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AERIAL GAMMA RAY AND MAGNETIC SURVEY
RATON BASIN PROJECT
GALLUP QUADRANGLE , ARIZONA/NEW MEXICO

FINAL REPORT
VOLUME II

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GEOLOGICAL SURVEY OF WYOMING



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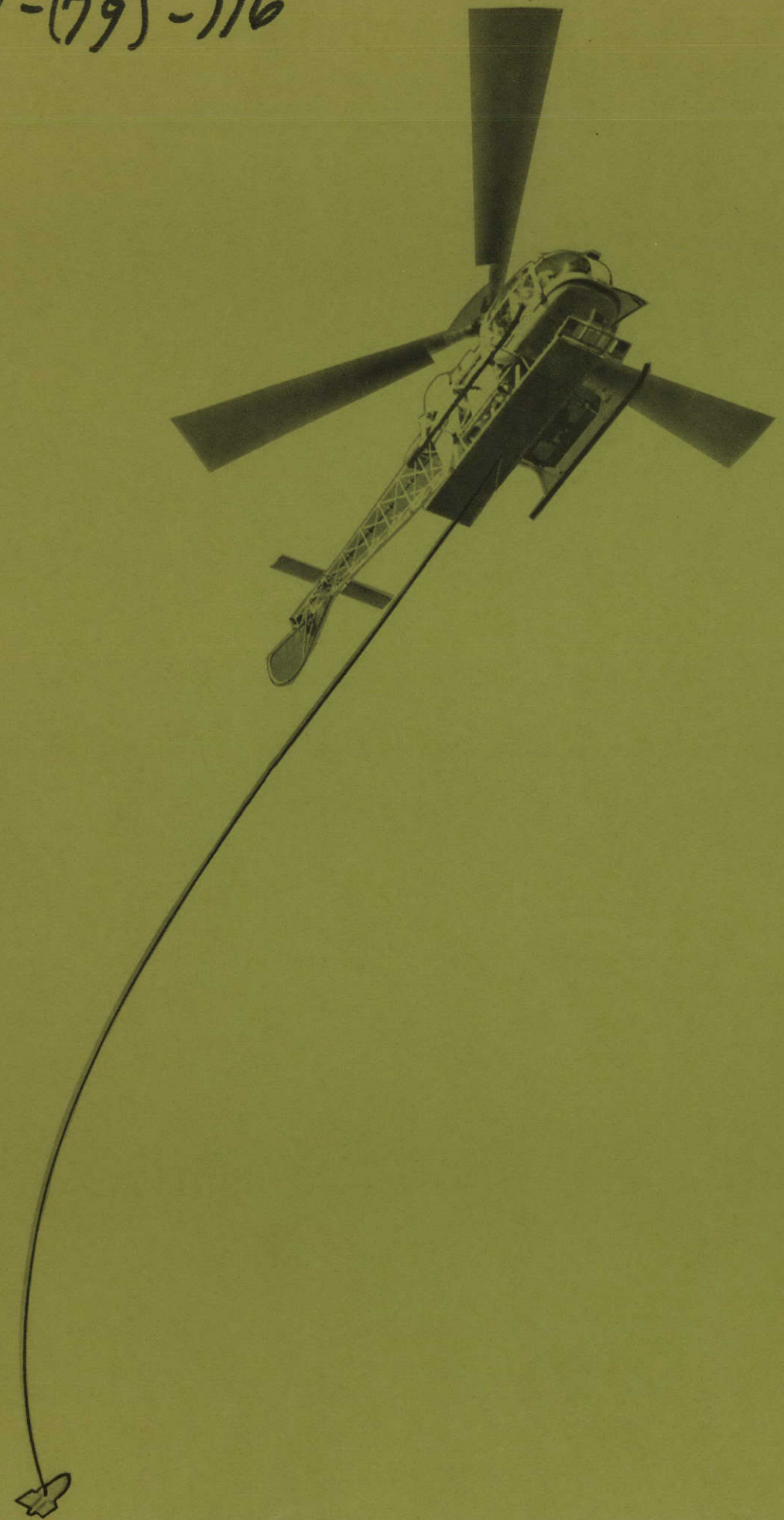
geoMetrics
Sunnyvale, California

JUNE 1979

Work Performed Under
Bendix Field Engineering Corporation
Grand Junction Operations, Grand Junction, Colorado
Subcontract 78-182-L
and
Bendix Contract EY-76-C-13-1664

Prepared for the
Department of Energy
Grand Junction Office
Grand Junction, Colorado 81501

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ABSTRACT

The Gallup 1° x 2° quadrangle includes portions of 5 major geologic structures which from east to west are: (1) the San Juan Basin; (2) the Zuni Uplift; (3) the Gallup Sag; (4) the Defiance Uplift; and (5) the Black Mesa Basin. Portions of the Mount Taylor and Hopi Buttes Volcanic Fields are present in the southeastern corner and the eastern edge respectively. Most exposed rocks in the quadrangle are Mesozoic and Tertiary sediments, and Quaternary surficial units, with minor amounts of Paleozoic and Precambrian rocks within the uplifts.

Uranium ore is currently being produced from the large Jurassic and Cretaceous sandstone deposits in the Smith Lake and Gallup Mining Districts. Scattered uranium occurrences exist in various Precambrian, Paleozoic and Mesozoic rocks throughout the quadrangle.

A total of 129 groups of statistically anomalous uranium samples were defined as anomalies and discussed in the report. Several anomalies are associated with the major uranium districts. Others are associated with geologic units known to contain uranium occurrences in the quadrangle and elsewhere. The largest number of anomalous samples occur in scattered exposures of surficial deposits, and in the Triassic Chinle Formation near the quadrangle's western edge.

Magnetic data generally outline the major geologic structures, except where overlying Tertiary volcanics obscure the deeper magnetic sources. Some magnetic responses outline areas which do not reflect structure as mapped by Hackman and Olson (1977) on the Dakota Sandstone Base, and may result from deeper magnetic sources.

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INTRODUCTION

General

The U.S. Geological Survey Map I-981 (Hackman and Olson, 1977) served as a base map for the Gallup quadrangle. Map unit descriptions were taken from the accompanying map legend. (See Appendix A). Supplemental geologic information was taken from Mallory (1972), and the Tectonic Map of the United States (1962). The 1:250,000 scale Gallup topographic maps, along with more recently revised 1:24,000 scale topographic maps and flight recovery film, were used to delineate topographic and cultural features of importance to the interpretation process.

Several geologic units on the original map were combined because of discontinuous contact lines. (See the map unit conversion table Appendix D). Unit symbols on the original geologic map in parenthesis, representing outcrops of geologic units with no surficial exposure in the map perspective, were ignored. Data for the eastern portions of lines 31 (fiducials 23525 to 23871) and 32 (fiducials 22454 to 22732) are not included in this report due to electronic malfunctions.

Physiography

The Gallup quadrangle lies within the Colorado Plateau Province; here represented by semi-arid butte-mesa country of the San Juan and Black Mesa Basins, and lightly forested uplands in the Chuska Mountains, Defiance Plateau and Zuni Mountains. Elevations in the province range from below 5,500 feet in the Painted Desert in the southwest corner, to 9,256 feet on Mount Sedgwick in the Zuni Mountains. The San Juan Basin lies at a relatively even 6,100 feet. Elevations in the Chuska Mountains exceed 9,000 feet, and a substantial portion of the Defiance Plateau lies above 8,000 feet. The Balakai Mesa in the Black Mesa Basin lies at approximately 7,400 feet. The Continental Divide loops around the central portion of the Zuni Mountains on the eastern side of the quadrangle (Figure 1).

GEOLOGY

Structure

Within this portion of the Colorado Plateau there are 5 major tectonic structures. The northwestern end of the Zuni Uplift occupies 25% of the quadrangle in the southeast corner. A large section of Precambrian crystalline rocks is exposed in the uplift's center. The San Juan Basin in the northeast corner covers 15% of the quadrangle, and contains Phanerozoic sediments of 9,000 feet thickness. West of the San Juan Basin is the Defiance Uplift, occupying 25% of the quadrangle, which exposes small amounts of Precambrian rocks beneath a thin veneer of Permo-Pennsylvanian Supai Formation. Between the Zuni Uplift and the Defiance Uplift is the Gallup Sag, a 6,000 foot

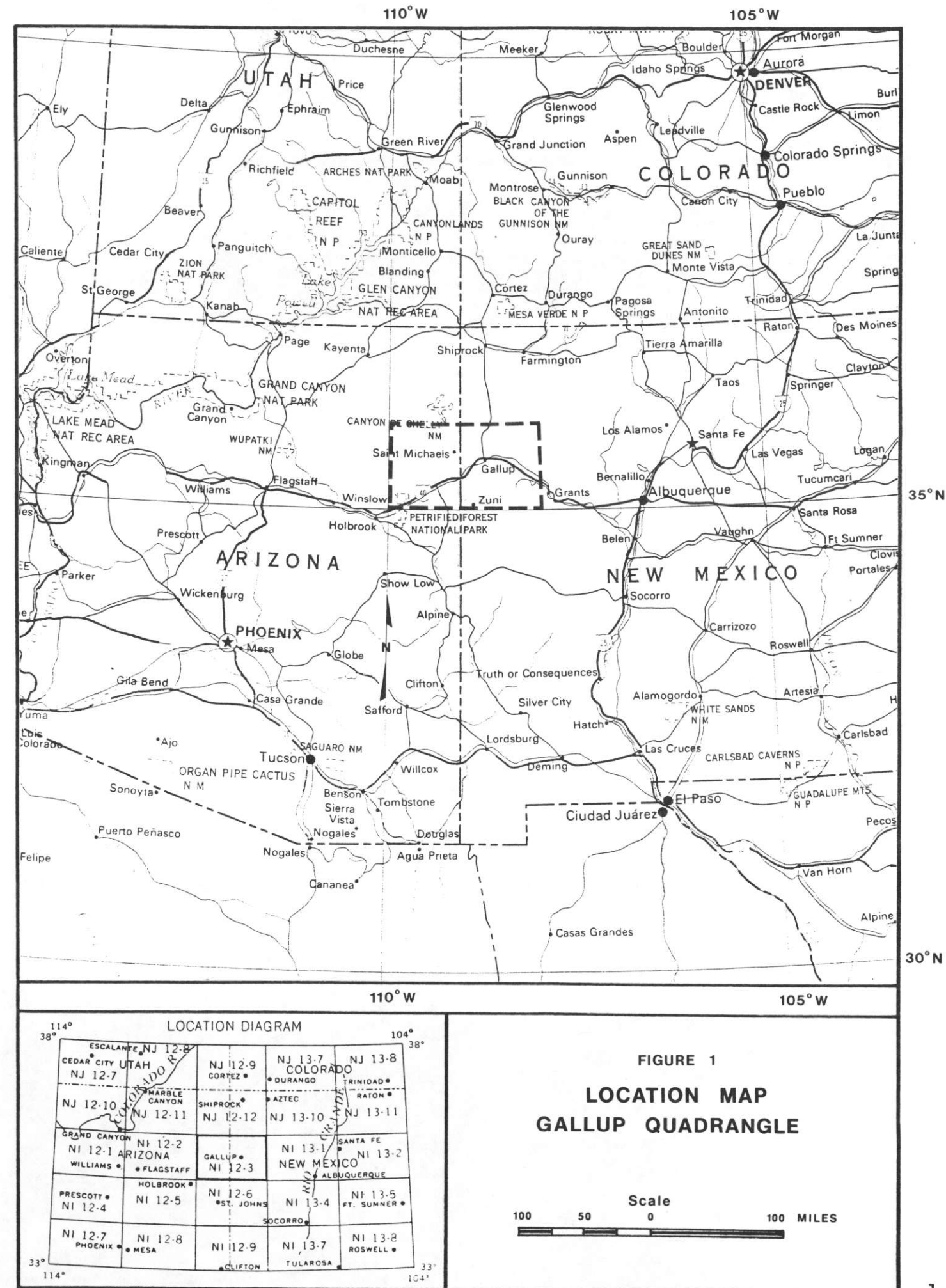


FIGURE 1
LOCATION MAP
GALLUP QUADRANGLE

Scale
100 50 0 100 MILES

thick basin covering 15% of the quadrangle in the southern central section and connecting with the San Juan Basin to the north. At the western edge of the quadrangle is the Black Mesa Basin, which covers 20% of the quadrangle, and contains over 8,000 feet of Phanerozoic sediments (Figure 2).

Faulting in the Gallup quadrangle is limited to a few zones of complex dip-slip faults in the San Juan Basin, and the Zuni and Defiance Uplifts. In the Defiance Uplift the faults strike in a northeasterly direction. A zone of reverse faulting is supposed to exist on the western edge of the Zuni Uplift (Mallory, 1972, pp. 40-41). This zone is apparently represented at the surface by faults which strike northwesterly along the southwestern edge of the Precambrian exposures.

Surficial Geology

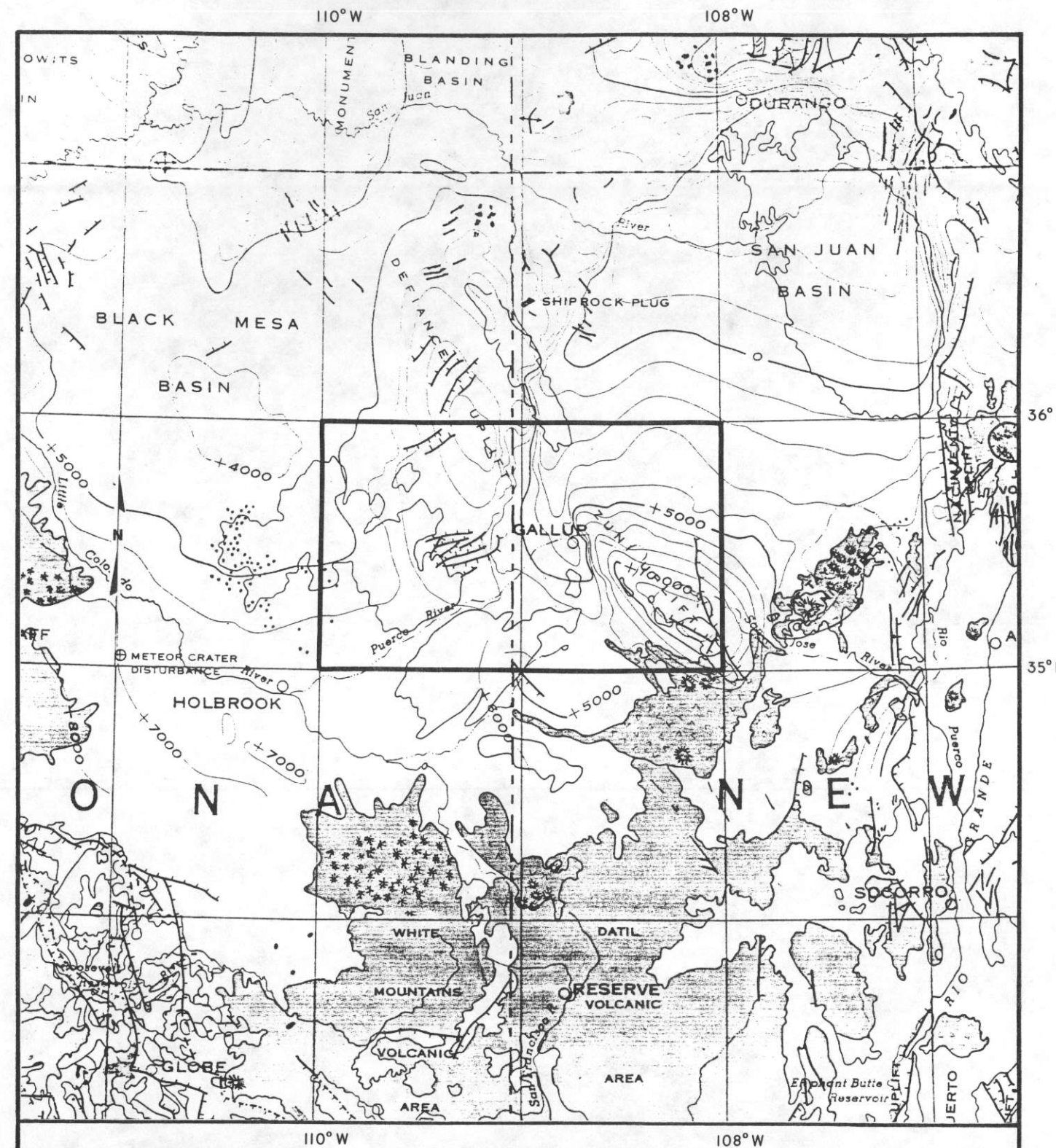
Precambrian crystalline basement is exposed within the Zuni and Defiance Uplifts, constituting approximately 1% of the quadrangle. Paleozoic sedimentary units dominate the central portions of the uplifted areas, and account for nearly 15% of the quadrangle. Mesozoic strata overlie the Paleozoic in the basins and account for 60% of the exposed surface of the quadrangle. The remainder is covered by Cenozoic nonmarine sediments and volcanogenic deposits.

Paleozoic sediments of dominantly nonmarine origins are also exposed on the uplifts. The section of Paleozoic in the quadrangle is represented by rocks of Pennsylvanian age or younger, which lie unconformably atop the Precambrian.

Mesozoic rocks representing dominantly nonmarine environments (and some transitional to marine depositional environments) overlie the Paleozoic in most areas outside the uplifts. The Mesozoic section includes the two principal uranium-bearing formations: the Triassic Chinle Formation, and the Jurassic Morrison Formation. Some minor uranium deposits are found in the Jurassic Todilto Limestone, and in the Cretaceous Dakota Sandstone, and the Menefee and Fruitland Formations.

The Chinle Formation as mapped in the Gallup quadrangle consists of the Owl Rock, Petrified Forest, Songela Sandstone, Monitor Butte, and Shinarump Members. (Because of discontinuous contact lines, only the Shinarump Member was processed separately). The Morrison Formation as mapped in the Gallup quadrangle includes the Brushy Basin, Westwater Canyon and Recapture Member (undivided west of the Defiance Uplift).

Cenozoic rocks in the Gallup quadrangle consist primarily of several restricted formations of nonmarine sandstones and shales, with some volcanogenic units relating to: the Hopi Buttes on the west side of



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

FIGURE 2
TECTONIC STRUCTURE MAP
GALLUP QUADRANGLE

Scale 1:2,500,000
25 0 25 50 75 MILES

the quadrangle; the Mount Taylor volcanics, primarily to the east of the quadrangle; and some isolated igneous activity in the Defiance Plateau areas. Most of the volcanics are Quaternary basalts in the Mount Taylor area. The Hopi Buttes are primarily flows and associated pyroclastic lamprophyric rocks, with associated tuffs, other pyroclastics, and spring deposits. Volcanics in the Defiance area are similar to the Hopi Buttes deposits in mineralogy and mode of occurrence, but are less extensive spatially.

Uranium Mineralization

Most of the uranium deposits in this quadrangle are one of a variety of tabular epigenetic deposits which occur in sedimentary beds and which lack features commonly associated with deposits of hydrothermal origin. Such deposits are commonly believed to have formed by precipitation of uranium from circulating meteoric and/or connate water. It is recognized that the leaching, transportation and redeposition of uranium from these types of deposits can result in secondary concentrations of various forms.

A uranium deposit has been prospected in a Precambrian porphyritic aplite at the northwestern base of Mount Sedgwick. Uranium deposits have also been mined in the Zuni Mountains south of the Precambrian site in carbonaceous fluvial "red beds" of the Lower Permian Abo Formation.

Epigenetic deposits are found in Triassic Chinle Formation scattered around the western half of the quadrangle. Several prospects occur in the Defiance Uplift and nearby portions of the Black Mesa Basin. The uranium is found primarily in carbonaceous fluvial sandstones and conglomerates. Though one deposit in the Zuni Mountains appears to be in the Shinarump Member, the more uraniferous rock units are the Monitor Butte and Petrified Forest Members.

The principal uranium mineralization occurs as epigenetic deposits within high energy fluvial, carbonaceous sandstone of the Brushy Basin and Westwater Canyon Members of the Morrison Formation in the Smith Lake District; and in the Morrison, as well as the Cretaceous Dakota Sandstone and Crevasse Canyon Formation in the Gallup District (Figure 3). Within the Grants Mineral Belt, of which these two districts form a large portion, 113,862 tons of U_3O_8 have been produced from the Morrison Formation alone. Deposits in the Todilto Limestone and Dakota Sandstone have produced 2,964 tons of U_3O_8 . Mine water has produced another 1,145 tons. The latest exploration work known is in the Crownpoint area, where in 1975 Phillips Petroleum apparently found ore deposits estimated at 25 million pounds of recoverable U_3O_8 . This deposit, as with most areas currently being mined, is underground.

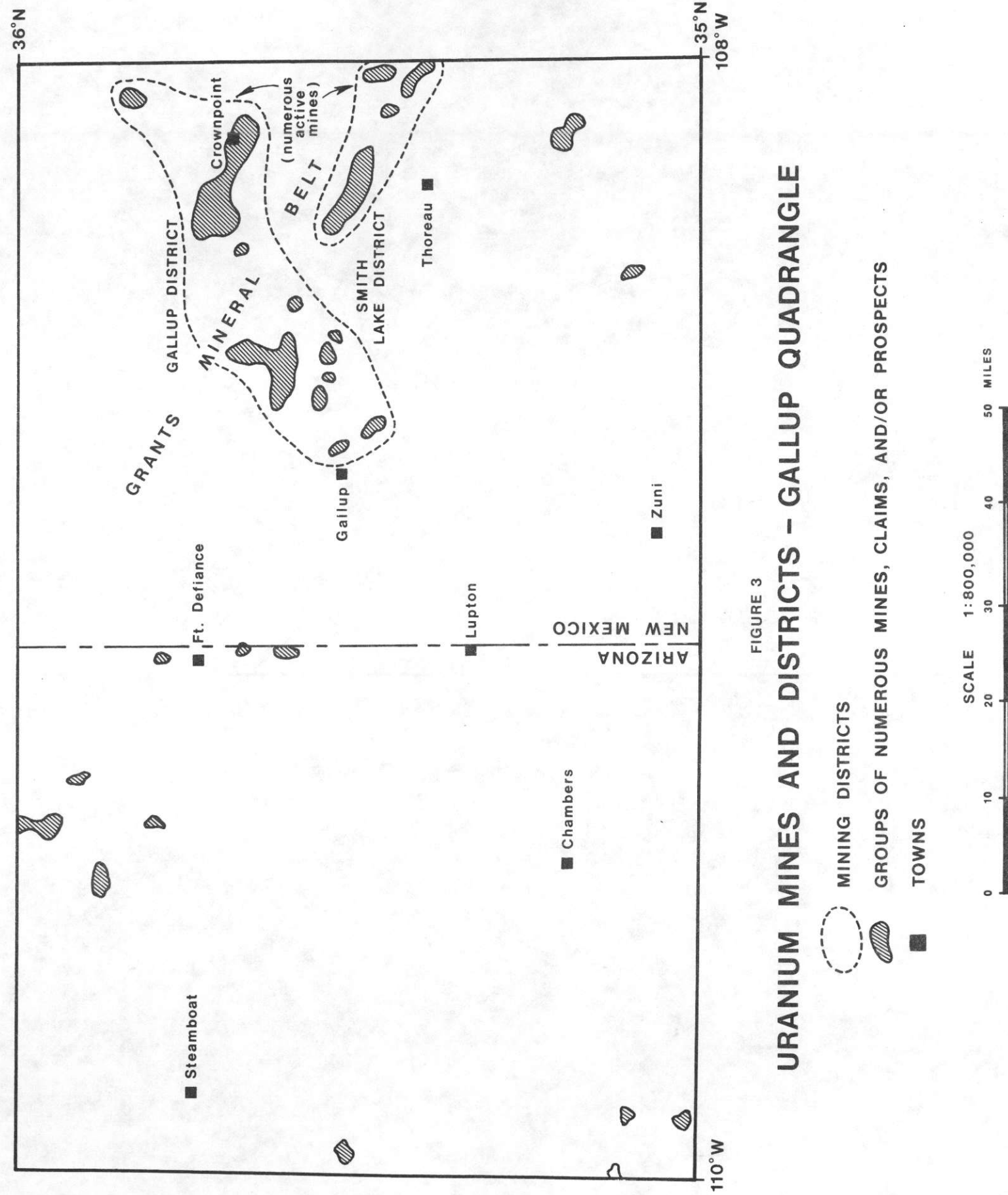


FIGURE 3
URANIUM MINES AND DISTRICTS - GALLUP QUADRANGLE

Excellent reviews of the history, production, and reserve estimates of the Grants Mineral Belt are in Chenoweth (1977), and Ridgely and others (1978), in the context of how they relate to uranium resources in the San Juan Basin.

INTERPRETATION OF GEOPHYSICAL DATA

Radiometric Data

There are 129 statistical uranium anomalies which meet the criteria set forth in Volume I. These anomalies are listed in Table 1 and are displayed on Figure 4. A summary listing of anomalous samples per computer map unit is contained in Table 2. Pseudocontour maps of potassium, uranium, thorium, and residual magnetics, used in the interpretation, are included as Figures 5-8. A correlation table between computer map units and the original geologic units can be found in Appendix D.

The average uranium window count rate for the entire quadrangle is 21.5 cps. No map units have average count rates over 30 cps. Map units KKF at 29.5 cps and KMD at 28.2 cps have the highest average uranium window count rates in the quadrangle. These units are widespread and are not host rocks for known uranium deposits (as defined by Hackman and Olson, 1977).

Areas on the uranium pseudocontour map (Figure 6) with count rate higher than 30 cps (>1 standard deviation from the quadrangle average) cover approximately 10% of the quadrangle as relatively small patches in the eastern half and along the northern and western edge. The two largest patches of >30 cps count rate (one at the northwest end of the Zuni Uplift, and the other at the southeast end of the Chuska Mountains) contain areas with average count rates exceeding 50 cps.

The first patch, just north of the town of Gallup, lies primarily within the Gallup mining districts and may be associated with nearby mining activity. Some areas in the district directly above known mines showed no anomalous count rates. The second large patch shows strong correlation with the Chuska Sandstone (TC), underlying Cretaceous Menefee Formation (KMF) and associated surficial cover (QCL, QC); but no known mining activity is in the area.

The Smith Lake District exhibits uranium window count rates ranging from average to >40 cps, though the correlation between high count rates and known mines is sketchy. The lowest uranium count rates occur in the western half and the eastern quarter (exclusive of the Smith Lake District). In the eastern half the correlation is with a combination of Triassic units (TRWR, TRMK, and TRC) and a variety of surficial units (QA, QAO, QE, etc.), along the eastern peripheral

area of the Black Mesa Basin. In the eastern quarter, some Paleozoic units (PG, PGY and PY) in the Zuni Uplift correlate well with below average count rate areas; and units KMF and QAE commonly show lower than average count rates in the San Juan Basin. Unit QB, a basalt of the Mount Taylor volcanics has an average uranium count rate of 14.2 cps, and is expressed clearly on Figure 6 in the southeastern of the quadrangle.

All the Precambrian units in Gallup quadrangle are distinctive in that all have average potassium count rates higher than 200 cps (2.4 - 2.9 equivalent percent K). They are the only units with >200 cps potassium window count rates. These units are characterized by greater than average uranium count rates, and are among the units with the highest thorium as well.

Map units TC (Chuska Sandstone) and JMWR (Westwater Canyon and Recapture members of the Morrison Formation) have average U/T ratios of .78 and .73 respectively; the highest in the quadrangle. Map unit JMWR is associated with the Gallup Mining District, whereas map unit TC does not show correlation with any mining activity.

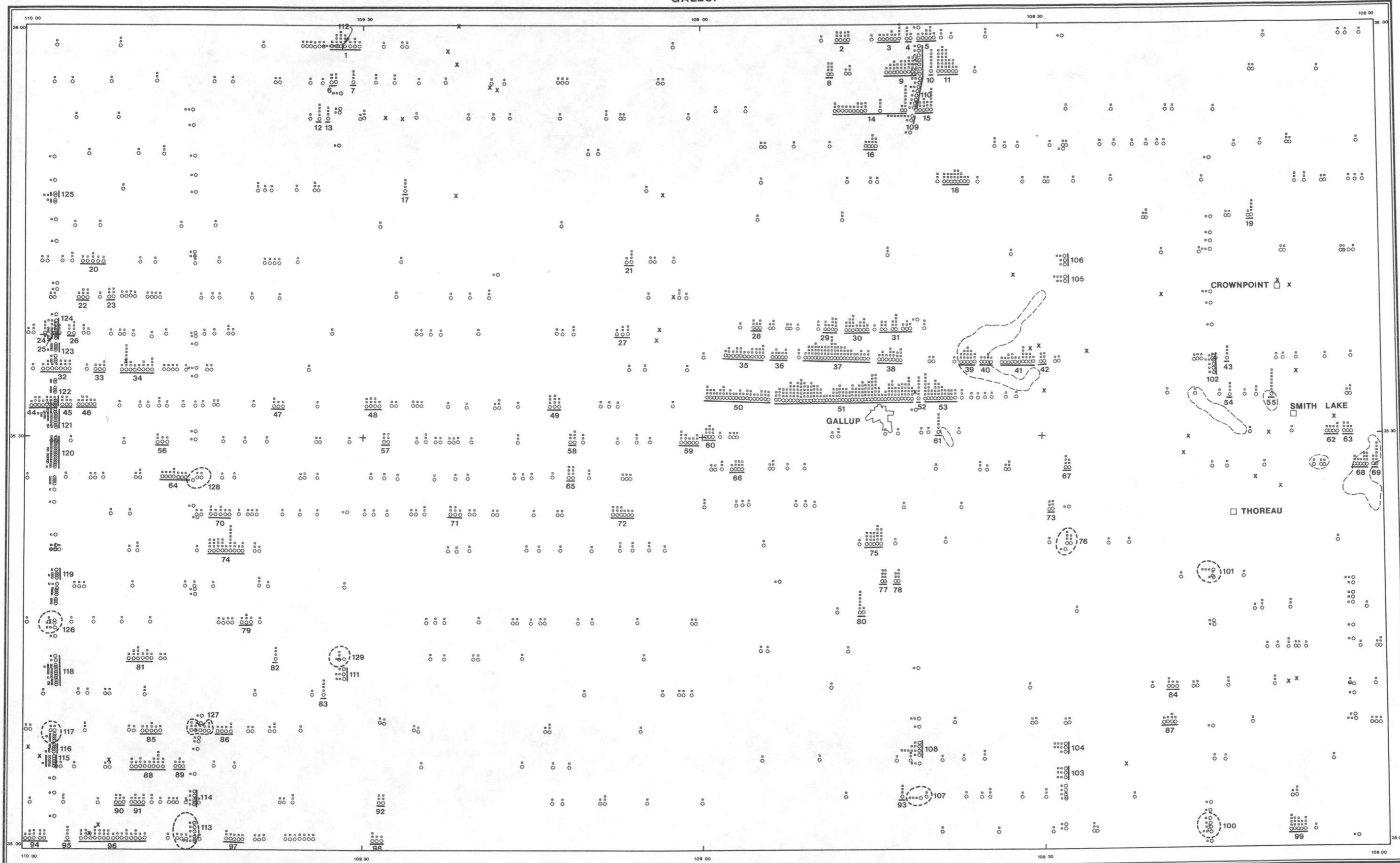
Quaternary surficial deposits (QAE, QA, QAO, and QC) contain the most anomalous samples (242 total). These samples are scattered throughout the quadrangle.

Mapped exposures of Chinle (TRC) exclusive of the Shinarump Member have 60 anomalous samples which predominantly occur in the western half of the quadrangle. (Anomalies 1, 6, 7, 12, 13, 17, 27, 81, 85, 86, 88-91, 94-97, and 112-118). The highest peak count rate among these anomalies is 48.2 cps in anomaly 12. A number of anomalies in the same general area occur primarily in surficial cover (anomalies 24-26, 32-34, 44-46, 64, 70, 74, 79, 81, 86, 90, 96, 111, 113-115, 117, 119-124, 126, and 128-129; peak count rates ranging from 27 to 64 cps), and in Tertiary units associated with Hopi Buttes Volcanics (anomalies 20, 22, 23, 32, 34, 44-47, 56, 64, 70, 74, 75, 77, 78, 82, 83, 92, 98, 111, 121-123, and 128; peak count rates range from 27 to 64 cps).

Anomalies 28-31, 35-42, 50-53, 59-61, and 66 occur in a distinctive group, which curves around the northwestern tip of the Zuni Uplift, and lies adjacent to the town of Gallup. This group corresponds to one of the large count rate patches discussed earlier and lies partially within the Gallup Mining District. Map units KMF, KMFC, KC, KGM, KD, and KM are the primary components of these anomalies. Peak count rates range from 38.2 cps at anomaly 28, to 67 cps at anomaly 37. Anomalies 37-42, 52, 53, and 61 occur at least partially over known mining activity.

In the Chuska Mountains, over the other large patch of high uranium window count rates, anomalies 2-5, 8-11, 14-16, 109, and 110 occur over surficial cover, Chuska Sandstone, and Cretaceous Menefee,

GALLUP



URANIUM ANOMALY/
INTERPRETATION MAP

GALLUP QUADRANGLE
U.S. DEPARTMENT OF ENERGY

APPROXIMATE SCALE 1:500,000

EXPLANATION

- x - URANIUM MINE OR PROSPECT
- - GROUP OF URANIUM MINES AND/OR PROSPECTS
- - 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:
geoMetrics

Figure 4 - Uranium Anomaly/Interpretation Map - Gallup Quadrangle

Table 1
URANIUM ANOMALY SUMMARY

ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF								ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF								
				1	2	3	4	5	6	7	>7					1	2	3	4	5	6	7	>7	
1	24	QAE/1, TRC/4, TRCS/2	44.6	3	1	2	1	0	0	0	0	22	31	TBU/3	28.4	1	2	0	0	0	0	0	0	0
2	24	TC/4	54.6	0	4	0	0	0	0	0	0	23	31	TBU/2	30.2	0	2	0	0	0	0	0	0	0
3	24	QC/5, KMF/1	70.6	4	1	0	1	0	0	0	0	24	32	QE/1	38.7	0	0	1	0	0	0	0	0	0
4	24	QAE/2	43.7	1	0	1	0	0	0	0	0	25	32	QE/2	38.7	0	1	1	0	0	0	0	0	0
5(c)	24	QAE/3, KMF/1, QAO/1	46.6	3	1	1	0	0	0	0	0	26	32	QAE/1, QE/1	40.7	0	1	1	0	0	0	0	0	0
6	25	TRC/2	32.0	0	2	0	0	0	0	0	0	27	32	TRC/3	33.2	1	2	0	0	0	0	0	0	0
7	25	TRC/1	42.9	0	0	1	0	0	0	0	0	28 (c)	32	QAE/3	38.2	1	2	0	0	0	0	0	0	0
8	25	TC/2	67.2	0	0	2	0	0	0	0	0	29 (c)	32	KMF/2, QAE/2	48.1	1	1	2	0	0	0	0	0	0
9	25	QC/9	103.3	1	2	3	3	0	0	0	0	30 (c)	32	QAE/5, KMF/2	61.8	2	2	2	1	0	0	0	0	0
10	25	QAE/1	66.7	0	0	0	0	0	1	0	0	31	32	KMF/4, KMFC/1, KC/2	62.9	2	4	0	1	0	0	0	0	0
11(c)	25	QAO/6	60.7	1	0	2	0	0	2	1	0	32	33	QAE/3, TBL/1, QAD/2, QA/1	42.9	3	4	0	0	0	0	0	0	0
12	26	TRC/1	48.2	0	0	0	1	0	0	0	0	33	33	QAO/3	32.6	2	1	0	0	0	0	0	0	0
13	26	TRC/1	40.4	0	0	1	0	0	0	0	0	34	33	QA/4, TBU/2, TBL/2	51.6	4	2	1	0	0	0	1	0	0
14	26	QC/8, TC/1, KKF/2, KMF/1	87.8	6	4	1	0	0	0	1	0	35	33	KMFC/7, QAE/2, KMF/2	46.6	4	6	1	0	0	0	0	0	0
15(c)	26	QC/4, QAE/1	82.7	0	3	1	0	0	1	0	0	36	33	KMF/4, QAE/1	39.9	3	2	0	0	0	0	0	0	0
16(c)	27	QAE/4	46.2	2	1	1	0	0	0	0	0	37 (c,m)	33	KMF/9, QAE/11	67.0	4	4	9	2	0	1	0	0	0
17	28	TRC/1	39.3	0	0	1	0	0	0	0	0	38 (m)	33	KMF/5, KC/1, KG/1	49.7	2	3	2	0	0	0	0	0	0
18	28	QAE/8	46.5	2	4	2	0	0	0	0	0	39 (m)	33	QA/5	62.6	0	2	2	1	0	0	0	0	0
19	29	KP/2	37.3	1	0	0	1	0	0	0	0	40 (m)	33	QA/4	39.7	3	1	0	0	0	0	0	0	0
20	30	TBU/2, QAE/2, JMW/1	28.9	4	1	0	0	0	0	0	0	41 (m)	33	KD/1, QA/6, QAO/1, JM/2	45.0	5	4	0	1	0	0	0	0	0
21	30	TRCS/2	29.3	1	0	1	0	0	0	0	0	42 (m)	33	QA/1, JM/1	41.6	0	2	0	0	0	0	0	0	0
												43	33	QA/1	55.5	0	0	1	0	0	0	0	0	0

Table 1 (Continued)
URANIUM ANOMALY SUMMARY

ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF								ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF									
				1	2	3	4	5	6	7	>7					1	2	3	4	5	6	7	>7		
44	34	TBL/2, QAE/5	39.0	2	5	0	0	0	0	0	0	0	65	36	PD/2	29.6	0	0	2	0	0	0	0	0	0
45	34	QAE/1, TBL/1, TBV/1	40.7	1	2	0	0	0	0	0	0	0	66(c)	36	KM/1, QA/3	43.2	1	3	0	0	0	0	0	0	0
46	34	TBL/2, QAE/1, QA/2	41.3	3	2	0	0	0	0	0	0	0	67	36	TRCM/2	30.2	0	1	1	0	0	0	0	0	0
47	34	TBU/3	25.9	2	1	0	0	0	0	0	0	0	68(m)	36	QAE/2, JM/1, KD/2	47.9	2	1	2	0	0	0	0	0	0
48	34	PD/4	26.2	1	3	0	0	0	0	0	0	0	69(m)	36	QA/1, KDM/1	62.2	0	1	0	0	0	0	1	0	0
49	34	PD/3	28.6	0	1	2	0	0	0	0	0	0	70	37	TBU/4, QAO/1	27.3	3	2	0	0	0	0	0	0	0
50	34	KC/13, QA/1, KMFC/5	50.8	7	10	2	0	0	0	0	0	0	71	37	PD/3	24.9	1	2	0	0	0	0	0	0	0
51	34	KC/10, QAE/8, KMFC/2, KMF/10, QA/10, KG/1, JCSS/1	86.5	4	3	12	12	7	2	2	0	0	72	37	PD/5, TRC/1	24.8	3	3	0	0	0	0	0	0	0
												73	37	TRCM/2	28.1	0	2	0	0	0	0	0	0	0	0
52 (m)	34	JE/1	46.0	0	0	0	0	0	0	1	0	0	74	38	QAO/4, TBL/1, TBU/4	53.8	2	2	4	0	0	0	0	1	0
53 (m)	34	QAO/1, QA/8, JTE/1	69.8	0	5	1	2	1	0	1	0	0	75(c)	38	TBU/2, QAO/3	47.5	0	0	3	1	1	0	0	0	0
54 (c)	34	KM/1	39.4	0	0	1	0	0	0	0	0	0	76	38/TL23	PY/3	30.8	1	1	1	0	0	0	0	0	0
55 (m)	34	KM/1	66.7	0	0	0	0	0	0	0	1	0	77	39	TBU/2	34.5	0	0	2	0	0	0	0	0	0
56	35	TBU/2, QAO/1	26.6	2	1	0	0	0	0	0	0	0	78	39	TBU/2	35.0	0	1	1	0	0	0	0	0	0
57	35	PD/2	26.3	0	2	0	0	0	0	0	0	0	79	40	QAE/3	37.9	2	1	0	0	0	0	0	0	0
58	35	TRCS/2	27.5	0	1	1	0	0	0	0	0	0	80	40	TBU/1, KC/1	46.8	1	0	0	0	0	0	1	0	0
59	35	KGM/5	42.6	2	2	1	0	0	0	0	0	0	81	41	TRC/4, QAE/2	37.7	3	2	1	0	0	0	0	0	0
60	35	QA/1, KGM/2	41.0	0	2	1	0	0	0	0	0	0	82	41	TBU/1	31.0	0	0	1	0	0	0	0	0	0
61 (m)	35	KD/1	66.1	0	0	0	0	1	0	0	0	0	83	42	TBU/1	38.5	0	0	0	1	0	0	0	0	0
62 (m?)	35	QA/2, KDML/2	36.2	3	1	0	0	0	0	0	0	0	84	42	PCGM/3	34.5	2	1	0	0	0	0	0	0	0
63 (m?)	35	KDML/3	37.3	1	2	0	0	0	0	0	0	0	85	43	TRC/5	31.3	4	1	0	0	0	0	0	0	0
64	36	QAO/5, TBU/2	31.8	6	1	0	0	0	0	0	0	0	86	43	TRC/2, QAO/2	32.3	3	1	0	0	0	0	0	0	0

Table 1 (Continued)
URANIUM ANOMALY SUMMARY

ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF							ANOMALY NUMBER	FLIGHT LINE NUMBER	COMPUTER MAP UNIT AND NUMBER OF ANOMALOUS SAMPLES IN UNIT	PEAK CPS	NUMBER OF SAMPLES WITH A STANDARD DEVIATION OF								
				1	2	3	4	5	6	7					>7	1	2	3	4	5	6	7	>7
87	43	PG/4	22.1	3	1	0	0	0	0	0	0	109	TL24	KMF/1, QAO/1	58.3	1	0	0	0	0	0	1	0
88	44	TRC/8	47.3	3	4	0	1	0	0	0	0	110	TL24	QC/15	67.4	10	5	0	0	0	0	0	0
89	44	TRC/3	33.0	2	1	0	0	0	0	0	0	111	TL28	TBU/2, QED/1	28.9	1	2	0	0	0	0	0	0
90	45	TRC/2, QA/1	36.5	1	2	0	0	0	0	0	0	112	TL28	TRC/1	46.8	0	0	0	1	0	0	0	0
91	45	TRC/4	33.9	2	2	0	0	0	0	0	0	113	TL29/46	QAO/4, TRC/4, QAL/1	36.3	9	0	1	0	0	0	0	0
92	45	TBU/1, QAO/1	29.9	0	2	0	0	0	0	0	0	114	TL29	TRC/3, QAO/1	30.9	3	1	0	0	0	0	0	0
93	45	JCSE/1	27.9	0	0	1	0	0	0	0	0	115	TL30	TRC/4, QA/1	41.9	0	4	1	0	0	0	0	0
94	46	TRC/5	35.2	1	4	0	0	0	0	0	0	116	TL30	TRC/4	31.9	3	1	0	0	0	0	0	0
95(m)	46	TRC/1	39.4	0	0	1	0	0	0	0	0	117	TL30/43	QAO/5, TRC/1	29.8	5	1	0	0	0	0	0	0
96(c,m)	46	TRC/8, QAO/7	38.3	7	7	1	0	0	0	0	0	118	TL30	TRC/10	39.3	2	7	1	0	0	0	0	0
97	46	TRC/5	33.3	4	1	0	0	0	0	0	0	119	TL30	QAO/3	30.4	2	1	0	0	0	0	0	0
98	46	TBU/3	26.7	2	1	0	0	0	0	0	0	120	TL30	QA/1, QAE/14	41.8	7	8	0	0	0	0	0	0
99	46	PSA/2, PG/3	33.9	0	1	3	1	0	0	0	0	121	TL30	QA/3, QAE/2, TBL/4	64.4	1	4	2	1	1	0	0	0
100	TL22/46	QB/5	25.8	4	1	0	0	0	0	0	0	122	TL30	QAE/2, TBL/1	40.2	2	1	0	0	0	0	0	0
101	TL22/39	TRCM/3	29.4	2	0	1	0	0	0	0	0	123	TL30	QAE/3, TBL/1	35.6	3	1	0	0	0	0	0	0
102	TL22	KM/4, QA/1	35.7	4	1	0	0	0	0	0	0	124	TL30	QE/6	38.1	1	4	1	0	0	0	0	0
103	TL23	QA/1, KMDM/2	37.7	0	3	0	0	0	0	0	0	125		KT/2	36.3	0	2	0	0	0	0	0	0
104	TL23	KD/1, JCSE/2	30.9	1	0	2	0	0	0	0	0	126	TL30/40	QAO/4	31.0	2	2	0	0	0	0	0	0
105	TL23	KP/2	36.0	0	1	1	0	0	0	0	0	127	TL29/43	TRC/5	31.0	3	2	0	0	0	0	0	0
106	TL23	KP/3	26.3	2	1	0	0	0	0	0	0	128	TL29/36	QAO/2, TBU/1	37.0	2	1	0	0	0	0	0	0
107	TL24/45	KDM/1, KM/1	38.9	1	0	1	0	0	0	0	0	129	TL28/41	QED/2	30.0	1	1	0	0	0	0	0	0
108	TL24	QAE/1, QB/1, QA/1, KM/1	44.1	2	1	0	0	1	0	0	0												

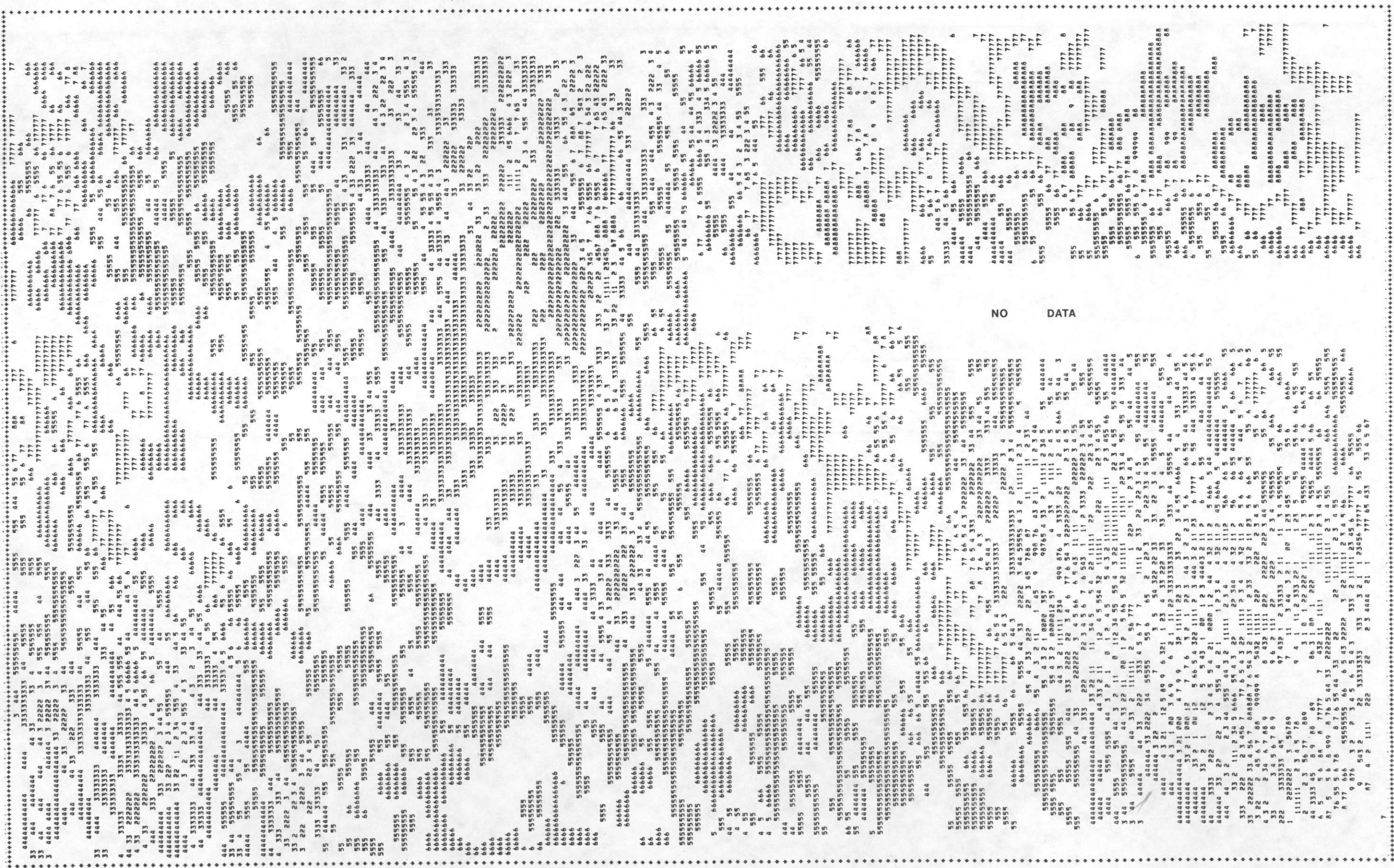
NOTES: (m) implies anomaly is near a uranium mine or milling operation such as the Ambrosia Lake District.

(c) implies anomaly is associated with cultural features such as cities, highways, quarries, railroads, etc.

TABLE 2
 Frequency of Anomalous Samples per Map Unit

<u>COMPUTER MAP UNIT</u>	<u>NUMBER OF ANOMALOUS SAMPLES</u>	<u>COMPUTER MAP UNIT</u>	<u>NUMBER OF ANOMALOUS SAMPLES</u>
QAE	94	JM	4
TRC	91	PCGM	3
QA	60	JCSE	3
QAO	52	KKF	2
KMF	42	KG	2
QC	41	KDM	2
TBU	39	PY	2
KC	27	PSA	2
PD	19	KMDM	2
KMFC	15	KT	2
TBL	15	JMW	1
QE	10	TBV	1
KM	9	JCSS	1
TC	7	JE	1
KP	7	JTE	1
KGM	7	QED	1
PG	7		
TRCS	6		
QB	6		
KD	5		
KDML	5		
TRCM	5		

GALLUP

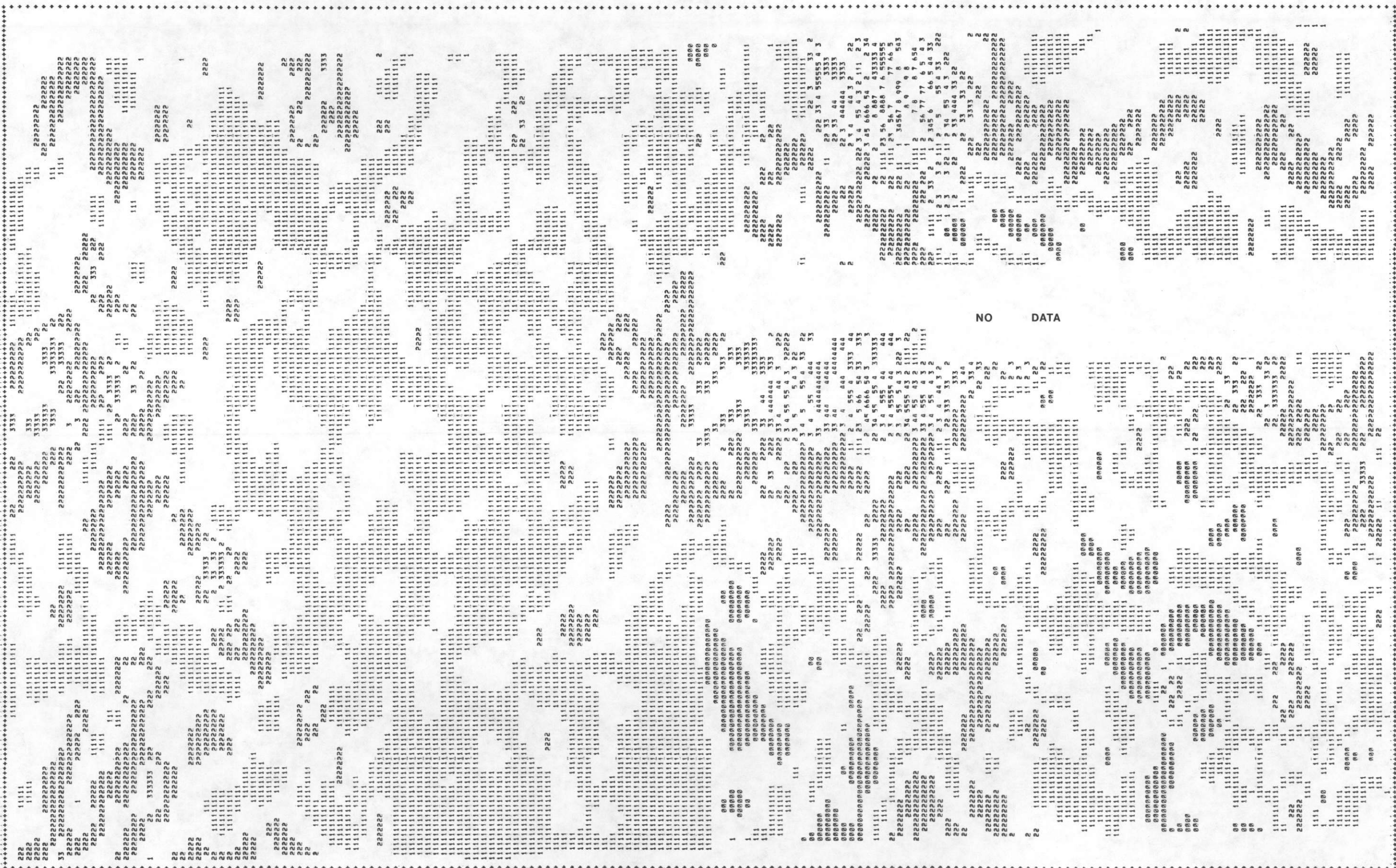


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7	112.5
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9	137.5
0	150.0
1	162.5
2	175.0
3	187.5
4	200.0
5	212.5
6	225.0
7	237.5
8	250.0
9	262.5
0	275.0
1	287.5
2	300.0
3	312.5
4	325.0
5	337.5
6	350.0
7	362.5
8	375.0
9	387.5
0	400.0
1	412.5
2	425.0
3	437.5
4	450.0
5	462.5
6	475.0
7	487.5
8	500.0
9	512.5
0	525.0
1	537.5
2	550.0
3	562.5
4	575.0
5	587.5
6	600.0
7	612.5
8	625.0
9	637.5
0	650.0
1	662.5
2	675.0
3	687.5
4	700.0
5	712.5
6	725.0
7	737.5
8	750.0
9	762.5
0	775.0
1	787.5
2	800.0
3	812.5
4	825.0
5	837.5
6	850.0
7	862.5
8	875.0
9	887.5
0	900.0
1	912.5
2	925.0
3	937.5
4	950.0
5	962.5
6	975.0
7	987.5
8	1000.0
9	1012.5
0	1025.0
1	1037.5
2	1050.0
3	1062.5
4	1075.0
5	1087.5
6	1100.0
7	1112.5
8	1125.0
9	1137.5
0	1150.0
1	1162.5
2	1175.0
3	1187.5
4	1200.0
5	1212.5
6	1225.0
7	1237.5
8	1250.0
9	1262.5
0	1275.0
1	1287.5
2	1300.0
3	1312.5
4	1325.0
5	1337.5
6	1350.0
7	1362.5
8	1375.0
9	1387.5
0	1400.0
1	1412.5
2	1425.0
3	1437.5
4	1450.0
5	1462.5
6	1475.0
7	1487.5
8	1500.0
9	1512.5
0	1525.0
1	1537.5
2	1550.0
3	1562.5
4	1575.0
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7	1612.5
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1	1662.5
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9	1762.5
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1	1787.5
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3	2062.5
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7	2112.5
8	2125.0
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2	2175.0
3	2187.5
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7	2237.5
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9	2262.5
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1	2287.5
2	2300.0
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7	2362.5
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3	2437.5
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9	2637.5
0	2650.0
1	2662.5
2	2675.0
3	2687.5
4	2700.0
5	2712.5
6	2725.0
7	2737.5
8	2750.0
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0	2775.0
1	2787.5
2	2800.0
3	2812.5
4	2825.0
5	2837.5
6	2850.0
7	2862.5
8	2875.0
9	2887.5
0	2900.0
1	2912.5
2	2925.0
3	2937.5
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5	2962.5
6	2975.0
7	2987.5
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9	3012.5
0	3025.0
1	3037.5
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4	3075.0
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6	3100.0
7	3112.5
8	3125.0
9	3137.5
0	3150.0
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2	3175.0
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5	3212.5
6	3225.0
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3	5812.5
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6	5850.0
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8	6375.0
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GALLUP



NO DATA

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3	25.0
4	30.0
5	35.0
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Figure 6 - Uranium Pseudo-Contour Map - Gallup Quadrangle

GALLUP

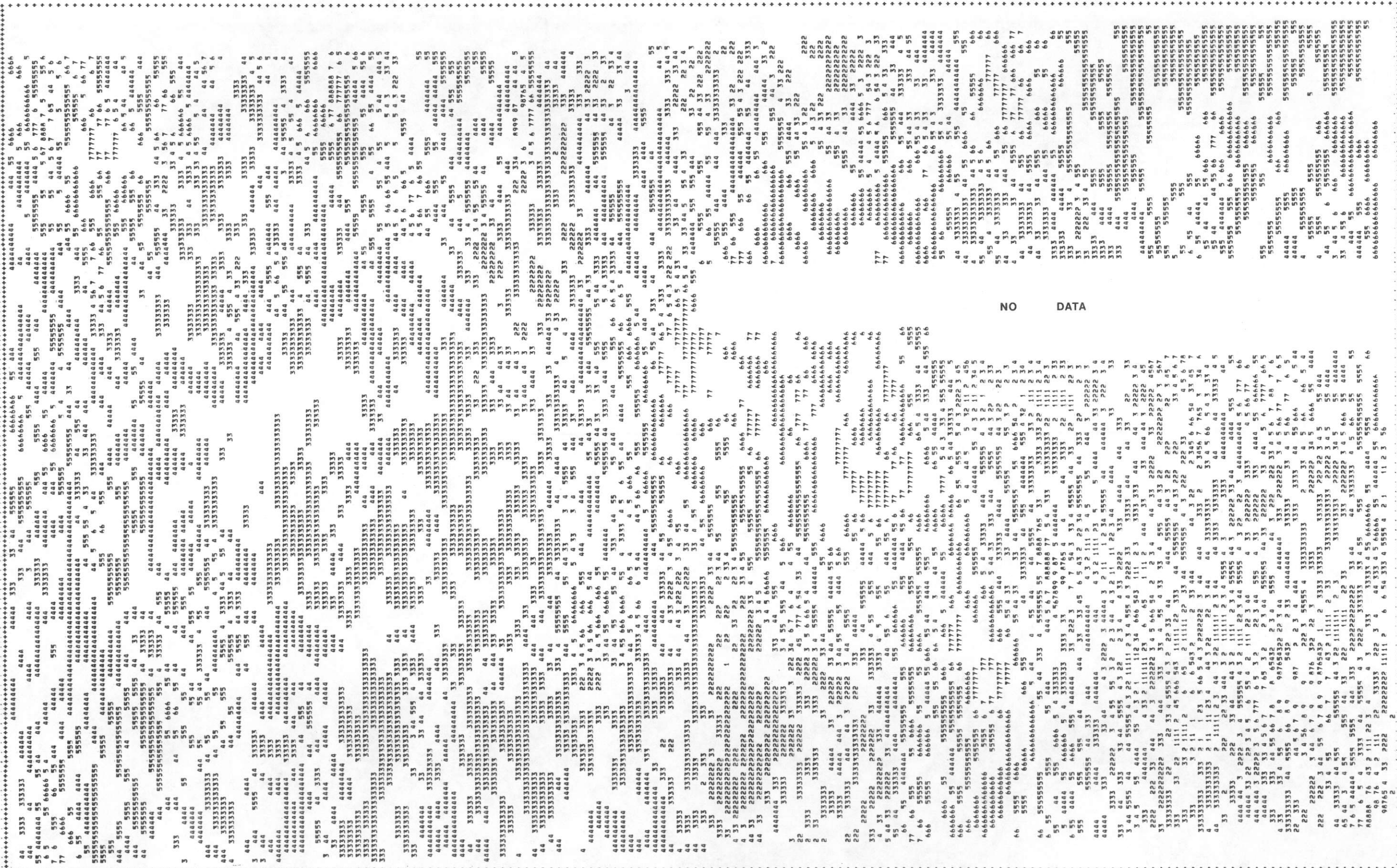
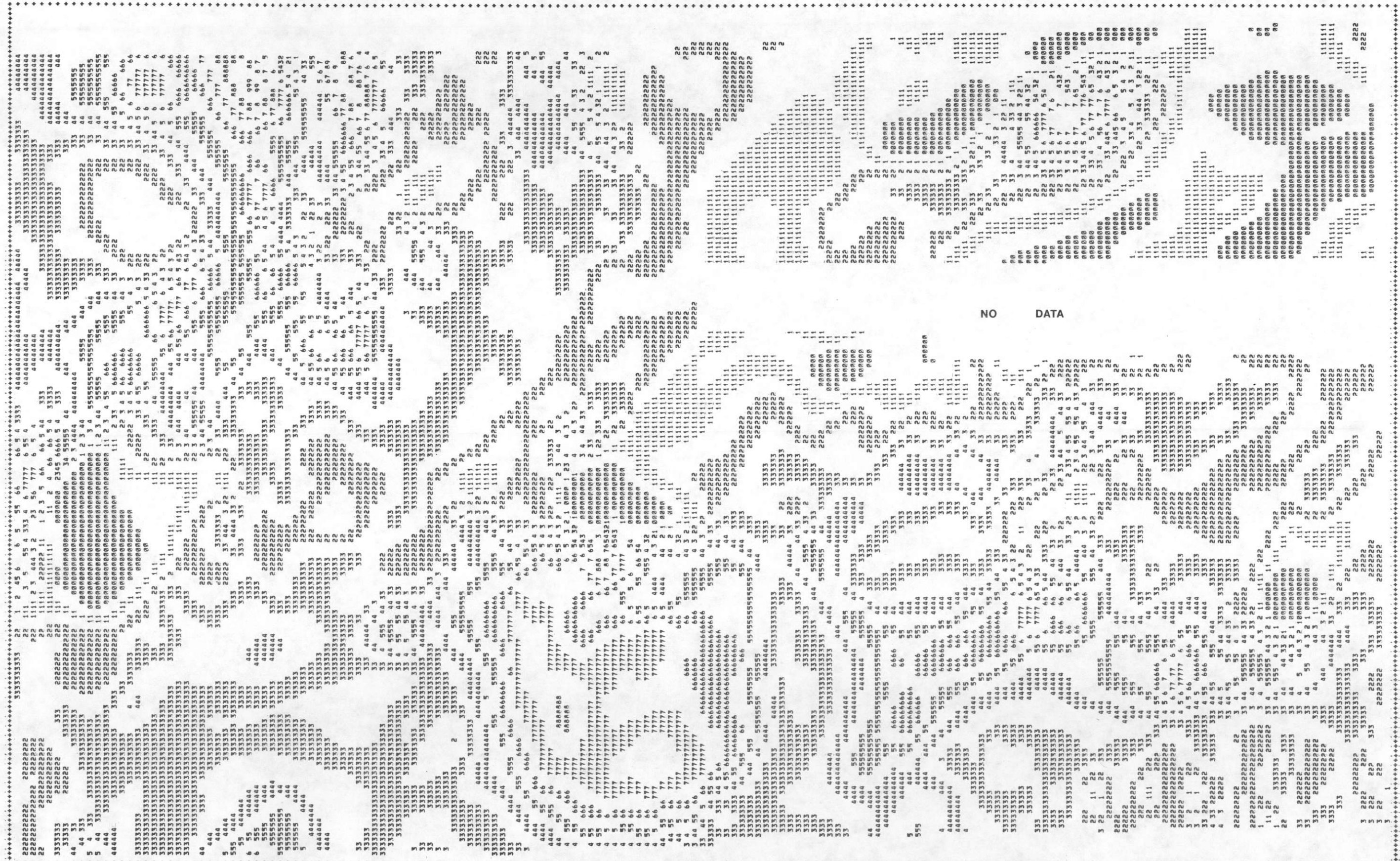


Figure 7 - Thorium Pseudo-Contour Map - Gallup Quadrangle

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9	55.0
0	60.0
1	65.0
2	70.0
3	75.0
4	80.0
5	85.0
6	90.0
7	95.0
8	100.0
9	105.0

GALLUP



PRINT CHARACTER	VALUE	EXPLANATION
0	0	LE
1	500	500'
2	400	400'
3	300	300'
4	200	200'
5	100	100'
6	50	50'
7	100	100'
8	150	150'
9	200	200'
BT	300	300'

Figure 8 - Residual Magnetic Pseudo-Contour Map - Gallup Quadrangle

Kirtland, and Fruitland Formations. No known mining activity is in this area according to available sources. Peak count rates in the uranium window range from 44 cps in anomaly 4, to 103 cps in anomaly 9 (the highest in the quadrangle).

Anomalies 43, 54, 55, 62, 63, 68, 69, and 102 occur over Jurassic and Cretaceous rocks, and surficial deposits (Map Units JM, KD, KDM, KDML, and QA) in the Smith Lake District. All but anomalies 43, 54, and 102 occur over known mine activity. Peak count rates range from 36 cps in anomaly 54, to 67 cps in anomaly 55.

Between the Smith Lake District and the Chuska Mountain area, anomalies 18, 19, 105, and 106 lie over units KP and QAE. These anomalies may reflect a possible extension of the Grants Mineral Belt toward the Chuska Mountains, which more detailed study could define. Peak count rates range from 26 cps in anomaly 105, to 37 cps in anomaly 19. Anomaly 19 is near the town of Crownpoint, but no known mining activity is present in that area.

Magnetic Data

The Gallup Quadrangle contains portions of the San Juan and Black Mesa Basins, the Gallup Sag, and parts of the Zuni and Defiance Uplifts. The two basins shoal to the south from the northeastern and northwestern corners respectively. Their greatest depths are more than 8,000 feet. Precambrian rocks are exposed in the cores of the two uplifts, which occupy the southeastern quarter and the central northern region of the quadrangle respectively. The Gallup Sag lies between the two uplifts near the center of the quadrangle.

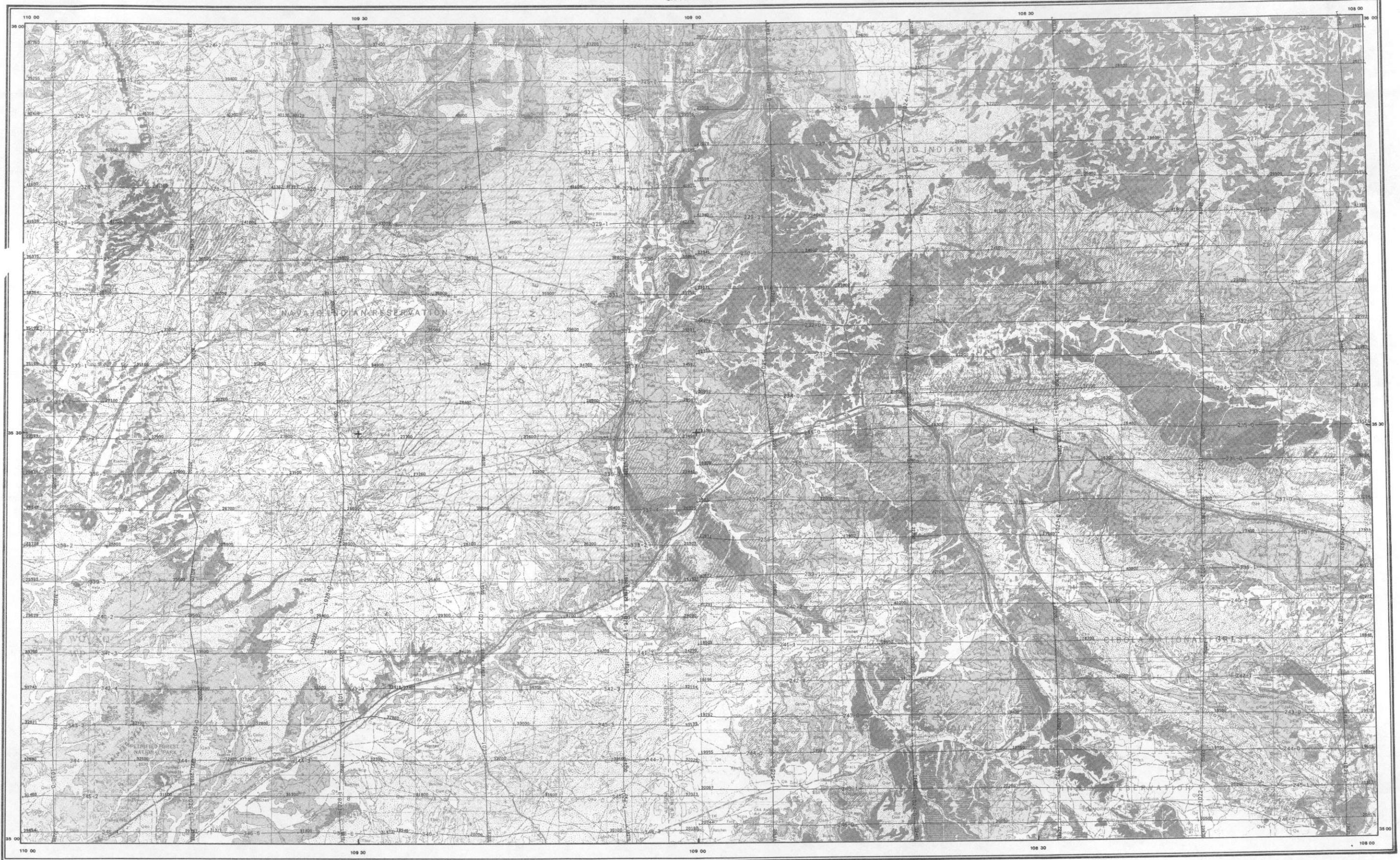
In general the magnetic data corresponds moderately well with known structural information. The major structures are faintly outlined (Figure 8), but their boundaries are largely gradational. An overprint of high frequency wavelengths is present in the western half and the extreme southeastern corner of the quadrangle which may correspond to Cenozoic igneous activity in those areas (Hopi Buttes and Mount Taylor Volcanics). Some faults in the Zuni and Defiance Uplifts appear to have some expression on the magnetic field contour map, but the structure contour map by Hackman and Olson (1977), using the base of the Dakota Sandstone bears little resemblance to the magnetic structure as mapped. A large area of anomalous field intensity and wavelength in the San Juan Basin does not appear to relate to any feature on the surface or any structure above the Dakota Sandstone base. This feature probably relates to some structure below the Dakota Sandstone or to some local difference in the mineralogy of the magnetic basement.

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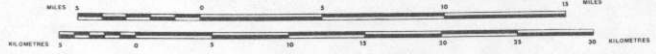
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APPENDIX A - Flight Path

GALLUP



SCALE 1:500,000



FEDERAL NUMBER 053-0 LINE NUMBER

FLIGHT LINE SPACING 3.8 MILE(S)
 FLIGHT ALTITUDE 400 FEET AMT
 FLOWN AND COMPILED 1978 - 1979



114°	113°	112°	111°	110°
ESCALANTE, NJ 12-9 CERCA DEL LEFAY, NJ 12-7 NJ 12-10	NJ 12-9 COLORADO NJ 12-11	NJ 13-7 COLORADO NJ 13-10	NJ 13-8 COLORADO NJ 13-11	104°
SANTA FE NI 12-1 ARIZONA WILLIAMS, NI 12-5 PRESCOTT, NI 12-4 NI 12-7	GALLUP, NI 12-3 NI 12-6 NI 12-8	SANTA FE NI 13-7 NEW MEXICO NI 13-4 NI 13-5	SANTA FE NI 13-2 NI 13-3 NI 13-6 NI 13-8	104°
114°	113°	112°	111°	110°


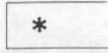


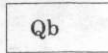
LOCATION INDEX

FLIGHT PATH RECOVERY

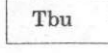


RATON BASIN PROJECT

U. S. DEPARTMENT OF ENERGY

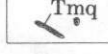

PYROCLASTIC DEBRIS AND BASALT FLOWS IN ZUNI MOUNTAINS AREA (HOLOCENE AND PLEISTOCENE):

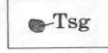
-  Qva Ash and cinders of basaltic composition
-  * Cinder cone
-  Qby Younger basalt flows
-  Qbo Older basalt flows
-  Qb Basalt flows undifferentiated—Includes dark aphanitic vesicular flows. Basaltic flows are 64 m (210 ft) thick in a drill hole southeast of Pescado Dam. Some of these flows and the basalt on Lookout Mountain may be as old as Tertiary

BIDAHOCHI FORMATION (PLIOCENE):


-  Tbu Upper member—Predominantly white to very pale brown poorly cemented medium- to fine-grained argillaceous sandstone; a few beds of rhyolitic ash in lower part. Mostly of fluvial origin. Weathers into ledges, alternating with steep white slopes. Thickness 0-183 m (0-600 ft); thickest near south-central border of mapped area
-  Tbv Volcanic member—Dense dark lavas containing phenocrysts of augite and less commonly of hornblende and biotite. Thickness 0-60 m (0-197 ft); locally caps mesas. A flow just west of mapped area has a K-Ar age of 4.1 m.y. (million years) (Evernden and others, 1964, p. 164)
-  Tbl Lower member—Banded gray, brown, and pink flat-bedded mudstone and argillaceous fine-grained sandstone; a few beds of rhyolitic ash. Mostly of lacustrine origin. Weathers to ledgy slope. Thickness 0-49 m (0-160 ft)

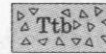
ROCKS OF HOPI BUTTES VOLCANIC FIELD—MONCHIQUE PROVINCE (PLIOCENE)—Includes the volcanic member of the Bidahochi Formation in this province

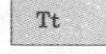
-  Tmq Monchiquite—Trachybasaltic-lamprophyric rock composed chiefly of augite and olivine, small but varied amounts of hornblende and biotite, sparse orthoclase, plagioclase, and analcite in dikes and necks
-  Teb Explosion breccia—Tuff, breccia, monchiquite lava, agglomerate, and sparse to abundant large blocks and small fragments of older rock in diatremes or volcanic necks. All or a combination of these rocks may be present in a vent. Locally includes some spring deposits and commonly overlain by thin-bedded lacustrine marly clays, siltstone, and tuffaceous sandstone. The age of two monchiquite diatremes in adjacent parts of the Hopi Buttes volcanic field a few kilometers (miles) west of mapped area ranges from 2 to 5.5 m.y., radiometrically determined by means of fission tracks (Naesser, 1971, p. 4983). Some diatremes locally contain uranium mineralization (usually <0.01 percent) (Shoemaker, 1956)

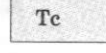
-  Tsg Spring deposits—Impure travertine and small amounts of chert associated with igneous rocks of Hope Buttes volcanic field; may have been deposited during course of volcanism or shortly afterwards. Contains small uranium prospect

ROCKS OF ZILDITLOI AND TWIN CONES VOLCANIC FIELDS—MINETTE PROVINCE (MIDDLE OLIGOCENE):

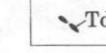
-  Tmn Minette—Dikes and necks of lamprophyric rocks composed of biotite and subordinate diopside phenocrysts in a groundmass of orthoclase or sanidine. In necks, minette commonly is encased and mapped to include the breccia composed of fragments of lava, mudstone, and sandstone, and sparse granite and gneiss xenoliths. Queried where correlation uncertain

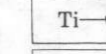
-  Ttb Tuff breccia—Green-gray lapilli tuff and small outcrops of kimberlite tuff. Tuff contains olivine and garnet crystals and fragments of igneous and metamorphic rocks as well as angular and rounded pebbles of chert, quartzite, and slate; generally interbedded with cinders; in diatrema. The age of the Buell Mountain diatrema is about 31 m.y., radiometrically determined by means of fission tracks (Naesser, 1971, p. 4980)

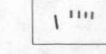
-  Tt Trachybasalt—Extrusive basaltic rock composed of diopside, biotite-phlogopite, sanidine, and accessory minerals; locally, some glass. Present as a flow in Buell Mountain area and caps Zilditloi Mountain (a diatrema)

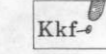
-  Tc CHUSKA SANDSTONE (LOWER OLIGOCENE TO EOCENE?)—Pinkish- and yellowish-gray massive crossbedded very fine grained to coarse-grained sandstone; some interbedded siltstone. Of eolian and fluvial origin. Although early investigators considered the Chuska Sandstone as Pliocene(?) in age, later investigators considered it to be Miocene or Oligocene in age (Ackers, Shorty, and Stevens, 1971, p. D12). Subsequent middle Oligocene dating of volcanic rocks of the minette province (Naesser, 1971, p. 4983), some of which intrude the Chuska Sandstone north of the mapped area, indicate that the Chuska Sandstone is at least as old as early Oligocene. Thickness about 305 m (1,000 ft)


INTRUSIVE ROCKS (TERTIARY)—Exact age and correlation uncertain


-  Td Diabase dike—Dark-gray fine-grained holocrystalline olivine diabase dike located 8 km (5 mi) north-northwest of Thoreau. Fine-grained greenish-black diabase dikes in southernmost Precambrian rocks in Zuni Mountains


-  Ti Intrusive rock undifferentiated—Plug or neck 11 km (7 mi) southeast of Zuni Reservoir

-  T FLUORSPAR VEINS IN ZUNI MOUNTAINS (TERTIARY?)—Coarsely crystalline green fluorite, commonly brecciated in veins as much as 4.6 m (15 ft) wide and as much as hundreds of meters (feet) long


-  Kkf KIRTLAND AND FRUITLAND FORMATIONS (UPPER CRETACEOUS)—Light-olive-gray to yellowish-gray thin-bedded bentonitic shale; carbonaceous shale near base. Continental in origin. Thickness as much as 152 m (500 ft). This is the upper 152 m of the Tohachi Shale of Gregory (1916, p. 80), which was remapped and redefined by Allen and Balk (1954). (See discussion by O'Sullivan, Repenning, Beaumont, and Page, 1972, p. 47.) This unit is now correlated with the Kirtland and Fruitland Formations undivided; forms a distinct unit as mapped to the north by Ziegler (1955)


-  Kmf MENEFEE FORMATION (UPPER CRETACEOUS)—Interbedded yellowish-gray to grayish-orange lenticular fine- to medium-grained sandstone, dusty-yellow to olive-gray sandy shale and mudstone, dark-gray to black shale, and coal. Of continental origin. Consists of an upper coal-bearing member, the Allison Member in the middle (as much as 609 m or 2,000 ft thick) containing very little coal, and the Cleary Coal Member at the base. Where the Point Lookout Sandstone is absent the Cleary Coal Member is not distinguished from the Gibson Coal Member of the Crevasse Canyon Formation and the two are mapped together. Thickness as much as 914 m (3,000 ft) in Chuska Mountain area

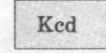
-  Kpl POINT LOOKOUT SANDSTONE (UPPER CRETACEOUS)—Grayish- to pale-orange fine- to medium-grained generally even-bedded, but in places cross-bedded, moderately well-sorted quartzose cliff-forming sandstone. Of near-shore origin. Caps mesas and benches. Average thickness about 61 m (200 ft); thickens to about 92 m (300 ft) where joined by the Hosta Tongue at southwestward pinchout of the underlying Satan Tongue of the Mancos Shale. Becomes coarse grained and wedges out abruptly within a few kilometers (miles) southwest of merger

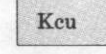
-  Kph Hosta Tongue—Grayish-orange to yellowish-gray fine-grained thick-bedded well-sorted calcareous sandstone of near-shore origin. Forms prominent ledgy cliff. Merges with the main body of the Point Lookout Sandstone at pinchout of the overlying Satan Tongue of Mancos Shale; wedges out northeastward where Satan Tongue joins main body of Mancos Shale. Thickness as much as 30 m (99 ft)

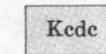
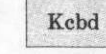
CREVASSE CANYON FORMATION (UPPER CRETACEOUS):


-  Kcg Gibson Coal Member—Light-gray and light-olive-gray very fine grained lenticular interbedded sandstone, gray siltstone, gray and brown carbonaceous shale, and beds of coal; coal beds generally more than 35 cm (14 in.) thick. Mostly of delta-swamp and flood-plain origin near the sea. Forms slopes. Thickness as much as 117 m (550 ft) in Tohatchi area and 85 m (280 ft) in Gallup area; thins northeastward


-  Kcb Bartlett Barren Member—Similar in lithology and origin to Gibson Coal Member, but deposited farther from the sea. Contains more sandstone, less carbonaceous shale, and few coal beds; all coal beds are less than 35 cm (14 in.) thick; forms ledgy slopes. Average thickness in Gallup area is 117 m (384 ft); thins northeastward and merges with Gibson Coal Member

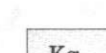
-  Kcd Dalton Sandstone Member—Grayish-orange and grayish-yellow fine- to medium-grained massive to thin-bedded, partly crossbedded, cliff-forming sandstone and minor intercalated sandy shale. Of mostly littoral origin. Thickness as much as 46 m (150 ft); thins and wedges out southwestward 7 km (4.5 mi.) northeast of Gallup and 11 km (7 mi.) northeast of Window Rock; grades northeastward into Mancos Shale; locally split into upper and lower part by the upper part of the Mulatto Tongue of the Mancos Shale


-  Kcu Gibson Coal and Dalton Sandstone Members

-  Kcdc Dilco Coal Member—Yellowish-gray or pale-orange irregularly bedded poorly cemented sandstone and siltstone; carbonaceous shale and beds of coal, some beds >36 cm (>14 in.) thick. Mostly of swamp and flood-plain origin. Forms ledgy slopes. Thickness about 92 m (301 ft) in Gallup area, 55 m (180 ft) north of Prewitt, and 23 m (75 ft) in Todilto Park area; thins northeastward
-  Kcbd Bartlett Barren and Dilco Coal Members

-  Kcsd Stray sandstone and Dilco Coal Member—Stray sandstone (Kcs*) an informal term, of Sears, Hunt, and Hendricks (1941) and its equivalent to Borrego Pass Lentil of Crevasse Canyon formation (Corrêa, 1970b). Very pale gray fine- to coarse-grained and conglomerate lenticular crossbedded fossiliferous near-shore sandstone. Thickness 23 m (75 ft) north of Prewitt; grades westward into top of Dilco Coal Member north of Smith Lake

-  Kmf CLEARY COAL MEMBER OF MENEFEE FORMATION AND GIBSON COAL MEMBER OF CREVASSE CANYON FORMATION (UPPER CRETACEOUS)—Mapped only where Point Lookout Sandstone is absent

-  Kg GALLUP SANDSTONE (UPPER CRETACEOUS):
Main body—Moderate-reddish-gray to pale-yellowish-gray and pale-brown thin- to thick-bedded lenticular very fine- to coarse-grained sandstone containing lesser amounts of brown carbonaceous shale, gray siltstone, and lenses of coal, of nonmarine and littoral origin. About 34 m (111 ft) thick near Casamero Lake, 54 m (177 ft) thick at Todilto Park, and 61 m (200 ft) thick east of Zuni Reservoir. North and east of Gallup, it is mostly a fine-grained sandstone and intertongues with the Mancos Shale. In the eastern part of the mapped area it includes the Gallego Sandstone Member at the top. Some underlying unnamed tongues and lentils of Gallup Sandstone are mapped with the Mancos Shale in this area

-  Kg Lower part (Kg1*)—Separated from the main body of Gallup Sandstone by the Pescado Tongue of the Mancos Shale. Maximum thickness is 69 m (226 ft) east of Zuni Reservoir; grades out northeastward into the Mancos Shale about 5 km (3 mi.) north of Upper Nutria and also 5 km (3 mi.) south of Window Rock. Some of the unnamed tongues and lentils of the Gallup Sandstone mapped with the Mancos Shale east and northeast of Gallup may in part be equivalents of the lower part of the Gallup Sandstone

Kms

MANCOS SHALE (UPPER CRETACEOUS):

Satan Tongue—Consists principally of dark-gray sandy marine shale and numerous thin beds of fine-grained calcareous sandstone becoming increasingly sandy towards pinchout; forms slopes. Thickens northeastward from a wedge-edge 6 km (4 mi.) southeast of Todilto Park and 29 km (18 mi.) northeast of Gallup to about 91 m (300 ft) in the subsurface near northeastern corner of mapped area

Kmm

Mulatto Tongue—Dark-gray to yellowish-brown sandy marine shale and numerous thin beds of fine-grained calcareous sandstone; becomes increasingly sandy southwestward; forms slopes. Thickens northeastward from a wedge-edge 11 km (7 mi.) south of Todilto Park, at Crevasse Canyon and 19 km (12 mi.) northeast of Gallup to about 152 m (500 ft) in subsurface near northeastern corner of mapped area. Locally northeast of Gallup the Mulatto Tongue is split into an upper and lower tongue by a lower tongue of the Dalton Sandstone Member of the Crevasse Canyon Formation

Km

Main body—Medium-dark-gray to nearly black, in places banded, fissile calcareous marine claystone, siltstone, and mudstone, interbedded near top and bottom with thin to thick beds of yellowish-brown sandstone; lower part contains thin beds of bentonite; weathers bluish gray; forms slopes. Thickness <90 m (<295 ft) southeast of Zuni Reservoir. Thickens northwestward, northward, and northeastward; 168 m (551 ft) thick at Balakai Point, 230 m (754 ft) at Todilto Park, and about 153 m (501 ft) near Smith Lake. Intertongues southwestward with continental beds. East and northeast of Gallup the main body as mapped includes in upper 61 m (200 ft) the D-Cross Tongue and some unnamed tongues of Mancos Shale and Gallup Sandstone. The D-Cross Tongue wedges out southward in the hogback east of Gallup and on East Defiance monocline south of Todilto Park. East of Gallup, but not recognized in Gallup area, the main body includes the Juana Lopez Member, an orange, brown-weathering, fetid highly fossiliferous calcarenite interbedded with dark-gray shale; generally about 14-28 m (45-91 ft) thick; forms benches and cuestas; is as much as 77 m (253 ft) stratigraphically above the top of the Twowells Sandstone Tongue of the Dakota Sandstone

The following additional tongues of the Mancos Shale, listed in descending order, are present in the mapped area and are mapped with other formational units where they are separated from the main body:

Pescado Tongue—Marine shale and sandy shale about 40 m (131 ft) thick where it joins the main body of the Mancos north of Upper Nutria and south of Window Rock; thins southwestward to about 16 m (52 ft) east of Zuni Reservoir. The Pescado Tongue probably correlates with the middle carbonaceous member of the Toreva Formation in the southern part of Black Mesa

Horsehead Tongue of Pike (1947)—Dark-gray marine shale about 12 m (39 ft) thick where it joins the main body of the Mancos southeast of Zuni Reservoir; thins southward and wedges out a few kilometers (few miles) south of mapped area

Whitewater Arroyo Shale Tongue (Kmw*)—Yellowish-brown to yellow fossiliferous shale; about 32 m (104 ft) thick near Smith Lake and 20 m (65 ft)

thick east of Zuni Reservoir; wedges out in main body of Dakota Sandstone 5 km (3 mi.) southeast of St. Michaels and also just south of mapped area
Unnamed tongue in Smith Lake area—About 8 m (26 ft) thick 3 km (2 mi.) south of Casamero Lake; wedges out westward in main body of Dakota Sandstone 8 km (5 mi.) northwest of Thoreau. Probably equivalent of the Clay Mesa Shale Tongue of Mancos (Landis, Dane, and Cobban, 1973) in the Grants-Laguna area east of mapped area

Kmp

SATAN TONGUE OF MANCOS SHALE AND HOSTA TONGUE OF POINT LOOKOUT SANDSTONE (UPPER CRETACEOUS)—Locally mapped together in Crownpoint-Coyote Canyon area

Kgmp

GALLUP SANDSTONE AND MANCOS SHALE (UPPER CRETACEOUS):

Main body of Gallup Sandstone, Pescado Tongue of Mancos Shale, and lower part of Gallup Sandstone mapped together in Manuelito area

Kmpg

Pescado Tongue of Mancos Shale and lower part of Gallup Sandstone mapped together in Black Rock-Ramah area

Kt

TOREVA FORMATION (UPPER CRETACEOUS)—In southeastern Black Mesa consists of a cliff-forming upper sandstone member, yellowish-gray to grayish-orange-pink, fine-grained to conglomeratic, of continental origin; a slope-forming middle carbonaceous member of mostly fluvial and paludal origin; and a crossbedded cliff-forming lower sandstone member, light-brown to pale-yellowish, fine- to medium-grained, and of continental origin. Total average thickness about 91 m (300 ft). The Toreva Formation in southeastern Black Mesa is in part correlative with the lower part of the Gallup Sandstone southwest of Gallup

Kmha

MANCOS SHALE AND UNDERLYING SANDSTONE TONGUE (UPPER CRETACEOUS)—Horsehead Tongue of Pike (1947) of Mancos Shale and underlying sandstone tongue mapped together southeast of Zuni Reservoir. The sandstone tongue (Kma*), a wedge of coaly sandstone and sandy carbonaceous shale 0-40 m (130 ft) thick, thickens southward and was mapped by Pike (1947) as the Atarque Member of Mesaverde Formation

Ka

DAKOTA SANDSTONE (UPPER AND LOWER CRETACEOUS):

Main body—Cliff-forming layers of lenticular fluvial and littoral commonly crossbedded very pale orange or pale-brown fine- to coarse-grained sandstone interbedded with slope-, bench-, or niche-forming yellowish-gray to olive mudstone and dark-gray or brown carbonaceous shale and coal; local basal quartz-, quartzite-, and chert-pebble conglomerate. Formation sparsely fossiliferous. Thickness 15-92 m (50-300 ft); average thickness about 46 m (150 ft). Upper part intertongues with Mancos Shale. Contains small uranium deposits

In the mapped area the Dakota Sandstone includes the following subdivisions which are not shown separately:

Twowells Sandstone Tongue—Yellowish-brown to buff medium- to fine-grained well-sorted sandstone; locally contains lenticular beds of silty shale and fossiliferous limestone; locally present in eastern half of mapped area. Thickness 2 m (7 ft) at eastern border of map, about 11 m (35 ft) near Zuni Reservoir; joins main body of Dakota north of Manuelito and south of mapped area

Kma

Kmdm

Kdm

Kdml

Jm

MANCOS SHALE AND DAKOTA SANDSTONE

Mancos Shale and Dakota Sandstone—Locally mapped together in Black Mesa basin

Main body of Mancos Shale, Twowells Sandstone Tongue of Dakota Sandstone, and Whitewater Arroyo Shale Tongue of Mancos Shale

Twowells Sandstone Tongue of Dakota Sandstone and Whitewater Arroyo Shale Tongue of Mancos Shale

Unnamed tongues of Dakota Sandstone, intervening lowermost tongue of Mancos Shale, and underlying unit of Dakota Sandstone—Probably equivalent in descending order to Paguate Sandstone Tongue of the Dakota Sandstone, Clay Mesa Shale Tongue of the Mancos Shale, Cubero Sandstone Tongue of the Dakota Sandstone, and upper part of the Oak Canyon Member of the Dakota Sandstone

Jmw

MORRISON FORMATION (UPPER JURASSIC)—Continental sequence of variegated mudstone, claystone, and sandstone. Consists of the Brushy Basin, Westwater Canyon, and Recapture Members in the mapped area. Thins southward from a maximum thickness of 168 m (551 ft) in Todilto Park to zero in south-central part of mapped area

Brushy Basin Member (Jmb*)—Greenish- to purplish-gray bentonitic claystone and sandy siltstone containing yellowish-brown, pink, and white fine- to coarse-grained sandstone lenses; fluvial and lacustrine deposits; slope former. Thickness 37 m (121 ft) at eastern margin of mapped area; thins westward to a wedge edge. Contains uranium deposits. On the north flank of Zuni Mountains the Brushy Basin Member is the Casamero Member of the Morrison Formation of Smith (1967)

Westwater Canyon Member—Yellowish-gray to reddish-brown fine- to coarse-grained fluvial crossbedded sandstone; locally contains stringers and layers of pebbles and lenses of reddish-brown to purplish-gray claystone and siltstone; forms ledgy cliff and steep slopes. Thickness 0-92 m (0-301 ft); southward thinning due to pre-Dakota erosion, but may in part grade laterally into Cow Springs Sandstone; intertongues with Brushy Basin Member. Contains numerous uranium deposits. On north flank of Zuni Mountains the Westwater Canyon Member is the Prewitt Member of the Morrison Formation of Smith (1954 and 1957)

Jmr

Recapture Member—Alternating beds of reddish-brown claystone and silty claystone and light-gray to greenish-white fine- to medium-grained well-sorted sandstone; of fluvial origin; forms steep color-banded slopes. Thickness ranges from about 70 m (229 ft) at Todilto Park to 40 m (131 ft) north of Prewitt; thins southward to a wedge edge by intertonguing and lateral gradation into Cow Springs Sandstone. Contains uranium deposits. From North Guam to its wedge out along the Nutria monocline south of Gallup, a lower persistent tongue is mapped with the Cow Springs Sandstone. On the north flank of the Zuni

Jmwr

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Je

Mountains the Recapture Member is the Chavez Member of the Morrison Formation of Smith (1954 and 1957)

Westwater Canyon and Recapture Members

COW SPRINGS SANDSTONE (UPPER JURASSIC)—

Light-greenish-gray to gray and light-reddish-brown to pale-orange fine- to medium-grained crossbedded and flat-bedded sandstone and silty sandstone. About 61 m (200 ft) thick at Todilto Park, 46 m (150 ft) thick north of Prewitt; thickens southwestward to about 158 m (518 ft) near Zuni Reservoir. Weathers to vertical cliffs or smooth rounded surfaces. Mostly eolian, but locally of fluvial and lacustrine origin. Intertongues and in part grades laterally into Summerville Formation and the Recapture and possibly the Westwater Canyon Members of the Morrison Formation. East of Fort Wingate the upper third of unit is predominantly eolian and tongues out near Prewitt into the lower and predominantly fluvial part. The lower fluvial facies, previously mapped as Bluff Sandstone (Green and Pierson, 1971) is now assigned to the Cow Springs Sandstone (Green, 1976)

In the Black Mesa area the Cow Springs includes lateral equivalents of the Summerville Formation

In the Lupton-Zuni Reservoir area the Cow Springs may include some lateral equivalents of the Morrison Formation. In this same area the Cow Springs Sandstone is the Zuni Sandstone of Dutton (1885, p. 137) and Dane and Bachman (1957), and on the flanks of the Zuni Mountains the Thoreau Formation of Smith (1954 and 1957, p. 57)

SUMMERVILLE FORMATION (UPPER JURASSIC)—



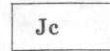
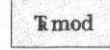




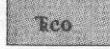

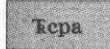
Reddish-brown to light-orange very fine- to fine-grained flat-bedded silty sandstone and reddish-brown thin-bedded claystone and siltstone; mainly shallow water and mudflat deposits; forms banded steep slopes and cliffs; becomes increasingly sandy southward. Grades into Cow Springs Sandstone south of Todilto Park and along the Nutria monocline (M. W. Green, oral commun., 1973). As much as 61 m (200 ft) thick in Todilto Park

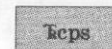
COW SPRINGS SANDSTONE AND SUMMERVILLE FORMATION

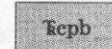
TODILTO LIMESTONE (UPPER JURASSIC)—Light- to dark-gray thin-bedded limestone, locally containing small secondary calcite crystals; lower third commonly laminated sandy limestone. Abnormal marine or saline lacustrine deposit. About 9 m (30 ft) thick near Prewitt and 7 m (23 ft) at Todilto Park; thins southwestward to limit of deposition just south of Todilto Park and north-northeast of Gallup. Contains small uranium deposits

ENTRADA SANDSTONE (UPPER JURASSIC)—Reddish-orange to reddish-brown fine- to medium-grained eolian crossbedded sandstone and dark-reddish-brown clayey siltstone and very fine grained silty sandstone of subaqueous origin. Thickness 183 m (600 ft) near Fort Wingate; thins in all directions. Sandstone units are prominent cliff formers; silty units weather to pinnacles or rounded pillars called hoodoos. In much of mapped area Entrada comprises three lithologic subdivisions, not uniformly correlated throughout map (O'Sullivan and Craig, 1973). East of Gallup includes a sandstone previously mapped as the Lukachukai Member of the Wingate Sandstone, but which is now assigned to the Iyanbito Member of the Entrada (Green, 1974)

Geologic Map Explanation, continued

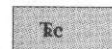
-  TODILTO LIMESTONE AND ENTRADA SANDSTONE
-  COW SPRINGS SANDSTONE AND ENTRADA SANDSTONE
-  CARMEL FORMATION (UPPER AND MIDDLE JURASSIC)—Reddish-orange or yellowish-gray fine- to medium-grained ledge-forming sandstone and dark-reddish-brown, in places silty and sandy, slope-forming shale; mostly of fluvial or marginal marine origin; becomes more shaly northward and more sandy southward. Thickens from 19 m (63 ft) west of Ganado to 46 m (150 ft) at the northwestern edge of map. Either wedges out eastward or, as suggested by O'Sullivan and Craig (1973, p. 79), may grade into the lower part of the Entrada Sandstone in the Lupton area and the Iyanbito Member (Green, 1974) of the Entrada Sandstone in the Gallup-Grants area
-  DINOSAUR CANYON SANDSTONE MEMBER OF MOENAVE FORMATION (UPPER TRIASSIC?)—Moderate-reddish-orange to light-brown very fine- to medium-grained lenticular crossbedded and flat-bedded sandstone, silty sandstone, and siltstone; generally a cliff former; mostly fluvial. Present only in northwest part of mapped area. It is 25 m (81 ft) thick 11 km (7 mi.) west of Ganado and rapidly thins northward to a wedge edge
-  WINGATE SANDSTONE (UPPER TRIASSIC)
-  Lukachukai Member—Uniformly moderate-reddish-orange to light-brown very fine- to fine-grained crossbedded cliff-forming sandstone of eolian origin. Present only in northwestern part of mapped area; inferred eastern wedge-out several kilometers (miles) west of Ganado. Thickens northward to about 31 m (100 ft) at map edge
-  Rock Point Member—Reddish-orange and reddish-brown siltstone and spotted light-greenish-gray very fine grained sandstone; forms ledges and slopes. Mostly of flood-plain and lagoonal origin; becomes more fluvial in Lupton-Zuni Reservoir area. Thickness as much as 153 m (500 ft) in western part of mapped area; about 45 m (150 ft) on East Defiance monocline; wedges out northward on Nutria monocline southeast of Gallup (M. W. Green, oral commun., 1973); not present in Gallup-Thoreau area
-  CHINLE FORMATION (UPPER TRIASSIC)—Varicolored terrestrial deposits, predominantly shale in upper part and sandstone in lower part. In most of mapped area 366-457 m (1,200-1,500 ft) thick; thins generally northwestward from Zuni Mountains; all members intertongue
-  Owl Rock Member—Mottled very pale blue to greenish-gray and pink limestone, silty limestone, and chert-nodule limestone, interbedded with reddish-orange to greenish-purple claystone and siltstone; mostly of lacustrine origin; locally contains lenses of lime-pellet conglomerate and chert-limestone breccia; forms ledgy slopes. Thickness 98 m (321 ft) at Todilto Park; thins southeastward; absent in southeast part of mapped area
-  Petrified Forest Member—Variegated claystone, siltstone, and minor amounts of sandstone and locally petrified wood; slope and ledge former. Thickness about 381 m (1,250 ft) in Thoreau area; thins westward. Three subdivisions generally present, but not everywhere mapped separately. Contains small "channel-type" uranium deposits
-  Upper part—Banded moderate-grayish-red to pale-reddish-brown and purple flat-bedded mudstone,

 Selsela Sandstone Bed—Mainly light-gray to yellowish-brown very fine grained to conglomeratic channel sandstone and several minor but similar sandstone beds separated by layers of bluish-gray mudstone and siltstone; forms ledges and benches. As much as 50 m (164 ft) thick at Fort Defiance; thins to east, south, and west

 Lower part—Slate-blue to gray and reddish-purple broad channel deposits of mudstone and lesser but varying amounts of tuffaceous siltstone and sandstone; forms badlands and rolling slopes. About 76 m (250 ft) thick in Thoreau and Chambers area; thins southeastward

 Owl Rock Member and upper part of Petrified Forest Member

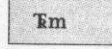
 Monitor Butte Member—In Defiance Plateau, predominantly dusky- to grayish-red claystone and sandy siltstone; some grayish-red lenticular beds of sandstone and limestone-pebble conglomerate; mostly of fluvial origin. In the Zuni Mountains, where it is not differentiated, it consists of an upper very fine- to fine-grained crossbedded sandstone about 10 m (33 ft) thick and a lower siltstone as much as 107 m (350 ft) thick. Forms irregular ledges and slopes. Thickest in Zuni Mountains—about 119 m (390 ft). Contains several "channel-type" uranium deposits in the Defiance Plateau and Fort Wingate areas

 Owl Rock, Petrified Forest, and Monitor Butte Members

 Shinarump Member—Yellowish-orange to yellowish-gray and grayish-purple very fine to very coarse grained fluvial quartzose and conglomeratic sandstone and lesser amounts of pale-red to light-greenish-gray mudstone; forms cliff or ledge. Thickness 0-30 m (100 ft); locally absent in Ganado-Fluted Rock area and in Zuni Mountains. Contains uranium deposits

 MOENKOPI FORMATION (MIDDLE? AND LOWER TRIASSIC):

 Holbrook Member—Pale-red thin- to thick-bedded very fine to fine-grained lenticular and wedge-shaped sandstones, silty sandstones, and mudstones, and some lenticular limestones and mud-chip conglomerates of fluvial, deltaic, and lagoonal origin; weathers to moderate to steep slopes. Thickness 0-49 m (0-160 ft); thickens westward

 MOENKOPI(?) FORMATION—Continental and near-marine sedimentary rocks of questionable Moenkopi age in Zuni Mountains (Cooley and others, 1969). The exact relationship of this unit to the Holbrook Member and possibly other members of the Moenkopi Formation in Arizona is not known. Mapped separately only in a small area southwest of Fort Wingate. The Moenkopi(?) includes greenish- or yellowish-white to reddish-brown lenticular siltstone, mudstone, and silty sandstone; crossbedded very fine to fine-grained sandstone; conglomerate contains quartz, quartzite, and jasper pebbles; locally a basal limestone breccia cemented with chert. Forms ledges and steep slopes. Locally absent and generally < 15 m (< 50 ft) thick

siltstone, and sandy siltstone of fluvial origin; forms badlands and rolling slopes. Thickens generally eastward to about 275 m (902 ft) in Thoreau area. In same general area may include the Correo Sandstone Bed of the Petrified Forest Member, about 8 m (27 ft) thick

Sonsela Sandstone Bed—Mainly light-gray to yellowish-brown very fine grained to conglomeratic channel sandstone and several minor but similar sandstone beds separated by layers of bluish-gray mudstone and siltstone; forms ledges and benches. As much as 50 m (164 ft) thick at Fort Defiance; thins to east, south, and west

Lower part—Slate-blue to gray and reddish-purple broad channel deposits of mudstone and lesser but varying amounts of tuffaceous siltstone and sandstone; forms badlands and rolling slopes. About 76 m (250 ft) thick in Thoreau and Chambers area; thins southeastward

Owl Rock Member and upper part of Petrified Forest Member

Monitor Butte Member—In Defiance Plateau, predominantly dusky- to grayish-red claystone and sandy siltstone; some grayish-red lenticular beds of sandstone and limestone-pebble conglomerate; mostly of fluvial origin. In the Zuni Mountains, where it is not differentiated, it consists of an upper very fine- to fine-grained crossbedded sandstone about 10 m (33 ft) thick and a lower siltstone as much as 107 m (350 ft) thick. Forms irregular ledges and slopes. Thickest in Zuni Mountains—about 119 m (390 ft). Contains several "channel-type" uranium deposits in the Defiance Plateau and Fort Wingate areas

Owl Rock, Petrified Forest, and Monitor Butte Members


Shinarump Member—Yellowish-orange to yellowish-gray and grayish-purple very fine to very coarse grained fluvial quartzose and conglomeratic sandstone and lesser amounts of pale-red to light-greenish-gray mudstone; forms cliff or ledge. Thickness 0-30 m (100 ft); locally absent in Ganado-Fluted Rock area and in Zuni Mountains. Contains uranium deposits

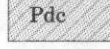
In southern part of Defiance Plateau map unit also includes a northward-thinning wedge of the overlying Mesa Redondo Member, a very dark red to purple, mottled grayish-red, very fine- to coarse-grained sandstone, locally conglomeratic; of fluvial origin; 0-9 m (30 ft) thick

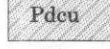
MOENKOPI FORMATION (MIDDLE? AND LOWER TRIASSIC):

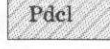
Holbrook Member—Pale-red thin- to thick-bedded very fine to fine-grained lenticular and wedge-shaped sandstones, silty sandstones, and mudstones, and some lenticular limestones and mud-chip conglomerates of fluvial, deltaic, and lagoonal origin; weathers to moderate to steep slopes. Thickness 0-49 m (0-160 ft); thickens westward

MOENKOPI(?) FORMATION—Continental and near-marine sedimentary rocks of questionable Moenkopi age in Zuni Mountains (Cooley and others, 1969). The exact relationship of this unit to the Holbrook Member and possibly other members of the Moenkopi Formation in Arizona is not known. Mapped separately only in a small area southwest of Fort Wingate. The Moenkopi(?) includes greenish- or yellowish-white to reddish-brown lenticular siltstone, mudstone, and silty sandstone; crossbedded very fine to fine-grained sandstone; conglomerate contains quartz, quartzite, and jasper pebbles; locally a basal limestone breccia cemented with chert. Forms ledges and steep slopes. Locally absent and generally < 15 m (< 50 ft) thick

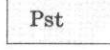
 LOWER PART OF CHINLE FORMATION AND MOENKOPI(?) FORMATION—In most of Zuni Mountains includes the lower part of the Petrified Forest Member, the Monitor Butte Member, and, where present, the Shinarump Member of the Chinle Formation and the Moenkopi(?) Formation. Along a part of the Nutria monocline near Grasshopper Spring includes all the Chinle Formation and the Moenkopi(?) Formation. In a small area southeast of Fort Wingate includes only the Monitor Butte Member and Shinarump Member of the Chinle Formation and the Moenkopi(?) Formation

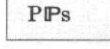
 CHELLY SANDSTONE (LOWER PERMIAN)—Undivided in northern part of Defiance Plateau; as mapped includes a northwest-thinning tongue of Supai Formation

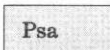
 Upper member—Grayish-orange-pink to moderate-reddish-orange fine- to medium-grained crossbedded sandstone of littoral origin; forms vertical cliffs or flat even-stripped surface. About 76 m (250 ft) thick; thickens to northwest


 Lower member—Moderate-reddish-orange fine- to medium-grained crossbedded sandstone and flat-bedded silty sandstone; of littoral origin; forms vertical cliff in canyon walls. Thickness 0-61 m (0-200 ft); thins southeastward to a wedge edge

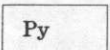
SUPAI FORMATION (LOWER PERMIAN AND PENNSYLVANIAN):

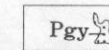
 Upper tongue (Lower Permian)—Alternating moderate-reddish-brown and moderate-reddish-orange fine-grained thin- to thick-bedded sandstone and siltstone, some crossbedding, of mostly flood-plain origin; forms irregular ledges and slopes. About 72 m (235 ft) thick where it joins in subsurface the main body of Supai on Defiance Plateau; thins northwestward


 Main body (Lower Permian and Pennsylvanian)—Predominantly alternating moderate-reddish-brown and moderate-reddish-orange fine-grained thin- to thick-bedded sandstone and siltstone mostly of flood-plain origin; subordinate beds of impure limestone of probable lagoonal origin, mudstone-pebble conglomerate, gypsum beds, and basal conglomerate; forms irregular ledges and slopes. About 152 m (500 ft) thick in Quartzite Canyon; thickens to about 579 m (1,900 ft) in subsurface in southwest corner of mapped area. The Supai is only of Early Permian age on Defiance Plateau (Irwin, Stevens, and Cooley, 1971, p. 11, pl. 2). To the northwest, west, and southwest in subsurface it is Permian and Pennsylvanian in age

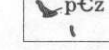
 SAN ANDRES LIMESTONE (LOWER PERMIAN)—Mostly gray to yellow thick-bedded fossiliferous cavernous dolomitic limestone of marine origin. Forms cliff or persistent dip slope; a sandstone bed about 6 m (20 ft) thick locally present in lower part. Thickness 15-44 m (50-145 ft); locally absent in Zuni Mountains; thickens to southeast

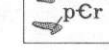
 GLORIETA SANDSTONE (LOWER PERMIAN)—White to buff very pure well-sorted medium-grained crossbedded quartz sandstone weathering yellow to light brown; well cemented with silica or calcite; of littoral origin; forms cliff, ridge, or long persistent dip slope. Thins southeastward in Zuni Mountains from about 92 m (300 ft) near McGaffey to about 46 m (150 ft) in southeast corner of mapped area


 YESO FORMATION (LOWER PERMIAN)—Pale-reddish-brown medium- to fine-grained thick- and thin-bedded locally crossbedded sandstone and siltstone grades upward into pink, white, and yellow alternating layers of friable sandstone; several limestone and gypsum beds present in upper part of formation,

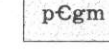
 GLORIETA SANDSTONE AND YESO FORMATION

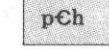
 ABO FORMATION (LOWER PERMIAN)—Moderate-red (brick-red) to dusky-red medium- to fine-grained sandstone and siltstone mostly of flood-plain origin. Forms cliffs and steep slopes. Thickness of 92-305 m (300-1,000 ft). Locally, at base of map unit, arkosic conglomerate and sandstone and medium-gray limestone beds, which are all of questionable Pennsylvanian age (Read and Wanek, 1961, p. 3), are mapped with the Abo

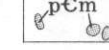
 PRECAMBRIAN(?) ROCKS OF DEFIANCE PLATEAU—Gray or purple fine-grained siliceous well-bedded quartzite; some ripple marks and slate-pebble conglomerate lenses


 PRECAMBRIAN ROCKS OF DEFIANCE PLATEAU—Granite, quartzite, schist, silicified limestone, greenstone, and low-grade phyllite


 PRECAMBRIAN ROCKS OF ZUNI MOUNTAINS—In Zuni Mountains Precambrian rocks have been mapped by E. N. Goddard (1966) in detail only east of 108°15' longitude

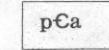
 Gneissic granite (composite unit west of 108°15')—Predominantly reddish-pink gneissic granite and lesser amounts of metarhyolite. Locally includes dark-green to almost black schist (mainly chlorite), pale-pink gneiss, and irregular veins of white quartz

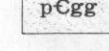
 Hornblende, gabbro, and intrusive basalt—Dikes and small irregular bodies; locally bordered by hornblende granite


 Metarhyolite—Pale-red to grayish-orange-pink well-foliated metarhyolite composed of abundant small ellipsoidal quartz metacrysts in a fine-grained ground-mass of quartz, orthoclase, and some biotite; altered to quartz-sericite schist where sheared; lineation shown by ellipsoidal quartz grains

 Porphyritic aplite—Moderate-orange-pink slightly gneissic porphyritic aplite consisting of scattered microcline phenocrysts in medium-grained ground-mass of quartz, orthoclase, and minor biotite. Stocks and dikes intrude gneissic granite, and one irregular dike intrudes gneissic aplite. In southeast corner of mapped area locally includes some quartz monzonite gneiss

 Gneissic aplite—Grayish- to moderate-orange-pink sugary well-foliated gneissic aplite consisting of microcline, quartz, some orthoclase and oligoclase, and minor amounts of muscovite and biotite. In irregular masses and dikes intruding, but locally gradational with, the gneissic granite. Locally includes some biotite schist

 Aplitic granite—Grayish- to moderate-orange-pink gneissic fine- to medium-grained aplitic granite; gradational with gneissic granite; composed of potassium feldspar, quartz, and small amounts of oligoclase, biotite, and muscovite

 Gneissic granite—Pinkish- to medium-gray fine- to coarse-grained and locally porphyritic gneissic granite; composed of orthoclase, quartz, oligoclase, and abundant hornblende and biotite. Part of an unnamed batholith. Locally, includes some younger diorite and monzonite dikes, biotite granite, porphyritic granite, syenite, quartzite, biotite schist, quartz monzonite gneiss, and injection gneiss

 Hornblende gneiss and associated rocks—Dark-green gneiss containing lenses of gneissic gabbro and layers of aplite

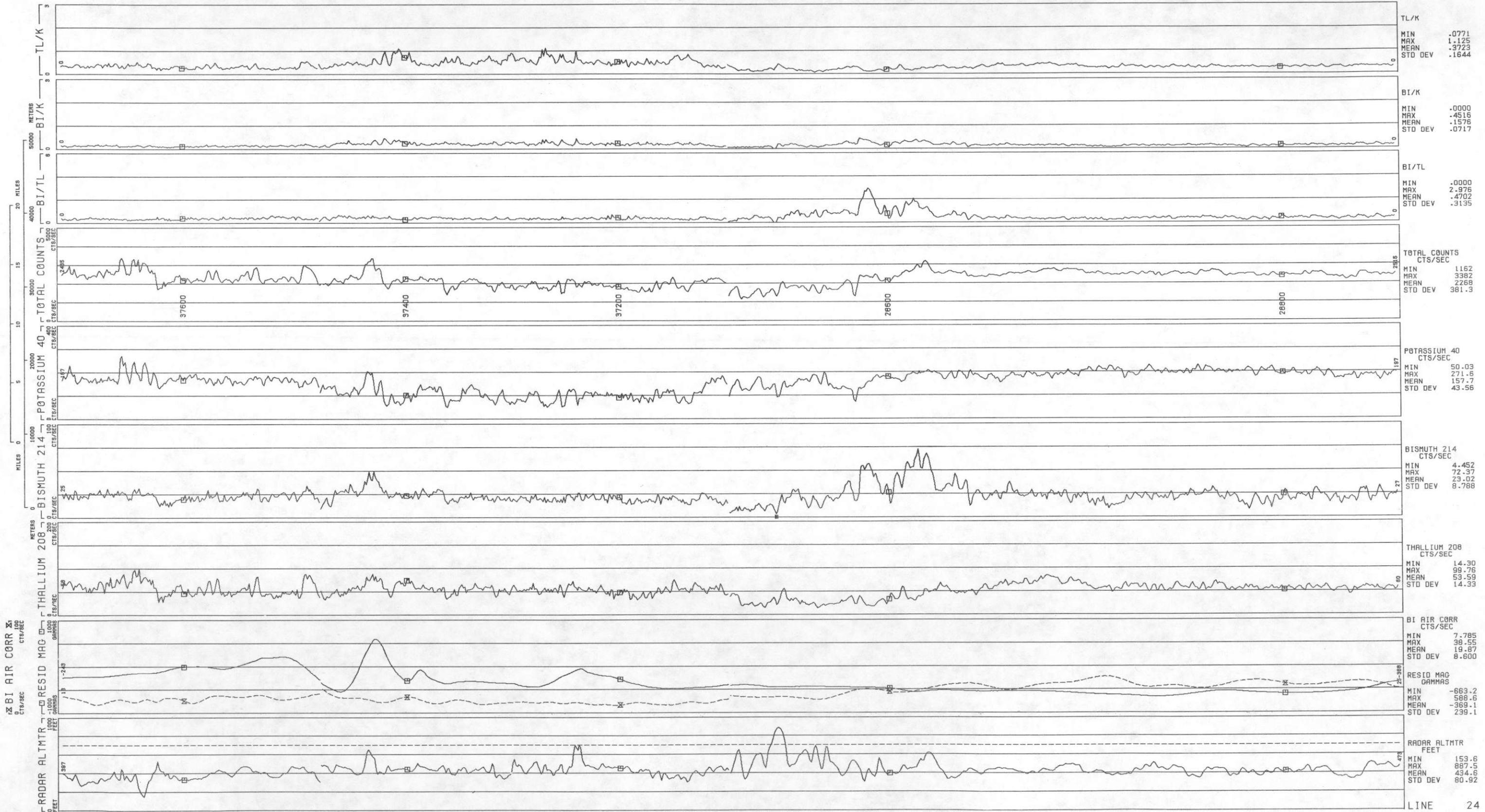
*Indicates letter symbol for a stratigraphic unit that is not mapped separately but limit or wedgeout is shown on map and schematic diagram

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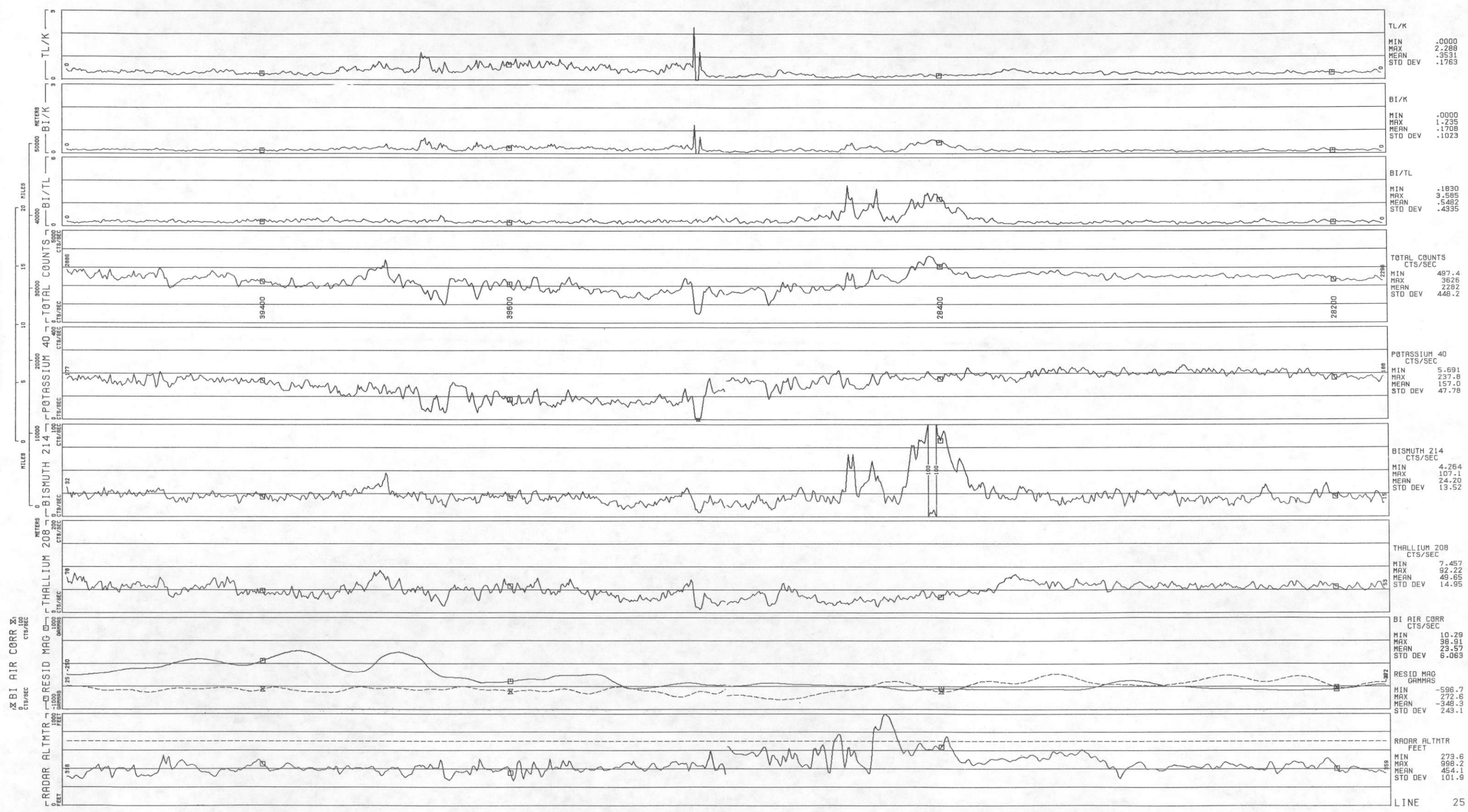
APPENDIX B - Profiles

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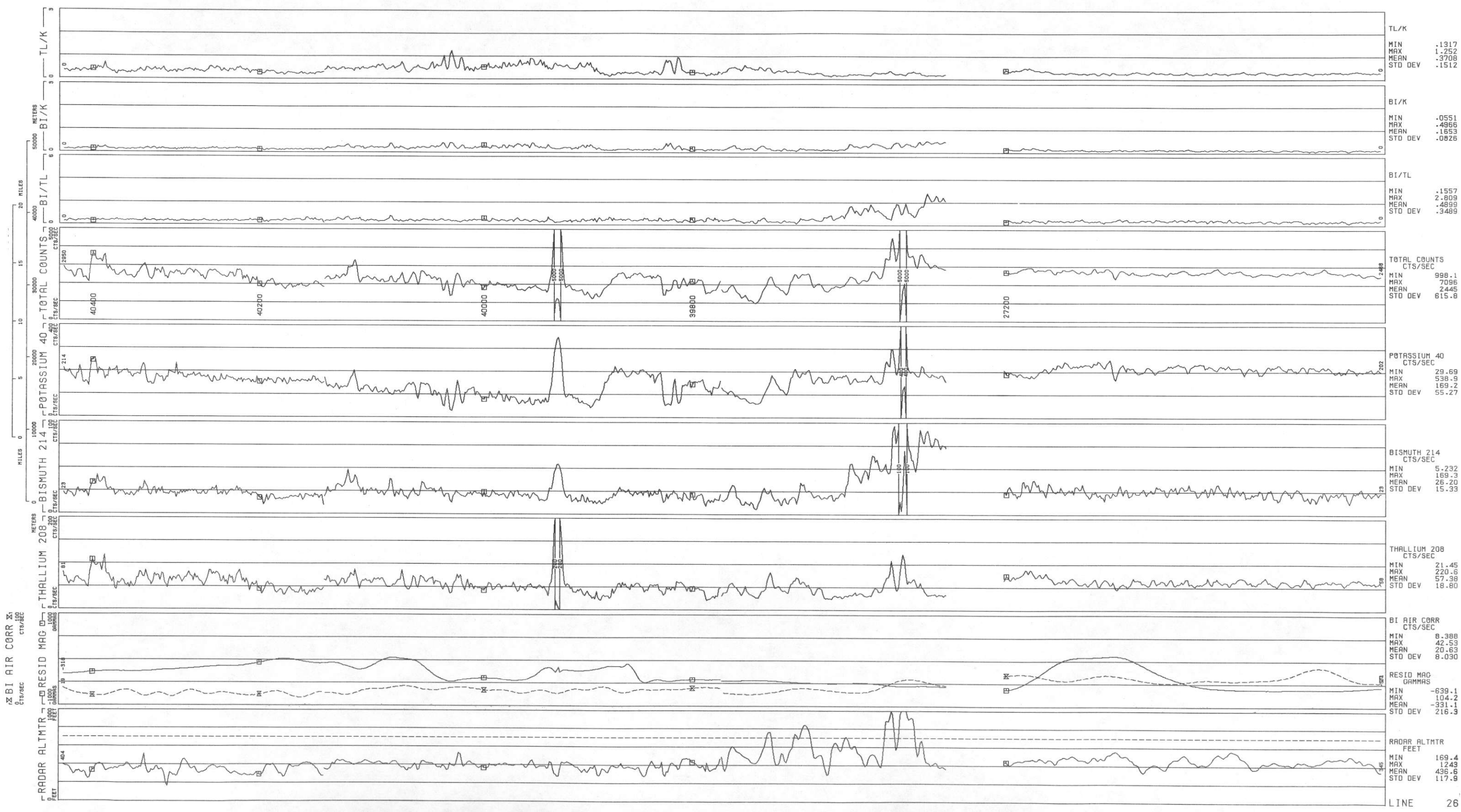


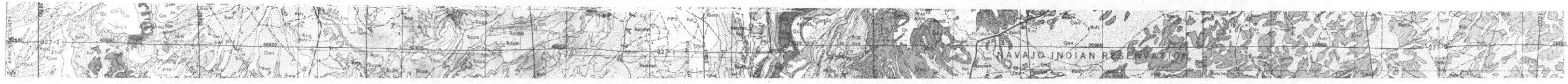


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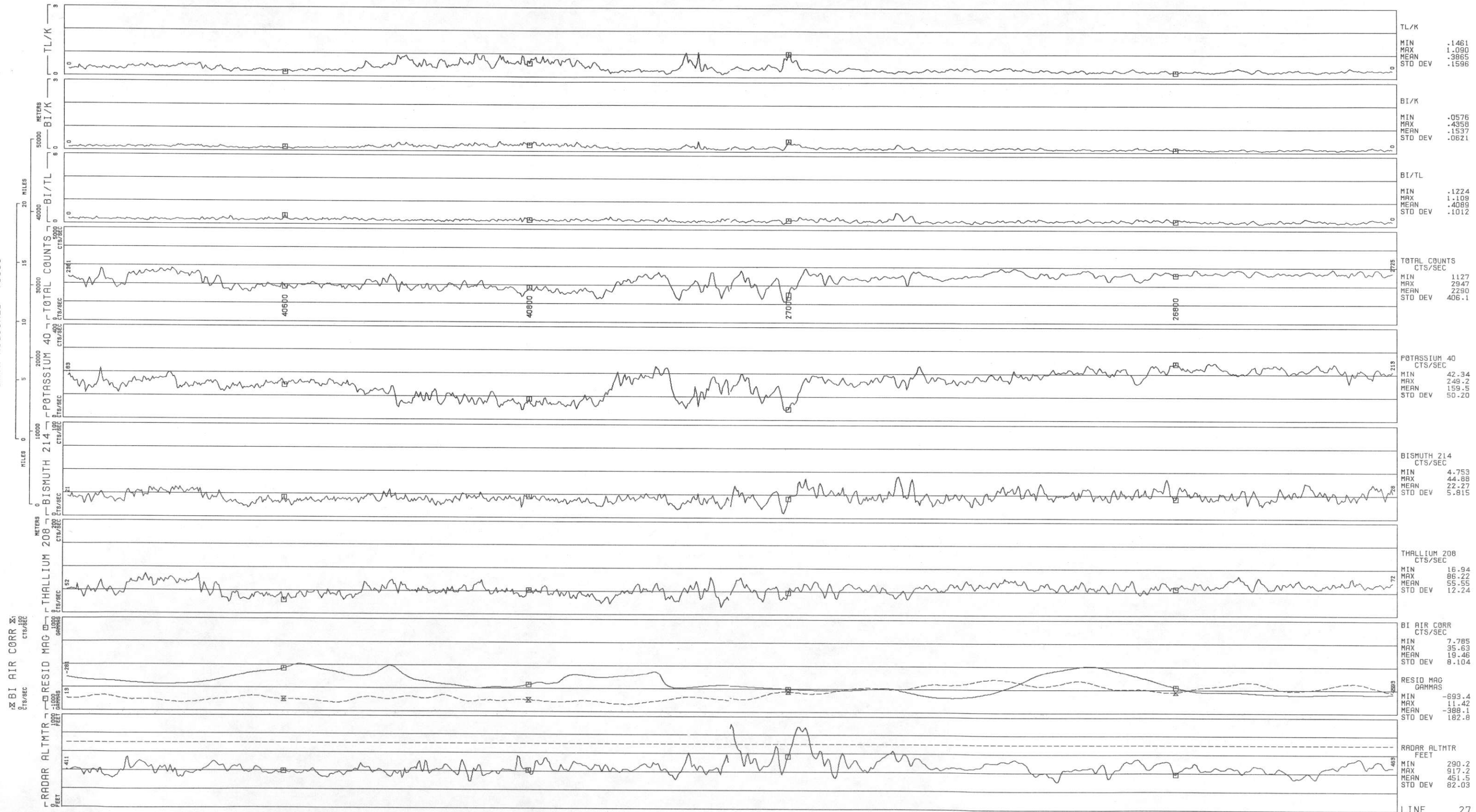


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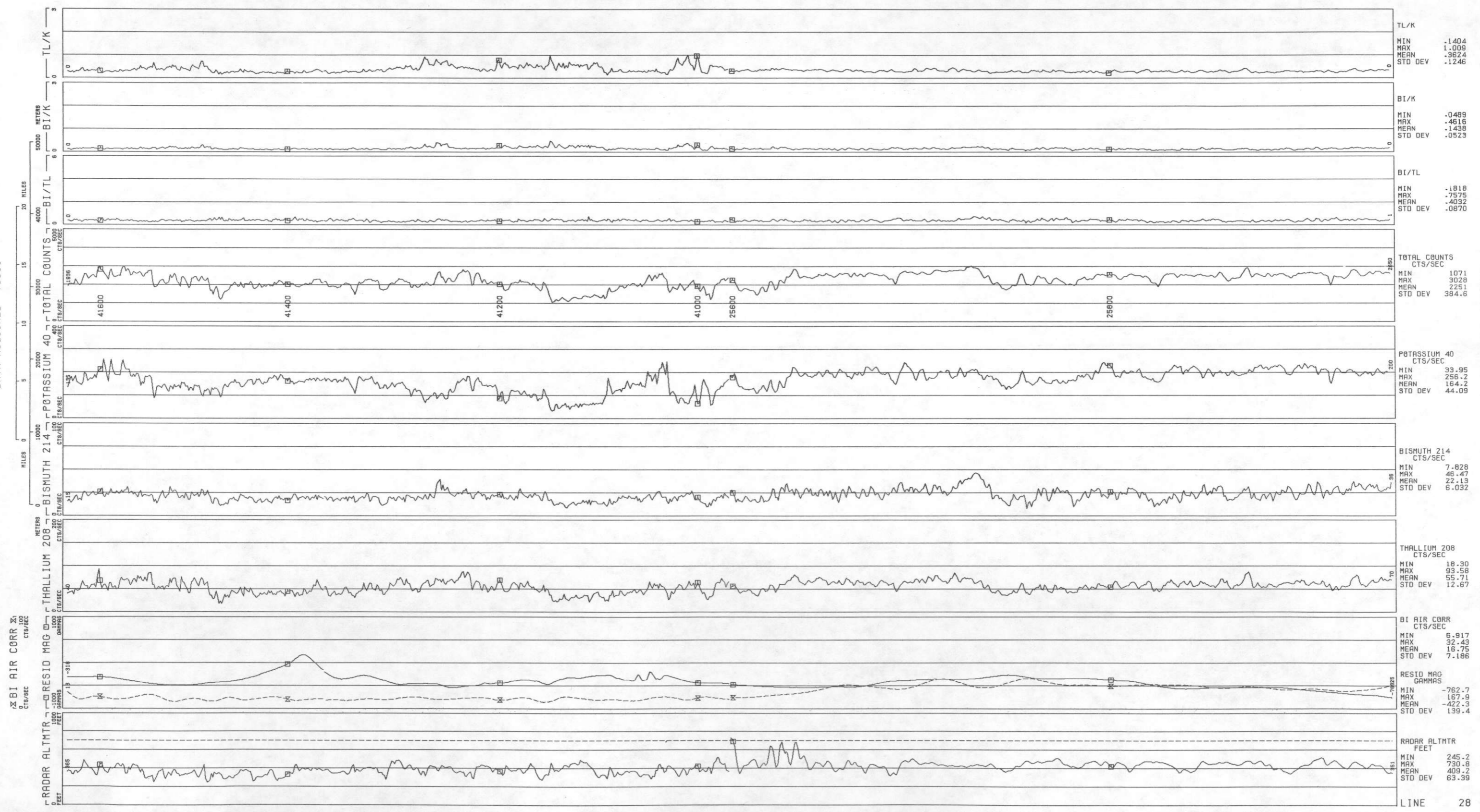


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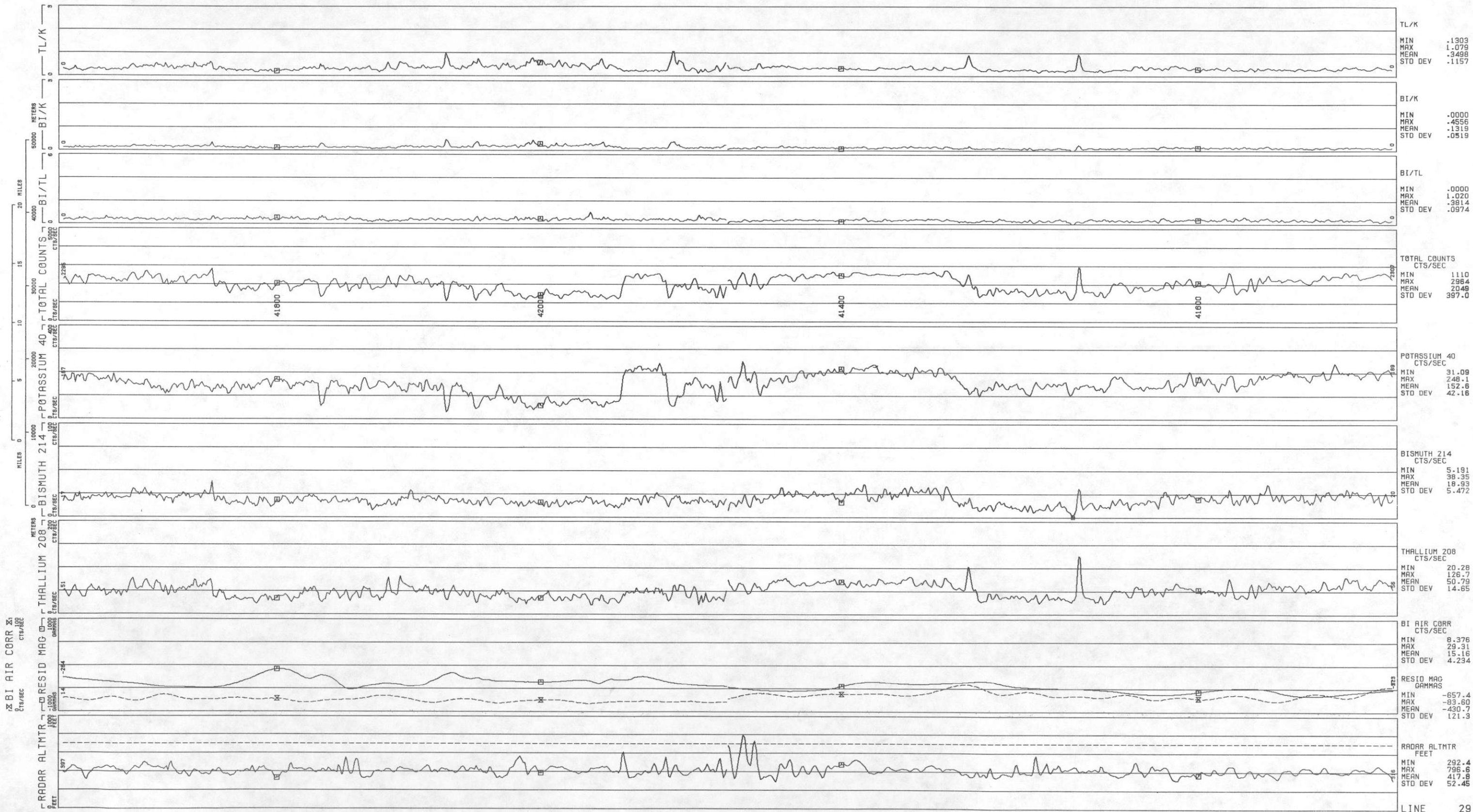


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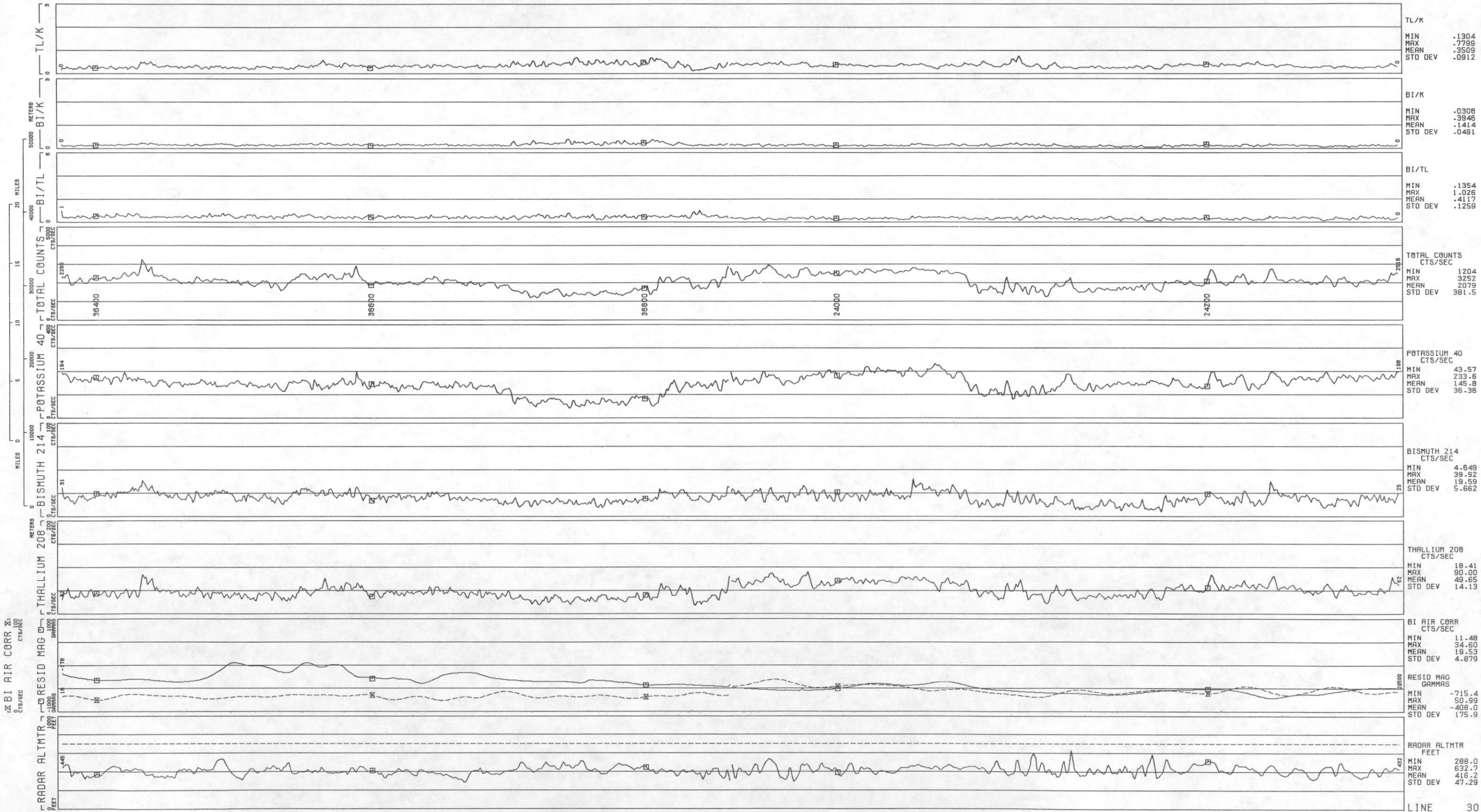


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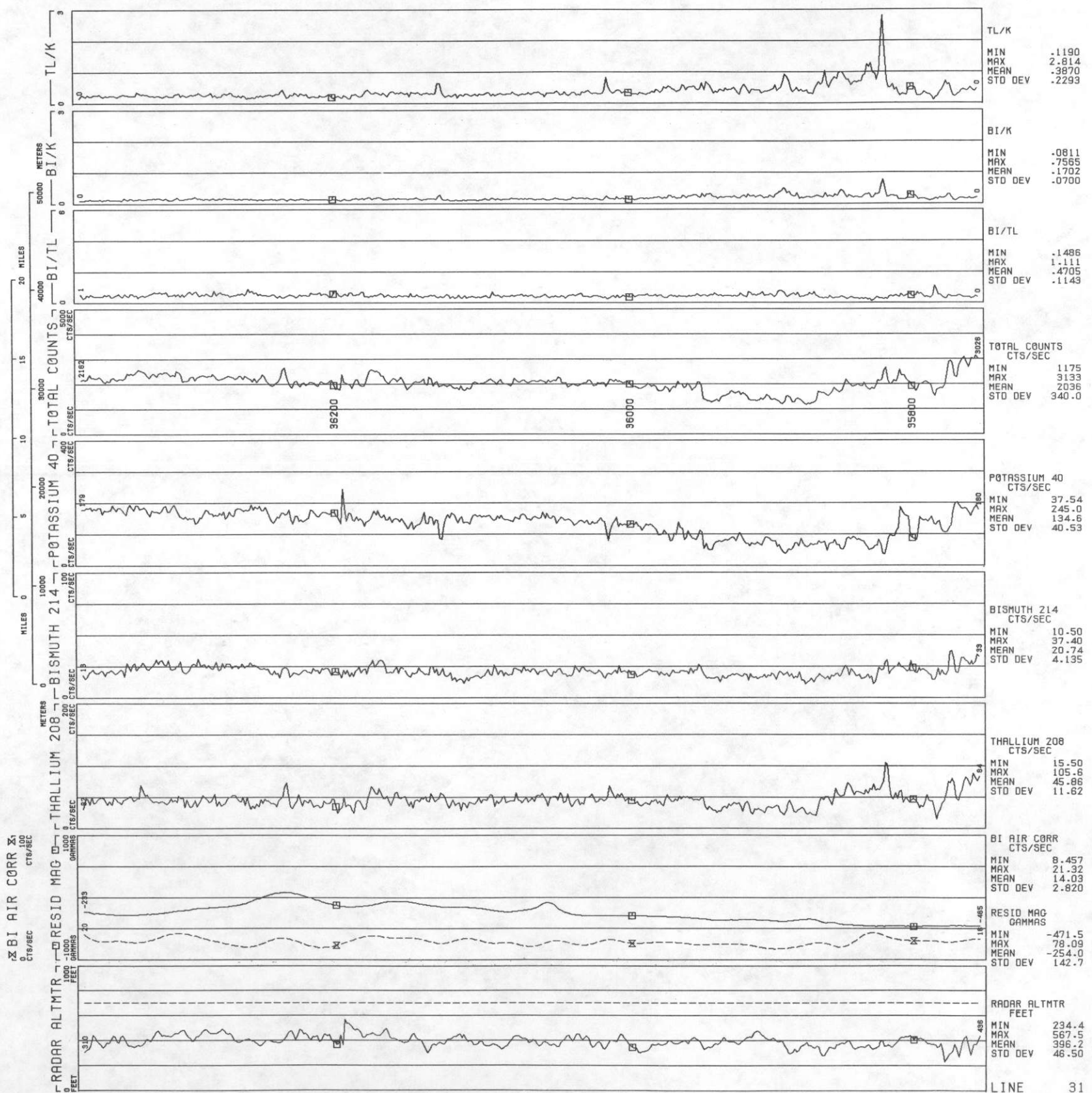


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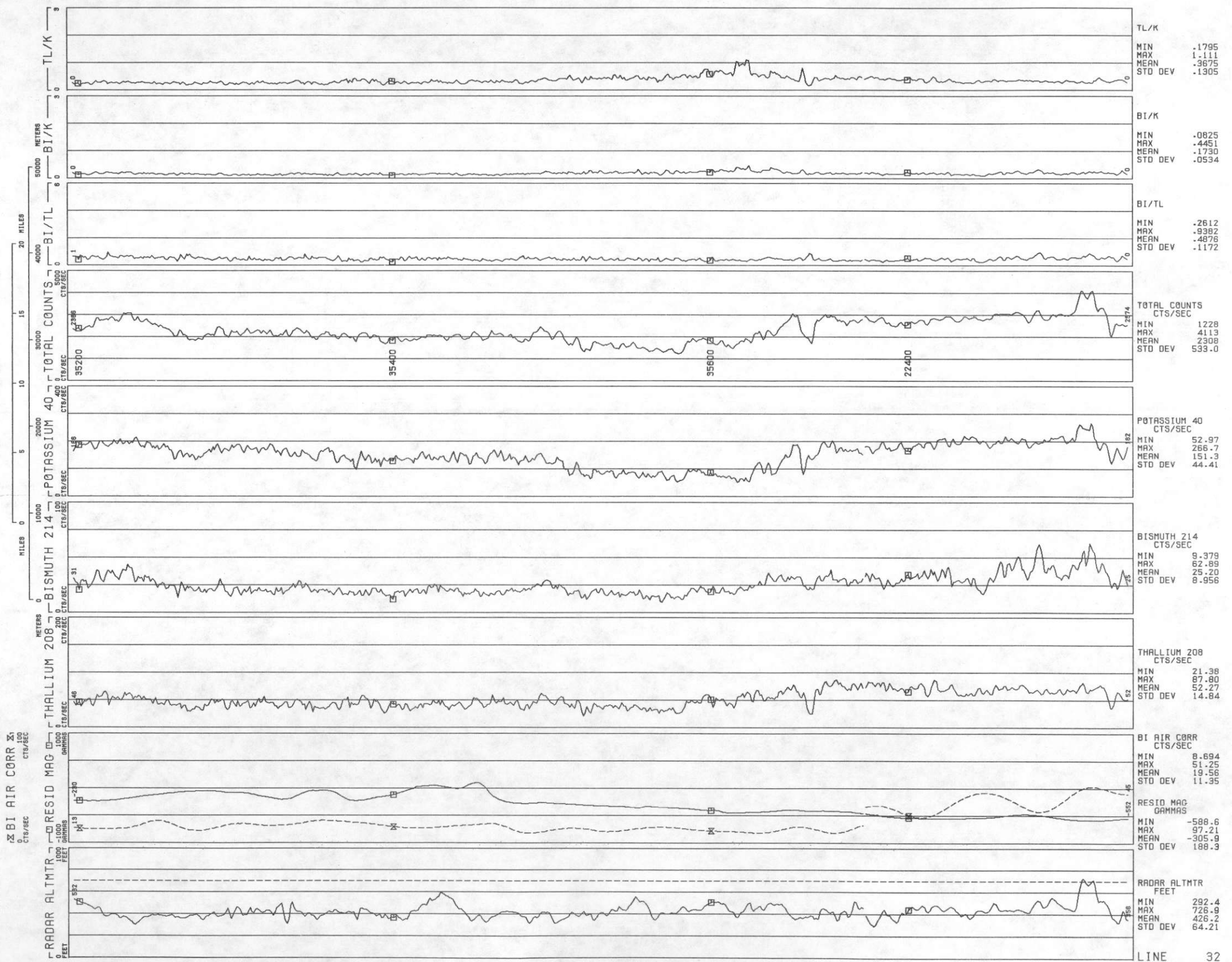


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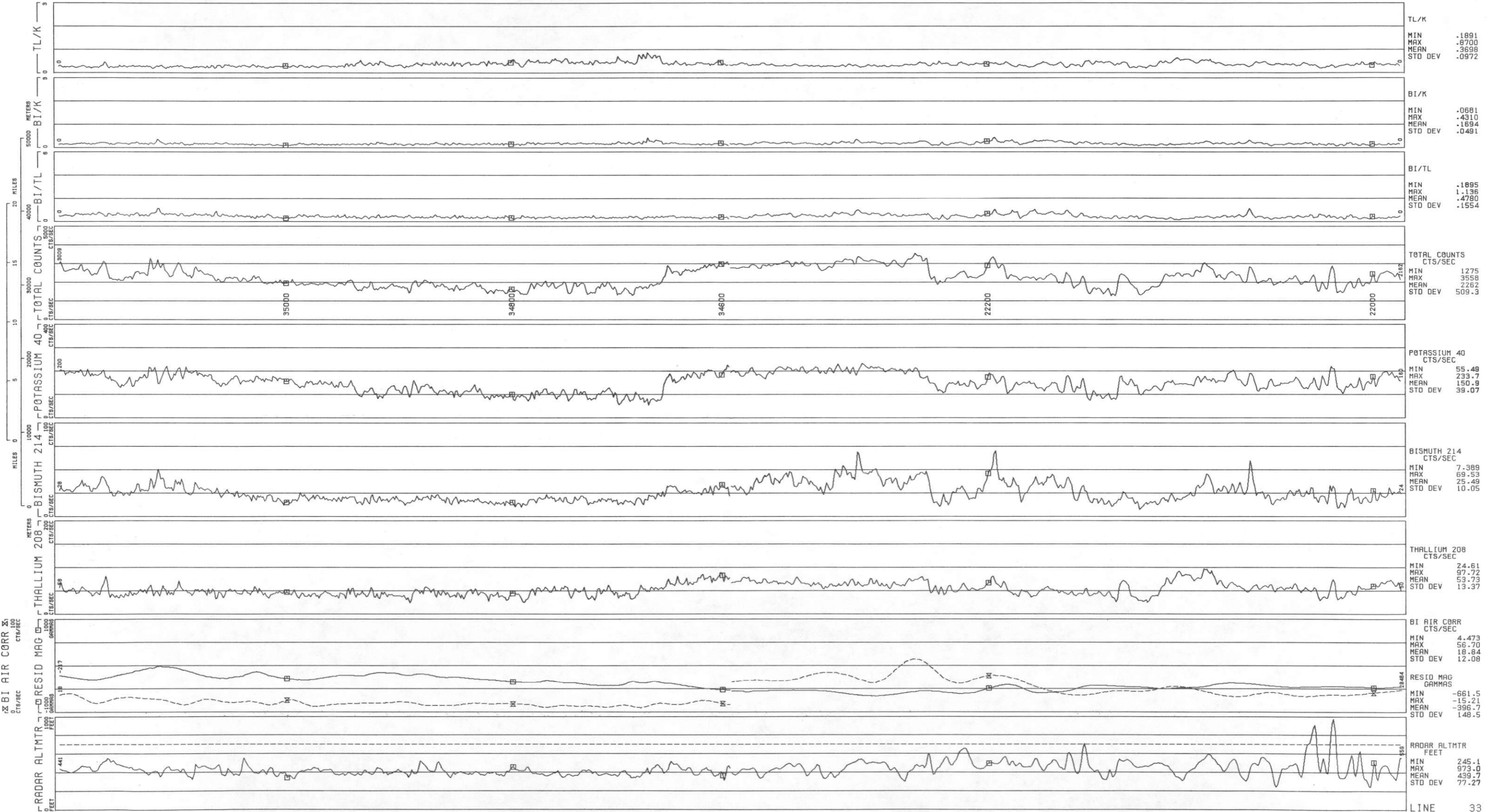


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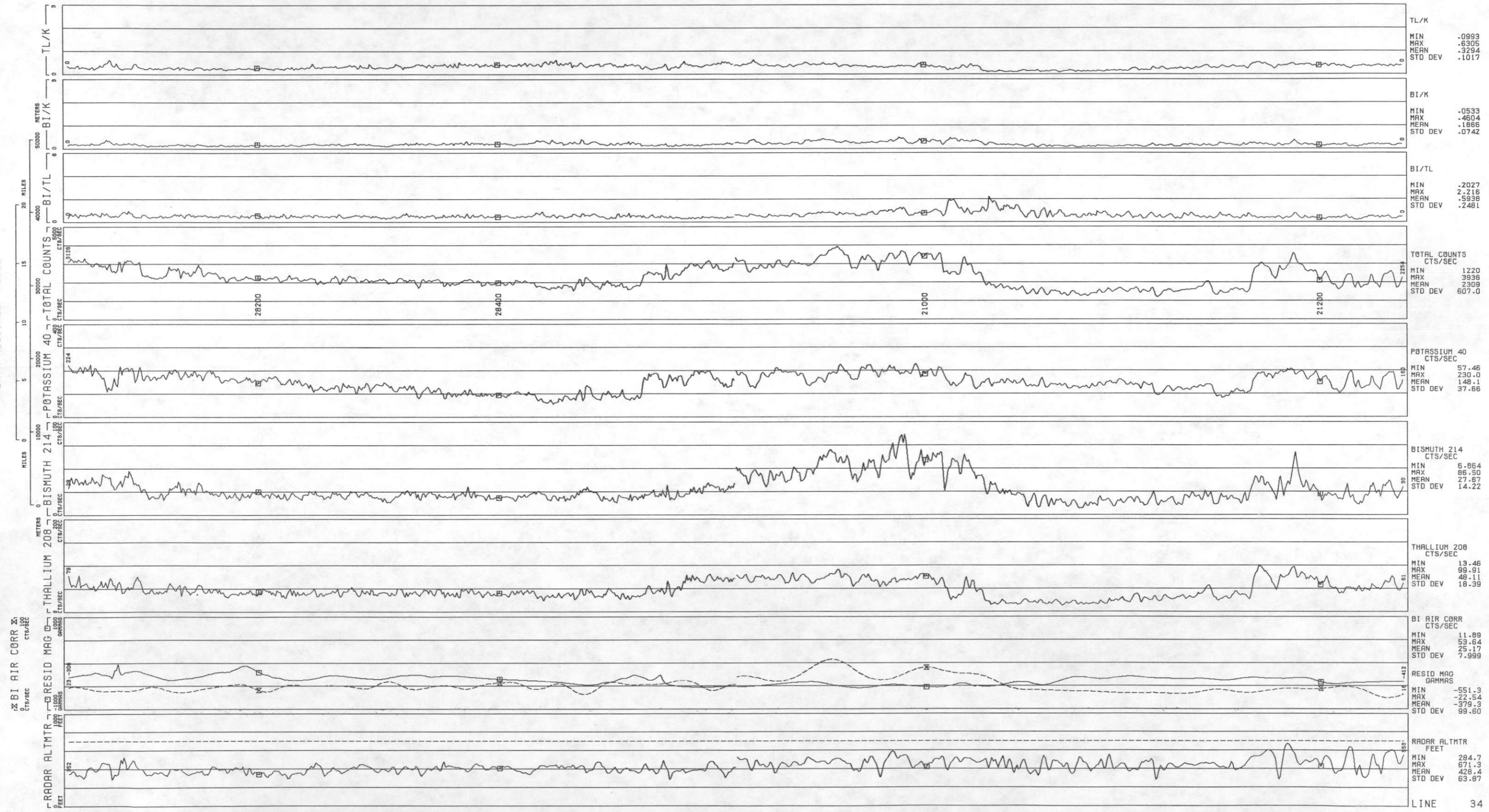
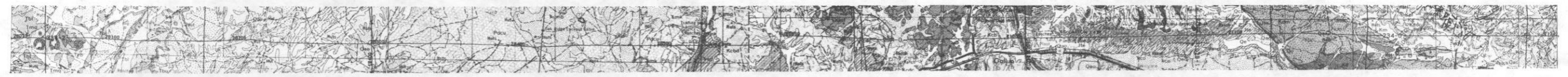




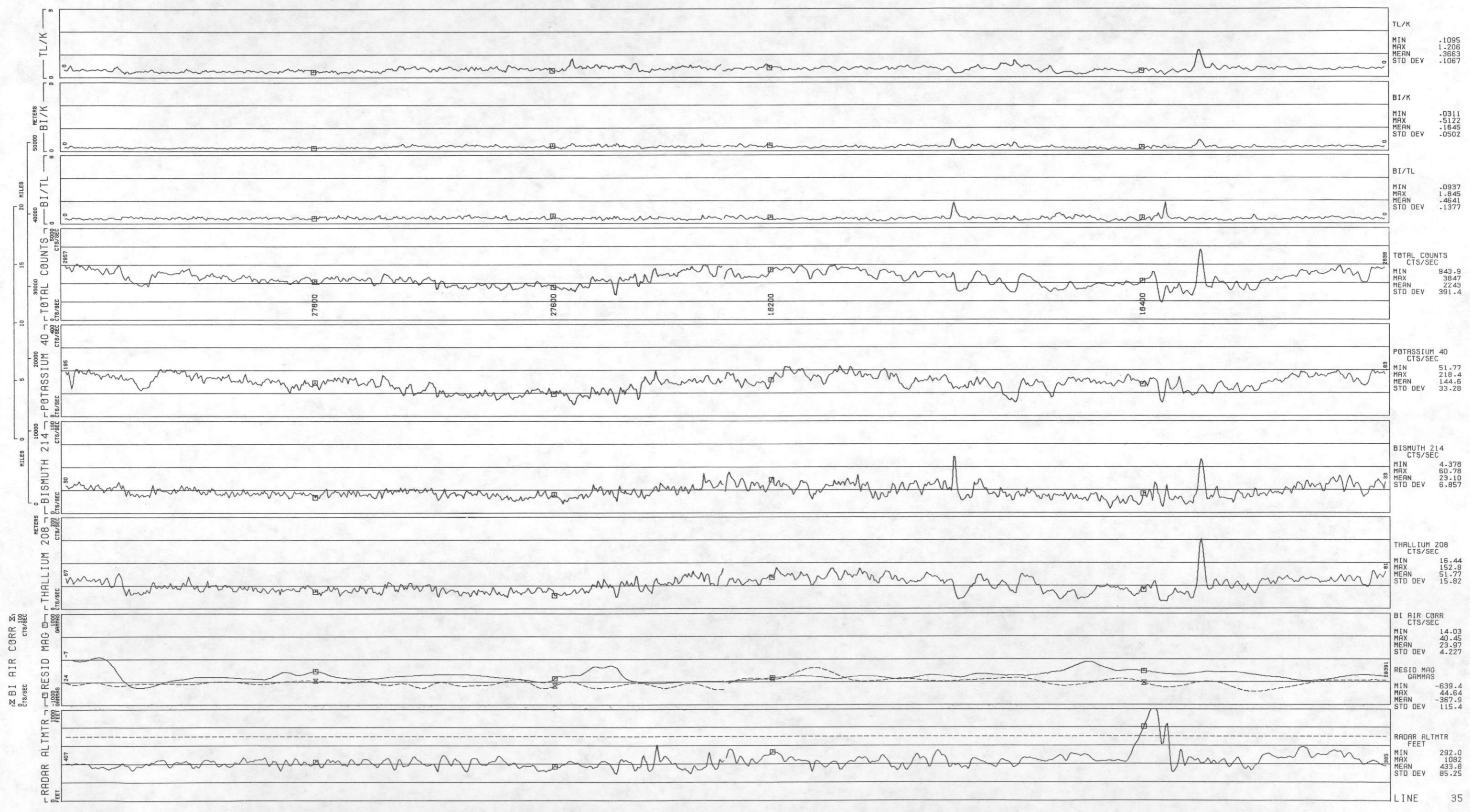
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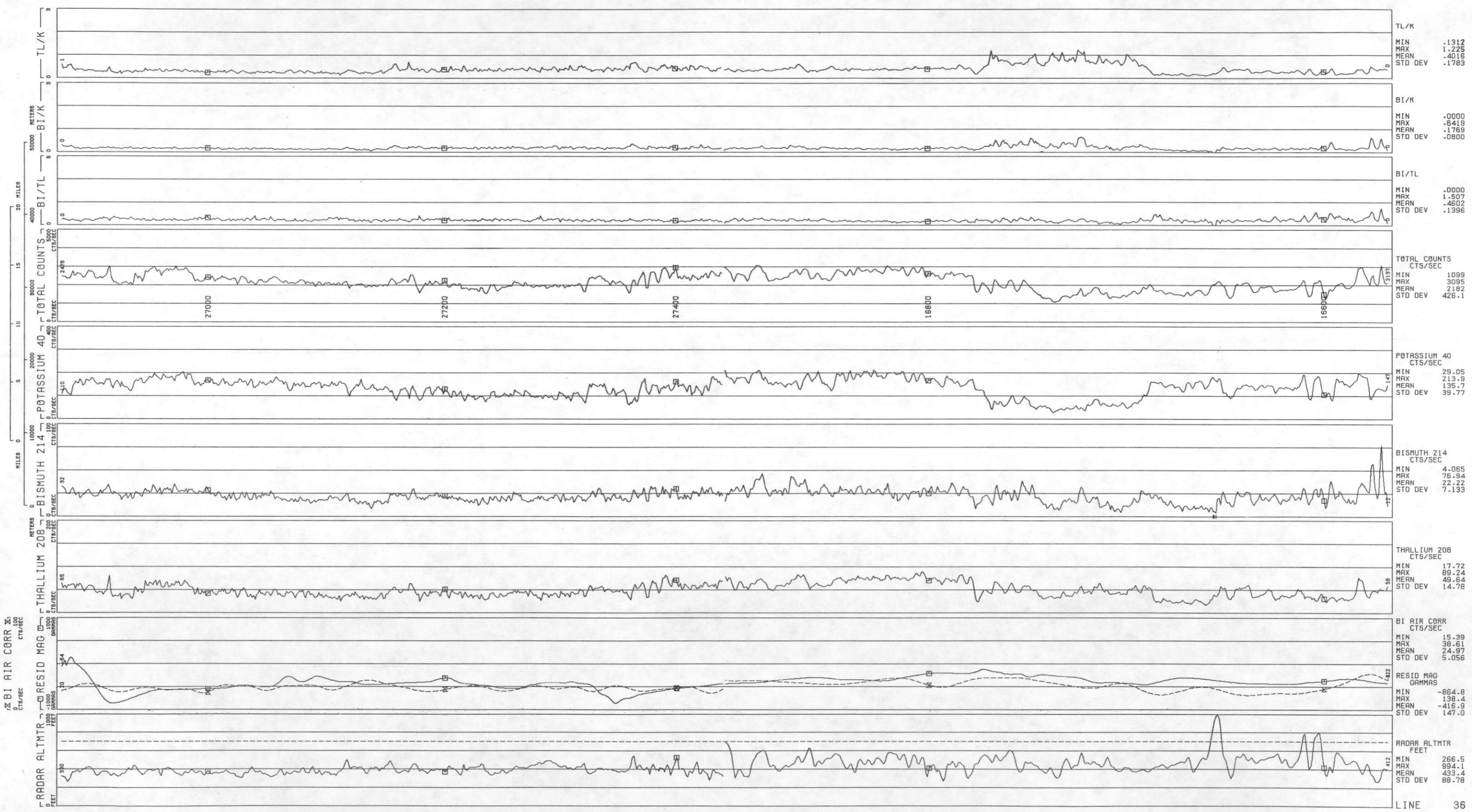
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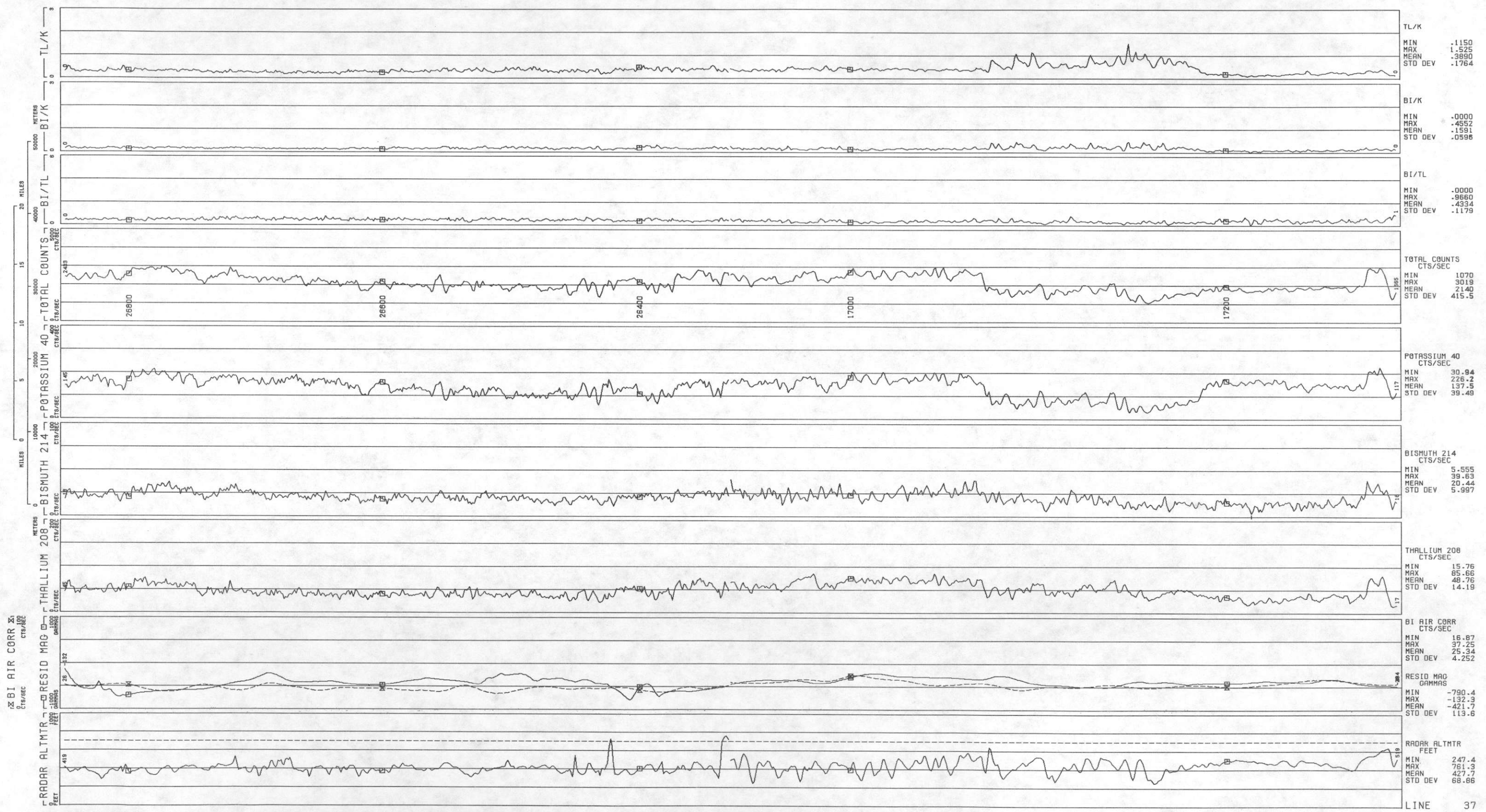
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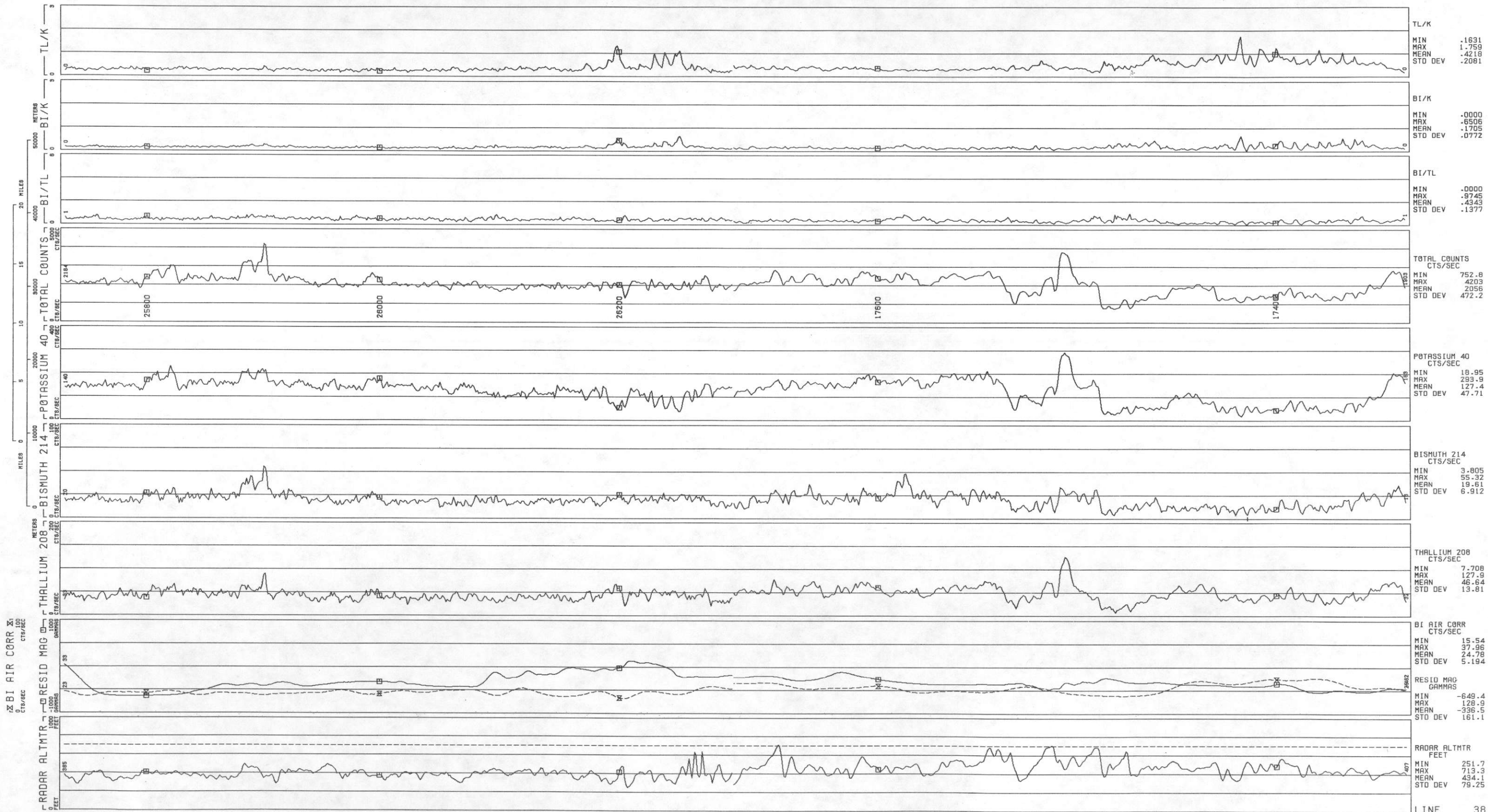


