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GJBX--388-81 Vol. 1

DE82 005536

National Uranium Resource Evaluation

**Airborne Gamma-Ray Spectrometer
And Magnetometer Survey
Roseburg Quadrangle, Oregon**

Final Report - Volume I

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

March 1981

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

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AIRBORNE GAMMA-RAY SPECTROMETER
AND
MAGNETOMETER SURVEY

ROSEBURG
OREGON

FINAL REPORT
VOLUME I

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AERO SERVICE DIVISION
WESTERN GEOPHYSICAL COMPANY
OF AMERICA
HOUSTON, TEXAS

APRIL 1981

PREPARED FOR THE U. S. DEPARTMENT OF ENERGY
ASSISTANT SECRETARY FOR RESOURCE APPLICATIONS
GRAND JUNCTION OFFICE, COLORADO
UNDER CONTRACT NO. DE-AC13-76GJ01664
AND BENDIX FIELD ENGINEERING CORPORATION
SUBCONTRACT NO. 80-460
PROJECT NO. IGO205

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Figure 1

ROSEBURG QUADRANGLE

INDEX MAP

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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 Roseburg, Oregon, 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 1596 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.

Figure 2

9/10

FLIGHT PATH
ROSEBURG
MK 10-2
DOE/NUCE

X.....FILM IDENTIFIED TRAVERSE/TIE LINE INTERSECTION
A.....FILM IDENTIFIED BROWNING CONTROL
.....INDEX FIDUCIAL (100 FIDUCIAL INTERVALS)
FLORIN 1000

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

Aircraft Specifications and Characteristics

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

8-19-88 LML

J
H
G
F
E
D
C
B
A

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AERO SERVICE
LITTON HOUSTON TEXAS

DWN	DATE	TITLE
CHKD		BLOCK DIAGRAM
		HISENS AGRS 2000R SYSTEM

SIZE	DRAWING NO	REV	SHEI
B			

Figure 3

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 μ seconds per pulse due to the converter and approximately 1.5 μ seconds due to the remainder of the electronic circuit, for a combined total dead time of approximately 9.5 μ seconds 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 Roseburg, Oregon, 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 1596 miles are in the Roseburg 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 Roseburg 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 I I
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 410 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
CUAD ROSEBURG

TERRAIN CLEARANCE HISTOGRAM
JOB 627

AERG SERVICE
QUAD ROSEBURG

GROUND SPEED
JOB 627

HISTOGRAM

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)
$U_{2\pi}$	:	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:

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

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

$2.33 (\text{Sum Corrections})^{1/2} < \text{Count Rate} < 2.71 + 4.65 (\text{Sum Corrections})^{1/2}$:
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, in gammas. 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 Roseburg quadrangle is located in southwestern Oregon and includes the area between 43° to 44° north latitude and 122° to 124° west longitude. It covers parts of Coos, Douglas, Lane, and Klamath counties.

Portions of four geomorphic provinces are located within the survey area. Each is characterized by a relatively unique suite of rocks and resulting topographic expressions. The pre-Tertiary rocks of the Klamath Mountains province form a region of generally rugged topography characterized by steep slopes, narrow sinuous ridges, and deep canyons. Elevations range from approximately 600 feet above sea level at Dillard and Myrtle Creek to 3468 feet a.s.l. at Lane Mountain. The Coastal Range province occupies the majority of the western half of the map area. Over this area of Tertiary marine sediments and submarine lavas, the topography exhibits lower relief and is less deformed than in the Klamath Mountains region. Elevations are generally higher in the southern portion of the Range and vary between lows of less than 200 feet a.s.l. along portions of the Umpqua River to highs over 3175 feet and 3290 feet a.s.l. at Bear Mountain and Kenyon Mountain respectively. A small portion of the north-central part of the area is within the limits of the Willamette Valley, a relatively flat alluvial plain with occasional low hills. The remainder of the quadrangle falls within the Western and High Cascades provinces. The Western Cascades are characterized by a rugged topography having irregular ridges and deep narrow valleys. This area is covered primarily by late Eocene to late Miocene volcanic flows and pyroclastic rocks. Elevations range from less than 1000 feet up to 5933 feet a.s.l. at Bohemia Mountain. The High Cascades form a relatively narrow, high plateau built up by Plio-Pleistocene volcanic rocks. Superimposed upon this plateau are the peaks of even younger volcanoes. The highest elevations attained within the Roseburg quadrangle are found in this area, reaching up to 8744 feet a.s.l. at Diamond Peak.

The Cascade Range forms an effective weather barrier which separates Oregon into a well-watered, vegetated western region and a semi-arid to arid eastern region. The climate within the survey area is moderate to moist and temperate. Summers are generally warm and dry with intermittent rain while winters are cool and wet. Due to the proximity of the Pacific Ocean and the

prevailing westerly winds, annual rainfall can reach up to one hundred inches along the interior uplands of the western part of the area.

The area is well drained by a number of rivers and creeks. Major among these are the Umpqua River system and its tributaries.

The geology of the Roseburg quadrangle was compiled in 1980 by Martel Laboratories, Inc., for the U. S. Department of Energy for use in the present radiometric survey program. It is based on pre-existing publications of the U. S. Geologic Survey and the State of Oregon Department of Geology and Mineral Industries.

Stratigraphy

Rocks exposed in the survey area range in age from late Jurassic through Recent time.

Exposures of Jurassic and Cretaceous age are restricted to outcrops in the southern part of the quadrangle in the Klamath Mountains province. The principal geologic units mapped here include rocks of the Dothan, Galice, and Rogue formations. This group of formations has, in turn, been divided into sedimentary, igneous, and metamorphic units. The exact stratigraphic relationship of these three formations is uncertain. However, most recent studies favor a Rogue, Galice, then Dothan stratigraphic succession with the Rogue and Galice formations being pre-Nevadan in age or at least pre-dating the later phases of this orogeny. This is based, in part, on intrusives of the Nevadan Orogeny cutting these two formations while the Dothan formation lacks these intrusions suggesting a post-Nevadan age of deposition.

Also included in the Klamath Mountains province are numerous small exposures of the Riddle formation. It is given a Late Jurassic age on the map used here. However, most evidence points to an Early Cretaceous age. Two small outcrops of marine sedimentary rocks of Cretaceous age are approximately located in the extreme southern part of the area.

At the close of the Mesozoic era, much of Oregon was covered by warm, shallow, tropical seas, the eastern margins of which are under the present Cascade Range. The northern Klamath Mountains were the primary source of thousands of feet of sediments which accumulated in a large geosynclinal basin occupying an area now covered by the Coast Range and Willamette Valley. These sediments are interbedded with vast quantities of lavas, basalt flows,

breccias, and pyroclastics contributed by almost continuous early and middle Eocene volcanism. Spasmodic tectonic events in the southern part of the basin and the Klamath Mountains are reflected by unconformities separating the early through early late Eocene formations. The base of Eocene deposition is formed by the Umpqua formation. This same unit has been mapped elsewhere as the Roseburg, Lookingglass, and Flourney formations. These were followed by deposition of the Tyee and Burpee formations and then the Yam Hill formation. Marine sedimentary rocks laid down in the Roseburg area up through the close of Eocene time include parts of the Elkton, Bateman, and Spencer formations of Baldwin (1974). He also gives formational status to two units of late Eocene pyroclastic rocks, the Colestine and Fisher formations.

During Oligocene time, the basin continued to decrease in size and the Coast Range began to form. An arm of the sea extended southward into the Willamette Valley. Tuffaceous sediments of the Eugene formation were deposited here by westward flowing rivers carrying ash erupted from the volcanoes that were building the Cascade Range.

Volcanic material continued to accumulate over the Cascade Range during the Miocene epoch. At the same time, continuing uplift occurred over most of Western Oregon. By the close of the Pliocene epoch, the main Cascade Range had been formed and the High Cascades were beginning to develop. Volcanic activity continued through the Pleistocene epoch and into Holocene time further adding to the High Cascades. The eruption of Mount Mazama led to the formation of the Crater Lake caldera (located south of the survey area in the Medford quadrangle). Ash from this and other Holocene eruptions has formed deposits mantling many slopes of the central High Cascade Range.

A description of the various geologic formations mapped in the Roseburg quadrangle is given below, beginning with the oldest.

Sedimentary Rocks of the Galice Formation (Jg)

This subunit of the Galice formation is formed by thick sections of marine sedimentary rocks. As mapped here, it is reported to consist primarily of dark-gray to black fine-grained, thinly layered slaty to phyllitic mudstones. It has been described elsewhere as containing dark slaty siltstone with interbeds of graywacke sandstone in lesser amounts plus conglomerate in occasional lenses.

Volcanics of the Galice and Rogue Formations (Jgv)

Interbedded with the sediments of the Galice formation are thick greenish-gray, altered andesite and basalt flows, flow breccias, and agglomerates. Volcanics of the older Rogue formation consist of rocks varying in composition from intermediate to felsic including andesitic to dacitic flow rock, tuff, flow breccias and pillow lavas. Regional low grade metamorphism has altered these volcanic rocks to hard, siliceous greenstone.

Metamorphic Rocks Derived from the Galice and Rogue Formations (Jgg)

These rocks include localized pyroxene gneiss and amphibole gneiss. The pyroxene gneiss has, in places, been reduced to tremolite-chlorite-calcite schist.

Sedimentary Rocks of the Dothan Formation (Jd)

The Dothan formation sedimentary rocks are the most extensive of the Upper Jurassic deposits. They form a thick series of predominately massive, well-indurated, medium grained, poorly to moderately sorted lithic graywackes. Also included in lesser amounts may be local interbeds of dark gray to black mudstone, some shale, lenticular bodies of thin bedded chert, and possibly some scarce conglomerate composed of greenstone and chert clasts and/or, more rarely, quartz rich granitic cobbles.

Volcanics of the Dothan Formation (Jdv)

These are primarily green to rust-red, altered dense basalt flows and flow breccia, commonly amygdaloidal and often exhibiting pillow structures.

Metamorphic Rocks Derived from the Dothan Formation (Jdg)

Metamorphic rocks derived from the Dothan formation include gneiss and schist.

Riddle Formation (Jr)

Though mapped here as a late Jurassic unit, the Riddle formation is generally considered to be of early Cretaceous age. It consists of massive chert pebble conglomerate overlain by alternating medium-bedded dark-gray lithic sandstone, siltstone, and conglomerate and a few small limestone lentils. As mapped here, it is reported as dark-gray siltstone.

Peridotite and Serpentine (Jui)

The Peridotite is described by Wells (1955) as green medium-grained rock consisting of olivine with or without other mafic minerals. The alteration process forming the Serpentine is uncertain as is the time of alteration. It is yellow through olive green to black in color occurring in small blocks or aggregations of curved shiny translucent plates, Wells (1955).

Felsic Intrusive Rocks (KJif)

Exposures of these Jurassic and Cretaceous rocks are limited to two small outcrops in the Klamath Mountains. The unit was not overflowed nor sampled by the present survey.

Marine Sedimentary Rocks (Klm)

The unit, as mapped here, is described as alternating well-indurated greenish-gray fine-grained sandstone and sandy siltstone.

Basalt (Telb)

This unit corresponds for the most part to the submarine basalt flows, pillow lavas, and breccias which form the base of the Umpqua formation. Outcrops are generally found in the axial zones of northeast trending anticlines and on the upthrust side of local faults. The basalts are dark gray, aphanitic to porphyritic and range in composition from tholeiitic to olivine-rich. Constituents found in small amounts include up to 12% magnetite along with minor hypersthene and apatite. This unit is comparable to the Siletz River volcanics found to the north. Age assignments are generally given as early Eocene.

Umpqua Formation (Telu)

The Umpqua formation is made up of three thick, unconformably-bound sequences of rhythmically bedded sandstone, siltstone and/or mudstone each of which are underlain by basal conglomerate or pebbly sandstone. The lower sequence conformably overlies the Umpqua basalts in most places. However, along the northeast trending Bonanza fault, the basalts have been thrust over the upper sequence member and the middle member is missing. Baldwin (1974) has given formational status to these three members calling them the Roseburg, Lookingglass, and Flournoy formations respectively. He includes the Umpqua basalts as the base of the Roseburg formation.

Sediments of the lower Umpqua member consist of a local basal cobble conglomerate with clasts of basalt, quartzite, sandstone and chert. Overlying this are several thousand feet of rhythmically bedded olive-green to gray sandstone and shale. The sandstone is a well-indurated, fine to medium grained, lithic to feldspathic graywacke. The basal conglomerate of the middle member ranges from zero to seven hundred (700) feet in thickness and contains pebbles of quartzite, chert, basalt, metamorphic rocks, and granite. Medium- to coarse-grained, lithic to feldspathic graywackes overlie the conglomerate and in turn grade upward into sandstone and mudstone and then siltstone high in the section. Overall thickness of the middle member ranges up to 7000 feet. The upper member consists of up to 3900 feet of basal sandstone and pebbly sandstone and overlying gray siltstone with minor thin beds of sandstone.

Sediments of the Umpqua formation range in age from early through middle Eocene.

Tyee and Burpee Formation (Teme)

The Tyee formation is an upper middle Eocene unit of rhythmically bedded, bluish-gray to gray micaceous and feldspathic sandstone and dark mudstone. The Roseburg quadrangle falls within the southern part of the Tyee depositional basin. Here, conglomerates of andesite, quartzite, chert, and basalt plus local coal beds are also significant constituents. Total thickness of this unit is approximately 7000 feet.

Yam Hill Formation (Tem)

As mapped here, sediments of the Yam Hill formation are described as dark-gray, faintly bedded shale and siltstone along with some massive basaltic sandstone and rhythmically bedded sandstone and siltstone. It is exposed over a large area along the Elkton syncline south of the Umpqua River. The formation is generally given an upper middle to lower late Eocene age.

Marine Sedimentary Rocks (Teum)

This unit is found in two outcrop areas in the Roseburg quadrangle where it corresponds to either the Bateman or Spencer formations as mapped by Baldwin (1974). Exposures overlying the Yam Hill formation along the Elkton syncline correlate with the Bateman formation. The unit comprises up to 1500 feet of shallow water marine and continental beds consisting of cross-bedded

and current sorted sandstone with some interbedded silty sandstone and siltstone. Coal beds occur in the upper part of the unit. The outcrop area along the western margin of the Willamette Valley correlates with the Spencer formation. Here these rocks unconformably overlie the Tyee formation. The Spencer formation is a late Eocene unit of massive, arkosic, micaceous, semi-friable sandstone containing interbeds of light colored fissile sandstone and fine tuff. It thickens in a northward direction toward the Eugene area where it reaches a thickness of approximately 2000 feet.

