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National Uranium Resource Evaluation

**Airborne Gamma-Ray Spectrometer
And Magnetometer Survey
Alturas Quadrangle, California**

Final Report - Volume I

**Aero Service Division
Western Geophysical Company of America
Houston, Texas 77001**

April 1981

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

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

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AIRBORNE GAMMA-RAY SPECTROMETER
AND
MAGNETOMETER SURVEY

ALTURAS QUADRANGLE
CALIFORNIA

FINAL REPORT
VOLUME I

AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA
HOUSTON, TEXAS

MAY 1981

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ASSISTANT SECRETARY FOR RESOURCE APPLICATIONS
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EB
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Figure 1

ALTURAS QUADRANGLE

INDEX MAP

TABLE OF CONTENTS

INTRODUCTION	7
DATA ACQUISITION	11
Aircraft	11
Gamma-Ray Spectrometer System	11
Magnetometer	14
PRODUCTION SUMMARY	15
DATA REDUCTION	23
DATA PRESENTATION	29
General	29
Radiometric Multiple-Parameter Stacked Profiles	29
Magnetic and Ancillary Parameter Stacked Profiles	30
Histograms	30
Anomaly Maps	30
Computer Printer Maps	31
GEOLOGY	33
General	33
Stratigraphy	34
Structure	38
INTERPRETATION	39
General	39
Geochemical Analysis	40
Printer Contour and Anomaly Map Analysis	42
SELECTED REFERENCES	75

LIST OF FIGURES

Figure 1	
Index Map	Frontispiece
Figure 2	
Final Flight Path Map	9
Figure 3	
Block Diagram HISENS AGRS 2000R System	12
Figure 4	
Terrain Clearance Histogram	20
Figure 5	
Ground Speed Histogram	21
Figure 6	
Data Reduction Flow Diagram	24
Figure 7	
Total Magnetic Field Contour Map	45
Figure 8	
Potassium Average Contour Map	49
Figure 9	
Uranium Average Contour Map	53
Figure 10	
Thorium Average Contour Map	57
Figure 11	
Uranium/Potassium Ratio Map	61
Figure 12	
Uranium/Thorium Ratio Map	65
Figure 13	
Thorium/Potassium Ratio Map	69
Figure 14	
Interpretation Map	73

LIST OF TABLES

Table I	
Aircraft Specifications and Characteristics	11
Table II	
Daily Production Summary	16
Table III	
Legend to Total Field Map	43
Table IV	
Legend to Potassium Average Map	47
Table V	
Legend to Uranium Average Map	51
Table VI	
Legend to Thorium Average Map	55
Table VII	
Legend to Uranium/Potassium Ratio Map	59
Table VIII	
Legend to Uranium/Thorium Ratio Map	63
Table IX	
Legend to Thorium/Potassium Ratio Map	67

TABLE OF APPENDICES

Appendix A	
Geologic Legend	77
Appendix B	
List of Geologic Units by Anomaly	81
Appendix C	
List of Anomalies by Geologic Unit	83
Appendix D	
Mean Radiometric Values by Geologic Unit	85
Appendix E	
Standard Deviation Tables	91
Appendix F	
Format, Single Record Data Listing	101
Appendix G	
Format, Average Record Data Listing	103
Appendix H	
Format, DOE SINGLE RECORD REDUCED DATA TAPE	105
Appendix I	
Format, DOE RAW SPECTRAL DATA TAPE	109
Appendix J	
Format, DOE STATISTICAL ANALYSIS DATA TAPE	113
Appendix K	
Format, DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE	117
Appendix L	
Format, DOE MAGNETIC DATA TAPE	121
Appendix M	
Reduced Calibration and-Test Line Data	123
Appendix N	
Renumbered to Original Fiducial Correlations	125

INTRODUCTION

During the months of August, September, and October of 1980, Aero Service Division Western Geophysical Company of America conducted an airborne high sensitivity gamma-ray spectrometer and magnetometer survey over ten (10) areas over northern California and southwestern Oregon. These include the 2° x 1° NTMS quadrangles of Roseburg, Medford, Weed, Alturas, Redding, Susanville, Ukiah, and Chico along with the 1° x 2° areas of the Coos Bay quadrangle and the Crescent City/Eureka areas combined. This report discusses the results obtained over the Alturas, California, map area.

Traverse lines were flown in an east-west direction at a line spacing of six (6) miles. Tie lines were flown north-south approximately eighteen (18) miles apart. A total of 16,880.5 line miles of geophysical data were acquired, compiled, and interpreted during the survey, of which 1631.6 line miles are in this quadrangle.

This report is a result of work performed under Bendix Field Engineering Corporation Subcontract No. 80-460, Project No. IG0205, as part of the National Uranium Resources Evaluation. NURE is a program of the U. S. Department of Energy's Grand Junction, Colorado, office to acquire and compile geologic and other information with which to assess the magnitude and distribution of uranium resources and to determine areas favorable for the occurrence of uranium in the United States.

The data were reduced and compiled in accordance with the technical specifications of the contract as stated in BFEC 1200-C and BFEC 1250-A. The parameters used in the processing of the radiometric data have been substantiated in a previously submitted calibration report of the Sikorsky S-58T installed airborne gamma-ray spectrometer system.

DATA ACQUISITION

Aircraft

The survey was conducted using a Sikorsky S-58T helicopter, registration N94523, owned and operated by Carson Helicopters, Inc., Perkasio, Pennsylvania. The flight crew consisted of a pilot (Carson), a navigator (Aero), and an electronics system operator (Aero). Some of the more pertinent characteristics and specifications of the aircraft are listed below:

T A B L E I

<u>Aircraft Specifications and Characteristics</u>	
Aircraft	Sikorsky Model S-58T, Registration N94523
Engine	Pratt - Whitney PT 6T Twinpack
Take off power	1875 Shaft HP.
Fuel Capacity	350 U. S. Gal.
Hourly Fuel Consumption	100 U. S. Gal.
Range at Cruise Speed	450 Miles
Rate of Climb	1200 Feet per Min.
Service Ceiling	12500 Feet
Maximum Gross Weight	13000 Lbs.
Empty Weight	7200 Lbs.
Useful Load	5800 Lbs.
Pay Load	1700 Lbs.

Gamma-Ray Spectrometer System

The survey was conducted using Aero Service's HISENS A(irborne) G(amma)-R(ay) S(pectrometer) 2000 R system shown in block diagrammatic form in Figure 3, page 12.

The detector assembly of the spectrometer consists of a primary detector, sensing data over a 4π solid angle, and an upward looking detector, sensing data over a 2π solid angle only. The primary detector package consists of 12

-12-

Figure 3

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AERO SERVICE
LITTON HOUSTON TEXAS

DWN	DATE	TITLE
CHKD		
APPD		

BLOCK DIAGRAM
HISENS AGRS 2000R SYSTEM

SIZE	DRAWING NO	REV	SHEET
B			

logs of 4" x 4" x 16" of Polyscin®, NaI(Tl), each hermetically sealed in a steel container and coupled to a high quality photo-multiplier tube. The sensors are assembled in three slabs of four logs each. Each slab is enclosed in a heated and thermally stabilized container. Total volume of the primary detector is 3072 cubic inches (50.34 liters).

The upward looking detector consists of two 4" x 4" x 16" logs of Polyscin®, each hermetically sealed in a steel container and coupled to a high quality photo-multiplier tube and enclosed within separate heated and thermally stabilized containers. Each of the upward looking detectors is mounted on top of one of the primary detector packages, separated by a 0.75" slab of lead shielding, in order to provide the 85% shielding effect @ 3.000 MeV.

The preamplifiers provide, with the photo-multipliers, virtually the total signal amplification. In order to ensure maximum stability, the preamplifiers are enclosed within the thermally stabilized packages.

The combined signal of each detector slab is output into the amplifiers, whose main purpose is summing the incoming pulses and shaping them into a bipolar gaussian form.

The summed and shaped signal from the amplifiers is input into the pulse height converter. This unit performs basically three functions: it determines whether a pulse has been received, it determines its amplitude and it converts the amplitude into a digital number. Since a successive approximation analog to digital converter is used, total dead time of the system is the same regardless of the energy of the pulse. This dead time is approximately 8 µseconds per pulse due to the converter and approximately 1.5 µseconds due to the remainder of the electronic circuit, for a combined total dead time of approximately 9.5 µseconds per pulse. The exact system dead time, or rather live time, is measured in microseconds and recorded in milliseconds as channel zero (0) of the multispectral gamma-ray data.

The function of pulse height analyzer is performed by the HP 21 MX series Hewlett Packard minicomputer, which also stores and formats the data, outputs them on tape and compares the recorded data with the data stored in memory for a fool-proof read after write check.

The gamma-ray spectrometer system includes further a Rosemount barometric

altimeter, a Honeywell radar altimeter and a temperature transducer. A discrete interface exists in the Hewlett Packard minicomputer to accommodate a Doppler navigation system as well as other navigation systems, such as ANA, LORAN-C, OMEGA and others, although none of these were used.

Two tape drives are employed to record the data and automatic switching between the two occurs as each tape ends. Data are collected each second and recorded every five seconds. In addition to the gamma-ray spectrometer data of both the primary and upward looking systems, radar altimeter, barometric altimeter, atmospheric temperature, real time, gamma-ray spectrometer live time and magnetometer data are recorded.

Additional ancillary equipment carried aboard the helicopter includes a cathode ray tube display, a 6-channel heat sensitive analog recorder and a 35mm camera, triggered by the data controller at a preselected interval.

Magnetometer

The magnetic sensor used for the survey was a Varian V-85 proton free-precession magnetometer. This sensor was housed in a fiberglass bird and trailed approximately 100' below the aircraft to ensure optimal signal sensitivity without need for extensive aircraft compensation. The magnetic data were recorded in increments of 0.01 gammas, with a sensitivity of 0.1 gammas.

PRODUCTION SUMMARY

The 2° x 1° NTMS quadrangle of Alturas, California, was surveyed as part of a subcontract covering ten (10) areas located over northern California and southwestern Oregon. These include the 2° x 1° quadrangles of Roseburg, Medford, Weed, Alturas, Redding, Susanville, Ukiah, and Chico along with the 1° x 2° areas of the Coos Bay quadrangle and the Crescent City/Eureka areas combined. The subcontract covered the flying of a total of 16,880.5 line miles, of which 1631.6 miles are in the Alturas quadrangle.

Four main bases of operations were used during the survey. Eugene, Oregon, located just north of the Roseburg quadrangle, was used from the commencement of operations through Flight 27 on August 22, 1980. Medford, Oregon, in the Medford quadrangle, was then used up through Flight 86 on September 19th. The aircraft and crew then moved to Redding, California, for operations through Flight 130 on October 2, 1980. The final base of operations was located at Yuba City, California, in the Chico quadrangle. Throughout the survey, extensive use was made of both a fuel truck and smaller, secondary airstrips for remote refueling stops, thus extending the helicopter's effective production range.

The first production flight was made on August 11, 1980. A total of 143 flights were made with the last flight being completed on October 9, 1980. Production flights were not possible for twenty of the sixty-one days the aircraft and crew were on site. One day was used to complete the high altitude calibration flight, ten days were lost to inclement weather conditions, six days were lost to aircraft maintenance, one day to electronic maintenance, and two days to the illness of the AGRS system operator. Many of these nonproduction days were used to complete the three moves to new operations bases. A complete summary of daily operations is given in Table II, pages 16, 17 and 18.

Total flying time was 253.2 hours for an average production rate of 66.7 miles per hour. An average of 118.1 miles were acquired per production flight and 411.7 miles were acquired each production day. When computed over the total number of days on site, data acquisition averaged 276.7 miles per day.

Flight line directions and spacing for the Alturas quadrangle were east-west traverse lines 6 miles apart and north-south tie lines flown at 18 mile intervals. The nominal terrain clearance for the survey was 400 feet.

T A B L E II
Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
08/09/80	Eugene, Oregon	Ferry to Eugene, Ore.	
08/10/80	Eugene, Oregon	High altitude test	
08/11/80	Eugene, Oregon	Production	11, 12
08/12/80	Eugene, Oregon	Weather	
08/13/80	Eugene, Oregon	Weather	
08/14/80	Eugene, Oregon	Production	13, 14
08/15/80	Eugene, Oregon	Abort - helicopter	15
08/16/80	Eugene, Oregon	Helicopter maintenance	
08/17/80	Eugene, Oregon	Helicopter maintenance	
08/18/80	Eugene, Oregon	Helicopter maintenance	
08/19/80	Eugene, Oregon	Helicopter maintenance	
08/20/80	Eugene, Oregon	Production	16, 17, 18, 19
08/21/80	Eugene, Oregon	Production	20, 21, 22
08/22/80	Eugene, Oregon	Production	23, 24, 25, 26, 27
08/23/80	Medford, Oregon	Weather	
08/24/80	Medford, Oregon	Production	28, 29, 30, 31
08/25/80	Medford, Oregon	Production	32, 33, 34, 35, 36
08/26/80	Medford, Oregon	Production	37, 38, 39
08/27/80	Medford, Oregon	Weather	
08/28/80	Medford, Oregon	Production	40
08/29/80	Medford, Oregon	Production	41, 42, 43, 44, 45
08/30/80	Medford, Oregon	Production	46
08/31/80	Medford, Oregon	Abort-cloud cover	47
09/01/80	Medford, Oregon	Production	48, 49, 50
09/02/80	Medford, Oregon	Weather	
09/03/80	Medford, Oregon	Production	51, 52, 53
09/04/80	Medford, Oregon	Production	54, 55, 56
09/05/80	Medford, Oregon	Weather	
09/06/80	Medford, Oregon	Production	57, 58, 59, 60

Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
09/07/80	Medford, Oregon	Production then high winds	61, 62
09/08/80	Medford, Oregon	Magnetometer failure then production	63, 64, 65
09/09/80	Medford, Oregon	Helicopter maintenance	
09/10/80	Medford, Oregon	Production	66, 67
09/11/80	Medford, Oregon	Production	68, 69, 70, 71, 72
09/12/80	Medford, Oregon	Weather	
09/13/80	Medford, Oregon	Weather	
09/14/80	Medford, Oregon	Clouds and fog, then production	73, 74, 75, 76, 77
09/15/80	Medford, Oregon	Production	78, 79, 80, 81, 82
09/16/80	Medford, Oregon	Production	83, 84, 85
09/17/80	Medford, Oregon	Production	86
09/18/80	Redding, California	Weather	
09/19/80	Redding, California	Production	87, 88
09/20/80	Redding, California	Production	89
09/21/80	Redding, California	Production	90, 91, 92, 93, 94
09/22/80	Redding, California	Production	95, 96, 97, 98
09/23/80	Redding, California	Production	99, 100, 101, 102
09/24/80	Redding, California	Production	103, 104, 105, 106
09/25/80	Redding, California	Production	107, 108, 109, 110, 111
09/26/80	Redding, California	Production	112, 113, 114, 115
09/27/80	Redding, California	Production	116, 117, 118, 119
09/28/80	Redding, California	Production	120, 121
09/29/80	Redding, California	Production	122, 123, 124, 125
09/30/80	Redding, California	Production	126
10/01/80	Redding, California	Production	127, 128, 129, 130
10/02/80	Redding, California	Operator sick	
10/03/80	Yuba, California	Operator sick	
10/04/80	Yuba, California	Production	131, 132, 133, 134
10/05/80	Yuba, California	Production	135, 136, 137, 138
10/06/80	Yuba, California	Production	139, 140, 141, 142, 143

Daily Production Summary

<u>DATE</u>	<u>BASE</u>	<u>ACTIVITY</u>	<u>FLIGHT NO.</u>
10/07/80	Yuba, California	Production	144, 145, 146, 147
10/08/80	Yuba, California	Production	148, 149, 150, 151
10/09/80	Yuba, California	Production	152, 153

Figure 4 shows a histogram of the terrain clearance of the helicopter as recorded by the radar altimeter. The histogram takes into account all final samples in this quadrangle. The mean terrain clearance, as observed, is approximately 400 feet. The ground speed of the aircraft, as determined from the distances between samples based on their final X-Y positions, is depicted in graphic form in the histogram of Figure 5, page 21.

AERO SERVICE
QUAD ALTURAS

GROUND SPEED
JOB 627

HISTOGRAM

NUMBER OF DATA POINTS

21/22

Figure 5

MILES
PER
HOUR

DATA REDUCTION

The data reduction process as used in the processing of the airborne gamma-ray spectrometer and magnetometer data obtained within the Department of Energy (DOE) National Uranium Resource Evaluation (NURE) program is shown in flow chart form in Figure 6, page 24.

Upon arrival in the Houston office, the digital data are edited and a back-up tape is generally produced. The EDIT consists partly of a data quality check, enabling the elimination of single record spikes in any field, outside a specified preselected limit. The EDIT program further checks for data continuity and flags all data acquired at terrain clearances exceeding the survey specification. The EDIT further sums a preselected number of spectral records at the beginning and end of each survey line and fits a gaussian curve to diagnostic photopeaks, such as the Tl^{208} peak at 2614.5 KeV and the K^{40} peak at 1460 KeV for low altitude lines and the annihilation peak at 511 KeV and the K^{40} peak at 1460 KeV for high altitude lines. The position of these photopeaks is determined with an accuracy of better than 0.1 of a channel and is used to determine the exact position of the energy windows with regard to channel numbers. At the same time the calculated standard deviations of the fitted gaussian curves serve to obtain the system resolution at the photopeaks used. Note that the 2π system resolutions as determined at the K^{40} photopeak proved to exceed the 8% specification throughout much of the survey. This was most likely due to a small crack in one of the two 2π crystals. However, this condition proved not to adversely affect the acquisition or reduction of the radiometric data and it was decided, after consultation with BFEC, not to replace the crystal in the interest of expediting the completion of the survey. The window count rates are normalized for live time and are calculated as follows:

K	:	1362 KeV - 1566 KeV (Channel 114 → 130, @ 12 KeV/Channel)
U	:	1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)
T	:	2406 KeV - 2826 KeV (Channel 201 → 235, @ 12 KeV/Channel)
T.C.	:	390 KeV - 2982 KeV (Channel 33 → 248, @ 12 KeV/Channel)
Cosmic	:	3054 KeV - 6000 KeV (Channel 255)
$\text{U}_{2\pi}$	:	1662 KeV - 1866 KeV (Channel 139 → 155, @ 12 KeV/Channel)

The above channel numbers are valid only if system gain corresponds

exactly to 12 KeV per channel and there is no zero shift.