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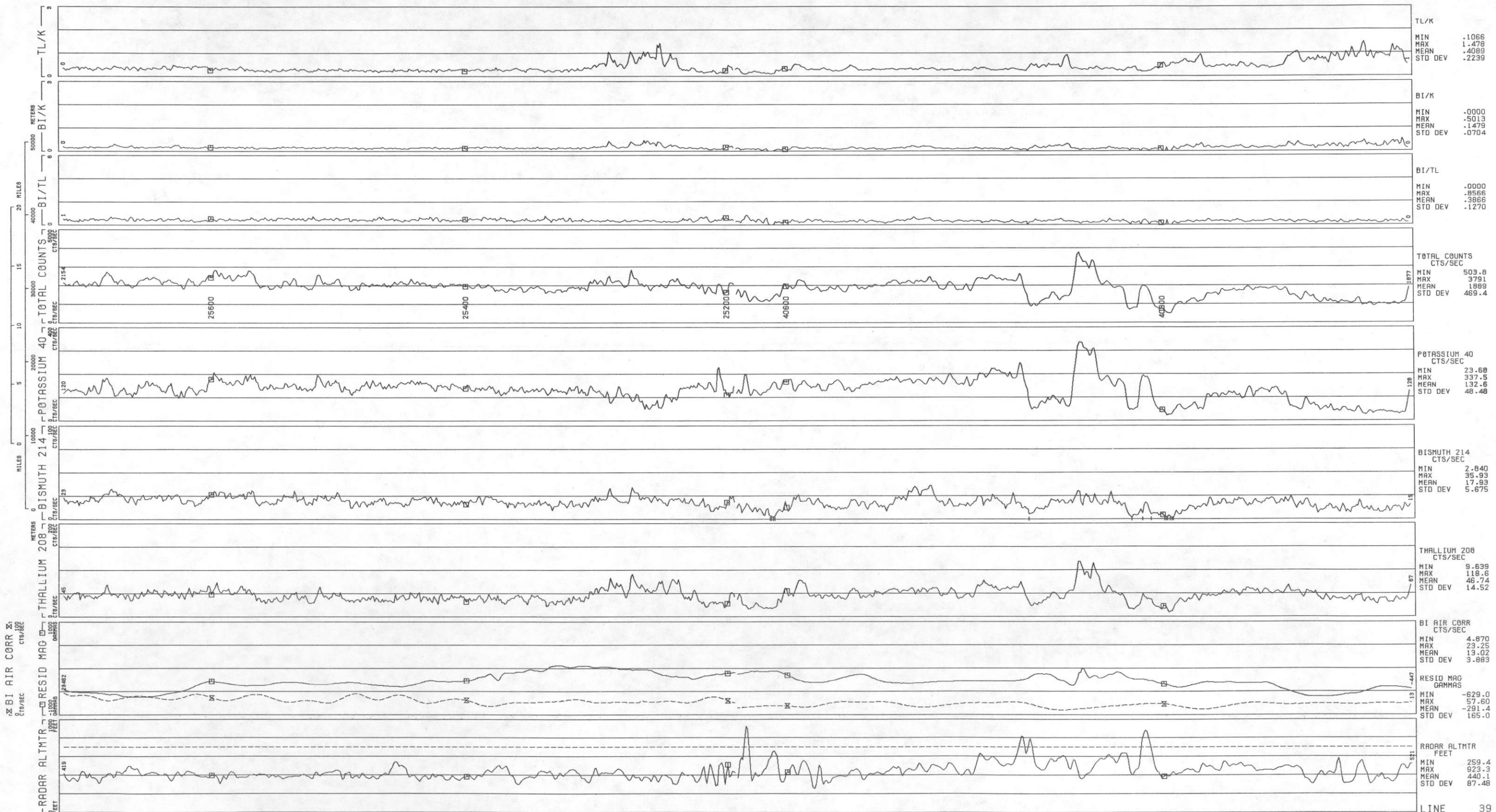




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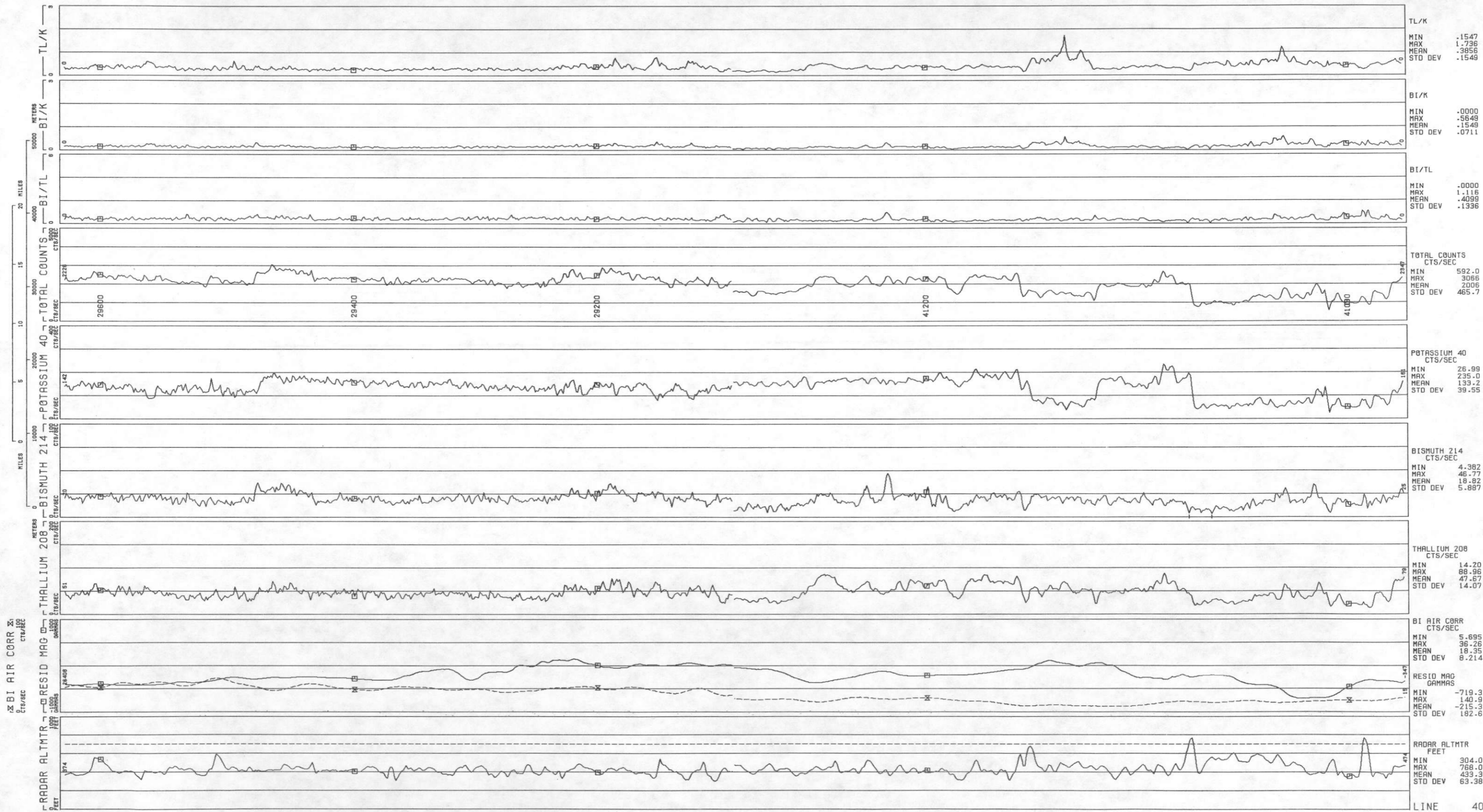


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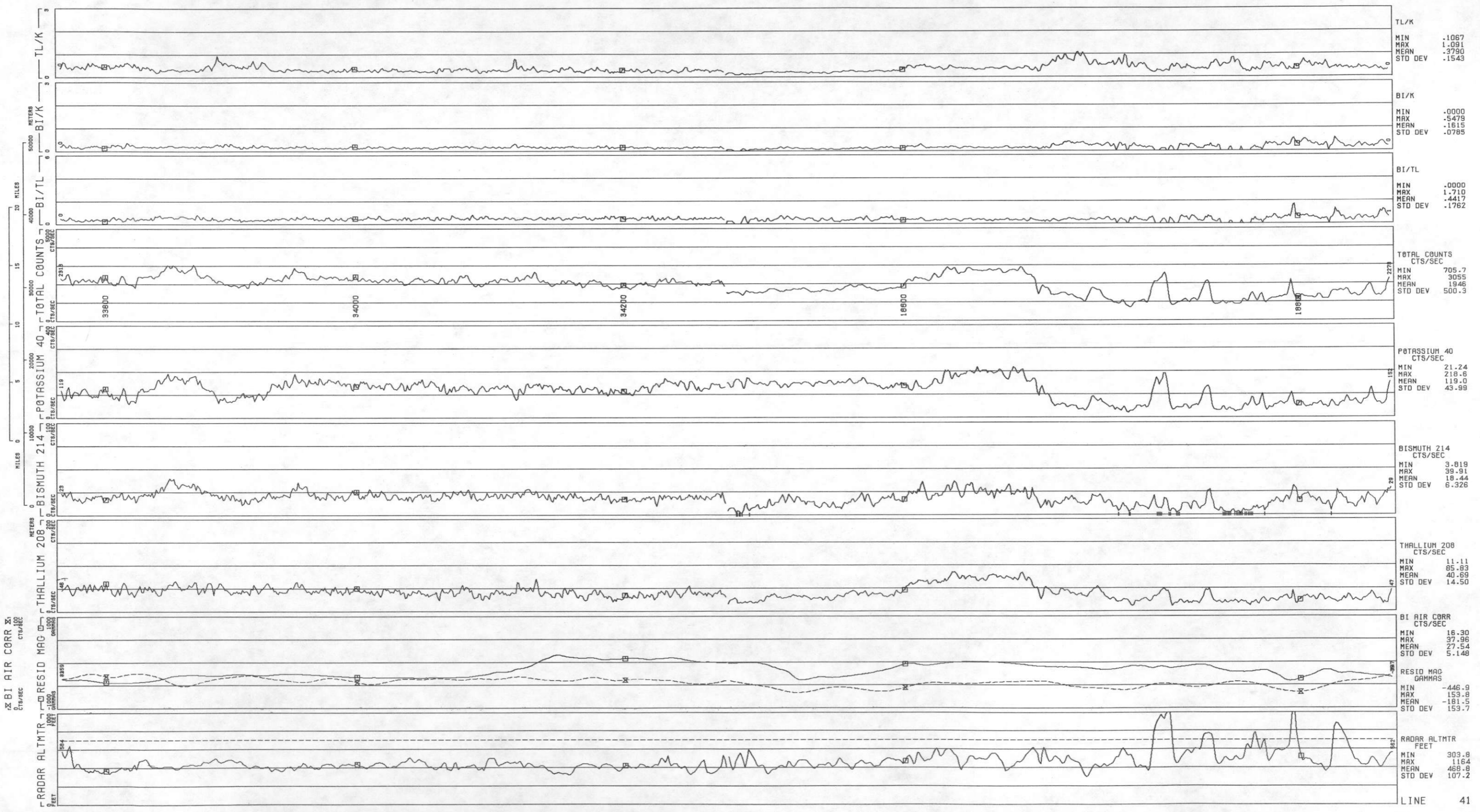


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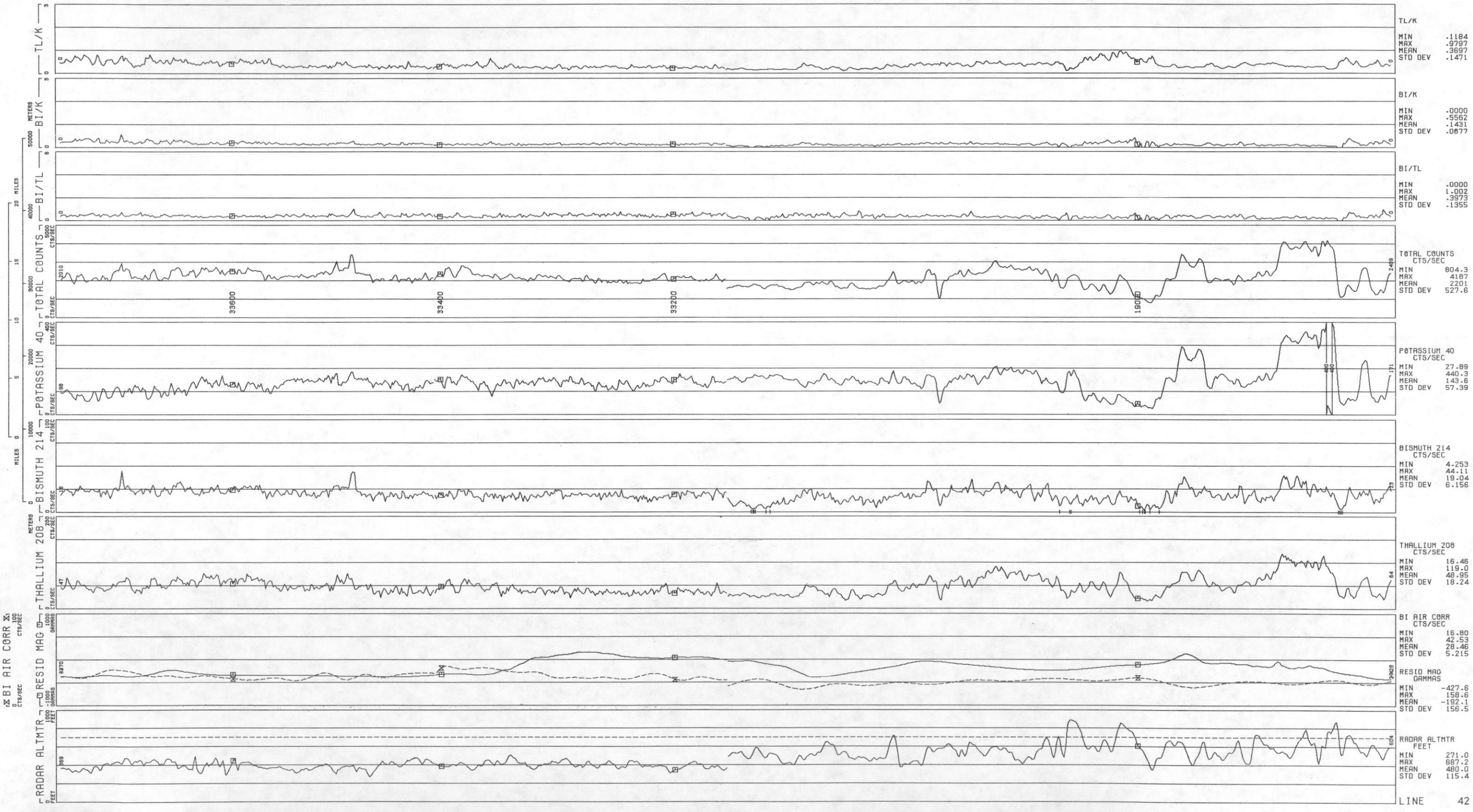


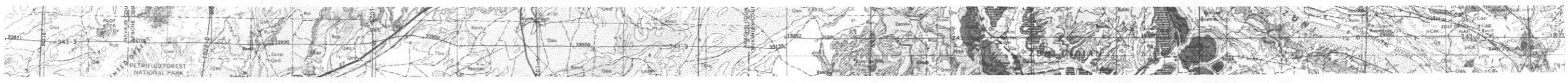
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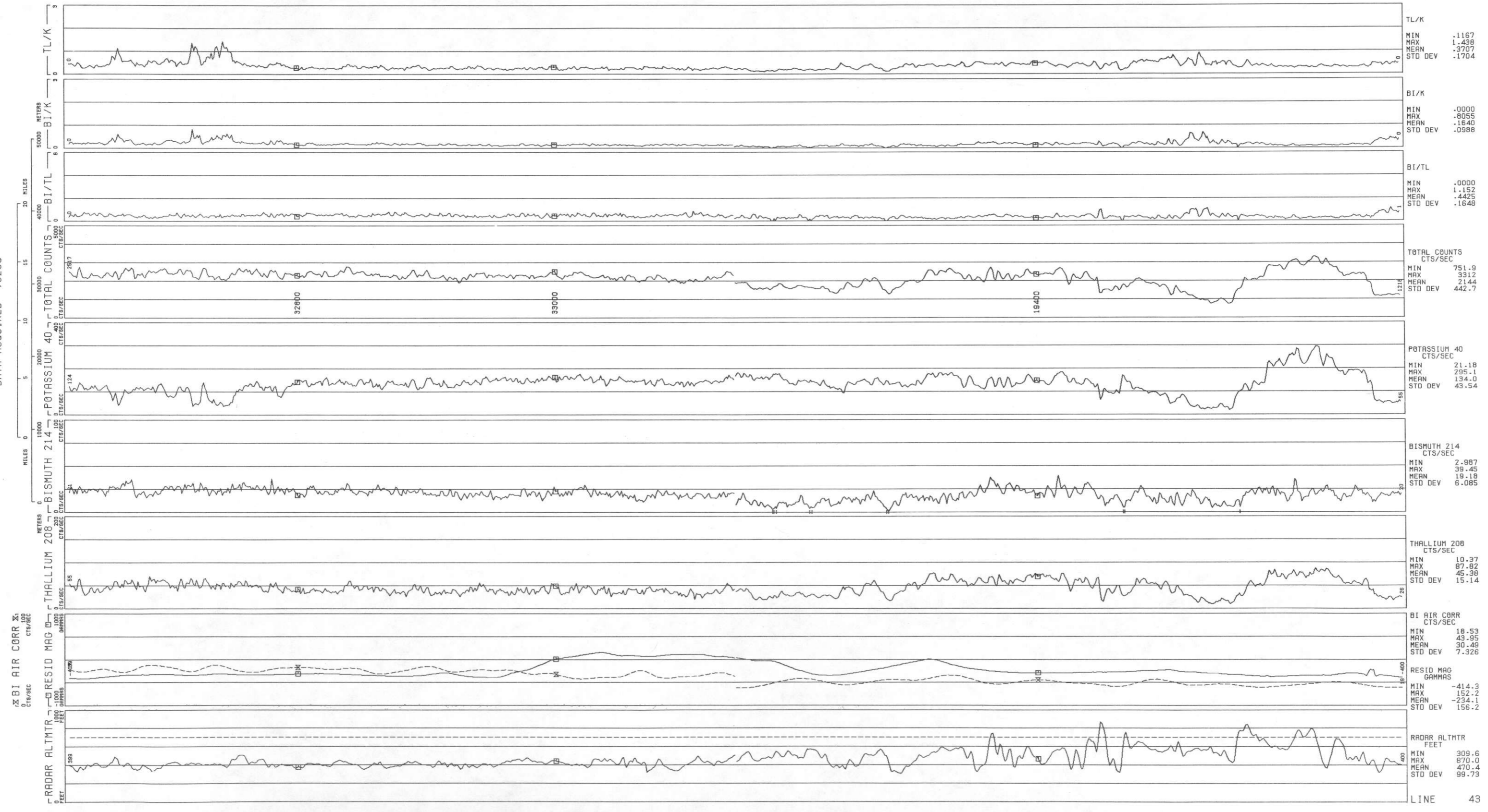


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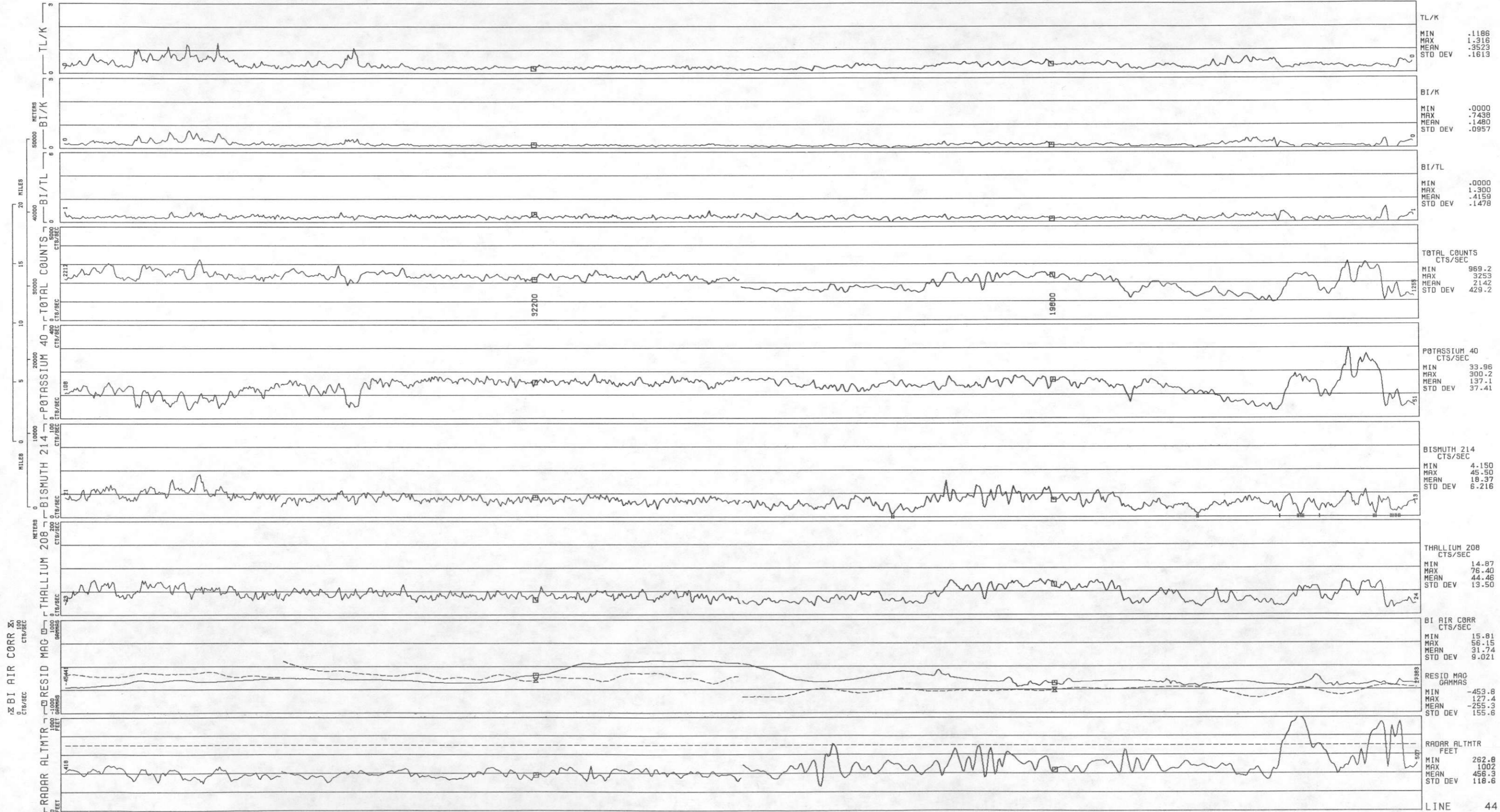


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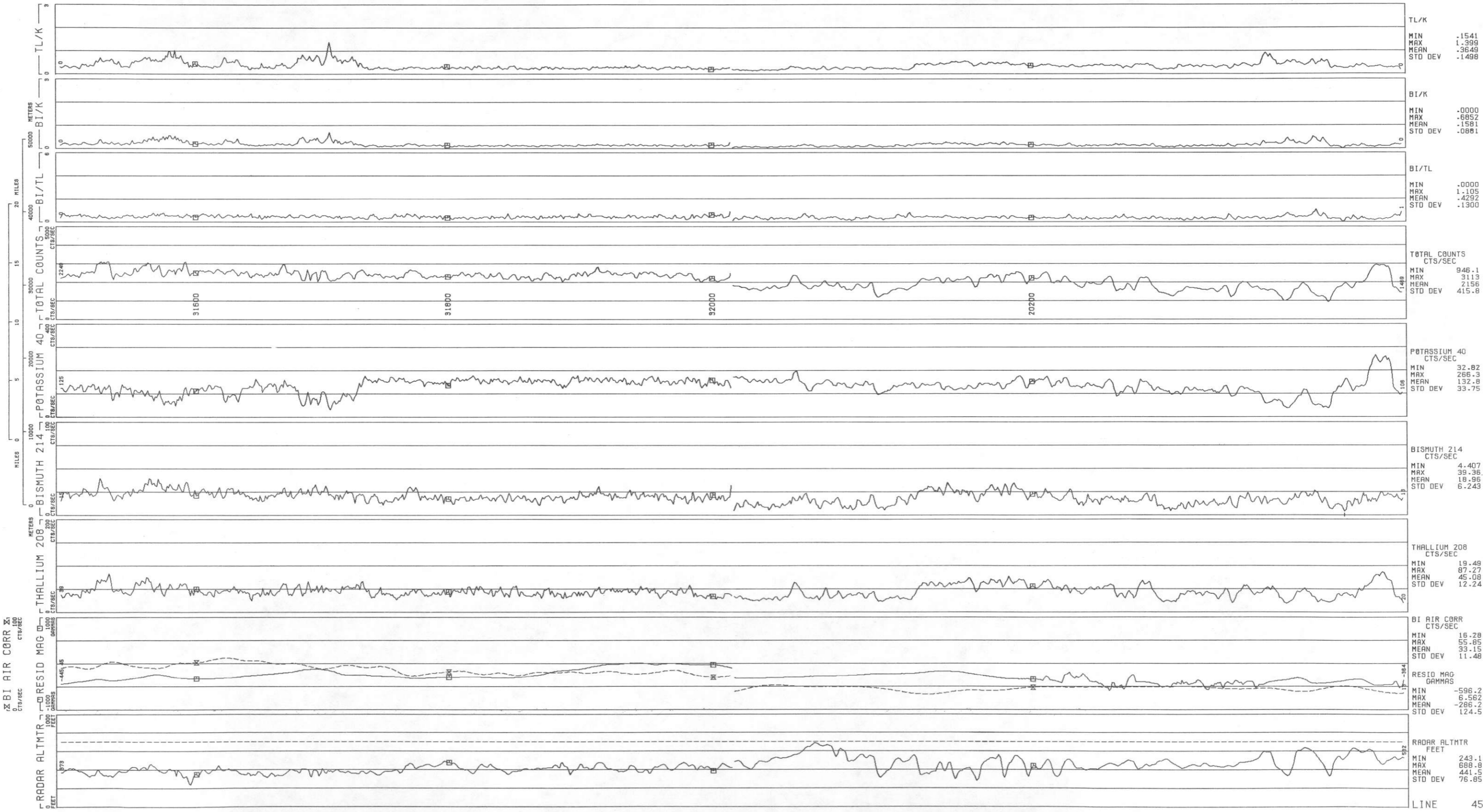


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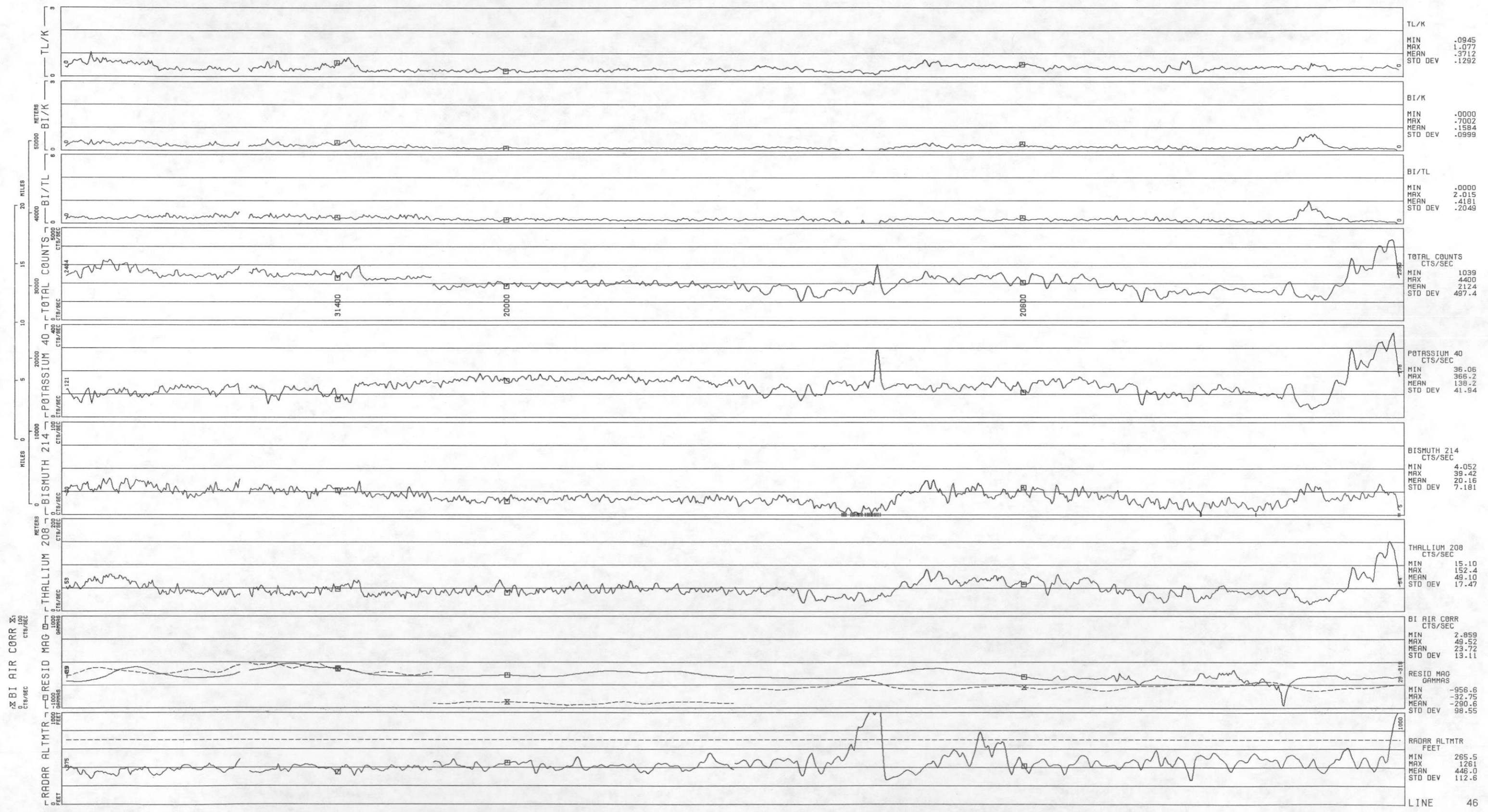


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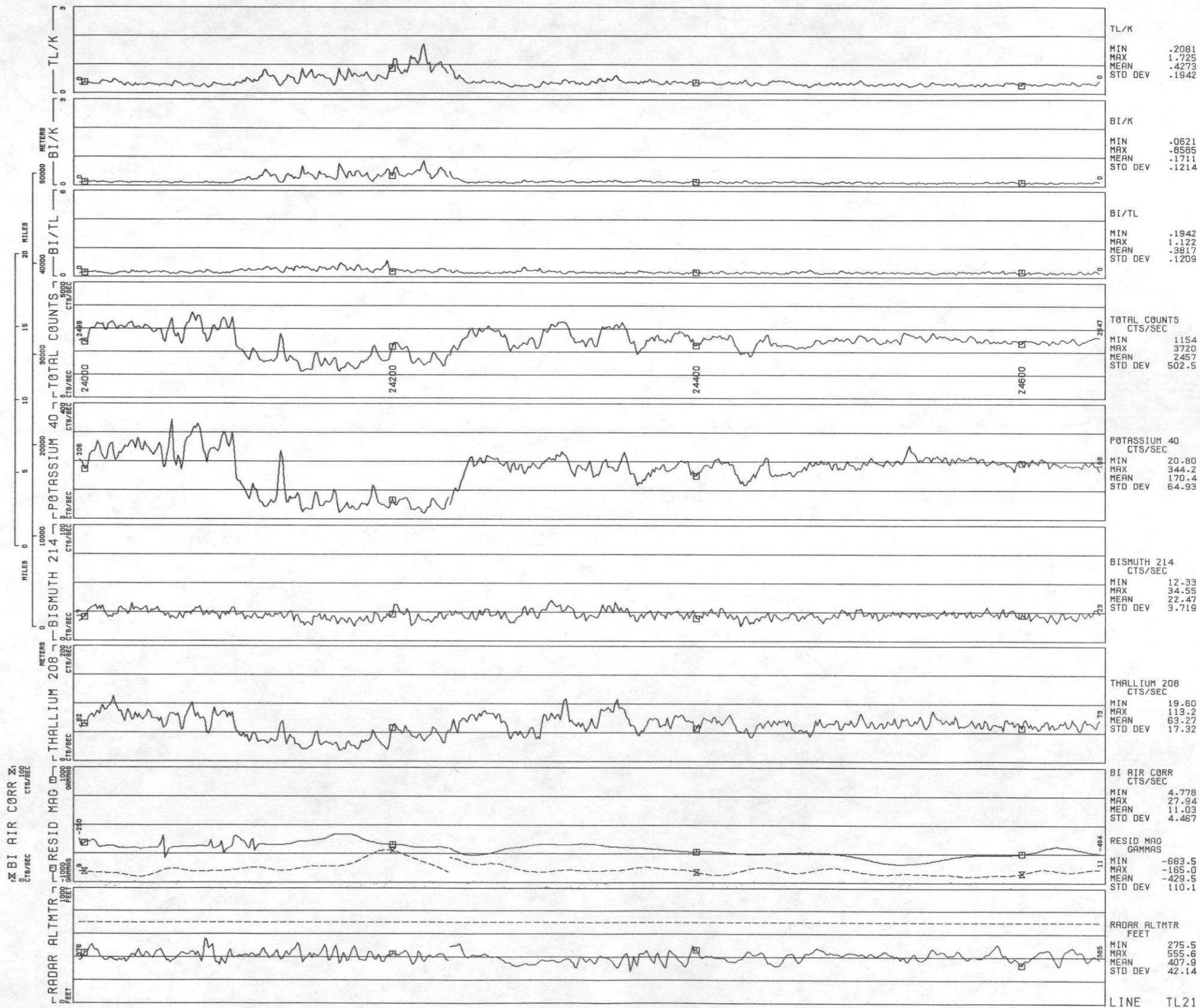


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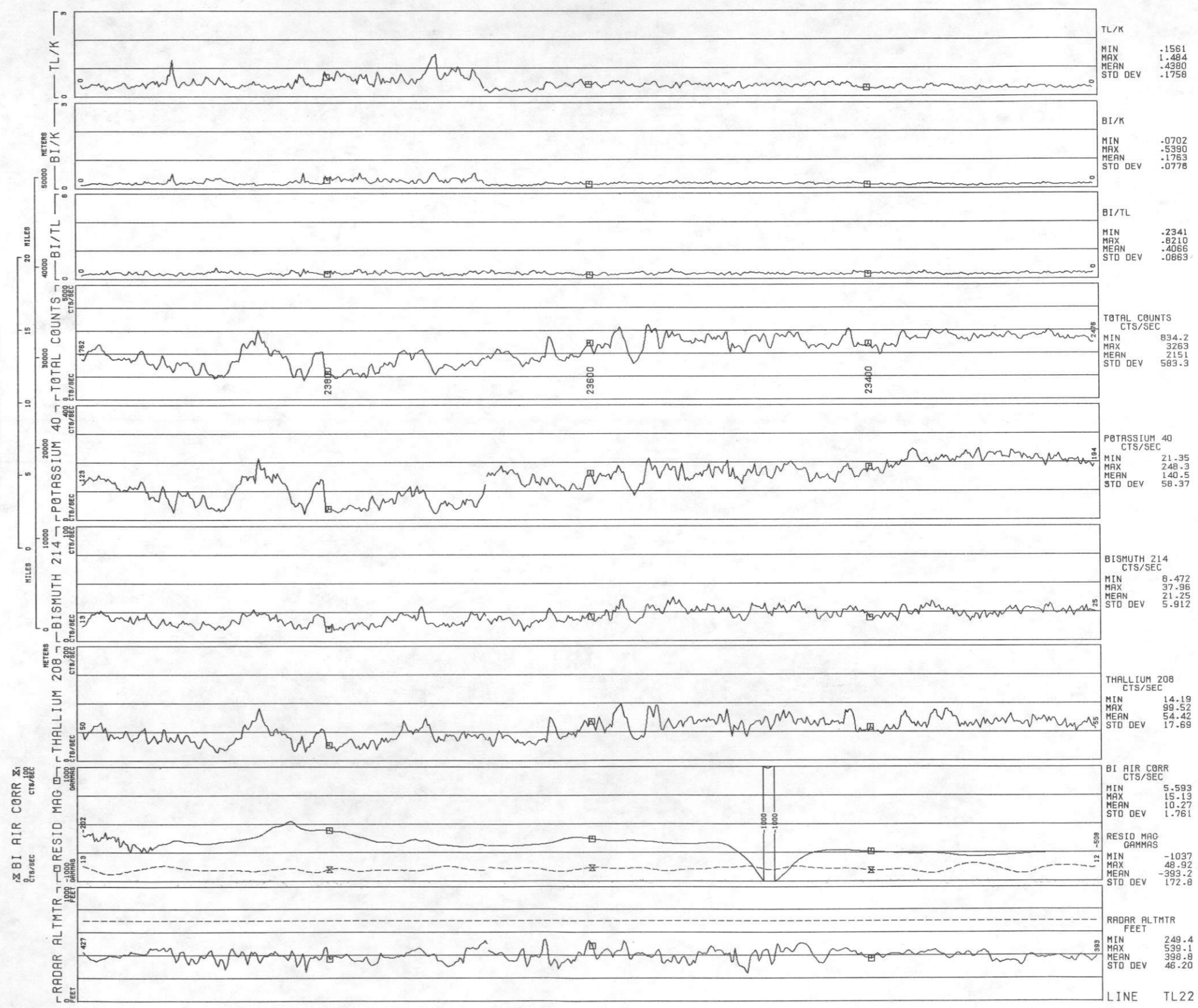


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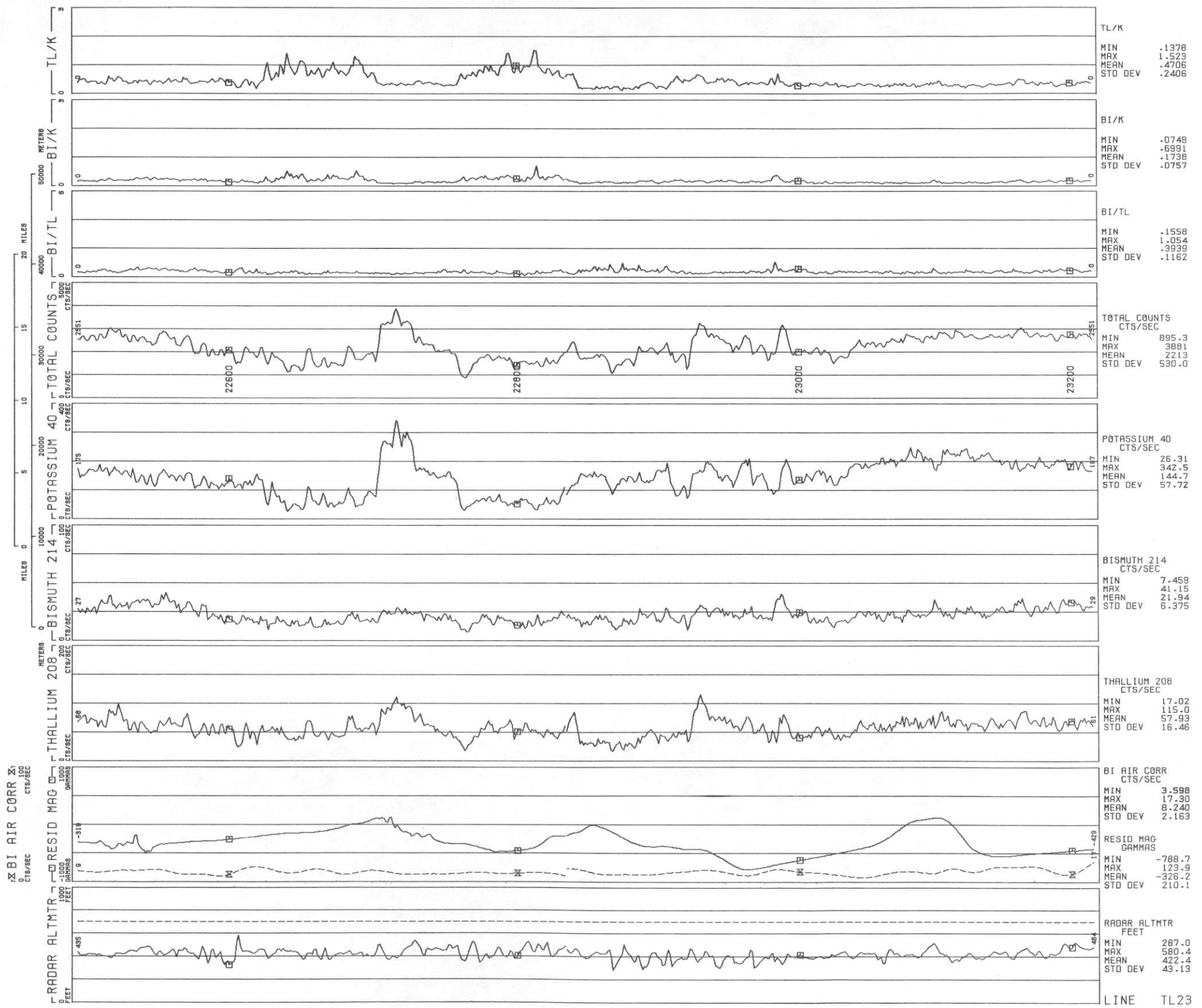
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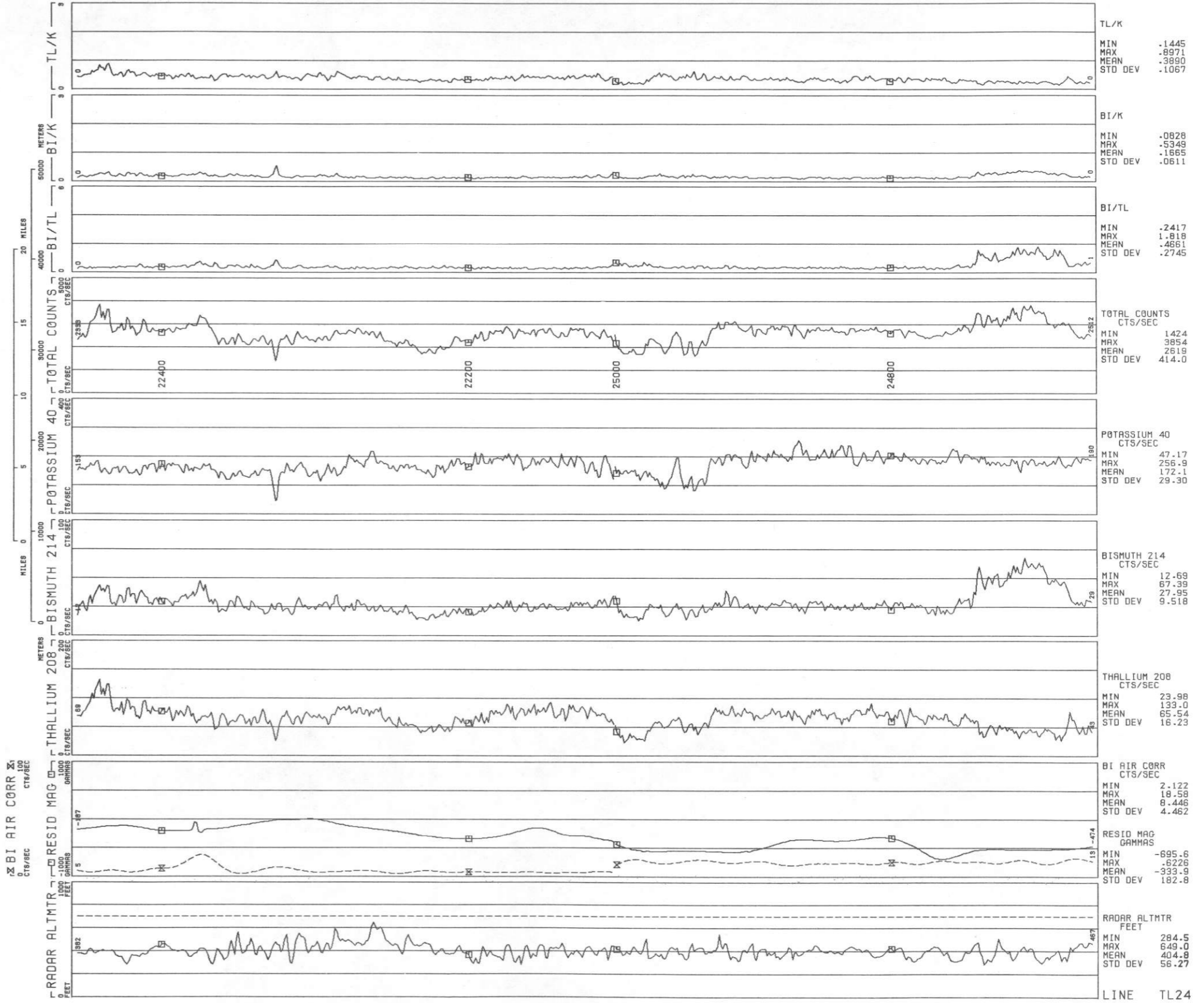


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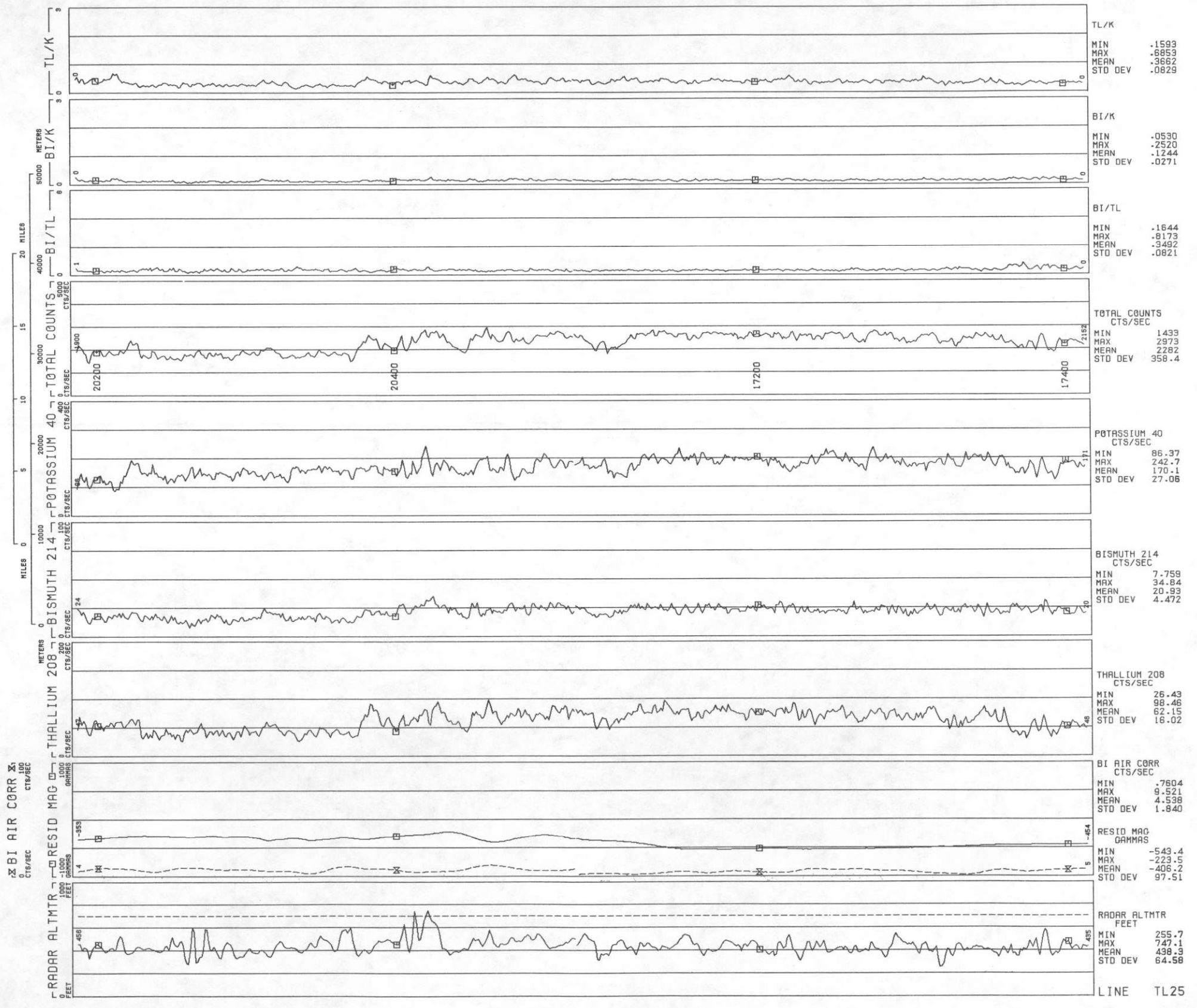


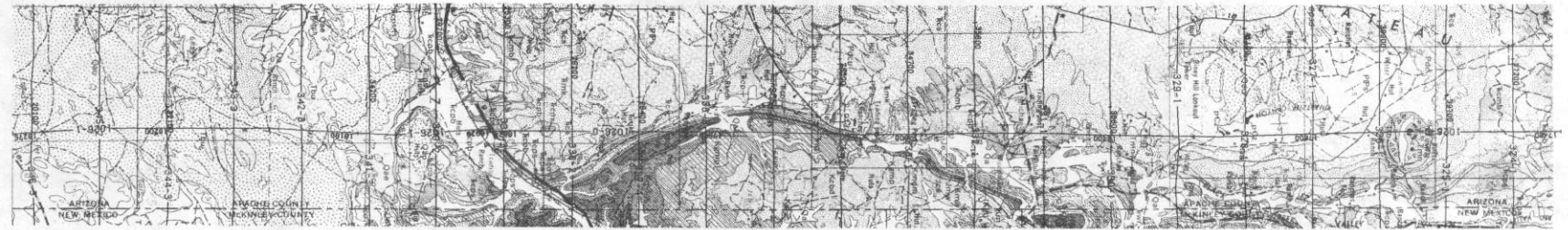
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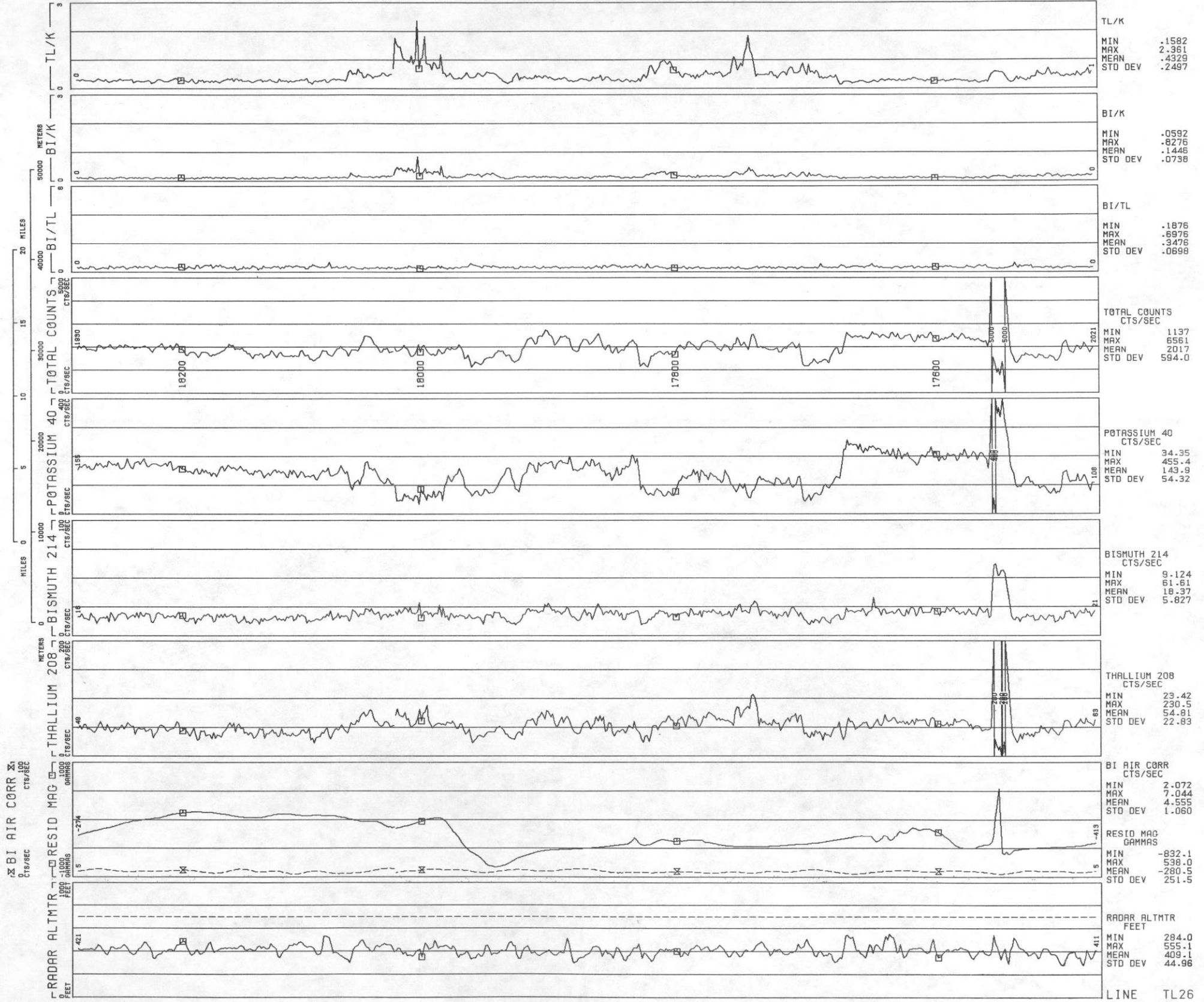


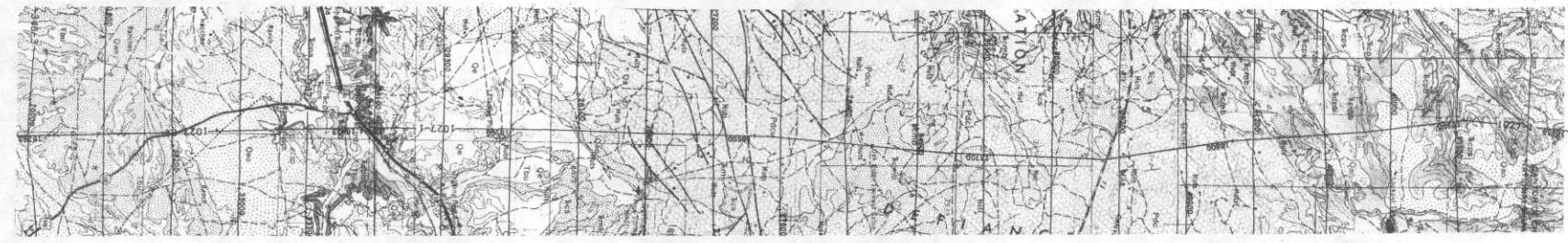
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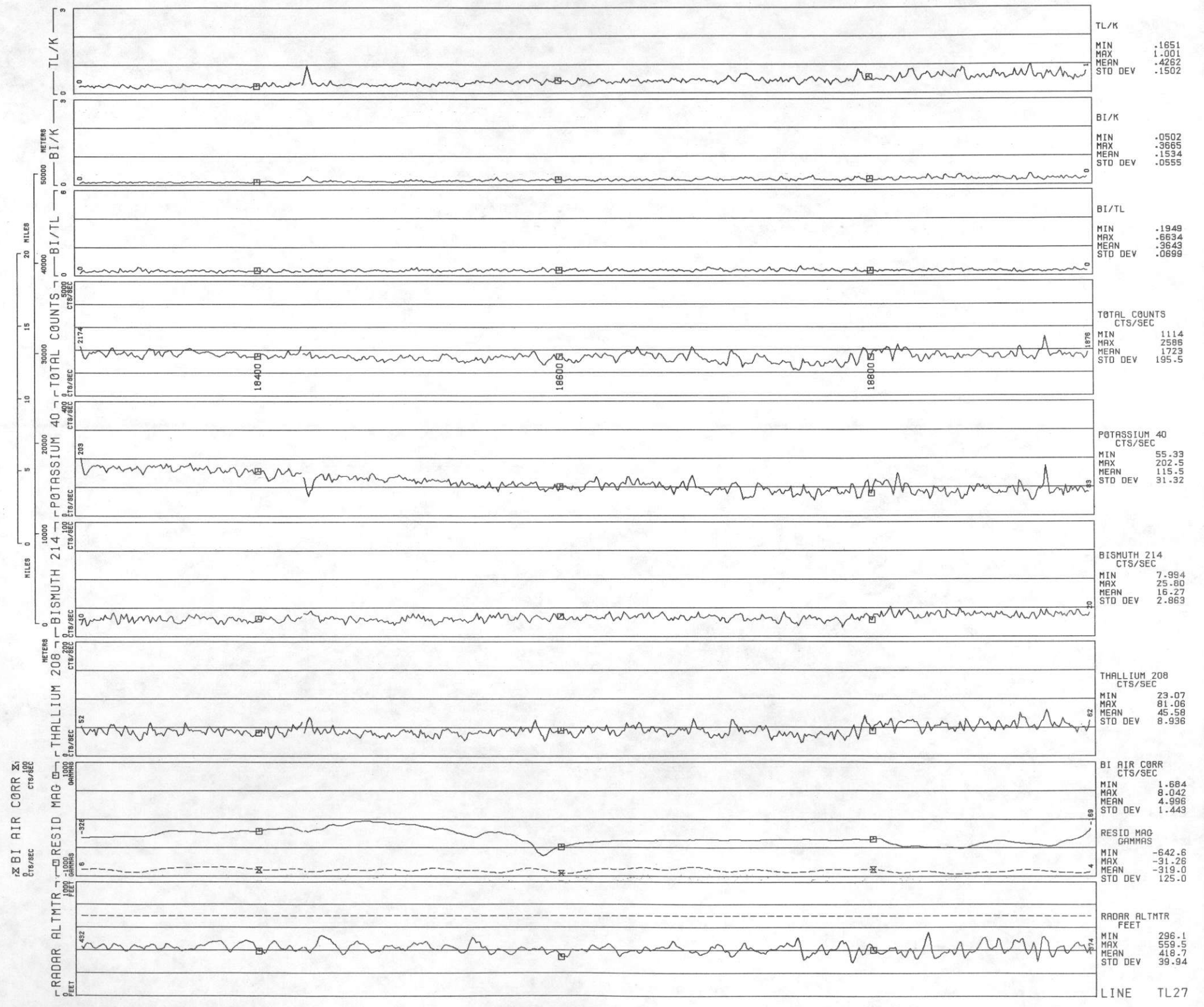


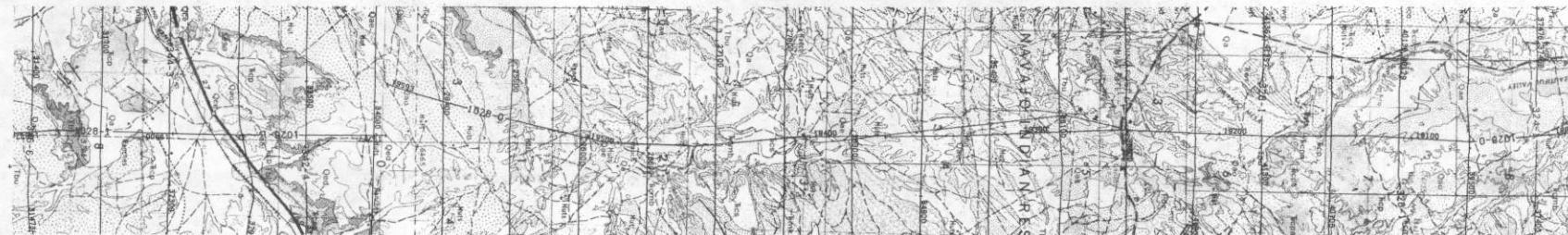
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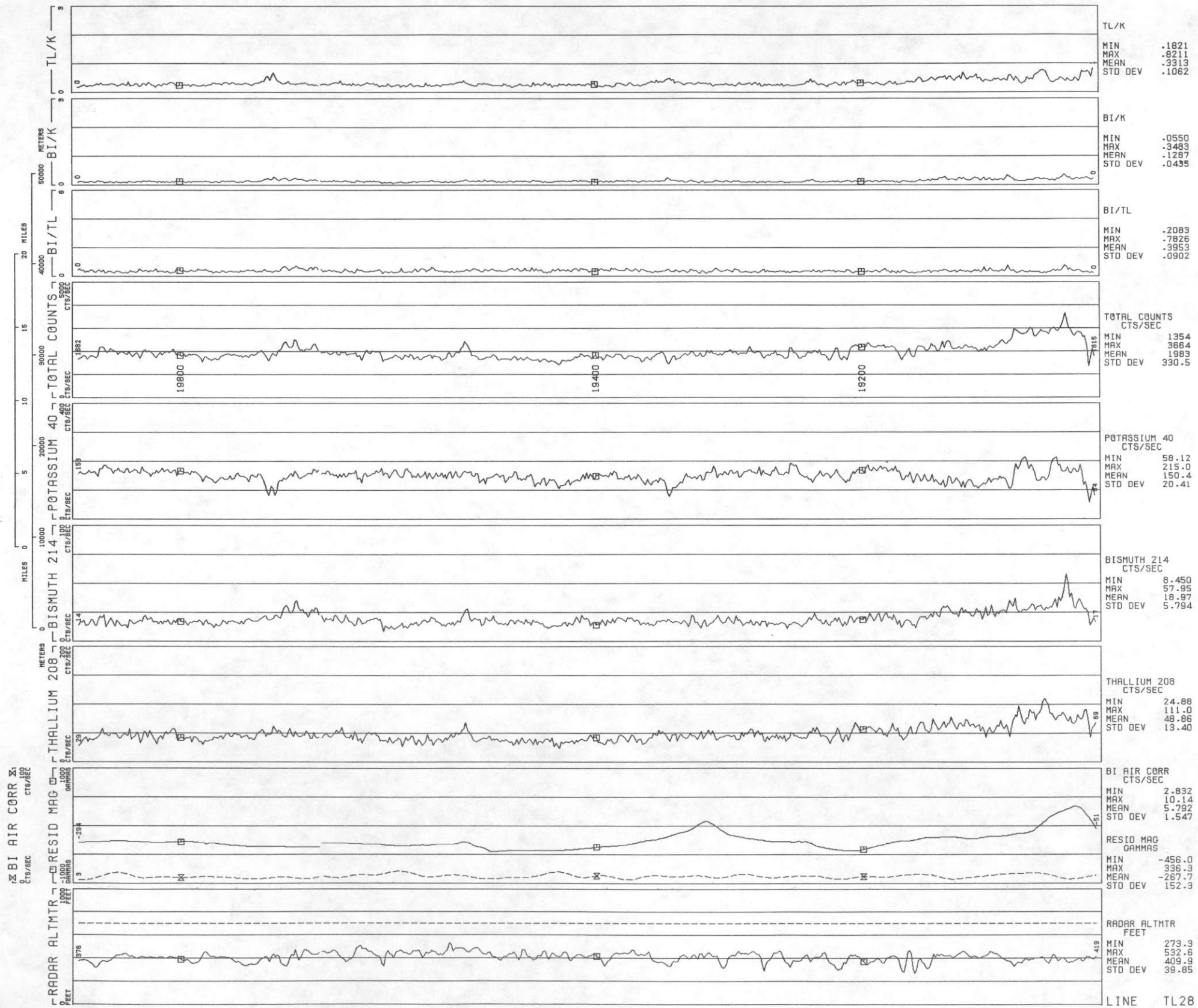


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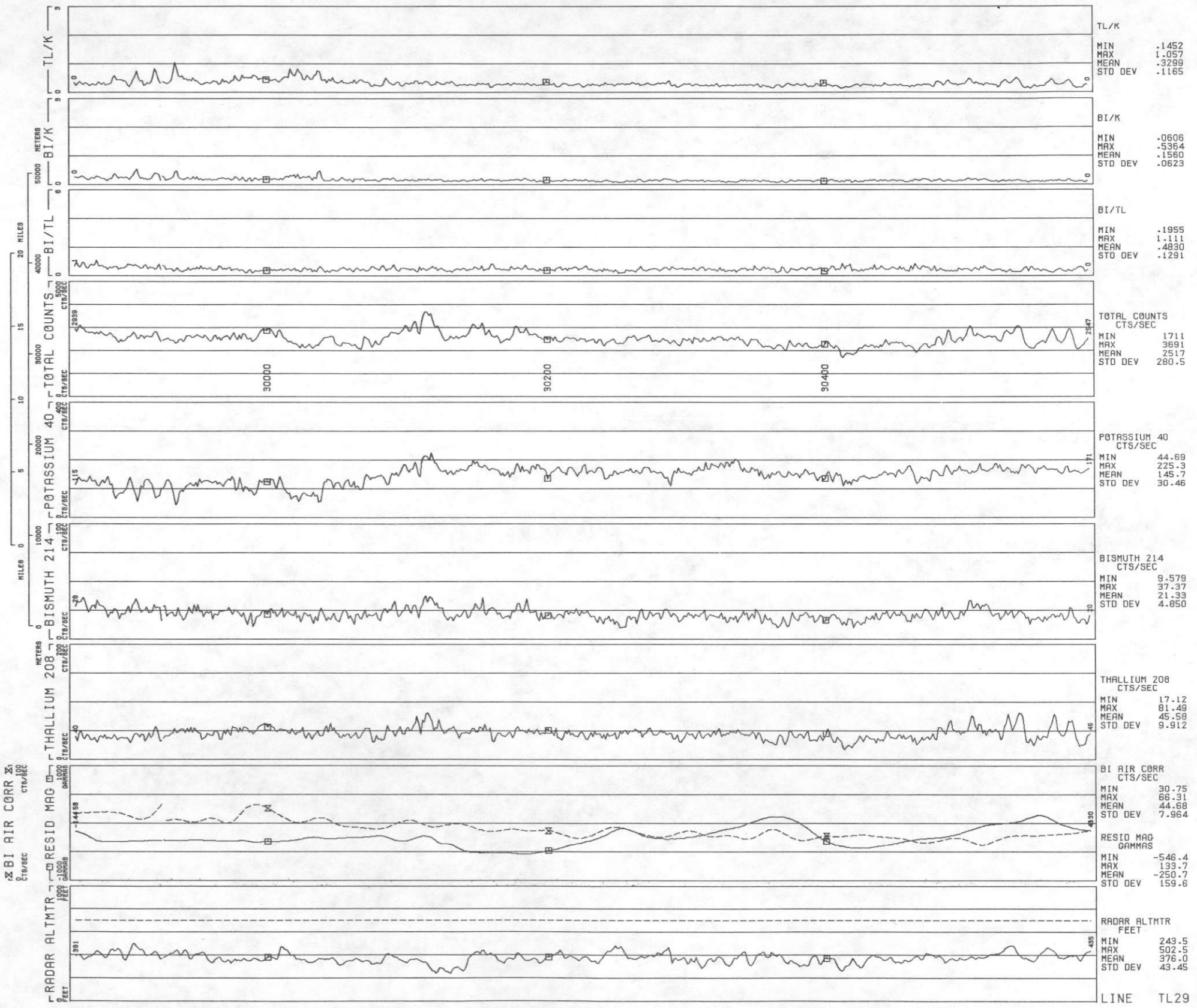


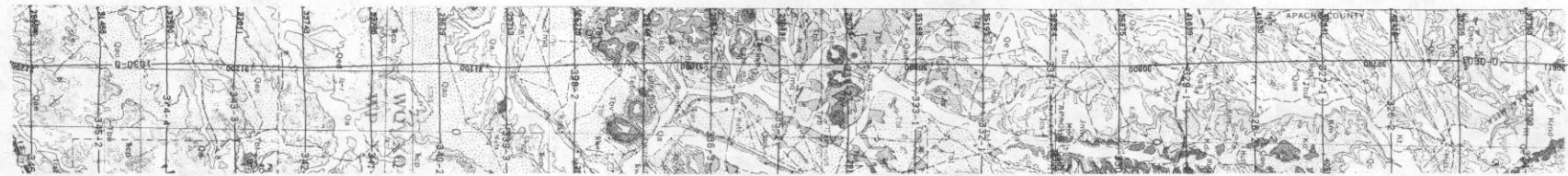
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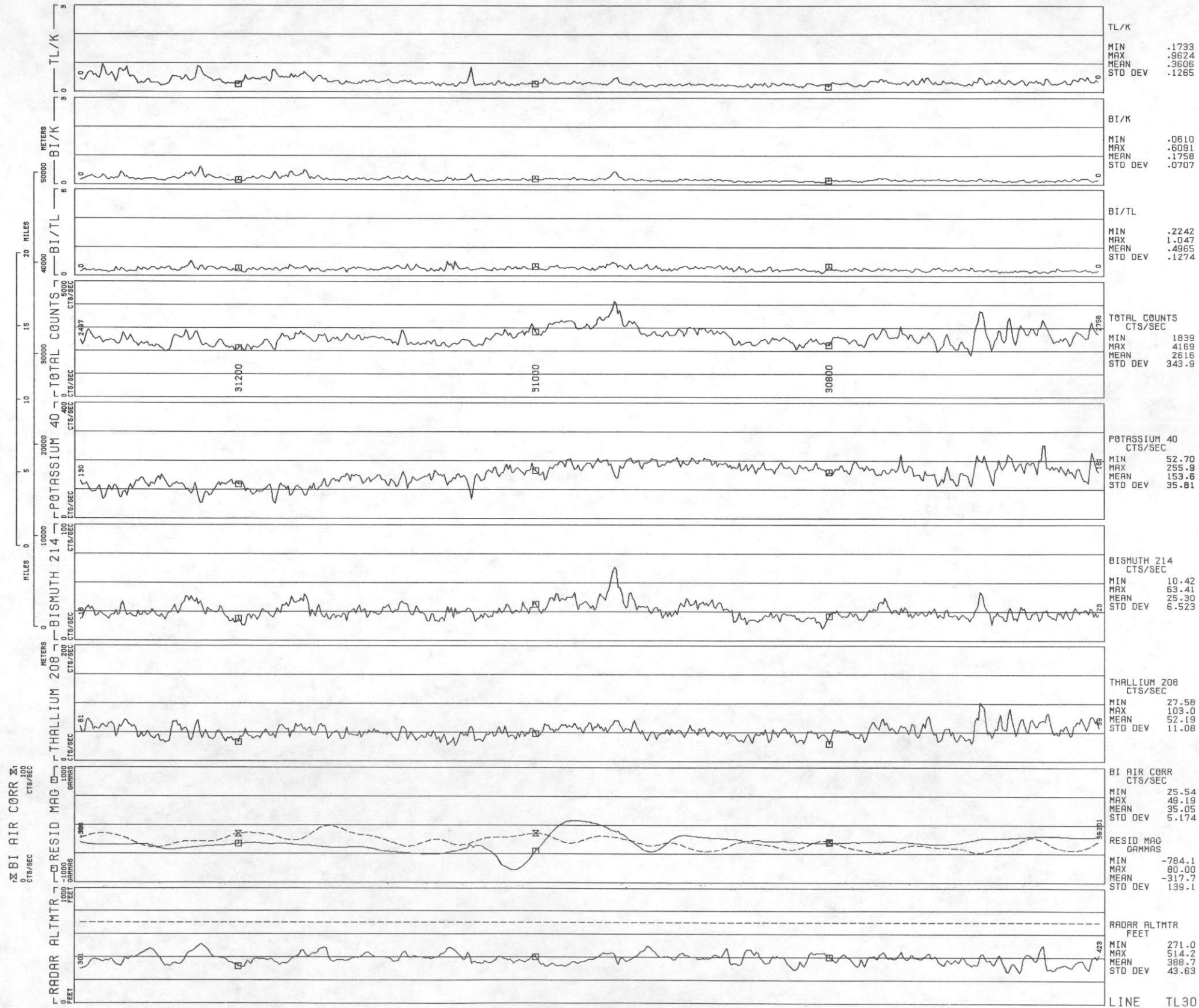


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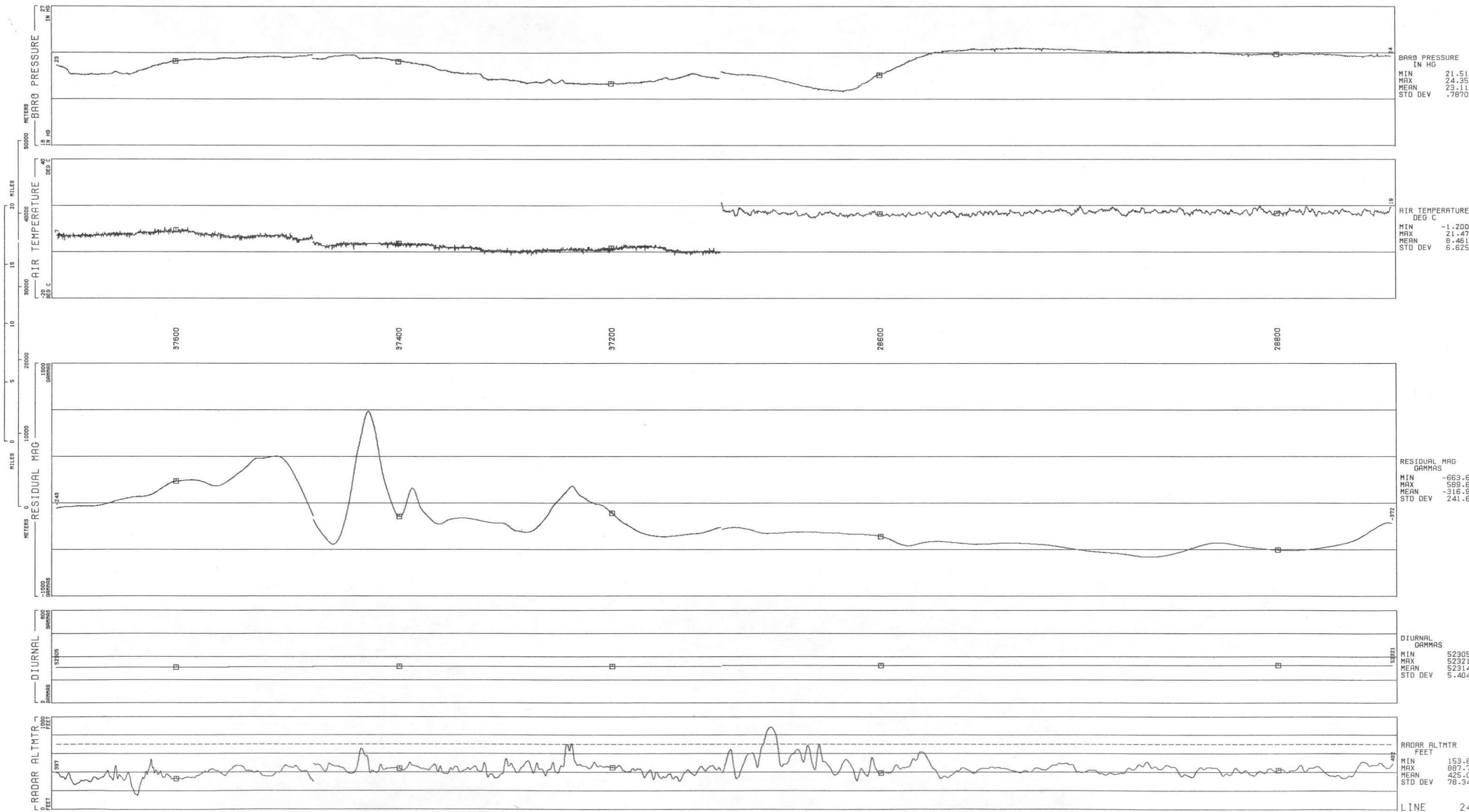


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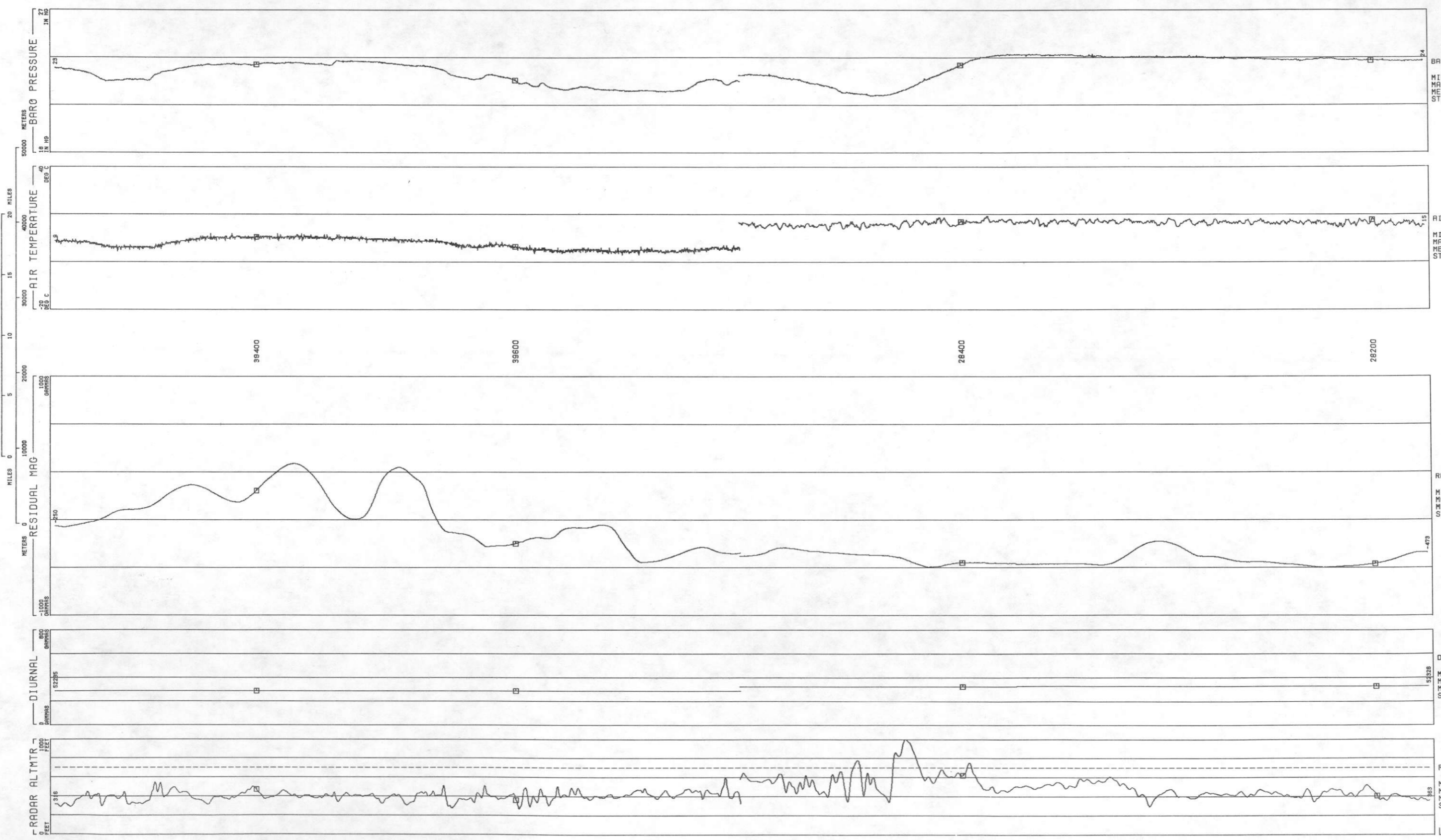


LINE TL30

LINE 24
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DATA ACQUIRED 78301



25
LINE
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MEAN 23.14
STD DEV .7640

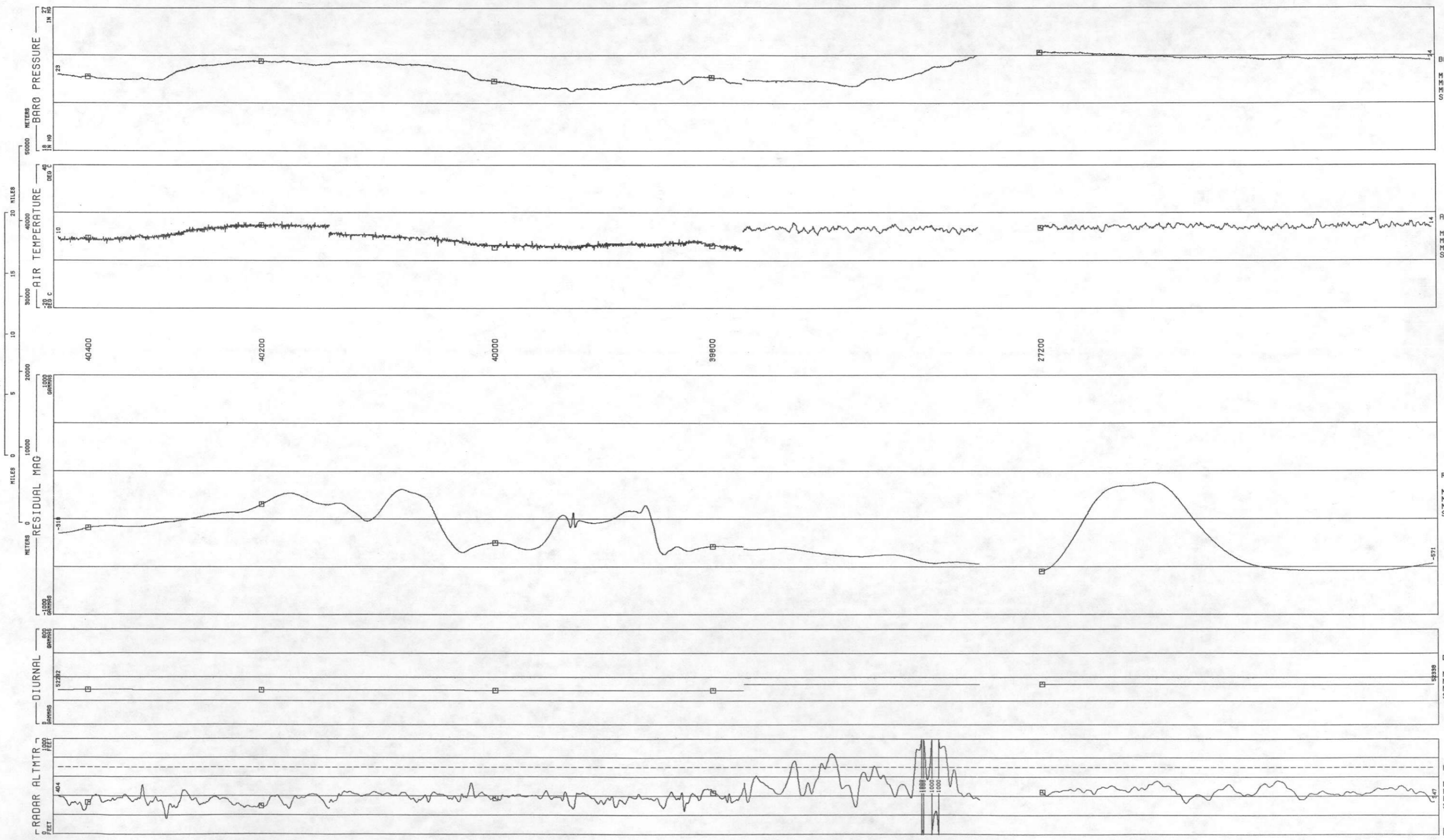
AIR TEMPERATURE
DEG C
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MAX 19.32
MEAN 11.05
STD DEV 4.667

RESIDUAL MAG
GAMMAS
MIN -596.8
MAX 273.4
MEAN -313.9
STD DEV 248.9

DIURNAL
GAMMAS
MIN 52284
MAX 52326
MEAN 52300
STD DEV 19.37

RADAR ALTMTR
FEET
MIN 271.0
MAX 999.8
MEAN 442.5
STD DEV 94.66

LINE 26
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
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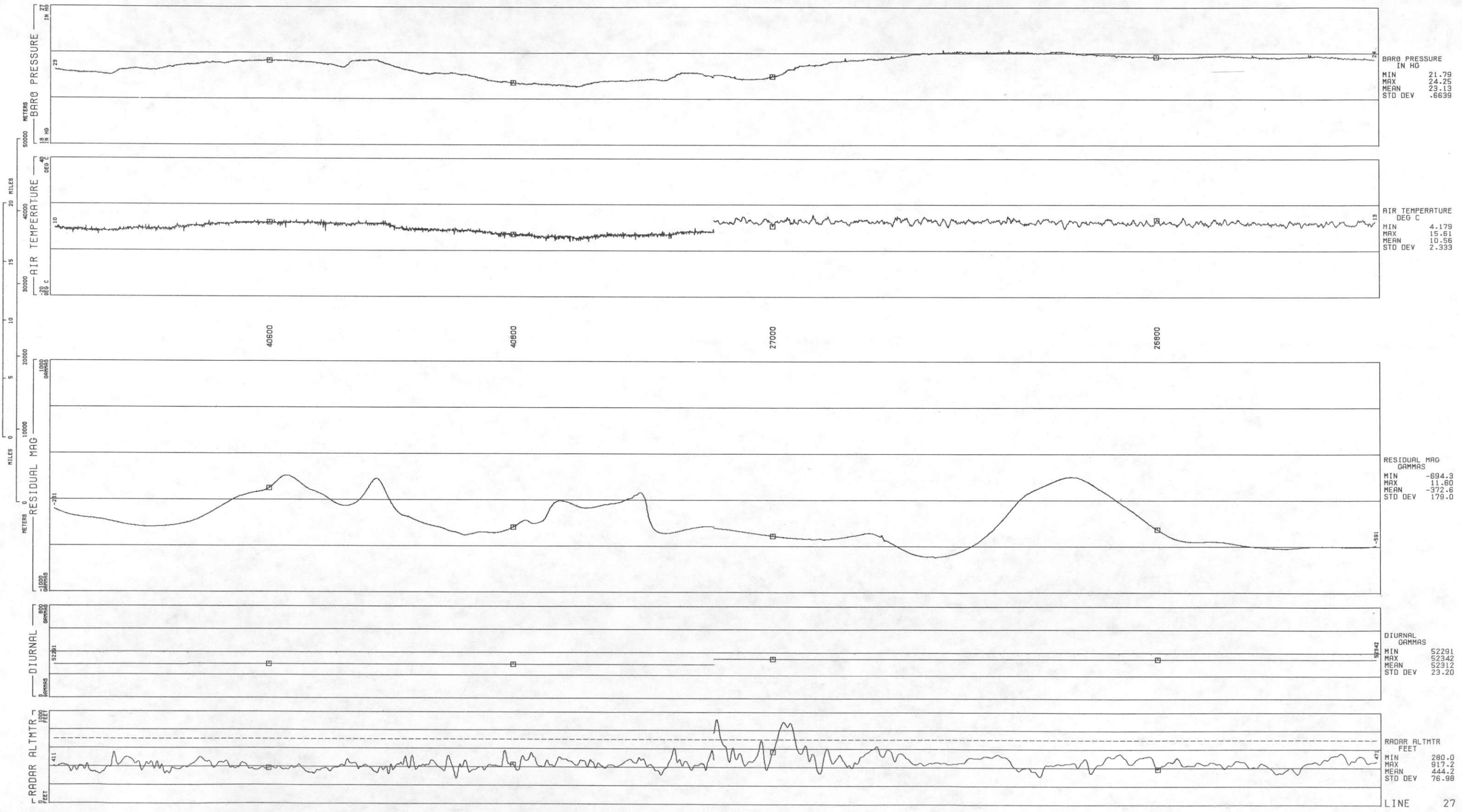
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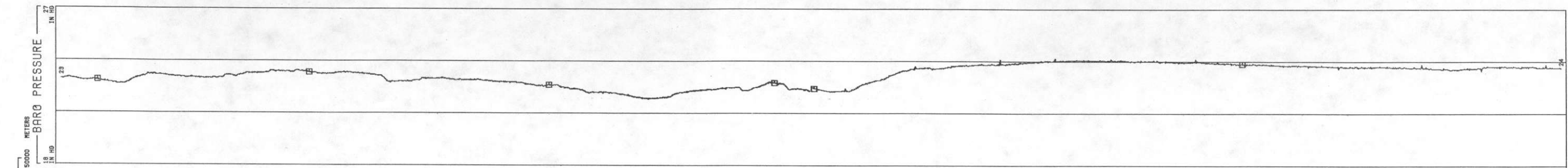
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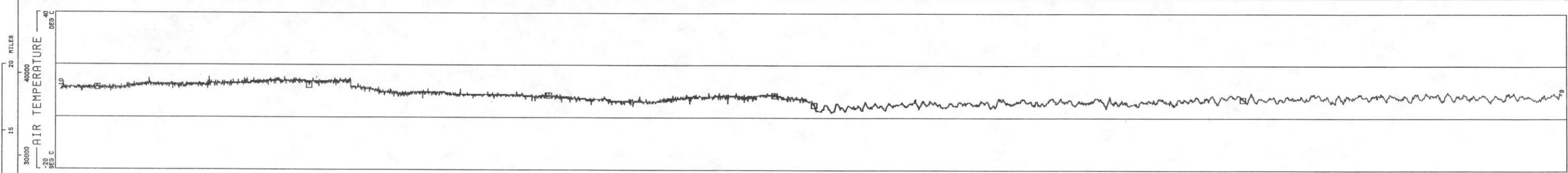
27
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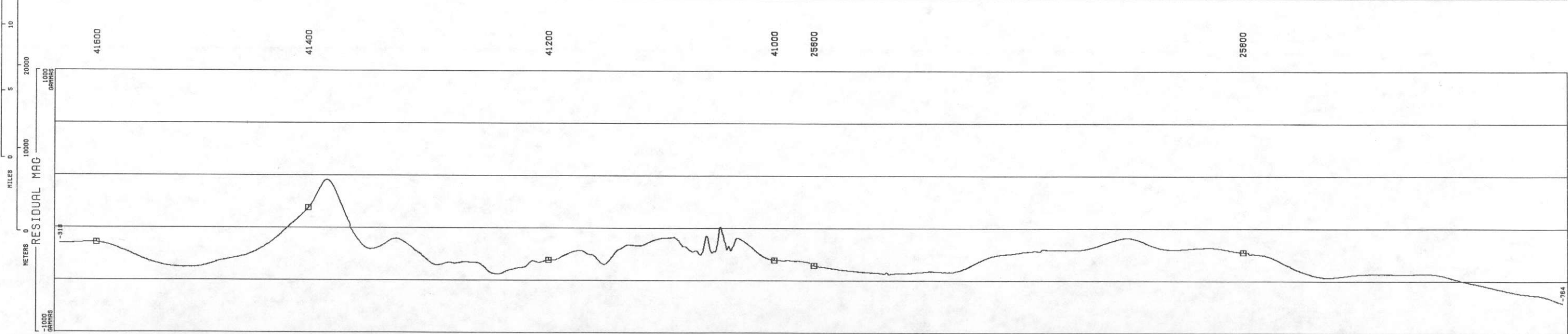
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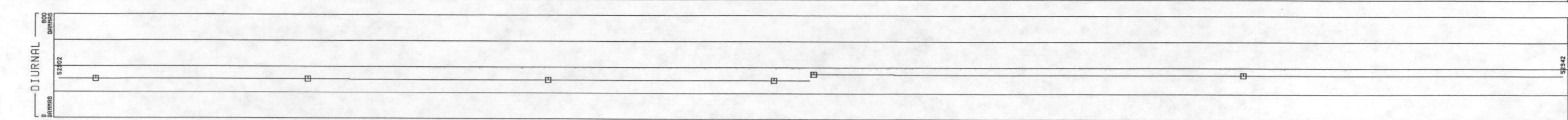
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STD DEV .5977



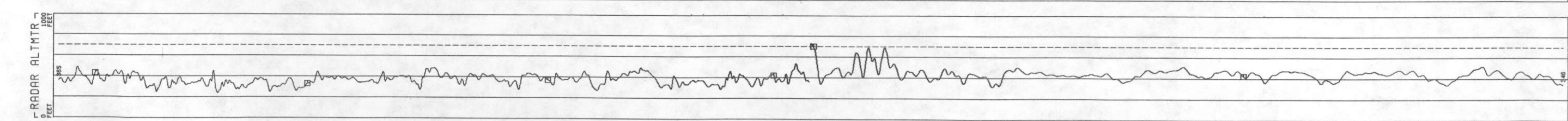
AIR TEMPERATURE
DEG C
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STD DEV 2.778



RESIDUAL MAG
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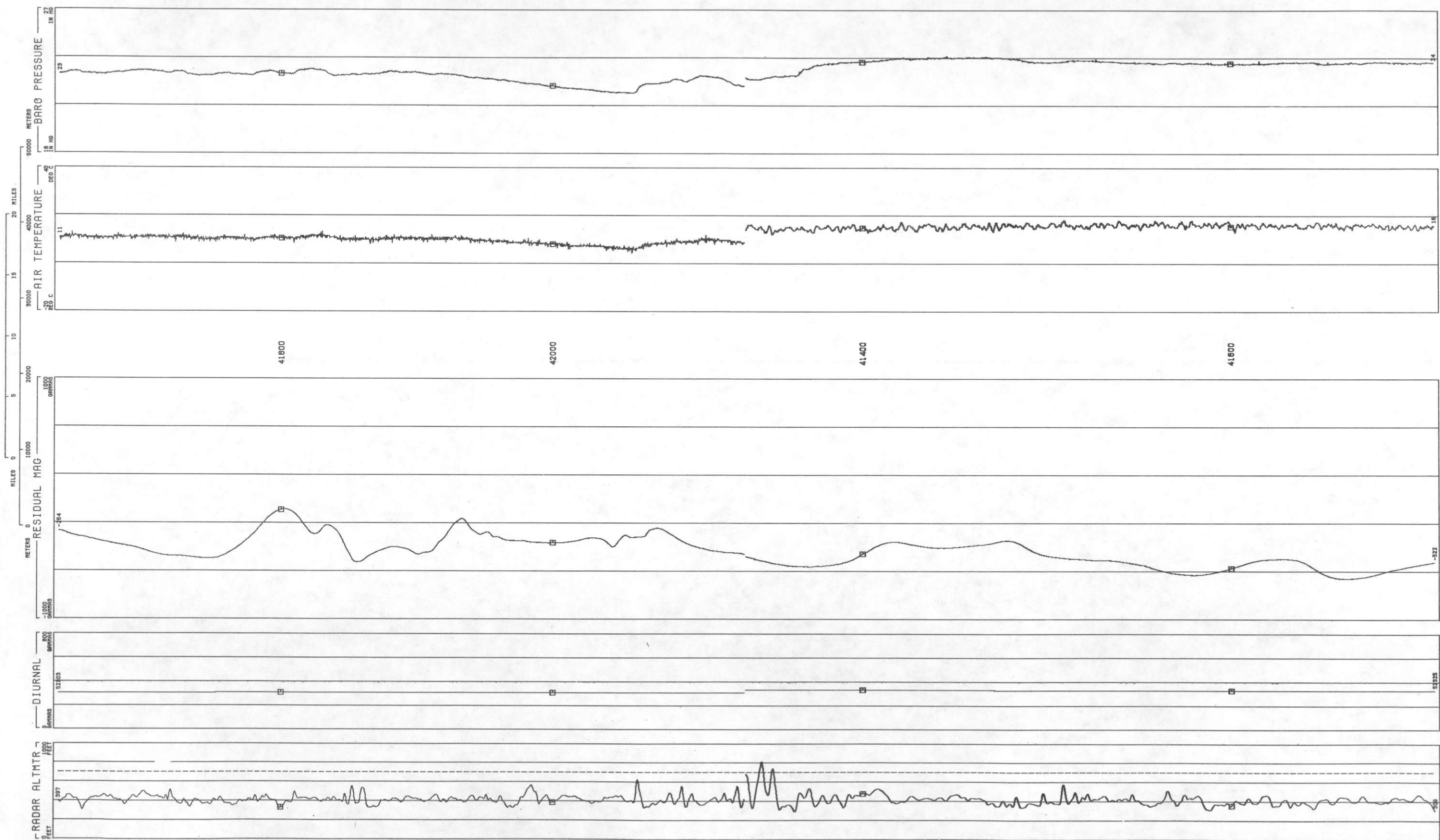


DIURNAL
GAMMAS
MIN 52296
MAX 52344
MEAN 52314
STD DEV 21.05



RADAR ALTMTR
FEET
MIN 242.8
MAX 730.8
MEAN 397.6
STD DEV 61.08

LINE 29
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78305



BARO PRESSURE
IN HG
MIN 21.79
MAX 24.14
MEAN 23.16
STD DEV .5847

AIR TEMPERATURE
DEG C
MIN 4.577
MAX 18.30
MEAN 12.23
STD DEV 3.131

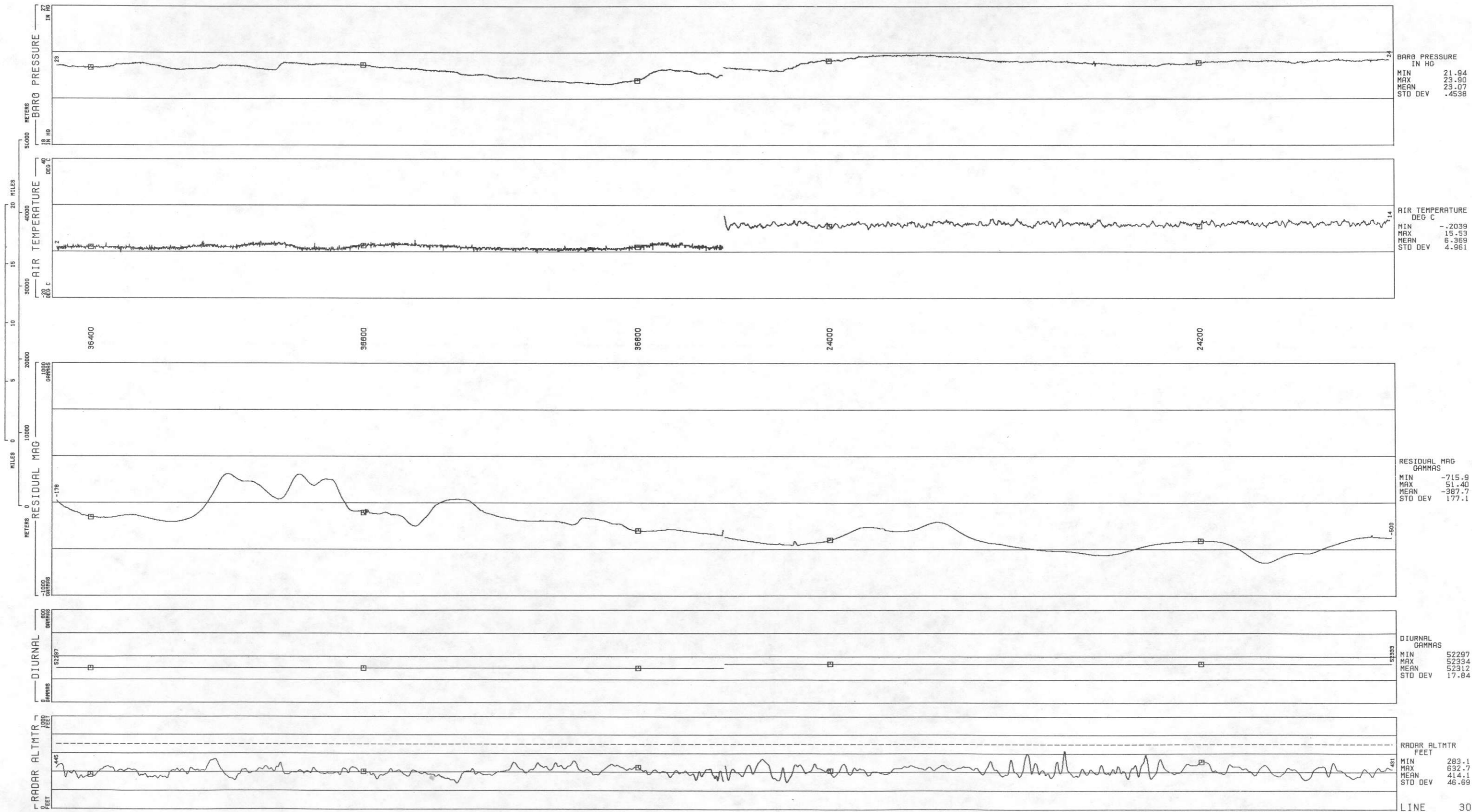
RESIDUAL MAG
GAMMAS
MIN -659.0
MAX -82.48
MEAN -419.2
STD DEV 121.6

DIURNAL
GAMMAS
MIN 52303
MAX 52330
MEAN 52314
STD DEV 11.08

RADAR ALTMTR
FEET
MIN 290.6
MAX 811.4
MEAN 417.3
STD DEV 50.07

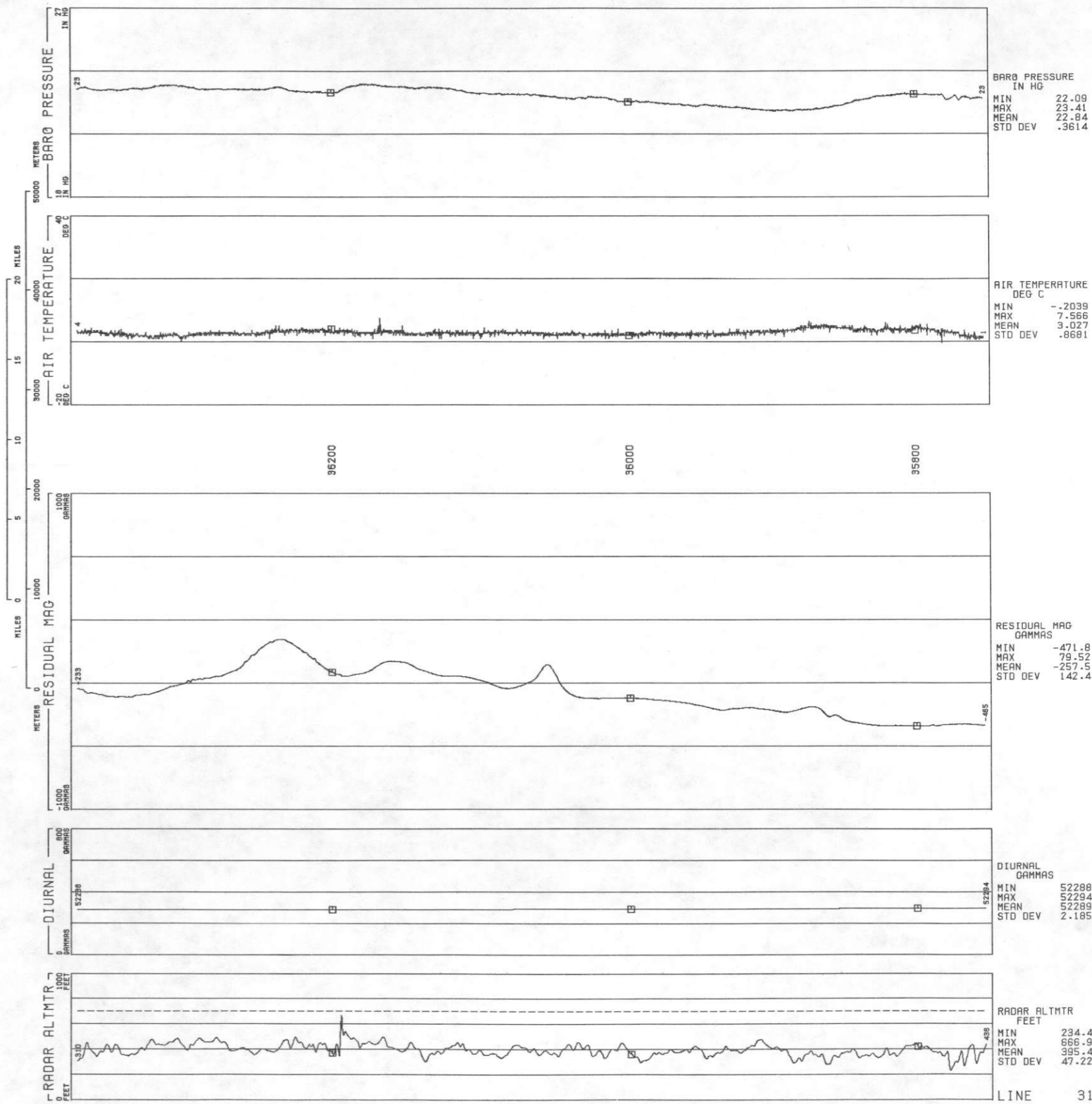


LINE 30
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78300



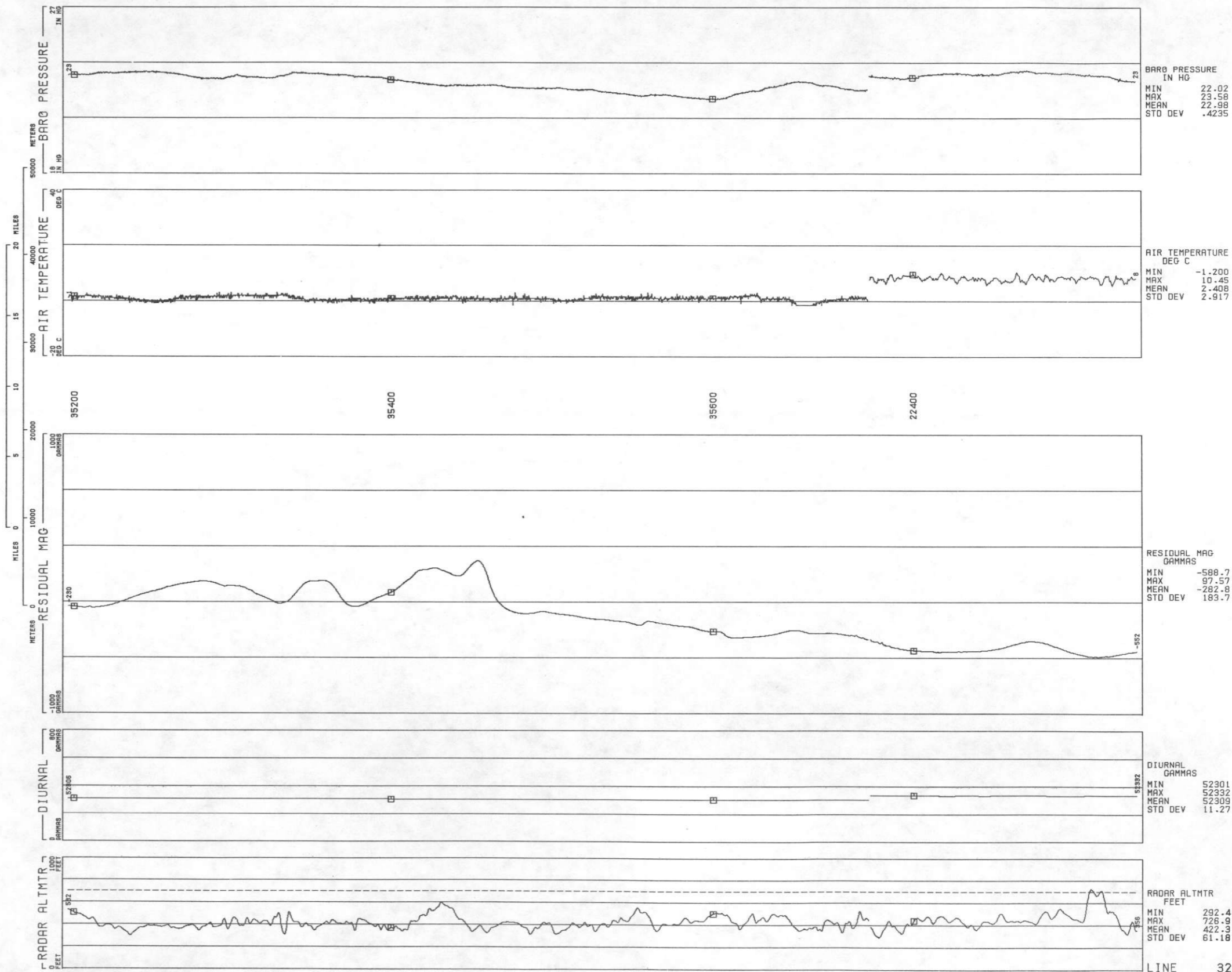


LINE 31
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78333

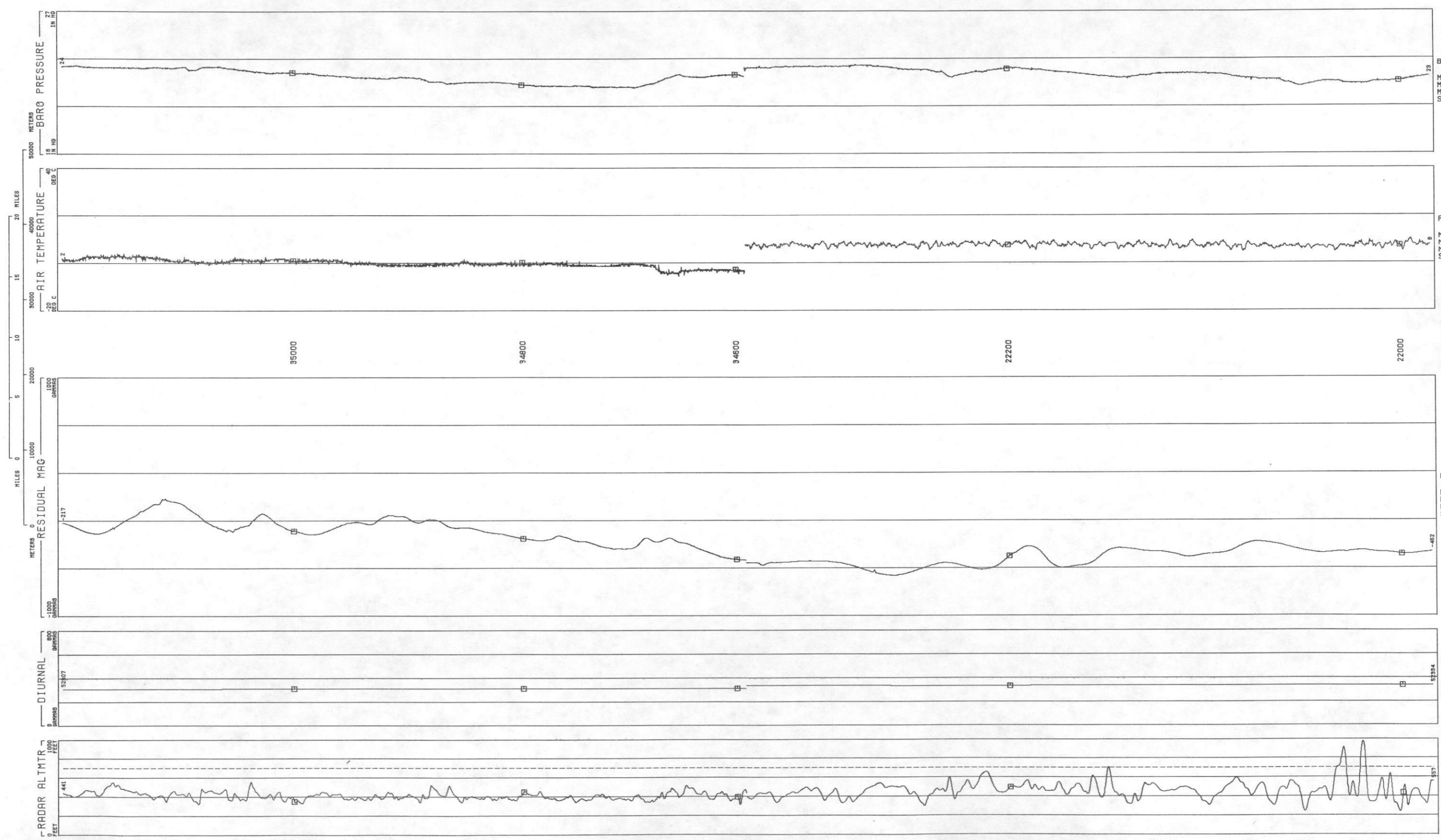




LINE 32
RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78300



LINE 33
RATON BASIN - GALLUP NMMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78300



BARO PRESSURE
IN HG
MIN 22.16
MAX 29.64
MEAN 22.93
STD DEV .4216

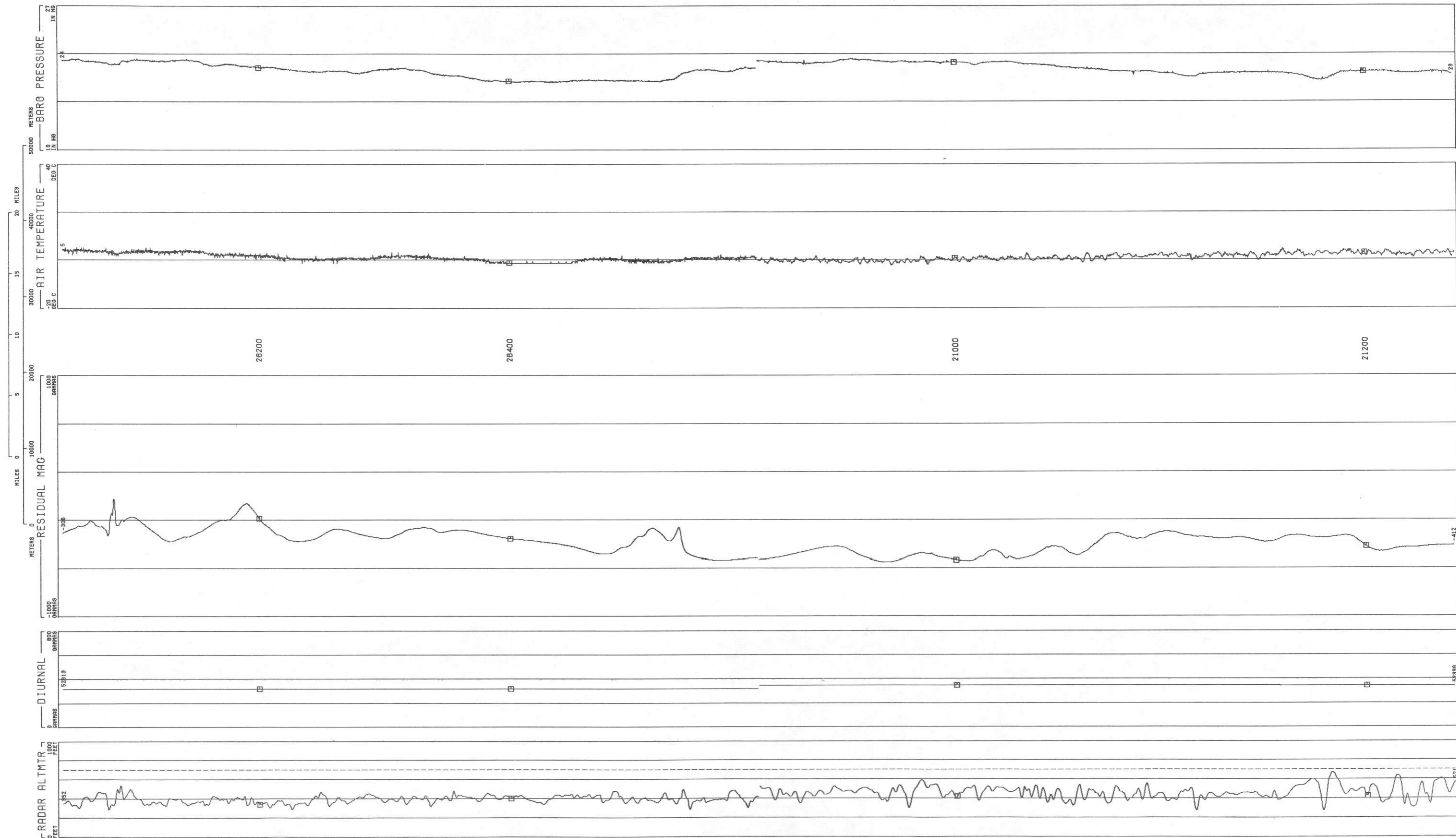
AIR TEMPERATURE
DEG C
MIN -5.500
MAX 10.13
MEAN 2.720
STD DEV 3.907

RESIDUAL MAG
GAMMAS
MIN -661.7
MAX -15.21
MEAN -369.4
STD DEV 146.8

DIURNAL
GAMMAS
MIN 52307
MAX 52334
MEAN 52317
STD DEV 11.21

RADAR ALTMTR
FEET
MIN 241.4
MAX 973.0
MEAN 432.2
STD DEV 71.21

LINE 34
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78300



BARO PRESSURE
IN HG
MIN 22.21
MAX 23.72
MEAN 22.99
STD DEV .4296

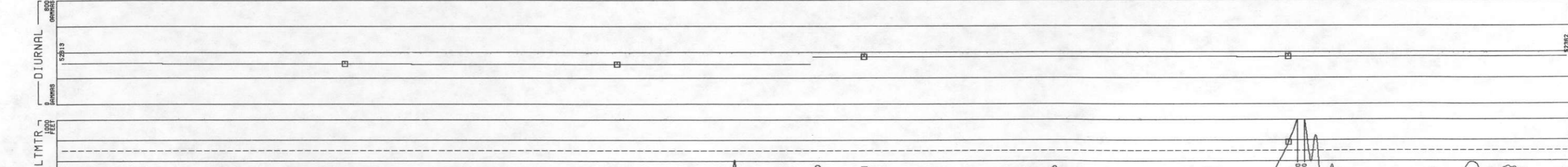
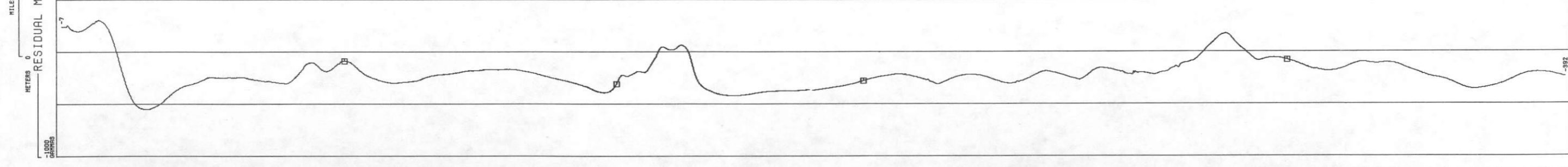
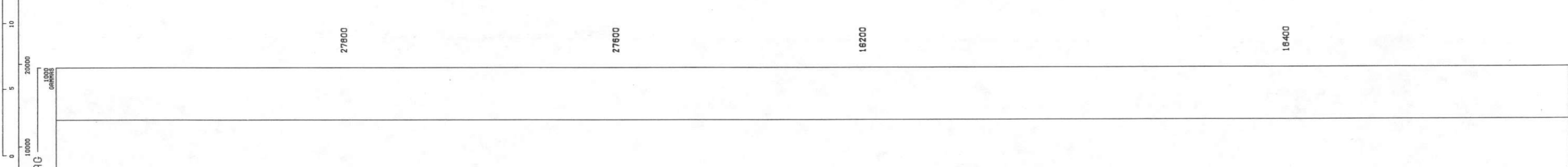
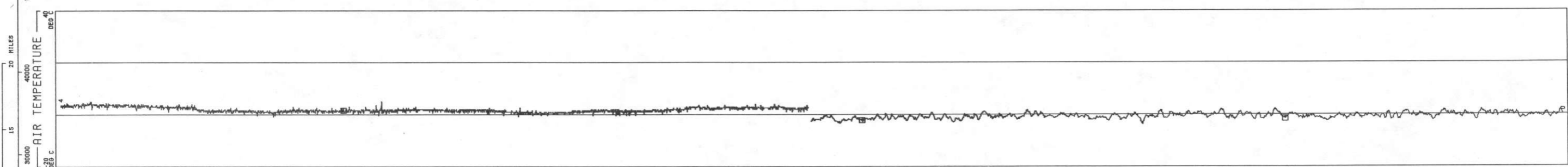
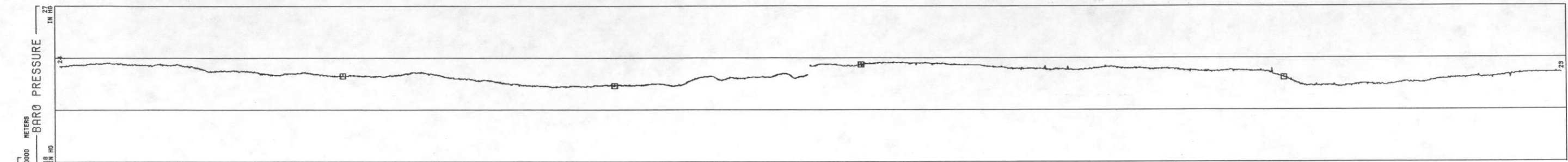
AIR TEMPERATURE
DEG C
MIN -2.387
MAX 5.075
MEAN 1.151
STD DEV 1.501

RESIDUAL MAG
GAMMAS
MIN -551.7
MAX -22.44
MEAN -367.4
STD DEV 103.9

DIURNAL
GAMMAS
MIN 52313
MAX 52343
MEAN 52324
STD DEV 13.10

RADAR ALTMTR
FEET
MIN 275.4
MAX 673.6
MEAN 419.5
STD DEV 60.74

LINE 35
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



BARO PRESSURE IN HG
MIN 22.30
MAX 23.78
MEAN 23.05
STD DEV .4240

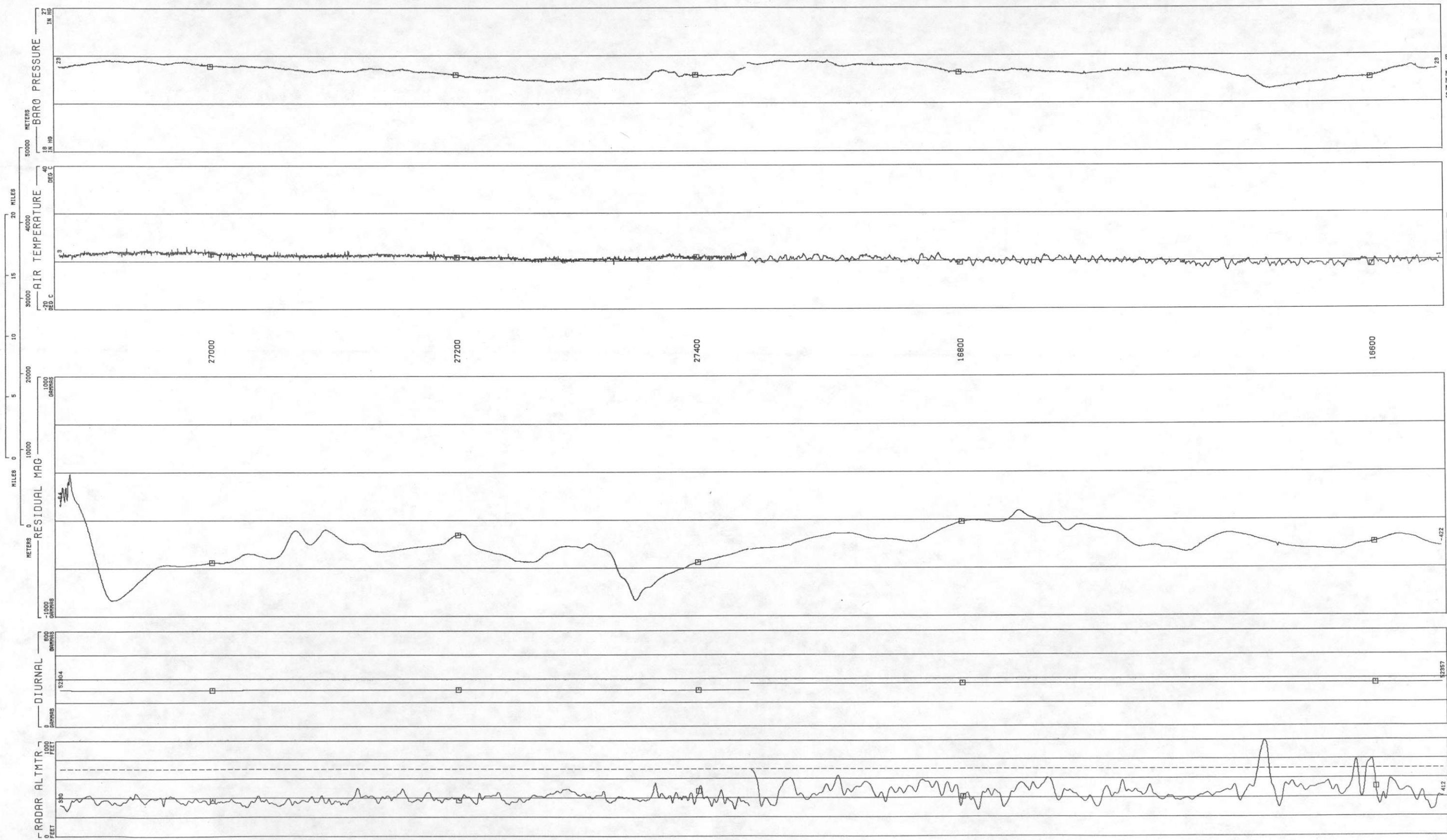
AIR TEMPERATURE DEG C
MIN -3.650
MAX 5.075
MEAN 1.011
STD DEV 1.549

RESIDUAL MAG GAMMAS
MIN -639.8
MAX 44.76
MEAN -371.3
STD DEV 118.8

DIURNAL GAMMAS
MIN 52306
MAX 52364
MEAN 52329
STD DEV 26.37

RADAR ALTMTR FEET
MIN 290.8
MAX 1087
MEAN 426.6
STD DEV 77.75

LINE 36
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



BARO PRESSURE
IN HG
MIN 21.84
MAX 23.75
MEAN 23.02
STD DEV .4029

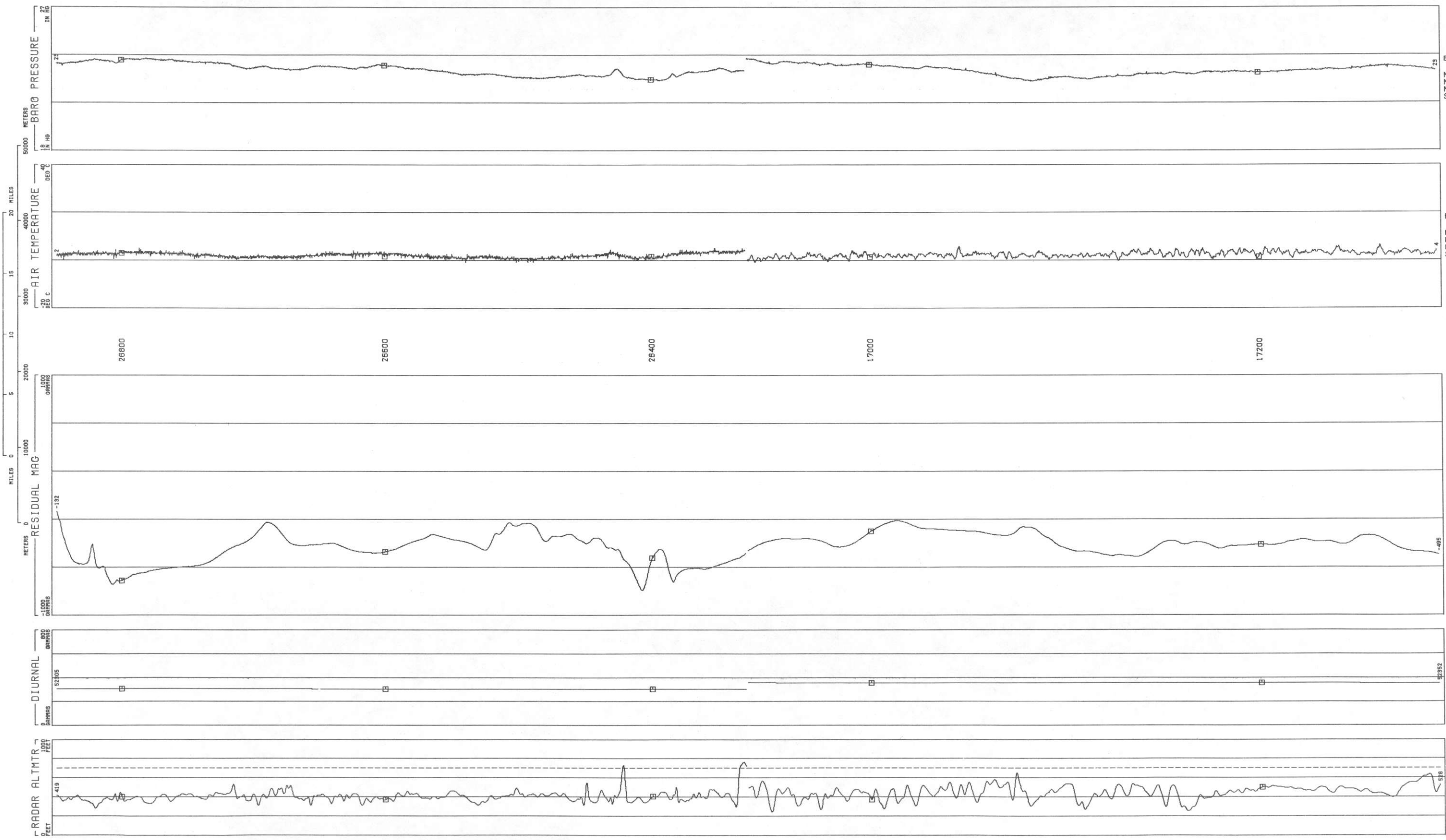
AIR TEMPERATURE
DEG C
MIN -4.092
MAX 6.072
MEAN 1.382
STD DEV 1.605

RESIDUAL MAG
GAMMAS
MIN -865.5
MAX 188.7
MEAN -436.6
STD DEV 154.2

DIURNAL
GAMMAS
MIN 52302
MAX 52356
MEAN 52324
STD DEV 25.46

RADAR ALTMTR
FEET
MIN 266.5
MAX 994.1
MEAN 421.7
STD DEV 80.94

37
LINE NTMS NI 12-3 GEOMETRICS
RATON BASIN - GALLUP DATA ACQUIRED 78299



BARO PRESSURE
IN HG
MIN 22.37
MAX 23.81
MEAN 23.09
STD DEV .3555

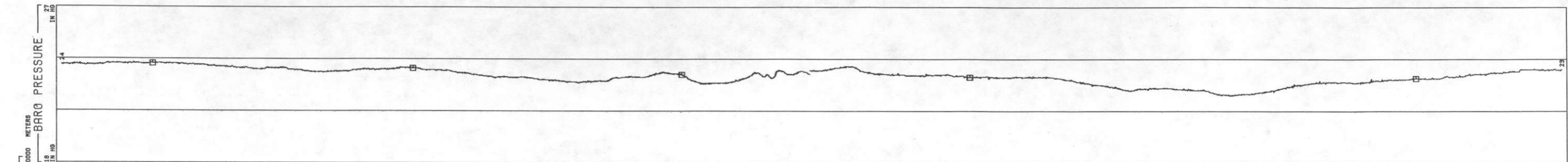
AIR TEMPERATURE
DEG C
MIN -7.019
MAX 6.540
MEAN 2.353
STD DEV 1.012

RESIDUAL MAG
GAMMAS
MIN -790.4
MAX -132.3
MEAN -430.1
STD DEV 117.7

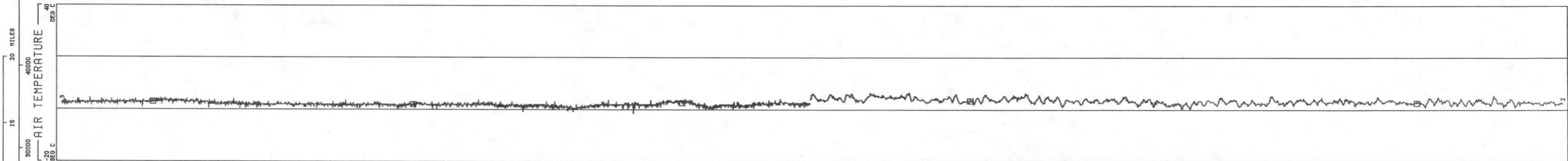
DIURNAL
GAMMAS
MIN 52303
MAX 52357
MEAN 52323
STD DEV 24.45

RADAR ALTMTR
FEET
MIN 247.4
MAX 761.3
MEAN 422.5
STD DEV 66.29

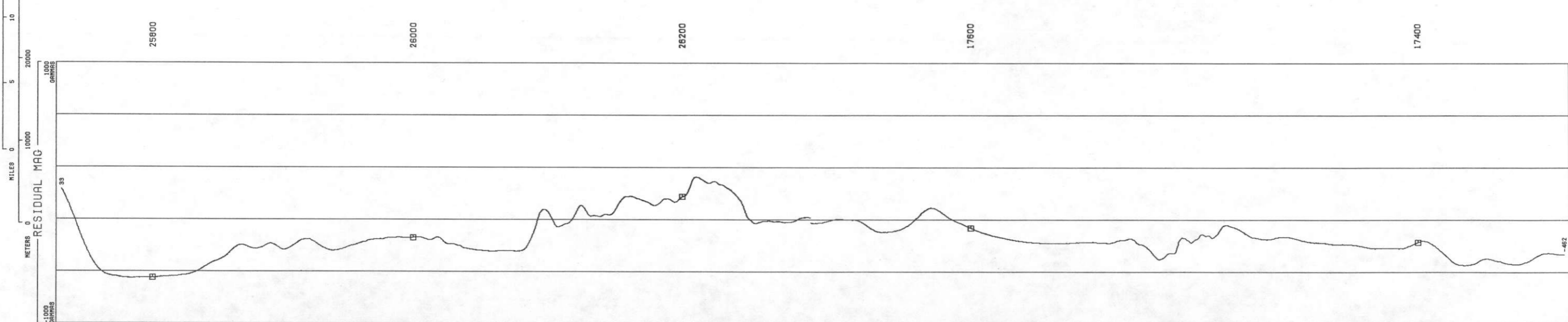
LINE 38
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



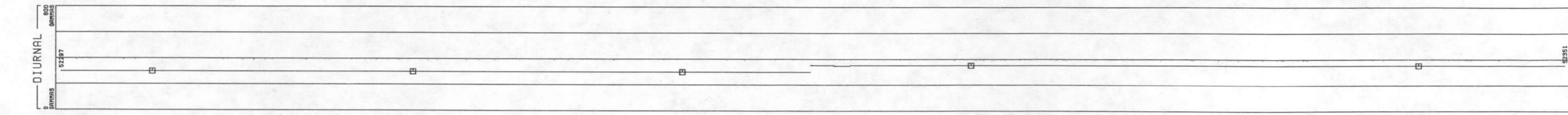
BARO PRESSURE
IN HG
MIN 21.91
MAX 23.75
MEAN 23.09
STD DEV .4355



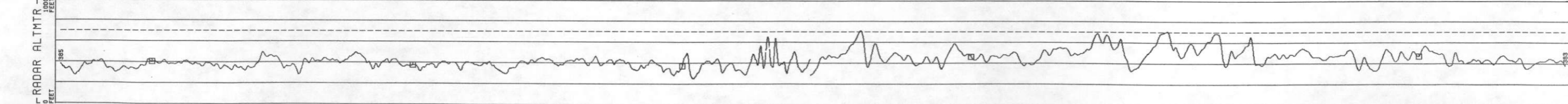
AIR TEMPERATURE
DEG C
MIN -1.200
MAX 6.641
MEAN 2.691
STD DEV 1.057



RESIDUAL MAG
GAMMAS
MIN -649.4
MAX 129.0
MEAN -330.4
STD DEV 176.0

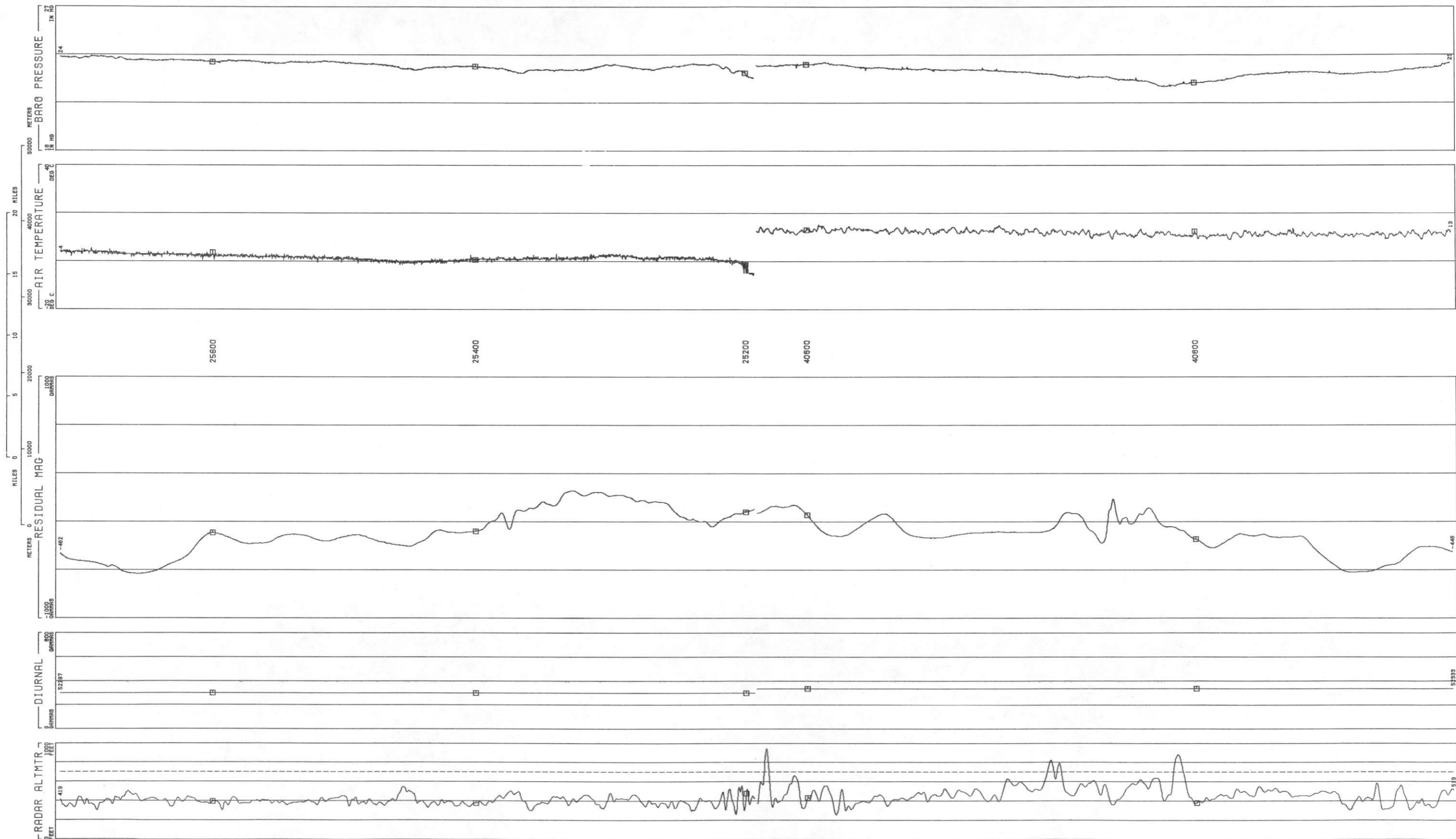


DIURNAL
GAMMAS
MIN 52297
MAX 52352
MEAN 52316
STD DEV 25.55



RADAR ALTMTR
FEET
MIN 251.7
MAX 713.3
MEAN 421.8
STD DEV 75.60

LINE 39
RATON BASIN - GALLUP NMMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78305



BARO PRESSURE
IN HG
MIN 22.02
MAX 23.32
MEAN 23.20
STD DEV .3828

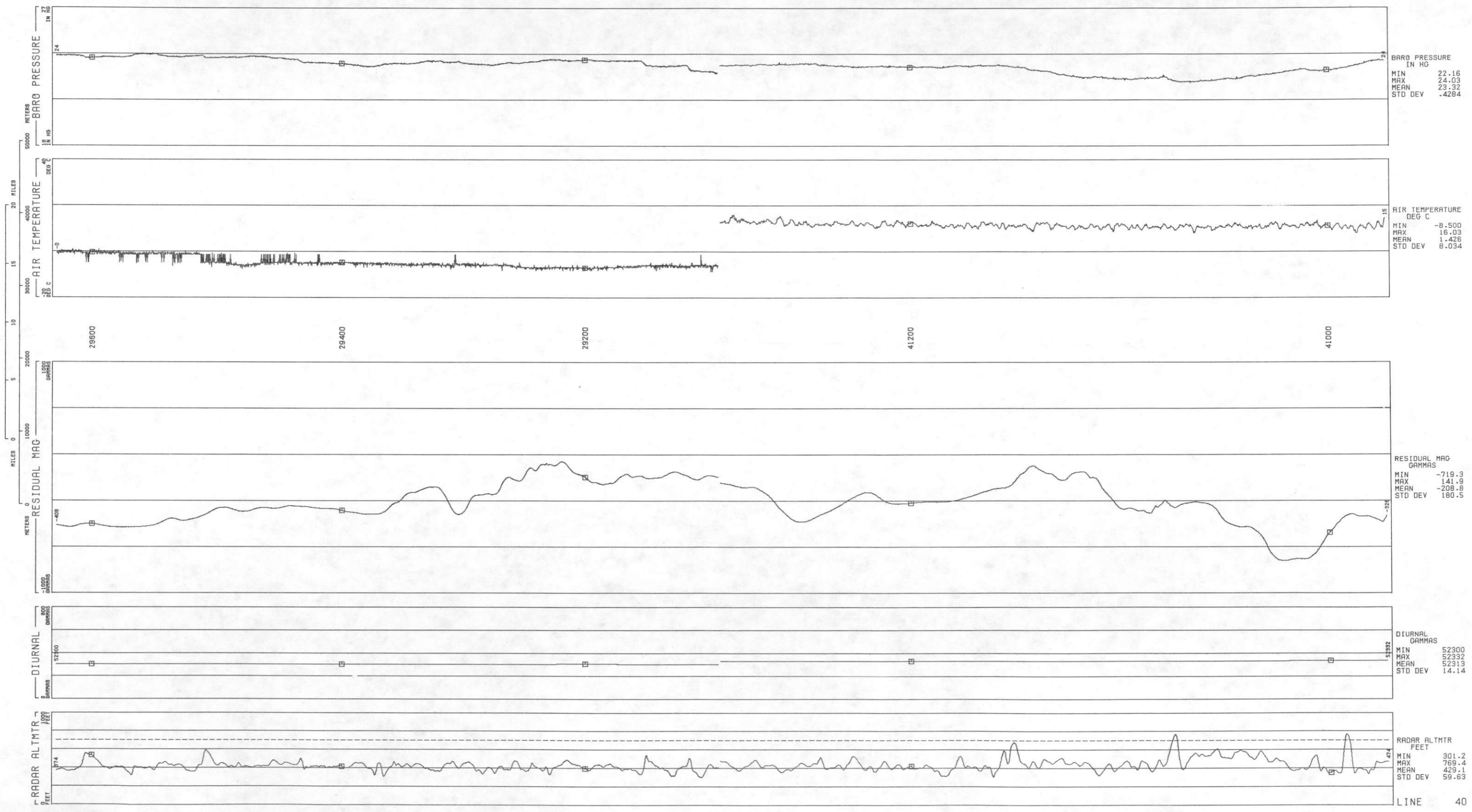
AIR TEMPERATURE
DEG C
MIN -5.600
MAX 15.25
MEAN 5.821
STD DEV 5.250

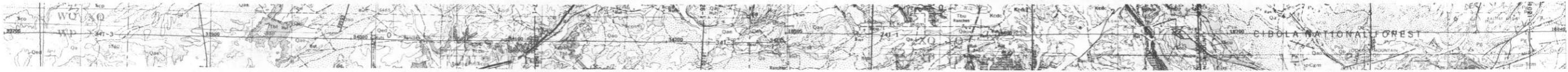
RESIDUAL MAG
GAMMAS
MIN -629.5
MAX 58.92
MEAN -288.1
STD DEV 168.5

DIURNAL
GAMMAS
MIN 52297
MAX 52334
MEAN 52312
STD DEV 17.87

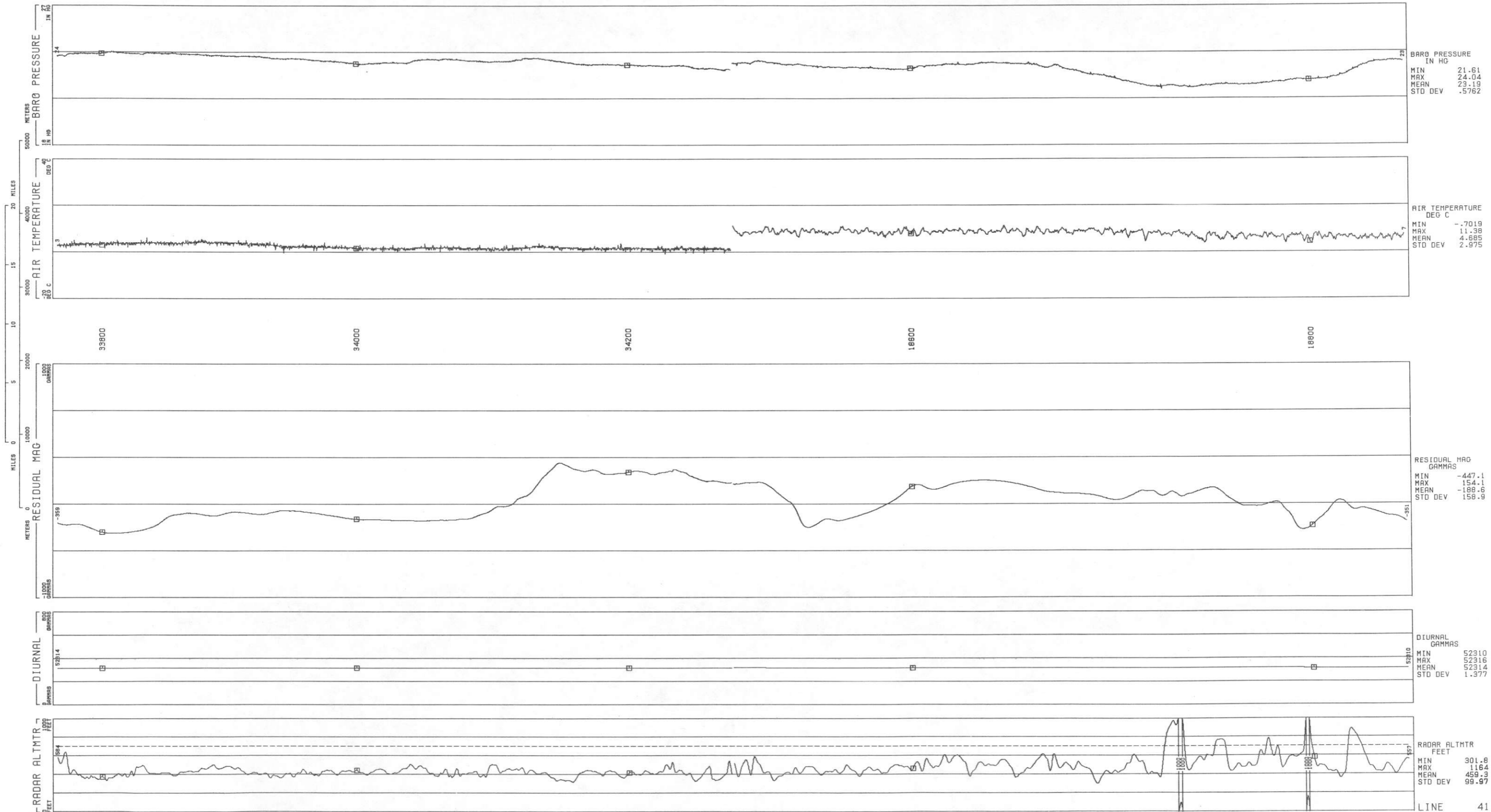
RADAR ALTMTR
FEET
MIN 256.5
MAX 940.9
MEAN 432.1
STD DEV 82.21

40
LINE
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78305

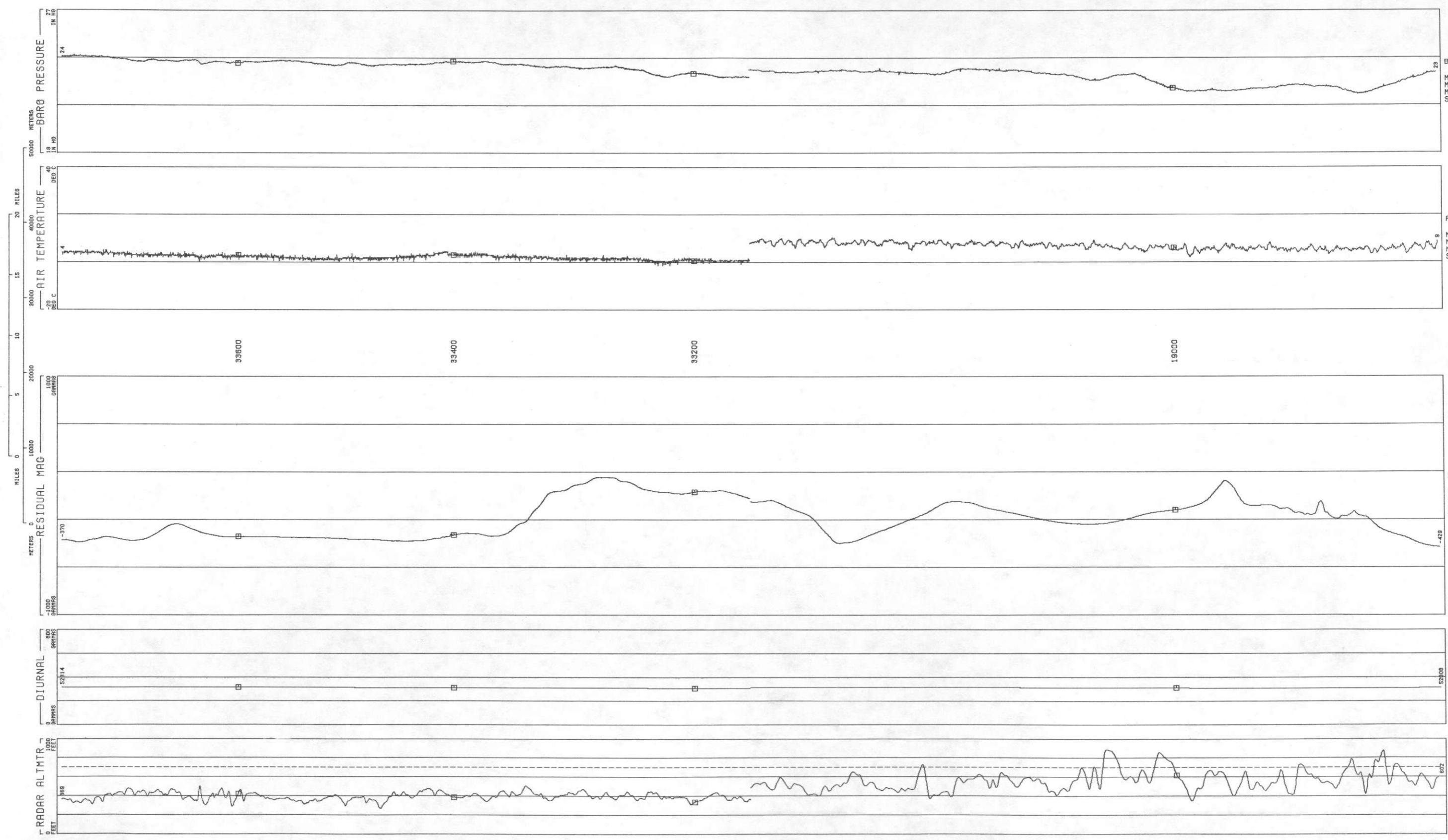




LINE 41
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



LINE 42
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



BARO PRESSURE
IN HG
MIN 21.71
MAX 24.18
MEAN 23.27
STD DEV .5757

AIR TEMPERATURE
DEG C
MIN -1.200
MAX 10.47
MEAN 3.889
STD DEV 2.547

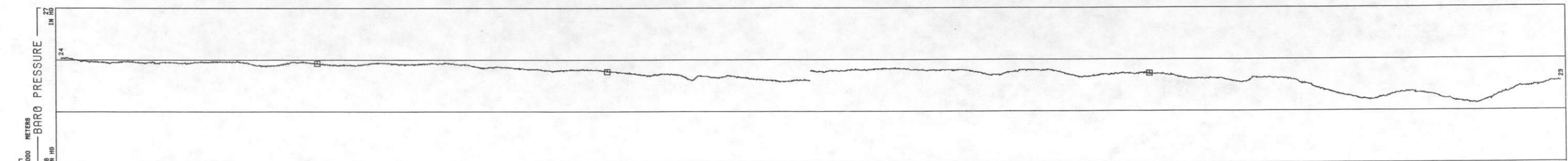
RESIDUAL MAG
GAMMAS
MIN -429.0
MAX 158.8
MEAN -198.7
STD DEV 166.9

DIURNAL
GAMMAS
MIN 52307
MAX 52316
MEAN 52310
STD DEV 2.421

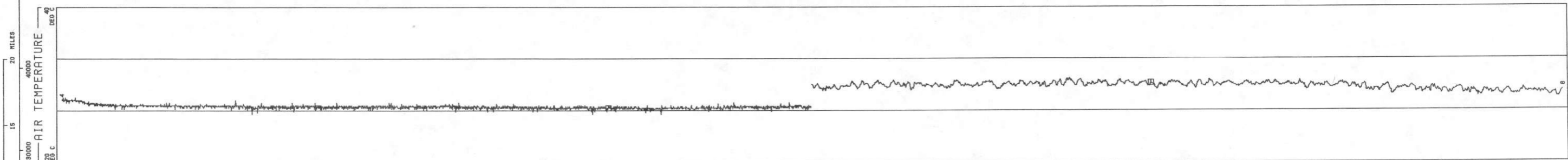
RADAR ALTMTR
FEET
MIN 270.4
MAX 888.8
MEAN 455.3
STD DEV 106.2



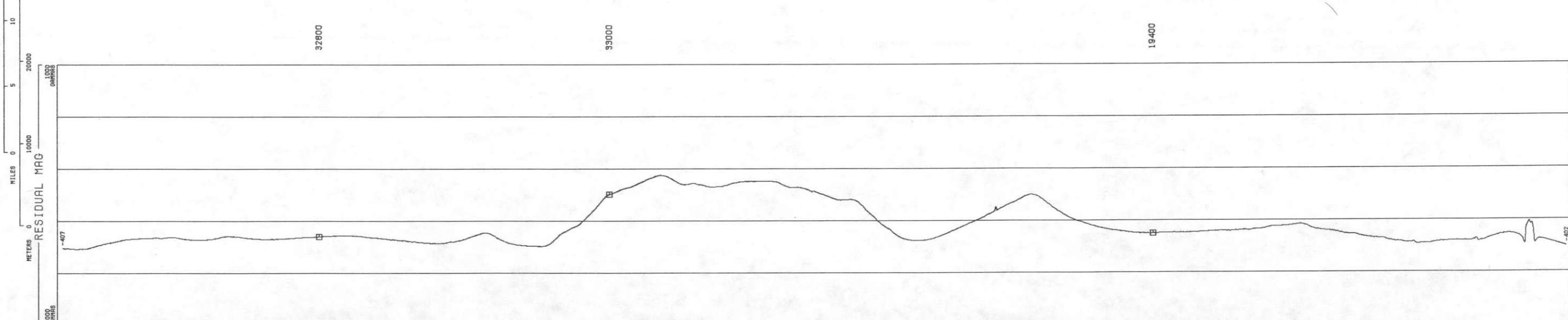
LINE 43
 RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78299



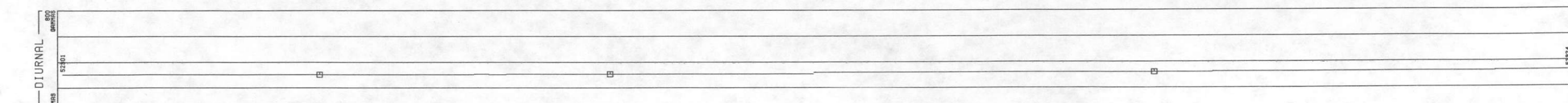
BARO PRESSURE
 IN HG
 MIN 21.42
 MAX 24.15
 MEAN 23.26
 STD DEV .6032



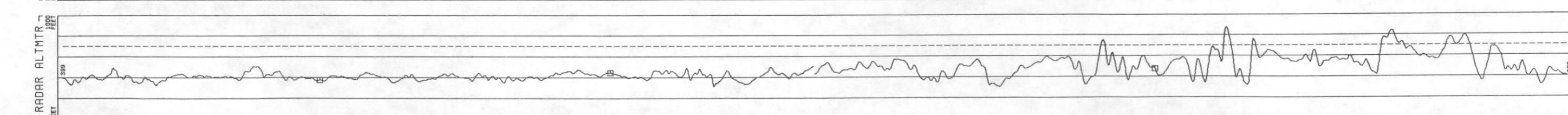
AIR TEMPERATURE
 DEG C
 MIN -1.200
 MAX 12.52
 MEAN 4.594
 STD DEV 3.915



RESIDUAL MAG
 GAMMAS
 MIN -414.6
 MAX 152.0
 MEAN -230.9
 STD DEV 164.7

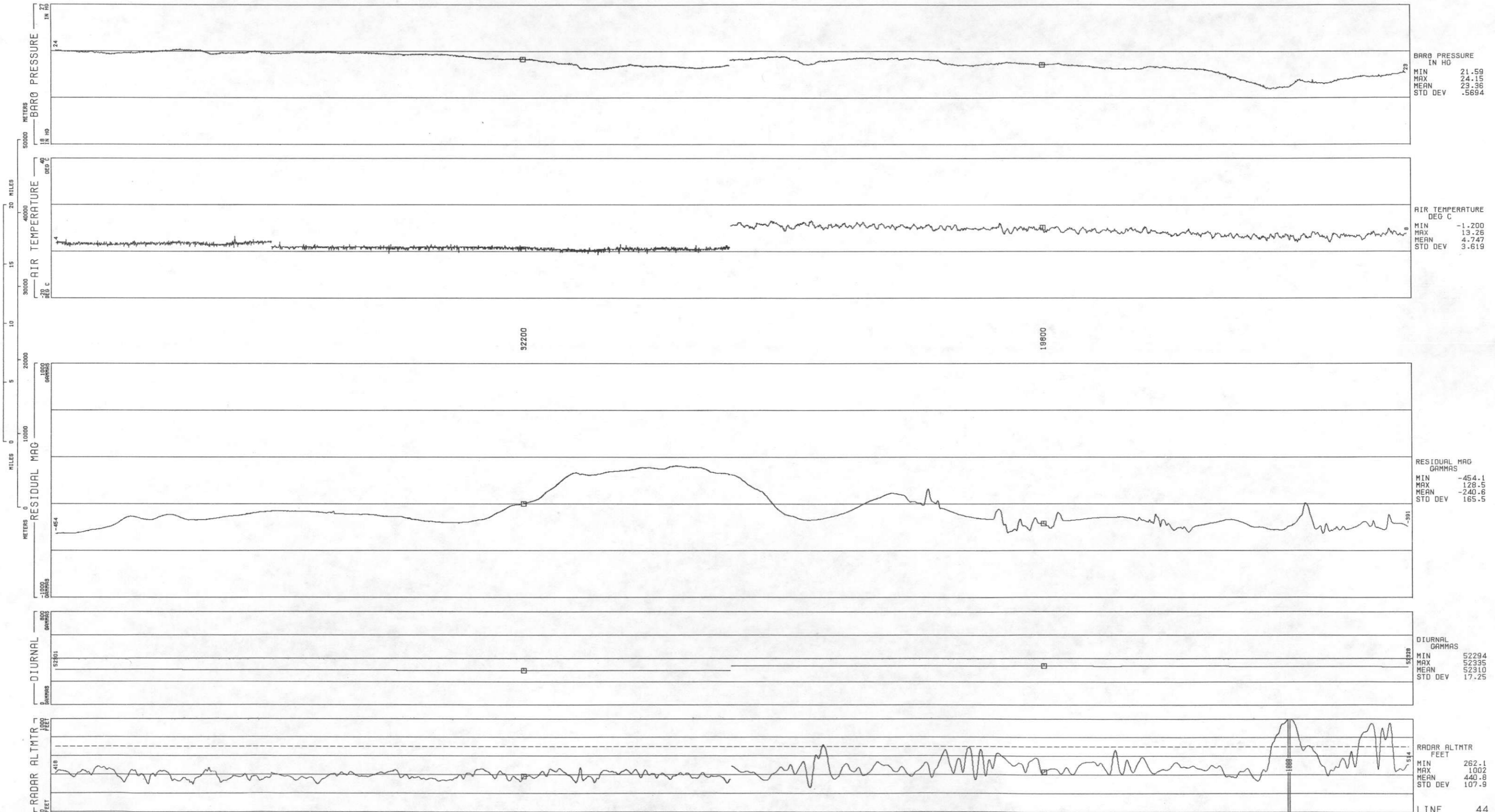


DIURNAL
 GAMMAS
 MIN 52301
 MAX 52325
 MEAN 52310
 STD DEV 8.319

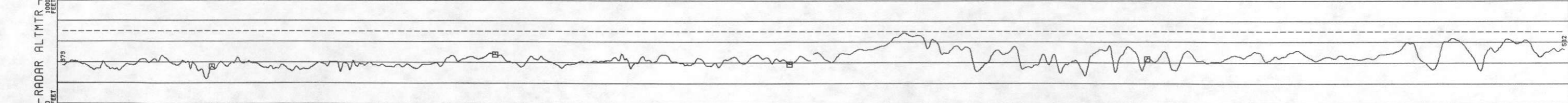
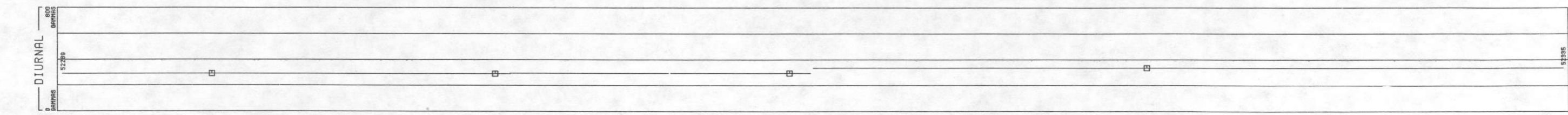
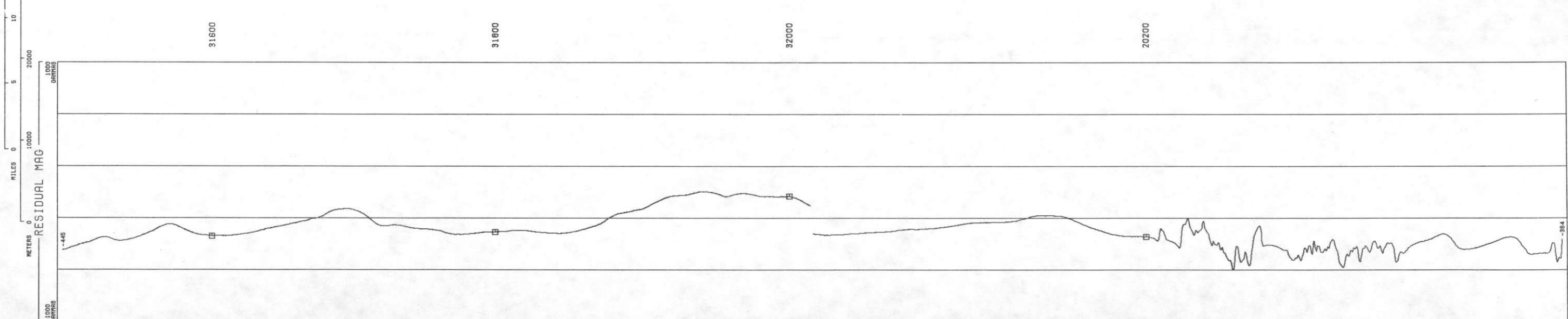
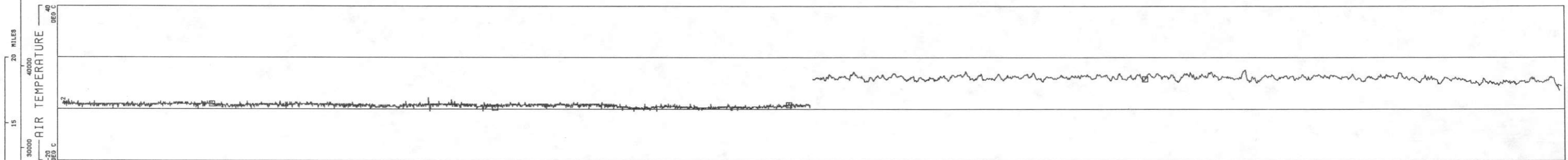
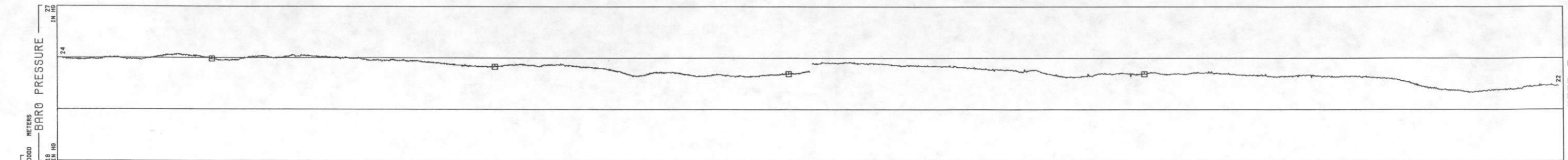