Pyroclastic Rocks (Teup)

These are the only completely nonmarine rocks of Eocene age found in the area. They consist of a series of flows, breccias, tuffs, and tuffaceous sandstones and conglomerates. These rocks correspond to parts of the Colestin formation.

Eugene Formation (Tom)

This is an early and middle Oligocene unit found only in the central and southern Willamette Valley. It consists of neritic, yellowish-gray, arkosic and tuffaceous volcanic sandstone. Vitric tuffs, vitric crystal tuffs, and conglomerate containing pumiceous lapilli, basalt fragments, and andesitic fragments are also included in subordinate amounts.

Felsic Intrusive Rocks (Tif)

These rocks, ranging in probable age from Oligocene to Pliocene, occur in small stocks and dikes and consist of medium- to light-gray fine-grained, porphyritic diorite and quartz diorite with some granodiorite and granite.

Mafic Intrusive Rocks (Tim)

Exposures in the Cascade Range consist of dark-gray fine-grained diabase and basalt in small sills and dikes. Over the Coast Range the rocks consist of sills and small stocks of dark-gray fine- to coarse-grained granophyric gabbro and granophyric diorite plus diabase, gabbro, and diorite dikes.

Felsic Intrusive Rocks (Tmoi)

These rocks are found in a few very small exposures in the Cascade Range. They consist of light-colored fine-grained rhyolite and dacite porphyry plugs and dikes.

Basalt (Tmob)

This unit consists of dark-gray porphyritic olivine-augite basalt flows with interbedded pyroclastic rocks.

Andesite (Tmoq)

Massive dark-gray porphyritic basaltic andesite along with some gray porphyritic andesite flows and breccias and interbedded pyroclastic rocks.

Pyroclastic Rocks (Tmop)

The unit contains poorly bedded light-colored dacite and andesite lapilli tuff, welded tuff, and breccia, stratified tuff and tuffaceous sandstone and conglomerate, along with dacite flows and domes. It contains some intercalated andesite (Tmoq) and basalt (Tmob) flows. Rocks are locally altered to greenstone. Age assignments range from Oligocene to lower Miocene.

Mafic Intrusive Rocks (Tmui)

These rocks are middle (?) and upper Miocene in age and consist of fine-grained dark-colored diabase and andesite porphyry plugs and vent breccia.

Basalt (Tmub)

Middle (?) and upper Miocene rocks consisting of massive dark-gray aphanitic to porphyritic basalt and basaltic andesite flows.

Andesite (Tmua)

Middle (?) and upper Miocene in age, these rocks are gray porphyritic pyroxene andesite and dark-gray aphanitic to porphyritic basaltic andesite. They occur mainly as flows in the southern Cascade Range while in the northern part of the range they consist of flows, mudflow breccias, lapilli tuff, and tuff.

Mafic Intrusive Rocks (QTim)

This Pliocene and Pleistocene rock unit is made up of medium- to dark-gray fine-grained andesite porphyry, olivine diabase, and microrite in dikes, plugs, and vent breccia.

Basaltic and Andesitic Tuff (QTp)

Basaltic and andesitic varicolored tuff, tuff breccia, and agglomerate forming summit cones of the High Cascades.

Basalt and Andesite (QTbq)

Gray open-textured olivine basalt and olivine-bearing andesite along with subordinate dense porphyritic pyroxene andesite occurring as flows and subordinate breccia forming lava domes, cones, and intercanion flows.

Basalt (Qb)

Light- to dark-gray dense- to open-textured olivine basalt and olivine-bearing andesite which forms lava domes and intercanion flows. Upper Pleistocene to Recent in age.

Pyroclastic Rocks (Qp)

Dark-gray to red basaltic and andesitic pyroclastic rocks forming cinder cones. Upper Pleistocene to Recent in age.

Andesite (Qa)

Light-gray pyroxene andesite and olivine-bearing andesite flows and pyroclastic rocks forming composite cones and intercanion flows. Upper Pleistocene to Recent in age.

Pumice and Ash (Qrp)

Recent deposits of unconsolidated white to buff dacite ash-flow and ash-fall.

Nonmarine Terrace Deposits (Qpln and Qpun)

Lower and upper Pleistocene deposits of semi-consolidated, deeply weathered gravel and sand capping high (Qpln) and low (Qpun) terraces along streams in the western part of the Cascade Range.

Landslide Debris ((Qls)

Alluvium (Qal)

Upper Pleistocene to Recent deposits of unconsolidated sand, gravel, silt, clay, and pyroclastic debris.

Structure

The survey area is located near the western edge of the North American continental plate. Interaction between this plate and various ancestral places of the Pacific Ocean resulted in a zone of severe deformation active over long periods of time. This is reflected in the intensely folded and

metamorphosed older strata and the almost continuous record of volcanism from the oldest rocks in the Klamath Mountains to the relatively young lavas of the High Cascades.

The northern Klamath Mountains are characterized by northeasterly trending compressive structures. Thrust faults, block faulting, and scattered local basins or downwarps are products of Late Mesozoic and Early Tertiary tectonic episodes. Uplift of this region began in Late Tertiary time and continued into the Quaternary period.

The volcanic centers of the Cascade Range are aligned with a northerly trend of parallel fractures. These are thought to have served as the channelways for the magma which formed the range. The volcanic sequence here is estimated to be over 10,000 feet thick with at least one-half of this material now depressed below sea level. Intermittent downwarping during much of the Cenozoic Era has produced north to northeasterly trending anticlines and synclines. A few northwest to north trending steeply dipping faults have been recognized.

Sediments which filled the Tertiary geosynclinal basin were uplifted to form the Coast Range. The two converging crests of the Coast Range upwarp are separated over much of their extent by the Elkton syncline. Folded structures trend north/south along the western crest of the range and east/west to northeast/southwest along the eastern crest.

The Coos Bay synclinorium, an area of crustal weakness containing numerous anticlines and synclines, is centered at Coos Bay, west of the survey area.

Economic Geology

Metalliferous mineralization within the area can be related to two periods of igneous activity. In the Klamath Mountains, intrusions during the Late Jurassic Nevadan orogeny and dacitic dikes of Tertiary age provided favorable environments for mineralization. The same is true for intrusive basalt, diabase, diorite, and nepheline syenite in Tertiary dikes, sills, and plugs in the Coast Range and Western Cascades.

Gold, nickel and chromium along with lesser amounts of antimony, copper, iron, mercury, platinum, silver, tungsten and zinc have been mined in or around the area.

No known uranium or thorium deposits are present in the area. Uranium has been mined to the east of the area in Lake County, primarily at White King. Here, recent mineralization originated in a relatively low-temperature hydrothermal alteration of clayey tuffs, tuff breccia, agglomerates and basaltic lava flows of Pliocene age.

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

The geological map of the Roseburg quadrangle distinguishes 37 geologic units. Eight of these units were not sampled by the survey. These include the Quaternary landslide deposits (Qls), Quaternary andesite (Qa), Pliocene and Pleistocene tuff (QTP), and mafic intrusive rocks (QTim), Miocene mafic intrusive rocks (Tmui), Miocene and Oligocene basalt (Tmob) and felsic intrusive rocks (Tmoi), and the Cretaceous and Jurassic felsic intrusive rocks (KJif). Distribution histograms of the six radiometric parameters were prepared for all digitized geologic units plus a water unit. Formations Qpln, Qp, Tif, Tom, Klm, Jui, Jr, Jg, and Jdg all contain too few samples to yield diagnostic histograms. The samples of unit Qpln, Lower Pleistocene terrace deposits, and unit Jdg, metamorphic rocks derived from the Dothan formation, fit well with the radiometric signatures of the Upper Pleistocene terrace deposits, Qpun, and the metamorphic rocks derived from the Galice and Rogue formations, Jgg, respectively. As such, these formations have been combined into units of Pleistocene terrace deposits (QT) and Jurassic metamorphic rocks (JGDG).

Relatively clean, single peaked, radiometric distributions curves are obtained for formations Qrp, QTba, Tmua, Tmop, Tmoa, Teup, Tem, Teme, Telm, Telb, and Jd. The K, eU, and eT histograms for some of these formations exhibit short, high concentration tails. For the Middle (?) and Upper Miocene andesite unit, Tmua, these high values occur over outcrops along traverse 190 at Rhododendron Ridge and traverse 210 at Hershberger Mountain. The higher concentration levels of the Oligocene to Lower Miocene pyroclastic rocks, Tmop, are found primarily in three areas: along traverse 150 north of Monte Rico Ridge and east of Scorpion Butte, along traverse 180 just north of Highway 138 in the Rattlesnake Rock area, and along traverse 200 south of Bow Creek. A forest clearing just west of tie line 1050 along traverse 160 is the source of the higher concentrations levels in the Oligocene to Lower Miocene andesite unit, Tmoa. The thorium histogram for the unit of submarine basalt which forms the base of the Umpqua formation, Telb, exhibits a long,

pronounced tail of higher concentration values. These were observed on traverse 140 over an outcrop at Mount Yoncalla.

Relatively complex, multiple peaked histograms were obtained for a number of geologic units. Samples falling under the individual peaks were analyzed using a pseudo anomaly map, in this case potassium, on which samples under a specific distribution peak are assigned a particular standard deviation sign and number. Samples under the high peak (above 1.25%K) of the Quaternary alluvium unit (Qal) correspond to deposits along the Umpqua River where overflowed by lines 140, 150, 160, and 1030. Samples under the lower peak (below 0.5%K) were obtained on traverse 100 where it intersects with tie line 1050 northwest of Fall Creek, and also along the south fork of the McKenzie River and on traverse 120 along Silk Creek west of Cottage Grove. The higher concentration peak (above 0.5%K) of the Quaternary basalt unit (Qb) applies to samples obtained on traverse 180 over a deposit between Rattlesnake Rock and Soda Spring along Highway 138 and a second deposit located due north of Pig Iron Mountain. Samples under the high peak (above 1.0%K) of the Oligocene to Pliocene mafic intrusive rocks (Tim) correspond to small outcrops of this unit in the vicinity of Ben More Mountain.

The geologic formation believed to be most promising for possible uranium enrichment appears to be unit Tim with a normal uranium distribution and a mean value of $U = 1.09 \pm 0.60$ ppm. Units Teme and Tmoq, both with normal uranium distributions, follow with mean values of 1.09 ± 0.44 ppm and 0.67 ± 0.37 ppm respectively.

The formation with the greatest number of uranium anomalies is the unit of Oligocene to Lower Miocene pyroclastic rocks, Tmop, with sixteen (16). This is followed by unit Teme, Tyee and Burpee formations, with twelve (12) anomalies. The formation with the greatest number of anomalies per 1000 samples, excluding formations with a low number of samples or with only one anomaly, is Tmua, Middle (?) and Upper Miocene andesite, with 1.63 anomalies. This is followed by units Telb with 1.40 anomalies, Tmoa with 1.32 anomalies, Tmop with 1.23 anomalies, and Teme with 0.95 anomalies per one thousand samples.

Printer Contour and Anomaly Map Analysis

Computer printer maps of the total magnetic intensity and of the six

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	52650.0
1	52650.0	52800.0
2	52800.0	52950.0
3	52950.0	53100.0
4	53100.0	53250.0
5	53250.0	53400.0
6	53400.0	53550.0
7	53550.0	53700.0
8	53700.0	53850.0
9	53850.0	54000.0
+	54000.0	

• Figure 7
• 49/50

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	0.29
1	0.29	0.38
2	0.38	0.47
3	0.47	0.56
4	0.56	0.65
5	0.65	0.74
6	0.74	0.83
7	0.83	0.92
8	0.92	1.01
9	1.01	1.10
+	1.10	