The CORRECT program applies the background and cosmic corrections to the single record window count rates, corrects the data for Compton scatter and atmospheric radon, and normalizes the terrain clearance. Background count rates and cosmic factors were determined from high altitude test data acquired over the Pacific Ocean, offshore California.

Potassium Background	=	50.04 counts per second
Uranium Background	=	8.21 counts per second
Thorium Background	=	7.26 counts per second
Total Count Background	=	286.06 counts per second
2 π Bismuth Background	=	0.81 counts per second

Potassium Cosmic factor	=	0.250	c.p.s. per count 4 π cosmic
Uranium Cosmic factor	=	0.202	c.p.s./cps 4 π cosmic
Thorium Cosmic factor	=	0.278	c.p.s./cps 4 π cosmic
Total Count Cosmic factor	=	4.438	c.p.s./cps 4 π cosmic
2 π Bismuth Cosmic factor	=	0.0505	c.p.s./cps 4 π cosmic

The Compton scatter functions were determined from data obtained over the Grand Junction test pads, using the radiometric analysis of the bulk sample with natural water content.

$$\begin{aligned}T/U &= \tau = 0.08 \\U/T &= \alpha = 0.30 + 0.02 + 0.000076H \\K/T &= \beta = 0.37 \\K/U &= \gamma = 0.90\end{aligned}$$

The 2 π and 4 π uranium window count rates are related through the geometric or equivalency factor. For the present system, installed in the Sikorsky S-58T, this factor, $f = 5.1$. Part of the terrestrial radiation of energy higher than 1662 KeV - the lower threshold of the uranium window - is detected in the uranium window of the upward looking detector, due to incomplete shielding, skyshine and shine-around. This shine-through/shine-around effect is assumed to be a function of both the intensity of the terrestrial uranium and thorium radiation and of the aircraft terrain clearance. From multi-altitude data acquired over the Lake Mead Dynamic Test

Range the shine-through/shine-around effect was determined for each altitude level. The data provided a best fit for a linear terrain clearance function as follows:

$$\text{shine-through/shine-around} = (0.067 - 2.6 \times 10^{-5}H) (U_{4\pi} + 0.30T_{4\pi})$$

The shine-through/shine-around corrected Biair Count rate is then:

$$U_{2\pi c} = \frac{U_{2\pi} - (U_{4\pi} + 0.30T) (0.067 - 2.6 \times 10^{-5}H)}{1 - 5.1 (0.067 - 2.6 \times 10^{-5}H)}$$

The shine-through/shine-around correction is applied to the $U_{2\pi}$ count rate at each single record. The single record $U_{2\pi}$ count rates are then averaged over 35 records to make them statistically compatible with the data of the primary system. The atmospheric radon correction is applied to both the $U_{4\pi}$ and the Total Count count rates. The equivalency factor for the $U_{4\pi}/U_{2\pi} = 5.1$, for Total Count/ $U_{2\pi}$ it is 73.5.

Within the CORRECT program the data are normalized to a common datum of 400 feet terrain clearance. An exponential formula is used, based on an air column reduced to a standard temperature and pressure of 0°C and 760mm Hg. (32°F and 29.92" Hg). The air absorption coefficients used are those derived from the multiple altitude flight over the Lake Mead Dynamic Test Range for thorium, potassium and Total Count. The air absorption factor for uranium is obtained by straight interpolation between the potassium and thorium air absorption factors. Their values are respectively:

$$\begin{aligned}\mu_K &= 2.67 \times 10^{-3} \text{ per foot} \\ \mu_U &= 2.52 \times 10^{-3} \text{ per foot} \\ \mu_{Th} &= 2.11 \times 10^{-3} \text{ per foot} \\ \mu_{TC} &= 2.16 \times 10^{-3} \text{ per foot}\end{aligned}$$

The formula used for the altitude normalization is:

$$N_{400} = N_H \cdot e^{-\mu(400 - \frac{273}{273+t} \cdot \frac{P}{29.92} \cdot H)}$$

Where N_{400} , N_H are respectively the count rates at 400 feet and at altitude H, μ is air absorption factor, t is temperature in degrees Celsius and P is barometric pressure in inches Hg.

The last operation in the CORRECT program is the determination of statistical adequacy of the data. The criteria for adequacy of the data are based on the work of Lloyd A. Currie (op.cit.). A critical level is recognized, below which all observations made fail to detect a signal, i.e. 95% of all measurements fall within the "normal" distribution of "noise". The detection level is similarly defined as the level above which 95% of the measurements made fall within the normal Poisson distribution of "signal". Currie's critical level has been adopted as the count rate level below which data are inadequate. Data with count rates above the critical level but below the detection level are considered marginal. Above the detection level data are considered adequate. For the single record data the formulas are then:

Count Rate $\leq 2.33 (\text{Sum Corrections})^{1/2}$: data inadequate

$2.33 (\text{Sum Corrections})^{1/2} < \text{Count Rate} \leq 2.71 + 4.65 (\text{Sum Corrections})^{1/2}$:
data marginal

Count Rate $> 2.71 + 4.65 (\text{Sum Corrections})^{1/2}$: data adequate

No ratios have been calculated involving inadequate data in either numerator or denominator. Ratios have been calculated when the data in the numerator are marginal, provided the data in the denominator are adequate.

The thorium, uranium and potassium data are subsequently averaged over 9 records in the SPECAVG program. The output is a spectrometer master tape containing both averaged and single record data.

Parallel with the radiometric data reduction process, the magnetic data are edited and processed. Using the recovered film intersections and the established ground identities, preliminary flight paths are prepared. The flight path is refined in the magnetic adjustment program until an accurate final flight path has been obtained. The reduced spectrometer data are then merged with the final X-Y position of the data points, the reduced magnetic data and the digitized geology, and a master tape is produced with data that pertain to each quadrangle only. The REGROUP program then eliminates all duplicate line segments, inserts reflight segments where required, orders the remaining line segments and renumbers the fiducials of these segments such that the resulting line is directionally consistent with location sequential sample numbers. The renumbered fiducials increase from west to east for traverse lines and south to north for tie lines. A listing relating the

renumbered fiducials to the original fiducial numbers as recorded in flight is included in this volume as Appendix N and can also be found in the back of Volume II. This listing gives both the line number as it appears on all final data and the line number as recorded in flight. Similarly, the start and end fiducials of each final line and/or line segment shown on the flight path base map are given along with the corresponding start and end fiducials as recorded in flight. When correlated with the final fiducial numbers, the original fiducials will increase sequentially for lines flown west to east or south to north and decrease for lines flown in the opposite directions.

The following processing steps are STATANAL and HISTGRM. HISTGRM groups the radiometric data by geological cell units, determines the distribution of the data as normal or lognormal, calculates the mean (for normally distributed data) or the mode (for lognormal distributions) as well as the standard deviations. The results from HISTGRM are used in the STATANAL program, which calculates the signed standard deviation from the mean for each averaged sample for each of the six radiometric parameters. Its output is the Final Spectrometer Master Tape, from which the anomaly maps, the statistical analysis tape, the averaged record and single record reduced data tapes and listings, the flight path maps and the radiometric and magnetic profiles are produced.

DATA PRESENTATION

General

The final data are presented in four different forms: on magnetic tape; on microfiche; in graphic form as profiles and histograms; and in map form as anomaly maps, flight path maps, and computer printer maps.

The histograms and the multiparameter profiles are presented with the anomaly maps and flight path map in a separate bound volume. Complete data listings of both the reduced single record and the reduced averaged record data are found in the back of this report. The format of the printout of the microfiches and the format of the data files delivered on magnetic tape are in accordance with the specifications of the BFEC 1200-C and are described in appendices F through L of this report.

Radiometric Multiple-Parameter Stacked Profiles

The radiometric profiles have been prepared at the horizontal scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. Displayed are from top to bottom: total magnetic intensity, IGRF removed, in gammas; radar altimeter, in feet; ratio of eT concentration in ppm/potassium concentration in %; ratio of eU/K; eU/eT ratio, atmospheric radon (BIAC) in counts per second, equivalenced to the 4π count rate; apparent concentration of terrestrial eT in ppm, apparent concentration of terrestrial eU in ppm; apparent concentration of potassium in %; "Total Count" count rate. Flags are indicated, where needed, below the base line of the corresponding parameter. A short flag indicates marginal data, including terrain clearances between 700 and 1000 feet, while a long flag indicates inadequate data. Fiducial markers are plotted every 200 records, along the top of the profile, every 10 records near the bottom.

The flight path and the geologic formations overflown along the line are shown on the bottom of both the radiometric and magnetic multiple-parameter stacked profiles below the lower fiducial markers. Six tiers of formation identifiers along with short markers on the flight line are used to indicate changes along the profile with the base of the identifier letters aligned with the corresponding marker. The first identifier found on the westernmost end of the profile applies to the start of the line and this formation continues until the next marker is encountered. Subsequent changes to the geology are

similarly indicated along the profile.

Magnetic and Ancillary Parameter Stacked Profiles

The magnetic profiles have also been plotted at scales of 1:250,000 and 1:500,000 on an automated flatbed plotter. The plotting sequence of the profiles is, from top to bottom: barometric pressure at aircraft altitude in mm Hg; atmospheric ambient temperature in degrees Celsius, terrain clearance in feet; magnetic variations at base station, in gammas; total magnetic intensity, IGRF removed, plotted at 50 gammas per scale division. Fiducial markers are again plotted every 200 records along the top of the profiles, every 10 records near the bottom.

Histograms

Histograms have been prepared for the six radiometric parameters for each geologic cell unit of the NTMS quadrangle area. The horizontal scale of the plots is constant for each of the parameters. Frequency grouping has generally been done in 100 groups per full scale, although in some cases more groups may have been used for better definition. In all cases the vertical scale was normalized to the number of samples observed in the group with the highest sample frequency.

For each histogram the frequency distribution type (normal or lognormal) is listed, as well as the mean (or mode in case of lognormal distribution) and the signed standard deviations. Note that for both the normal and lognormal distribution curves the standard deviation is given in terms of the parameter value (K, eU, eT, eU/K, eU/eT and eT/K). The actual standard deviation is obtained by subtracting the mean parameter value from the +1 standard deviation figure in case of a normal distribution, by dividing the mode value into the +1 standard deviation figure in case of a lognormal distribution. In case of lognormal distribution curves the standard deviation is thus a multiplication factor.

Each histogram further lists the total number of samples observed in the geologic unit and the number of statistically adequate/marginal data samples in each parameter plot.

Anomaly Maps

The anomaly maps have been prepared at scales of 1:250,000 and 1:500,000

on an automated flatbed plotter. The fiducial numbers along the flight lines match those of the corresponding profiles. Positive signed deviations of the mean are indicated by a plus sign to the north or west of the flight lines, while negative signed deviations are indicated by a minus, plotted to the south or east of the line. The number of pluses or minuses corresponds with the levels of standard deviation from the mean. To avoid crowding, standard deviation signs are calculated and plotted for every fifth sample only.

Computer Printer Maps

Computer printer plots are produced for the total field and the six radiometric channels. Upper and lower limits were chosen based on the minimum and maximum values of the gridded data. Ten intervals are represented by the contour values 0 to 9. A minus (-) or a plus (+) sign represents those values less than the lower limit or those values higher than the upper limit.

The interval for each integer contour is further divided into two groups. For those values less than .5, the contour is printed; e.g. for values 4.0 to 4.5, the value 4 is printed, while values of 4.6 through 4.9 are left blank.

GEOLOGY

General

The Alturas quadrangle is located in northeastern California and occupies the area between 41° to 42° north latitude and 120° to 122° west longitude. The Pit River drains the south-central portion of the quadrangle toward the south, then winds westward in the southern part of the map area. Tributaries of the Pit River include the Fall River, in Fall River Valley, Kosk Creek, in the southwestern corner of the quadrangle, Ash Creek in Big Valley, Turner Creek, Clover Swale Creek, Canyon Creek and Rattlesnake Creek, all west of Alturas, and the north and south forks of the Pit River, north and south of Alturas. Many small streams drain into the three internally draining lakes in the eastern portion of the Alturas quadrangle; Upper Lake, Middle Alkali Lake and Lower Lake. The Clear Lake Reservoir is filled by Willow Creek and drained to the north by the Lost River. Goose Lake is filled by way of several short streams, which are common to the dendritic drainage pattern. Damming of streams has created a number of small lakes.

Parts of four distinct geomorphic provinces are contained within the boundaries of the Alturas quadrangle. Comprising most of the central and northwestern areas, the Modoc Plateau is an interior platform with elevations ranging from 4000 to 6000 feet above sea level. This province is the southern extension of an Oregon lava field, consisting of thick accumulations of flows and tuff beds, frequently interrupted by small volcanic cones. Drainage in the area is characteristically sluggish, with small merky lakes and marshes present locally. The Modoc Plateau is bounded on the west by the Cascade Range and by the Basin-Ranges on the east. Covering the eastern quarter of the quadrangle, the Basin-Ranges is a distinctively Nevadan Province, lying wholly within the Great Basin of California. The roughly parallel, structurally controlled system of alternating ridges and valleys yields the name of the province. Rivers and streams drain toward the center of the area, with lakes and playas occurring commonly.

The Cascade Range Province, somewhat confined to a southwestern portion of the map area, is a chain of volcanic cones which extends northward into Oregon and Washington. Topography in the province is accented by many deep, steep walled canyons formed principally by the carving waters of the south draining Pit River. Cinder cones are present throughout the province, and

particularly so in the vicinity of Medicine Lake.

The Klamath Mountains Province, located in the southwest area of the quadrangle, in the area of Grizzly Peak, is notable for its complex and rugged topography with peaks reaching over 6000 feet above sea level. Further characterized by a distinctly different lithocomplex from the other provinces, the Klamath Mountains, which continue into Oregon, are similar to the Sierra Nevada, exposing hard Cretaceous rocks by dissection.

Geological information was taken primarily from the Alturas Sheet of the Geologic Map of California, compiled by Thomas E. Gay, Jr. and Quintin A. Aune in 1958. Additional sources of information from the California Division of Mines and Geology included the Geomorphic Map of California, Bulletin 138 (plate 2), prepared by Olaf P. Jenkins (1938), and the Fault Map of California with Locations of Volcanoes, Thermal Springs and Thermal Wells, compiled by Charles W. Jennings, et al (1975). Some general information about local geomorphology and historical geology was obtained from Geology of California by Robert M. Norris and Robert W. Webb (1976).

Stratigraphy

A variety of igneous rocks crop out over most of the surface in the Modoc Plateau area. Dominantly volcanic in nature, Tertiary, Miocene and Pliocene basalts, andesites and pyroclastics, Tertiary intrusive rhyolites, Pleistocene basalts and andesites, and Recent basalt comprise the bulk of the plutonic rocks. To a lesser extent, upper Tertiary and Quaternary sediments include nonmarine deposits and Recent lacustrine, alluvial and dune deposits.

Comprised by many of the same igneous rock types as the Modoc Province, the Basin-Ranges consist to a large extent of Miocene through Pleistocene basalts, intrusives and pyroclastics. Nonmarine terrace, lacustrine, alluvial and dune deposits from the Miocene to the Pleistocene are also common in a goodly proportion.

The Cascade Range is comprised dominantly of Miocene, Pliocene and Pleistocene andesite and basalt, Pliocene, Pleistocene and Recent rhyolite and a variety of pyroclastic rocks, and some Recent basalt. Local alluvial and glacial deposits comprise the Pleistocene sediments.

Within the Klamath Mountains Province there are little or no volcanic rocks, being confined to a single small Tertiary outcrop. Triassic and

Jurassic marine and Eocene nonmarine sequences comprise the bulk of the stratigraphy. A brief description of the stratigraphic units occurring within the Alturas quadrangle follows, beginning with the oldest.

Jurassic and/or Triassic Metavolcanic Rocks (JTv)

These metavolcanic rocks include metadacites and meta-andesites which occur as sills and flows. Also occurring are volcanic breccias and locally fossiliferous tuff. In the Chico quadrangle, the metavolcanics are comprised of amphibolites, metabasalt and rhyolite, quartz and hornblende porphyries.

Triassic Marine Sedimentary and Metasedimentary Rocks (R)

The Triassic marine sediments consist of interbedded limestone, sandstone and shale with locally occurring hornfels, quartzite and volcanic conglomerate.

Middle and Lower Jurassic Marine Sedimentary and Metasedimentary Rocks (Jml)

Middle and lower Jurassic marine sediments include argillites, tuffaceous sandstone and shale, along with locally fossiliferous limestone. Slates and metaconglomerates generally comprise the metamorphic rocks.

Tertiary Volcanic Rocks (Tv)

The volcanics of the Tertiary period in the area are comprised of light colored andesite flows (Tv^a), basaltic flows and plugs (Tv^b), and locally pyroclastic tuffs and breccias (Tv^p). The Ukiah quadrangle Tertiary volcanics are comprised of basalt only.

Tertiary Intrusive Rocks (Ti)

Intrusives include rhyolite plugs, andesitic breccias along with basaltic dikes and plugs.

Eocene Nonmarine Sedimentary Rocks (Ec)

Arkosic sandstones, quartzomaceous sandstones, shales and conglomerates comprise the bulk of the Eocene nonmarine sediments. In the Chico and Susanville quadrangles auriferous gravel deposits occur locally. Thin coal veins make up part of the section in the Redding quadrangle, locally.

Oligocene Nonmarine Sedimentary Rocks (ϕ c)

Locally conglomeratic shaly sandstones and sandy shales comprise the Oligocene nonmarine sediments.

Miocene Volcanic Rocks (Mv)

Rhyolite and andesite flows (Mv^r), (Mv^a) with local thin layers of tuff and obsidian, often associated with pyroclastic breccias (Mv^p) and mudflows, make up the section of Miocene volcanic rocks throughout most of the area. In addition, extensive black basaltic flows (Mv^b) occur in the Alturas and Susanville quadrangles.

