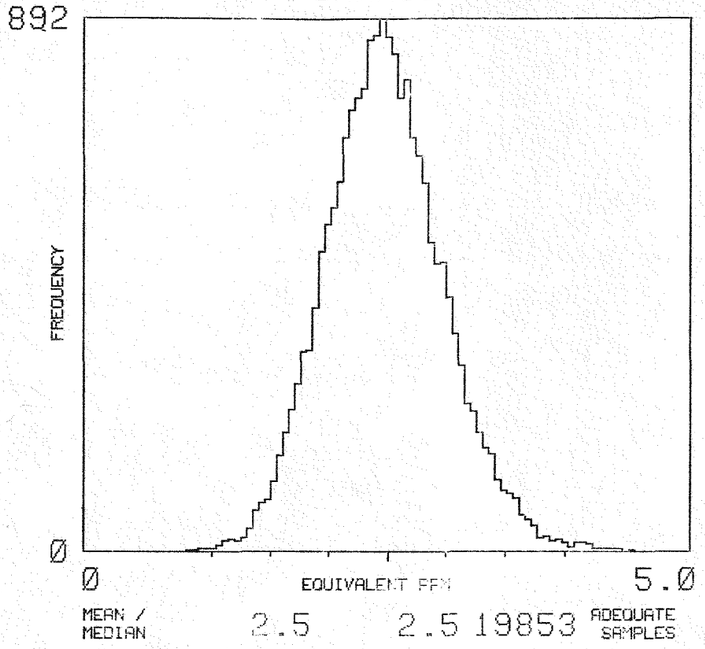
TOTAL NUMBER OF SAMPLES 19870

THORIUM



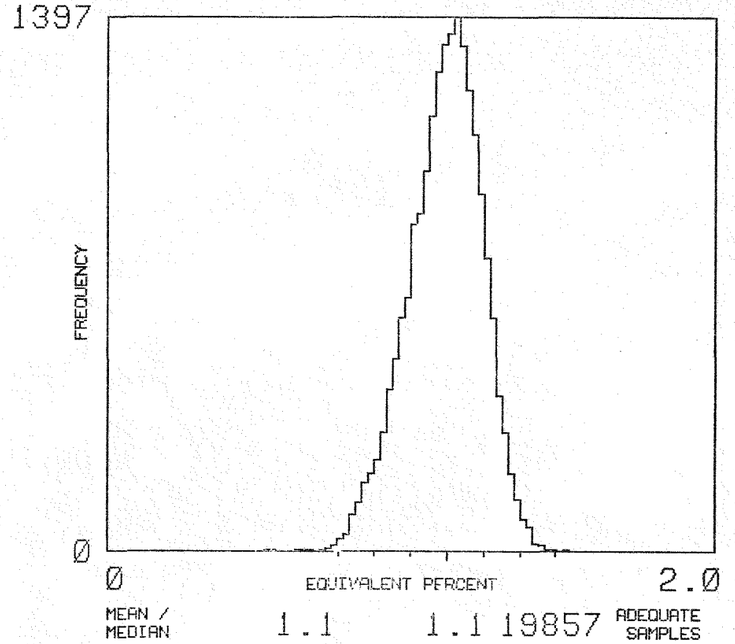
MEAN / MEDIAN 7.2 7.3 19858 ADEQUATE SAMPLES

URANIUM



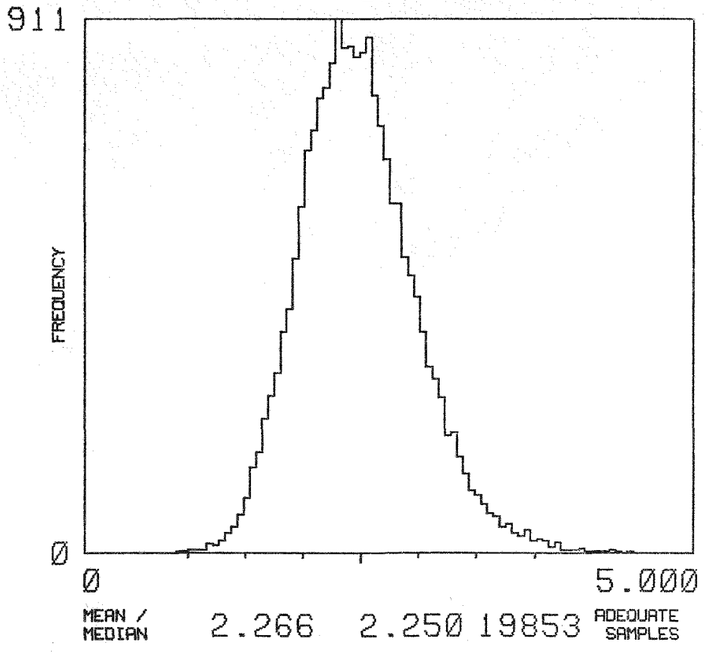
MEAN / MEDIAN 2.5 2.5 19853 ADEQUATE SAMPLES

POTASSIUM



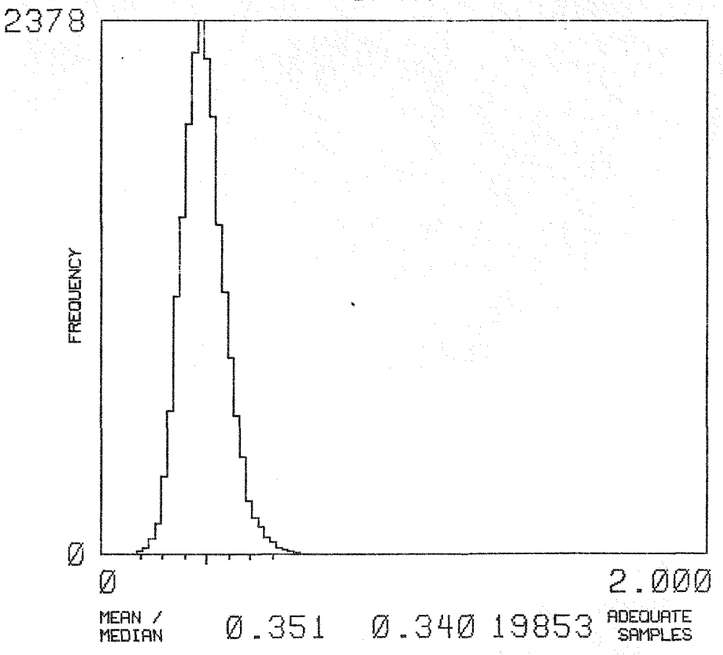
MEAN / MEDIAN 1.1 1.1 19857 ADEQUATE SAMPLES

U/K



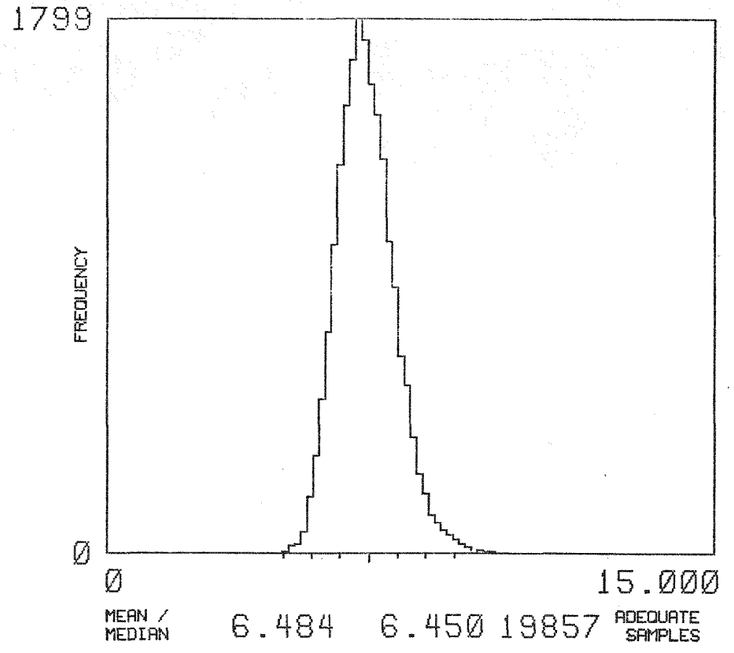
MEAN / MEDIAN 2.266 2.25Ø 19853 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.351 Ø.34Ø 19853 ADEQUATE SAMPLES