X3= 590560.0

Y3= 48816.69.0

```

.455544 56 89+++ 988765 67655 46666 6 7898888+ 852 123321 3457765333 222222100 0 111000 12344311111100 1 111
. 5 55 6 89 9 98776 6 4 566 6 78 8 8998521 2332 23566543 34543 2 1 0 1 1 1 1 3 432 1 00 11 22 22221111
. 5 666 789999 8 7 6666 6 6 7 8887642 1 123454 3 34 44333 2 1 1 11 1 23 322 1 1 1 00
. 5 6 7 8 8888 8 7 78887 66 7 7777 88753 1 2 3 3 222 2 3 43 2 1111 2 2222 1 1 1 222 11
. 5 67765 5 6 77 7 89 8 7 6 6 7 6 678 8643 1 1 2 332 2 111 2 2 1 1 2222 22 1 1 1 222 2
.55 6775 456 6 679 98 7 66 6 6 765 569 7421 1 1 12332 1 1 1 12332 2 2 2 10 0 1 1 1 1 111 1233
. 666 5 4 4 5 6 6 799 988 8 9 98666 6 76 5 68999986421 11 12 2 1 1 00 1 1 1 2 2 2 1 0 1 2 11111111 1 1233
. 77 6 55555 6 7 89 9999 977 7777 66 6 665432 11 11 2 10 0 1 111 2 2 1 1 2 222 1 1 11111 2 2
. 88 88887 6 78999 9 9887 77 7 65 44 421 00 0 1 22 111 1 000 1 22 2 11 221111 23 4432 1 1 2222 2 2
.9997 7 6 789 99 87 7 7 764 44321 0 02332 1 1 000000 1 22 21 1 2333222 3455431 1 22 2 22
. 9988 777 6 78 99 87 7 788888764 4 431 02332 1 10 01 2 21 1 2 333 2 3455421 1 22 2 21
. 8 887 6 66 7 89 99 9887 88 876544 432100000 122 111 1000000 1 2 1 22 2 2 3 4 321 1 2 22 1
. 88764 45 6 7 88 99 999 99 888 9999887766654321 1 2 2 11 2111 1 111 2 344433 33 2 1111 2 2 1
. 7 7665 6 6 788 8 9 9 9998 8 9 99888888642 0 12 32 1 1 2 1 11 1 2 33 345553 22222 2 2 1
.77 7766 6 67899 8 9 9 89 99 9 999 962 0 123 32 221 1 1 1 1 1 22 23332 24432 2 22 221 0
. 7 7777 66 67 88 89 988 99 9 9 99 9 8410 1 2 3 2 22 11 222222 1111 2 333 2 3443 2222 2 2 2222222 210-
. 7 7 6 6 7 7 89 99 8 8888 88 9999 99 96321 22 22 2 222 333 2 2222 2222 2 23 3 22 222 210 -
. 6 6 555 6 789 98 89 99 9 97 55 78 9631 2332 111 2333333 2 2 33332 3333 2 23 3 33333 2 111
.766 7888764 45 6 79 97 7 9 9 9643 358998 63 13321 123444 3 2 2 3 45433 443 333332 3 3 344 33333 2 2 3
. 5 6789876555 6 79 97 8 9999 974 3 5788 8 62 13321 13 33 2 2345543 44 3 3 3 3 3 333 2 2
. 5 66 6 666666 7 89 9888 98 99 9 97655 67 7 653211 11 22 1111 2 3 3 22 3 4 44 4 3 3 33 33 22222 3 3333 33333
. 666 6 7777 87 888 89 98 89 99 87766 654321 1 1 1 11 2 3333333 4 4 3 3 333 22 2 1 2 2 2 3 3
. 66 6 55 789988888 87 79 9 99987654210 12210 0 122222 2 34555544 456665 3 2 2 2 2 1 1 2 3333 3 4444
.66 6 5 57 8 8 87 78 8 9 9986530 035652 02 2 2 2 3456654 578753 32 2332 1 2 21 1 2 344 3 4 4
. 6 6 5 678988 8 887 89 9 9 99 875422 3566420 01 2 222 2 35666 5 4 456 65433 2 2 32 1 1 2 1 1 2 3 444 44 4
. 6 66666 7 77777 88 7 8 9 9999 99 88 9 87 6555 66 643210 11 2 34666 5 44 5 5 43 2 2 2 1 11 1 2 3 4 4
.66 6 6 666 7887 789 99 98 89 87 6 6 77776532111 1 23455 444 44 432 11 11 1 1 2 3 3 44 5
.66 6 6 79976 68 9 97 6899876 77 77775421 2 1 124564 33 4554 4 55321 1 1 1 1 1 1 233 34 55
.5 6 6666 6 6 7997 68 9 996 6799876 787 65321 2 1 24554 34 4 4 4 5431 1 1 1 1 1 1 2 33 33 4 4 4
.55 6 55 6 7776 78 876 78 999 976 7887 6 6 666654321 11 23 3 3 44 3 44 4 321 222 11 1111 11 2 3 44
.655 4 5 6899 9998 77 8 999 99877 7 6 5543221 1111 2 3 3 2 34 4 3 3 3 32 11 2221 1 2 3 4 4
.6643 4688 9 97 789 99 9 8 76 55555555 432 1 1 2 222 2356532 23 3 321 123321 22 3 4444 44
.554 368999 97 6789 99 8 7765 4444444 321 1 1 1 2 2 2356532 3 3 4443 1 23 443321 22 33 444 4
.65533 45789 87 7 899 9 98 7 654 333332 1 222 1111 2 3 22 2 34543 2 344 554333 4444443 222222 3 4444 4
.66 54 56789 998 77 8 9 9 8 999 87 654 33 2222 1 22 222222222 33333333 33333 45 6655444 544 33 3 44 555 4
.766654 45678 99987 7 8 99 987 6543 222 1 11 12333 443 3 3 44444 3 2 3 4567877544 444 3 33333 3 4 5 55 4
.777765555 6789987 6 78 97 6 532 1 1 13565 4664 3433 3 4 333 32 23 457999865 33333 34443 3 4555555 5
.+9876666 6 78 86 67 78 86 5432 1 3467764 4 43 3 3 3 33 3 32 3 45678876543 3 33 3 4 55 5 4
.88876 6 6 7 76 777 89 99876 5 43 2222 234688764 333 2 33 22 3 44444 5 6 66 54 3 33 3 4 5 6665 4
.66 7 88876 5 67 7 7 88 8987 66 543 22 2 3467876432 11 2 3 33 2 23444 44 5 544 3 2222 3 4 5 6 5 4
.4567666 654 45677 66 8987 898765 432 233 2 235676531 000 123 32 2 2 2345655 4 45 55543 22 22 2 34 5 5 5 4
.35776 6654 46 6 68986 6 7 5 4 3 23 32 234566520 0134432 2332 2 35665 543 345 5543 2 2 23455 5 5 4
.34566 54 56 66 7 76 5 4 443 4 5444 677765421 0123 3 2
```

$$\chi^2 = 590560.0$$

Y2= 4761000.0

TABLE V

LEGEND TO URANIUM AVERAGE MAP (PPM)

CONTOUR VALUE	LOWER LIMIT	UPPER LIMIT
-		0.30
0	0.30	0.45
1	0.45	0.60
2	0.60	0.75
3	0.75	0.90
4	0.90	1.05
5	1.05	1.20
6	1.20	1.35
7	1.35	1.50
8	1.50	1.65
9	1.65	1.80
+	1.80	

FILE PRINT

Y3= 4881669.0

Y2= 4761000.0

TABLE VI

LEGEND TO THORIUM AVERAGE MAP (PPM)

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		1.00
0	1.00	1.50
1	1.50	2.00
2	2.00	2.50
3	2.50	3.00
4	3.00	3.50
5	3.50	4.00
6	4.00	4.50
7	4.50	5.00
8	5.00	5.50
9	5.50	6.00
+	6.00	

CALIFORNIA ROSEBURG THORIUM AVG GRID FILE PRINT

X4= 418000.0

Y4= 4881669.0

X3= 590560.0

Y3= 4881669.0

```

+      8      0      1      4      -
.555 66666 7899 98777 8888777 7888766 78 998 9875321 233333 34565433 21 1 233 443322210 123333 321000000 0--
. 566 777 7 8 9 8 888 8 8 99987 7 8 8753 2 33333 3 45 5 666432 2 3 333 2 11 2 3 332 1 000000 1110 ----
. 6 7 7777 888 8 99 9 877 8 87642 22 3 4 5 43 2222222 2 2 33 2 1 000 0
. 6 7 77 8 8888 88 88 8 875432 22 3 4 4444 33 2 2 2 22 2222 1 00 00 00000
. 5 6 777 6666 7 8 99 8 77 8 8 77 8 99998643 2 2 34 4 3 22 222 111 2 2 2 1 1 1 0 0 00 0 0 00 1
.55 67 7 6 6 7899 98 7 78999 99 87 789 96321 1 2 45543 3432 12 222 1 123 2 2 3 21 1 1 0 0 0 0122
. 666 6 6666 7 8 9 9888 9 99 8 77 8 99 998764222 34 44 3 3 21 1111 2 2 2 222 111 111 0000000 0 00 1 2
. 777666 6 7 8 9 99 9999 9 8 8 9 9987765433 3 3 2 111 11 222222 11 0000 1 1
. 77 888876 6 7 8 99 9999 8 77 8 9 9 875433333 3 2 1 1 1 1 111 233322 11 00 11
. 7 8888876 788 89 9 9 8 7 7 7 8 9 997532 2 3 44 32 1111 1 1 1 1 1 2 2345432 1 0 0 1 1 1
. 78 7 67 7 89 9 9 97 77 7899 9 99742 23 4 4 4 32 2222 1 11 1 111 2 222 3 4 32 1 1 00 1 111 0
. 77 7 88766 7 8 9 9 877 77 8 99998754 222 3 3 2 1 11 1 22 333 333 2 1 1 1 0
. 7776 6 77 8 99 9 888 888 8764433 3 33 3 222 11 22 33 222 1 1 1 0
. 6 666 7 8 9 999999987 8 8 8 999 99964 2 3 3 3 3 22 2 22 11 22 2 33 2 111 1 1 1 0
.56 7 8 88 9 9 988 8 8 89 9 8 731 13443 23442 1 1 2 2 2 3 21 1 1 1 10-
. 6 777 7 8 99 9 99999 998 8 8999 999 8532 3 3 2 3 2222 2222 1 22 2222 21111 1 1 10 -
. 6 7 8 999 998 888 8 99 9 99987543 3 3333 222 333 22 2 11 1 10 -
. 6 7 877 7 7 8999 998 7 8 8 8 999 9 9865444 3 222 333333333 22 3444 3 22 2 2 3 2 1 1111 1 1 00
. 6 6 788 7 677 78 9 86 68998 7899 899 963 4432 2 3 4 3 22 2367643 2 22 23432 11 1 1 1 2 1 111
. 5 6788 77 7 78 99 87 78 8 78 9 88 999854 4 32 2 3 33 2 245654 333 22 222 22 1 1 1 11 1
. 56 7 7 7 8 999 987 8 87 8 7777653 23 333 2 2 2 2 3 45544 3 22 1 1 11111 1
. 6 7 8888888 77 7 7 899 99999888 8 88 7 665432 2 22222 2 22 33333 444 4 3 22222 1 1 1
. 6 7899 87 666 6 6899 98 7 8 87 65 4321 123 2 2 22 2 34 55444 3 4 54 3 22 11111 1 000 111 2222
.76 77 89 976 6766 7999 987 7 999864 321 25652 1 2 2 2 34 5654 3 46764 2 1 1 10 0 1 2 2
. 7 78 998766 7 7 8 99 98 7 7 88 7654433 45654 21 22 3 4 555 4 3 455443 22 1 1 1 0 0 1111 2 2
. 77 899 99888888888 9 9 998 7 7 76 5 44 55 54332222 22 34 555 444 433 2 1 1 00 1 2 2
.77 8 999999 999 98 87 666 6 5 55 544 3 2 2 3 4 44 555 44 443 3 2 1 11 1 22 2
.87 89 9 99 99 9 98 8875 56765 5555 5 4 3 2 34554 4 5 54 4 44432 1 00 1 1 1 222 2 2
.77 9 99 89 9 9 9988 874 57765 55 5 5 44432 35775 3 3565 44 32 110 1221 1 2 222
.777 8 99 9999999 999 8 7655 5 55 44444 4 444 333 2 222 344 44 4 333 3 2 11 00 1 1 0 1 2
.66 7 89 999 88 9 8 99998 7 6 555 44 333 3333 22 2 3 44444 5554 3 3 4432 00 111 0 1 0 0 11 22
.66 78 99 9987 78998 89 98 6 5 4 33 33 22 22 111 2 33 4 3 45 66432 2 466520 012210 01110 1 222
.66 78 9 9986 68 97 789 87 55 4 33 2222221 1 1 1 23 4 3 35687521 12 45553111 22 2211 10 1 222222 2
.77 66 89 98 76 788 7 8 98876 5 4 3 2 1 11 2 111 22 3 3 2 345 54322 3 4 55432222 22 11 1 22 2
.777 6 6799 99 8 77 7 88 7 65 4 33 22 111 1 22 22222 3 33 3 333333 4 55 5 4333 22 1 2 2
.77 7 6 7899999998 7 666 8999888 7654 3 2 1111 122 333333333 3 44444 3 22 3 567765 43 333 2 1 2 2
.98 76 679 9 9 8 7 6 67 999975 3 3321 12343 54 554 3 33 4 4321 12 358 86 433 222 333332 1 1 2 3333333 2
.888 7 8 999 8 7 666 79 9875 3 2 1 1 2333 3333333 44 3 2 2 2 2 3 4567765 432 2 22 1 2 33 2
.88 8 88 88888 777 7 8 999876 543 2 111111 23 4 3 22222 3 33 2 2 33 44 55555 4332222 22222 1111 2 33 22
. 7 8 9998 7777 7 8 9876 54 3 2 23 32 1111 2 3 3 22222222 33 44 44444443 333 2 1 1 2 3 3 2 1
.77 8 888876 67888 88 9999765 43 2 11 23 321 0 0 123 32 2 3 44 4 333 44432 1 1 1 2 2 2 1
.67887 6 67 8 77765 3432 1 1 234321 13444 32 2222 234 432 23 44321 1 1 12 2 2 2 1
.56 7 77 66666 7 77 6543 3 32222222222 3 443 210 012 3 3222 2 22 33 4 43333 4 321 11 1 2 333 222
.45 67 8877 7 7 6 543 3 44 33333 443 4566532 1 0000 12 3 33333332 3 4 444444 321 00 1 2 333 2
.34 5678887 7 7 65 4 3 2 345544444 55554 443 2 1 000 1234444 3333 22 3 4 566664 3210 0 1 2 33 33
.3 34567777 7 8 88754 32 3567655 55 78875432 00 0 0 024555 44
```

X.1= 418000.0

Y1= 4761000.0

X2= 590560.0

Y2= 4761000.0

TABLE VII

LEGEND TO URANIUM/POTASSIUM MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.50
0	0.50	0.60
1	0.60	0.70
2	0.70	0.80
3	0.80	0.90
4	0.90	1.00
5	1.00	1.10
6	1.10	1.20
7	1.20	1.30
8	1.30	1.40
9	1.40	1.50
+	1.50	

```

X1= 418000.0
Y1= 4761000.0

```

```
X2= 590560.0
Y2= 4761000.0
```

TABLE VIII

LEGEND TO URANIUM/THORIUM MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		0.200
0	0.200	0.225
1	0.225	0.250
2	0.250	0.275
3	0.275	0.300
4	0.300	0.325
5	0.325	0.350
6	0.350	0.375
7	0.375	0.400
8	0.400	0.425
9	0.425	0.450
+	0.450	