RADAR ALTMTR
 FEET
 MIN 308.8
 MAX 878.9
 MEAN 456.1
 STD DEV 92.12

LINE 44
RATON BASIN - CALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



LINE 45
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299



BARO PRESSURE
IN HG
MIN 22.00
MAX 24.23
MEAN 23.43
STD DEV .5267

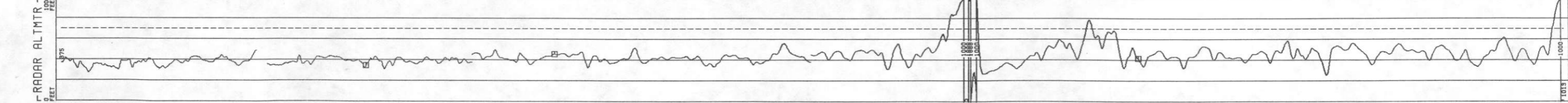
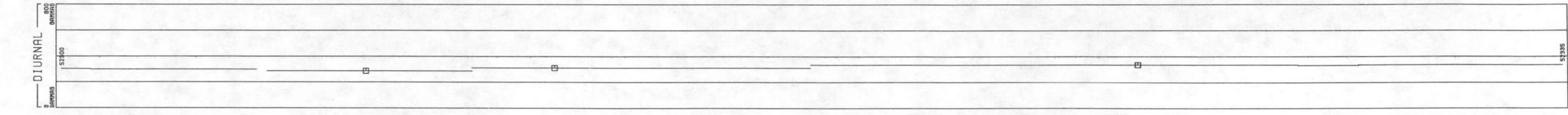
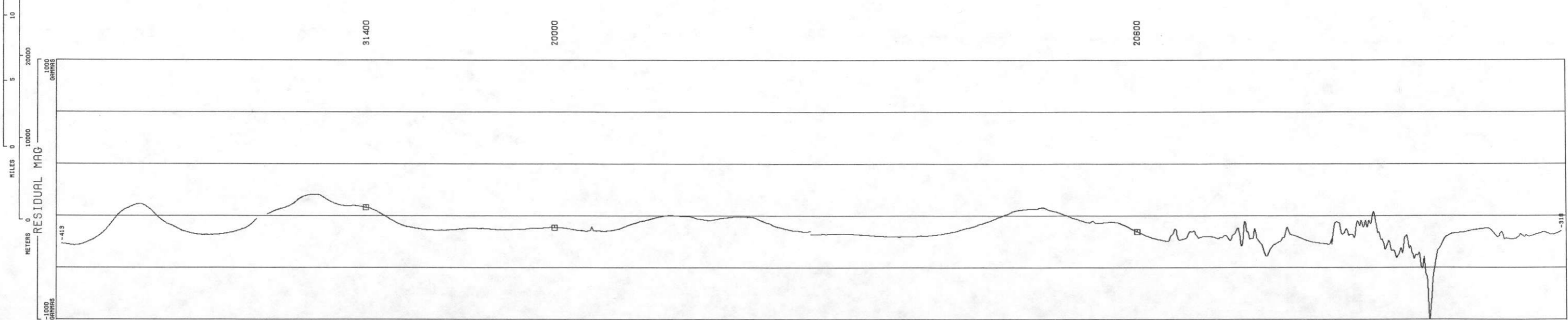
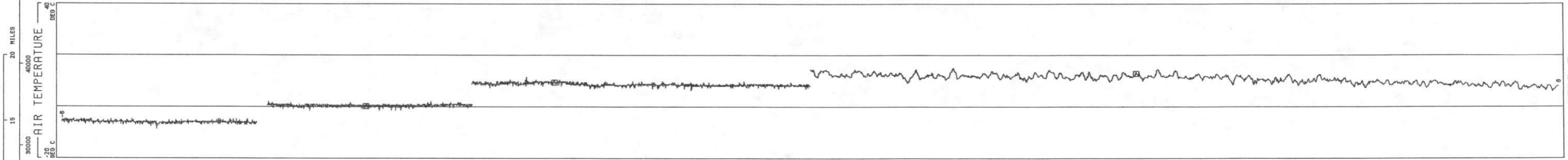
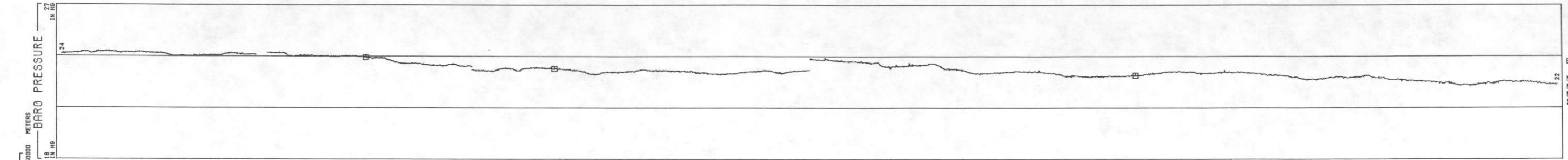
AIR TEMPERATURE
DEG C
MIN -70.19
MAX 15.31
MEAN 5.393
STD DEV 5.117

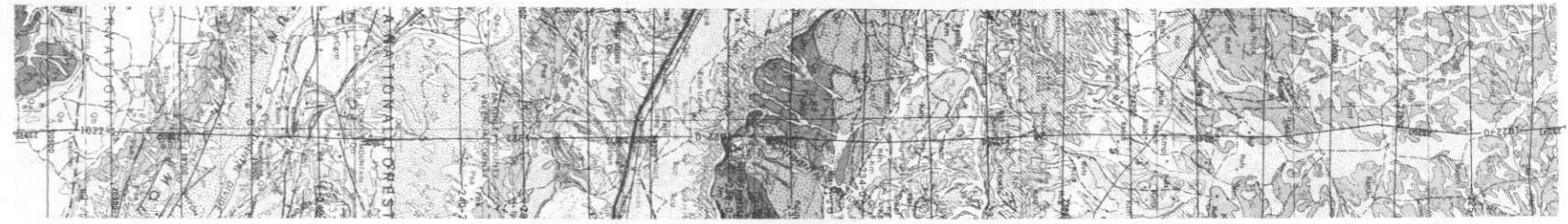
RESIDUAL MAG
GAMMAS
MIN -596.2
MAX 6.562
MEAN -271.4
STD DEV 124.7

DIURNAL
GAMMAS
MIN 52289
MAX 52335
MEAN 52307
STD DEV 20.92

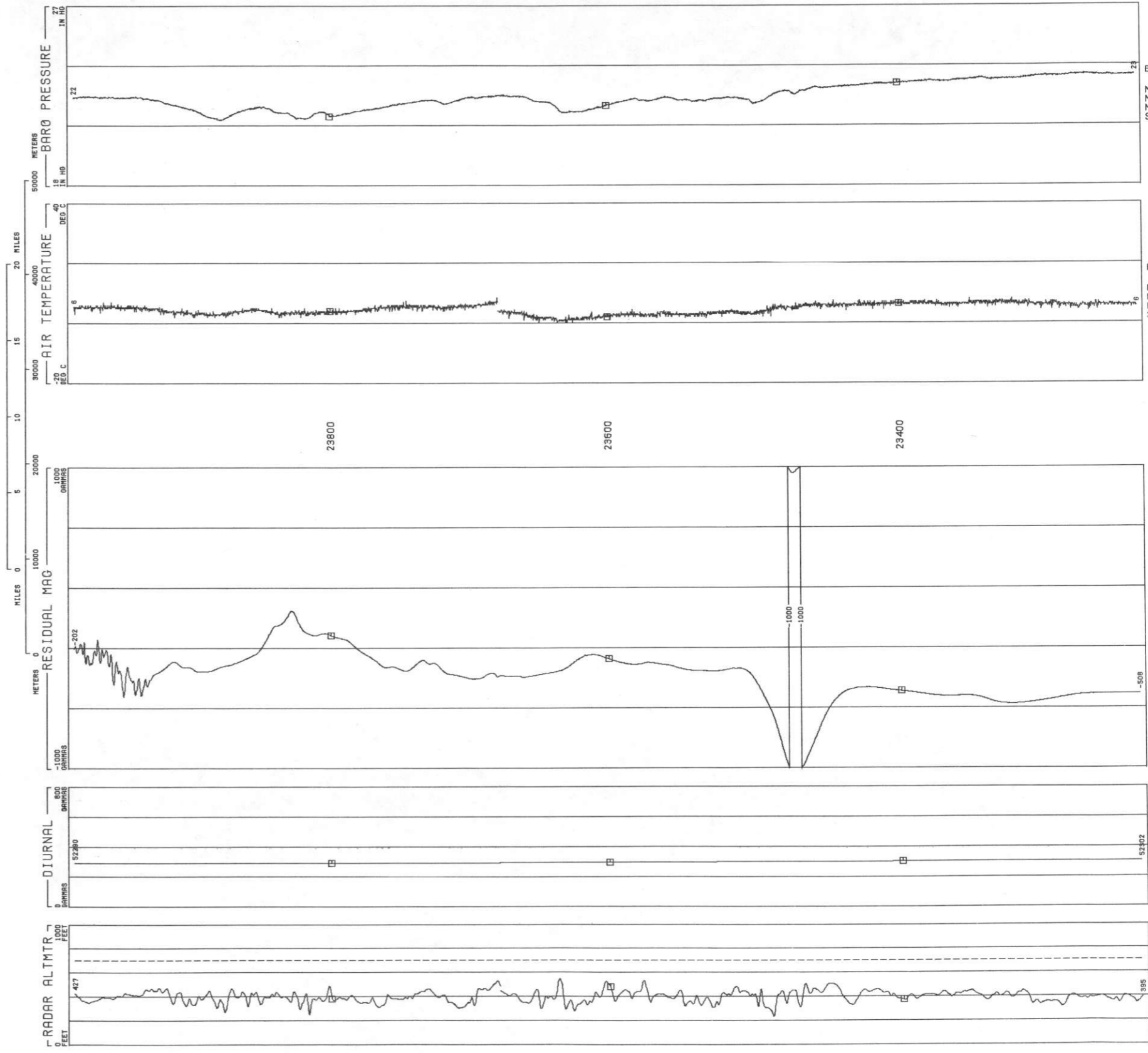
RADAR ALTMTR
FEET
MIN 241.3
MAX 688.8
MEAN 429.1
STD DEV 71.20

LINE 46
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78299





LINE TL22
RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78327



BARO PRESSURE
IN HG
MIN 21.29
MAX 23.56
MEAN 22.45
STD DEV .6184

AIR TEMPERATURE
DEG C
MIN -29.42
MAX 8.562
MEAN 4.689
STD DEV 1.542

RESIDUAL MAG
GAMMAS
MIN -1038
MAX 49.70
MEAN -392.5
STD DEV 176.7

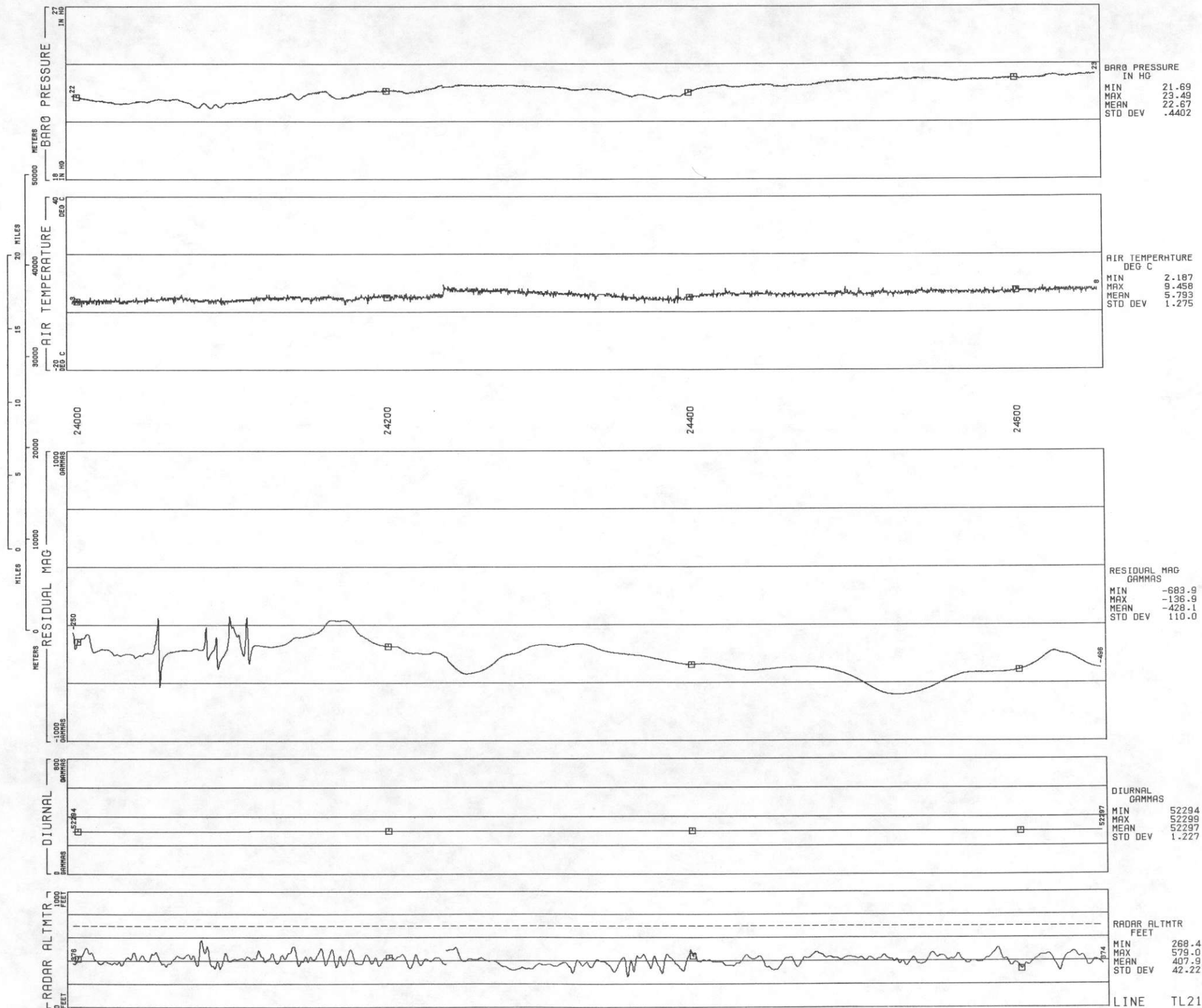
DIURNAL
GAMMAS
MIN 52288
MAX 52302
MEAN 52294
STD DEV 4.725

RADAR ALTMTR
FEET
MIN 235.2
MAX 546.3
MEAN 398.9
STD DEV 46.44

LINE TL22



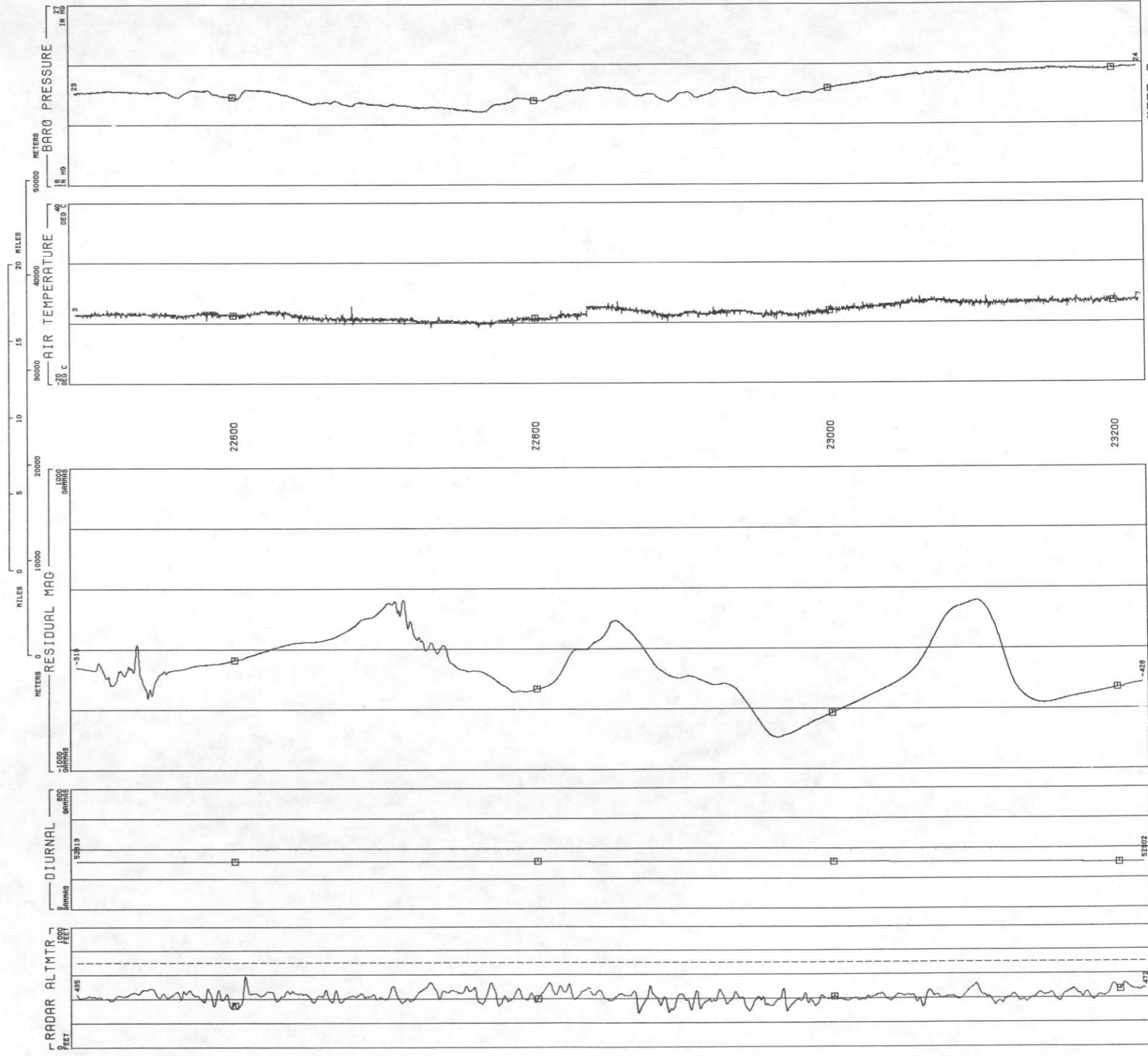
LINE TL21
RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78927



LINE TL21



LINE TL23
RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78327



BARO PRESSURE
IN HG
MIN 21.65
MAX 23.85
MEAN 22.74
STD DEV .6008

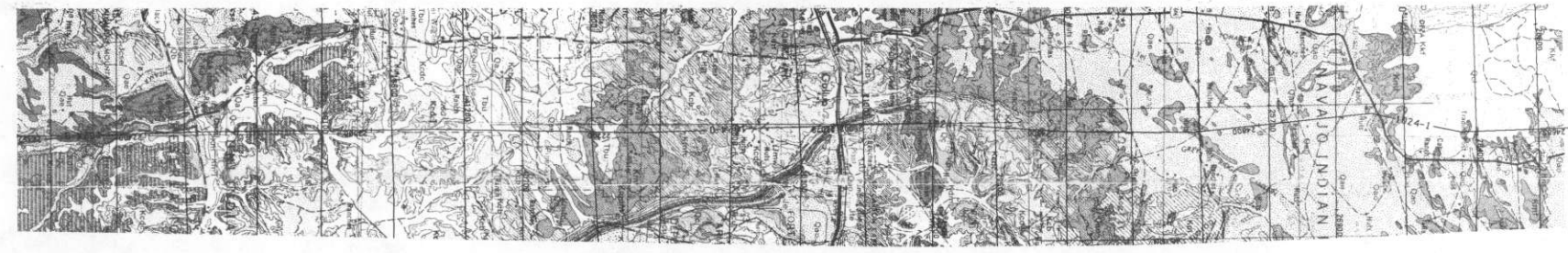
AIR TEMPERATURE
DEG C
MIN -1.200
MAX 8.960
MEAN 3.757
STD DEV 2.128

RESIDUAL MAG
GAMMAS
MIN -789.2
MAX 126.7
MEAN -319.9
STD DEV 213.0

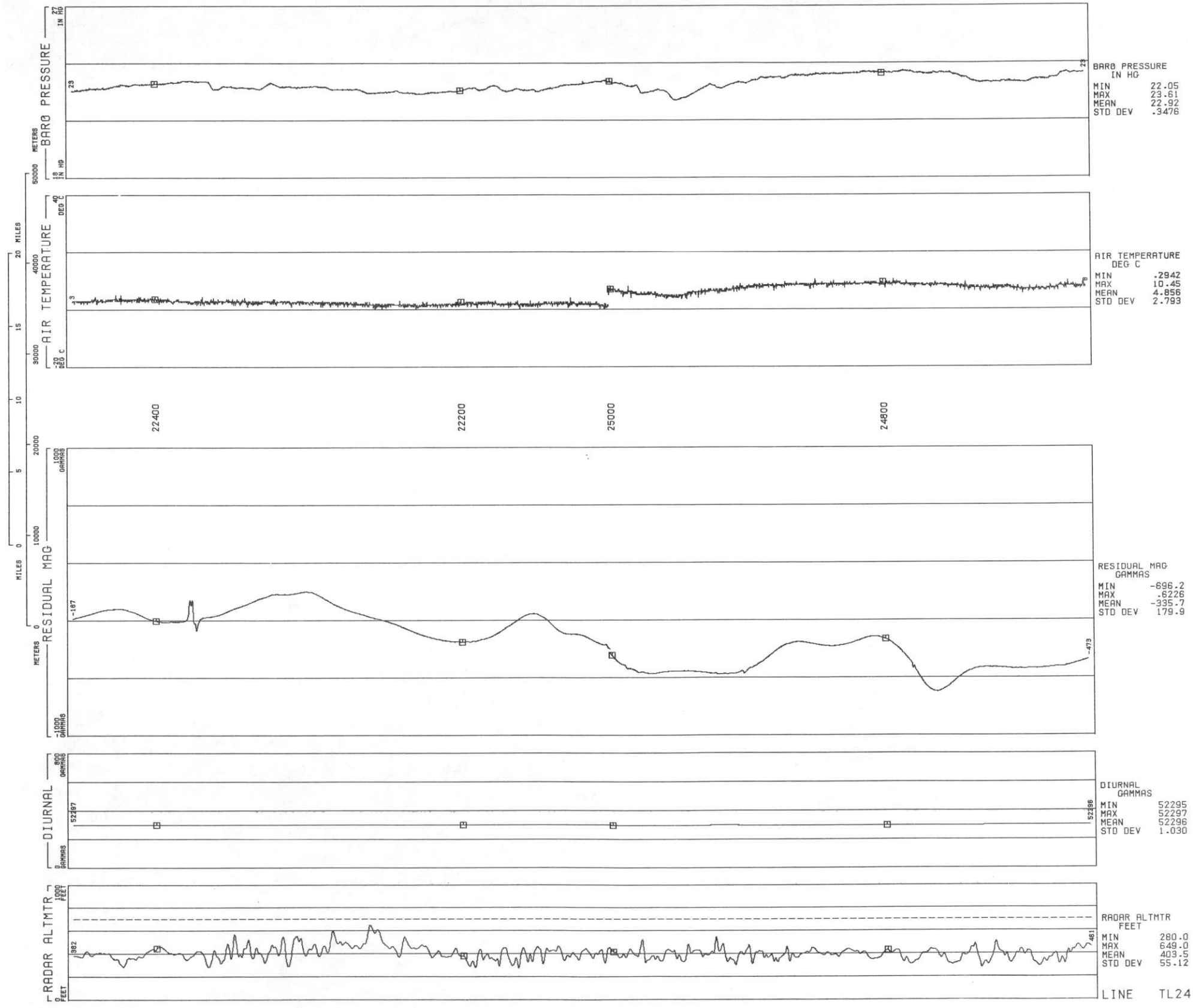
DIURNAL
GAMMAS
MIN 52302
MAX 52314
MEAN 52310
STD DEV 3.332

RADAR ALTMTR
FEET
MIN 284.9
MAX 589.4
MEAN 422.1
STD DEV 43.03

LINE TL23

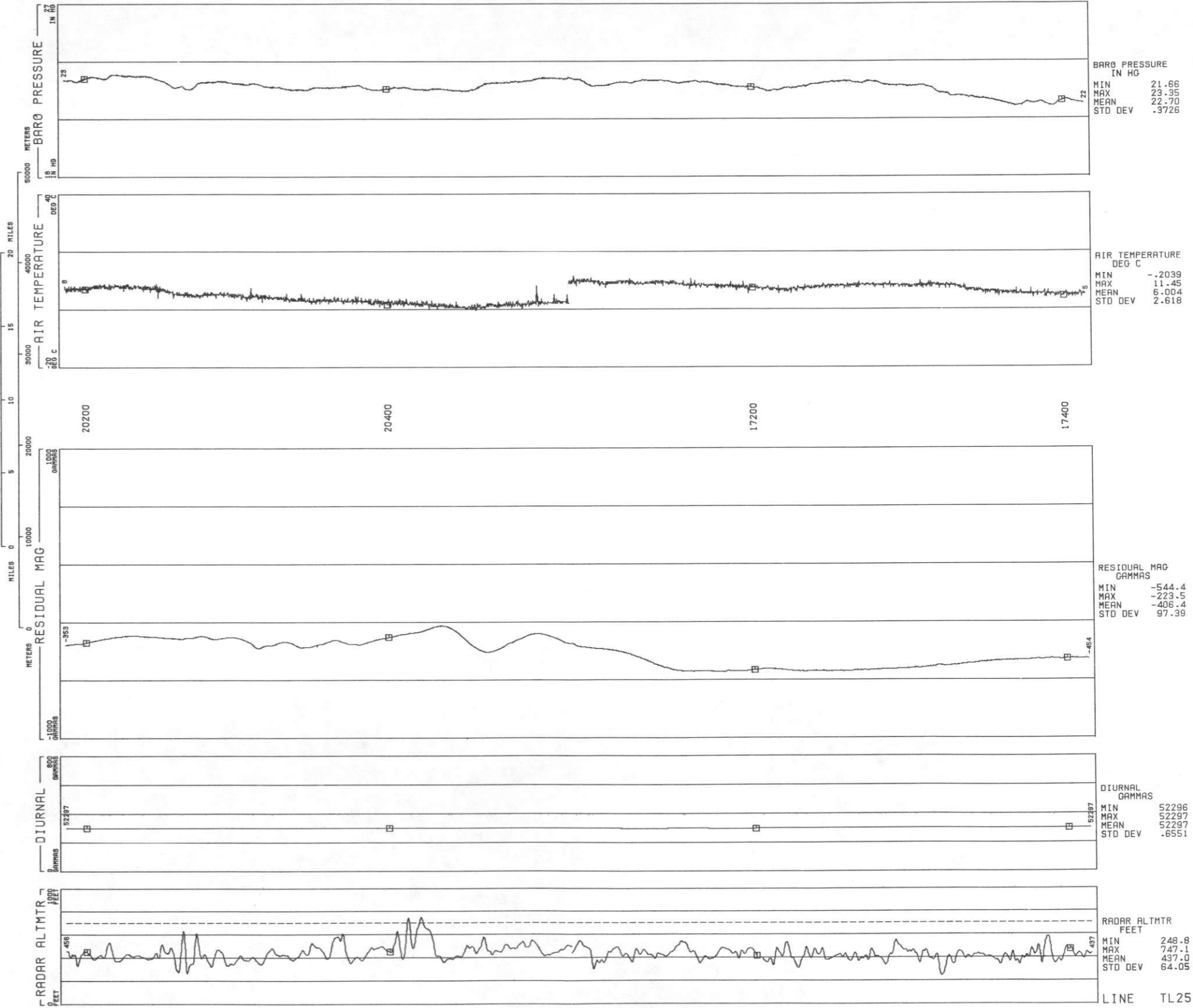


LINE TL24
RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
DATA ACQUIRED 78327



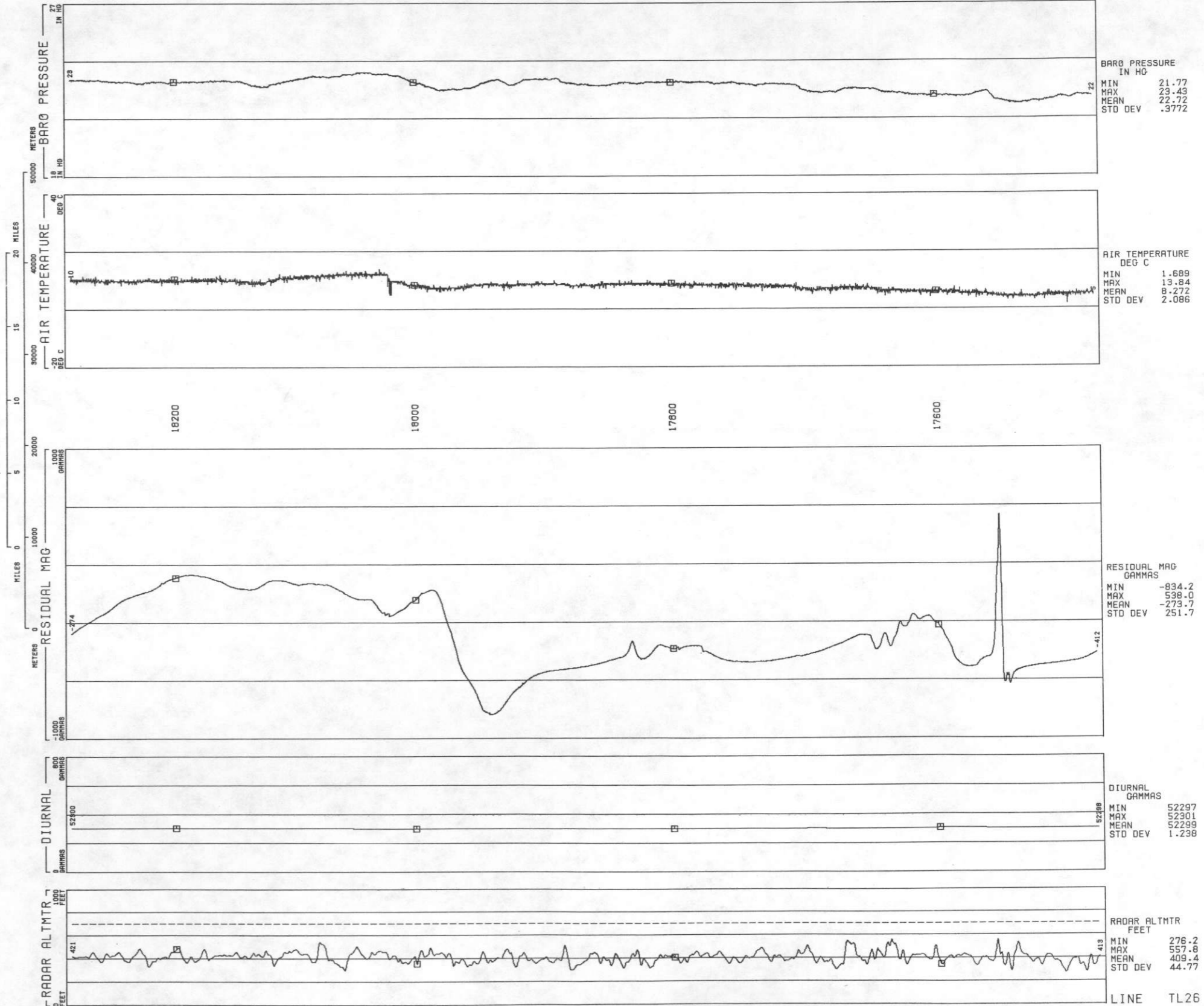


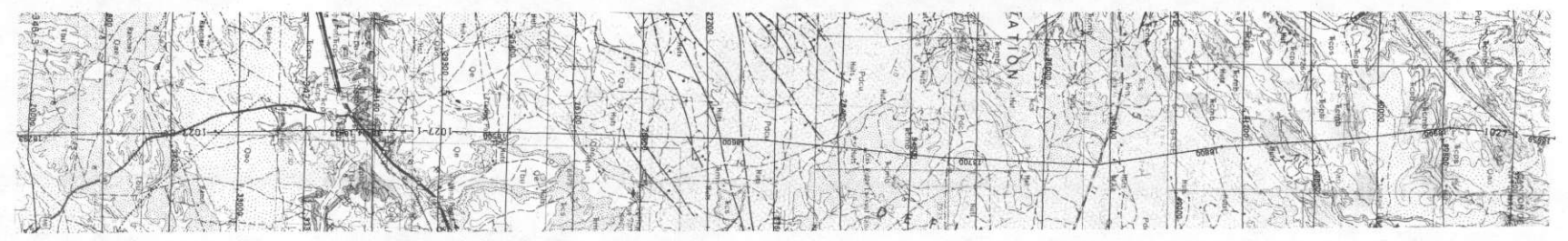
LINE TL25
 RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78926



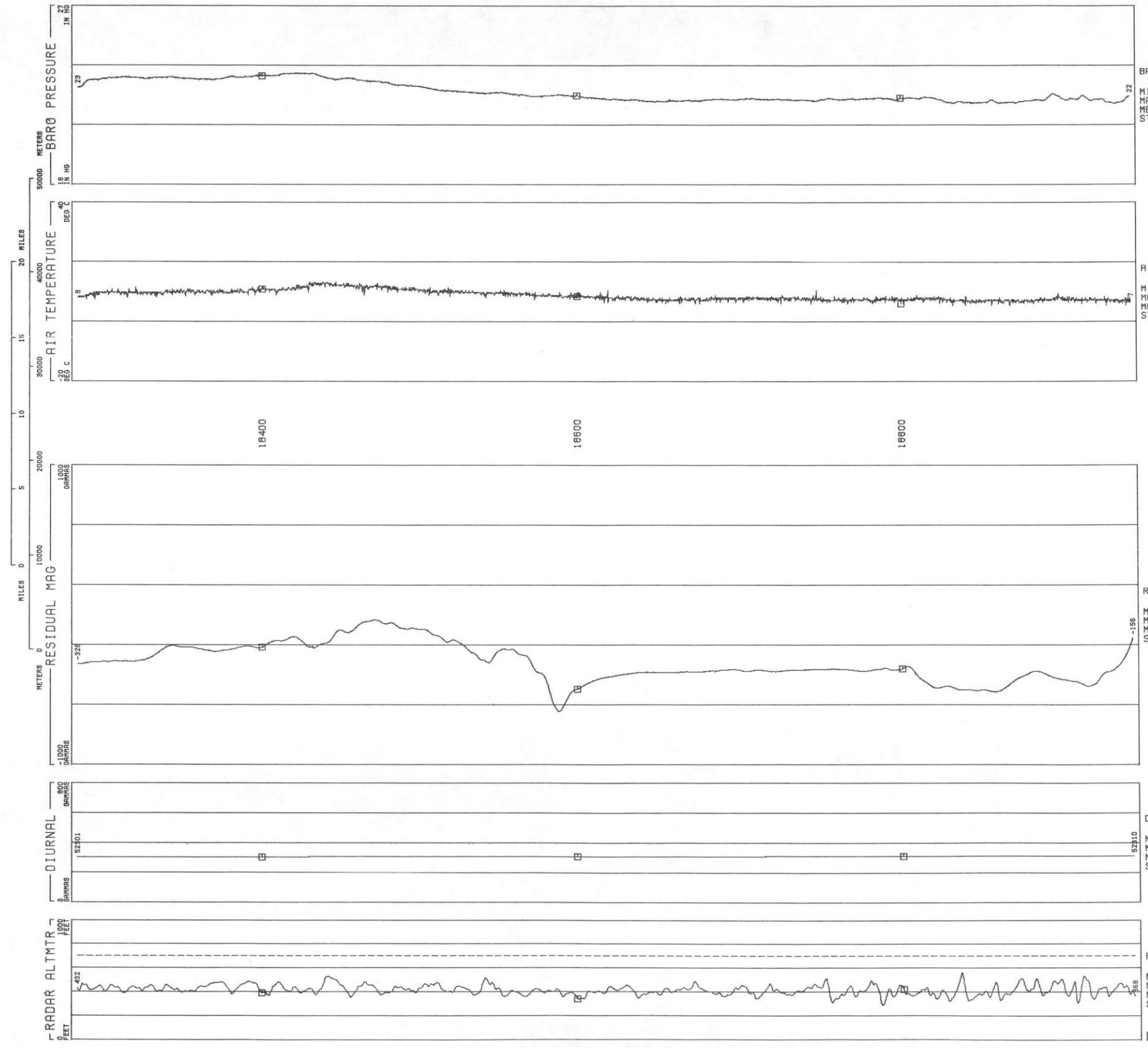


LINE TL26
 RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78326





LINE TL27
 RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78926



BARO PRESSURE
 IN HG
 MIN 22.08
 MAX 23.63
 MEAN 22.65
 STD DEV .4853

AIR TEMPERATURE
 DEG C
 MIN 5.574
 MAX 13.34
 MEAN 8.766
 STD DEV 1.633

RESIDUAL MAG
 GAMMAS
 MIN -642.9
 MAX -31.08
 MEAN -322.4
 STD DEV 125.1

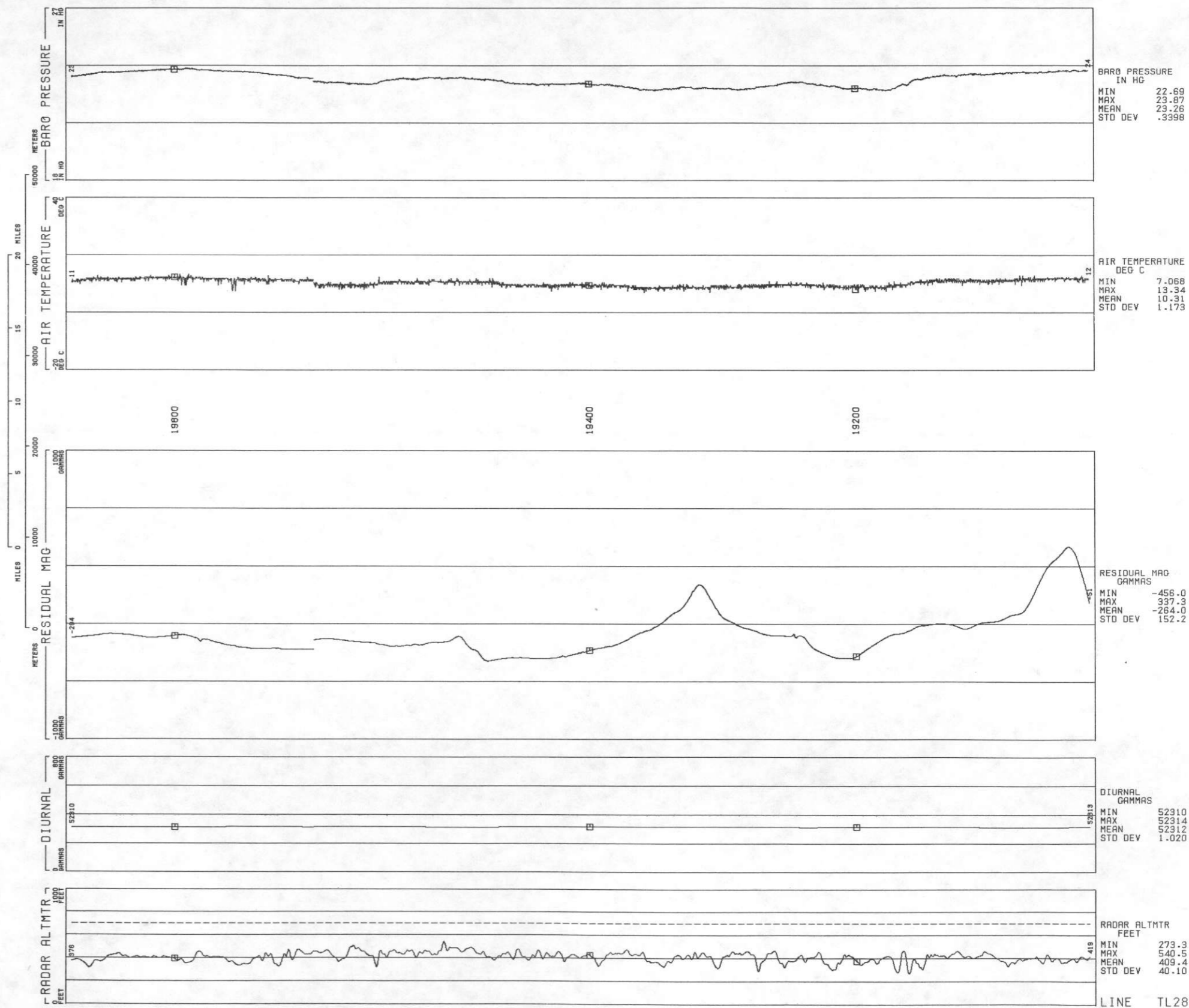
DIURNAL
 GAMMAS
 MIN 52301
 MAX 52310
 MEAN 52306
 STD DEV 2.914

RADAR ALTMTR
 FEET
 MIN 291.6
 MAX 560.4
 MEAN 418.4
 STD DEV 40.25

LINE TL27

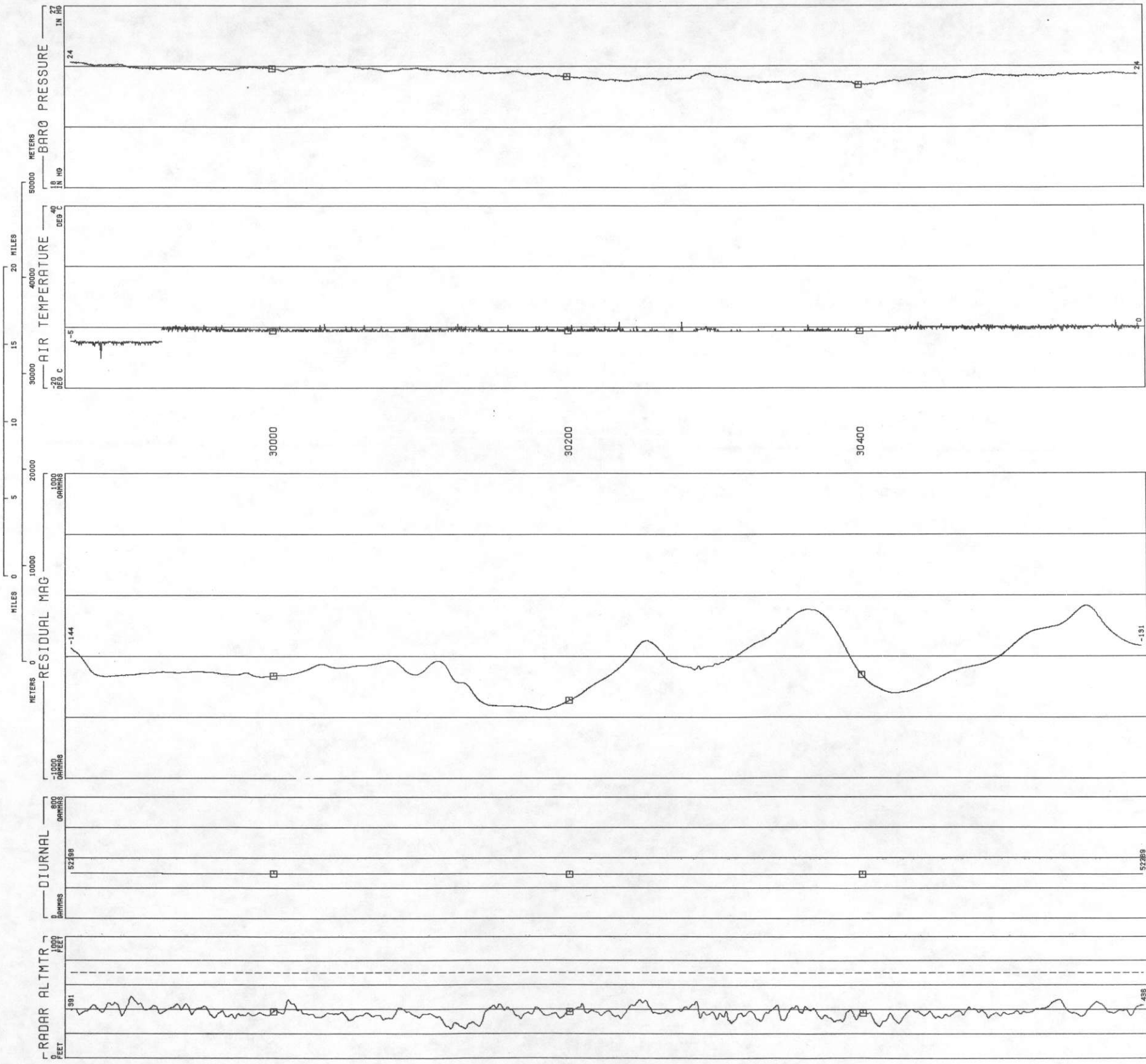


LINE TL28
 RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78326





LINE TL29
 RATON BASIN - GALLUP NTMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78332



BARO PRESSURE
 IN HG
 MIN 23.07
 MAX 24.23
 MEAN 23.62
 STD DEV .2767

AIR TEMPERATURE
 DEG C
 MIN -10.00
 MAX 2.187
 MEAN -1.029
 STD DEV 1.251

RESIDUAL MAG
 GAMMAS
 MIN -546.8
 MAX 133.9
 MEAN -256.6
 STD DEV 158.6

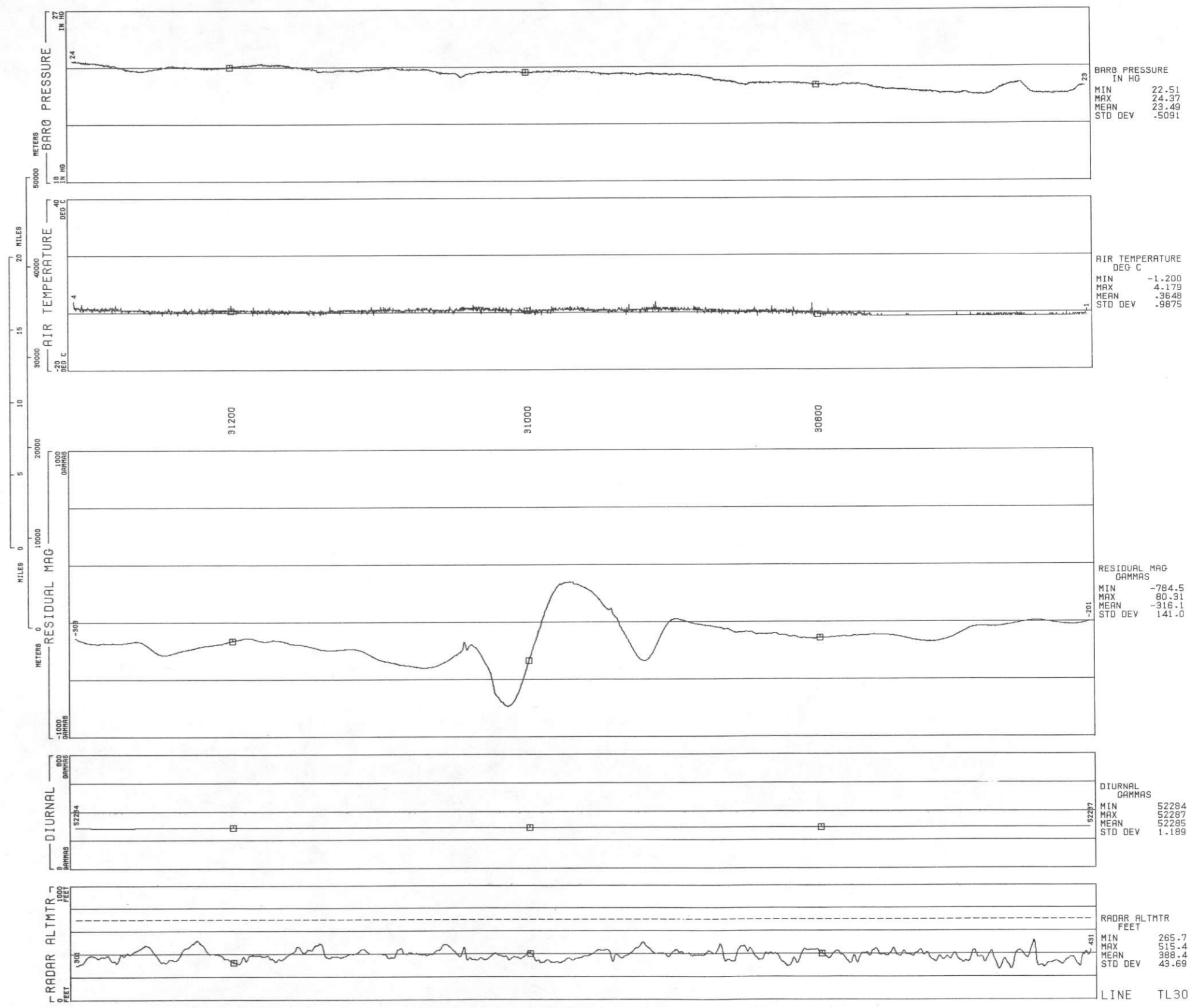
DIURNAL
 GAMMAS
 MIN 52289
 MAX 52298
 MEAN 52292
 STD DEV 2.129

RADAR ALTMTR
 FEET
 MIN 242.9
 MAX 508.7
 MEAN 375.1
 STD DEV 42.82

LINE TL29

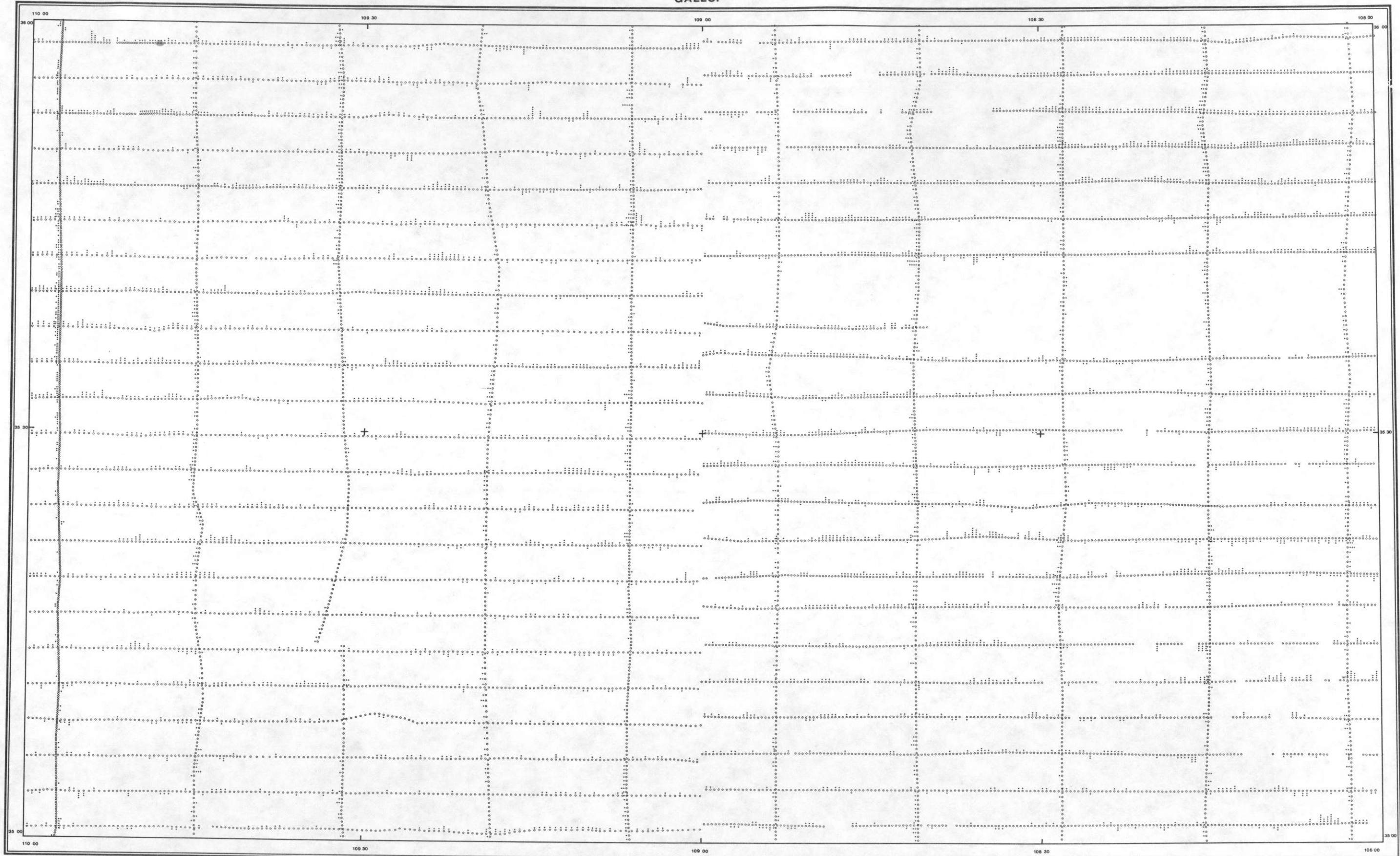


LINE TL30
 RATON BASIN - GALLUP NIMS NI 12-3 GEOMETRICS
 DATA ACQUIRED 78332

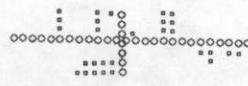
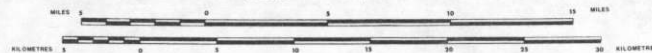


APPENDIX C - Contour Maps

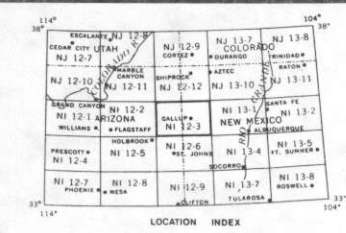
GALLUP



SCALE 1:500,000



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

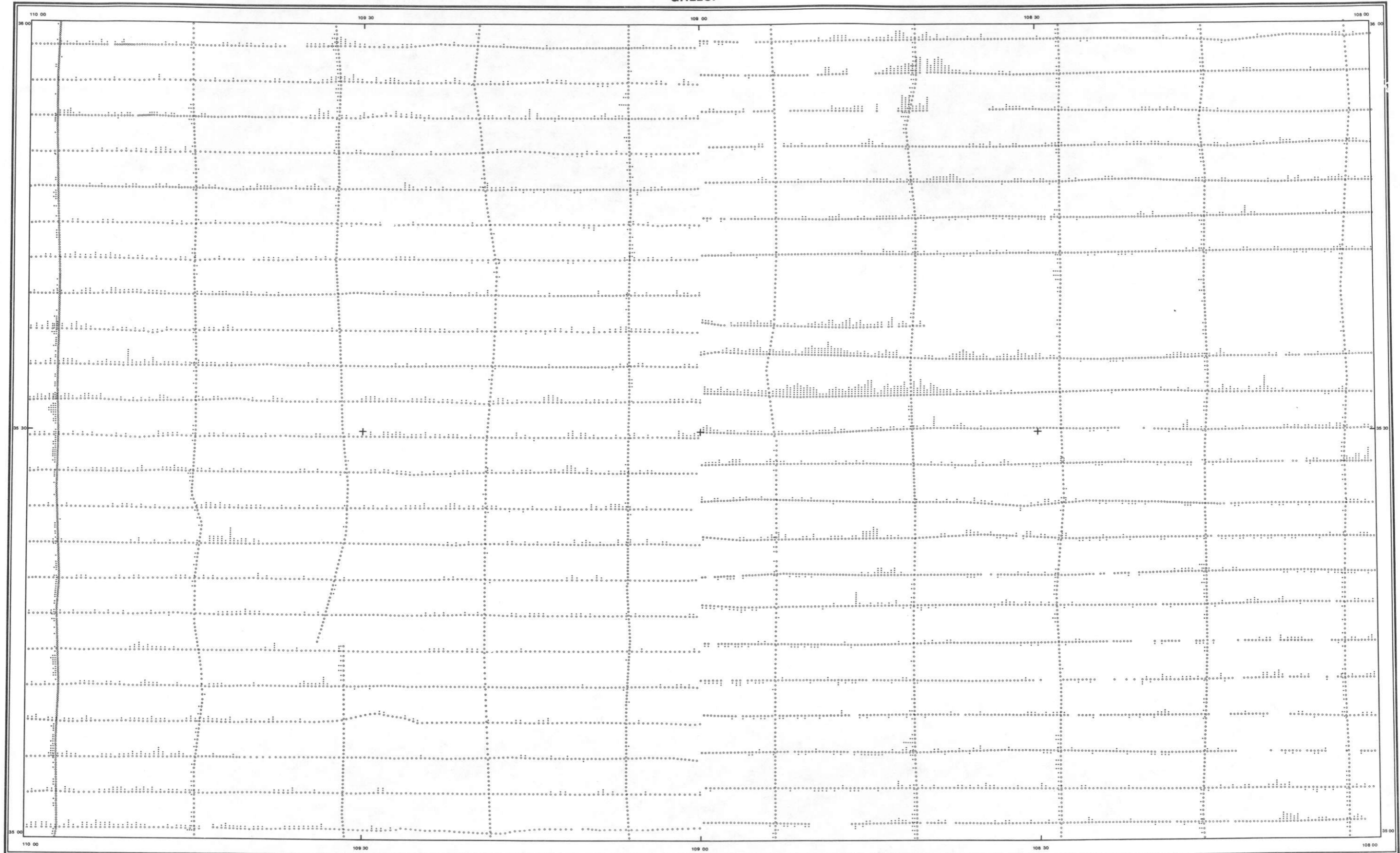


POTASSIUM ANOMALY MAP

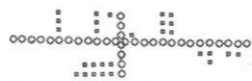
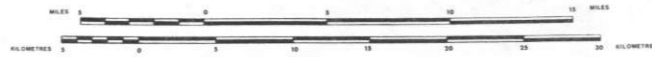
RATON BASIN PROJECT

U. S. DEPARTMENT OF ENERGY

GALLUP

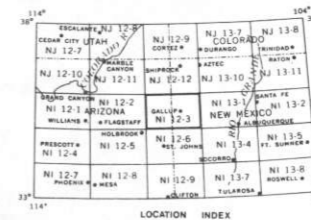


SCALE 1:500,000



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

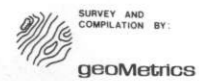
NOTE: ON E-W LINES, +σ TO NORTH, -σ TO SOUTH.
 ON N-S LINES, +σ TO WEST, -σ TO EAST.



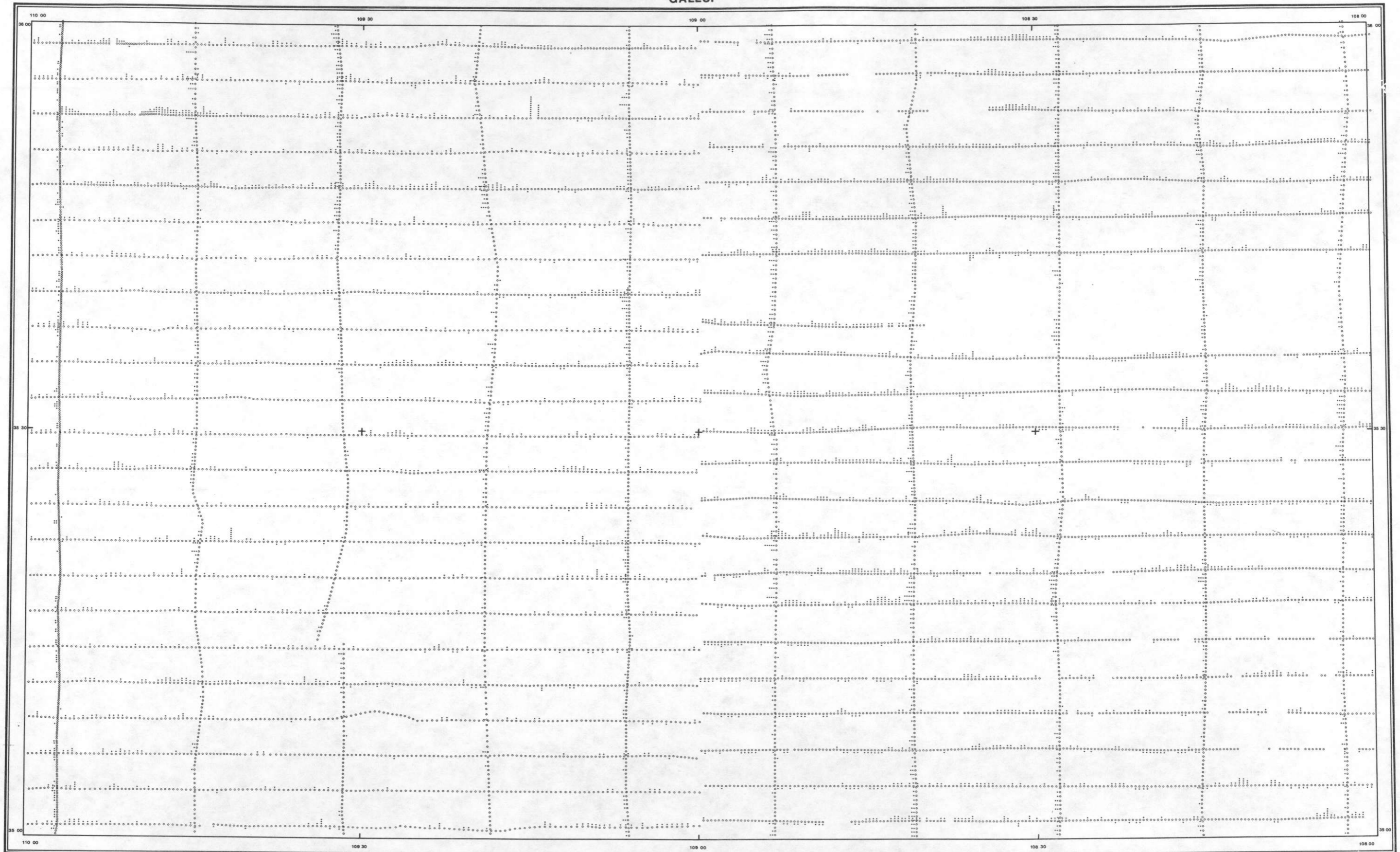
URANIUM ANOMALY MAP

RATON BASIN PROJECT

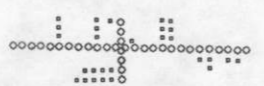
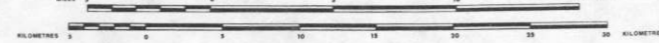
U. S. DEPARTMENT OF ENERGY



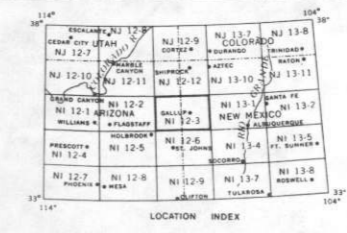
GALLUP



SCALE 1:500,000



○ - DATA STATISTICALLY ADEQUATE
 ○ - 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.



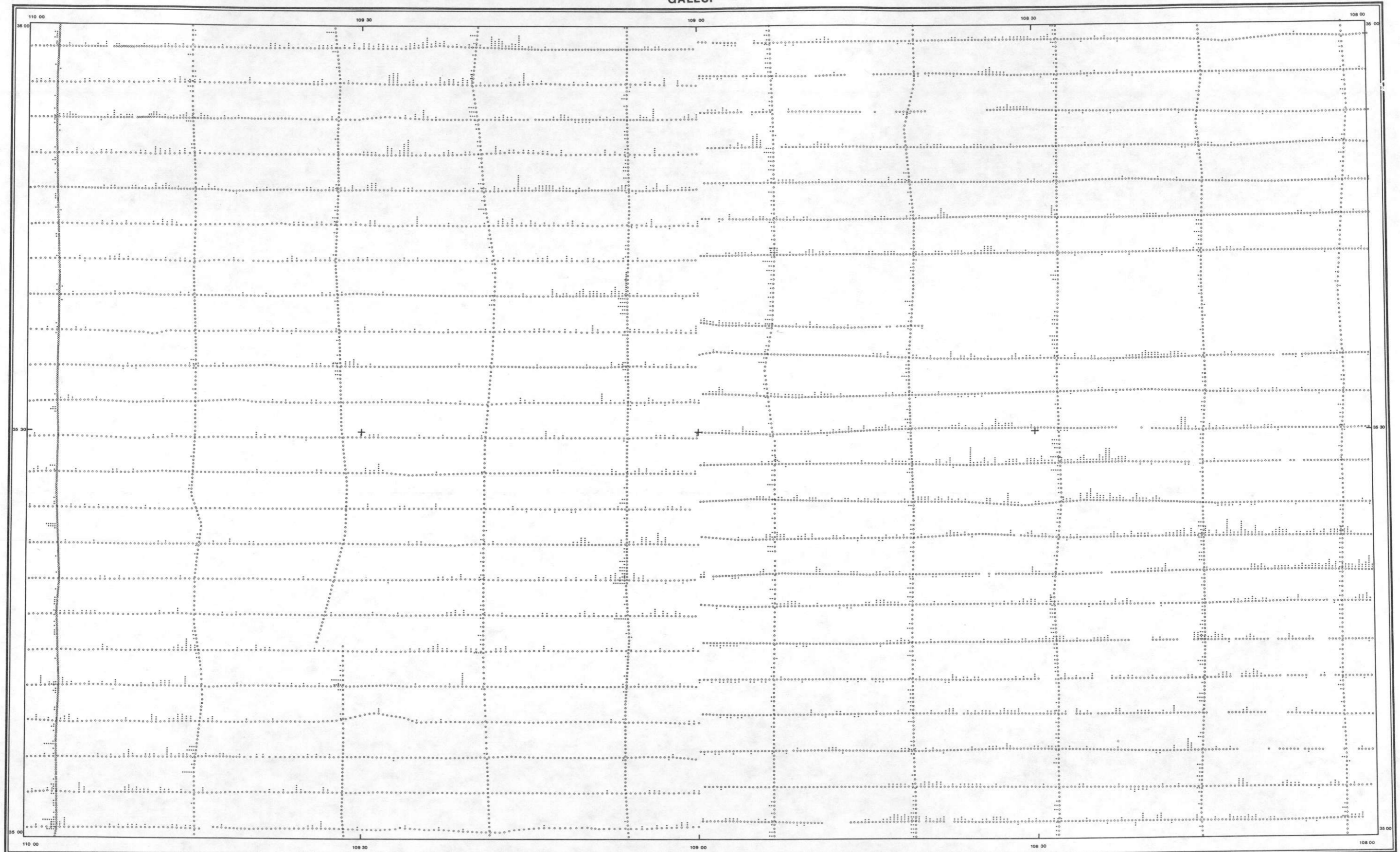
THORIUM ANOMALY MAP

RATON BASIN PROJECT

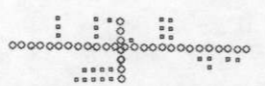
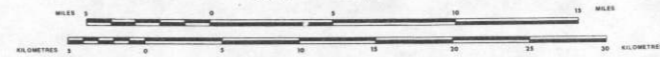
U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILATION BY:
 geoMetrics

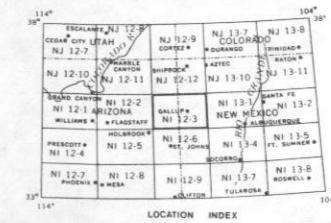
GALLUP



SCALE 1:500,000



○ - DATA STATISTICALLY ADEQUATE
 □ - 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.

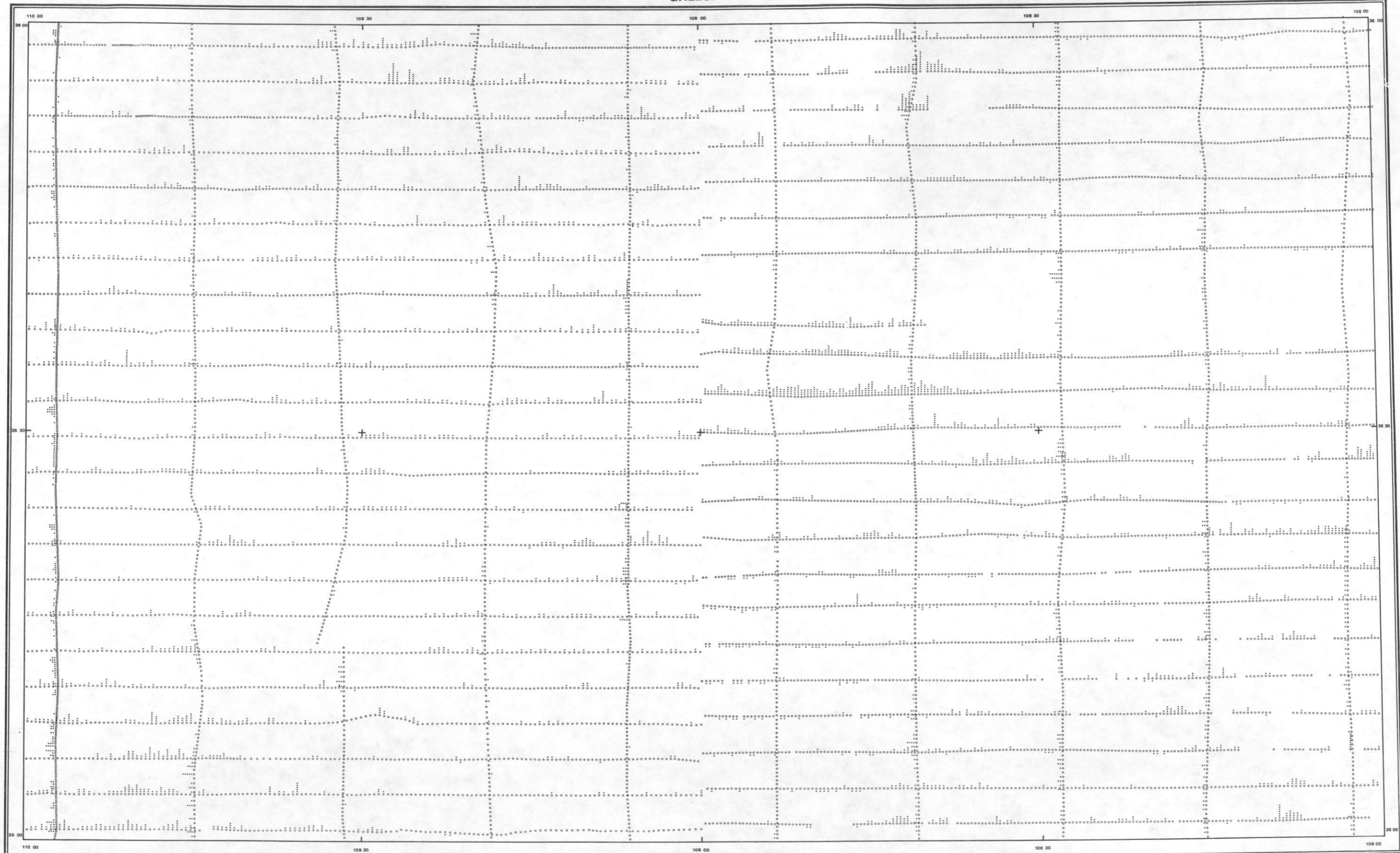


THORIUM/POTASSIUM ANOMALY MAP

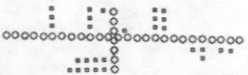
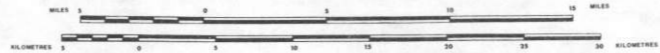
RATON BASIN PROJECT

U. S. DEPARTMENT OF ENERGY

GALLUP

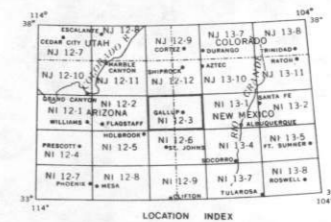


SCALE 1:500,000



○ - DATA STATISTICALLY ADEQUATE
 ■ - 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.



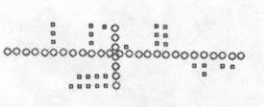
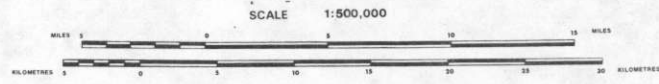
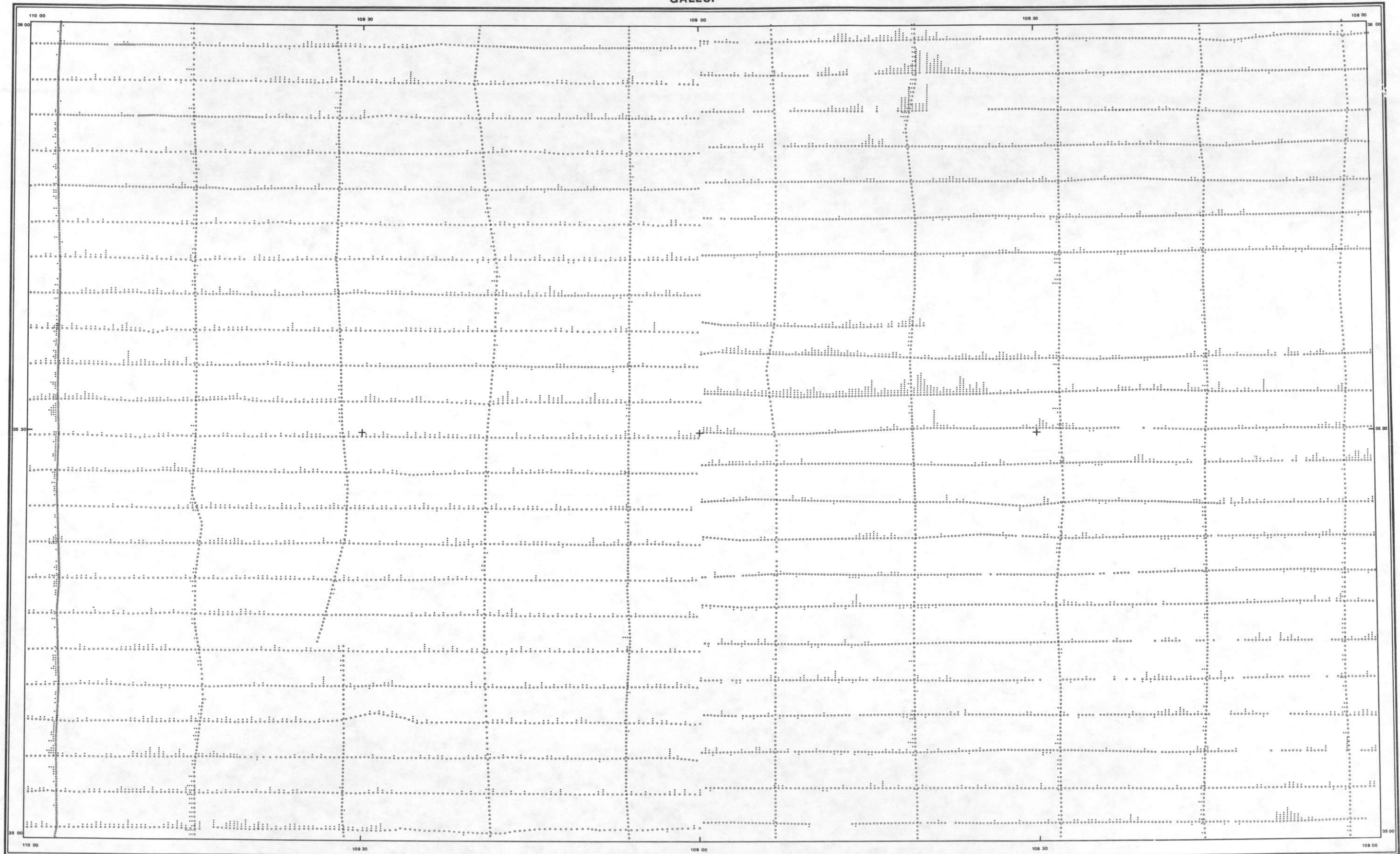
URANIUM/POTASSIUM ANOMALY MAP

RATON BASIN PROJECT

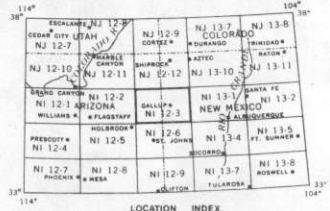
U. S. DEPARTMENT OF ENERGY

SURVEY AND
 COMPILATION BY:
 geoMetrics

GALLUP



○ - DATA STATISTICALLY ADEQUATE
 □ - 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.



URANIUM/THORIUM ANOMALY MAP

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 COMPILATION BY:
 geoMetrics

APPENDIX D - Histograms

COMPUTER MAP UNIT SYMBOL CONVERSION TABLE (cont'd.)

<u>COMPUTER MAP UNIT SYMBOL</u>	<u>GEOLOGIC MAP UNIT SYMBOL</u>	<u>COMPUTER MAP UNIT SYMBOL</u>	<u>GEOLOGIC MAP UNIT SYMBOL</u>
PG	Pg	PCGM	pεgm
PY	Py	*PCH	pεh
PGY	Pgy	PCM	pεm
PA	Pa	PCP	pεp
*PCZ	pεz	PCAP	pεap
*PCR	pεr	*PCA	pεa
PCGM	pεgm		

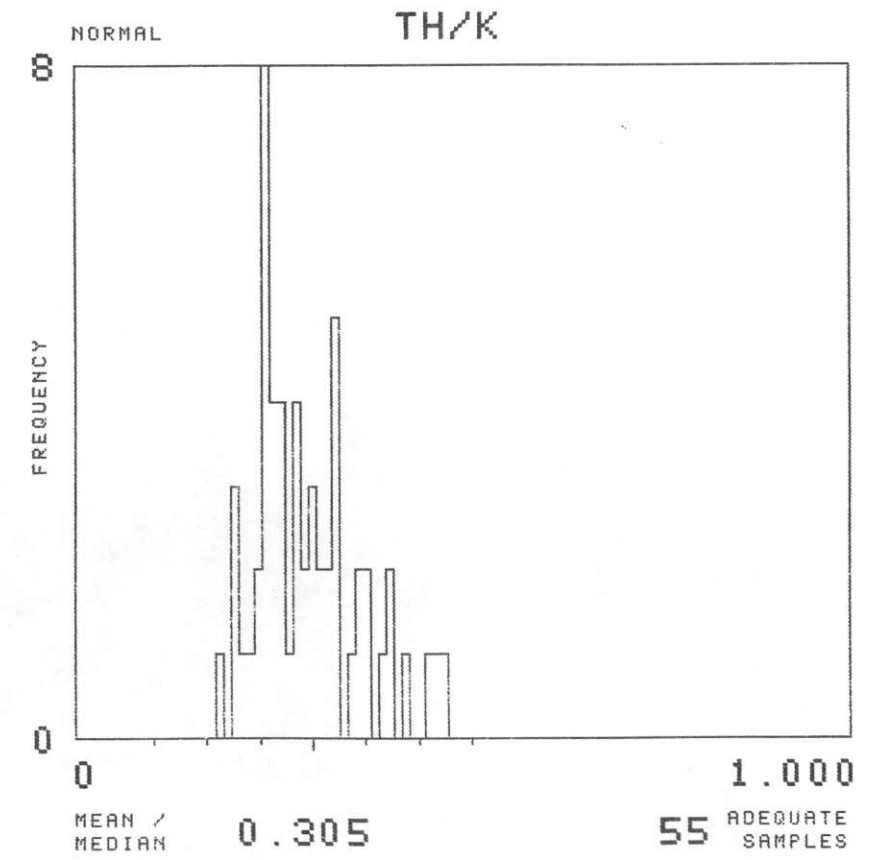
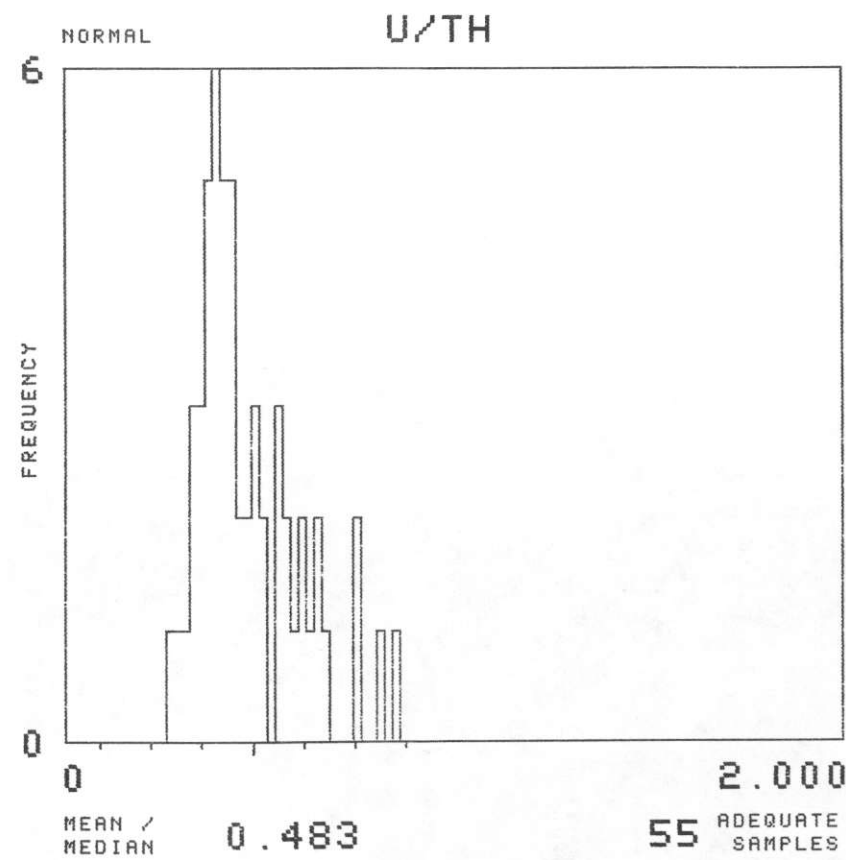
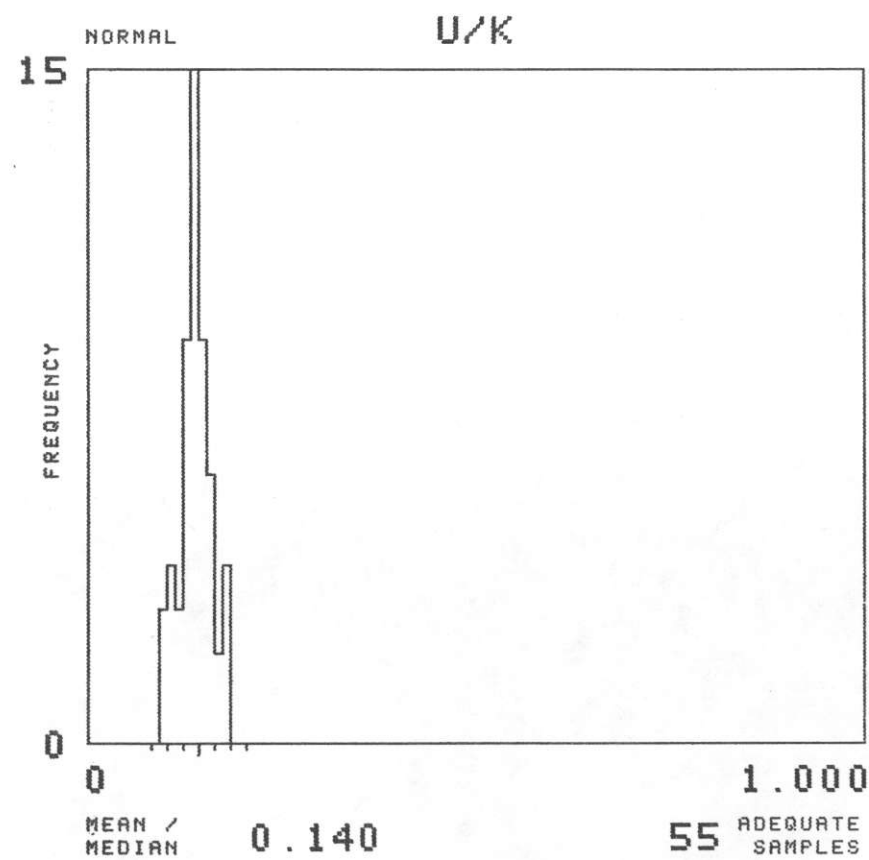
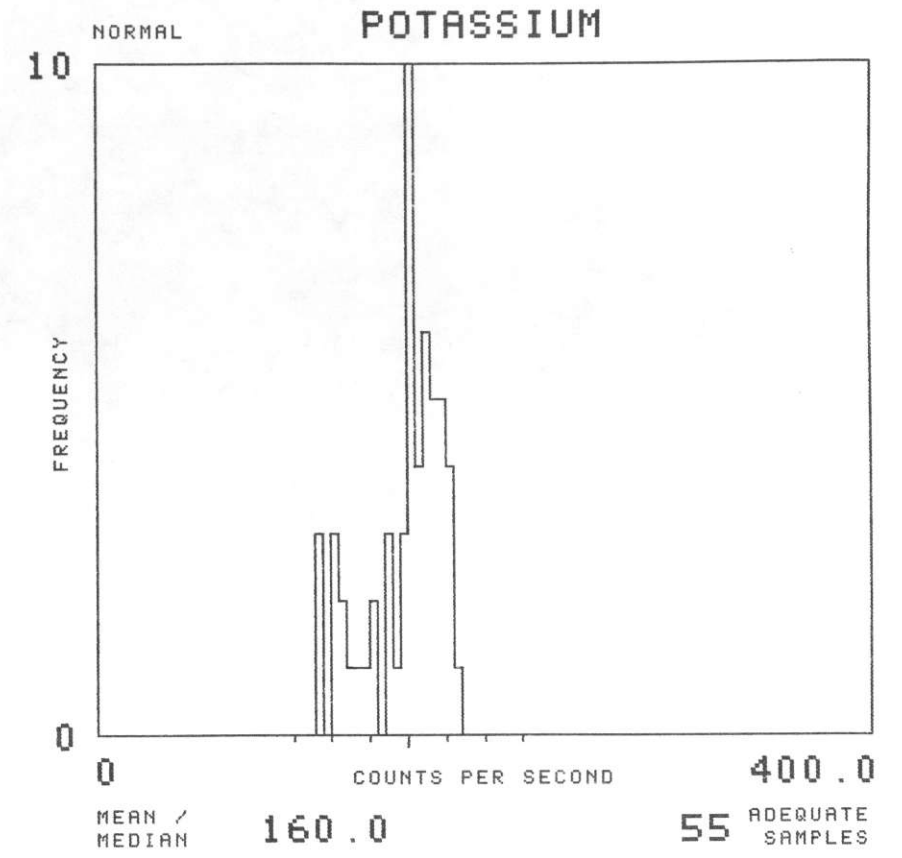
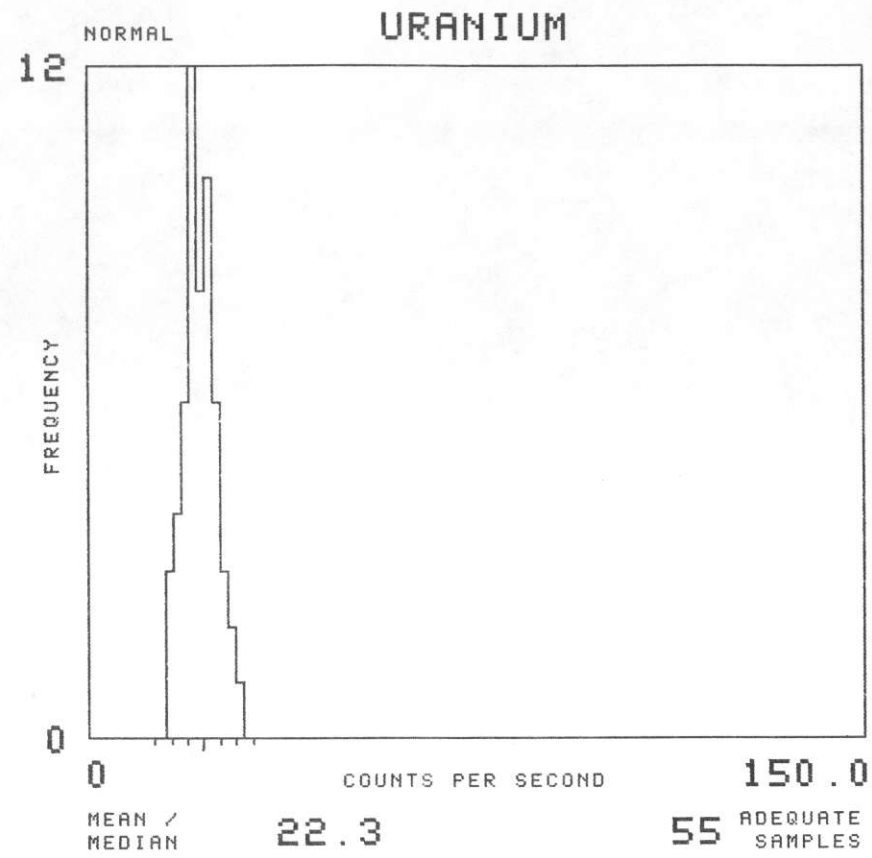
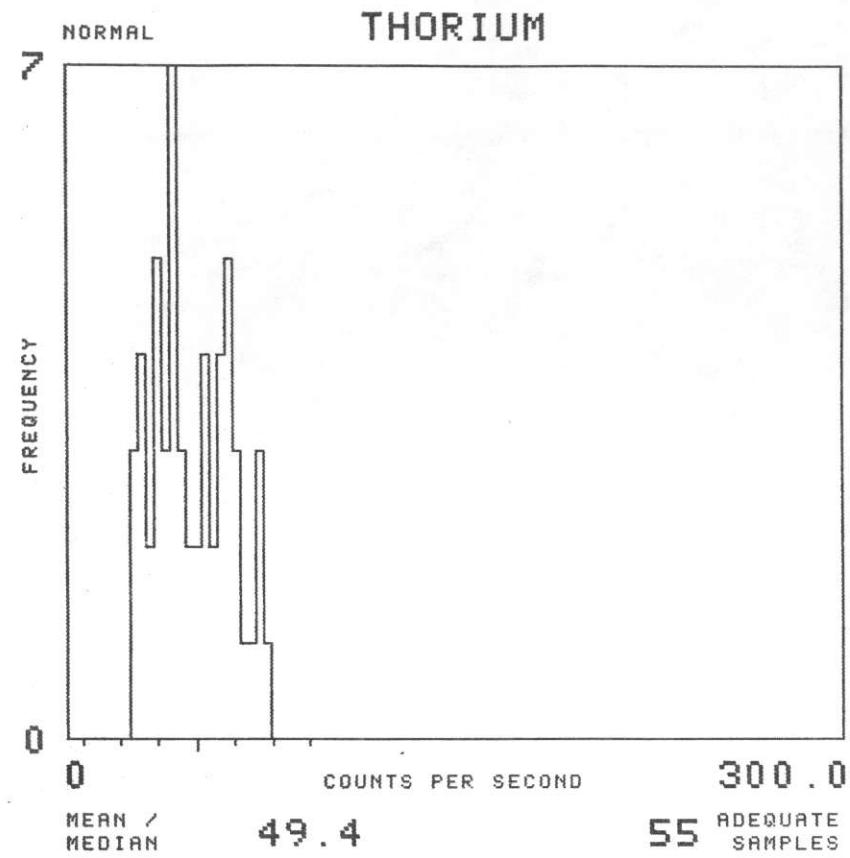
NOTES: On the following pages, histograms for each computer map unit are included in the same order as they appear on the above list.

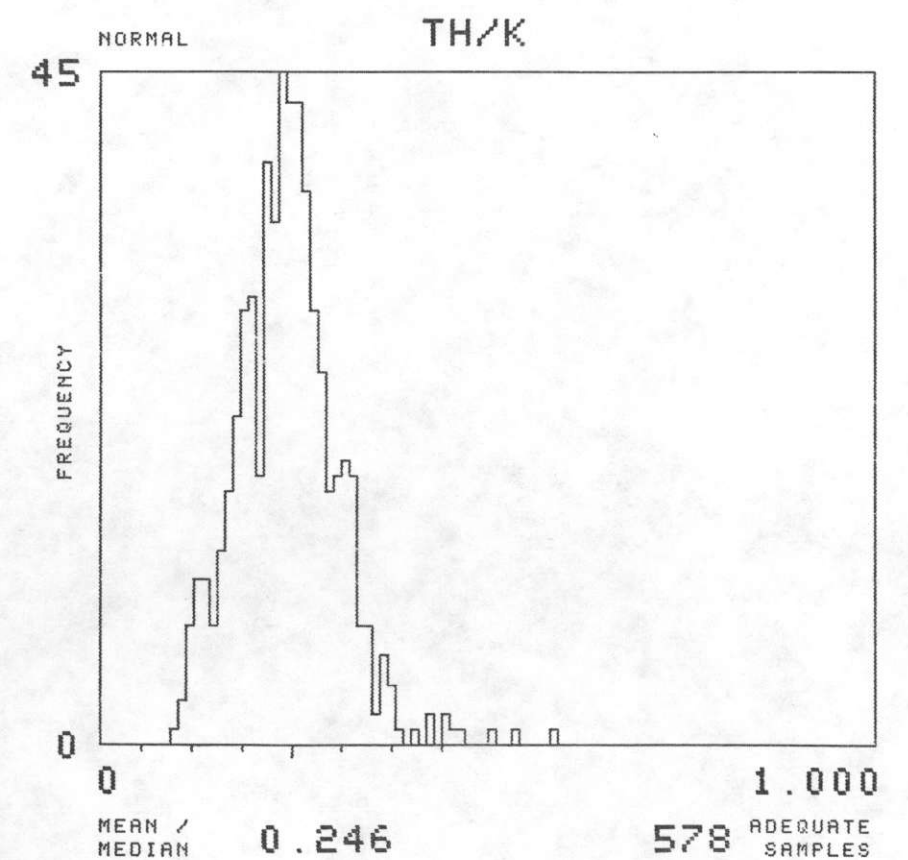
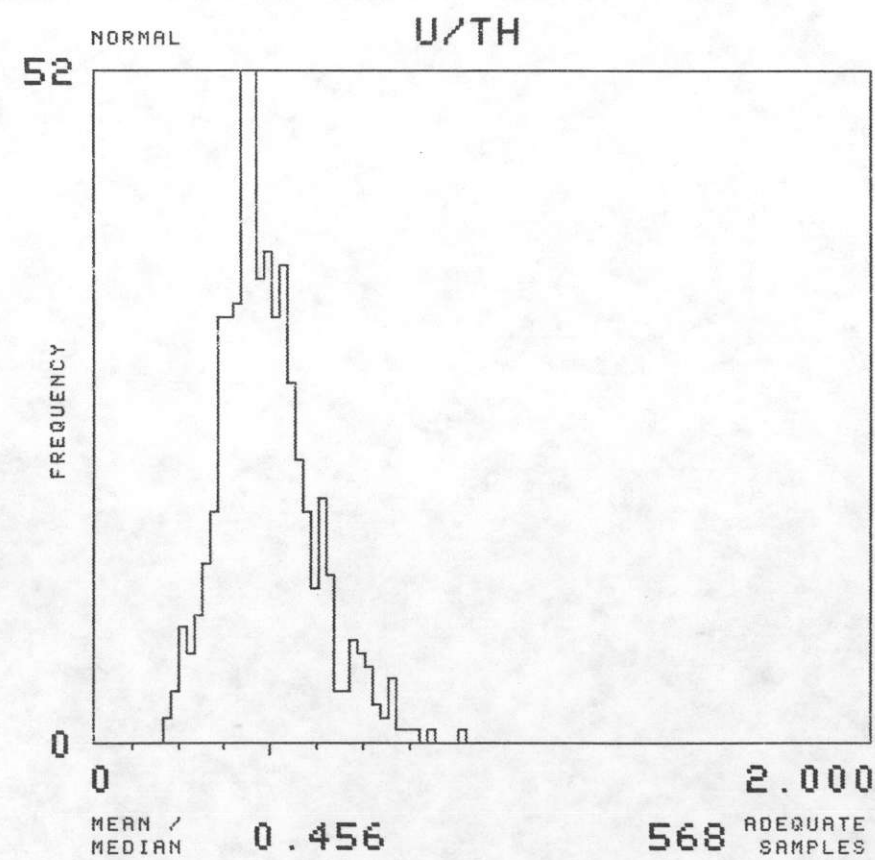
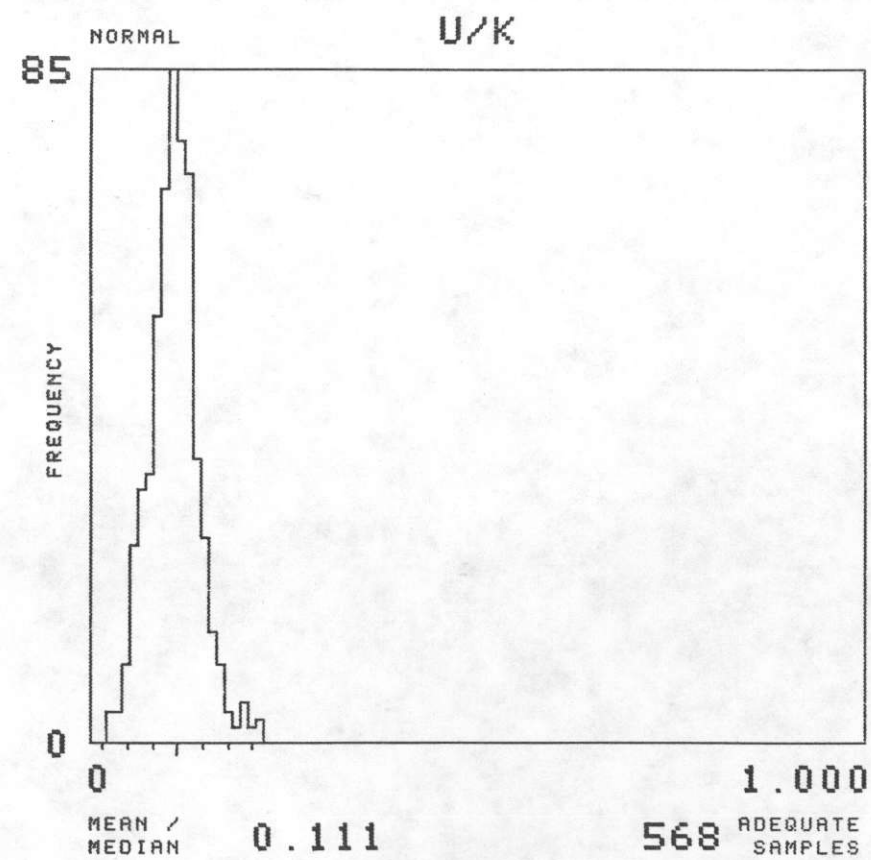
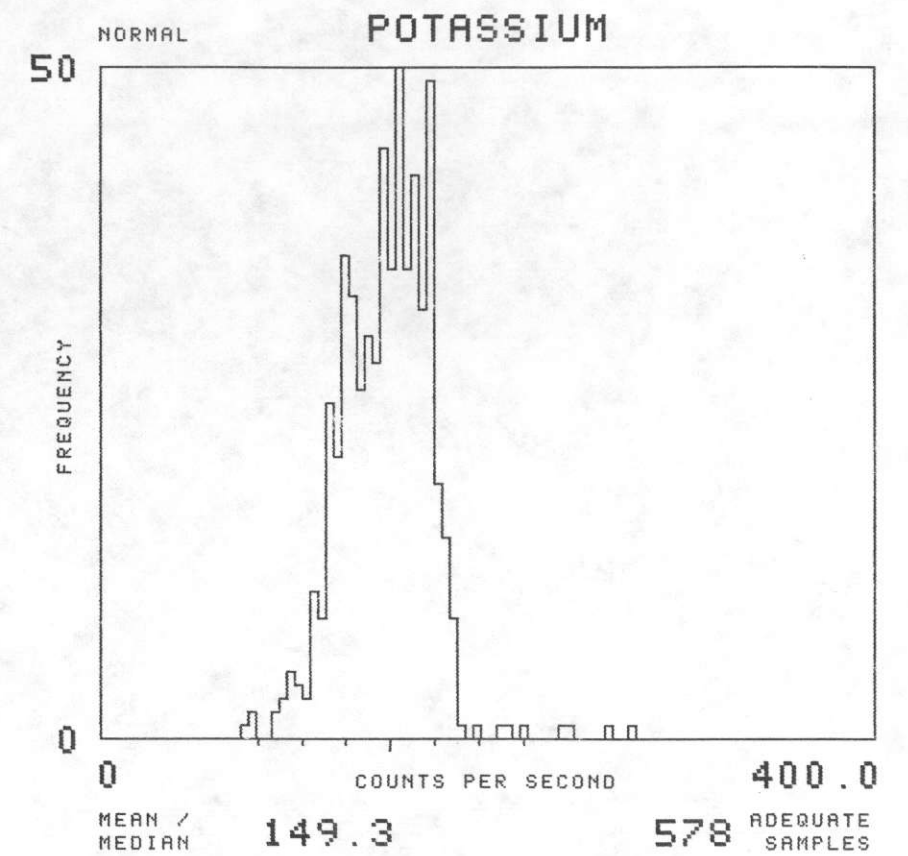
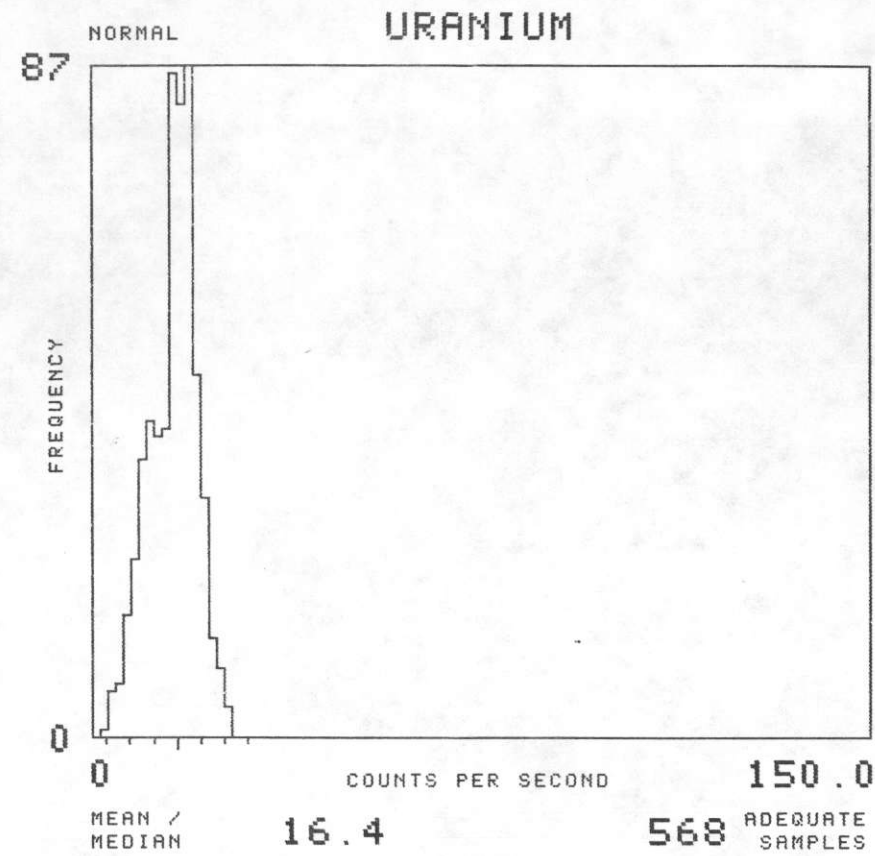
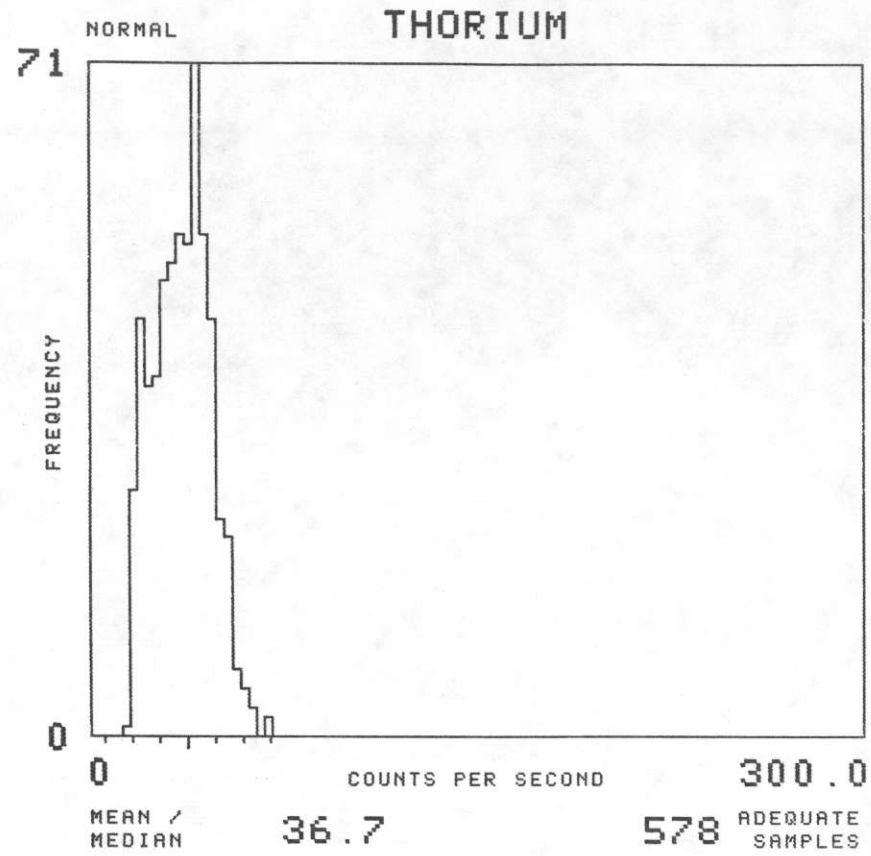
Geologic descriptions of the original geologic map units are in Appendix A.

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

*A statistical analysis was not done due to an inadequate number of samples. Therefore, there are no histograms for units marked in this way.

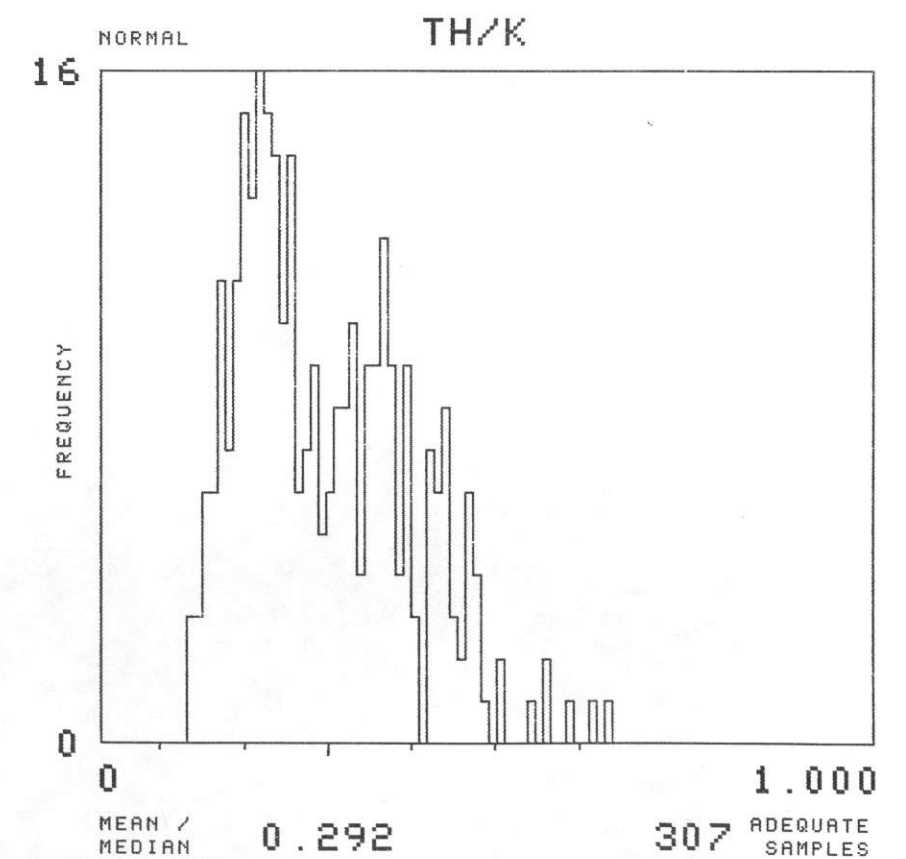
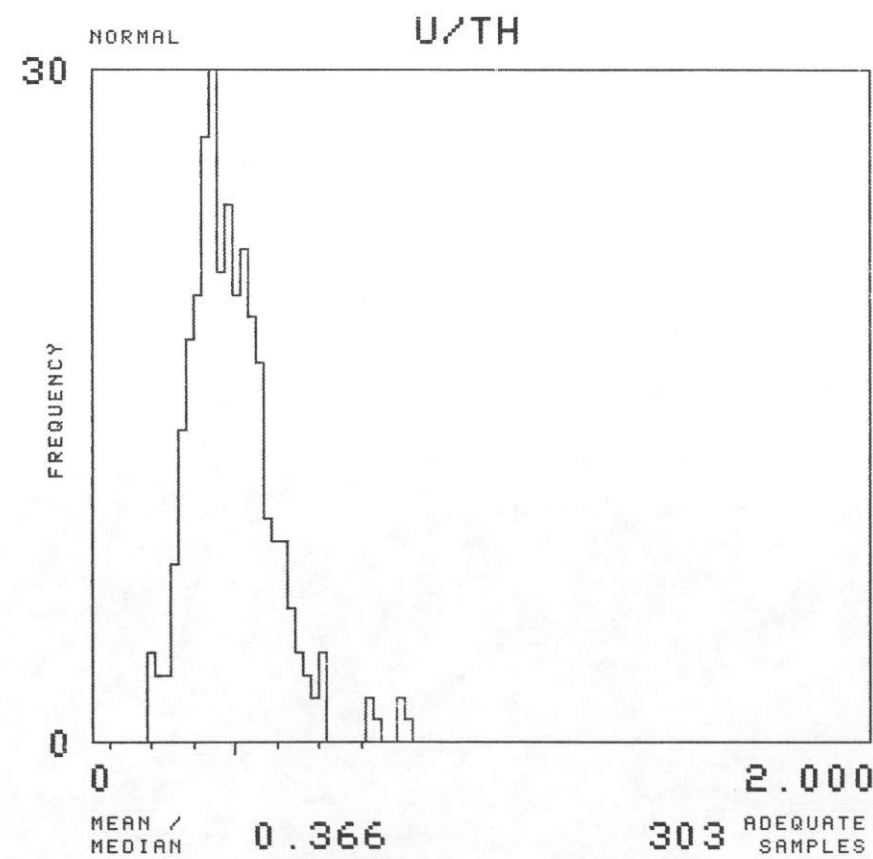
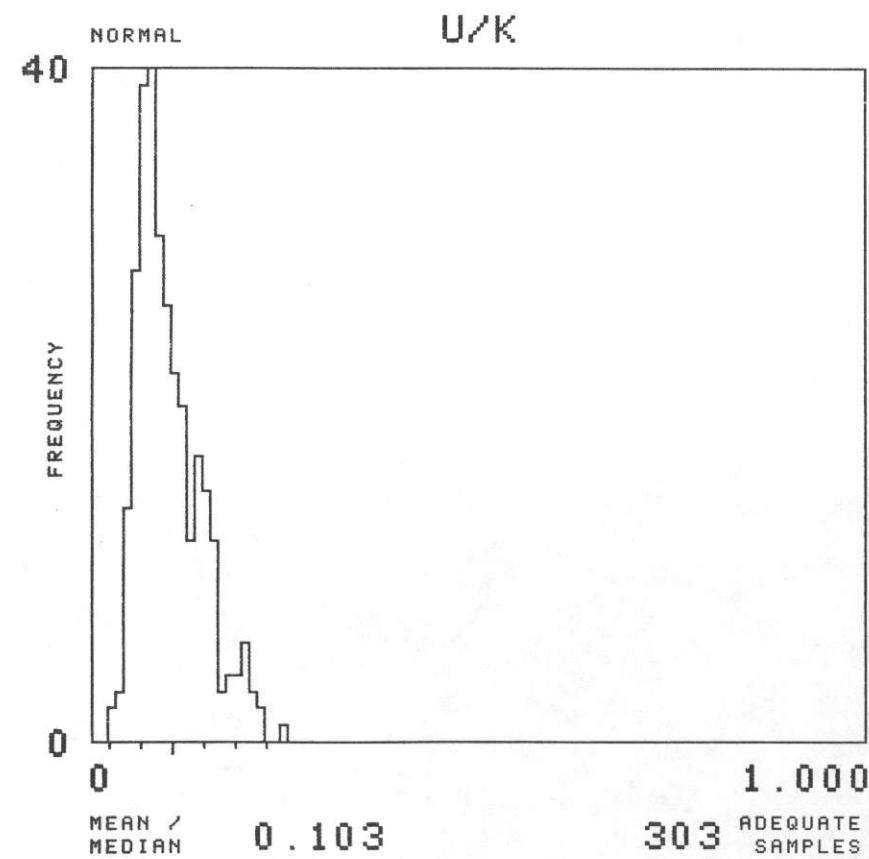
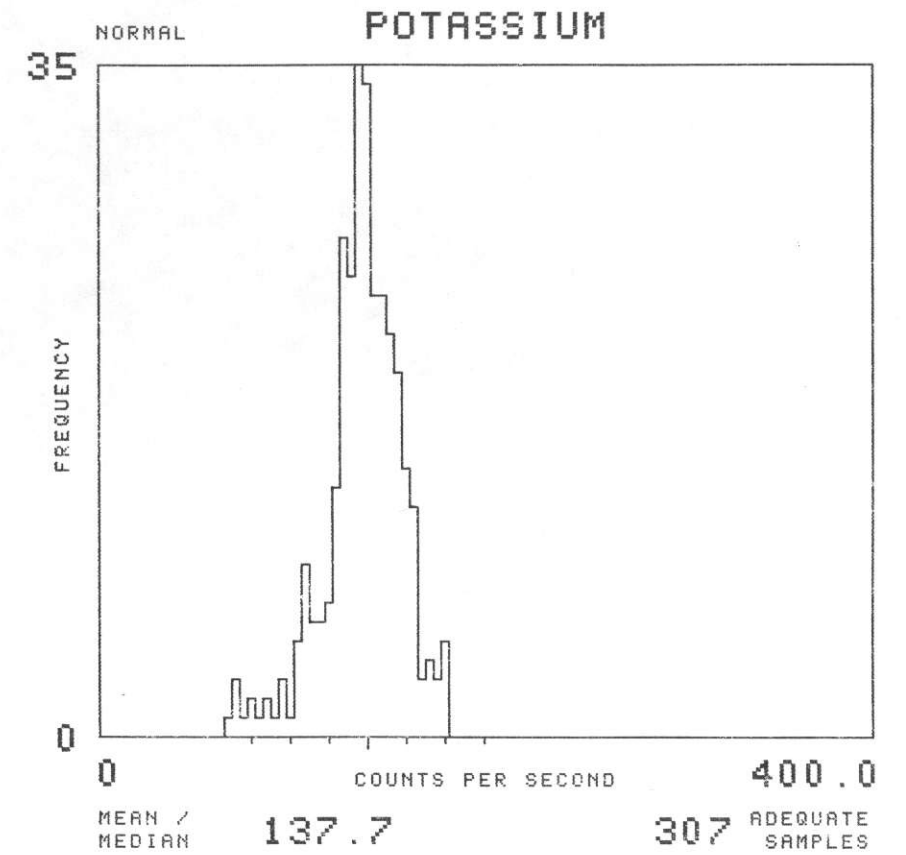
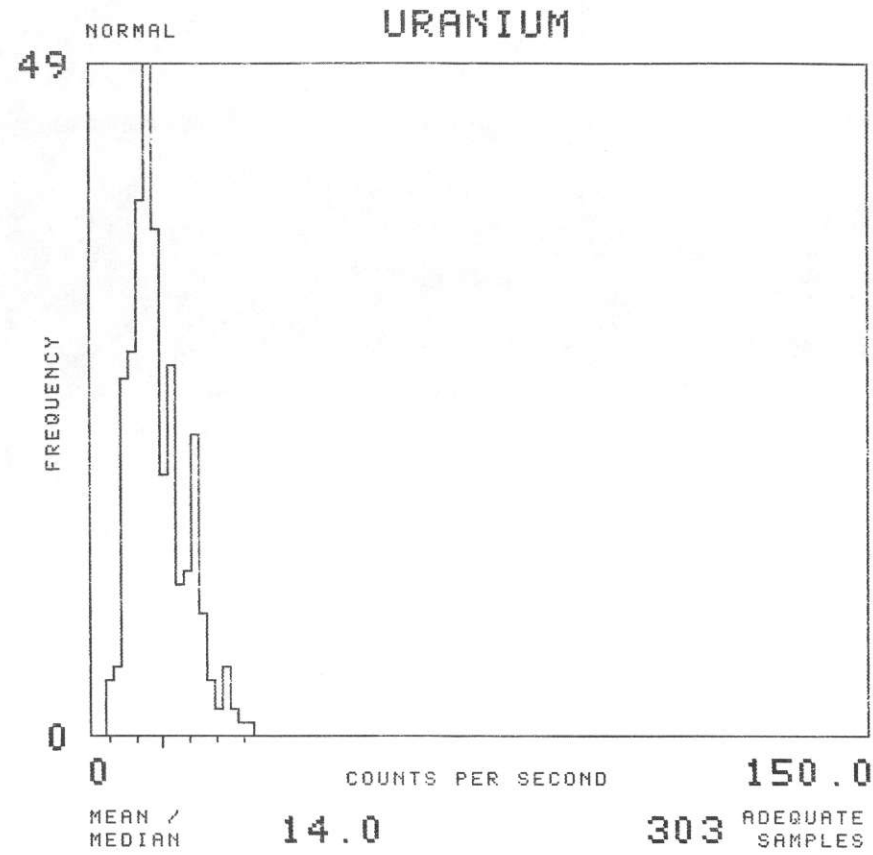
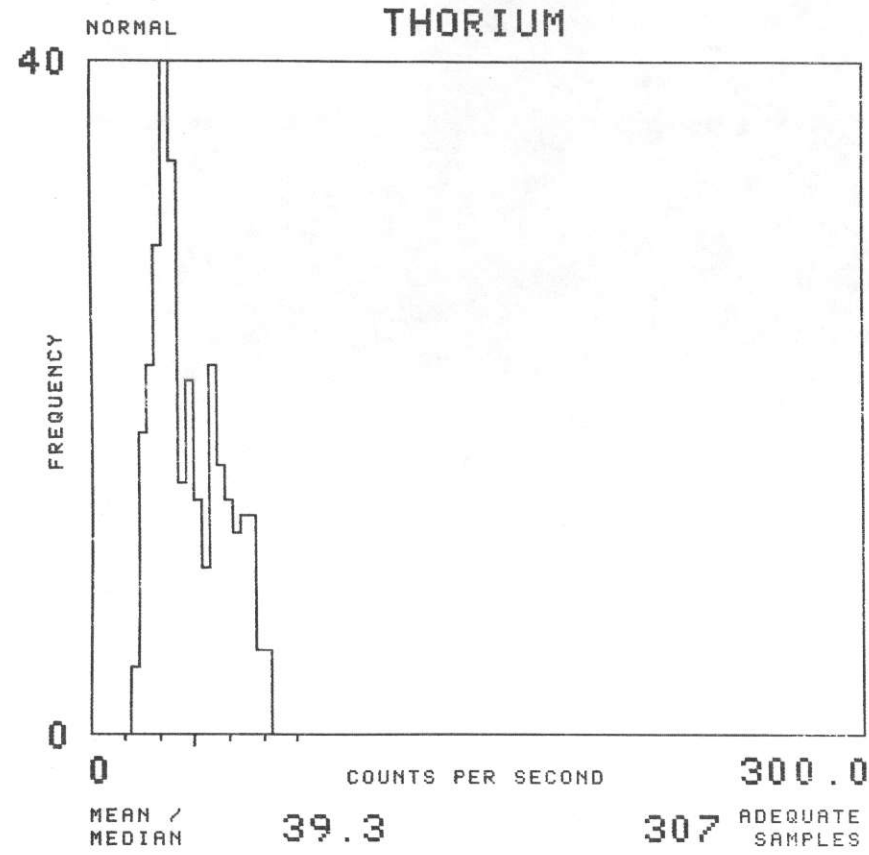
+Combined into a single unit because of discontinuous contact lines.

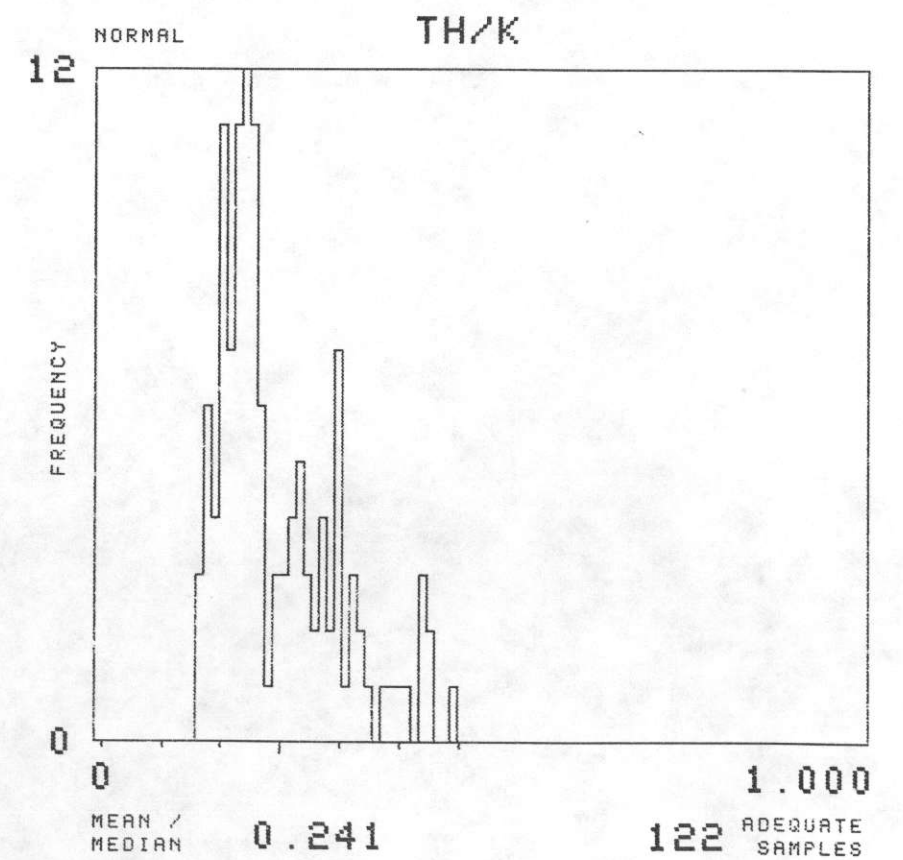
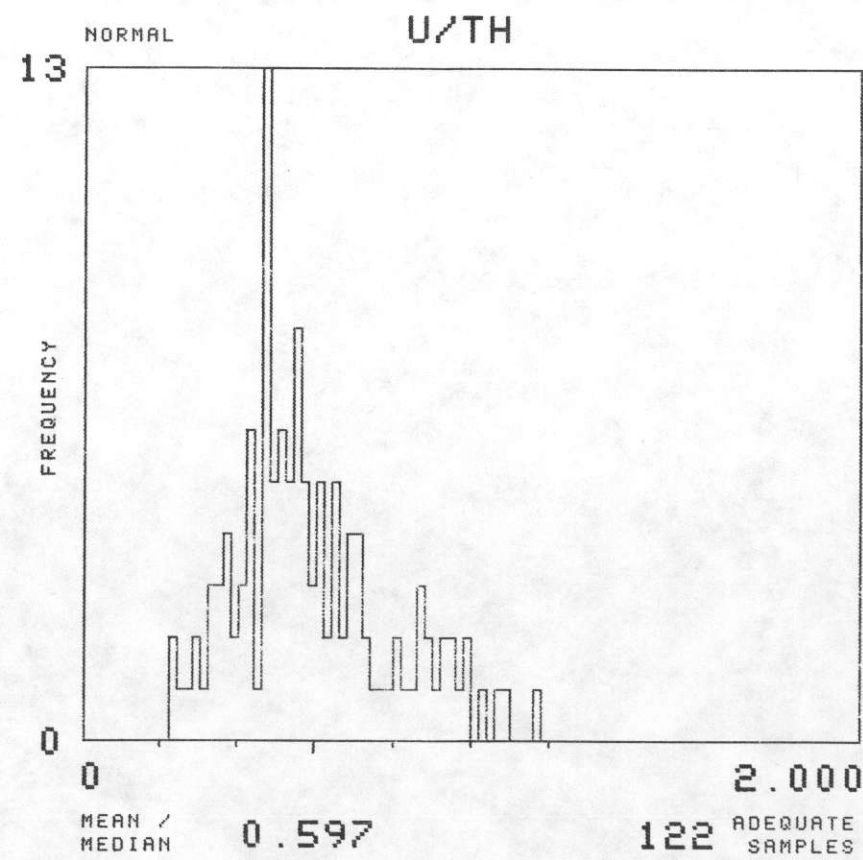
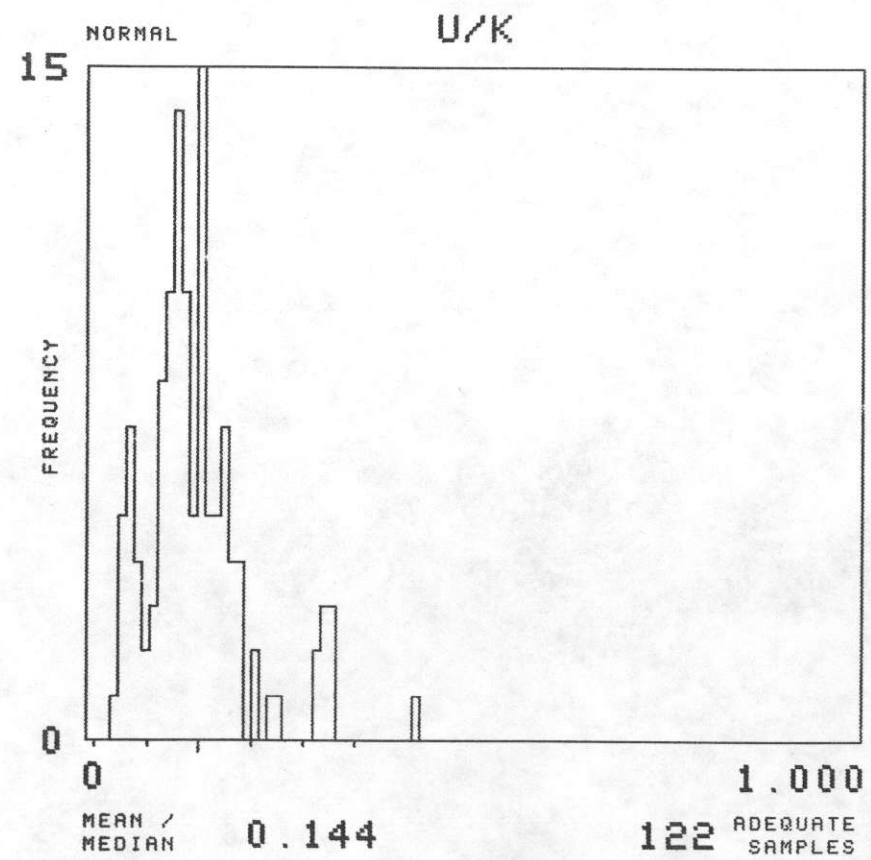
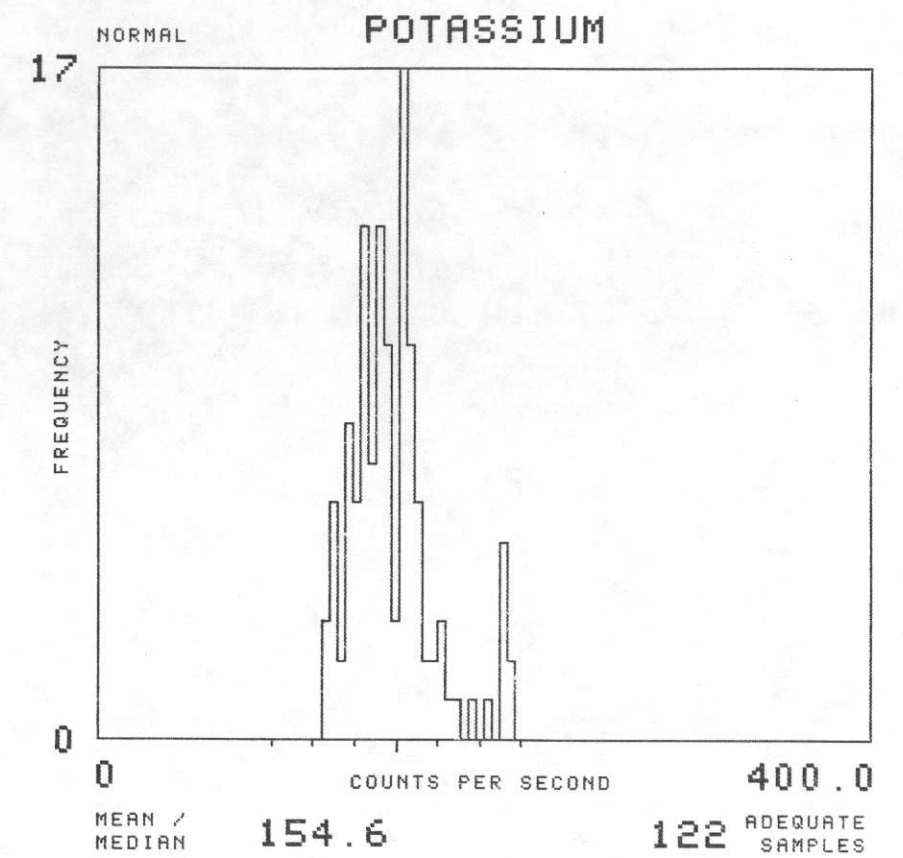
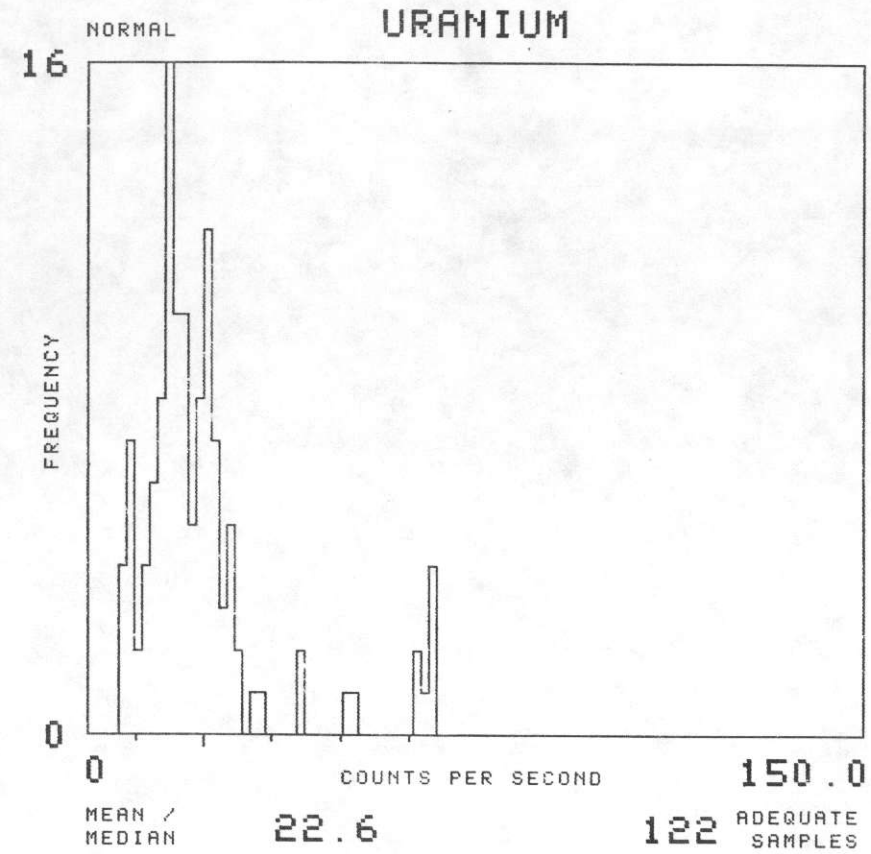
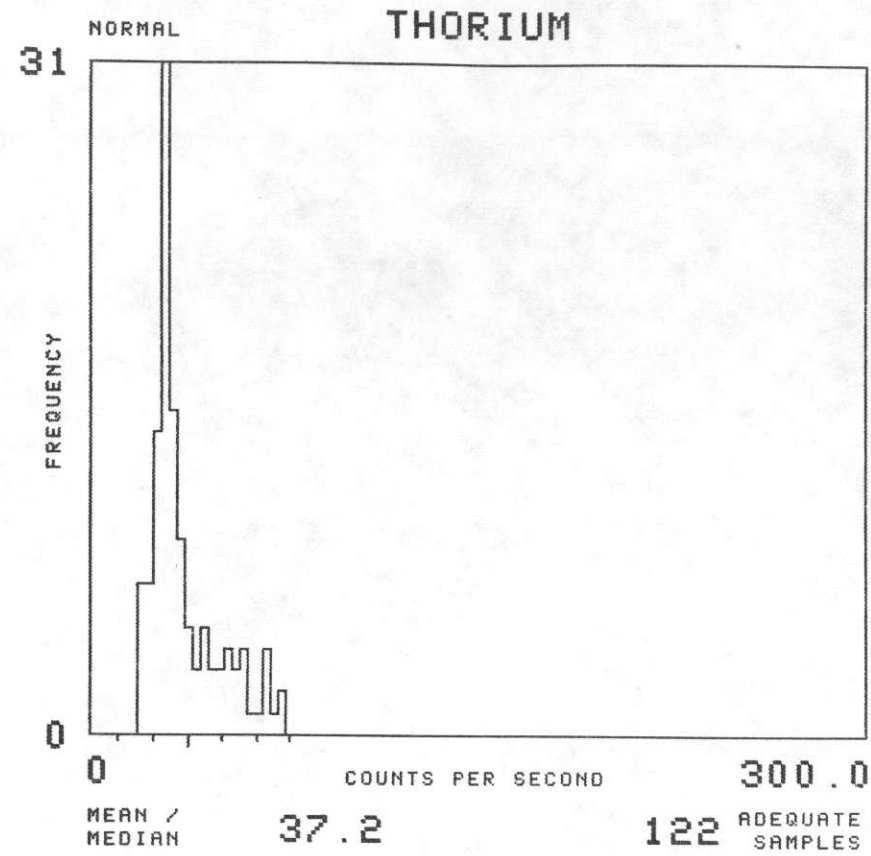




NTMS NI 12-3 GALLUP

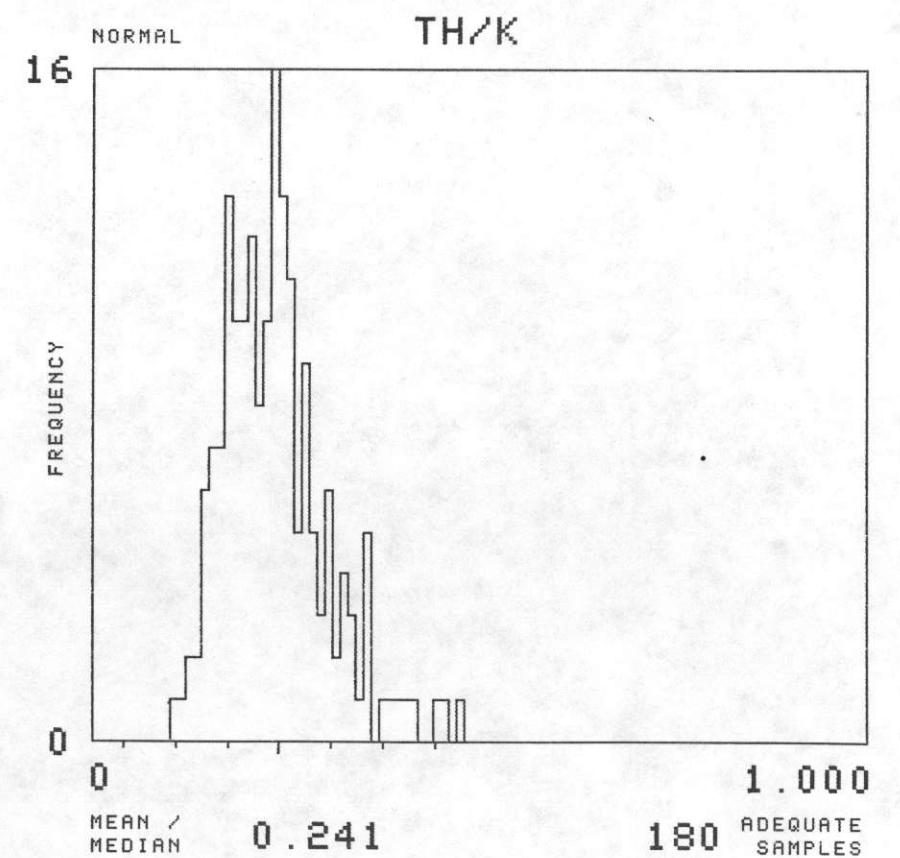
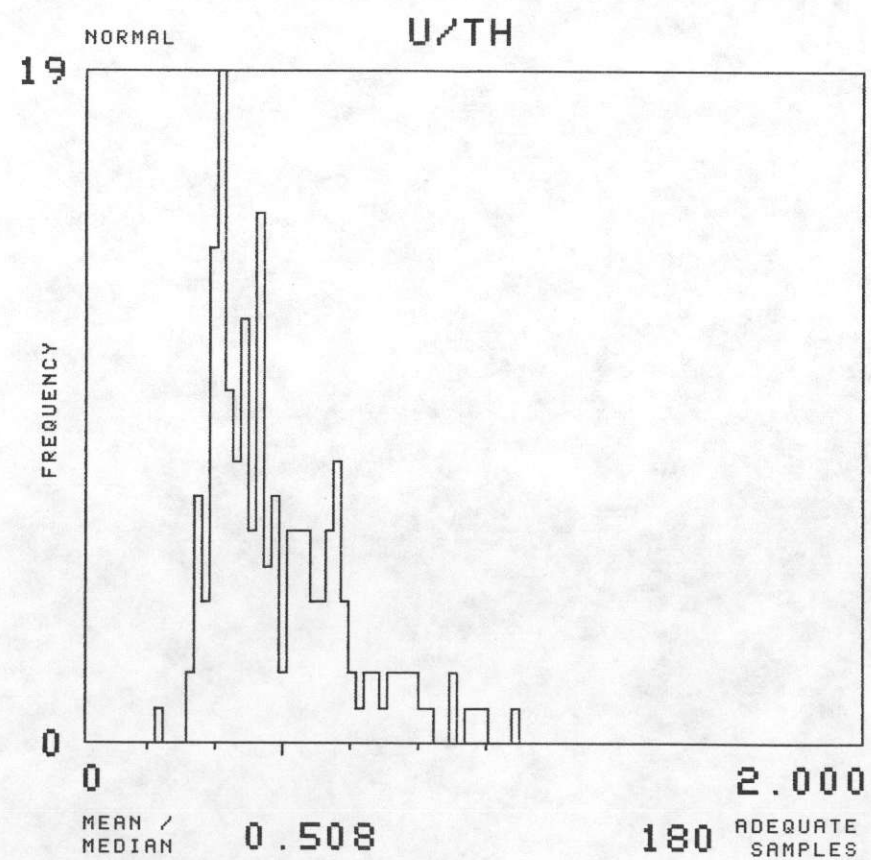
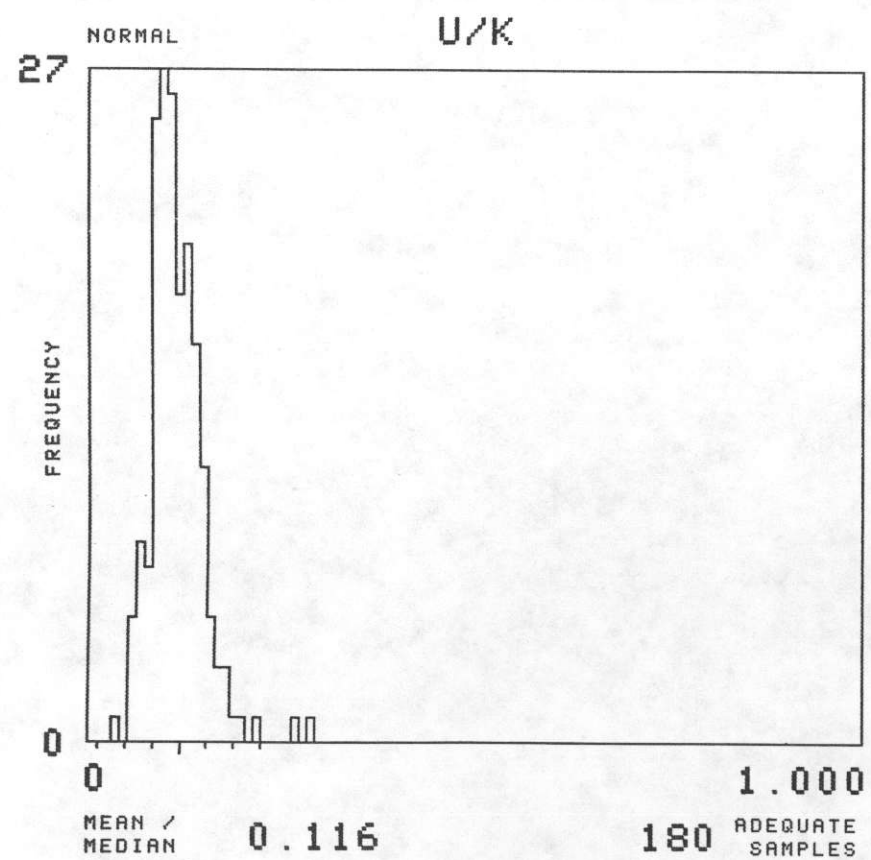
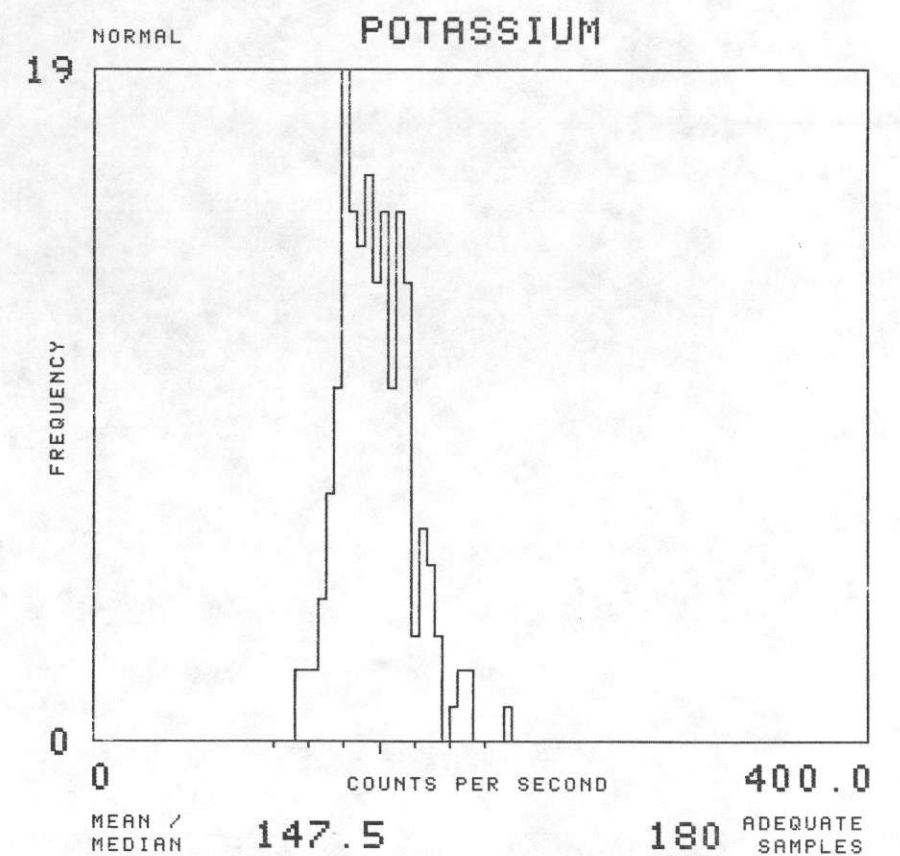
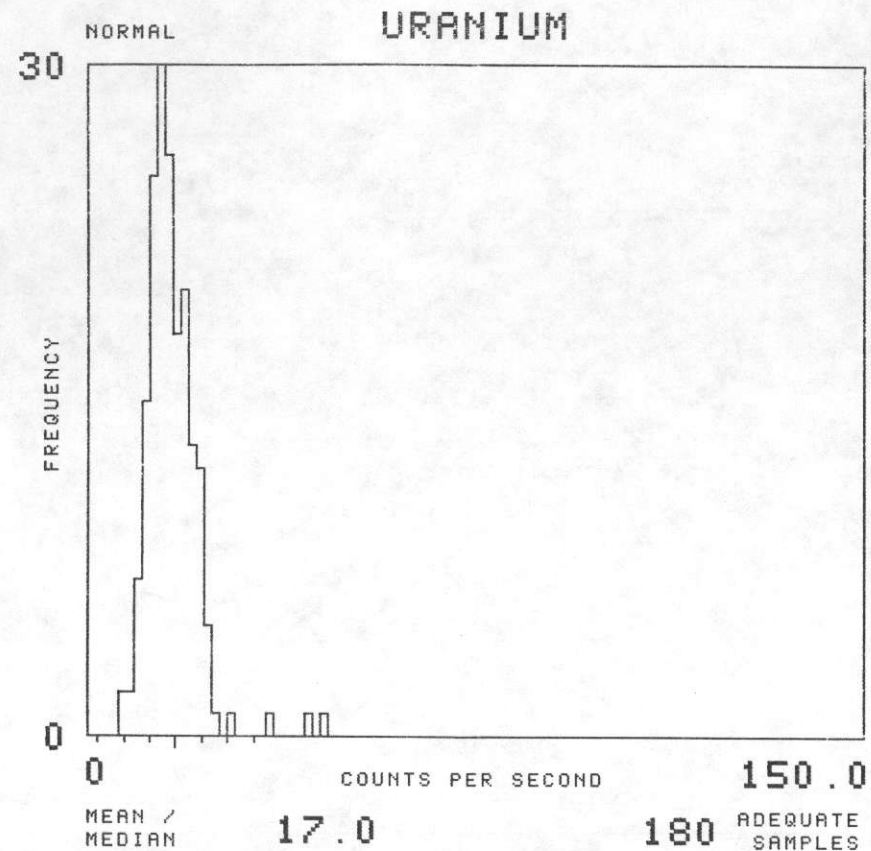
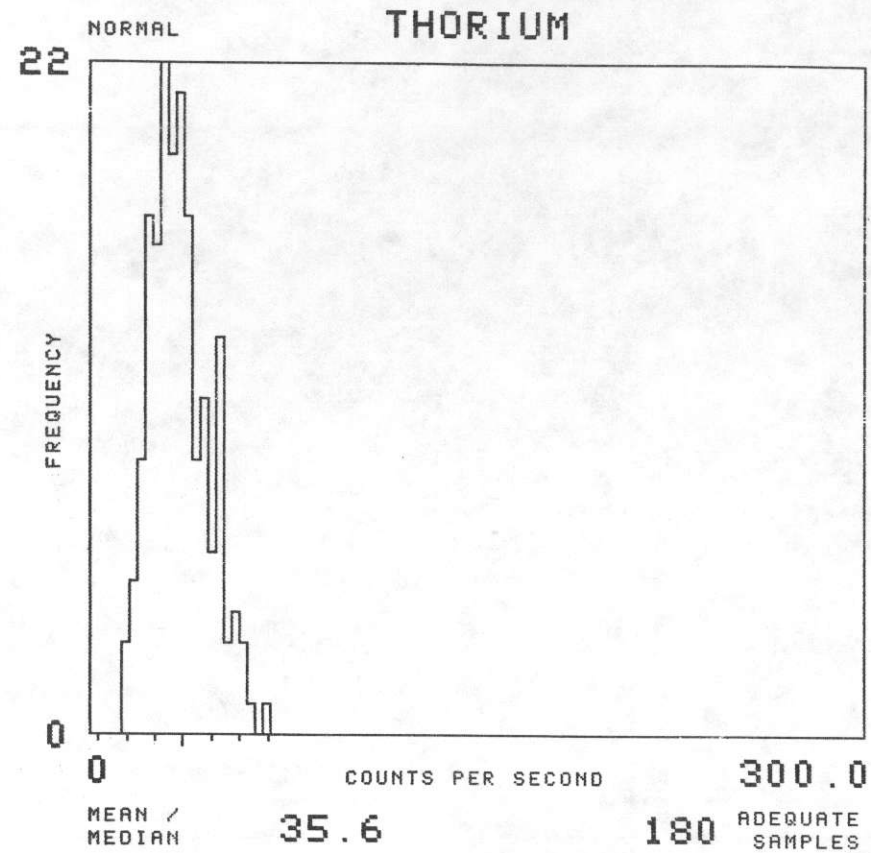
MAP UNIT : JCSE TOTAL NUMBER OF SAMPLES 345





NTMS NI 12-3 GALLUP

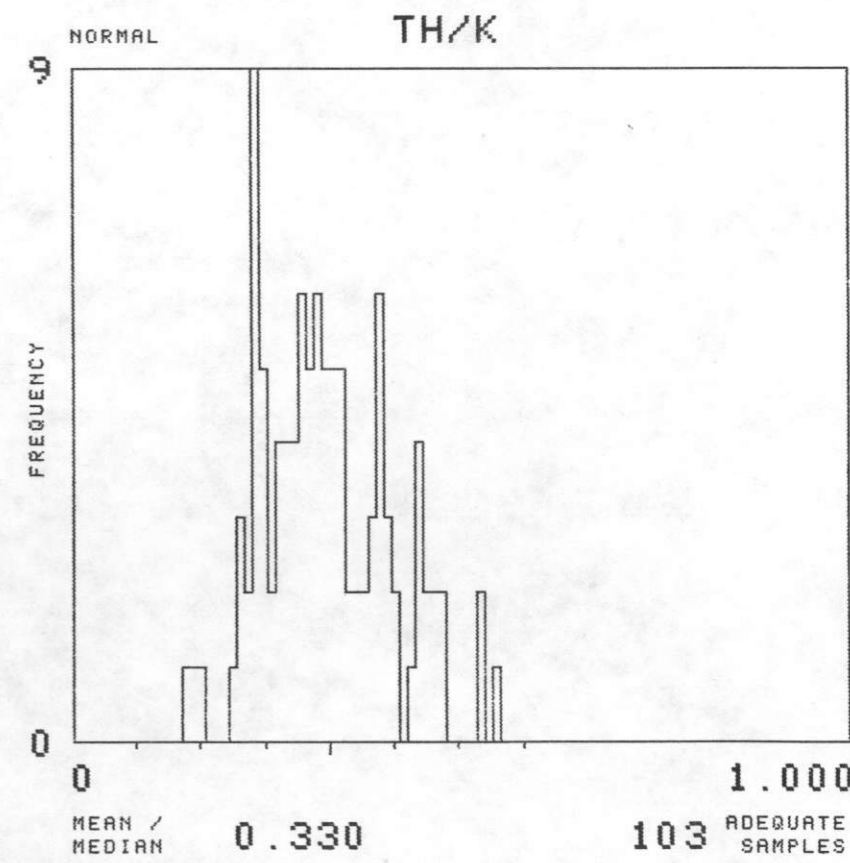
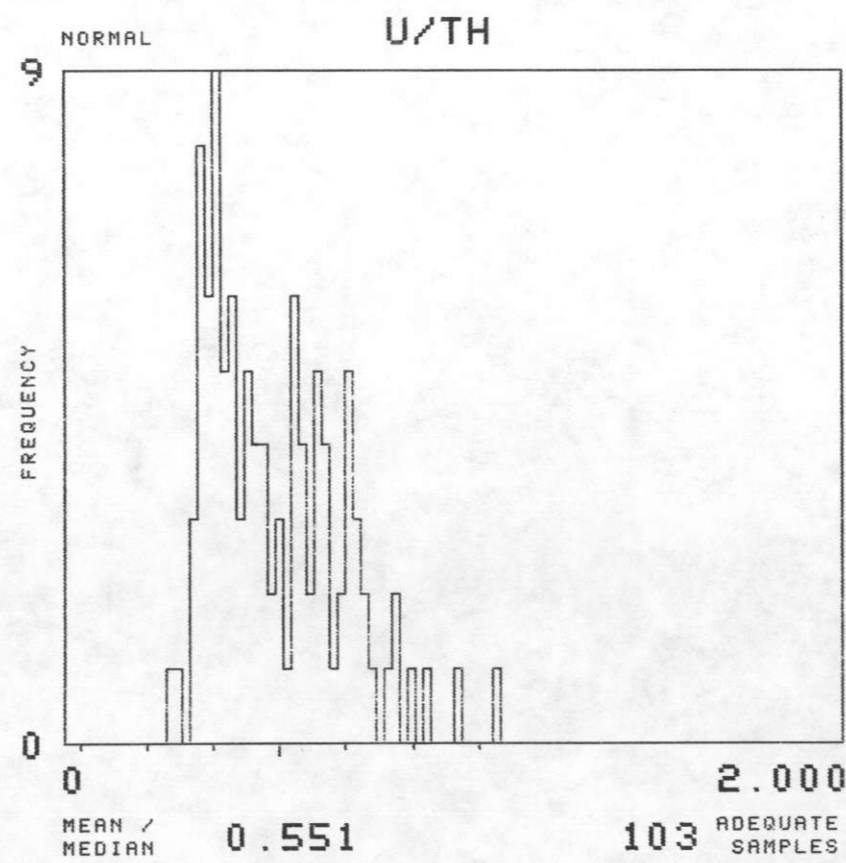
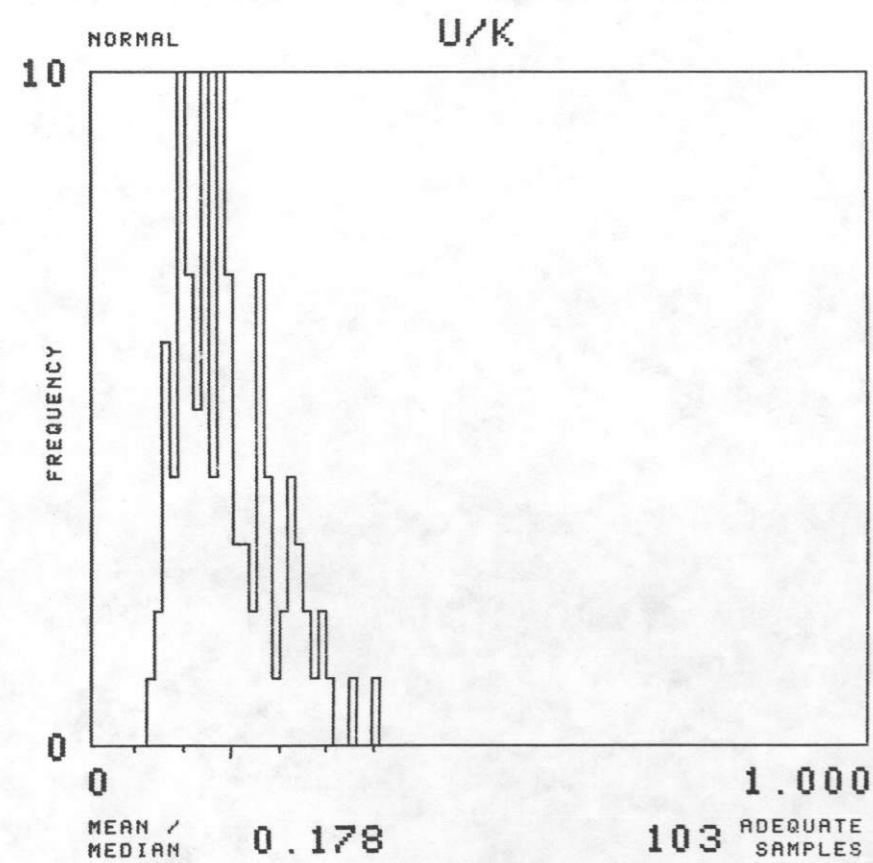
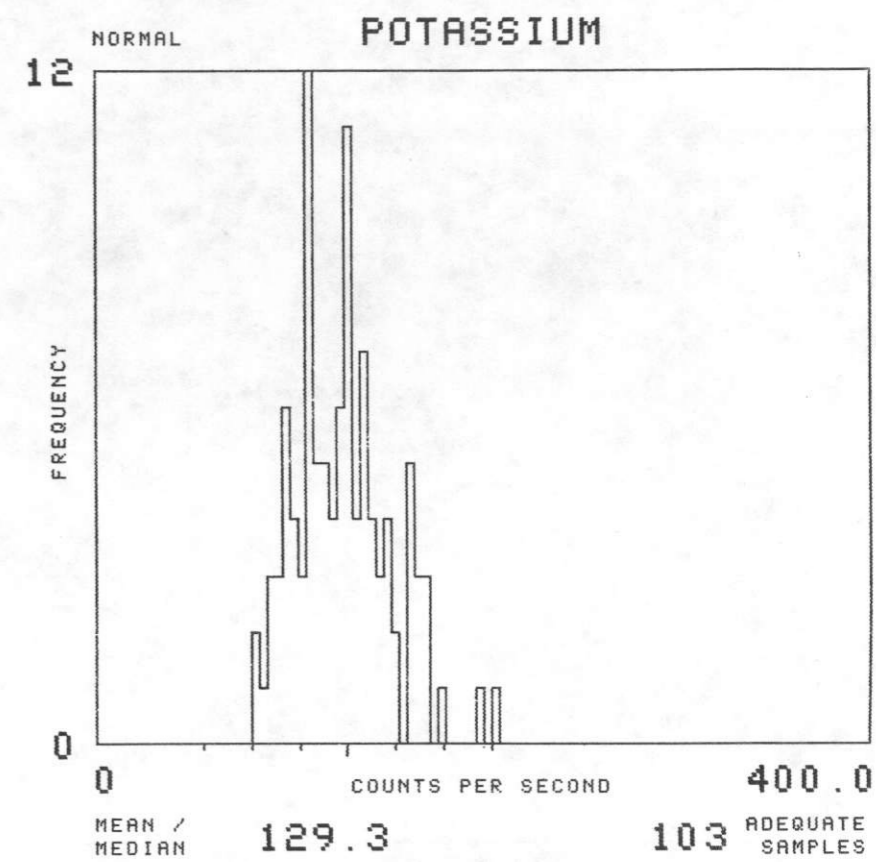
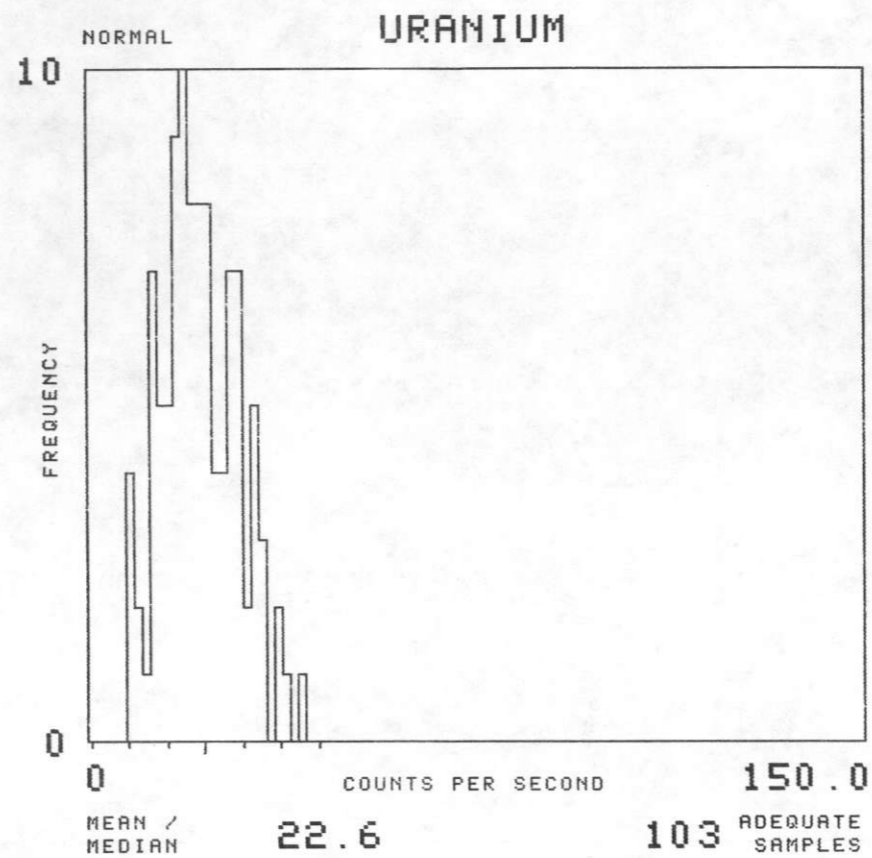
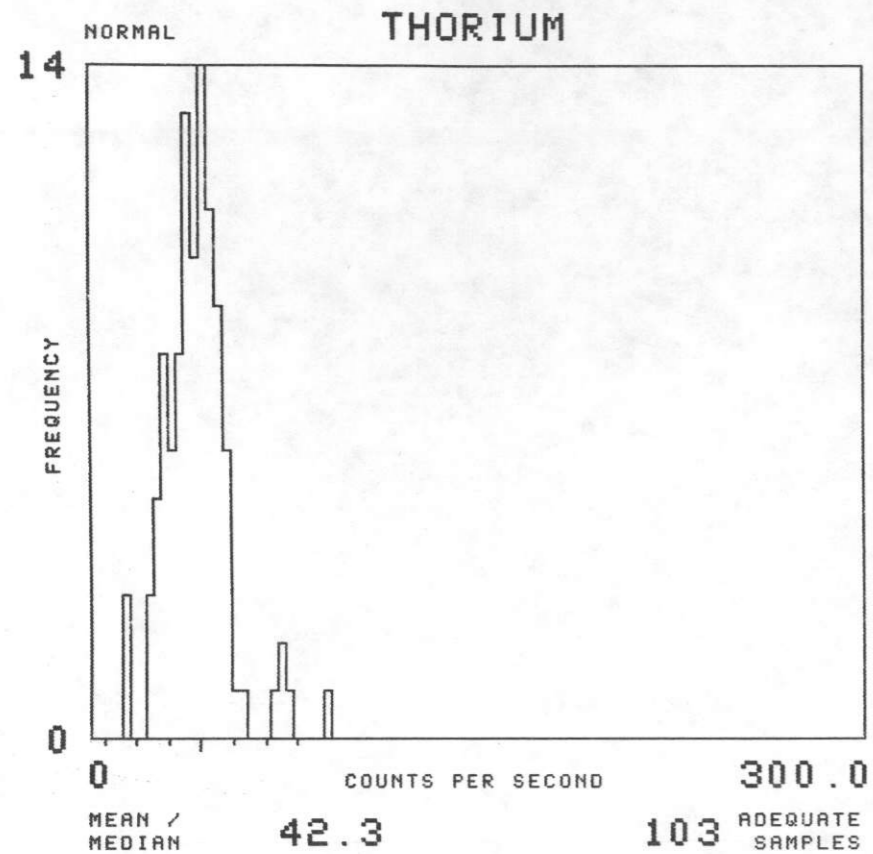
MAP UNIT : JE TOTAL NUMBER OF SAMPLES 183