TH/K

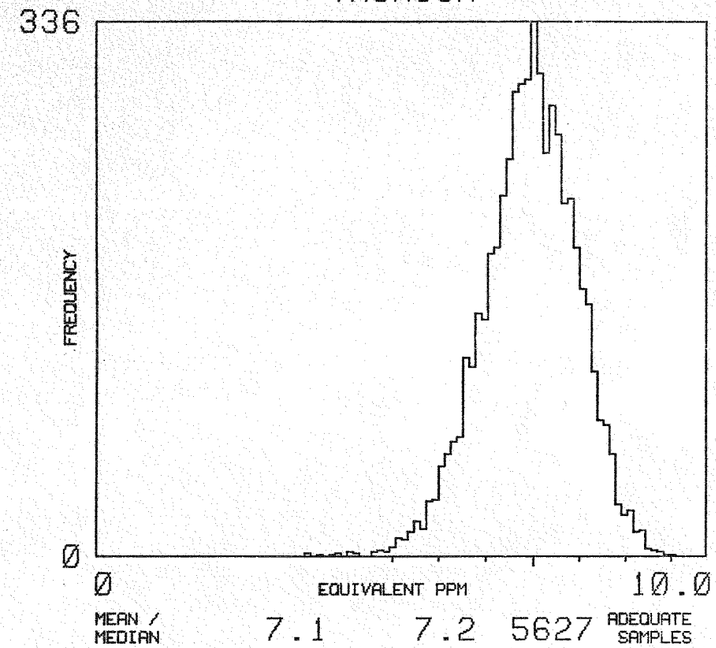


MEAN / MEDIAN 6.484 6.45Ø 19857 ADEQUATE SAMPLES

NK 15-8 DES MOINES

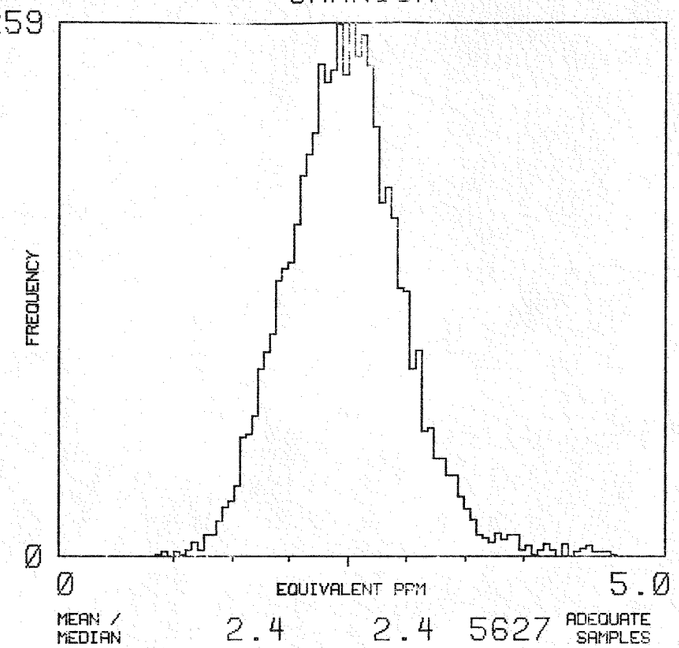
MAP UNIT : QKA TOTAL NUMBER OF SAMPLES 5627

THORIUM



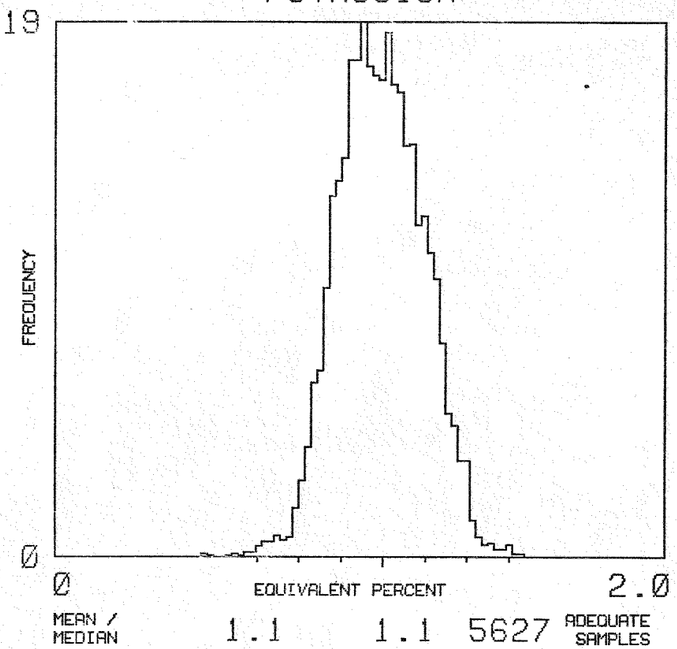
MEAN / MEDIAN 7.1 7.2 5627 ADEQUATE SAMPLES

URANIUM



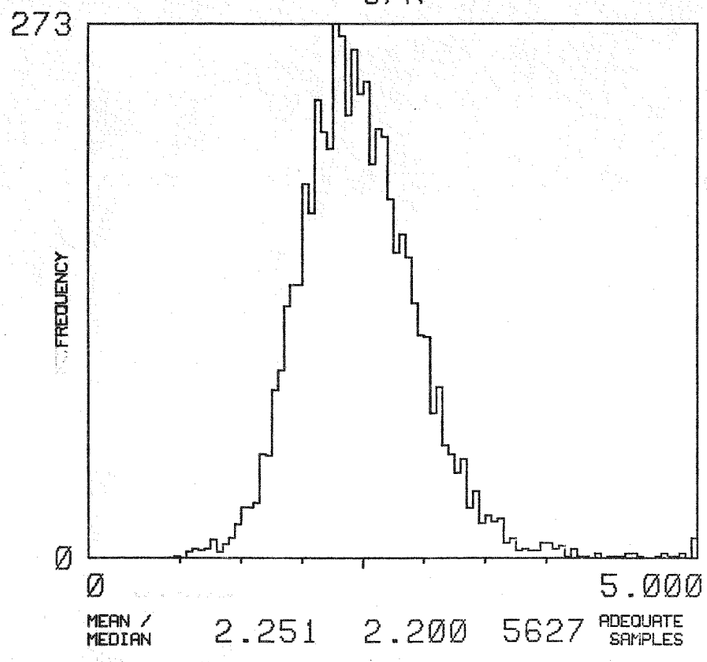
MEAN / MEDIAN 2.4 2.4 5627 ADEQUATE SAMPLES