X4= 418000.0
Y4= 4881669.0

X3= 590560.0
Y3= 4881669.0

```

      4
-- 24432 1000000 1221-- 01111 - 036742210 1231----- 0 01357631 1210      851-- 1221- 05786432 22 32 25++ 5      7
- 12321      1 1 0      0 1 0      03553 2 11 2210      0 10 1345421 1 231 2478530 012210 156654 32 2 1 235997 68 7 56764 34 44 4
- 0 0 0      1 11 0      0 0      0233      2 22 10 12221 1 2 2 111      2 23321 0 12 21 24 5 4 321 1234677 7 8766 76555 431--
. 000      01111 1      0000      0 01 2 222 22 2 10 1 11 00 1 111      1 111111111 0 12 33 2 3 4 44 444332 34566 77 888877766554321
. 100 11111 1 1 11 0 01111 0 012 111 2      2100      0 00 0 00 00      02344 3 34 4 3 46652 1 2466 7899 98875 4321
. 210      012 11 221 0 0122 10 2330 023333210 00 00      110 00      157753 23455 3 36863 0 3566 79 9 85 45420
. 110      01 1 1 1 00 1 2221111 0 1 2 2100 0 12110 00 0 00      134321 24554 33 4 4 32210 011 34 4 56789 99887666543
. 111 2221 1      11 11      1111      2 2 10 123321 0 000      0 12 3 3 2 34 544444 44 3321111 22 3 33 4566 6 76 654
. 10 1233221 00      0 1 1 11 0000 1 11      10 1 2332 00 1111111 0 27 842 2467754 45554 3 467653 2 331 0 11 2345 67887
. 210      012210 0 0 02321 0 0      011 1 221 012321 12 2 332 0 135643 1479964 3467753 36741 1 13420 134 4 95
. 1 2 21 11 0 111 0 03420 110      011 12320 02 331 12 3 4431 034420 03688643 3455421 366422 2 2331 247777 998
. 21      111      11 111 2221100      0 11      10 122 210 01 1 2 210 148 9621 2356654 33 3 3320 1332 3320 0 1235 5 5 654
. 111 2221 00 11      22 2 10      0 1 22 11 2 2211 0 1 2 222 345 54333 443 22 3 33 3 4566543 33 332222 345654 33
. 110      0 122222      2 22210 0 1 1 22 22 11 2344320 0 12 333 2 34 44 3 2 1 2 222 368997544444444443 4789998510-
. 210 1110      012333      3332 1 10      111 2333332 0 2478520 01246652 15776554 44320 0121 1235689755 5 7764 599 6 1
. 111      0000 1 2      2210      0111      12 22221 12443210 00 12 3 3 478 9775 4 3211 2 22 3 444444 4 4 5 654 5788776310 1
. 1 12444311111 2      2 1000000 1 0 1 11 11 2 2 10 1 2 2222 3 4566654 33 2 2 3321 12 3 4 5 5 67754 43322
. 00 12 3 22      11 2 2 11 1111      0 0 1 2222 1 1 11 122 1111 3577777632 1 11 2 3333 21 0 0 1234 5 67886 577643
. 00 1 233332 1 12 210 01321 1211 110      01210 00 0342 122 0 12358 93 01 134 55542 10 0134 45666 7 86 9 6444
. 0 0 0 01 1 1 1 2 2 10 121 1 1 110      012 10 0 0 013321 12332100 1347999621 1 1 123 5 53 35530 01 344 5 6775 56887654
. - 0 111 11 1 1 2 2 1110 01 11 1 0 01 2 3 4432 2 33 21 2 3 2110 036642 1 2 3 4 543 332221 2 34 5 543 345 5 5
. - 0 0 1111 0 12 222210 01      1 00 11 2 456654333 3 22 2 10 013 3 22222 3 44 5 6787643222 345 5 5 42 234 567
. - 000      01 210 0333      3111 2 11 2 1 0 1 22 23444 4443 222 33 21 122 22 333 3 4665 5 432 23676 5 5 641 0234568
. --      0 1 10      12 22 1 23531 2310 1332 12 3456651 12 4 531 0 12 33 24542 36874 3 345431 49 85 45678 9543 35 54
. - 0110      0 0      01 2221 23 222 32211 2333322 23454322 2 2 3 3211 2 22 34 3 456655 56 874 2111 356 54 5 6532 344 55
. -      0 0 0 1 22 33 3 333333333 444444444 333 22 1 23 444 66543 333333 4 5 66 5 8 744332 34 4444 5 67875 5
. 0000      0 0 0 1 22 3 33 4444 4567653 3443 22 2 1 1245653 1 2344 3 2 45 6 765 568765 4 44 4 33 455 44 4 4 55
. 0 1110      011      0 1 2 3 4 4 5 644 458 75 642 1 2 1 00 148973 0 14564 22 257888885 2456 5 4 46542 2356430 1344 457
. 21 10      0 0210      0 1 2 355 4 45 67754 46 7 68620 021 0 49 93 1 2 1 047898651 024 42 13443 3 4 4 565 3 44
. 11110      0 11000 111 22 12 33 45 55 5689986 6664332 21 00 2467654332 2 2222 346 776521 345 543 55543 456 789972 134
. 100 000      0 1 22222222 21 12 222 3 4 55 6 66 77 65433 21 2 3455 554432 22 35689876 5433 3455554 48 961 23466 64210 0346
. 00 0 0      0 1 343 3 33332221 12 1111 34565 44 56 78877543 2 23 45 653 3432 2459 85 5 54 35688643 146532 45 6654322211-
. 10 01220      0 1 4543 3 44 43210 01 10 146764 3455 69 987542 23 46 7888865421 135 877554 34576321 013444 4 5 6 777764310
. 110 0      0 1 233      3210 0 1 000 134 43 222 355776543 33 4 56 8 865433 468 98765432 234432 1 23 4 4 5 678 85321
. 1111 221100 1 2 3 3 3 210 0 00 11 2 33 22210 012345554433 3 4 578 87555555 677776 54 333 455432 2 344 5 67776 787643
. 11 10 0 111 11 234 3 33 210 0 0 01 23 2 1 2211 02456543 3 3 22 4567865 666 5 4 5 5 43 2 35677643 1 345 5 888 89 755
. 11 45641 1 210 1553 3 333322221 12 321 037 6 279852 3442 1 46775 588643 3 42 0 158 9863 3665 55 5 67644 466
. 43 3 20 01 1 0 1453 3 3 21 1 1 012 233211 2 57641 13566533 321 222 3 4 56654 333 32 26 7642 2344 5 5 567 765 66
. 55431      0 1 11 23 3 3 2 1111 10 122 3 3333322 11 234555444 3 22 3466654 44444 33 57899887544 4 5 5 67 776 77
. 44320      01 1 1 23 3 210 01 111 23 44 5 665410 023 45 665 43 333 45 544 33 4 3 2 3578765 44 5 666 6 777 7
. 33321      01221 1344 432 1 2 222 1 13565 6998766532 34 56776543 3 57876432 234 3 444 3 368998654 4 566 77 8 8 7+
. 4444421 023431 12 3 2 22 466641 0 04785 6 60 0 23 45678876543 343 35530 13 3 365 44442 479 84 4 56666 799 9887 6
. 344320      012 22111 2 3333332 11 0 123 5677644333 4 5677 76543 3 333 454432 3 33 4 444 31 135888765444 5 6 7 76 5
. 3 44332111      2 333 3 2 1 00 1 2 3443 34 5 6 77 7 65432 1 23 45 55433 3 3 4 4 32 2456 55 555 55 555555 543
. 2345532 1 22 11 2 22 3 45 66430 01 1 0 13443 4 55 67 8888765420 0 135776654 3 22 34 4 3 32 4665 33 45 665 55 4 3 455432
. 1368741 0122 1 22 1 3 34578641 010 24 56897 6 78 9 99630 146888775310 24653 354 58 951 12357875 5542 2355421
. 039 6300 1220 01221 12 45798531 0 1 0 023 4 5 5 7 7 8 9887632 01356777664321 24553 3 5678 84 1 2456765 5 5532 2565310
. 13466543222 1 1 2 222 3 55432100000 1 2 21 124 56 7777776543211 21 03565 43 22 34 444 55 66664333 45 5 44 56788
. 33 4321 1 1 1 2 33333333 2 1111111 11 2 3310 0134 5 66 66 5433333 4 55 54 3 2 3 4 555 5555 44 4 5 5 44 2
. 44 3 21 11 0 2 34544 222 1 1 33322 1 123 4 568874 456666 5 5 66444 6799865 43 22 235 66654 3 3 33 4 5 55
. 5432 23211 110 012357751 1 3 444 33321 23 55 64 33 21 654 36886 66 567 765432 22 25677764 244 3 234565 5

```

X1= 418000.0
Y1= 4761000.0

X2= 590560.0
Y2= 4761000.0

TABLE IX

LEGEND TO THORIUM/POTASSIUM RATIO MAP

<u>CONTOUR VALUE</u>	<u>LOWER LIMIT</u>	<u>UPPER LIMIT</u>
-		2.50
0	2.50	3.50
1	3.50	4.50
2	4.50	5.50
3	5.50	6.50
4	6.50	7.50
5	7.50	8.50
6	8.50	9.50
7	9.50	10.50
8	10.50	11.50
9	11.50	12.50
+	12.50	


```
X1= 418000.0
Y1= 4761000.0
```

```

X2= 590560.0
Y2= 4761000.0

```

radiometric parameters have been prepared in addition to the radiometric anomaly maps. These pseudo-contour maps, at a scale of 1:500,000, are included in this volume as Figures 7 through 13. The grid spacing for these maps is relatively wide at 2117 by 1270 meters.

The total intensity map shows a number of rather distinct trend zones which approximately parallel the geomorphic provinces included in the quadrangle. The western portion of the area over the Coast Range exhibits a subdued response pattern of broad low frequency anomalies. The total intensity averages on the order of 53,175 gammas. Two relatively strong positive anomalies of approximately 900 gammas are located over the eastern part of the range. The first is in the Bear Mountain and Mount Yoncalla area over an outcrop of the basal basalts of the Umpqua formation (Telb). The second is over a faulted contact between these basalts and the Tyee and Burpee formations (Teme) located at the intersection of traverse 150 and tie line 1040. The north-central portion of the quadrangle over the Willamette Valley has the highest average magnetic intensity, approximately 53,650 gammas, and exhibits a number of positive anomalies, reaching on the order of 54,000 gammas. The magnetic field is very active over the Plio-Pleistocene basalts and andesites of the High Cascades, varying from lows of 52,500 gammas to highs again over 54,000 gammas. Anomalies are narrow and gradients very steep.

The radiometric response over the area also appears to vary as a function of the geomorphic provinces and the rock types exposed in these provinces. The highest levels of apparent concentrations in uranium, thorium, and potassium are all encountered over a large area within the Coast Range. Here, these three parameters average on the order of 1.1 ppm eU, 5.0 ppm Th, and 0.9% K and locally reach above 2.0 ppm, 7.5 ppm, and 1.5% respectively. However, the eU/eT, eU/K, and eT/K ratios remain very low over the vast majority of this area.

Over the Klamath Mountains Province, there is a distinct correlation between the relative levels of the radiometric responses and the different formation outcrop areas. This is most easily seen on the potassium map where the highest concentration levels, up to 1%, are over exposures of the sediments and volcanics of the Dothan formation (Jd and Jdv) and the sediments of the Galice formation (Jg). The lowest concentration levels are found over

the volcanic rocks of the Galice and Rogue formations (Jgv) and the metamorphic rocks derived from these two formations (Jgg). This same correlation can be seen on the maps for thorium and, to some extent, uranium even though the uranium response over the area is basically low, varying between approximately 0.5 ppm and 1.0 ppm. Here again, all three radiometric ratios are in general at very low levels. The eU/eT ratio does reach up to level 9 (0.45) over unit JGG along traverse 200. This is most likely due to the very low thorium response in this area.

The volcanic rocks of the High Cascades and the northern one-third of the Western Cascades exhibit low radiometric responses. Uranium ranges between 0.3 and 0.9 ppm, thorium between 1.0 and 2.5 ppm, and potassium between 0.2 and 0.65%. While the eU/K ratio over the High Cascades is almost everywhere very low, the eU/eT ratio reaches relatively high values in a number of zones in this region.

The two uranium ratios together attain their greatest values over zones within the Western Cascades and the eastern margin of the Coast Range. Uranium, thorium, and potassium levels are highly variable over these regions. Where coincident with the higher levels in eU, these zones of positive eU/K and/or eU/eTh anomalies have been outlined on the interpretation map.

Based on the criteria outlined in the general section on interpretation, a total of thirty-eight (38) uranium anomalies have been indicated on the interpretation map. Most of these zones are only weakly to moderately anomalous in uranium, the uranium/potassium ratio and/or the uranium/thorium ratio. These are generally considered to have been adequately described in the anomaly listing of Appendix B and are not further discussed in this report.

Anomaly 7 exhibits good responses in both the eU/K and eU/Th traces on the radiometric profiles, while the uranium response is moderately anomalous at 1.0 ppm. This zone, located at the intersection of traverse 110 with tie line 1060, is over Middle (?) and Upper Miocene andesites (Tmua) and Oligocene to Lower Miocene pyroclastic rocks (Tmop).

Anomaly 20, along traverse 160 over andesites (Tmoa) of Oligocene to lower Miocene age, stands out on the radiometric profile as an especially strong response on the eU/eT trace. This narrow anomaly is also apparent in

Figure 14

the eU/K trace and the uranium trace where it reaches up to 2.5 ppm eU.

Anomaly 26 exhibits a particularly good response on the eU/eT anomaly map. Uranium concentrations here are on the order of 2.0 ppm over pyroclastic rocks of Oligocene to lower Miocene age (T_{mop}).

Anomaly 28 has a good eU/K response accompanied by moderate eU and eU/T responses. An anomaly is also visible on the radiometric profile in the eT/K trace over this zone within the Tyee and Burpee formations (T_{eme}). As such, the good eU/K response may be due to a local decrease in potassium concentrations.

Anomaly 32 exhibits moderate to good anomalies in both uranium and the uranium/thorium ratio, along with a moderate uranium/potassium anomaly. Uranium concentrations exceed 2.5 ppm over this zone within the Tyee and Burpee formations (T_{eme}). Thorium and potassium responses are both at normal levels here. Anomalies 7, 20, 26, and 32 may form prospective targets for further investigation.

A few rather pronounced zones of increased concentration levels are shown on the thorium anomaly map over the Western Cascades. These fall within exposures of the Oligocene to Lower Miocene pyroclastic rocks (T_{mop}) and andesites (T_{moa}). Thorium concentrations reach or exceed the +3 standard deviation level of approximately 6 ppm.

These zones also display increased responses in both uranium and potassium concentrations. Although these increases appear to be of a lesser magnitude than those in thorium, both the thorium/potassium ratio and the uranium/thorium ratio remain at normal levels over these zones. As there is no indication of a preferential accumulation of thorium within these zones, none have been outlined as thorium anomalies on the interpretation map. Nevertheless, this area may be of interest for more detailed investigation due to both the localized zones of increased thorium response and the fact that these pyroclastic rocks (T_{mop}) and andesites (T_{moa}) appear to be favorable hosts of possible economic uranium deposits.