Undivided Miocene Nonmarine Sedimentary Rocks (Mc)

The undivided Miocene nonmarine sediments are predominantly comprised of beds of diatomite and tuff.

Pliocene Volcanic Rocks (Pv)

The Pliocene volcanics in the Chico, Susanville and Alturas quadrangles consist of rhyolites (Pv^r), andesites (Pv^a), basaltic flows (Pv^b) and breccias, along with pyroclastic tuffs and mudflows (Pv^p). The Weed, Eureka and Redding volcanics are essentially the same assemblage with the exception of the rhyolites. Basalts and tuffs are the prevalent volcanic rock types in the Ukiah quadrangle.

Upper Pliocene Nonmarine Sedimentary Rocks (Puc)

Locally tuffaceous silt, sand, gravel and claystones comprise the bulk of the upper Pliocene nonmarine section in the area. In the Alturas quadrangle, fossiliferous sandstones and conglomerates also occur. Lacustrine deposits in the Susanville and Weed quadrangles are characterized by being locally diatomaceous.

Undivided Pliocene Nonmarine Sedimentary Rocks (Pc)

Undivided nonmarine sediments in this quadrangle are comprised generally of sandstones, siltstones and gravel.

Quaternary and/or Pliocene Cinder Cones (*)

Locally basaltic cinder cones occur in the Susanville and Alturas quadrangles and are associated with volcanic tuffs in their occurrence in the Chico quadrangle.

Pleistocene Volcanic Rocks (Qpv)

Basaltic flows (Qpv^b) and pyroclastic tuffs (Qpv^P) occur throughout the area in all but the Ukiah and Redding quadrangles. The Pleistocene volcanics in the Alturas, Susanville and Weed quadrangles are comprised predominantly of andesites (Qpv^a) and rhyolites (Qpv^r).

Pleistocene Nonmarine Sedimentary Deposits (Qc)

Pleistocene nonmarine sediments consist generally of fanglomerates, deltaic sandstones, siltstones, gravel and clay. In the Susanville, Chico and Redding quadrangles the sediments also include intercolated volcanic ash or debris.

Recent Volcanic Rocks (Qrv)

Basaltic (Qrv^b), rhyolitic (Qrv^r) and pyroclastic (Qrv^P) volcanics occur throughout the area. Rocks in the Susanville, Alturas and Weed quadrangles are further characterized by the occurrence of tuff, lapilli, and local obsidian and cinders.

Quaternary Nonmarine Terrace Deposits (Qt)

The Quaternary nonmarine terraces include river, stream and lake terrace deposits, along with some fanglomerates, deltaic and slope wash deposits.

Quaternary Glacial Deposits (Qg)

Terminal and lateral moraines, till and fluvoglacial deposits along with later associated accumulations, such as bog and soil, make up the major Quaternary glacial deposits throughout the area.

Quaternary Lake Deposits (Ql)

The Quaternary lake deposits include sand, silt, ash and local diatomaceous earth in playa-like deposits in scattered basins of interior drainage. This part of the section in the Weed and Redding quadrangles also includes predominant glacial lake deposits.

Recent Alluvium (Qal)

Alluvial silt to coarse gravel, which is locally brecciated or conglomeratic, occurs in the Great Valley and is often associated with fan, terrace or local lacustrine deposits. Recent alluvium in the Weed and Susanville quadrangles also includes areas of local glacial outwash.

Recent Dune and Coast Sand (Qs)

Well sorted dune sand and older eolian sand occur along the coastal areas of the Eureka and Ukiah quadrangles.

Structure

The structural trend, based on fault patterns in the Alturas quadrangle, varies between north-south and northwest-southeast. Most of the faults in the area show evidence of recent activity. Two major recent faults are the Surprise Valley Fault, on the western side of Surprise Valley, and the Likely Fault, which cuts a virtually straight path from Ambrose off of the map area to the southeast in the vicinity of Tulelake Reservoir.

The major concentration of cinder cones is in the western third of the quadrangle, and particularly near Medicine Lake. Hot springs are located around the three alkali lakes and the Surprise Fault scarp.

INTERPRETATION

General

The airborne gamma-ray spectrometer survey is conducted in support of the Department of Energy's National Uranium Resource Evaluation (NURE) program. The primary purpose of the survey is regional resource evaluation as opposed to local anomaly identifications. The interpretation of the radiometric data is directed towards determining zones of possible depletion of uranium which may have served as possible uranium sources, outlining areas of regional enrichment in uranium and indicating the geological formations which are most likely to be mineralized within a possible uranium province.

The areas of possible uranium depletion/enrichment are outlined with the aid of anomaly maps, which have been previously described. Enrichment or depletion of uranium on a regional scale is assumed to have taken place if the U/T and U/K ratio values remain higher/lower than at least one standard deviation above/below the mean for a distance of at least a mile, provided the K, U and T count rates are at the same time not less than one standard deviation below the mean. One mile equals approximately 35 samples.

The probability of a geologic formation to be mineralized by a given element may be estimated from the dispersion of the geochemical distribution curve (i.e. the smaller the ratio of the standard deviation over the mean) the less the likelihood that an extremely high concentration of that element exists within that formation. Obviously, the opposite holds true as well.

The decision of both the "favorability" of a formation and of the presence of a regional geochemical anomaly is influenced to a large extent by the choice of the geological cell units used in the correlation of the radiometric and geologic data.

The radiometric parameters used in the present report are concentrations in parts per million of equivalent uranium and equivalent thorium and in percent of potassium and their ratios. The radiometric count rates of the helicopter borne A.G.R.S. (Airborne Gamma-Ray Spectrometer) system were calibrated at the Lake Mead Dynamic Test Range against sources of known concentrations of potassium, uranium and thorium. The sensitivities of the A.G.R.S. system, normalized to 400 feet terrain clearance at standard temperature and pressure are:

<u>Radioelement</u>	<u>Count Rate</u>	<u>Concentration</u>
Potassium	105.71	1%K
Uranium	12.05	1ppm eU
Thorium	7.32	1ppm eT

Geochemical Analysis

Thirty-one recognized geologic units have been sampled and statistically analyzed on the Alturas quadrangle. One of these (QAL) is a composite of generalized Quaternary alluvium (Qal) and dune sand (Qs). The contribution of the latter unit was minor; only thirty-two samples out of a total of one thousand nine hundred and twenty-three.

In addition, samples were analyzed over a small unmapped area in the southwestern part of the quadrangle and were designated UNK, and samples were analyzed over extensive bodies of water.

Of the sedimentary rocks outcropping in the Alturas quadrangle, only the Pliocene nonmarine rocks (Pc), the Quaternary lake deposits (Ql) and the Quaternary riverine alluvium (Qal) are exposed widely enough to permit sufficient sampling for reliable analysis.

The Pliocene nonmarine sediments (Pc) are generally restricted in outcrop to the south-central part of the quadrangle, along the river and stream valleys. The histograms suggest normal distribution of the radioactive elements on all three spectral windows. The Quaternary lake deposits are exposed throughout the map sheet area in river valleys and flood plains. This rock unit also displays normal distribution curves in the histogram studies, with modest deviation in the uranium and thorium spectral channels. It suggests that the Quaternary lake deposits are similarly of relatively homogeneous composition.

The Quaternary alluvium (Qal) is distributed throughout the quadrangle, with the largest exposure in the east along the western side of Surprise Valley. It includes a few samples of Quaternary dunes and shoreline sands (Qs). The thorium histogram distribution curve is normal in shape, but it shows a small secondary peak at a slightly higher concentration (approximately 7 ppm) than the primary peak (approximately 4.5 ppm). The potassium curve likewise suggests a dual peak, although the curve is extremely erratic. The uranium concentration histogram shows a distinct tailing toward the higher

concentrations and it is judged to be lognormal in distribution. The overall aspect of the formation suggests that it consists of two distinct compositional components. The proximity of the lakes alternatively suggest that the dual peaks may simply reflect preferential absorption of "wet" and "dry" components of the formation. (The dune and shoreline sands (Qs) are not likely to be the second component as they constitute less than two percent of the samples.)

Tertiary intrusive rocks (Ti) are exposed in the Warner Mountains, between Goose Lake and Upper Alkali Lake in the northeastern part of the quadrangle. They display broad, erratic distribution curves and a very wide range of equivalent uranium and thorium concentration on the pertinent spectral channels. This indicates that the rock unit is heterogeneous in composition.

Most of the map sheet is overlain by volcanic flows of upper Tertiary and Pleistocene age, with vastly predominating basaltic rocks. The histogram distribution curves for all of the basalt sequences; Pliocene, Miocene, Pleistocene and undifferentiated Tertiary (Pv^b , Mv^b , Qpv^b and Tv^b) are remarkably similar. All four have narrow, symmetrical thorium and uranium histogram curves displaying normal distribution and relatively low standard deviation values. The potassium curves also show great similarity, although there is some irregularity from curve to curve because minor variation in potassic feldspar concentration is likely to manifest itself as great variation in potassium content.

The Tertiary pyroclastic formation (Tv^P) shows substantially the same characteristics in its histogram curves as the basaltic rocks, leading to the speculation that the Tertiary pyroclastics are also basaltic in general composition. The largest region of Tertiary pyroclastic exposure is in the east-center in the Warner Mountains, and in the south-center. It is likely that the pyroclastics differentiated by epoch (Miocene, Pliocene and Pleistocene) are also basaltic, but the number of samples obtained over these formations is not sufficient to assess them reliably.

Andesitic and rhyolitic volcanics of Miocene, Pliocene, Pleistocene and undifferentiated Tertiary age were also sampled and analyzed statistically, but the number of samples obtained over these formations is not sufficient for conclusive analysis. The Pleistocene rhyolitic volcanics (Qpv^r), while

including only a few (thirty-two) samples, indicate very high concentrations of radioactive elements; a thorium mean of 11.3 ppm, a uranium mean of 3.6 ppm, and a potassium mean of 2.8% volumetric. An increase in radioactive minerals is to be anticipated in felsic rocks. The Pleistocene andesitic volcanics (Qpv^a) show clear double peaking in all three spectral channels. This may be due to two compositional components, possibly rhyolite and basalt.

Consideration of regional depletion and enrichment of uranium and thorium are not applicable in the Alturas quadrangle, except in the very limited areas around the lakes and river valleys where there are young alluvial deposits. By far, the bulk of the map sheet area is covered with relatively young volcanic flows which derive their compositions from their parent magmas and have not yet contributed significant sedimentary deposits. It is possible that in the limited region of Goose Lake in the northeast and Surprise Valley in the east, the alluvial formations may have experienced some enrichment from the Warner Mountains, but it is not indicated in the uranium/potassium and thorium/potassium ratio studies.

Computer Printer and Anomaly Map Analysis

Computer generated maps of the total magnetic intensity, the three diagnostic radiometric spectral channels and their comparative ratios, were prepared at a scale of 1:500,000. The grid spacing on these maps is 1270 meters by 2117 meters, so that the generated maps are far too generalized to permit anything but the broadest of observations.

The magnetic intensity level in the Alturas quadrangle varies widely, with local relief well in excess of one thousand gammas. The shape and distribution of the anomalies is irregular. This is the pattern to be expected in an area of widely exposed volcanic flows having variably mafic compositions.

The region is characterized by moderately high gamma radiation in the area of the Warner Mountains in the east and the Pliocene-Pleistocene cinder cone area in the west-center. In general, the relatively radioactive areas appear to be associated with the mafic volcanics, notably the Tertiary and Quaternary basalts. All of the anomalous areas show increases in all three spectral channels.

The areas of increased radioactive level in the northeast, Anomalies 1, 2

TABLE III

LEGEND TO TOTAL FIELD MAP (GAMMA)

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		52500.0
0	52500.0	52600.0
1	52600.0	52700.0
2	52700.0	52800.0
3	52800.0	52900.0
4	52900.0	53000.0
5	53000.0	53100.0
6	53100.0	53200.0
7	53200.0	53300.0
8	53300.0	53400.0
9	53400.0	53500.0
+	53500.0	

```
X1= 582000.0
Y1= 4539000.0
```

TABLE IV

LEGEND TO POTASSIUM AVERAGE MAP (PERCENT)

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.20
0	0.20	0.35
1	0.35	0.50
2	0.50	0.65
3	0.65	0.80
4	0.80	0.95
5	0.95	1.10
6	1.10	1.35
7	1.35	1.40
8	1.40	1.65
9	1.65	1.70
+	1.70	

POTASSIUM AVERAGE

X3= 725200.00

Y3= 4059609.0

• Figure 0

$$2 = 0.75 \text{ days}$$
$$Y_2 = +5549000.0$$

TABLE V

LEGEND TO URANIUM AVERAGE MAP (PPM)

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.20
0	0.20	0.43
1	0.43	0.66
2	0.66	0.89
3	0.89	1.12
4	1.12	1.35
5	1.35	1.58
6	1.58	1.81
7	1.81	2.04
8	2.04	2.27
9	2.27	2.50
+	2.50	

X1= 582000.0
Y1= 4539000.0

X2= 753560.0

TABLE VI

LEGEND TO THORIUM AVERAGE MAP (PPM)

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		1.40
0	1.40	1.90
1	1.90	2.40
2	2.40	2.90
3	2.90	3.40
4	3.40	3.90
5	3.90	4.40
6	4.40	4.90
7	4.90	5.40
8	5.40	5.90
9	5.90	6.40
+	6.40	

TABLE VII

LEGEND TO URANIUM/POTASSIUM RATIO MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.60
0	0.60	0.75
1	0.75	0.90
2	0.90	1.05
3	1.05	1.20
4	1.20	1.35
5	1.35	1.50
6	1.50	1.65
7	1.65	1.80
8	1.80	1.95
9	1.95	2.10
+	2.10	

X4= 582000.0

X3= 753560.0

Y4= 4659665.0

Y3= 4659669.0

[illegible]

X1= 582000.0

$$X_2 = 753500.0$$

Y1= 4539000.0

Y2= 4539000.0

TABLE VIII

LEGEND TO URANIUM/THORIUM RATIO MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.130
0	0.130	0.155
1	0.155	0.180
2	0.180	0.205
3	0.205	0.230
4	0.230	0.255
5	0.255	0.280
6	0.280	0.305
7	0.305	0.330
8	0.330	0.355
9	0.355	0.380
+	0.380	

X4= 582000.0

Y 3= 75 55 60.0

Y4= 4659669.0

$$Y_3 = 4659669.0$$

0 6 9 4322210- 3

4 222 -012211 23 34331 3677422 469 988777 4568999888875443210 11

+861--- 2 8 4331 - 876 67655 766 78853 467764 36897520 10000 10- 12332 2 33 2 2454 33 4678 8 7 664 567 77777 9998532111

.875210 1256665544 222 24566 66 666 77 7654 5 54 457 754321 1111 2111 2344322 3 2 3 456 7 77 5 6 6666665443221

.654332 345 5 44333 4 5 67 8887777 88 765 44 333 4 5 5433222222 2222 2 2 222 3333333 33 45 6 6 66 6666 55 5 432222

.44 4 33 456665 4 5554 4 5 67 9 98 7 89 8654 3 2 11 234554322 3 4333333 444432 11 23 3 2 3 3 2 3 4 5 677 6 5 578766542 135

.44 444 68 9654 46764 345 6 8 96 69 54321 0 02466532 2356544 5554 44 21 1235431 24442 1 234 56 6 54 5788765432 3

.3 4 555 676 4 56764 245 54 369 87 78 84432 1 1 0 12345432 3 44 333333 2 11 2 34432 332 0 012345 66 6 5 5 678876 54333

.33 4 4 4 5666544 5 66 8 8 77 88764 3 2 1 111 23 433222222 3333 222 33 4433 222 1 0 1234 5 66 6 5 5 66 54 3

.4444 4 5 66 6655 5 567 77 6543 222222 1 2 3 32 111 2 222 2 2 2 3 444 432 1 11 12 3 4 566 65 4 5 5 56 7765432

.544 3333 4 55 66 777766665 677 6543 11 2 21 1234432 00 1 111 22 2321 1 45666 553 1 10 135543 3466777543 35 67898777642 2

.654 2 23 4 568777 897 8988887 665421 01 23333 333 56520 0 1 2 32 1234555 543222 23455 4 45 6 65444 5 6 666543 2

.7543 3 444 566 5 7 77 77777 7 6 5 43211 2 3 4432 34 431 0 0 1345421 2 34 4 4433 2 3 4554 55 6 6555543 345 4332

.554 3 3 4 555 5 6 7776 67 7 654 33 33333 4 5 666543 22111 1 1111 2 3 3 467765 5 444 567776 5542 3454332

.444 3 3 4 555 44 5 67 77 88887642 234444 45 67777542 1 22 1 000 00 1 2 34 3 2 34 4 56663 3 469 974 457865 432 2

.33 33 3 456543 3 567887 5 79 9730 136774 57986 7652 023210 0 0 0 0 1 1 124432 2 2 2 467863 2358 9854 4 55 4 3 2

.33 3 34 5532 368752 2379 85 69 9632 3567753 57876 66542 22 2 1000 0 01 1 23 33 2 2 24554 333 4567 6 5554 3 4 4 3 2

.3 4 5654333 566543 45789997 78 9765 5 66655 566544 55432 2 111 1 222 22222 2 34 55 44444 5 6 6 543 34 4 33

.23 3 45 544 44 566666 7 89 98 999 9987766 7776 555 4333 4 3 33 22 1 0 24553 233 22222 32 1 234555 4 5 55 665 5 665 4 3

.2 3 4 544 3 4 6788888 99999 999 9988887 8765 4432 3 44 33 43 210 0 0 036632 23321 02366654 55 56 5 56 67 98776 5443

.22 357653 37 999 9999 98 9875 5554 45664 444 210 0000 0 1356432222 233 21 3 45 55 555 5 5 6 7887 6554 5

.333333 4565444 57 5 99 9988877666654 32 1 234 43 3 3 2111 2 3322 34433 3 2 3 3332 3 4 555 5 4 5 5555 555

.5555555 666666 789 9 999999999 9888 7 6 544444 3320 023 33333 3 2222 333 3 33 33 45554444 56666 5 44 4 5 5 5 5 666