POTASSIUM



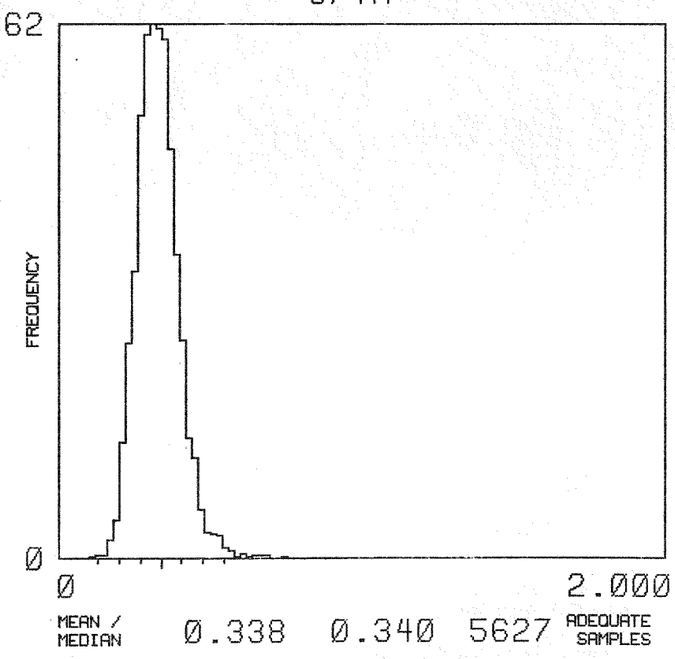
MEAN / MEDIAN 1.1 1.1 5627 ADEQUATE SAMPLES

U/K



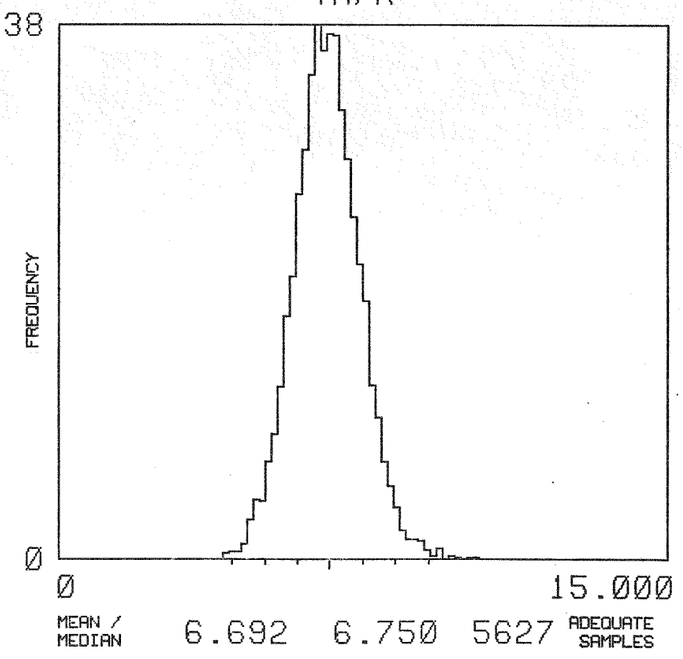
MEAN / MEDIAN 2.251 2.200 5627 ADEQUATE SAMPLES

U/TH



MEAN / MEDIAN Ø.338 Ø.34Ø 5627 ADEQUATE SAMPLES

TH/K



MEAN / MEDIAN 6.692 6.750 5627 ADEQUATE SAMPLES

DES MOINES QUADRANGLE

Computer Map Unit Symbol Conversion Table

Computer Map Unit Symbol	Geologic Map Unit Symbol
QAL	Qal
QL	Ql
QE	Qe
QO	Qo
QW	Qw
QD	Qd
* QF	Qf
QK	Qk
QKA	Qka