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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>Description</u>
QAL	Qal	Pleistocene to Recent deposits of alluvium
QLS	Qls	Landslide deposits
QT	Qpln, Qpun	Lower and Upper Pleistocene terrace deposits of pumice and ash
QRP	Qrp	Recent deposits of pumice and ash
QA	Qa	Andesite
QP	Qp	Pyroclastic rocks
QB	Qb	Basalt
QTBA	QTba	Pliocene and Pleistocene basalt and andesite
QTP	QTp	Basaltic and andesitic tuff
QTIM	QTim	Mafic intrusive rocks
TMUA	Tmua	Middle (?) and Upper Miocene andesite
TMUB	Tmub	Basalt and basaltic andesite flows
TMUI	Tmui	Mafic intrusive rocks
TMOP	Tmop	Oligocene to Lower Miocene pyroclastic rocks
TMOA	Tmoa	Andesite
TMOB	Tmob	Basalt
TMOI	Tmoi	Felsic intrusive rocks
TIM	Tim	Oligocene to Pliocene mafic intrusive rocks
TIF	Tif	Oligocene to Pliocene felsic intrusive rocks
TOM	Tom	Eugene Formation, early and middle Oligocene sandstone
TEUP	Teup	Eocene pyroclastic rocks
TEUM	Teum	Marine sedimentary rocks - Bateman and Spencer Formations
TEM	Tem	Yam Hill Formation, upper middle to lower late Eocene sediments

TEME	Teme	Tyee and Burpee Formations, upper middle Eocene sandstone and mudstone
TELM	Telm	Umpqua Formation, early through middle Eocene sediments
TELB	Telb	Submarine basalt forming base of the Umpqua Formation
KLM	Klm	Cretaceous marine sedimentary rocks
KJIF	KJif	Cretaceous and Jurassic felsic intrusive rocks
JUI	Jui	Jurassic peridotite and serpentine
JR	Jr	Riddle Formation
JD	Jd	Dothan Formation - sedimentary rocks
JDV	Jdv	Dothan Formation - volcanic rocks
JG	Jg	Galice and Rogue Formations - volcanic rocks
JGV	Jgv	Galice and Rogue Formations - volcanic rocks
JGDG	Jgg, Jdg	Metamorphic rocks derived from the Galice, Rogue and Dothan formations, gneiss and schist
W		Water

A P P E N D I X B

List of Geologic Units by Anomaly

List of Geologic Formations by Anomaly

<u>Anomaly</u>	<u>Formation (s)</u>	<u>Location</u> t - traverse tl - tie line	<u>Fid.</u>	<u>Brief Description</u>
1.	Qt	t-100	7350	moderate U/K anomaly, weak to moderate U and U/T anomalies
2.	Tmop	t-100	7700	moderate U and U/K anomalies, very little U/T support
3.	Tmop	t-100 tl-1060	8070 3180	weak to moderate U anomaly with scattered moderate ratio support
4.	Teme	t-110	1580	weak to moderate U, U/K and U/T anomalies
5.	Teme	T-110	1830	weak to moderate U, U/K and U/T anomalies
6.	Teum	tl-1040	5570	good U anomaly with limited moderate ratio support in zone of locally increased T and K responses
7.	Tmua/Tmop	T-110 tl-1060	3235 2970	moderate U anomaly with good ratio support
8.	Tmua	t-110	3745	moderate U, U/K, and U/T anomalies
9.	Teme	t-120	3860	moderate to good U anomaly, good U/K support in center of zone, weak to moderate U/T support in area of locally increased T response
10.	Tmop	tl-1050	2860	weak to moderate U, U/K and U/T anomalies
11.	Teme	t-130	1575	weak to moderate U, U/K and U/T anomalies
12.	Teme	t-130	1740	weak to moderate U, U/K and U/T anomalies

13.	Tmop	t-130 tl-1060	3790 2570	moderate U anomaly with only limited ratio support
14.	Tmop	t-140	7600	weak to moderate U and U/T anomalies with very weak U/K support
15.	Tmop	t-140	7770	weak to moderate U, T, and K anomalies, very weak ratio support
16.	Telb/Teme	t-150	2160	moderate U anomaly, moderate ratio support over Teme
17.	Tmop	t-150	3065	weak to moderate U, U/K and U/T anomalies
18.	Teme	t-160	9945	moderate U anomaly with weak to moderate ratio support, no support from intersecting tie line
19.	Teme	t-160	10425	moderate to good U anomaly, weak to moderate U/K and U/T anomalies in zone of locally increased T and K responses
20.	Tmoa	t-160	10985	narrow, moderate U and U/K anomalies with strong U/T support
21.	Tmoa/Tmop	t-160	11450	weak to moderate U, U/K and U/T anomalies
22.	Teme	t-170	6030	moderate U/T anomaly, weak to moderate U and U/K anomalies
23.	Teme	t-170 tl-1030	7135 12400	moderate to good U anomaly with weak to moderate ratio support, T and K responses locally increased
24.	Tmoa	t-170	8220	moderate U anomaly, weak to moderate U/K and U/T anomalies

25.	Tmop	t-170	8335	weak to moderate U and U/K anomalies, no U/T support
26.	Tmop	t-170	8570	moderate to good U/T anomaly, moderate U and U/K anomalies
27.	Tmop	t-170	8745	moderate U anomaly, weak U/K anomaly, no U/T support in zone of increased responses in U, K, and T
28.	Teme	t-180	4700	good U/K anomaly, moderate U and U/T anomalies
29.	Tmoa/Tmop	t-180	6155	moderate U anomaly, weak to moderate U/K and U/T anomalies, ratio support best in center of zone over Tmop
30.	Tmop	tl-1060	1470	moderate to good U/T anomaly, weak to moderate U and U/K anomalies, no support from intersecting traverse
31.	Tmop/Tmua	t-180	6850	weak to moderate U anomaly, weak ratio support
32.	Teme	t-190	2885	moderate to good U and U/T anomalies, moderate U/K anomaly
33.	Telb	t-190	4070	weak to moderate U, U/K and U/T anomalies
34.	Tmua	t-190	5510	moderate U anomaly, weak to moderate ratio support in area of local narrow moderate K and T anomalies
35.	QTba	t-190	5965	moderate U anomaly with weak ratio support
36.	Telm	t-200	330	moderate U, U/K, and U/T anomalies

37.	Tmoa	t-210	4920	weak to moderate U anomaly with weak ratio support
38.	Tmop	t-210	5020	weak U, U/K and U/T anomalies

A P P E N D I X C

List of Anomalies by Geologic Unit

List of Anomalies by Geologic Formation

<u>Formation</u>	<u>Aero Symbol</u>	<u>No. of Samples</u>	<u>No. of U Anomalies</u>	<u>No. of Th. Anomalies</u>
Qal	QAL	1491	-	
Qls	-	-	-	
Qpln,Qpun	QT	230	1	
Qrp	QRP	376	-	
Qa	-	-	-	
Qp	QP	56	-	
Qb	QB	646	-	
QTha	QTBA	6679	1	
QTp	-	-	-	
Qtm	-	-	-	
Tmua	TMUA	2453	4	
Tmub	TMUB	416	-	
Tmui	-	-	-	
Tmop	TMOP	13004	16	
Tmoa	TMOA	3779	5	
Tmob	-	-	-	
Tmoi	-	-	-	
Tim	TIM	195	-	
Tif	TIF	12	-	
Tom	TOM	89	-	
Teup	TEUP	1628	-	
Teum	TEUM	609	1	
Tem	TEM	2006	-	
Teme	TEME	12661	12	
Telm	TELM	4283	1	

Telb	TELB	1428	2
Klm	KLM	59	-
KJif	-	-	-
Jui	JUI	103	-
Jr	JR	106	-
Jd	JD	857	-
Jdv	JDV	204	-
Jg	JG	88	-
Jgv	JGV	585	-
Jgg, Jdg	JGDG	384	-
WA	W	137	-

A P P E N D I X D

Mean Radiometric Values by Geologic Unit

MEAN VALUE BY GEOLOGIC MAP UNIT

ROSEBURG

QUAD

LINE 100

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TEME	0.34	1.11	12.16	0.234	1.438	6.163
QAL	0.14	0.73	7.37	0.306	1.276	3.852
TEUM	0.35	1.02	14.00	0.202	1.062	5.223
TEUP	0.17	0.55	6.61	0.202	1.330	6.080
TMUB	0.19	0.74	5.51	0.268	2.044	7.594
TOM	0.22	0.95	10.78	0.309	1.340	4.465

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TIM	0.13	0.55	7.35	0.303	1.070	3.589
QT	0.29	1.02	8.68	0.237	2.672	9.438
TMOA	0.13	0.57	6.05	0.339	1.500	4.663
TMOP	0.15	0.65	4.84	0.296	2.264	7.446
TMUA	0.09	0.46	4.43	0.352	1.533	4.176
QTBA	0.08	0.29	3.36	0.296	1.402	4.715

LINE 110

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.34	1.08	11.59	0.226	1.470	6.446
QAL	0.23	0.73	8.53	0.196	1.146	4.885
TEUM	0.31	0.82	14.18	0.199	0.860	4.418
TEUP	0.13	0.33	5.12	0.154	1.127	6.335
QT	0.23	0.60	5.83	0.184	1.492	8.913
TMUB	0.15	0.53	4.22	0.229	2.088	8.427
QB	0.09	0.31	4.50	0.255	1.124	4.086

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TMOP	0.14	0.56	5.07	0.287	1.677	6.000
TMOA	0.11	0.29	4.45	0.179	1.096	5.572
W	0.10	0.62	1.69	0.295	3.017	9.062
TIM	0.10	0.36	4.99	0.204	0.905	4.021
TMUA	0.08	0.56	3.83	0.501	2.321	4.645
QTBA	0.12	0.47	5.92	0.281	1.151	4.292

LINE 120

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.38	1.20	12.80	0.223	1.465	6.580
QAL	0.29	0.97	8.46	0.230	1.984	8.589
TEUM	0.35	1.61	8.35	0.265	2.498	9.506
TEUP	0.14	0.57	2.66	0.274	3.277	11.665
TIM	0.13	0.21	2.79	0.096	1.107	9.447

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TMUB	0.17	0.56	2.52	0.212	2.653	12.576
TMOP	0.14	0.55	5.15	0.272	1.750	7.080
TMUA	0.11	0.47	5.23	0.294	1.628	4.679
QB	0.21	0.74	6.05	0.243	1.827	7.525
QTBA	0.09	0.50	4.83	0.370	1.455	4.196

LINE 130

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.36	1.22	14.26	0.234	1.283	5.532
TEUM	0.17	0.83	5.72	0.384	2.236	6.028
TEUP	0.17	0.61	4.71	0.265	2.139	8.240
TMOP	0.13	0.63	5.20	0.314	1.962	6.159
W	0.14	0.24	5.69	0.128	0.609	5.065

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TMOA	0.15	0.61	5.87	0.286	1.830	6.209
QAL	0.22	1.12	10.94	0.360	1.551	4.243
QTBA	0.09	0.55	4.93	0.384	1.615	4.220
TMUA	0.12	0.61	6.99	0.362	1.407	3.455

LINE 140

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.36	1.16	14.73	0.232	1.212	5.253
TEM	0.38	1.23	11.73	0.223	1.590	7.302
QAL	0.42	1.48	16.33	0.241	1.272	5.242
TELM	0.35	1.10	14.68	0.216	1.066	4.968
TELB	0.37	0.87	7.78	0.163	1.554	9.527
QTBA	0.12	0.65	7.04	0.384	1.359	3.755

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEUM	0.33	1.16	12.00	0.239	1.366	5.739
TEUP	0.20	0.72	5.83	0.249	1.762	8.658
TMOP	0.16	0.61	6.80	0.269	1.409	5.458
TMOA	0.16	0.63	6.63	0.283	1.571	5.368
W	0.04	0.0	1.64	0.0	0.0	4.857

MEAN VALUE BY GEOLOGIC MAP UNIT

ROSEBURG

QUAD

LINE 150

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TEME	0.33	1.07	13.72	0.224	1.168	5.290
TEM	0.35	1.08	13.59	0.224	1.187	5.420
QAL	0.42	1.68	17.90	0.283	1.338	4.912
TEUM	0.31	0.96	13.94	0.220	1.045	4.722
TELM	0.23	0.79	12.09	0.231	0.925	4.011
TELB	0.15	0.61	4.88	0.251	1.794	7.297

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TIM	0.17	1.01	5.33	0.199	1.158	7.594
TEUP	0.11	0.48	2.29	0.347	3.400	9.577
TNUB	0.14	0.54	6.34	0.279	1.321	5.447
TMOA	0.18	0.75	7.92	0.277	1.274	4.667
TNUP	0.18	0.79	7.66	0.286	1.445	5.034
QTBA	0.11	0.52	6.24	0.333	1.216	3.663

LINE 160

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.35	1.32	13.24	0.256	1.442	6.106
TEM	0.43	1.24	11.47	0.204	1.717	8.464
QAL	0.39	1.22	16.72	0.207	1.005	4.922
TELM	0.26	1.34	12.02	0.372	1.682	4.583
TIM	0.28	1.98	10.87	0.492	2.677	5.429
W	0.05	0.25	2.26	0.616	2.688	4.690

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEUP	0.18	0.64	5.43	0.255	1.830	7.095
TNUP	0.17	0.81	6.58	0.295	1.579	5.504
TMOA	0.18	0.82	6.59	0.295	1.673	5.845
TNUA	0.15	0.36	5.69	0.128	0.870	5.467
QTBA	0.12	0.56	5.86	0.318	1.334	4.296

LINE 170

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.35	1.32	13.56	0.261	1.500	5.892
TEM	0.41	1.30	14.08	0.225	1.691	7.326
TEUM	0.39	1.39	15.55	0.264	1.351	5.252
TELM	0.22	0.85	11.12	0.292	1.215	4.061
TELB	0.09	0.53	4.39	0.392	1.978	4.249
QTBA	0.11	0.57	5.87	0.349	1.415	4.059

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEUP	0.13	0.53	5.94	0.286	1.164	4.903
TNUP	0.17	0.94	6.04	0.363	2.275	6.252
TIF	0.07	0.32	4.03	0.355	1.147	3.445
TMOA	0.17	0.91	5.81	0.343	2.406	6.677
TNUA	0.12	0.73	6.70	0.406	1.470	3.816

LINE 180

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.35	1.31	13.03	0.269	1.578	5.937
TEM	0.42	1.18	14.75	0.196	1.151	5.977
TELM	0.25	0.96	13.08	0.249	0.995	4.170
TELB	0.11	0.51	5.43	0.289	1.450	4.435
TMOA	0.17	0.79	6.28	0.334	2.061	6.209

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TIM	0.11	1.00	3.75	0.646	3.872	6.036
TNUP	0.22	0.97	8.89	0.312	1.643	5.270
QB	0.19	0.80	8.78	0.315	1.315	4.513
TNUA	0.15	0.80	4.51	0.373	2.596	6.981
QTBA	0.14	0.71	7.93	0.356	1.263	3.609