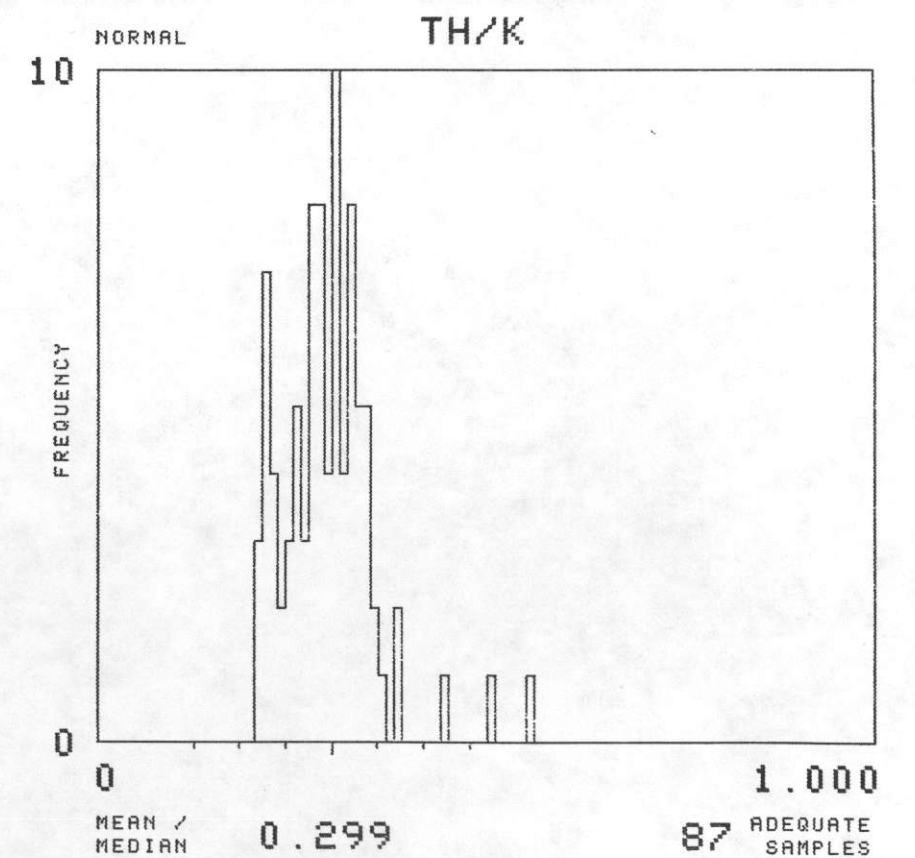
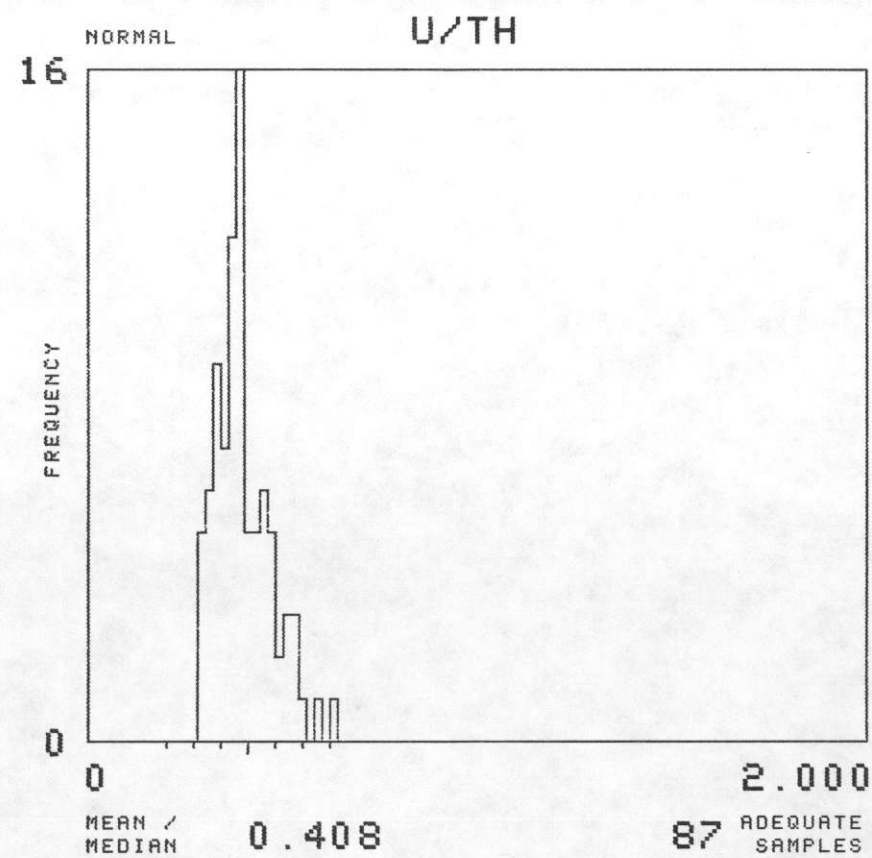
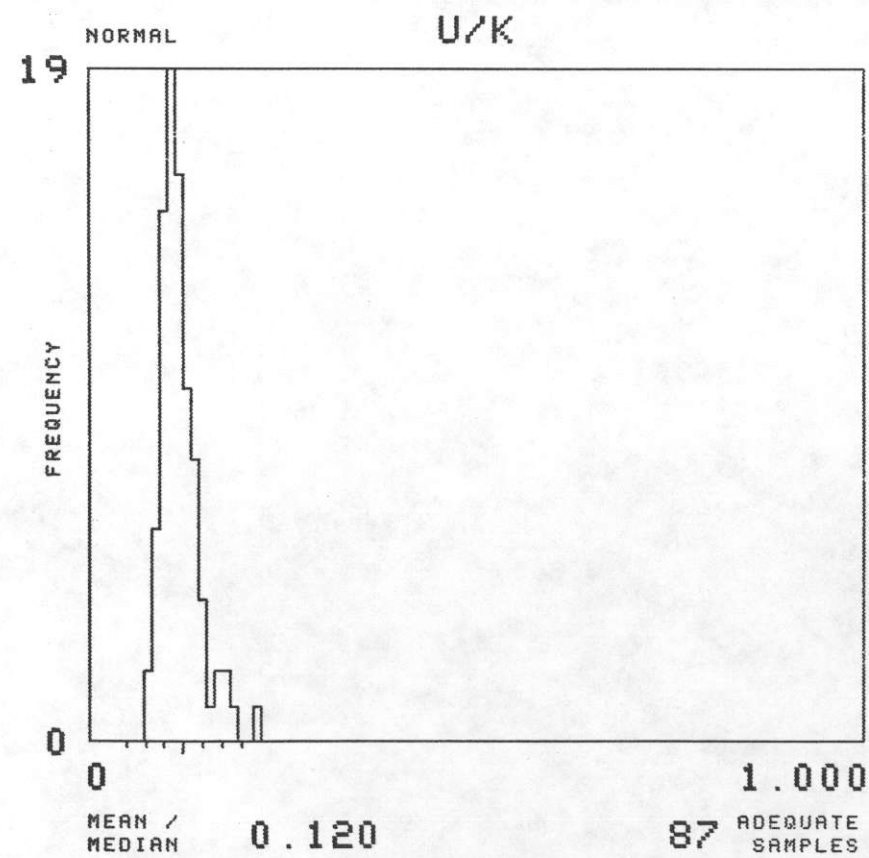
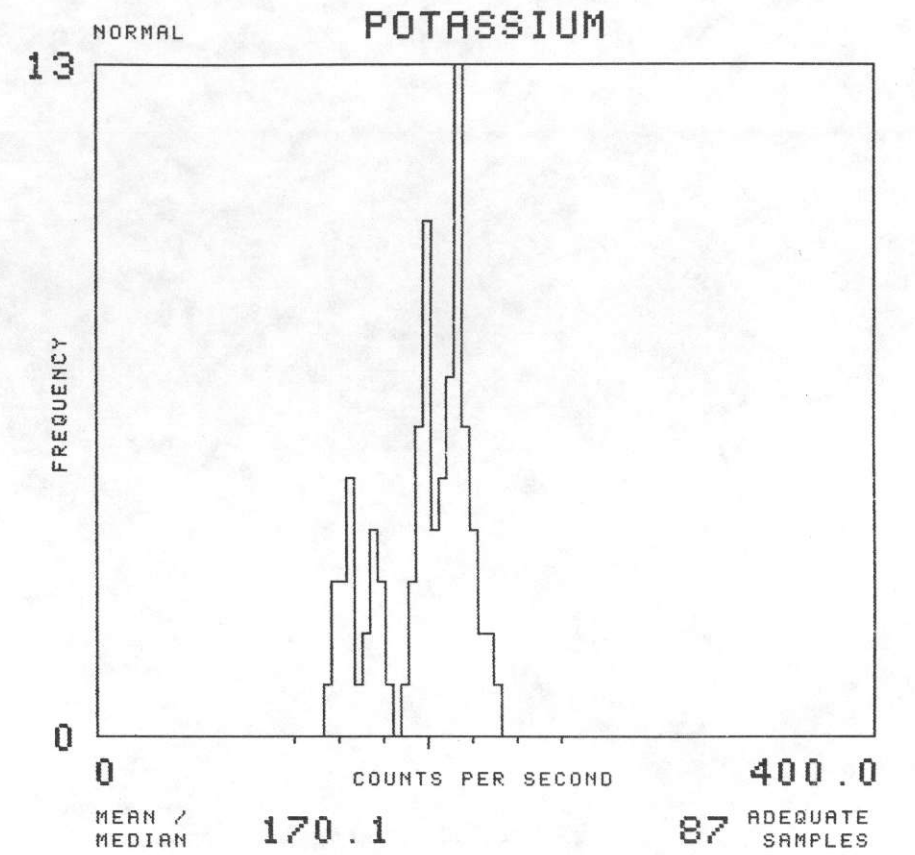
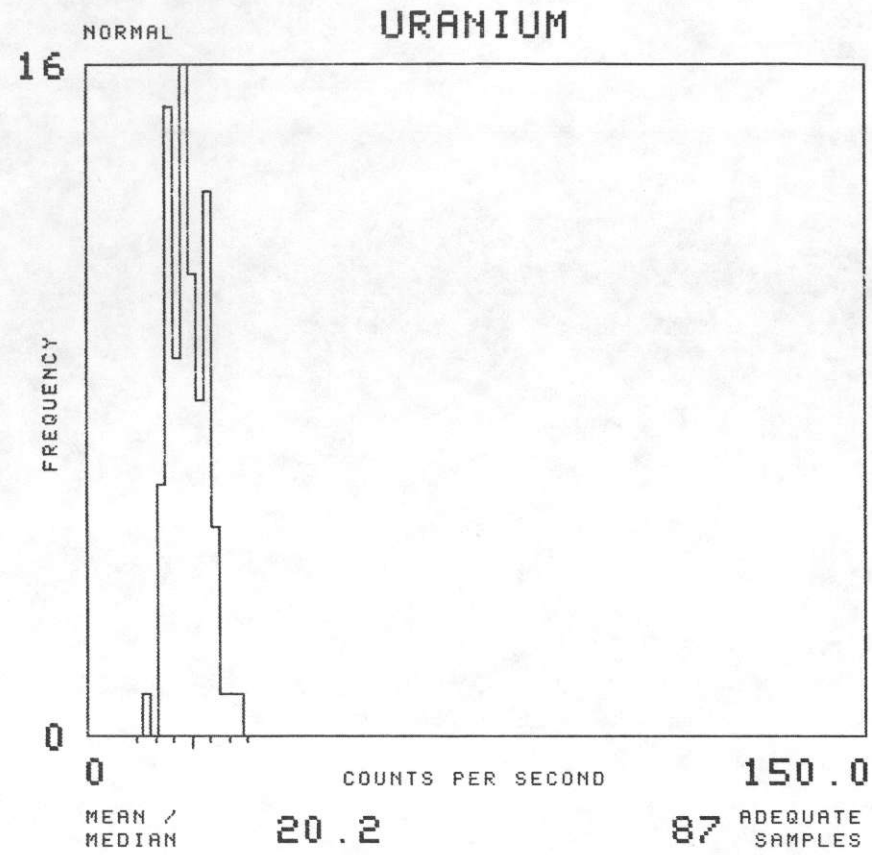
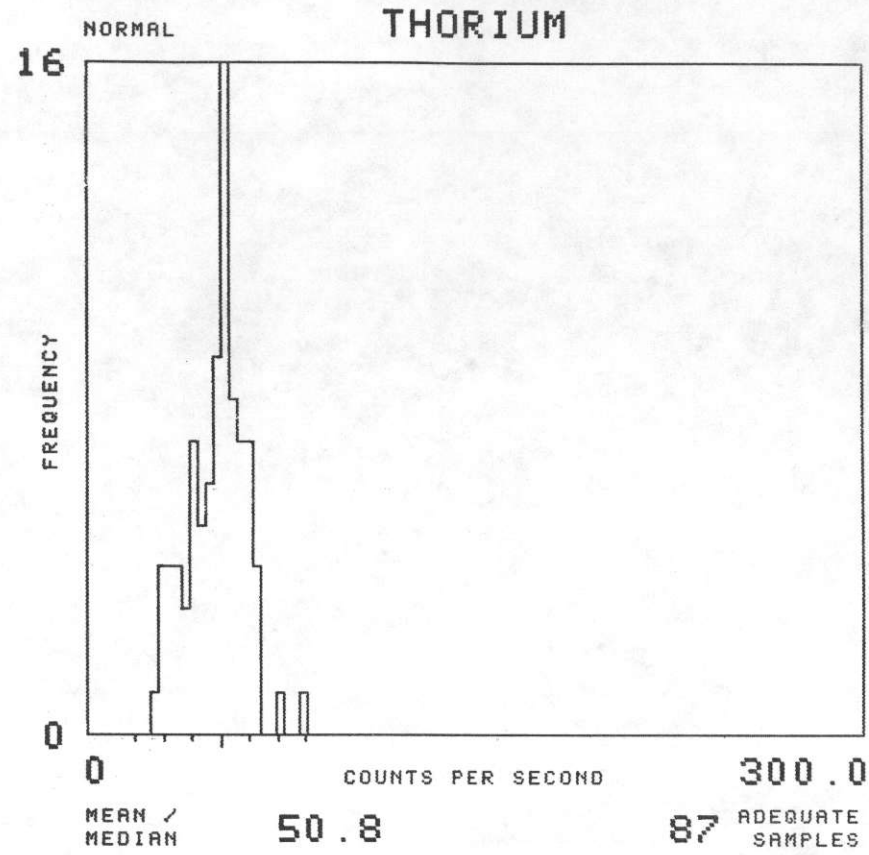


NTMS NI 12-3 GALLUP

MAP UNIT : JM

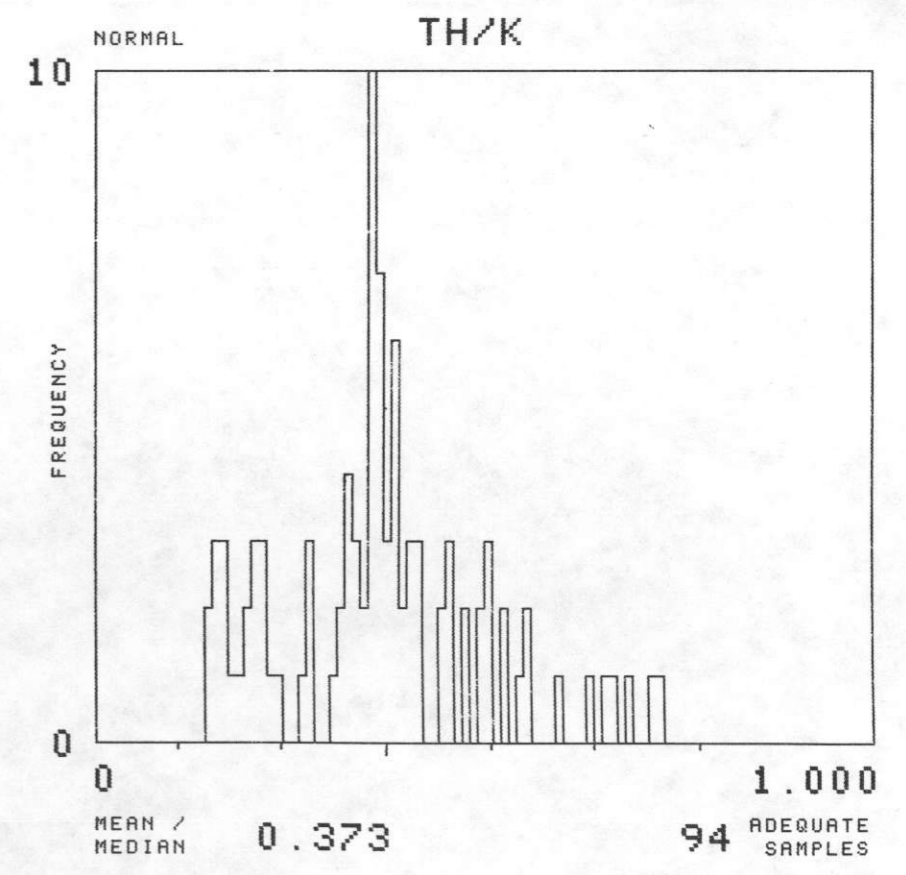
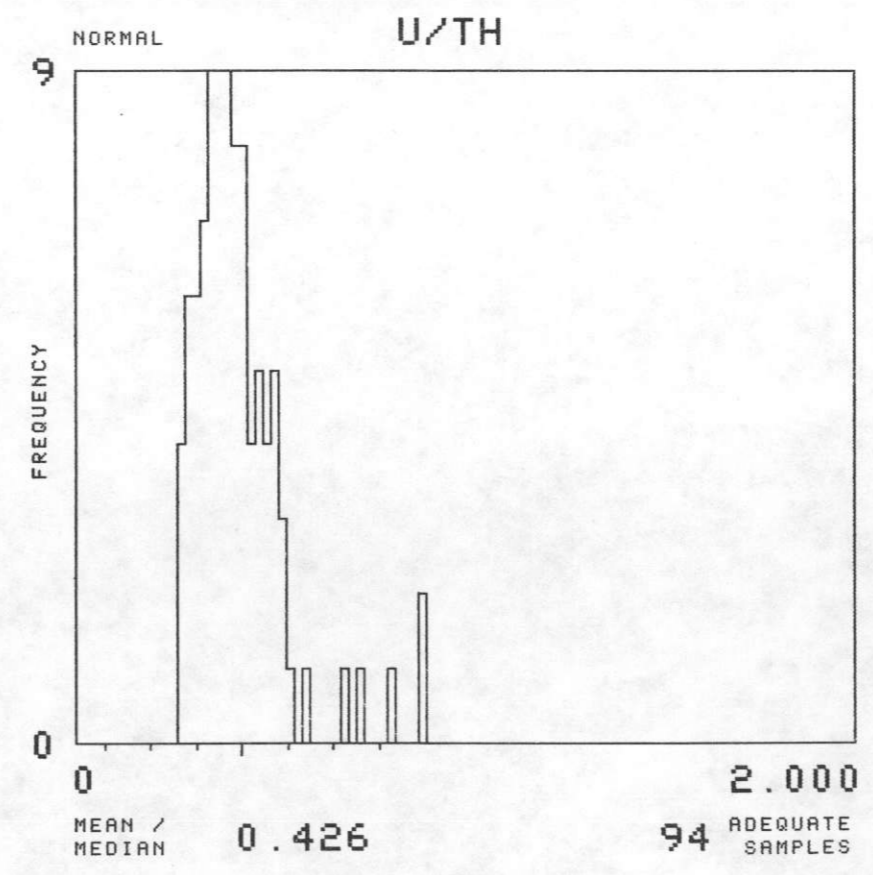
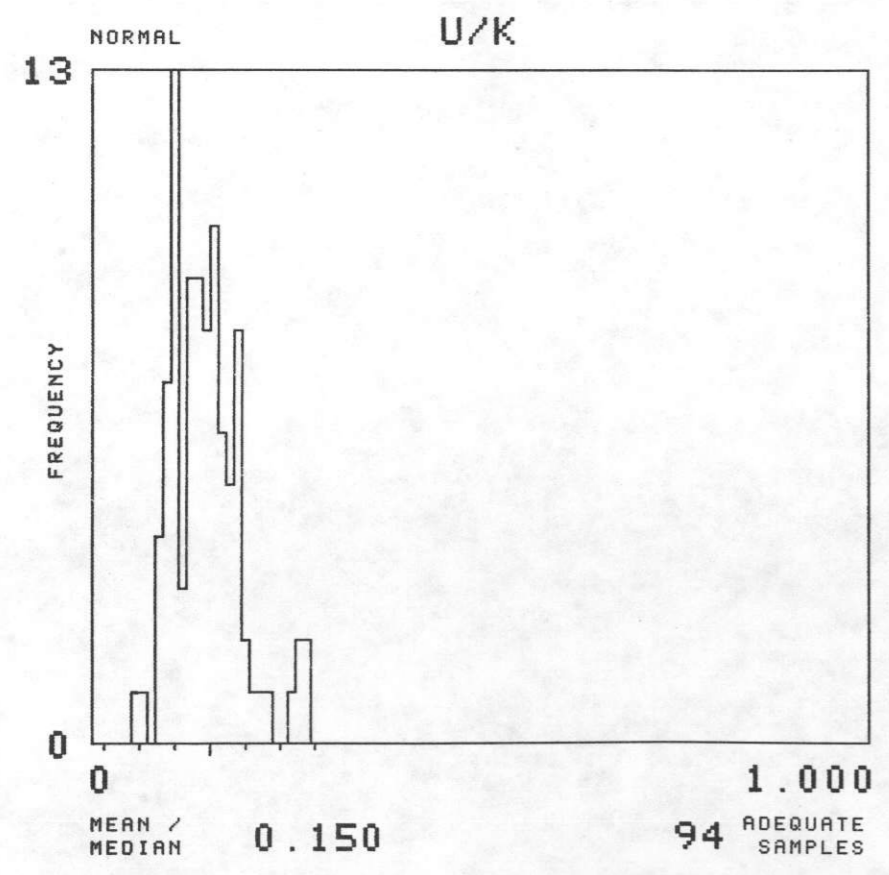
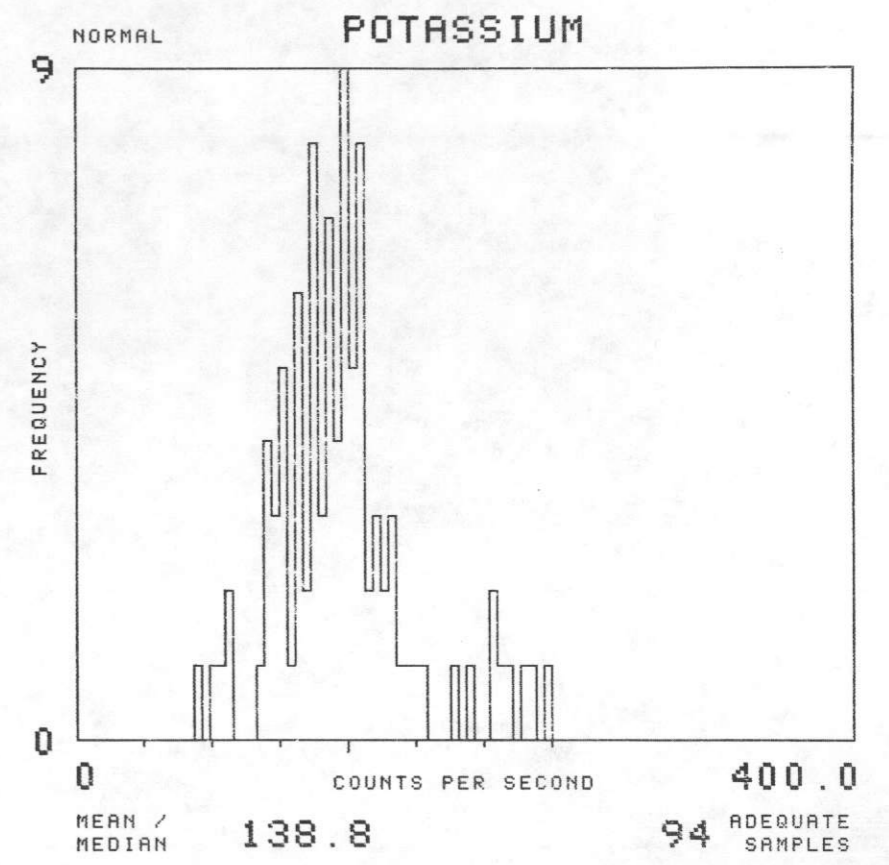
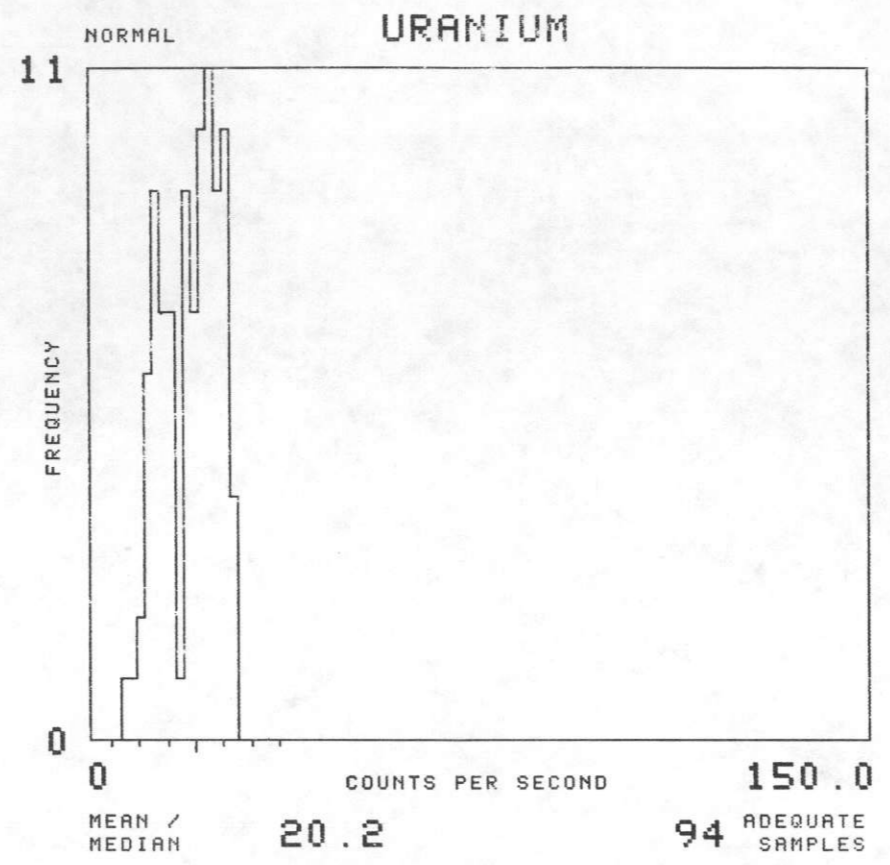
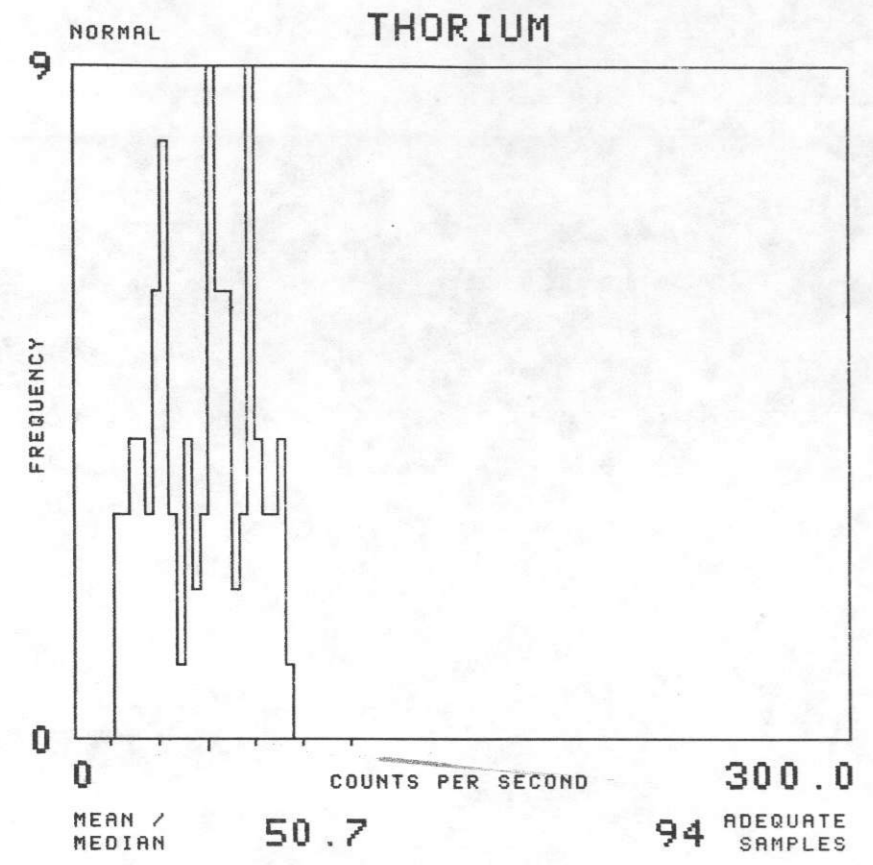
TOTAL NUMBER OF SAMPLES 116





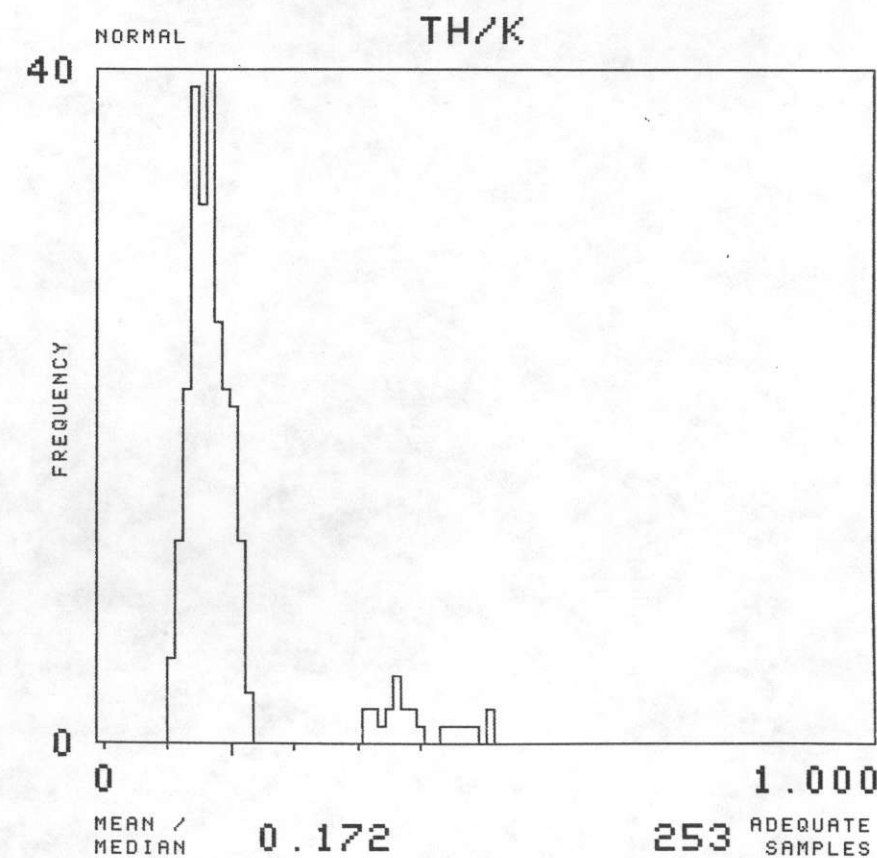
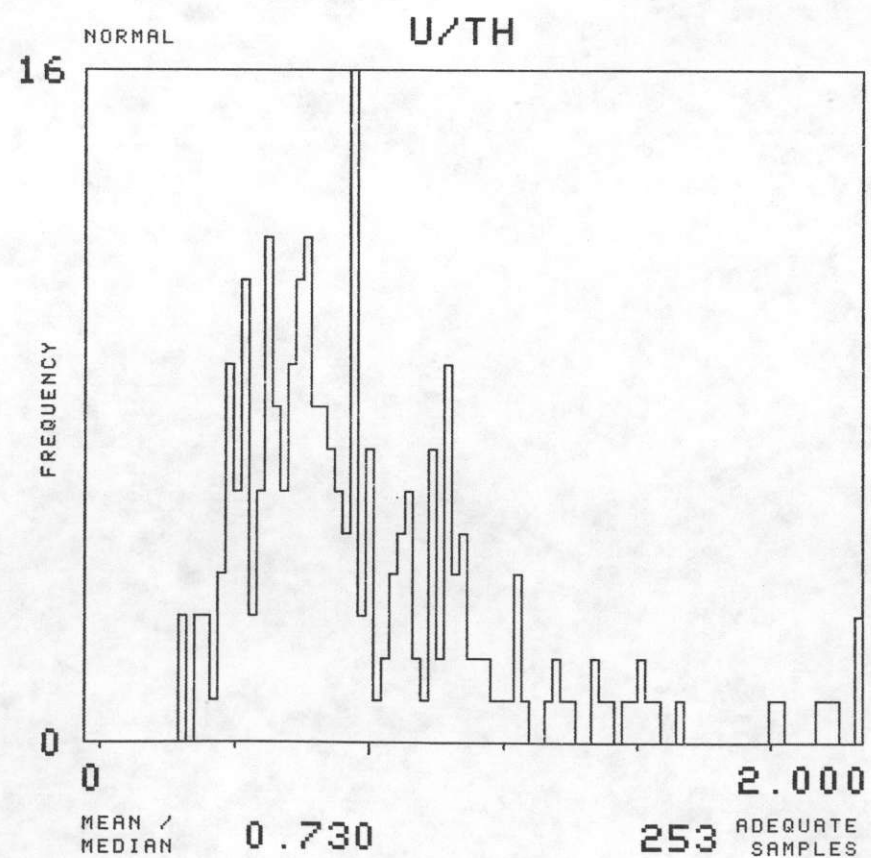
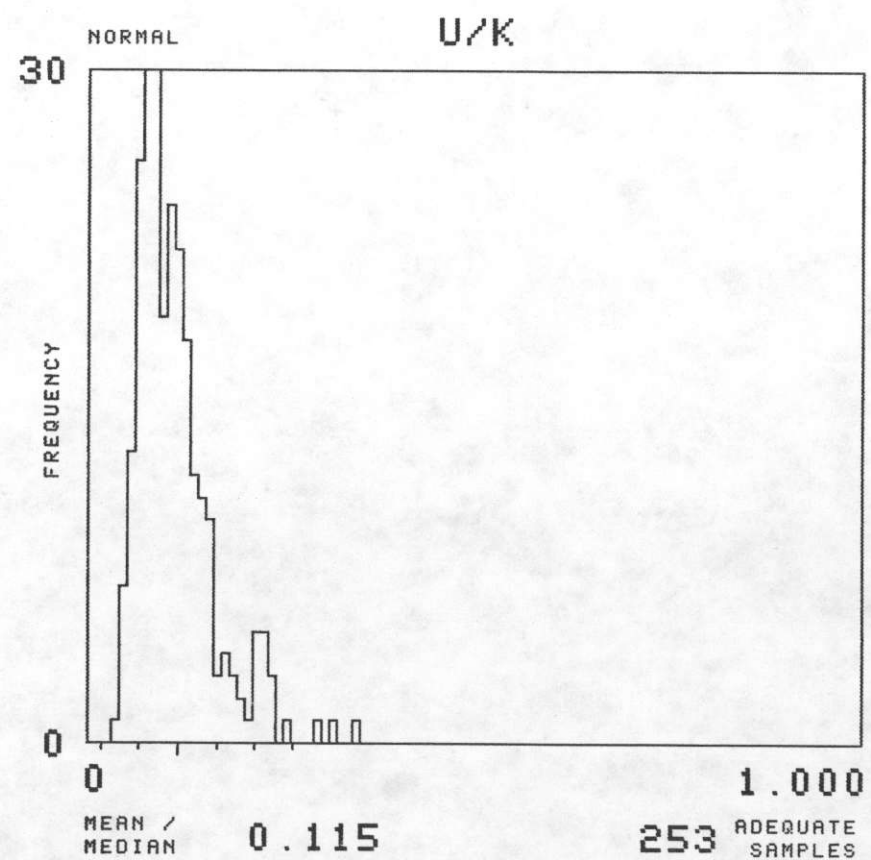
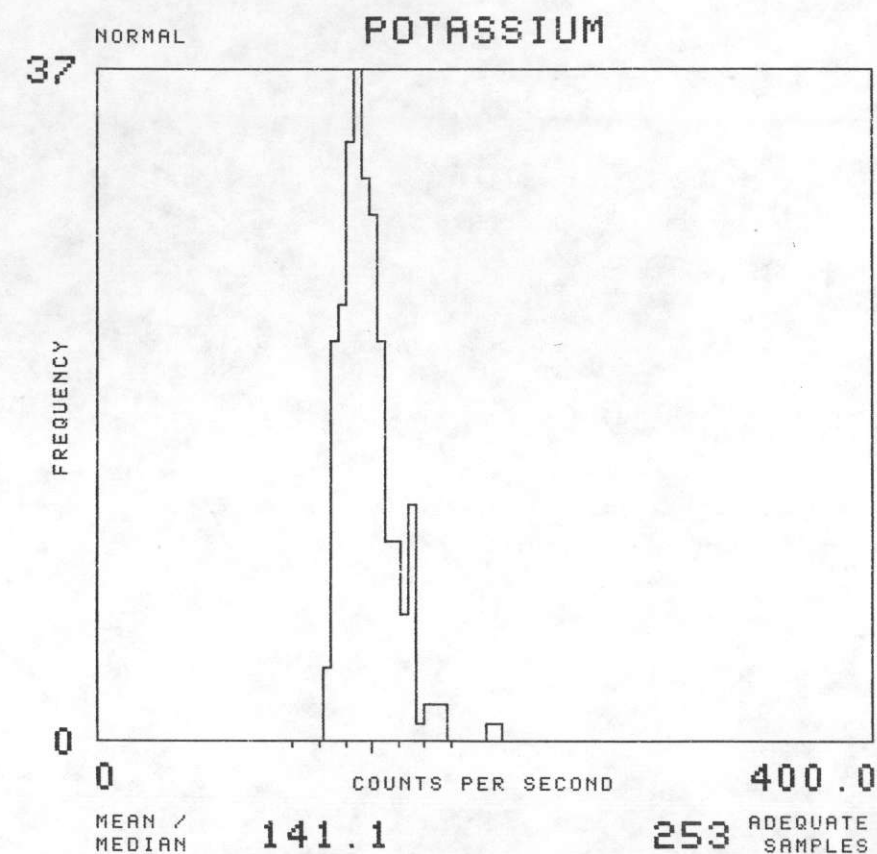
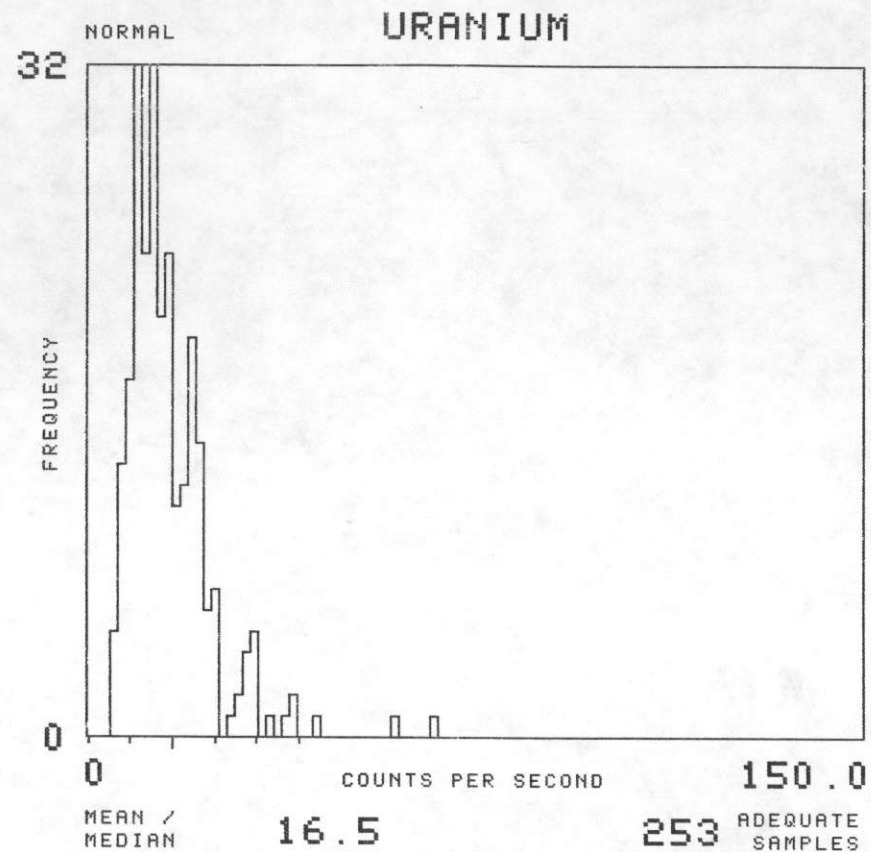
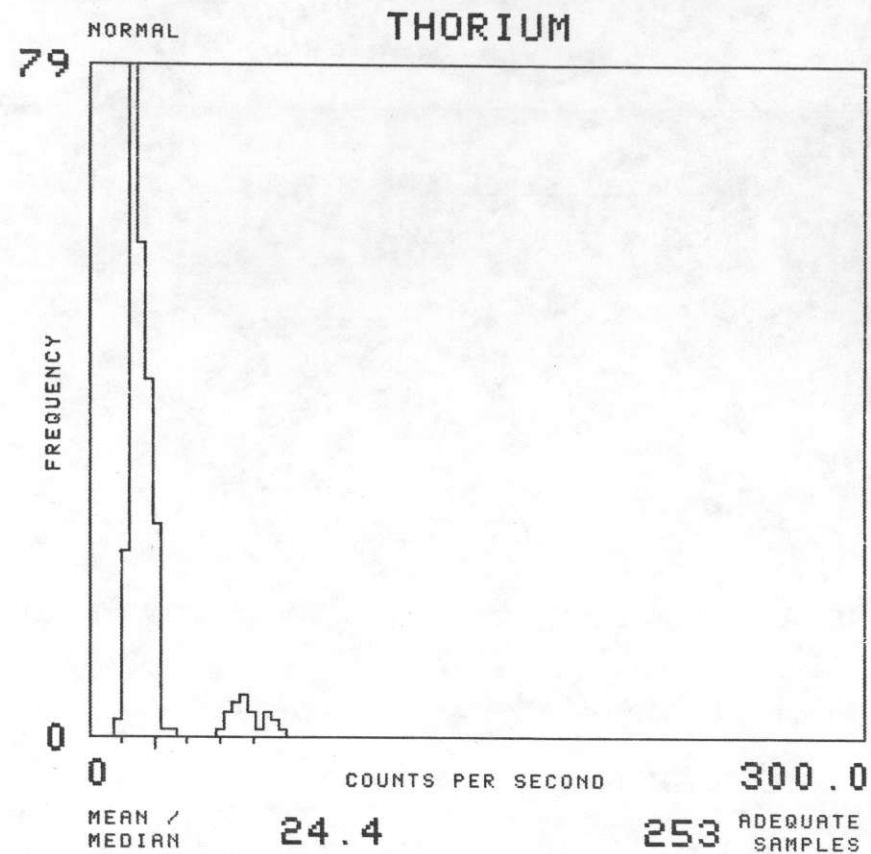
NTMS NI 12-3 GALLUP

MAP UNIT : JMW TOTAL NUMBER OF SAMPLES 100



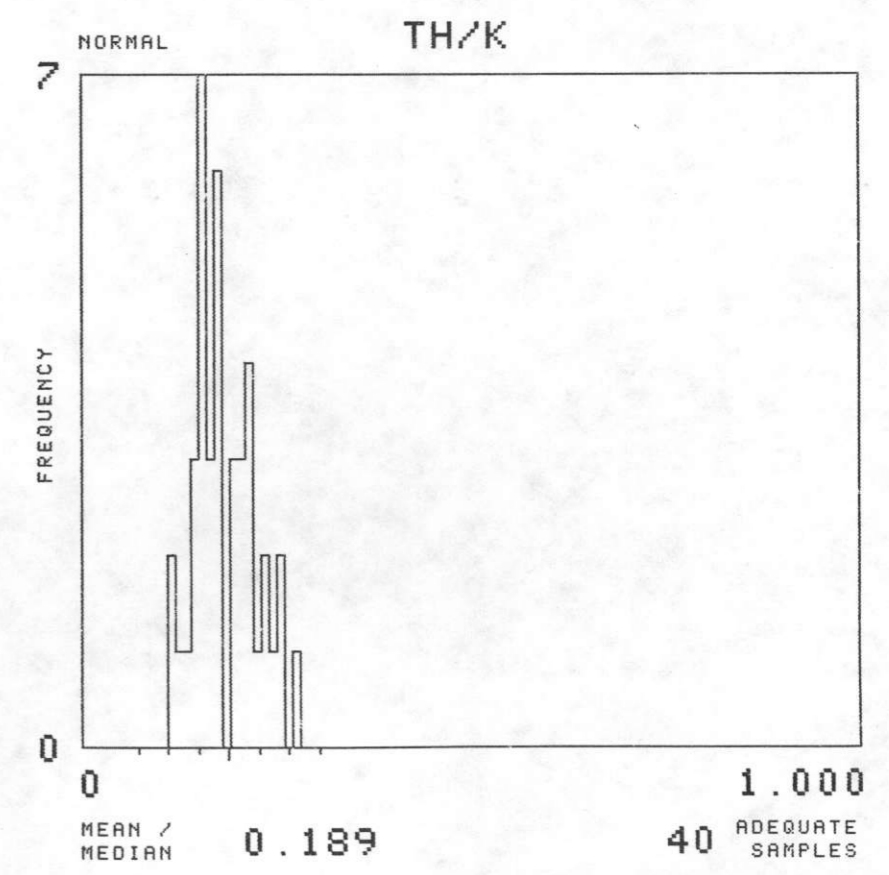
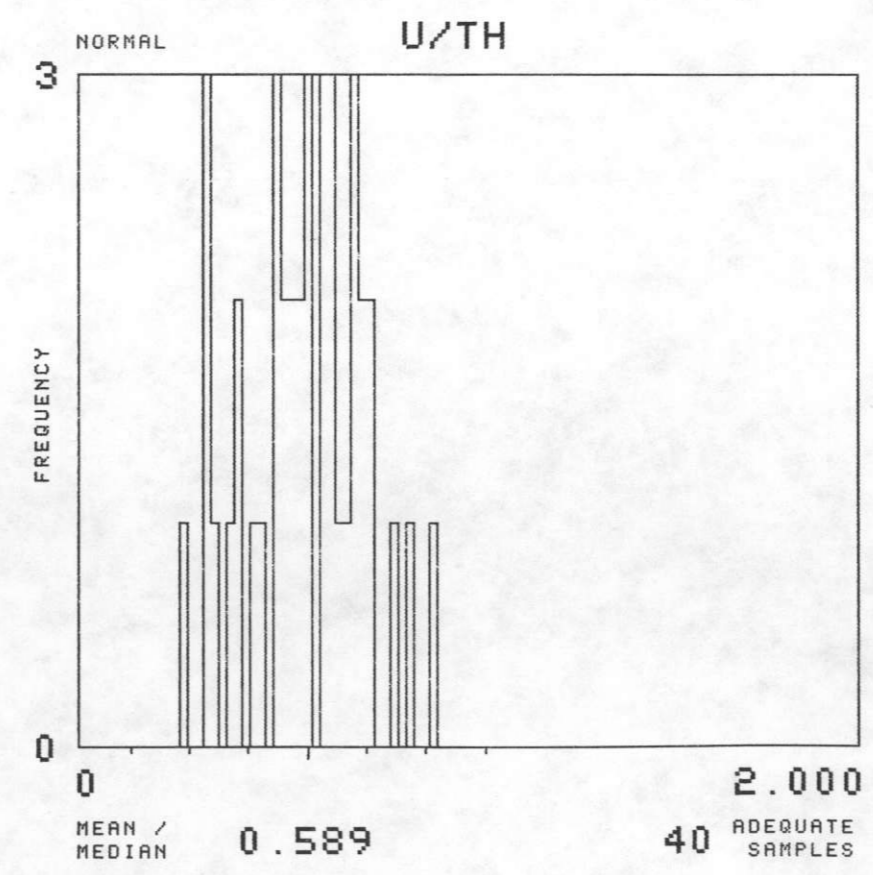
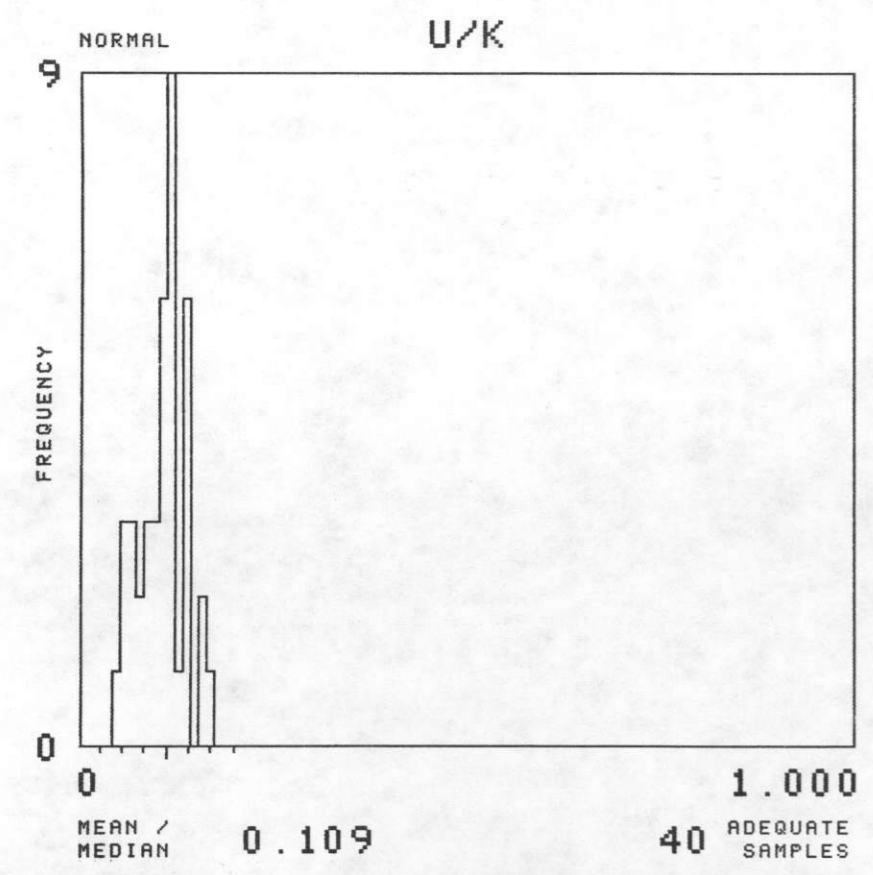
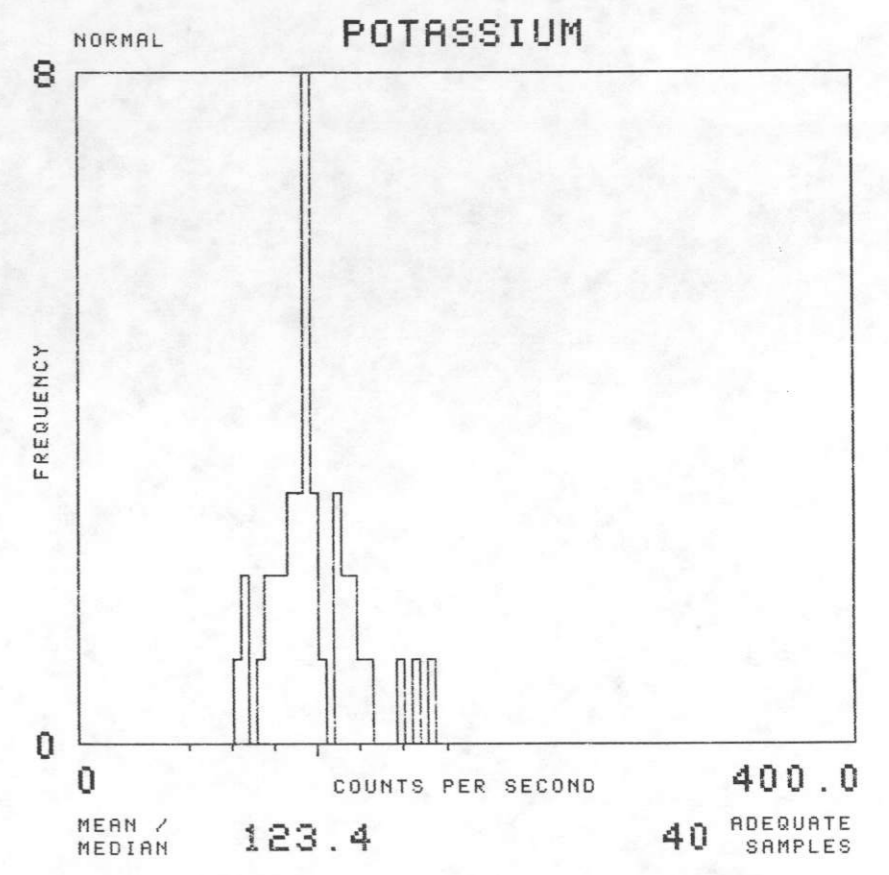
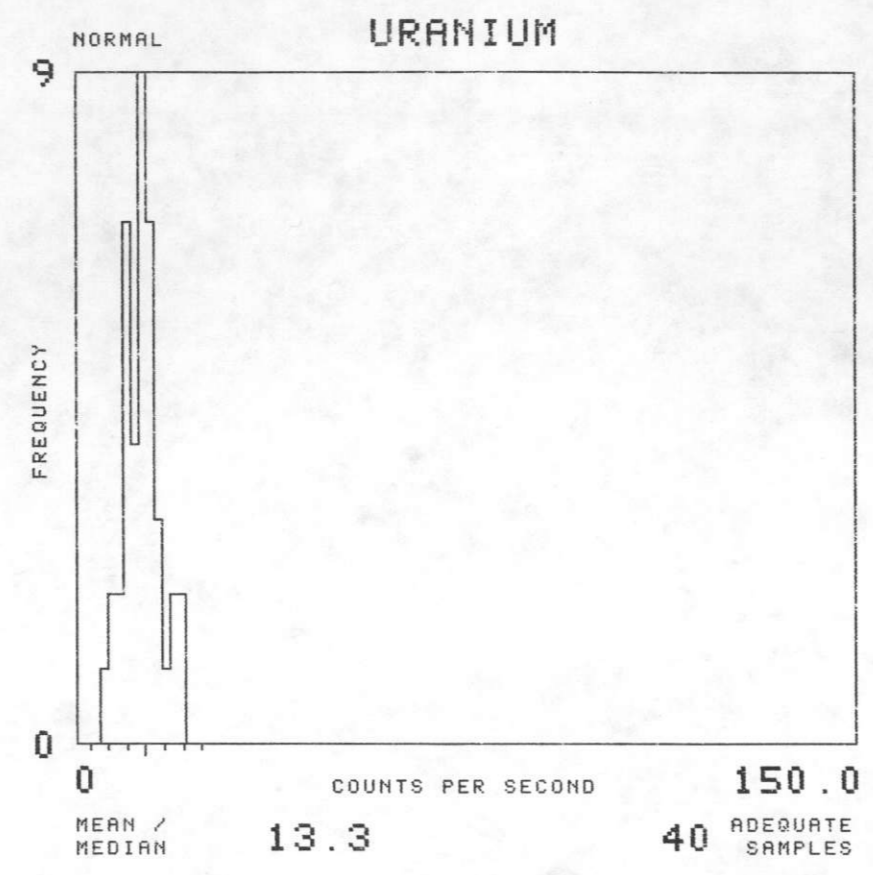
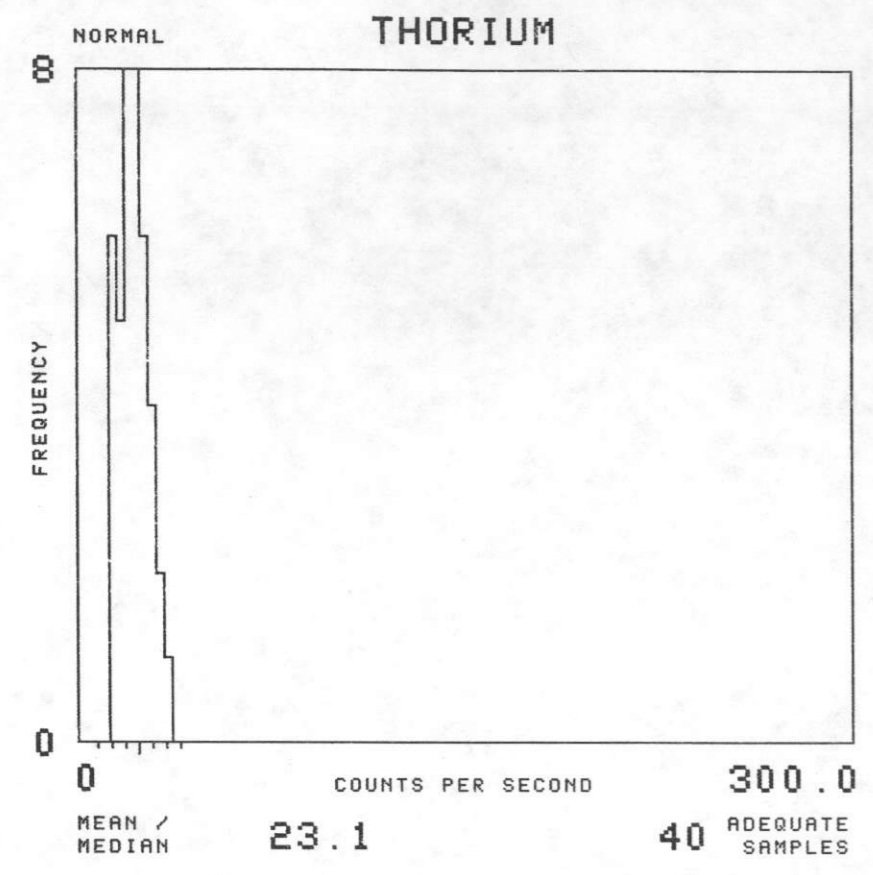
NTMS NI 12-3 GALLUP

MAP UNIT : JMWR TOTAL NUMBER OF SAMPLES 258



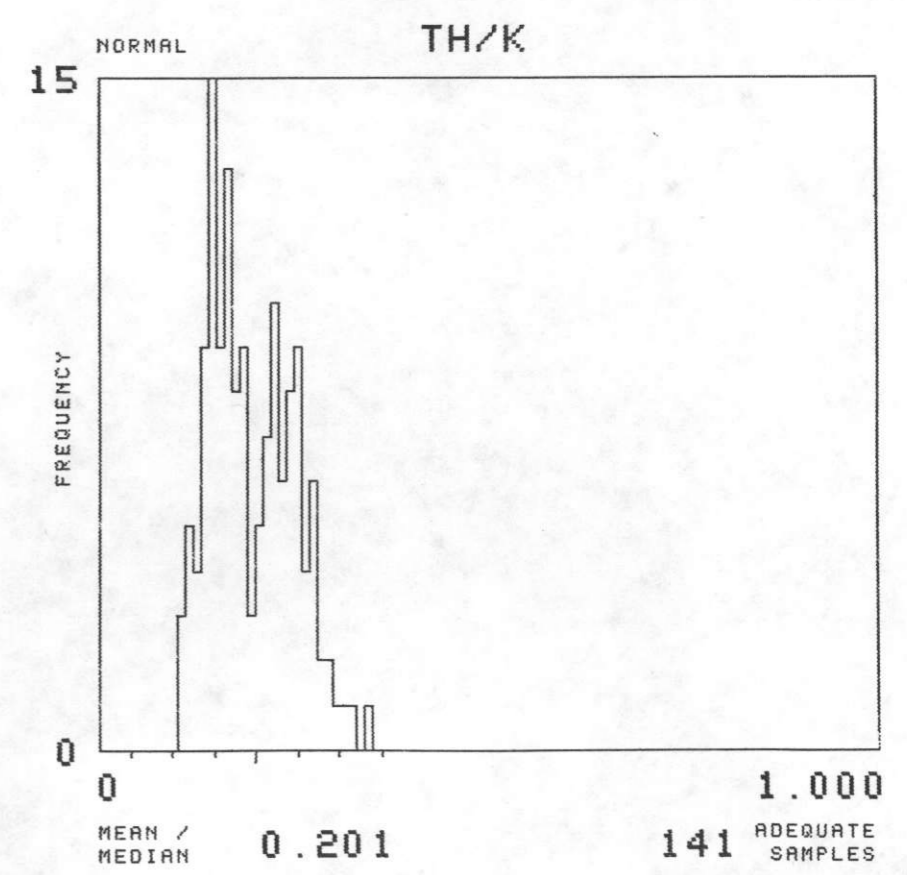
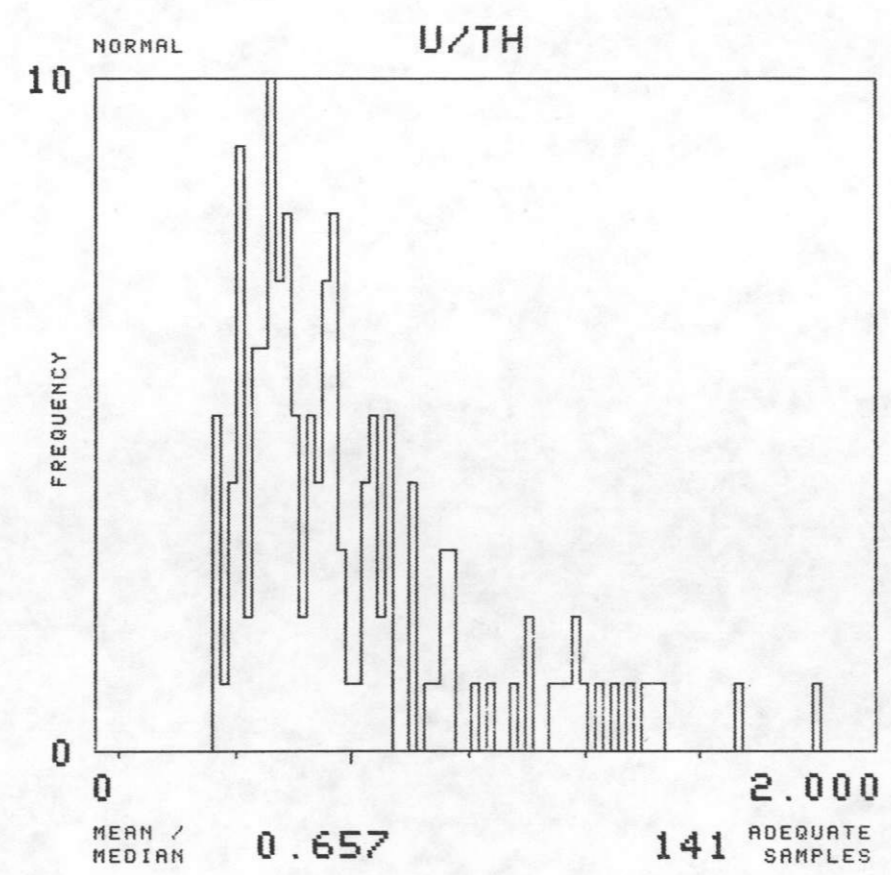
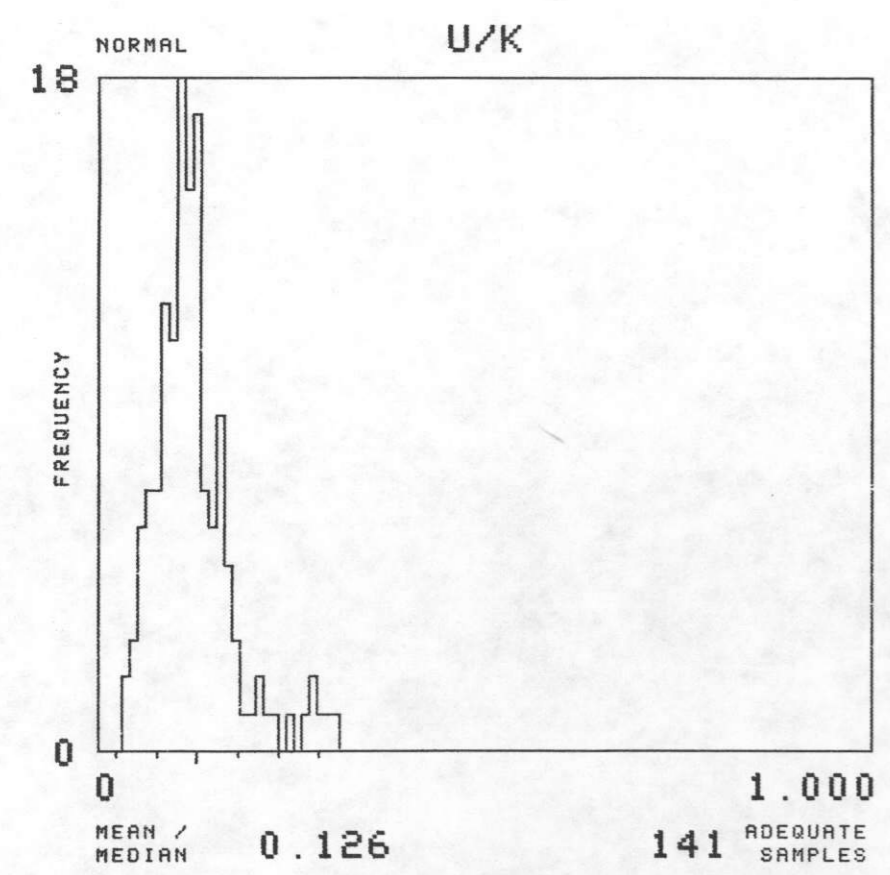
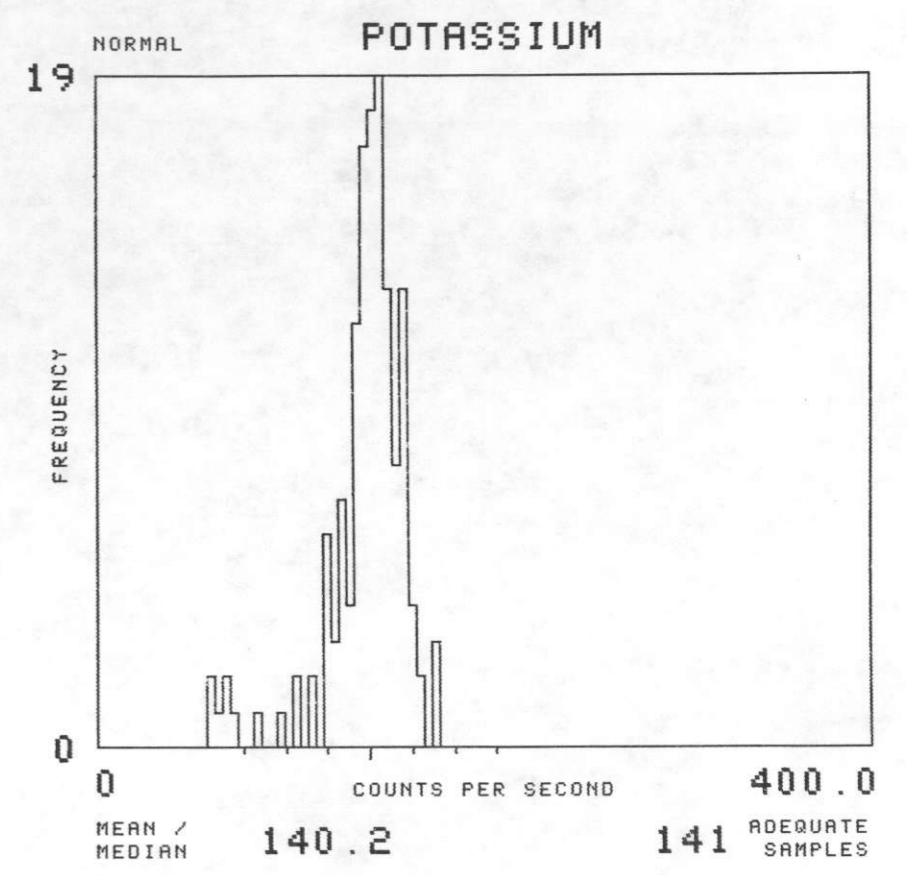
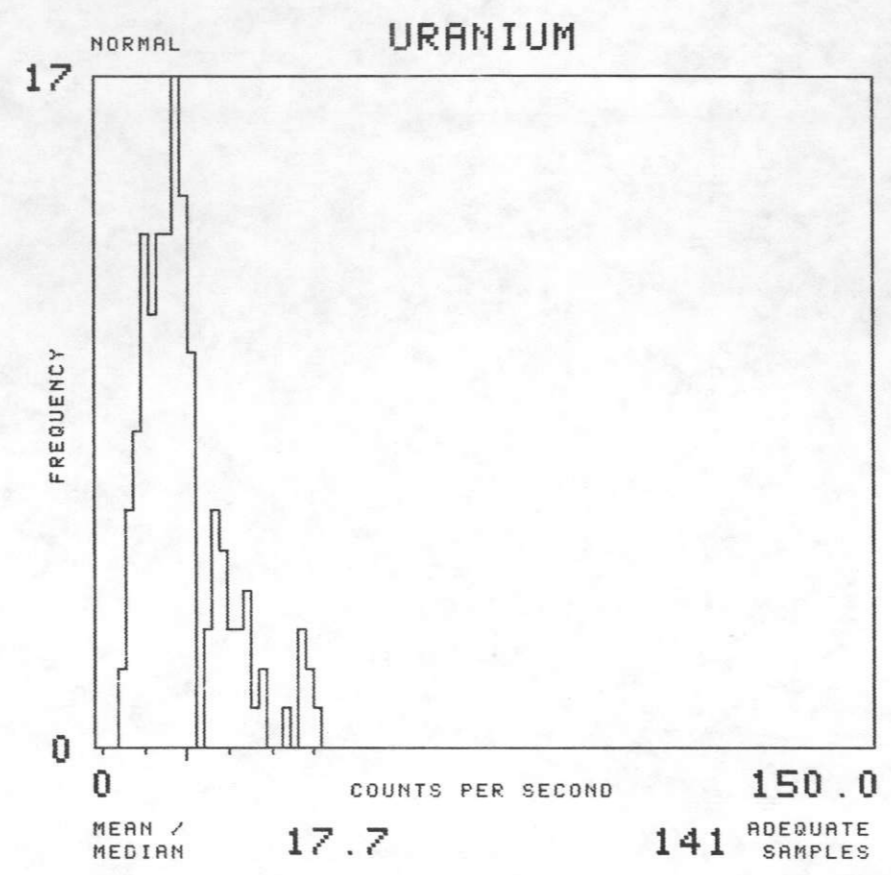
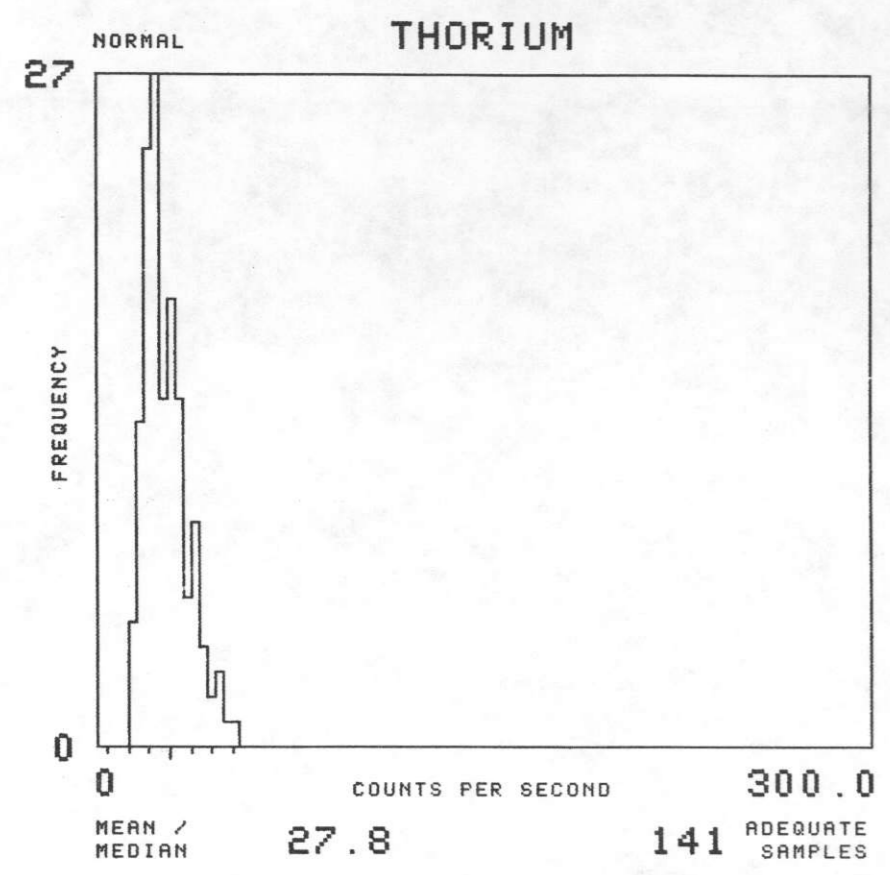
NTMS NI 12-3 GALLUP

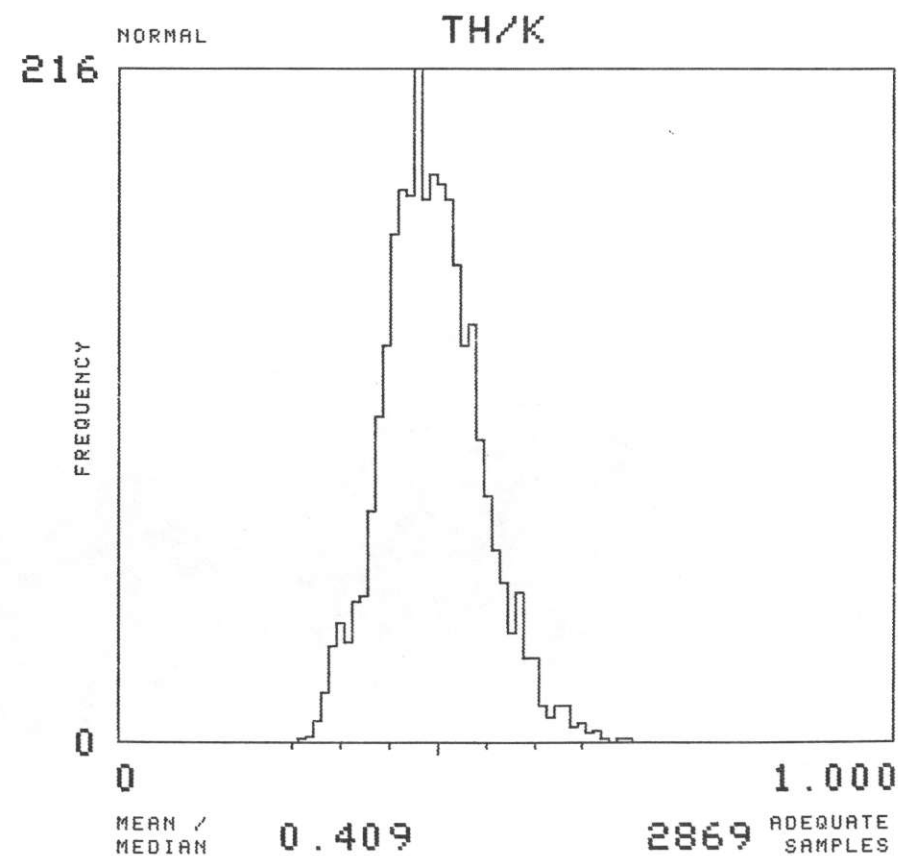
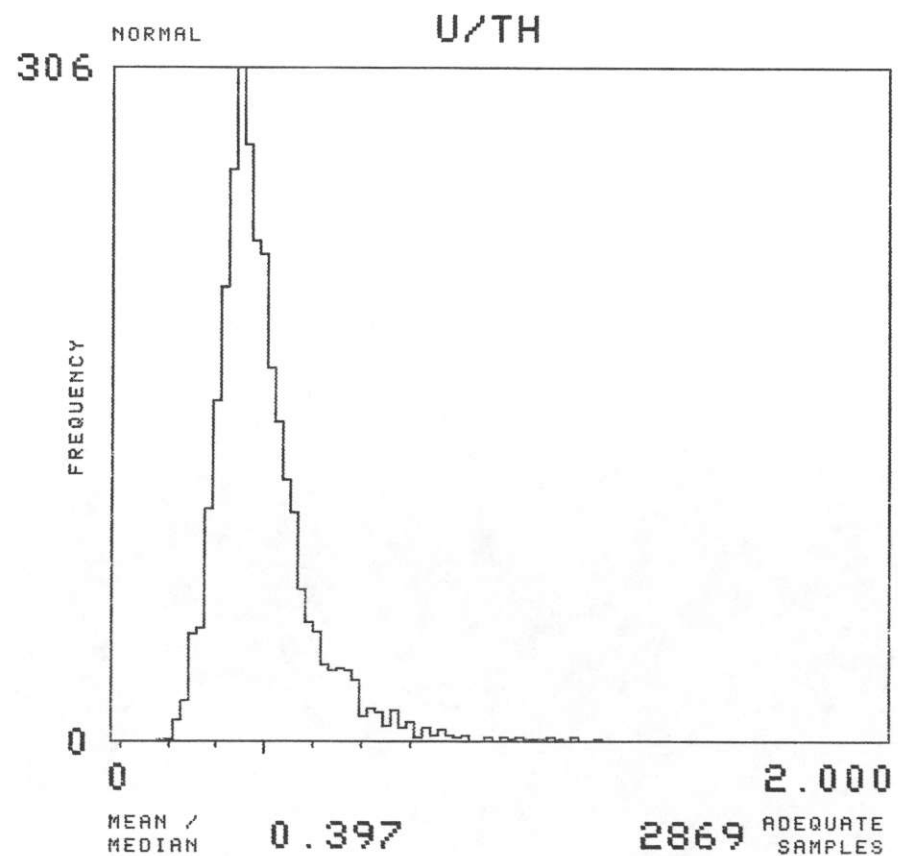
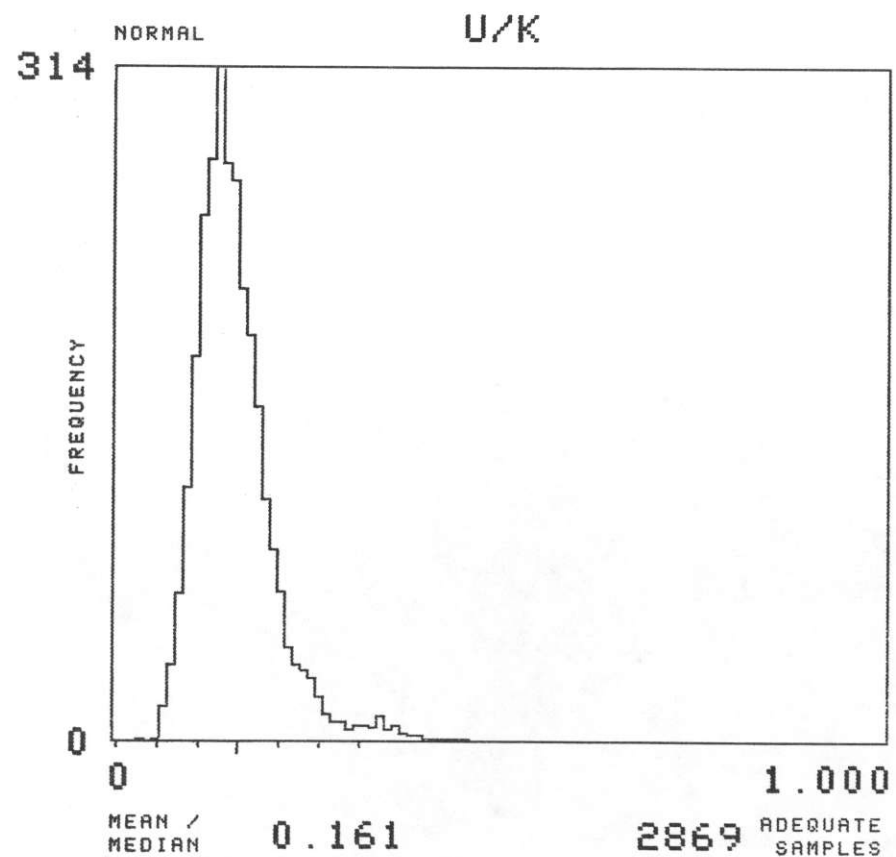
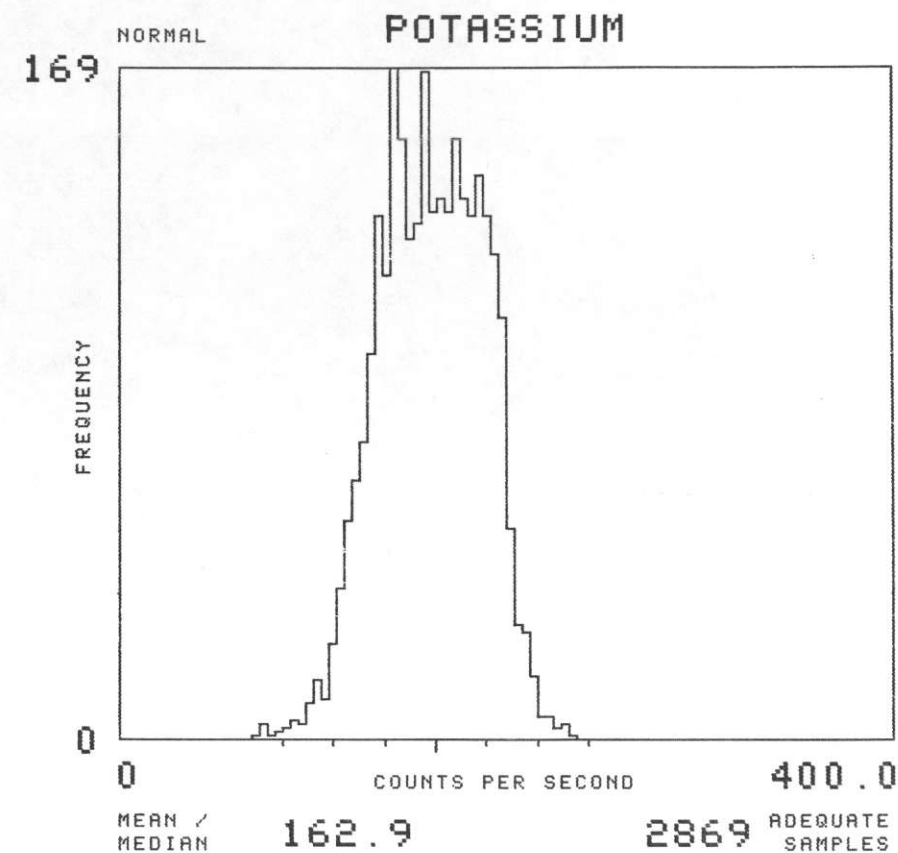
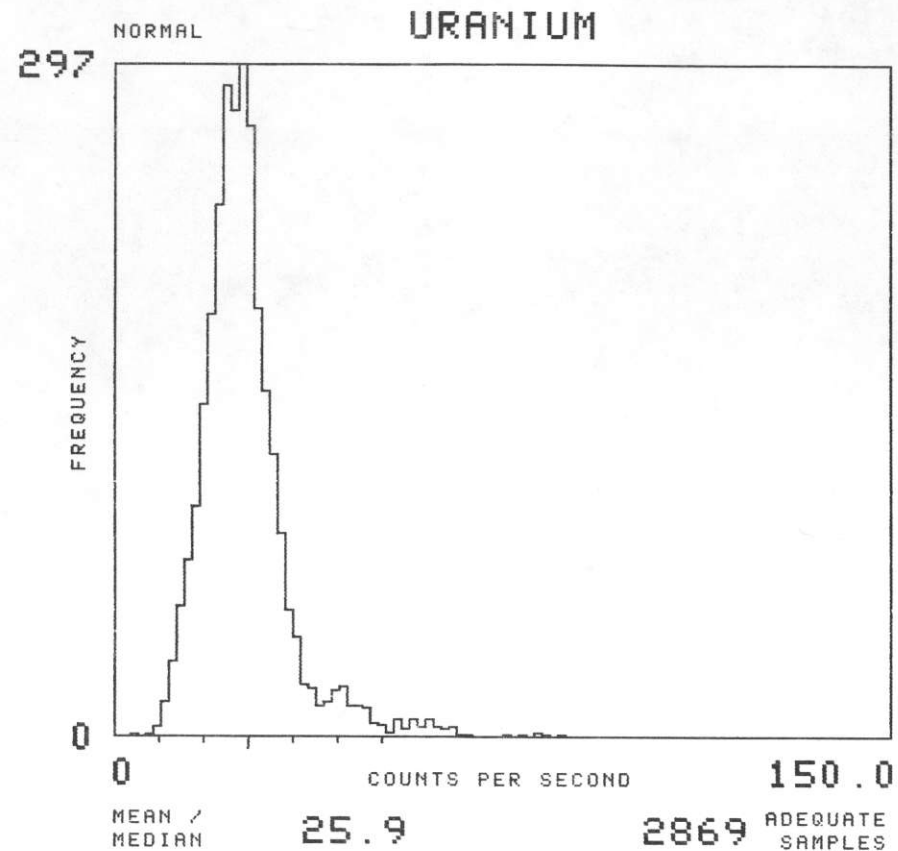
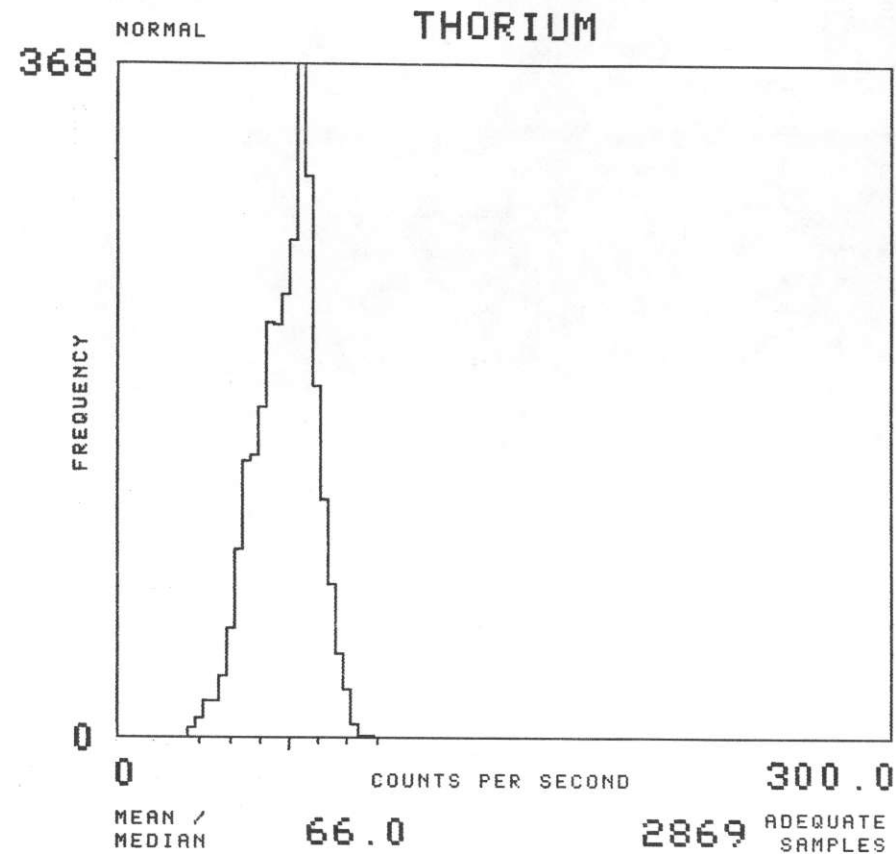
MAP UNIT : JS TOTAL NUMBER OF SAMPLES 42



NTMS NI 12-3 GALLUP

MAP UNIT : JTE TOTAL NUMBER OF SAMPLES 143

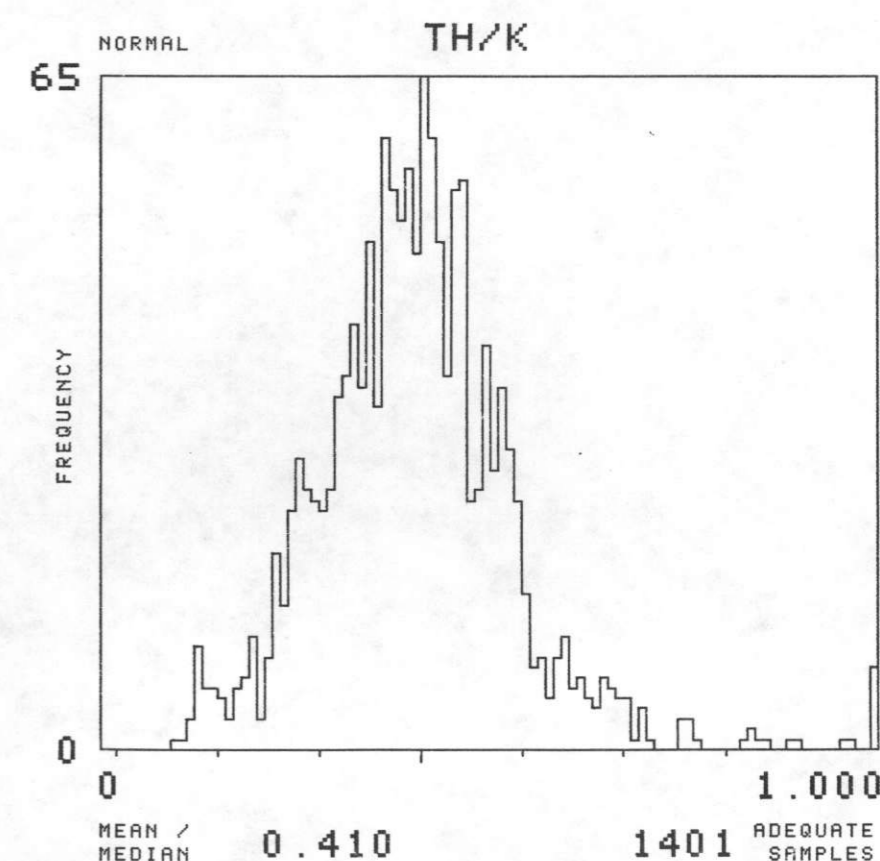
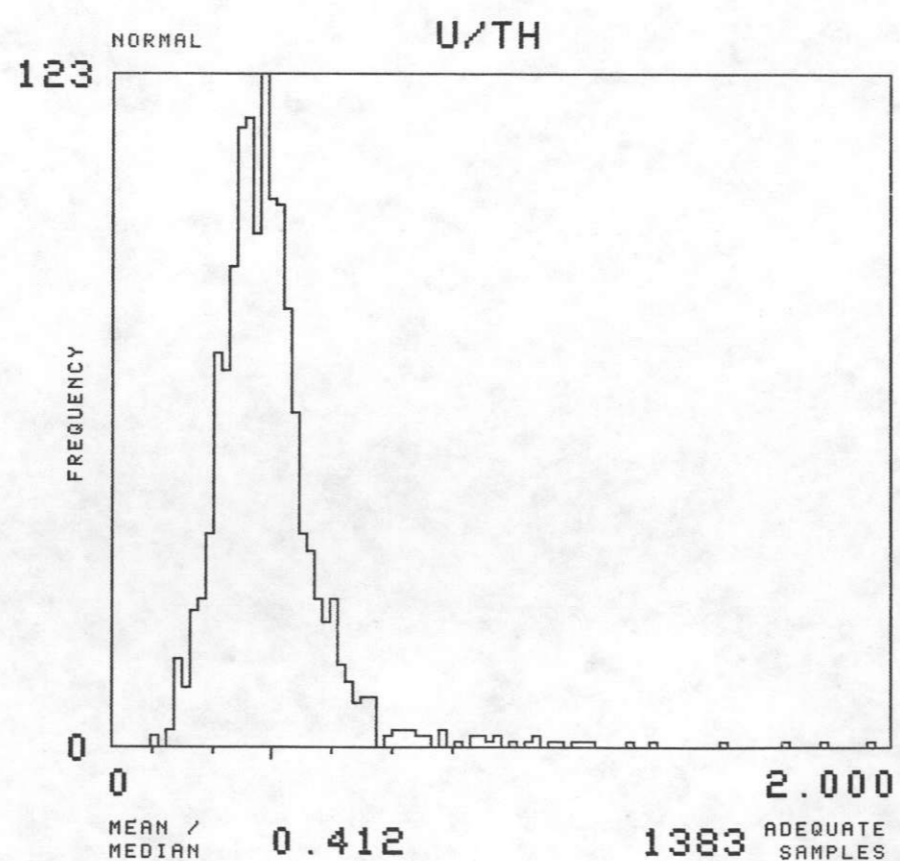
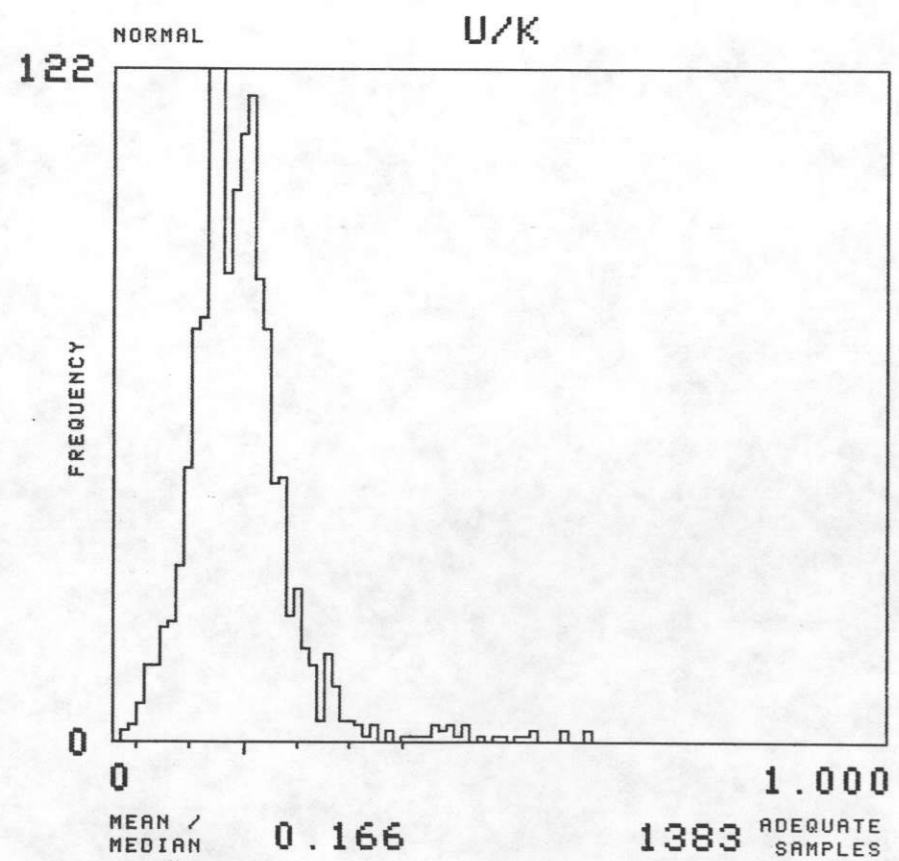
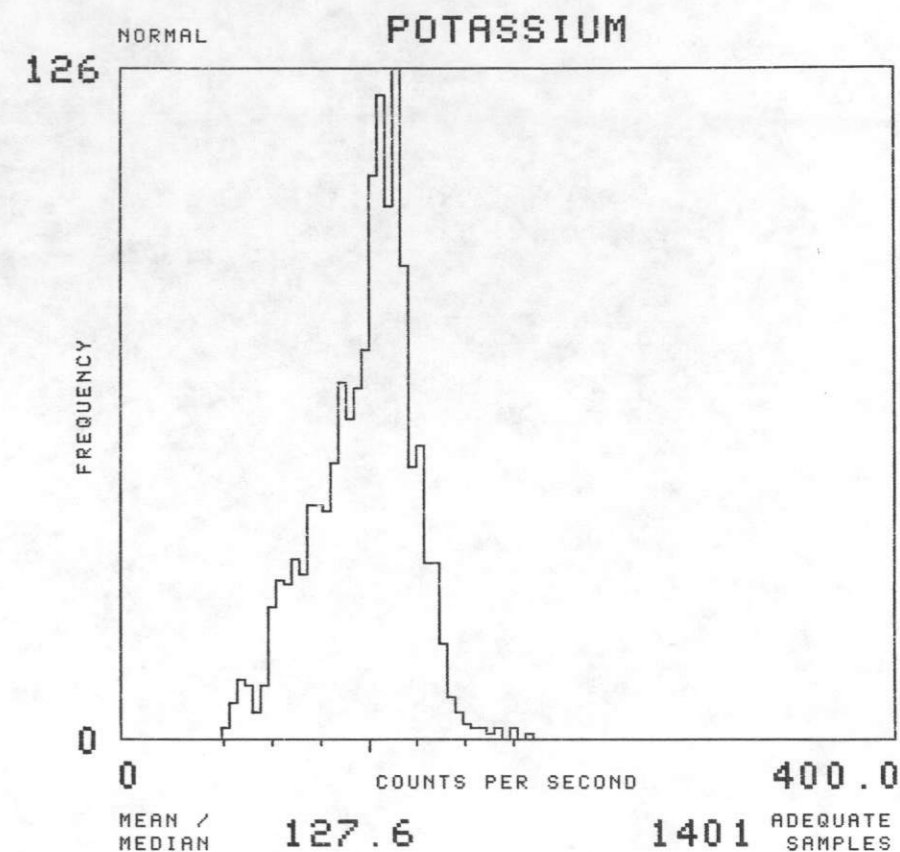
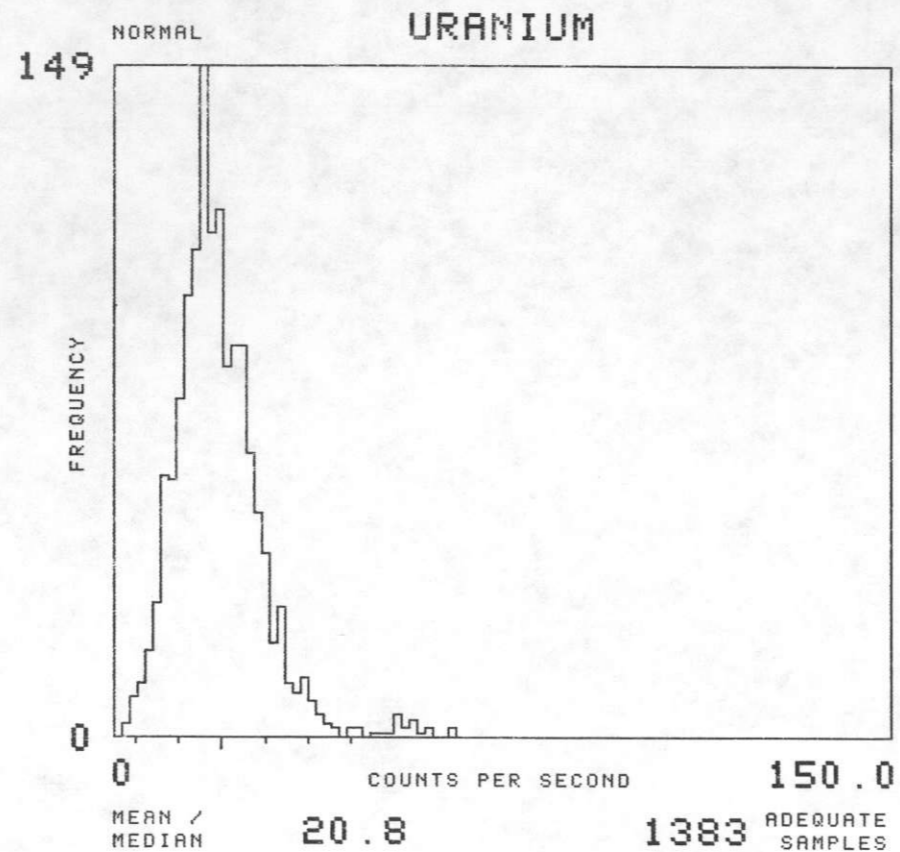
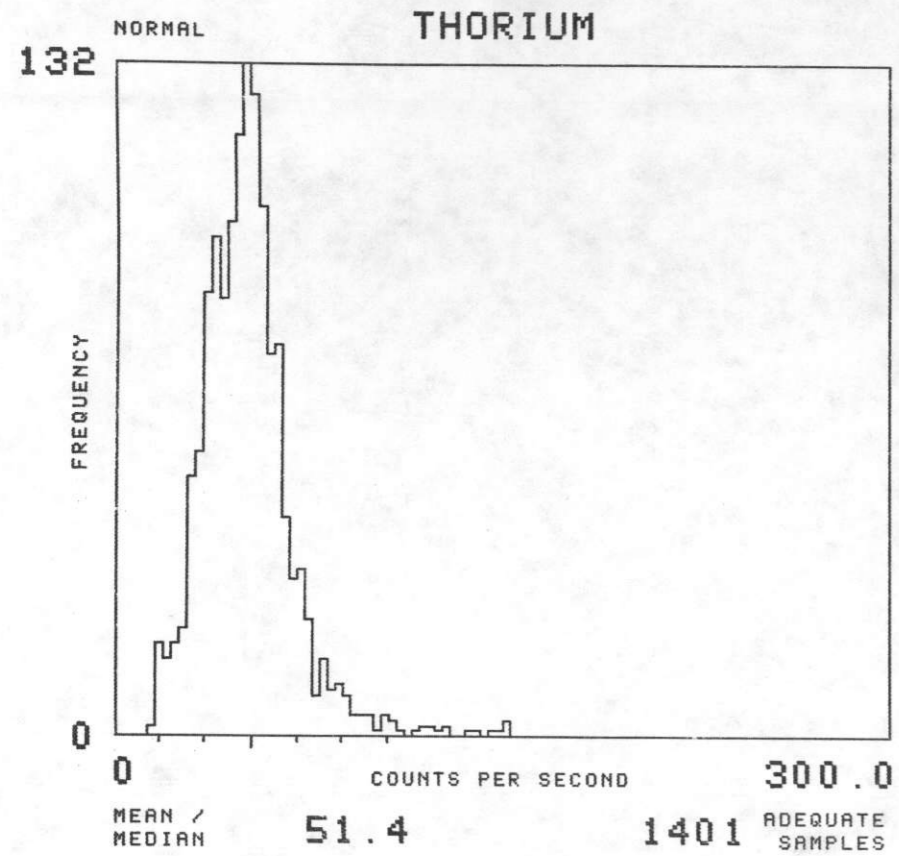


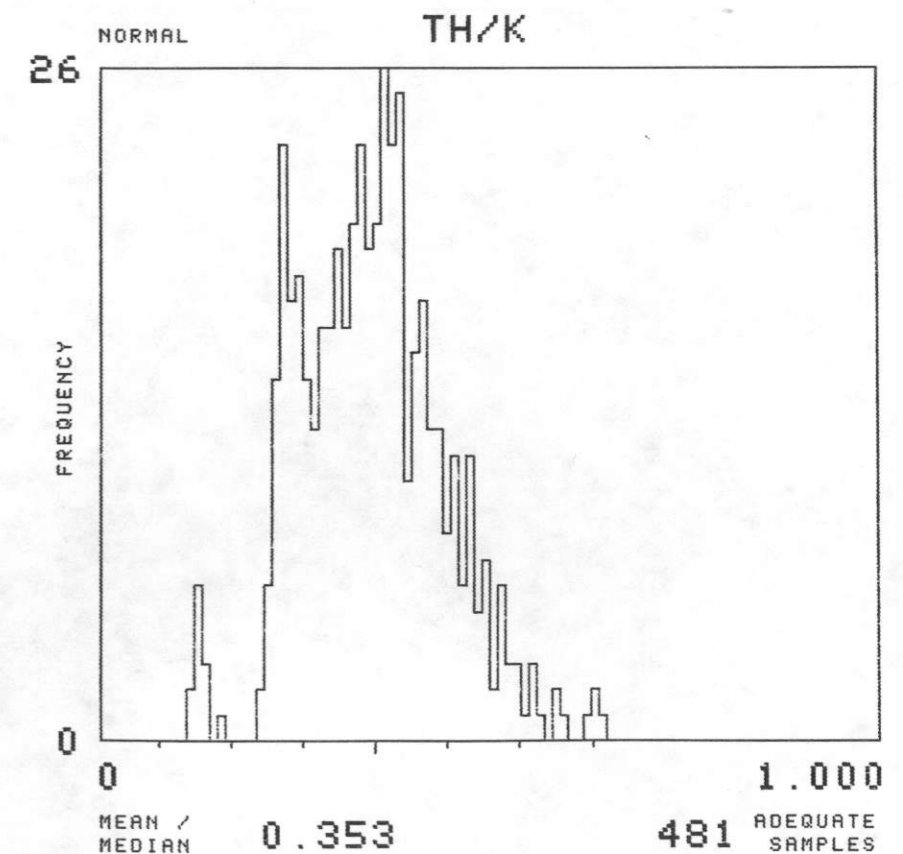
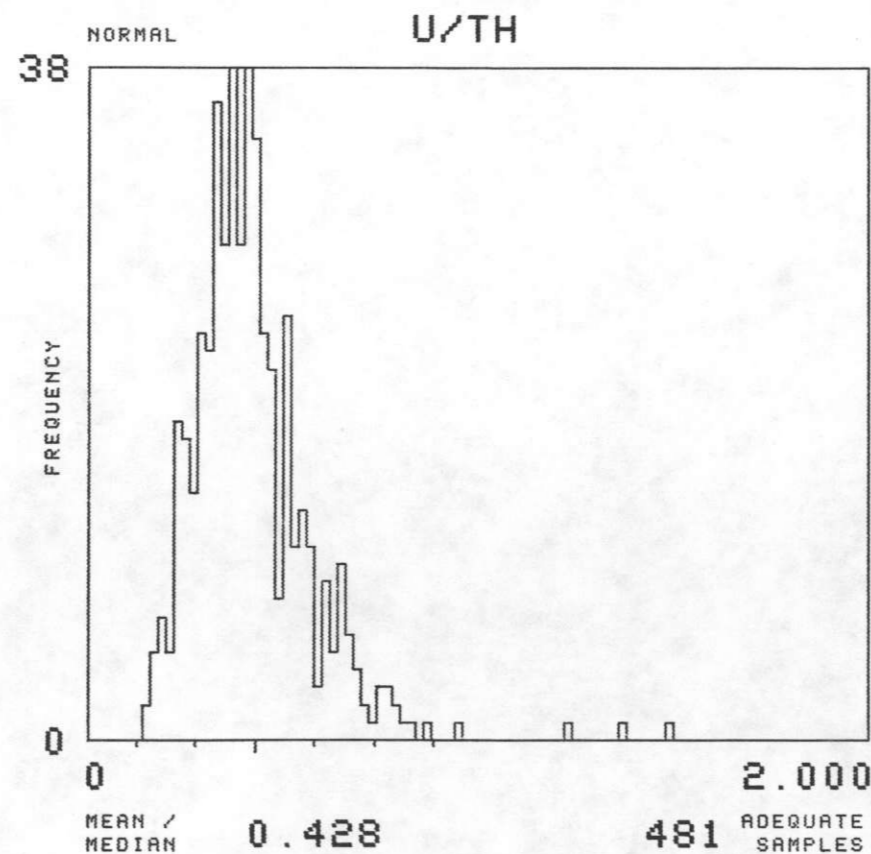
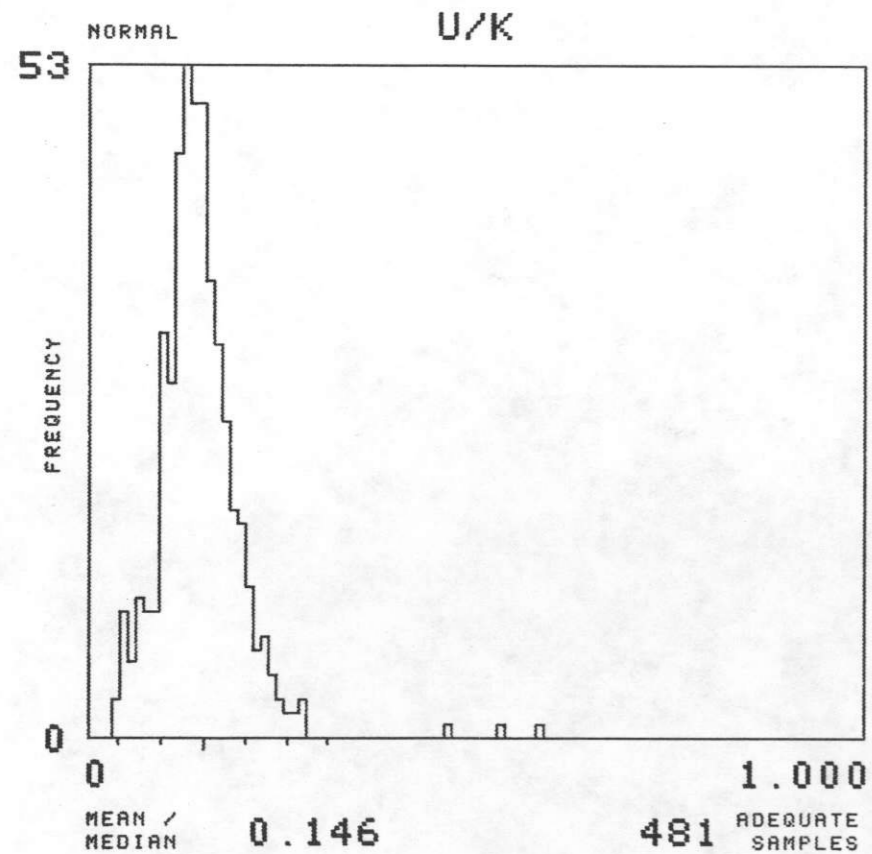
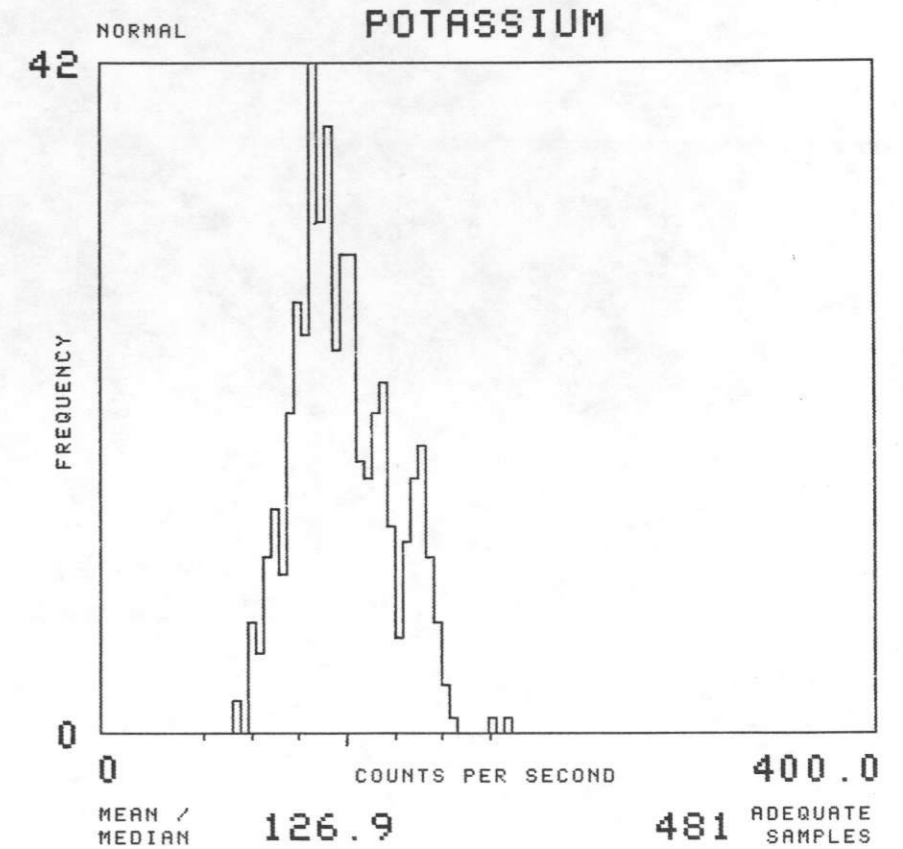
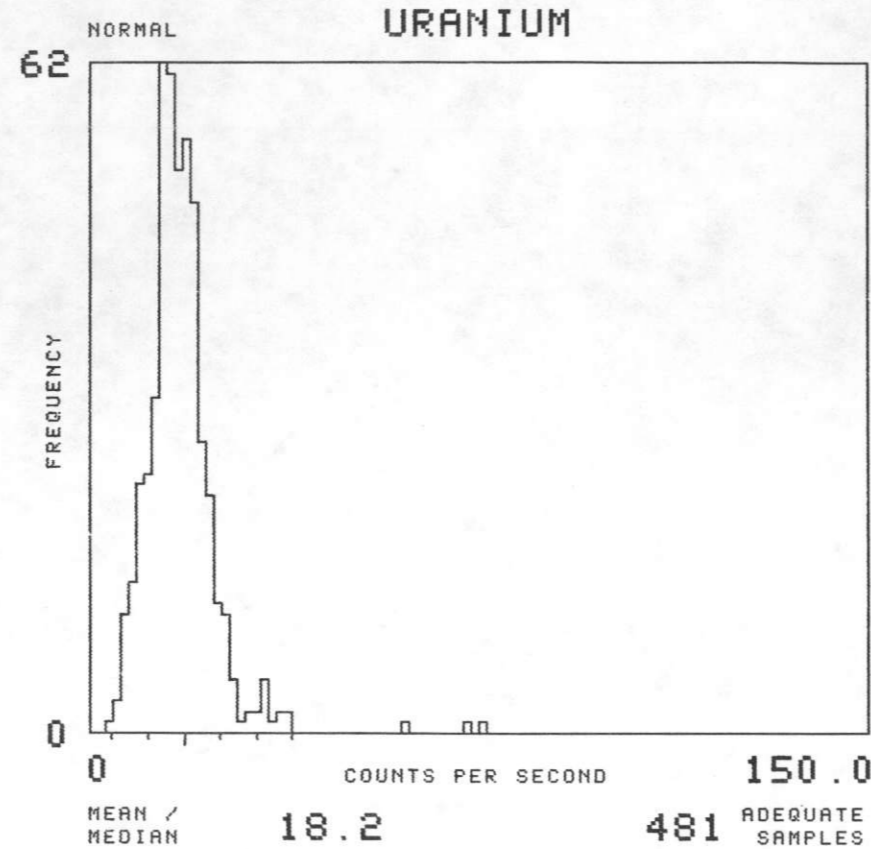
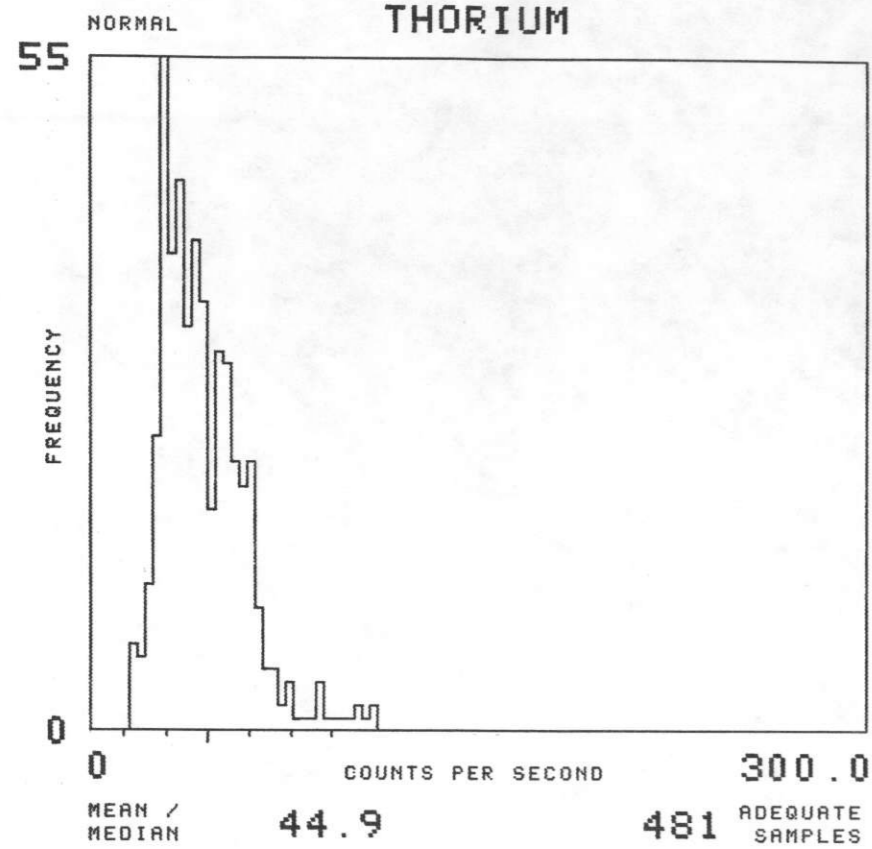


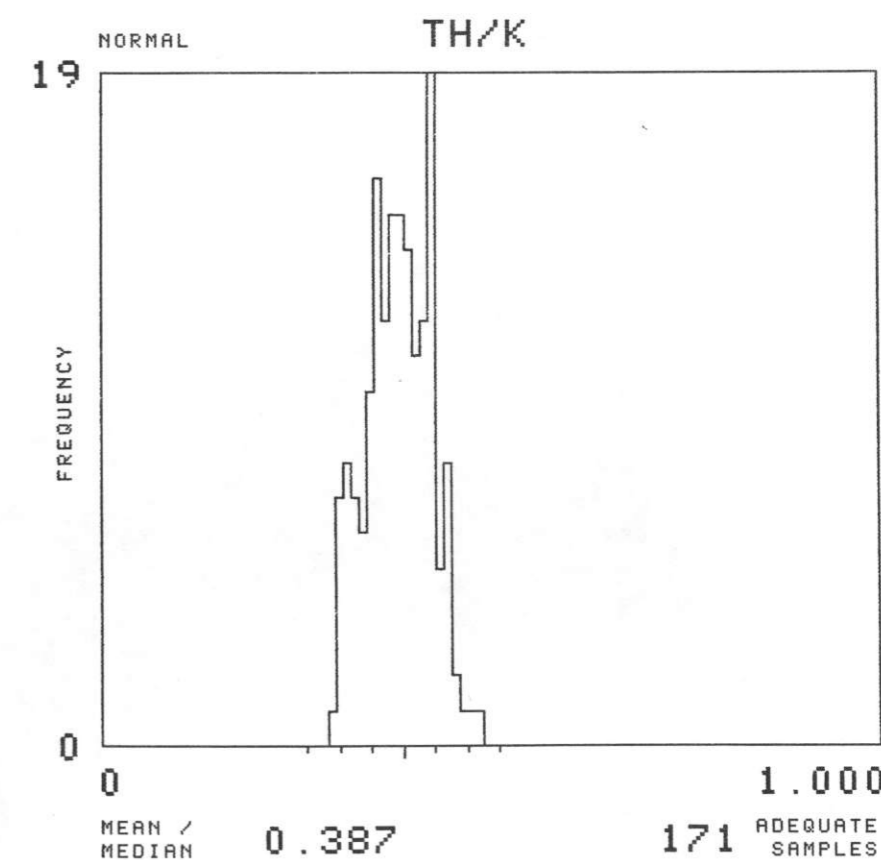
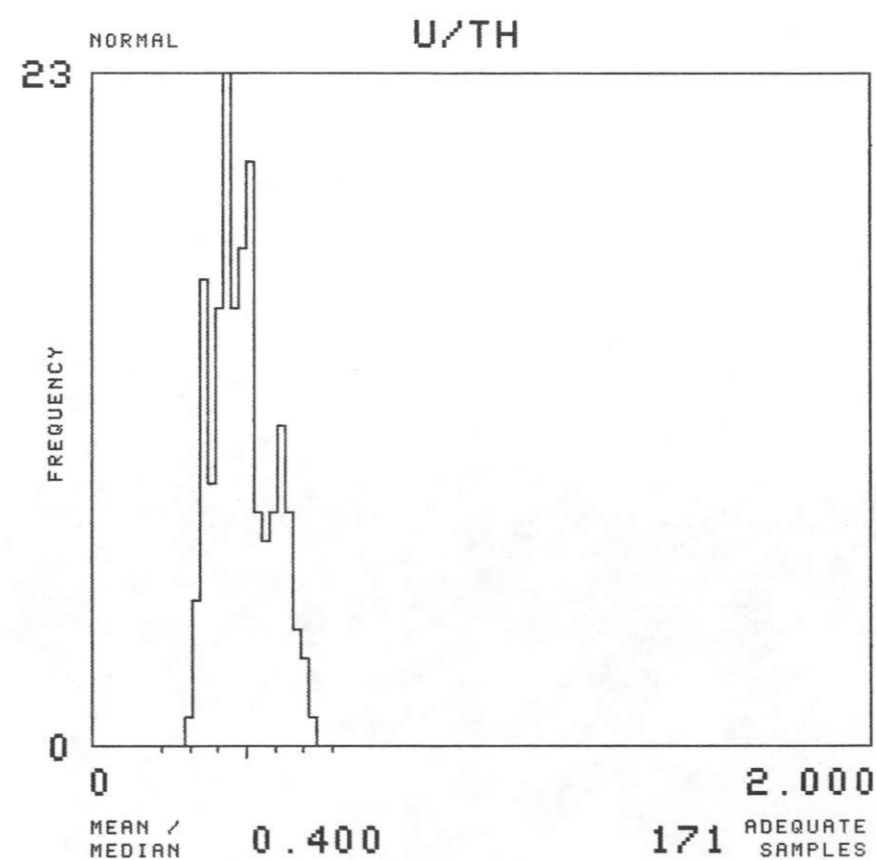
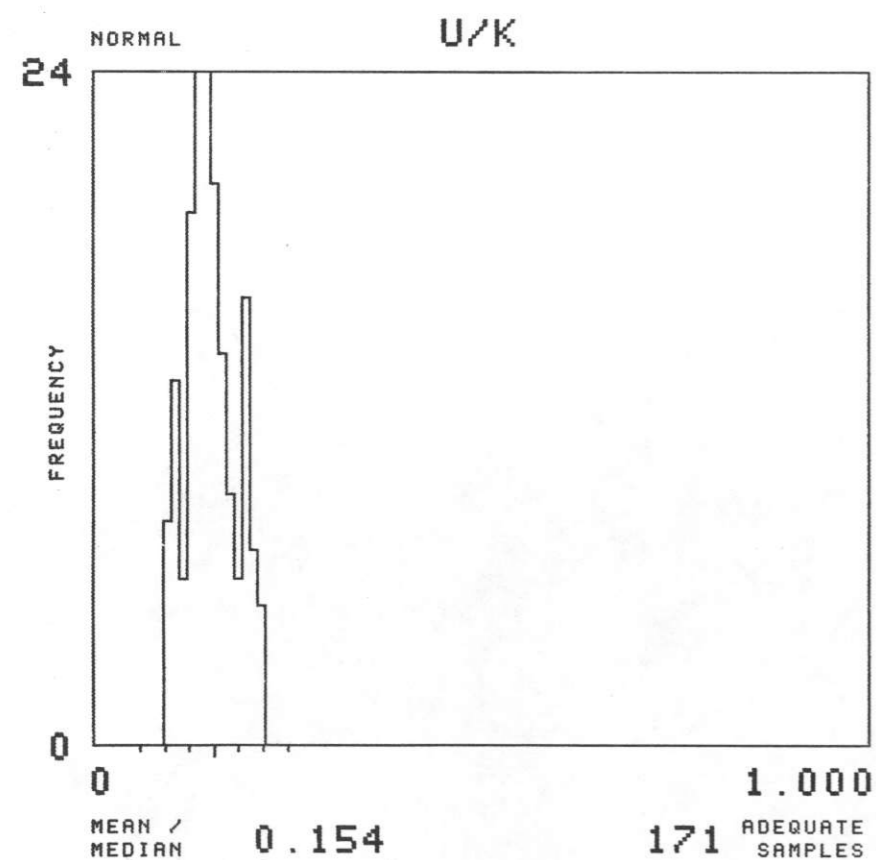
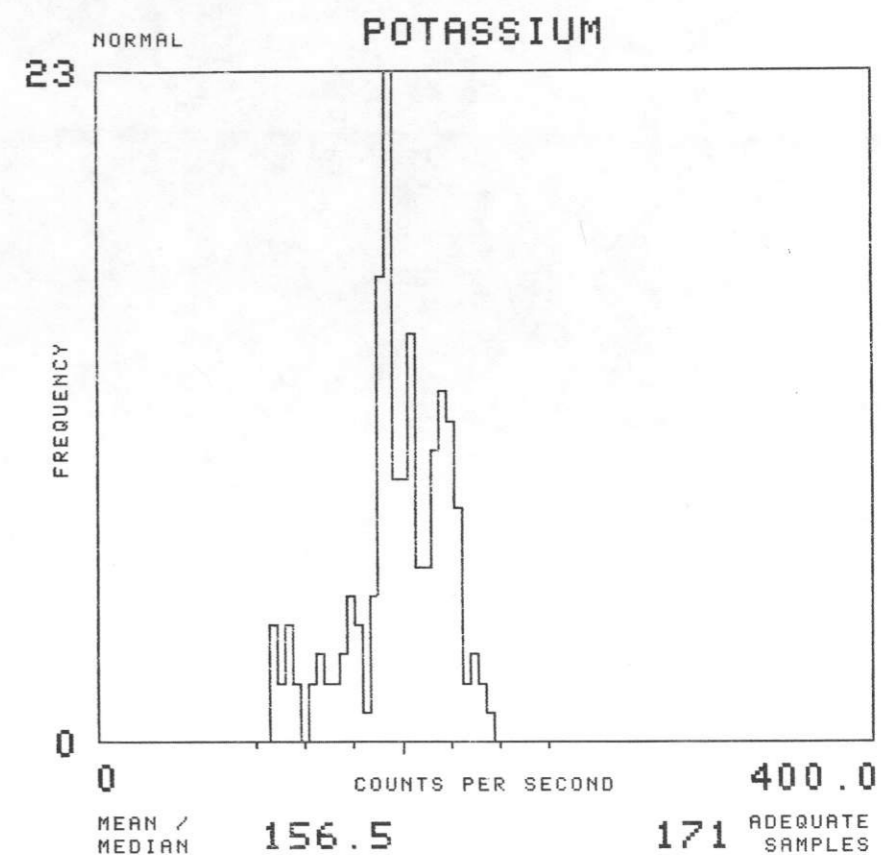
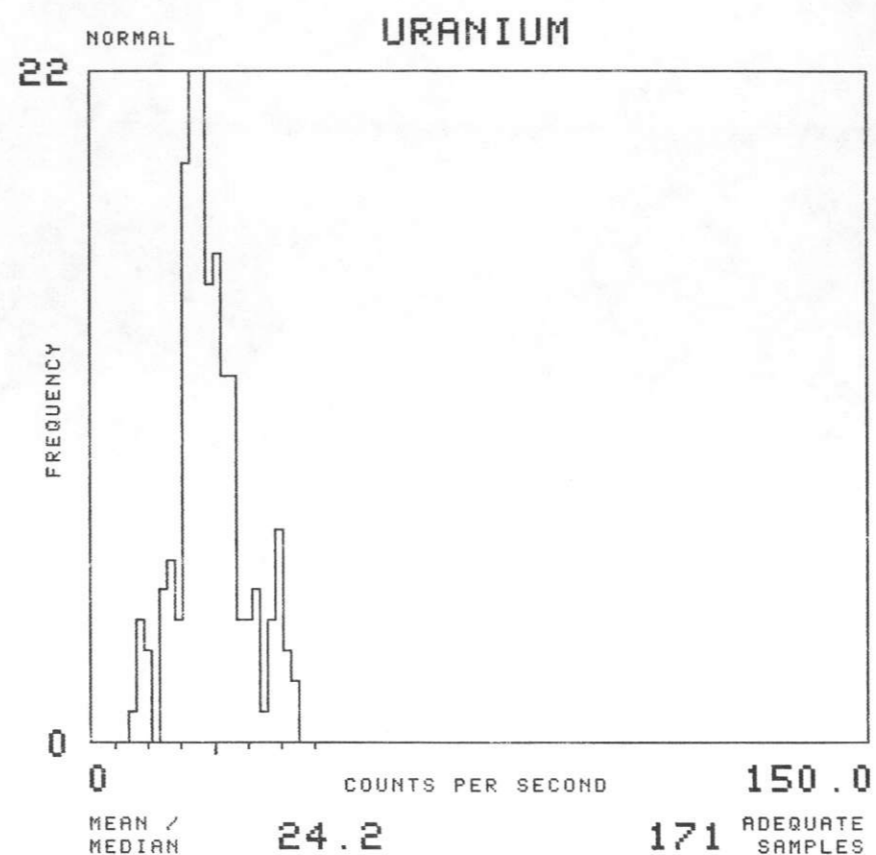
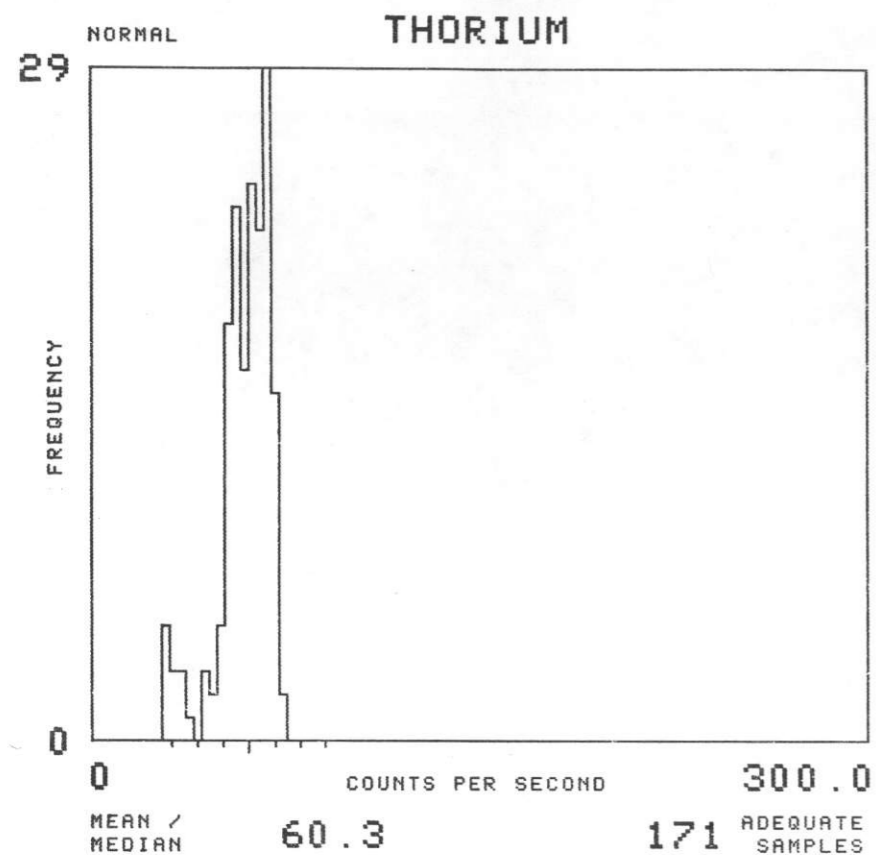
NTMS NI 12-3 GALLUP

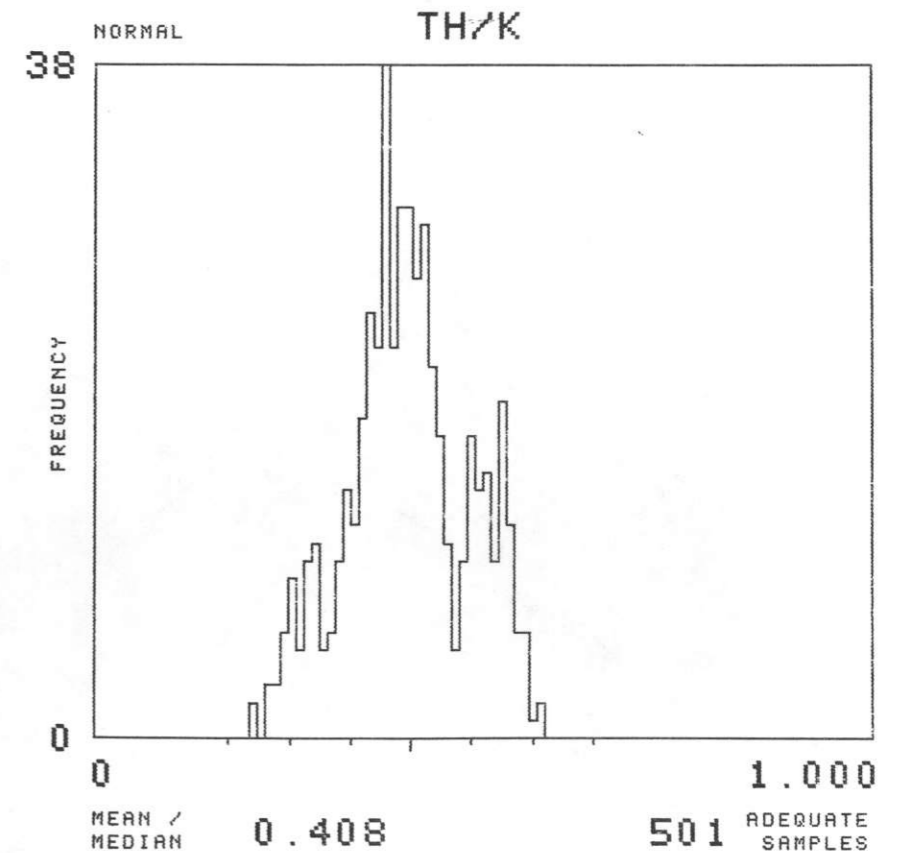
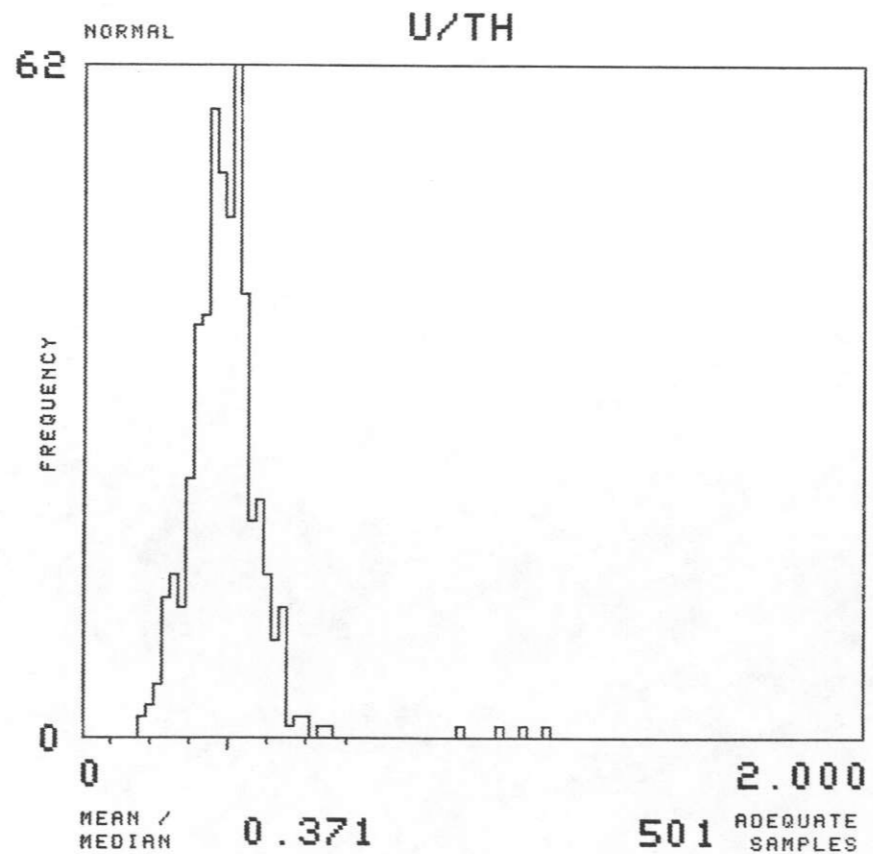
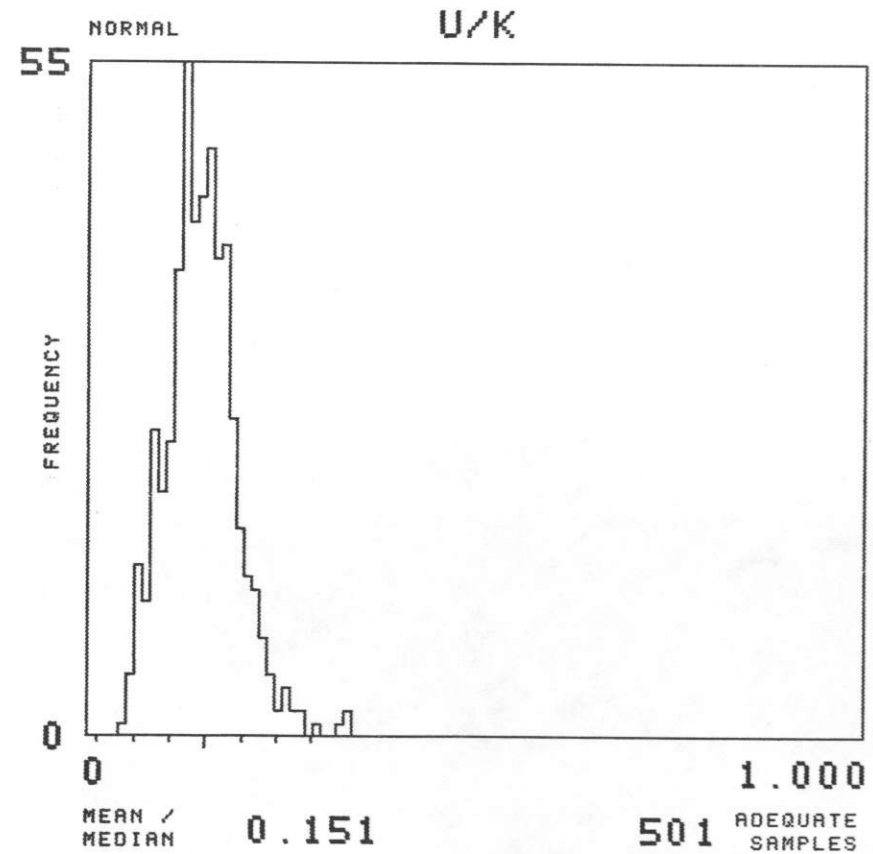
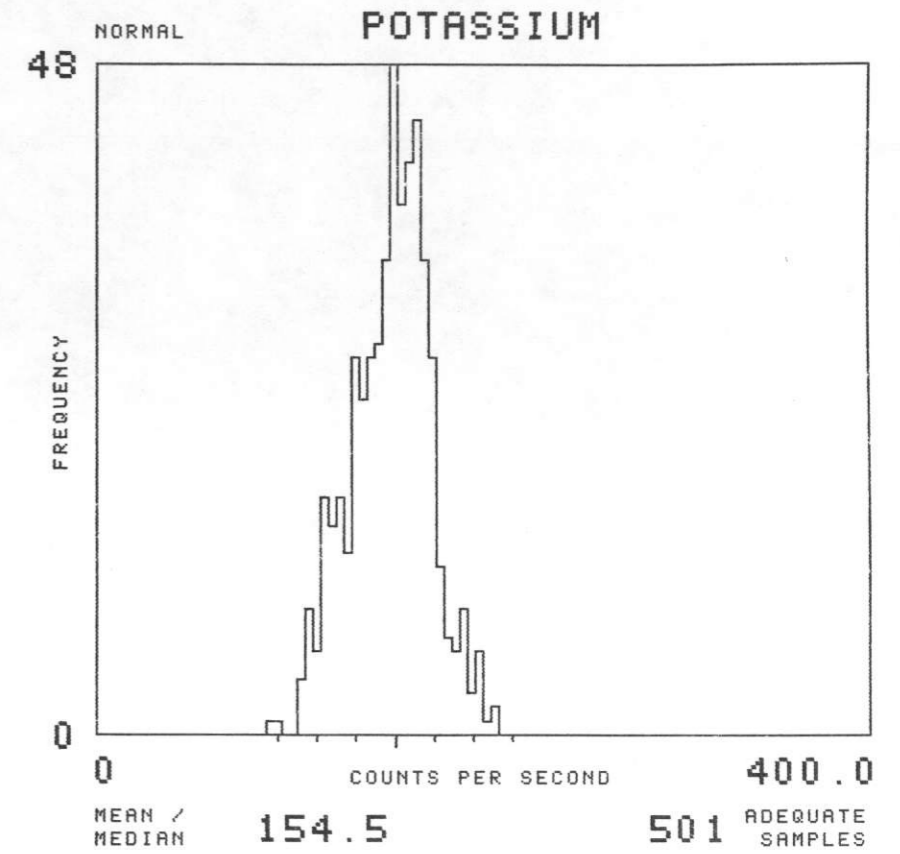
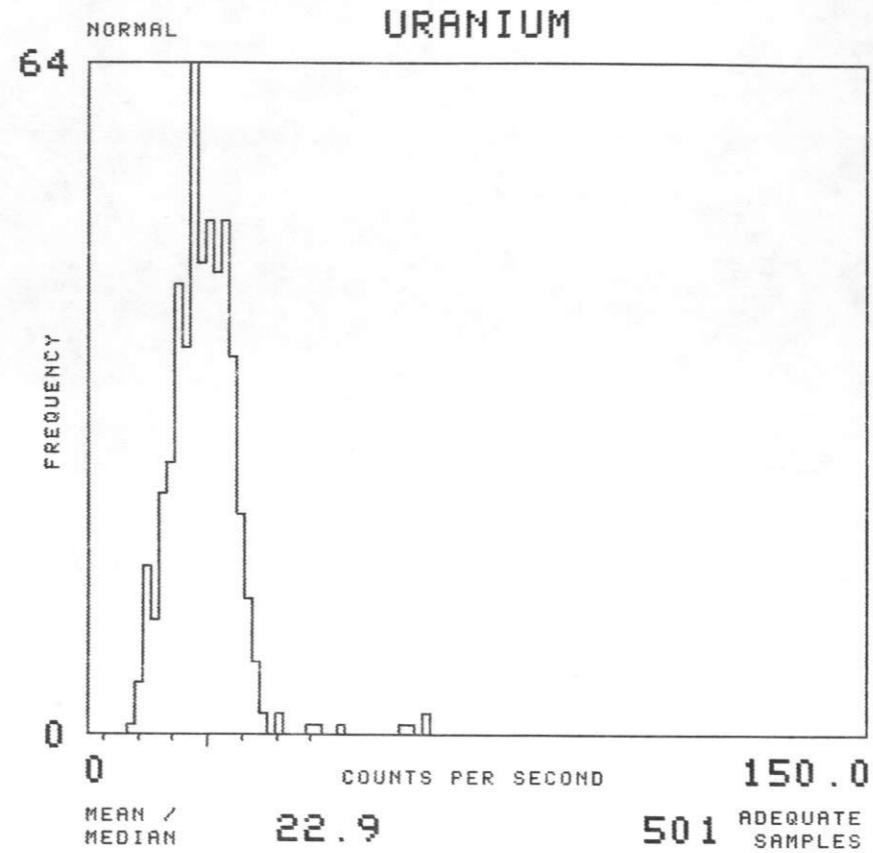
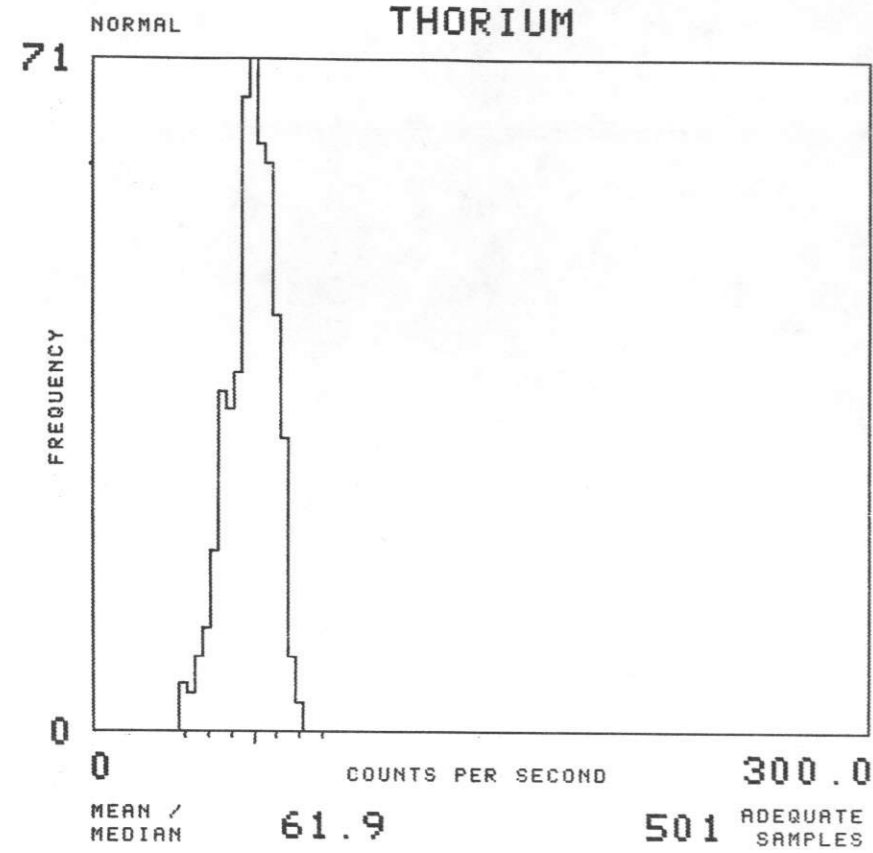
MAP UNIT : KD

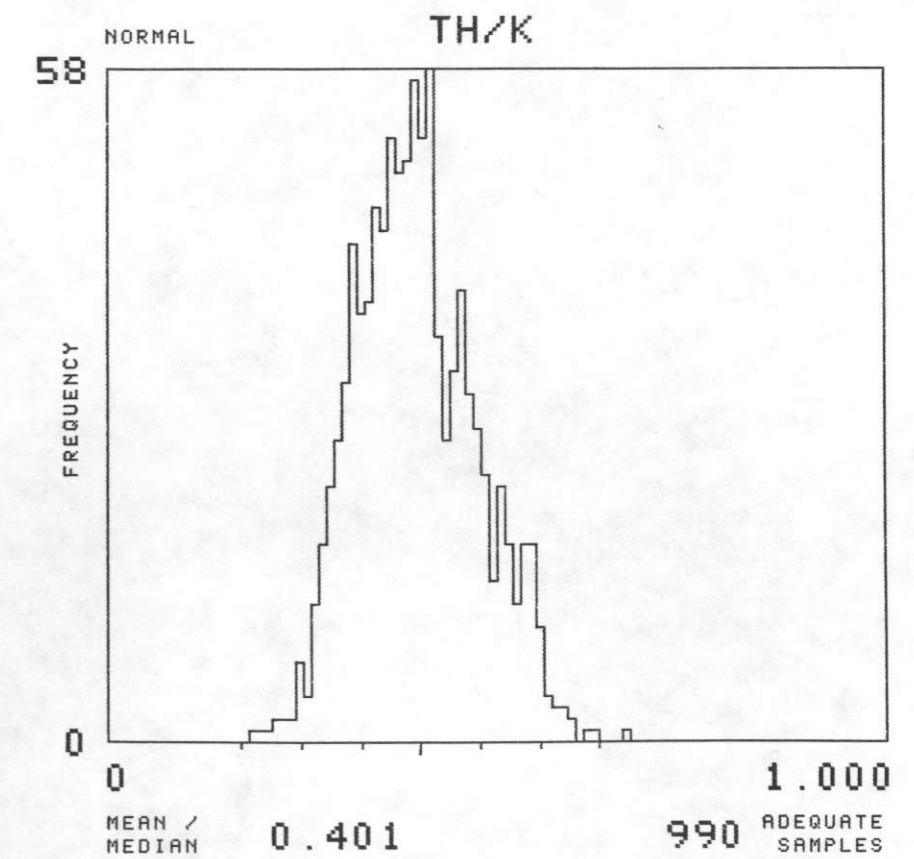
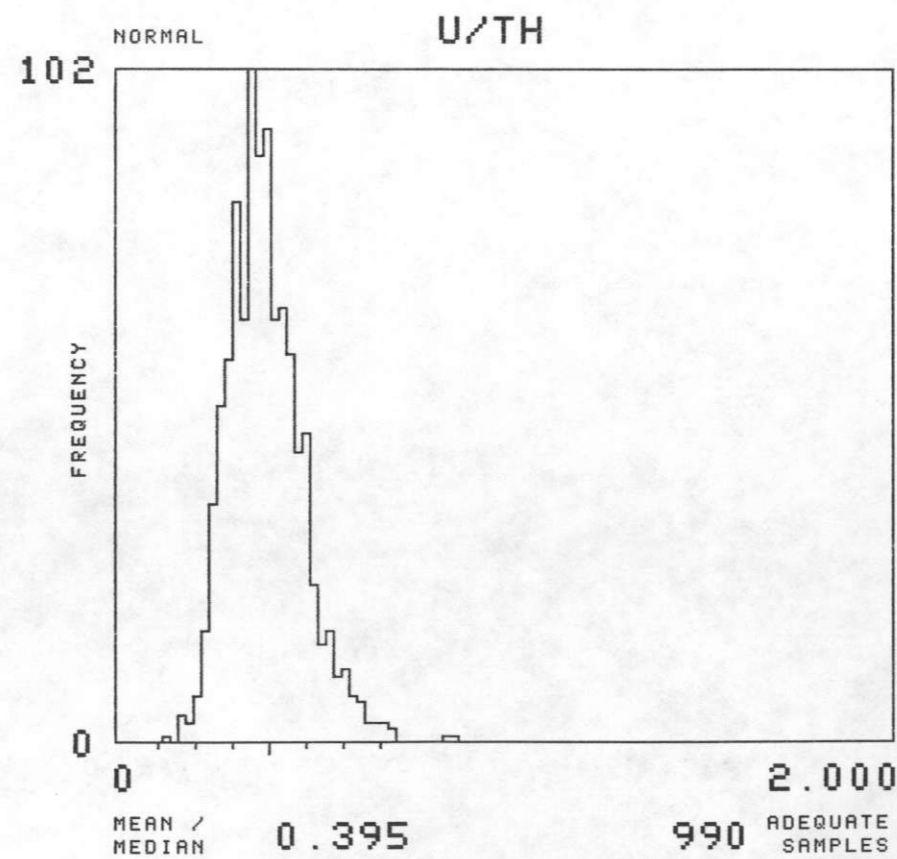
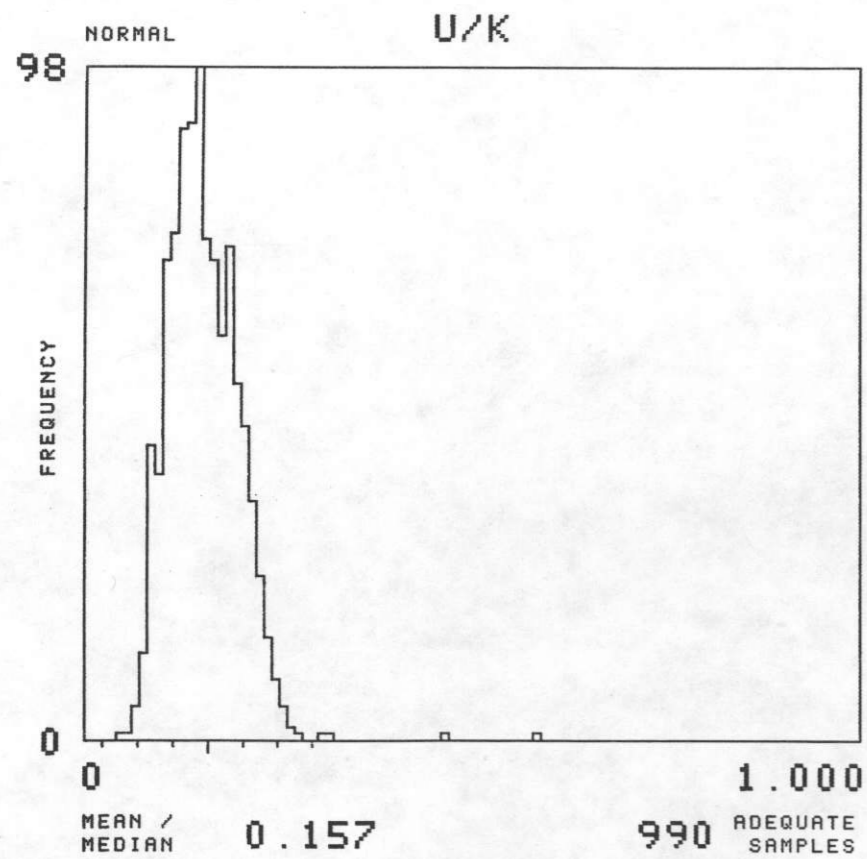
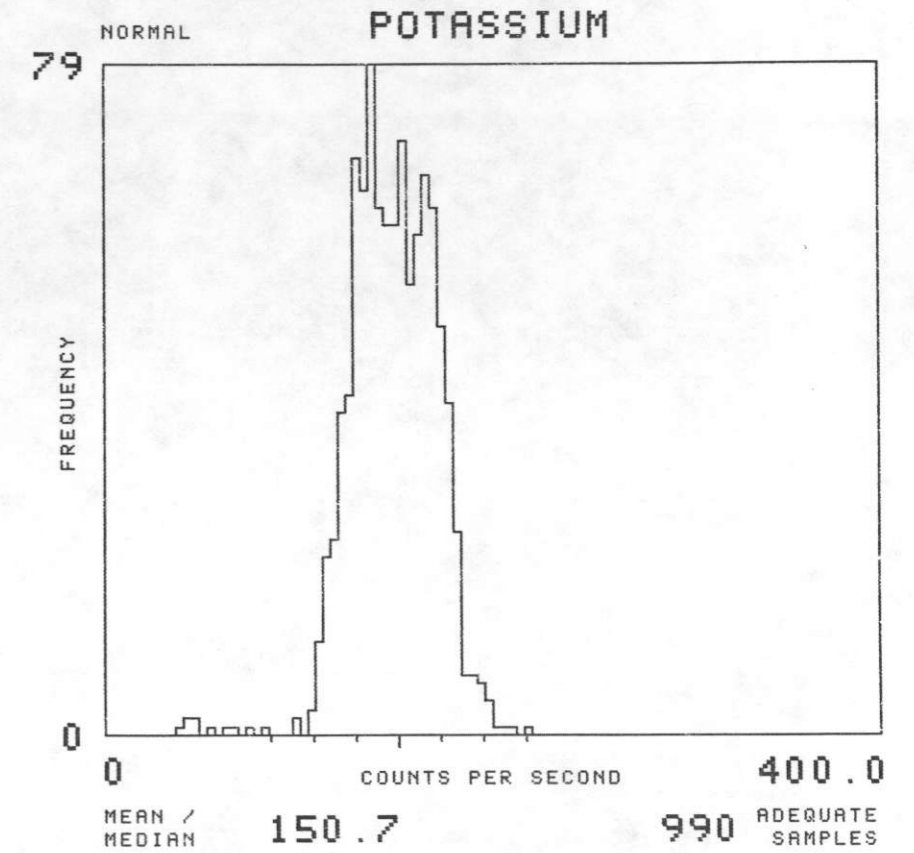
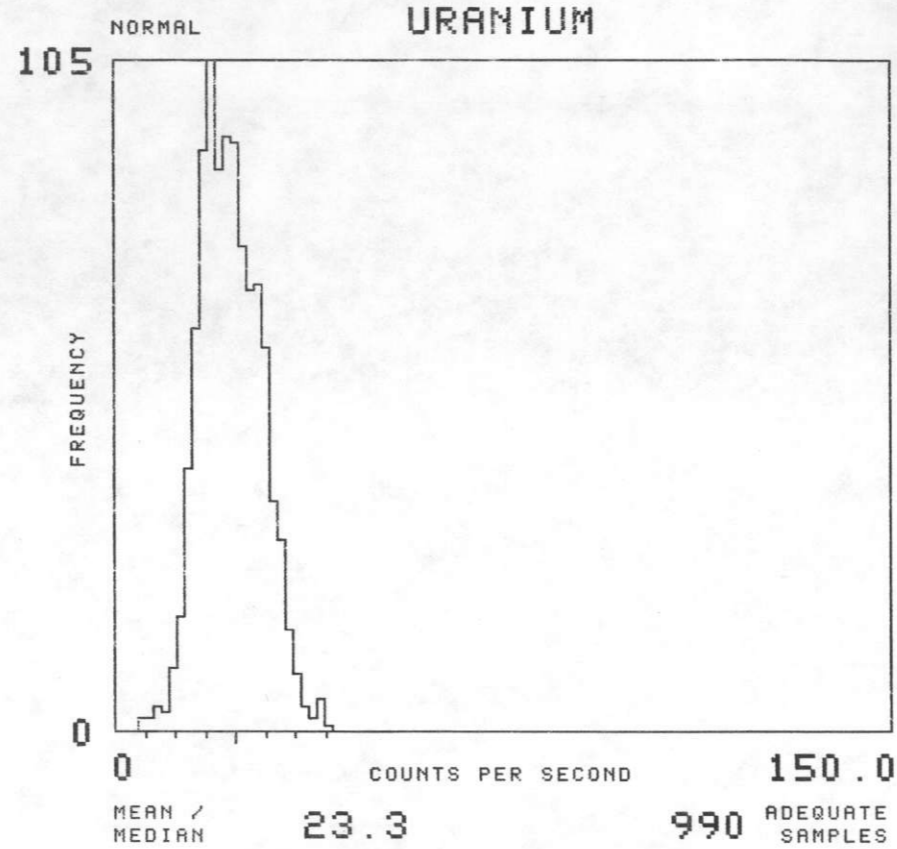
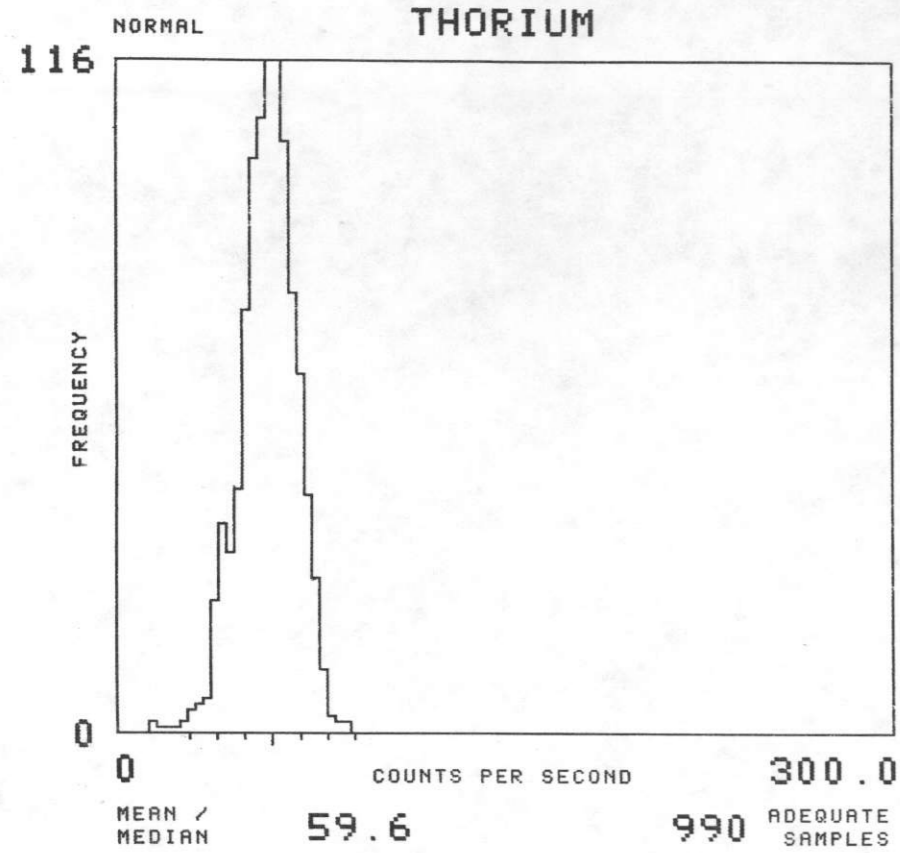
TOTAL NUMBER OF SAMPLES 1415