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	250	QW / 2	/ 0	/ 0	2.9	0	2	0	0	0	0	0	0
2 C	250	QW / 2	/ 0	/ 0	2.9	0	2	0	0	0	0	0	0
3 C	250	QW / 2	/ 0	/ 0	3.1	1	0	1	0	0	0	0	0
4 C	250	QW / 1	/ 0	/ 0	3.0	0	0	1	0	0	0	0	0
5 C	250	QW / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
6 C	250	QL / 2	/ 0	/ 0	3.8	1	0	1	0	0	0	0	0
7 C	250	QL / 3	/ 0	/ 0	4.0	0	1	2	0	0	0	0	0
8 C	250	QL / 2	/ 0	/ 0	3.8	0	1	1	0	0	0	0	0
9 C	250	QL / 3	/ 0	/ 0	3.4	1	2	0	0	0	0	0	0
10 C	250	QL / 2	/ 0	/ 0	4.2	1	0	0	1	0	0	0	0
11 C	250	QL / 4	/ 0	/ 0	3.6	1	3	0	0	0	0	0	0
12 C	250	QL / 1QK	/ 4	/ 0	3.3	4	1	0	0	0	0	0	0
13 C	250	QL / 2QK	/ 1	/ 0	3.8	0	2	1	0	0	0	0	0
14 C	250	QK / 1QAL	/ 2	/ 0	3.3	2	1	0	0	0	0	0	0
15 C	250	QK / 5	/ 0	/ 0	4.2	4	0	1	0	0	0	0	0
16 C	260	QL / 4	/ 0	/ 0	3.3	3	1	0	0	0	0	0	0
17 C	260	QL / 3	/ 0	/ 0	3.9	2	0	1	0	0	0	0	0
18 C	260	QL / 6	/ 0	/ 0	3.3	4	2	0	0	0	0	0	0
19 C	260	QL / 4	/ 0	/ 0	3.6	1	3	0	0	0	0	0	0
20 C	260	QAL / 3QK	/ 2	/ 0	3.5	1	4	0	0	0	0	0	0
21 C	260	QK / 2	/ 0	/ 0	4.1	1	0	1	0	0	0	0	0
22 C	260	QL / 3	/ 0	/ 0	3.4	1	2	0	0	0	0	0	0
23 C	260	QL / 2	/ 0	/ 0	4.1	1	0	1	0	0	0	0	0
24 C	260	QL / 4	/ 0	/ 0	4.0	0	3	1	0	0	0	0	0
25 C	260	QK / 4	/ 0	/ 0	3.4	2	2	0	0	0	0	0	0
26 C	260	QK / 1	/ 0	/ 0	4.0	0	0	1	0	0	0	0	0
27 C	260	QK / 2	/ 0	/ 0	3.4	0	2	0	0	0	0	0	0
28 C	270	QW / 3	/ 0	/ 0	3.0	0	3	0	0	0	0	0	0
29 C	270	QW / 4	/ 0	/ 0	3.0	3	0	1	0	0	0	0	0
30 C	270	QW / 2QAL	/ 1	/ 0	3.1	1	1	1	0	0	0	0	0
31 C	270	QK / 4	/ 0	/ 0	3.4	3	1	0	0	0	0	0	0
32 C	270	QK / 9	/ 0	/ 0	3.4	8	1	0	0	0	0	0	0
33 C	290	QW / 5	/ 0	/ 0	2.7	3	2	0	0	0	0	0	0
34 C	290	QW / 5	/ 0	/ 0	3.7	1	2	1	1	0	0	0	0
35 C	290	QW / 2	/ 0	/ 0	4.0	0	0	0	1	1	0	0	0
36 C	290	QW / 1	/ 0	/ 0	3.0	0	0	1	0	0	0	0	0
37 C	290	QK / 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
38 C	300	QKA / 1	/ 0	/ 0	3.8	0	0	1	0	0	0	0	0
39 C	300	QKA / 3	/ 0	/ 0	3.4	2	1	0	0	0	0	0	0
40 C	300	QKA / 5	/ 0	/ 0	4.2	0	3	1	1	0	0	0	0
41 C	300	QKA / 1QD	/ 2	/ 0	3.4	1	1	1	0	0	0	0	0
42 C	300	QD / 3QK	/ 2	/ 0	4.4	1	2	1	1	0	0	0	0
43 C	300	QK / 3QAL	/ 1	/ 0	4.0	1	2	1	0	0	0	0	0
44 C	300	QL / 1	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0
45 C	300	QK / 2	/ 0	/ 0	3.4	0	2	0	0	0	0	0	0
46 C	300	QK / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0
47 C	300	QK / 3	/ 0	/ 0	3.7	0	3	0	0	0	0	0	0
48 C	300	QK / 4QAL	/ 1	/ 0	3.3	3	2	0	0	0	0	0	0
49 C	310	QKA / 1	/ 0	/ 0	4.0	0	0	1	0	0	0	0	0
50 C	310	QKA / 3	/ 0	/ 0	4.4	0	1	1	1	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	310	GKA / 3	/ 0	/ 0	3.5	1	2	0	0	0	0	0	0
52 C	310	GKA / 3	/ 0	/ 0	3.4	2	1	0	0	0	0	0	0
53 C	310	GKA / 4	/ 0	/ 0	3.4	1	3	0	0	0	0	0	0
54 C	310	GKA / 2GAL	/ 2	/ 0	4.2	0	2	0	2	0	0	0	0
55 C	310	GK / 7	/ 0	/ 0	4.0	2	3	2	0	0	0	0	0
56 C	310	GK / 1	/ 0	/ 0	3.9	0	0	1	0	0	0	0	0
57 C	310	GK / 2	/ 0	/ 0	4.1	1	0	1	0	0	0	0	0
58 C	310	GK / 2	/ 0	/ 0	3.6	0	2	0	0	0	0	0	0
59 C	310	GK / 4GAL	/ 3	/ 0	3.7	2	5	0	0	0	0	0	0
60 C	310	GK / 3GAL	/ 1	/ 0	3.8	0	3	1	0	0	0	0	0
61 C	310	GK / 3	/ 0	/ 0	3.6	0	3	0	0	0	0	0	0
62 C	310	GAL / 2GK	/ 1	/ 0	3.7	0	3	0	0	0	0	0	0
63 C	310	GAL / 2GK	/ 3	/ 0	3.5	4	1	0	0	0	0	0	0
64 C	310	GK / 3	/ 0	/ 0	3.5	2	1	0	0	0	0	0	0
65 C	320	GKA / 3	/ 0	/ 0	3.4	1	2	0	0	0	0	0	0
66 C	320	GKA / 2	/ 0	/ 0	3.2	0	2	0	0	0	0	0	0
67 C	320	GKA / 3	/ 0	/ 0	3.7	2	0	1	0	0	0	0	0
68 C	320	GKA / 3	/ 0	/ 0	3.9	1	1	1	0	0	0	0	0
69 C	320	GAL / 1	/ 0	/ 0	3.8	0	0	1	0	0	0	0	0
70 C	320	GK / 5	/ 0	/ 0	3.8	1	3	1	0	0	0	0	0
71 C	320	GK / 1	/ 0	/ 0	3.8	0	0	1	0	0	0	0	0
72 C	320	GK / 4	/ 0	/ 0	3.4	3	1	0	0	0	0	0	0
73 C	320	GK / 3	/ 0	/ 0	3.6	2	1	0	0	0	0	0	0
74 C	320	GK / 5	/ 0	/ 0	3.7	2	3	0	0	0	0	0	0
75 C	320	GK / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0
76 C	330	GKA / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0
77 C	330	GAL / 1GK	/ 1	/ 0	3.6	0	2	0	0	0	0	0	0
78 C	330	GK / 3	/ 0	/ 0	4.2	0	2	0	1	0	0	0	0
79 C	330	GK / 2	/ 0	/ 0	3.7	0	2	0	0	0	0	0	0
80 C	330	GK / 4	/ 0	/ 0	3.6	1	3	0	0	0	0	0	0
81 C	330	GK / 2	/ 0	/ 0	3.9	0	1	1	0	0	0	0	0
82 C	330	GK / 2	/ 0	/ 0	3.8	0	1	1	0	0	0	0	0
83 C	330	GK / 3	/ 0	/ 0	3.7	2	1	0	0	0	0	0	0
84 C	330	GK / 4	/ 0	/ 0	3.8	1	1	2	0	0	0	0	0
85 C	330	GK / 5	/ 0	/ 0	3.4	3	2	0	0	0	0	0	0
86 C	340	GK / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0
87 C	340	GK / 5	/ 0	/ 0	3.6	3	2	0	0	0	0	0	0
88 C	340	GK / 2	/ 0	/ 0	3.3	0	2	0	0	0	0	0	0
89 C	360	GK / 1	/ 0	/ 0	4.2	0	0	0	1	0	0	0	0
90 C	1070	GW / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
91 C	1080	GKA / 3	/ 0	/ 0	3.2	2	1	0	0	0	0	0	0
92 C	1080	GW / 1	/ 0	/ 0	3.1	0	0	1	0	0	0	0	0
93 C	1090	GK / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0
94 C	1090	GAL / 2	/ 0	/ 0	3.4	0	2	0	0	0	0	0	0
95 C	1090	GK / 3	/ 0	/ 0	3.4	1	2	0	0	0	0	0	0
96 C	1090	GK / 3	/ 0	/ 0	3.5	2	1	0	0	0	0	0	0
97 C	1100	GK / 3	/ 0	/ 0	3.6	0	3	0	0	0	0	0	0
98 C	1100	GK / 1GAL	/ 2	/ 0	3.3	2	1	0	0	0	0	0	0
99 C	1110	GK / 1GAL	/ 1	/ 0	4.0	0	1	1	0	0	0	0	0
100 C	1110	GAL / 3	/ 0	/ 0	3.3	2	1	0	0	0	0	0	0

ANOMALY SUMMARY TABLE

ANOMALY	FLIGHT	COMPUTER MAP UNIT AND NO. ANOMALOUS SAMPLES IN UNIT			PEAK PPM	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF :							
						1	2	3	4	5	6	7	GT7
101 C	1110 GK	/ 2	/ 0	/ 0	4.3	0	1	0	1	0	0	0	0
102 C	1110 GK	/ 1	/ 0	/ 0	4.1	0	0	1	0	0	0	0	0
103 C	1110 GK	/ 9QAL	/ 2	/ 0	4.2	0	7	3	1	0	0	0	0
104 C	1110 GK	/10QAL	/ 1	/ 0	4.5	3	5	2	1	0	0	0	0
105 C	1110 GK	/ 4	/ 0	/ 0	4.1	2	1	1	0	0	0	0	0
106 C	1110 GK	/ 3	/ 0	/ 0	4.1	1	1	1	0	0	0	0	0
107 C	1120 GK	/ 3	/ 0	/ 0	3.3	1	2	0	0	0	0	0	0
108 C	1120 GK	/ 6	/ 0	/ 0	3.7	3	2	1	0	0	0	0	0
109 C	1120 GK	/ 1QAL	/ 2	/ 0	3.7	2	1	0	0	0	0	0	0

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

C INDICATES THAT THE ANOMALY LIES OVER A CULTURAL FEATURE.

W INDICATES POSSIBLE INTERFERENCE BY WEATHER PHENOMENA.