.66 7 9 98777 8 9999 8888 998 7 66543 222 3 210 012 222 3 3 333 44432 23443 2 344 5764 577776 54 3 3 5 655 5 789

.789 988 998 99 9 8 8 7 789876 55531 00 1 1 2 2 23542 2 3 4 34 5 8 551 025642 1354 468986543 589886 54 44 5543 34 566

.67 7 8 99 9 8 87 65 56 64 3442 0 1221 02553 2 3 443 44 566532 234 432 34 5 687654 456 666 5 444 432 234 5 5

.89 99 9 9 588 7 6 688863 2100 111 22 2 11 2 2 2 3 4444 43 3333 44 3 4 55 6653 34 5 5 567753 234 444

.78 9 99999999 9 9 88 7 66 7 76543 33333333333 22222 2 11 2 3 45 655 4444433 4 4 3 4 566 6555433 4 5 6 5 4 579875 4544 33

.5678 8 7 89 98 8 999876 5 788865 4444 555444443 34332 22 10 012 34578654 57754 355543 345677 66664 2 345 5 775 35787654 55 43 21

.246997 79 86 789 9764 479 95 55 688665 543 44433333210 1 23699753 7 84 34 4 3 45666 67764 34 55 66544 567 76665 43 2

.56887 7 78 97 6 7 898765 4 44444 5665 4444321 0233 211 2 346 76 67887544 44 4 55 55432 234 5 5 677 775 4 432

.67 8 7777 8887 666666 5 4 3 34 44444 3 321 023 321 23 45 55 6 5 44 4 55 54310 013456 666 5 5678888764 466421

.7888 76 677 7 6 55554 3 4 5432 235 44 43 3 3 3444333 4443211 234 5 55 5665 4 33 4 55 543210 268876 6653 3589 9876555 43

.9988876 67 8765 4 4321 135543 34554 4552 0232 2455 45666431 24554 554 58 8655 42 35655 6653 2110 25776 66 55 67 776 55 54 32

+ 98 89766 9 95 34431 13566 5 6664 3575 23443 3 55555554421 2 3 4 43 34 5 4 33 4 5543 2 111 345 6 66 7 7654 455 4 3

.8877 66 777666543 23210 23566555 5433 4543 44433 3 3 34 433333 33 2 2 34 4 4 4 420 02345 66 77 765555 5 44

.776 555555555 4 3 2

X1= 582000.0

Y2= 753560.0

Y1= 4539000.0

Y2= 453 90 00.0

TABLE IX

LEGEND TO THORIUM/POTASSIUM RATIO MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		2.75
0	2.75	3.40
1	3.40	4.05
2	4.05	4.70
3	4.70	5.35
4	5.35	6.00
5	6.00	6.65
6	6.65	7.30
7	7.30	7.95
8	7.95	8.60
9	8.60	9.25
+	9.25	

X4= 582000.0

$$V_3 = 75\,3560.0$$

Y4= 4659669.0

$$Y3 = 4659669.0$$
[illegible]

X1= 582000.0

$$X_2 = 75.3560$$

Y1= 4539000.0

Y2= 453 9000.0

and 6, on line 450 fiducials 20320-20520, line 460 fiducials 18820-19020 and line 490 fiducials 6900-6950, are mainly associated with the Quaternary alluvial material along the eastern edges of Goose Lake and in Surprise Valley. In these zones the concentration of equivalent uranium ranges up to, and in some places exceeds, 2.5 ppm and the concentration of equivalent thorium ranges up to, and over, 6.4 ppm.

The Quaternary lake deposits in Surprise Valley display variably anomalous radioactive levels in all three spectral windows, comparable to the Goose Lake Quaternary alluvium. It is unlikely that these young alluvial deposits are derived from the volcanics in the adjacent Warner Mountains and have been concentrated and enriched to some degree in the erosion/deposition cycle.

Anomaly 3, radiating from the Tertiary intrusive (Ti) exposure encountered on line 470 fiducials 16400-16550, in the Warner Mountains east of Goose Lake, also shows an increased level of gamma radiation in both uranium and thorium channels. Equivalent uranium is in the range of 4.4 to over 5.5 ppm.

Several irregular zones of increased radiation are encountered in the west-central part of the quadrangle. All of these appear to have their sources in exposed basaltic rocks. On line 490, Anomalies 4 and 5 display gradual increase between fiducials 4600 and 5000, suggesting a systematic change in the constitution of the formation rather than a sharply differentiated deposit. The radiation increase is associated with Pleistocene and Recent basaltic volcanics.

Anomalies 7, 8, 9, 10 and 11 are all located in the west-central part of the Alturas quadrangle. They, too, are caused by Pliocene, Pleistocene and Recent basaltic flows. However, their increases in radioactive level tend to be more erratic than the profile of Anomalies 4 and 5, possibly indicating some structural control to account for the more abrupt delineation of the zones of comparatively strong and weak radiation.

Anomalies 12 and 13 are in the southeastern corner of the map sheet, on lines 530 fiducials 15500-15600 and 540 fiducials 18980-19110, respectively. Both are associated with Tertiary volcanics, and Anomaly 12 is located over a mountain peak.

None of the thirteen anomalies are considered likely to have their sources in commercial deposits of radioactive ores.

0 10 20
STATUTE MILES

AERO SERVICE

LEGEND
③ URANIUM & THORIUM ANOMALIES

INTERPRETATION MAP
ALTURAS QUADRANGLE
U.S. DEPARTMENT OF ENERGY

FIGURE 14
73/74

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A P P E N D I X A

Geologic Legend

GEOLOGIC LEGEND

<u>Aero Symbol</u>	<u>Map Symbol</u>	<u>Unit Description</u>
QS	Qs	Recent dune sand and coast sand
QAL	Qal	Recent alluvium
QL	Ql	Quaternary lake deposits
QG	Qg	Quaternary glacial deposits
QT	Qt	Quaternary nonmarine terrace deposits
QRV	Qrv	Recent volcanic rocks including: andesites rhyolites basalts and pyroclastics
QRVA	Qrv ^a	
QVRV	Qrv ^r	
QRVD	Qrv ^b	
QRVP	Qrv ^p	
QC	Qc	Pleistocene nonmarine sedimentary deposits
QPV	Qpv	Pleistocene volcanic rocks including: andesites rhyolites basalts and pyroclastics
QPVA	Qpv ^a	
QPVR	Qpv ^r	
QPVb	Qpv ^b	
QPVP	Qpv ^p	
	*	Quaternary and/or Pliocene cinder cones
PC	Pc	Undivided Pliocene nonmarine sedimentary rocks
PUC	Puc	Upper Pliocene nonmarine sedimentary rocks
PV	Pv	Pliocene volcanic rocks including: andesites rhyolites basalts and pyroclastics
PVA	Pv ^a	
PVR	Pv ^r	
PVB	Pv ^b	
PVP	Pv ^p	
MC	Mc	Undivided Miocene nonmarine sedimentary rocks
MV	Mv	Miocene volcanic rocks including: andesites rhyolites basalts and pyroclastics
MVA	Mv ^a	
MVR	Mv ^r	
MVB	Mv ^b	
MVP	Mv ^p	
OC	Øc	Oligocene nonmarine sedimentary rocks
EC	Ec	Eocene nonmarine sedimentary rocks

<u>Aero Symbol</u>	<u>Map Symbol</u>	<u>Unit Description</u>
TI	Ti	Tertiary intrusive (hypabyssal) rocks, including:
TIA	Ti ^a	andesites
TIR	Ti ^r	rhyolites and
TIB	Ti ^b	basalts
TV	Tv	Tertiary volcanic rocks including:
TVA	Tv ^a	andesites
TVR	Tv ^r	rhyolites
TVB	Tv ^b	basalts and
TVP	Tv ^p	pyroclastics
JML	Jml	Middle and lower Jurassic marine sedimentary and metasedimentary rocks
TR	R	Triassic marine sedimentary and metasedimentary rocks
JTRV	JTv	Jurassic and/or Triassic metavolcanic rocks
W		Water
UNK		areas of unknown or incompletely mapped geology

A P P E N D I X B

List of Geologic Units by Anomaly

List of Geologic Formations by Anomaly

(Uranium Anomalies)				
<u>Anomaly</u>	<u>Formations</u>	<u>LOCATION</u>		<u>Brief Description</u>
		<u>t-traverse</u> <u>tl-tie line</u>	<u>Fiducial</u> <u>Interval</u>	
1	Qal Tv ^P	t-450	20320-20520	Strong U, Th and K radiation; No discernible U/K, Th/K or U/Th
2	Qc	t-460	18830-19020	Strong U, Th and K radiation; No discernible U/K, Th/K or U/Th
3	Tt	t-470	16400-16550	U, Th and K anomaly, terrain clearance adequate although anomaly is on mountain
4	Qrv ^b	t-490	4600-4830	Gradual increase in U, Th and K; No U/K, Th/K or U/Th
5	Qpv ^b	t-490	4850-5000	Gradual increase in U, Th and K; No U/K, Th/K or U/Th
6	Ql	t-490	6900-6950	Modest increase in U and K; No th, U/K, Th/K or U/Th
7	Pv ^b	tl-3060	1980-2010	Modest increase in U and K; No th, U/K, Th/K or U/Th
8	Pv ^b Qrv ^b	t-500	1380-1480	Increase in U, K, and Th; No discernible U/K, Th/K or U/Th
9	Qpv ^b Qpv ^a	tl-3070	5640-5770	Increase in U, K, and Th; No discernible U/K, Th/K or U/Th
10	Qpv ^b	t-510	2770-2880	Modest increase in U, Th and K; No U/K, Th/K or U/Th
11	Qpv ^b Qrv ^b	tl-3060	1690-1760	Modest increase in U, Th and K; No U/K, Th/K or U/Th
12	Tv ^P	t-530	15500-15600	Abrupt increase in U, Th and K; No U/K, Th/K or U/Th
13	Mv ^b	t-540	18980-19110	Abrupt increase in U, Th and K; No U/K, Th/K or U/Th

A P P E N D I X C

List of Anomalies by Geologic Unit

List of Anomalies by Geologic Formation

<u>Aero Symbol</u>	<u>Formation</u>	<u>No. of Samples</u>	<u>No. of Uranium and Thorium Anomalies</u>
QAL	Qal	1923	1
QC	Qc	551	1
QL	Ql	3996	1
QRVB	Qrv ^b	3285	3
QPVB	Qpv ^b	8500	4
QFVA	Qpv ^a	394	1
TI	Ti	544	1
TVP	Tv ^p	3135	2
PVB	Pv ^b	6057	2
MVB	Mv ^b	6168	1

All other formations have no associated anomalies

A P P E N D I X D

Mean Radiometric Values by Geologic Unit

MEAN VALUE BY GEOLOGIC MAP UNIT

ALTURAS QUAD

LINE 450

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
QL	0.13	0.63	8.16	0.283	0.923	3.170
PVB	0.18	0.67	9.30	0.258	1.142	4.060
QAL	0.32	1.82	20.91	0.275	0.917	3.155
W	0.04	0.36	2.42	0.203	0.577	3.499
PC	0.09	0.59	11.18	0.439	0.757	1.719
MV	0.32	0.55	12.60	0.122	0.648	5.369

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TVP	0.29	1.44	15.17	0.293	1.168	4.029
QPV	0.17	0.50	5.32	0.214	1.411	6.752
MVB	0.22	0.55	8.36	0.204	1.260	6.484
TI	0.49	2.37	35.10	0.346	1.034	3.058
MVA	0.32	1.49	23.15	0.325	0.924	2.835

LINE 460

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QL	0.19	0.80	12.06	0.322	1.067	3.411
QAL	0.37	1.69	24.58	0.280	0.934	3.916
PVB	0.17	0.56	9.74	0.262	0.855	3.503
PC	0.15	0.56	8.68	0.251	0.882	3.636
QPV	0.20	0.67	8.18	0.237	1.281	5.464
W	0.05	0.33	3.05	0.255	1.579	4.747
MVR	0.52	2.01	36.26	0.270	0.799	2.963

UNIT	THOR	JRN	PJT	U/TH	U/K	TH/K
TVP	0.27	0.85	14.97	0.224	0.813	3.657
MVB	0.25	0.87	10.77	0.220	1.218	5.703
QC	0.56	2.23	27.59	0.283	1.171	4.176
TI	0.34	1.65	23.97	0.345	0.997	2.907
MVP	0.37	1.42	24.75	0.260	0.809	3.155
QT	0.49	2.62	32.97	0.374	1.158	3.102

LINE 470

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QAL	0.31	1.15	16.23	0.251	1.014	4.429
QPV	0.22	0.70	8.98	0.226	1.160	5.422
QVP	0.22	0.67	11.46	0.214	0.833	3.936
PVB	0.18	0.64	11.97	0.244	0.757	3.352
QRV	0.17	0.38	8.06	0.161	0.719	4.378
PC	0.18	0.79	12.70	0.302	0.899	2.957
QL	0.24	0.99	17.01	0.284	0.859	3.114

UNIT	THOR	JRN	PJT	U/TH	U/K	TH/K
QRV	0.23	0.51	11.57	0.162	0.591	4.116
TVA	0.32	0.98	16.17	0.209	0.874	4.257
TVP	0.26	0.95	19.25	0.250	0.712	2.846
W	0.15	0.58	6.14	0.233	1.009	4.397
MVB	0.27	0.88	16.67	0.208	0.765	3.727
QC	0.25	0.55	8.65	0.187	1.116	5.978
TI	0.74	3.32	38.59	0.315	1.238	3.972

LINE 480

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
PVB	0.18	0.62	8.72	0.232	1.047	4.453
QPV	0.25	0.75	9.41	0.203	1.135	5.939
QRV	0.26	1.02	13.08	0.271	1.113	4.237
PVP	0.29	0.73	13.04	0.175	0.792	4.572
PVA	0.27	0.66	12.98	0.167	0.732	4.388
W	0.15	0.58	6.18	0.224	1.391	5.543

UNIT	THOR	JRN	PJT	U/TH	U/K	TH/K
QAL	0.35	1.50	19.35	0.250	1.046	3.755
MVB	0.24	0.63	12.32	0.184	0.774	4.235
QC	0.35	1.10	19.94	0.223	0.853	3.819
QL	0.26	1.03	17.11	0.269	0.920	3.409
TVP	0.18	0.53	9.77	0.247	0.924	3.842
TI	0.33	1.83	20.58	0.359	1.222	3.617

MEAN VALUE BY GEOLOGIC MAP UNIT

ALTURAS

QUAD

LINE 490

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
QAL	0.28	1.05	16.40	0.255	0.911	3.846
QPV	0.24	0.80	8.92	0.217	1.245	6.068
PVB	0.21	0.89	8.17	0.301	1.508	5.422
QPVA	0.35	1.81	18.96	0.335	1.294	3.966
PVA	0.33	1.56	15.49	0.326	1.468	4.671
PVP	0.29	1.96	13.38	0.481	2.133	4.476
QRVP	0.67	3.79	34.72	0.395	1.579	4.016
QRVB	0.54	2.94	27.53	0.358	1.501	4.352
QPV	0.69	3.67	36.77	0.369	1.446	3.930

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TVB	0.31	1.55	14.52	0.346	1.543	4.534
MVB	0.25	0.85	9.28	0.236	1.361	5.932
W	0.29	0.52	6.28	0.124	1.255	10.098
TVP	0.23	0.98	11.28	0.279	1.212	4.151
QC	0.31	1.08	14.35	0.230	1.055	4.757
MV	0.35	1.17	16.11	0.233	1.049	4.516
QL	0.31	1.33	22.09	0.298	0.864	2.932
MC	0.22	0.81	14.46	0.253	0.819	3.228
MVP	0.25	0.75	16.68	0.209	0.633	3.052

LINE 500

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QRVB	0.28	1.13	11.49	0.241	1.227	5.674
PVA	0.27	1.44	13.84	0.372	1.524	4.159
PVB	0.34	1.57	16.00	0.307	1.363	4.586
QPVA	0.22	1.00	11.17	0.332	1.386	4.185
QRV	0.30	1.47	14.43	0.335	1.435	4.484
PVP	0.52	2.95	22.43	0.396	1.915	4.847
QPV	0.19	0.61	6.51	0.233	1.515	6.273
QL	0.33	1.23	22.96	0.282	0.775	2.801

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
MVB	0.22	0.74	6.62	0.236	1.524	7.032
QAL	0.24	0.87	13.75	0.247	0.980	4.341
W	0.16	0.56	6.58	0.220	1.309	5.743
PC	0.17	0.66	9.04	0.286	1.086	4.037
QC	0.27	0.79	14.10	0.233	0.811	4.016
TVP	0.24	0.88	13.35	0.251	0.967	3.849
QC	0.19	0.41	11.60	0.148	0.536	3.454

LINE 510

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
PVA	0.24	1.05	11.23	0.304	1.423	4.663
QPV	0.28	1.39	12.06	0.310	1.525	5.036
QRVB	0.22	0.91	9.11	0.296	1.495	5.123
QRV	0.35	1.69	14.91	0.326	1.597	4.918
PVB	0.21	0.76	7.55	0.249	1.433	5.950
MVB	0.19	0.69	7.02	0.229	1.367	5.620
TVP	0.24	0.96	12.28	0.267	1.103	4.197

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
PC	0.28	1.07	14.45	0.278	1.145	4.141
QAL	0.25	0.92	14.79	0.252	0.878	3.654
W	0.19	0.70	10.51	0.257	0.945	3.854
PVP	0.33	1.30	19.71	0.280	0.957	3.443
QL	0.27	0.90	14.57	0.233	0.907	3.925
QC	0.29	0.93	14.14	0.221	0.944	4.234
QT	0.28	1.22	17.89	0.314	1.032	3.231

LINE 520

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QPV	0.21	0.82	8.36	0.281	1.627	5.891
QAL	0.26	0.91	14.32	0.244	0.963	4.062
TVB	0.18	0.83	7.28	0.322	1.705	5.377
QRVB	0.22	0.77	7.26	0.247	1.558	6.388
MVB	0.18	0.70	7.73	0.266	1.366	5.381
TVP	0.23	1.04	13.97	0.281	0.977	3.489
MVA	0.18	0.61	9.81	0.234	0.933	3.909
QC	0.34	1.41	18.71	0.287	1.084	3.777