LINE 190

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TELM	0.24	1.01	10.37	0.302	1.511	5.182
TEME	0.32	1.21	10.99	0.262	1.724	6.518
TELB	0.12	0.64	6.61	0.366	1.483	3.869
JGDG	0.22	0.55	9.45	0.174	0.833	4.745
JD	0.20	0.58	11.31	0.220	0.756	3.642
JDV	0.14	0.61	8.28	0.315	1.086	3.469

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
JGV	0.07	0.54	3.11	0.251	1.061	3.470
TMOA	0.15	0.71	5.96	0.336	2.035	5.950
TNUP	0.17	0.79	7.74	0.313	1.515	4.856
TNUA	0.16	0.99	7.91	0.410	1.770	4.204
QTBA	0.13	0.77	7.58	0.393	1.319	3.547
QP	0.14	0.51	6.61	0.267	0.880	3.489

MEAN VALUE BY GEOLOGIC MAP UNIT

ROSEBURG

QUAD

LINE 200

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TELM	0.22	0.94	9.97	0.315	1.484	4.763
TEME	0.33	1.16	11.00	0.239	1.693	7.119
JDV	0.16	0.56	9.44	0.280	0.915	3.588
JD	0.27	0.80	15.38	0.204	0.756	3.706
JUI	0.13	0.89	10.26	0.333	1.513	2.485
JGV	0.04	0.43	3.66	0.0	1.566	2.719
GRP	0.18	0.64	10.77	0.245	0.864	3.586

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
JGDG	0.08	0.49	5.84	0.379	1.620	3.505
TEUP	0.04	0.0	3.37	0.0	0.0	2.295
TMOP	0.21	0.90	8.00	0.300	1.660	5.698
TMUA	0.22	0.62	7.46	0.198	1.268	6.287
TMUA	0.09	0.44	5.25	0.309	1.292	3.509
QTBA	0.14	0.59	8.32	0.317	1.060	3.440

LINE 210

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TELM	0.20	0.83	8.73	0.293	1.401	4.942
TEME	0.34	1.09	11.61	0.220	1.476	6.370
JD	0.19	0.77	9.28	0.279	1.248	4.436
JDV	0.17	0.61	10.13	0.227	0.764	3.349
JUI	0.07	0.44	5.97	0.304	0.867	2.212
JR	0.14	0.50	9.32	0.223	0.697	2.940
KLM	0.21	1.19	12.38	0.412	1.432	3.583

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
JGV	0.11	0.52	6.11	0.260	1.234	3.951
JGDG	0.06	0.57	4.00	0.409	1.906	3.334
JG	0.26	1.04	11.61	0.280	1.373	4.965
TMOP	0.21	0.98	7.52	0.323	2.024	6.668
TMUA	0.15	0.91	5.57	0.412	2.320	6.086
TMUA	0.15	0.56	7.20	0.279	1.124	4.113
QRP	0.13	0.60	8.02	0.337	1.094	3.373

LINE 1020

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TELM	0.22	0.88	6.45	0.254	2.186	8.456
TEME	0.34	1.00	11.44	0.208	1.323	6.487
TEM	0.44	1.15	10.74	0.184	1.725	9.227

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEUM	0.43	1.33	11.59	0.213	1.669	7.771
TIM	0.37	1.35	12.76	0.260	1.658	6.370
QAL	0.42	0.86	11.10	0.143	1.157	8.081

LINE 1030

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TELM	0.26	0.80	11.99	0.230	0.987	4.377
JD	0.26	0.94	12.80	0.250	1.045	4.249
TELB	0.14	0.37	8.54	0.205	0.645	3.432

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TEME	0.42	1.23	14.83	0.206	1.290	6.318
TEM	0.48	1.65	15.97	0.244	1.573	6.365
QAL	0.39	1.19	14.42	0.204	1.216	5.954

LINE 1040

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
JGV	0.08	0.46	6.13	0.330	0.969	2.880
JR	0.18	0.52	10.55	0.204	0.651	3.486
JUI	0.09	0.51	6.18	0.299	0.960	3.235
JDV	0.15	0.66	8.45	0.234	0.852	3.648
JD	0.26	0.99	14.66	0.282	1.027	3.689
JGDG	0.21	0.62	9.41	0.209	1.002	4.806
TEUP	0.21	0.77	6.59	0.252	1.921	7.409

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TELM	0.21	0.90	11.34	0.310	1.179	3.926
TELB	0.09	0.48	4.33	0.352	1.719	4.746
TIM	0.29	1.38	14.08	0.335	1.448	4.302
TEME	0.41	1.41	16.38	0.242	1.299	5.356
QAL	0.19	0.56	9.25	0.228	0.886	4.134
TEUM	0.22	0.77	5.61	0.260	2.260	9.300

MEAN VALUE BY GEOLOGIC MAP UNIT

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QUAD

LINE 1050

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TMOA	0.16	0.80	7.05	0.340	1.710	5.135
TMOP	0.15	0.72	5.78	0.330	2.044	6.294
QAL	0.14	0.72	6.27	0.364	2.253	5.379

UNIT	E THOR	E URN	POT PCT	U/TH	U/K	TH/K
TIM	0.13	0.0	5.03	0.0	0.0	5.472
QT	0.14	0.0	8.54	0.0	0.0	3.435

LINE 1060

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
TMUA	0.08	0.45	5.61	0.316	1.129	3.272
TMOP	0.15	0.76	6.66	0.355	1.800	5.342
QAL	0.12	0.90	7.71	0.559	2.537	3.556

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QB	0.16	0.66	4.44	0.364	1.874	7.505
TMUA	0.14	0.85	5.79	0.452	2.273	4.860

LINE 1070

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
QRP	0.18	0.82	10.51	0.322	1.120	3.561
QTBA	0.13	0.66	7.78	0.339	1.226	3.541
QP	0.17	0.73	10.09	0.322	1.068	3.484
QB	0.18	0.89	9.83	0.349	1.316	3.837
TMUA	0.07	0.49	4.62	0.392	1.744	3.339

UNIT	THOR	URN	POT	U/TH	U/K	TH/K
W	0.07	0.36	3.66	0.281	0.969	3.463
TIM	0.14	0.28	8.59	0.145	0.487	3.410
TMUP	0.13	0.35	7.73	0.353	0.604	3.444
QAL	0.07	0.0	4.79	0.0	0.0	2.804

A P P E N D I X E

Standard Deviation Table

ROSEBURG

QUAD

FORMATION QAL

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1470	4.04	NORMAL	-4.78	-1.84	1.10	6.98	9.93	12.87
E URANIUM	1222	0.84	LOGNORMAL	0.26	0.38	0.57	1.25	1.86	2.76
POTASSIUM	1482	0.33	LOGNORMAL	0.06	0.10	0.18	0.59	1.06	1.89
EU/K	1211	0.95	LOGNORMAL	0.08	0.18	0.42	2.17	4.95	11.30
EU/ETH	1169	0.22	NORMAL	-0.05	0.04	0.13	0.30	0.39	0.48
ETH/K	1211	5.00	LOGNORMAL	1.07	1.79	2.99	8.35	13.96	23.34

FORMATION GRP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	376	2.33	NORMAL	0.24	0.94	1.63	3.02	3.72	4.41
E URANIUM	368	0.58	NORMAL	-0.15	0.09	0.34	0.83	1.07	1.31
POTASSIUM	376	0.68	NORMAL	0.25	0.39	0.53	0.82	0.97	1.11
EU/K	368	0.83	NORMAL	-0.11	0.21	0.52	1.15	1.46	1.77
EU/ETH	368	0.25	NORMAL	-0.06	0.04	0.14	0.35	0.46	0.56
ETH/K	368	3.43	NORMAL	1.62	2.22	2.82	4.03	4.63	5.23

FORMATION GP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	56	2.44	NORMAL	0.69	1.27	1.86	3.03	3.61	4.20
E URANIUM	54	0.57	NORMAL	-0.03	0.17	0.37	0.77	0.97	1.17
POTASSIUM	56	0.64	LOGNORMAL	0.42	0.48	0.56	0.73	0.83	0.96
EU/K	54	0.80	NORMAL	-0.21	0.13	0.46	1.13	1.47	1.80
EU/ETH	54	0.24	NORMAL	-0.15	-0.02	0.11	0.37	0.49	0.62
ETH/K	54	3.44	NORMAL	1.85	2.38	2.91	3.97	4.50	5.03

FORMATION QT

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	230	3.90	NORMAL	-0.63	0.88	2.39	5.42	6.93	8.44
E URANIUM	174	0.77	NORMAL	-0.56	-0.12	0.33	1.22	1.66	2.11
POTASSIUM	230	0.54	NORMAL	-0.27	0.00	0.27	0.81	1.08	1.35
EU/K	174	0.74	LOGNORMAL	0.05	0.13	0.30	1.81	4.40	10.71
EU/ETH	174	0.17	NORMAL	-0.10	-0.01	0.08	0.25	0.34	0.43
ETH/K	174	4.78	LOGNORMAL	0.78	1.43	2.62	8.75	16.00	29.25

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QUAD

FORMATION Q8

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	646	2.53	NORMAL	-1.03	0.16	1.34	3.71	4.90	6.08
E URANIUM	459	0.68	NORMAL	-0.30	0.03	0.35	1.00	1.32	1.65
POTASSIUM	646	0.51	NORMAL	-0.16	0.06	0.28	0.73	0.95	1.17
EU/K	459	1.20	NORMAL	-0.31	0.19	0.69	1.70	2.21	2.71
EU/ETH	450	0.24	NORMAL	-0.09	0.02	0.13	0.36	0.47	0.58
ETH/K	459	3.91	LOGNORMAL	0.95	1.53	2.44	6.25	10.00	16.00

FORMATION CTBA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	6615	1.74	NORMAL	-0.38	0.33	1.03	2.45	3.16	3.87
E URANIUM	5130	0.53	NORMAL	-0.25	0.01	0.27	0.79	1.05	1.31
POTASSIUM	6643	0.49	NORMAL	-0.08	0.11	0.30	0.68	0.87	1.06
EU/K	5117	1.06	NORMAL	-0.31	0.15	0.60	1.51	1.97	2.42
EU/ETH	4895	0.28	NORMAL	-0.08	0.04	0.16	0.39	0.51	0.63
ETH/K	5110	3.67	NORMAL	1.09	1.95	2.81	4.53	5.39	6.25

FORMATION TMUA

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	2411	1.33	NORMAL	-0.68	-0.01	0.66	2.00	2.67	3.34
E URANIUM	1496	0.31	LOGNORMAL	0.04	0.08	0.16	0.60	1.17	2.25
POTASSIUM	2453	0.38	NORMAL	-0.04	0.10	0.24	0.52	0.66	0.80
EU/K	1488	1.03	LOGNORMAL	0.16	0.29	0.55	1.92	3.60	6.75
EU/ETH	1203	0.28	NORMAL	-0.14	0.00	0.14	0.42	0.56	0.70
ETH/K	1462	3.83	NORMAL	-0.11	1.20	2.52	5.14	6.46	7.77

FORMATION TMUB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	416	2.47	NORMAL	0.40	1.09	1.78	3.16	3.85	4.54
E URANIUM	295	0.54	NORMAL	-0.33	-0.04	0.25	0.83	1.12	1.40
POTASSIUM	416	0.36	NORMAL	-0.12	0.04	0.20	0.52	0.68	0.84
EU/K	294	0.99	LOGNORMAL	0.24	0.38	0.61	1.59	2.55	4.11
EU/ETH	295	0.20	NORMAL	-0.08	0.01	0.11	0.29	0.39	0.48
ETH/K	294	6.19	LOGNORMAL	2.30	3.20	4.45	8.61	11.99	16.68

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QUAD

DATA	SAMPLES	MEAN		FORMATION		TMOP			
				-3	-2	-1	+1	+2	+3
E THORIUM	12942	2.54	NORMAL	-0.79	0.32	1.43	3.65	4.75	5.86
E URANIUM	10276	0.39	LOGNORMAL	0.06	0.11	0.21	0.73	1.36	2.53
POTASSIUM	12943	0.34	LOGNORMAL	0.07	0.12	0.20	0.56	0.94	1.57
EU/K	10215	1.09	LOGNORMAL	0.16	0.30	0.57	2.07	3.93	7.47
EU/ETH	10105	0.25	NORMAL	-0.09	0.02	0.13	0.36	0.47	0.58
ETH/K	10214	4.73	LOGNORMAL	0.91	1.58	2.74	8.18	14.15	24.48

DATA	SAMPLES	MEAN		FORMATION		TMOA			
				-3	-2	-1	+1	+2	+3
E THORIUM	3775	2.43	NORMAL	-0.77	0.30	1.36	3.50	4.56	5.63
E URANIUM	2817	0.67	NORMAL	-0.43	-0.06	0.31	1.04	1.41	1.77
POTASSIUM	3778	0.39	LOGNORMAL	0.09	0.15	0.24	0.63	1.03	1.67
EU/K	2804	1.01	LOGNORMAL	0.11	0.23	0.48	2.09	4.35	9.04
EU/ETH	2768	0.25	NORMAL	-0.11	0.01	0.13	0.37	0.50	0.62
ETH/K	2801	4.70	LOGNORMAL	0.81	1.46	2.62	8.42	15.10	27.08

DATA	SAMPLES	MEAN		FORMATION		TIM			
				-3	-2	-1	+1	+2	+3
E THORIUM	195	3.53	NORMAL	-2.67	-0.61	1.46	5.59	7.66	9.73
E URANIUM	150	1.09	NORMAL	-0.72	-0.11	0.49	1.70	2.30	2.90
POTASSIUM	195	0.70	NORMAL	-0.67	-0.21	0.24	1.15	1.61	2.07
EU/K	150	1.06	LOGNORMAL	0.24	0.39	0.64	1.75	2.90	4.78
EU/ETH	150	0.26	NORMAL	-0.08	0.03	0.14	0.37	0.48	0.59
ETH/K	150	5.05	NORMAL	1.30	2.55	3.80	6.30	7.55	8.80

DATA	SAMPLES	MEAN		FORMATION		TIF			
				-3	-2	-1	+1	+2	+3
E THORIUM	12	0.90	NORMAL	0.49	0.62	0.76	1.03	1.17	1.30
E URANIUM	8	0.24	NORMAL	0.08	0.13	0.18	0.29	0.35	0.40
POTASSIUM	12	0.28	NORMAL	0.18	0.21	0.25	0.32	0.35	0.38
EU/K	8	0.92	NORMAL	0.18	0.43	0.67	1.17	1.42	1.67
EU/ETH	5	0.29	NORMAL	0.07	0.14	0.21	0.36	0.43	0.50
ETH/K	8	3.44	NORMAL	1.96	2.45	2.94	3.93	4.42	4.92