MAP UNIT GAL

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.6319	0.7794	0.9269	1.0744	1.2219	1.3694	1.5169
URANIUM	DIST	NORMAL	0.8111	1.3578	1.9045	2.4512	2.9979	3.5446	4.0913
THORIUM	DIST	NORMAL	3.4771	4.4998	5.5225	6.5452	7.5679	8.5906	9.6133
U/K	DIST	NORMAL	0.6613	1.2108	1.7603	2.3098	2.8593	3.4088	3.9583
U/TH	DIST	NORMAL	0.1177	0.2051	0.2925	0.3799	0.4673	0.5547	0.6421
TH/K	DIST	NORMAL	3.7706	4.5555	5.3404	6.1253	6.9102	7.6951	8.4800

MAP UNIT QL

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.8888	0.9844	1.0800	1.1756	1.2712	1.3668	1.4624
URANIUM	DIST	NORMAL	1.2271	1.6796	2.1321	2.5846	3.0371	3.4896	3.9421
THORIUM	DIST	NORMAL	5.3254	5.9702	6.6150	7.2598	7.9046	8.5494	9.1942
U/K	DIST	NORMAL	0.9242	1.3536	1.7830	2.2124	2.6418	3.0712	3.5006
U/TH	DIST	NORMAL	0.1521	0.2209	0.2897	0.3585	0.4273	0.4961	0.5649
TH/K	DIST	NORMAL	4.4064	5.0037	5.6010	6.1983	6.7956	7.3929	7.9902

MAP UNIT QE

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.8422	0.9579	1.0736	1.1893	1.3050	1.4207	1.5364
URANIUM	DIST	NORMAL	1.7226	2.0722	2.4218	2.7714	3.1210	3.4706	3.8202
THORIUM	DIST	NORMAL	4.5958	5.4846	6.3734	7.2622	8.1510	9.0398	9.9286
U/K	DIST	NORMAL	1.3505	1.6829	2.0153	2.3477	2.6801	3.0125	3.3449
U/TH	DIST	NORMAL	0.2368	0.2861	0.3354	0.3847	0.4340	0.4833	0.5326
TH/K	DIST	NORMAL	4.6028	5.1046	5.6064	6.1082	6.6100	7.1118	7.6136

MAP UNIT QO

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.5518	0.7133	0.8748	1.0363	1.1978	1.3593	1.5208
URANIUM	DIST	NORMAL	0.5725	1.0684	1.5643	2.0602	2.5561	3.0520	3.5479
THORIUM	DIST	NORMAL	2.0278	3.1584	4.2890	5.4196	6.5502	7.6808	8.8114
U/K	DIST	NORMAL	0.0153	0.6936	1.3719	2.0502	2.7285	3.4068	4.0851
U/TH	DIST	NORMAL	0.0292	0.1511	0.2730	0.3949	0.5168	0.6387	0.7606
TH/K	DIST	NORMAL	2.6175	3.5062	4.3949	5.2836	6.1723	7.0610	7.9497

MAP UNIT GW

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.7482	0.8501	0.9520	1.0539	1.1558	1.2577	1.3596
URANIUM	DIST	NORMAL	0.7483	1.1600	1.5717	1.9834	2.3951	2.8068	3.2185
THORIUM	DIST	NORMAL	3.3710	4.0632	4.7554	5.4476	6.1398	6.8320	7.5242
U/K	DIST	NORMAL	0.4736	0.9514	1.4292	1.9070	2.3848	2.8626	3.3404
U/TH	DIST	NORMAL	0.0883	0.1824	0.2765	0.3706	0.4647	0.5588	0.6529
TH/K	DIST	NORMAL	3.3326	3.9520	4.5714	5.1908	5.8102	6.4296	7.0490

MAP UNIT QD

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.8393	0.9303	1.0213	1.1123	1.2033	1.2943	1.3853
URANIUM	DIST	NORMAL	1.2289	1.5708	1.9127	2.2546	2.5965	2.9384	3.2803
THORIUM	DIST	NORMAL	4.1957	4.7449	5.2941	5.8433	6.3925	6.9417	7.4909
U/K	DIST	NORMAL	0.9620	1.3223	1.6826	2.0429	2.4032	2.7635	3.1238
U/TH	DIST	NORMAL	0.1619	0.2383	0.3147	0.3911	0.4675	0.5439	0.6203
TH/K	DIST	NORMAL	3.7927	4.2858	4.7789	5.2720	5.7651	6.2582	6.7513

MAP UNIT QK

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.7636	0.8824	1.0012	1.1200	1.2388	1.3576	1.4764
URANIUM	DIST	NORMAL	1.0646	1.5494	2.0342	2.5190	3.0038	3.4886	3.9734
THORIUM	DIST	NORMAL	5.0218	5.7553	6.4888	7.2223	7.9558	8.6893	9.4228
U/K	DIST	NORMAL	0.8441	1.3182	1.7923	2.2664	2.7405	3.2146	3.6887
U/TH	DIST	NORMAL	0.1344	0.2066	0.2788	0.3510	0.4232	0.4954	0.5676
TH/K	DIST	NORMAL	4.3745	5.0776	5.7807	6.4838	7.1869	7.8900	8.5931

MAP UNIT QKA

			-3	-2	-1	0	+1	+2	+3
POTASIUM	DIST	NORMAL	0.6645	0.8021	0.9397	1.0773	1.2149	1.3525	1.4901
URANIUM	DIST	NORMAL	0.9541	1.4353	1.9165	2.3977	2.8789	3.3601	3.8413
THORIUM	DIST	NORMAL	4.8466	5.6116	6.3766	7.1416	7.9066	8.6716	9.4366
U/K	DIST	NORMAL	0.7512	1.2513	1.7514	2.2515	2.7516	3.2517	3.7518
U/TH	DIST	NORMAL	0.1304	0.1995	0.2686	0.3377	0.4068	0.4759	0.5450
TH/K	DIST	NORMAL	4.2763	5.0815	5.8867	6.6919	7.4971	8.3023	9.1075

LINE BASED MEAN CONCENTRATIONS
AND RATIOS PER ROCK TYPE

MAP UNIT GAL

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.047	1.047	1.035	1.065	1.096	1.095	1.129	1.054	1.098	1.028	1.038	0.906	1.025	1.155	1.100
URANIUM	2.424	2.439	2.183	1.991	2.293	2.353	2.851	2.584	2.359	2.488	2.280	2.001	2.194	2.466	2.435
THORIUM	6.074	6.297	6.219	6.130	6.756	6.968	7.087	6.452	6.827	6.518	6.026	5.366	5.311	6.940	6.862
U/K	2.342	2.357	2.133	1.992	2.103	2.165	2.533	2.565	2.160	2.454	2.210	2.020	2.155	2.140	2.237
U/TH	0.403	0.391	0.359	0.355	0.341	0.340	0.406	0.408	0.348	0.387	0.384	0.346	0.417	0.359	0.358
TH/K	5.833	6.072	6.039	5.736	6.185	6.392	6.287	6.302	6.249	6.346	5.795	5.994	5.189	6.007	6.265

	1100	1110	1120
POTASIUM	1.126	1.030	1.050
URANIUM	2.626	2.820	2.498
THORIUM	6.638	6.273	6.612
U/K	2.365	2.767	2.403
U/TH	0.400	0.454	0.382
TH/K	5.954	6.130	6.334

MAP UNIT QL

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.194	1.173	1.171	1.159	1.239	1.262	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.186
URANIUM	2.717	2.770	2.634	2.488	2.447	2.943	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.474
THORIUM	7.343	7.234	7.187	7.169	7.256	8.253	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	7.508
U/K	2.290	2.382	2.267	2.152	1.983	2.343	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	2.102
U/TH	0.373	0.386	0.369	0.349	0.339	0.357	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.331
TH/K	6.171	6.190	6.172	6.194	5.873	6.565	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	6.358