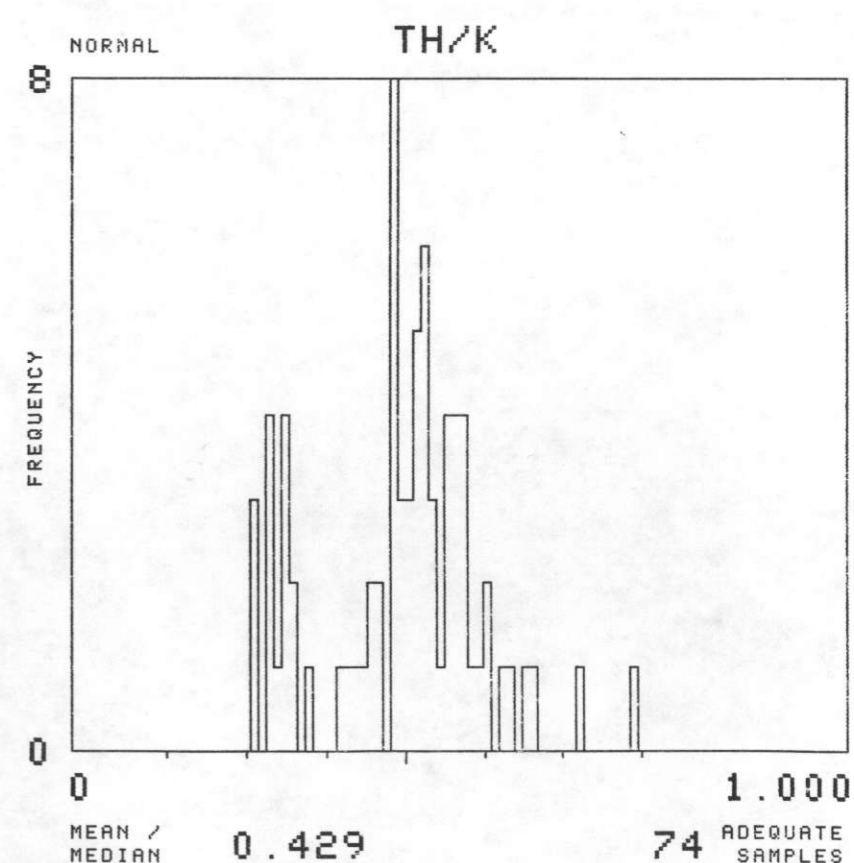
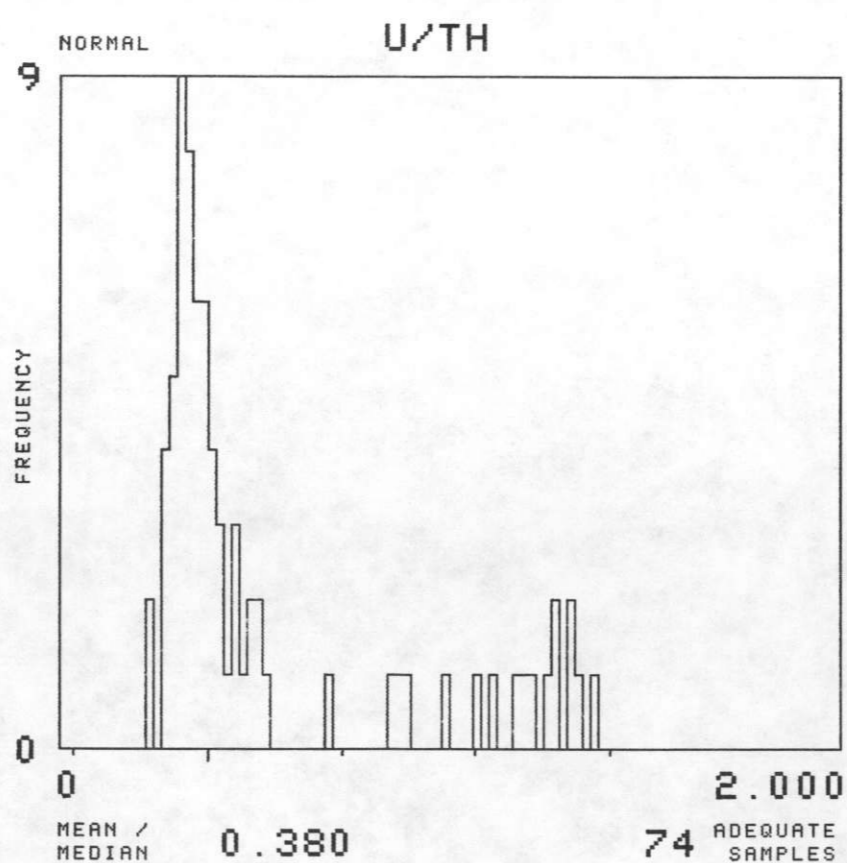
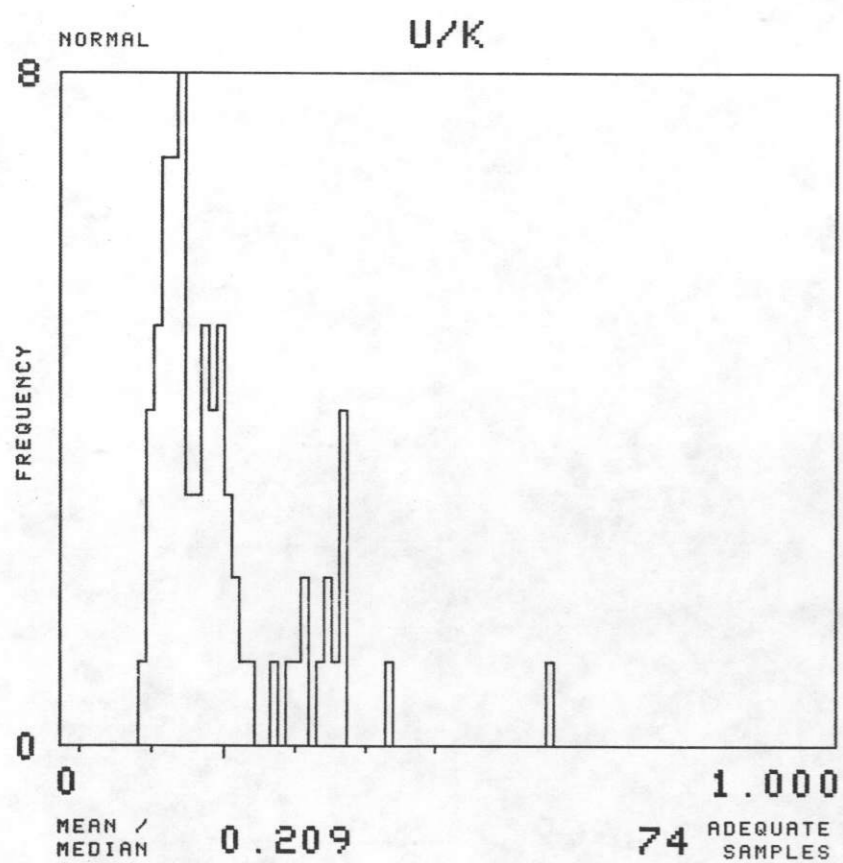
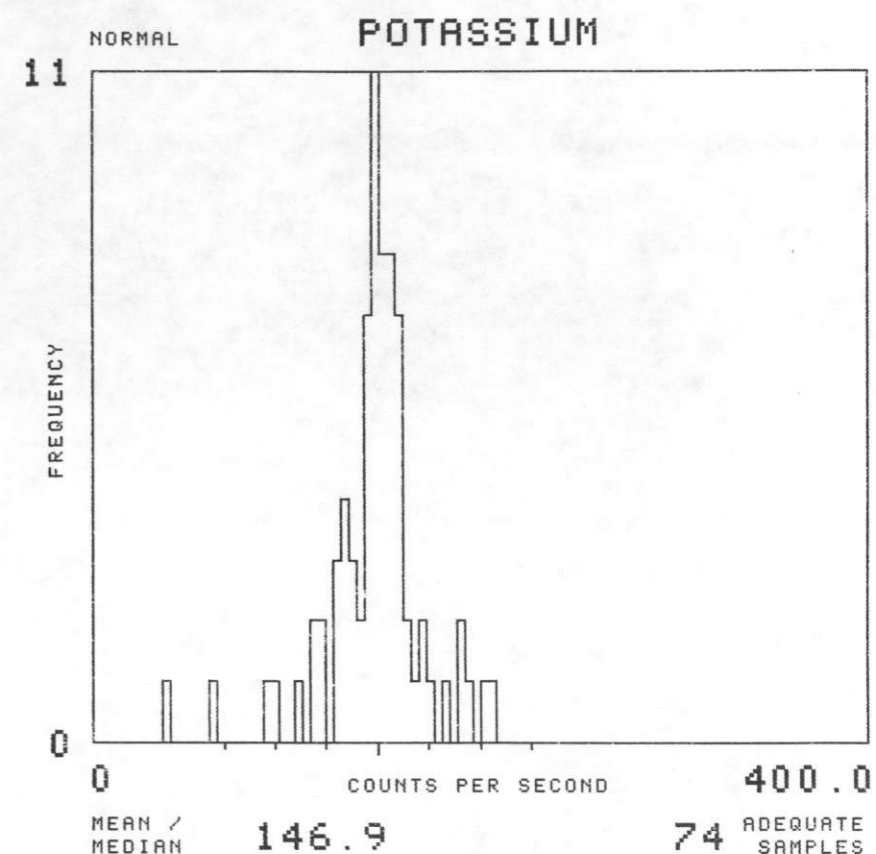
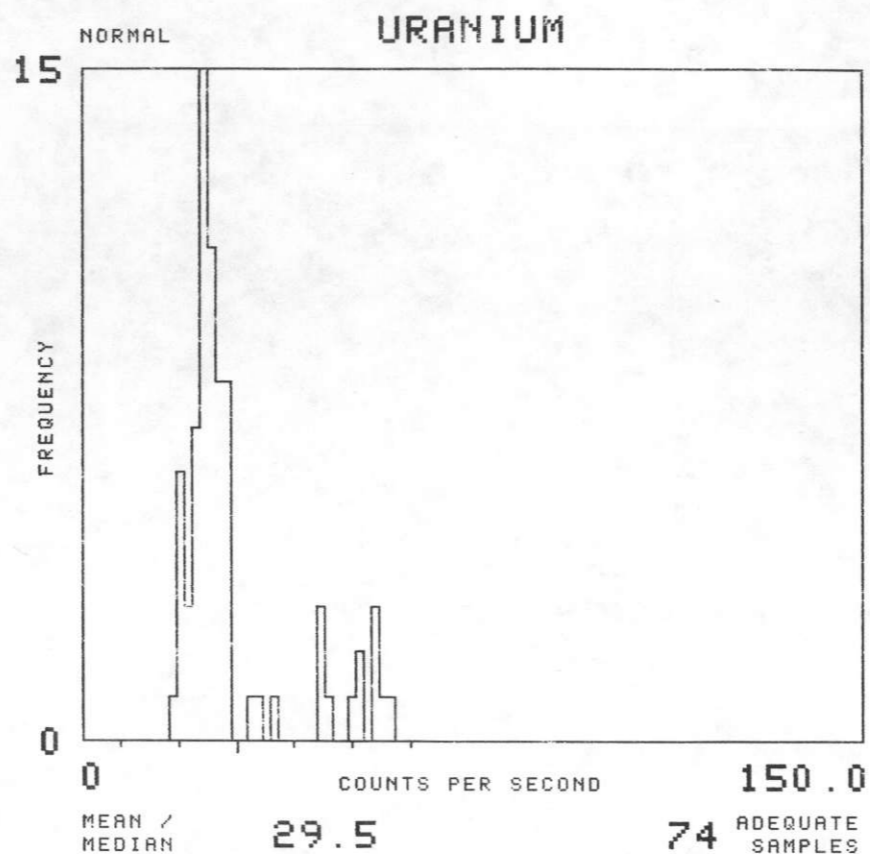
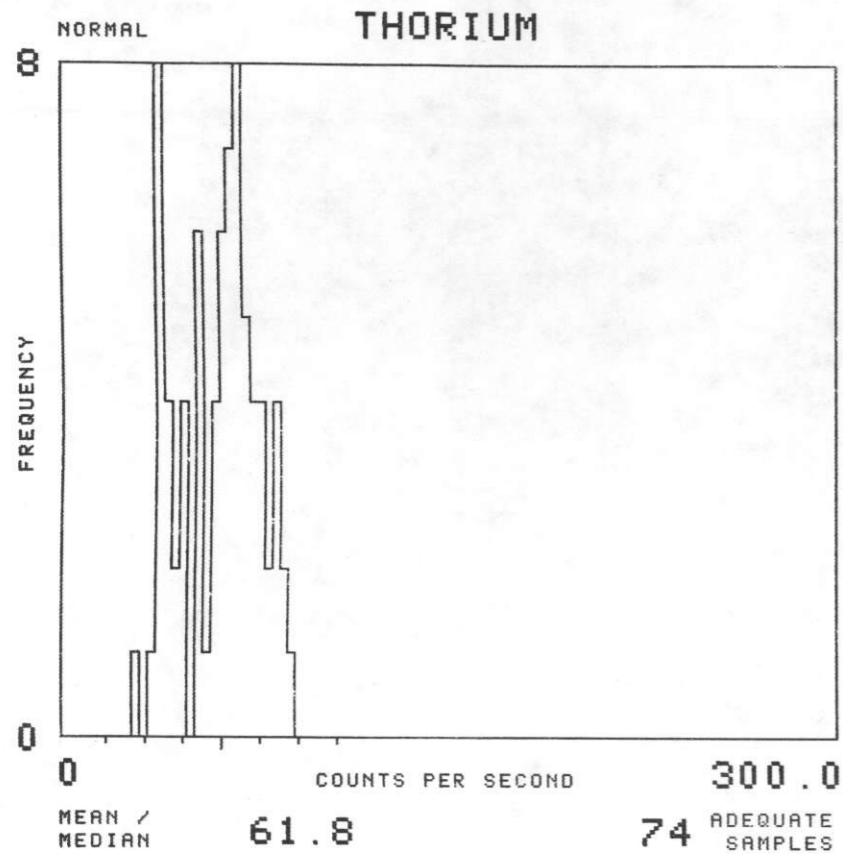




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MAP UNIT : KKF

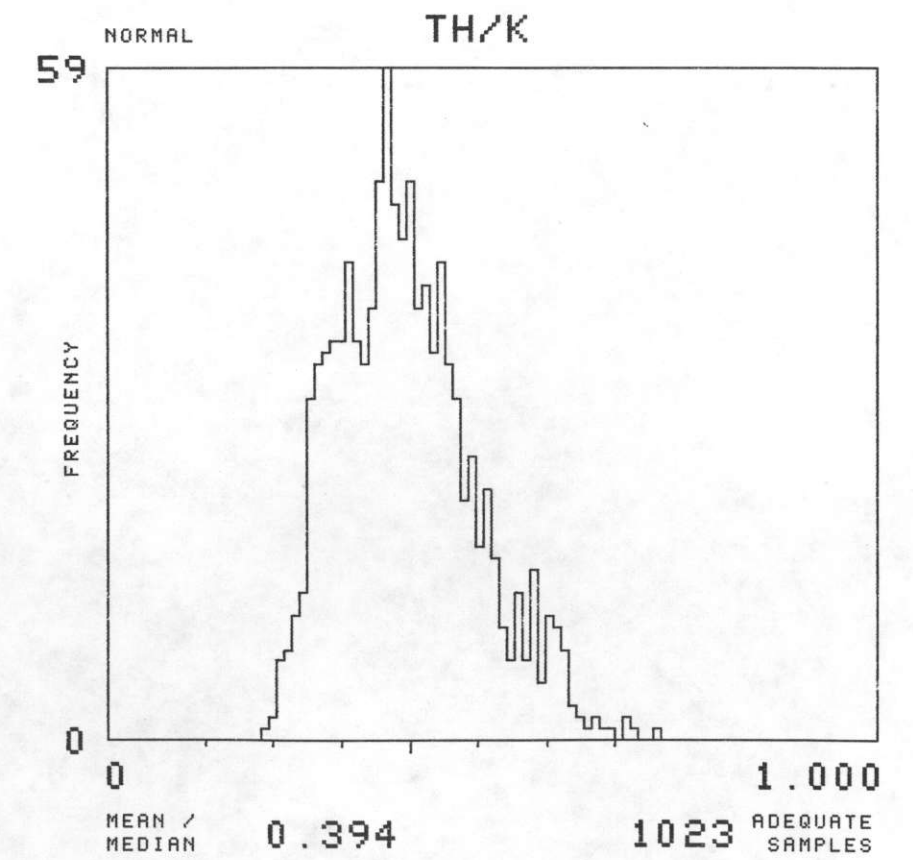
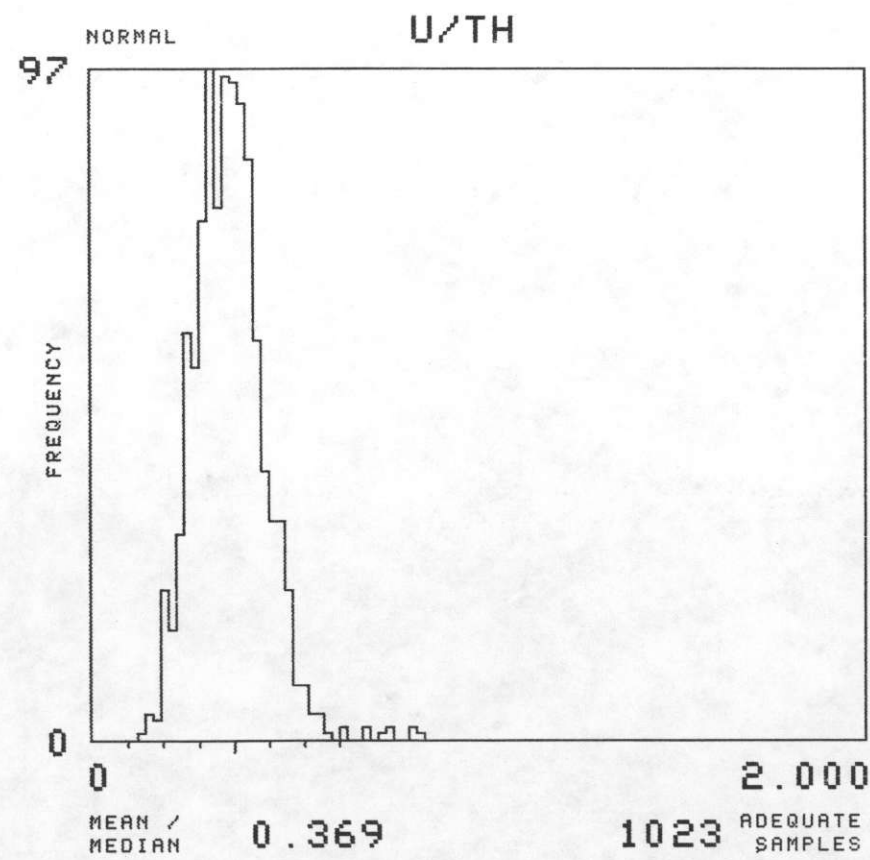
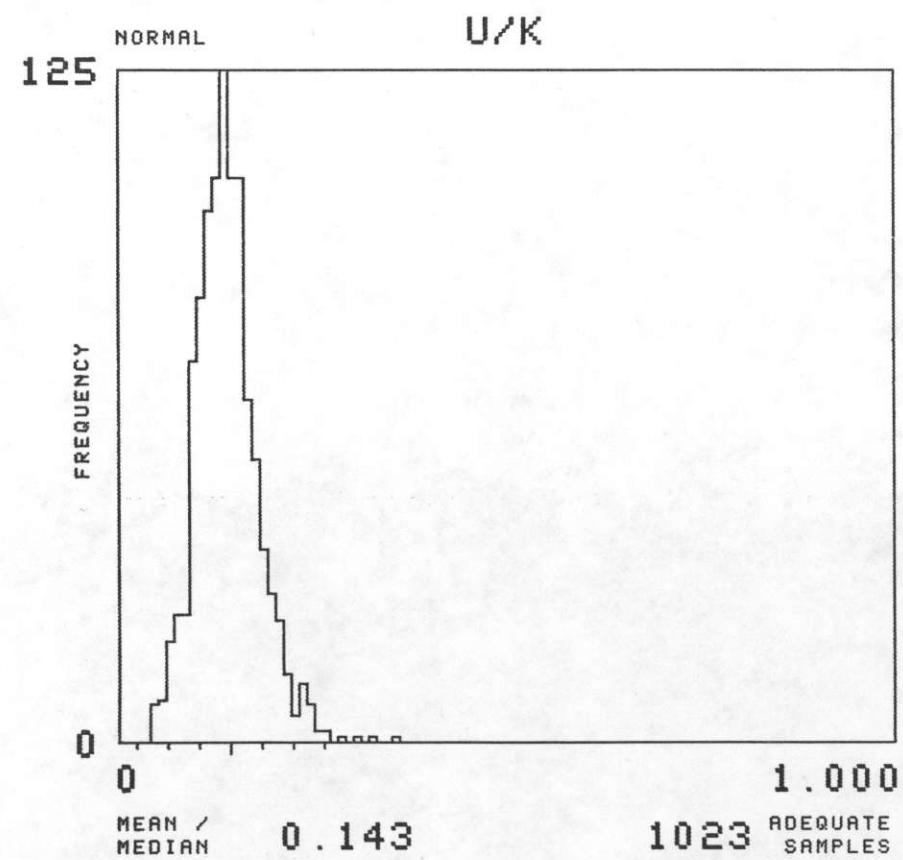
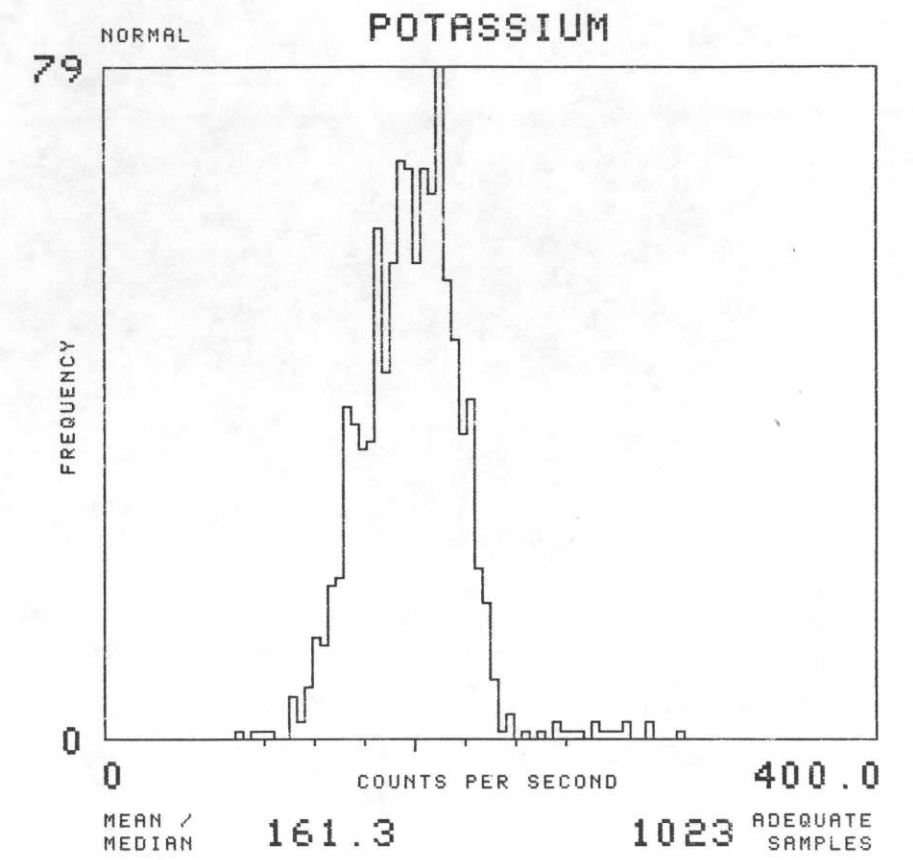
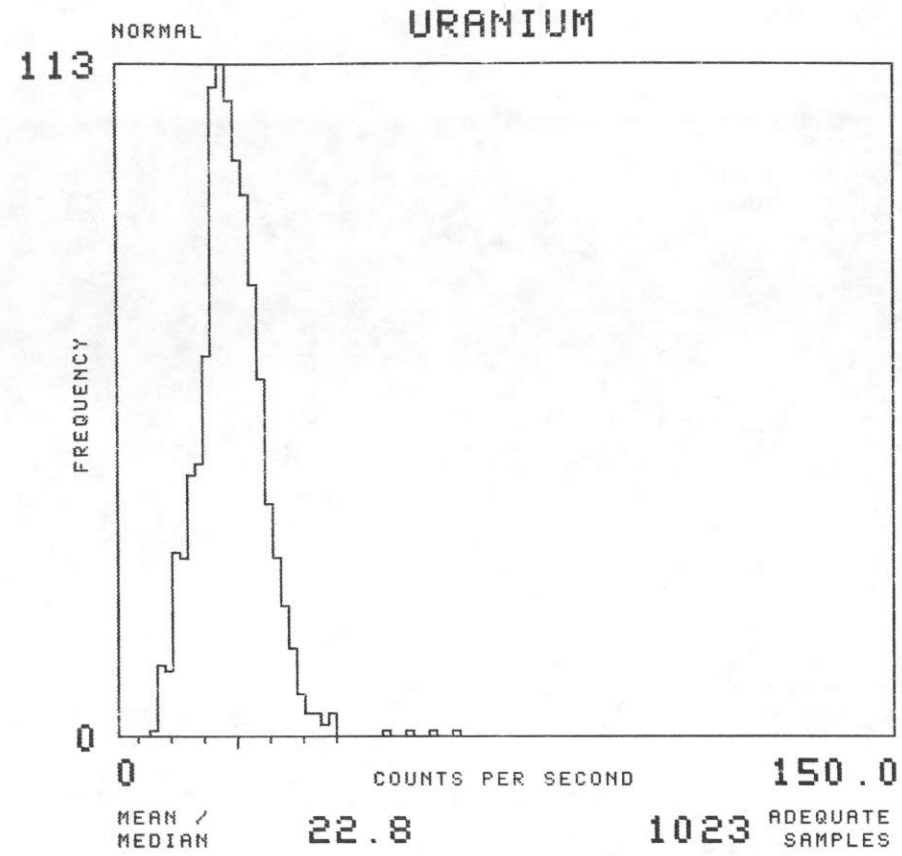
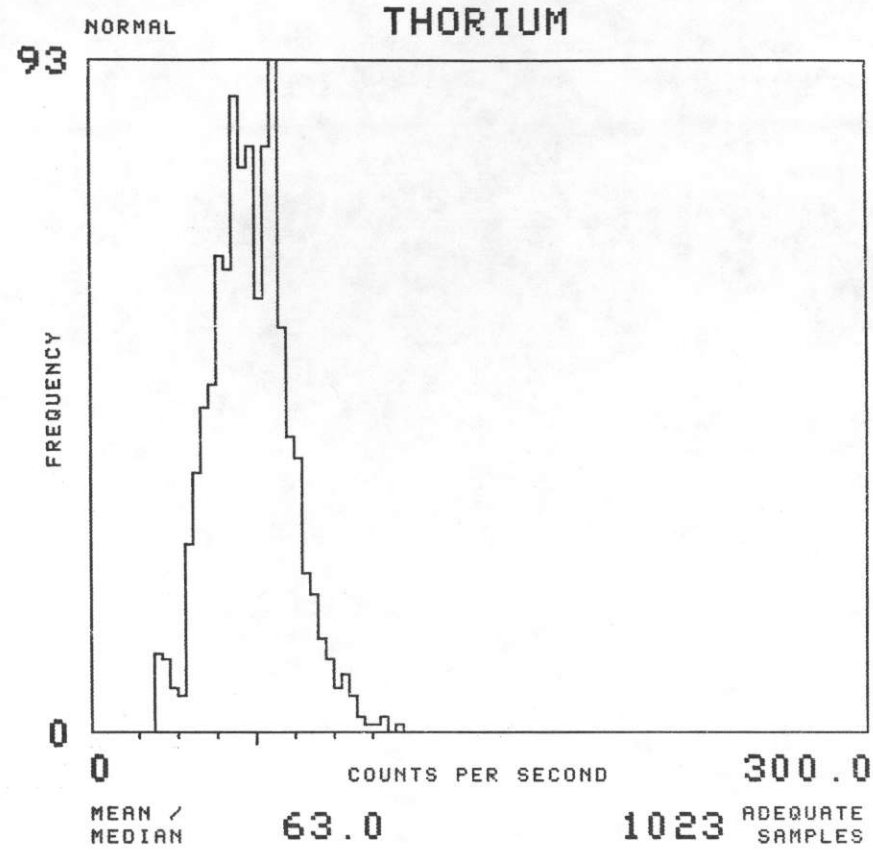
TOTAL NUMBER OF SAMPLES 74

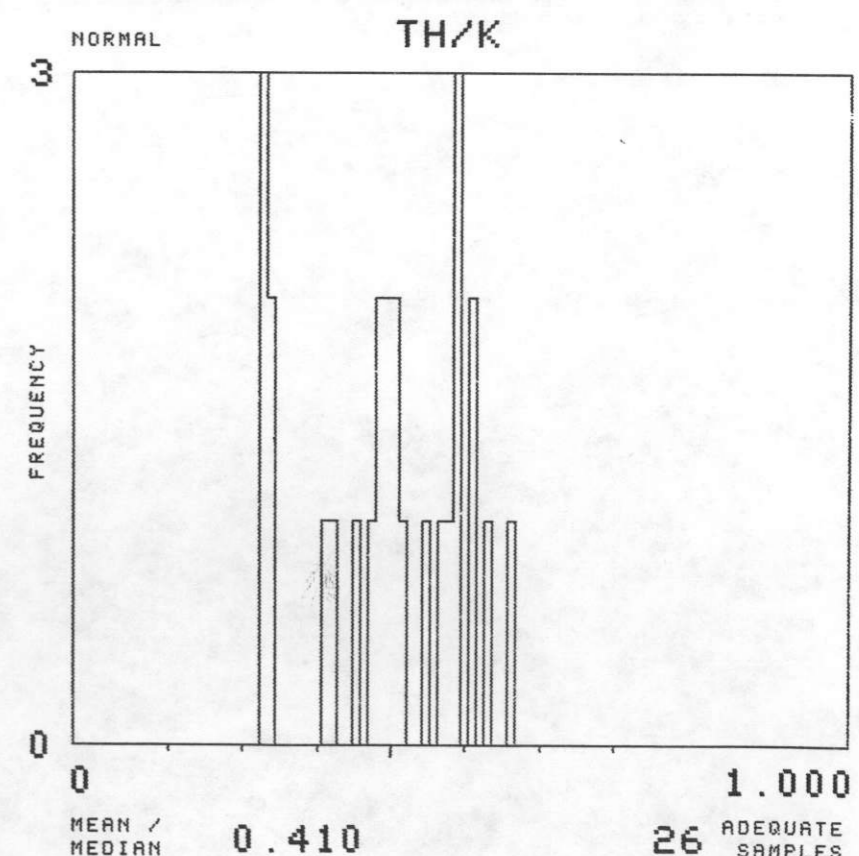
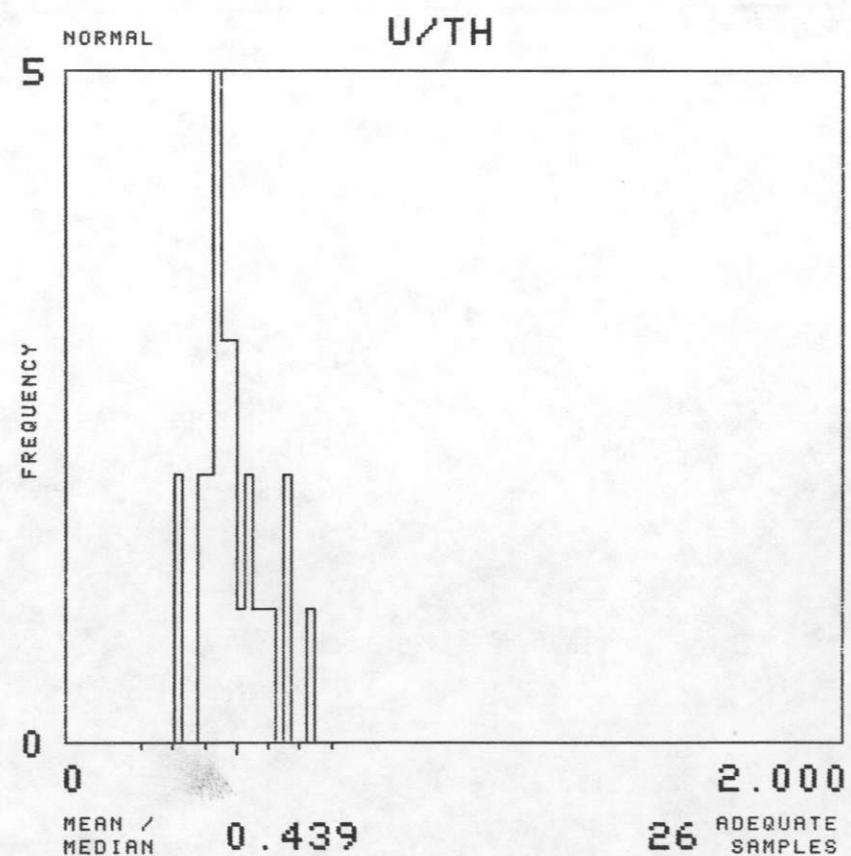
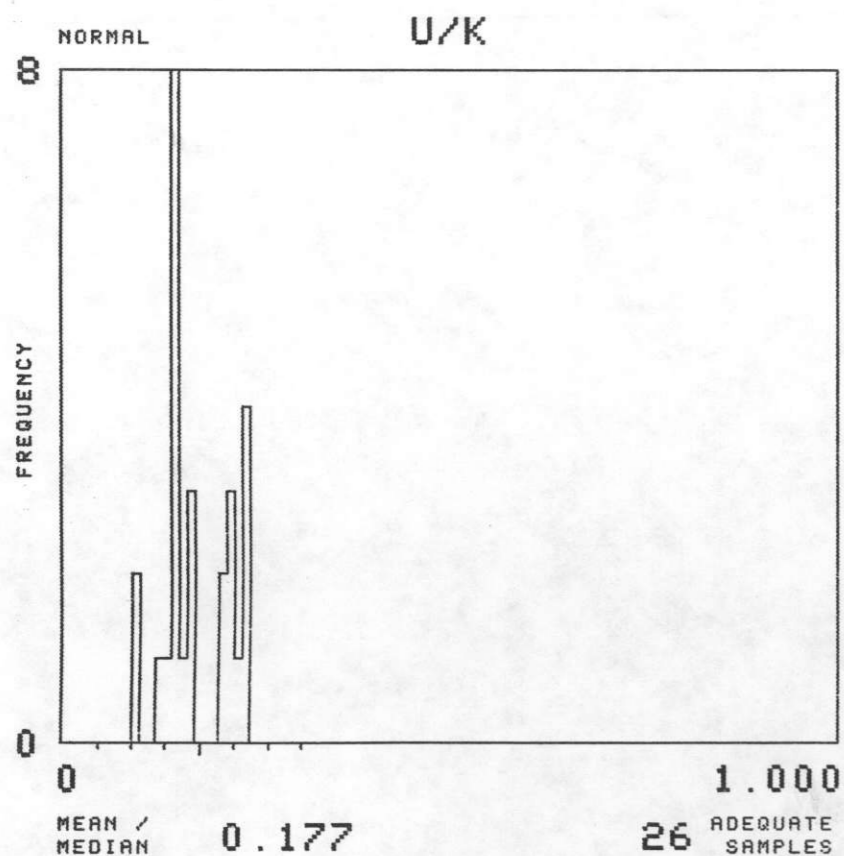
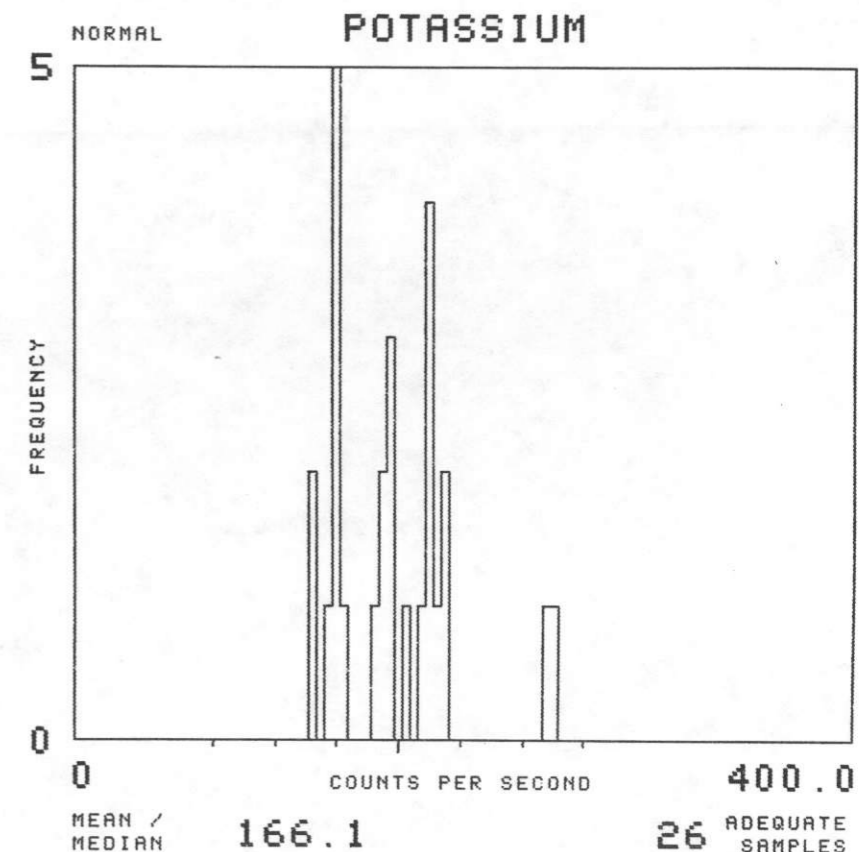
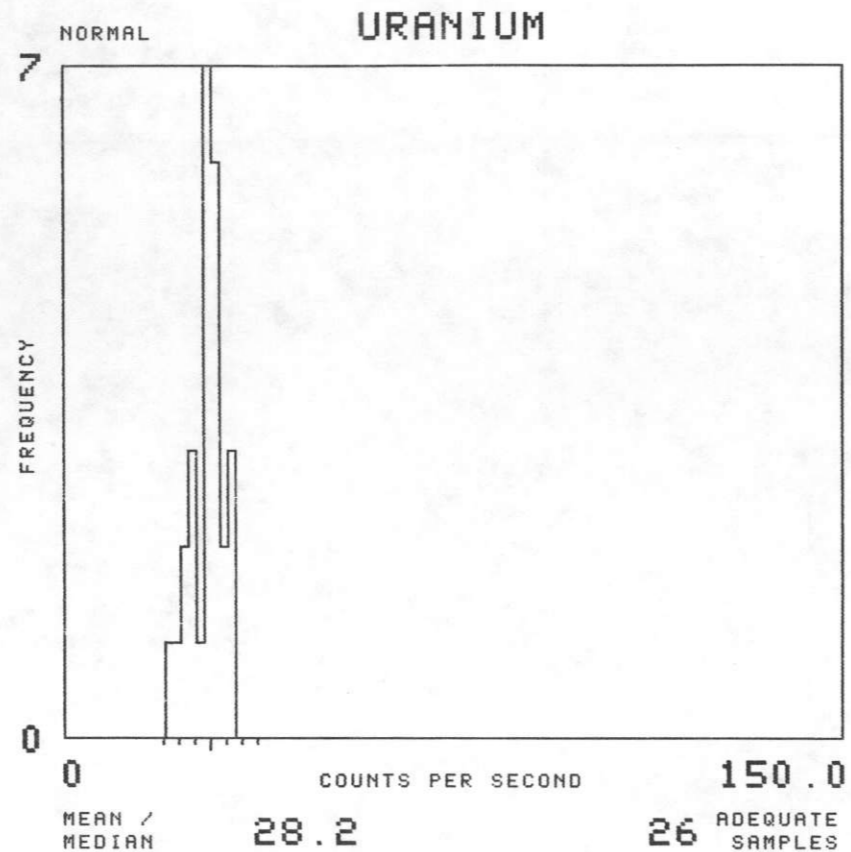
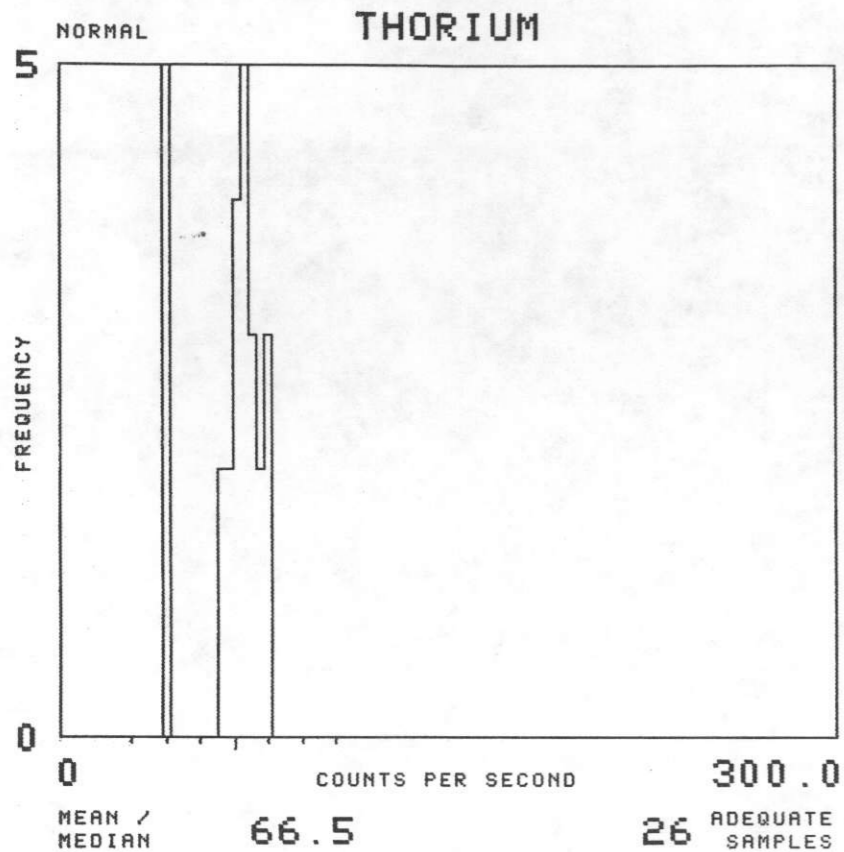


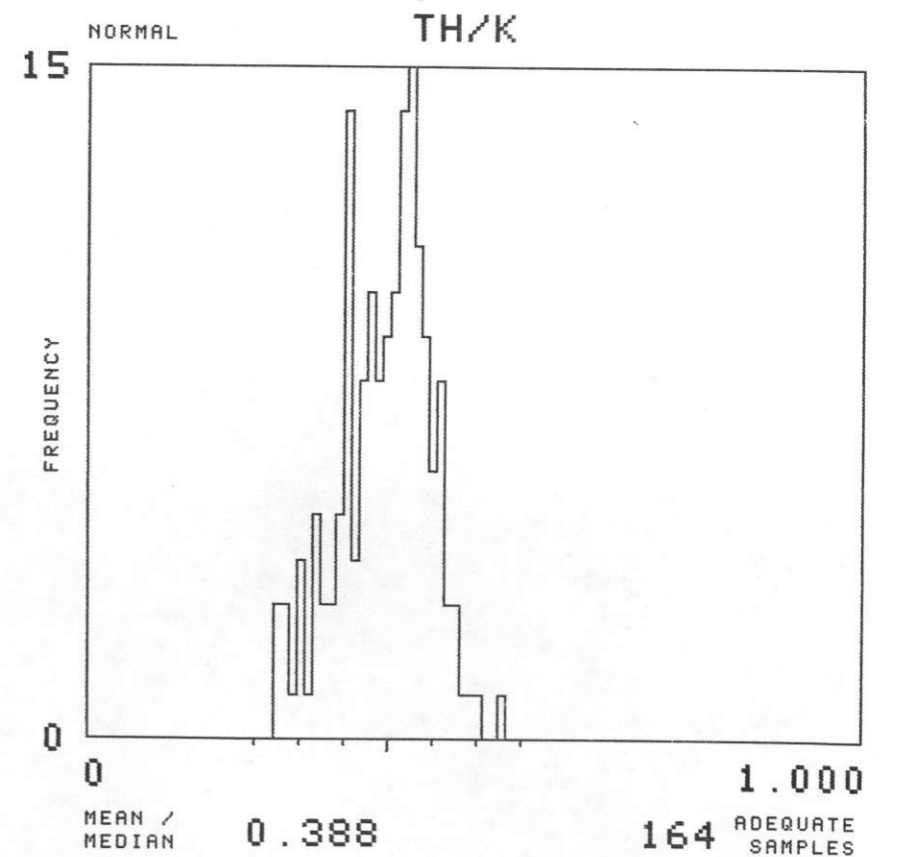
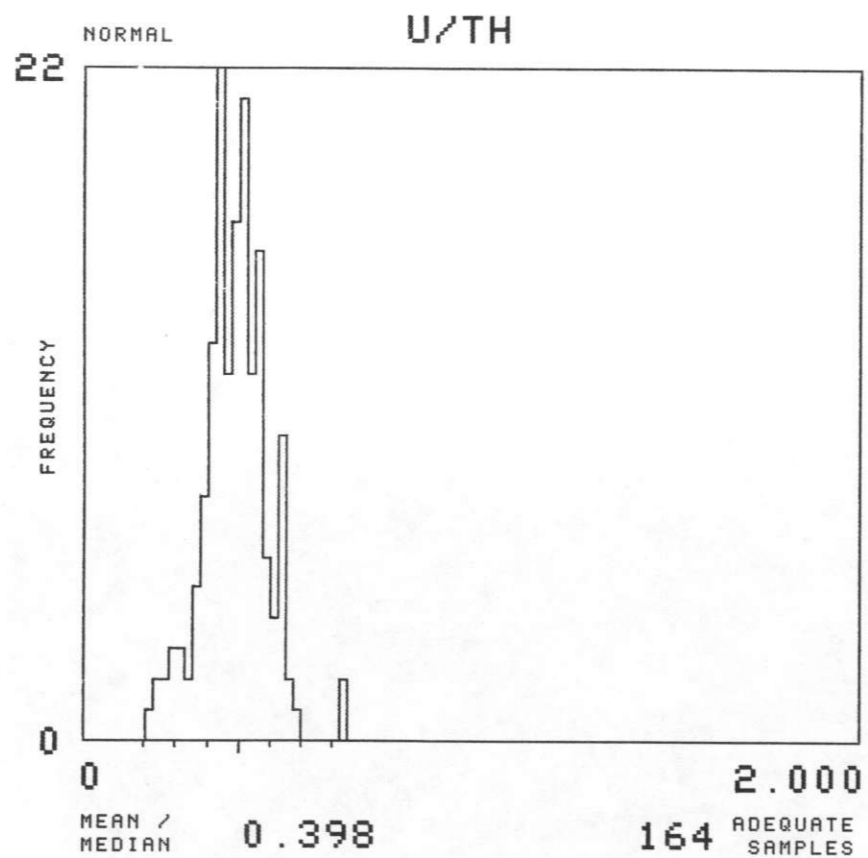
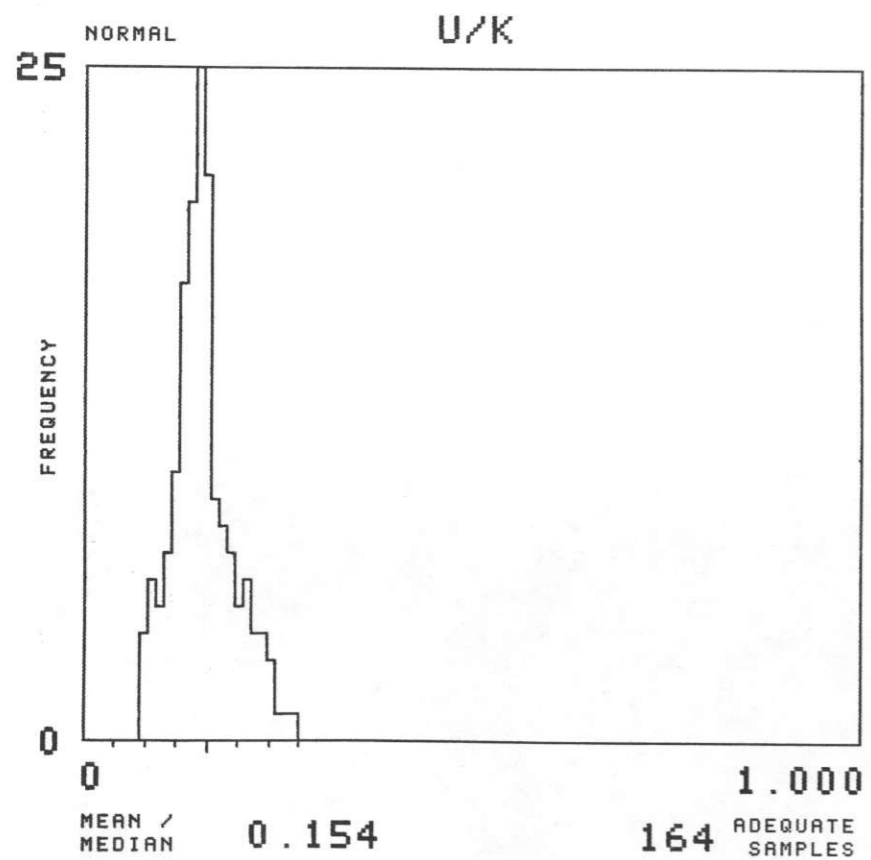
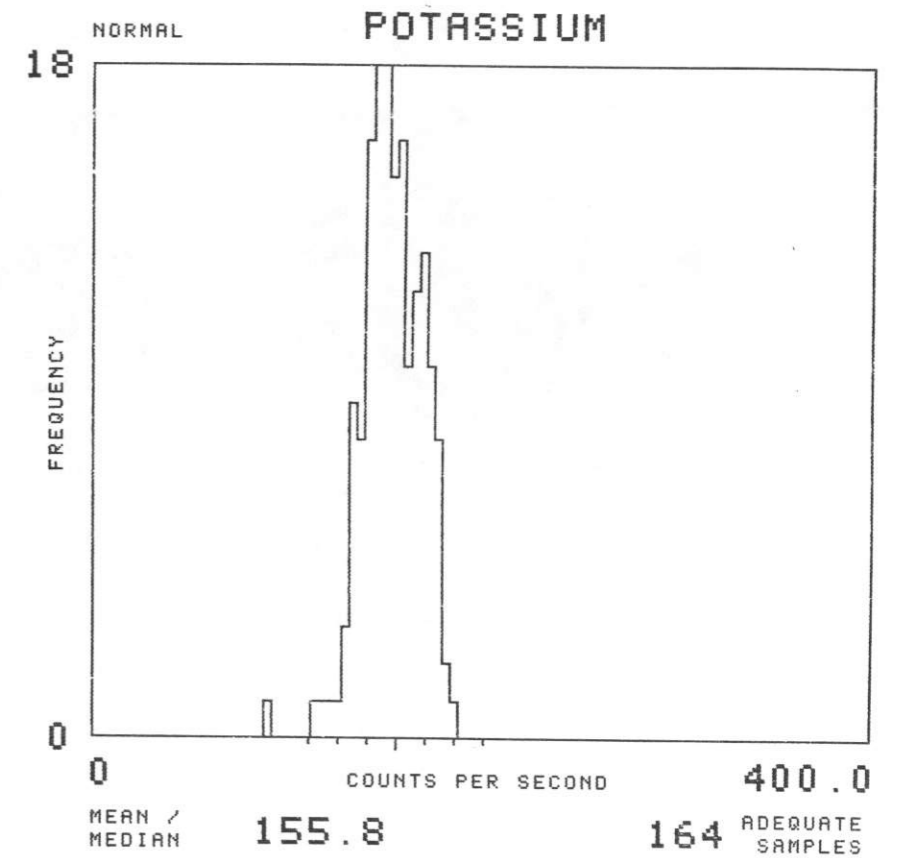
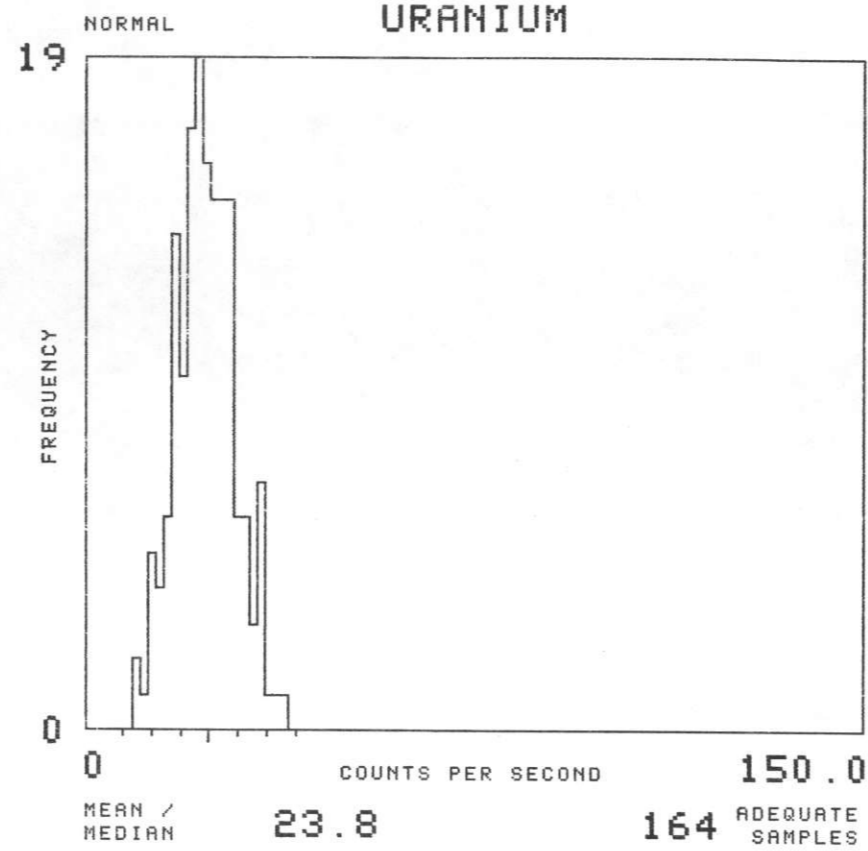
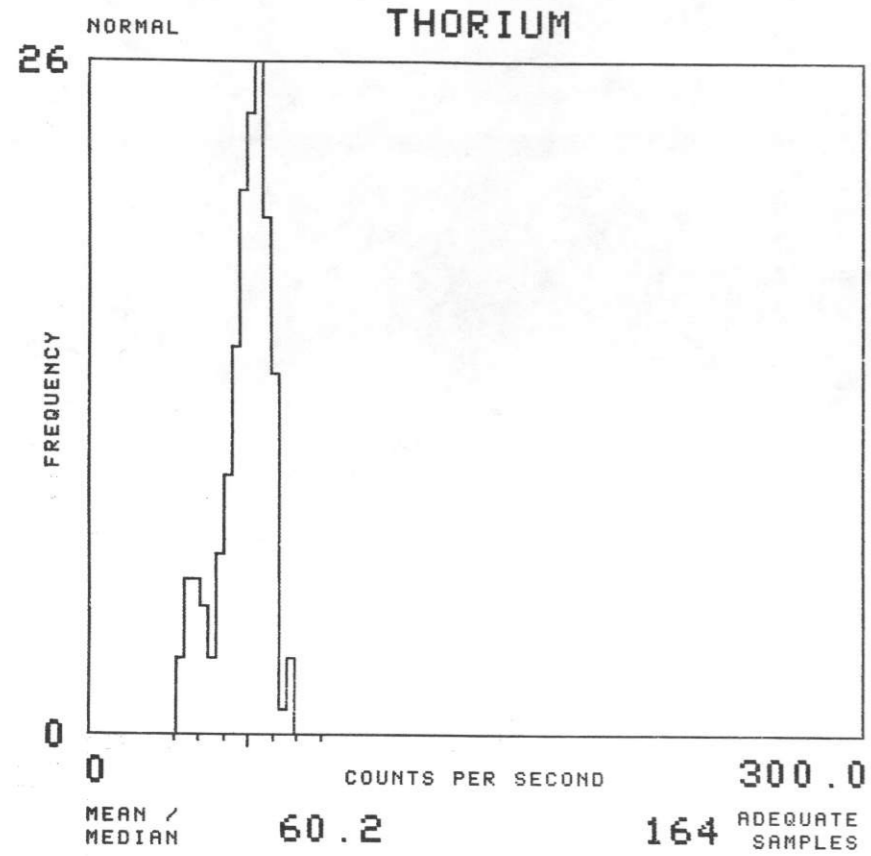
NTMS NI 12-3 GALLUP

MAP UNIT : KM

TOTAL NUMBER OF SAMPLES 1052

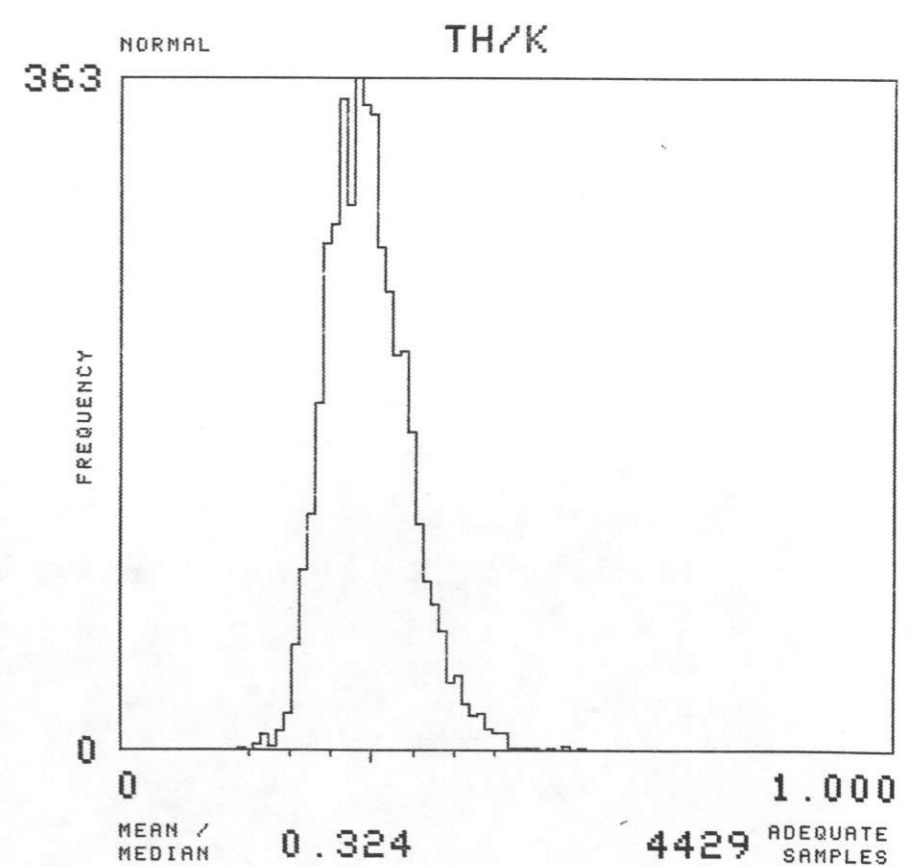
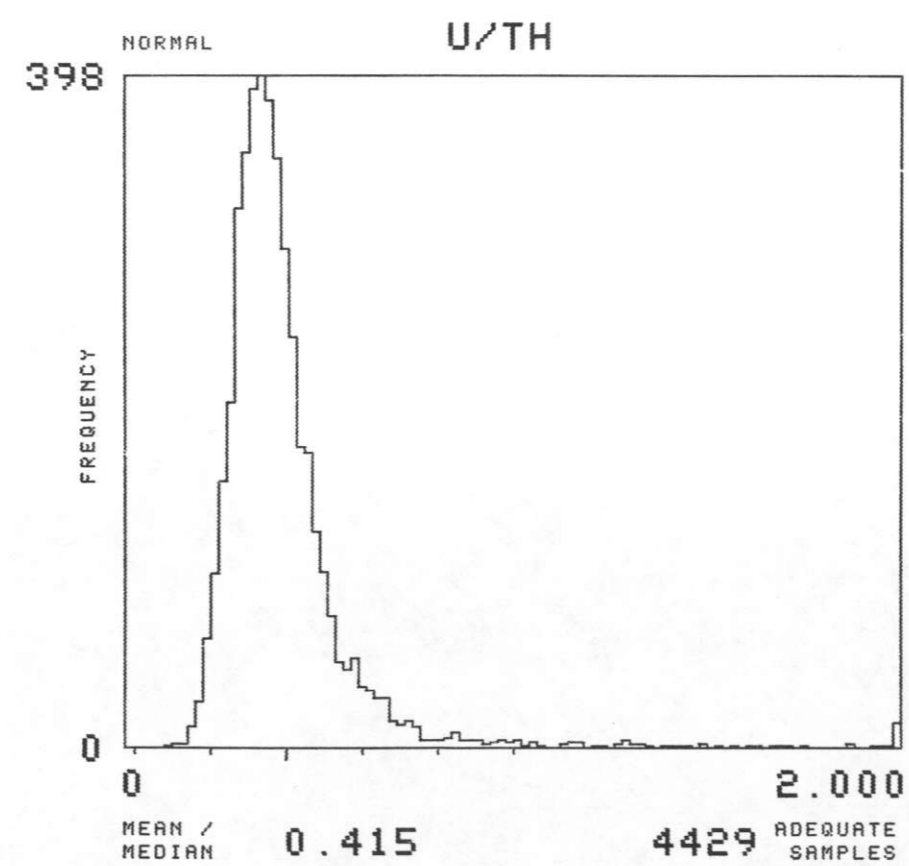
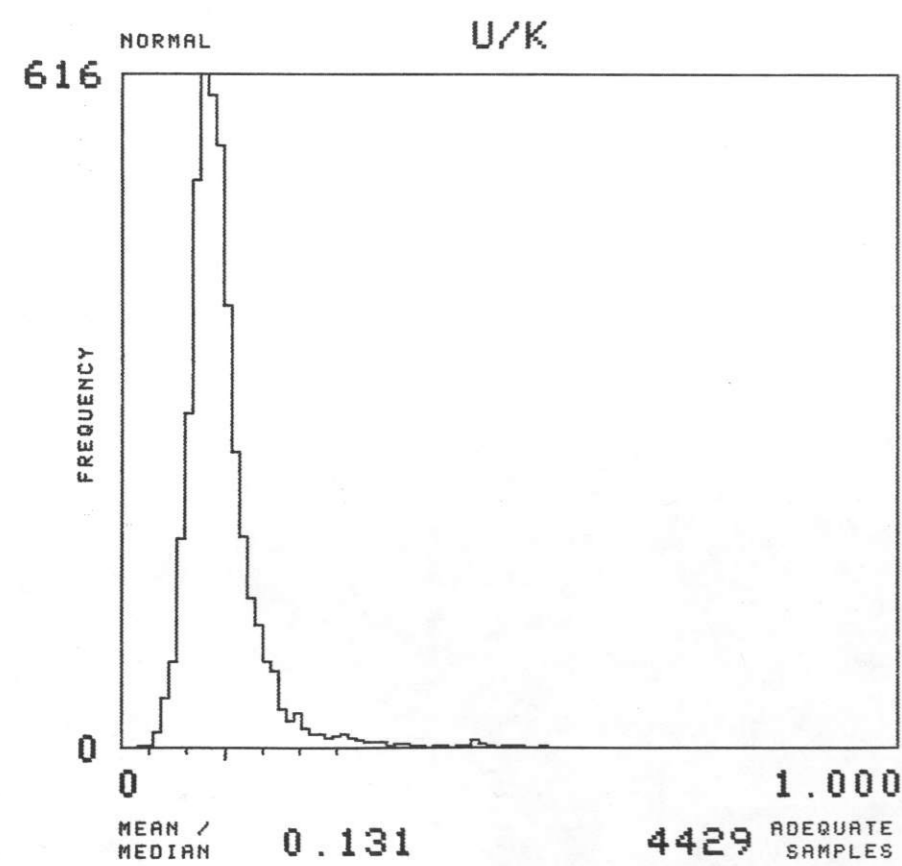
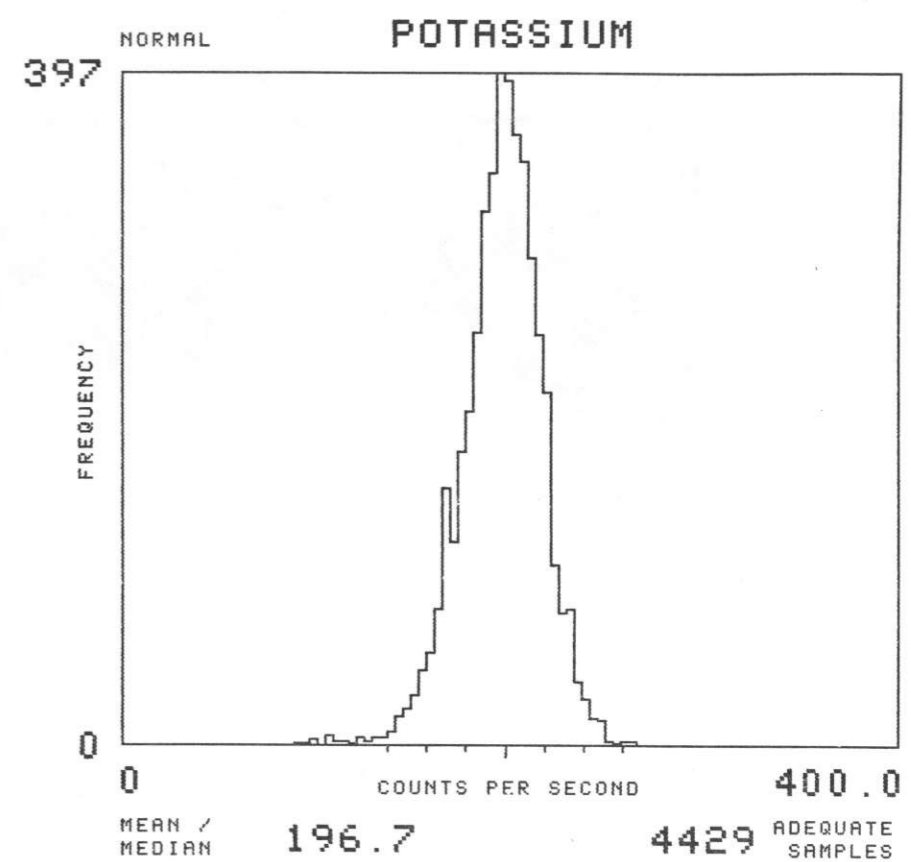
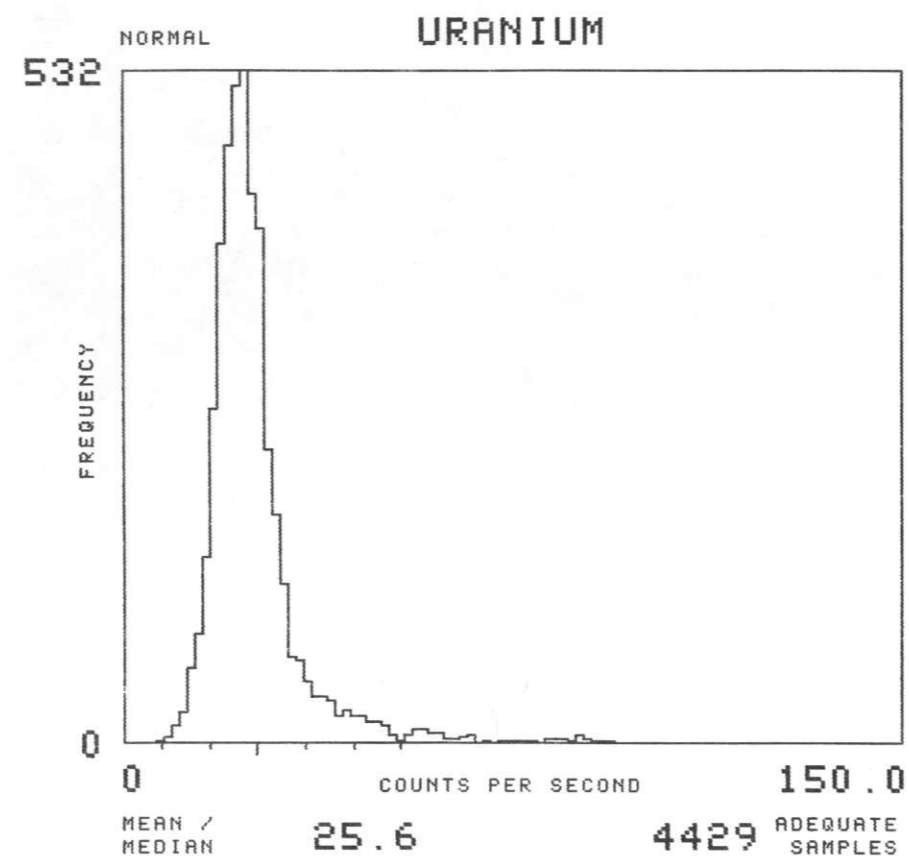
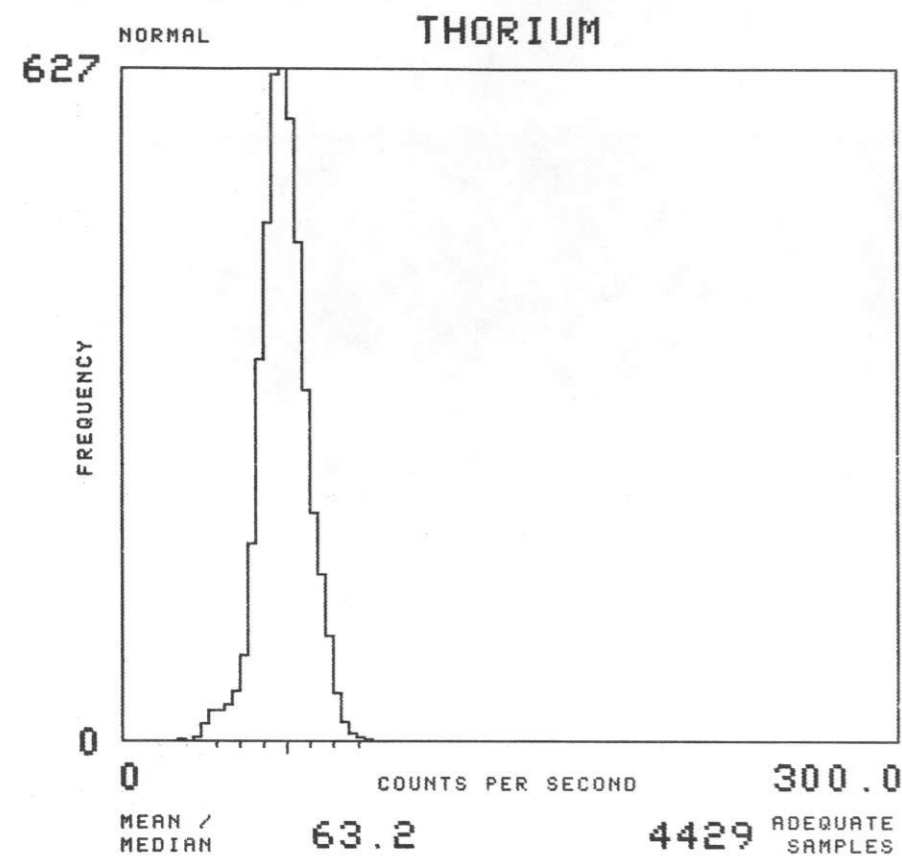






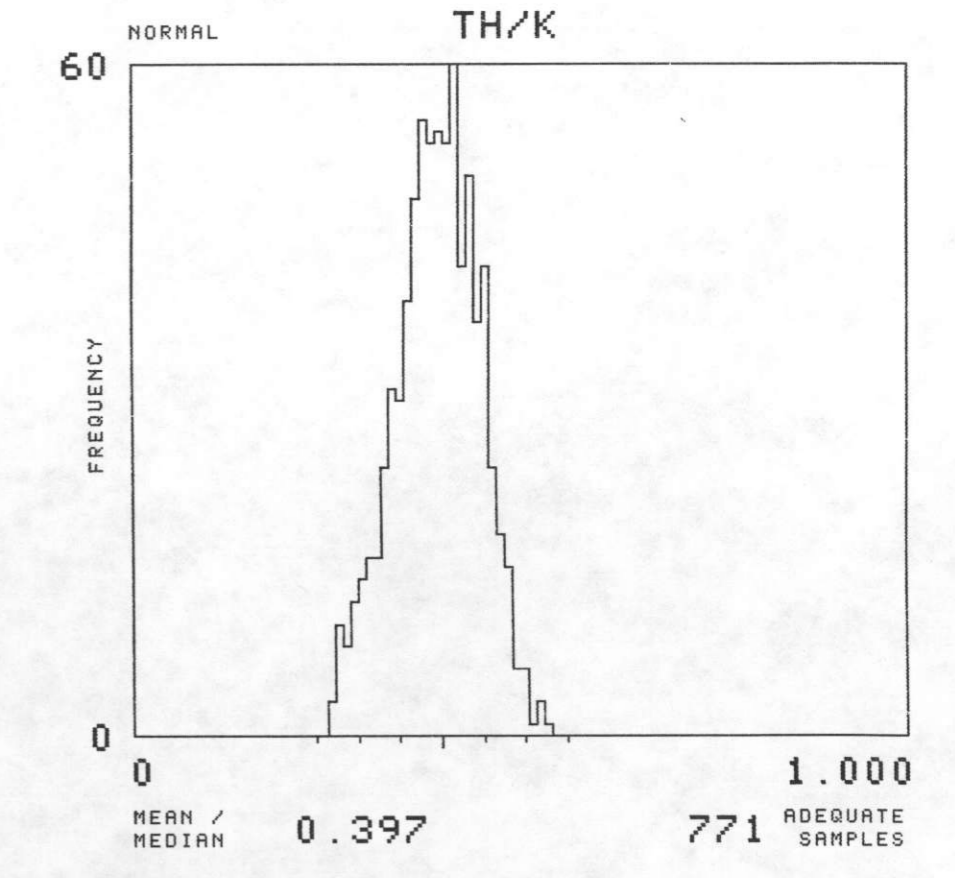
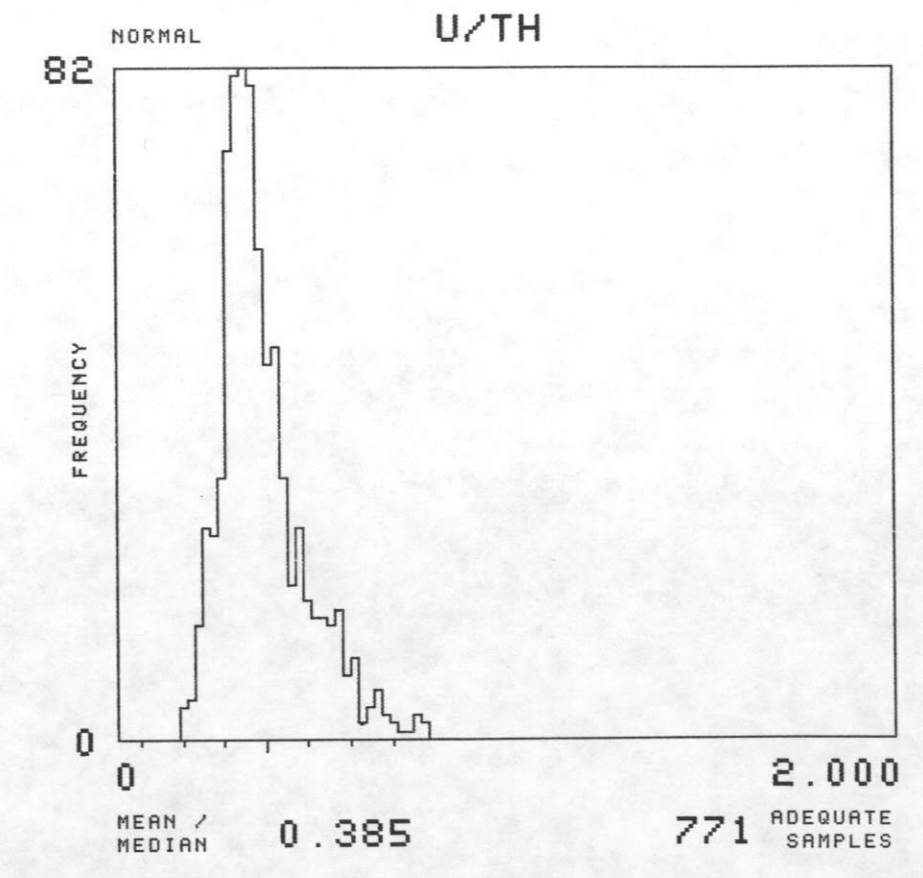
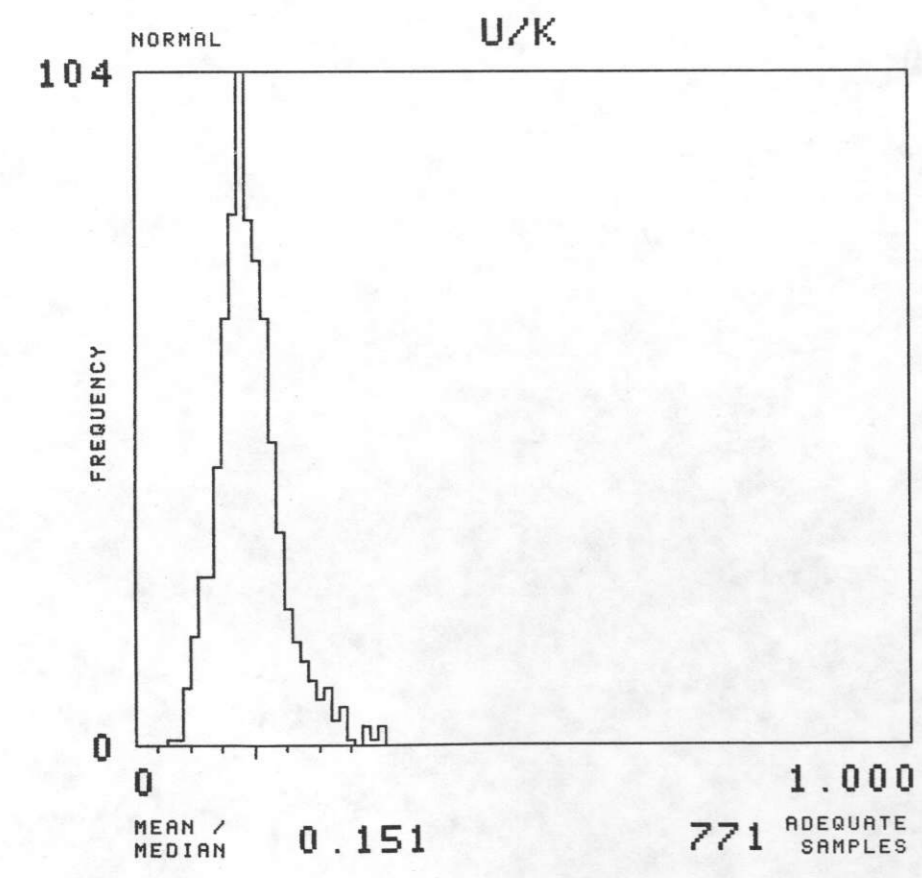
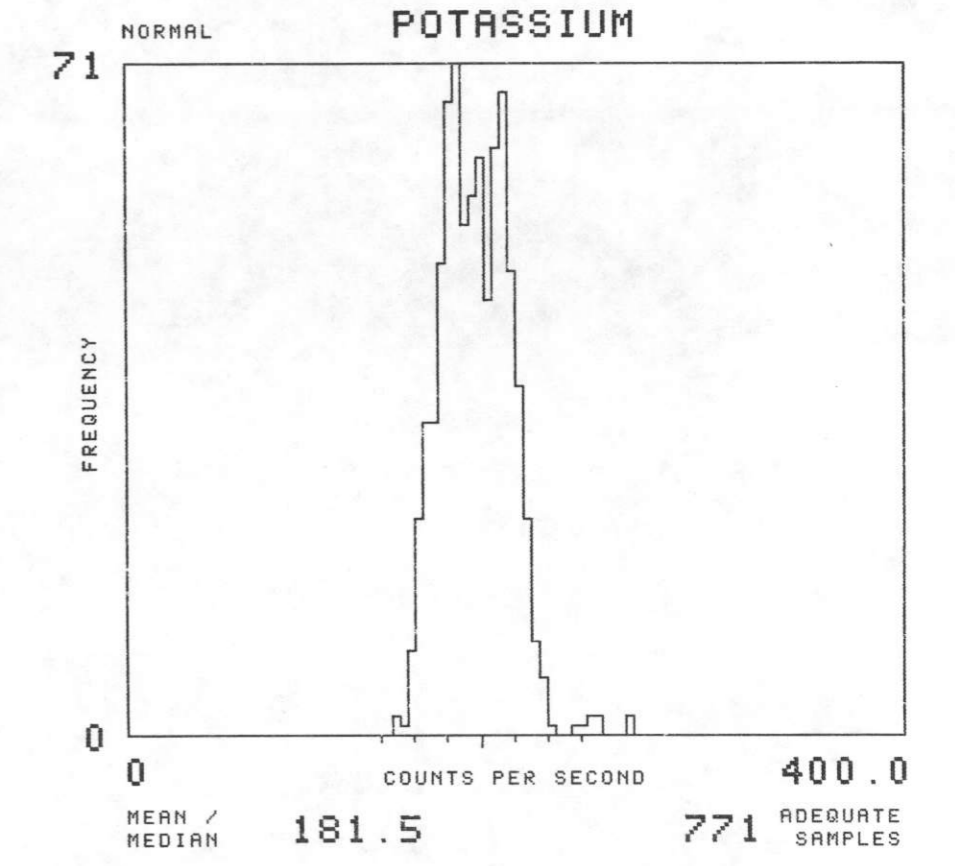
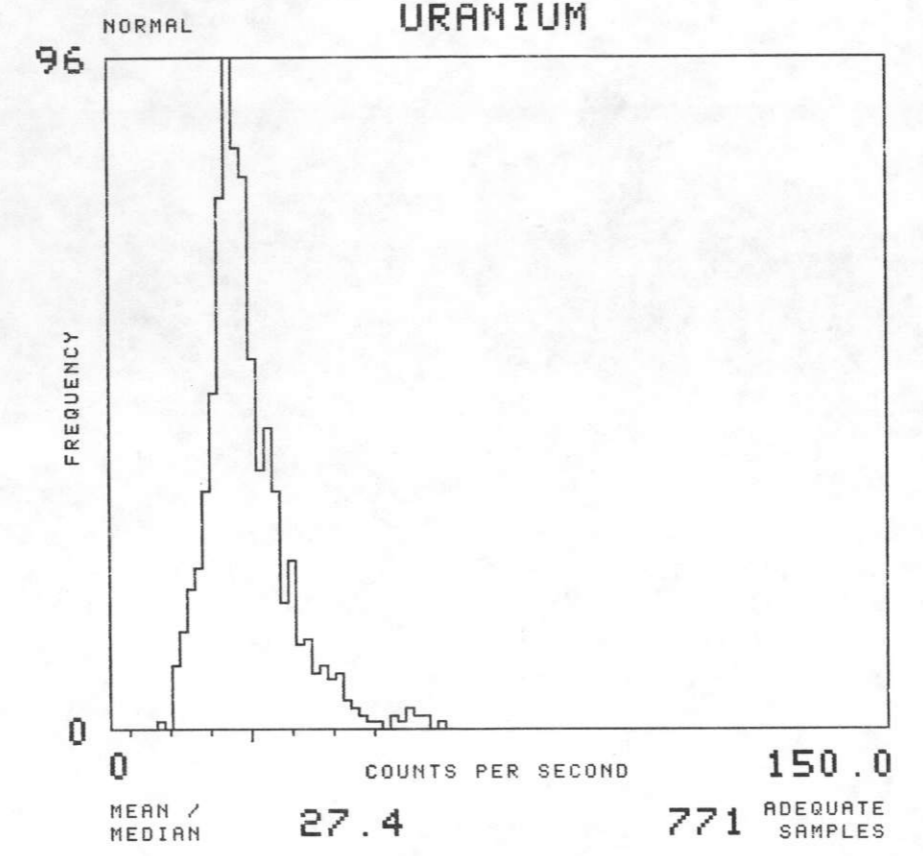
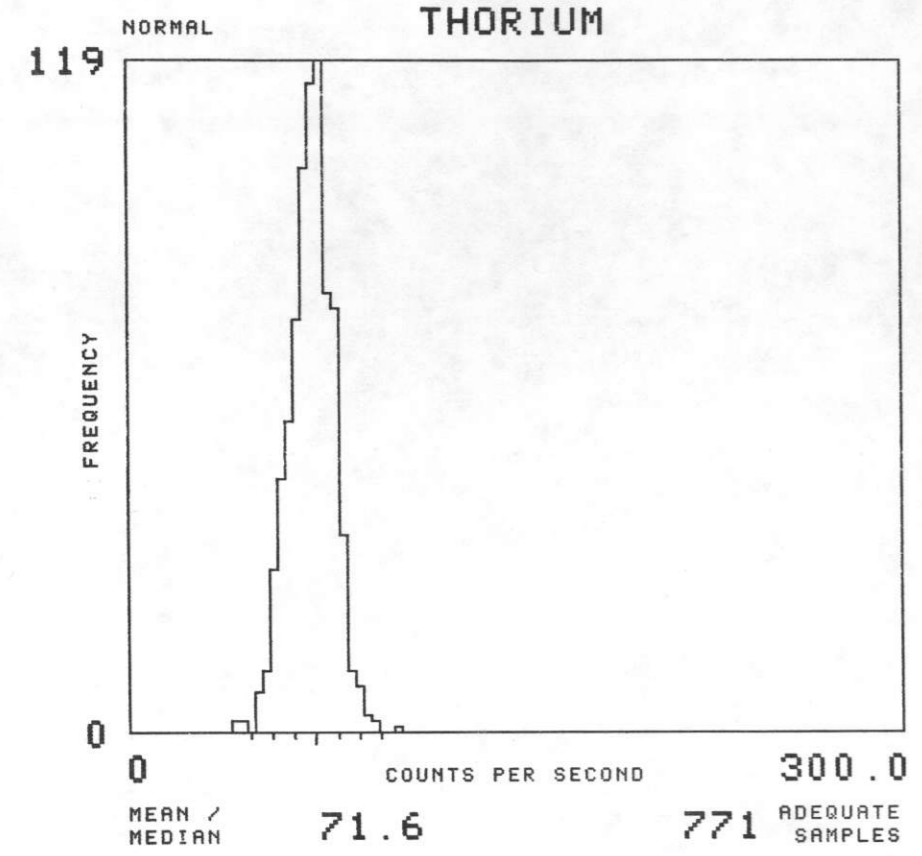
NTMS NI 12-3 GALLUP

MAP UNIT : KMF TOTAL NUMBER OF SAMPLES 4528



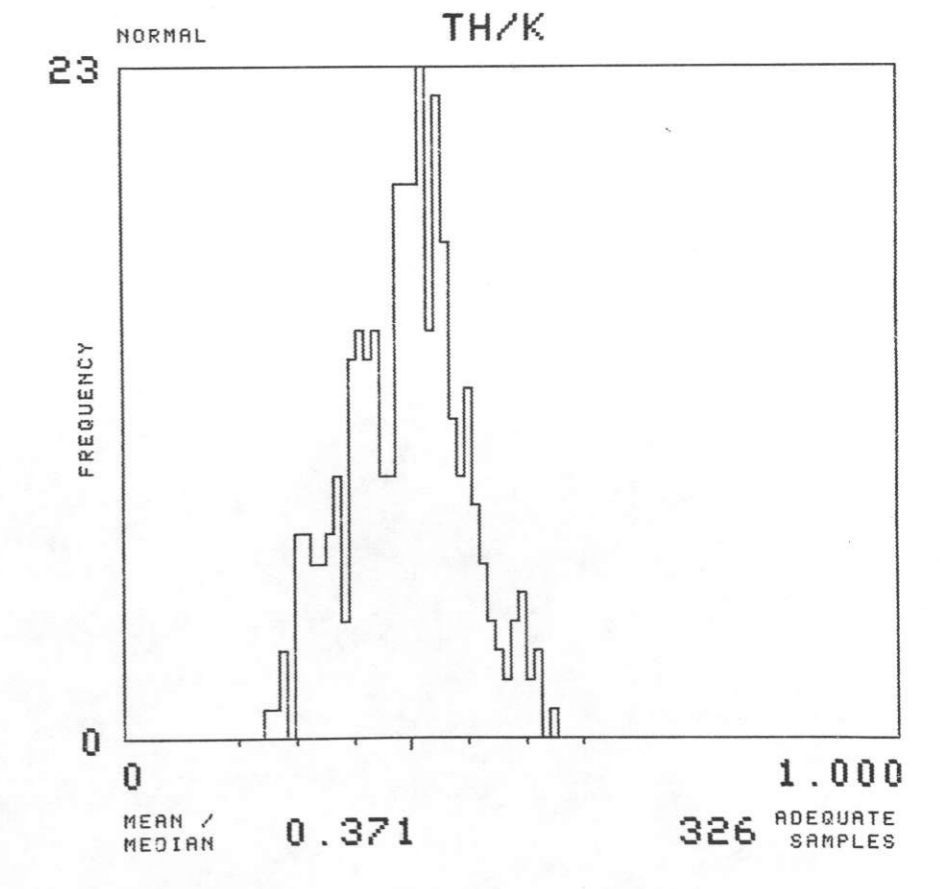
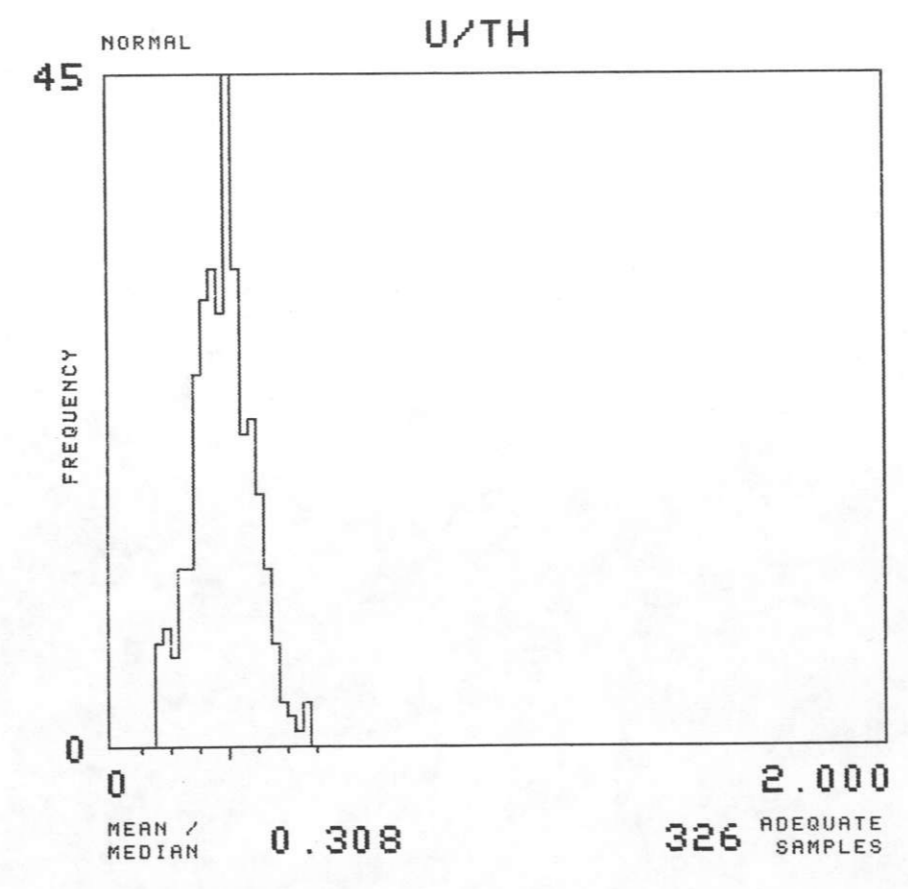
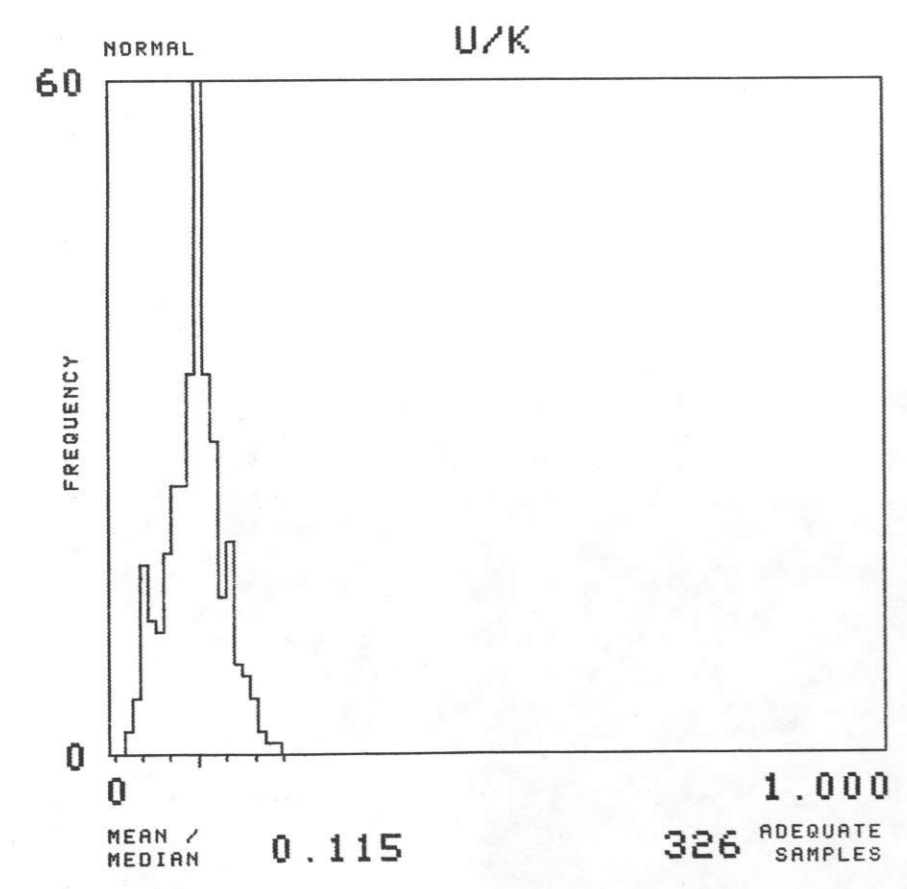
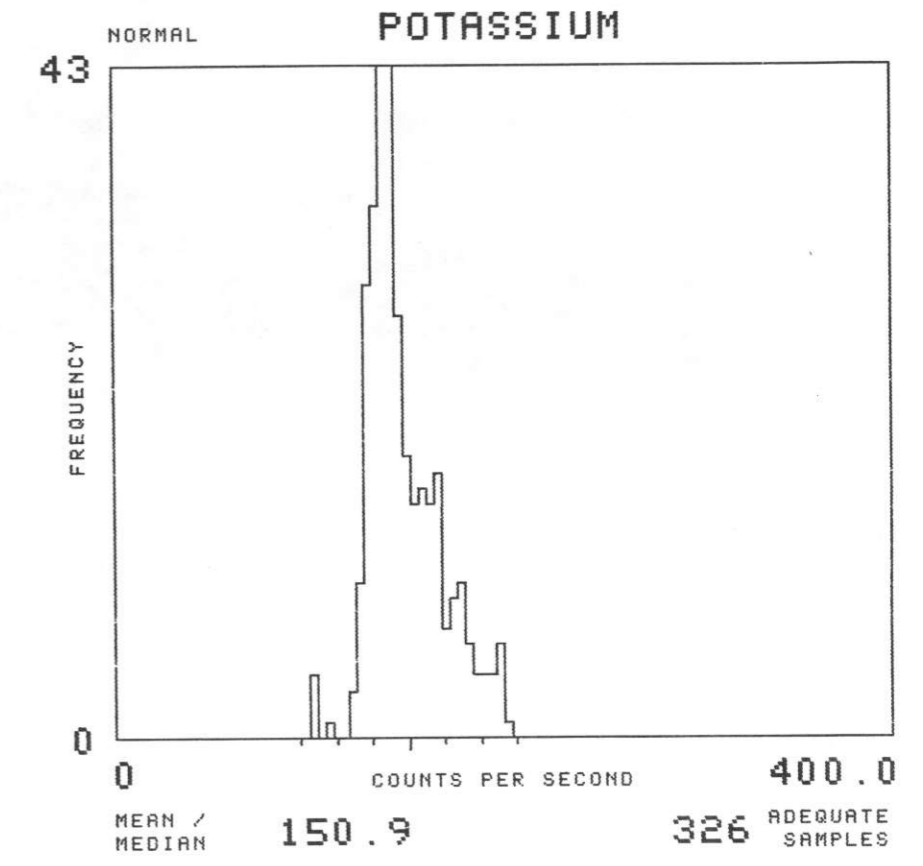
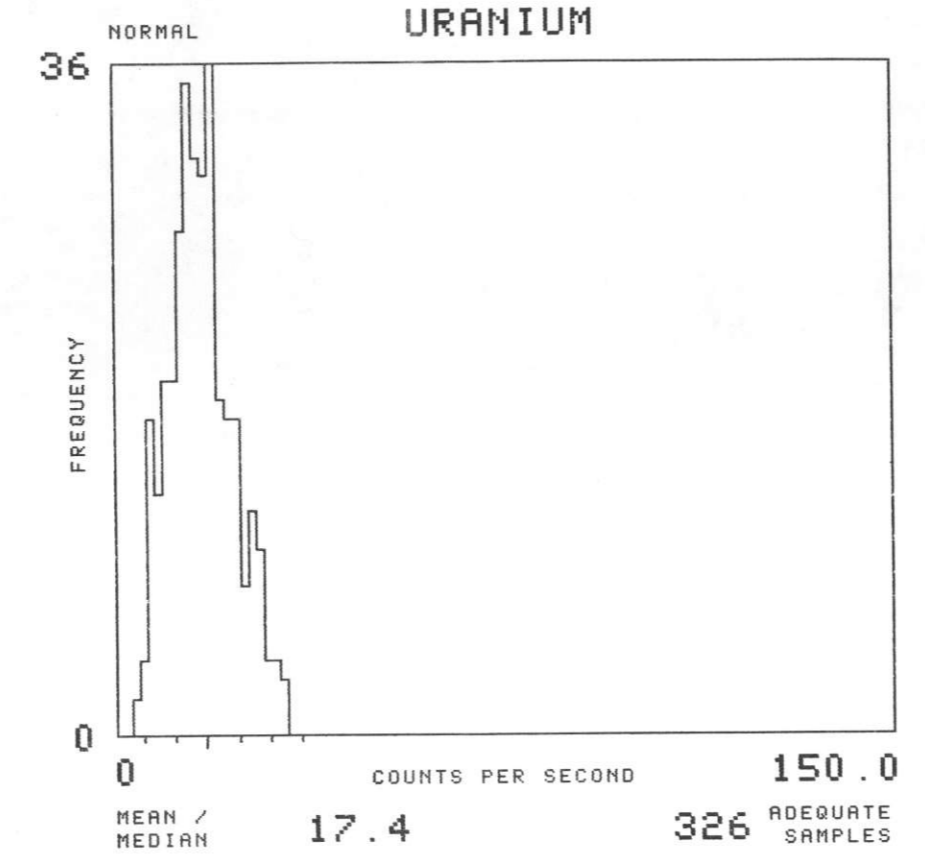
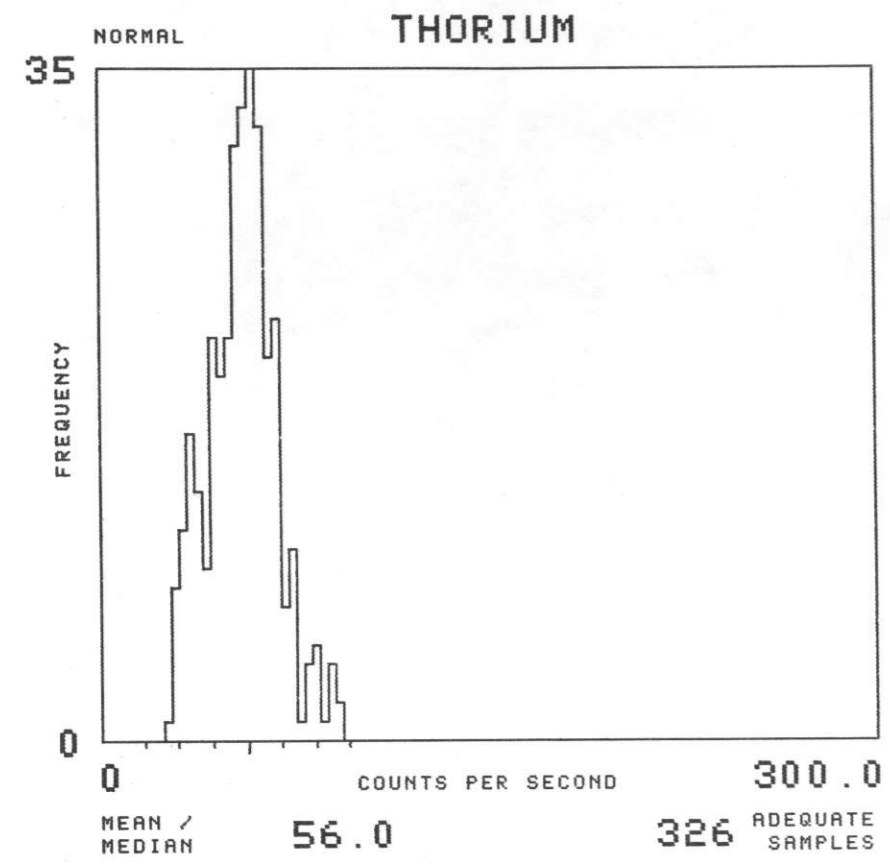
NTMS NI 12-3 GALLUP

MAP UNIT : KMFC TOTAL NUMBER OF SAMPLES 771



NTMS NI 12-3 GALLUP

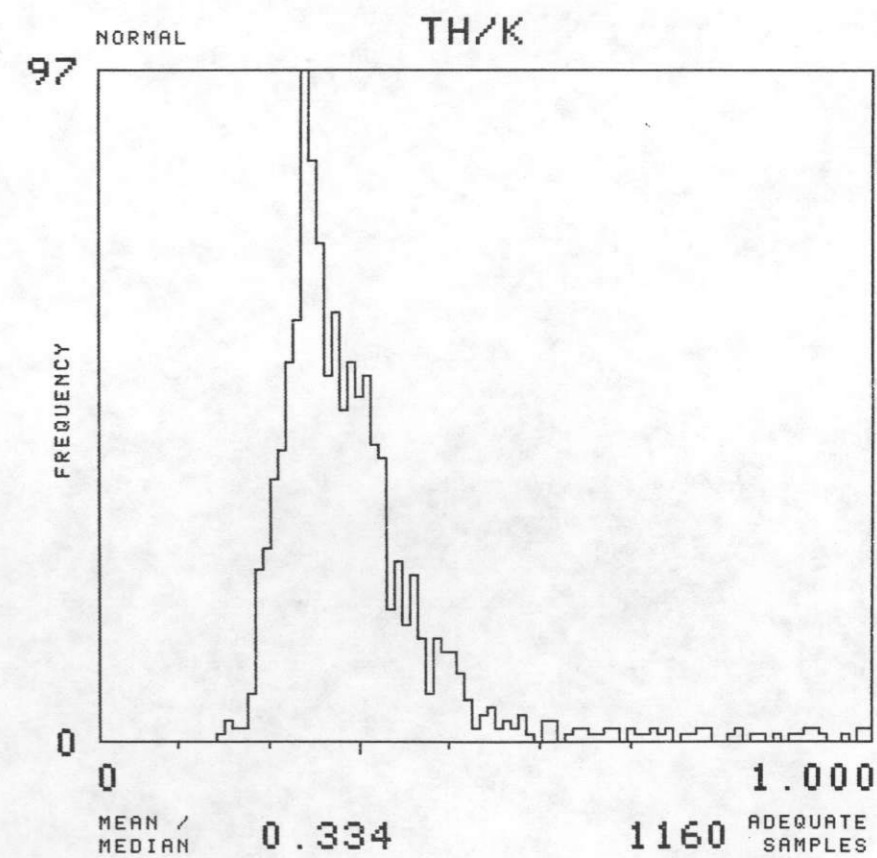
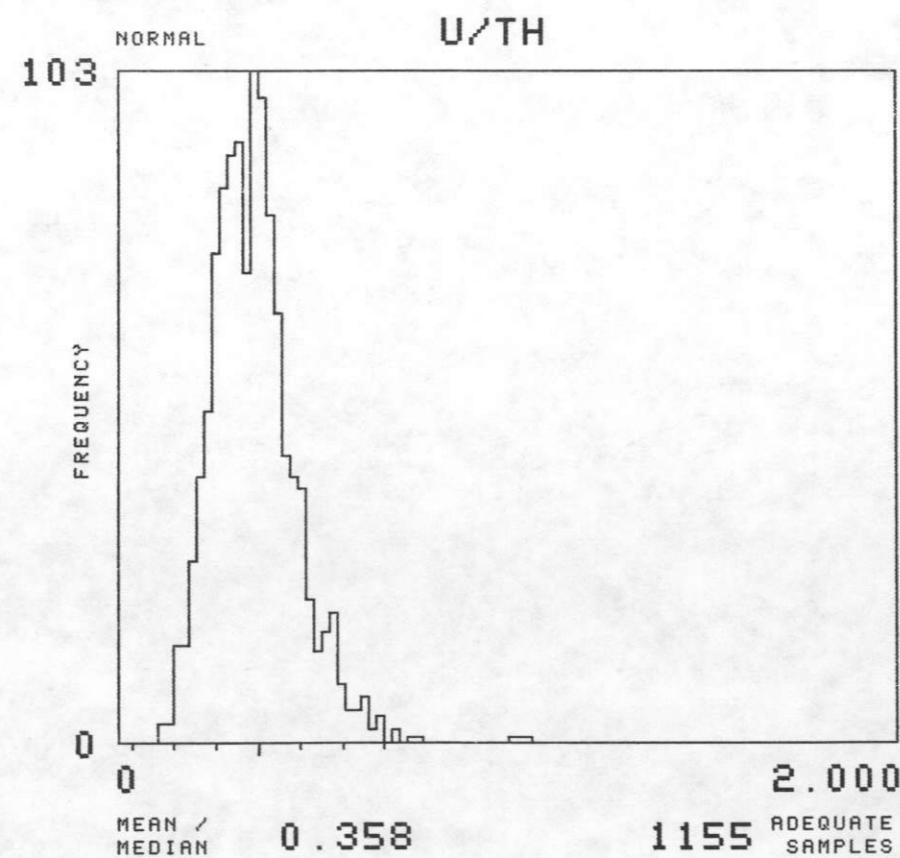
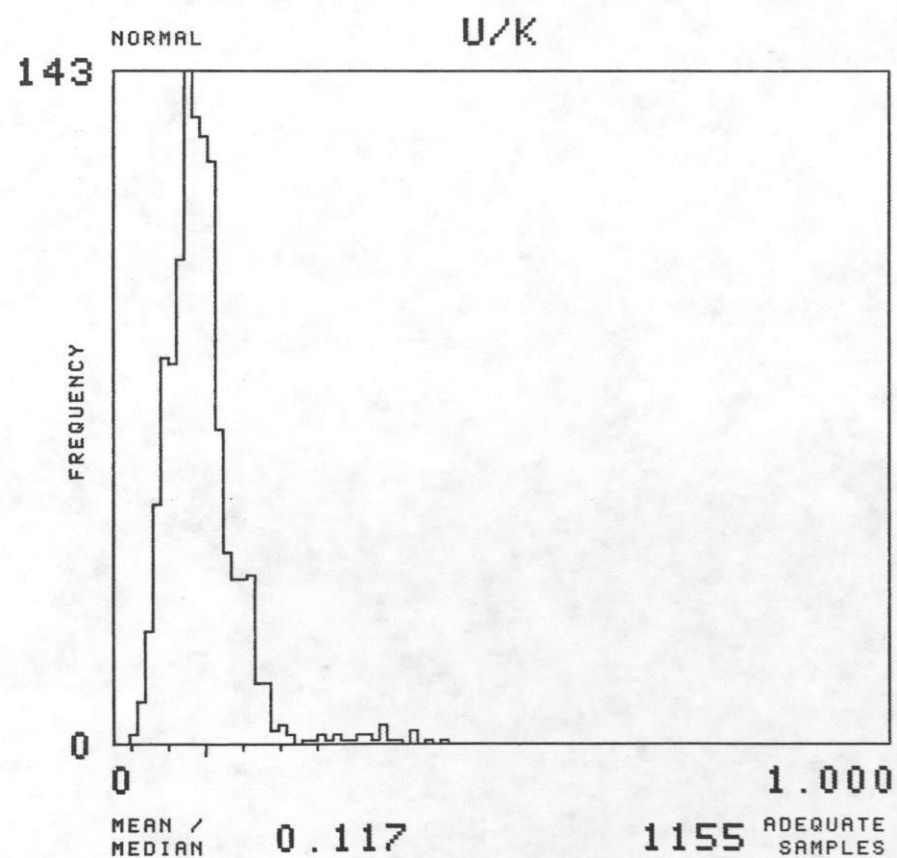
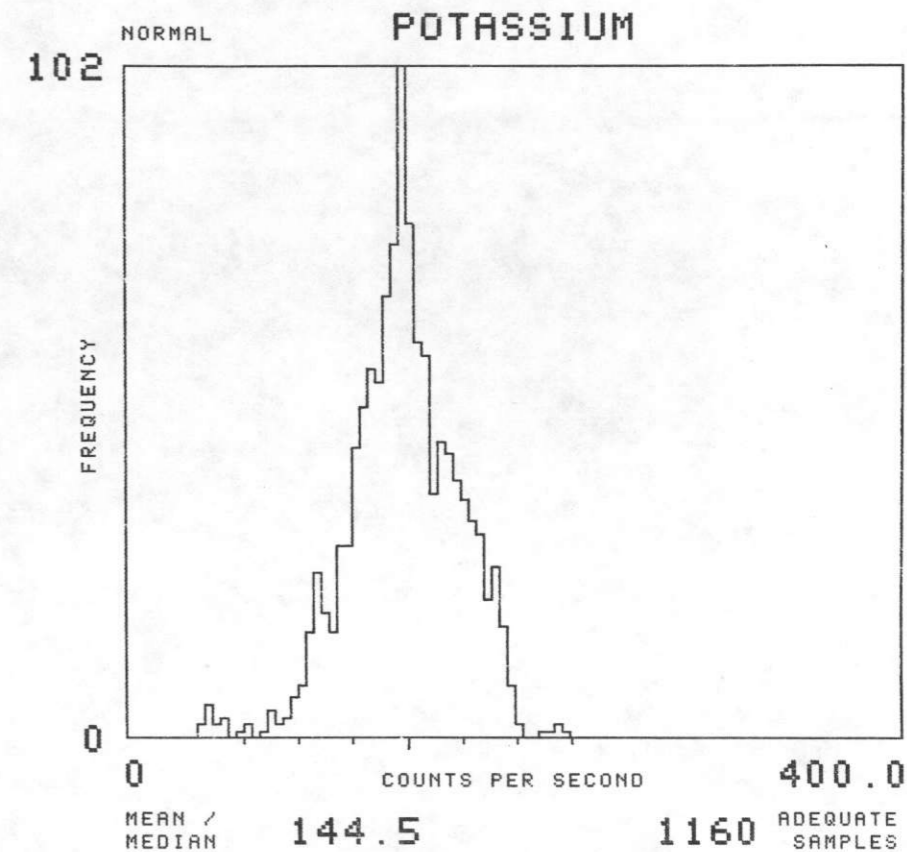
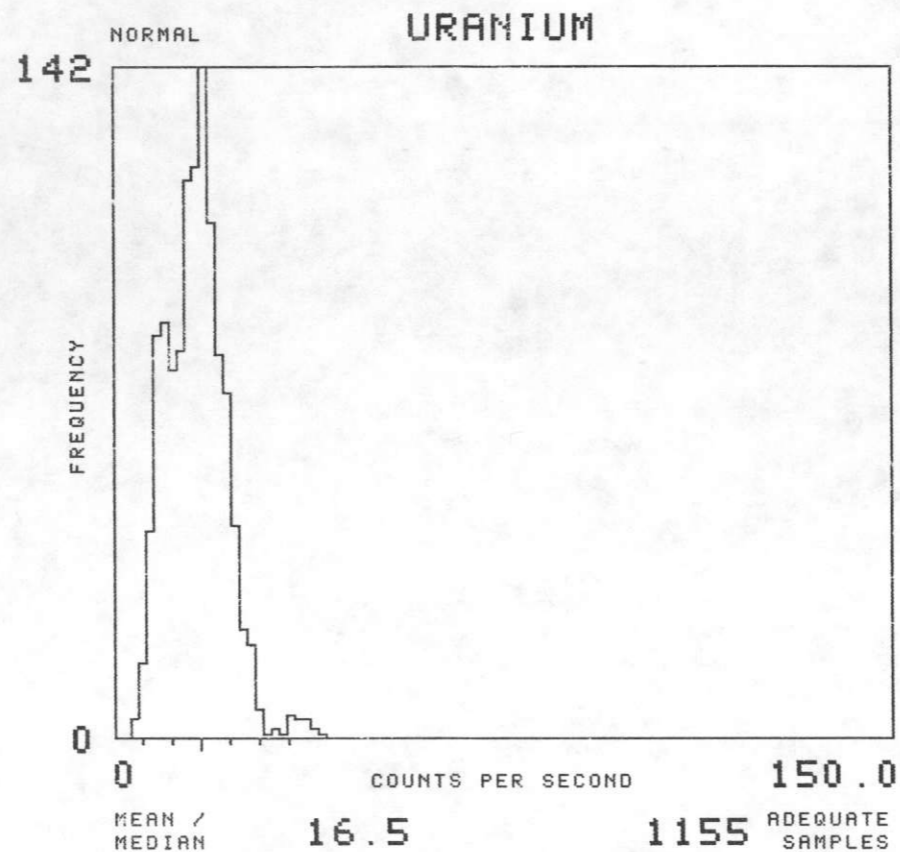
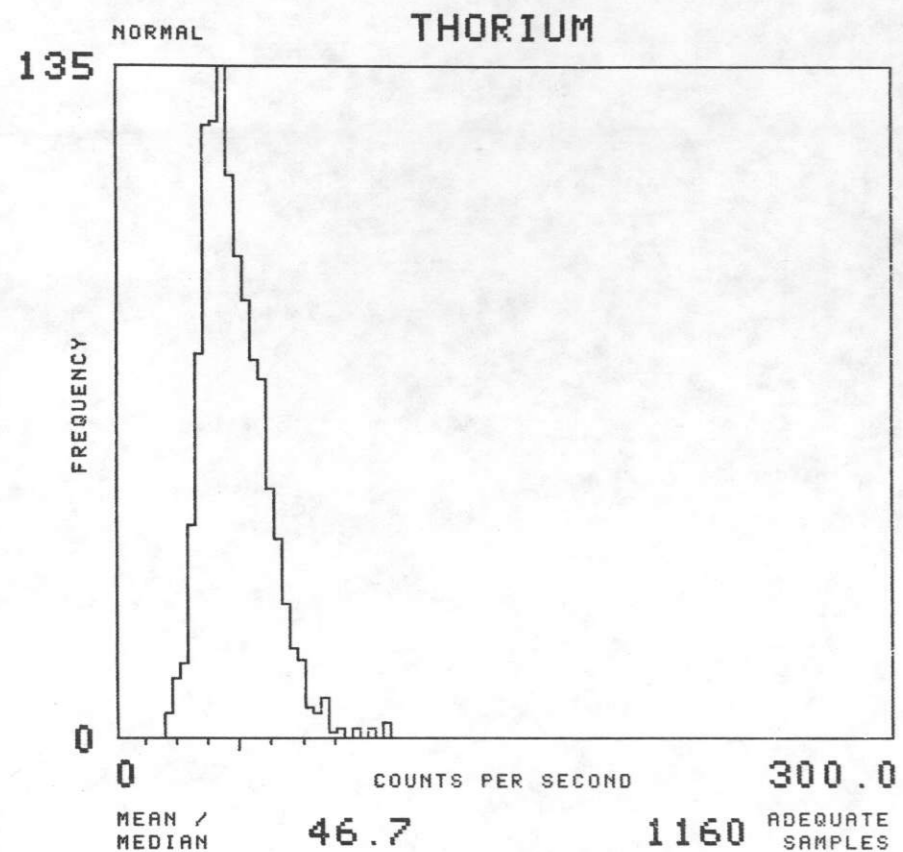
MAP UNIT : KMP TOTAL NUMBER OF SAMPLES 326



NTMS NI 12-3 GALLUP

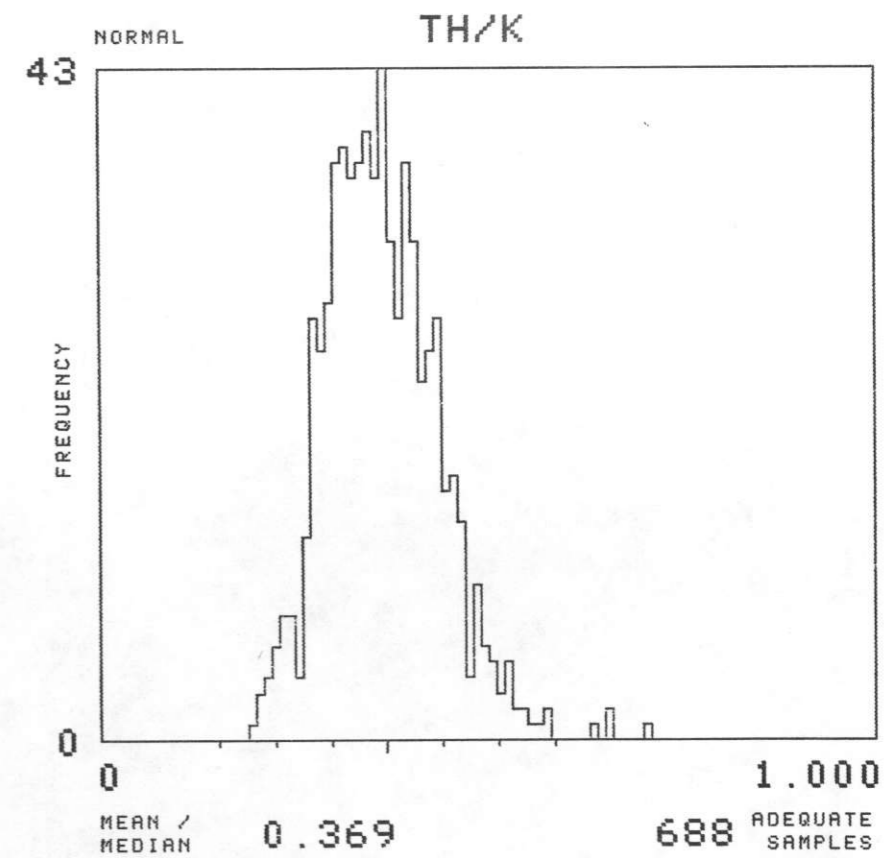
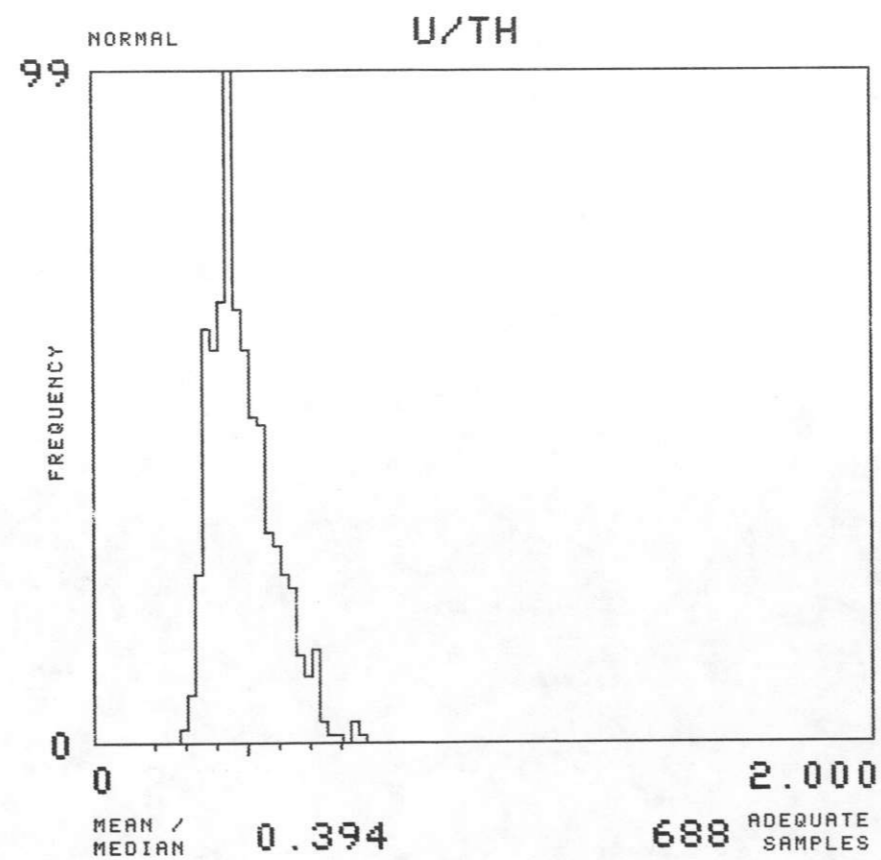
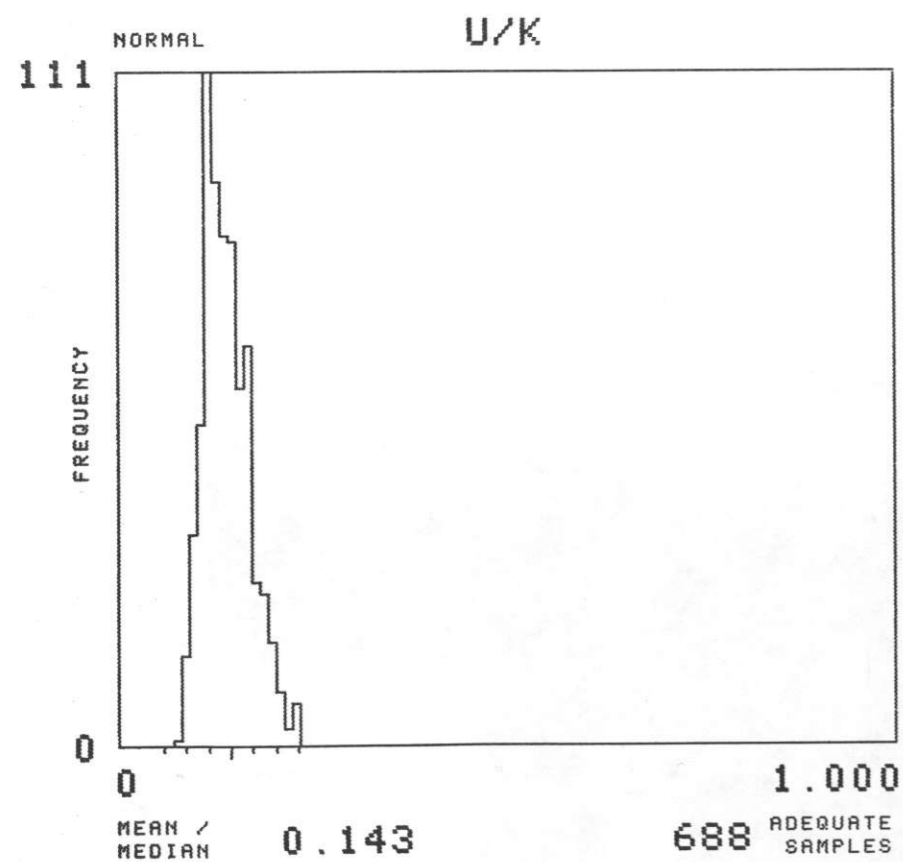
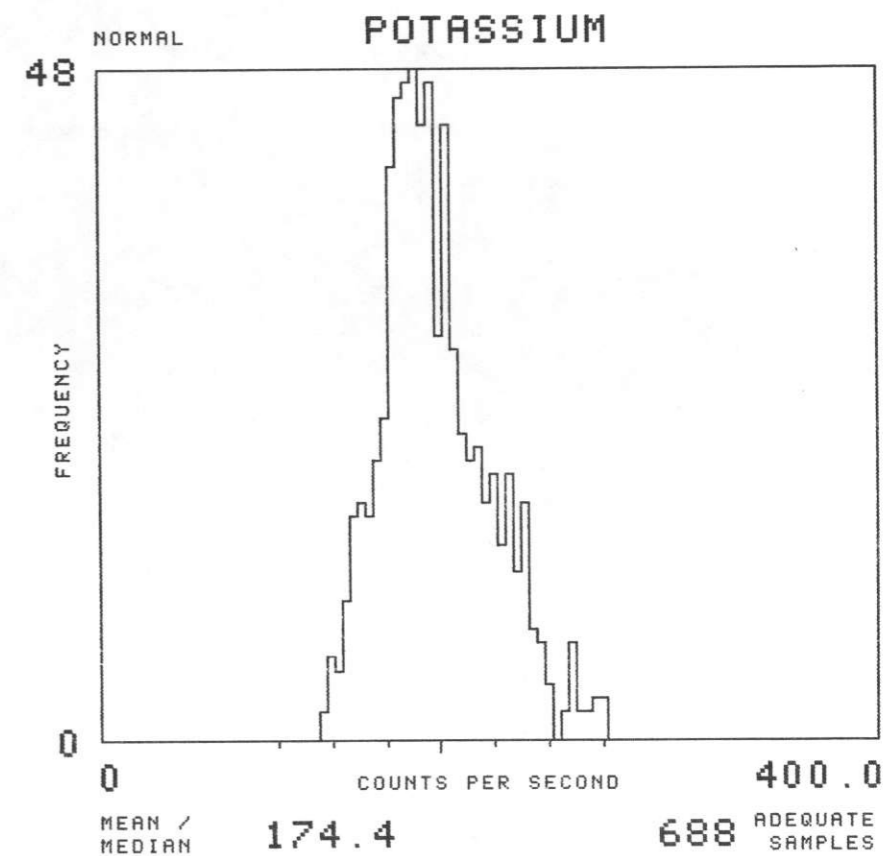
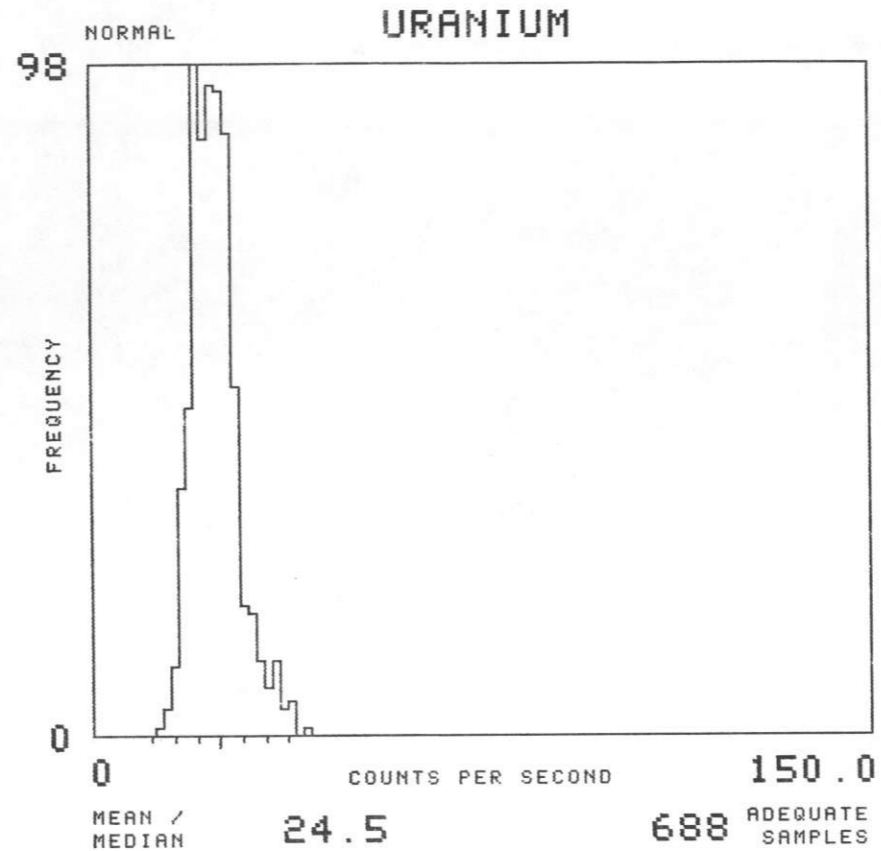
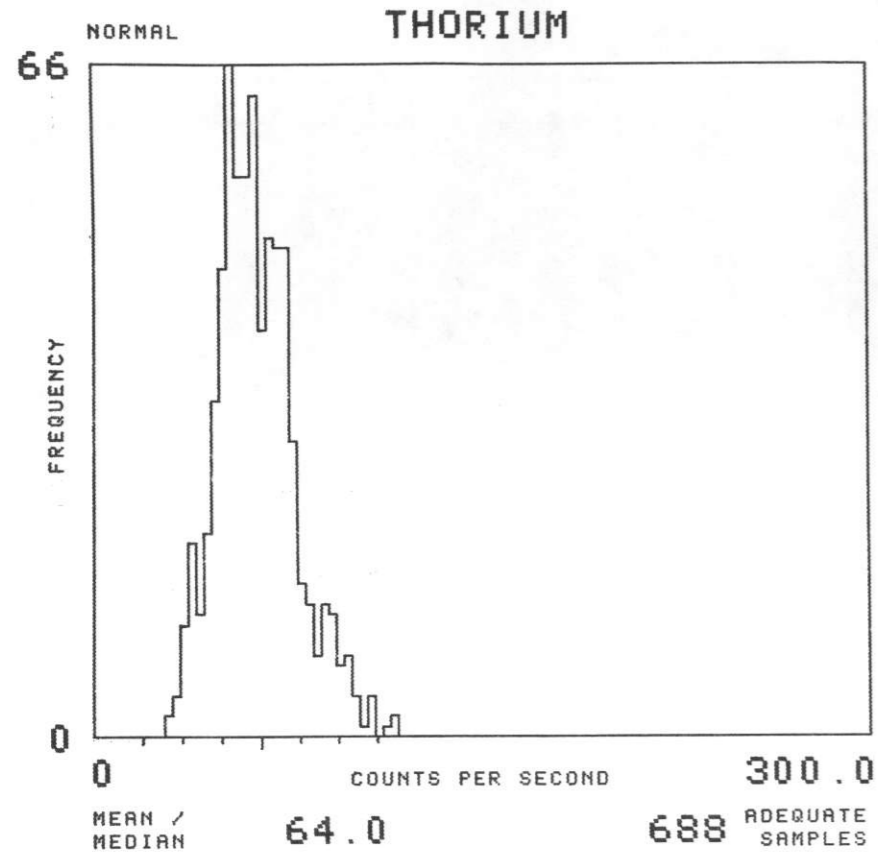
MAP UNIT : KP

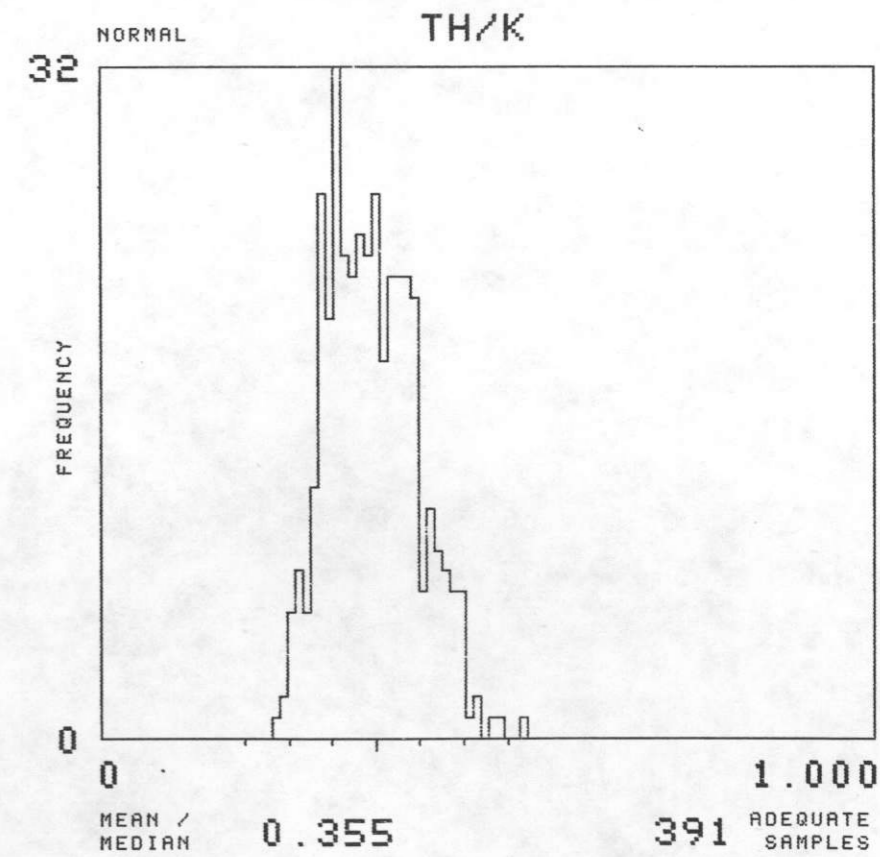
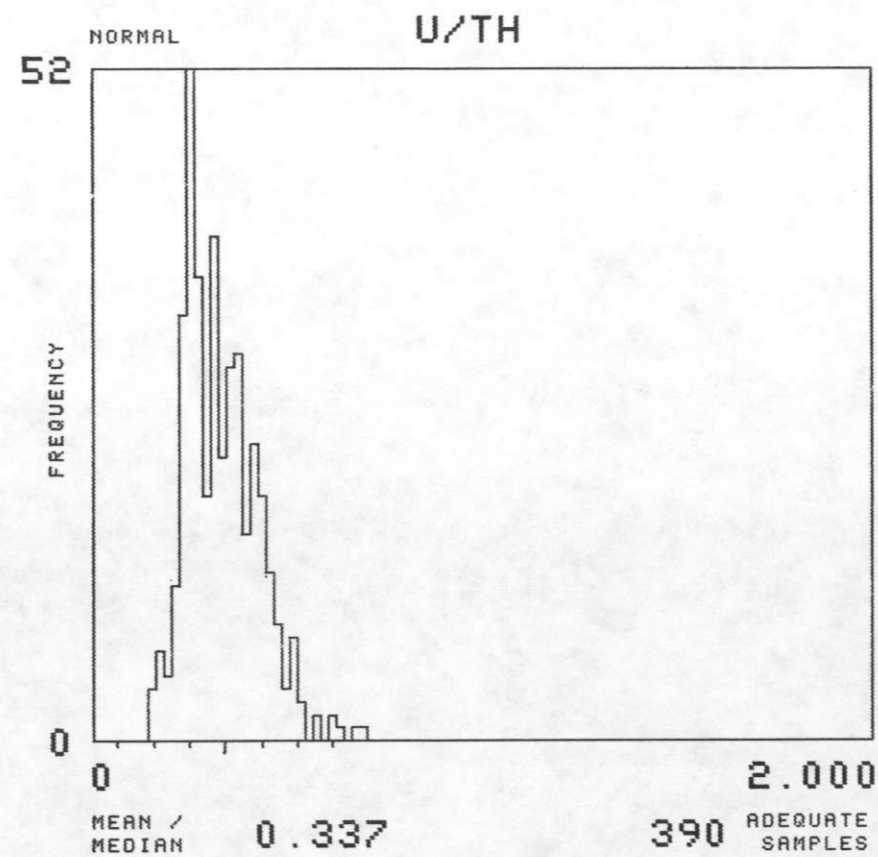
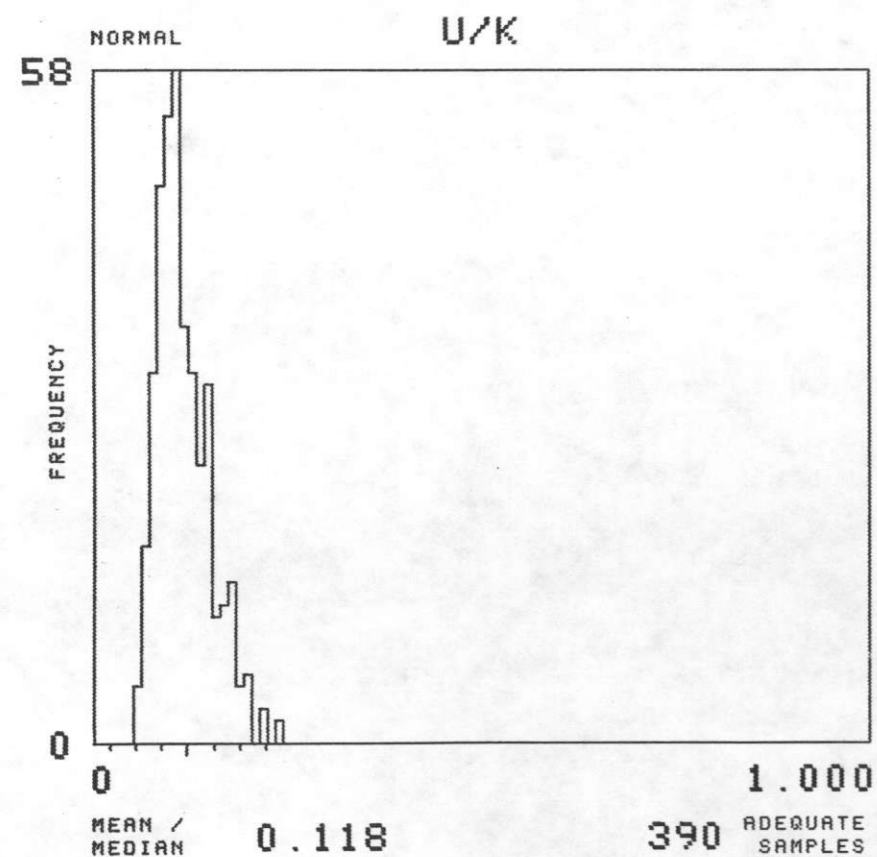
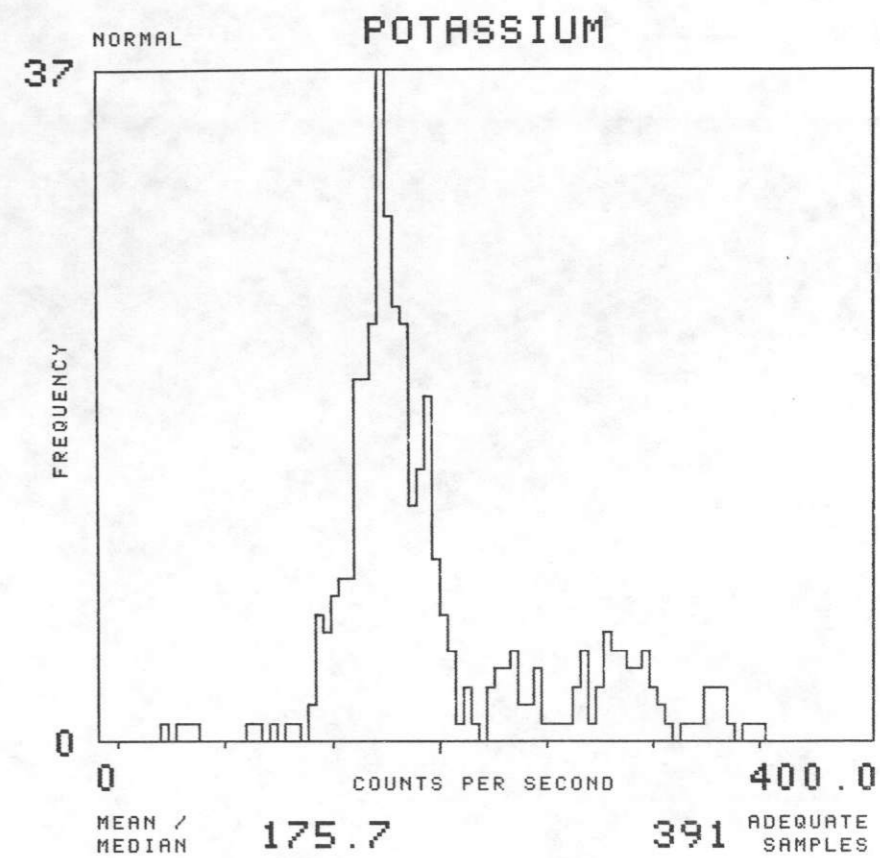
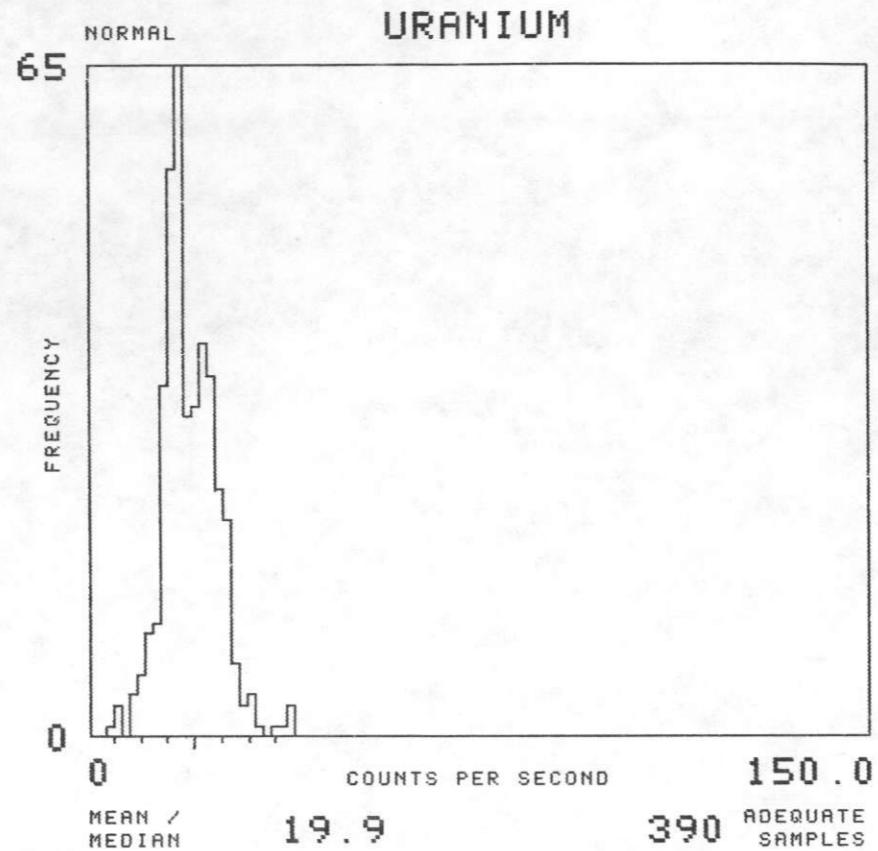
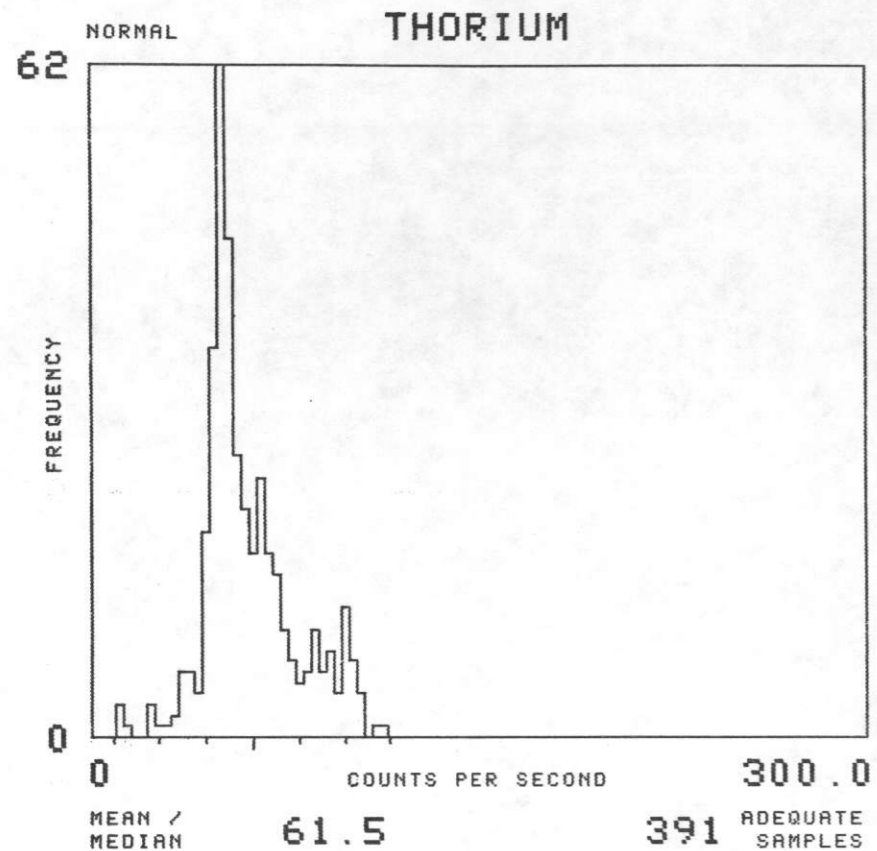
TOTAL NUMBER OF SAMPLES 1175



NTMS NI 12-3 GALLUP

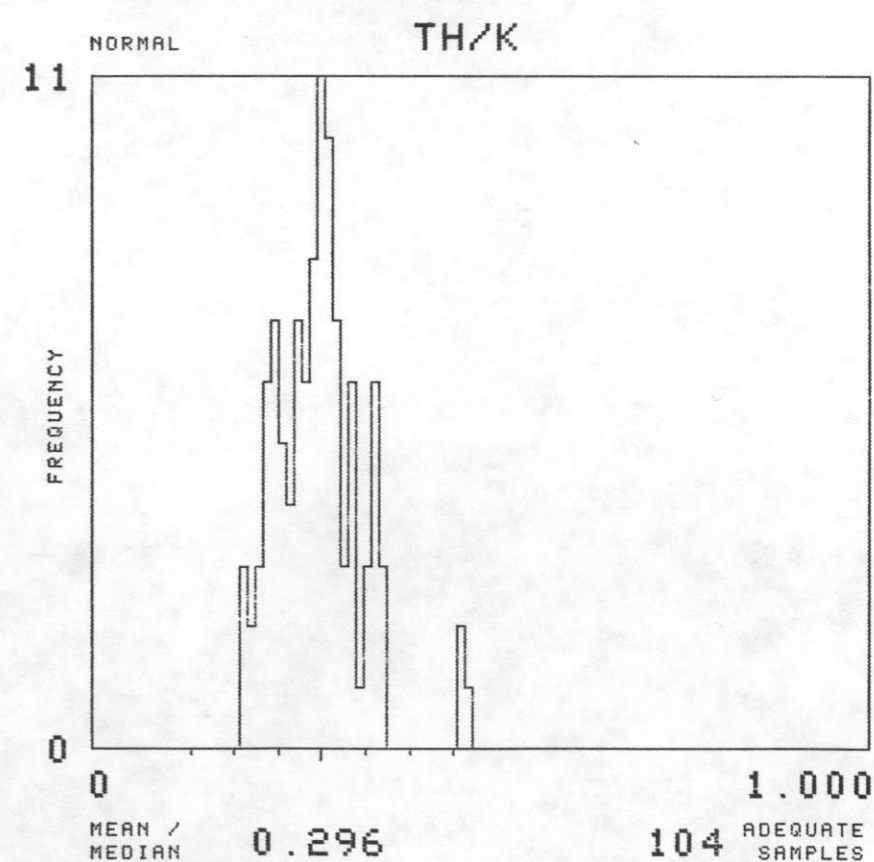
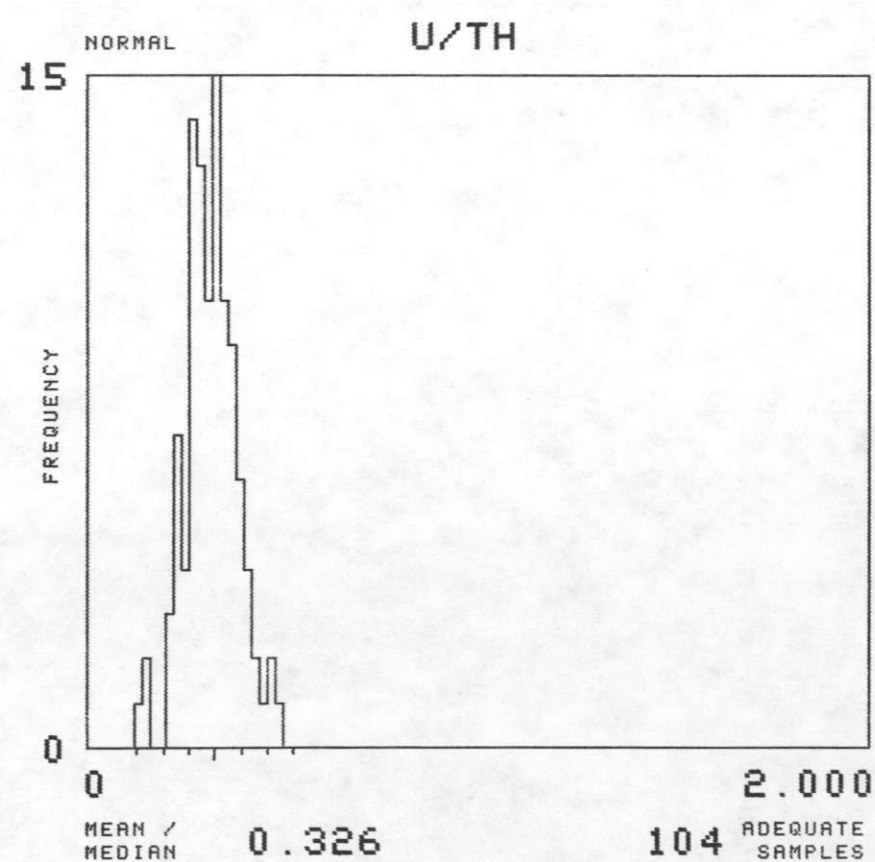
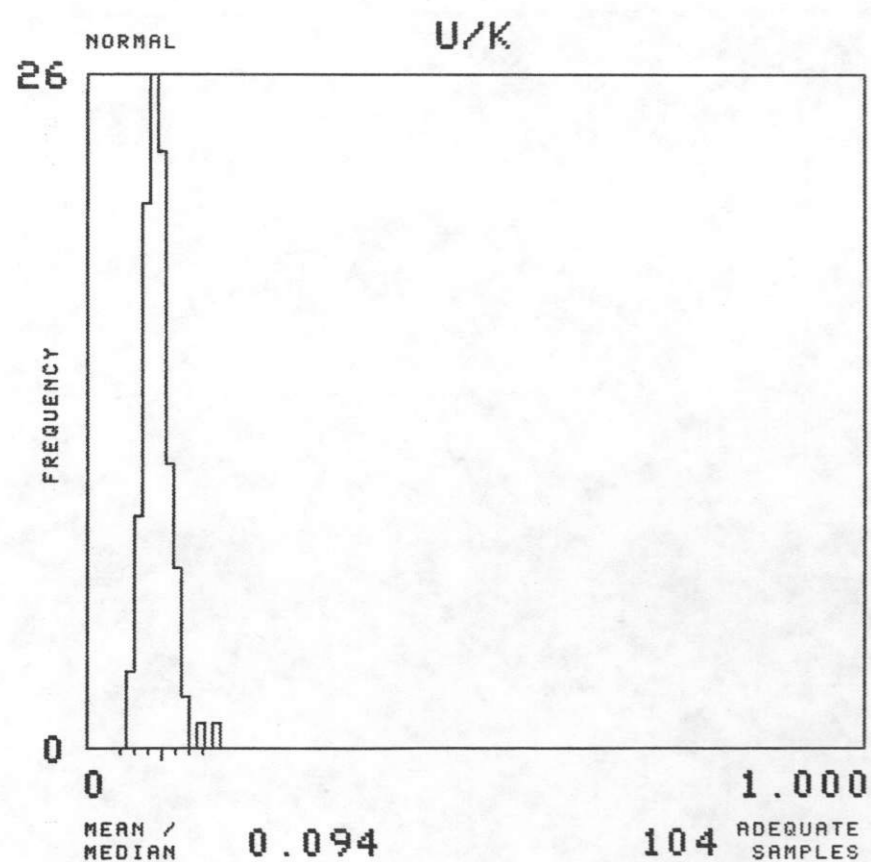
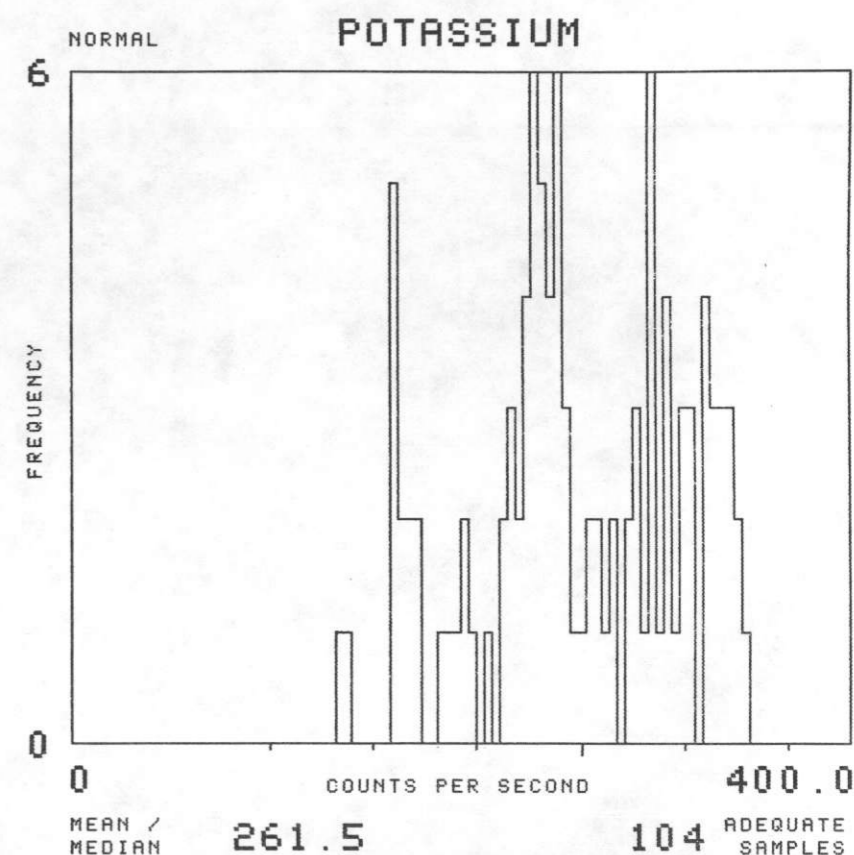
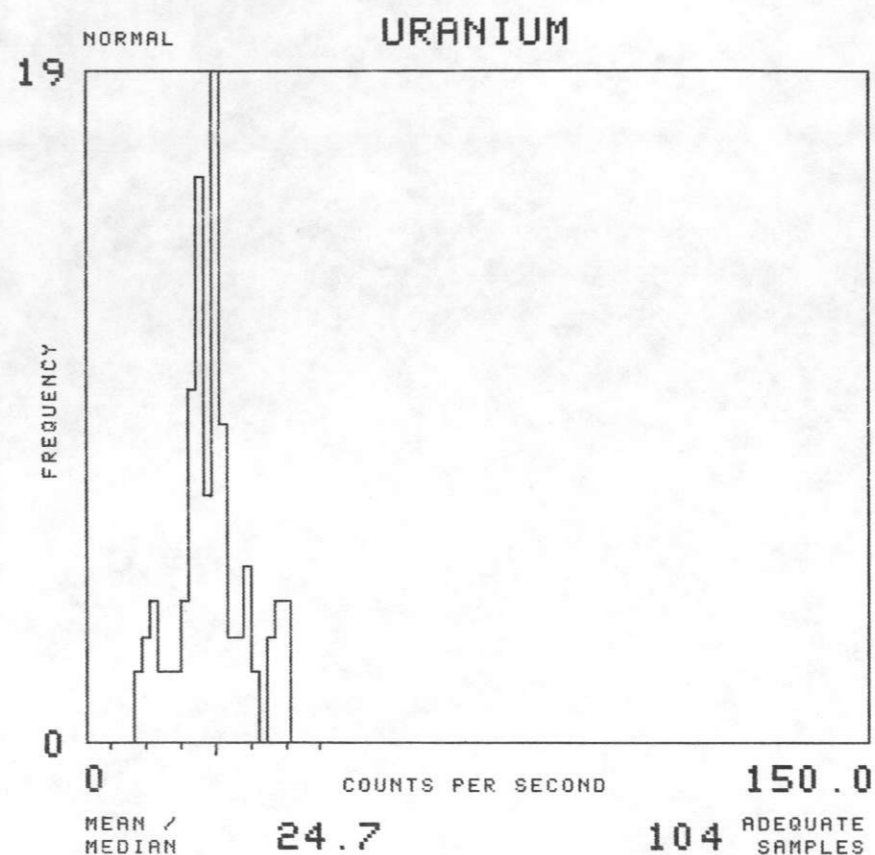
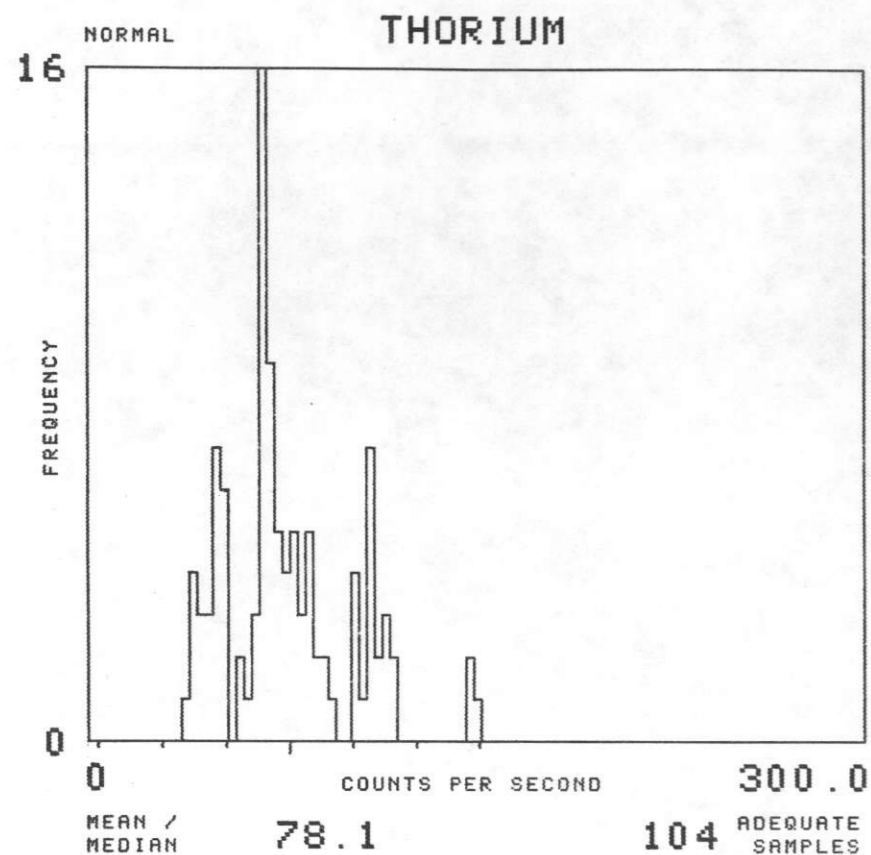
MAP UNIT : KT TOTAL NUMBER OF SAMPLES 696





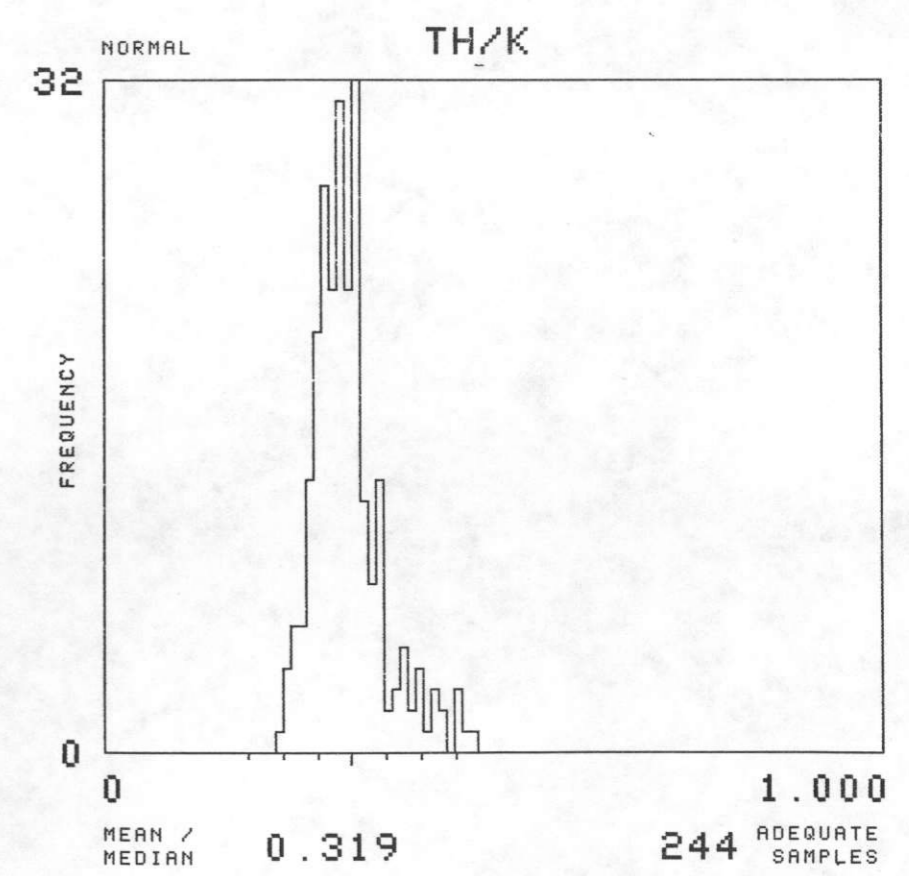
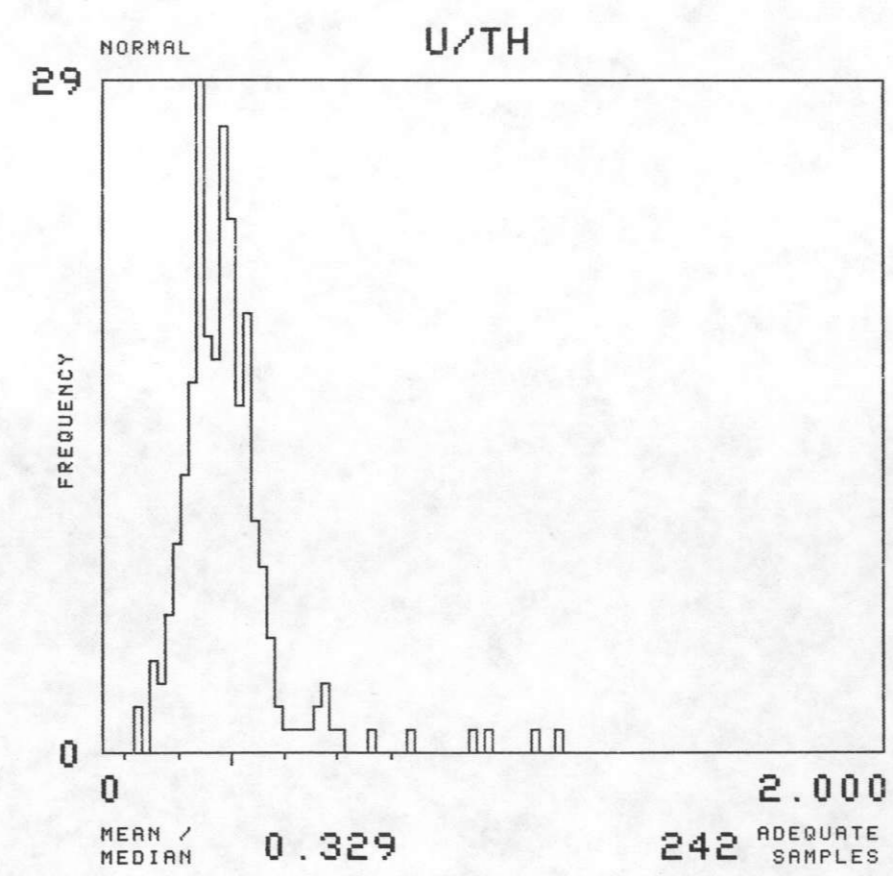
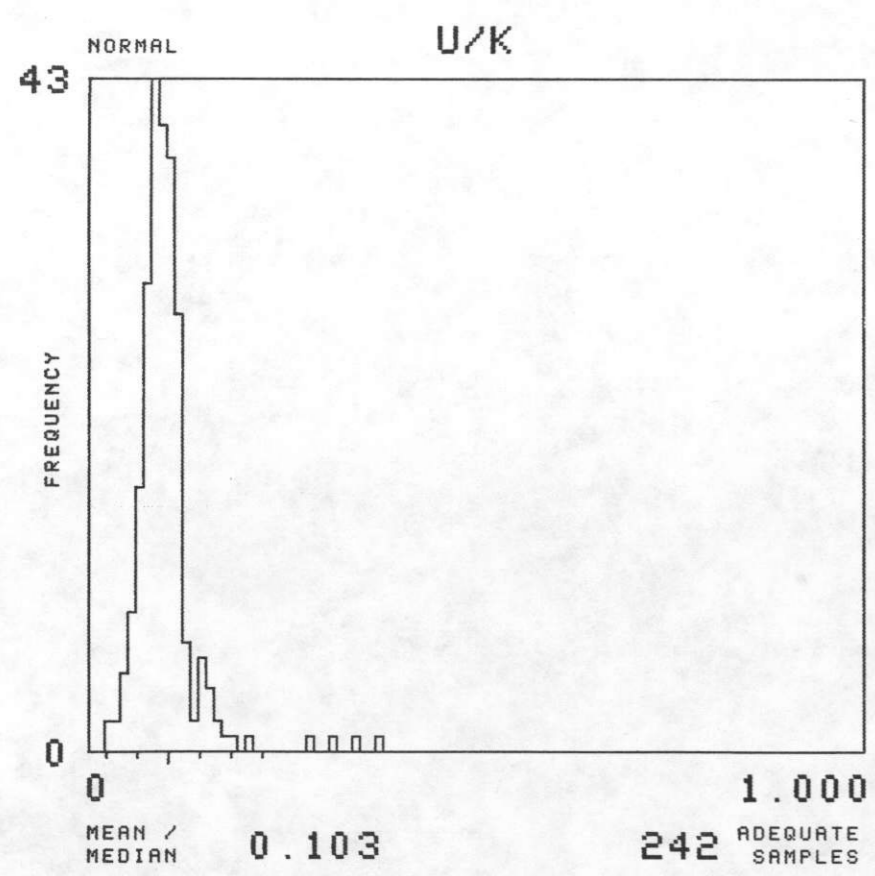
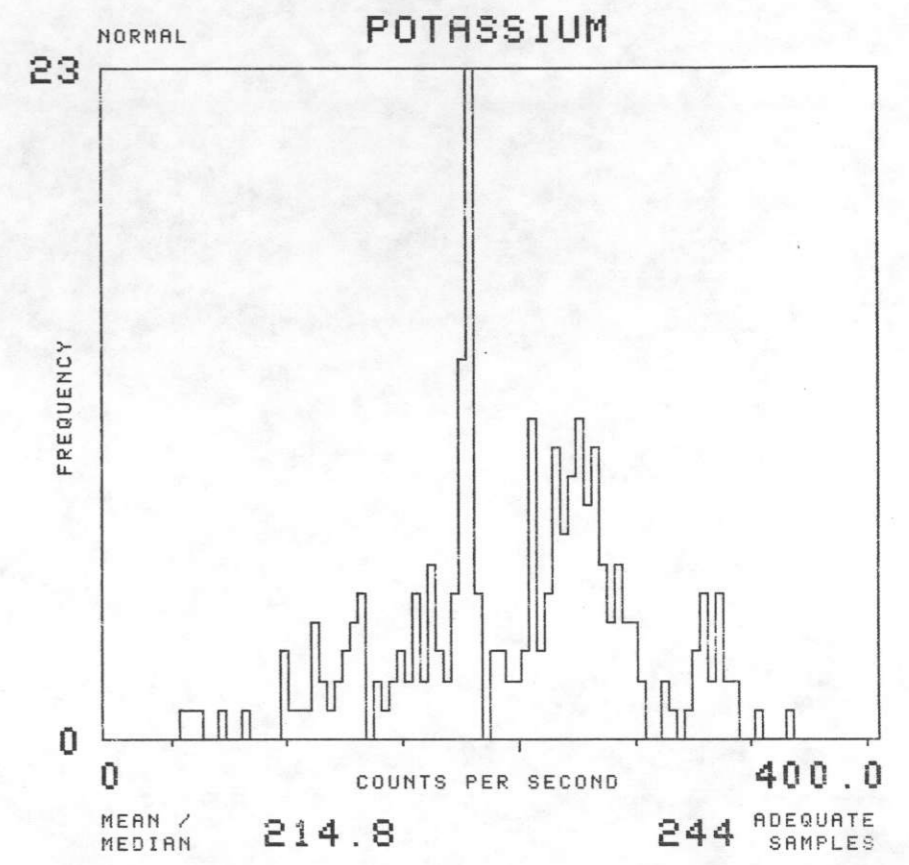
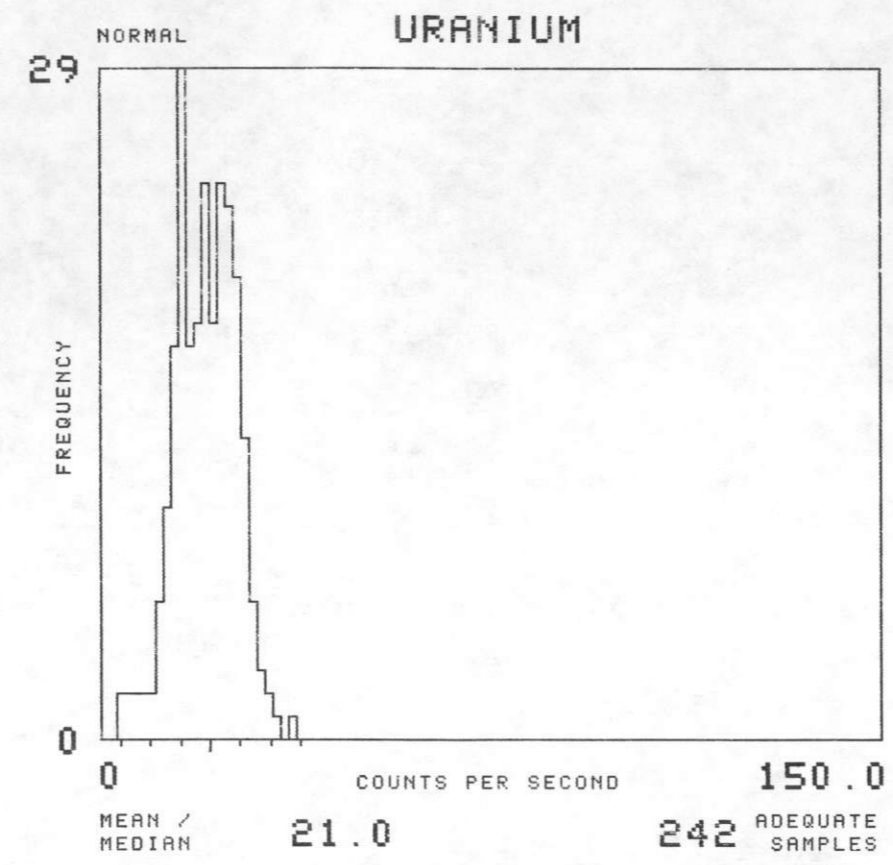
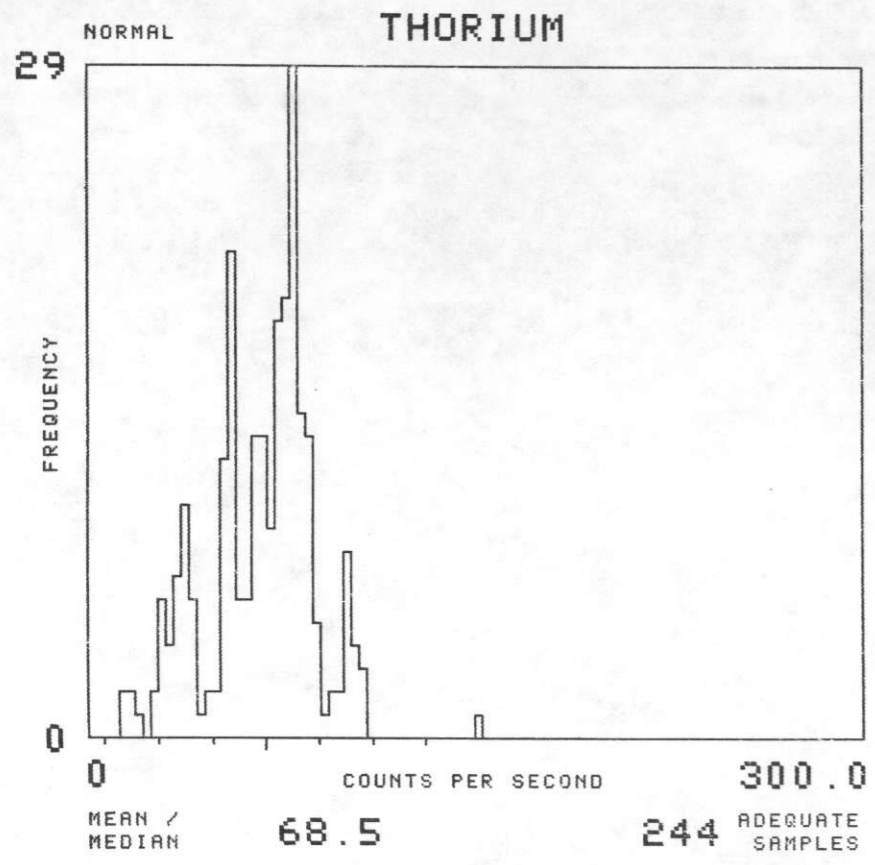
NTMS NI 12-3 GALLUP