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TV	0.33	0.64	13.93	0.134	0.683	4.973
W	0.22	0.91	13.61	0.277	0.994	3.835
PVB	0.22	0.76	9.80	0.236	1.145	4.944
PC	0.27	1.05	14.62	0.282	1.039	3.923
PVP	0.31	1.40	16.04	0.319	1.294	4.058
QL	0.22	0.68	13.37	0.221	0.798	3.816
MVP	0.32	1.72	20.38	0.367	1.210	3.336

MEAN VALUE BY GEOLOGIC MAP UNIT

ALTURAS

QUAD

LINE 530

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
QPV	0.22	0.69	6.95	0.215	1.373	6.981
QAL	0.23	0.77	10.27	0.231	1.403	7.224
PVB	0.24	0.80	7.98	0.239	1.645	6.904
TVB	0.21	0.74	7.22	0.242	1.581	7.051
QRV	0.24	0.72	5.05	0.213	2.087	9.969
QRVB	0.10	0.46	3.99	0.320	1.781	5.429
MVB	0.20	0.69	7.90	0.240	1.304	5.957
TV	0.18	0.67	5.31	0.279	1.943	7.212

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
W	0.19	0.62	7.33	0.244	1.493	6.372
QL	0.19	0.61	10.46	0.248	1.350	5.490
TVP	0.28	1.14	15.27	0.261	1.035	4.091
PC	0.27	0.99	15.25	0.248	0.924	3.811
MVA	0.28	1.36	13.28	0.335	1.424	4.313
MVP	0.15	1.21	11.51	0.554	1.518	2.751
TI	0.41	2.01	29.07	0.342	0.995	2.912
DC	0.30	0.97	22.31	0.226	0.623	2.755

LINE 540

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
UNK	0.20	0.88	8.44	0.311	1.523	4.987
TVB	0.19	0.83	6.23	0.318	1.999	6.588
QPV	0.20	0.45	4.95	0.153	1.262	8.591
MVB	0.24	0.81	11.23	0.220	1.038	4.750
QRVB	0.11	0.46	4.22	0.300	1.613	5.500
QAL	0.25	0.95	10.34	0.264	1.359	5.472
QL	0.26	0.88	11.96	0.229	1.057	5.150

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
PC	0.30	0.99	14.21	0.230	1.027	4.507
TVP	0.21	0.75	9.28	0.248	1.213	4.944
MVP	0.45	1.93	22.98	0.272	1.161	4.399
PVB	0.25	0.77	12.52	0.217	0.895	4.309
W	0.20	1.24	12.24	0.261	1.128	4.674
TV	0.77	3.85	39.85	0.351	1.405	4.012
MVA	0.18	0.66	8.16	0.256	1.158	4.548

LINE 550

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TR	0.16	1.01	10.38	0.455	1.493	3.381
MVA	0.18	1.02	8.19	0.382	1.782	4.751
EC	0.18	0.42	6.22	0.168	0.952	6.211
TVP	0.23	0.70	10.91	0.231	1.000	4.425
TVB	0.22	0.87	8.22	0.292	1.845	6.425
MVB	0.19	0.61	6.54	0.230	1.600	7.477
QL	0.23	0.70	8.23	0.216	1.335	6.139
QPV	0.24	0.74	13.06	0.216	0.815	3.910

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QRVB	0.10	0.54	3.42	0.284	1.830	6.021
W	0.02	0.31	0.96	0.0	1.956	1.778
PC	0.28	0.90	10.65	0.219	1.230	5.633
QC	0.25	0.77	12.42	0.219	0.914	4.180
QAL	0.29	1.30	13.65	0.319	1.388	4.352
PVB	0.26	0.82	12.93	0.225	0.934	4.245
MVP	0.31	1.26	14.33	0.290	1.293	4.465

LINE 560

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TV	0.16	0.89	7.34	0.396	1.797	4.316
JML	0.21	1.55	8.98	0.530	3.175	6.131
JTRV	0.18	1.00	11.29	0.382	1.280	3.387
EC	0.30	1.10	12.21	0.258	1.317	5.289
TVA	0.21	0.80	7.58	0.263	1.690	6.357
MVB	0.16	0.53	4.67	0.210	1.861	7.811
PC	0.18	0.68	7.25	0.239	1.239	5.599
W	0.06	0.0	2.01	0.0	0.0	6.046
TI	0.48	1.53	19.29	0.224	1.125	5.140

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QPV	0.22	0.92	8.18	0.289	1.747	6.333
PVA	0.31	0.90	9.14	0.188	1.374	7.031
QL	0.29	0.90	12.47	0.207	1.027	4.957
QC	0.26	0.99	12.53	0.261	1.127	4.421
TVB	0.29	0.86	10.49	0.207	1.256	6.133
QAL	0.26	0.96	12.99	0.270	1.075	4.256
PVB	0.23	0.81	10.75	0.239	1.113	4.882
MVP	0.38	1.56	16.37	0.299	1.483	4.995

MEAN VALUE BY GEOLOGIC MAP UNIT

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QUAD

LINE 3060

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
EC	0.15	0.53	6.35	0.248	1.213	5.067
MVB	0.22	0.71	4.56	0.224	2.369	10.671
TR	0.17	1.21	10.76	0.488	1.561	3.391
UNK	0.18	0.82	10.23	0.334	1.283	4.277
TVB	0.20	0.65	6.26	0.240	1.593	7.198
PVB	0.20	0.71	9.54	0.235	1.116	4.875
W	0.05	0.0	4.19	0.0	0.0	3.139

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
QPV	0.27	0.93	12.62	0.231	1.041	4.602
QRV	0.35	1.69	16.76	0.331	1.456	4.441
QVA	0.26	1.45	11.84	0.380	1.739	4.641
QAL	0.33	2.11	16.28	0.447	1.888	4.250
QL	0.25	0.73	10.69	0.203	0.998	4.872
QL	0.09	0.30	7.82	0.191	0.683	2.445

LINE 3070

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
PC	0.38	0.82	16.92	0.150	0.703	4.739
PVA	0.40	1.40	13.42	0.256	1.537	6.408
QL	0.21	0.76	8.33	0.252	1.375	5.791
QRV	0.25	1.22	10.76	0.271	1.403	5.696

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QPV	0.36	1.92	16.88	0.350	1.772	5.233
TVB	0.22	0.99	9.68	0.329	1.530	4.718
QVP	0.67	3.83	33.54	0.395	1.651	4.184
W	0.03	0.33	0.97	0.0	0.0	6.377

LINE 3080

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QAL	0.28	0.79	7.91	0.199	1.443	7.311
TVB	0.30	1.03	10.46	0.247	1.441	6.011
QL	0.24	0.65	7.09	0.194	1.449	7.409
QPV	0.25	0.89	9.57	0.225	1.303	5.893
TVP	0.20	0.48	6.14	0.158	1.123	6.994
TV	0.23	0.74	11.11	0.234	0.924	4.900

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
MVB	0.25	0.59	7.51	0.170	1.194	7.019
QRV	0.23	0.43	6.98	0.130	0.871	6.783
W	0.06	0.80	4.71	0.173	0.887	4.953
TVA	0.28	0.65	12.70	0.167	0.683	4.622
PVB	0.23	0.74	10.43	0.220	1.021	4.703
QRV	0.20	0.72	10.78	0.249	0.970	3.985

LINE 3090

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TI	0.26	1.33	38.53	0.361	0.533	2.132
PVB	0.21	0.93	13.54	0.312	1.372	4.206
MVP	0.39	1.45	16.19	0.261	1.321	5.070
TVP	0.20	0.62	9.17	0.202	0.990	4.972
W	0.19	0.78	3.30	0.300	3.814	12.512

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
MVB	0.20	0.62	8.40	0.227	1.241	5.437
PC	0.22	0.87	10.94	0.254	1.089	4.300
QAL	0.19	0.79	6.94	0.275	1.705	6.870
QPV	0.20	0.65	6.50	0.221	1.517	6.751

LINE 3100

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QL	0.25	0.76	13.70	0.227	0.817	3.793
QT	0.30	0.75	13.40	0.178	0.817	4.695
PVB	0.27	0.78	13.91	0.200	0.825	4.241
PC	0.27	1.01	13.78	0.258	1.037	4.207

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QAL	0.24	1.07	13.46	0.319	1.160	3.744
QPV	0.23	0.66	7.90	0.204	1.260	6.232
W	0.12	0.61	10.06	0.249	0.730	3.213
QC	0.24	0.90	11.87	0.264	1.118	4.247

MEAN VALUE BY GEOLOGIC MAP UNIT

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QUAD

LINE 3110

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K	UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
MVP	0.24	0.67	11.75	0.196	0.813	4.265	TVP	0.24	1.19	18.58	0.339	0.893	2.653
PVB	0.24	0.63	11.64	0.190	0.815	4.395	QC	0.46	1.94	24.69	0.272	1.065	3.912
W	0.16	0.62	9.50	0.222	0.755	3.648	QAL	0.37	1.58	23.55	0.299	0.987	3.375
MVB	0.30	1.16	17.60	0.245	0.893	3.839	QT	0.36	1.57	24.30	0.312	0.953	3.086
MVA	0.28	1.25	18.34	0.317	0.399	3.163	QL	0.30	1.06	18.40	0.244	0.821	3.474
TI	0.36	1.46	33.01	0.293	0.695	2.376	MVR	0.37	2.05	25.20	0.355	1.078	3.037

A P P E N D I X E

Standard Deviation Table

ALTRAS

QUAD

FORMATION

QPVR

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	32	11.32	NORMAL	9.08	9.83	10.57	12.06	12.81	13.55
E URANIUM	32	3.59	NORMAL	3.18	3.32	3.46	3.73	3.87	4.00
POTASSIUM	32	2.77	NORMAL	2.56	2.63	2.70	2.83	2.90	2.97
EU/K	32	1.22	NORMAL	0.39	1.00	1.11	1.32	1.44	1.55
EU/ETH	32	0.30	NORMAL	0.22	0.25	0.27	0.33	0.36	0.39
ETH/K	32	3.82	NORMAL	2.59	3.00	3.41	4.23	4.63	5.04

FORMATION

QPVA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	394	4.75	NORMAL	-1.45	0.62	2.68	6.81	8.88	10.94
E URANIUM	389	1.42	NORMAL	-1.10	-0.26	0.58	2.26	3.11	3.95
POTASSIUM	394	1.18	NORMAL	-0.71	-0.08	0.55	1.81	2.44	3.07
EU/K	389	1.11	NORMAL	0.11	0.44	0.78	1.45	1.78	2.12
EU/ETH	389	0.28	NORMAL	0.03	0.11	0.19	0.36	0.44	0.53
ETH/K	389	3.91	NORMAL	2.06	2.67	3.29	4.53	5.14	5.76

FORMATION

QL

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	3904	3.56	NORMAL	-0.85	0.62	2.09	5.03	6.50	7.97
E URANIUM	3526	0.77	NORMAL	-0.32	0.04	0.40	1.13	1.50	1.86
POTASSIUM	3968	0.93	NORMAL	-0.44	0.01	0.47	1.39	1.85	2.30
EU/K	3518	0.81	NORMAL	-0.26	0.09	0.45	1.16	1.52	1.88
EU/ETH	3467	0.20	NORMAL	-0.05	0.04	0.12	0.29	0.37	0.45
ETH/K	3503	3.39	LOGNORMAL	0.76	1.25	2.06	5.57	9.17	15.10

FORMATION

PVB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	6057	3.53	NORMAL	0.52	1.52	2.53	4.54	5.55	6.55
E URANIUM	5406	0.69	NORMAL	-0.23	0.08	0.38	0.99	1.30	1.61
POTASSIUM	6057	0.80	NORMAL	-0.06	0.23	0.52	1.09	1.38	1.66
EU/K	5406	0.37	NORMAL	-0.36	0.05	0.46	1.28	1.69	2.10
EU/ETH	5395	0.19	NORMAL	-0.04	0.03	0.11	0.27	0.34	0.42
ETH/K	5406	4.55	NORMAL	0.40	1.79	3.17	5.94	7.32	8.70

ALTURAS

QUAD

FORMATION

QAL

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1923	4.62	NORMAL	-0.49	1.21	2.92	6.33	8.03	9.73
E URANIUM	1777	0.64	LOGNORMAL	0.11	0.20	0.36	1.15	2.06	3.71
POTASSIUM	1923	1.05	LOGNORMAL	0.33	0.48	0.71	1.55	2.29	3.39
EU/K	1777	0.85	NORMAL	-0.15	0.19	0.52	1.19	1.52	1.86
EU/ETH	1777	0.21	NORMAL	-0.02	0.06	0.14	0.29	0.37	0.44
ETH/K	1777	3.44	LOGNORMAL	0.63	1.11	1.95	6.05	10.65	18.75

FORMATION

W

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1882	2.01	NORMAL	-3.37	-1.58	0.22	3.80	5.60	7.39
E URANIUM	1159	0.50	NORMAL	-0.35	-0.07	0.22	0.79	1.07	1.35
POTASSIUM	1673	0.06	LOGNORMAL	0.00	0.01	0.02	0.20	0.64	2.11
EU/K	1002	0.48	LOGNORMAL	0.05	0.10	0.22	1.05	2.31	5.06
EU/ETH	976	0.18	NORMAL	-0.08	0.01	0.09	0.27	0.35	0.44
ETH/K	957	2.98	LOGNORMAL	0.47	0.87	1.61	5.50	10.16	18.75

FORMATION

PC

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1954	4.05	NORMAL	0.04	1.38	2.71	5.39	6.73	8.07
E URANIUM	1864	0.86	NORMAL	-0.25	0.12	0.49	1.24	1.61	1.98
POTASSIUM	1954	0.94	NORMAL	-0.04	0.29	0.61	1.27	1.59	1.92
EU/K	1864	0.87	NORMAL	-0.14	0.19	0.53	1.21	1.54	1.88
EU/ETH	1864	0.21	NORMAL	-0.01	0.06	0.13	0.28	0.35	0.42
ETH/K	1864	4.24	NORMAL	0.78	1.94	3.09	5.39	6.54	7.69

FORMATION

TVP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	3135	3.39	LOGNORMAL	0.85	1.35	2.14	5.37	8.51	13.48
E URANIUM	2810	0.60	LOGNORMAL	0.09	0.17	0.32	1.14	2.16	4.09
POTASSIUM	3135	0.75	LOGNORMAL	0.21	0.32	0.49	1.14	1.74	2.66
EU/K	2810	0.83	NORMAL	-0.31	0.07	0.45	1.21	1.59	1.97
EU/ETH	2809	0.21	NORMAL	-0.05	0.03	0.12	0.29	0.38	0.46
ETH/K	2810	4.04	NORMAL	0.55	1.71	2.88	5.20	6.37	7.53

A_TLRAS

QUAD

FORMATION QPVB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	8500	3.52	NORMAL	0.76	1.68	2.60	4.44	5.36	6.28
E URANIUM	7240	0.68	NORMAL	-0.31	0.02	0.35	1.01	1.34	1.66
POTASSIUM	8500	0.47	LOGNORMAL	0.10	0.17	0.28	0.78	1.31	2.19
EU/K	7239	1.08	NORMAL	-0.42	0.08	0.58	1.58	2.07	2.57
EU/ETH	7238	0.18	NORMAL	-0.07	0.01	0.10	0.26	0.35	0.43
ETH/K	7239	5.92	NORMAL	0.43	2.30	4.11	7.73	9.54	11.36

FORMATION MVB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	6168	3.55	NORMAL	0.61	1.59	2.57	4.53	5.51	6.49
E URANIUM	5298	0.57	LOGNORMAL	0.08	0.16	0.30	1.07	2.01	3.79
POTASSIUM	6168	0.48	LOGNORMAL	0.07	0.14	0.26	0.90	1.69	3.16
EU/K	5298	1.02	NORMAL	-0.53	-0.01	0.50	1.54	2.06	2.58
EU/ETH	5298	0.18	NORMAL	-0.05	0.03	0.10	0.25	0.33	0.40
ETH/K	5298	5.80	NORMAL	-1.49	0.94	3.37	8.23	10.66	13.09

FORMATION TI

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	544	6.16	LOGNORMAL	2.30	3.19	4.44	8.56	11.89	16.52
E URANIUM	542	2.13	NORMAL	-1.21	-0.10	1.02	3.25	4.36	5.48
POTASSIUM	544	2.33	NORMAL	-0.68	0.32	1.33	3.34	4.34	5.34
EU/K	542	0.84	NORMAL	-0.20	0.15	0.50	1.15	1.54	1.89
EU/ETH	542	0.26	NORMAL	0.04	0.11	0.19	0.34	0.41	0.48
ETH/K	542	3.28	NORMAL	-0.15	0.99	2.13	4.42	5.56	6.71

FORMATION MVA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	334	3.37	NORMAL	-1.06	0.41	1.89	4.85	6.32	7.80
E URANIUM	307	0.83	NORMAL	-0.59	-0.12	0.35	1.30	1.78	2.25
POTASSIUM	334	0.60	LOGNORMAL	0.17	0.26	0.39	0.92	1.40	2.15
EU/K	307	0.87	NORMAL	-0.21	0.15	0.51	1.23	1.58	1.94
EU/ETH	307	0.23	NORMAL	-0.02	0.06	0.15	0.31	0.39	0.48
ETH/K	307	3.76	NORMAL	0.57	1.63	2.69	4.62	5.89	6.95

ALTLRAS

QUAD

FORMATION

MV

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	78	5.47	NORMAL	3.98	4.48	4.97	5.97	6.46	6.96
E URANIUM	78	0.94	NORMAL	-0.08	0.26	0.60	1.28	1.62	1.96
POTASSIUM	78	1.14	NORMAL	0.73	0.86	1.00	1.27	1.41	1.55
EU/K	78	0.76	NORMAL	-0.01	0.25	0.50	1.01	1.27	1.52
EU/ETH	78	0.16	NORMAL	-0.01	0.04	0.10	0.22	0.28	0.34
ETH/K	78	4.57	NORMAL	3.09	3.59	4.08	5.07	5.56	6.05