	1100	1110	1120
POTASIUM	1.144	1.118	1.109
URANIUM	2.227	2.072	2.293
THORIUM	7.033	7.246	6.944
U/K	1.960	1.864	2.082
U/TH	0.318	0.289	0.335
TH/K	6.173	6.486	6.288

MAP UNIT GE

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.189	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	2.771	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	7.262	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	2.348	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	0.385	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	6.108	0.000	0.000	0.000	0.000	0.000

	1100	1110	1120
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 QD

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.048	0.820	1.050	1.011	0.000	1.046	0.000	0.000	0.000	0.000	0.000	0.000	1.064	1.047	0.000
URANIUM	2.364	2.742	2.156	1.810	0.000	2.401	0.000	0.000	0.000	0.000	0.000	0.000	1.970	1.887	0.000
THORIUM	6.034	3.887	5.350	4.927	0.000	6.186	0.000	0.000	0.000	0.000	0.000	0.000	5.399	5.420	0.000
U/K	2.262	3.390	2.087	1.799	0.000	2.537	0.000	0.000	0.000	0.000	0.000	0.000	1.874	1.840	0.000
U/TH	0.394	0.707	0.416	0.374	0.000	0.432	0.000	0.000	0.000	0.000	0.000	0.000	0.371	0.353	0.000
TH/K	5.762	4.802	5.158	4.944	0.000	6.033	0.000	0.000	0.000	0.000	0.000	0.000	5.095	5.228	0.000

	1100	1110	1120
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 GW

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.051	1.033	1.058	1.048	1.095	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.056	1.055	0.000
URANIUM	2.046	1.920	2.121	1.818	2.289	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.783	1.838	0.000
THORIUM	5.578	5.364	5.312	5.344	5.817	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.346	5.418	0.000
U/K	1.966	1.876	2.045	1.765	2.126	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.719	1.759	0.000
U/TH	0.372	0.362	0.411	0.348	0.401	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.340	0.343	0.000
TH/K	5.330	5.212	5.046	5.122	5.321	0.000	0.000	0.000	0.000	0.000	0.000	0.000	5.096	5.164	0.000

	1100	1110	1120
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 QD

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.102	1.095	0.000	0.000	0.000	1.167	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
URANIUM	2.426	2.188	0.000	0.000	0.000	1.887	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
THORIUM	5.669	5.637	0.000	0.000	0.000	6.622	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/K	2.214	2.004	0.000	0.000	0.000	1.636	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
U/TH	0.429	0.390	0.000	0.000	0.000	0.289	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
TH/K	5.188	5.148	0.000	0.000	0.000	5.683	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

	1100	1110	1120
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 QK

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	1.144	1.124	1.170	1.128	1.149	1.140	1.142	1.136	1.133	1.139	1.087	1.022	0.000	1.136	1.126
URANIUM	2.650	3.096	2.664	2.348	2.454	2.519	2.483	2.595	2.670	2.669	2.477	2.349	0.000	2.482	2.469
THORIUM	7.141	6.812	7.353	7.099	7.191	7.321	7.175	7.211	7.516	7.412	7.391	7.025	0.000	7.609	7.354
U/K	2.324	2.774	2.287	2.098	2.153	2.222	2.193	2.297	2.384	2.366	2.299	2.318	0.000	2.202	2.206
U/TH	0.372	0.459	0.364	0.333	0.344	0.345	0.348	0.361	0.359	0.363	0.338	0.338	0.000	0.329	0.337
TH/K	6.259	6.064	6.303	6.326	6.291	6.457	6.321	6.383	6.675	6.539	6.849	6.906	0.000	6.741	6.581

	1100	1110	1120
POTASIUM	1.112	1.109	1.098
URANIUM	2.506	2.511	2.393
THORIUM	7.119	6.980	7.061
U/K	2.282	2.288	2.201
U/TH	0.356	0.362	0.342
TH/K	6.453	6.331	6.462

MAP UNIT QKA

	250	260	270	280	290	300	310	320	330	340	350	360	1070	1080	1090
POTASIUM	0.000	0.000	0.000	0.000	0.000	1.278	1.129	1.103	1.126	1.062	1.036	1.001	1.092	1.042	0.000
URANIUM	0.000	0.000	0.000	0.000	0.000	2.797	2.690	2.688	2.638	2.433	2.280	2.204	2.250	2.306	0.000
THORIUM	0.000	0.000	0.000	0.000	0.000	8.050	7.293	7.282	7.241	7.070	7.186	7.099	6.887	7.137	0.000
U/K	0.000	0.000	0.000	0.000	0.000	2.219	2.441	2.466	2.381	2.329	2.217	2.222	2.081	2.232	0.000
U/TH	0.000	0.000	0.000	0.000	0.000	0.349	0.372	0.372	0.368	0.347	0.319	0.313	0.328	0.324	0.000
TH/K	0.000	0.000	0.000	0.000	0.000	6.353	6.531	6.660	6.479	6.718	6.977	7.136	6.361	6.906	0.000

	1100	1110	1120
POTASIUM	0.000	0.000	0.000
URANIUM	0.000	0.000	0.000
THORIUM	0.000	0.000	0.000
U/K	0.000	0.000	0.000
U/TH	0.000	0.000	0.000
TH/K	0.000	0.000	0.000