MAP UNIT : PCAP TOTAL NUMBER OF SAMPLES 115



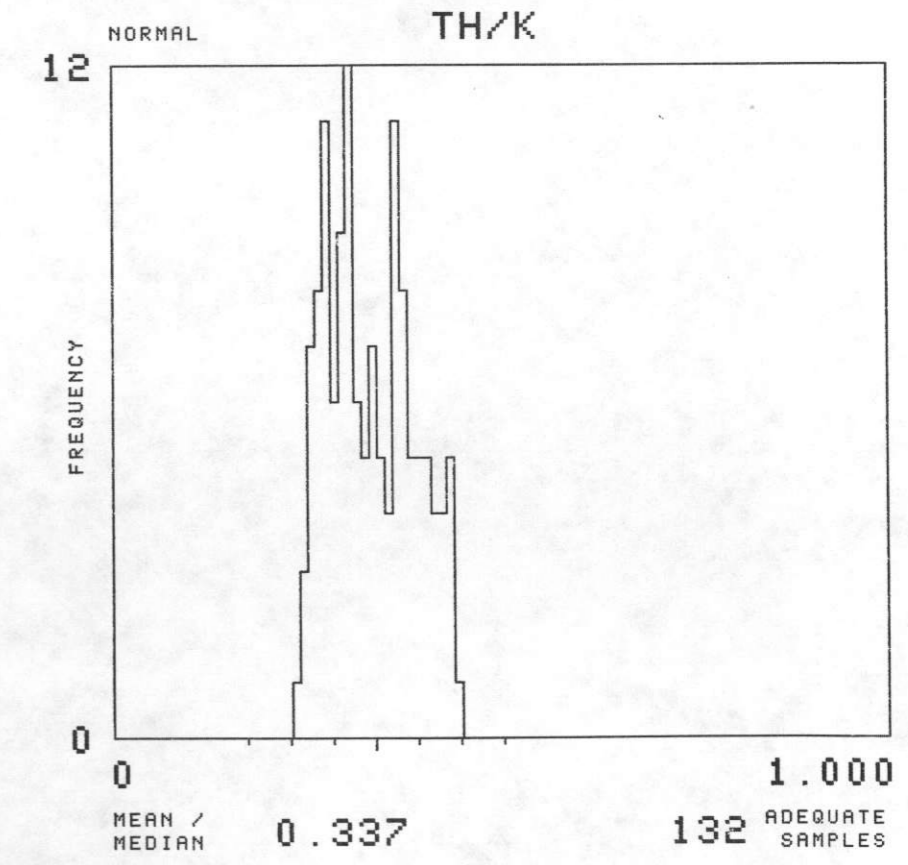
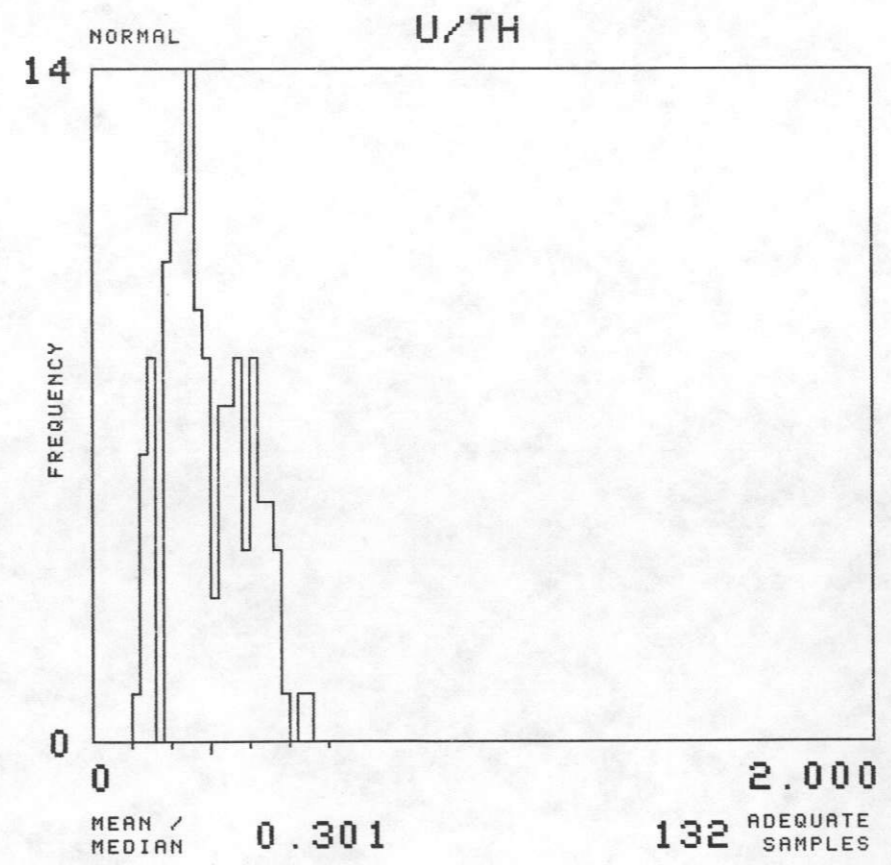
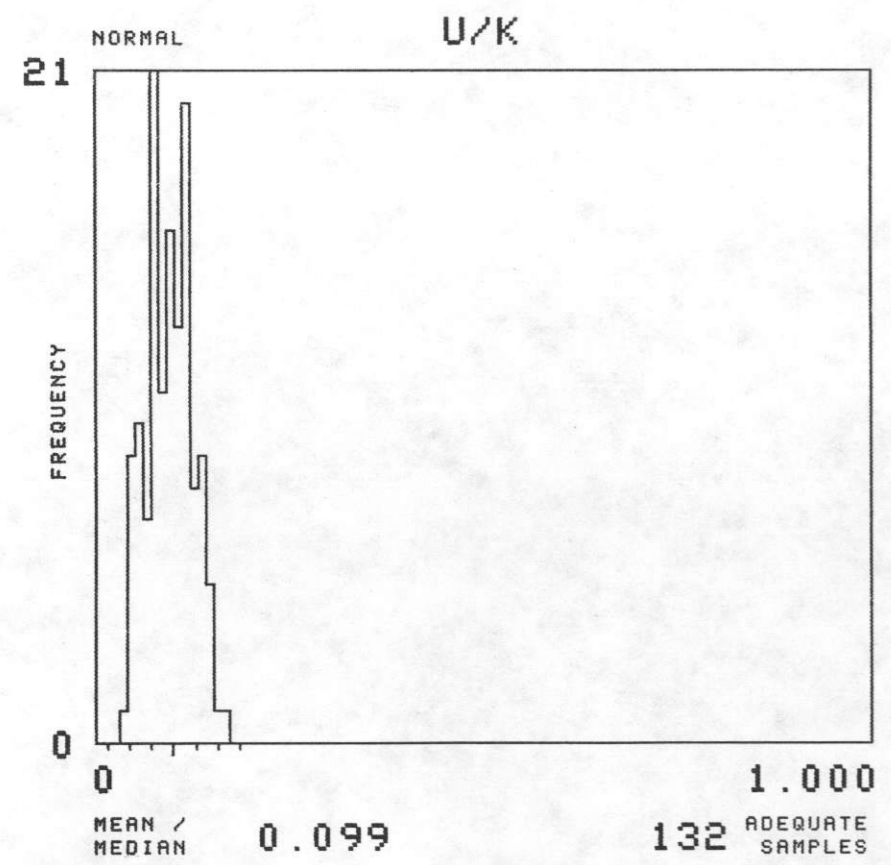
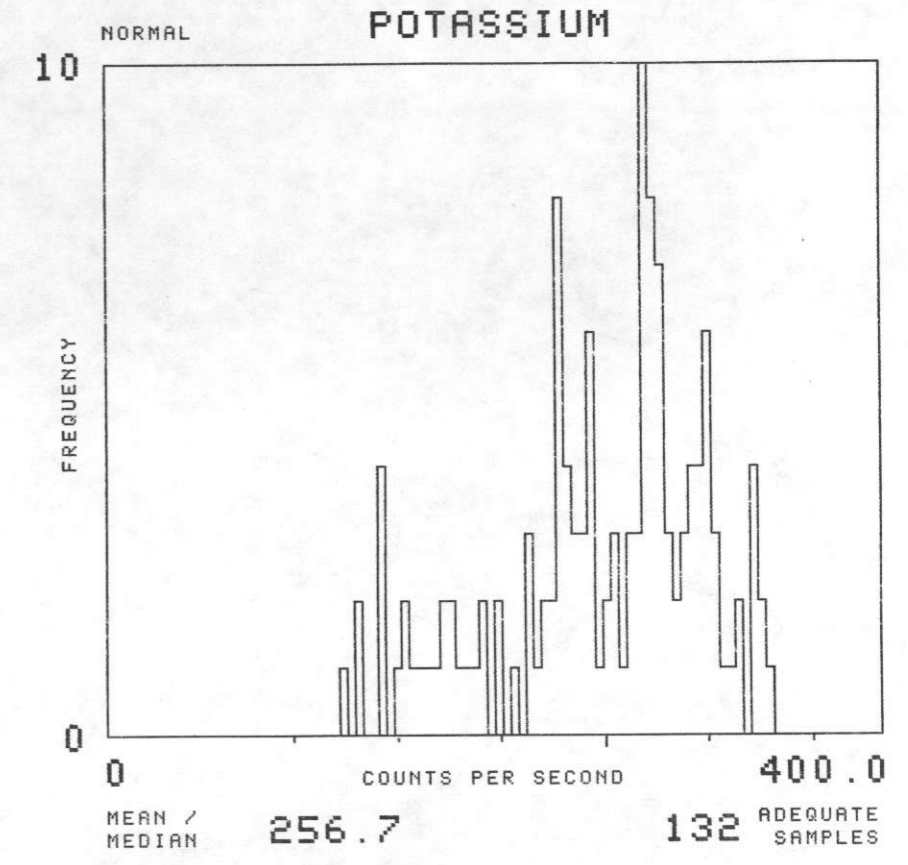
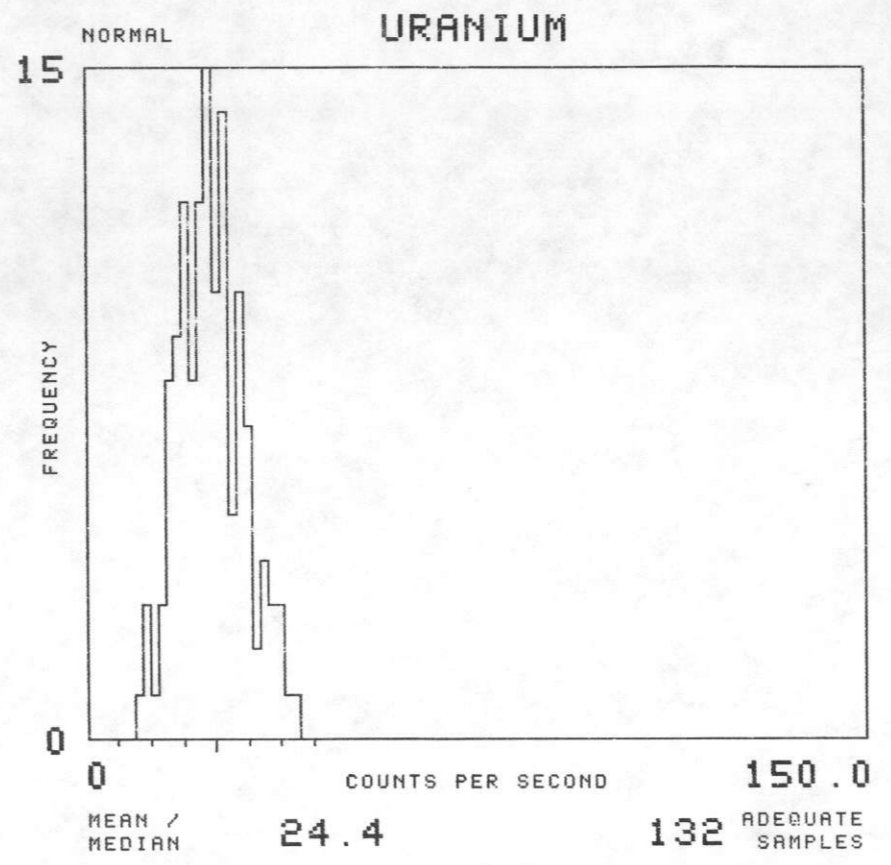
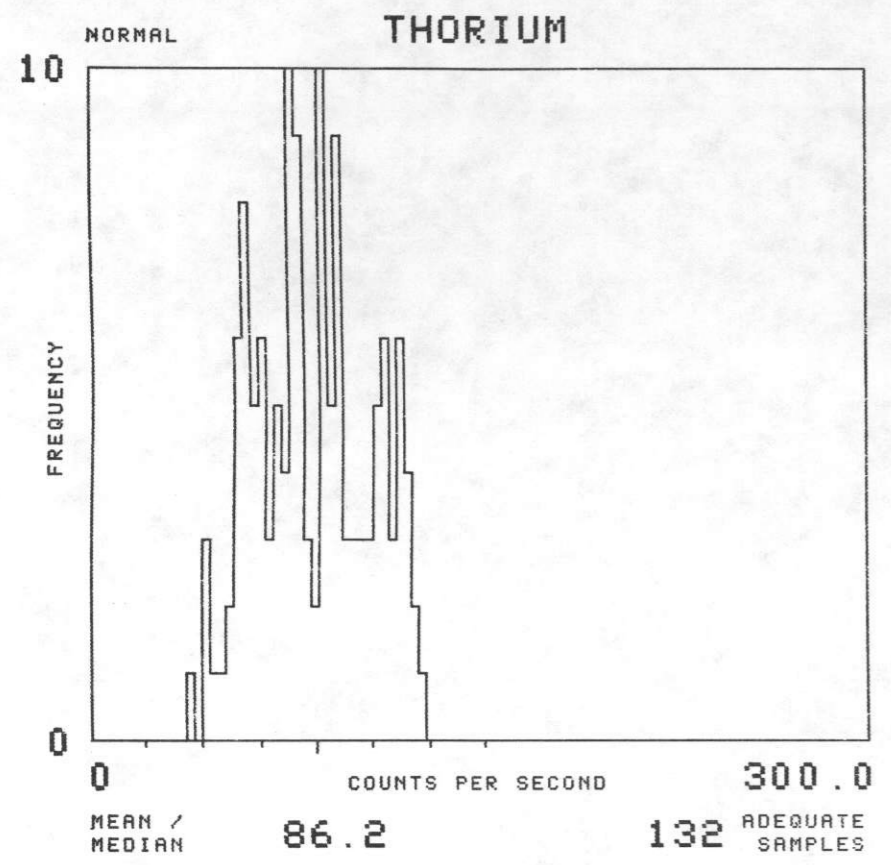
NTMS NI 12-3 GALLUP

MAP UNIT : PC66 TOTAL NUMBER OF SAMPLES 278



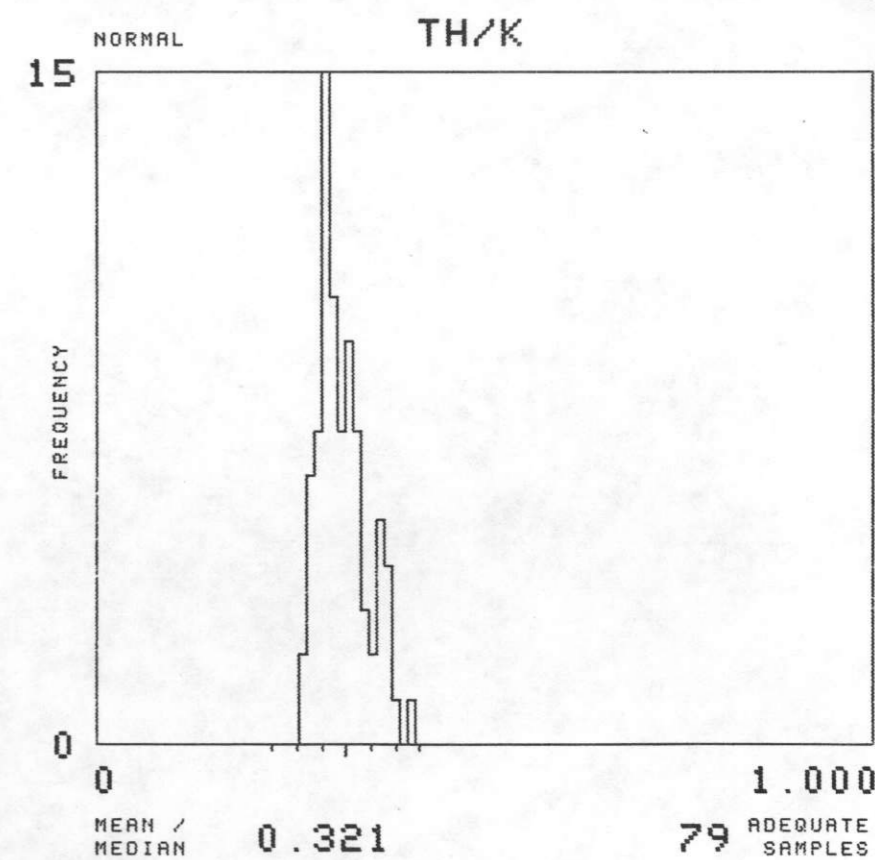
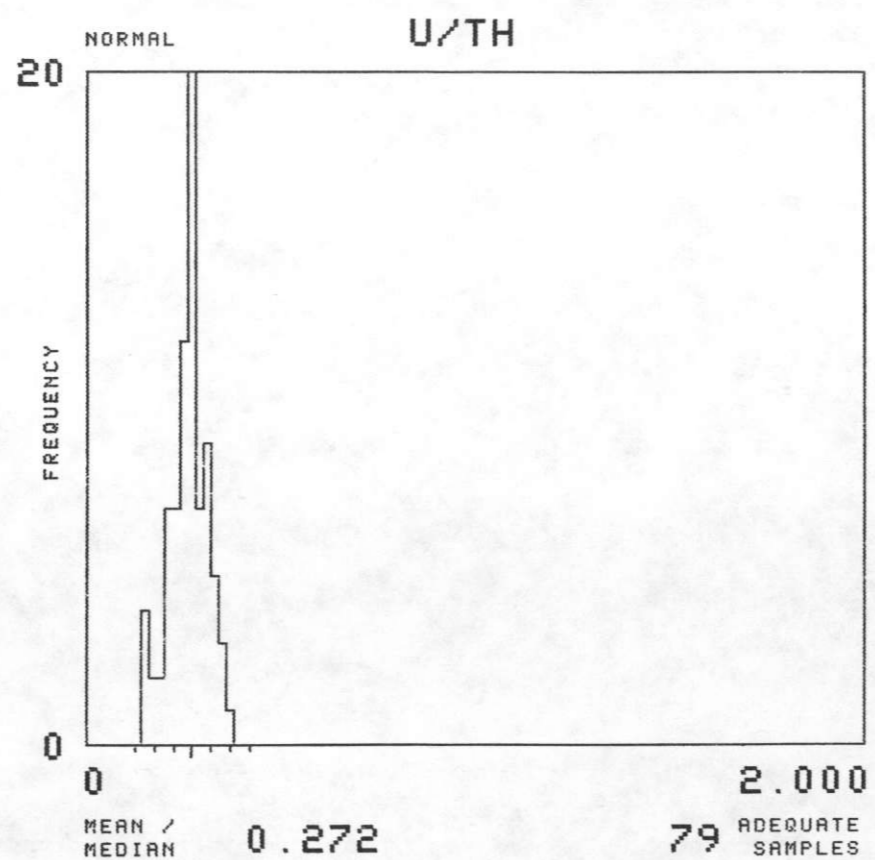
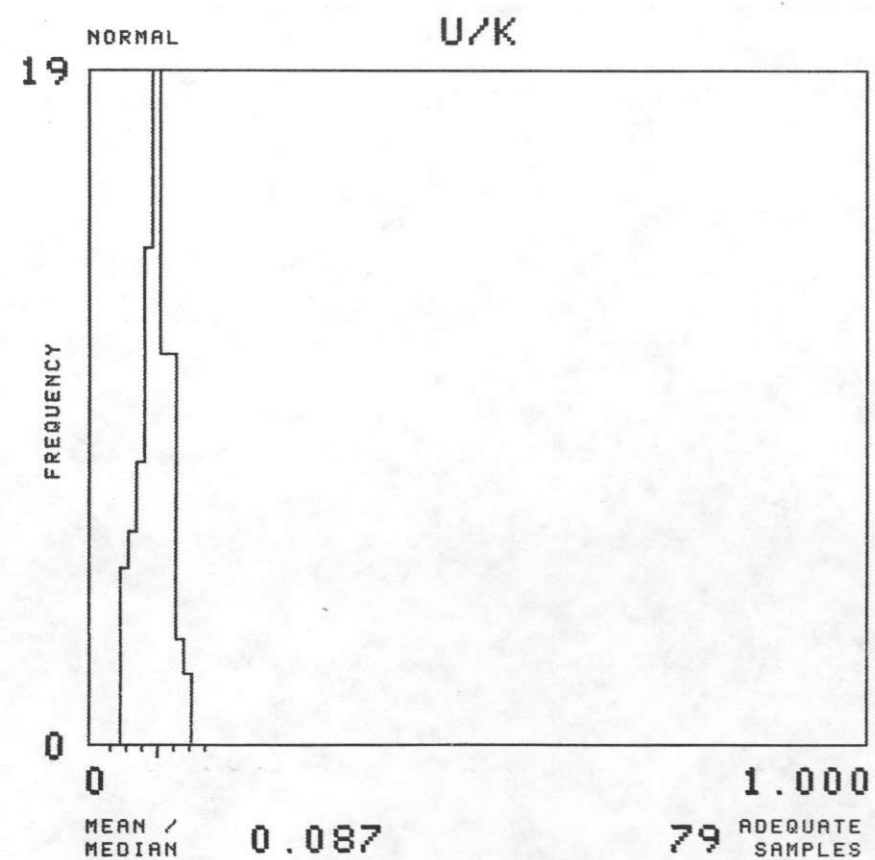
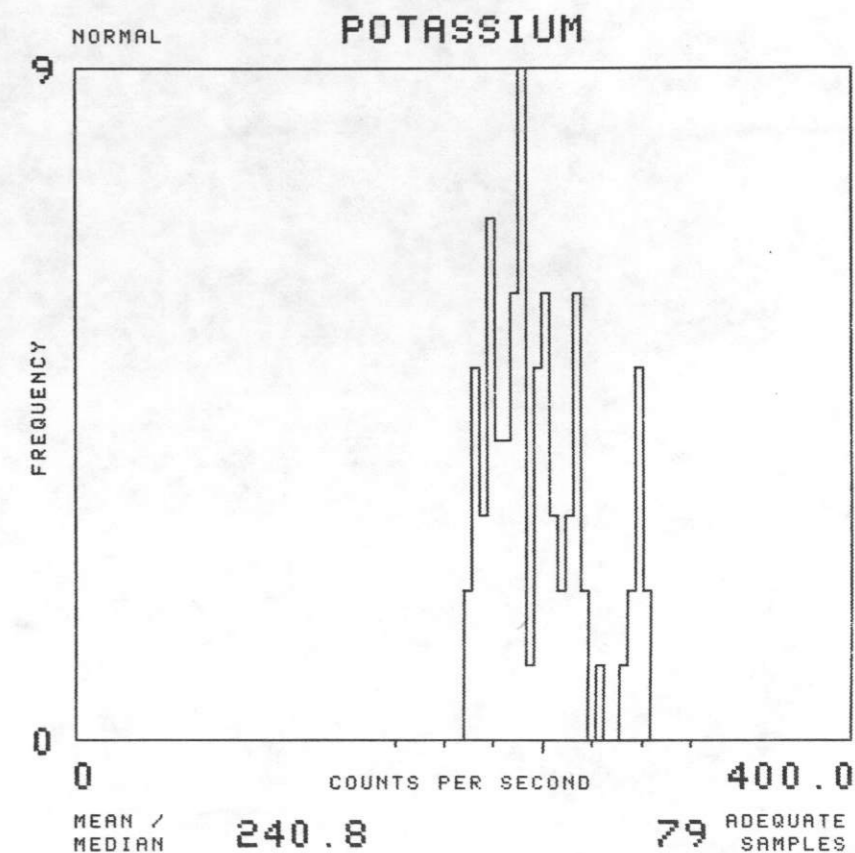
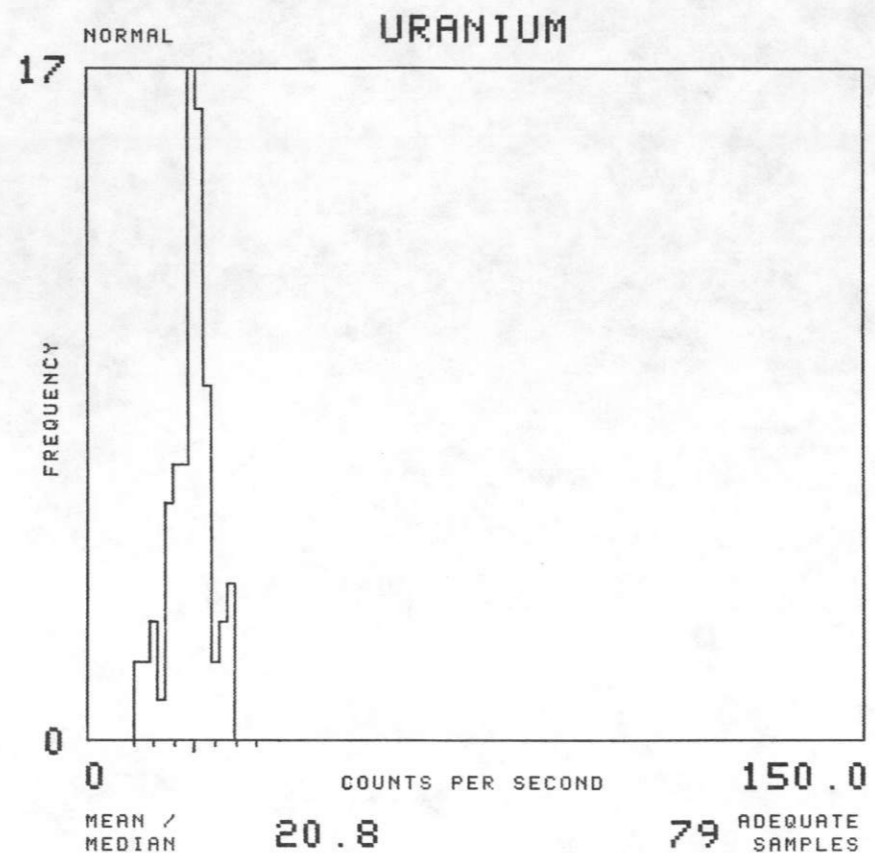
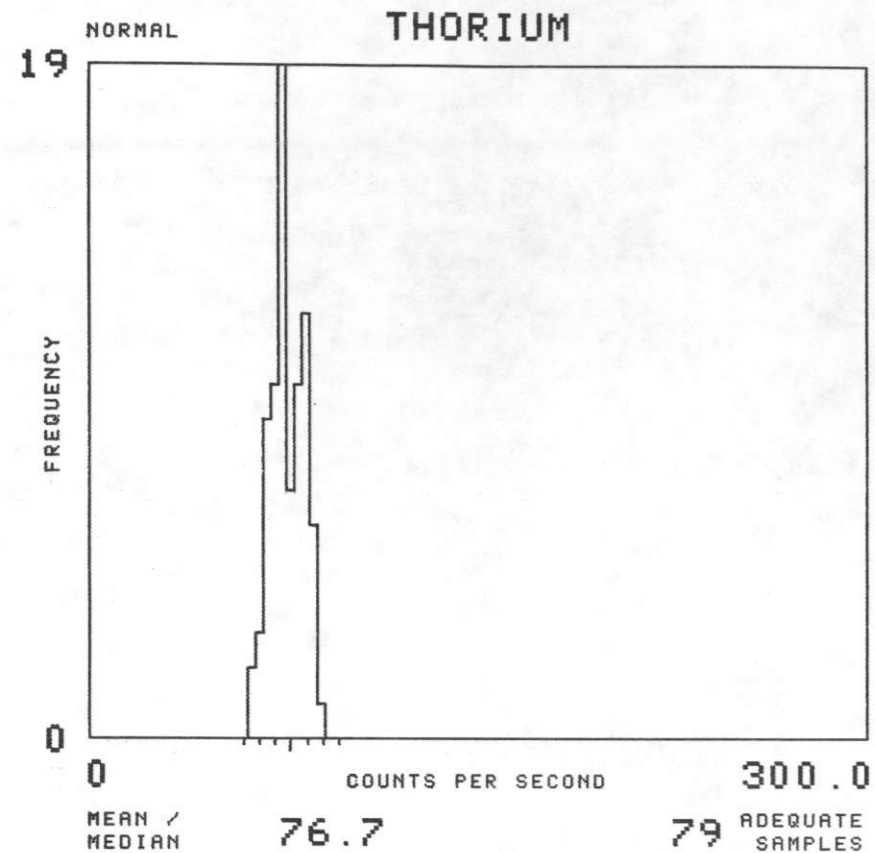
NTMS NI 12-3 GALLUP

MAP UNIT : PCGM TOTAL NUMBER OF SAMPLES 132



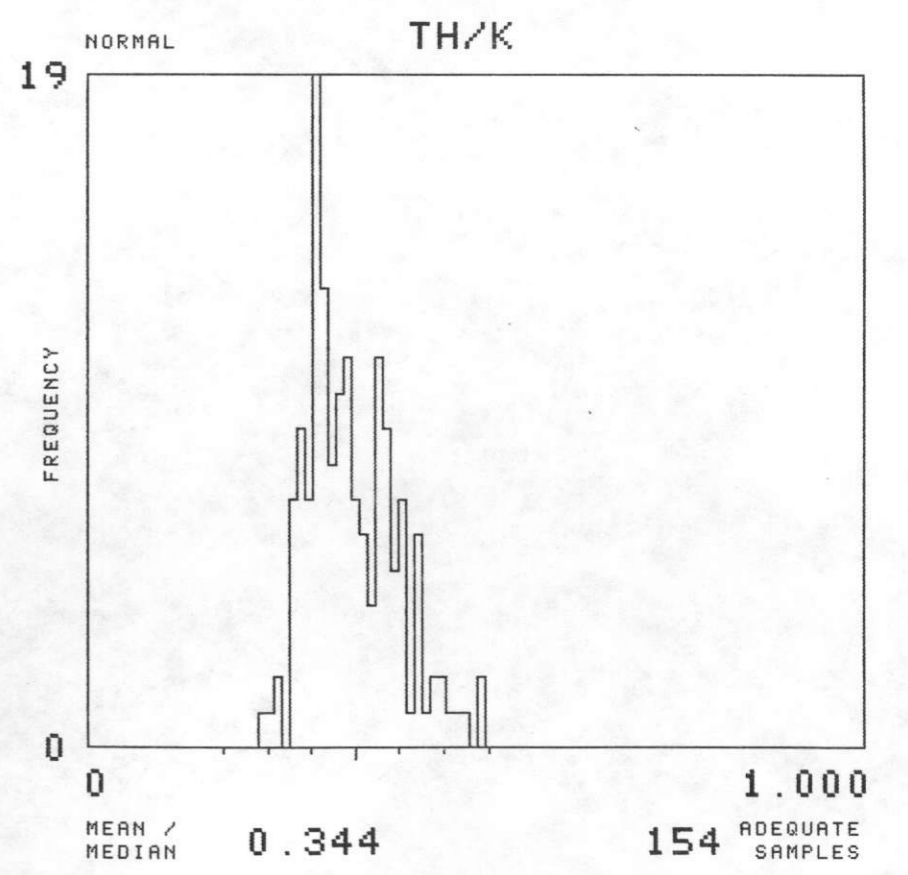
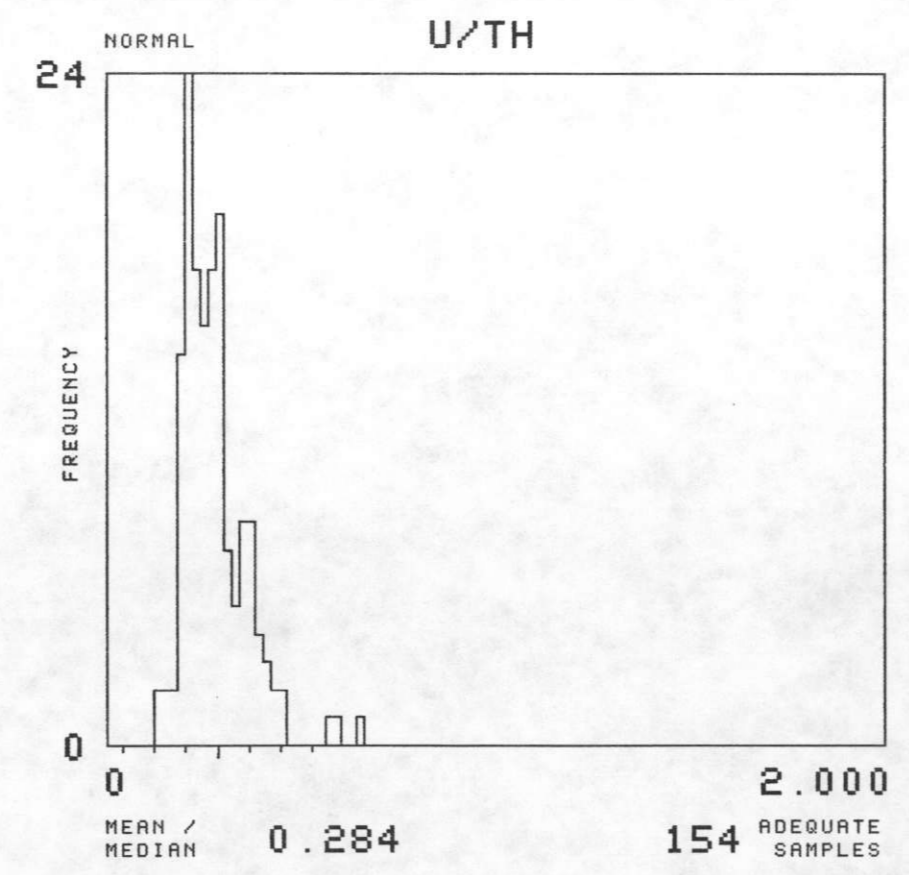
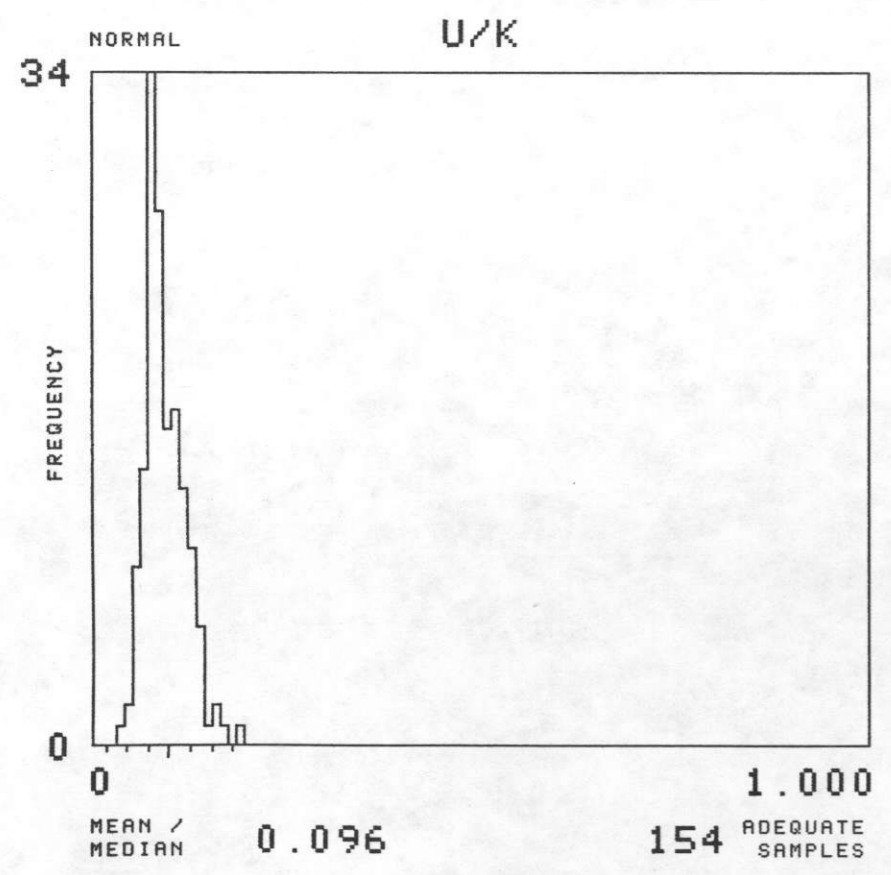
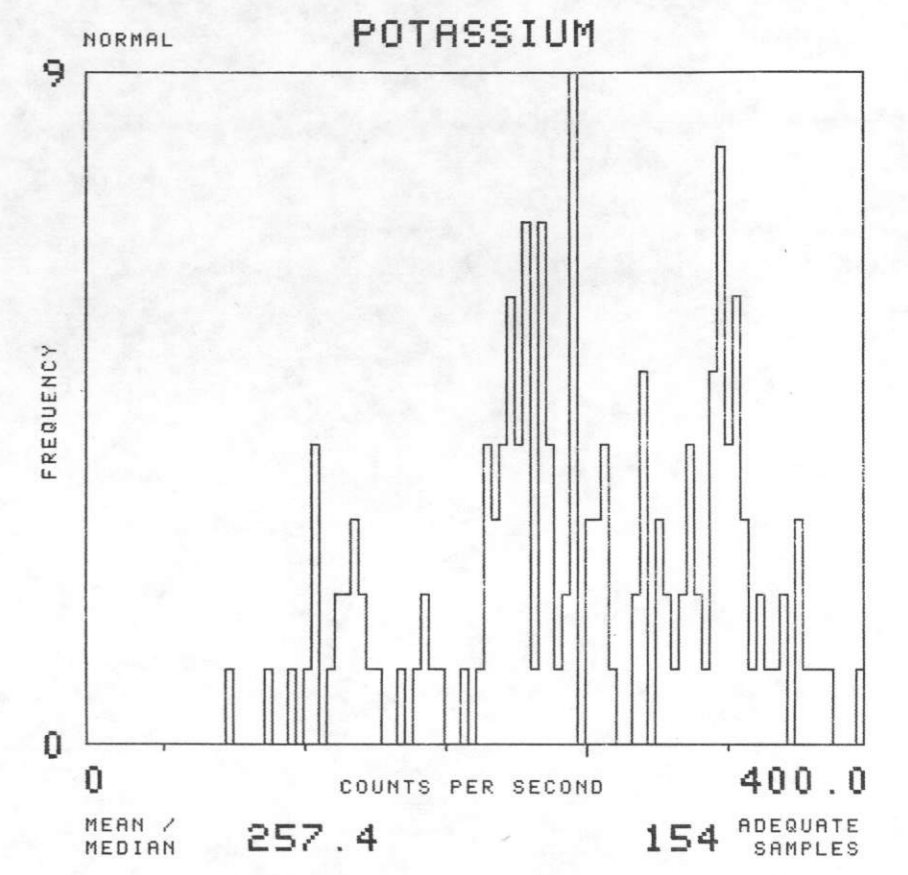
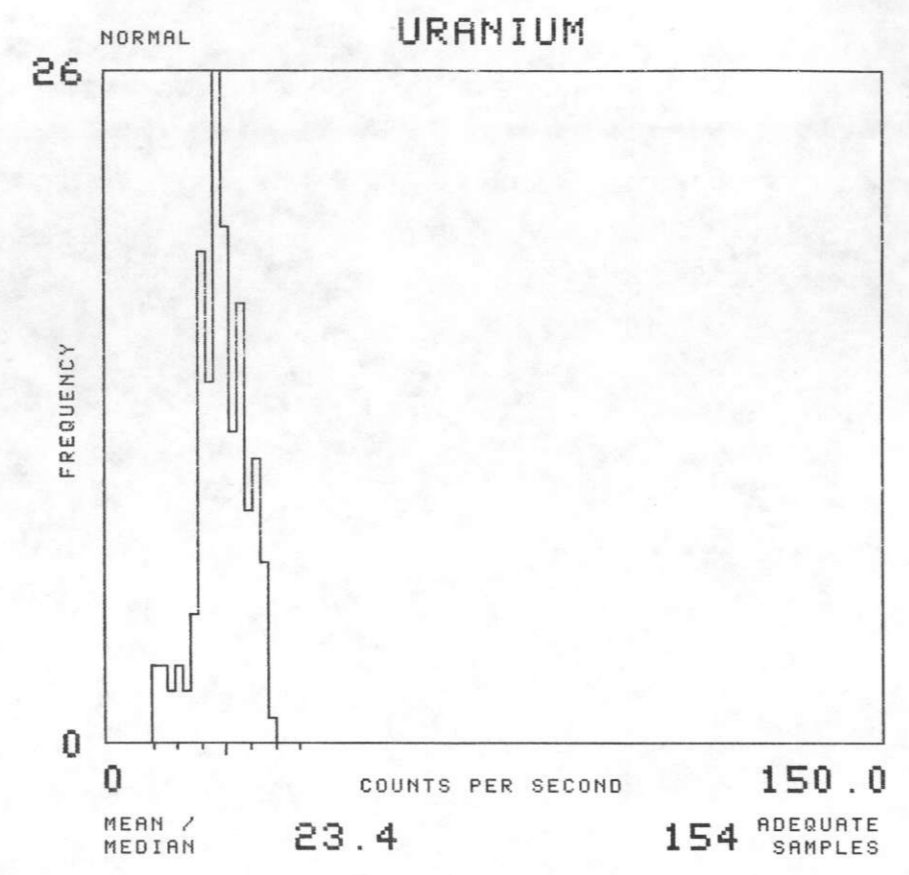
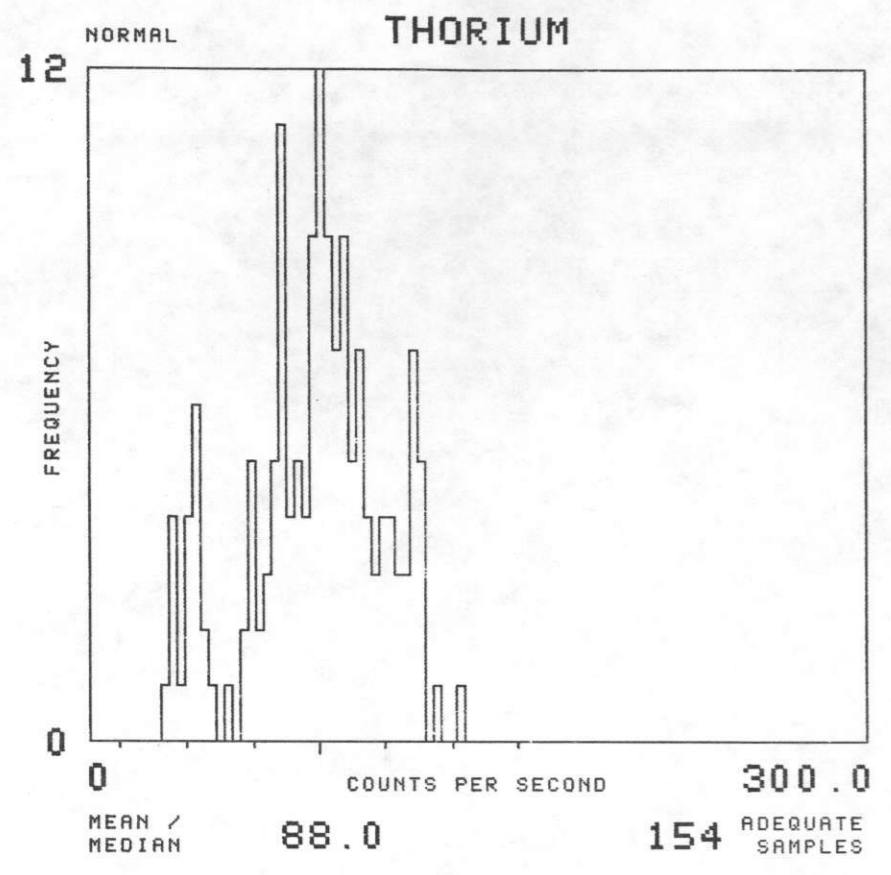
NTMS NI 12-3 GALLUP

MAP UNIT : PCM TOTAL NUMBER OF SAMPLES 118



NTMS NI 12-3 GALLUP

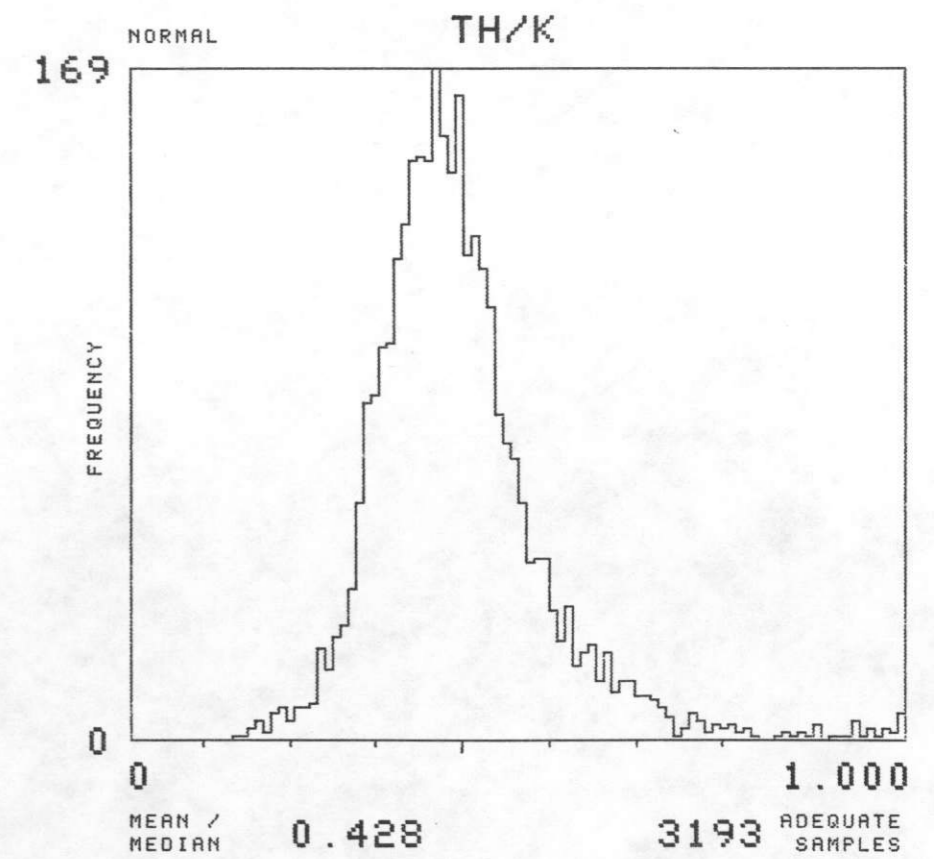
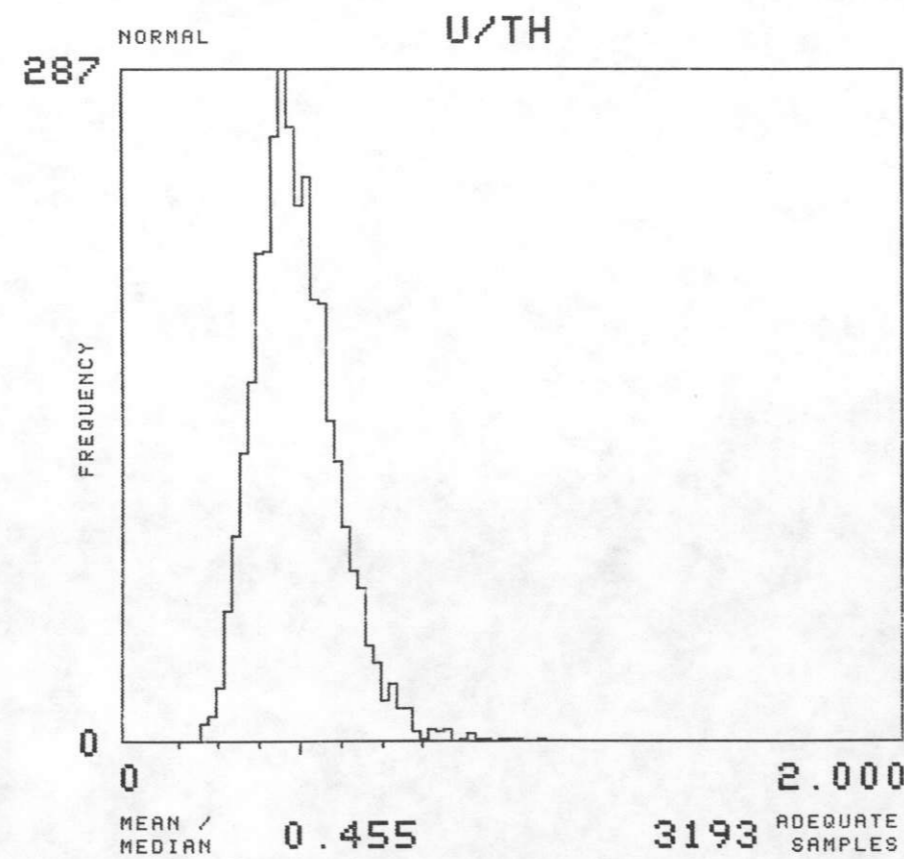
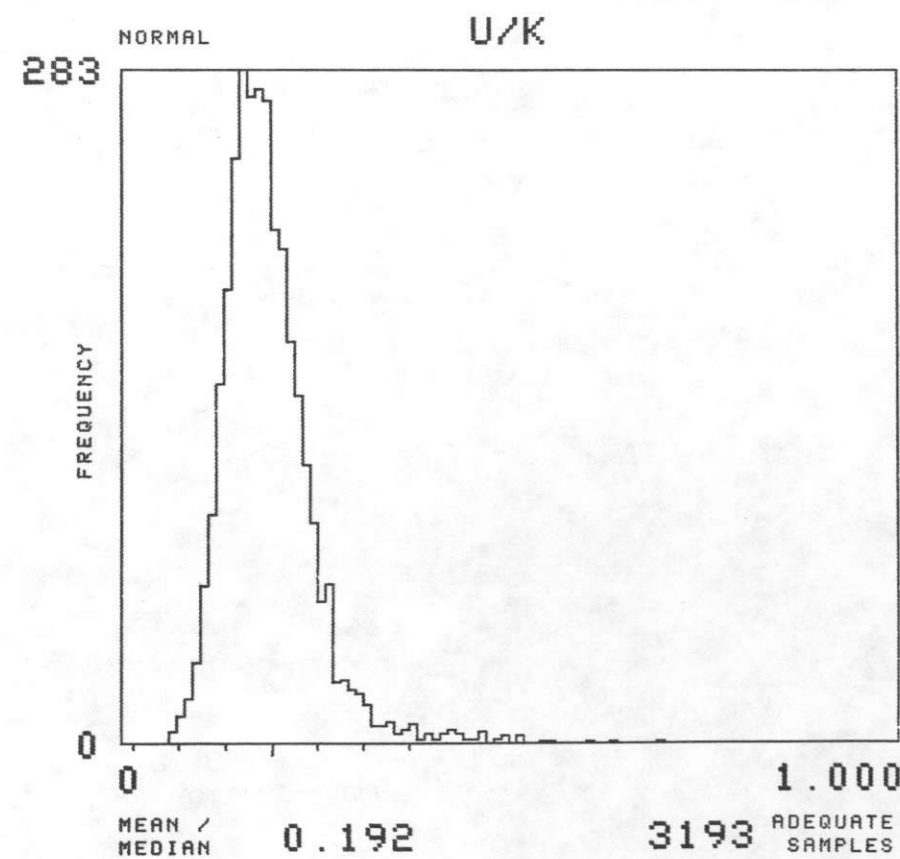
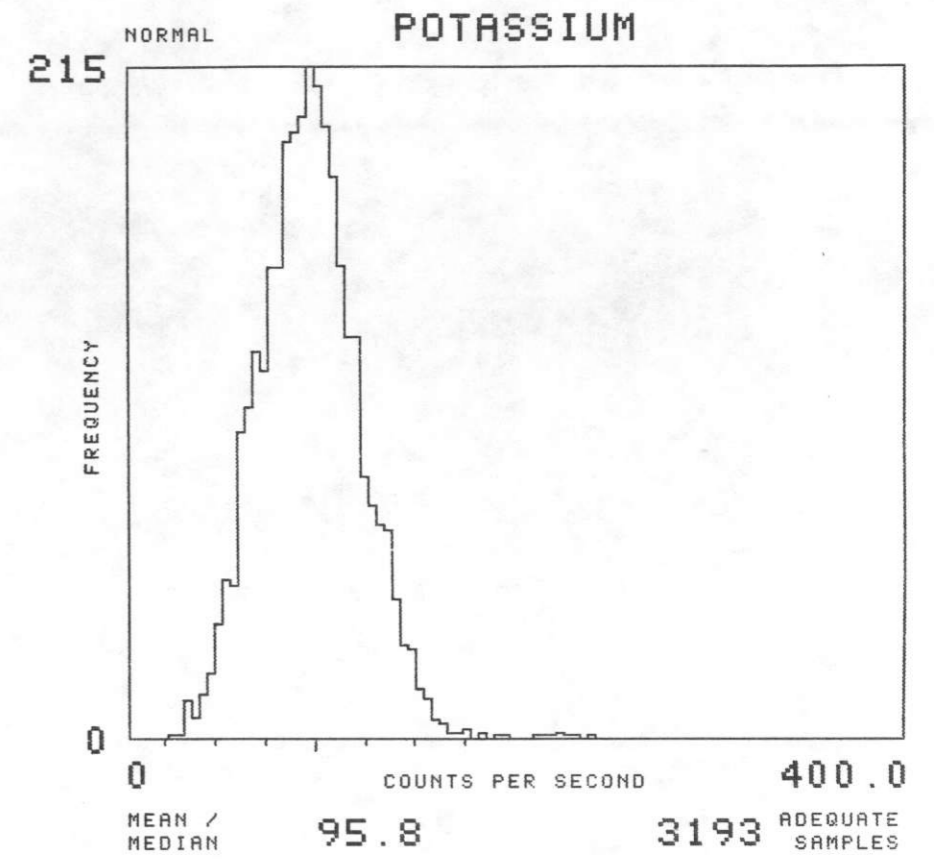
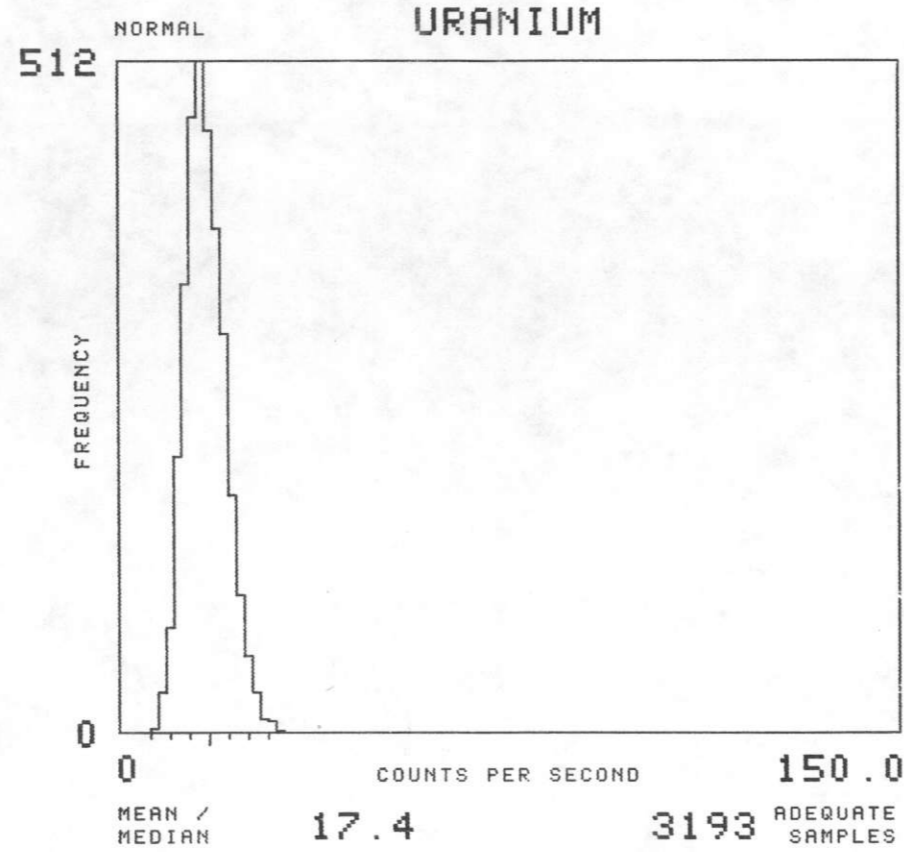
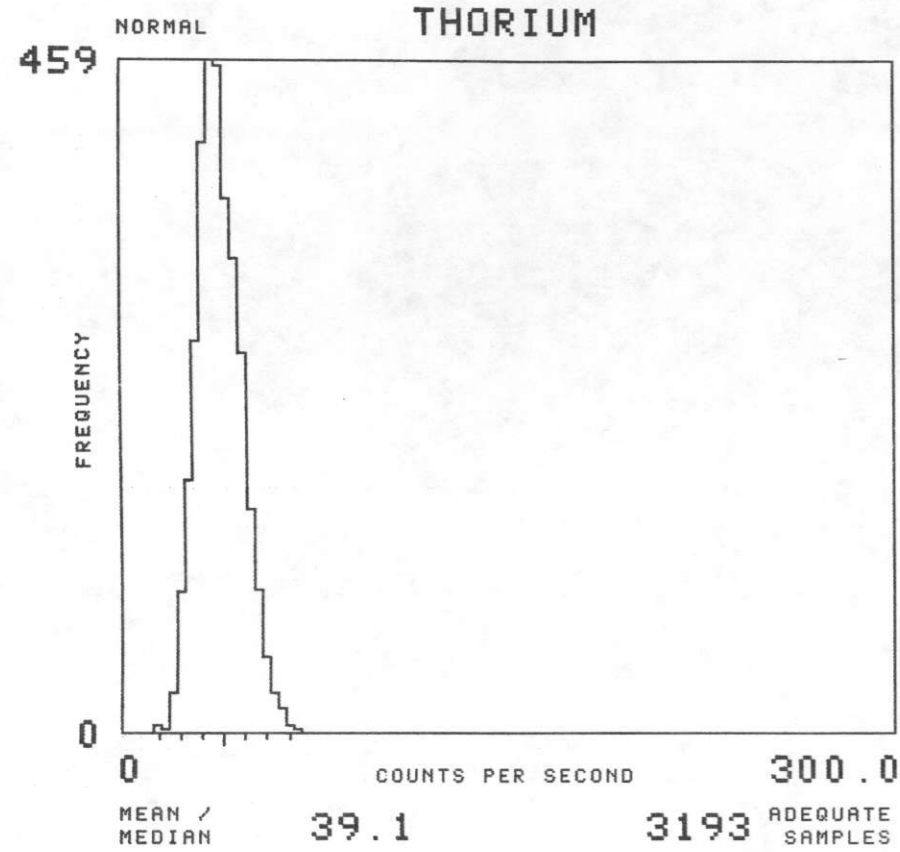
MAP UNIT : PCP TOTAL NUMBER OF SAMPLES 170

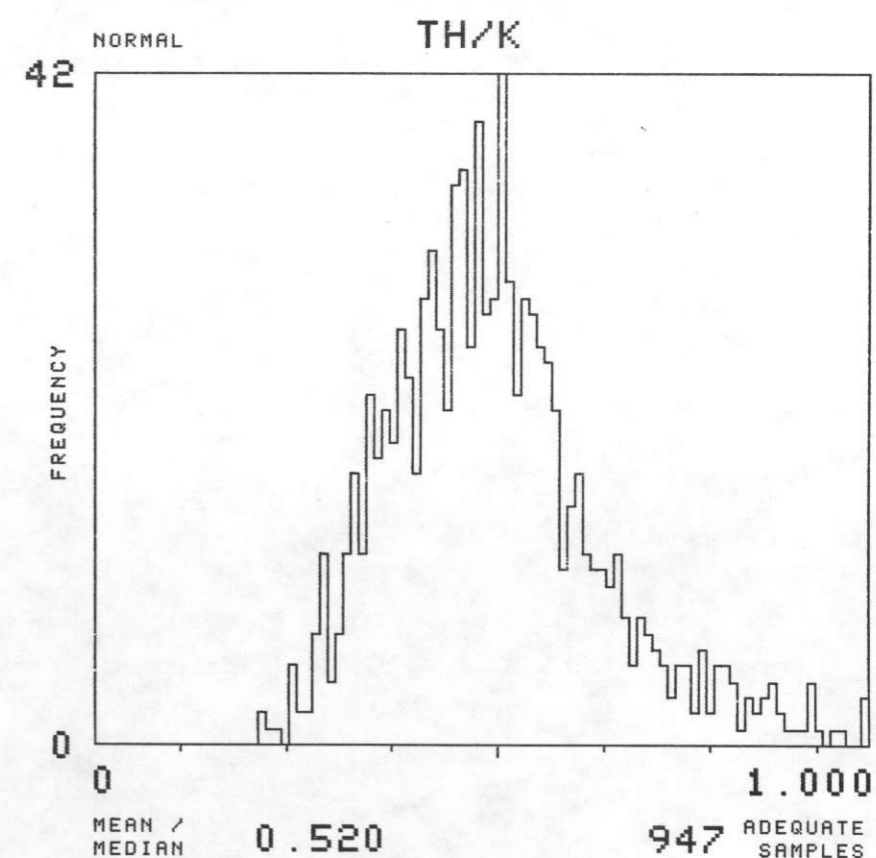
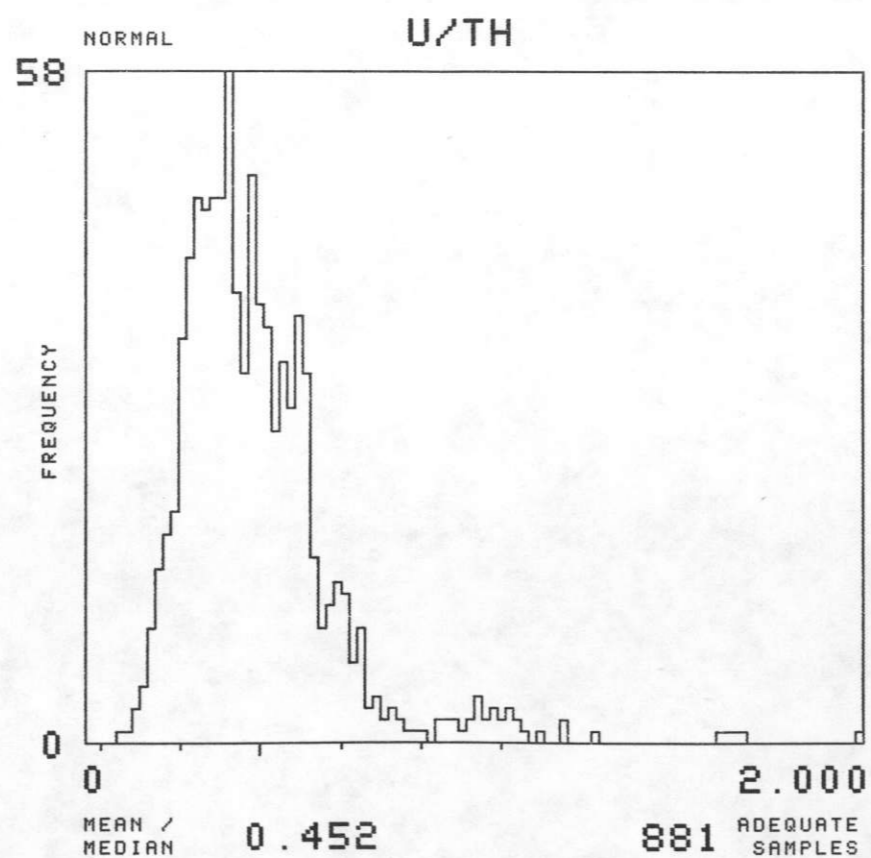
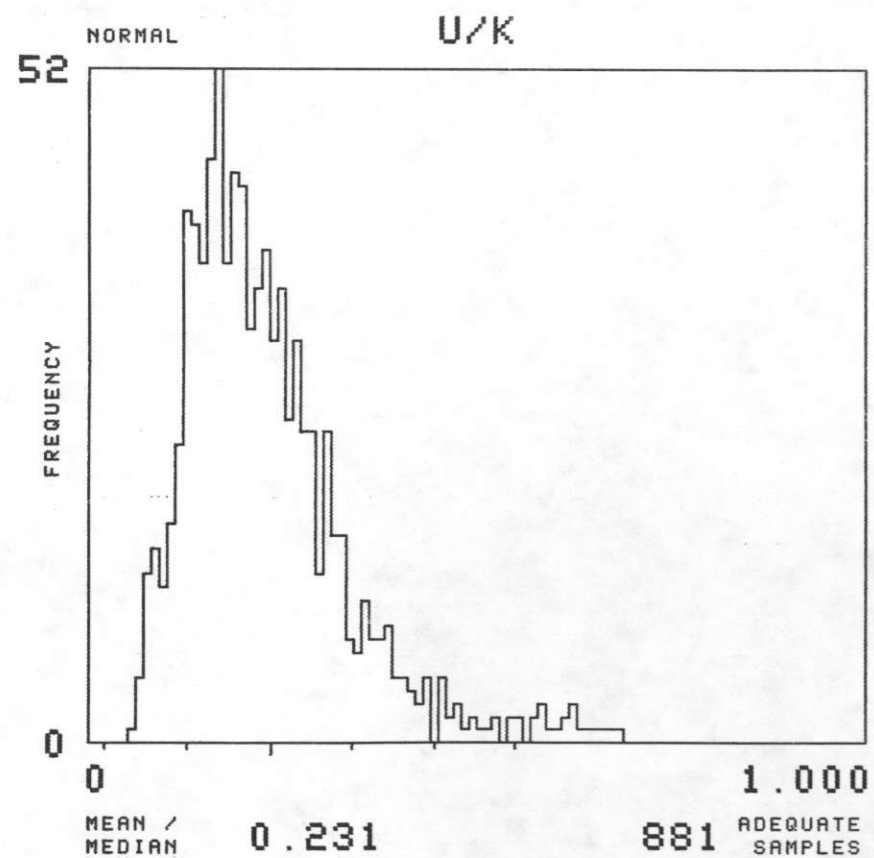
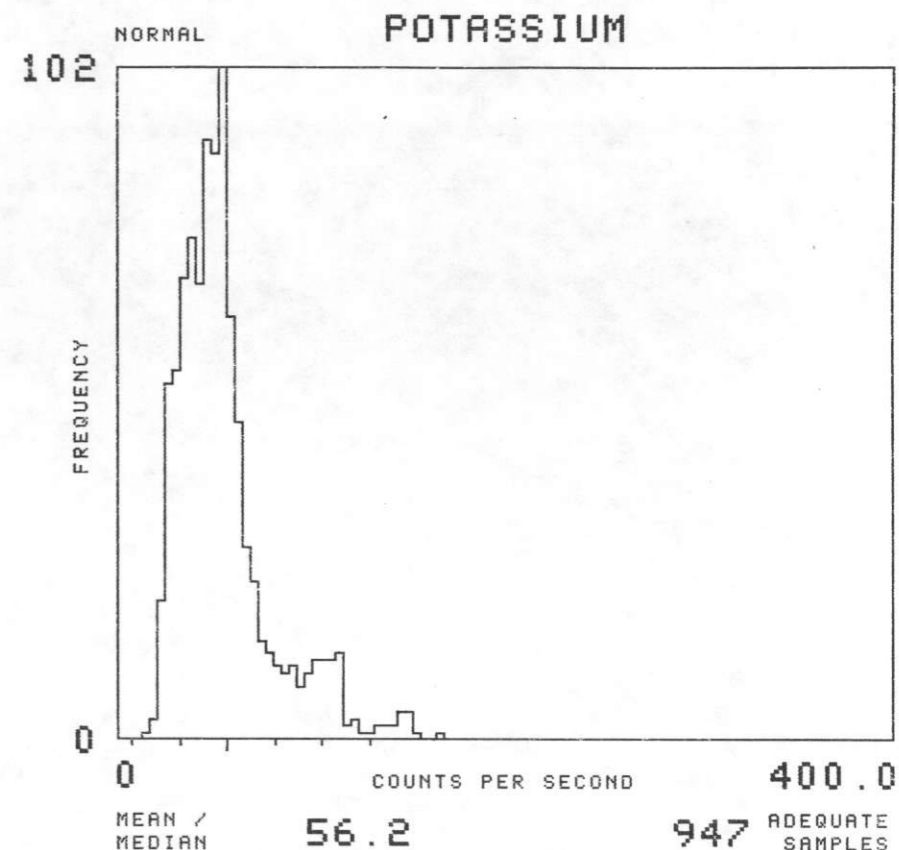
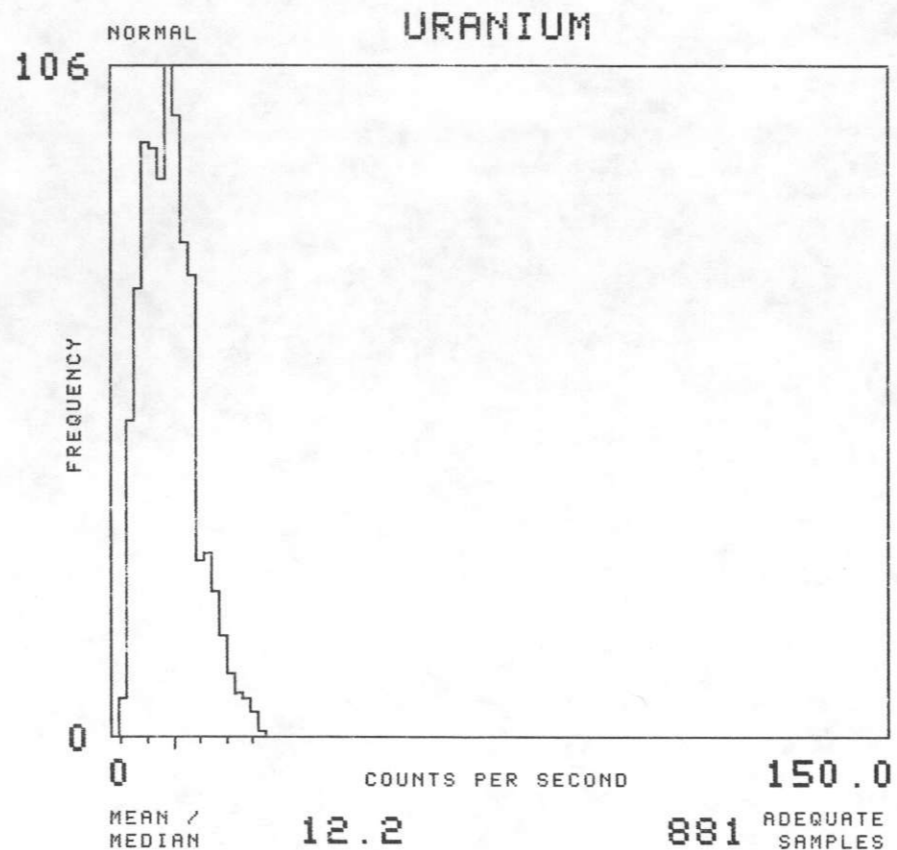
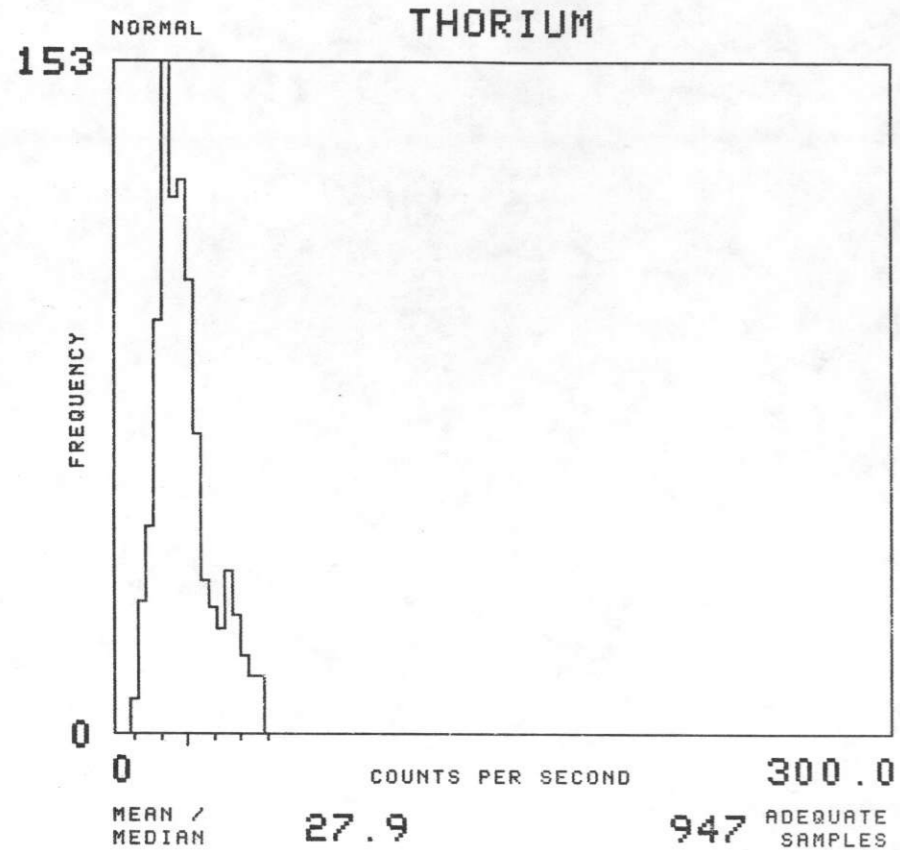


NTMS NI 12-3 GALLUP

MAP UNIT : PD

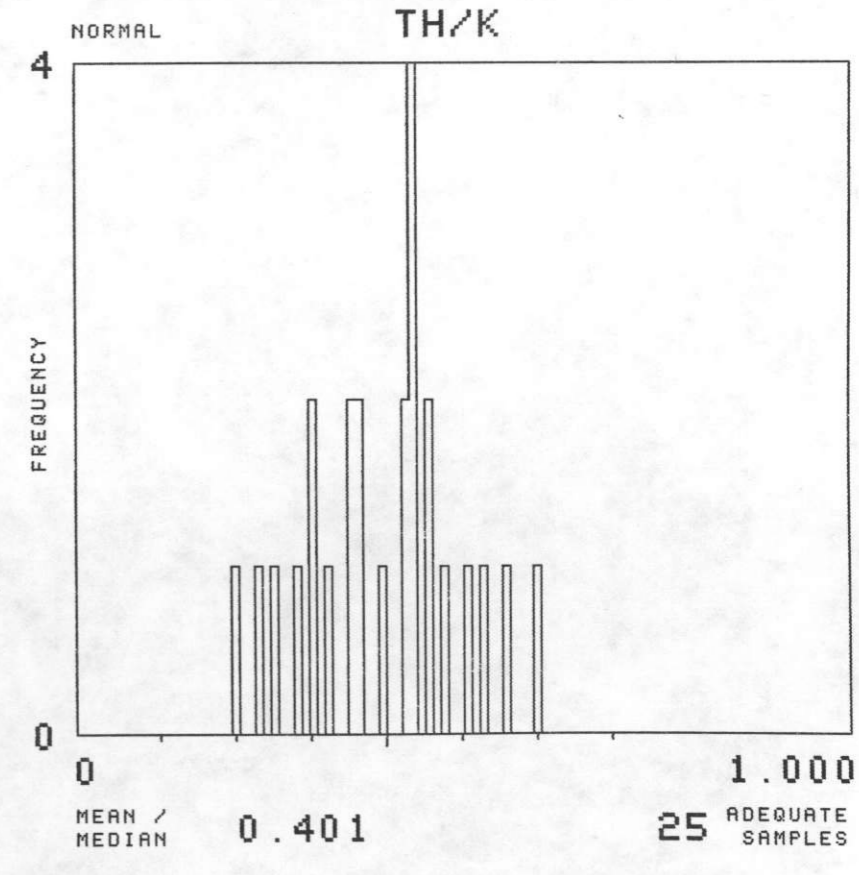
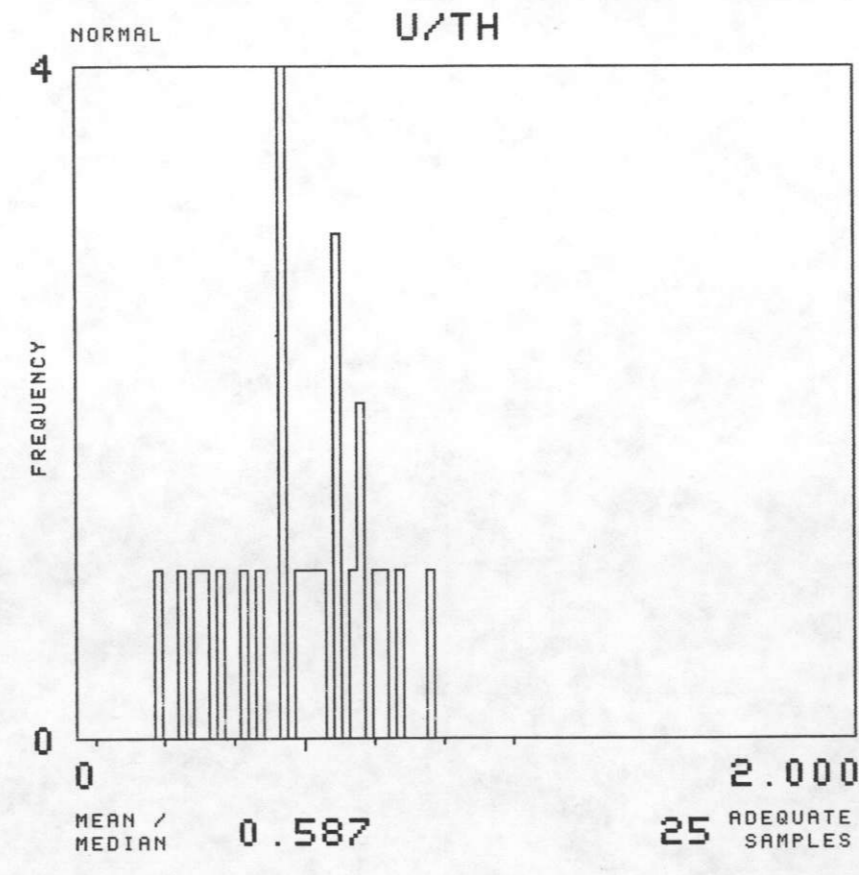
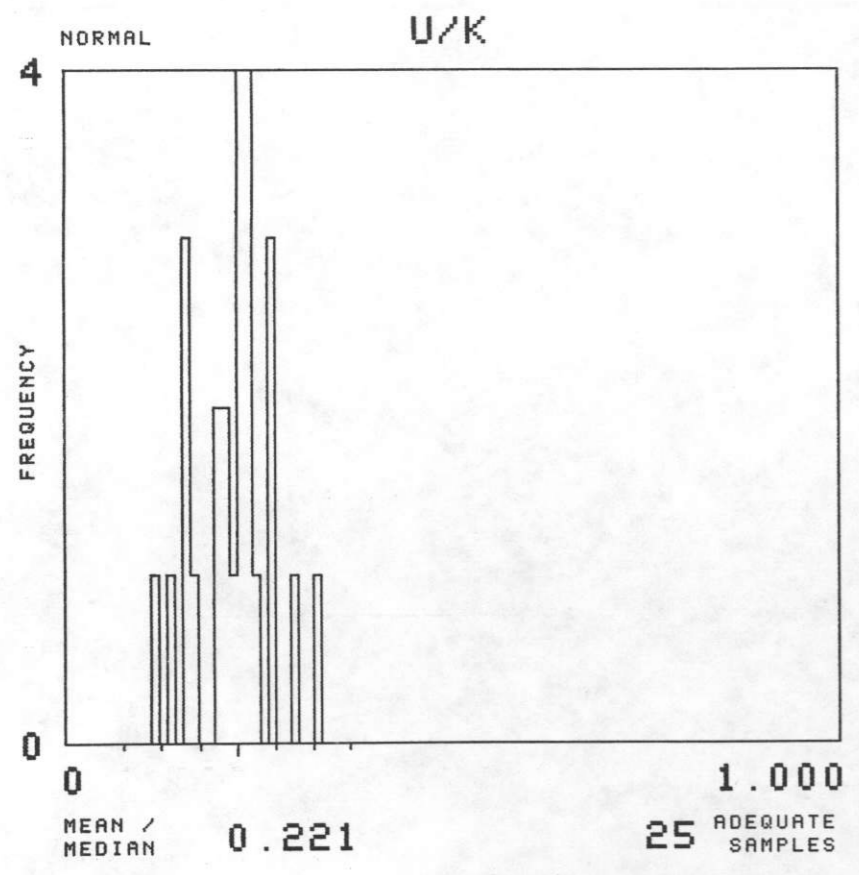
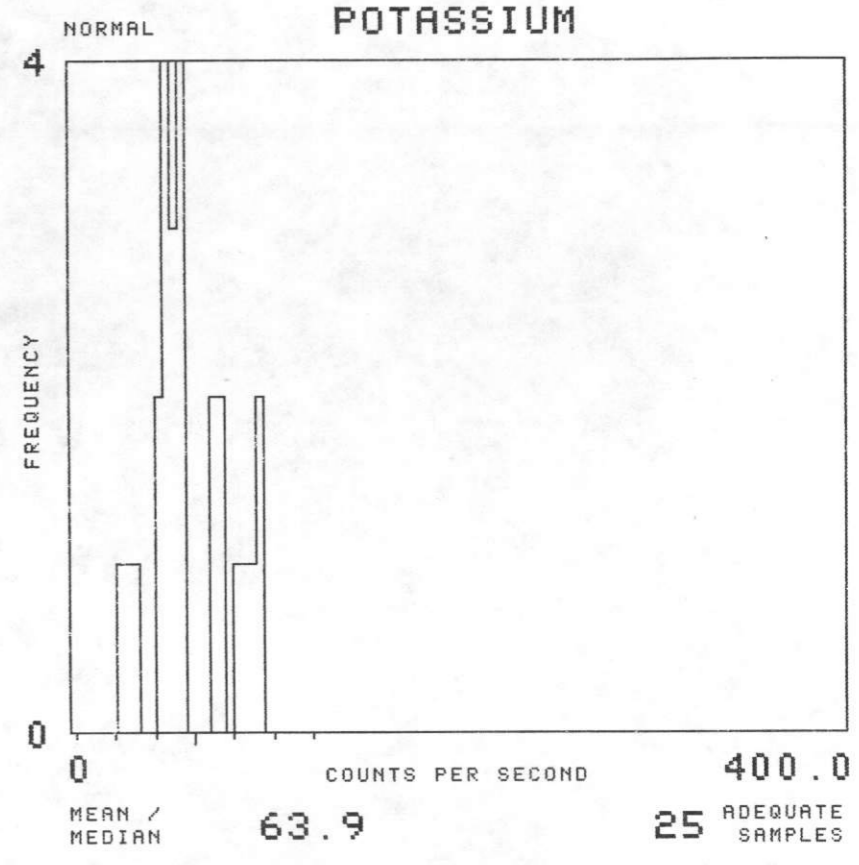
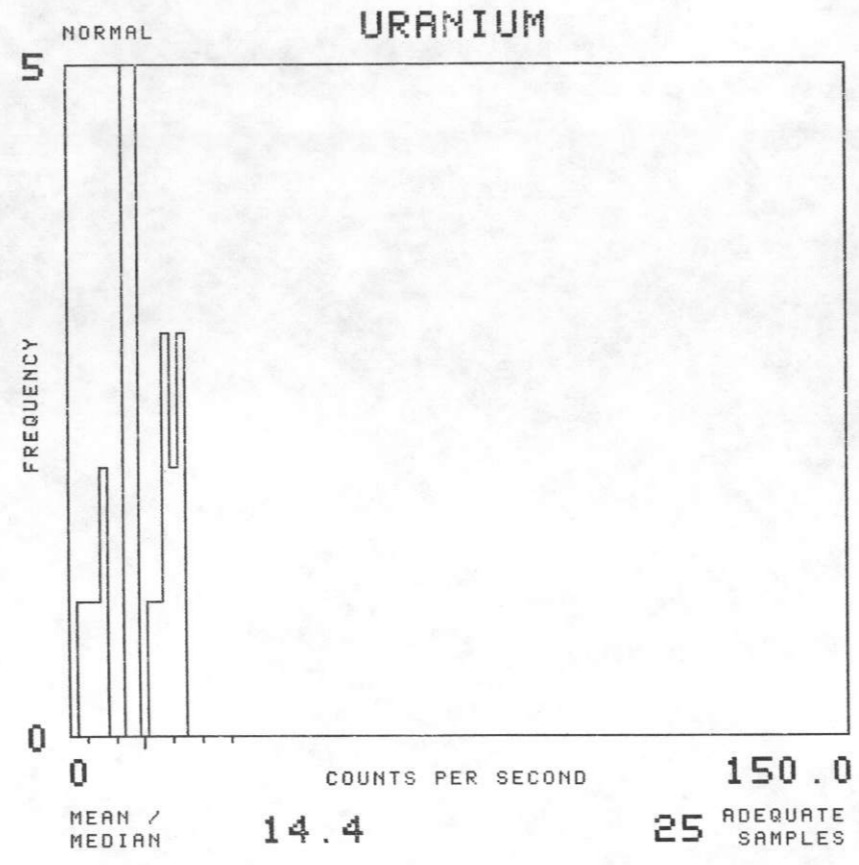
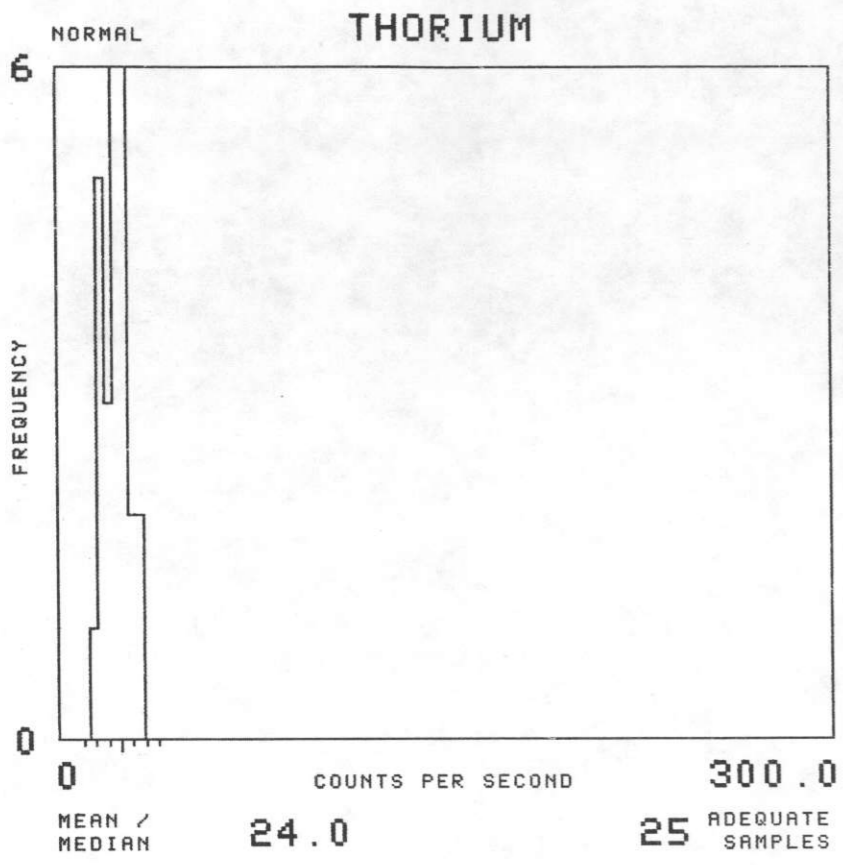
TOTAL NUMBER OF SAMPLES 3195





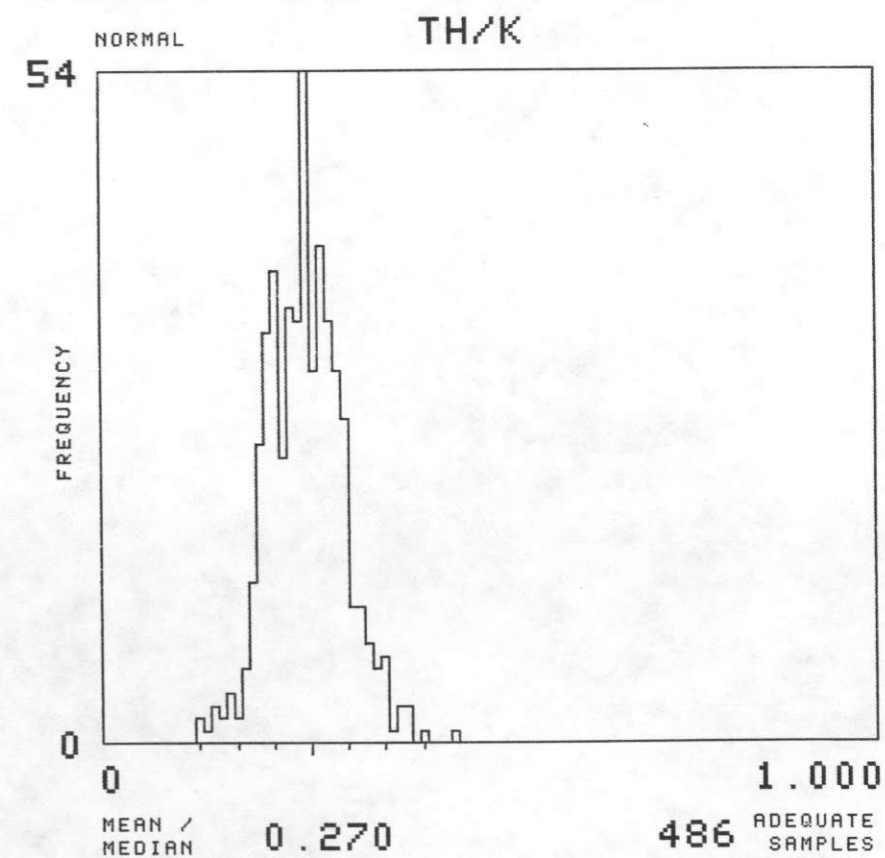
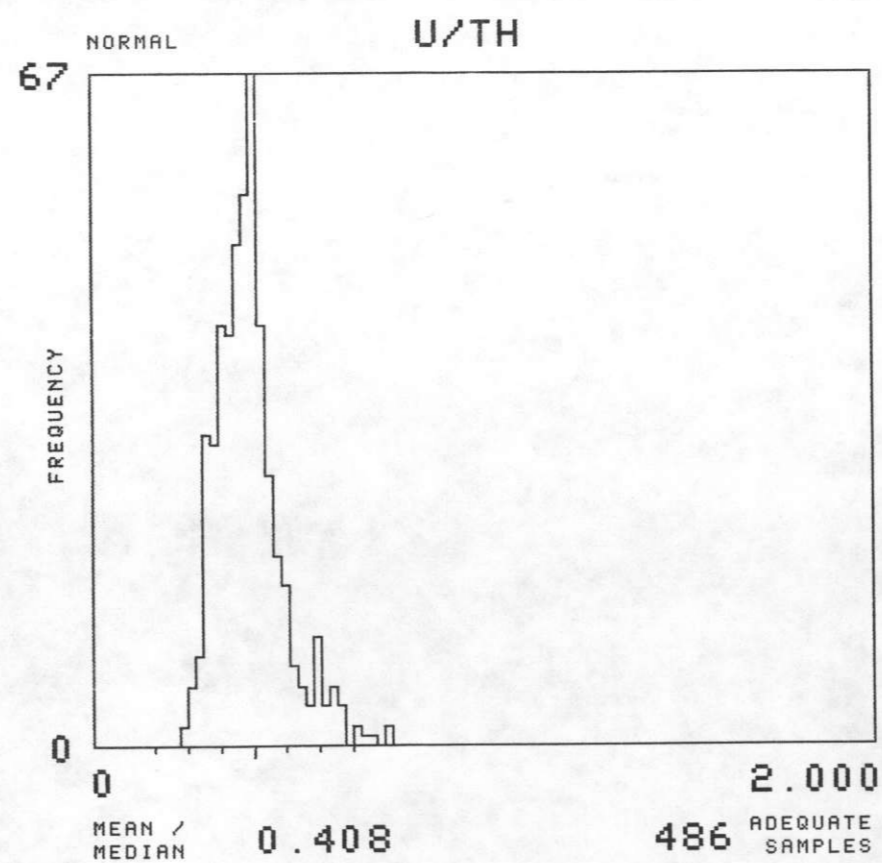
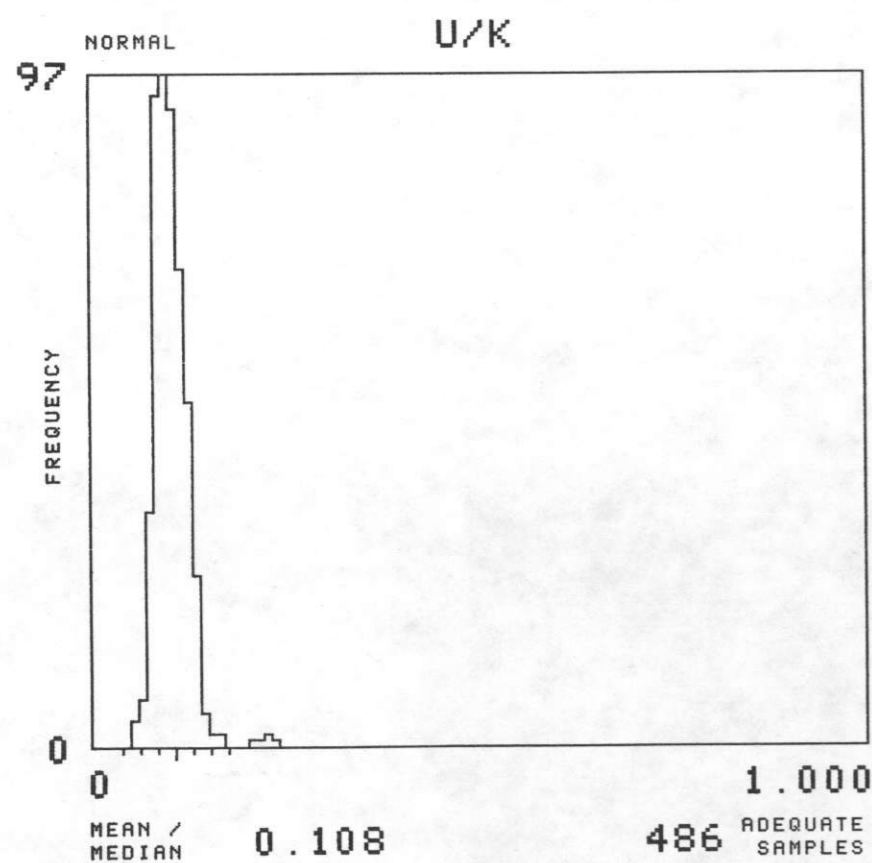
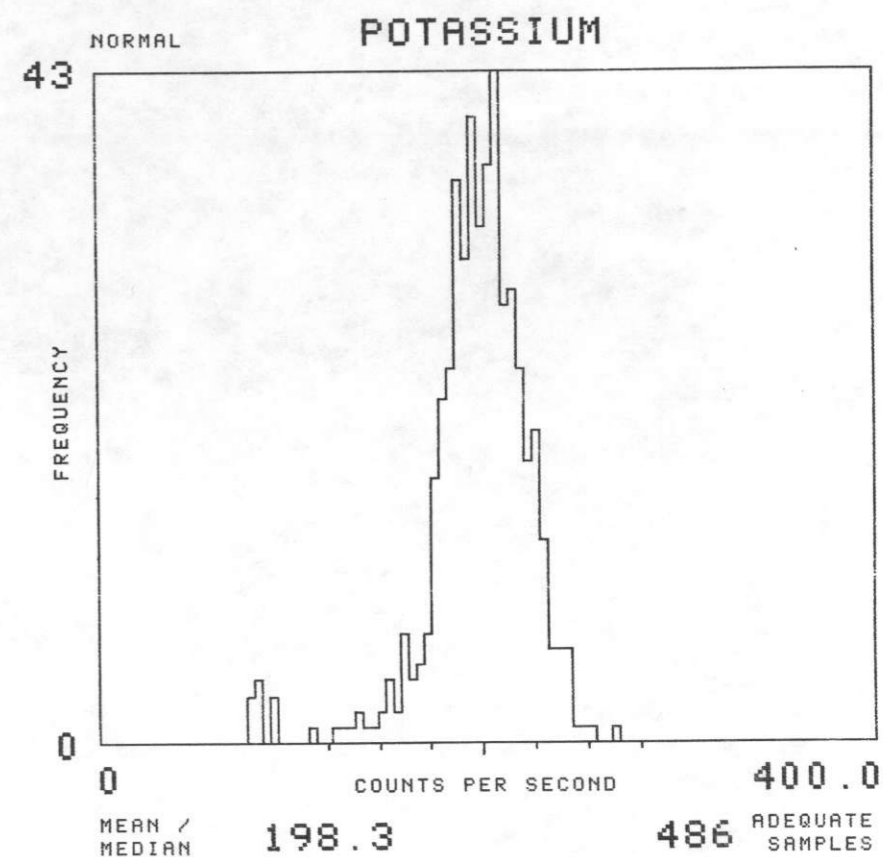
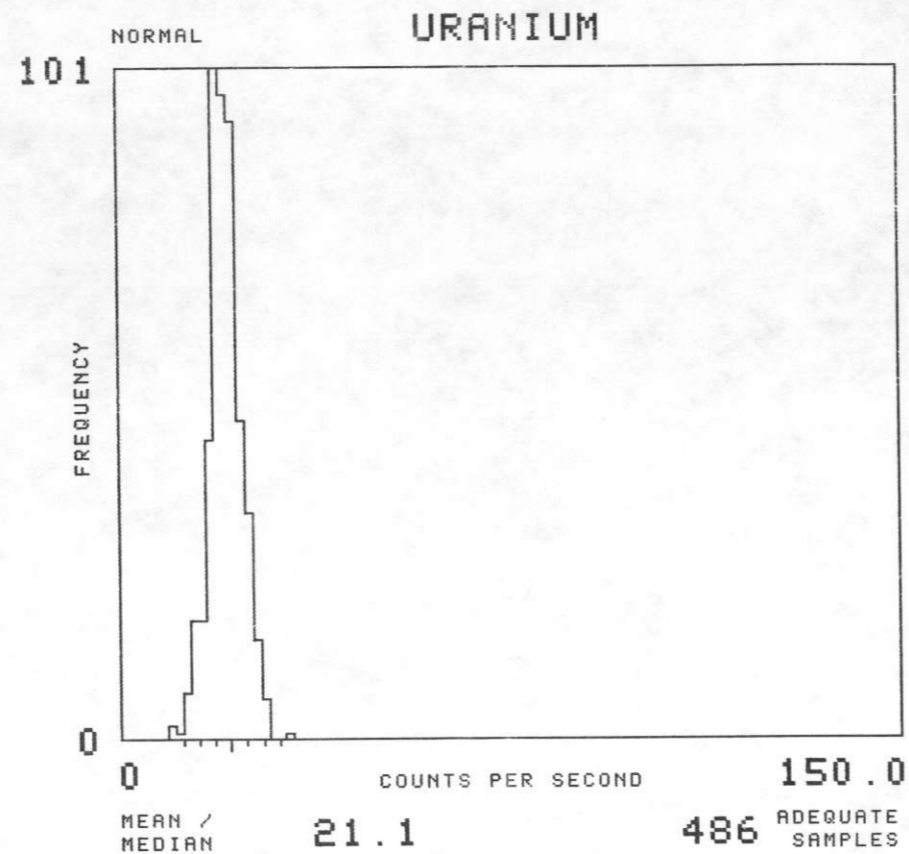
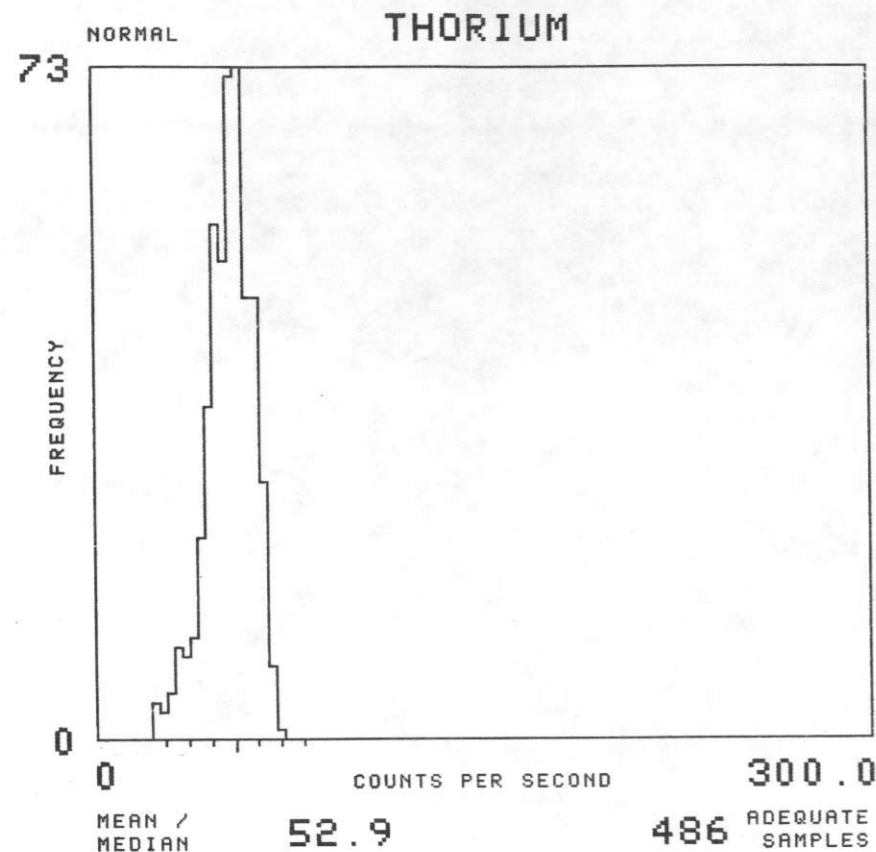
NTMS NI 12-3 GALLUP

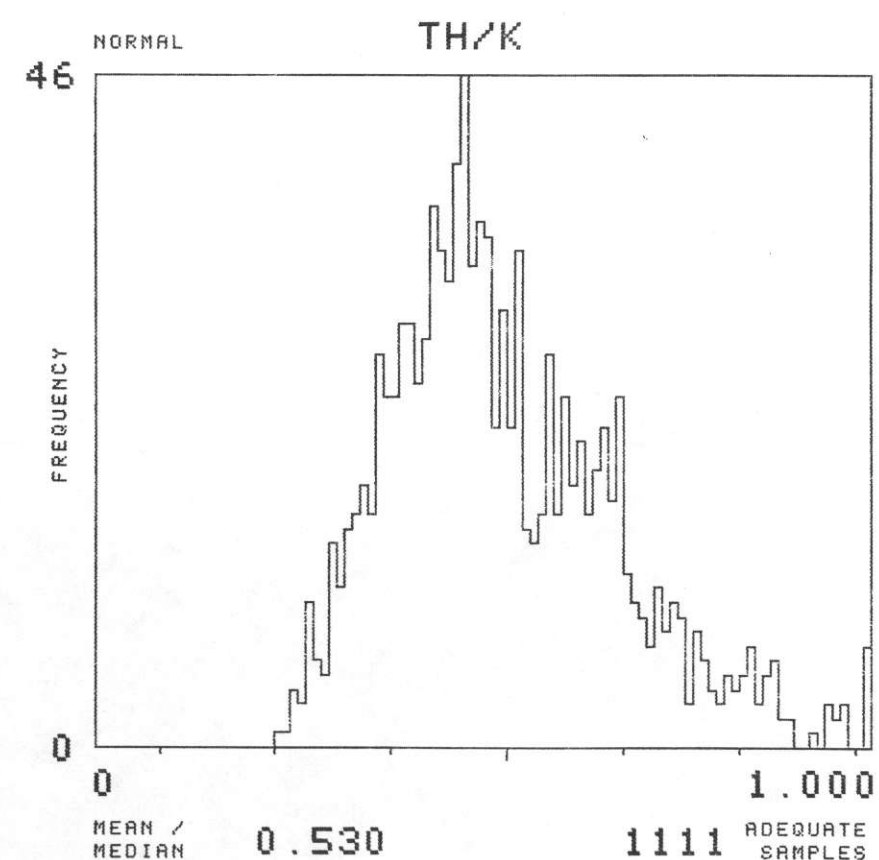
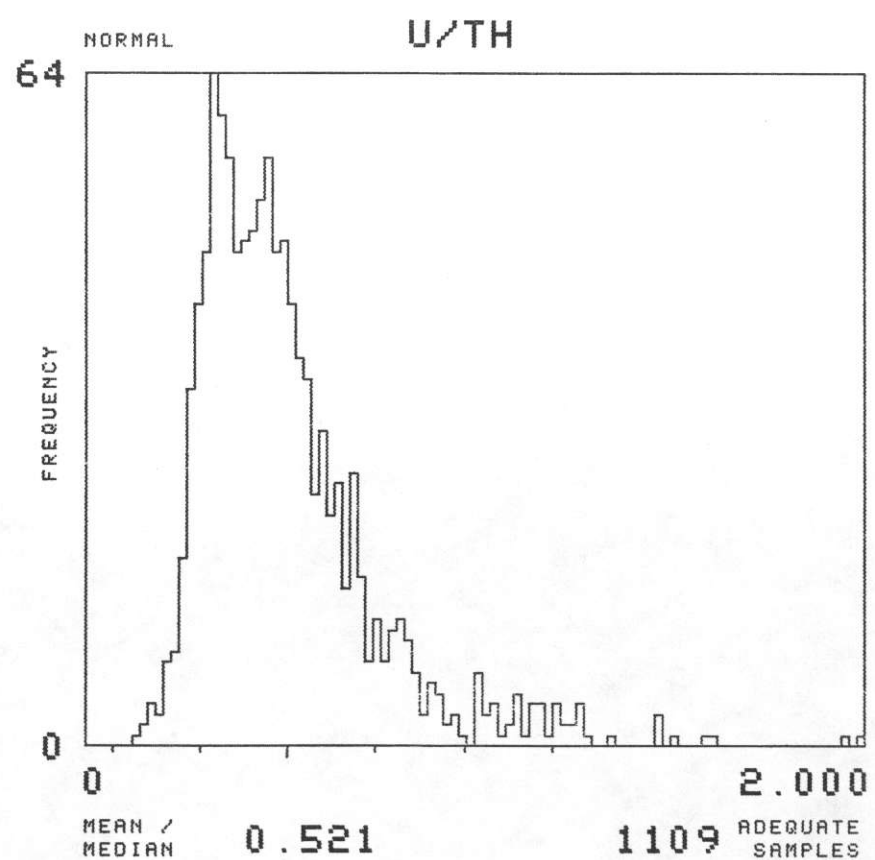
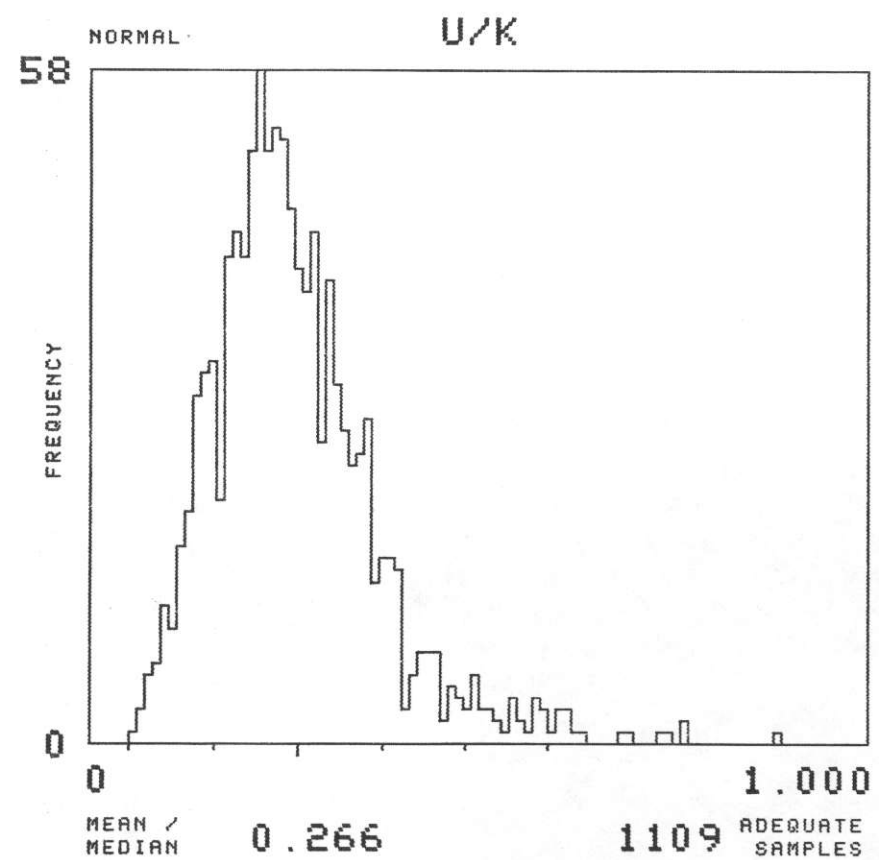
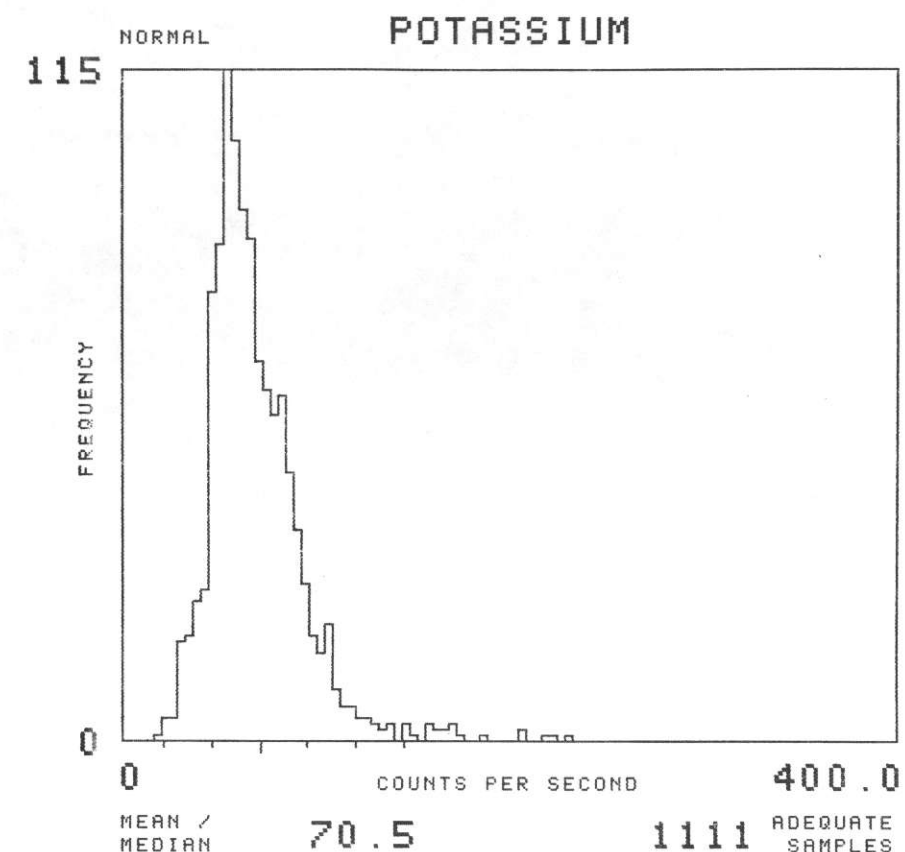
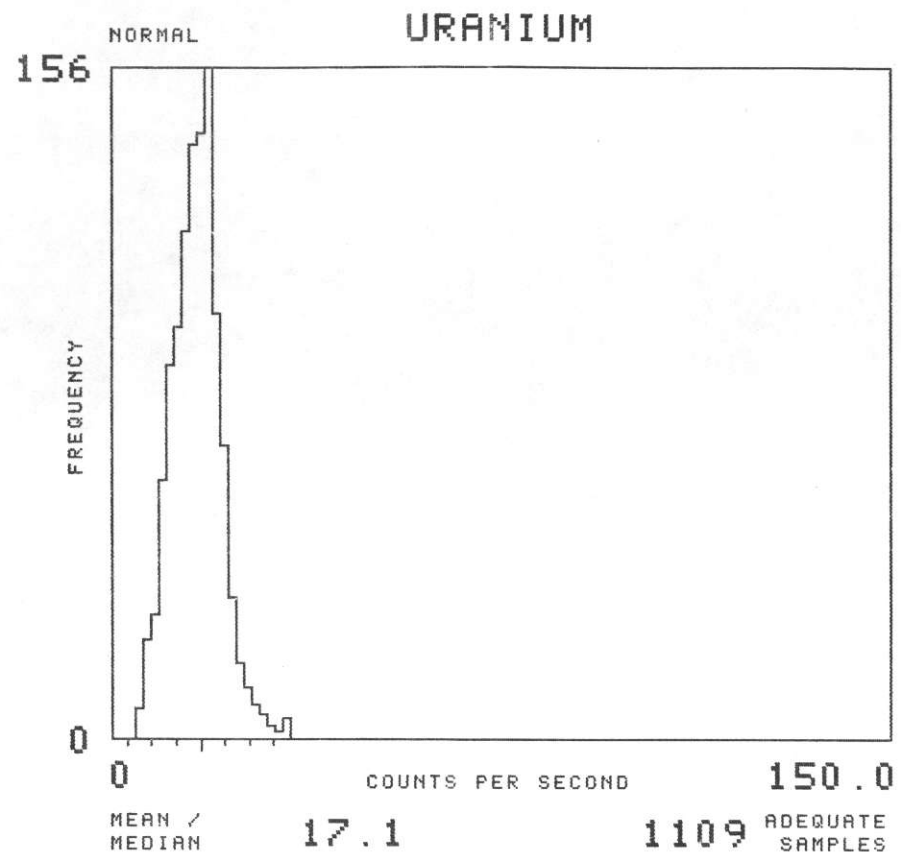
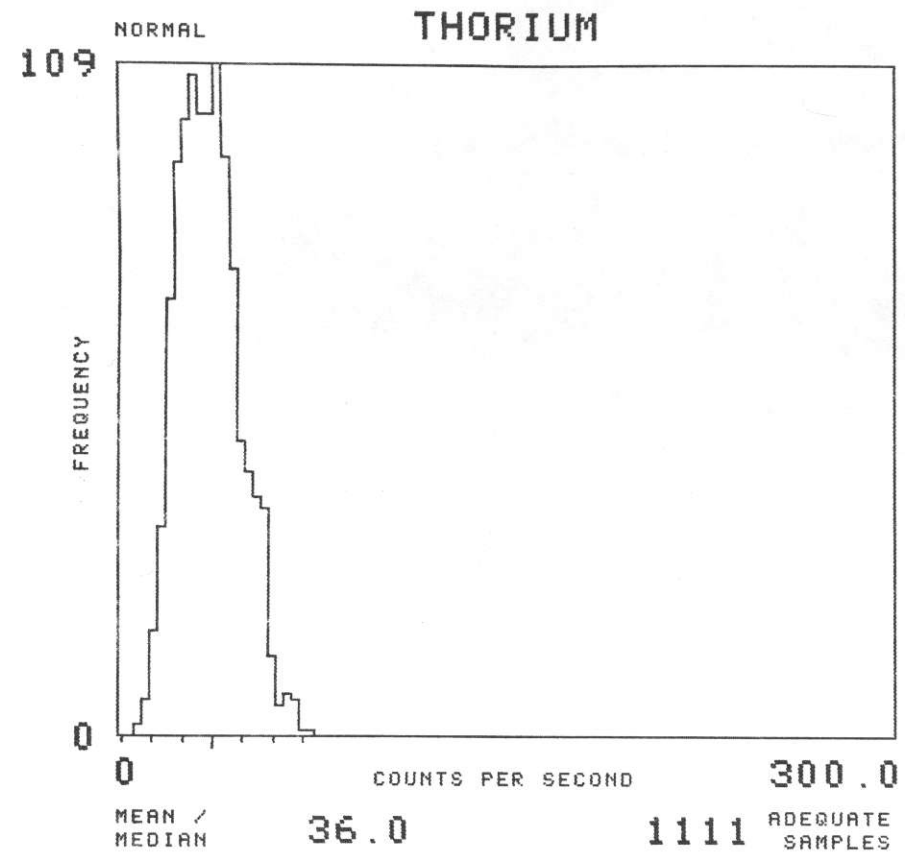
MAP UNIT : PGY TOTAL NUMBER OF SAMPLES 26

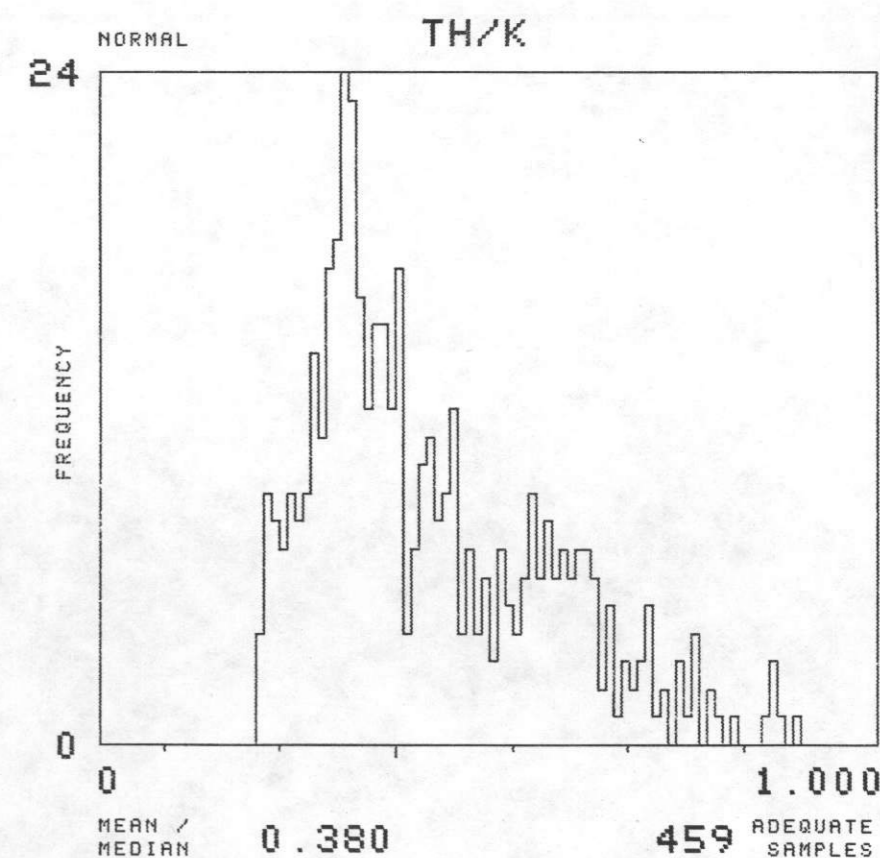
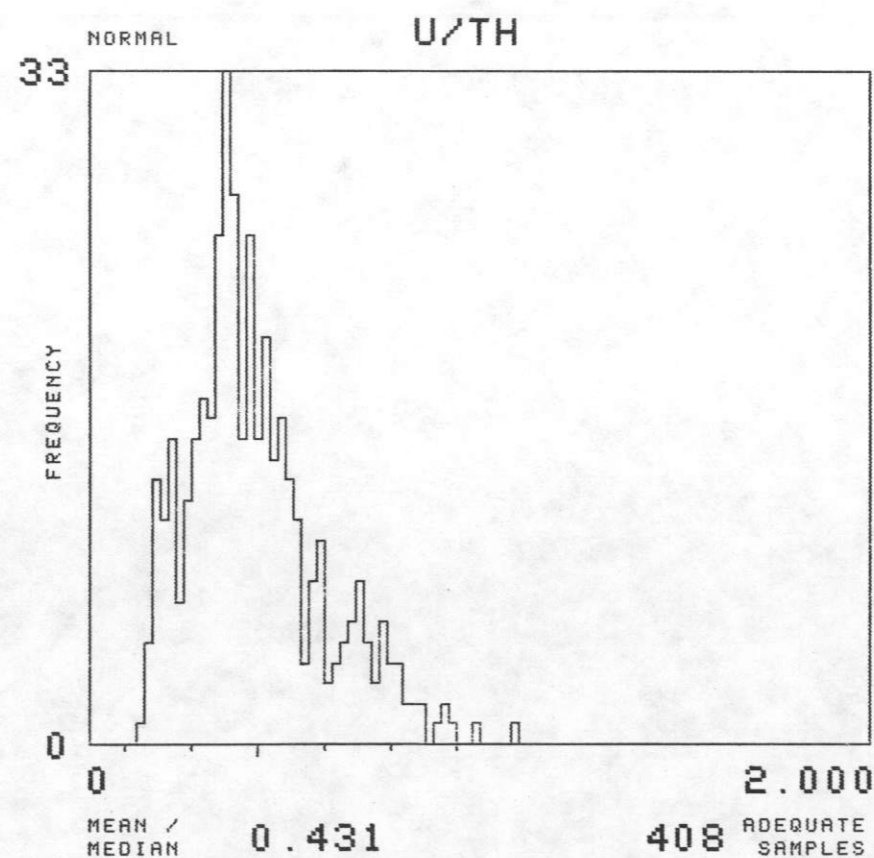
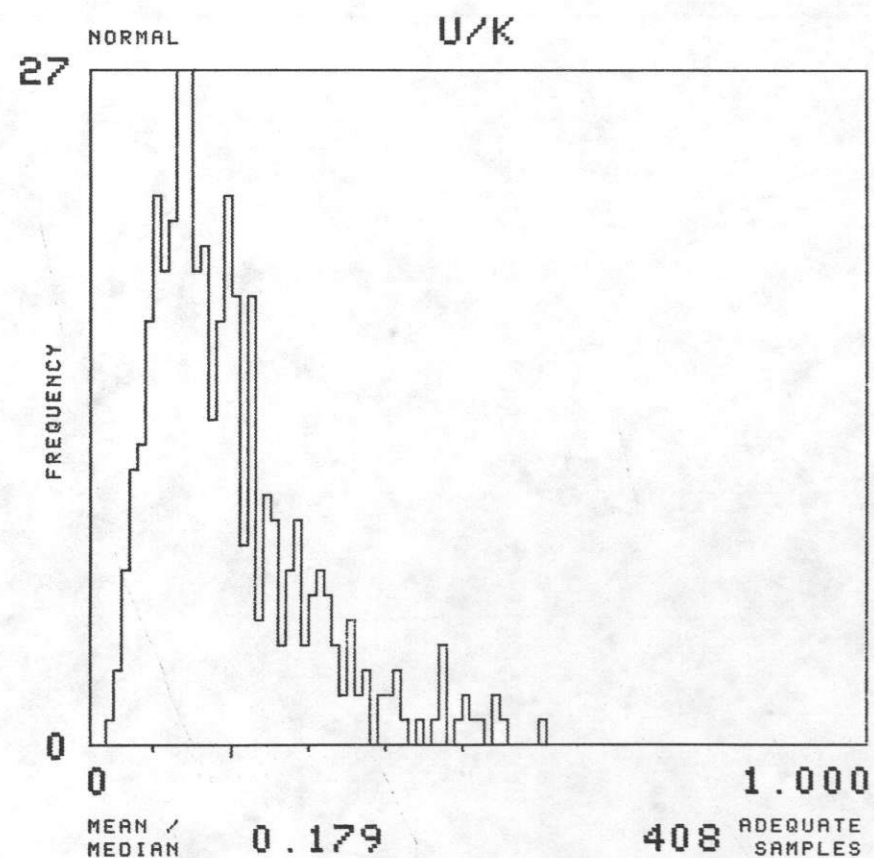
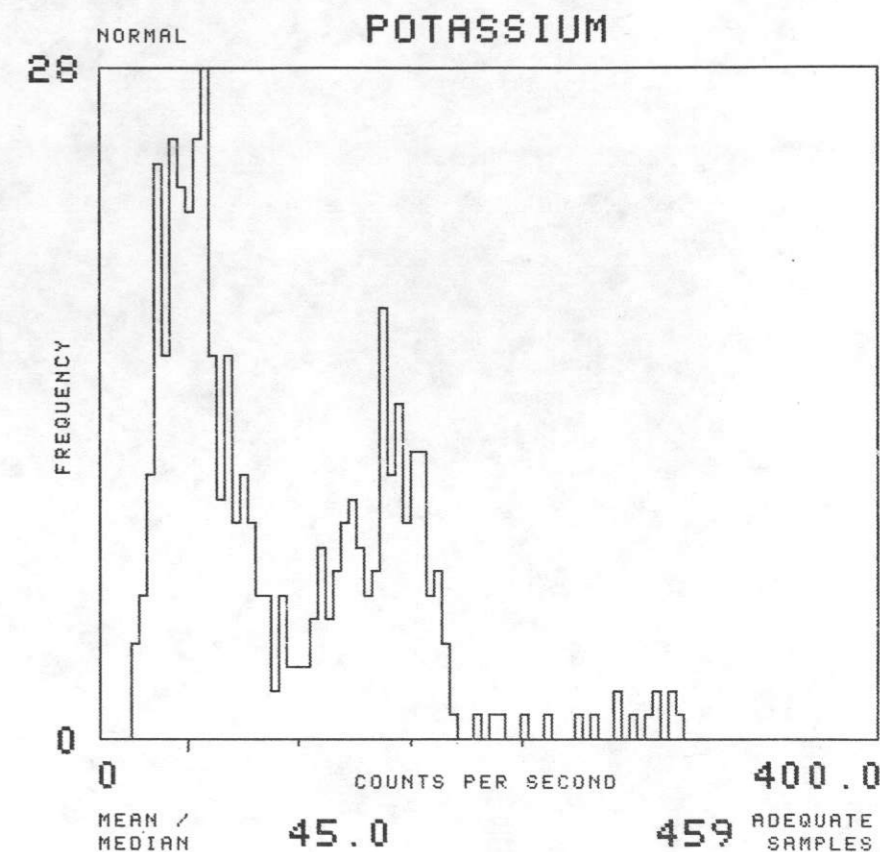
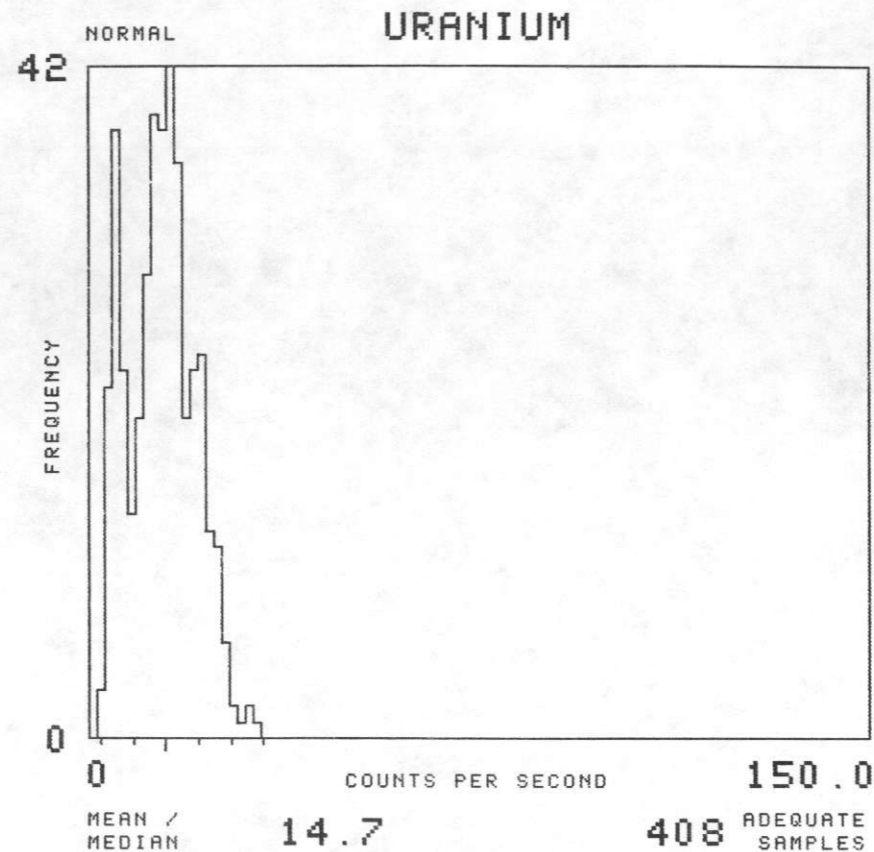
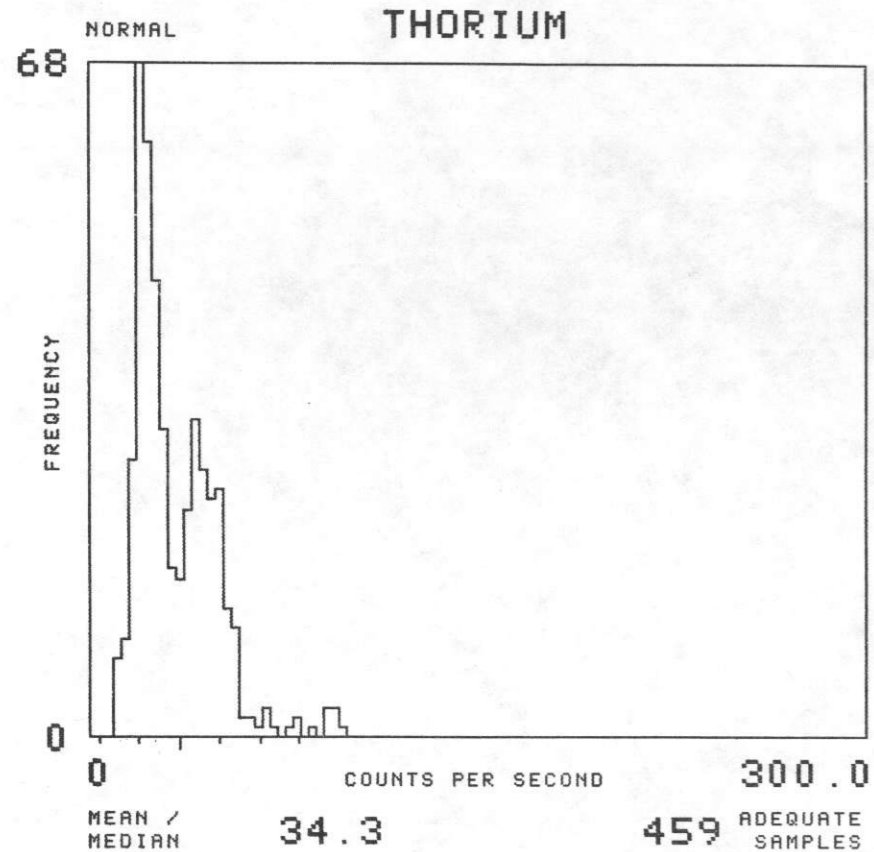


NTMS NI 12-3 GALLUP

MAP UNIT : PPS TOTAL NUMBER OF SAMPLES 486

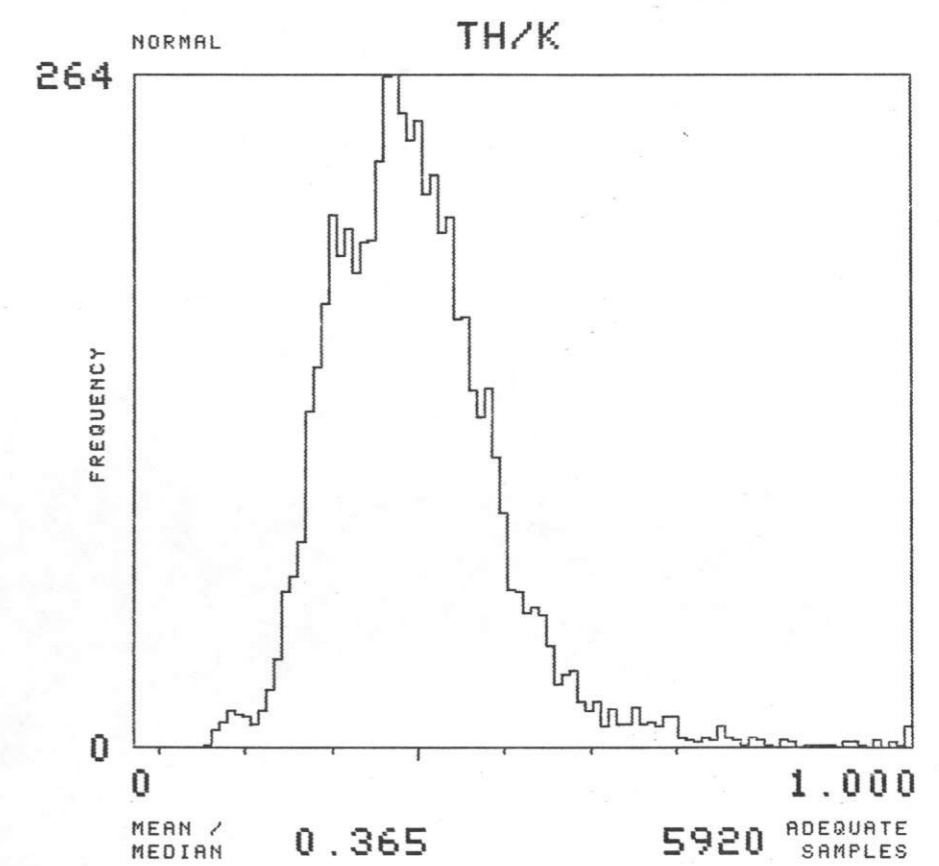
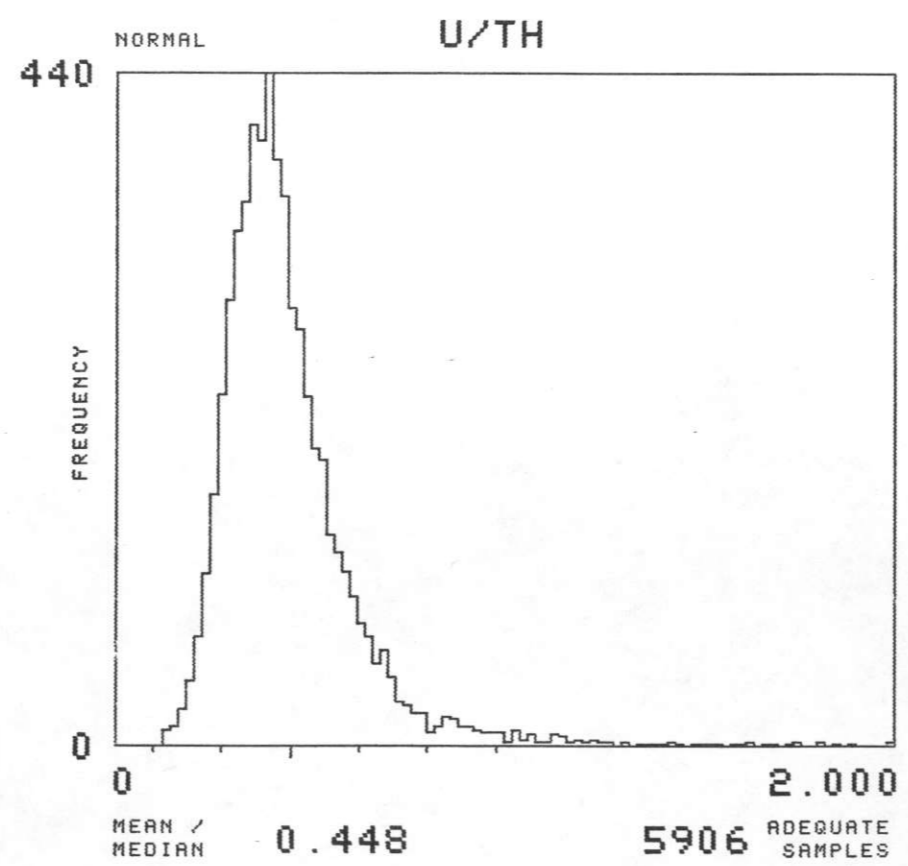
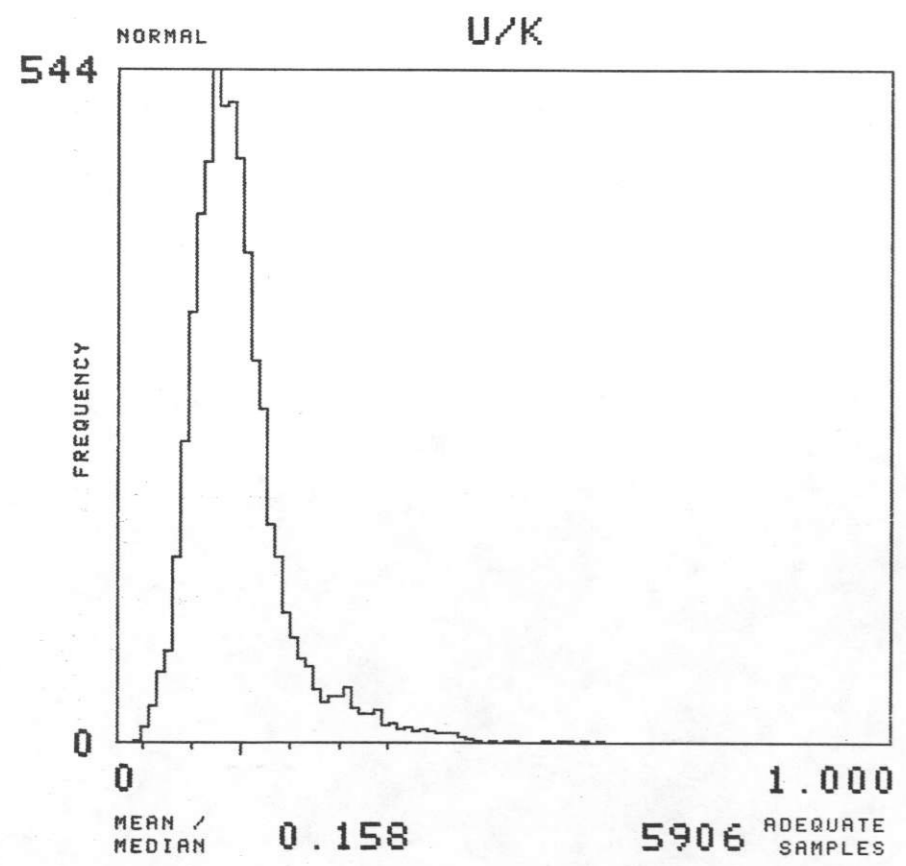
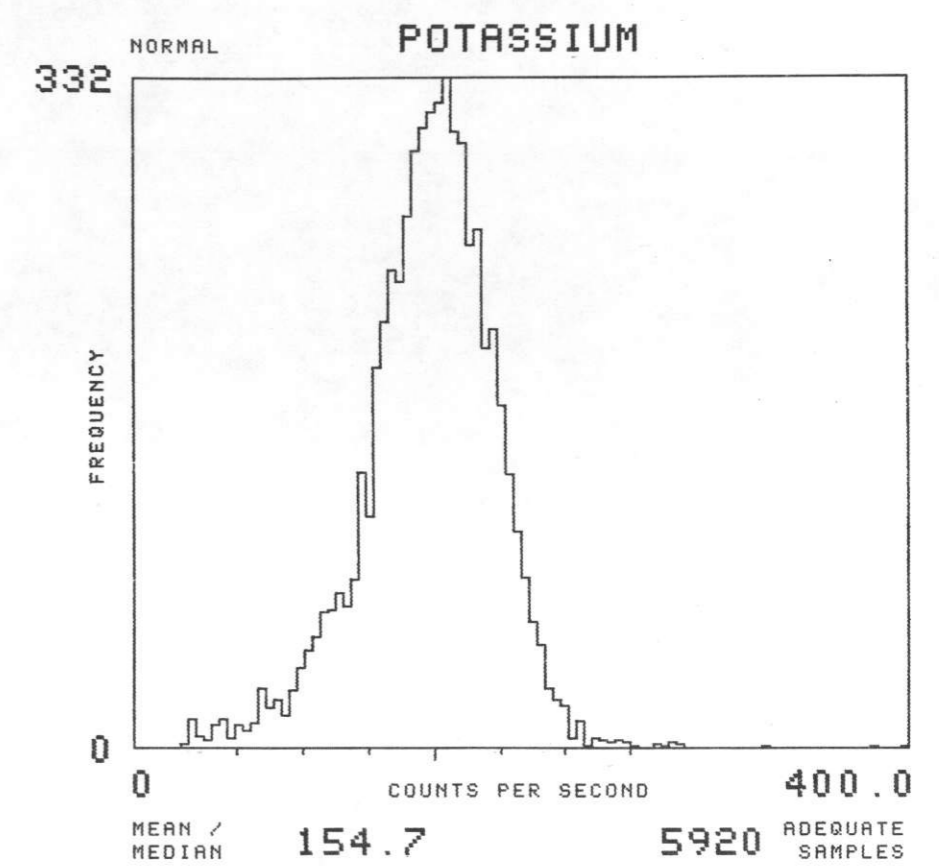
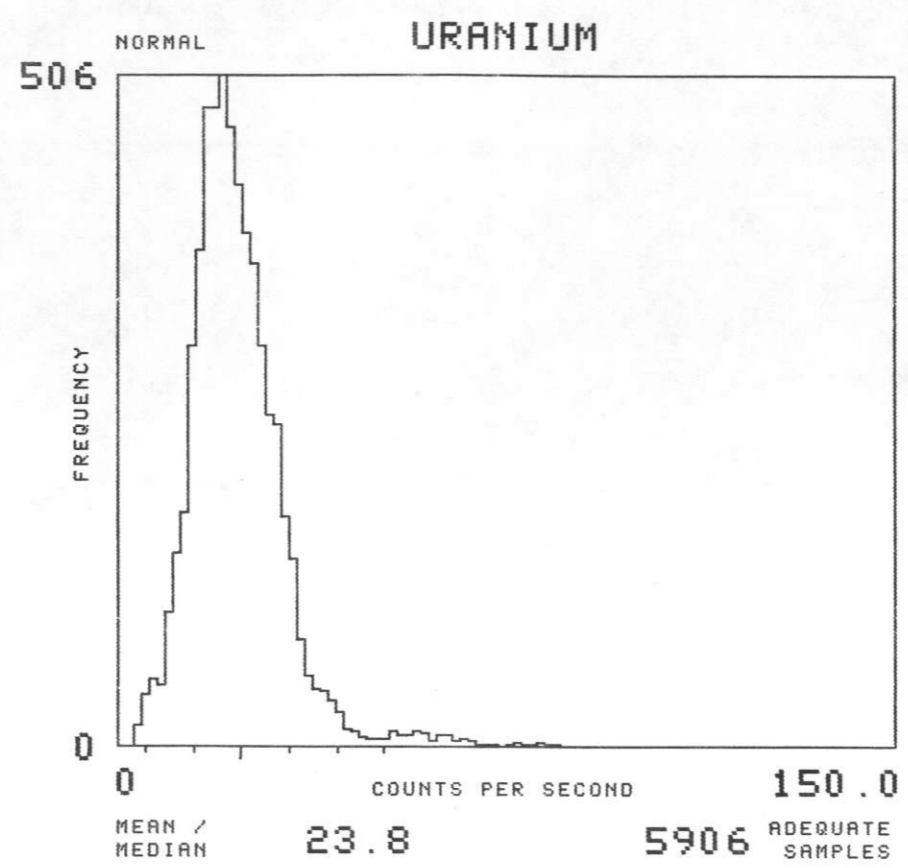
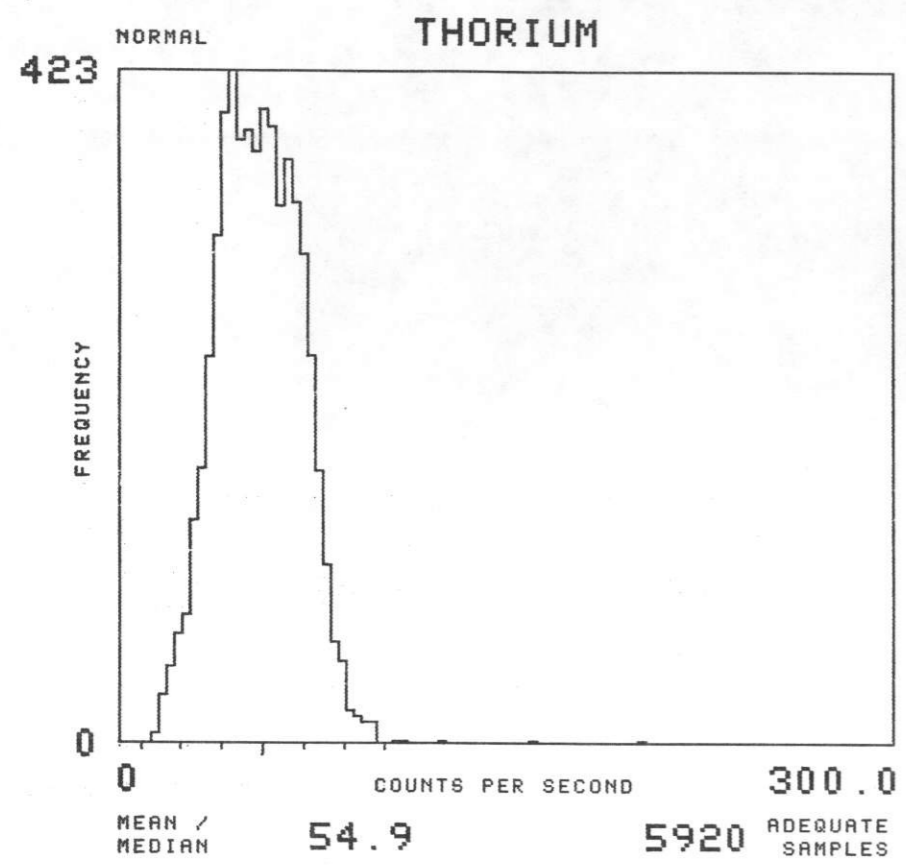






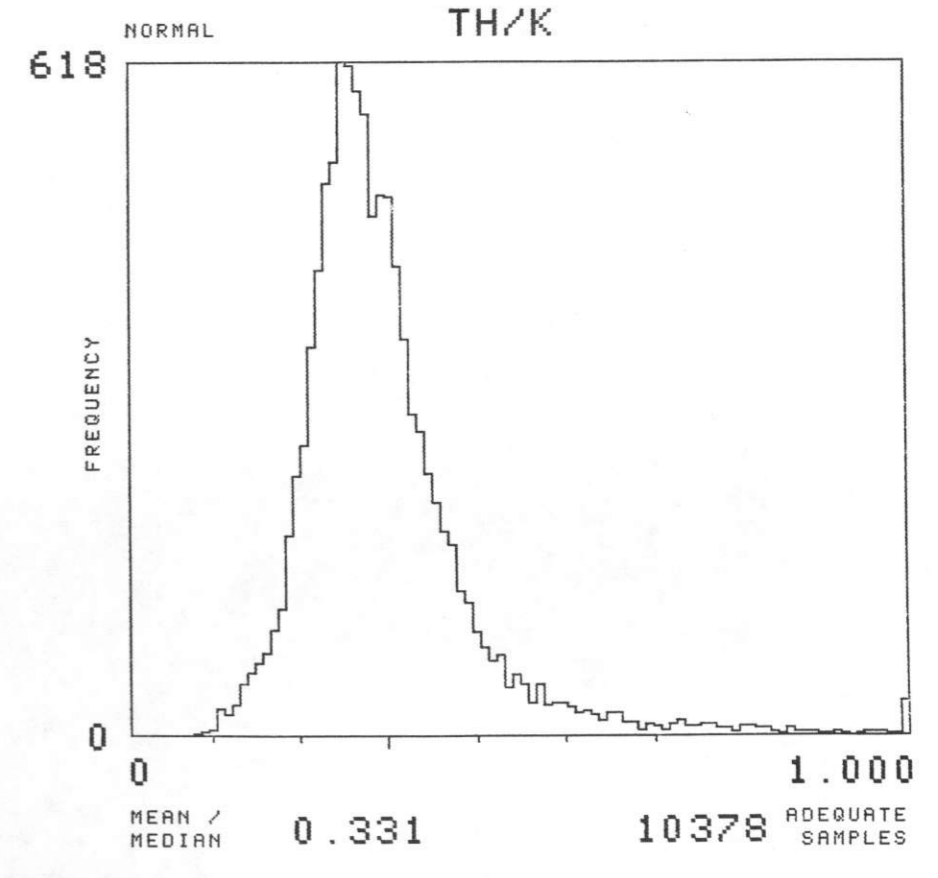
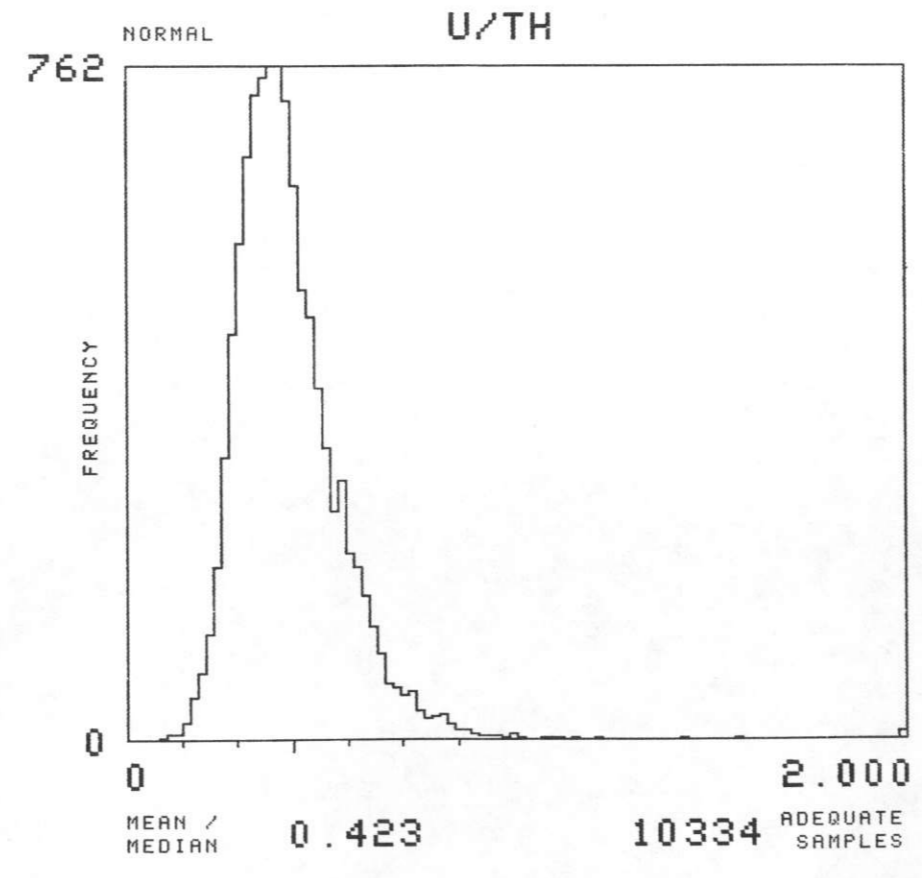
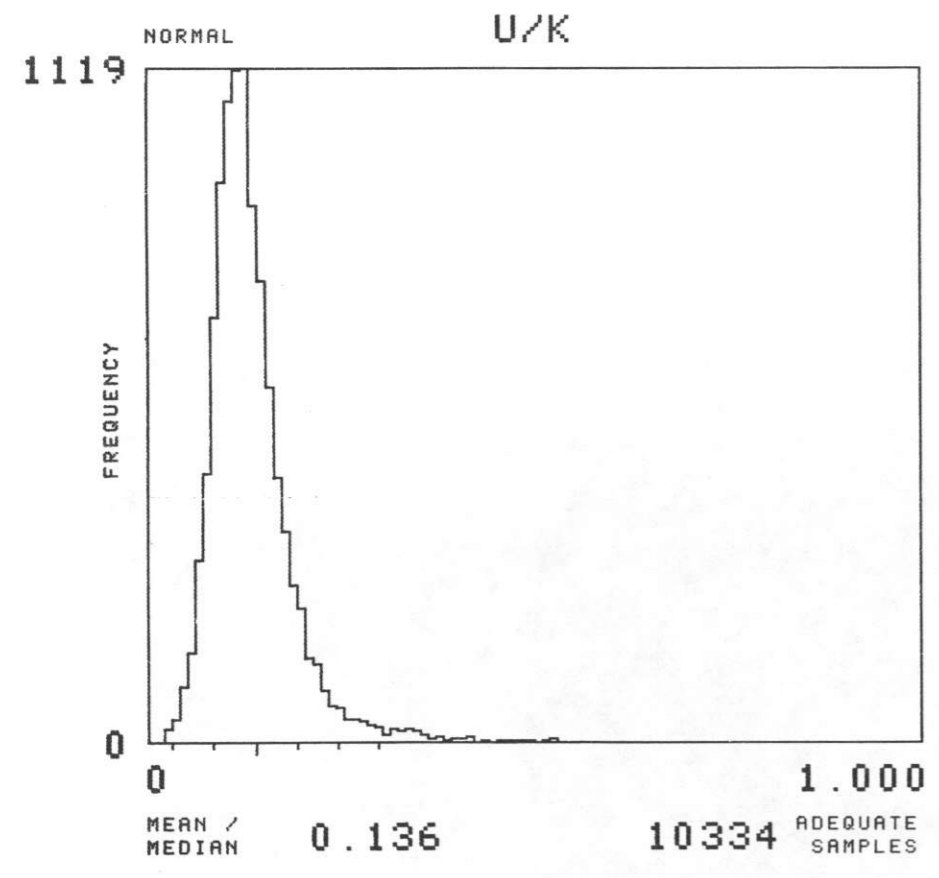
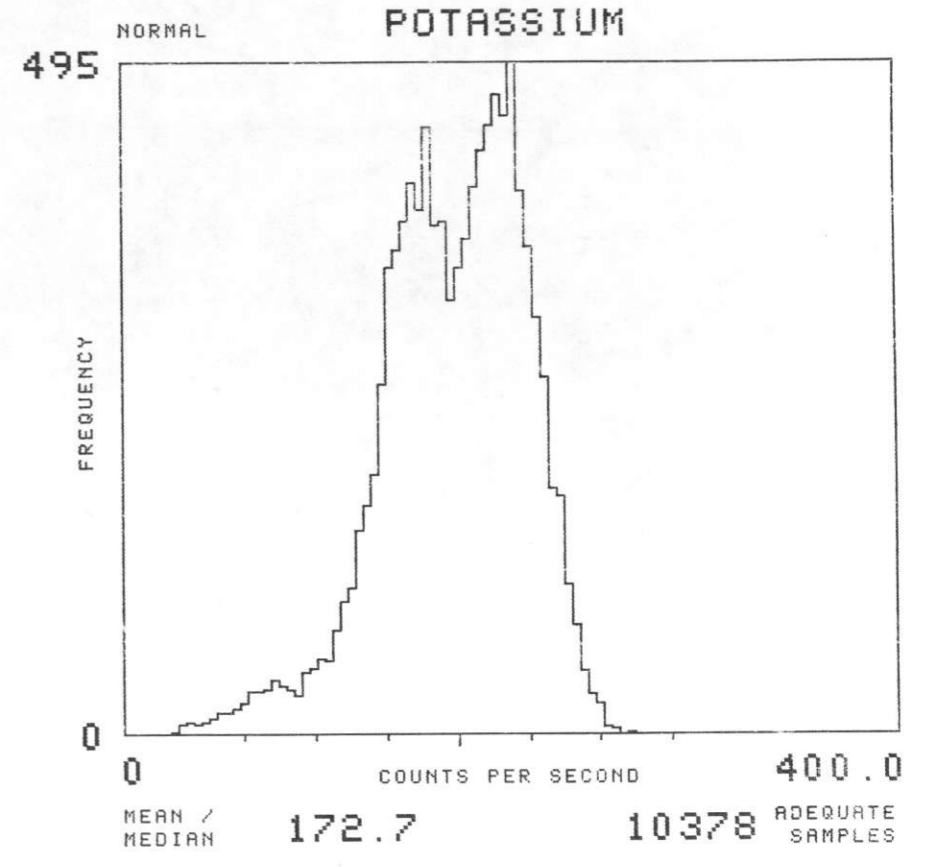
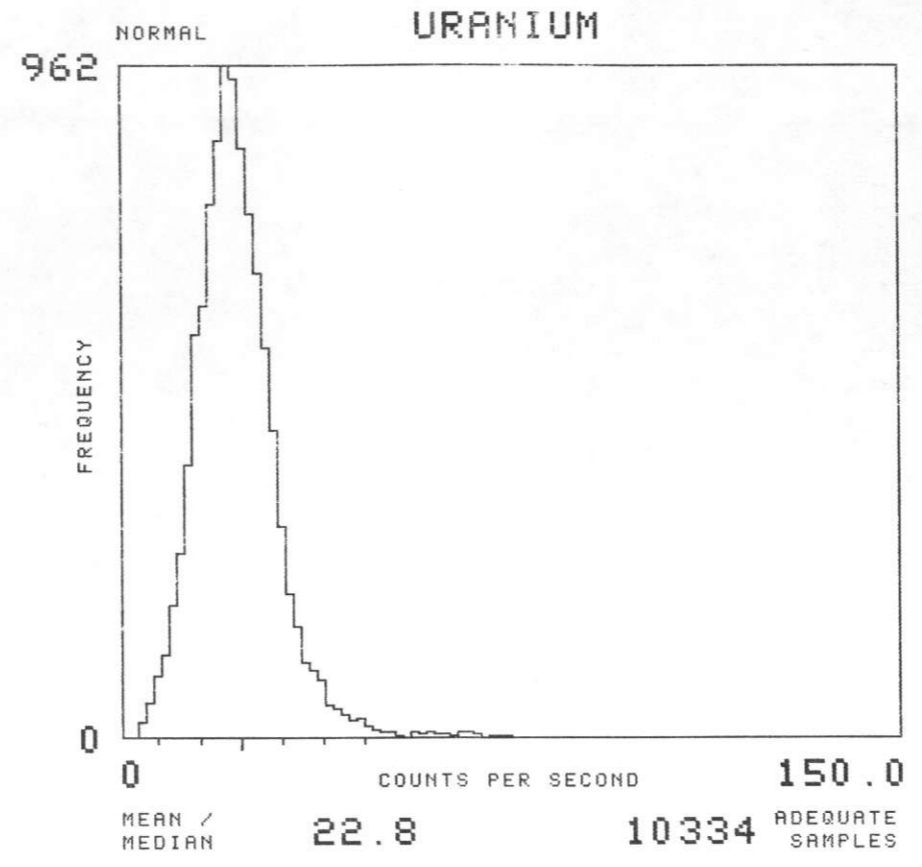
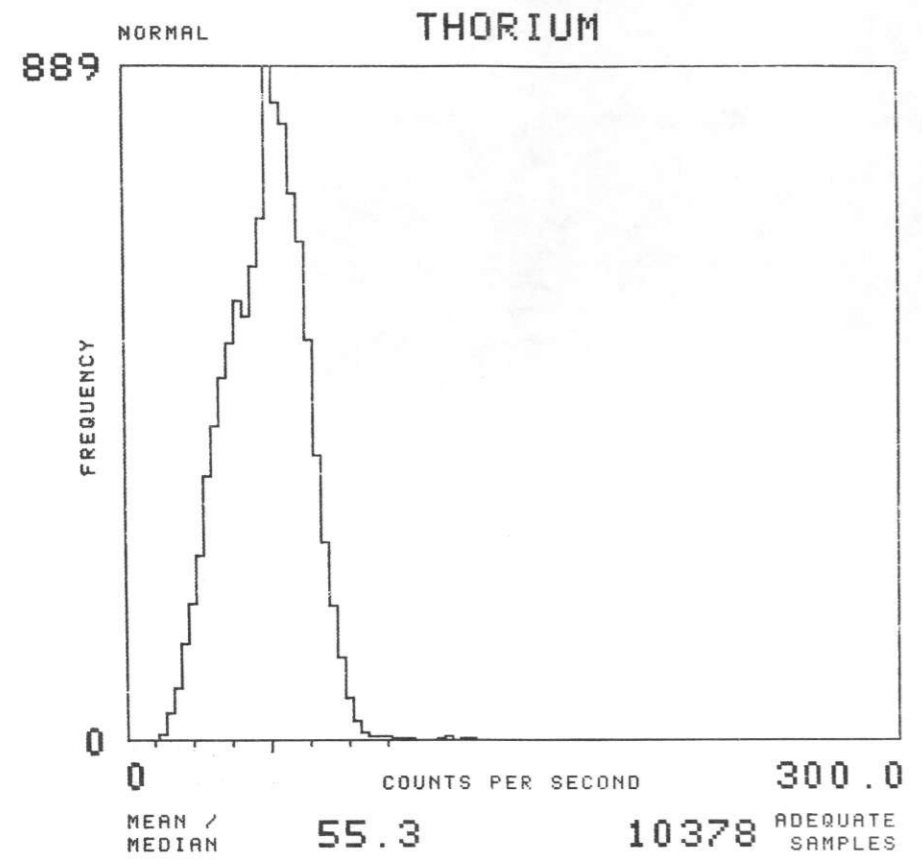
NTMS NI 12-3 GALLUP