FORMATION

QC

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	551	4.54	NORMAL	1.52	2.53	3.54	5.55	6.56	7.57
E URANIUM	545	0.94	NORMAL	-0.27	0.13	0.54	1.34	1.74	2.15
POTASSIUM	551	1.05	NORMAL	0.16	0.46	0.76	1.35	1.64	1.94
EU/K	545	0.84	NORMAL	-0.08	0.23	0.53	1.14	1.44	1.75
EU/ETH	545	0.20	NORMAL	-0.02	0.05	0.13	0.27	0.34	0.41
ETH/K	545	4.21	NORMAL	1.98	2.72	3.47	4.96	5.71	6.45

FORMATION

MVP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1180	5.71	NORMAL	0.23	2.05	3.88	7.53	9.36	11.19
E URANIUM	1164	1.11	LOGNORMAL	0.31	0.48	0.73	1.69	2.58	3.93
POTASSIUM	1180	1.05	LOGNORMAL	0.35	0.51	0.73	1.52	2.19	3.16
EU/K	1164	1.06	NORMAL	-0.00	0.35	0.71	1.42	1.77	2.13
EU/ETH	1164	0.23	NORMAL	0.03	0.10	0.16	0.29	0.36	0.42
ETH/K	1164	4.52	NORMAL	1.39	2.43	3.48	5.56	6.60	7.64

FORMATION

QT

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	126	5.12	LOGNORMAL	3.08	3.65	4.32	6.07	7.19	8.52
E URANIUM	125	1.11	LOGNORMAL	0.43	0.59	0.81	1.51	2.06	2.82
POTASSIUM	126	1.60	NORMAL	-0.41	0.26	0.93	2.27	2.94	3.61
EU/K	125	0.76	NORMAL	-0.09	0.19	0.48	1.04	1.33	1.61
EU/ETH	125	0.24	NORMAL	-0.06	0.04	0.14	0.34	0.44	0.54
ETH/K	125	3.29	NORMAL	1.27	1.95	2.62	3.97	4.64	5.31

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QUAD

FORMATION

MVR

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	42	6.94	NORMAL	0.22	2.46	4.70	9.18	11.42	13.67
E URANIUM	42	1.96	NORMAL	-1.35	-0.25	0.85	3.05	4.16	5.26
POTASSIUM	42	2.25	NORMAL	0.25	0.92	1.58	2.91	3.58	4.25
EU/K	42	0.76	NORMAL	-0.40	-0.02	0.37	1.15	1.54	1.92
EU/ETH	42	0.26	NORMAL	-0.08	0.03	0.14	0.37	0.49	0.60
ETH/K	42	2.82	NORMAL	1.61	2.01	2.42	3.23	3.63	4.04

FORMATION

QPVP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	19	3.36	NORMAL	2.71	2.93	3.14	3.58	3.79	4.01
E URANIUM	19	0.59	NORMAL	-0.07	0.15	0.37	0.81	1.03	1.25
POTASSIUM	19	0.85	NORMAL	0.74	0.77	0.81	0.38	0.92	0.95
EU/K	19	0.64	NORMAL	-0.10	0.15	0.39	0.39	1.14	1.38
EU/ETH	19	0.17	NORMAL	0.00	0.06	0.12	0.23	0.28	0.34
ETH/K	19	2.73	NORMAL	3.03	3.26	3.50	3.96	4.20	4.43

FORMATION

QRV

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	540	4.49	NORMAL	0.01	1.51	3.00	5.98	7.48	8.97
E URANIUM	535	0.87	LOGNORMAL	0.21	0.34	0.54	1.38	2.21	3.52
POTASSIUM	540	0.86	LOGNORMAL	0.30	0.43	0.61	1.21	1.71	2.43
EU/K	535	1.23	NORMAL	-0.07	0.37	0.80	1.66	2.09	2.53
EU/ETH	535	0.27	NORMAL	-0.04	0.06	0.16	0.37	0.47	0.58
ETH/K	535	4.60	NORMAL	1.65	2.63	3.61	5.58	6.57	7.55

FORMATION

QRVB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	3279	3.64	NORMAL	-1.93	-0.08	1.78	5.49	7.35	9.21
E URANIUM	2676	0.36	LOGNORMAL	0.03	0.06	0.15	0.83	1.95	4.57
POTASSIUM	3285	0.56	LOGNORMAL	0.11	0.18	0.32	0.97	1.69	2.94
EU/K	2676	1.18	NORMAL	-0.27	0.21	0.70	1.67	2.15	2.64
EU/ETH	2661	0.22	NORMAL	-0.08	0.02	0.12	0.33	0.43	0.53
ETH/K	2675	5.30	NORMAL	0.75	2.26	3.78	6.81	8.33	9.85

ALTRAS

QUAD

FORMATION

TVA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	252	4.29	NORMAL	-0.58	1.04	2.67	5.92	7.54	9.17
E URANIUM	237	0.80	NORMAL	-0.23	0.11	0.45	1.14	1.49	1.83
POTASSIUM	252	0.89	NORMAL	-0.41	0.02	0.46	1.33	1.77	2.20
EU/K	237	0.74	LOGNORMAL	0.16	0.26	0.44	1.24	2.08	3.48
EU/ETH	237	0.18	NORMAL	0.00	0.06	0.12	0.24	0.30	0.36
ETH/K	237	5.15	NORMAL	0.82	2.26	3.70	6.59	8.03	9.48

FORMATION

PVP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	189	4.93	NORMAL	2.55	3.35	4.14	5.72	6.52	7.31
E URANIUM	181	1.21	NORMAL	-0.50	0.07	0.64	1.78	2.35	2.93
POTASSIUM	189	1.01	LOGNORMAL	0.57	0.69	0.83	1.23	1.50	1.82
EU/K	181	0.75	LOGNORMAL	0.23	0.35	0.51	1.10	1.62	2.39
EU/ETH	181	0.23	NORMAL	-0.06	0.04	0.13	0.33	0.42	0.52
ETH/K	181	4.06	NORMAL	1.67	2.47	3.27	4.86	5.66	6.45

FORMATION

RVA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	871	4.65	NORMAL	0.10	1.62	3.13	6.17	7.68	9.20
E URANIUM	856	1.19	NORMAL	-0.28	0.21	0.70	1.68	2.17	2.66
POTASSIUM	871	0.94	NORMAL	0.12	0.40	0.67	1.22	1.49	1.77
EU/K	856	1.20	NORMAL	0.01	0.41	0.80	1.60	1.99	2.39
EU/ETH	856	0.25	NORMAL	-0.05	0.05	0.15	0.35	0.44	0.54
ETH/K	856	4.36	LOGNORMAL	1.77	2.39	3.23	5.89	7.97	10.77

FORMATION

QRVP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	248	10.92	NORMAL	5.42	7.25	9.09	12.76	14.59	16.43
E URANIUM	248	3.73	NORMAL	1.45	2.21	2.97	4.49	5.26	6.02
POTASSIUM	248	2.57	NORMAL	1.47	1.83	2.20	2.94	3.31	3.67
EU/K	248	1.36	NORMAL	0.81	0.99	1.18	1.55	1.73	1.92
EU/ETH	248	0.33	NORMAL	0.19	0.23	0.28	0.37	0.42	0.46
ETH/K	248	3.93	NORMAL	2.66	3.09	3.51	4.35	4.77	5.19

ALTURAS

QUAD

FORMATION

TVB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	2513	3.40	NORMAL	0.14	1.23	2.31	4.49	5.58	6.67
E URANIUM	2384	0.76	NORMAL	-0.29	0.06	0.41	1.11	1.46	1.81
POTASSIUM	2513	0.57	NORMAL	-0.15	0.09	0.33	0.81	1.06	1.30
EU/K	2384	1.41	NORMAL	-0.51	0.13	0.77	2.05	2.69	3.34
EU/ETH	2384	0.22	NORMAL	-0.09	0.01	0.12	0.33	0.43	0.54
ETH/K	2384	5.02	LOGNORMAL	1.61	2.36	3.44	7.33	10.70	15.62

FORMATION

MC

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	29	3.45	NORMAL	1.93	2.45	2.97	4.01	4.53	5.05
E URANIUM	29	0.73	NORMAL	0.17	0.36	0.55	0.92	1.10	1.29
POTASSIUM	29	1.07	NORMAL	0.60	0.76	0.91	1.22	1.38	1.53
EU/K	29	0.63	NORMAL	0.08	0.26	0.44	0.81	0.99	1.17
EU/ETH	29	0.20	NORMAL	0.09	0.13	0.17	0.24	0.28	0.32
ETH/K	29	3.05	NORMAL	2.38	2.61	2.83	3.28	3.50	3.73

FORMATION

OC

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	86	6.06	NORMAL	-2.74	0.20	3.13	9.00	11.93	14.86
E URANIUM	76	1.56	NORMAL	-1.27	-0.33	0.61	2.50	3.44	4.38
POTASSIUM	86	1.57	NORMAL	-0.56	0.15	0.86	2.27	2.98	3.69
EU/K	76	0.79	NORMAL	-0.10	0.20	0.50	1.09	1.39	1.68
EU/ETH	76	0.21	NORMAL	0.05	0.10	0.16	0.27	0.32	0.38
ETH/K	76	3.65	NORMAL	2.03	2.57	3.11	4.19	4.73	5.27

FORMATION

TV

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	248	3.28	LOGNORMAL	0.69	1.13	1.87	5.07	8.37	13.80
E URANIUM	233	0.61	LOGNORMAL	0.09	0.17	0.32	1.16	2.19	4.15
POTASSIUM	248	0.95	NORMAL	-0.20	0.19	0.57	1.33	1.71	2.09
EU/K	233	1.13	NORMAL	-0.15	0.28	0.71	1.56	1.99	2.42
EU/ETH	233	0.22	NORMAL	-0.18	-0.04	0.09	0.35	0.48	0.62
ETH/K	233	4.11	LOGNORMAL	1.55	2.14	2.97	5.70	7.89	10.93

ALTLRAS

QUAD

FORMATION

UNK

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	224	2.95	NORMAL	0.04	1.01	1.98	3.92	4.89	5.86
E URANIUM	220	0.78	NORMAL	0.02	0.28	0.53	1.03	1.28	1.53
POTASSIUM	224	0.45	LOGNORMAL	0.19	0.26	0.36	0.68	0.93	1.28
EU/K	220	1.20	NORMAL	-0.18	0.28	0.74	1.66	2.12	2.58
EU/ETH	220	0.26	NORMAL	-0.00	0.08	0.17	0.35	0.44	0.52
ETH/K	220	4.65	NORMAL	0.28	1.73	3.19	6.11	7.57	9.02

FORMATION

TR

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	341	2.51	NORMAL	0.92	1.45	1.98	3.04	3.57	4.10
E URANIUM	333	0.98	NORMAL	-0.34	0.10	0.54	1.43	1.87	2.31
POTASSIUM	342	0.77	NORMAL	0.32	0.47	0.62	0.92	1.07	1.21
EU/K	333	1.03	LOGNORMAL	0.26	0.41	0.65	1.64	2.61	4.14
EU/ETH	330	0.26	LOGNORMAL	0.07	0.10	0.17	0.42	0.66	1.04
ETH/K	332	3.20	NORMAL	0.84	1.63	2.41	3.98	4.77	5.55

FORMATION

EC

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	240	2.90	LOGNORMAL	1.21	1.62	2.17	3.88	5.19	6.94
E URANIUM	182	0.38	LOGNORMAL	0.07	0.13	0.22	0.66	1.14	1.98
POTASSIUM	240	0.47	LOGNORMAL	0.16	0.22	0.32	0.68	0.98	1.41
EU/K	182	0.99	NORMAL	-0.14	0.24	0.61	1.36	1.74	2.11
EU/ETH	182	0.19	NORMAL	-0.07	0.02	0.10	0.27	0.36	0.44
ETH/K	182	5.28	NORMAL	2.19	3.22	4.25	6.31	7.34	8.37

FORMATION

JML

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	82	3.23	NORMAL	1.52	2.09	2.66	3.80	4.37	4.93
E URANIUM	82	1.47	NORMAL	0.90	1.09	1.28	1.66	1.86	2.05
POTASSIUM	82	0.46	LOGNORMAL	0.15	0.22	0.31	0.67	0.97	1.41
EU/K	82	1.49	LOGNORMAL	0.27	0.47	0.84	2.65	4.69	8.33
EU/ETH	82	0.44	NORMAL	0.18	0.26	0.35	0.53	0.62	0.71
ETH/K	82	5.21	LOGNORMAL	1.65	2.42	3.55	7.64	11.20	16.43

ALTLAS

QUAD

FORMATION ° JTRV

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	40	2.83	NORMAL	-0.09	0.88	1.86	3.80	4.77	5.75
E URANIUM	40	0.70	LOGNORMAL	0.28	0.38	0.52	0.95	1.29	1.75
POTASSIUM	40	0.69	LOGNORMAL	0.41	0.48	0.58	0.82	0.98	1.16
EU/K	40	1.05	NORMAL	0.07	0.40	0.72	1.38	1.70	2.03
EU/ETH	40	0.31	NORMAL	0.11	0.18	0.25	0.38	0.45	0.52
ETH/K	40	3.24	NORMAL	0.51	1.42	2.33	4.15	5.06	5.97

A P P E N D I X F

Format, Single Record Data Listing

REC NO.	LAT	LONG	RESID MAG	TERR CL	FLG	GEOL UNIT	ATM COSM	TOTAL COUNT	FLG	ETH PPM	FLG	EU PPM	FLG	K PC1	FLG	LU/ETH	EU/K	ETH/K	TEMP CELCIUS	BARO PRES MMHG
			GAMMA	FEET			CPS	U CPS												
5079	64.0086	-160.9199	55305	763	MAR	W	31	1	-12	NAD	-1.1	NAD	-0.5	NAD	0.0	NAD	0.0	0.0	12.7	746.8
5080	64.0087	-160.9189	55305	751	MAR	W	28	1	36	MAR	0.0	NAD	0.1	NAD	0.1	NAD	0.0	0.0	12.7	747.1
5081	64.0087	-160.9176	55305	741	MAR	W	26	1	4	NAD	0.2	NAD	0.1	NAD	-0.1	NAD	0.0	0.0	12.7	747.4
5082	64.0088	-160.9166	55305	730	MAR	W	35	1	-60	NAD	0.0	NAD	0.3	NAD	-0.1	NAD	0.0	0.0	12.7	747.7
5083	64.0088	-160.9154	55305	722	MAR	W	26	1	-4	NAD	-2.7	NAD	2.3	-0.4	NAD	0.0	0.0	0.0	12.7	748.0
5084	64.0089	-160.9144	55305	712	MAR	W	28	1	-12	NAD	0.5	NAD	-1.7	NAD	0.3	NAD	0.0	0.0	12.7	748.1
5085	64.0089	-160.9131	55305	702	MAR	W	23	1	37	MAR	0.0	NAD	0.4	NAD	-0.3	NAD	0.0	0.0	12.7	748.5
5086	64.0090	-160.9121	55305	691		W	22	1	50		0.3	NAD	-0.1	NAD	0.0	NAD	0.0	0.0	12.7	748.8
5087	64.0091	-160.9109	55305	680		W	23	1	46		0.3	NAD	0.0	NAD	-0.0	NAD	0.0	0.0	12.7	749.1
5088	64.0092	-160.9099	55305	673		W	17	1	72		0.6	MAR	0.3	NAD	-0.3	NAD	0.0	0.0	12.8	749.3
5089	64.0092	-160.9087	55305	668		W	20	1	156		-1.6	NAD	0.7	MAR	-0.0	NAD	0.0	0.0	12.8	749.4
5090	64.0093	-160.9075	55304	666		W	32	1	113		0.0	NAD	0.6	MAR	0.0	NAD	0.0	0.0	12.8	749.4
5091	64.0093	-160.9064	55304	667		W	30	1	247		-0.2	NAD	0.6	MAR	0.1	NAD	0.0	0.0	12.8	749.3
5092	64.0094	-160.9052	55304	671		W	29	1	343		0.2	NAD	1.1		0.3		0.0	4.0	12.8	749.2
5093	64.0094	-160.9042	55304	679		W	23	1	659		2.9		-0.8	NAD	0.8		0.0	0.0	12.8	748.9
5094	64.0095	-160.9030	55304	683		W	34	0	965		3.2		1.4		0.8		0.5	1.9	12.9	748.5
5095	64.0096	-160.9017	55305	647		KS	24	0	1208		8.6		0.0	NAD	0.5		0.0	0.0	12.9	748.1
5096	64.0096	-160.9007	55305	463		KS	12	0	945		2.5		1.7		0.5		0.7	3.5	12.9	747.8
5097	64.0098	-160.8995	55305	455		KS	20	0	831		3.0		1.5		0.6		0.5	2.8	12.9	747.6
5098	64.0098	-160.8985	55305	457		KS	22	0	759		2.2		1.4		0.3		0.6	5.1	12.9	747.1
5099	64.0099	-160.8973	55305	465		KS	29	0	699		1.7		2.0		0.5		1.1	4.4	12.9	746.5
5100	64.0100	-160.8962	55305	479		KS	28	0	610		0.5	NAD	1.3		0.4		0.0	3.7	12.9	746.1
5101	64.0100	-160.8950	55305	497		KS	26	0	581		2.2		0.5	MAR	0.3		0.2	1.6	12.9	746.0
5102	64.0101	-160.8940	55304	518		KS	35	0	512		1.3		-0.2	NAD	0.3		0.0	0.0	12.9	745.7
5103	64.0101	-160.8928	55303	540		KS	20	0	677		2.1		1.0		0.2		0.5	5.6	12.8	745.5
5104	64.0102	-160.8918	55303	569		KS	26	0	579		1.7		1.2		0.1	MAR	0.7	12.6	12.8	745.5
5105	64.0103	-160.8905	55304	608		KS	21	-1	611		3.2		3.1		0.0	NAD	1.0	0.0	12.8	745.6
5106	64.0103	-160.8895	55303	614		KS	16	-1	551		3.7		0.2	NAD	0.3		0.0	0.0	12.8	745.5
5107	64.0104	-160.8883	55304	595		KS	37	-1	488		1.6		2.4		0.1	MAR	1.5	18.6	12.5	745.4
5108	64.0105	-160.8873	55302	575		KS	22	-1	510		0.2	NAD	1.3		0.3		0.0	5.1	12.8	745.3
5109	64.0106	-160.8860	55304	552		KS	28	-1	437		0.0	NAD	1.0		0.1	MAR	0.0	9.0	12.8	745.2
5110	64.0107	-160.8848	55305	532		KS	25	-1	405		0.3	NAD	1.1		0.3		0.0	4.0	12.8	745.1
5111	64.0107	-160.8838	55305	514		KS	25	-1	379		1.0	MAR	-0.1	NAD	0.3		0.0	0.0	12.8	744.7
5112	64.0108	-160.8826	55305	501		KS	35	-1	325		0.5	MAR	1.4		0.1	MAR	2.5	13.6	12.8	744.5
5113	64.0108	-160.8816	55305	490		KS	20	-1	411		0.0	NAD	1.1		0.0	NAD	0.0	0.0	12.8	744.3
5114	64.0109	-160.8803	55305	481		KS	22	-1	417		1.0		1.0		0.1	MAR	1.0	12.7	12.9	744.3
5115	64.0110	-160.8791	55305	477		KS	28	-1	517		0.8	MAR	1.1		0.3		1.3	4.0	12.8	744.1
5116	64.0110	-160.8781	55304	479		KS	17	0	616		1.4		0.7		0.5		0.5	1.4	12.8	744.0
5117	64.0111	-160.8769	55304	486		KS	23	0	623		4.3		0.8		0.6		0.2	1.4	12.8	743.9
5118	64.0111	-160.8759	55303	493		KS	22	0	607		2.5		1.5		0.1		0.6	10.2	12.8	744.0
5119	64.0112	-160.8746	55303	510		KS	21	0	693		3.5		0.5	MAR	3.5		0.2	1.1	12.8	744.2
5120	64.0113	-160.8734	55303	509		KS	22	-1	633		2.2		2.6		0.3		1.2	8.6	12.8	744.2
5121	64.0113	-160.8724	55302	516		KS	30	-1	636		3.7		0.2	NAD	0.3		0.0	0.0	12.8	744.5
5122	64.0113	-160.8712	55302	519		KS	25	-2	777		5.1		1.5		0.3		0.3	9.9	12.8	744.9
5123	64.0113	-160.8701	55302	518		KS	26	-2	653		3.8		0.9		0.4		0.2	2.2	12.8	745.1
5124	64.0113	-160.8689	55302	517		KS	32	-2	718		0.8	MAR	1.9		0.7		2.1	2.8	12.8	745.6
5125	64.0113	-160.8677	55302	523		KS	32	-2	763		2.7		2.2		0.2		0.8	13.0	12.8	746.1
5126	64.0114	-160.8667	55302	521		KS	25	-1	781		3.2		1.3		0.6		0.4	2.4	12.8	746.4
5127	64.0114	-160.8654	55301	529		KS	26	-1	736		1.1	MAR	2.6		0.3		2.2	8.2	12.9	746.8
5128	64.0114	-160.8644	55300	574		KS	23	-1	668		3.2		0.2	NAD	0.4		0.0	0.0	12.9	747.1
5129	64.0114	-160.8632	55300	592		KS	21	0	640		2.4		3.5		-0.0	NAD	1.4	0.0	12.9	747.3
5130	64.0113	-160.8620	55300	606		KS	14	0	696		1.9		1.9		0.3		1.0	7.1	12.9	747.3
5131	64.0113	-160.8609	55302	617		KS	27	0	595		1.4		0.7	MAR	0.3		0.5	2.4	13.0	747.7