APPENDIX H - Pseudo Contour Maps

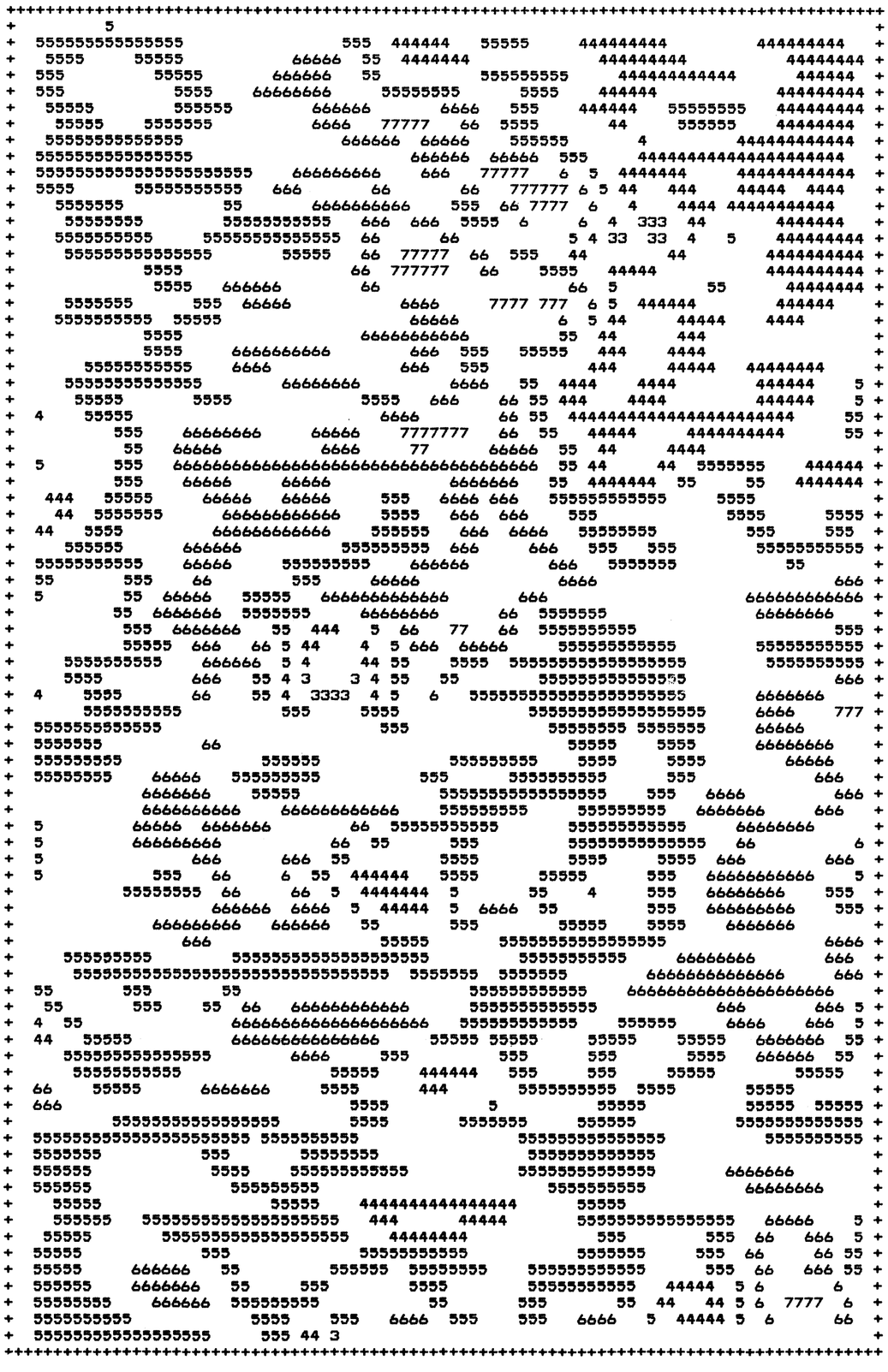
DES MOINES

Potassium Pseudo-Contour Map - Des Moines 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