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QUAD

FORMATION TOM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	89	3.47	NORMAL	0.30	1.35	2.41	4.53	5.58	6.64
E URANIUM	87	0.87	NORMAL	-0.13	0.21	0.54	1.21	1.54	1.87
POTASSIUM	89	0.79	NORMAL	0.01	0.27	0.53	1.05	1.31	1.57
EU/K	87	1.10	NORMAL	-0.27	0.19	0.65	1.56	2.02	2.47
EU/ETH	87	0.24	NORMAL	-0.08	0.03	0.14	0.35	0.46	0.57
ETH/K	87	4.08	LOGNORMAL	1.89	2.44	3.16	5.28	6.82	8.82

FORMATION TEUM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	609	5.25	NORMAL	-1.33	0.87	3.06	7.44	9.64	11.83
E URANIUM	599	1.05	NORMAL	-0.38	0.10	0.58	1.53	2.01	2.49
POTASSIUM	609	0.93	NORMAL	-0.40	0.04	0.49	1.38	1.82	2.26
EU/K	599	1.05	LOGNORMAL	0.22	0.37	0.62	1.77	2.98	5.01
EU/ETH	599	0.19	NORMAL	-0.04	0.04	0.11	0.27	0.34	0.42
ETH/K	599	4.97	LOGNORMAL	0.97	1.68	2.89	8.57	14.76	25.42

FORMATION TEUP

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1628	2.64	NORMAL	-0.67	0.43	1.54	3.75	4.85	5.95
E URANIUM	1163	0.58	NORMAL	-0.40	-0.07	0.26	0.91	1.24	1.57
POTASSIUM	1623	0.26	LOGNORMAL	0.05	0.08	0.15	0.46	0.80	1.41
EU/K	1144	1.20	LOGNORMAL	0.22	0.39	0.68	2.09	3.65	6.38
EU/ETH	1163	0.19	NORMAL	-0.07	0.02	0.11	0.28	0.37	0.46
ETH/K	1144	5.01	LOGNORMAL	0.98	1.69	2.91	8.62	14.83	25.51

FORMATION TEM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	2004	6.53	NORMAL	1.55	3.21	4.87	8.19	9.85	11.51
E URANIUM	1945	1.14	NORMAL	-0.19	0.25	0.70	1.59	2.04	2.48
POTASSIUM	2003	0.92	NORMAL	-0.07	0.26	0.59	1.25	1.58	1.91
EU/K	1945	1.33	NORMAL	-0.50	0.11	0.72	1.94	2.55	3.16
EU/ETH	1945	0.16	NORMAL	-0.03	0.03	0.10	0.23	0.29	0.35
ETH/K	1945	6.19	LOGNORMAL	1.56	2.47	3.91	9.80	15.52	24.58

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QUAD

FORMATION TELM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	12661	5.68	NORMAL	1.24	2.72	4.20	7.15	8.63	10.11
E URANIUM	12266	1.09	NORMAL	-0.23	0.21	0.65	1.53	1.97	2.41
POTASSIUM	12661	0.96	NORMAL	-0.04	0.29	0.63	1.30	1.63	1.97
EU/K	12266	1.16	NORMAL	-0.34	0.16	0.66	1.65	2.15	2.65
EU/ETH	12266	0.18	NORMAL	-0.03	0.04	0.11	0.25	0.31	0.38
ETH/K	12266	5.33	LOGNORMAL	1.61	2.40	3.57	7.96	11.88	17.72

FORMATION TELM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	4283	2.72	LOGNORMAL	0.83	1.23	1.83	4.05	6.01	8.94
E URANIUM	3807	0.96	NORMAL	-0.43	-0.00	0.43	1.29	1.72	2.15
POTASSIUM	4283	0.79	NORMAL	-0.21	0.12	0.46	1.12	1.45	1.79
EU/K	3801	1.12	NORMAL	-0.48	0.05	0.58	1.65	2.18	2.71
EU/ETH	3803	0.23	NORMAL	-0.09	0.02	0.12	0.34	0.44	0.55
ETH/K	3801	4.71	NORMAL	1.21	2.37	3.54	5.87	7.04	8.21

FORMATION TELB

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	1427	1.38	LOGNORMAL	0.16	0.33	0.67	2.83	5.82	11.94
E URANIUM	783	0.41	LOGNORMAL	0.09	0.15	0.25	0.67	1.09	1.79
POTASSIUM	1428	0.27	LOGNORMAL	0.07	0.11	0.17	0.43	0.69	1.10
EU/K	781	1.02	LOGNORMAL	0.18	0.32	0.58	1.82	3.24	5.77
EU/ETH	771	0.16	LOGNORMAL	0.03	0.05	0.09	0.28	0.49	0.87
ETH/K	781	3.71	LOGNORMAL	0.75	1.28	2.18	6.32	10.76	18.32

FORMATION KLM

DATA	SAMPLES	MEAN		-3	-2	-1	+1	+2	+3
E THORIUM	59	3.33	NORMAL	-0.27	0.93	2.13	4.53	5.73	6.94
E URANIUM	59	1.11	NORMAL	0.19	0.49	0.80	1.42	1.72	2.03
POTASSIUM	59	0.91	NORMAL	0.35	0.54	0.73	1.10	1.29	1.47
EU/K	59	1.19	NORMAL	0.03	0.42	0.80	1.58	1.97	2.36
EU/ETH	59	0.33	NORMAL	0.03	0.13	0.23	0.43	0.53	0.63
ETH/K	59	3.56	NORMAL	1.16	1.96	2.76	4.36	5.16	5.96

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QUAD

DATA	SAMPLES	MEAN		FORMATION		JR				
				-3	-2	-1	+1	+2	+3	
E THORIUM	105	2.35	NORMAL	-0.64	0.36	1.36	3.35	4.35	5.35	
E URANIUM	65	0.42	NORMAL	-0.12	0.08	0.24	0.80	0.79	0.97	
POTASSIUM	106	0.73	NORMAL	-0.01	0.24	0.48	0.98	1.23	1.47	
EU/K	65	0.49	NORMAL	-0.04	0.14	0.31	0.67	0.84	1.02	
EU/ETH	65	0.16	NORMAL	-0.01	0.05	0.10	0.22	0.27	0.33	
ETH/K	65	3.17	NORMAL	1.52	2.07	2.62	3.72	4.27	4.82	

DATA	SAMPLES	MEAN		FORMATION		JG				
				-3	-2	-1	+1	+2	+3	
E THORIUM	88	4.10	NORMAL	0.88	1.96	3.03	5.17	6.25	7.32	
E URANIUM	88	0.96	NORMAL	-0.50	-0.02	0.47	1.44	1.93	2.41	
POTASSIUM	88	0.86	NORMAL	-0.06	0.24	0.55	1.16	1.47	1.78	
EU/K	88	1.12	NORMAL	-0.42	0.09	0.61	1.64	2.16	2.67	
EU/ETH	88	0.22	NORMAL	-0.08	0.02	0.12	0.32	0.42	0.52	
ETH/K	88	4.71	LOGNORMAL	2.21	2.85	3.66	6.07	7.81	10.04	

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DATA	SAMPLES	MEAN		FORMATION		JD				
				-3	-2	-1	+1	+2	+3	
E THORIUM	857	3.78	NORMAL	0.05	1.30	2.54	5.03	6.27	7.52	
E URANIUM	779	0.74	NORMAL	-0.26	0.08	0.41	1.08	1.41	1.75	
POTASSIUM	857	0.97	NORMAL	0.08	0.38	0.68	1.27	1.57	1.86	
EU/K	779	0.75	NORMAL	-0.35	0.01	0.38	1.12	1.49	1.86	
EU/ETH	779	0.19	NORMAL	-0.04	0.04	0.11	0.26	0.34	0.41	
ETH/K	779	3.94	NORMAL	1.73	2.46	3.20	4.67	5.41	6.15	

DATA	SAMPLES	MEAN		FORMATION		JUI				
				-3	-2	-1	+1	+2	+3	
E THORIUM	97	1.39	NORMAL	-1.46	-0.51	0.44	2.35	3.30	4.25	
E URANIUM	65	0.36	LOGNORMAL	0.07	0.12	0.20	0.64	1.13	1.99	
POTASSIUM	103	0.54	NORMAL	-0.25	0.01	0.28	0.80	1.07	1.33	
EU/K	65	0.62	LOGNORMAL	0.10	0.18	0.33	1.15	2.15	4.00	
EU/ETH	51	0.25	NORMAL	0.04	0.11	0.18	0.32	0.39	0.46	
ETH/K	64	2.53	NORMAL	0.18	0.96	1.75	3.32	4.11	4.89	

ROSEBURG

QUAD

DATA	SAMPLES	MEAN		FORMATION		JGV				
				-3	-2	-1	+1	+2	+3	
E THORIUM	500	1.26	NORMAL	-1.03	-0.27	0.50	2.03	2.79	3.56	
E URANIUM	166	0.41	NORMAL	-0.16	0.03	0.22	0.61	0.80	0.99	
POTASSIUM	578	0.36	NORMAL	-0.21	-0.02	0.17	0.55	0.74	0.93	
EU/K	152	0.92	NORMAL	-0.42	0.03	0.47	1.36	1.80	2.25	
EU/ETH	131	0.22	NORMAL	-0.08	0.02	0.12	0.32	0.43	0.53	
ETH/K	146	3.78	NORMAL	-0.03	1.24	2.51	5.04	6.31	7.58	

DATA	SAMPLES	MEAN		FORMATION		JDV				
				-3	-2	-1	+1	+2	+3	
E THORIUM	204	2.45	NORMAL	-0.97	0.17	1.31	3.59	4.73	5.86	
E URANIUM	145	0.52	NORMAL	-0.15	0.07	0.29	0.74	0.96	1.19	
POTASSIUM	204	0.69	NORMAL	-0.01	0.23	0.46	0.92	1.16	1.39	
EU/K	145	0.67	NORMAL	-0.35	-0.01	0.33	1.01	1.36	1.70	
EU/ETH	144	0.20	NORMAL	-0.11	-0.01	0.10	0.30	0.41	0.51	
ETH/K	145	3.49	NORMAL	1.25	2.00	2.75	4.24	4.99	5.74	

DATA	SAMPLES	MEAN		FORMATION		JGDG				
				-3	-2	-1	+1	+2	+3	
E THORIUM	373	1.25	NORMAL	-1.07	-0.29	0.48	2.03	2.80	3.58	
E URANIUM	204	0.44	NORMAL	-0.17	0.03	0.23	0.64	0.84	1.04	
POTASSIUM	384	0.40	NORMAL	-0.21	-0.01	0.20	0.60	0.81	1.01	
EU/K	202	0.59	LOGNORMAL	0.07	0.14	0.29	1.23	2.54	3.27	
EU/ETH	169	0.27	NORMAL	-0.17	-0.02	0.12	0.41	0.56	0.71	
ETH/K	202	4.31	NORMAL	-2.17	-0.01	2.15	6.46	8.62	10.78	

DATA	SAMPLES	MEAN		FORMATION		M				
				-3	-2	-1	+1	+2	+3	
E THORIUM	69	0.52	LOGNORMAL	0.09	0.16	0.28	0.95	1.73	3.15	
E URANIUM	33	0.29	NORMAL	-0.41	-0.18	0.06	0.52	0.75	0.98	
POTASSIUM	62	0.08	LOGNORMAL	0.01	0.02	0.04	0.16	0.30	0.58	
EU/K	20	1.81	NORMAL	-1.22	-0.21	0.80	2.82	3.83	4.84	
EU/ETH	15	0.24	NORMAL	0.10	0.15	0.19	0.29	0.34	0.38	
ETH/K	20	3.26	LOGNORMAL	0.87	1.35	2.10	5.06	7.86	12.21	

A P P E N D I X F

Format, Single Record Data Listing

REC NO.	LAT	LONG	RESID MAG GAMMA	TERR CL FEET	FLG	GEOL UNIT	COSM CPS	U CPS	ATM TOTAL COUNT CPS	FLG	ETH PPM	FLG	EU PPM	FLG	K PCT	FLG	EU/ETH	EU/K	ETH/K	TEMP CELCIUS	BARO PRES MMHG
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	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	0.0	12.7	747.1
5081	64.0087	-160.9176	55305	741	MAR	W	26	1	4	NAU	0.2	NAD	0.1	NAD	-0.1	NAD	0.0	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	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	0.0	NAD	0.0	0.0	0.0	12.7	748.1
5085	64.0099	-160.9131	55305	702	MAR	W	23	1	37	MAR	0.0	NAD	0.4	NAD	-0.3	NAD	0.0	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	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	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	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	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	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	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	0.0	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	3.5	12.8	748.9
5094	64.0095	-160.9030	55304	663		W	34	0	965		3.2		1.4		0.8		0.5	1.9	4.1	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	18.3	12.9	748.1
5096	64.0096	-160.9007	55305	663		KS	12	0	945		2.5		1.7		0.5		0.7	3.5	5.2	12.9	747.8
5097	64.0098	-160.8995	55305	655		KS	20	0	831		3.0		1.5		0.6		0.5	2.8	5.5	12.9	747.6
5098	64.0098	-160.8985	55305	657		KS	22	0	759		2.2		1.4		0.3		0.8	5.1	8.1	12.9	747.1
5099	64.0099	-160.8973	55305	665		KS	29	0	699		1.7		2.0		0.5		1.1	4.4	4.1	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	0.0	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	7.0	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	4.2	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	11.2	12.8	745.5
5104	64.0102	-160.8918	55303	569		KS	26	0	579		1.7		1.2		0.1	MAR	0.7	12.8	17.6	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	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	11.1	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	12.8	745.4
5108	64.0105	-160.8873	55302	575		KS	22	-1	510		0.2	NAD	1.3		0.3		0.0	5.1	0.0	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	0.0	12.8	745.2
5110	64.0107	-160.8848	55305	532		KS	25	-1	405		0.5	NAD	1.1		0.3		0.0	4.0	0.0	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	3.0	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	5.5	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	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	12.8	744.3
5115	64.0110	-160.8791	55305	477		KS	28	-1	517		0.8	MAR	1.1		0.3		1.3	4.0	3.1	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	2.8	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	7.0	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	17.5	12.8	744.0
5119	64.0112	-160.8746	55303	500		KS	21	0	693		3.5		0.5	MAR	0.5		0.2	1.1	7.4	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	7.2	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	10.9	12.8	744.5
5122	64.0113	-160.8712	55302	519		KS	25	-2	777		5.1		1.5		0.3		0.5	9.9	20.2	12.8	744.9
5123	64.0113	-160.8701	55302	518		KS	26	-2	658		3.8		0.9		0.4		0.2	2.2	9.0	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	1.3	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	16.0	12.8	746.1
5126	64.0114	-160.8667	55302	541		KS	25	-1	781		3.2		1.3		0.6		0.4	2.4	5.9	12.8	746.4
5127	64.0114	-160.8654	55301	559		KS	26	-1	736		1.1	MAR	2.6		0.3		2.2	8.2	3.8	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	7.4	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	0.0	12.9	747.3
5130	64.0113	-160.8620	55303	606		KS	14	0	696		1.9		1.9		0.3		1.0	7.1	6.9	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	4.4	13.0	747.7