SINGLE RECORD DATA

LINE

240

PAGE

1

FINISHED OUTPUTTING LINE 240

LINE 220 FIDS 2935 TJ 4865 OUTPUT TO SRRD TAPE

A P P E N D I X G

Format, Average Record Data Listing

RECORD NUMBER	LATITUDE	LONGITUDE	RESTD TOTAL FIELD GAMMA	GLHL UNIT	CUSM CPS	ATM. URAN CPS	TOTAL COUNT CPS	ETH PPM	STD FLG	DEV	STD FLG	DEV	POT PCF	STD FLG	DEV	EU LTH RATIO	STD DEV	EU PUTA RATIO	STD DEV	ETH PUTA RATIO	STD DEV
5238	64.0098	-160.7455	55285	W	33	-6	980	3.7	1	1.9	2	0.7	1	0.5	0	2.8	0	5.2	0		
5239	64.0098	-160.7444	55283	KS	43	-6	952	3.7	0	1.9	0	0.7	0	0.5	1	2.9	0	5.3	0		
5240	64.0098	-160.7434	55285	KS	27	-5	998	3.7	0	2.1	0	0.7	0	0.6	2	3.1	1	5.3	0		
5241	64.0098	-160.7422	55287	KS	33	-5	1047	3.5	0	2.2	0	0.7	0	0.6	2	3.2	1	5.2	0		
5242	64.0098	-160.7412	55288	KS	31	-5	1083	3.5	0	2.1	0	0.7	0	0.6	2	2.9	0	4.8	0		
5243	64.0097	-160.7389	55287	KS	30	-4	1156	3.7	0	1.9	0	0.7	0	0.5	1	2.7	0	5.0	0		
5244	64.0097	-160.7389	55287	KS	31	-4	1182	4.1	0	1.9	0	0.8	0	0.5	1	2.5	0	5.3	0		
5245	64.0097	-160.7389	55286	KS	26	-4	1245	4.0	0	1.7	0	0.8	0	0.4	0	2.1	0	4.9	0		
5246	64.0096	-160.7356	55285	KS	38	-4	1148	3.8	0	1.6	0	0.8	0	0.4	0	2.1	0	4.8	0		
5247	64.0097	-160.7356	55285	KS	30	-3	1211	3.7	0	1.5	0	0.8	0	0.4	0	1.9	0	4.5	0		
5248	64.0096	-160.7344	55285	KS	30	-3	1076	3.8	0	1.5	0	0.8	0	0.4	0	1.9	0	4.7	0		
5249	64.0096	-160.7334	55284	KS	29	-3	1016	3.7	0	1.3	0	0.8	0	0.4	0	1.6	0	4.6	0		
5250	64.0096	-160.7324	55283	KS	33	-3	975	3.7	0	1.2	0	0.8	0	0.3	0	1.6	0	4.8	0		
5251	64.0095	-160.7311	55283	KS	23	-3	976	3.5	0	1.2	0	0.7	0	0.3	0	1.7	0	5.0	0		
5252	64.0095	-160.7301	55283	KS	30	-3	948	3.7	0	1.1	0	0.7	0	0.3	0	1.6	0	5.1	0		
5253	64.0095	-160.7239	55284	KS	33	-3	921	3.8	0	1.0	-1	0.7	0	0.3	0	1.4	-1	5.2	0		
5254	64.0095	-160.7278	55284	KS	37	-2	803	4.0	0	1.0	-1	0.7	0	0.3	0	1.5	-1	5.6	0		
5255	64.0095	-160.7266	55283	KS	23	-2	954	4.1	0	1.0	-1	0.7	0	0.3	-1	1.4	-1	5.5	0		
5256	64.0094	-160.7256	55283	KS	29	-1	1006	4.3	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.8	0		
5257	64.0094	-160.7244	55283	KS	37	-1	1133	4.0	0	1.0	-1	0.7	0	0.2	-1	1.3	-1	5.5	0		
5258	64.0094	-160.7233	55284	KS	23	0	1106	4.1	0	1.0	-1	0.7	0	0.2	-1	1.4	-1	5.9	0		
5259	64.0094	-160.7221	55285	KS	28	0	1034	4.1	0	0.8	-1	0.7	0	0.2	-1	1.2	-1	6.1	0		
5260	64.0094	-160.7211	55284	KS	21	0	963	4.1	0	0.8	-1	0.7	0	0.2	-1	1.3	-1	6.2	0		
5261	64.0093	-160.7199	55284	KS	27	0	840	3.7	0	0.8	-1	0.6	0	0.2	-1	1.3	-1	6.1	0		
5262	64.0093	-160.7188	55284	KS	29	0	718	3.2	0	0.9	-1	0.5	-1	0.3	0	1.7	0	6.0	0		
5263	64.0092	-160.7176	55284	KS	33	0	605	2.5	-1	0.9	-1	0.5	-1	0.4	0	1.8	0	5.2	0		
5264	64.0092	-160.7166	55284	KS	32	0	635	2.1	-1	0.8	-1	0.4	-1	0.4	0	1.9	0	5.2	0		
5265	64.0093	-160.7156	55283	KS	35	0	507	1.7	-1	0.7	-1	0.3	-1	0.4	0	2.2	0	5.3	0		
5266	64.0092	-160.7143	55283	KS	26	-1	521	1.6	-1	0.7	-1	0.3	-1	0.5	1	2.5	0	5.4	0		
5267	64.0092	-160.7133	55283	KS	19	-1	465	1.4	-1	0.8	-1	0.3	-1	0.6	2	2.9	1	5.1	0		
5268	64.0091	-160.7121	55283	W	34	-1	287	1.3	0	0.9	1	0.3	1	0.7	1	3.1	0	4.6	-1		
5269	64.0091	-160.7110	55282	KS	29	-1	398	1.3	-1	1.0	-1	0.3	-1	0.8	3	3.4	1	4.4	0		
5270	64.0092	-160.7100	55282	KS	42	-1	516	1.7	-1	1.1	0	0.3	-1	0.6	2	3.2	1	5.1	0		
5271	64.0092	-160.7090	55283	KS	29	0	716	1.9	-1	1.0	-1	0.4	-1	0.6	2	2.8	0	5.1	0		
5272	64.0092	-160.7078	55283	KS	25	0	781	2.1	-1	1.1	0	0.4	-1	0.5	1	2.9	0	5.2	0		
5273	64.0092	-160.7068	55282	KS	32	0	738	2.4	-1	1.1	0	0.4	-1	0.5	1	2.7	0	6.0	0		
5274	64.0091	-160.7057	55281	KS	25	0	853	2.5	-1	1.1	0	0.4	-1	0.5	1	2.7	0	5.9	0		
5275	64.0091	-160.7047	55282	KS	22	0	796	2.5	-1	1.1	0	0.5	-1	0.4	0	2.4	0	5.8	0		
5276	64.0091	-160.7037	55281	KS	21	0	904	2.9	-1	1.0	-1	0.5	-1	0.4	0	2.2	0	6.1	0		
5277	64.0092	-160.7025	55281	KS	37	1	810	2.9	-1	1.0	-1	0.4	-1	0.4	0	2.3	0	6.5	0		
5278	64.0092	-160.7014	55280	KS	27	2	764	3.0	0	0.9	-1	0.5	-1	0.3	0	1.9	0	6.3	0		
5279	64.0092	-160.7004	55282	KS	31	1	750	2.9	-1	0.9	-1	0.5	-1	0.3	0	2.0	0	6.0	0		
5280	64.0092	-160.6994	55283	KS	33	1	740	2.9	-1	1.0	-1	0.5	-1	0.3	0	2.1	0	6.2	0		
5281	64.0092	-160.6984	55283	KS	32	1	745	3.3	0	0.8	-1	0.5	-1	0.2	-1	1.7	0	7.1	0		
5282	64.0092	-160.6973	55283	KS	36	1	779	3.7	0	0.8	-1	0.5	0	0.2	-1	1.5	-1	6.5	0		
5283	64.0092	-160.6963	55283	KS	31	1	821	3.8	0	0.8	-1	0.6	0	0.2	-1	1.4	-1	6.6	0		
5284	64.0092	-160.6951	55283	KS	31	1	858	3.8	0	1.0	-1	0.6	0	0.3	0	1.8	0	6.5	0		
5285	64.0092	-160.6941	55284	KS	30	1	948	3.7	0	1.2	0	0.6	0	0.3	0	2.0	0	6.0	0		
5286	64.0093	-160.6931	55284	KS	26	0	1054	3.7	0	1.3	0	0.6	0	0.3	0	2.1	0	6.0	0		
5287	64.0093	-160.6920	55282	KS	32	0	963	3.3	0	1.5	0	0.6	0	0.4	0	2.4	0	5.7	0		
5288	64.0093	-160.6910	55281	KS	30	0	1040	3.3	0	1.3	0	0.6	0	0.4	0	2.1	0	5.5	0		
5289	64.0093	-160.6900	55281	KS	25	0	997	3.3	0	1.3	0	0.6	0	0.4	0	2.2	0	5.5	0		
5290	64.0093	-160.6890	55281	KS	32	0	944	3.0	0	1.5	0	0.6	0	0.5	1	2.5	0	5.0	0		

A P P E N D I X H

Format, DOE SINGLE RECORD REDUCED DATA TAPE

DOE SINGLE RECORD REDUCED DATA TAPE

Line	Character Number		
Number	12345678901	2345678901	23456789012345678901234567890123456789012
1	02	0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2			
3			SINGLE RECORD REDUCED DATA TAPE
4			
5			FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I1	NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR THIS QUADRANGLE
12			
13	5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
14	6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR FIRST SYSTEM
15			
16	7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
17			IN CPS PER PERCENT K FOR FIRST SYSTEM
18			
19	8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE
20			IN CPS PER PPM EQUIVALENT U
21			
22	9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE
23			IN CPS PER PPM EQUIVALENT TH
24			
25	10	I6	BLANK FIELD (999999)
26	11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
27			
28	12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS FOR FIRST SYSTEM
29			
30	13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST AERIAL SYSTEM
31			
32	14	I3	NUMBER OF CHANNELS (0-3 MEV) IN 2 PI SYSTEM FOR FIRST AERIAL SYSTEM
33			
34	15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR SECOND AERIAL SYSTEM
35	*	*	*
36	*	*	*
37	*	*	*
38	85-94	(SAME)	REPEAT OF ITEMS 5-14 FOR NINTH AERIAL SYSTEM
39	95	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
40	96	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
41	97	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
42	98	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT-LINE DATA WAS COLLECTED
43			
44	99-101	I4,6, &3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ON THIS TAPE
45			
46	*	*	*
47	*	*	*
48			
49	390-392	I4,6, &3	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS TAPE
50			
51			

Line	Character Number											
Number	1	2	3	4	5	6	7	8	9	0	1	2
52	FORMAT FOR SINGLE RECORD REDUCED DATA RECORD (THIRD THRU LAST BLOCK)											
53												
54	ITEM	FORMAT		DESCRIPTION								
55	1	I1		AERIAL SYSTEM IDENTIFICATION CODE								
56	2	I4		FLIGHT LINE NUMBER								
57	3	I6		RECORD IDENTIFICATION NUMBER								
58	4	I6		GMT TIME OF DAY (HHMMSS)								
59	5	F8.4		LATITUDE TO FOUR DECIMAL PLACES IN DEGREES								
60	6	F8.4		LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES								
61	7	F6.1		TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS								
62	8	F7.1		RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS								
63												
64	9	A8		SURFACE GEOLOGIC MAP UNIT CODE								
65	10	I4		QUALITY FLAG CODES								
66	11	F6.1		APPARENT CONCENTRATION OF TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE IN PERCENT K								
67												
68	12	F4.1		UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL PLACE IN PERCENT K								
69												
70	13	F6.1		APPARENT CONCENTRATION OF TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U								
71												
72	14	F4.1		UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT U								
73												
74	15	F6.1		APPARENT CONCENTRATION OF TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH								
75												
76	16	F4.1		UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH								
77												
78	17	F6.1		URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH								
79												
80	18	F6.1		URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K								
81												
82	19	F6.1		THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K								
83												
84	20	F8.1		GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND								
85												
86	21	F6.1		UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL PLACE IN COUNTS PER SECOND								
87												
88	22	F5.1		ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U								
89												
90	23	F4.1		UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL PLACE IN PPM EQUIVALENT U								
91												
92	24	F4.1		OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS								
93												
94	25	F5.1		OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG								

A P P E N D I X I

Format, DOE RAW SPECTRAL DATA TAPE

DOE RAW SPECTRAL DATA TAPE

Line	Character number
Number	12345678901234567890123456789012345678901234567890123456789012

1	01	0978	(DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2			
3			RAW SPECTRAL DATA TAPE
4			
5			FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK ON TAPE)
6			
7	ITEM	FORMAT	DESCRIPTION
8	1	A40	QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2	A20	NAME OF SUBCONTRACTOR
10	3	I4	APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4	I1	AERIAL SYSTEM IDENTIFICATION CODE
12	5	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER
13	6	I3	BFEC CALIBRATION REPORT NUMBER
14	7	F6.3	4PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
15			
16	8	F6.3	2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL PLACES IN SECONDS
17			
18	9	I3	NUMBER OF CHANNELS (0-3 MEV) FOR 4PI SYSTEM
19	10	I3	NUMBER OF CHANNELS (0-3 MEV) FOR 2PI SYSTEM
20	11	I3	NUMBER OF FLIGHT LINES ON THIS TAPE
21	12	I4	FIRST FLIGHT LINE NUMBER ON THIS TAPE
22	13	I6	FIRST RECORD NUMBER OF FIRST FLIGHT LINE
23	14	I3	JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE WAS COLLECTED
24			
25	15-17	I4,6 &3	REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS TAPE
26			
27	*	*	*
28	*	*	*
29	*	*	*
30	306-308	I4,6 &3	REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS TAPE
31			
32			
33			FORMAT FOR RAW SPECTRAL DATA RECORD (THIRD THRU LAST BLOCK ON TAPE)
34			
35	ITEM	FORMAT	DESCRIPTION
36	1	I1	AERIAL SYSTEM IDENTIFICATION CODE
37	2	I4	FLIGHT LINE NUMBER
38	3	I6	RECORD IDENTIFICATION NUMBER
39	4	I6	GMT TIME OF DAY (HHMMSS)
40	5	F8.4	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
41	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
42	7	F6.2	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
43	8	F7.1	TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE IN GAMMAS
44			
45	9	A8	SURFACE GEOLOGIC MAP UNIT CODE
46	10	I4	QUALITY FLAG CODES
47	11	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN DEGREES CELSIUS
48			
49	12	F5.1	OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
50	13	F5.3	LIVE TIME COUNTING PERIOD TO THREE DECIMAL PLACES IN SECONDS
51			