DES MOINES

Uranium Pseudo-Contour Map - Des Moines Quadrangle

EXPLANATION

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

SCALE IN EQUIVALENT PPM

H_{dm}^{2}

DES MOINES

Thorium Pseudo-Contour Map - Des Moines Quadrangle

EXPLANATION

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

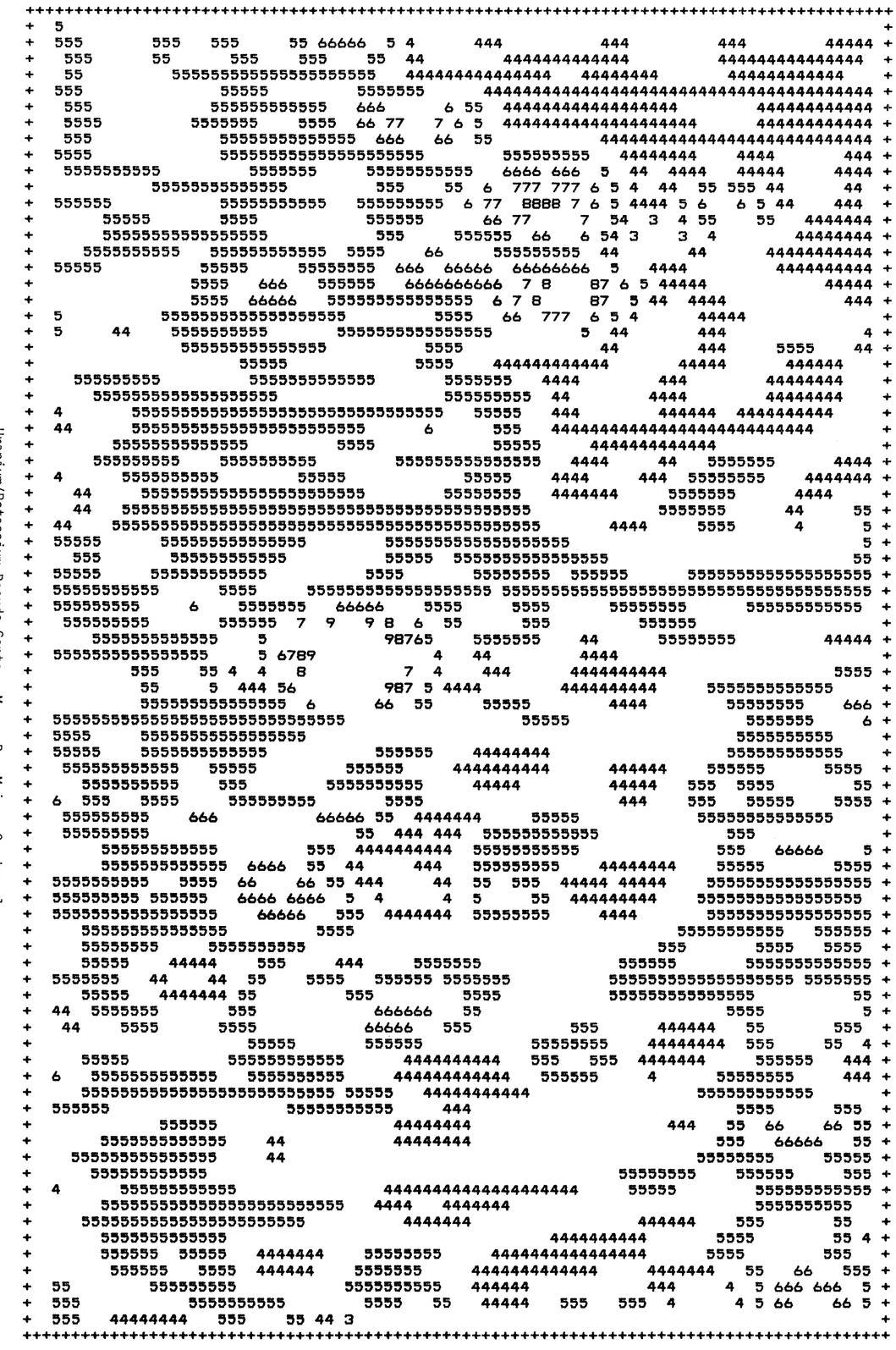
SCALE IN EQUIVALENT PPM

DES MOINES

EXPLANATION

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

Thorium/Potassium Pseudo-Contour Map - Des Moines Quadrangle



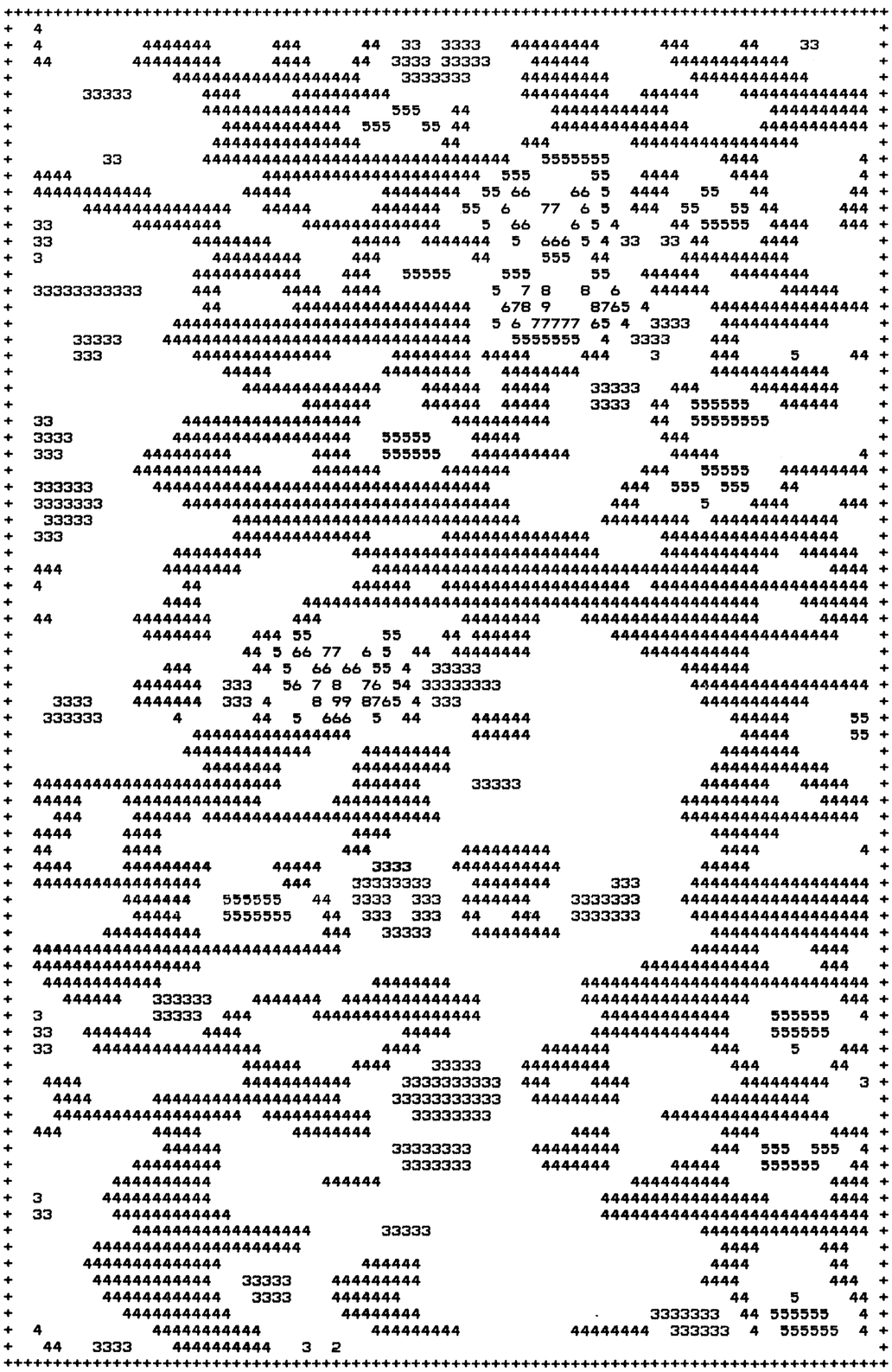
DES MOINES

Uranium/Potassium Pseudo-Contour Map - Des Moines Quadrangle

EXPLANATION

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

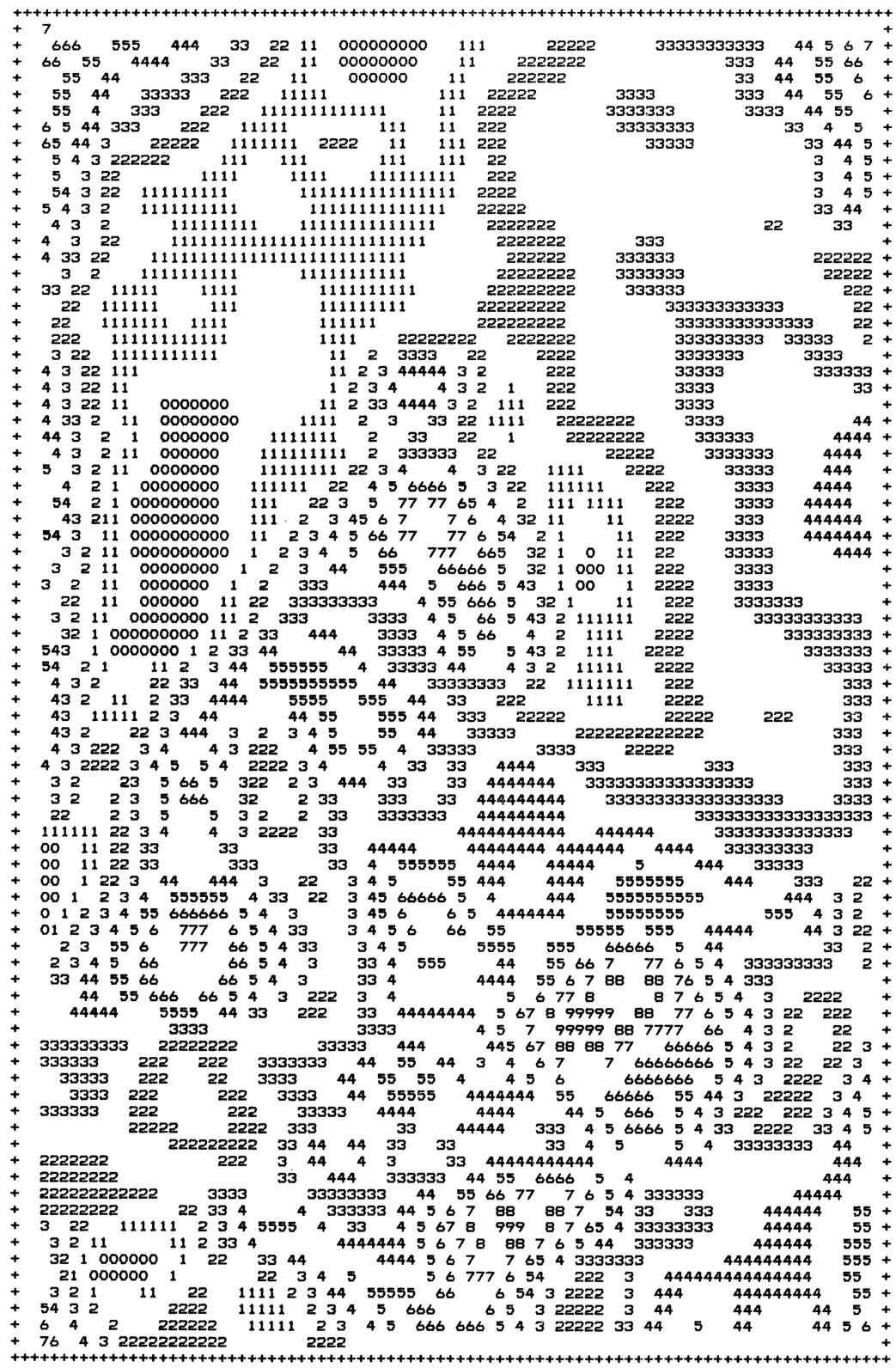
DES MOINES



Uranium/Thorium Pseudo-Contour Map - Des Moines Quadrangle

EXPLANATION

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



DES MOINES

Residual Magnetic Pseudo-Contour Map - Des Moines Quadrangle

SCALE IN GAMMAS

PRINT CHARACTER	VALUE
0	LE-1200. 0000
	-1200. 0000-1125. 0000
1	-1125. 0000-1050. 0000
	-1050. 0000 -975. 0000
2	-975. 0000 -900. 0000
	-900. 0000 -825. 0000
3	-825. 0000 -750. 0000
	-750. 0000 -675. 0000
4	-675. 0000 -600. 0000
	-600. 0000 -525. 0000
5	-525. 0000 -450. 0000
	-450. 0000 -375. 0000
6	-375. 0000 -300. 0000
	-300. 0000 -225. 0000
7	-225. 0000 -150. 0000
	-150. 0000 -75. 0000
8	-75. 0000 0. 0000
	0. 0000 75. 0000
9	75. 0000 150. 0000
	GT 150. 0000

EXPLANATION

N

H7
dm