MAP UNIT : QA TOTAL NUMBER OF SAMPLES 6024



NTMS NI 12-3 GALLUP

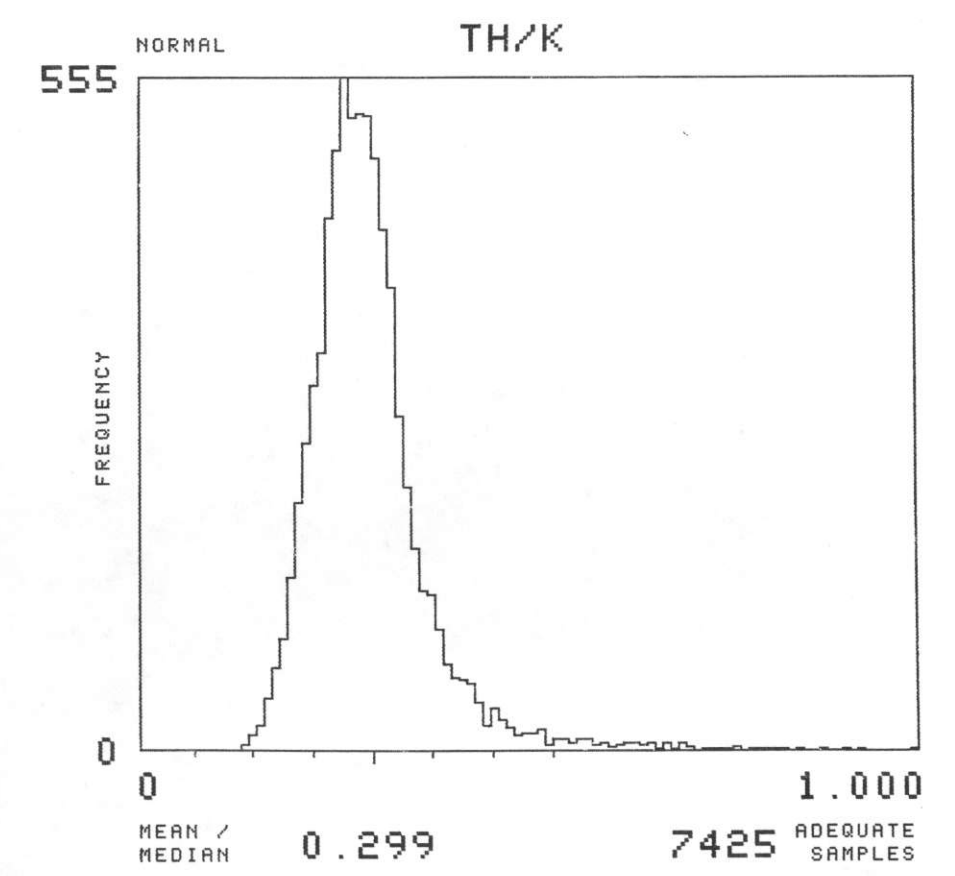
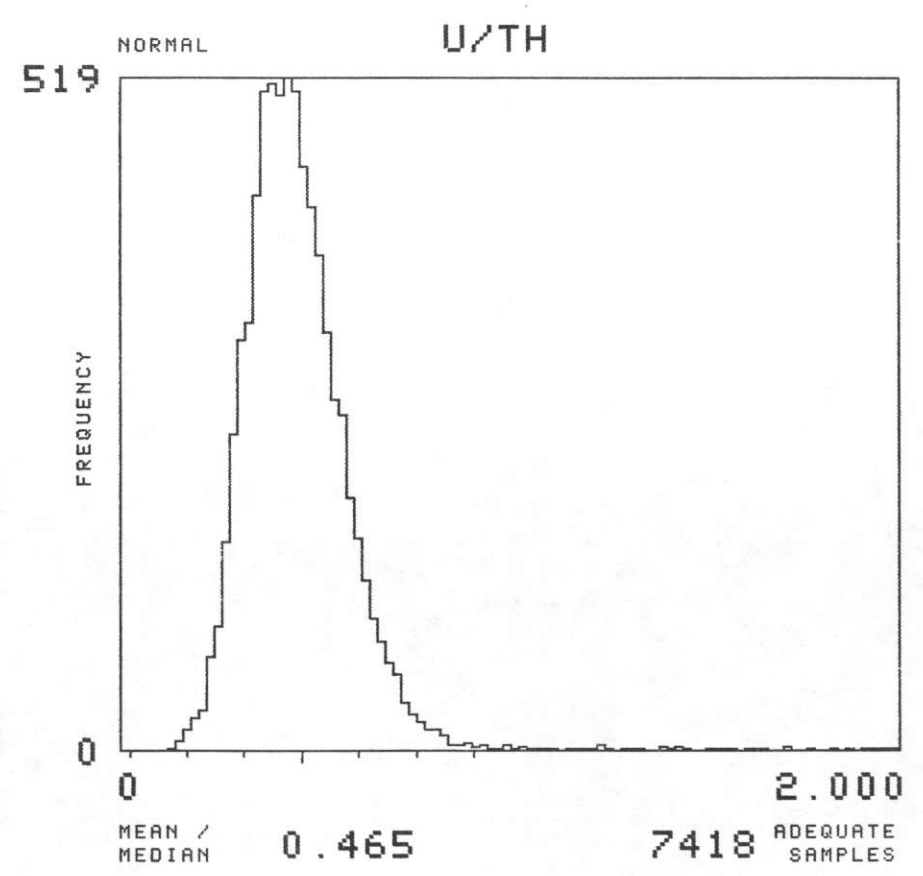
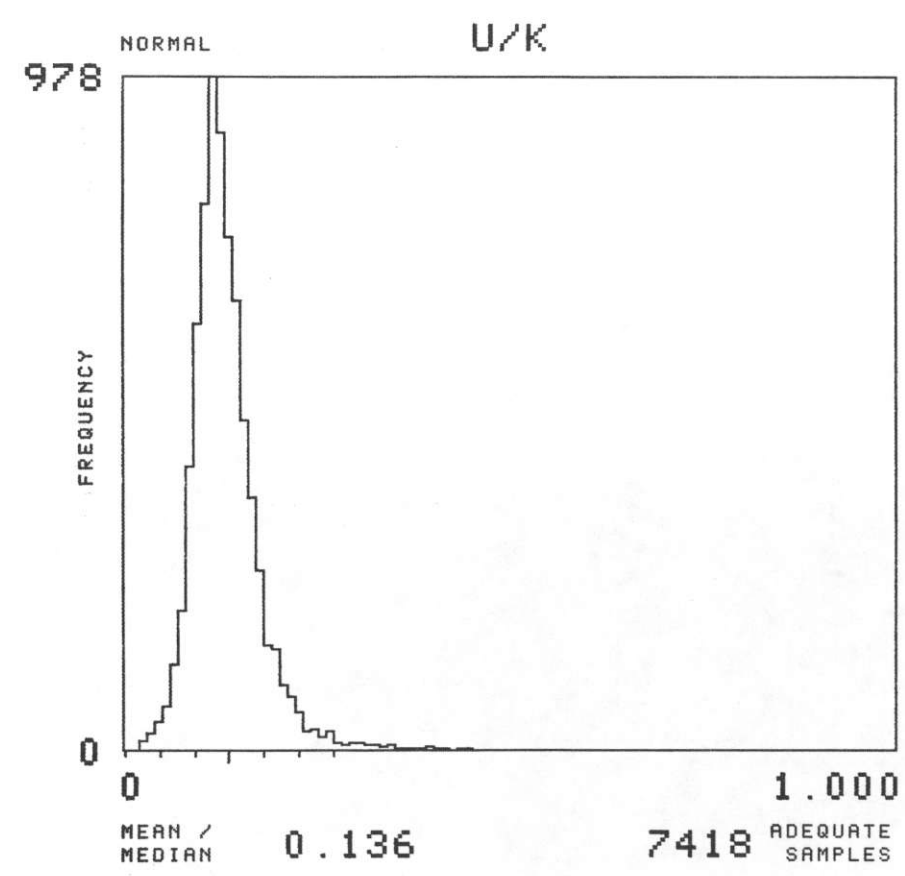
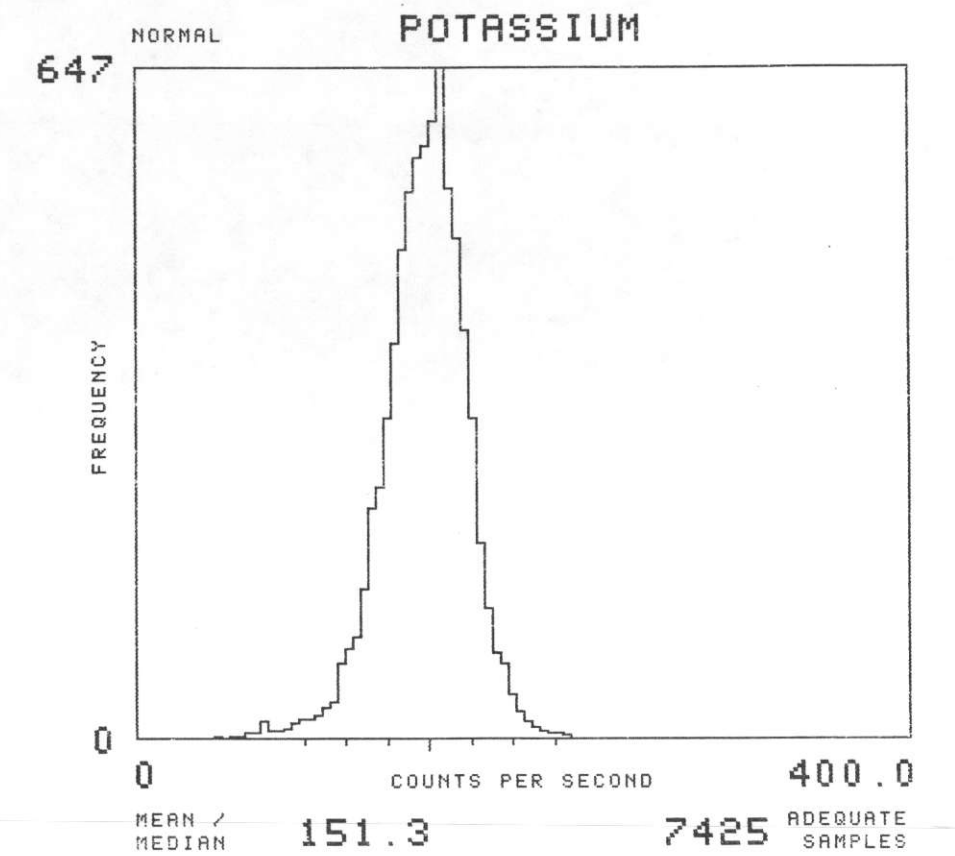
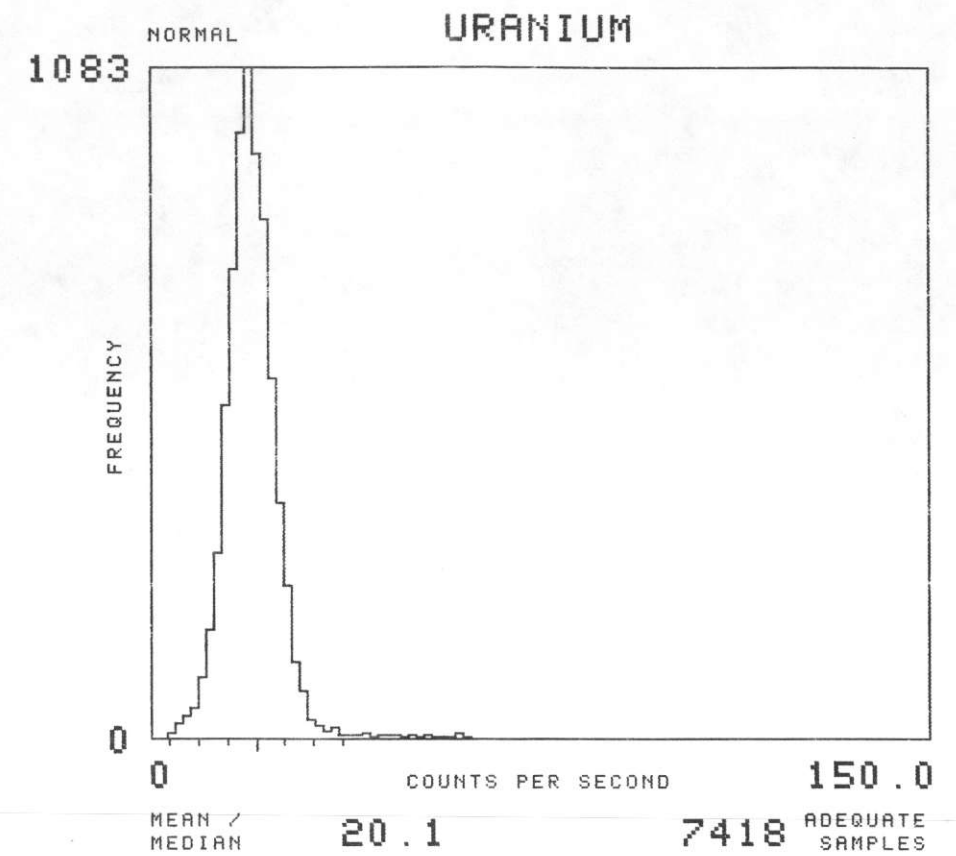
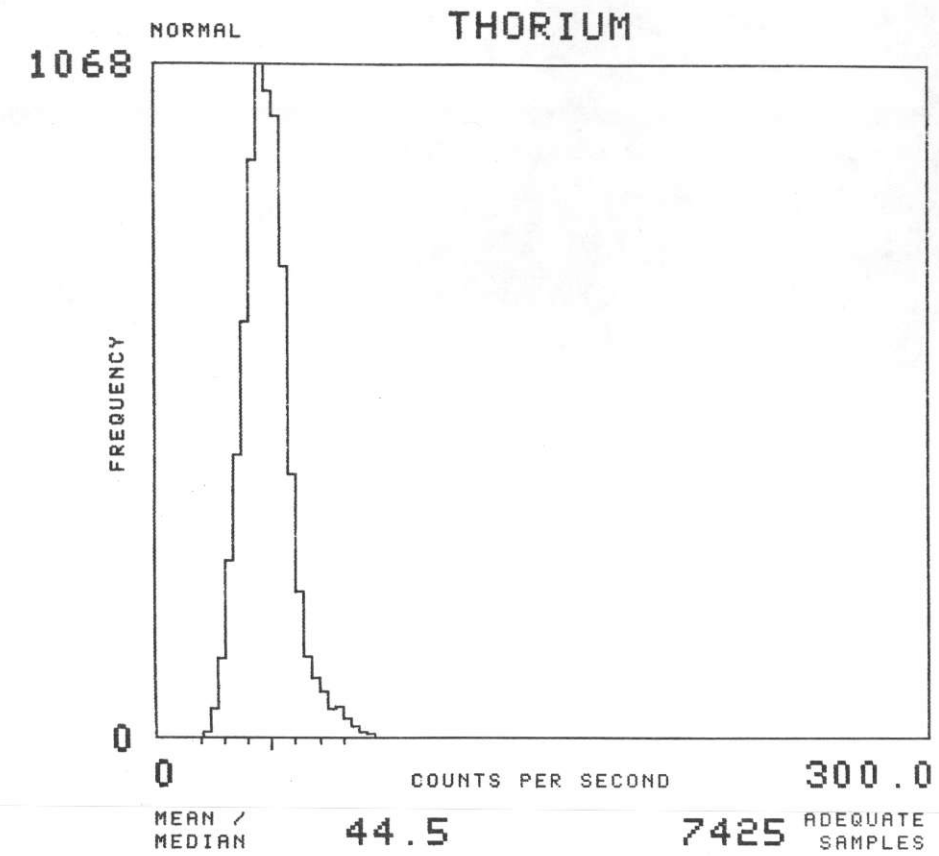
MAP UNIT : QAE TOTAL NUMBER OF SAMPLES 10460



NTMS NI 12-3 GALLUP

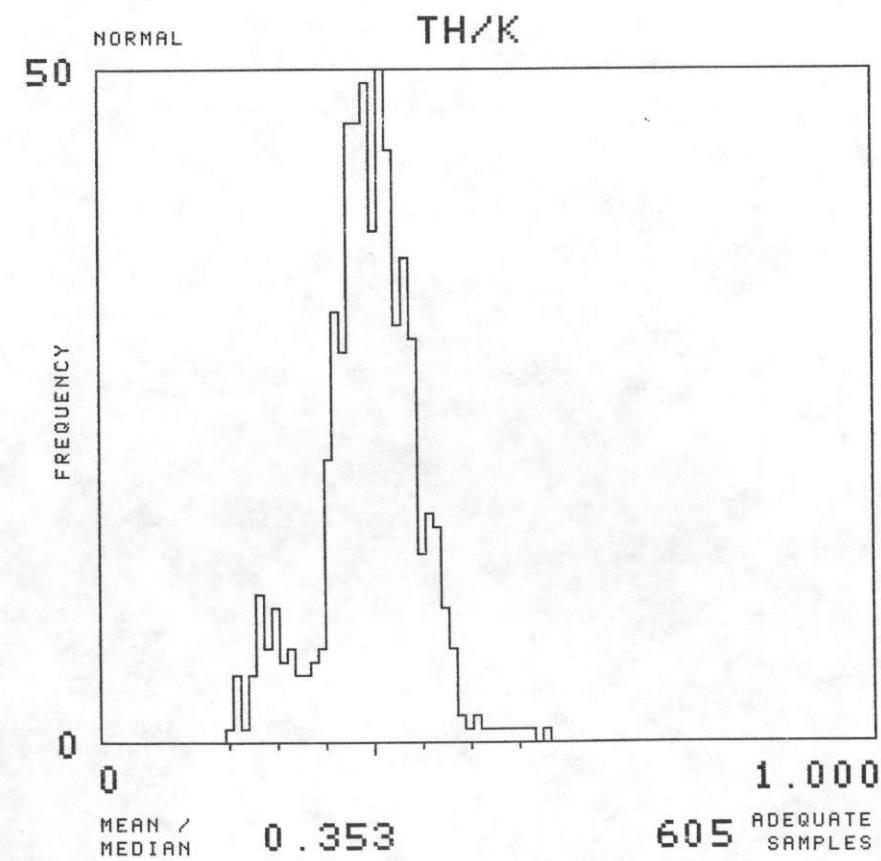
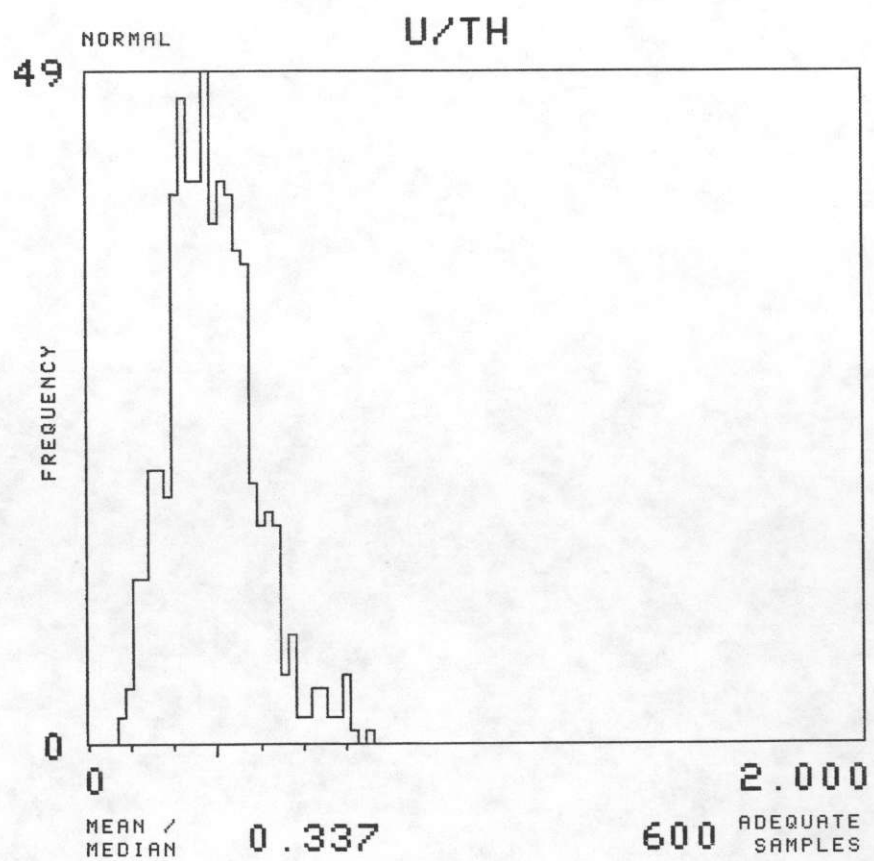
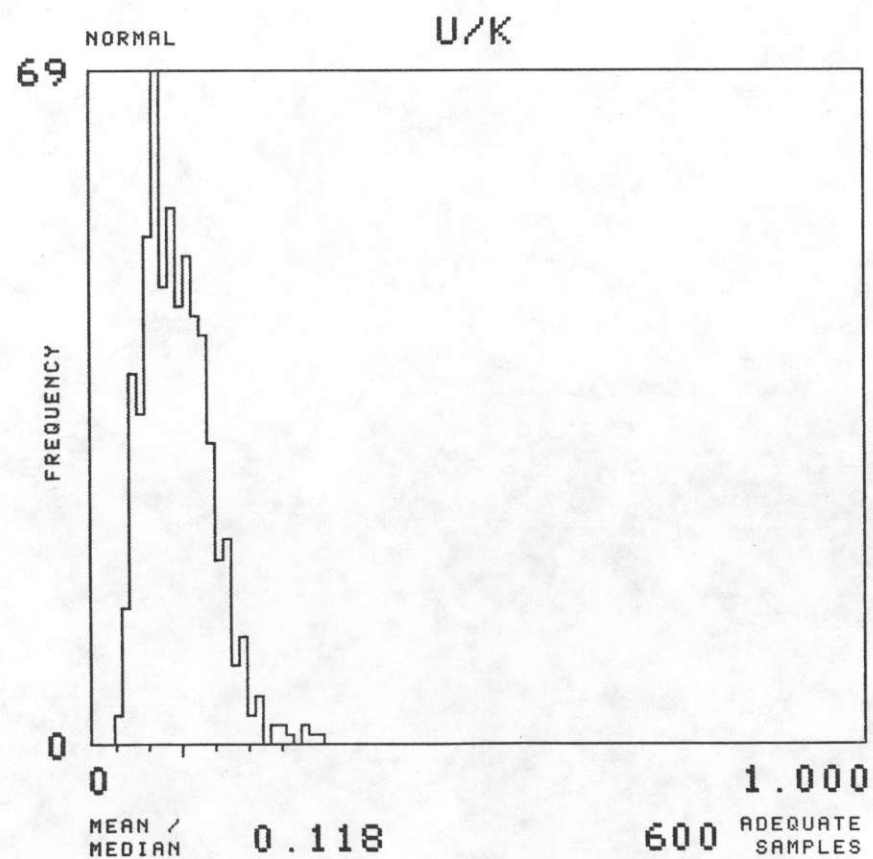
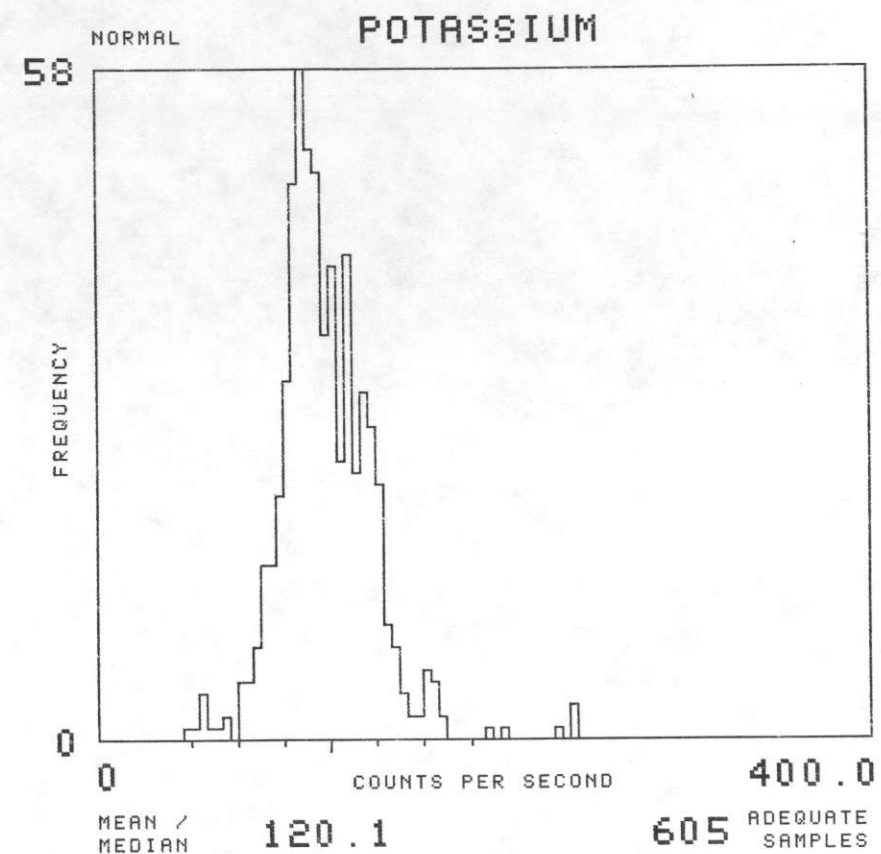
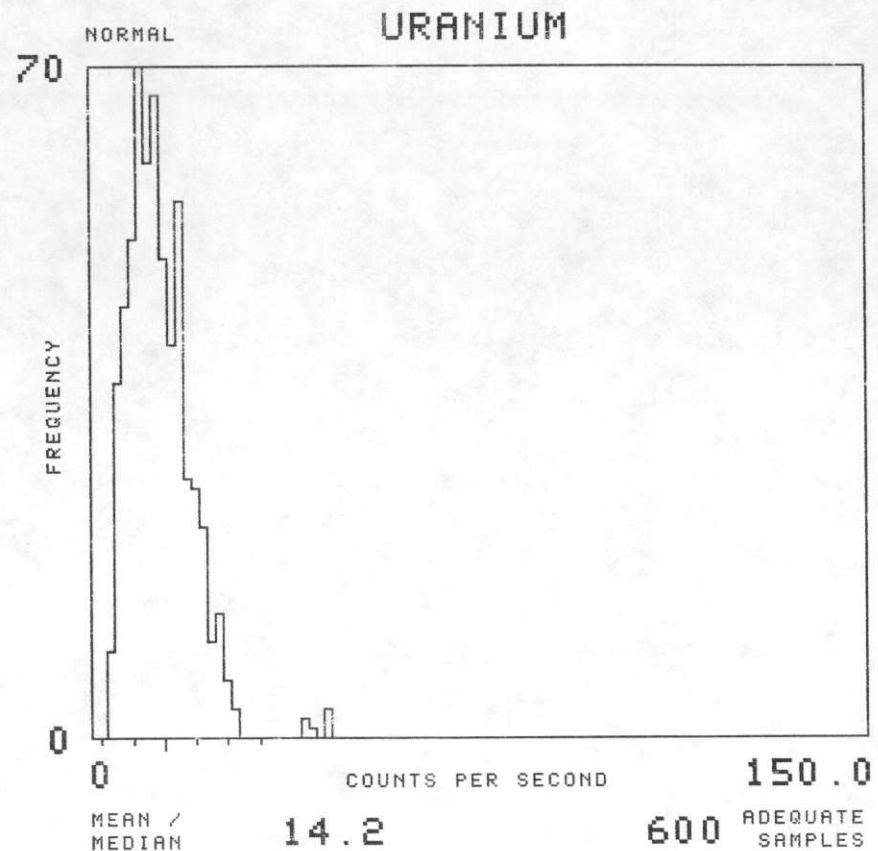
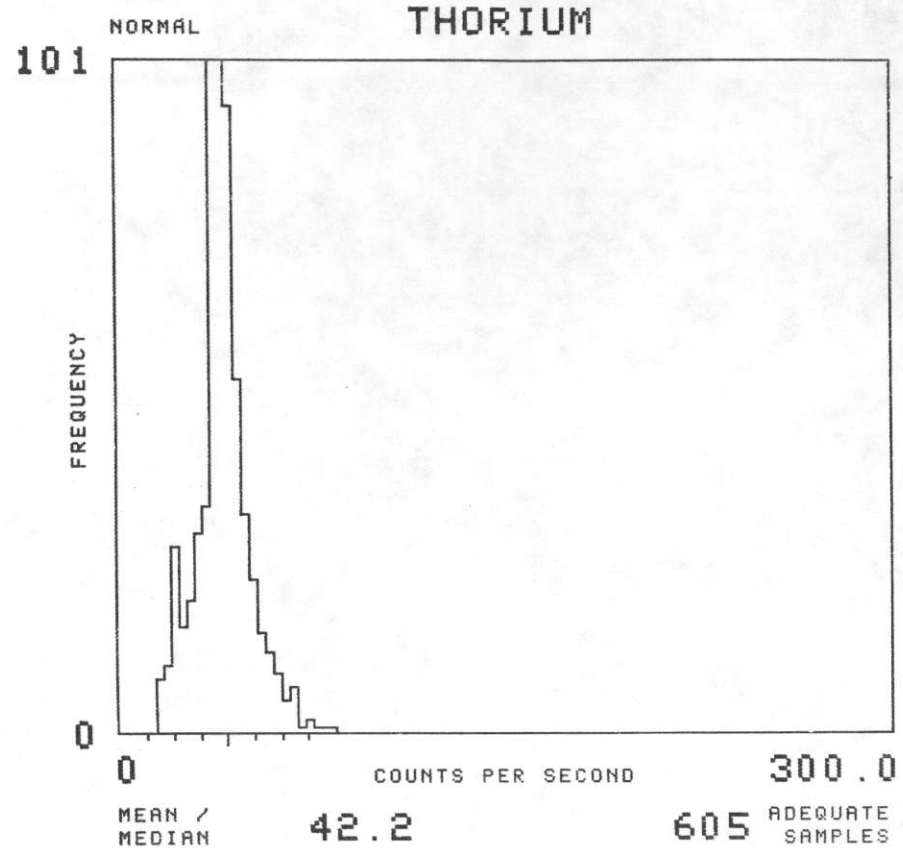
MAP UNIT : QAO

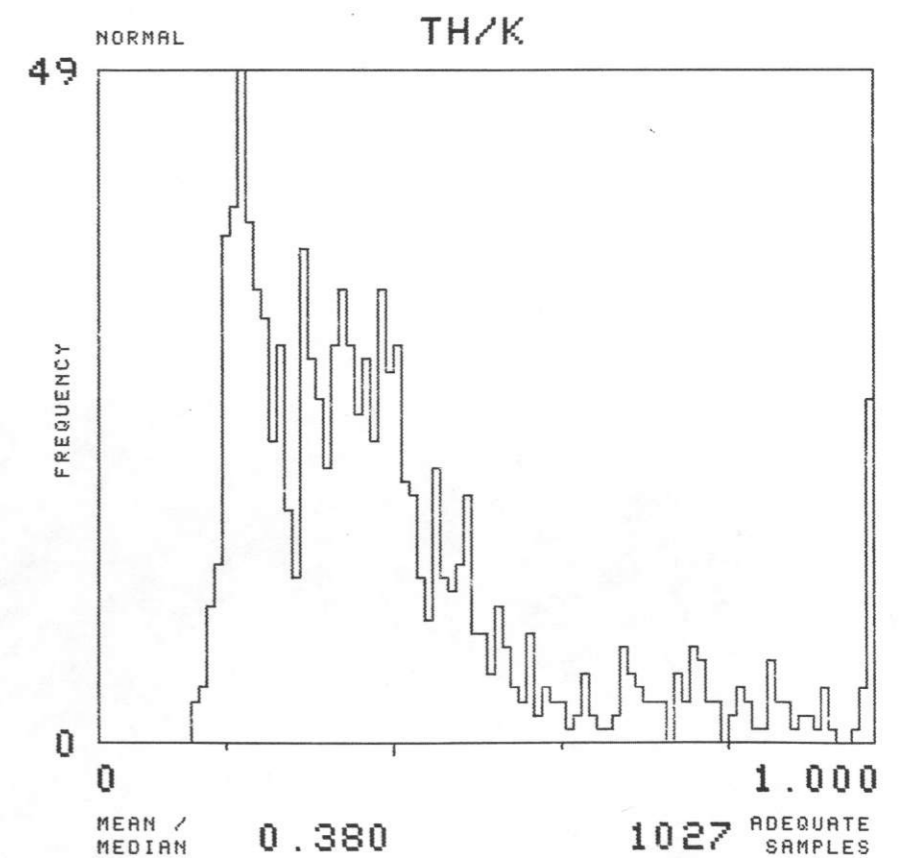
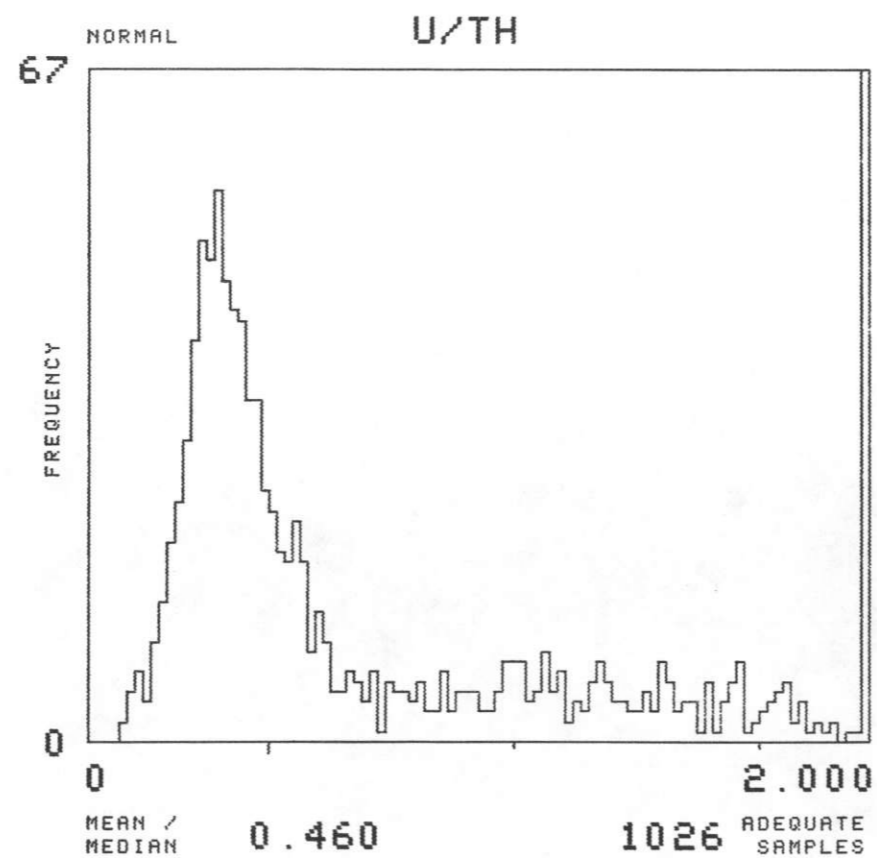
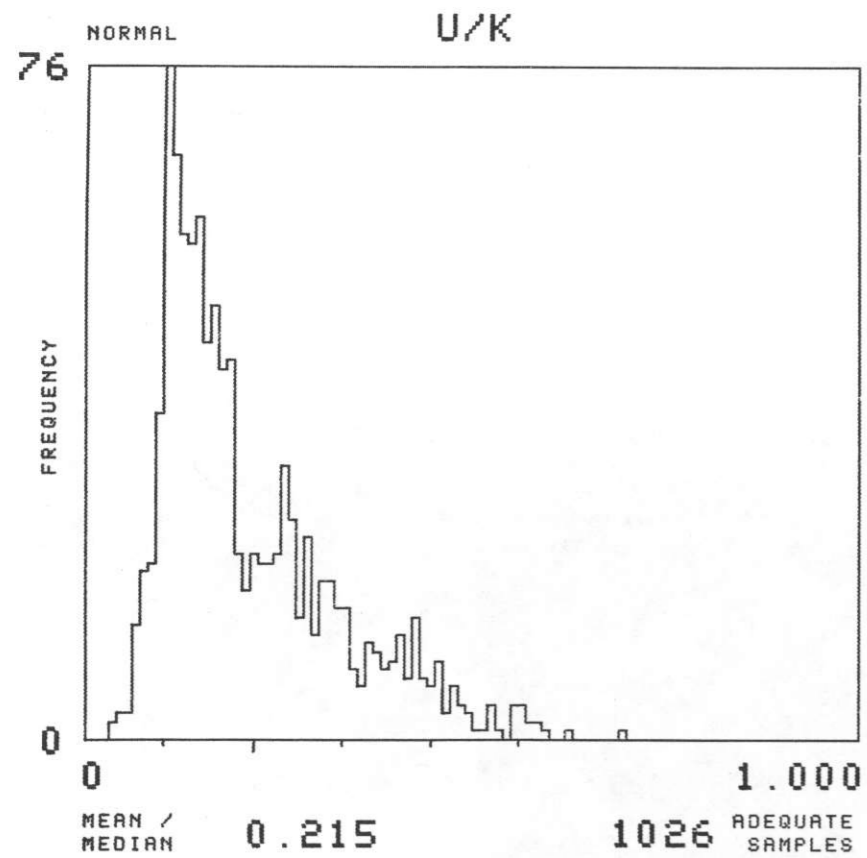
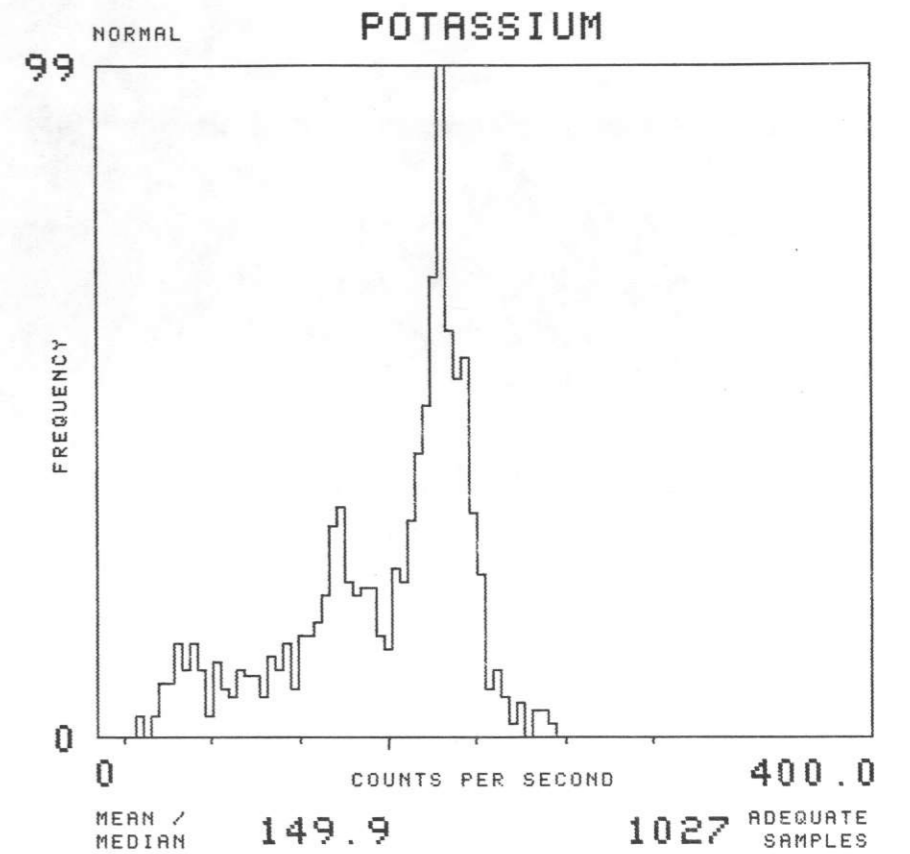
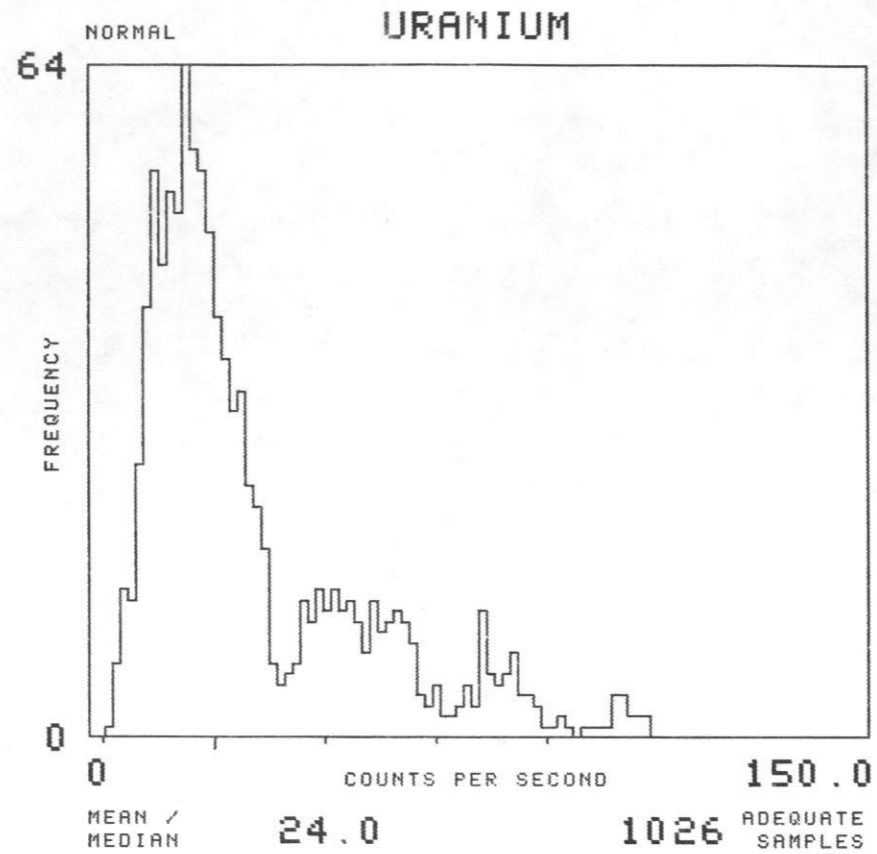
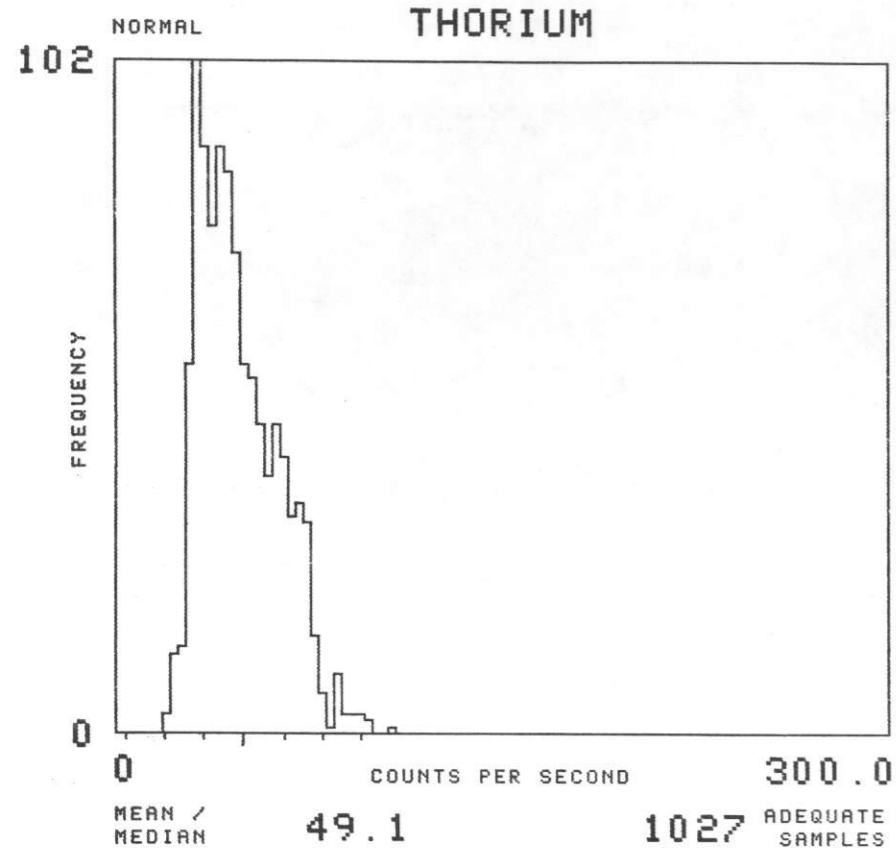
TOTAL NUMBER OF SAMPLES 7431



NTMS NI 12-3 GALLUP

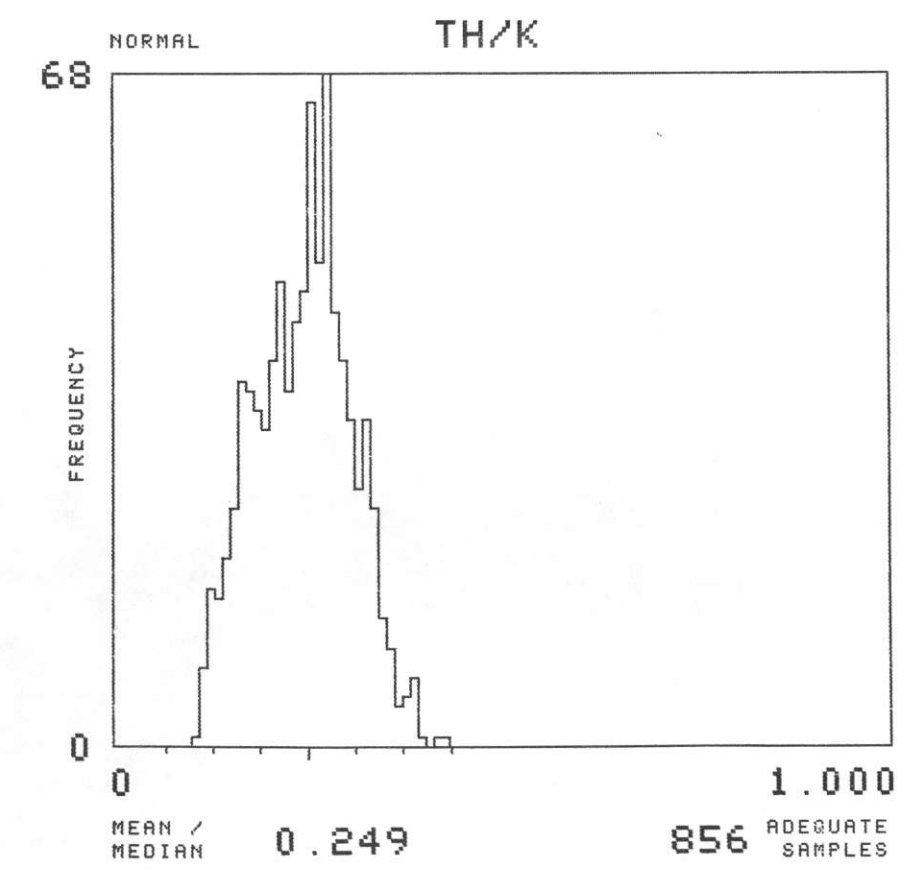
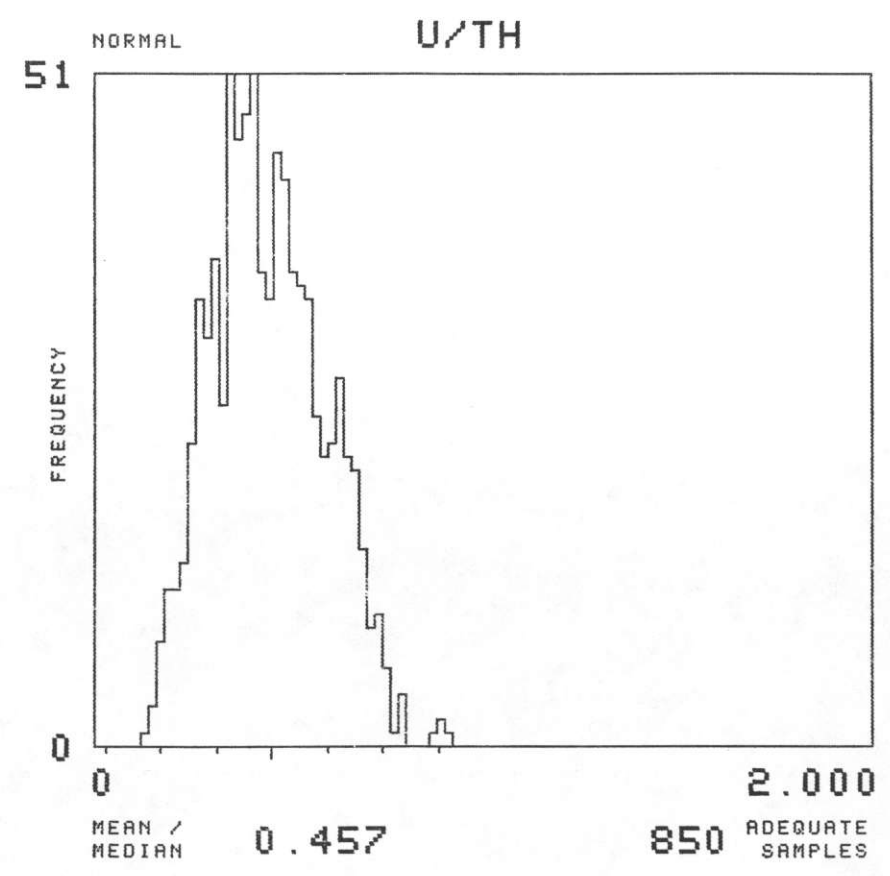
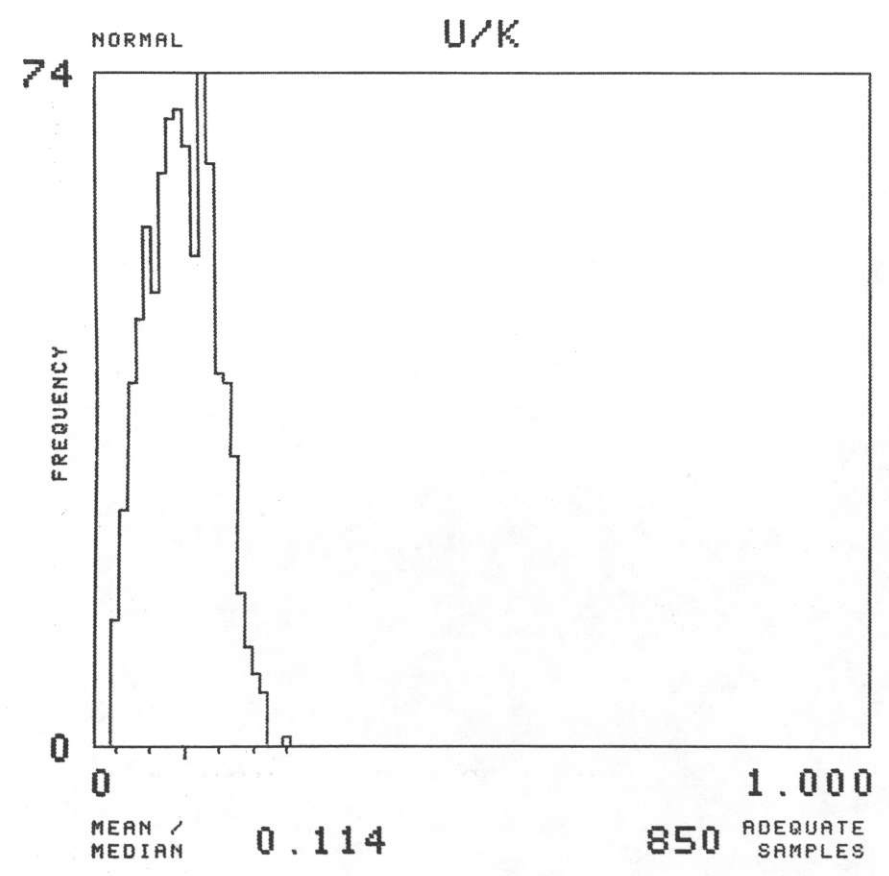
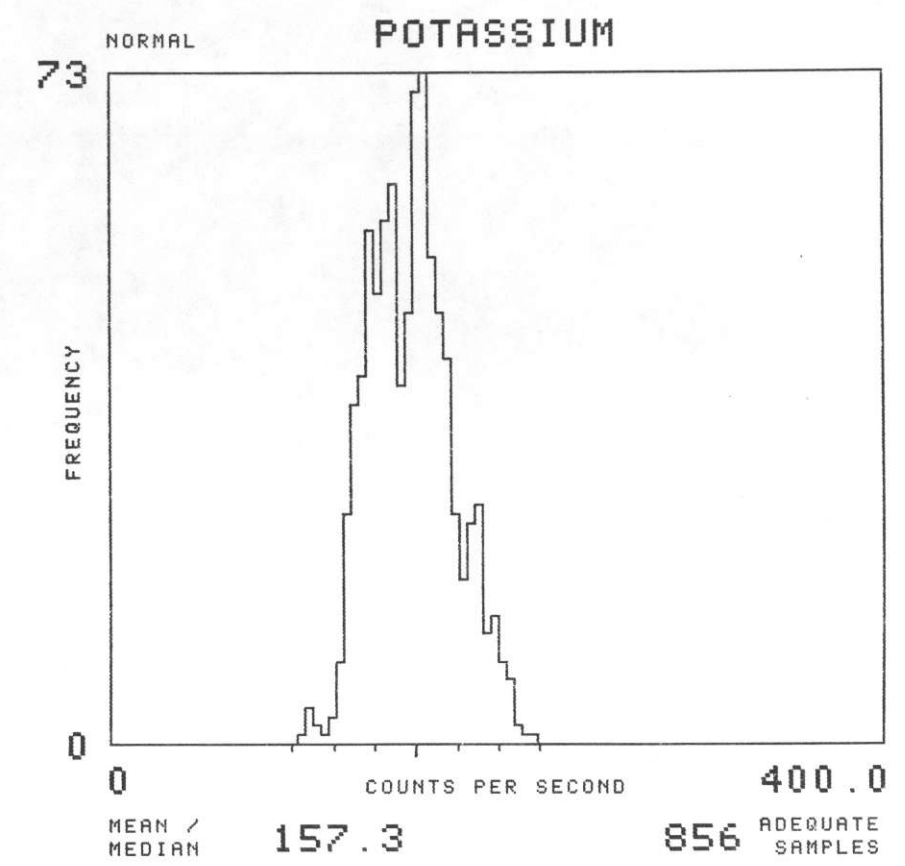
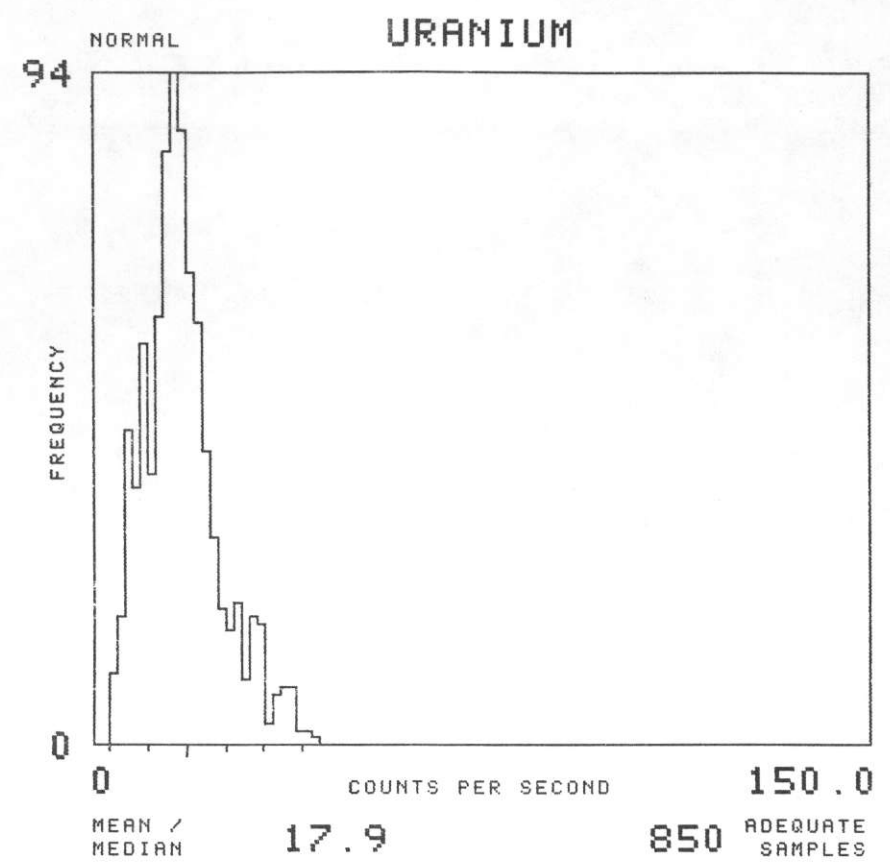
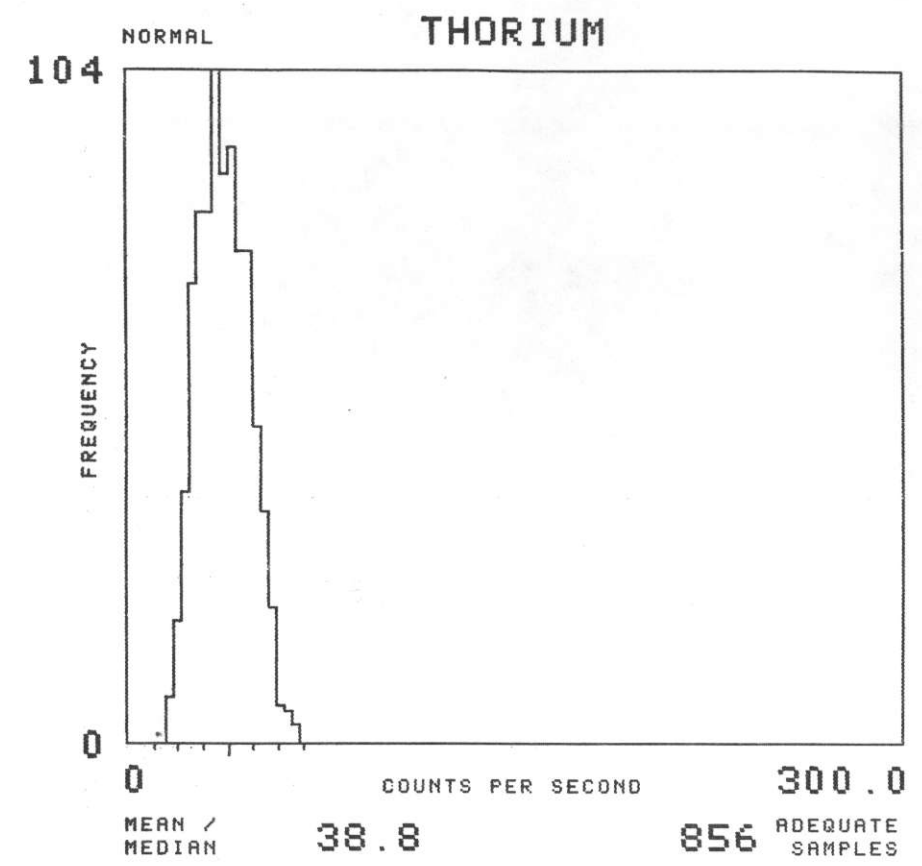
MAP UNIT : QB TOTAL NUMBER OF SAMPLES 605





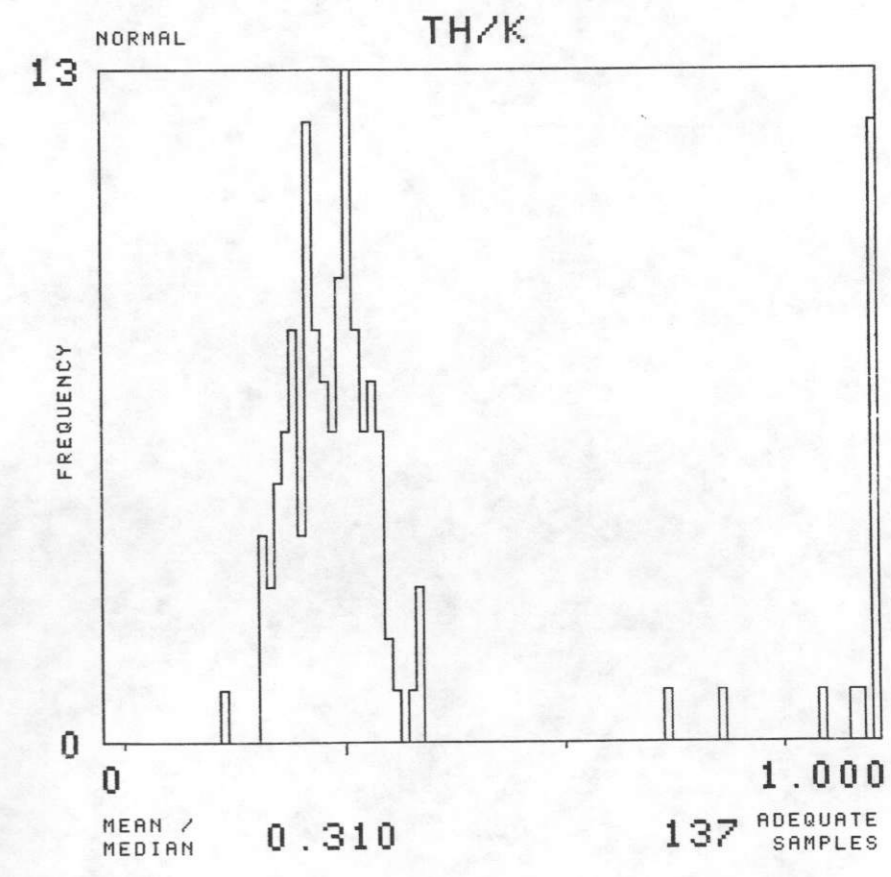
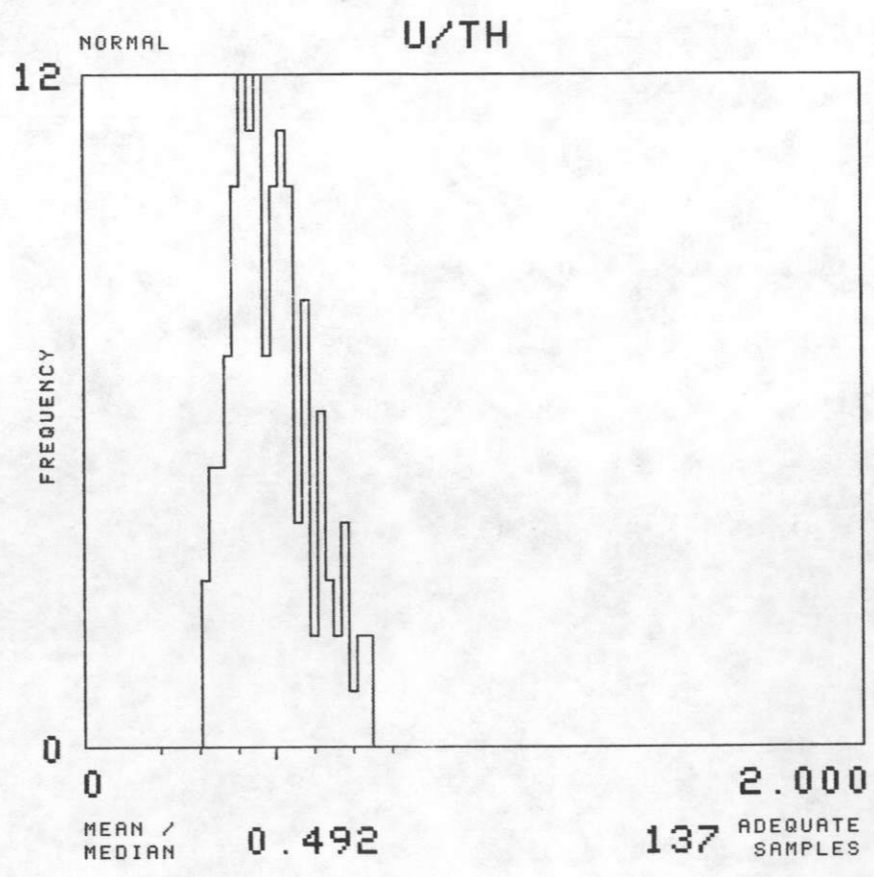
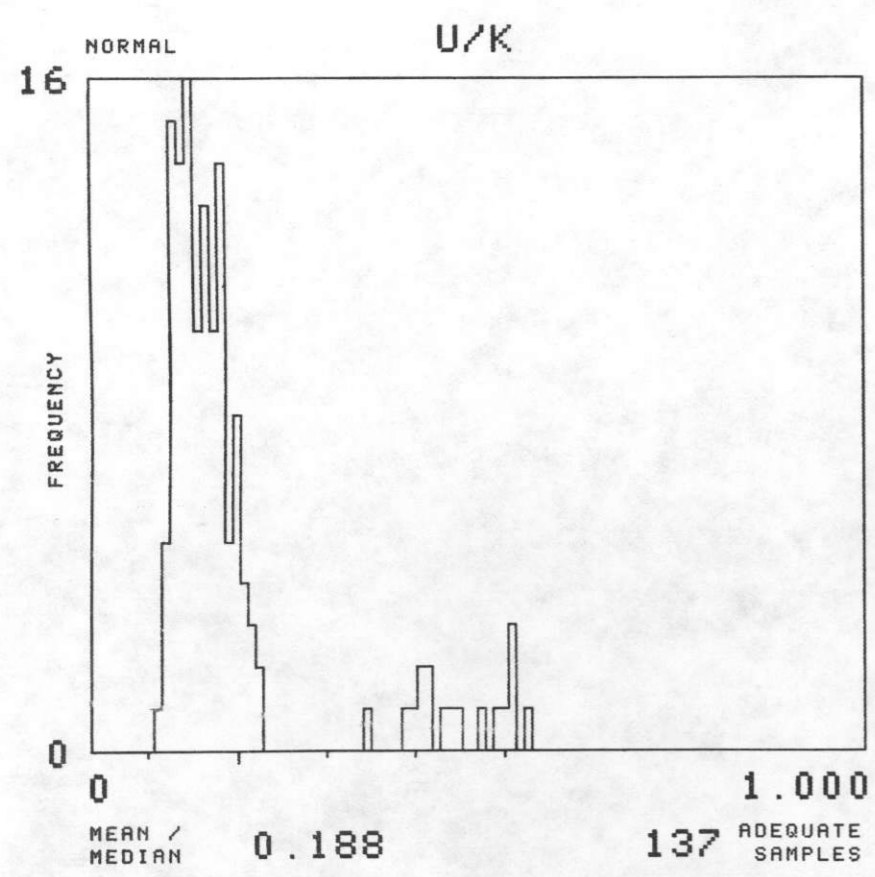
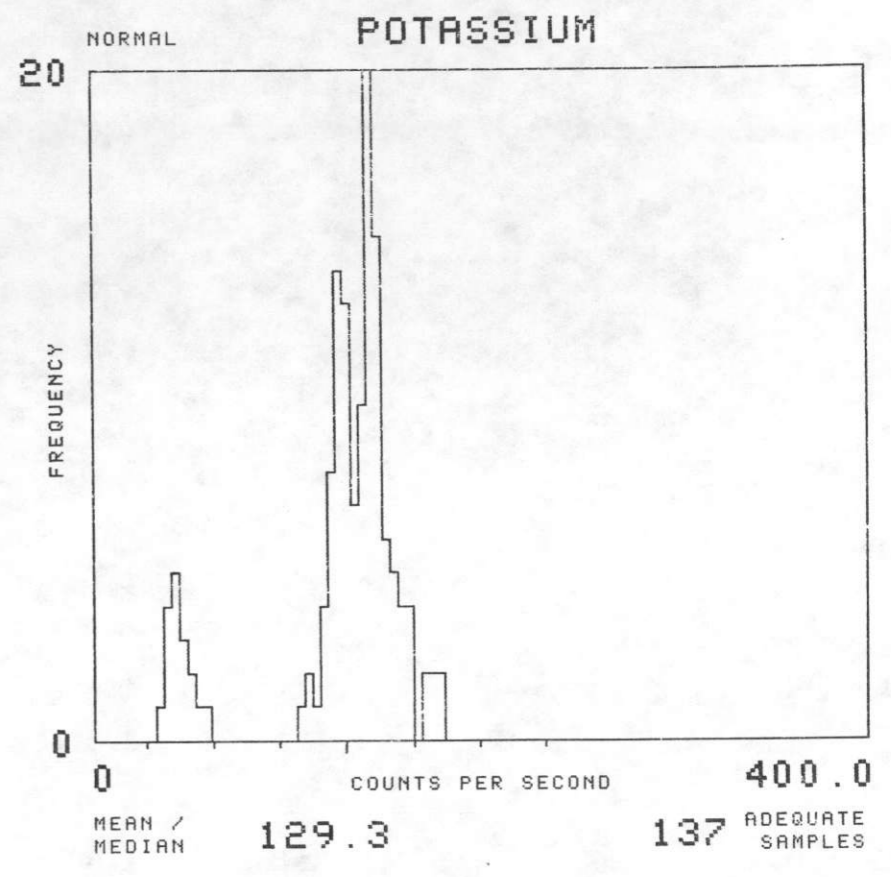
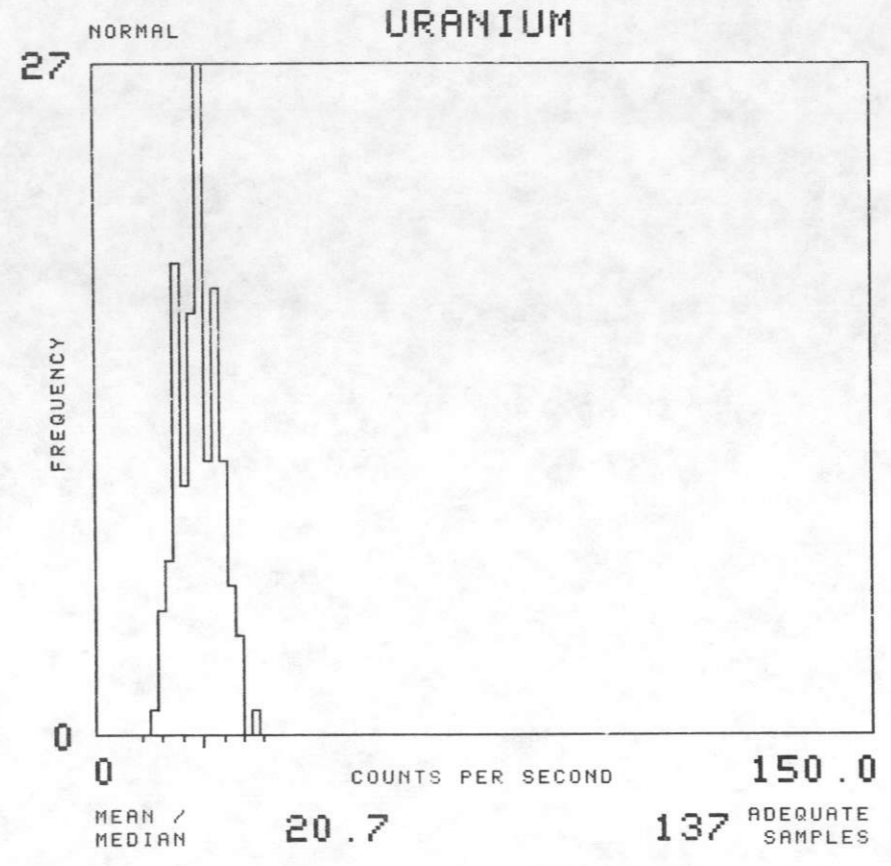
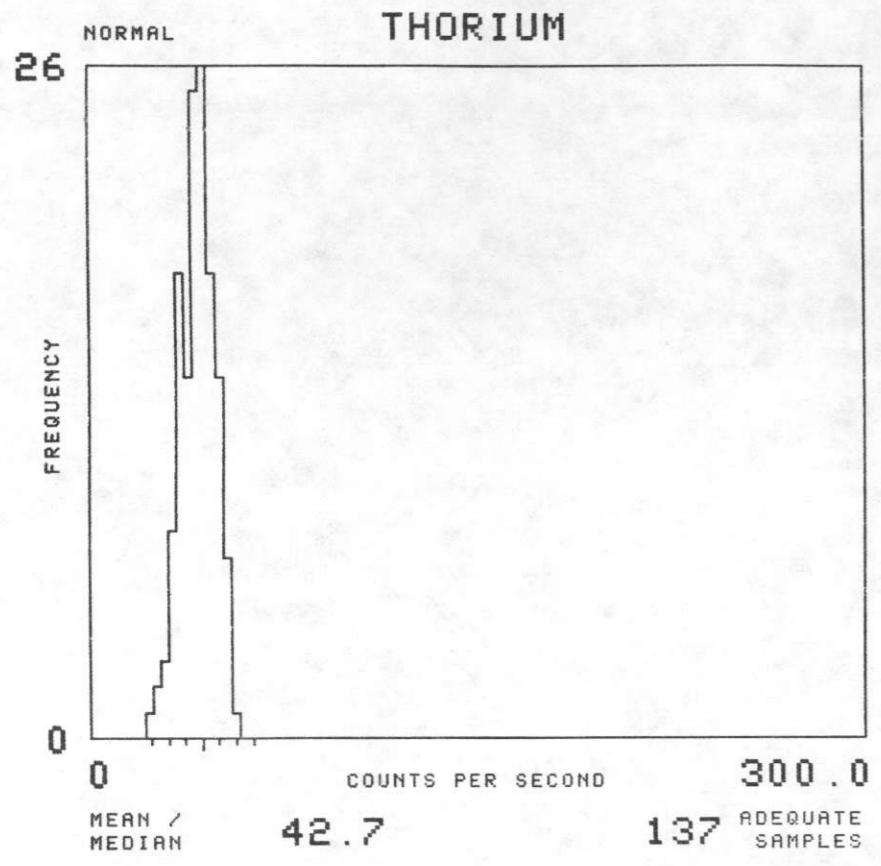
NTMS NI 12-3 GALLUP

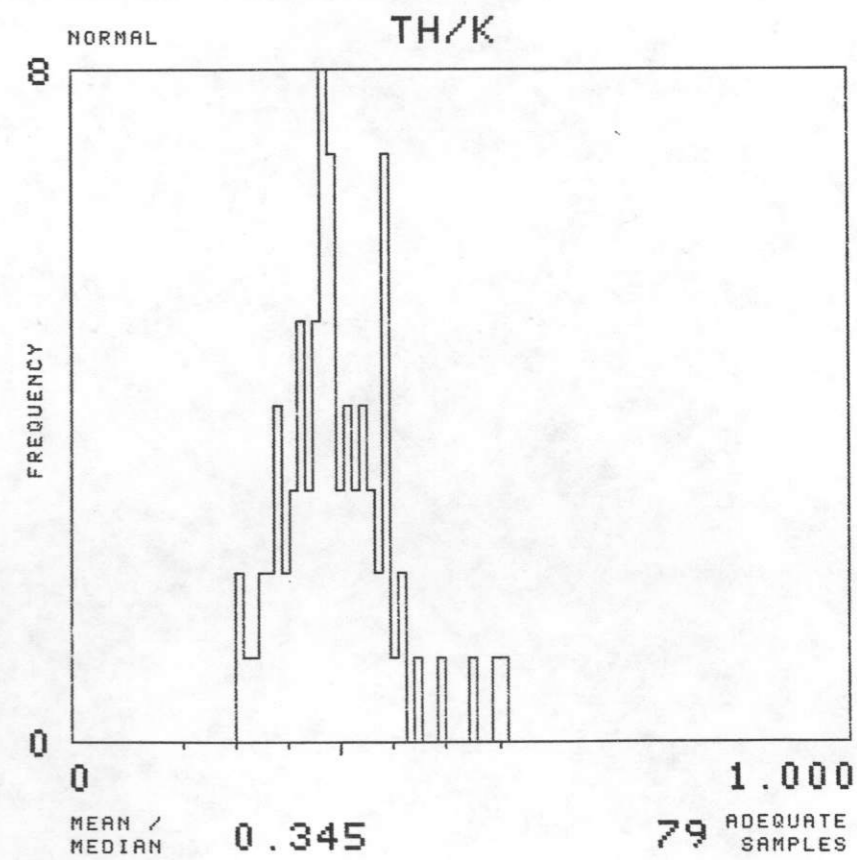
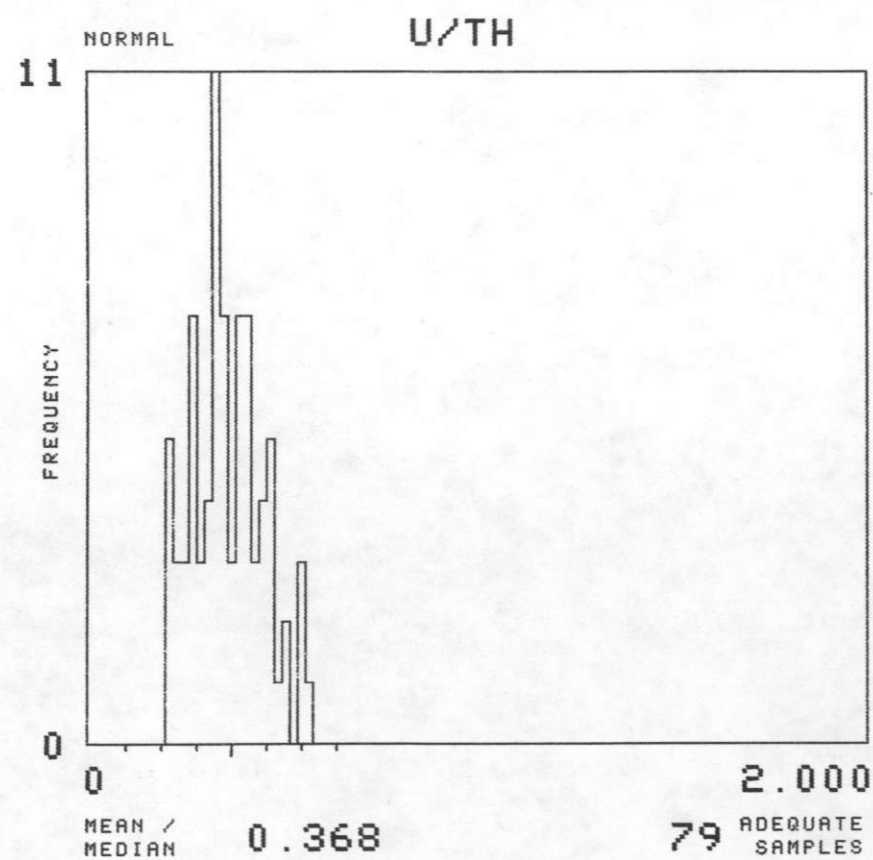
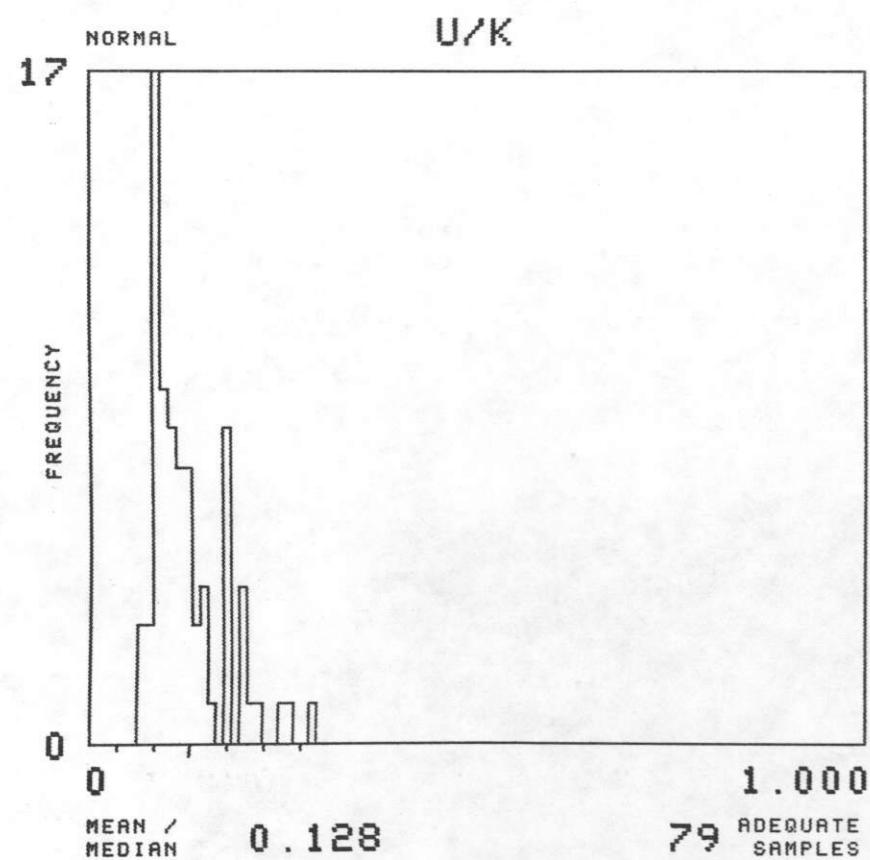
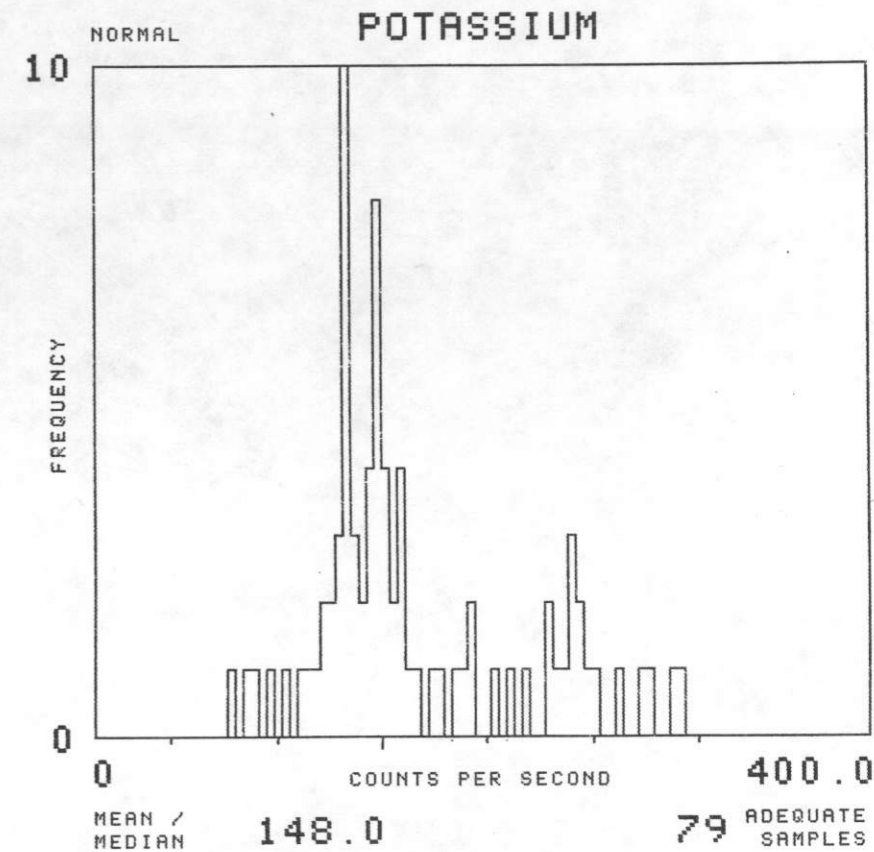
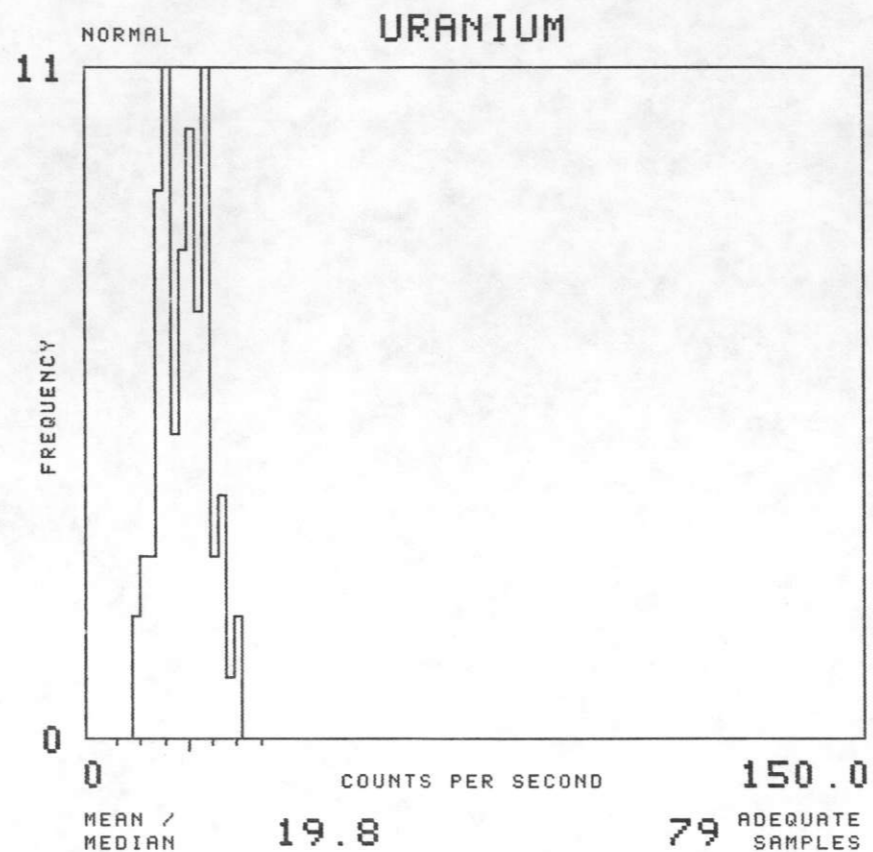
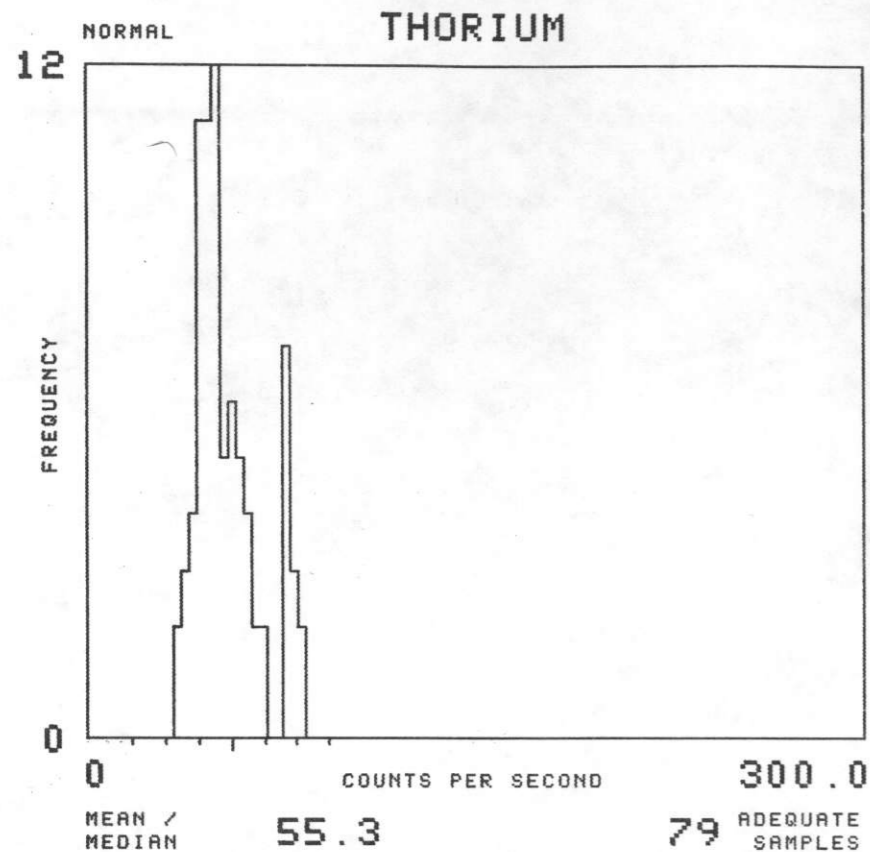
MAP UNIT : QE TOTAL NUMBER OF SAMPLES 858



NTMS NI 12-3 GALLUP

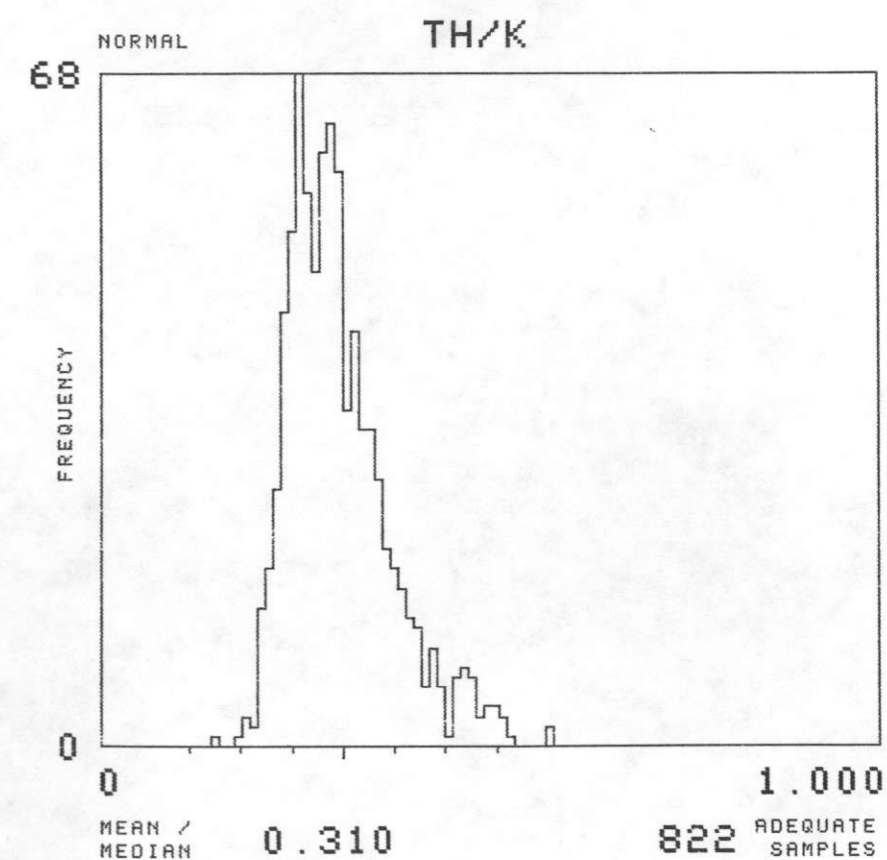
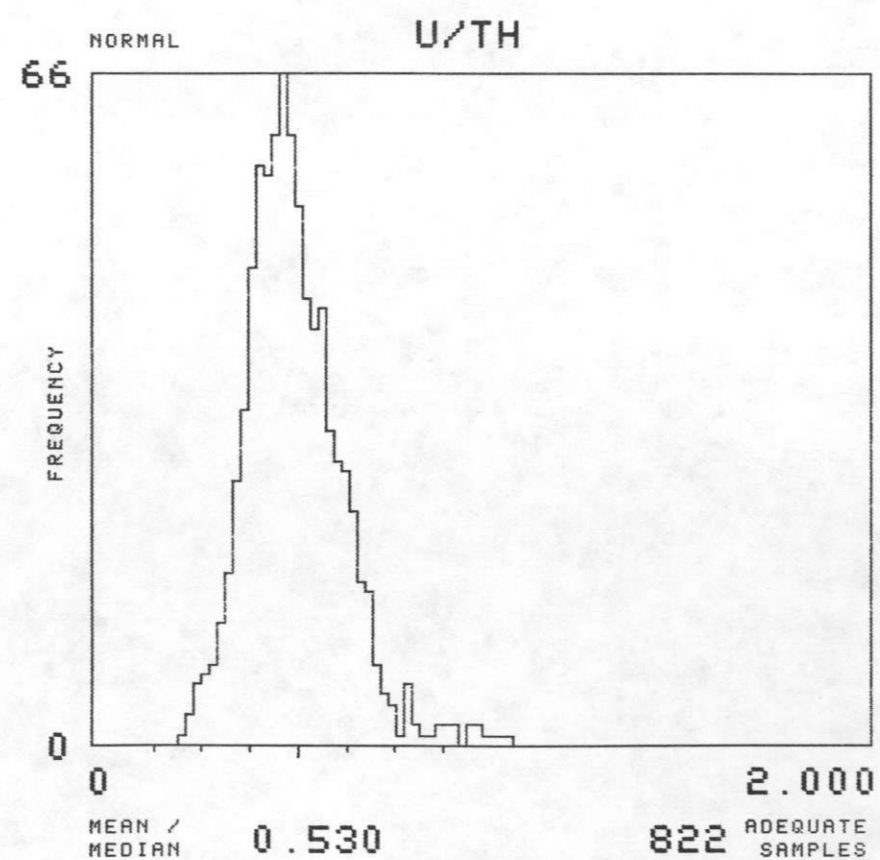
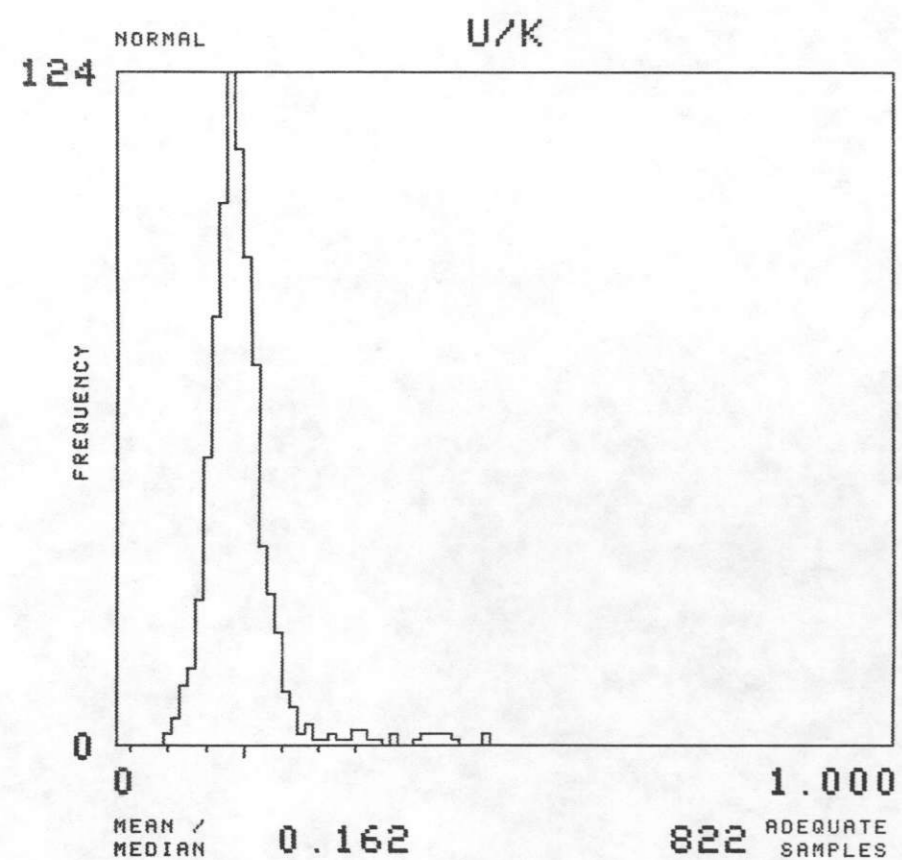
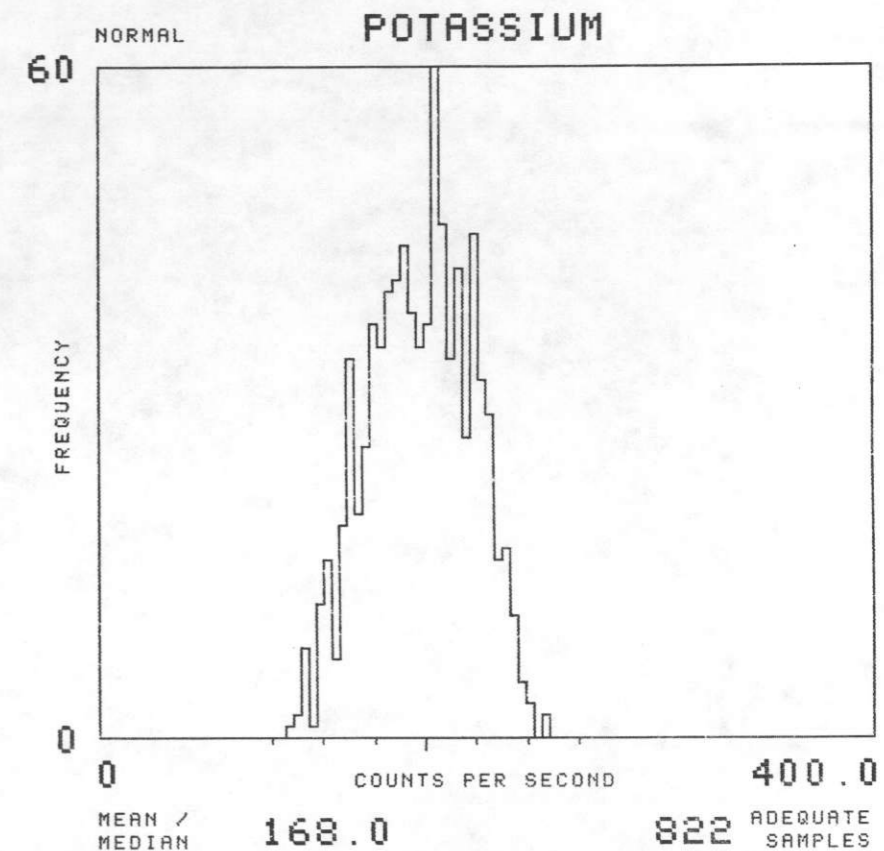
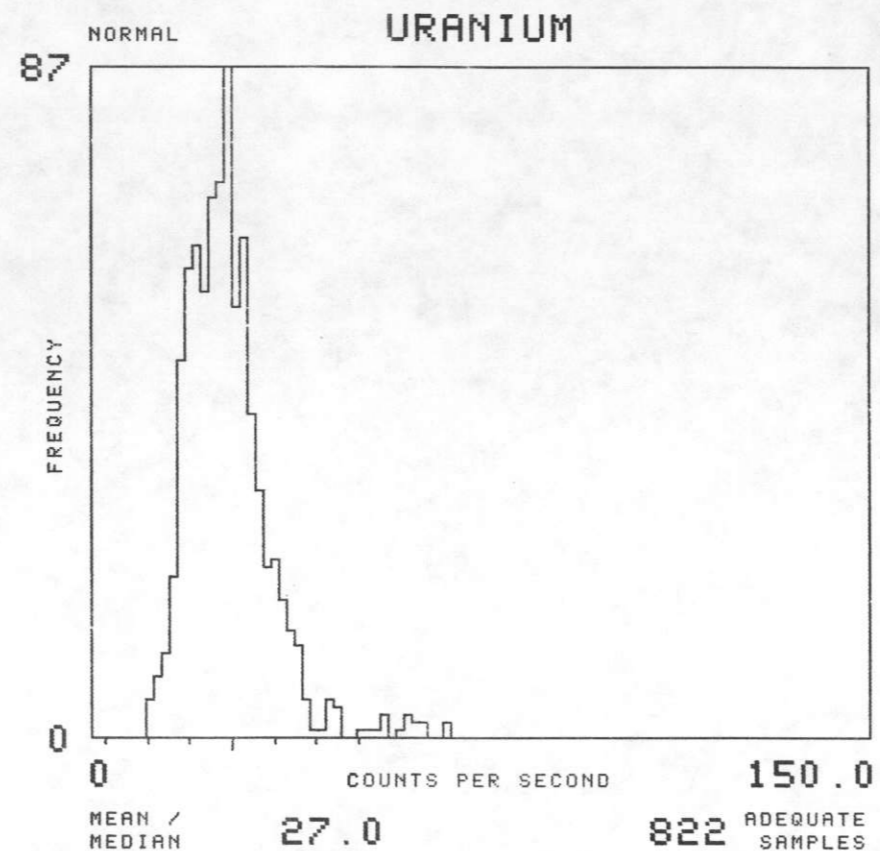
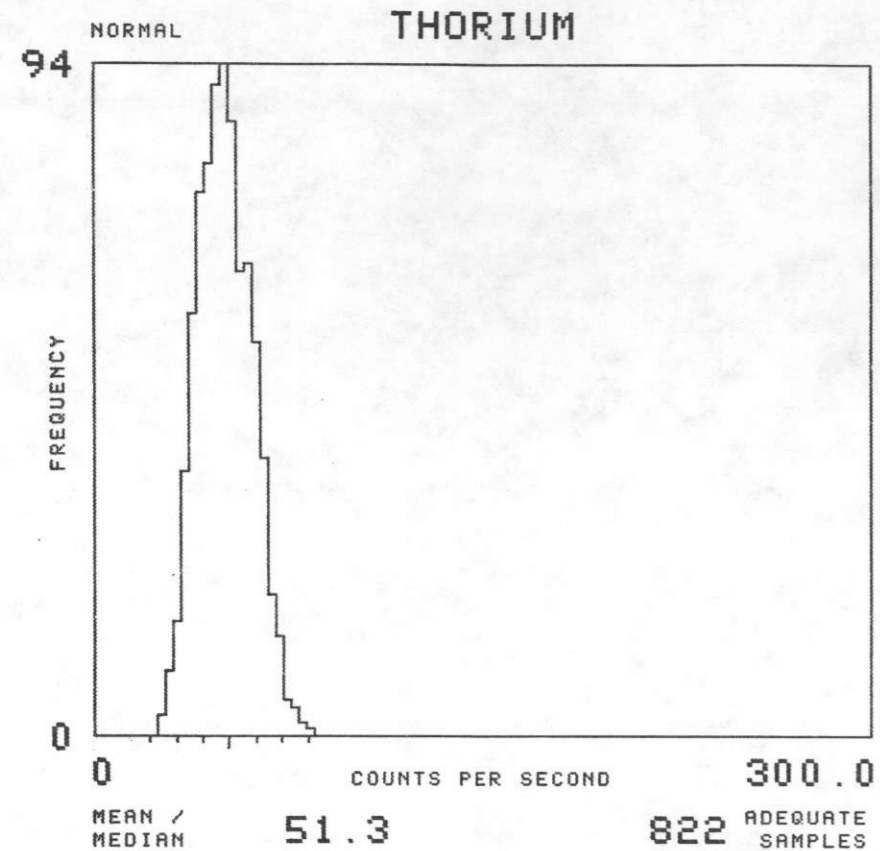
MAP UNIT : QED TOTAL NUMBER OF SAMPLES 137





NTMS NI 12-3 GALLUP

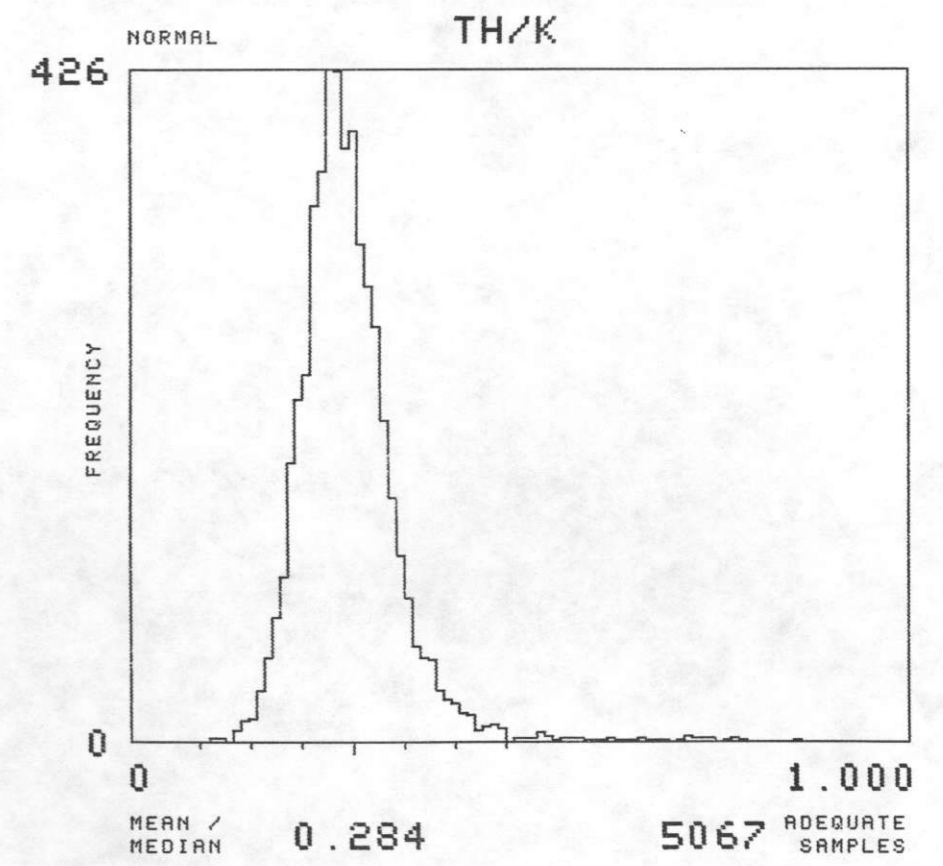
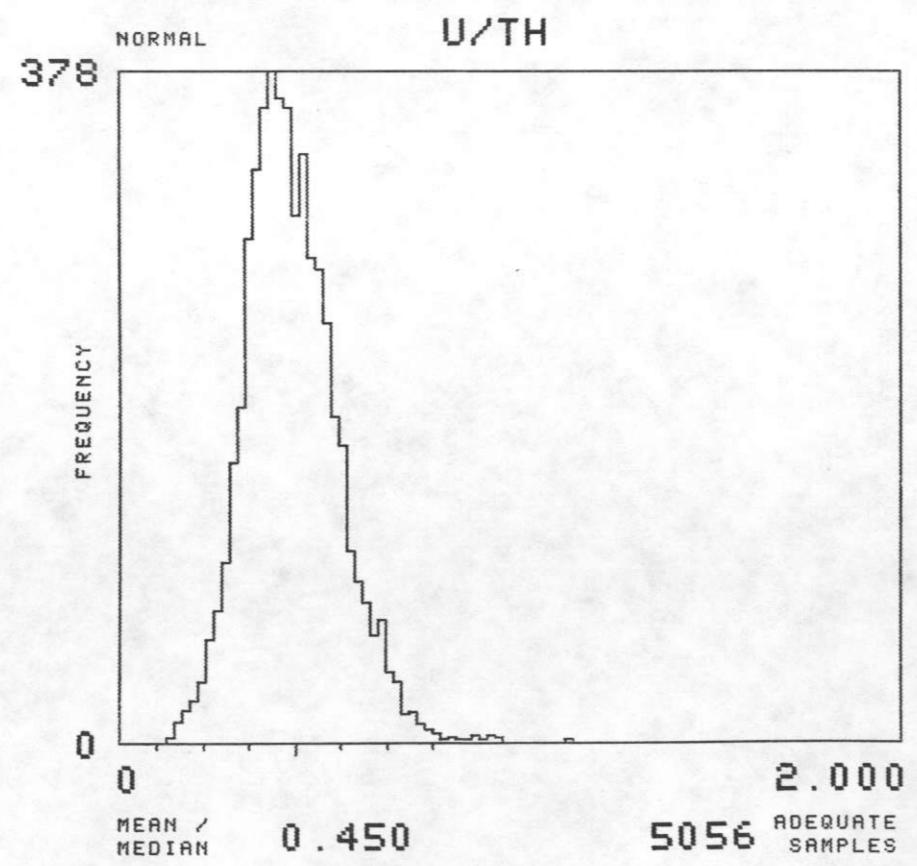
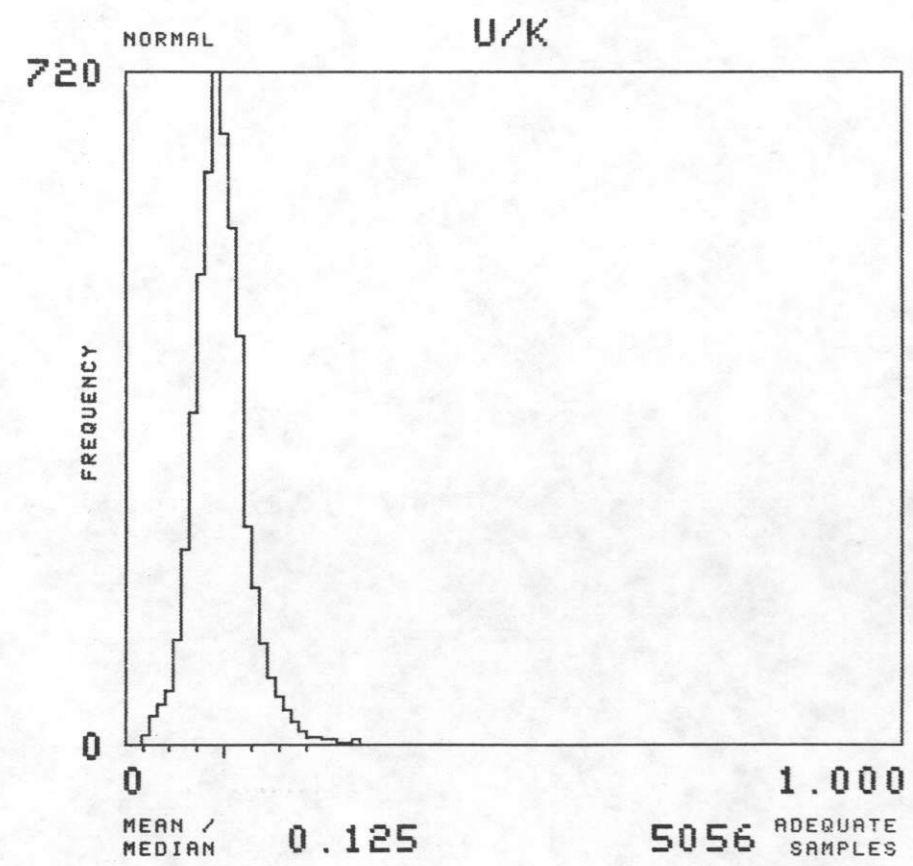
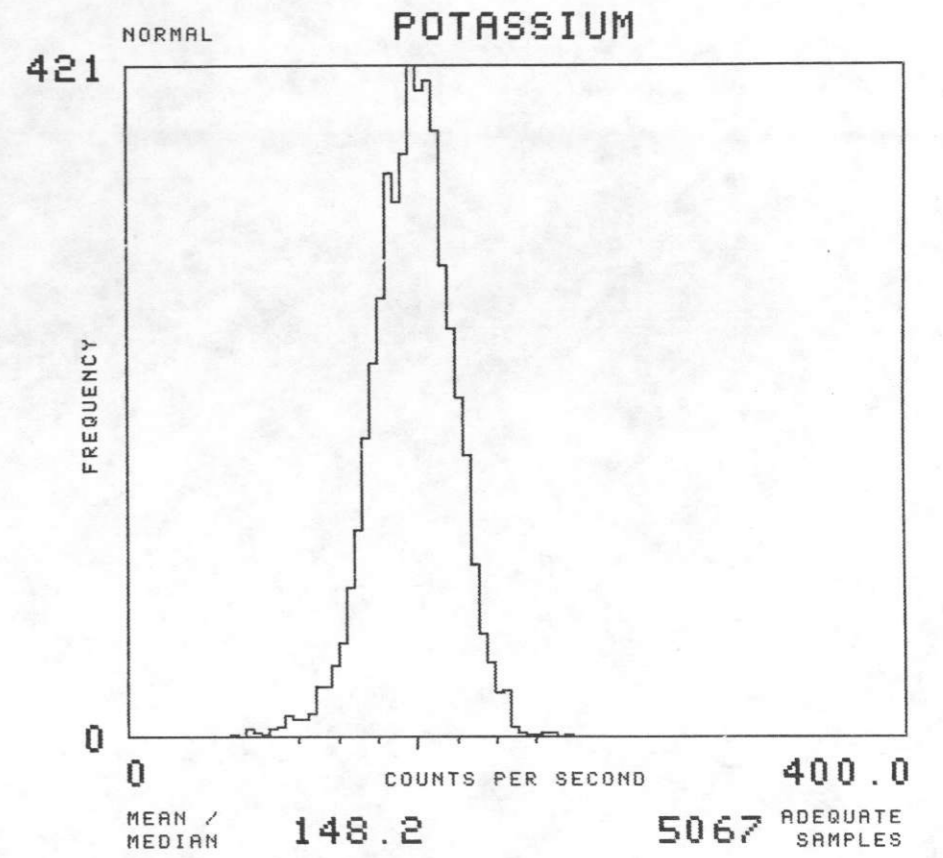
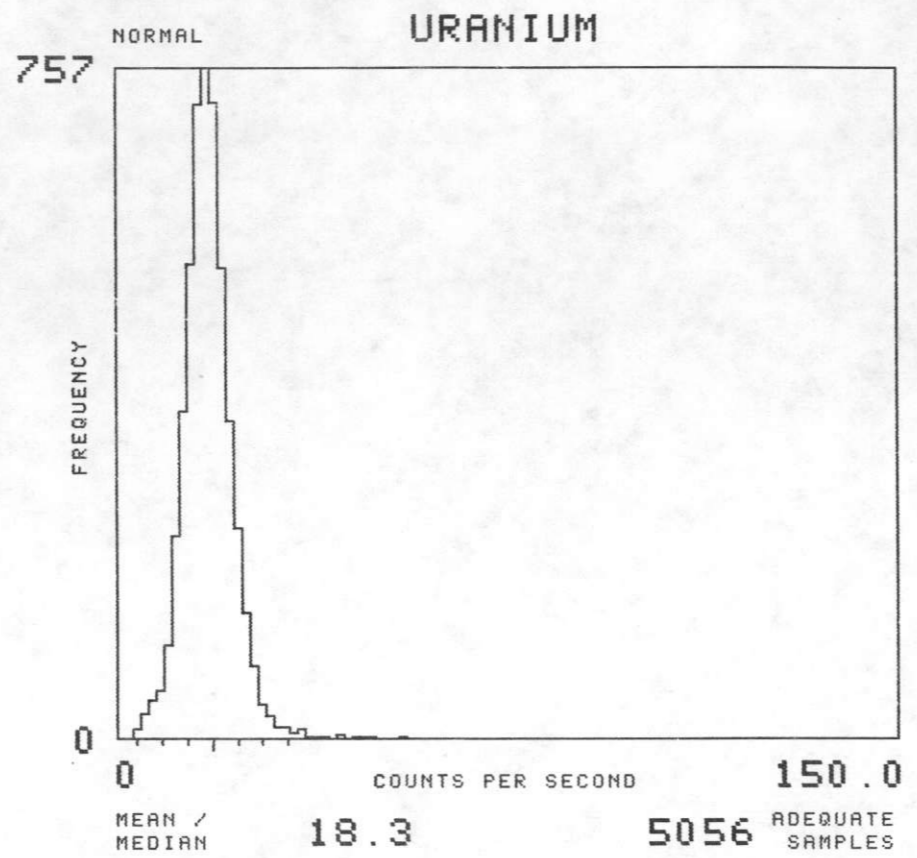
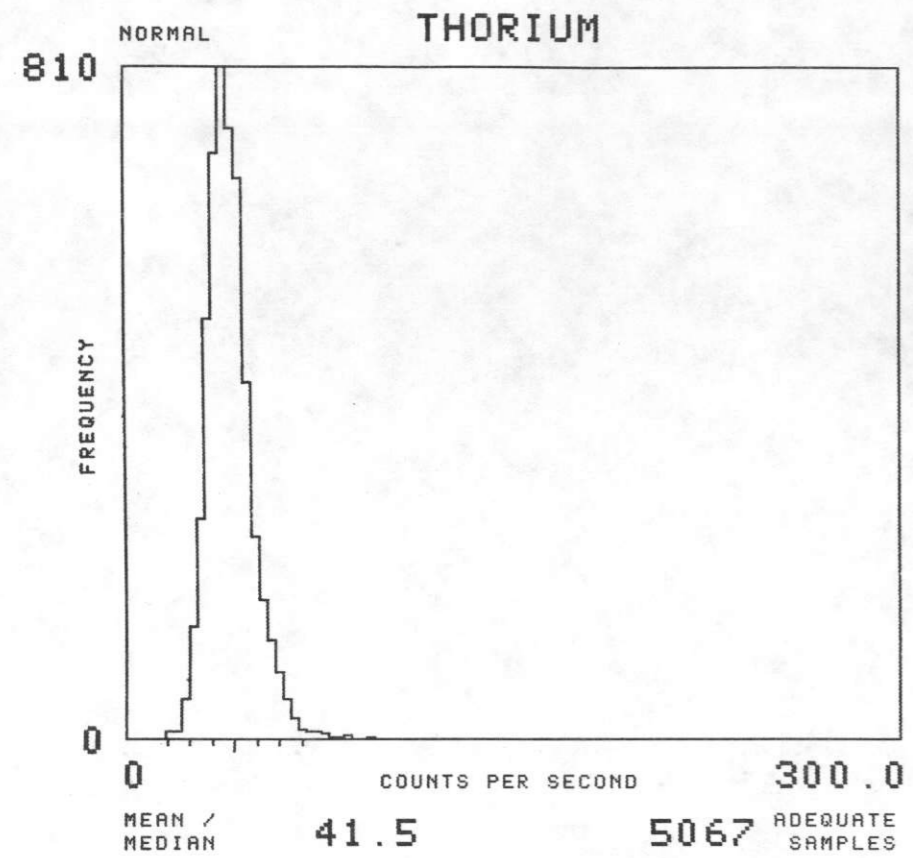
MAP UNIT : TBL TOTAL NUMBER OF SAMPLES 822



NTMS NI 12-3 GALLUP

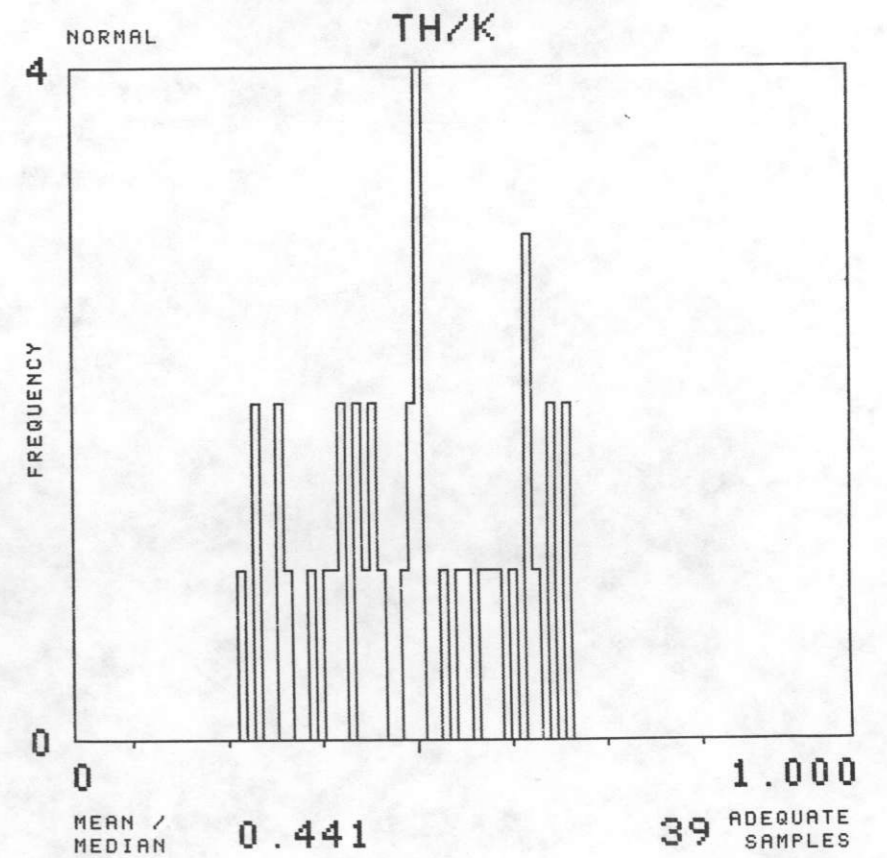
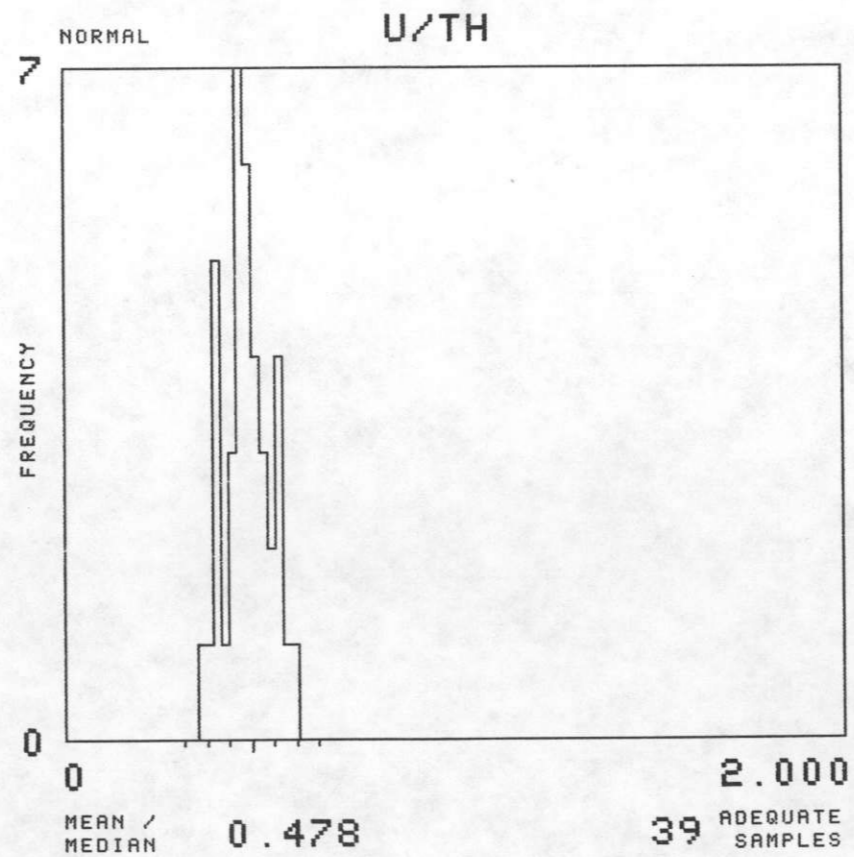
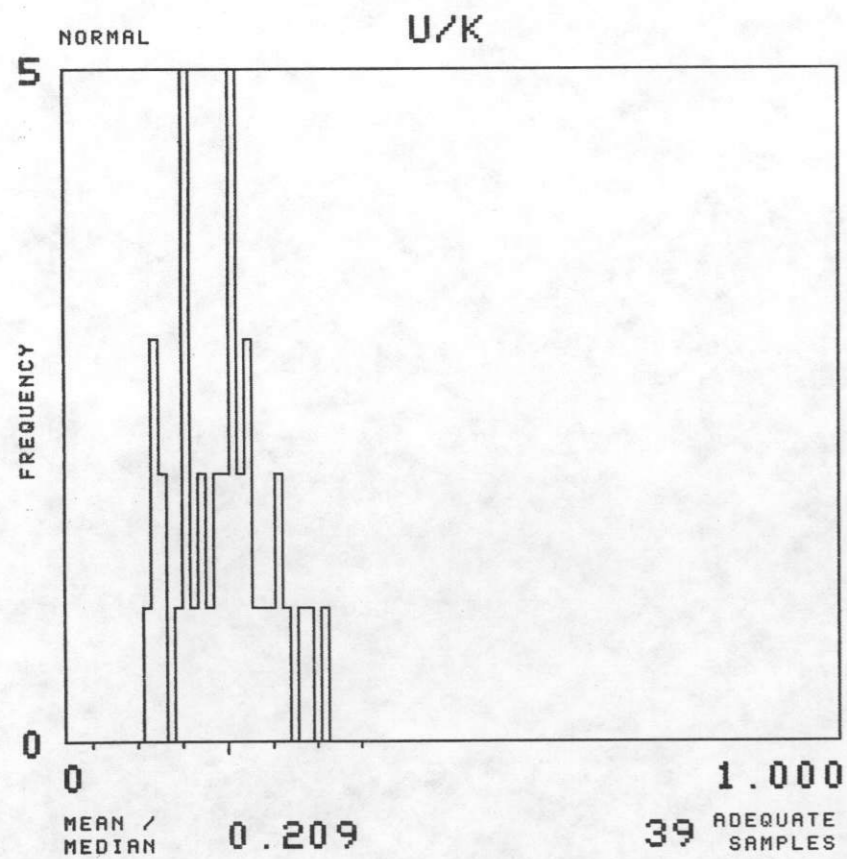
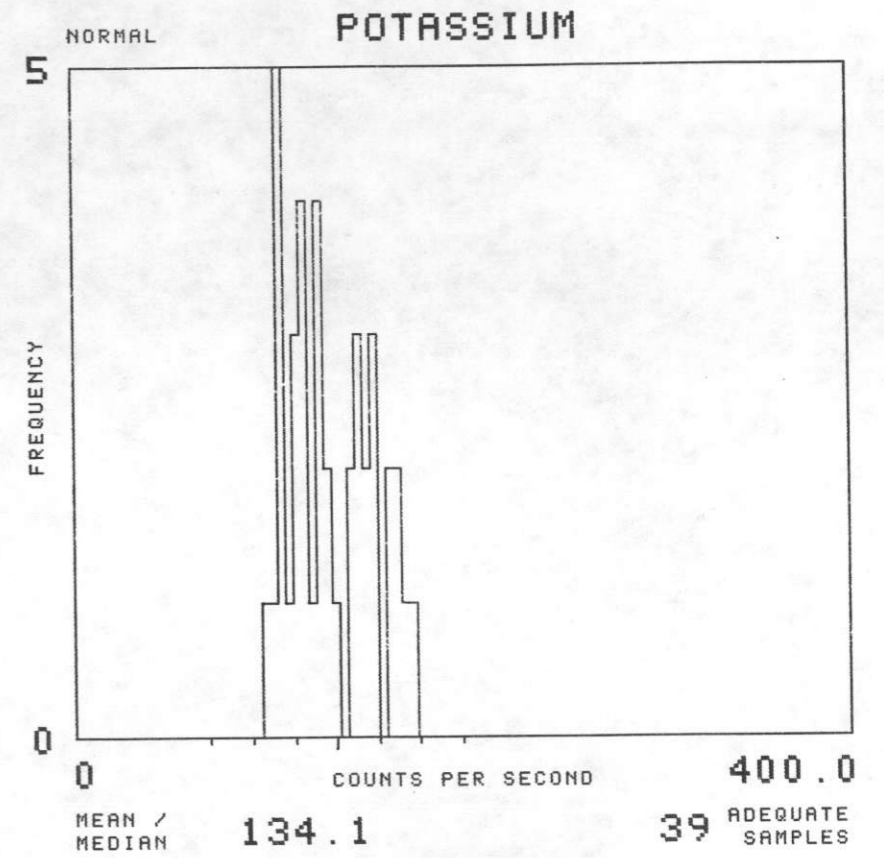
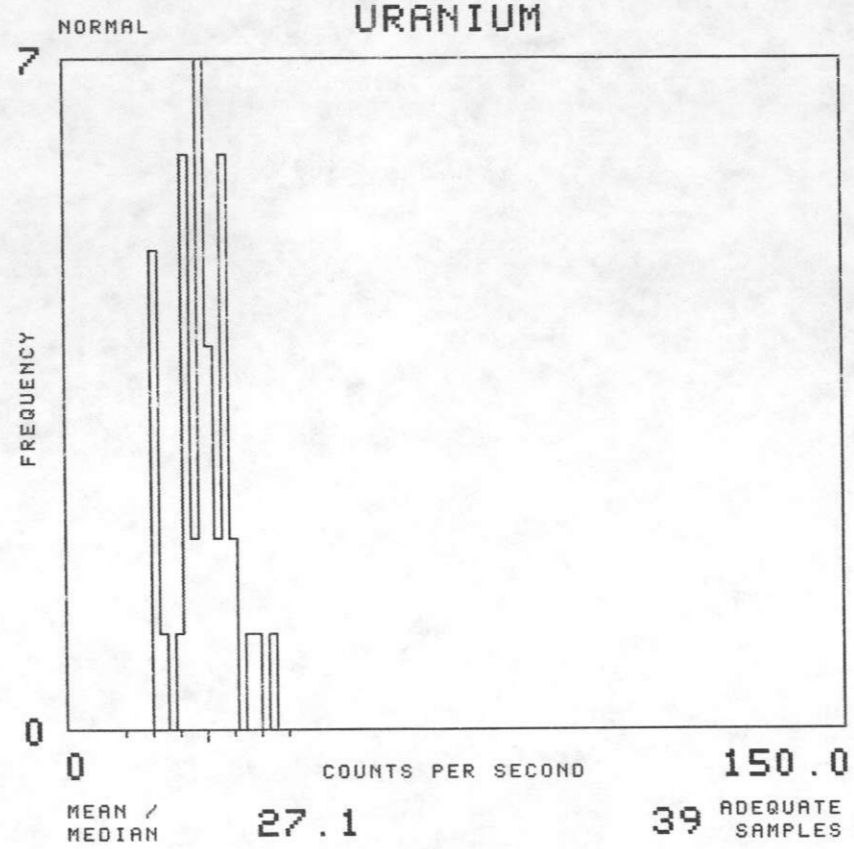
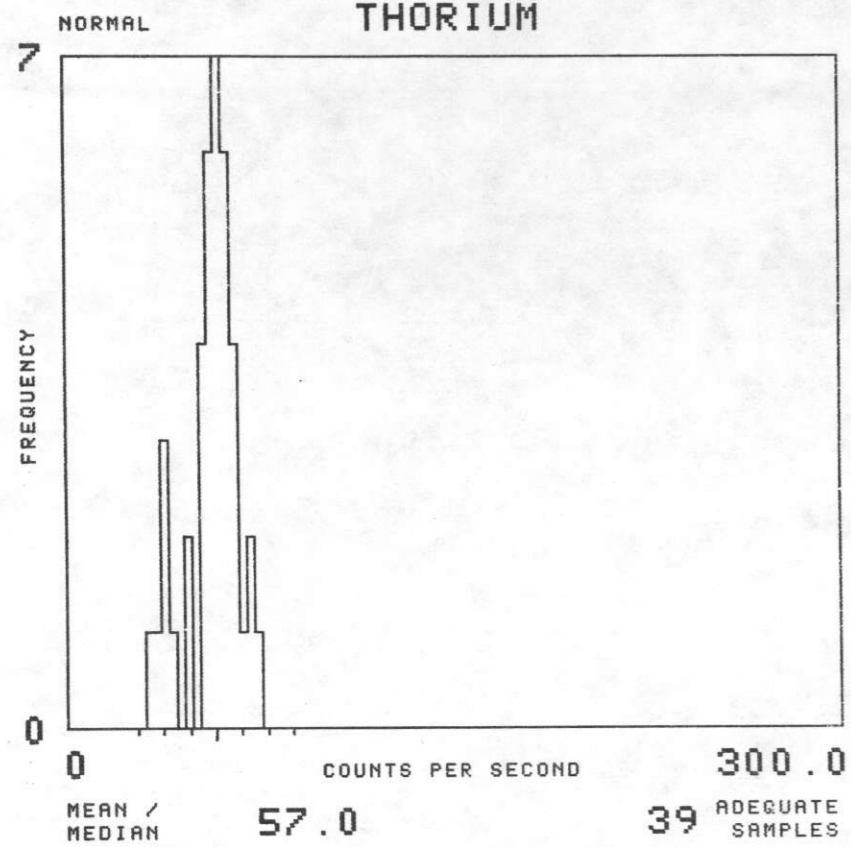
MAP UNIT : TBU

TOTAL NUMBER OF SAMPLES 5071



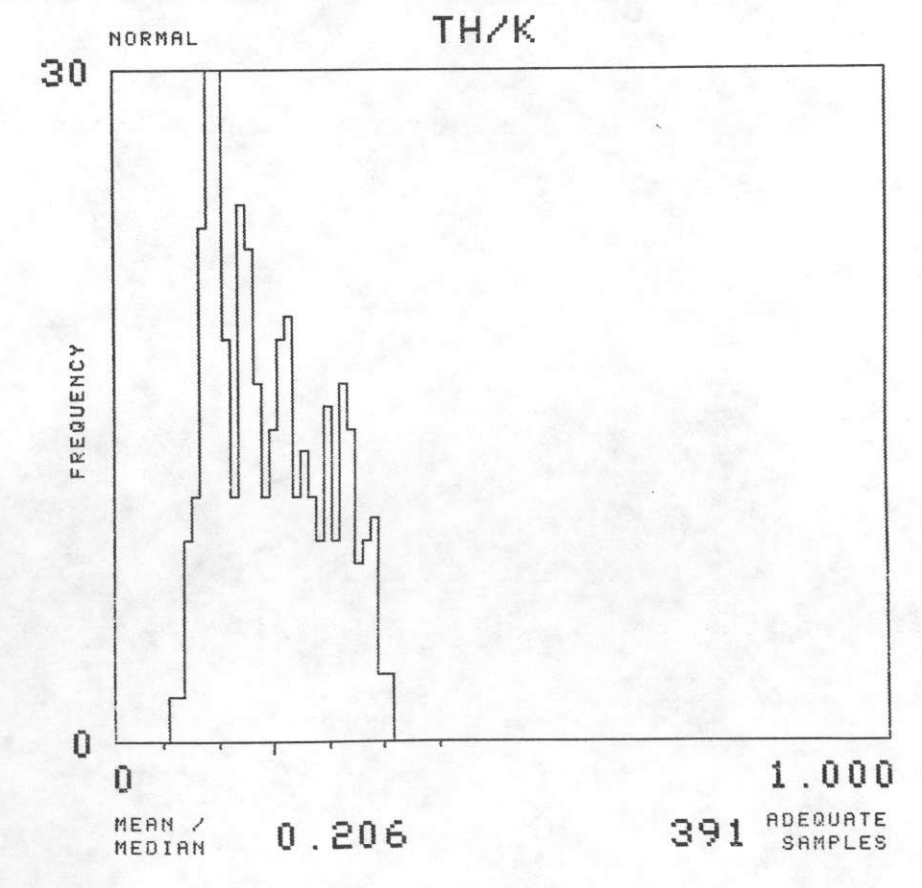
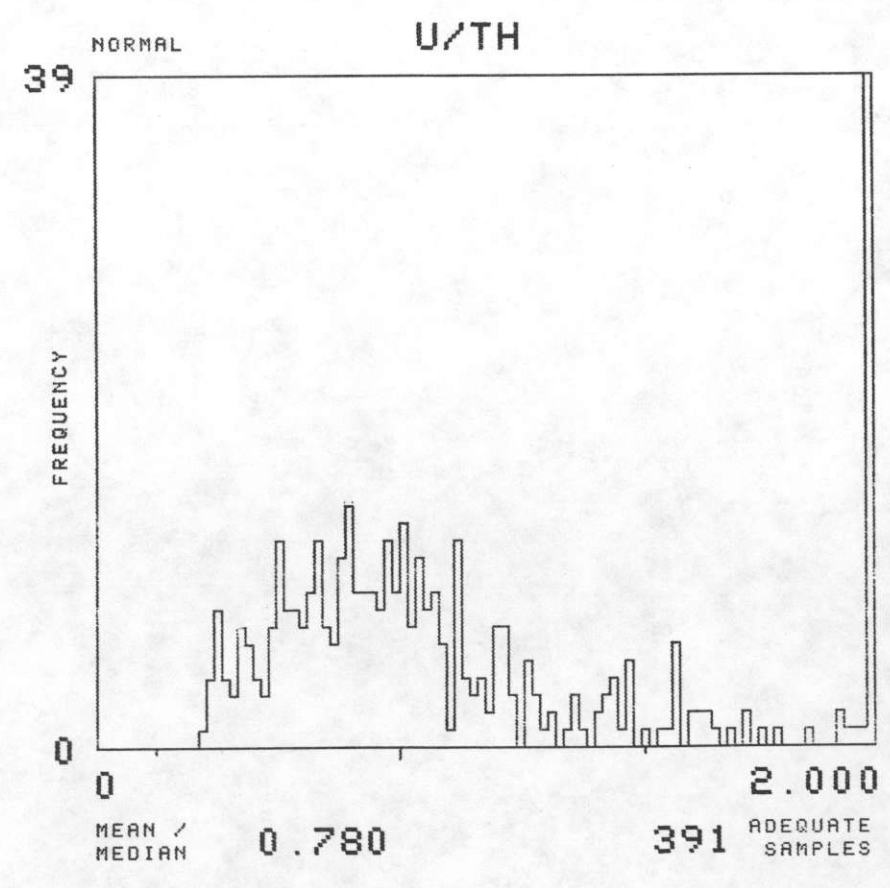
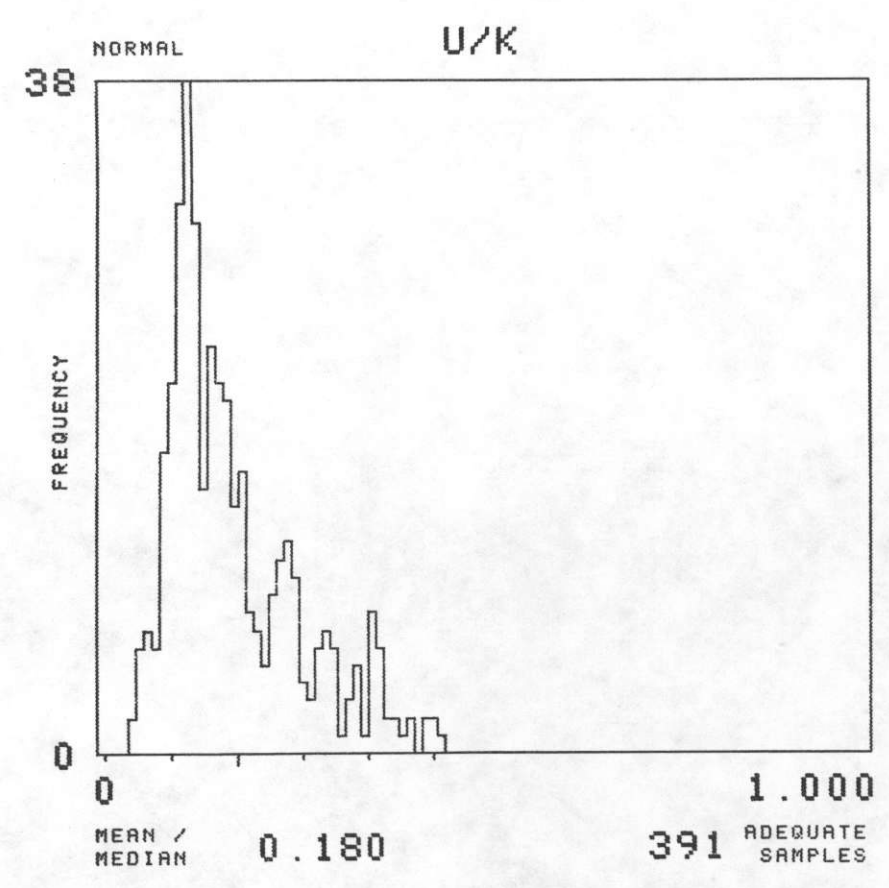
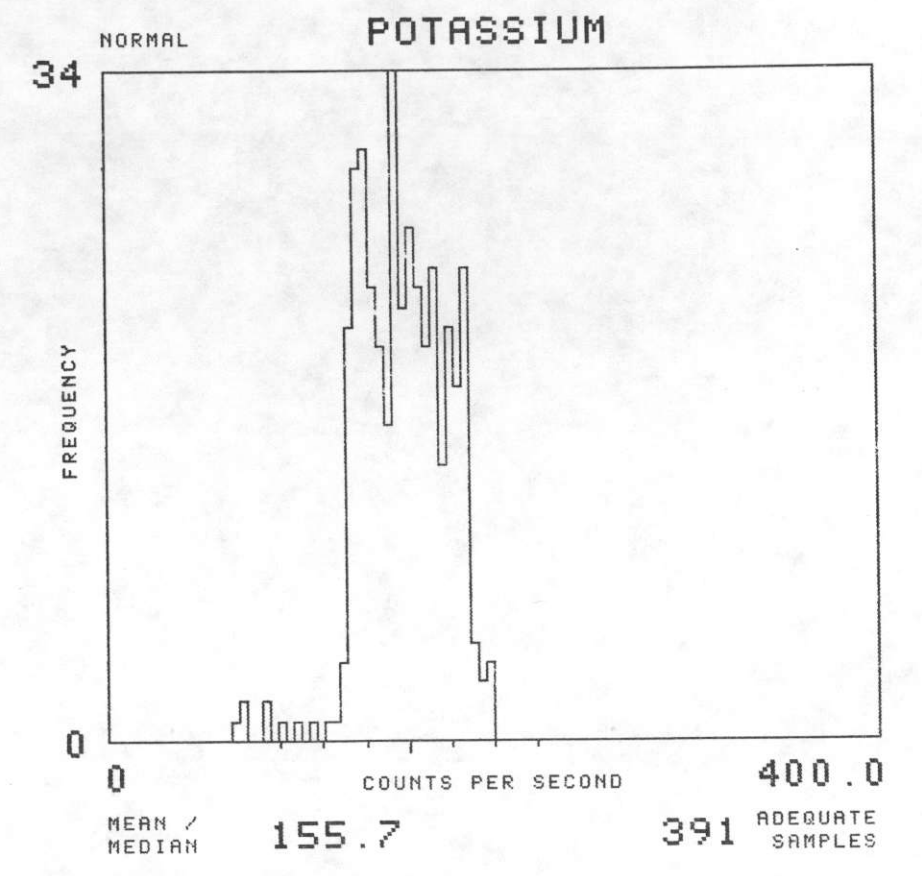
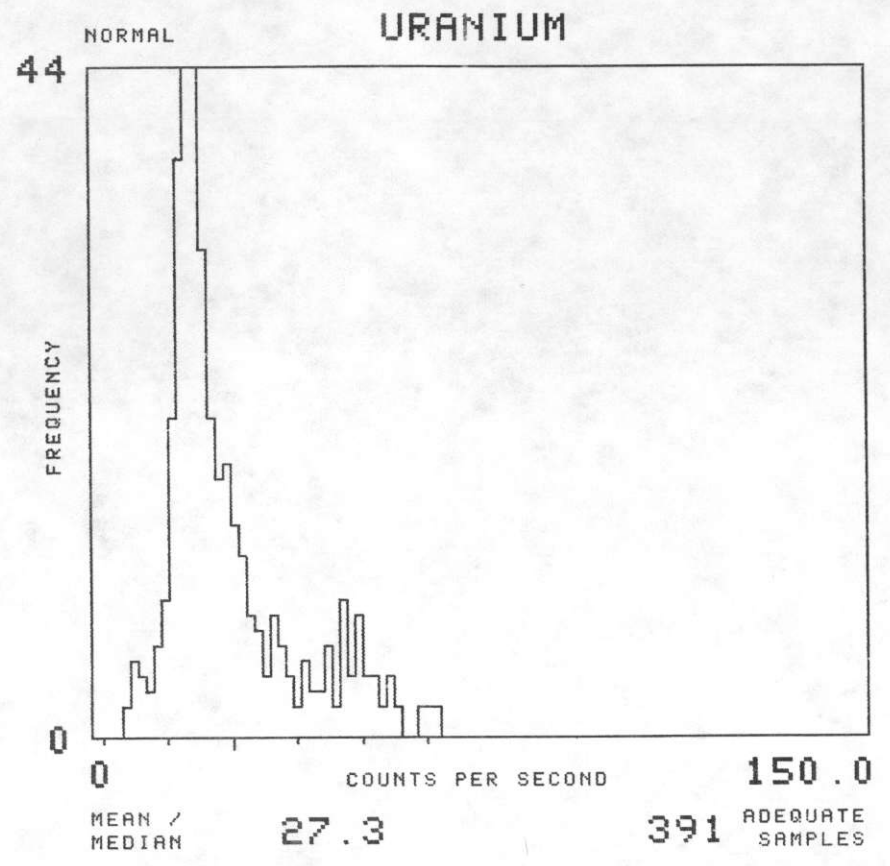
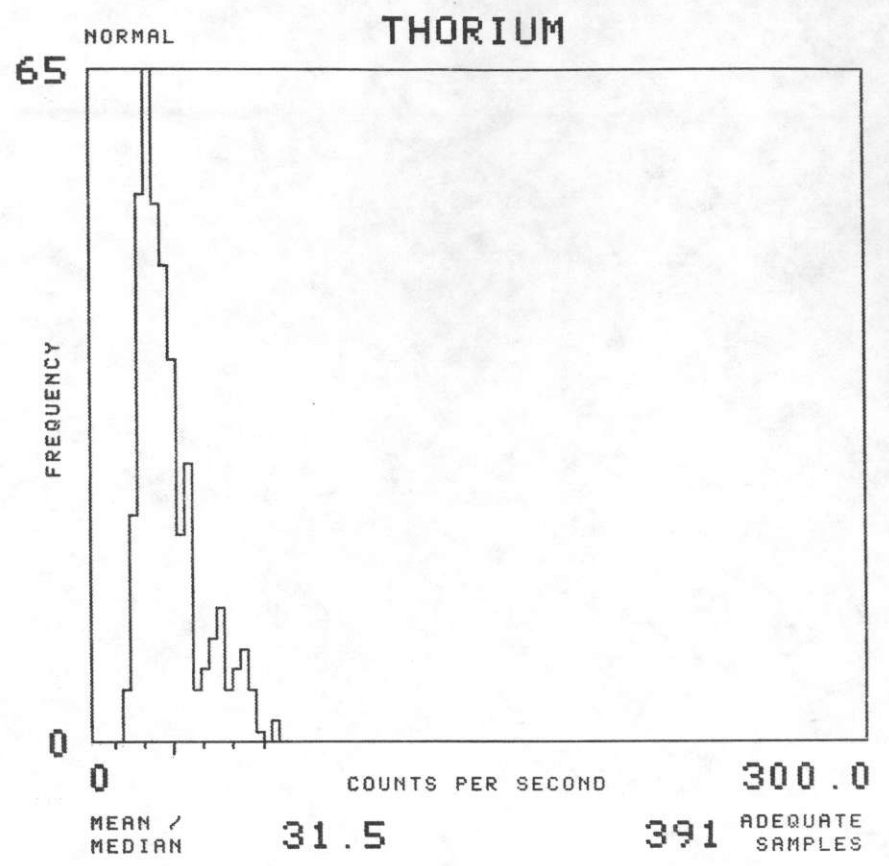
NTMS NI 12-3 GALLUP

MAP UNIT : TBV TOTAL NUMBER OF SAMPLES 39



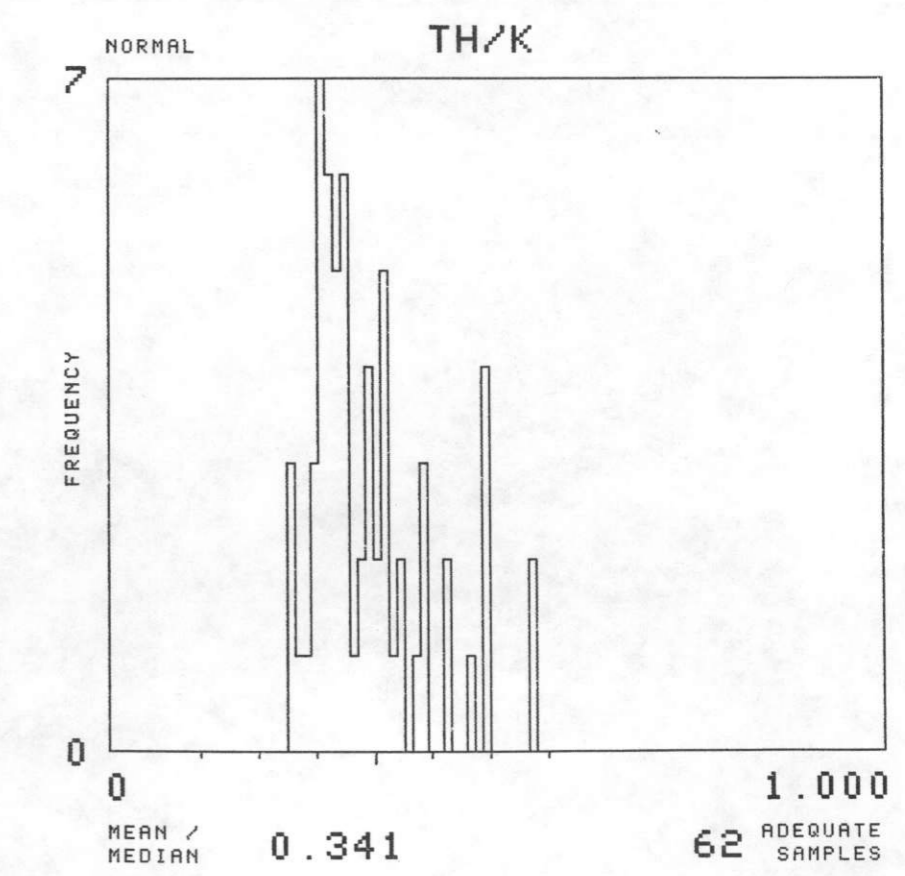
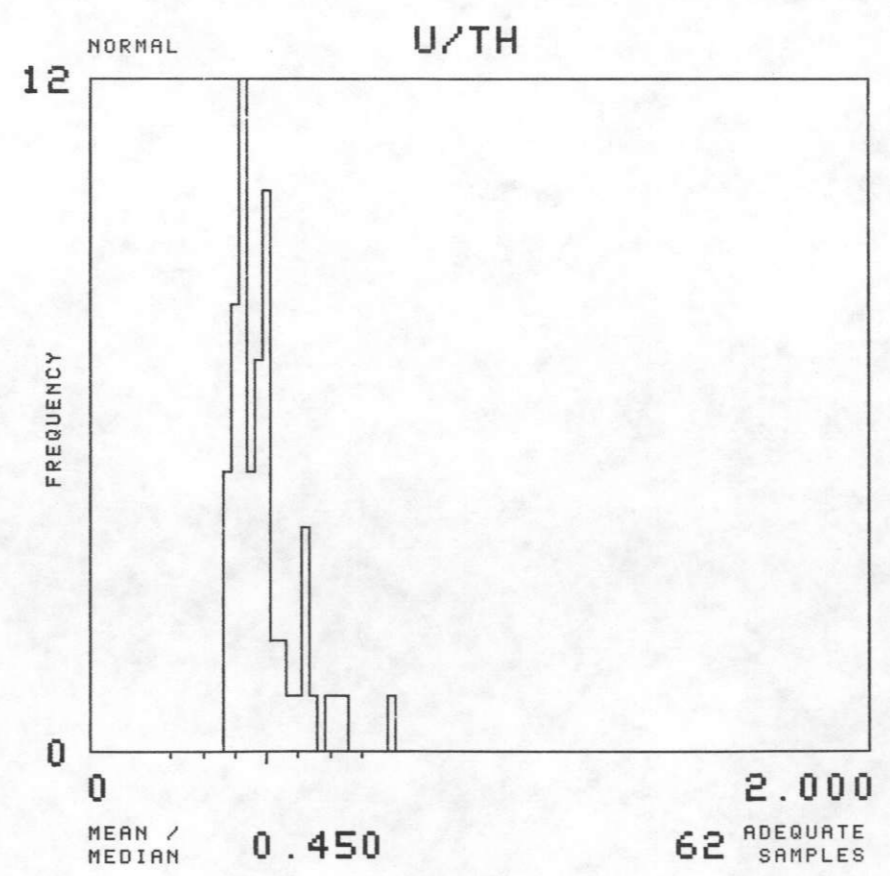
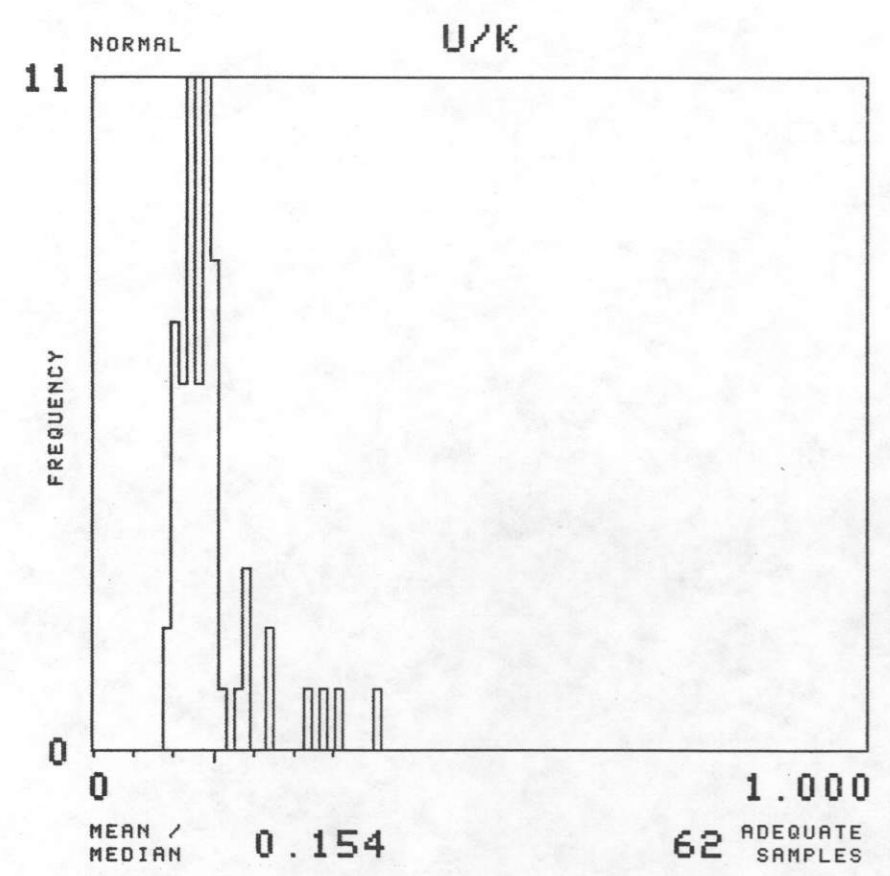
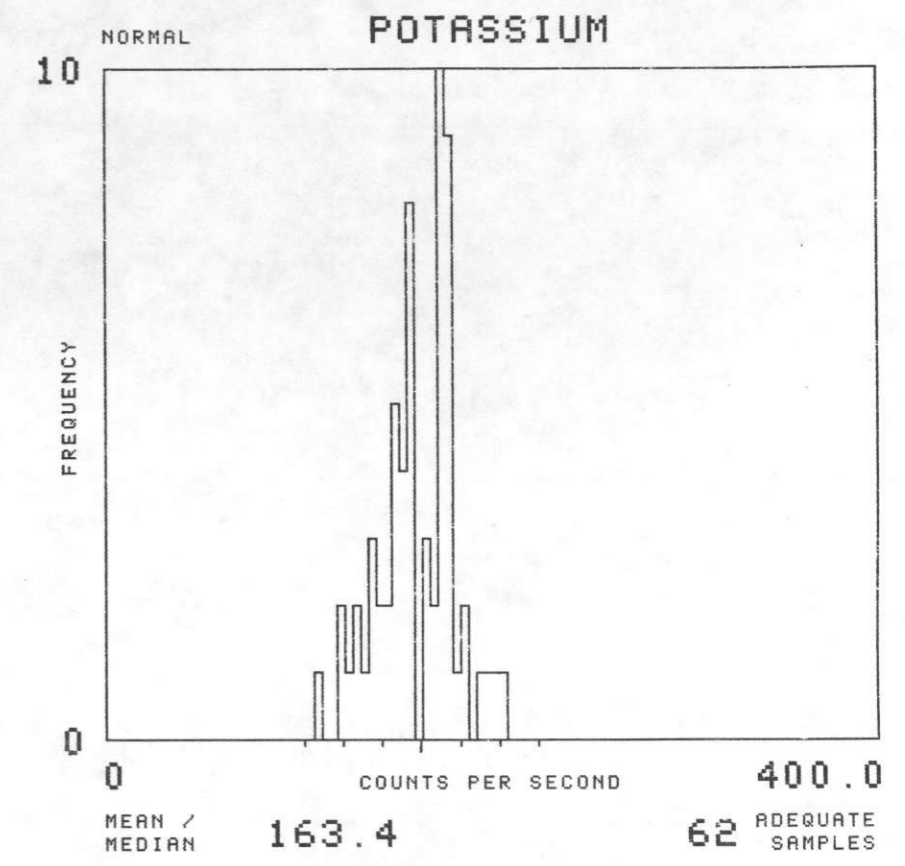
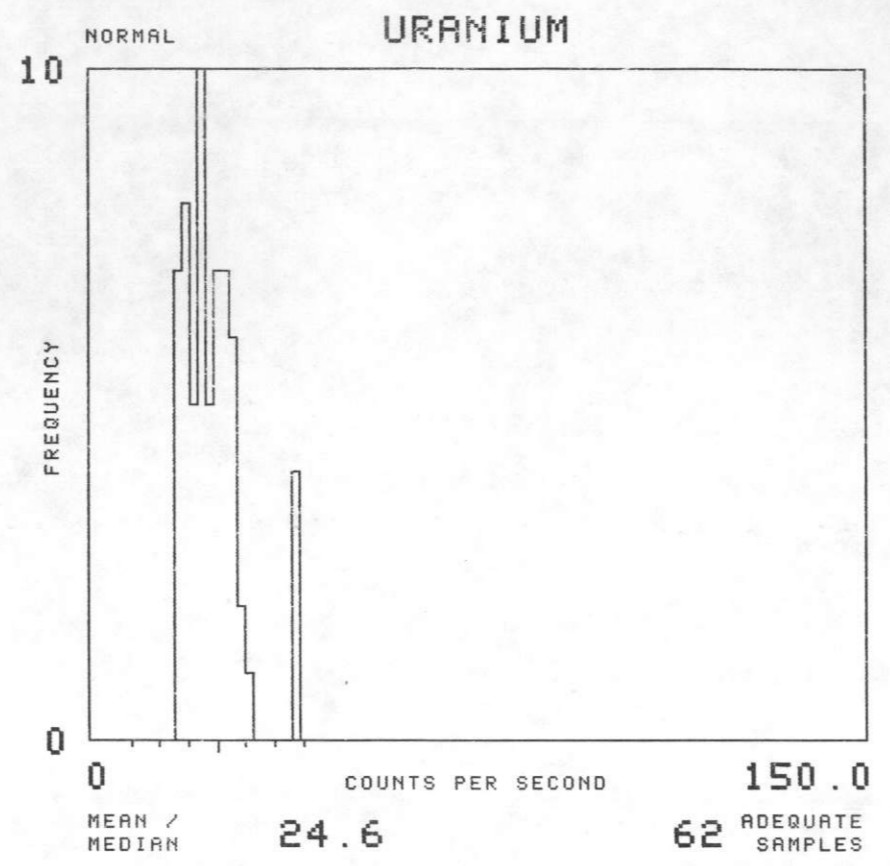
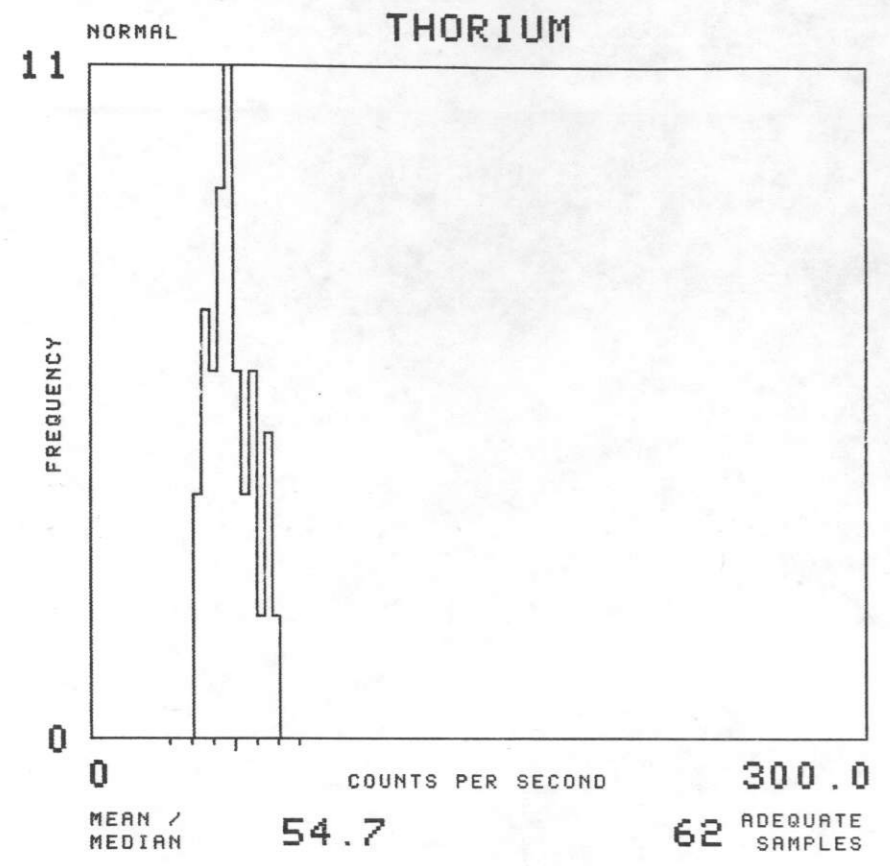
NTMS NI 12-3 GALLUP