[illegible]

A P P E N D I X J

Format, DOE STATISTICAL ANALYSIS DATA TAPE

DOE STATISTICAL ANALYSIS DATA TAPE

Line	Character Number
1	03 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2	
3	STATISTICAL ANALYSIS DATA TAPE
4	
5	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6	
7	ITEM FORMAT DESCRIPTION
8	1 A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2 A20 NAME OF SUBCONTRACTOR
10	3 I4 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4 I1 NUMBER OF AERIAL SYSTEMS USED TO COLLECT DATA FOR
12	
13	5 I1 THIS QUADRANGLE
14	6 A20 AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM
15	
16	7 F6.1 AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR
17	
18	
19	8 F6.1 FIRST SYSTEM
20	
21	
22	9 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
23	
24	
25	10 I6 TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE
26	11 F6.3 IN CPS PER PERCENT K
27	
28	12 F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
29	
30	
31	13 F6.1 TERRESTRIAL URANIUM (B1-214) TO ONE DECIMAL PLACE
32	
33	
34	14 F6.1 IN CPS PER PPM EQUIVALENT U
35	
36	
37	15-24 (SAME) NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO
38	
39	
40	
41	
42	
43	
44	
45	
46	
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48	
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51	

Line	Character Number
Number	1234567890123456789012345678901234567890123456789012

52	FORMAT FOR STATISTICAL ANALYSIS DATA RECORD. (THIRD THRU LAST BLOCK)		
53			
54	ITEM	FORMAT	DESCRIPTION
55	1	I1	AERIAL SYSTEM IDENTIFICATION CODE
56	2	I4	FLIGHT LINE NUMBER
57	3	I6	RECORD IDENTIFICATION NUMBER
58	4	I6	GMT TIME OF DAY (HHMMSS)
59	5	F.84	LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
60	6	F8.4	LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
61	7	F6.1	TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
62	8	F7.1	RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY
63			TO ONE DECIMAL PLACE IN GAMMAS
64	9	A8	SURFACE GEOLOGIC MAP UNIT CODE
65	10	I5	QUALITY FLAG CODES
66	11	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL POTASSIUM
67			(K-40) TO ONE DECIMAL PLACE IN PERCENT K
68	12	F4.1	UNCERTAINTY IN TERRESTRIAL POTASSIUM TO ONE DECIMAL
69			PLACE IN PERCENT K
70	13	F5.1	POTASSIUM STANDARD DEVIATION FROM THE MEAN TO ONE
71			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
72	14	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL URANIUM
73			(BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
74	15	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL
75			PLACE IN PPM EQUIVALENT U
76	16	F5.1	URANIUM STANDARD DEVIATION FROM THE MEAN TO ONE
77			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
78	17	F6.1	AVERAGED CONCENTRATION OF TERRESTRIAL THORIUM
79			(TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH
80	18	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL
81			PLACE IN PPM EQUIVALENT TH
82	19	F5.1	THORIUM STANDARD DEVIATION FROM THE MEAN TO ONE
83			DECIMAL PLACE AND ALGEBRAICALLY SIGNED
84	20	F8.1	GROSS GAMMA (0.4-3.0 MEV) COUNT RATE TO ONE DECIMAL
85			PLACE IN COUNTS PER SECOND
86	21	F6.1	UNCERTAINTY IN GROSS GAMMA COUNT RATE TO ONE DECIMAL
87			PLACE IN COUNTS PER SECOND
88	22	F5.1	ATMOSPHERIC BI-214 4PI CORRECTION TO ONE DECIMAL
89			PLACE IN PPM EQUIVALENT U
90	23	F4.1	UNCERTAINTY IN ATMOSPHERIC BI-214 4PI CORRECTION
91			TO ONE DECIMAL PLACE IN PPM EQUIVALENT U
92	24	F6.1	AVERAGED URANIUM-TO-THORIUM RATIO TO ONE DECIMAL
93			PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
94	25	F5.1	URANIUM-TO-THORIUM RATIO STANDARD DEVIATION FROM THE
95			MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY SIGNED
96	26	F6.1	AVERAGED URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
97			PLACE IN PPM EQUIVALENT U PER PERCENT K
98	27	F5.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
99			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
100			SIGNED
101	28	F6.1	AVERAGE THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL
102			PLACE IN PPM EQUIVALENT TH PER PERCENT K
103	29	F5.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION FROM
104			THE MEAN TO ONE DECIMAL PLACE AND ALGEBRAICALLY
105			SIGNED

A P P E N D I X K

Format, DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE

DOE STATISTICAL ANALYSIS SUMMARY DATA TAPE

Line Number	Character Number
1	05 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODE)
2	
3	STATISTICAL ANALYSIS SUMMARY TAPE (OR FILE)
4	
5	FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6	
7	ITEM FORMAT DESCRIPTION
8	1 A40 QUADRANGLE NAME AS PROJECT IDENTIFICATION
9	2 A20 NAME OF SUBCONTRACTOR
10	3 I4 APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11	4 I6 NUMBER OF GEOLOGIC MAP UNITS USED FOR THIS
12	QUADRANGLE
13	
14	FORMAT FOR STATISTICAL ANALYSIS SUMMARY DATA RECORD (THIRD THRU LAST
15	BLOCK)
16	
17	ITEM FORMAT DESCRIPTION
18	1 A8 SURFACE GEOLOGIC MAP UNIT IDENTIFYING CODE
19	2 I6 TOTAL RECORDS FOR GEOLOGIC MAP UNIT
20	3 I6 NUMBER OF POTASSIUM RECORDS COMPUTED FOR GEOLOGIC
21	UNITS
22	4 F6.1 POTASSIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE
23	IN PERCENT K
24	5 F6.1 POTASSIUM CONCENTRATION STANDARD DEVIATION TO ONE
25	DECIMAL PLACE IN PERCENT K
26	6 A3 POTASSIUM CONCENTRATION DISTRIBUTION CODE
27	7 I6 NUMBER OF URANIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
28	8 F6.1 URANIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE
29	IN PPM EQUIVALENT U
30	9 F6.1 URANIUM CONCENTRATION STANDARD DEVIATION TO ONE
31	DECIMAL PLACE IN PPM EQUIVALENT U
32	10 A3 URANIUM CONCENTRATION DISTRIBUTION CODE
33	11 I6 NUMBER OF THORIUM RECORDS COMPUTED FOR GEOLOGIC UNIT
34	12 F6.1 THORIUM CONCENTRATION MEAN TO ONE DECIMAL PLACE IN
35	PPM EQUIVALENT TH
36	13 F6.1 THORIUM CONCENTRATION STANDARD DEVIATION TO ONE
37	DECIMAL PLACE IN PPM EQUIVALENT TH
38	14 A3 THORIUM CONCENTRATION DISTRIBUTION CODE
39	15 I6 NUMBER OF URANIUM-TO-THORIUM RATIO RECORDS COMPUTED
40	FOR GEOLOGIC UNIT
41	16 F6.1 URANIUM-TO-THORIUM RATIO MEAN TO ONE DECIMAL PLACE
42	IN PPM EQUIVALENT U PER PPM EQUIVALENT TH
43	17 F6.1 URANIUM-TO-THORIUM RATIO STANDARD DEVIATION TO ONE
44	DECIMAL PLACE IN PPM EQUIVALENT U PER PPM EQUIVALENT
45	TH
46	18 A3 URANIUM-TO-THORIUM RATIO DISTRIBUTION CODE
47	19 I6 NUMBER OF URANIUM-TO-POTASSIUM RATIO RECORDS
48	COMPUTED FOR GEOLOGIC UNIT
49	20 F6.1 URANIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE
50	IN PPM EQUIVALENT U PER PERCENT K

Line	Character Number																															
Number	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2
51	21	F6.1	URANIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE																													
52			DECIMAL PLACE IN PPM EQUIVALENT U PER PERCENT K																													
53	22	A3	URANIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE																													
54	23	I6	NUMBER OF THORIUM-TO-POTASSIUM RATIO RECORDS																													
55			COMPUTED FOR GEOLOGIC UNIT																													
56	24	F6.1	THORIUM-TO-POTASSIUM RATIO MEAN TO ONE DECIMAL PLACE																													
57			IN PPM EQUIVALENT TH PER PERCENT K																													
58	25	F6.1	THORIUM-TO-POTASSIUM RATIO STANDARD DEVIATION TO ONE																													
59			DECIMAL PLACE IN PPM EQUIVALENT TH PER PERCENT K																													
60	26	A3	THORIUM-TO-POTASSIUM RATIO DISTRIBUTION CODE																													

A P P E N D I X L

Format, DOE MAGNETIC DATA TAPE

DOE MAGNETIC DATA TAPE FORMAT

Line Character Number
 Number 12345678901234567890123456789012345678901234567890123456789012

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1  04 0978 (DATA TAPE TYPE AND FORMAT SPECIFICATION DATE CODES)
2
3  MAGNETIC DATA TAPE
4
5  FORMAT FOR TAPE IDENTIFICATION BLOCK (SECOND BLOCK)
6
7  ITEM      FORMAT  DESCRIPTION
8  1         A40     QUADRANGLE NAME AS PROJECT IDENTIFICATION
9  2         A20     NAME OF SUBCONTRACTOR
10 3         I4      APPROXIMATE DATE OF SURVEY (MONTH, YEAR)
11 4         I3      NUMBER OF FLIGHT LINES ON THIS TAPE
12 5         I4      FIRST FLIGHT LINE OF THIS TAPE
13 6         I6      FIRST RECORD NUMBER OF FIRST FLIGHT LINE
14 7         I3      JULIAN DATE (DAY OF YEAR) FIRST FLIGHT LINE DATA WAS
15                COLLECTED
16 8         F8.4    LATITUDE OF GROUND BASE STATION TO FOUR DECIMAL
17                PLACES IN DEGREES FOR FIRST FLIGHT LINE
18 9         F8.4    LONGITUDE OF GROUND BASE STATION TO FOUR DECIMAL
19                PLACES IN DEGREES FOR FIRST FLIGHT LINE
20 10-14     (SAME)  REPEAT OF ITEMS 5-9 FOR SECOND FLIGHT LINE ON THIS
21                TAPE
22 *         *              *
23 *         *              *
24 *         *              *
25 495-499   (SAME)  REPEAT OF ITEMS 5-9 FOR 99TH FLIGHT LINE ON THIS
26                TAPE
27
28 FORMAT FOR MAGNETIC DATA RECORD (THIRD THRU LAST BLOCK)
29
30 ITEM      FORMAT  DESCRIPTION
31 1         I1      AERIAL SYSTEM IDENTIFICATION CODE
32 2         I4      FLIGHT LINE NUMBER
33 3         I6      RECORD IDENTIFICATION NUMBER
34 4         I6      GMT TIME OF DAY (HHMMSS)
35 5         F8.4    LATITUDE TO FOUR DECIMAL PLACES IN DEGREES
36 6         F8.4    LONGITUDE TO FOUR DECIMAL PLACES IN DEGREES
37 7         F6.1    TERRAIN CLEARANCE TO ONE DECIMAL PLACE IN METERS
38 8         F5.1    OUTSIDE AIR PRESSURE TO ONE DECIMAL PLACE IN MMHG
39 9         A8      SURFACE GEOLOGIC MAP UNIT CODE
40 10        F7.1    TOTAL MAGNETIC FIELD INTENSITY TO ONE DECIMAL PLACE
41                IN GAMMAS
42 11        F7.1    RESIDUAL (IGRF REMOVED) MAGNETIC FIELD INTENSITY
43                TO ONE DECIMAL PLACE IN GAMMAS
44 12        F7.1    DIURNAL MAGNETIC INTENSITY VARIATION TO ONE DECIMAL
45                PLACE IN GAMMAS
46 13        F7.1    MAGNETIC DEPTH-TO-BASEMENT TO ONE DECIMAL PLACE
47                IN METERS (IF REQUIRED)
  
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A P P E N D I X M

Reduced Calibration and Test Line Data

Reduced Calibration and Test Line Data

<u>Date</u>	<u>Flight</u>	<u>Res. Thor.</u>	<u>Res. Thor.</u>	<u>Low Preflight</u>			<u>Low Post Flight</u>		
		<u>583</u>	<u>2615</u>	<u>Alt.</u>	<u>T.C.</u>	<u>2π</u>	<u>Alt.</u>	<u>T.C.</u>	<u>2π</u>
08/28/80	40	6.7%	9.2%	400'	1225	9	No Test		
08/29/80	41	6.3%	9.3%	400'	1300	11	400'	1200	10
08/29/80	42	6.3%	9.3%	400'	1300	11	400'	1200	10
08/29/80	43	6.3%	9.3%	400'	1300	11	400'	1200	10
09/06/80	59	6.2%	9.0%	400'	1250	12	400'	1250	11
09/06/80	60	6.2%	9.0%	400'	1250	12	400'	1250	11
09/11/80	63	6.0%	9.3%	400'	1225	11	No Test		
09/11/80	69	6.0%	9.3%	400'	1225	11	No Test		
09/11/80	70	6.0%	9.3%	400'	1225	11	No Test		
09/11/80	71	6.0%	9.3%	400'	1225	11	No Test		
09/11/80	72	6.0%	9.3%	400'	1225	11	No Test		
09/17/80	36	5.9%	9.4%	No Test			No Test		
09/27/80	117	5.3%	8.9%	400'	1225	14	400'	1175	9
09/27/80	118	5.3%	8.9%	400'	1225	14	400'	1175	9
09/30/80	126	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

N/A = NOT AVAILABLE

A P P E N D I X N

Renumbered to Original Fiducial Correlations

ALTURAS QUADRANGLE

LINE 450 FLOWN AS LINE 450 AND 452

MAP FIDUCIALS 17962 TO 19166 CORRESPOND TO ORIGINAL FIDUCIALS 19166 TO 17962
 MAP FIDUCIALS 19167 TO 20832 CORRESPOND TO ORIGINAL FIDUCIALS 4341 TO 2675

LINE 460 FLOWN AS LINE 460 AND 462

MAP FIDUCIALS 16702 TO 17769 CORRESPOND TO ORIGINAL FIDUCIALS 17769 TO 16702
 MAP FIDUCIALS 17770 TO 19362 CORRESPOND TO ORIGINAL FIDUCIALS 893 TO 2485

LINE 470 FLOWN AS LINE 470

MAP FIDUCIALS 14146 TO 11852 CORRESPOND TO ORIGINAL FIDUCIALS 11852 TO 14146

LINE 480 FLOWN AS LINE 480 AND 483

MAP FIDUCIALS 1832 TO 2027 CORRESPOND TO ORIGINAL FIDUCIALS 2027 TO 1832
 MAP FIDUCIALS 2028 TO 4482 CORRESPOND TO ORIGINAL FIDUCIALS 8967 TO 11638

LINE 490 FLOWN AS LINE 490

MAP FIDUCIALS 3981 TO 7070 CORRESPOND TO ORIGINAL FIDUCIALS 7070 TO 3981

LINE 500 FLOWN AS LINE 500 AND 502

MAP FIDUCIALS 1009 TO 867 CORRESPOND TO ORIGINAL FIDUCIALS 867 TO 1009
 MAP FIDUCIALS 868 TO 3856 CORRESPOND TO ORIGINAL FIDUCIALS 1740 TO 3845

LINE 510 FLOWN AS LINE 510

MAP FIDUCIALS 2562 TO 5313 CORRESPOND TO ORIGINAL FIDUCIALS 5313 TO 2562

LINE 520 FLOWN AS LINE 520

MAP FIDUCIALS 5529 TO 8443 CORRESPOND TO ORIGINAL FIDUCIALS 8443 TO 5529

LINE 530 FLOWN AS LINE 530

MAP FIDUCIALS 12888 TO 15914 CORRESPOND TO ORIGINAL FIDUCIALS 15914 TO 12888

LINE 540 FLOWN AS LINE 540

MAP FIDUCIALS 16092 TO 19663 CORRESPOND TO ORIGINAL FIDUCIALS 19663 TO 16092

LINE 550 FLOWN AS LINE 552 AND 553

MAP FIDUCIALS 6272 TO 7035 CORRESPOND TO ORIGINAL FIDUCIALS 7035 TO 6272
 MAP FIDUCIALS 7036 TO 9264 CORRESPOND TO ORIGINAL FIDUCIALS 7287 TO 9516

LINE 560 FLOWN AS LINE 561 AND 562

MAP FIDUCIALS 4519 TO 5334 CORRESPOND TO ORIGINAL FIDUCIALS 5334 TO 4519
 MAP FIDUCIALS 5335 TO 7997 CORRESPOND TO ORIGINAL FIDUCIALS 12555 TO 9893

LINE 3060 FLOWN AS LINE 3061 AND 3060

MAP FIDUCIALS 895 TO 1448 CORRESPOND TO ORIGINAL FIDUCIALS 1448 TO 895
 MAP FIDUCIALS 1449 TO 2800 CORRESPOND TO ORIGINAL FIDUCIALS 65 TO 1417

LINE 3070 FLOWN AS LINE 3071 AND 3070

MAP FIDUCIALS 5140 TO 6467 CORRESPOND TO ORIGINAL FIDUCIALS 6467 TO 5140
 MAP FIDUCIALS 6468 TO 6780 CORRESPOND TO ORIGINAL FIDUCIALS 4904 TO 4591

LINE 3080 FLOWN AS LINE 3080

MAP FIDUCIALS 8426 TO 10295 CORRESPOND TO ORIGINAL FIDUCIALS 10295 TO 8426

LINE 3090 FLOWN AS LINE 3090
MAP FIDUCIALS 10509 TO 12415 CORRESPOND TO ORIGINAL FIDUCIALS 12415 TO 10509

LINE 3100 FLOWN AS LINE 3100
MAP FIDUCIALS 14336 TO 16192 CORRESPOND TO ORIGINAL FIDUCIALS 16192 TO 14336

LINE 3110 FLOWN AS LINE 3110
MAP FIDUCIALS 17299 TO 18433 CORRESPOND TO ORIGINAL FIDUCIALS 18433 TO 17299