SINGLE RECORD DATA LINE 240 PAGE 1

FINISHED OUTPUTTING LINE 240
 LINE 220 FIDS 2935 TO 4865 OUTPUT TO SRRO TAPE

A P P E N D I X G

Format, Average Record Data Listing

RECORD NUMBER	LATITUDE	LONGITUDE	RESID TOTAL FIELD GAMMA	GEOL UNIT	COSM CPS	ATM. URAN CPS	TOTAL COUNT CPS	ETH PPM	STD FLG	STD DEV	EU FLG	STD DEV	POT PCT	STD FLG	STD DEV	EU LTH RATIO	STD DEV	EU POTA RATIO	STD DEV	ETH POTA 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	55283	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	55298	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	-160.7399	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	-160.7379	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	-160.7366	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	55283	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	55295	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	-160.7299	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	55293	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	55294	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	55294	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	55294	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	790	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	64.0092	-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	64.0092	-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	64.0091	-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 Number	Character Number	
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 IN CPS PER PERCENT K FOR FIRST SYSTEM
17		
18		
19	8	F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL URANIUM (BI-214) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT U
20		
21		
22	9	F6.1 NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE IN CPS PER PPM EQUIVALENT TH
23		
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	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																		
63			TO ONE DECIMAL PLACE IN GAMMAS																		
64	9	A8	SURFACE GEOLOGIC MAP UNIT CODE																		
65	10	I4	QUALITY FLAG CODES																		
66	11	F6.1	APPARENT 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	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL URANIUM																		
71			(BI-214) TO ONE DECIMAL PLACE IN PPM EQUIVALENT U																		
72	14	F4.1	UNCERTAINTY IN TERRESTRIAL URANIUM TO ONE DECIMAL																		
73			PLACE IN PPM EQUIVALENT U																		
74	15	F6.1	APPARENT CONCENTRATION OF TERRESTRIAL THORIUM																		
75			(TL-208) TO ONE DECIMAL PLACE IN PPM EQUIVALENT TH																		
76	16	F4.1	UNCERTAINTY IN TERRESTRIAL THORIUM TO ONE DECIMAL																		
77			PLACE IN PPM EQUIVALENT TH																		
78	17	F6.1	URANIUM-TO-THORIUM RATIO TO ONE DECIMAL PLACE IN																		
79			PPM EQUIVALENT U PER PPM EQUIVALENT TH																		
80	18	F6.1	URANIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN																		
81			PPM EQUIVALENT U PER PERCENT K																		
82	19	F6.1	THORIUM-TO-POTASSIUM RATIO TO ONE DECIMAL PLACE IN																		
83			PPM EQUIVALENT TH PER PERCENT K																		
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	F4.1	OUTSIDE AIR TEMPERATURE TO ONE DECIMAL PLACE IN																		
93			DEGREES CELSIUS																		
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

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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
15                     PLACES IN SECONDS
16 8         F6.3    2PI SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL
17                     PLACES IN SECONDS
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
24                     COLLECTED
25 15-17     I4,6 &3 REPEAT OF ITEMS 12-14 FOR SECOND FLIGHT LINE ON THIS
26                     TAPE
27 *         *              *
28 *         *              *
29 *         *              *
30 306-308   I4,6 &3 REPEAT OF ITEMS 12-14 FOR 99TH FLIGHT LINE ON THIS
31                     TAPE
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
44                     IN GAMMAS
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
48                     DEGREES CELSIUS
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
51                     SECONDS
  
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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
52	14		I4																			
53																						
54	15		I4																			
55	16		I4																			
56	*		*																			
57	*		*																			
58	*		*																			
59	270		I4																			

A P P E N D I X J

Format, DOE STATISTICAL ANALYSIS DATA TAPE

DOE STATISTICAL ANALYSIS DATA TAPE

Line Number	Character Number 12345678901234567890123456789012345678901234567890123456789012											
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			THIS QUADRANGLE									
13	5	I1	AERIAL SYSTEM IDENTIFICATION CODE FOR FIRST SYSTEM									
14	6	A20	AIRCRAFT IDENTIFICATION BY TYPE AND FAA NUMBER FOR									
15			FIRST SYSTEM									
16	7	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO									
17			TERRESTRIAL POTASSIUM (K-40) TO ONE DECIMAL PLACE									
18			IN CPS PER PERCENT K									
19	8	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO									
20			TERRESTRIAL URANIUM (B1-214) TO ONE DECIMAL PLACE									
21			IN CPS PER PPM EQUIVALENT U									
22	9	F6.1	NOMINAL ALTITUDE SYSTEM SENSITIVITY RELATIVE TO									
23			TERRESTRIAL THORIUM (TL-208) TO ONE DECIMAL PLACE									
24			IN CPS PER PPM EQUIVALENT TH									
25	10	I6	BLANK FIELD (999999)									
26	11	F6.3	4PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL									
27			PLACES IN SECONDS FOR FIRST SYSTEM									
28	12	F6.3	2PI-SYSTEM DATA COLLECTION INTERVAL TO THREE DECIMAL									
29			PLACES IN SECONDS FOR FIRST SYSTEM									
30	13	I3	NUMBER OF CHANNELS (0-3 MEV) IN 4 PI SYSTEM FOR FIRST									
31			AERIAL SYSTEM									
32	14	I3	NUMBER OF CHANNELS (0-30 MEV) IN 2 PI SYSTEM FOR FIRST									
33			AERIAL SYSTEM									
34	15-24	(SAME)	REPEAT OF ITEMS 5-14 FOR 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									
43			COLLECTED									
44	99-101	I4,6 &3	REPEAT OF ITEMS 96-98 FOR SECOND FLIGHT LINE ONE THIS									
45			TAPE									
46	*	*	*									
47	*	*	*									
48	*	*	*									
49	390-392	I4,6 &3	REPEAT OF ITEMS 96-98 FOR 99TH FLIGHT LINE ON THIS									
50			TAPE									
51												

Line	Character Number											
Number	12345678901234567890123456789012345678901234567890123456789012											
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	Character Number
Number	12345678901234567890123456789012345678901234567890123456789012

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 Pre</u>			<u>Low Post</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>
08/14/80	13	8.8	6.3	400'	1450	N/A	400'	1450	N/A
08/14/80	14	8.8	6.3	400'	1450	N/A	400'	1450	N/A
08/20/80	16	8.6	6.3	400'	1450	10	400'	1450	11
08/20/80	17	8.6	6.3	400'	1450	10	400'	1450	11
08/20/80	18	8.6	6.3	400'	1450	10	400'	1450	11
08/20/80	19	8.6	6.3	400'	1450	10	400'	1450	11
08/21/80	20	8.5	5.6	400'	N/A	N/A	400'	1450	6
08/21/80	21	8.5	5.6	400'	N/A	N/A	400'	1450	6
08/21/80	22	8.5	5.6	400'	N/A	N/A	400'	1450	6
08/22/80	24	9.2	6.1	400'	1300	8	400'	1250	7
08/22/80	25	9.2	6.1	400'	1300	8	400'	1250	7
08/22/80	26	9.2	6.1	400'	1300	8	400'	1250	7
08/22/80	27	9.2	6.1	400'	1300	8	400'	1250	7
08/30/80	46	8.7	5.8	400'	2250	12	NO TEST		
09/14/80	75	9.5	6.0	400'	2000	9	400'	2000	8
09/15/80	79	8.8	5.3	400'	2250	11	350'	2000	10
09/15/80	80	8.8	5.3	400'	2250	11	350'	2000	10

N/A: NOT AVAILABLE

A P P E N D I X N

Remumbered to Original Fiducial Correlations

RESEBURG QUADRANGLE

LINE 100 FLCWN AS LINE 103 AND 101

~~MAP FIDUCIALS 5681 TO 6963 CORRESPOND TO ORIGINAL FIDUCIALS 6963 TO 5681~~
MAP FIDUCIALS 6964 TO 8935 CORRESPOND TO ORIGINAL FIDUCIALS 12338 TO 14309

LINE 110 FLEWN AS LINE 113 AND 112

MAP FIDUCIALS 706 TO 2600 CORRESPOND TO ORIGINAL FIDUCIALS 2600 TO 706
MAP FIDUCIALS 2601 TO 4068 CORRESPOND TO ORIGINAL FIDUCIALS 16037 TO 14570

LINE 120 FLCWN AS LINE 121 AND 122

MAP FIDUCIALS 3255 TO 5194 CORRESPOND TO ORIGINAL FIDUCIALS 3255 TO 5194
~~MAP FIDUCIALS 5195 TO 6644 CORRESPOND TO ORIGINAL FIDUCIALS 5591 TO 7040~~

LINE 130 FLCWN AS LINE 130 AND 132

~~MAP FIDUCIALS 1026 TO 3175 CORRESPOND TO ORIGINAL FIDUCIALS 3175 TO 1026~~
MAP FIDUCIALS 3176 TO 4502 CORRESPOND TO ORIGINAL FIDUCIALS 7242 TO 5916

~~LINE 140 FLEWN AS LINE 141 AND 143~~

MAP FIDUCIALS 5330 TO 6207 CORRESPOND TO ORIGINAL FIDUCIALS 6207 TO 5330
MAP FIDUCIALS 6208 TO 5089 CORRESPOND TO ORIGINAL FIDUCIALS 430 TO 3311

LINE 150 FLCWN AS LINE 150 155 156 AND 151

MAP FIDUCIALS 741 TO 1491 CORRESPOND TO ORIGINAL FIDUCIALS 741 TO 1491
~~MAP FIDUCIALS 1492 TO 2130 CORRESPOND TO ORIGINAL FIDUCIALS 10195 TO 10833~~
MAP FIDUCIALS 2131 TO 3256 CORRESPOND TO ORIGINAL FIDUCIALS 8630 TO 7505
MAP FIDUCIALS 3257 TO 4107 CORRESPOND TO ORIGINAL FIDUCIALS 8282 TO 7432

LINE 160 FLCWN AS LINE 161 162 AND 160

MAP FIDUCIALS 9099 TO 9962 CORRESPOND TO ORIGINAL FIDUCIALS 9099 TO 9962
~~MAP FIDUCIALS 9963 TO 12456 CORRESPOND TO ORIGINAL FIDUCIALS 3302 TO 5795~~
MAP FIDUCIALS 12457 TO 12644 CORRESPOND TO ORIGINAL FIDUCIALS 10571 TO 10384

~~LINE 170 FLEWN AS LINE 170 172 AND 171~~

MAP FIDUCIALS 6289 TO 7153 CORRESPOND TO ORIGINAL FIDUCIALS 6289 TO 7153
MAP FIDUCIALS 7154 TO 7666 CORRESPOND TO ORIGINAL FIDUCIALS 9297 TO 8785
~~MAP FIDUCIALS 7667 TO 7993 CORRESPOND TO ORIGINAL FIDUCIALS 7921 TO 10047~~

LINE 180 FLCWN AS LINE 180 AND 181

~~MAP FIDUCIALS 4159 TO 5005 CORRESPOND TO ORIGINAL FIDUCIALS 5005 TO 4159~~
MAP FIDUCIALS 5006 TO 7532 CORRESPOND TO ORIGINAL FIDUCIALS 4586 TO 7112

~~LINE 190 FLEWN AS LINE 190 AND 191~~

MAP FIDUCIALS 2822 TO 3656 CORRESPOND TO ORIGINAL FIDUCIALS 2822 TO 3656
MAP FIDUCIALS 3657 TO 6045 CORRESPOND TO ORIGINAL FIDUCIALS 13745 TO 16133

LINE 200 FLCWN AS LINE 201 AND 200

MAP FIDUCIALS 217 TO 1002 CORRESPOND TO ORIGINAL FIDUCIALS 1002 TO 217
~~MAP FIDUCIALS 1003 TO 3718 CORRESPOND TO ORIGINAL FIDUCIALS 7828 TO 5113~~

LINE 210 FLCWN AS LINE 212 AND 210

~~MAP FIDUCIALS 3254 TO 5143 CORRESPOND TO ORIGINAL FIDUCIALS 5143 TO 3254~~
MAP FIDUCIALS 5144 TO 6101 CORRESPOND TO ORIGINAL FIDUCIALS 3575 TO 4532

LINE 1020 FLCWN AS LINE 1021

MAP FIDUCIALS 13951 TO 16075 CORRESPOND TO ORIGINAL FIDUCIALS 16075 TO 13951

LINE 1030 FLCWN AS LINE 1031

MAP FIDUCIALS 11566 TO 13758 CORRESPOND TO ORIGINAL FIDUCIALS 11566 TO 13758

LINE 1040 FLCWN AS LINE 1040 AND 1041

MAP FIDUCIALS 3455 TO 4372 CORRESPOND TO ORIGINAL FIDUCIALS 3455 TO 4372

MAP FIDUCIALS 4373 TO 5951 CORRESPOND TO ORIGINAL FIDUCIALS 10504 TO 12082

LINE 1050 FLCWN AS LINE 1050

MAP FIDUCIALS 846 TO 3362 CORRESPOND TO ORIGINAL FIDUCIALS 3362 TO 846

LINE 1060 FLCWN AS LINE 1060

MAP FIDUCIALS 743 TO 3251 CORRESPOND TO ORIGINAL FIDUCIALS 3251 TO 743

LINE 1070 FLCWN AS LINE 1070

MAP FIDUCIALS 16420 TO 18531 CORRESPOND TO ORIGINAL FIDUCIALS 16420 TO 18531