MAP UNIT : TC TOTAL NUMBER OF SAMPLES 430



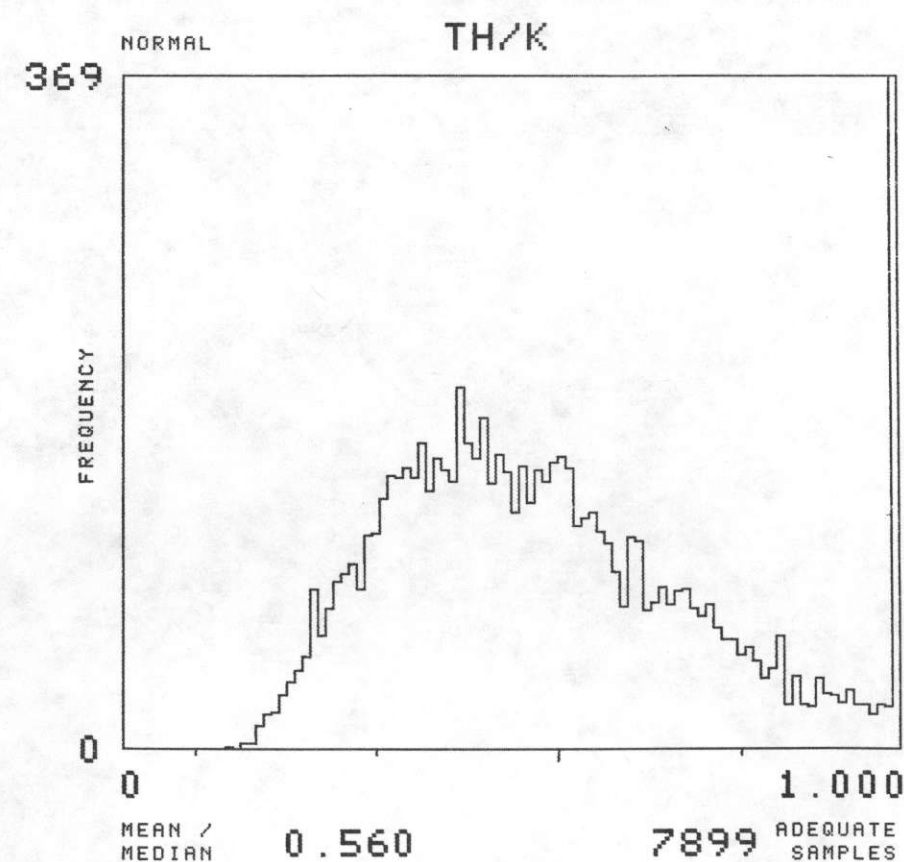
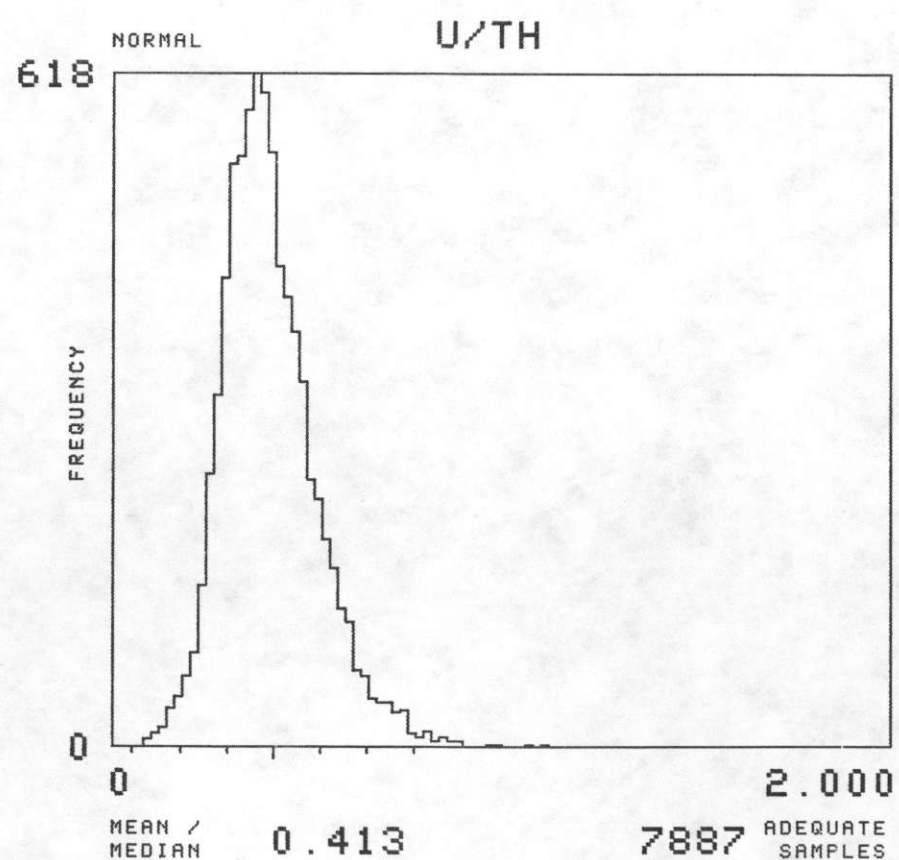
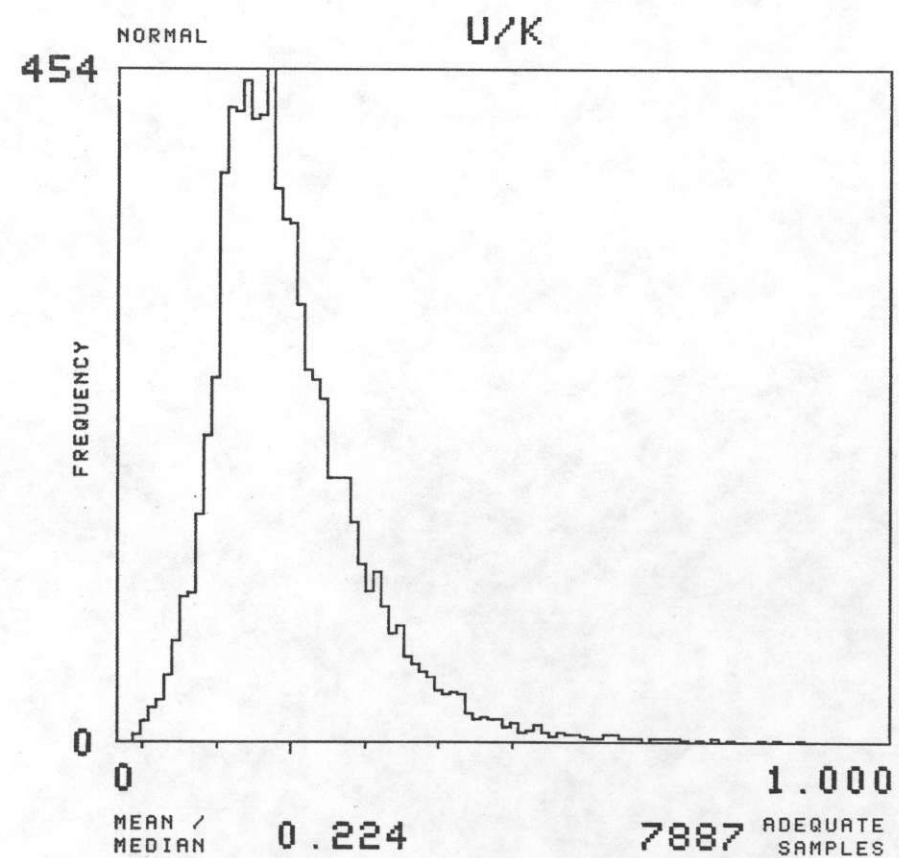
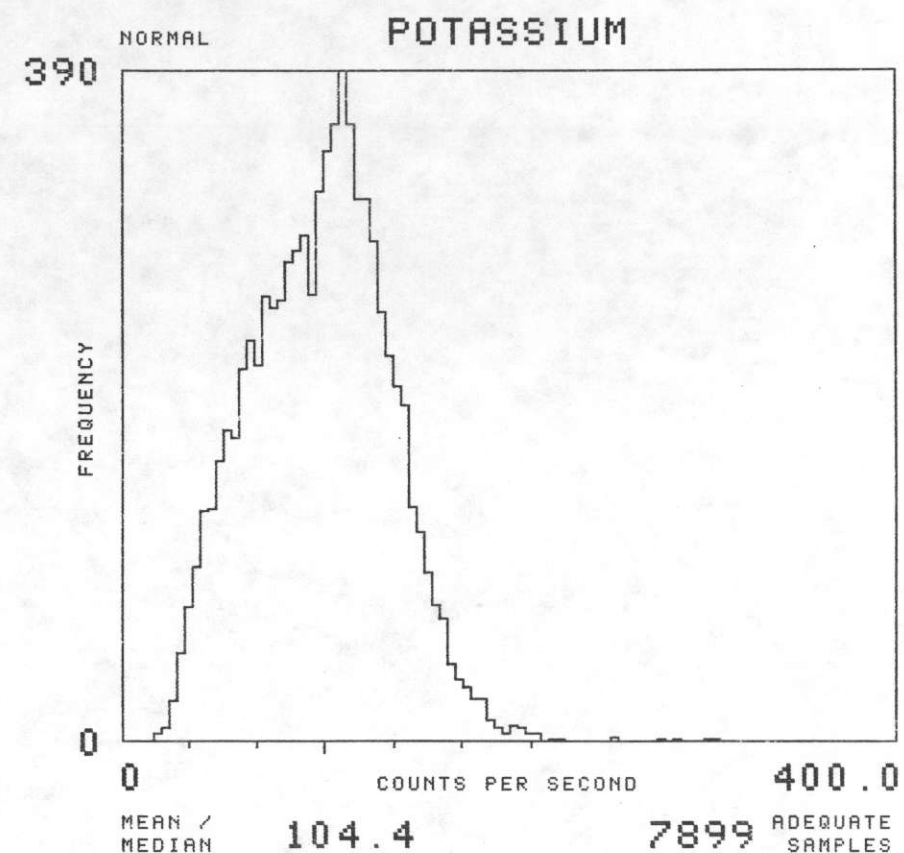
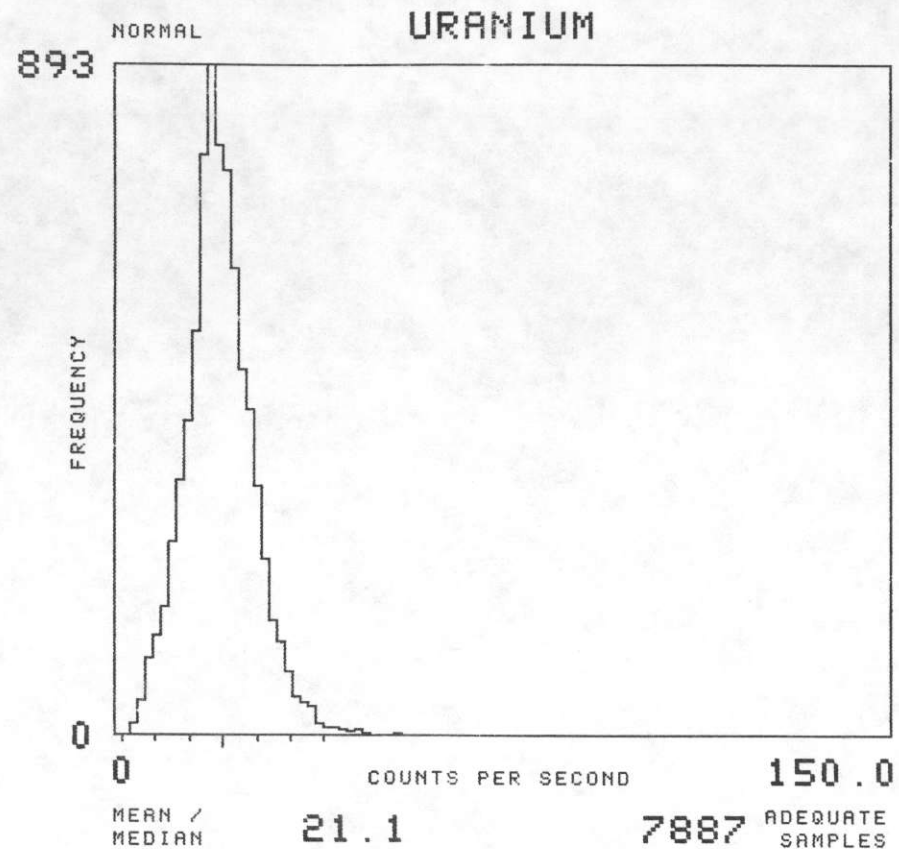
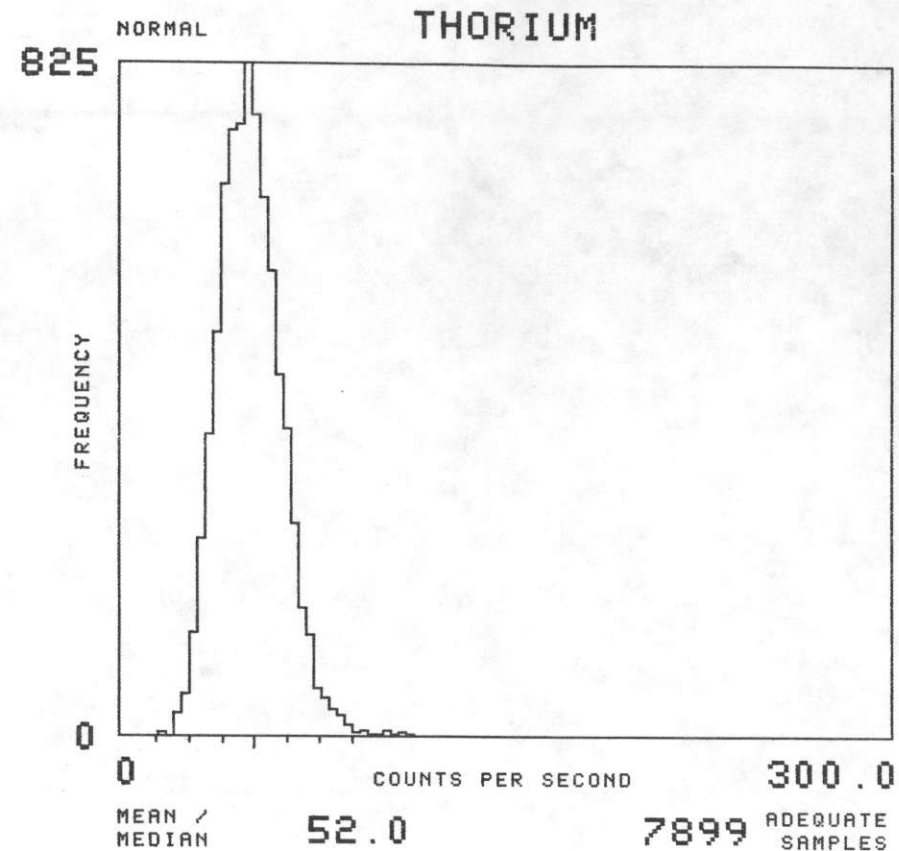
NTMS NI 12-3 GALLUP

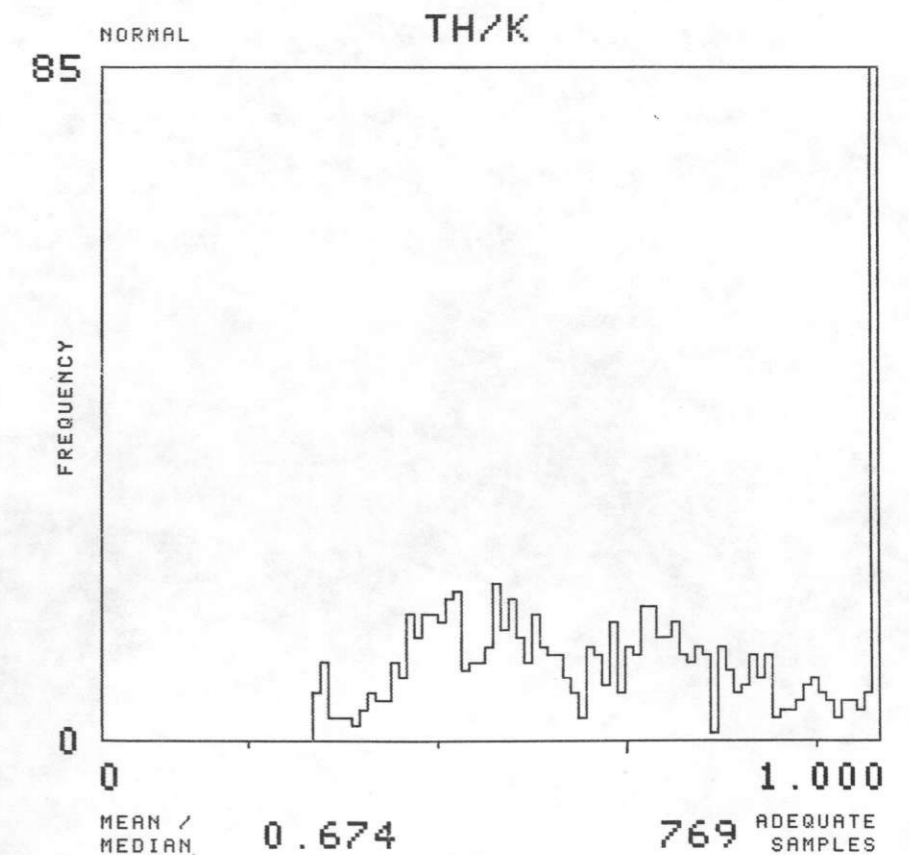
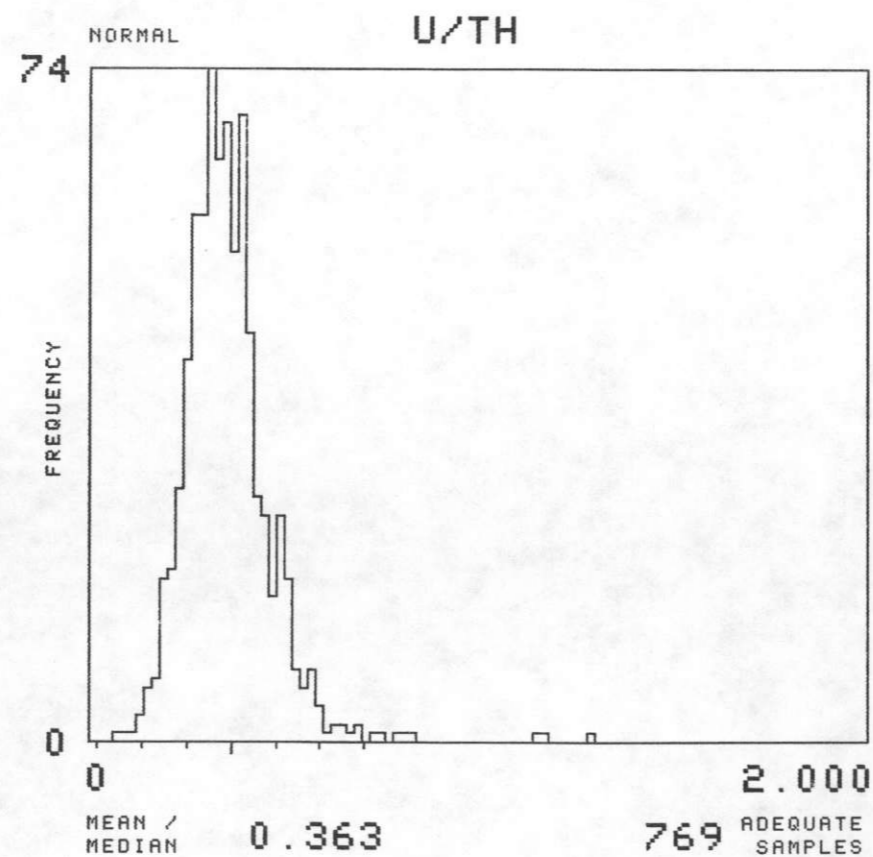
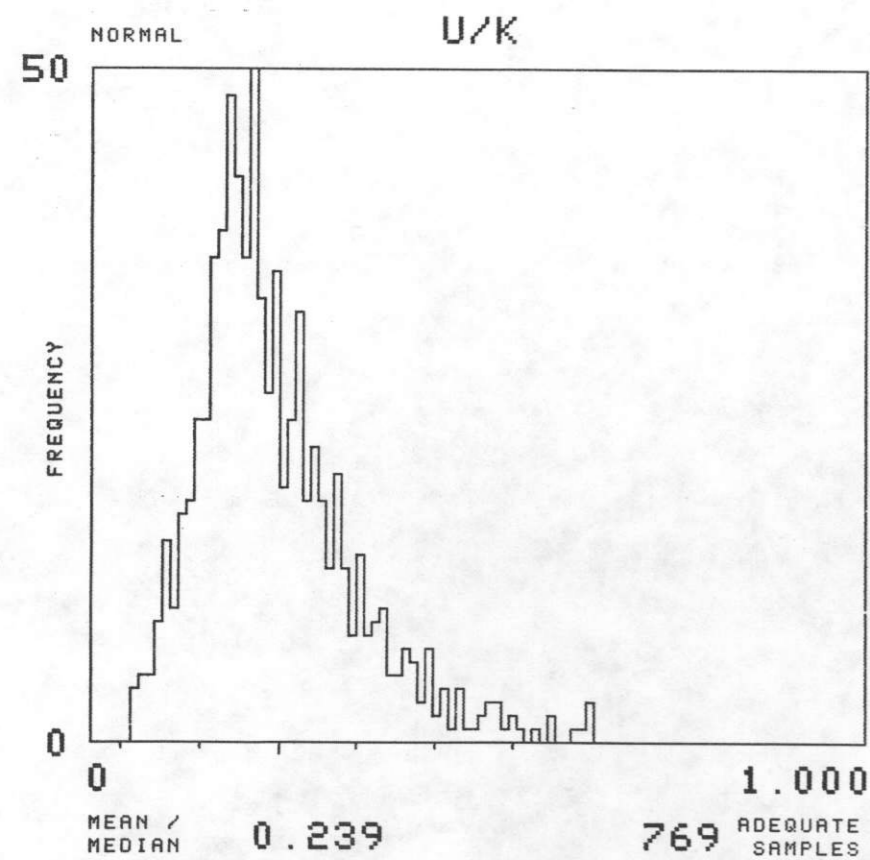
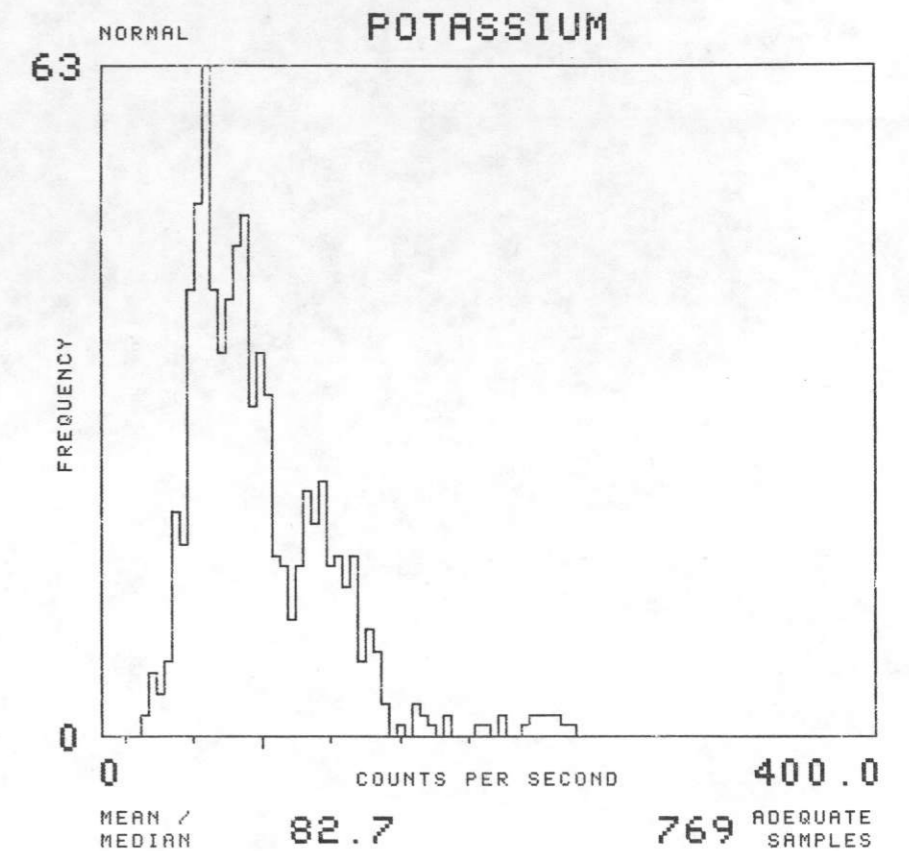
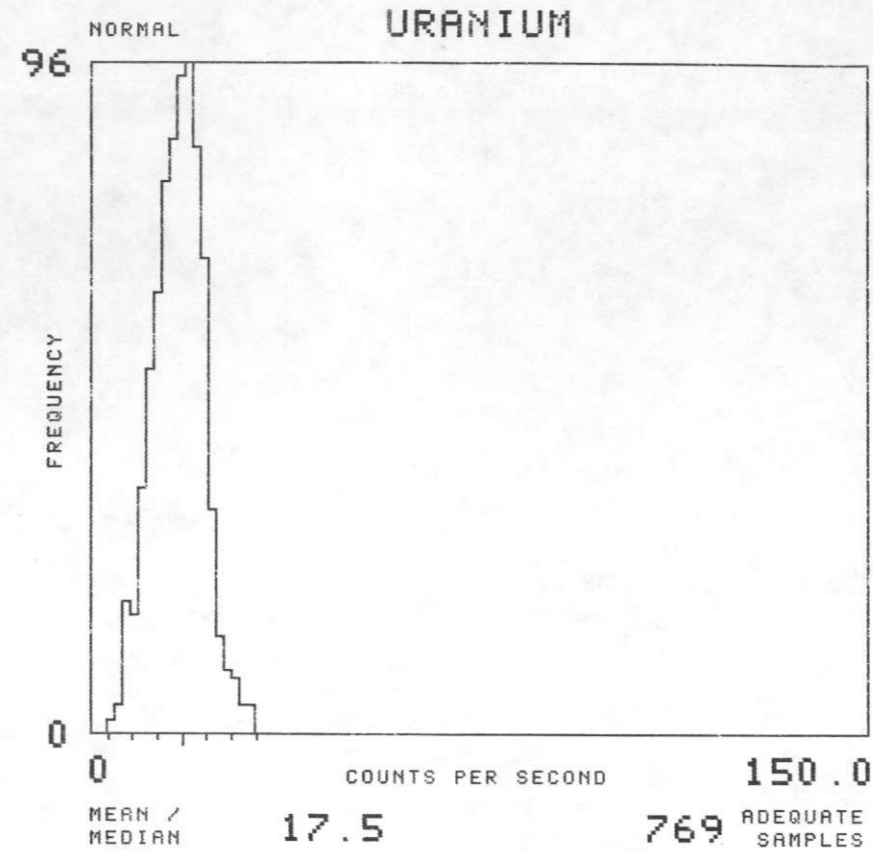
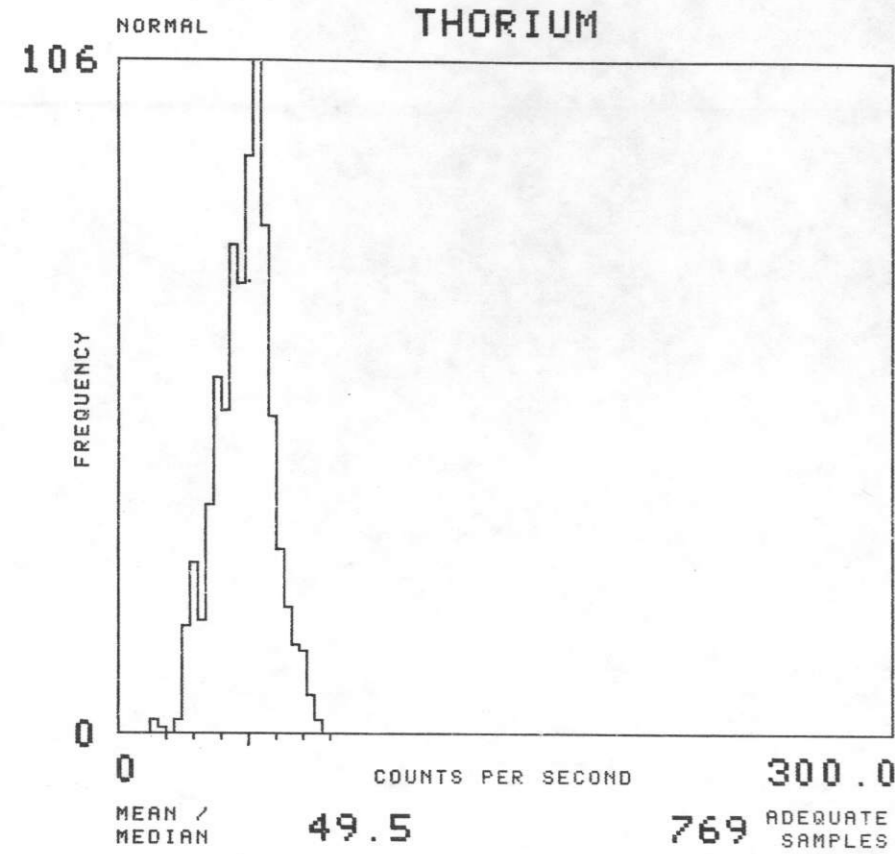
MAP UNIT : TEB TOTAL NUMBER OF SAMPLES 62



NTMS NI 12-3 GALLUP

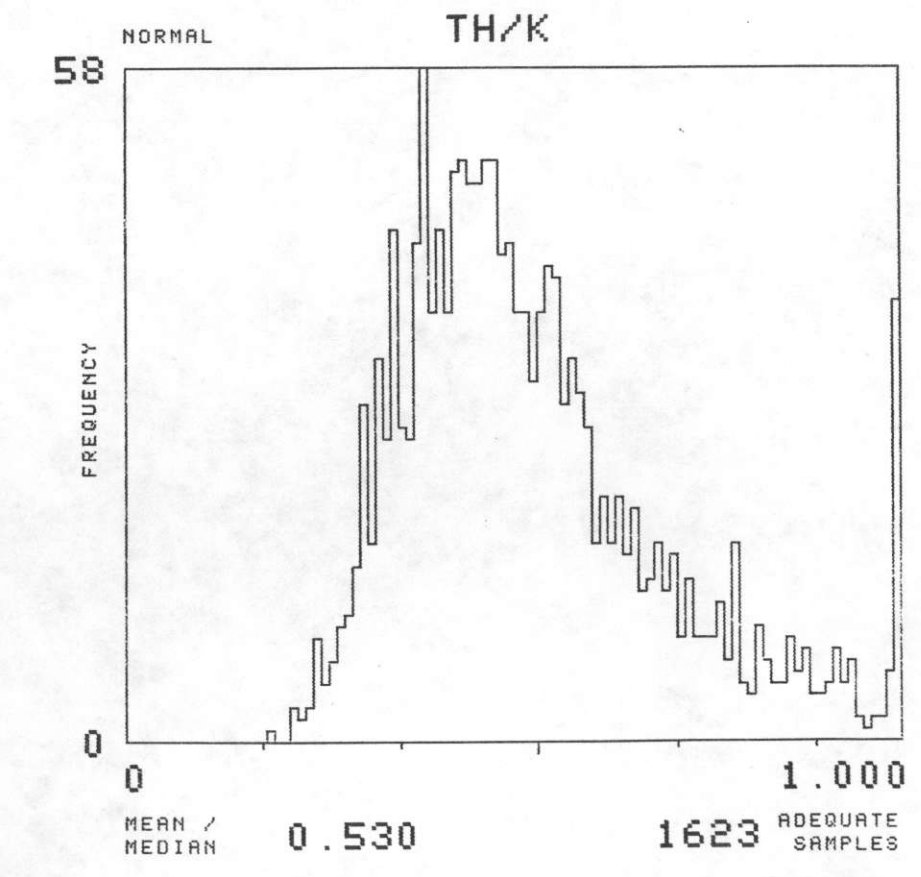
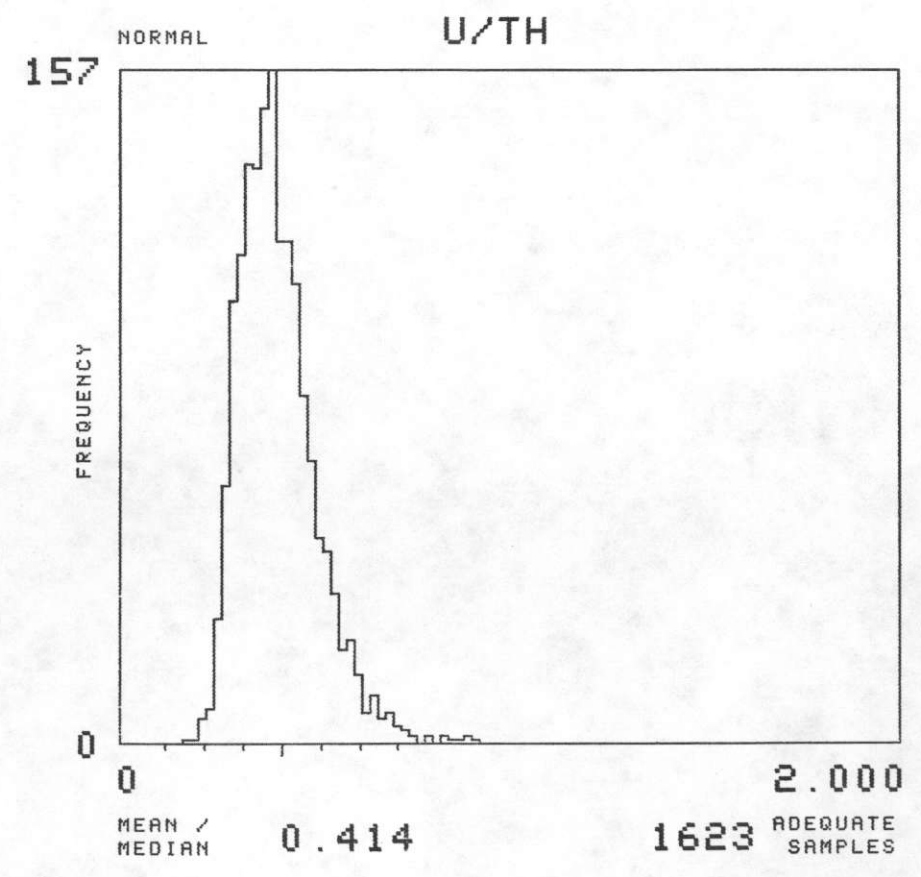
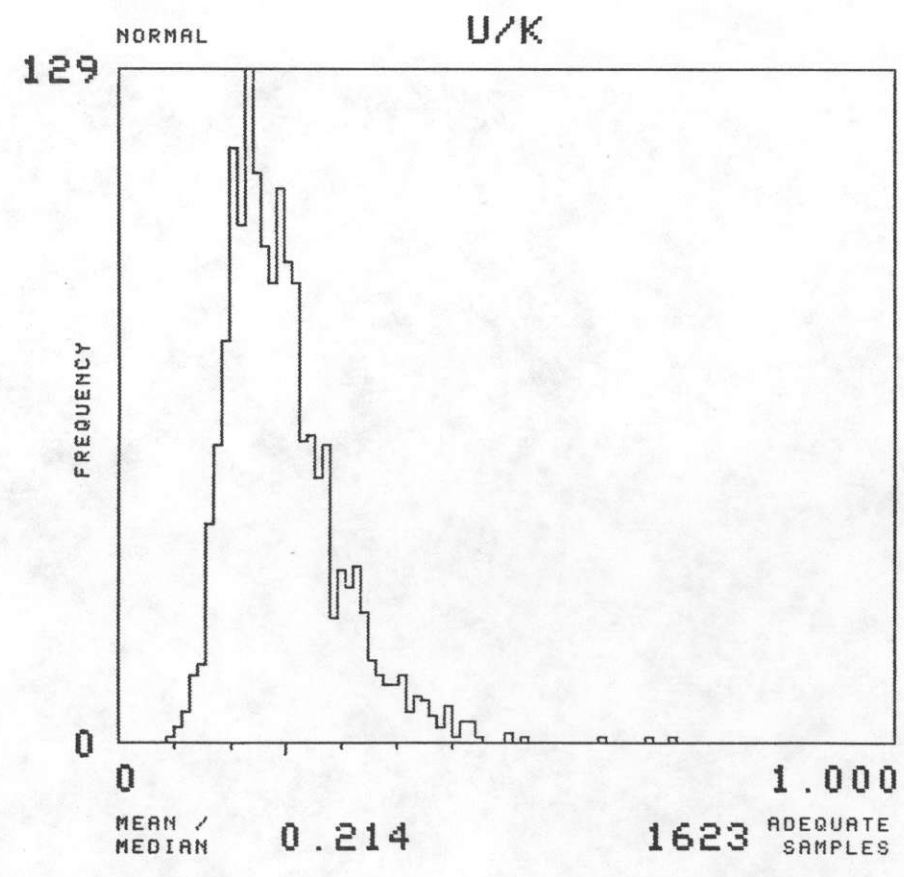
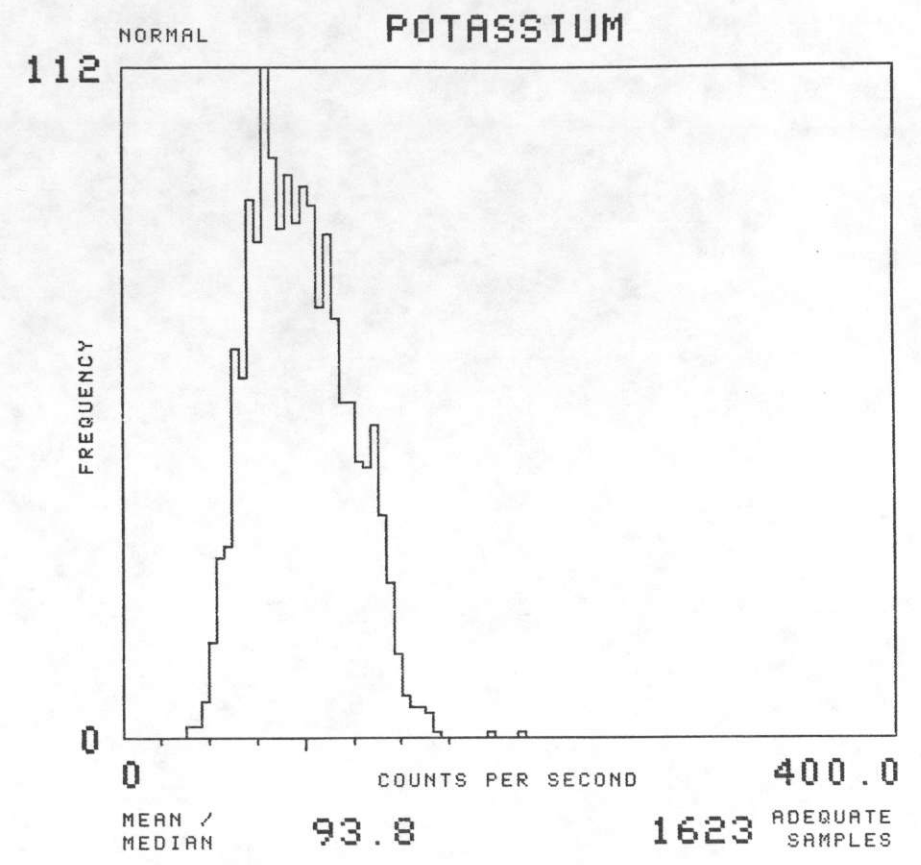
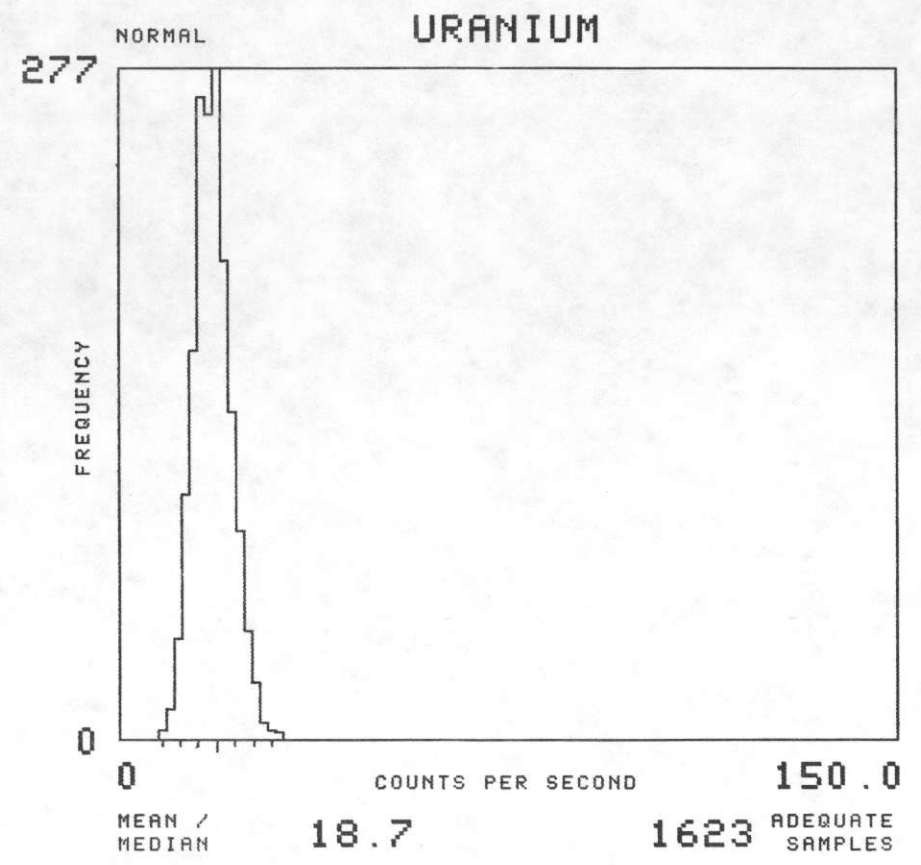
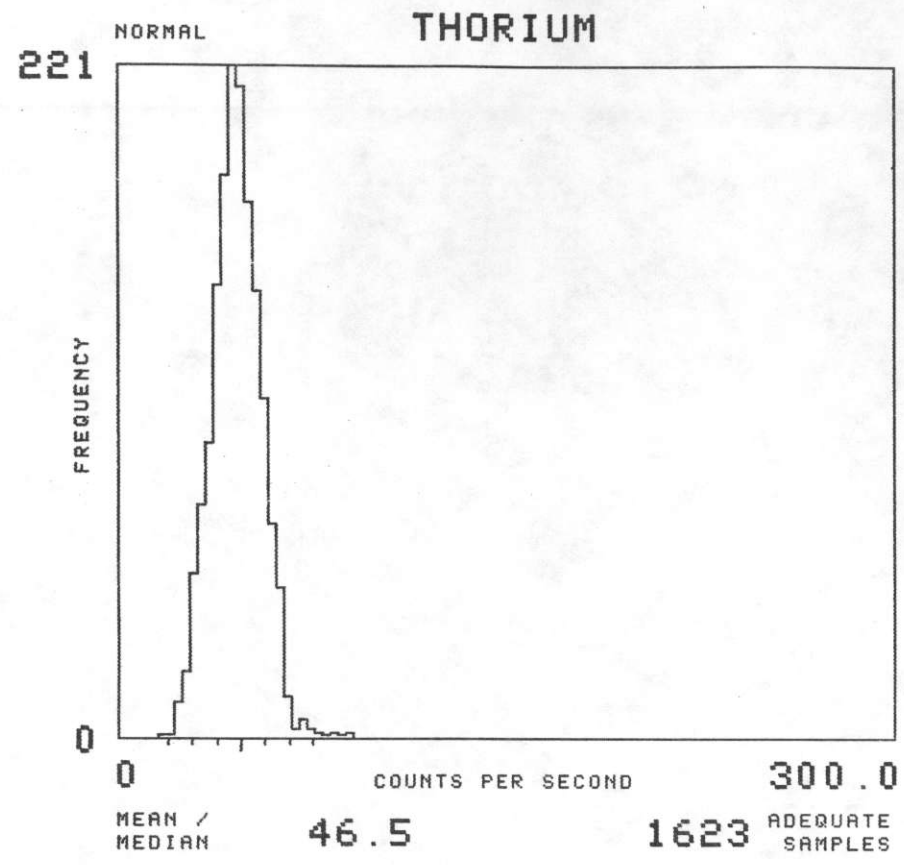
MAP UNIT : TRC TOTAL NUMBER OF SAMPLES 7942

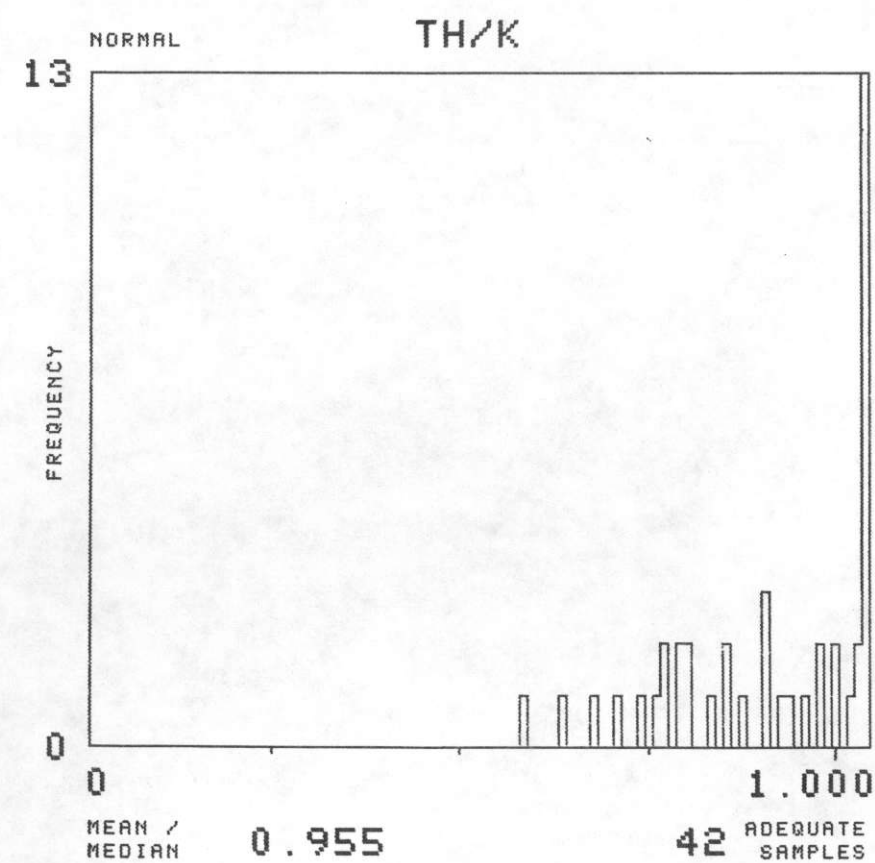
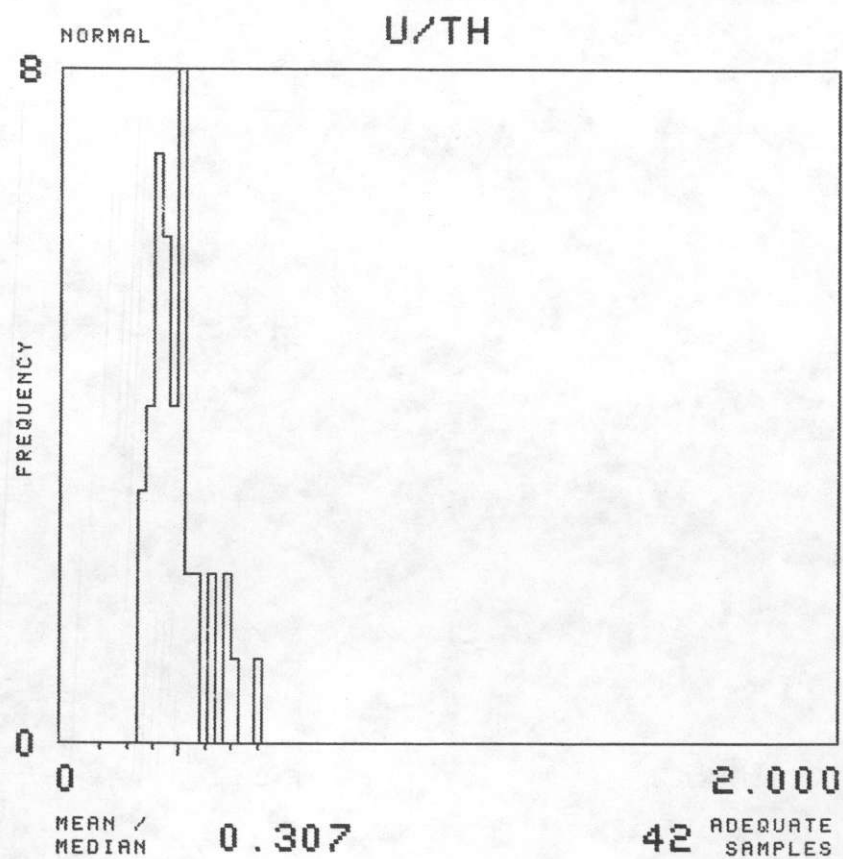
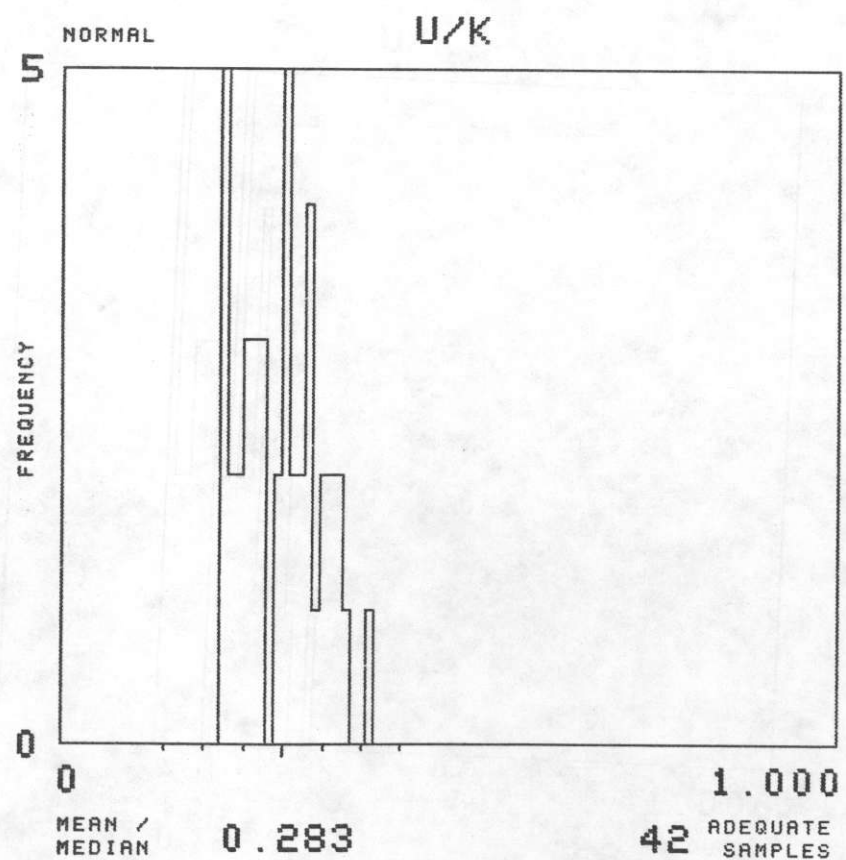
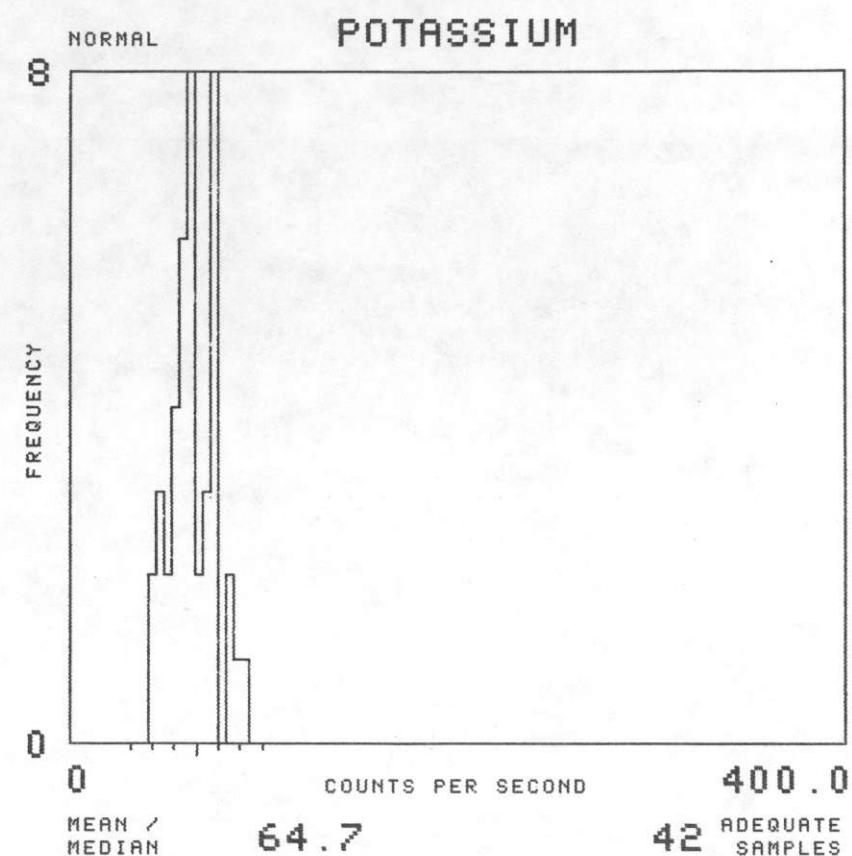
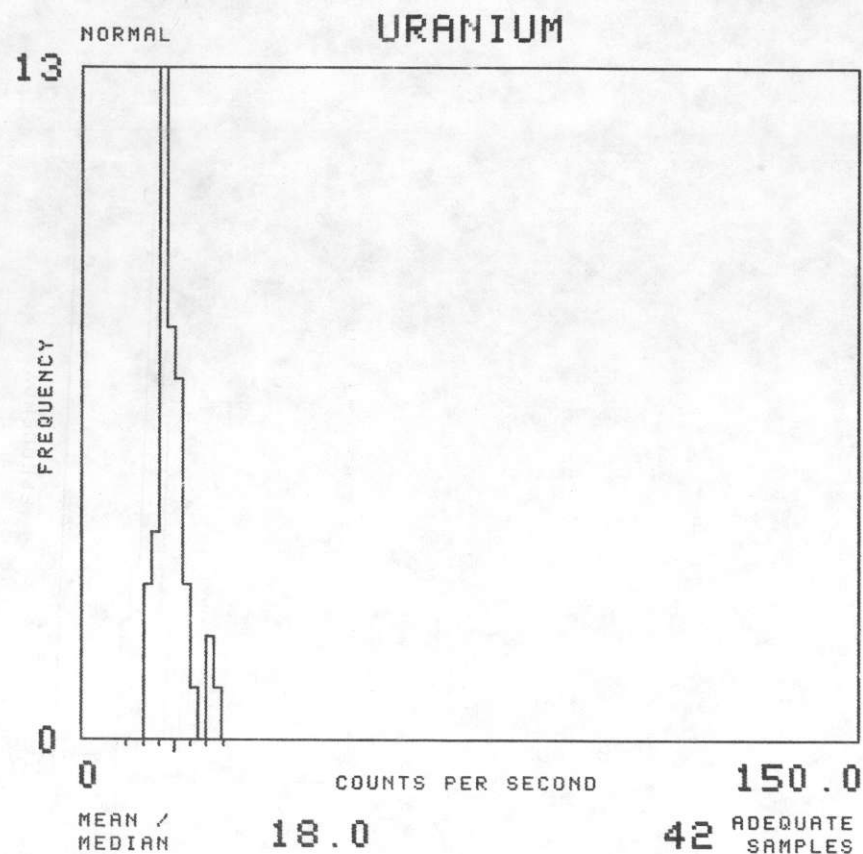
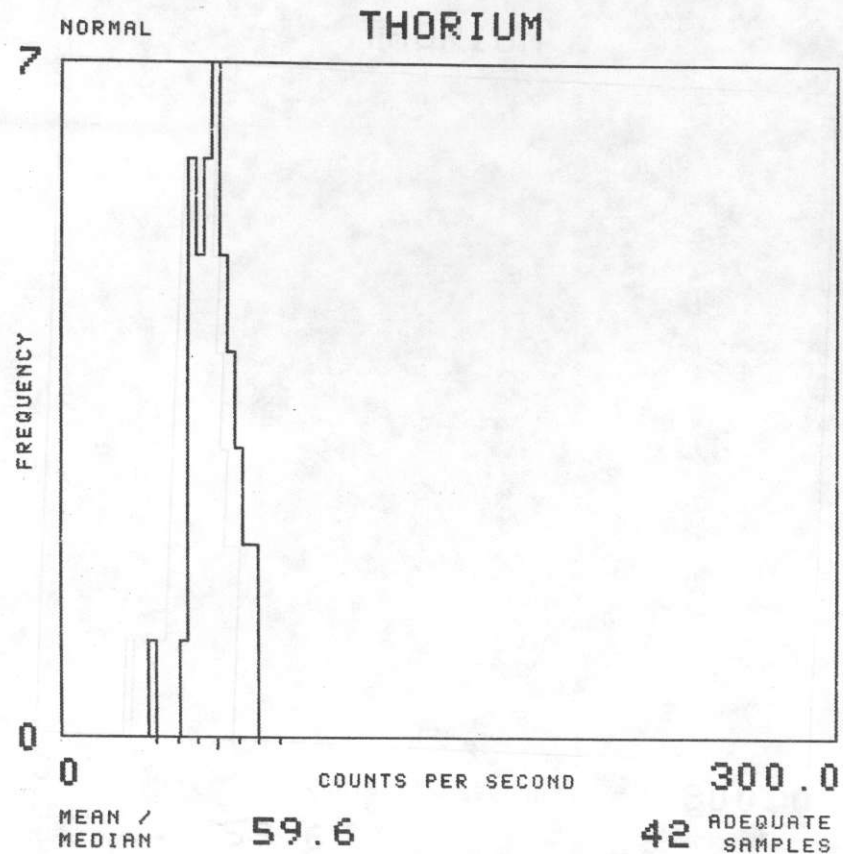




NTMS NI 12-3 GALLUP

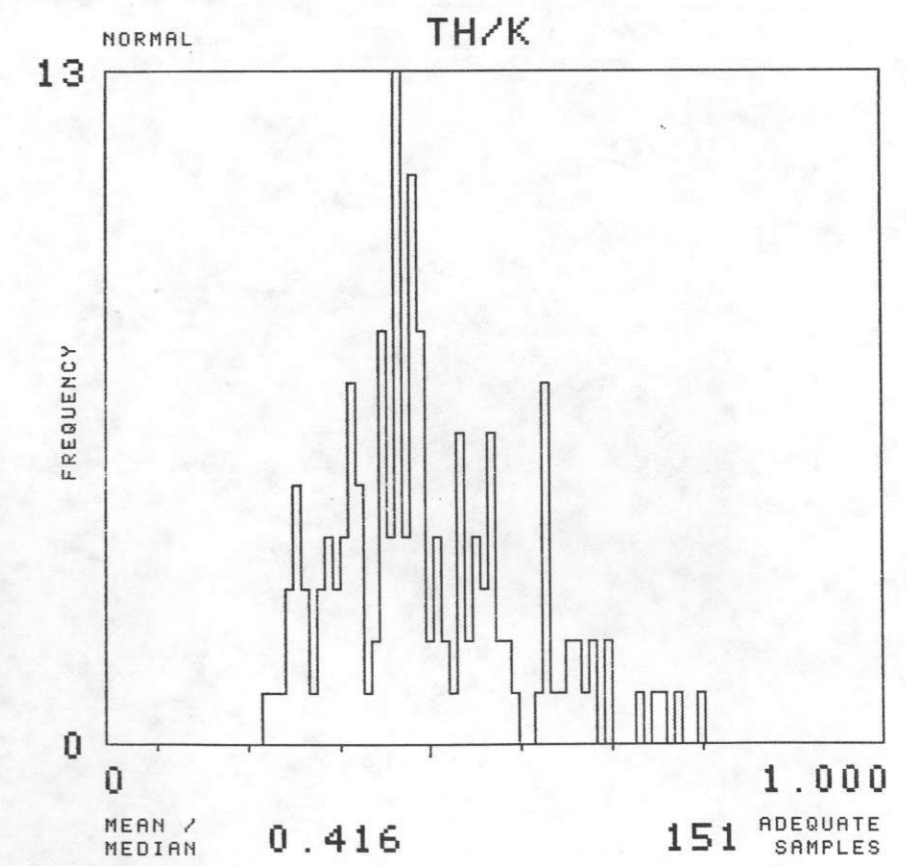
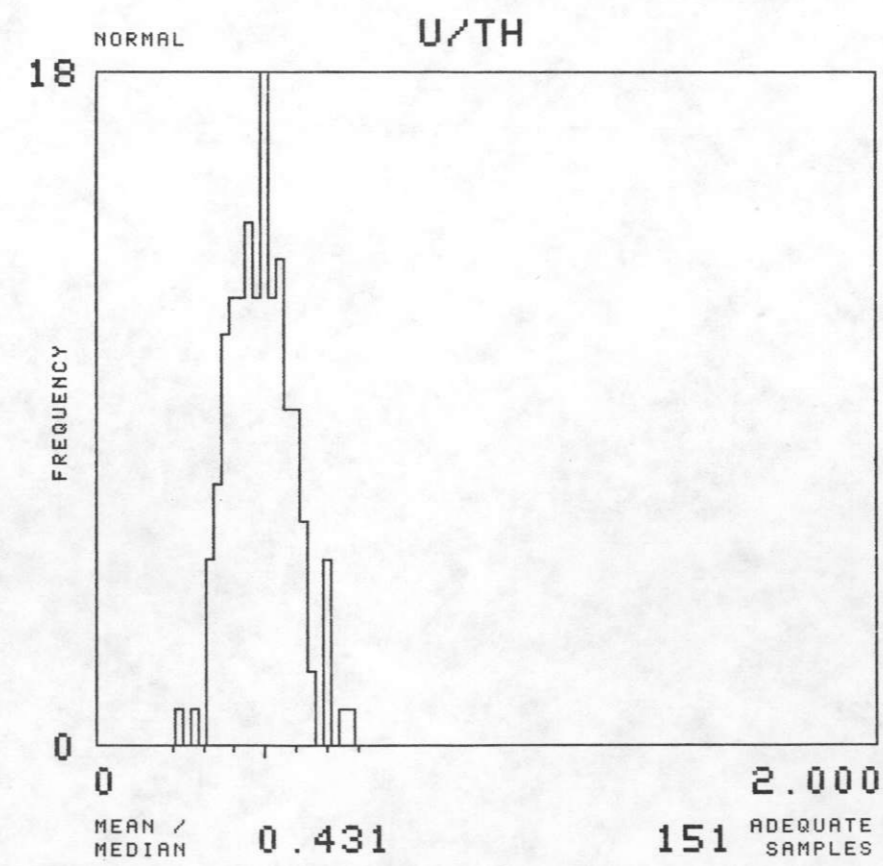
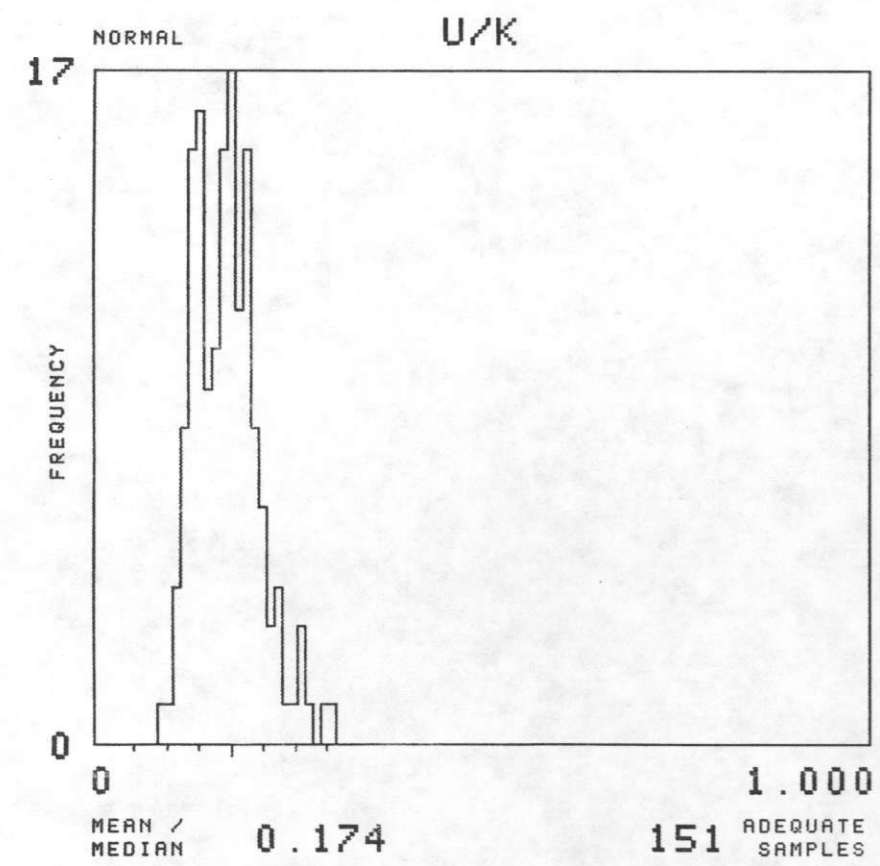
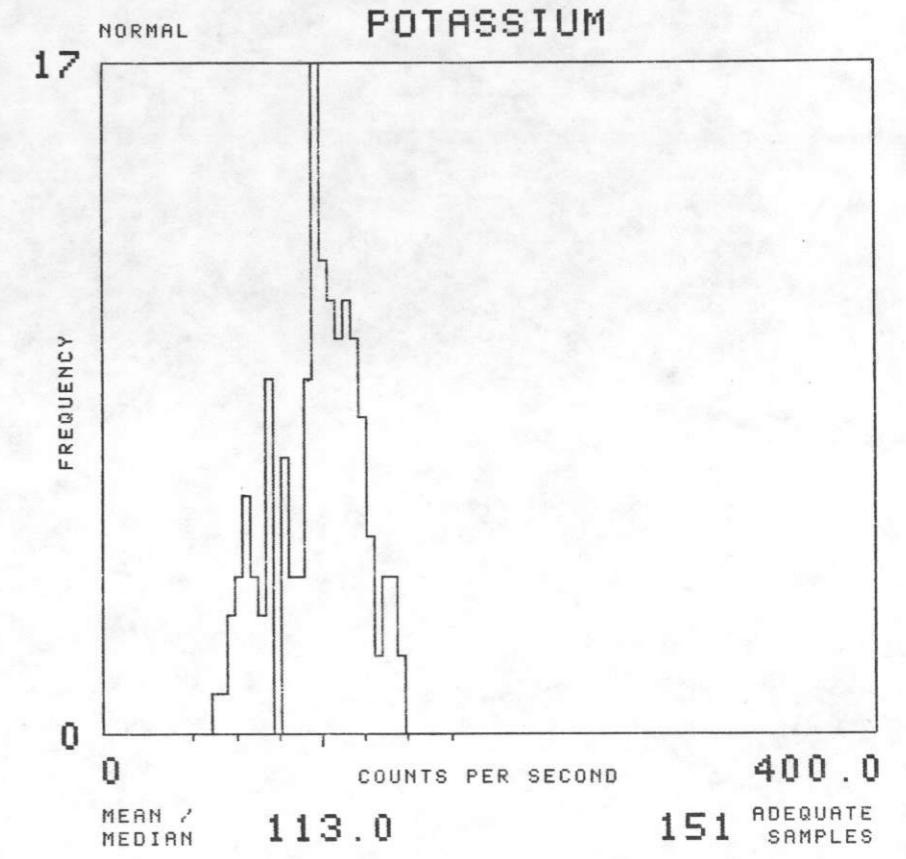
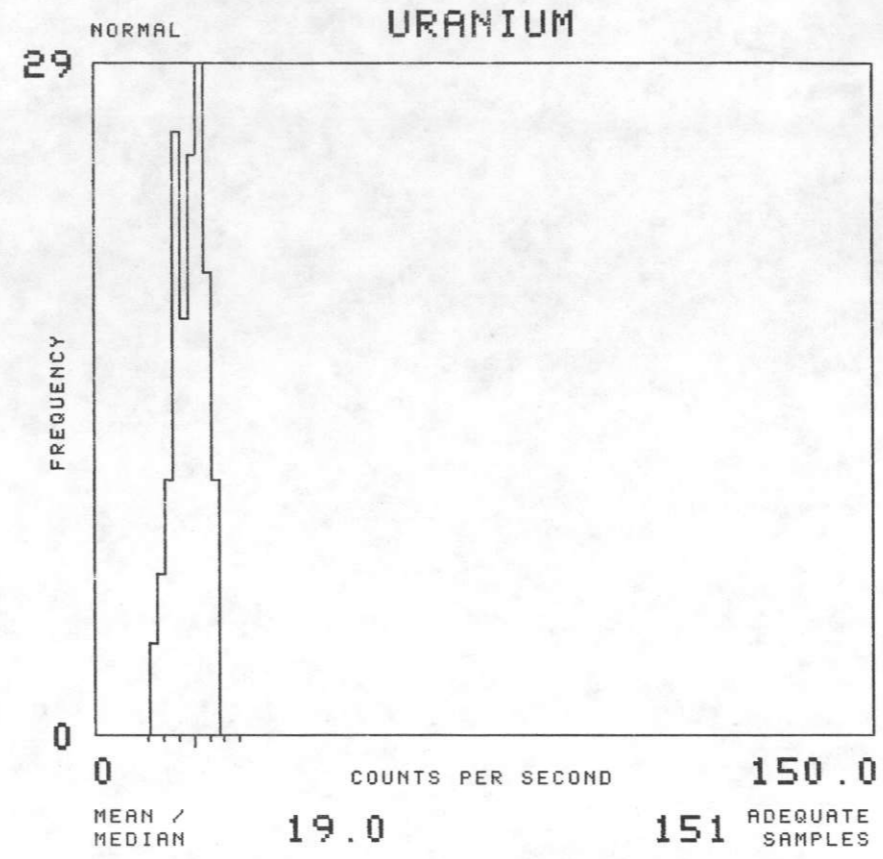
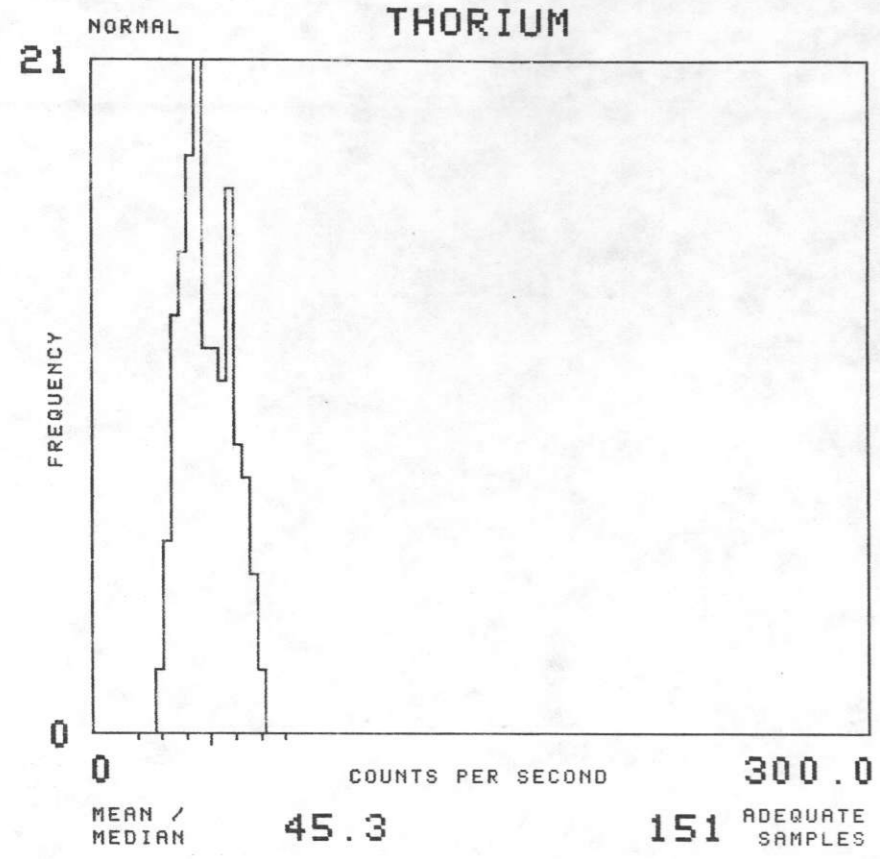
MAP UNIT : TRCS TOTAL NUMBER OF SAMPLES 1625





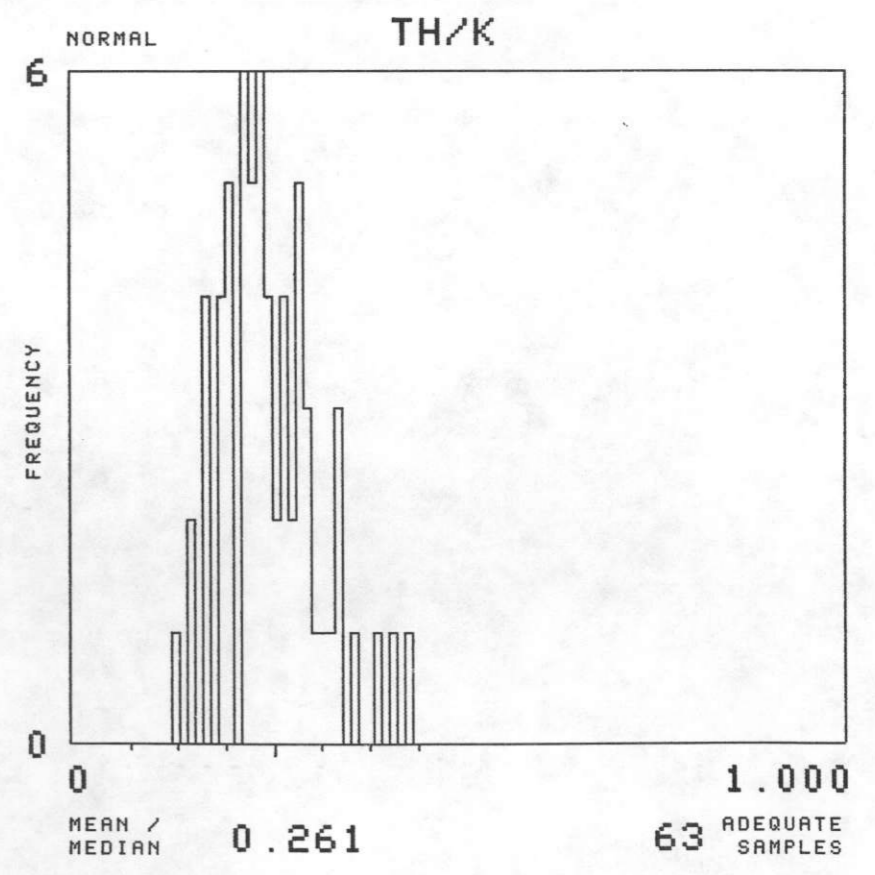
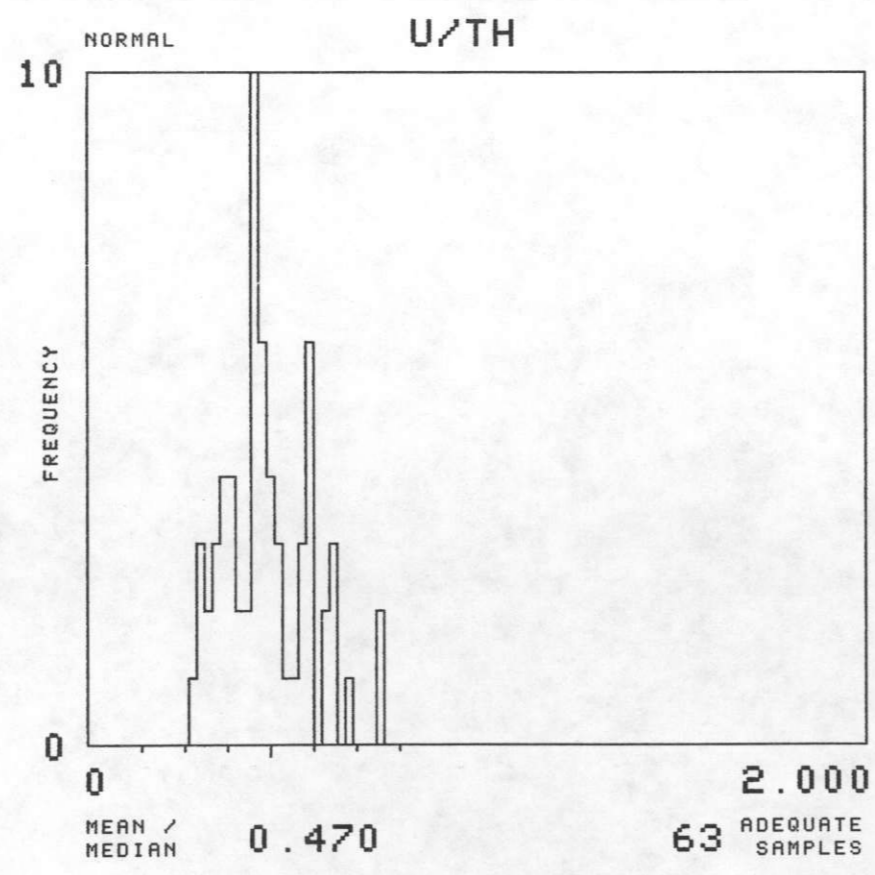
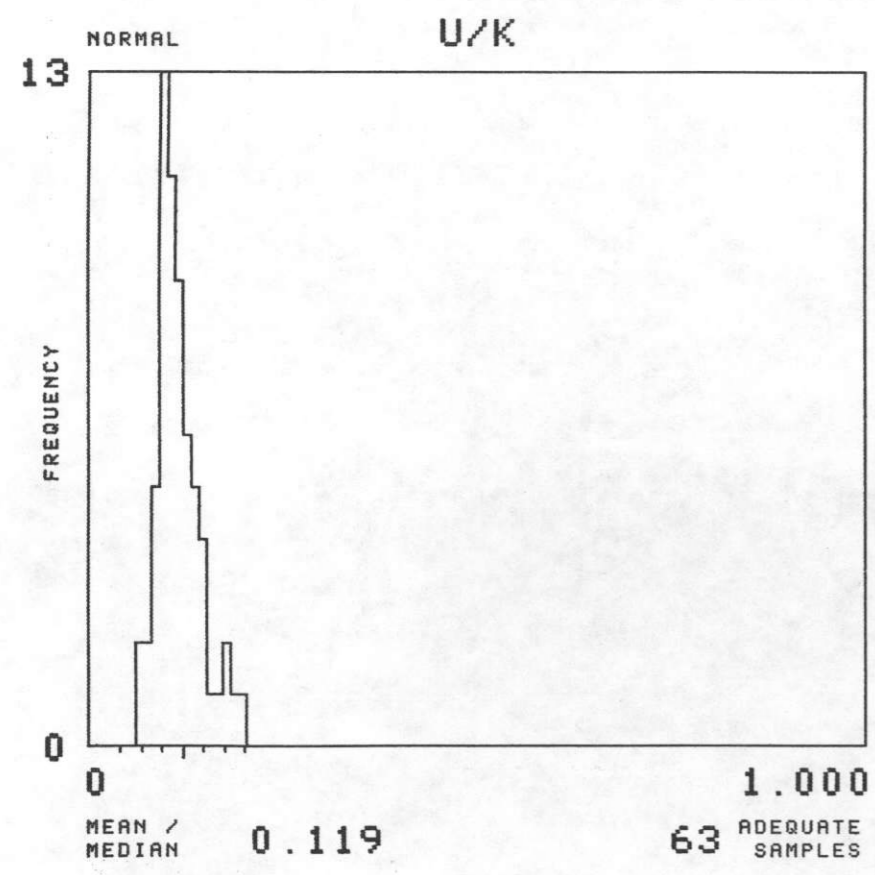
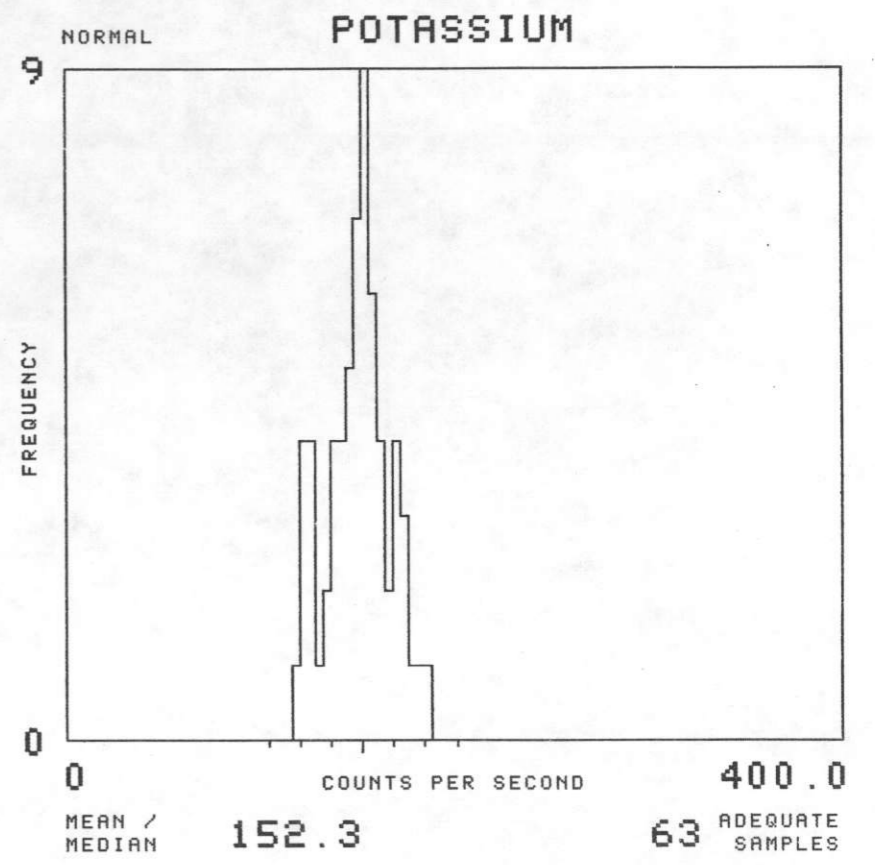
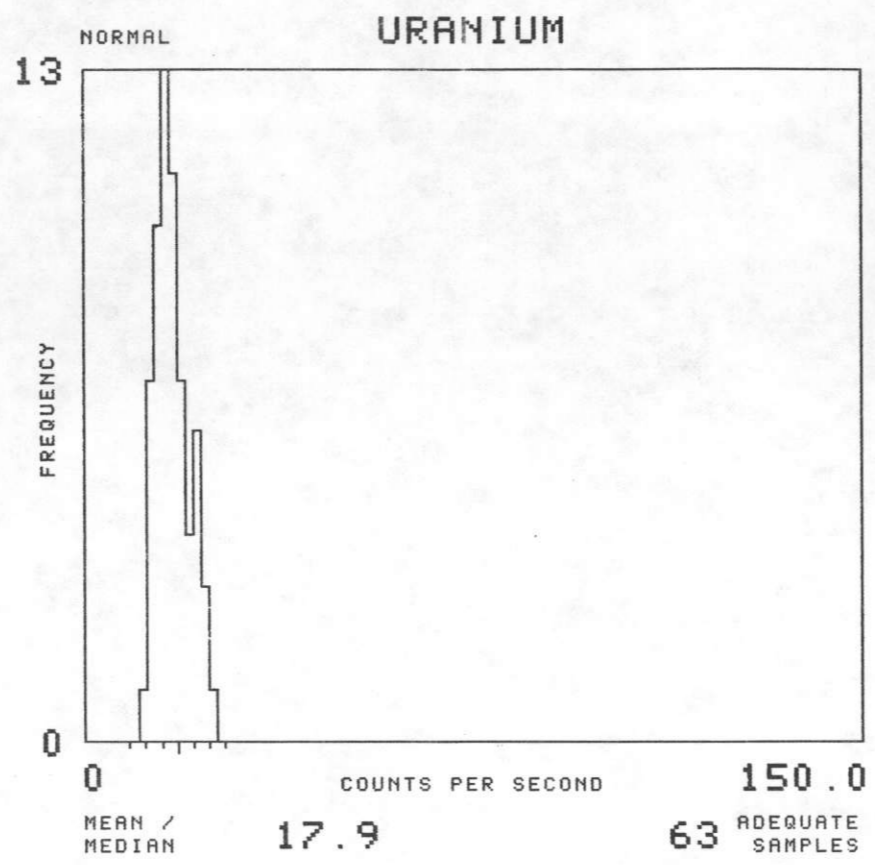
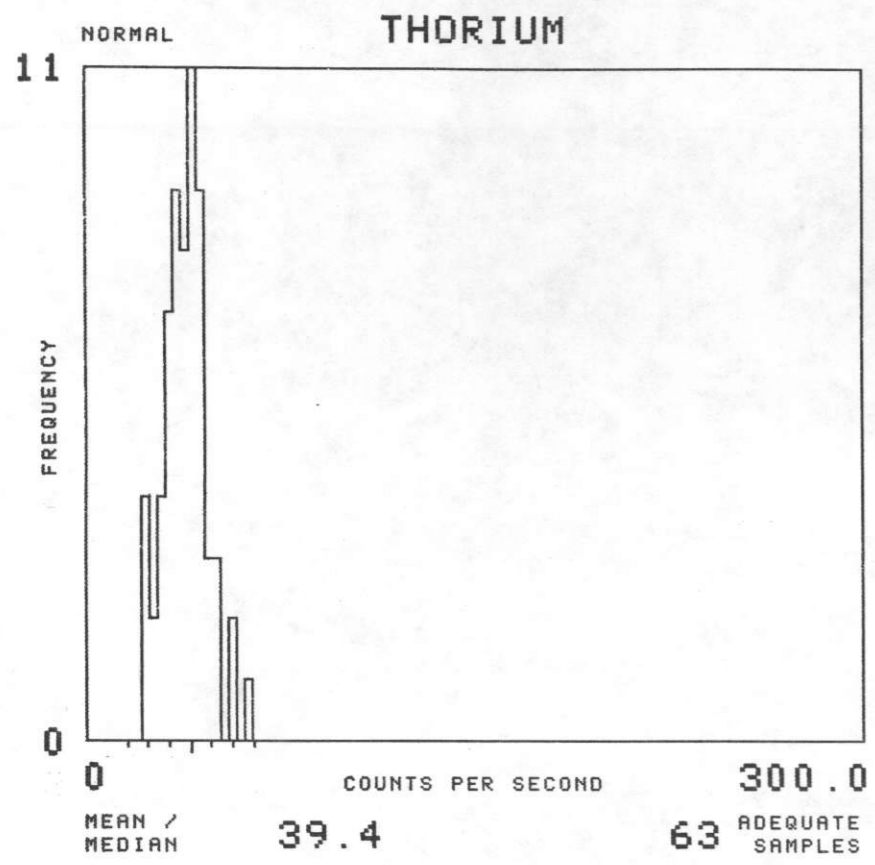
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MAP UNIT : TRMK TOTAL NUMBER OF SAMPLES 151



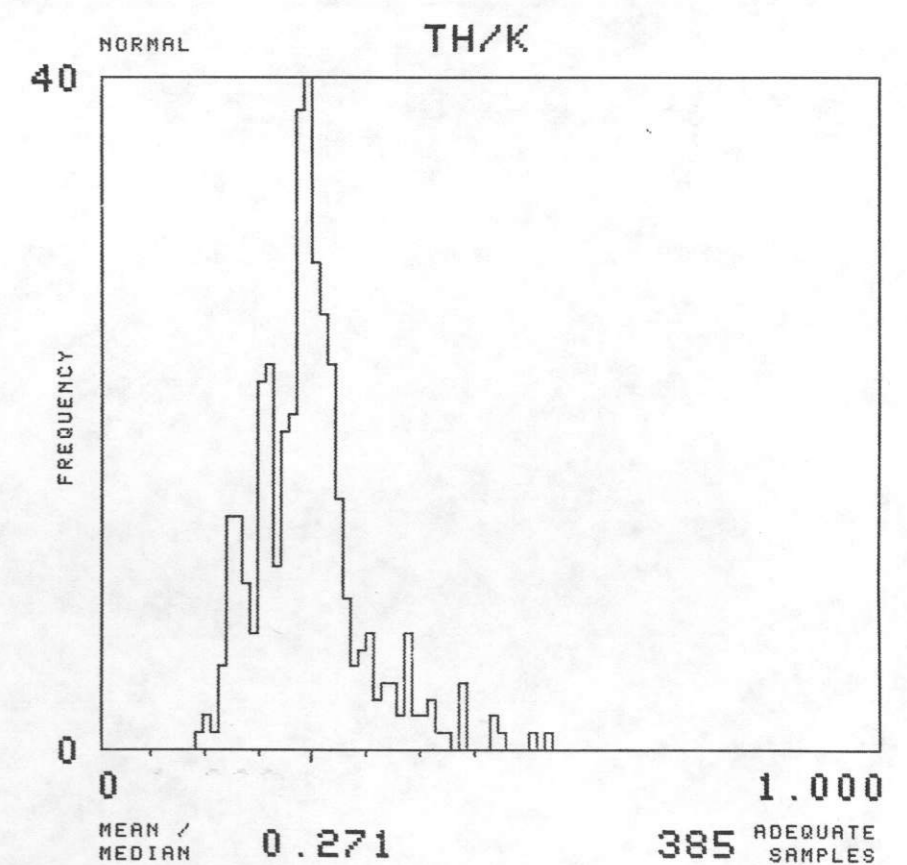
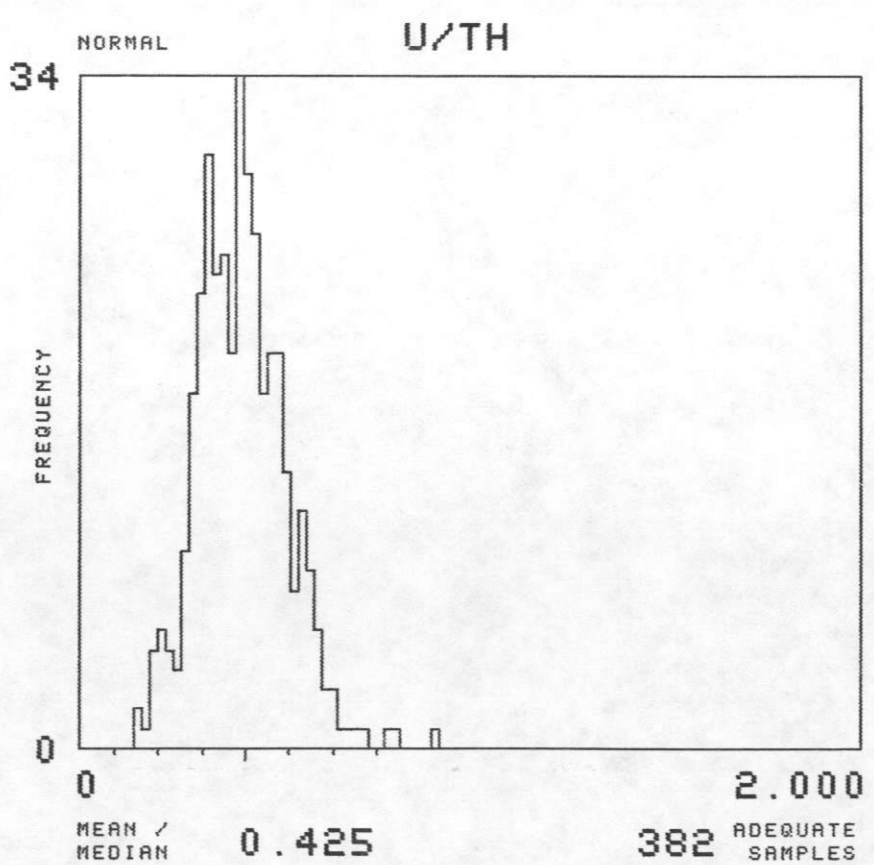
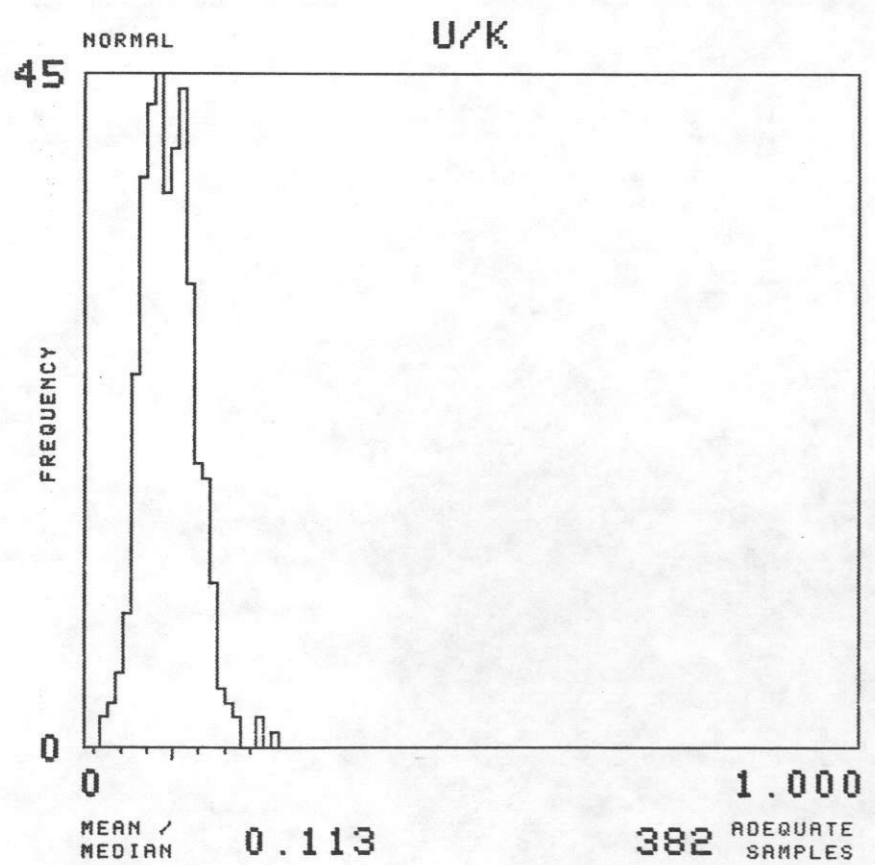
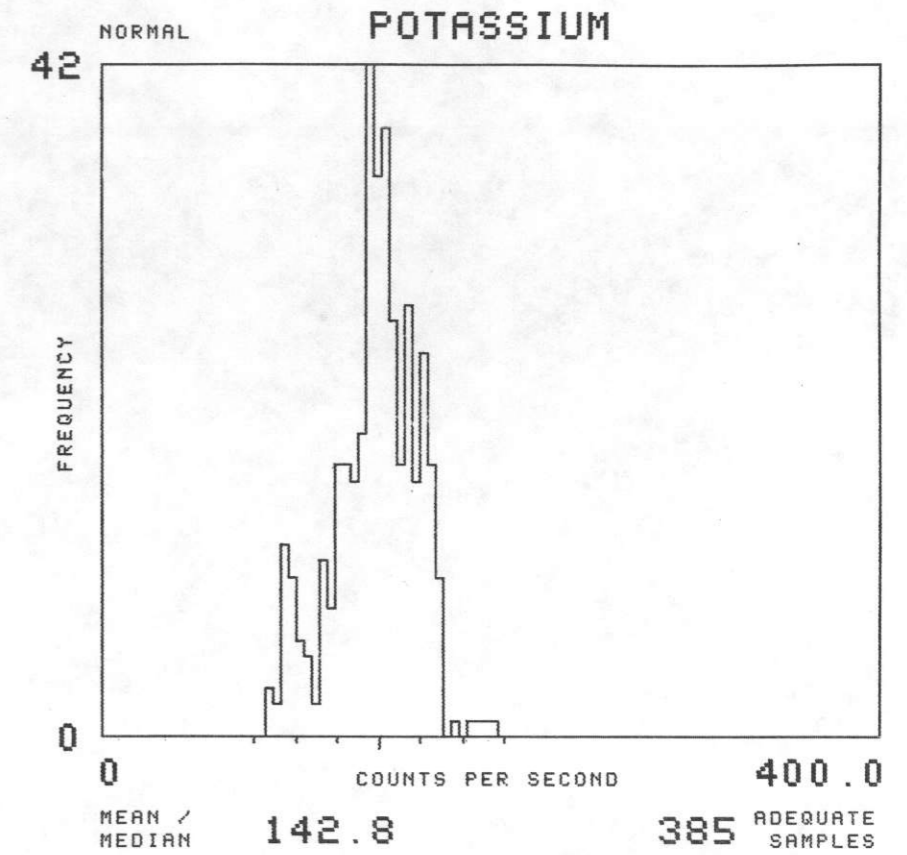
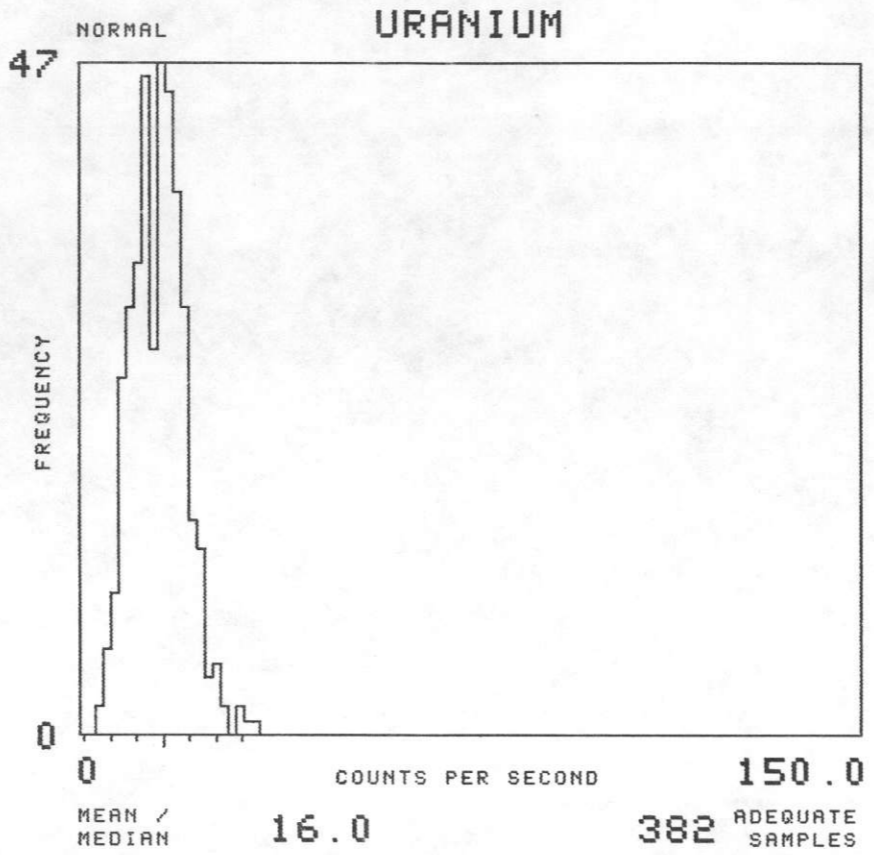
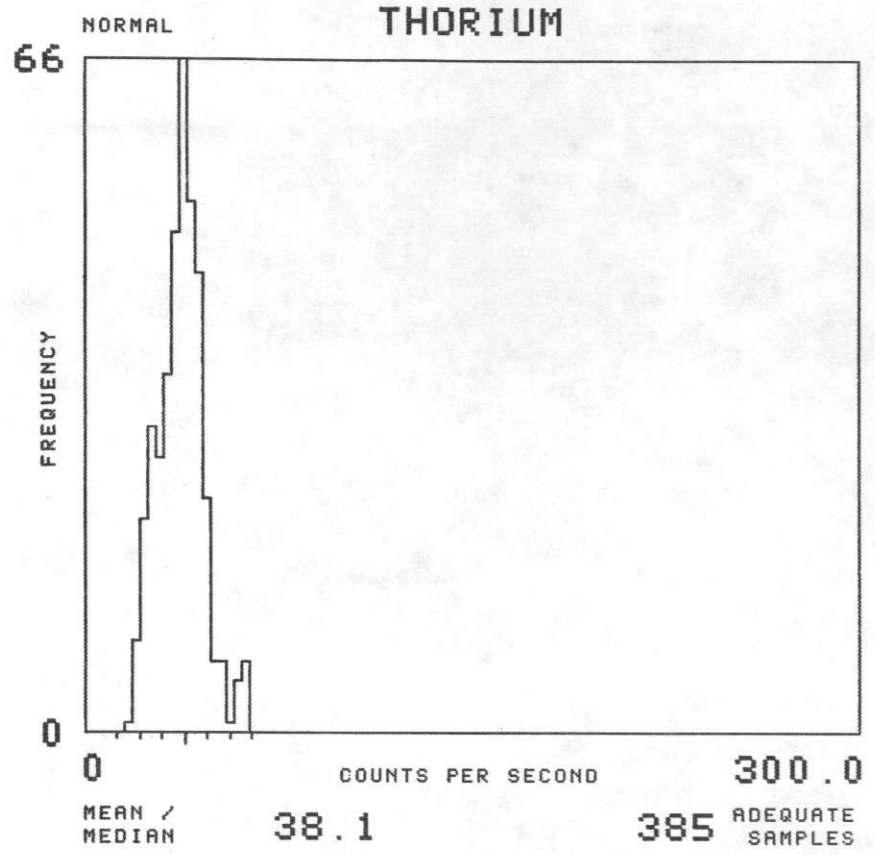
NTMS NI 12-3 GALLUP

MAP UNIT : TRWL TOTAL NUMBER OF SAMPLES 63



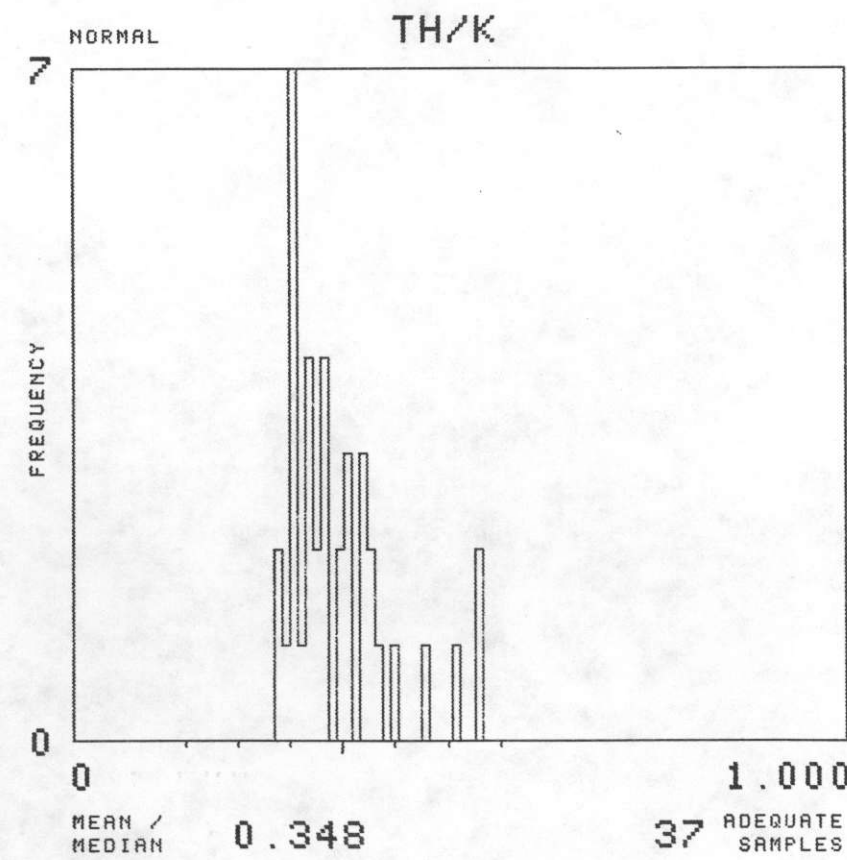
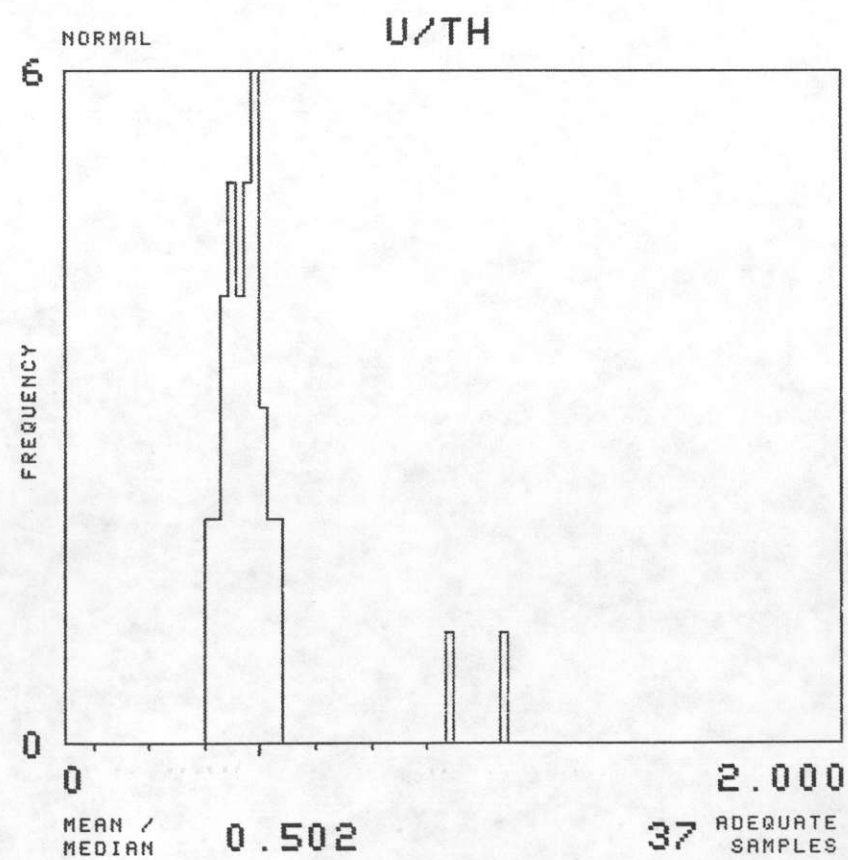
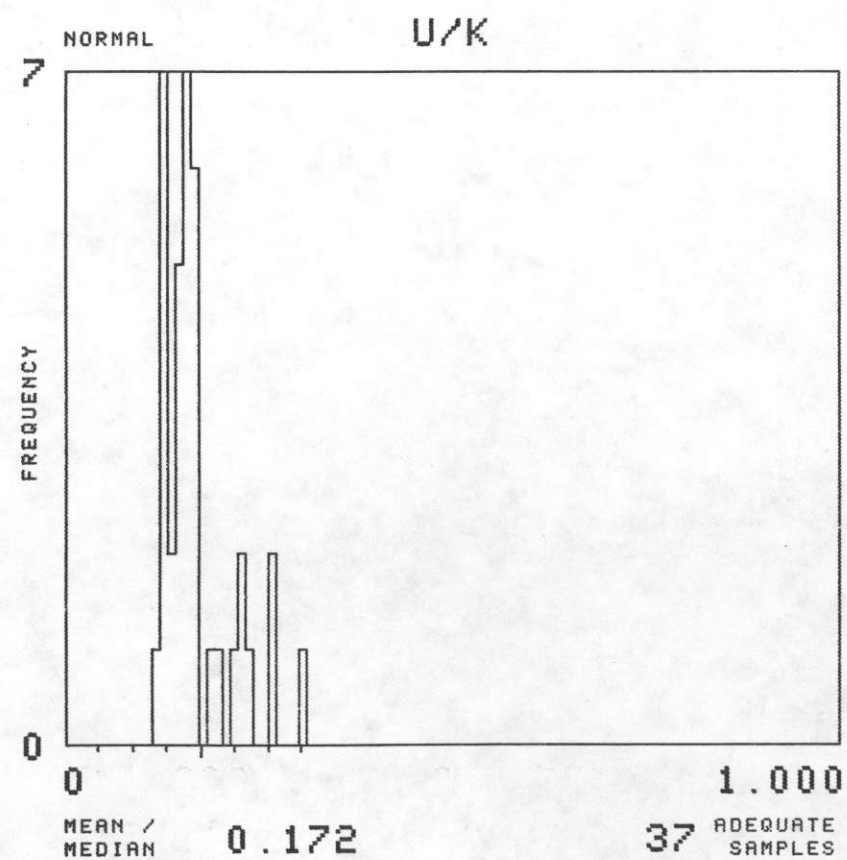
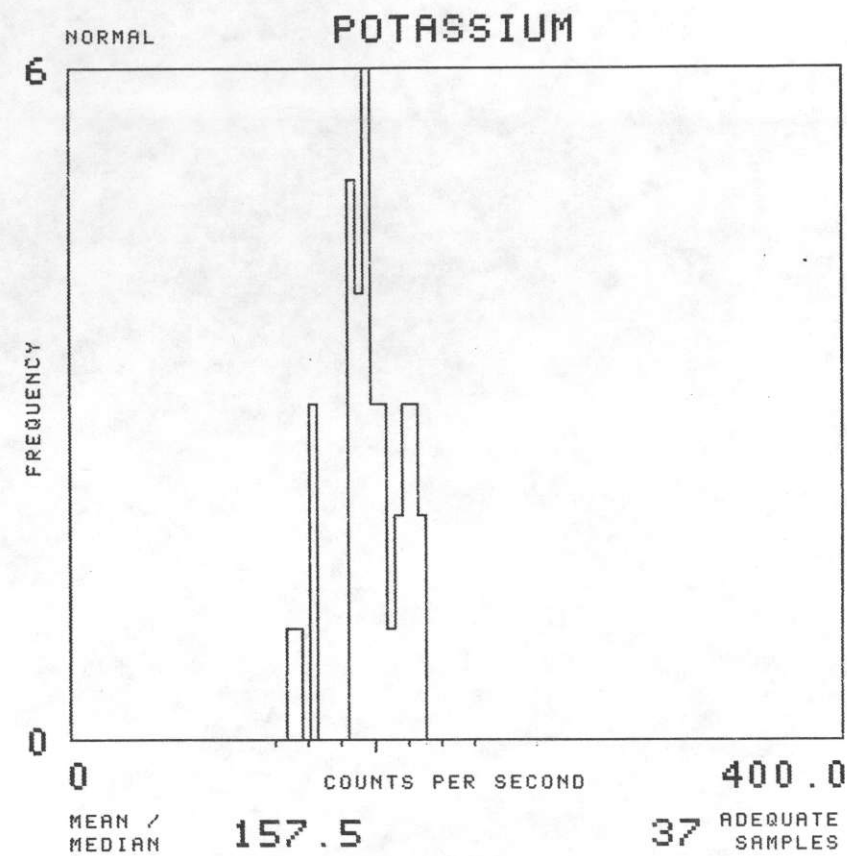
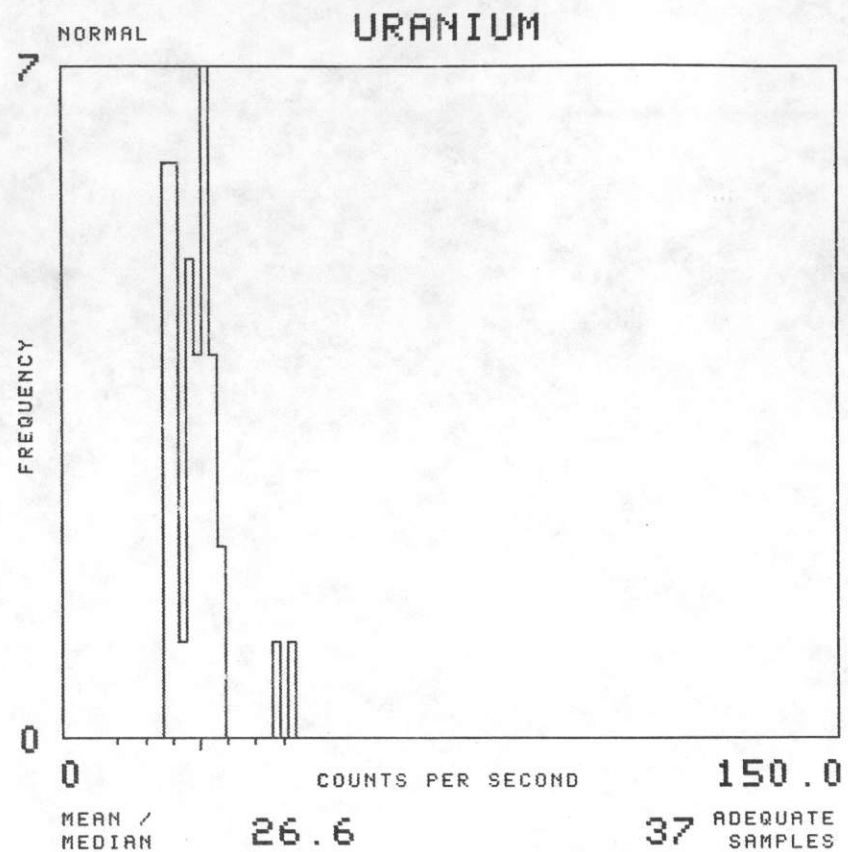
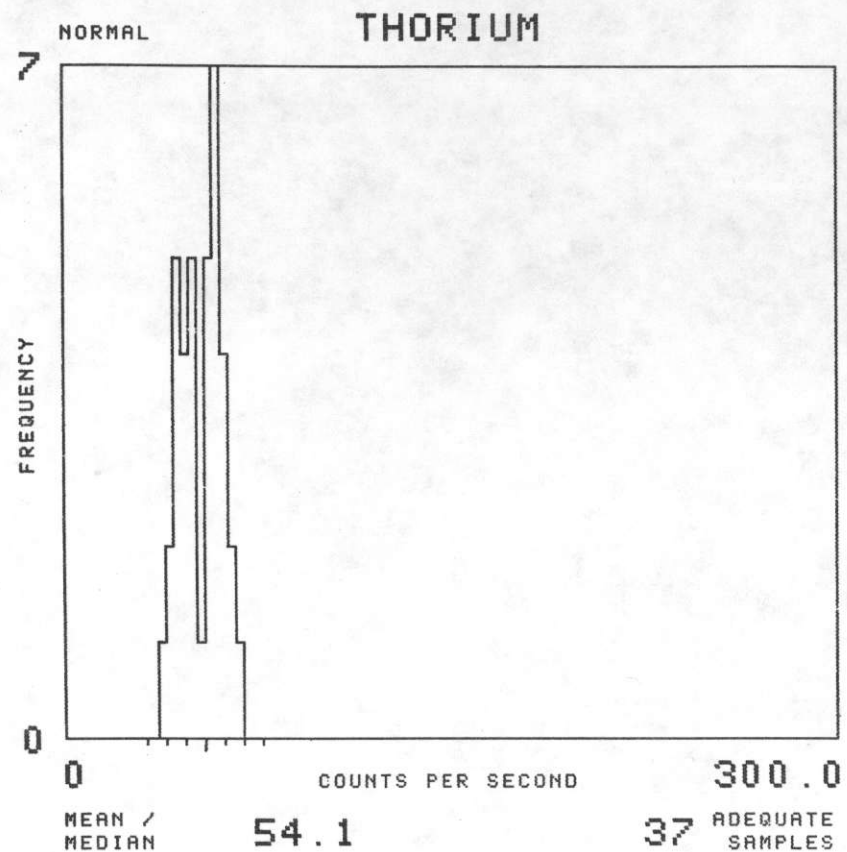
NTMS NI 12-3 GALLUP

MAP UNIT : TRWR TOTAL NUMBER OF SAMPLES 391



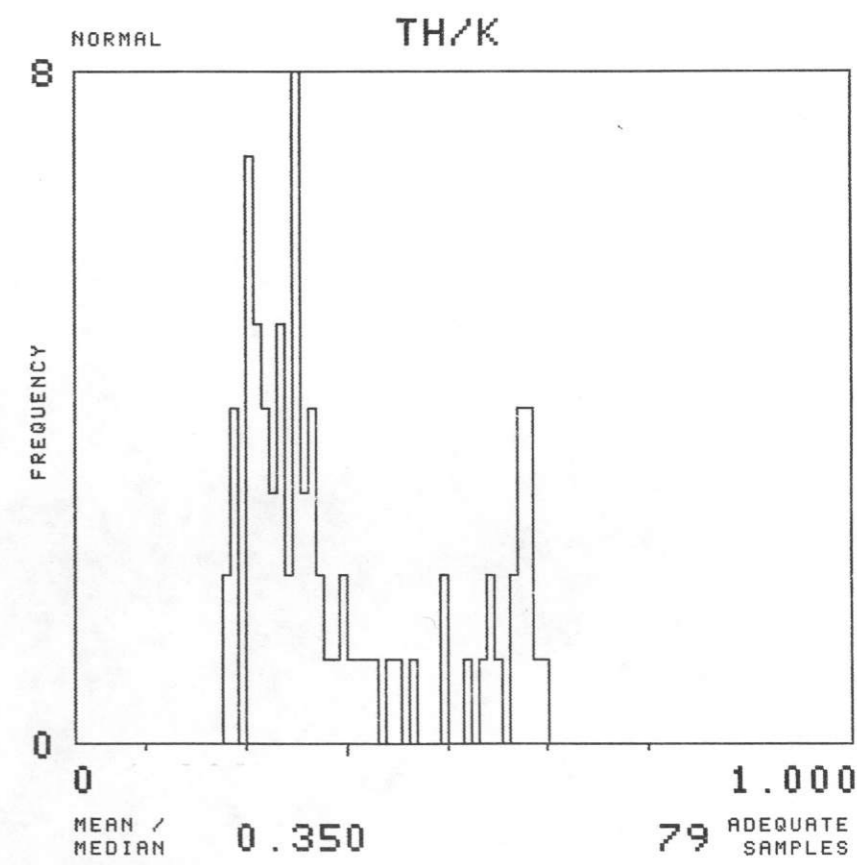
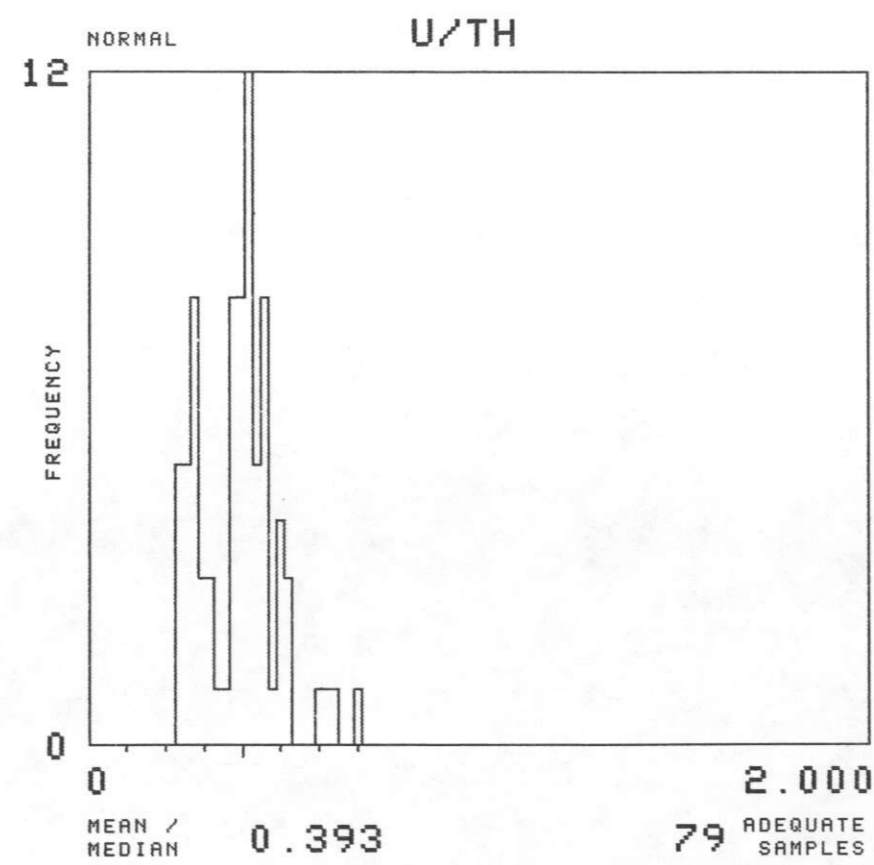
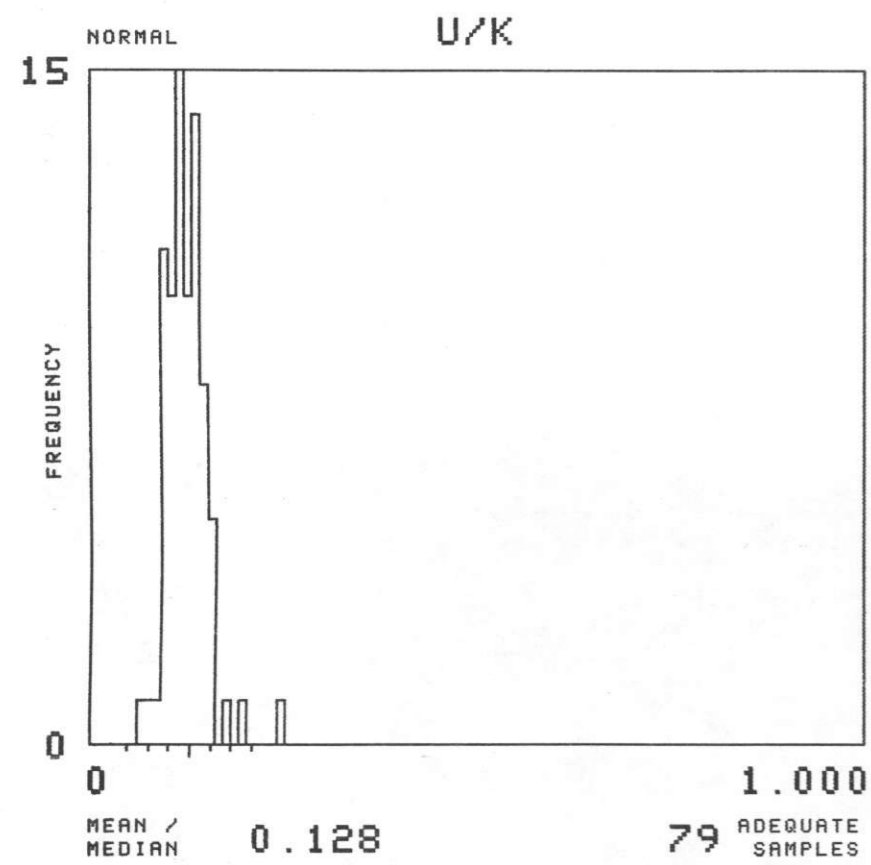
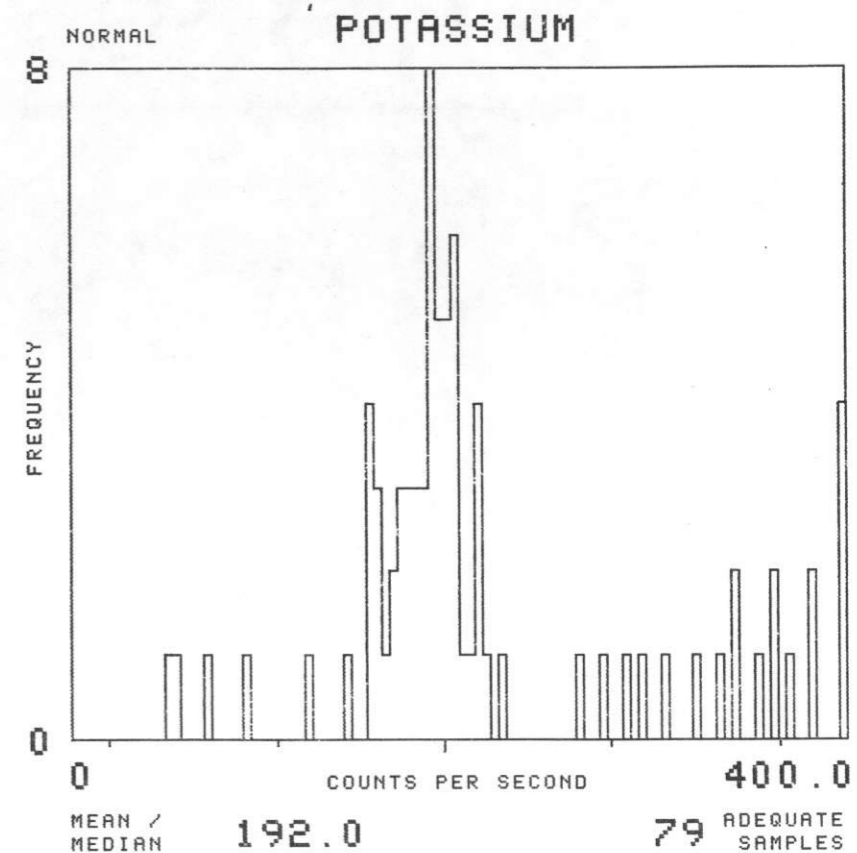
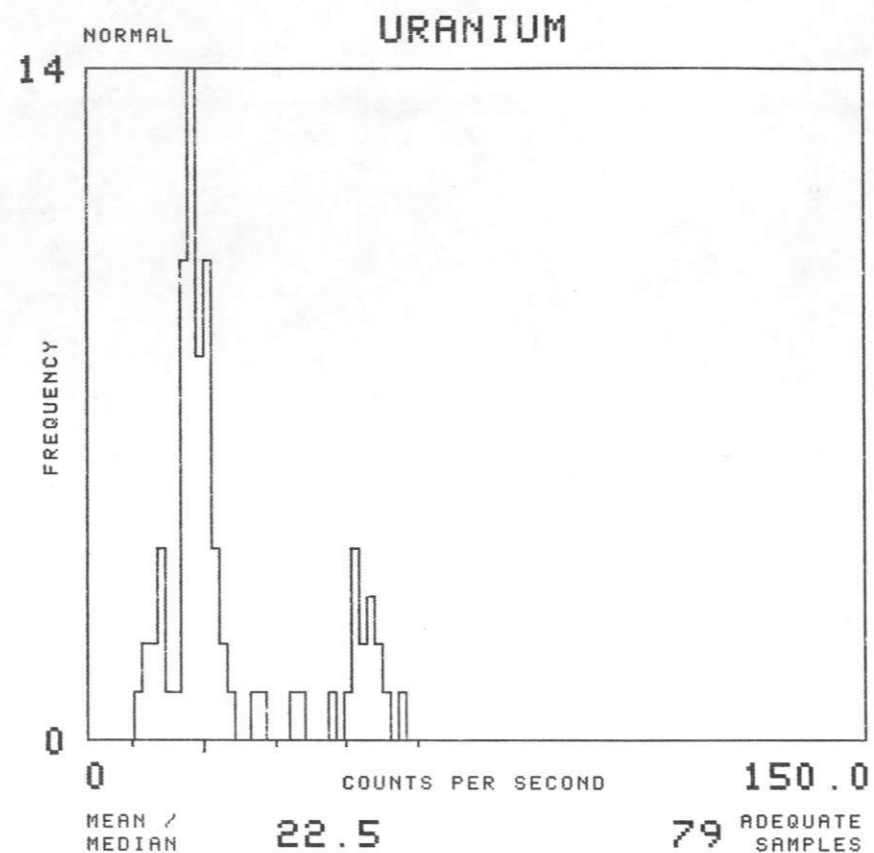
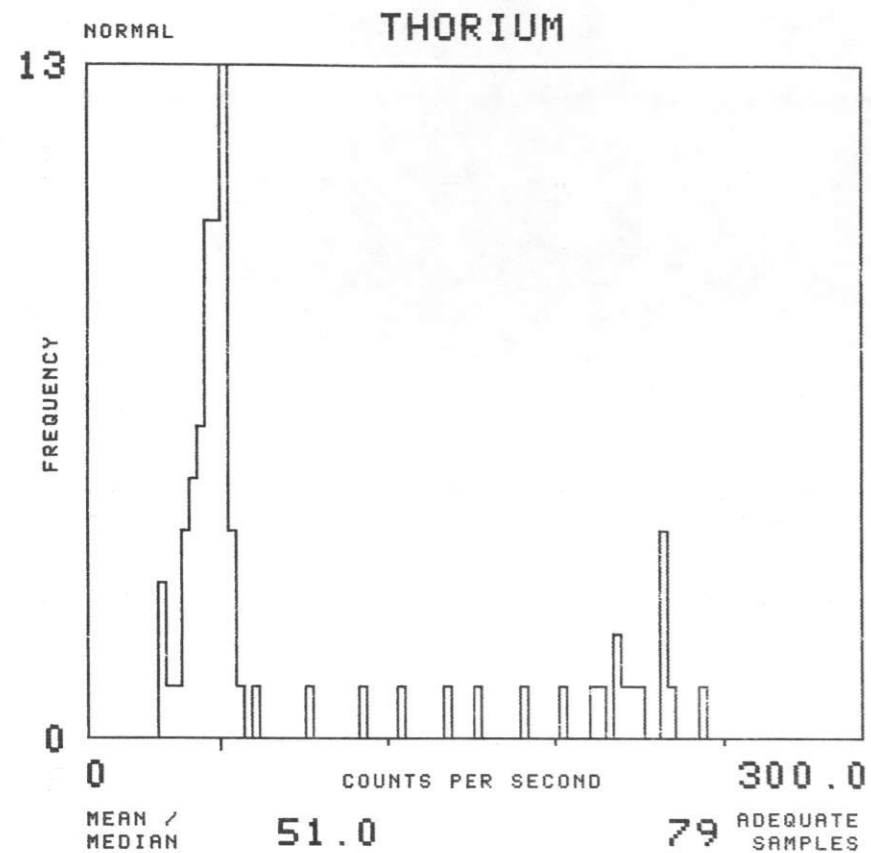
NTMS NI 12-3 GALLUP

MAP UNIT : TSG TOTAL NUMBER OF SAMPLES 37



NTMS NI 12-3 GALLUP

MAP UNIT : TTB TOTAL NUMBER OF SAMPLES 79



APPENDIX E - Statistical Tables

ROCK UNIT QA

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	117,3865	129,8243	142,2622	154,7000	167,1378	179,5757	192,0135
BI214	DIST NORMAL	9,1644	14,0430	18,9215	23,8000	28,6785	33,5570	38,4356
TL208	DIST NORMAL	32,6716	40,0811	47,4905	54,9000	62,3095	69,7189	77,1284
U/K	DIST NORMAL	-1,0339	-.6367	-.2394	.1578	.5550	.9523	1,3495
U/TH	DIST NORMAL	-1,5596	-.8905	-.2214	.4477	1,1168	1,7859	2,4550
TH/K	DIST NORMAL	-1,4475	-.8433	-.2392	.3650	.9692	1,5733	2,1775

ROCK UNIT QAE

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	133,2754	146,4169	159,5585	172,7000	185,8415	198,9831	212,1246
BI214	DIST NORMAL	8,4752	13,2501	18,0251	22,8000	27,5749	32,3499	37,1248
TL208	DIST NORMAL	32,9908	40,4272	47,8636	55,3000	62,7364	70,1728	77,6092
U/K	DIST NORMAL	-.9719	-.6024	-.2330	.1365	.5060	.8754	1,2449
U/TH	DIST NORMAL	-1,5284	-.8779	-.2273	.4232	1,0737	1,7243	2,3748
TH/K	DIST NORMAL	-1,3951	-.8197	-.2443	.3311	.9065	1,4819	2,0573

ROCK UNIT QE

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	119,6742	132,2161	144,7581	157,3000	169,8419	182,3839	194,9258
BI214	DIST NORMAL	5,2075	9,4383	13,6692	17,9000	22,1308	26,3617	30,5925
TL208	DIST NORMAL	20,1131	26,3421	32,5710	38,8000	45,0290	51,2579	57,4869
U/K	DIST NORMAL	-.8999	-.5619	-.2238	.1143	.4524	.7905	1,1285
U/TH	DIST NORMAL	-1,5715	-.8952	-.2189	.4574	1,1337	1,8100	2,4863
TH/K	DIST NORMAL	-1,2480	-.7490	-.2500	.2490	.7480	1,2470	1,7460

ROCK UNIT QED

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	95,1870	106,5580	117,9290	129,3000	140,6710	152,0420	163,4130
BI214	DIST NORMAL	7,0508	11,6005	16,1503	20,7000	25,2497	29,7995	34,3492
TL208	DIST NORMAL	23,0964	29,6310	36,1655	42,7000	49,2345	55,7690	62,3036
U/K	DIST NORMAL	-1,1128	-.6792	-.2456	.1880	.6216	1,0552	1,4888
U/TH	DIST NORMAL	-1,6126	-.9110	-.2093	.4923	1,1939	1,8956	2,5972
TH/K	DIST NORMAL	-1,3603	-.8036	-.2468	.3100	.8668	1,4236	1,9803

ROCK UNIT QC

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	113,1699	125,4133	137,6566	149,9000	162,1434	174,3867	186,6301
BI214	DIST NORMAL	9,3031	14,2020	19,1010	24,0000	28,8990	33,7980	38,6969
TL208	DIST NORMAL	28,0786	35,0857	42,0929	49,1000	56,1071	63,1143	70,1214
U/K	DIST NORMAL	-1,1767	-.7127	-.2487	.2153	.6793	1,1433	1,6073
U/TH	DIST NORMAL	-1,5747	-.8965	-.2182	.4600	1,1382	1,8165	2,4947
TH/K	DIST NORMAL	-1,4696	-.8530	-.2364	.3802	.9968	1,6134	2,2300

ROCK UNIT QAD

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	114,3988	126,6992	138,9996	151,3000	163,6004	175,9008	188,2012
BI214	DIST NORMAL	6,6501	11,1334	15,6167	20,1000	24,5833	29,0666	33,5499
TL208	DIST NORMAL	24,4875	31,1583	37,8292	44,5000	51,1708	57,8417	64,5125
U/K	DIST NORMAL	-.9710	-.6019	-.2329	.1362	.5053	.8743	1,2434
U/TH	DIST NORMAL	-1,5802	-.8986	-.2170	.4646	1,1462	1,8278	2,5094
TH/K	DIST NORMAL	-1,3421	-.7949	-.2478	.2994	.8466	1,3937	1,9409

ROCK UNIT QVA

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	111,5034	123,6690	135,8345	148,0000	160,1655	172,3310	184,4966
BI214	DIST NORMAL	6,4508	10,9006	15,3503	19,8000	24,2497	28,6994	33,1492
TL208	DIST NORMAL	32,9908	40,4272	47,8636	55,3000	62,7364	70,1728	77,6092
U/K	DIST NORMAL	-.9466	-.5883	-.2299	.1284	.4867	.8451	1,2034
U/TH	DIST NORMAL	-1,4523	-.8455	-.2386	.3683	.9752	1,5821	2,1889
TH/K	DIST NORMAL	-1,4179	-.8301	-.2423	.3455	.9333	1,5211	2,1089

ROCK UNIT QD

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	87,2230	98,1820	109,1410	120,1000	131,0590	142,0180	152,9770
BI214	DIST NORMAL	2,8951	6,6634	10,4317	14,2000	17,9683	21,7366	25,5049
TL208	DIST NORMAL	22,7115	29,2077	35,7038	42,2000	48,6962	55,1923	61,6885
U/K	DIST NORMAL	-.9122	-.5688	-.2255	.1179	.4613	.8046	1,1480
U/TH	DIST NORMAL	-1,4052	-.8243	-.2435	.3374	.9183	1,4991	2,0800
TH/K	DIST NORMAL	-1,4300	-.8355	-.2411	.3534	.9479	1,5423	2,1368

ROCK UNIT TBU

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	111,6788	123,8525	136,0263	148,2000	160,3737	172,5475	184,7212
BI214	DIST	NORMAL	5,4665	9,7443	14,0222	18,3000	22,5778	26,8557	31,1335
TL208	DIST	NORMAL	22,1739	28,6159	35,0580	41,5000	47,9420	54,3841	60,8261
U/K	DIST	NORMAL	-.9370	-.5828	-.2287	.1254	.4795	.8336	1,1878
U/TH	DIST	NORMAL	-1,5623	-.8916	-.2208	.4499	1,1206	1,7914	2,4621
TH/K	DIST	NORMAL	-1,3147	-.7818	-.2489	.2840	.8169	1,3498	1,8827

ROCK UNIT TBV

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	99,3595	110,9397	122,5198	134,1000	145,6802	157,2603	168,8405
BI214	DIST	NORMAL	11,4827	16,6885	21,8942	27,1000	32,3058	37,5115	42,7173
TL208	DIST	NORMAL	34,3505	41,9003	49,4502	57,0000	64,5498	72,0997	79,6495
U/K	DIST	NORMAL	-1,1618	-.7050	-.2481	.2087	.6655	1,1224	1,5792
U/TH	DIST	NORMAL	-1,5958	-.9046	-.2135	.4777	1,1689	1,8600	2,5512
TH/K	DIST	NORMAL	-1,5510	-.8871	-.2231	.4408	1,1047	1,7687	2,4326

ROCK UNIT TBL

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	129,1156	142,0770	155,0385	168,0000	180,9615	193,9230	206,8844
BI214	DIST	NORMAL	11,4115	16,6077	21,8038	27,0000	32,1962	37,3923	42,5885
TL208	DIST	NORMAL	29,8128	36,9752	44,1376	51,3000	58,4624	65,6248	72,7872
U/K	DIST	NORMAL	-1,0449	-.6427	-.2404	.1618	.5640	.9663	1,3685
U/TH	DIST	NORMAL	-1,6536	-.9259	-.1981	.5296	1,2573	1,9851	2,7128
TH/K	DIST	NORMAL	-1,3597	-.8032	-.2468	.3096	.8660	1,4224	1,9789

ROCK UNIT TER

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	125,0516	137,8344	150,6172	163,4000	176,1828	188,9656	201,7484
BI214	DIST	NORMAL	9,7205	14,6803	19,4402	24,6000	29,5598	34,5197	39,4795
TL208	DIST	NORMAL	32,5122	39,9081	47,3041	54,7000	62,0959	69,4919	76,8878
U/K	DIST	NORMAL	-1,0244	-.6315	-.2385	.1544	.5473	.9403	1,3332
U/TH	DIST	NORMAL	-1,5626	-.8917	-.2208	.4501	1,1210	1,7919	2,4628
TH/K	DIST	NORMAL	-1,4113	-.8271	-.2429	.3413	.9255	1,5097	2,0939

ROCK UNIT TSG

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	119,8503	132,4002	144,9501	157,5000	170,0499	182,5998	195,1497
BI214	DIST	NORMAL	11,1274	16,2850	21,4425	26,6000	31,7575	36,9150	42,0726
TL208	DIST	NORMAL	32,0342	39,3895	46,7447	54,1000	61,4553	68,8105	76,1658
U/K	DIST	NORMAL	-1,0722	-.6575	-.2427	.1720	.5867	1,0015	1,4162
U/TH	DIST	NORMAL	-1,6234	-.9150	-.2065	.5019	1,2103	1,9188	2,6272
TH/K	DIST	NORMAL	-1,4221	-.8320	-.2419	.3482	.9383	1,5284	2,1185

ROCK UNIT TTR

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	150,4308	164,2872	178,1436	192,0000	205,8564	219,7128	233,5692
BI214	DIST	NORMAL	8,2698	13,0132	17,7566	22,5000	27,2434	31,9868	36,7302
TL208	DIST	NORMAL	29,5757	36,7171	43,8586	51,0000	58,1414	65,2829	72,4243
U/K	DIST	NORMAL	-.9444	-.5870	-.2297	.1277	.4851	.8424	1,1998
U/TH	DIST	NORMAL	-1,4881	-.8610	-.2338	.3933	1,0204	1,6476	2,2747
TH/K	DIST	NORMAL	-1,4242	-.8329	-.2417	.3496	.9409	1,5321	2,1234

ROCK UNIT TC

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	118,2661	130,7440	143,2220	155,7000	168,1780	180,6560	193,1339
BI214	DIST	NORMAL	11,6252	16,8501	22,0751	27,3000	32,5249	37,7499	42,9748
TL208	DIST	NORMAL	14,6625	20,2750	25,8875	31,5000	37,1125	42,7250	48,3375
U/K	DIST	NORMAL	-1,0920	-.6681	-.2442	.1797	.6036	1,0275	1,4514
U/TH	DIST	NORMAL	-1,8695	-.9864	-.1032	.7800	1,6632	2,5464	3,4295
TH/K	DIST	NORMAL	-1,1552	-.7015	-.2479	.2058	.6595	1,1131	1,5668

ROCK UNIT KKF

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	110,5393	122,6595	134,7798	146,9000	159,0202	171,1405	183,2607
BI214	DIST	NORMAL	13,2058	18,6372	24,0686	29,5000	34,9314	40,3628	45,7942
TL208	DIST	NORMAL	38,2161	46,0774	53,9387	61,8000	69,6613	77,5226	85,3839
U/K	DIST	NORMAL	-1,1634	-.7058	-.2482	.2094	.6670	1,1246	1,5822
U/TH	DIST	NORMAL	-1,4693	-.8529	-.2364	.3800	.9964	1,6129	2,2293
TH/K	DIST	NORMAL	-1,5365	-.8812	-.2259	.4294	1,0847	1,7400	2,3953

ROCK UNIT KMF

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	154,6251	168,6500	182,6750	196,7000	210,7250	224,7500	238,7749
BI214	DIST NORMAL	10,4211	15,4807	20,5404	25,6000	30,6596	35,7193	40,7789
TL208	DIST NORMAL	39,3505	47,3003	55,2502	63,2000	71,1498	79,0997	87,0495
U/K	DIST NORMAL	-.9561	-.5936	-.2311	.1314	.4939	.8564	1,2189
U/TH	DIST NORMAL	-1,5181	-.8736	-.2291	.4154	1,0599	1,7044	2,3489
TH/K	DIST NORMAL	-1,3831	-.8142	-.2452	.3237	.8926	1,4616	2,0305

ROCK UNIT KP

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	108,4376	120,4584	132,4792	144,5000	156,5208	168,5416	180,5624
BI214	DIST NORMAL	4,3139	8,3760	12,4380	16,5000	20,5620	24,6240	28,6861
TL208	DIST NORMAL	26,1988	33,0325	39,8663	46,7000	53,5337	60,3675	67,2012
U/K	DIST NORMAL	-.9102	-.5677	-.2252	.1173	.4598	.8023	1,1448
U/TH	DIST NORMAL	-1,4365	-.8385	-.2404	.3577	.9558	1,5539	2,1519
TH/K	DIST NORMAL	-1,4001	-.8220	-.2439	.3342	.9123	1,4904	2,0685

ROCK UNIT KC

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	124,6103	137,3735	150,1368	162,9000	175,6632	188,4265	201,1897
BI214	DIST NORMAL	10,6324	15,7216	20,8108	25,9000	30,9892	36,0784	41,1676
TL208	DIST NORMAL	41,6279	49,7519	57,8760	66,0000	74,1240	82,2481	90,3721
U/K	DIST NORMAL	-1,0427	-.6415	-.2402	.1610	.5622	.9635	1,3647
U/TH	DIST NORMAL	-1,4927	-.8629	-.2332	.3966	1,0264	1,6561	2,2859
TH/K	DIST NORMAL	-1,5095	-.8700	-.2306	.4089	1,0484	1,6878	2,3273

ROCK UNIT KMFC

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	141,0834	154,5556	168,0278	181,5000	194,9722	208,4444	221,9166
BI214	DIST NORMAL	11,6965	16,9310	22,1655	27,4000	32,6345	37,8690	43,1035
TL208	DIST NORMAL	46,2150	54,6766	63,1383	71,6000	80,0617	88,5234	96,9850
U/K	DIST NORMAL	-1,0162	-.6270	-.2377	.1515	.5407	.9300	1,3192
U/TH	DIST NORMAL	-1,4759	-.8557	-.2356	.3846	1,0048	1,6249	2,2451
TH/K	DIST NORMAL	-1,4938	-.8634	-.2330	.3974	1,0278	1,6582	2,2886

ROCK UNIT KG

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	117,2106	129,6404	142,0702	154,5000	166,9298	179,3596	191,7894
BI214	DIST NORMAL	8,5438	13,3292	18,1146	22,9000	27,6854	32,4708	37,2562
TL208	DIST NORMAL	38,2970	46,1647	54,0323	61,9000	69,7677	77,6353	85,5030
U/K	DIST NORMAL	-1,0142	-.6259	-.2375	.1508	.5391	.9275	1,3158
U/TH	DIST NORMAL	-1,4566	-.8473	-.2381	.3712	.9805	1,5897	2,1990
TH/K	DIST NORMAL	-1,5078	-.8693	-.2308	.4077	1,0462	1,6847	2,3232

ROCK UNIT KM

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	123,1988	135,8992	148,5996	161,3000	174,0004	186,7008	199,4012
BI214	DIST NORMAL	8,4752	13,2501	18,0251	22,8000	27,5749	32,3499	37,1248
TL208	DIST NORMAL	39,1882	47,1255	55,0627	63,0000	70,9373	78,8745	86,8118
U/K	DIST NORMAL	-.9915	-.6133	-.2352	.1430	.5212	.8993	1,2775
U/TH	DIST NORMAL	-1,4532	-.8458	-.2385	.3689	.9763	1,5836	2,1910
TH/K	DIST NORMAL	-1,4891	-.8614	-.2337	.3940	1,0217	1,6494	2,2771

ROCK UNIT KMP

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	114,0476	126,3317	138,6159	150,9000	163,1841	175,4683	187,7524
BI214	DIST NORMAL	4,8860	9,0573	13,2287	17,4000	21,5713	25,7427	29,9140
TL208	DIST NORMAL	33,5501	41,0334	48,5167	56,0000	63,4833	70,9666	78,4499
U/K	DIST NORMAL	-.9017	-.5628	-.2240	.1148	.4536	.7924	1,1313
U/TH	DIST NORMAL	-1,3576	-.8023	-.2469	.3084	.8637	1,4191	1,9744
TH/K	DIST NORMAL	-1,4559	-.8470	-.2382	.3707	.9796	1,5884	2,1973

ROCK UNIT KGM

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	113,8720	126,1480	138,4240	150,7000	162,9760	175,2520	187,5280
BI214	DIST NORMAL	8,8190	13,6460	18,4730	23,3000	28,1270	32,9540	37,7810
TL208	DIST NORMAL	36,4397	44,1598	51,8799	59,6000	67,3201	75,0402	82,7603
U/K	DIST NORMAL	-1,0325	-.6359	-.2393	.1573	.5539	.9505	1,3471
U/TH	DIST NORMAL	-1,4910	-.8622	-.2334	.3954	1,0242	1,6530	2,2818
TH/K	DIST NORMAL	-1,4985	-.8654	-.2323	.4008	1,0339	1,6670	2,3001

		ROCK UNIT KT						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	134,7818	147,9879	161,1939	174,4000	187,6061	200,8121	214,0182
BI214	DIST NORMAL	9,6508	14,6005	19,5503	24,5000	29,4497	34,3995	39,3492
TL208	DIST NORMAL	40,0000	48,0000	56,0000	64,0000	72,0000	80,0000	88,0000
U/K	DIST NORMAL	-.9906	-.6128	-.2351	.1427	.5205	.8982	1,2760
U/TH	DIST NORMAL	-1,4898	-.8617	-.2336	.3945	1,0226	1,6507	2,2788
TH/K	DIST NORMAL	-1,4528	-.8456	-.2385	.3686	.9757	1,5828	2,1900

		ROCK UNIT KD						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	93,7119	105,0080	116,3040	127,6000	138,8960	150,1920	161,4881
BI214	DIST NORMAL	7,1179	11,6786	16,2393	20,8000	25,3607	29,9214	34,4821
TL208	DIST NORMAL	29,8919	37,0612	44,2306	51,4000	58,5694	65,7388	72,9081
U/K	DIST NORMAL	-1,0574	-.6494	-.2415	.1664	.5743	.9822	1,3902
U/TH	DIST NORMAL	-1,5140	-.8719	-.2298	.4123	1,0544	1,6965	2,3386
TH/K	DIST NORMAL	-1,5111	-.8707	-.2303	.4101	1,0505	1,6909	2,3313

		ROCK UNIT KMD						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	127,4361	140,3240	153,2120	166,1000	178,9880	191,8760	204,7639
BI214	DIST NORMAL	12,2689	17,5793	22,8896	28,2000	33,5104	38,8207	44,1311
TL208	DIST NORMAL	42,0357	50,1905	58,3452	66,5000	74,6548	82,8095	90,9643
U/K	DIST NORMAL	-1,0859	-.6648	-.2438	.1773	.5984	1,0194	1,4405
U/TH	DIST NORMAL	-1,5493	-.8864	-.2234	.4395	1,1024	1,7654	2,4283
TH/K	DIST NORMAL	-1,5113	-.8708	-.2302	.4103	1,0508	1,6914	2,3319

		ROCK UNIT KMDM						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	118,3540	130,8360	143,3180	155,8000	168,2820	180,7640	193,2460
BI214	DIST NORMAL	9,1644	14,0430	18,9215	23,8000	28,6785	33,5570	38,4356
TL208	DIST NORMAL	36,9234	44,6823	52,4411	60,2000	67,9589	75,7177	83,4766
U/K	DIST NORMAL	-1,0236	-.6310	-.2385	.1541	.5467	.9392	1,3318
U/TH	DIST NORMAL	-1,4952	-.8640	-.2328	.3984	1,0296	1,6608	2,2920
TH/K	DIST NORMAL	-1,4804	-.8577	-.2349	.3878	1,0105	1,6333	2,2560

		ROCK UNIT KDM						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	93,1050	104,3700	115,6350	126,9000	138,1650	149,4300	160,6950
BI214	DIST NORMAL	5,4016	9,6677	13,9339	18,2000	22,4661	26,7323	30,9984
TL208	DIST NORMAL	24,7978	31,4985	38,1993	44,9000	51,6007	58,3015	65,0022
U/K	DIST NORMAL	-1,0015	-.6188	-.2362	.1464	.5290	.9116	1,2943
U/TH	DIST NORMAL	-1,5348	-.8805	-.2262	.4281	1,0824	1,7367	2,3910
TH/K	DIST NORMAL	-1,4297	-.8354	-.2411	.3532	.9475	1,5418	2,1361

		ROCK UNIT KDML						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	118,9700	131,4800	143,9900	156,5000	169,0100	181,5200	194,0300
BI214	DIST NORMAL	9,4420	14,3613	19,2807	24,2000	29,1193	34,0387	38,9580
TL208	DIST NORMAL	37,0041	44,7694	52,5347	60,3000	68,0653	75,8306	83,5959
U/K	DIST NORMAL	-1,0247	-.6316	-.2386	.1545	.5476	.9406	1,3337
U/TH	DIST NORMAL	-1,4976	-.8650	-.2324	.4002	1,0328	1,6654	2,2980
TH/K	DIST NORMAL	-1,4789	-.8570	-.2352	.3867	1,0086	1,6304	2,2523

		ROCK UNIT JM						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	95,1870	106,5580	117,9290	129,3000	140,6710	152,0420	163,4130
BI214	DIST NORMAL	8,3382	13,0921	17,8461	22,6000	27,3539	32,1079	36,8618
TL208	DIST NORMAL	22,7885	29,2923	35,7962	42,3000	48,8038	55,3077	61,8115
U/K	DIST NORMAL	-1,0874	-.6657	-.2439	.1779	.5997	1,0215	1,4432
U/TH	DIST NORMAL	-1,6761	-.9337	-.1912	.5512	1,2936	2,0361	2,7785
TH/K	DIST NORMAL	-1,3930	-.8188	-.2445	.3298	.9041	1,4784	2,0526

		ROCK UNIT JMW						
		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	103,4560	115,2373	127,0187	138,8000	150,5813	162,3627	174,1440
BI214	DIST NORMAL	6,7167	11,2111	15,7056	20,2000	24,6944	29,1889	33,6833
TL208	DIST NORMAL	29,3388	36,4592	43,5796	50,7000	57,8204	64,9408	72,0612
U/K	DIST NORMAL	-1,0119	-.6246	-.2373	.1500	.5373	.9246	1,3119
U/TH	DIST NORMAL	-1,5322	-.8794	-.2267	.4261	1,0789	1,7316	2,3844
TH/K	DIST NORMAL	-1,4589	-.8483	-.2378	.3728	.9834	1,5939	2,2045

ROCK UNIT JMR

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	130,9733	144,0155	157,0578	170,1000	183,1422	196,1845	209,2267
BI214	DIST NORMAL	6,7167	11,2111	15,7056	20,2000	24,6944	29,1889	33,6833
TL208	DIST NORMAL	29,4178	36,5452	43,6726	50,8000	57,9274	65,0548	72,1822
U/K	DIST NORMAL	-.9209	-.5738	-.2266	.1205	.4676	.8148	1,1619
U/TH	DIST NORMAL	-1,5081	-.8694	-.2308	.4079	1,0466	1,6852	2,3239
TH/K	DIST NORMAL	-1,3418	-.7948	-.2478	.2992	.8462	1,3932	1,9402

ROCK UNIT JMWR

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	105,4643	117,3429	129,2214	141,1000	152,9786	164,8571	176,7357
BI214	DIST NORMAL	4,3139	8,3760	12,4380	16,5000	20,5620	24,6240	28,6861
TL208	DIST NORMAL	9,5811	14,5207	19,4604	24,4000	29,3396	34,2793	39,2189
U/K	DIST NORMAL	-.9030	-.5636	-.2242	.1152	.4546	.7940	1,1334
U/TH	DIST NORMAL	-1,8334	-.9789	-.1243	.7303	1,5849	2,4395	3,2940
TH/K	DIST NORMAL	-1,0714	-.6570	-.2427	.1717	.5861	1,0004	1,4148

ROCK UNIT JCS

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	112,6435	124,8623	137,0812	149,3000	161,5188	173,7377	185,9565
BI214	DIST NORMAL	4,2509	8,3006	12,3503	16,4000	20,4497	24,4994	28,5491
TL208	DIST NORMAL	18,5258	24,5839	30,6419	36,7000	42,7581	48,8161	54,8742
U/K	DIST NORMAL	-.8878	-.5549	-.2221	.1108	.4437	.7765	1,1094
U/TH	DIST NORMAL	-1,5700	-.8946	-.2193	.4561	1,1315	1,8068	2,4822
TH/K	DIST NORMAL	-1,2426	-.7463	-.2500	.2463	.7426	1,2389	1,7352

ROCK UNIT JS

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	90,0743	101,1829	112,2914	123,4000	134,5086	145,6171	156,7257
BI214	DIST NORMAL	2,3593	6,0062	9,6531	13,3000	16,9469	20,5938	24,2407
TL208	DIST NORMAL	8,6813	13,4875	18,2938	23,1000	27,9062	32,7125	37,5187
U/K	DIST NORMAL	-.8822	-.5517	-.2213	.1092	.4397	.7701	1,1006
U/TH	DIST NORMAL	-1,7131	-.9458	-.1786	.5887	1,3560	2,1232	2,8905
TH/K	DIST NORMAL	-1,1145	-.6801	-.2457	.1887	.6231	1,0575	1,4919

ROCK UNIT JCSS

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	117,2985	129,7324	142,1662	154,6000	167,0338	179,4676	191,9015
BI214	DIST NORMAL	8,3382	13,0921	17,8461	22,6000	27,3539	32,1079	36,8618
TL208	DIST NORMAL	18,9025	25,0016	31,1008	37,2000	43,2992	49,3984	55,4975
U/K	DIST NORMAL	-.9935	-.6145	-.2354	.1437	.5228	.9019	1,2809
U/TH	DIST NORMAL	-1,7214	-.9485	-.1755	.5975	1,3705	2,1435	2,9164
TH/K	DIST NORMAL	-1,2322	-.7410	-.2499	.2412	.7323	1,2234	1,7146

ROCK UNIT JE

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	111,0651	123,2101	135,3550	147,5000	159,6450	171,7899	183,9349
BI214	DIST NORMAL	4,6307	8,7538	12,8769	17,0000	21,1231	25,2462	29,3693
TL208	DIST NORMAL	17,7003	23,6669	29,6334	35,6000	41,5666	47,5331	53,4997
U/K	DIST NORMAL	-.9068	-.5658	-.2247	.1163	.4573	.7984	1,1394
U/TH	DIST NORMAL	-1,6302	-.9175	-.2047	.5080	1,2207	1,9335	2,6462
TH/K	DIST NORMAL	-1,2320	-.7409	-.2499	.2411	.7321	1,2231	1,7142

ROCK UNIT JTE

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	104,6782	116,5188	128,3594	140,2000	152,0406	163,8812	175,7218
BI214	DIST NORMAL	5,0786	9,2857	13,4929	17,7000	21,9071	26,1143	30,3214
TL208	DIST NORMAL	11,9823	17,2549	22,5274	27,8000	33,0726	38,3451	43,6177
U/K	DIST NORMAL	-.9386	-.5837	-.2289	.1259	.4807	.8355	1,1904
U/TH	DIST NORMAL	-1,7744	-.9640	-.1537	.6567	1,4671	2,2774	3,0878
TH/K	DIST NORMAL	-1,1431	-.6952	-.2473	.2006	.6485	1,0964	1,5443

ROCK UNIT JCSE

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	102,4963	114,2309	125,9654	137,7000	149,4346	161,1691	172,9037
BI214	DIST NORMAL	2,7750	6,5167	10,2583	14,0000	17,7417	21,4833	25,2250
TL208	DIST NORMAL	20,4931	26,7621	33,0310	39,3000	45,5690	51,8379	58,1069
U/K	DIST NORMAL	-.8602	-.5391	-.2180	.1031	.4242	.7453	1,0664
U/TH	DIST NORMAL	-1,4497	-.8443	-.2389	.3665	.9719	1,5773	2,1827
TH/K	DIST NORMAL	-1,3298	-.7891	-.2483	.2924	.8331	1,3739	1,9146

ROCK UNIT JC

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	122,0527	134,7018	147,3509	160,0000	172,6491	185,2982	197,9473
BI214	DIST NORMAL	8,1331	12,8554	17,5777	22,3000	27,0223	31,7446	36,4669
TL208	DIST NORMAL	28,3145	35,3430	42,3715	49,4000	56,4285	63,4570	70,4855
U/K	DIST NORMAL	-.9834	-.6088	-.2343	.1403	.5149	.8894	1,2640
U/TH	DIST NORMAL	-1,6015	-.9068	-.2121	.4826	1,1773	1,8720	2,5667
TH/K	DIST NORMAL	-1,3516	-.7995	-.2473	.3049	.8571	1,4093	1,9614

ROCK UNIT TRWL

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	115,2770	127,6180	139,9590	152,3000	164,6410	176,9820	189,3230
BI214	DIST NORMAL	5,2075	9,4383	13,6692	17,9000	22,1308	26,3617	30,5925
TL208	DIST NORMAL	20,5692	26,8461	33,1231	39,4000	45,6769	51,9539	58,2308
U/K	DIST NORMAL	-.9169	-.5715	-.2261	.1193	.4647	.8101	1,1555
U/TH	DIST NORMAL	-1,5867	-.9011	-.2156	.4700	1,1556	1,8411	2,5267
TH/K	DIST NORMAL	-1,2726	-.7612	-.2499	.2615	.7729	1,2842	1,7956

ROCK UNIT TRWR

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	106,9503	118,9002	130,8501	142,8000	154,7499	166,6998	178,6497
BI214	DIST NORMAL	4,0000	8,0000	12,0000	16,0000	20,0000	24,0000	28,0000
TL208	DIST NORMAL	19,5824	25,7550	31,9275	38,1000	44,2725	50,4450	56,6176
U/K	DIST NORMAL	-.8948	-.5589	-.2231	.1128	.4487	.7845	1,1204
U/TH	DIST NORMAL	-1,5309	-.8789	-.2269	.4251	1,0771	1,7291	2,3811
TH/K	DIST NORMAL	-1,2907	-.7702	-.2496	.2710	.7916	1,3122	1,8327

ROCK UNIT TRC

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	73,7471	83,9647	94,1824	104,4000	114,6176	124,8353	135,0529
BI214	DIST NORMAL	7,3196	11,9131	16,5065	21,1000	25,6935	30,2869	34,8804
TL208	DIST NORMAL	30,3667	37,5778	44,7889	52,0000	59,2111	66,4222	73,6333
U/K	DIST NORMAL	-1,1950	-.7221	-.2493	.2236	.6965	1,1693	1,6422
U/TH	DIST NORMAL	-1,5155	-.8725	-.2296	.4134	1,0564	1,6993	2,3423
TH/K	DIST NORMAL	-1,6850	-.9367	-.1883	.5600	1,3083	2,0567	2,8050

ROCK UNIT TRCS

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	64,7449	74,4299	84,1150	93,8000	103,4850	113,1701	122,8551
BI214	DIST NORMAL	5,7270	10,0513	14,3757	18,7000	23,0243	27,3487	31,6730
TL208	DIST NORMAL	26,0427	32,8618	39,6809	46,5000	53,3191	60,1382	66,9573
U/K	DIST NORMAL	-1,1731	-.7109	-.2486	.2137	.6760	1,1383	1,6005
U/TH	DIST NORMAL	-1,5160	-.8727	-.2295	.4138	1,0571	1,7003	2,3436
TH/K	DIST NORMAL	-1,6546	-.9262	-.1979	.5305	1,2589	1,9872	2,7156

ROCK UNIT TRMK

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	81,1096	91,7397	102,3699	113,0000	123,6301	134,2603	144,8904
BI214	DIST NORMAL	5,9233	10,2822	14,6411	19,0000	23,3589	27,7178	32,0767
TL208	DIST NORMAL	25,1084	31,8389	38,5695	45,3000	52,0305	58,7611	65,4916
U/K	DIST NORMAL	-1,0784	-.6608	-.2432	.1744	.5920	1,0096	1,4272
U/TH	DIST NORMAL	-1,5389	-.8822	-.2254	.4313	1,0880	1,7408	2,4015
TH/K	DIST NORMAL	-1,5187	-.8739	-.2290	.4158	1,0606	1,7055	2,3503

ROCK UNIT TRM

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	40,5691	48,6127	56,6564	64,7000	72,7436	80,7873	88,8309
BI214	DIST NORMAL	5,2721	9,5147	13,7574	18,0000	22,2426	26,4853	30,7279
TL208	DIST NORMAL	36,4397	44,1598	51,8799	59,6000	67,3201	75,0402	82,7603
U/K	DIST NORMAL	-1,3131	-.7810	-.2490	.2831	.8152	1,3472	1,8793
U/TH	DIST NORMAL	-1,3554	-.8012	-.2471	.3071	.8613	1,4154	1,9696
TH/K	DIST NORMAL	-1,9766	-.9995	-.2223	.9548	1,9319	2,9091	3,8862

ROCK UNIT TRCM

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	55,4181	64,5121	73,6060	82,7000	91,7940	100,8879	109,9819
BI214	DIST NORMAL	4,9501	9,1334	13,3167	17,5000	21,6833	25,8666	30,0499
TL208	DIST NORMAL	28,3931	35,4288	42,4644	49,5000	56,5356	63,5712	70,6069
U/K	DIST NORMAL	-1,2282	-.7391	-.2499	.2393	.7285	1,2177	1,7068
U/TH	DIST NORMAL	-1,4451	-.8423	-.2394	.3634	.9662	1,5691	2,1719
TH/K	DIST NORMAL	-1,7886	-.9679	-.1471	.6736	1,4943	2,3151	3,1358

ROCK UNIT PD

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	66,4368	76,2245	86,0123	95,8000	105,5877	115,3755	125,1632
BI214	DIST NORMAL	4,8860	9,0573	13,2287	17,4000	21,5713	25,7427	29,9140
TL208	DIST NORMAL	20,3410	26,5940	32,8470	39,1000	45,3530	51,6060	57,8590
U/K	DIST NORMAL	-1,1216	-.6838	-.2461	.1916	.6293	1,0670	1,5048
U/TH	DIST NORMAL	-1,5682	-.8939	-.2196	.4547	1,1290	1,8033	2,4776
TH/K	DIST NORMAL	-1,5343	-.8803	-.2263	.4277	1,0817	1,7357	2,3897

ROCK UNIT PPS

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	156,0543	170,1362	184,2181	198,3000	212,3819	226,4638	240,5457
BI214	DIST NORMAL	7,3196	11,9131	16,5065	21,1000	25,6935	30,2869	34,8804
TL208	DIST NORMAL	31,0803	38,3535	45,6268	52,9000	60,1732	67,4465	74,7197
U/K	DIST NORMAL	-.8786	-.5497	-.2207	.1082	.4371	.7661	1,0950
U/TH	DIST NORMAL	-1,5082	-.8695	-.2307	.4080	1,0467	1,6855	2,3242
TH/K	DIST NORMAL	-1,2887	-.7691	-.2496	.2699	.7894	1,3089	1,8285

ROCK UNIT PSA

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	45,3107	53,7071	62,1036	70,5000	78,8964	87,2929	95,6893
BI214	DIST NORMAL	4,6944	8,8296	12,9648	17,1000	21,2352	25,3704	29,5056
TL208	DIST NORMAL	18,0000	24,0000	30,0000	36,0000	42,0000	48,0000	54,0000
U/K	DIST NORMAL	-1,2814	-.7656	-.2497	.2661	.7819	1,2978	1,8136
U/TH	DIST NORMAL	-1,6444	-.9226	-.2008	.5210	1,2428	1,9646	2,6864
TH/K	DIST NORMAL	-1,6544	-.9261	-.1979	.5303	1,2585	1,9867	2,7150

ROCK UNIT PG

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	33,7100	41,2067	48,7033	56,2000	63,6967	71,1933	78,6900
BI214	DIST NORMAL	1,7215	5,2143	8,7072	12,2000	15,6928	19,1857	22,6785
TL208	DIST NORMAL	12,0539	17,3359	22,6180	27,9000	33,1820	38,4641	43,7461
U/K	DIST NORMAL	-1,2117	-.7307	-.2496	.2314	.7124	1,1935	1,6745
U/TH	DIST NORMAL	-1,5648	-.8926	-.2203	.4519	1,1241	1,7964	2,4686
TH/K	DIST NORMAL	-1,6439	-.9224	-.2010	.5205	1,2420	1,9634	2,6849

ROCK UNIT PY

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	24,8754	31,5836	38,2918	45,0000	51,7082	58,4164	65,1246
BI214	DIST NORMAL	3,1978	7,0319	10,8659	14,7000	18,5341	22,3681	26,2022
TL208	DIST NORMAL	16,7301	22,5868	28,4434	34,3000	40,1566	46,0132	51,8699
U/K	DIST NORMAL	-1,0913	-.6677	-.2442	.1794	.6030	1,0265	1,4501
U/TH	DIST NORMAL	-1,5389	-.8822	-.2254	.4313	1,0880	1,7448	2,4015
TH/K	DIST NORMAL	-1,4693	-.8529	-.2364	.3800	.9964	1,6129	2,2293

ROCK UNIT PGV

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	39,9188	47,9125	55,9063	63,9000	71,8937	79,8875	87,8812
BI214	DIST NORMAL	3,0158	6,8105	10,6053	14,4000	18,1947	21,9895	25,7842
TL208	DIST NORMAL	9,3031	14,2020	19,1010	24,0000	28,8990	33,7980	38,6969
U/K	DIST NORMAL	-1,1891	-.7191	-.2491	.2209	.6909	1,1609	1,6309
U/TH	DIST NORMAL	-1,7114	-.9453	-.1792	.5869	1,3530	2,1191	2,8852
TH/K	DIST NORMAL	-1,4989	-.8655	-.2322	.4011	1,0344	1,6677	2,3011

ROCK UNIT PA

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	135,9344	149,1896	162,4448	175,7000	188,9552	202,2104	215,4656
BI214	DIST NORMAL	6,5172	10,9781	15,4391	19,9000	24,3609	28,8219	33,2828
TL208	DIST NORMAL	37,9734	45,8156	53,6578	61,5000	69,3422	77,1844	85,0266
U/K	DIST NORMAL	-.9142	-.5700	-.2257	.1185	.4627	.8070	1,1512
U/TH	DIST NORMAL	-1,4052	-.8243	-.2435	.3374	.9183	1,4991	2,0800
TH/K	DIST NORMAL	-1,4318	-.8364	-.2409	.3546	.9501	1,5456	2,1410

ROCK UNIT PCGM

		-3	-2	-1	0	+1	+2	+3
K40	DIST NORMAL	208,6344	224,6563	240,6781	256,7000	272,7219	288,7437	304,7656
BI214	DIST NORMAL	9,5811	14,5207	19,4604	24,4000	29,3396	34,2793	39,2189
TL208	DIST NORMAL	58,3468	67,6312	76,9156	86,2000	95,4844	104,7688	114,0532
U/K	DIST NORMAL	-.8438	-.5296	-.2155	.0987	.4129	.7270	1,0412
U/TH	DIST NORMAL	-1,3442	-.7959	-.2477	.3006	.8489	1,3971	1,9454
TH/K	DIST NORMAL	-1,4047	-.8241	-.2435	.3371	.9177	1,4983	2,0789

ROCK UNIT PCM

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	194,2468	209,7645	225,2823	240,8000	256,3177	271,8355	287,3532
BI214	DIST	NORMAL	7,1179	11,6786	16,2393	20,8000	25,3607	29,9214	34,4821
TL208	DIST	NORMAL	50,4264	59,1843	67,9421	76,7000	85,4579	94,2157	102,9736
U/K	DIST	NORMAL	-.7995	-.5039	-.2082	.0874	.3830	.6787	.9743
U/TH	DIST	NORMAL	-1,2919	-.7707	-.2496	.2716	.7928	1,3139	1,8351
TH/K	DIST	NORMAL	-1,3784	-.8120	-.2456	.3208	.8872	1,4536	2,0200

ROCK UNIT PCP

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	209,2689	225,3126	241,3563	257,4000	273,4437	289,4874	305,5311
BI214	DIST	NORMAL	8,8879	13,7253	18,5626	23,4000	28,2374	33,0747	37,9121
TL208	DIST	NORMAL	59,8575	69,2383	78,6192	88,0000	97,3808	106,7617	116,1425
U/K	DIST	NORMAL	-.8343	-.5241	-.2140	.0962	.4064	.7165	1,0267
U/TH	DIST	NORMAL	-1,3140	-.7815	-.2489	.2836	.8161	1,3487	1,8812
TH/K	DIST	NORMAL	-1,4163	-.8294	-.2424	.3445	.9314	1,5184	2,1053

ROCK UNIT PCAP

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	212,9871	229,1581	245,3290	261,5000	277,6710	293,8419	310,0129
BI214	DIST	NORMAL	9,7903	14,7602	19,7301	24,7000	29,6699	34,6398	39,6097
TL208	DIST	NORMAL	51,5877	60,4252	69,2626	78,1000	86,9374	95,7748	104,6123
U/K	DIST	NORMAL	-.8273	-.5201	-.2128	.0944	.4016	.7089	1,0161
U/TH	DIST	NORMAL	-1,3874	-.8162	-.2449	.3263	.8975	1,4688	2,0400
TH/K	DIST	NORMAL	-1,3364	-.7922	-.2481	.2961	.8403	1,3844	1,9286

ROCK UNIT PCGG

			-3	-2	-1	0	+1	+2	+3
K40	DIST	NORMAL	170,8318	185,4879	200,1439	214,8000	229,4561	244,1121	258,7682
BI214	DIST	NORMAL	7,2523	11,8348	16,4174	21,0000	25,5826	30,1652	34,7477
TL208	DIST	NORMAL	43,6706	51,9471	60,2235	68,5000	76,7765	85,0529	93,3294
U/K	DIST	NORMAL	-.8602	-.5391	-.2180	.1031	.4242	.7453	1,0664
U/TH	DIST	NORMAL	-1,3922	-.8184	-.2445	.3293	.9031	1,4770	2,0508
TH/K	DIST	NORMAL	-1,3747	-.8103	-.2458	.3186	.8830	1,4475	2,0119

